Biological Systems Engineering
UNIVERSITY OF WISCONSIN-MADISON

2016 Annual Summary of Teaching, Research & Extension

College of Agricultural & Life Sciences
University of Wisconsin-Madison

Biological Systems Engineering
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Executive Summary

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

Our undergraduate program is fully accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org. Undergraduate enrollment is at an all-time high with over 190 students enrolled and continued growth projected into the future. We have become the largest of the applied agriculture departments in CALS as indicted by number of degrees granted by program. We attribute this growth to our relevance in meeting the grand challenges at the intersection of population growth, quality food supply and environmental quality, combined with our reputation of high-quality, personalized instruction and the success of job placement for our students. The department offers a wide range of courses to support our undergraduate specialization areas: Machinery Systems Engineering, Food and Bioprocess Engineering, and Natural Resources and Environmental Engineering. We also offer a general option that can be customized to the interests of individual students in areas such as structural systems, aquaculture, aquaponics and ecological engineering.

The graduate program offers both Master of Science and Doctoral degrees with over 40 graduate students. Our graduate research program is to advance the science of sustainable food and bio-products production systems, train graduate students, and to increase the quality of undergraduate instruction. Our research programs are financially supported by state and federal appropriations and by gifts and grants from industry, government agencies, and individuals. This support is gratefully acknowledged. The gifts and grants continue to increase as a percent of budget.

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

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

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

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

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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
O'Leary, Philip: Professor, Ph.D., Engineering Professional Development
Ralph, John: Professor, Ph.D., Biochemistry

Adjunct Faculty

Digman, Mathew: Ph.D., Biological Systems Engineering

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., Forestry

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
Barthels (Gerbitz), Hannah: Associate Outreach Specialist, AgrAbility of Wisconsin
Cronin, Keith: Assistant Researcher
Duvall, Benjamin: 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

Harde, Shirishkumar (Pan)
Seenivasan, Rajesh (Gunasekaran)
Sharara, Mahmoud (Runge)
Sundramoorthy, Ashok Kumar (Gunasekaran)
Zhou, Shengfei (Runge)

Master's Students

Buschert, Elizabeth (Thompson)
Eisner, Natalie (Luck)

Evans, Jeffrey (Anex)
Flick, Daniel (Shinners)
Francis Clar, Jordi (Anex)
Fuller, Sarah (Thompson)
Harmon, Joshua (Luck)
Harper, Matt (Choi)
Jordan, Kari (Gunasekaran/Connelly)
Jozik, Natalie (Anex)
McAfee, Joshua (Shinners)
Nigon, Cyrus (Shinners)
Powers, Andrew (Thompson)
Price, Evan (Runge)
Sanford, Joseph (Larson)
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)
Drewry, Jessica (Choi)
Gaillard, Richard (Vadas)
Gu, Lei (Anex)
Guan, Jiehao (Gunasekaran)
Gunukula, Sampath (Anex)
He, Shengzhi (Bohnhoff)
Hinde, Alysa (Larson)
Holly, Michael (Larson)
Holstein, Andrew (Bohnhoff)
Kim, Joonrae (Karthikeyan)
Lan, Wu (Ralph)
Li, Ning (Pan)
Li, Yanding (Ralph)
Liao, Yang (Pan)
Lu, Lin (Gunasekaran)
Mandalika, Anurag (Runge)
O'Dell, Jane (Rowell/Etzel)
Ortiz Reyes, Edgardo (Anex)
Wang, Hui (Larson/Noguera)
You, Youngsang (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.

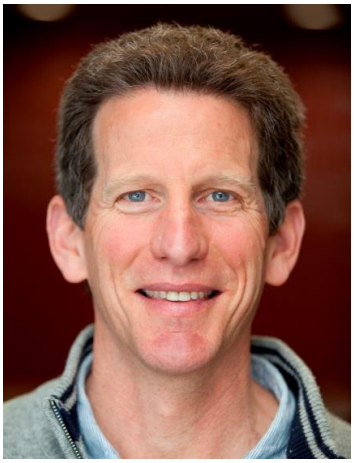
Each year about 45 graduate students are pursuing a Master of Science or Doctor of Philosophy degree in Biological Systems Engineering. In addition, our faculty advises several graduate-level students in other departments and in the programs of Water Resources Management and Land Resources Management 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
216	Irrigation Systems - Design & Use	CALS	1
218	Drainage Systems	CALS	1
249	Engineering Principles for Biological Systems.	BSE	3
270	Intro to Computer Aided Design	BSE	3
309	Career Management for Engineers	BSE	1
349	Quantitative Techniques for Biological Systems	BSE	3
351	Structural Design for Agricultural Facilities	BSE	3
356	Sustainable Residential Construction	BSE	3
364	Engineering Properties of Biological Materials	BSE	3
365	Instrumentation for Biological Systems	BSE	3
367	Renewable Energy Systems	BSE	3
372	On-Site Waste Water Treatment and Dispersal	BSE	2
441	Rheology of Foods and Biomaterials	BSE	3

460	Biorefining: Energy & Products from Renewable Resources	BSE	3
461	Bioprocessing Unit Operations	BSE	3
464	Heat and Mass Transfer in Biological Systems	BSE	3
472	Sediment and Bio-Nutrient Engineering & Mgmt.	BSE	3
473	Irrigation and Drainage Systems Design	BSE	3
475	Engineering Principles of Agricultural Machinery	BSE	3
476	Engineering Principles of Off-Road Vehicles	BSE	3
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 sustainability of biofuels and biorenewable chemicals, as well as the agricultural systems on which they depend. Dr. Anex's research group is studying the economic and environmental feasibility of biorenewable chemicals, corn production under future climate, and monitoring of soil microbial activity.

Dr. Anex's research combines process development in the laboratory with large-scale model-based assessment of agricultural-industrial systems. Key tools used to evaluate the economic efficiency and environmental sustainability of biobased products are Life Cycle Assessment (LCA) and Techno-economic Analysis (TEA). Dr. Anex and his students have been working to improve LCA and TEA methods to address the unique ways that biorenewable products couple agricultural and industrial systems.

Teaching

Spring 2016:

- BSE 001, Cooperative Education Program, 1 Credit, 1 Enrolled
- BSE 508, Biological Systems Engineering Design Practicum I, 2 Credits, 5 Enrolled
- BSE 349, Quantitative Techniques for Biological Systems, 3 Credits, 49 Enrolled
- BSE 990, Various Research Credits, 4 Enrolled

Fall 2016:

- BSE 001, Cooperative Education Program, 1 Credit, 3 Enrolled
- BSE 399, Coordinate Internship/Cooperative Education 2 Credits, 1 Enrolled
- BSE 509, Biological Systems Engineering Design Practicum II, 2 Credits, 4 Enrolled
- BSE 900, New Graduate Seminar, 1 Credit, 7 Enrolled
- BSE 990, Various Research Credits, 3 Enrolled

Graduate and Post Docs Advisees

1) Edgardo Ortiz-Reyes, Ph.D, BSE, 2016.
2) Lei Gu, Ph.D, BSE, 2016.
3) Jordi Francis Clar, Ph.D., BSE, 2020.
4) Spencer Evans, M.S., BSE & Agroecology, 2017.
5) Mahmoud Sharara, Post-Doctoral Researcher, Co-advised with Troy Runge.
6) Benjamin Duval, Research Associate.

Graduated

7) Sampath Gunukula, Ph.D, BSE, 2016.
8) Jordi Francis Clar, M.S., BSE, 2016.
9) Natalie Jozik, M.S., BSE, 2016.

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) Dried Distiller Grain Based Polymer Dispersions for Paper Coatings. Funding: USDA National Institute of Food and Agriculture and Critical Agricultural Materials Program.
4) NSF-Engineering Research Center for Biorenewable Chemicals (CBiRC). Funding: National Science Foundation. Collaboration with Iowa State University (lead institution), Rice University, University of California – Irvine, University of New Mexico, University of Virginia, Salk Institute, University of Michigan, Abo Akademi University (Finland), Eindhoven University of Technology (Netherlands), Fritz Haber Institute, Max Planck Society, and Technical University of Denmark.
5) A regional program for production of multiple agricultural feedstocks and processing to biofuels and biobased chemicals. Funding: USDA-NIFA-AFRI Coordinated Agriculture Project (CAP). Collaboration with Louisiana State University AgCenter (lead institution), Southern University, Texas A&M University, University of Arkansas at Monticello, Danisco Inc. and Virent Inc.
6) Climate Change, Mitigation, and Adaptation in Corn Based Cropping Systems. Funding: USDA-NIFA Coordinated Agriculture Project (CAP). Collaboration with Iowa State University (lead institution), Lincoln University, Michigan State University, The Ohio State University, Purdue University, University of Illinois, University of Minnesota, University of Missouri,

University of Wisconsin, USDA Agricultural Research Service – Columbus, Ohio, South Dakota State University, and USDA National Institute of Food and Agriculture (USDA-NIFA).

7) On-Farm Biomass Processing: Towards an Integrated High Solids Transporting/Storing/Processing System. Funding: USDA-NIFA Biomass Research and Development Initiative (BRDI). Collaboration with University of Kentucky (lead institution), North Carolina State University, Oak Ridge National Laboratory, University of Wisconsin, USDA-ARS–FAPU, USDA-ARS-NSL, Cornell University, USDA-ARS-GSWRL, and Case-New Holland America.

Publications

Peer-Reviewed Journal Articles

1) Anthony, R., M. Sharara, T. Runge, R. Anex. 2016. Life cycle comparison of petroleum- and bio-based paper binder from Distillers Grains (DG). *Industrial Crops and Products* 96: 1-7.
2) Gunukula, S. and R. Anex, 2016. Evaluating and Guiding the Development of Sustainable Biorenewable Chemicals with Feasible Space Analysis. *Biochemical Engineering Journal* 119: 74-83.
3) Li, A., B.D. Duval, R.P. Anex, P. Scharf, J. Ashtekar, P. Owens, C. Ellis. 2016. A case study of environmental benefits of sensor-based nitrogen application in corn. *Journal of Environmental Quality* 45(2): 675-683.
4) Gunukula, S., P. L. Keeling, R. P. Anex. 2016. Risk advantages of platform technologies for biorenewable chemical production. *Chemical Engineering Research and Design* 107: 24-33.

Abstracts, Posters, and Oral Presentations

1) Anex, R.P., P.C. Scharf, B.D. Duval, J.S. Evans. 2016. Improving life-cycle nitrogen use efficiency and environmental performance of corn production through fertilizer timing and rate. AFRI and NIWQP Project Director's Meeting, Washington, D.C., October 12-13.
2) Gu, L. and R. P. Anex. 2016. Model based evaluation of using cover crops as a climate change adaptation strategy. 2016 University of Minnesota Production Agriculture Symposium. St. Paul, MN, Mar 22.
3) Ortiz-Reyes, E. and R. P. Anex. 2016. Life cycle assessment method to estimate eutrophication impact of land application of phosphorous. Minorities in Agriculture, Natural Resources and Related Science 31st Annual Career Fair and Training Conference, Jacksonville, FL, March 30 – April 2.
4) Gu, L. and R. P. Anex. 2016. Climatic risk assessment to quantify the impacts of cover crop on nitrate loss: A model-based approach. 2016 Midwest Cover Crops Council (MCCC) Annual Meeting: The Science of Cover Crops. Madison, WI, Feb 23 - 24.

Awards

1) USDA-NIFA 2016 Partnership Award for multistate efforts.

Service

1) Associate Editor, Journal of Industrial Ecology
2) Associate Editor & Editorial Board member, International Journal of Life Cycle Assessment
3) Member, Leadership Committee, NSF Engineering Research Center for Biorenewable Chemicals
4) Member, Climate and Corn-based Cropping Systems Coordinated Agricultural Project Leadership Team
5) Member, UW Baldwin Wisconsin Idea Endowment grant review committee
6) Member, UW Physical Sciences Divisional Committee
7) Senator, UW Faculty Senate
8) Member, Wisconsin Energy Institute, Executive Committee
9) Chair, BSE Development and External Relations Committee
10) Chair, BSE Undergraduate Instruction and Program Committee
11) Member, BSE Graduate Instruction and Research Committee

David Bohnhoff

Professor, Ph.D.
50% Teaching / 50% Research
Structural and Building Construction Engineering

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

Work associated with the structural design of post-frame buildings falls into three primary categories: development of new analysis techniques, development and evaluation of new structural components, and dissemination of knowledge via development and interpretation of national standards and rewriting of the NFBA Post Frame Building Design Manual. Work during 2016 was primarily dedicated to the investigation of steel-reinforced precast concrete posts, development of rigid connections for attaching wood posts to concrete, and research on a steel-reinforced plastic-to-wood column connection.

Research on building environment control in 2016 was largely centered around the calibration of the rotatable guarded hot box (RGHB) completed earlier in the year. Initial specimen testing in the RGHB was untaken in the last couple months of 2016.

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 2016 involved fabrication and testing of an aspirator for hazelnut shell and kernel separation, design and fabrication of a three different units for separating hazelnut shells and kernels on the basis of rolling characteristics, work on a rotary drum sorter for hazelnuts, laboratory investigations on hazelnut cracking characteristics and equilibrium moisture content, design and fabrication of a specialty bike for local food delivery, design and fabrication of a hazelnut cluster dryer, and development of a combination compost sifter and seedball maker.

Teaching

Spring 2016

- BSE 508: BSE Design Practicum I
  - 2 credit lecture, 44 students
- BSE 356: Sustainable Residential Construction
  - 3 credits lecture, 34 students
- InterEgr 160: Introduction to Engineering Design
  - 3 credit lab/lecture course, 32 students
- BSE 001: Cooperative Education Program
  - 1 credit, 1 student
- BSE 699: Independent Study
  - 2/3 credits, 3 students

Fall 2016

- BSE 351: Structural Design of Agr. Facilities
  - 3 credit lecture, 22 students
- InterEgr 170: Design Practicum
  - 2 credit course, 24 students
- BSE 509: BSE Design Practicum II
  - 3 credit lab, 1 team, 4 students

Graduate Students Advised

Andy Holstein (Ph.D. Student)
Henry He (Ph.D. Student)

Extension/Outreach Activities

1) *Hazelnut Processing.* This work is an extension of activities associated with the Upper Midwest Hazelnut Development Initiative headed by UW Extension Agent Jason Fischbach. In 2016, helped design, fabricate and test (1) an aspirator for kernel and shell separation; (2) three different devices for kernel and shell separation on the basis of rolling characteristics; (3) a rotary drum sorter, and (4) a hazelnut cluster dryer.
2) *Wisconsin Frame Builders Association*. Served as WFBA advisor. Made a technical presentation on

the NFBA Post Frame Building Design Manual at the 2016 WFBA Annual Meeting.

Research

1) Evaluation and Optimization of Post-Frame Thermal Envelopes. Continued work with graduate students Holstein and He on a rotatable guarded hot box. Federal Hatch funded project.
2) Moment Resisting Post-to-Concrete Connection. Tested a series of rigid connections for attaching wood posts to concrete and analyzed data. Results captured in a technical paper presented at the 2016 ASABE Annual International Meeting. Also submitted a *Frame Building News* article on rigid connections. Funded in part by the National Frame Buildings Association.
3) Precast Concrete Posts. Designed, fabricated and field installed concrete posts that can be used for low-rise organic trellis systems, fences and for post-frame building columns. Completed laboratory tests and analysis on three different designs. Results were reported in a technical paper presented at the 2016 ASABE Annual International Meeting. Funded in part by the National Frame Buildings Association.
4). Bending Properties for a Steel Reinforced Plastic-to-Wood Column Connection. Conducted bending tests on a series of plastic-to-wood columns. Analyzed the test results and wrote an ASABE technical paper that was presented at the 2016 ASABE Annual International Meeting. Research supported by Walters Building Systems.
5) Hazelnut Properties. Determined the equilibrium moisture content of hazelnut husks, shells and kernels in 18 different environments. Data currently being analyzed with results to be included in a technical paper presented at the 2017 ASABE Annual International Meeting. Also began research on hazelnut cracking characteristics. Research supported by a SARE grant.
6) Use of Saturated Salt Solutions in Conditioning Organic Materials. Continued work in this area via conditioning of husk and unhusked hazelnuts, and the de-watering of aronia berries. Unfunded project.
7) 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. 2016. Progressive roof collapse due to CLR shifting. *Frame Building News*. In press.
2) Holstein, A.J. and D. R. Bohnhoff. 2015. Bending properties of concrete -to-wood I-section connections. *Applied Engineering in Agriculture,* 31(1): 121-131.
3) Bohnhoff, D.R. 2017. Rigid connections between wood posts and concrete. *Frame Building News*. In press.
4) Holstein, A. J., D.R. Bohnhoff and C.Y. Choi. 2016. A computational and experimental study of conjugate heat transfer through composite thermal envelopes in post-frame buildings. Submitted for publication in *Computers and Electronics in Agriculture*

Technical Publications

1) Bohnhoff, D.R., D.L. Pederson, and C. Klessig. 2016. Bending properties for a steel reinforced plastic-to-wood column connection. Presented at the 2016 ASABE International Meeting, Orlando, FL. ASABE Paper No. 2460772. ASABE St Joseph, MI. DOI: 10.13031/aim.202460772
2) Bohnhoff, D.R. 2016. Precast concrete posts for agricultural use. Presented at the 2016 ASABE International Meeting in Orlando, FL. ASABE Paper No. 2460547. ASABE. St Jospeh, MI. DOI: 10.13031/aim.202460547
3) Bohnhoff, D. R. 2016. Rigid concrete-to-wood post connection. ASABE Paper No. 2460665. St Joseph, MI: American Society of Agricultural and Biological Engineers. doi: 10.13031/aim.202460665

Awards

1) Faculty advisor for 2nd Place Team, 2016 ASABE AGCO Student Design Competition
2) Career Achievement Award, Wisconsin Section of the American Society of Agricultural and Biological Engineers, received March 30, 2016

Professional Development Activities

1) Wisconsin Frame Builders Association Annual Meeting, January 19-20, 2016 Dubuque, IA
2) MOSES Organic Farming Conference, February 25-27, 2016, LaCrosse, WI
3) Frame Building Expo, March 8-11, 2016, Indianapolis, IN
4) ASABE Annual International Meeting, July 26 - 29, 2015, July 17-20, 2016, Orlando, Florida, FL.

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 EP486.2
- Standards Development Committee for ASAE EP484
- Structures Committee, PAFS-20
- Agri-Industrial Facility Design and Operation Committee, PAFS-07/1
- Awards Coordinating Committee, M-102
- Wisconsin Section – Attended 2 section meetings in 2015

- Manuscript reviewer

ii. National Frame Builders Association
- Technical Publications Review Committee. Reviewed 4 FBN manuscripts in 2016.
- Technical Publications Review Committee Editor for 1 FBN manuscript
- NFBA Technical & Research Committee. Attended four meetings in 2016
- 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 Review Committee

iii. Advisory Committee for International Engineering Certificate

iv. BSE Undergraduate Instruction and Program Committee Chair

Christopher Choi

Professor
40% Teaching / 60% Research
Biological Heat and Mass transfer

Dr. Choi's research program is primarily focused on computational and experimental heat and mass transfer in biological, agricultural and environmental systems. Specifically, he has initiated and conducted research on the following topics; microclimate control, pathogen transport that occurs during spray irrigation of liquid manure, design and evaluation of systems for cooling dairy cows, and ground source heat exchangers.

Teaching

Spring 2016

- BSE 309, Biological Systems Engineering Design Practicum I
  2 Credits, One design teams, 4 Enrolled
- BSE 464, Biosystems Heat and Mass Transfer, 3 Credits, 13 Enrolled
- BSE 990, Research, Ind. Study, 2 credits, 2 Enrolled

Fall 2016

- BSE 270, Introduction to Computer Aided Design
  3 Credits, 57 Enrolled
- BSE 990, Research, Ind. Study, 3-6 credits, 2 Enrolled

Graduate and Post Docs Advisees

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

Funded Research Projects

1. Assessment of Environmental Impacts of Geothermal Source Heat Exchangers from Wisconsin Groundwater Coordinating Council
a. Collaborator(s): D. Hart and J. Tinjum
b. Funding: WI Groundwater Council.
c. Objectives: This work evaluates the presence, concentration level and spread of the thermal and chemical pollutants produced by a large-scale ground source heat exchanger. The results of the study should help in any effort to create regulatory guidelines for dealing with any threat these outcomes may pose to humans and the environment.
2. Assessment of Innovative Cooling Methods of Lactating Dairy Cows using Computational Fluid Dynamics
a. Collaborator(s): none
b. Funding: USDA
c. Objectives: The project will develop and test a series of computational models that are potentially capable of assessing (i) the effectiveness of an array of air jets aimed so as to impinge directly on targeted animals and (ii) a cooling mattress that transfers a cow's body heat away from the animal by means of thermal conduction.
3. Heat Stress and Dairy Cooling – A Survey
a. Collaborator(s): none
b. Funding: Schaefer Fan Co.
c. Objectives: The project will develop four survey papers for producers and researchers related to dairy cooling in America's Midwest, Arid- and Semi-Arid Regions, and Hot and Humid Regions.
4. Assessment of Large-Scale Geothermal Exchange Field using Computational Methods and the DTS measurement system
a. Collaborator(s): Jim Tinjum
b. Funding: Fall Competition, UW Vice Chancellor's Office
c. Objectives: The project will developed a unique research strategy for obtaining high-precision experimental measurements of temperature and heat flux profiles along the complete path of a closed-loop ground heat exchangers, one that includes heat flux occurring in the grout.

Publications

Peer reviewed Journal Articles

1) Mondaca M, CY Choi (2016) A computational fluid dynamics model of a perforated polyethylene tube ventilation system for dairy operations, *Transactions of the ASABE,* 59:6, 1585-1594.
2) Mondaca M, CY Choi (2016) An evaluation of simplifying assumptions in dairy cow computational fluid dynamics models, *Transactions of the ASABE,* 59:6, 1575-1584.
3) Rojano F, P Bournet, M Hassouna, P Robin, M Kacira, and CY Choi (2016) Computational modelling of thermal and humidity gradients inside a naturally ventilated poultry house, *Biosystems Engineering*. 151, 273-285.
4) Andrade M, CY Choi, K Lansey, D Jung (2016) Enhanced artificial neural network estimating water quality constraints for the optimal water distribution systems design. *ASCE Journal of Water Resources Planning and Management.* 142:9, 1-14.
5) Ozdogan-Dolcek A, I Atkins, MK Harper, JM Tinjum and CY Choi, (2016) Performance and sustainability of district-scale ground coupled heat pump systems, *Geotechnical and Geological Engineering*. DOI 10.1007/s10706-016-0147-y.
6) Floria LJ, Hart D, Tinjum J, CY Choi (2016) Potential impacts to groundwater from ground-coupled geothermal heat pumps in district scale, *Groundwater.* DOI 10.1111/gwat.12484.

Conference Proceedings and Presentations

1. Atkins I, M Mondaca, CY Choi (2016), Energy efficiency and air distribution of VFD-driven mechanical ventilation systems, ASABE Annual International Meeting, Orlando, Florida.
2. Drewry J, CY Choi, JM Powell (2016), Computational Fluid Dynamics modeling of conjugate heat and mass transport in dairy housing, ASABE Annual International Meeting, Orlando, Florida.
3. Choi CY, Mondaca M (2016) Evaluation and design of targeted cooling for dairy applications using CFD tools – A summary of recent advances, CIGR International Conferences on Agricultural Engineering, 2nd International Symposium of CFD Applications in Agriculture, Aarhus, Denmark.
4. Atkins I, CY Choi (2016) Winter borefield cooling for cooling-dominated Ground-Source Heat Pump systems in agriculture, CIGR International Conferences on Agricultural Engineering, 2nd International Symposium of CFD Applications in Agriculture, Aarhus, Denmark.
5. Drewry J, JM Powell, CY Choi (2016) Development of a computational model for the prediction of gaseous emissions from dairy cows, CIGR International Conferences on Agricultural Engineering, 2nd International Symposium of CFD Applications in Agriculture, Aarhus, Denmark.
6. Rojano F, P Bournet, N Hassouna, P Robin, M Kacira, CY Choi (2016) A 3D CFD model to assess the impact of the wind direction on the internal climate of a naturally ventilated poultry house, CIGR International Conferences on Agricultural Engineering, 2nd International Symposium of CFD Applications in Agriculture, Aarhus, Denmark.
7. Rojano F, P Bournet, N Hassouna, P Robin, M Kacira, CY Choi (2016) Gas discharge predictions for a naturally ventilated poultry house by means of a 3D CFD model, CIGR International Conferences on Agricultural Engineering, 2nd International Symposium of CFD Applications in Agriculture, Aarhus, Denmark.
8. McDaniel A, M Harper, D Fratta, JM Tinjum, CY Choi, DJ Hart (2016) Dynamic Calibration of a Fiber-Optic Distributed Temperature Sensing Network at a District-Scale Geothermal Exchange Borefield, ASCE Geo-Chicago, Chicago, IL.

Other Publications:

White paper series, featured trade journals and websites such as *Progressive Dairyman* (USA) and *International Dairy Topics* (UK)

Part 1. Atkins I, Choi CY, Holmes B (2016) Dairy Cooling: Benefits and Strategies.
Part 3. Atkins I, Choi CY (2016) Dairy Cooling in Arid and Semi-Arid Climates.
Part 2. Atkins I, Choi CY, Holmes, B (2016) Dairy Cooling in Humid Continental Climates.
Part 4. Atkins I, Choi CY, Bucklin R (2016) Diary Cooling in Subtropical Climates.

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
President, Association of Korean Agricultural, Biological, and Food Engineers (AKABFE), ASABE
Chair, ITSC-217 Computational Methods, Simulations and Applications
Session Organizer, 2016 ASABE International Conference - Computational Fluid Dynamics in Agriculture, Orlando, FL
Organizing Committee Member, the Second CIGR International CFD Symposium in Agriculture (2016, Aarhus, Denmark)

Member, ITSC-254 Emerging Info Systems
Member, PAFS-403 Dairy Facilities and Systems
Chair, CALS Facilities Committee
Member, CALS Curriculum Committee
Chair, BSE IT Committee, Chair
Member, BSE Executive Committee
Reviewer for Transactions of The ASABE and several energy and environmental engineering related journals
Graduate Thesis/Dissertation Committees at UW-Madison and Aarhus University, Denmark

Sundaram Gunasekaran

Professor, Ph.D.
50% Teaching / 50% Research
Program affiliations: Food Science, Materials Science and Engineering

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

Teaching

BSE/FS/ME 441: Rheology of Foods and Biomaterials, 22 students (course evaluation: 4.1)
BSE 509: Senior Design, 4 students (1 team)
BSE 900: Graduate Seminar, 10 students
BSE 901: Graduate Research Seminar, 11 students

Graduate and Post Docs Advisees

Omer Sadak, PhD (2018)
Jiehao Guan, PhD (2018)
Youngsang You, PhD (2018)
Lin Lu, PhD (2017)
Yi-Cheng Wang, PhD (2016)
Kari Jordan, MS (2017)
Ashok K. Sundramoorthy, Post-doc
Rajesh Seenivasan, Post-doc
Cao, Xiaodong, Post-doc
Gong, Sheng, Post-doc
Moayedzadeh, Saina, PhD Student visitor
Rehman, Anees, 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).
- Highly Flexible and Conducting Transparent CNT Film for Displays, UW Graduate School (Jack Ma, co-PI)
- Regeneration of Multi-Layered Vocal Fold Mucosa, NIH R01 (Welham, PI)

Grant Proposals

UW2020: Bartholomay (PI), Gunasekaran. Bioengineering solutions to the transcuticular insecticide delivery hurdle ($500,000, not funded)

USDA NIFA: An Immunobiosensing Method for Rapid On-site Detection of Listeria species ($499,887, not funded)

USDA NIFA: Taalat (PI), Gunasekaran. Molecular Pathogenesis for Early Detection of Bovine Tuberculosis ($500,000, not funded)

NIH: Low-Cost Blood Pressure Monitoring Device Based on Magnetic Microactuators and Shape Memory Alloys ($150,000, not funded)

NIH UWSDRC: A Multiplexed Microfluidic Platform for Prognosis of Primary Cutaneous Melanocytic Neoplasms ($30,000, not funded)

Peer-reviewed Journal Articles

Nourbakhsh H, Z Emam-Djomeh, A Madadlou, ME Mousavi, AA Moosavi-Movahedi, **S Gunasekaran**. 2016. Antioxidant peptidic particles for delivery of gallic acid. J Food Processing and Preservation. DOI: doi:10.1111/jfpp.12767

Yang J, Kwak TJ, Zhang X, McClain R, Chang W-J, **Gunasekaran S**. 2016. Digital pH test strips for in-field pH monitoring using iridium oxide-reduced graphene oxide hybrid thin films. ACS Sens. 2016, 1, 1235−124

Sundramoorthy AK, Sadak O, Anandhakumar S, **Gunasekaran S**. 2016. Synthesis of poly(8-aminopyrene-1,3,6-trisulfonic acid)/CNT nanocomposite for electrochemical detection of caffeine. J. Electrochemical Society 163(13):B638-B643

Bagci PO, **Gunasekaran S**. 2016. Iron-encapsulated cold-set whey protein isolate gel powder. Part 2: Effect of iron fortification on sensory and storage qualities of yogurt. Int. J. Dairy Tech 69(4):601–608

Lu L, Seenivasan R, Wang Y-C, Yu J-H, **Gunasekaran S**. 2016. An Electrochemical Immunosensor for Rapid and Sensitive Detection of Mycotoxins Fumonisin B1 and Deoxylnivalenol. Electrochimica Acta 213:89–97

Li Z, C Yao, Y-C Wang, S Mikael, **S Gunasekaran**, Z Ma, Z Cai, X Wang. 2016. High-density platinum nanoparticle-decorated titanium dioxide nanofiber network for efficient capillary photocatalytic hydrogen generation. J. Materials Chemistry A. 4:11672-11679

Eakasit S, **Gunasekaran S**. 2016. Insight into the property and behavior of saccharides in amorphous state. International Food Research Journal 23(4): 1700-1705

Eakasit S, **Gunasekaran S**. 2016. Thermal Evaluation of Sucrose-Maltodextrin-Sodium Citrate Bioglass: Glass Transition Temperature. Food Hydrocolloids 60:589-597

Nourbakhsh H, Madadlou A, Emam-Djomeh Z, Wang Y-C, **Gunasekaran S,** Mousavi M. 2016. One-pot nanoparticulation of potentially bioactive peptides and gallic acid encapsulation. Food Chemistry 210:317-324

Zong L, Sharara M, **Gunasekaran S**, Runge TM. 2016. Effects of Large-Scale Manure Treatment Processes on Pathogen Reduction, Protein Distributions and Nutrient Concentrations. Transactions of the ASABE. 59(2):695-702

Gungor K, A Alkan-Ozkaynak, KG Karthikeyan, F Evrendilek, **S Gunasekaran**. 2016. Modeling of solubilization dynamics of manure organic matter and phosphorus as a function of pH control and enzyme supplementation. Environment Protection Engineering 42(2):156-170

Nourbakhsh H, Madadlou A, Emam-Djomeh Z, Wang Y-C, **Gunasekaran S,** Mousavi M. 2016. A one-pot procedure for recovery of gallic acid from wastewater and encapsulation within protein particles. J. Agric. Food Chem. 64:1575−1582

Tau T, **S Gunasekaran**. 2016. Thermorheological Evaluation of Gelation of Gelatin with Sugar Substitutes. LWT-Food Science and Technology 69:570–578

Sundramoorthy Ak, BS Premkumar, **S Gunasekaran**. 2016. Reduced Graphene Oxide-Poly(3,4-ethylenedioxythiophene) Polystyrene Sulfonate Based Dual Selective Sensor for Iron in Different Oxidation States. ACS Sensors 1 (2):151–157

Zong L, Carroll ZS; Long SC, **Gunasekaran S**, Runge T. 2016. Use of cationic polymer to reduce pathogen indicators during dairy manure separation. J of Env. Management 166: 260-266

Invited Presentations

Gunasekaran S. 2016. Colorimetric biosensors for food quality. Zhejiang Academy of Agricultural Sciences, October 20, Hangzhou, China.

Awards

Fulbright Program Specialist (Uzbekistan)

Service

Graduate Research and Instruction (Chair, 20 h)
Undergraduate Curriculum Committee (20 h)
CALS Academic Planning Council (60 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. 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 4966 direct contacts via email or phone for requests for information, including speaking to over 780 participants in extension meetings. I worked in 36 counties with 33 different agents on client requested farm visits developing plans and educational materials to approximately 250 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 as they develop their new farmsteads and point of sale operations. Requests for dairy and beef cattle housing and handling systems are also popular. This work has been accomplished through the Dairy Modernization workgroup and the Livestock team. Green County and Pierce County had dairy facility tours with tour participants selected from farm that the agents and I had worked with earlier on their new facility designs.

I have been invited to present dairy educational seminars through the Global Dairy Outreach for a Cochran group from Venezuela. I have hosted lectures on campus for international visitors from Ireland, Finland, Japan, and Venezuela.

Teaching

I teach the BSE Farm and Industry Short Course "Livestock Housing" Short Course evaluations were done by Short Course office this year. My 2015 short course evaluation rating is 4.22. I also guest lecture for Dairy and Animal Science classes including 2 @ 2 week modules for the Senior Design Course DS234.

Meetings and Activities

- GrassWorks Grazing Conference Humane Cattle Handling
- WFBA Dubuque, IA
- Driftless Region Beef Conference
- Transition Cow Meeting
- Swiss Valley Young Cooperator Conference
- MN Parlor vs Robot Meetings
- WI Well Being Conference Humane Cattle Handling
- Countryside Meeting Webinar Purina
- Transition Cow Meeting Grant county
- Large Dairy Herd Management Conference
- Wednesday Night at the lab PBS Humane Cattle Handling and recorded for PBS
- St Croix Dairy Modernization Tours
- Northwest County Agent tour
- Farm Technology Days Walworth
- NW Grazing Meeting Siren
- Calf Meeting Altoona, Kimberley
- International Visitors tour host for Ireland, Finland, Japan, Venezuela

Invited Speaker

- Large Dairy Herd Management Conference ADSA
- Wednesday Night at the Lab
- Minnesota Robot versus Parlor Meetings
- Podcast Calf Facility Design and Management
- Podcast Heat Stress Mitigation

Dairy Modernization Extension Program Activity

I have made farm visits in the following 38 counties visiting approximately 250 livestock farms and developed preliminary designs for the farmsteads.

1. Brown (1x)
2. Buffalo (4x)
3. Columbia (2x)
4. Chippewa (2x)
5. Crawford (1x)
6. Dane (2x)
7. Dodge (1x)
8. Door (1x)
9. Dunn (1x)
10. Eau Claire (1x)
11. Fond du lac (1x)
12. Grant (3x)
13. Green (5x)
14. Green Lake (1x)
15. Jackson (1x)
16. Jefferson (1x)
17. Juneau (1x)
18. Kenosha (1x)
19. Kewaunee (3x)
20. Marathon (3x)
21. Marquette (2x)
22. Monroe (4x)
23. Oconto (1x)
24. Outagamie (2x)
25. Ozaukee (1x)
26. Pierce (2x)
27. Shawano (1x)
28. Sheboygan (3x)
29. St. Croix (1x)
30. Trempealeau (2x)
31. Vernon (1x)
32. Walworth (1x)
33. Washington (2x)
34. Waupaca (1x)
35. Waushara (1x)
36. Washburn/Sawyer /Burnett (1x)

Papers, Proceedings, Articles

Kammel, David W. 2016. Dairy Goat Facilities. Dairy Goat production handbook. Published by the American Institute for Goat Research, Langston University. Langston, OK 73050. www2.luresext.edu

Kammel, David W. 2016. How Much will that New Barn Cost You? Progressive Dairyman Magazine. www.Progressivedairy.com 7th most viewed article of 2016.

Kammel, David W. 2016. Building Cost Estimates-Beef Related Facilities Dairy. UWEX. Dairy Extension Resources. December 2015.

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

Awards

2016 ANRE Program Innovation Award Agricultural Podcasts Team

Presentations Developed

- Group Calf Barn Design and Management
- Design and Layout for Robotic Milking Systems
- Design of Humane Cattle Handling Facilities
- Systems Approach to Dairy Farmstead Design
- Large Dairy Herd Design in Temperate and Cold Climate
- Transition Cow Facility Design and Management
- Renovating Old Facilities and Handling Facilities
- Design and layout of Robotic Milking Systems
- Remodeling Retired Dairy Facilities for Beef Production

Professional Service

- BSE Departmental Extension, and Social Committee
- Phi Kappa Phi Honor Society
- Gamma Sigma Delta Honor Society
- Alpha Epsilon Honor Society
- ASABE member 29 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 2016
BSE 472, Sediment & Bio-nutrient Engineering and Management
3 Credits, 20 Enrolled
(Evaluation: 4.40/5)
BSE 309, Engr. Design Practicum
2 credits, 3 students advised
InterEgr 102, Introduction to Society's Engineering Challenges
2 Credits, 32 enrolled
Fall 2016
BSE 372, On-site Wastewater Treatment and Dispersal
2 Credits, 29 Enrolled
(Evaluation: 4.46/5)
BSE 509, Design Practicum II
3 Credits, 42 students enrolled

Graduate and Post Docs Advisees

1) Rania Bashar, PhD, BSE, 2017
2) Elizabeth Miller, PhD, METC, 2018, Co-advising with Joel Pedersen
3) Sara Nason, PhD, EC&T, 2018, Co-advising with Joel Pedersen
4) Joorae Roger Kim, PhD, BSE, 2020
5) Donnie Vineyard, PhD, BSE/Soils, 2020, Co-advising with Phillip Barak
6) Caroline Lierl, MS, Environment & Resources (Nelson Institute), 2018
7) Andrew Skog, MS, BSE, 2017, Co-advising with Anita Thompson
8) Zachariah Zopp, Assistant Reseacher, 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) 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).

4) Phosphorus Index and Snowmelt Runoff Risk Assessment: Demonstration and Refinement. Collaborators: A.M. Thompson, BSE; L.W. Good, Soils.
   Funding: USDA/CIG
   Objectives: Demonstrate the ability of a process-based P Index formulation to assess management effects on runoff P losses from fields under frozen soil conditions.
5) 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) Implications of Phosphorus Recovery from Wastewater for Biosolids Management. Funding: USDA-NIFA (Hatch)
9) Crop Plant Uptake of Pollutants of Emerging Concern.
   Collaborator: J. Pedersen, Soils
   Funding: USDA-NIFA (Hatch)

Publications

Peer reviewed Journal Articles

1) Vadas, P, L Good, W Jokela, KG Karthikeyan, F Arriaga, M Stock. 2016. Quantifying the Impact of Seasonal and Short-term Manure Application Decisions on Phosphorus Loss in Surface Runoff. J. Environmental Quality *(in press)*. doi:10.2134/jeq2016.06.0220
2) Zopp, Z, J Olstadt, KG Karthikeyan, AM Thompson, SC Long. 2016. A Cryptosporidium Soil Extraction by Filtration/IMS/FA Compatible with USEPA Method 1623.1. Agricultural & Environmental Letters. 1:160031. doi:10.2134/ael2016.08.0031.
3) Miller, EL, SL Nason, KG Karthikeyan, JA Pedersen. 2016. Root Uptake of Pharmaceutical and Personal Care Product Ingredients. Environmental Science & Technology. 50:525-541.
4) Gungor, K, AA Ozkaynak, KG Karthikeyan, F Evrendilek, S Gunasekaran. 2016. Modeling solubilization dynamics of manure organic matter and phosphorus as a function of pH control and enzyme supplementation. Environment Protection Engineering. 2:155-170.
5) Lamba, J, AM Thompson, JC Panuska, KG Karthikeyan. 2016. Effect of Best Management Practice Implementation on Sediment and Phosphorus Load Reductions at Subwatershed and Watershed Scale Agricultural Water Management. International Journal of Sediment Research. 31:386-394.
6) Zopp, Z, AM Thompson, KG Karthikeyan, F Madison, SC Long. 2016. Subsurface Transport of Cryptosporidium in Soils of Wisconsin's Carbonate Aquifer Region. J. Environmental Quality. 45:1607-1615. doi:10.2134/jeq2015.12.0592

Conference Presentations

1) Nason, SL, EL Miller, KG Karthikeyan, JA Pedersen 2016. Mixture Effects on Plant Uptake of Pharmaceuticals and Personal Care Products. Presentation at the 7th Society of Environmental Toxicology and Chemistry (SETAC) World Congress. Orlando, FL.
2) Miller, EL, SL Nason, KG Karthikeyan, JA Pedersen. 2016. Effects of carbamazepine exposure on the whole transcriptome of the model plant *Arabidopsis thaliana*. Poster presented at the 7th SETAC World Congress. Orlando, FL.
3) Nason, SL, EL Miller, KG Karthikeyan, JA Pedersen. 2016. Rhizosphere pH Influences Plant Uptake of Lamotrigine. Gordon Research Conference, Holderness, NH.
4) Miller, EL, SL Nason, CJ Hedman, KG Karthikeyan, JA Pedersen. 2016. Effect of Carbamezapine Exposure on the Whole Transcriptome of the Model Plant Arabidopsis thaliana. Gordon Research Conference, Holderness, NH.
5) Lamba, J, KG Karthikeyan, AM Thompson. 2016. Use of Fallout Radionuclides and Inorganic Tracers to Identity In-Stream Sediment Sources. Alabama Water Resources Conference and Symposium, Orange Beach, AL.
6) Miller, EL, SL Nason, KG Karthikeyan, JA Pedersen. 2016. Influence of Physiochemical Properties and Root Physiology in Predicting Plant Uptake of Pharmaceuticals and Personal Care Products. Presentation at the SETAC Midwest meeting, March 2016, Madison, WI
7) Nason, SL, ME Czerwinski, EL Miller, KG Karthikeyan, JA Pedersen, J.A. 2016. Does Carbamazepine affect the Phytotoxicity of Other Pharmaceuticals? Presentation at the SETAC Young Environmental Scientists (YES) Meeting. Gainesville, FL.
8) Miller, EL, SL Nason, KG Karthikeyan, JA Pedersen. 2016. Influence of Physiochemical Properties and

Root Physiology in Predicting Plant Uptake of Pharmaceuticals and Personal Care Products. Poster presented at the SETAC YES meeting, Gainesville, FL

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
Nominee, Science Advisory Board (Agricultural Science Committee), USEPA
Environment Technology
US-Israel BARD Program
US-Pakistan (NAS) Science & Technology Cooperation 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, Professional Nutrient Applicators Association of Wisconsin (PNAAW)

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

Teaching

Spring 2016
BSE 472, Sediment and Bio-Nutrient Engineering and Management
3 Credits, 20 Enrolled

Graduate, Post Docs, and other Advisees

Current
1) Joseph Sanford, Ph.D. Student, Biological Systems Engineering
2) Hui Wang, Ph.D. Candidate, Biological Systems Engineering
3) Emmy Tomforde, Ph.D., Student, Nelson Institute for Environmental Sciences
4) Alysa Bradley, Ph.D. Student, BSE, Biological Systems Engineering
5) Horacio A. Aguirre-Villegas, Ph.D. Assistant Scientist, Biological Systems Engineering
6) Mahmoud Sharara, Ph.D., Postdoctoral Researcher, Biological Systems Engineering
Completed in 2016
7) Aleia McCord, Ph.D., Nelson Institute for Environmental Sciences, Graduated Summer 2016
8) Michael Holly, Ph.D., Biological Systems Engineering, Graduated Summer 2016
9) Joseph Sanford, M.S., Biological Systems Engineering, Graduated Spring 2016

Extension / Outreach

30+ days of extension programing
International anaerobic digestion programming (Uganda, Rwanda, and Bolivia)
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 Enduring U.S. Dairy Sector, 30th ADSA Discover Conference, Chicago, IL
Anaerobic Digestion Tour
Dane County Manure Planning

Funded Research Projects Ongoing in 2016

10) Climate Change Mitigation and Adaptation In Dairy Production
Collaborators: M. Ruark, M. Jahn, M. Watteaux, 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)
11) 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
12) 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
13) 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
14) 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
15) Biogas Treatment to Remove Hydrogen Sulfide
Collaborators: n/a
Funding: UW Graduate School $35,860
Objectives: Develop a biological treatment system to reduce the H2S content from anaerobic digesters
16) 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
17) 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
18) 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
19) 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 diest
20) 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 applciation

Publications

Peer Reviewed Journal Articles

1. Wang, H., H. Aguirre-Villegas, R.A. Larson, and A. Alkan-Ozkaynak. 2016. Physical properties of liquid and slurry dairy manure pre and post digestion: density, total solids content, and volatile solids. *Transactions of the ASABE*. Accepted with Revision.
2. Holly, M.A., R.A. Larson, M. Powell, M. Ruark, and H. Aguirre-Villegas. 2016. Evaluating greenhouse gas and ammonia emissions from digested and separated manure through storage and land application. *Agriculture, Ecosystems & Environment*. Accepted with Revision.

3. Holly, M.A. and R.A. Larson. 2016. Treatment of Silage Runoff with Vegetated Filter Strips. *Transactions of the ASABE*. Accepted in Print.

4. 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 Technology*, xxx:1-11. Available online, in Print.

5. Burch, T., S. Spencer, J. Stokdyk, B. Kieke, R.A. Larson, A. Firnstahl, A. Rule, and M. Borchardt. 2016. Quantitative Microbial Risk Assessment for Spray Irrigation of Dairy Manure Based on an Empirical Fate and Transport Model. *Environmental Health Perspectives*. Accepted in print.

6. Sanford, J. and R.A. Larson. 2016. Evaluation of Phosphorus Filter Media for an Inline Subsurface Drainage Treatment System. *Journal of Environmental Quality*., 45(6):191-1925. doi:10.2134/jeq2016.01.0038.

7. McCord, A.I., S.A. Stefanos, V. Tumwesige, D. Lsoto, A. Meding, A. Adong, J.J. Schauer, and R.A. Larson. 2017. Biogas and the impacts of fuel choice on institutional kitchen air quality in Kampala, Uganda. *Indoor Air*. Accepted with Revisions.

8. Wang, H. and R.A. Larson. 2017. Effect of Dietary Tannin on Biomethane Potential of Diary Manure. *Environmental Technology*. Accepted with Revision.

9. Holly, M.A. and R.A. Larson. 2016. Effects of Manure Storage Additives on Manure Composition and Greenhouse Gas and Ammonia Emissions. *Transactions of the ASABE*. Accepted in Print.

Extension Document and Other Publications

10. Holly, Michael A.; Larson, Rebecca A.; Powell, J. Mark; Ruark, Matt; Barford, Carol (2016). Carbon Dioxide, Methane, Nitrous Oxide, and Ammonia Emissions from Digested and Separated Dairy Manure during Storage and Land Application. Ag Data Commons. http://dx.doi.org/10.15482/USDA.ADC/1332491

11. Genskow, K.D. and R.A. Larson (eds.). 2016. Considerations for the Use of Manure Irrigation Practices: Report from the Wisconsin Manure Irrigation Workgroup. University of Wisconsin-Extension and UW-Madison College of Agricultural and Life Sciences, Environmental Resources Center. Publication Number ERC 001-16.

12. R.A. Larson, M. Sharara, L.W. Good, P. Porter, T. Runge, V. Zavala, A. Sampat, and A. Smith. Evaluation of Manure Storage Capital Project in the Yahara River Watershed, BSE 001-016.

13. H. Aguirre-Villegas, R.A. Larson, M.D. Ruark. 2016. Methane Emissions from Dairy Cattle, Publication No. UWEX A4131-01 GWQ 073 (peer reviewed).

14. H. Aguirre-Villegas, R.A. Larson, M.D. Ruark. 2016. Dairy Anaerobic Digestion Systems and their Impact to Greenhouse Gas and Ammonia Emissions (peer reviewed, in print).

Invited Presentations:

1. Sharara, M.A., R.A. Larson, and T. Runge. 2016. Spatially-explicit methodology for manure management at the watershed level. *2016 ASABE Annual International Meeting, July 17-20, 2016, Orlando, FA*.

2. Aguirre-Villegas, H.A., R.A. Larson, and D. Reinemann. 2016. Life cycle carbon footprint and energy intensity of Wisconsin pasture-based dairy systems. *2016 ASABE Annual International Meeting, July 17-20, 2016, Orlando, FA*.

3. R.A. Larson. 2016. Manure Processing: Microbial Impacts on Manure Management Strategies. *2016 North American Alfalfa Conference.*

4. R.A. Larson and D. Lsoto. 2016. Integrating Biogas into Agricultural Systems. *Engineering and Technology Innovation for Global Food Security, October 24-27, 2016, Stellenbosch South Africa.*

5. R.A. Larson and D. Lsoto. 2016. Integrating Biogas Systems in Uganda. *Engineering and Technology Innovation for Global Food Security, October 24-27, 2016, Stellenbosch South Africa.*

6. R.A. Larson and D. Lsoto. 2016. Developing a Successful International Research and Development Team. *Engineering and Technology Innovation for Global Food Security, October 24-27, 2016, Stellenbosch South Africa.*

7. R.A. Larson. 2016. Wisconsin Public Utility Institute Energy Basics Course, Madison, WI, September 29, 2016. *From Waste to Worth: Anaerobic Digestion*.

8. R.A. Larson. 2016. Wisconsin Land and Water Conference, Elk Hart Lake, WI, March 3, 2016. *Manure Irrigation Considerations for Use*.

9. R.A. Larson. 2016. Kewaunee County Public Health Board Meeting, Kewaunee, WI, March 14, 2016. *Manure Irrigation Considerations for Use*.

10. R.A. Larson. 2016. Department of Agriculture, Trade, and Consumer Protection Board Meeting, Madison, WI, March 22, 2016. *Manure Irrigation Considerations for Use.*

11. R.A. Larson. 2016. Manure Irrigation Webinar, April 14, 2016

12. *Considerations for the Use of Manure Irrigation Practices.*)

13. R.A. Larson. 2016. Manure irrigation webinar May 16, 2016. *Addressing Stakeholder Questions Related to Manure Irrigation*.

14. R.A. Larson. 2016. Clean Lakes Alliance Scientific Speaker Series, June 9, 2016.

15. R.A. Larson. 2016. Manure Gas Safety Webinar, September 8, 2016. *Basics of Manure Gas Production*.

16. R.A. Larson. 2016. Wisconsin Towns Association Annual Meeting, October 10, 2016. *Considerations for the Use of Manure Irrigation Practices*.

17. R.A. Larson. 2016. 2016 Crop Management Conference, Madison, WI, January 13, 2016. *Evaluating Technology Options for Manure Transport and Land Application*.

18. R.A. Larson. 2016. North American Alfalfa Conference, July 13, 2016. *Manure Processing: Microbial Impacts on Manure Management Strategies*.

19. R.A. Larson. 2016. Dane county committee presentation, November 11, 2016. *Managing Manure Phosphorus in Dane County*.

Service

Biological Systems Engineering Committees
Extension
Pre-Professional Club
Faculty Meeting Secretary
CALS International Program Committee
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), Chair
Wisconsin Biogas Council, Advisory Committee
Reviewer for Journals and USDA panels
Manure Irrigation Workgroup
UWEX Dairy Team
UWEX Nutrient Management Team
UWEX Bio-energy/Bio-economy Team
Professional Nutrient Applicators Association of Wisconsin

Awards

2016 ASABE Superior Paper Award for "A New Model for Phosphorus Loss in Runoff from Outdoor Cattle Lots." American Society of Agricultural and Biological Engineers (ASABE).

1) Aguirre-Villegas, H. and R.A. Larson. Comparing different manure management practices in dairy farms of Wisconsin. ASABE Annual International Meeting, July 26-29, 2015, New Orleans, LA.
2) Larson, R.A., A. Bradley, and T. Runge. 2015. Impact of biochar additions to nitrogen leaching in sand columns. ASABE Annual International Meeting, July 26-29, 2015, New Orleans, LA.

Professional Development

UW Teaching Academy

Service

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

Brian D. Luck

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

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

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. Finally, applied research is being conducted on current remote sensing technologies and their application to cranberry production.

Dr. Luck's extension programming is centered around Precision Agriculture Technology. Topics of high interest in 2015 have been variable rate technology, remote sensing and the use of unmanned aerial vehicles (UAV's), and issues dealing with "big data" in agriculture.

Teaching

Spring 2016
BSE 508 (2 credits): ¼ Scale Tractor Design Team (4 Students).
SC_FISC 38-016 Precision Agriculture Technologies: Guest Lecture.
Fall 2016
BSE 509 (2 credits): ¼ Scale Tractor Design Team (4 Students).
SC_BSE 92 Farm Machinery: Guest Lecture.

Graduate Student Advisees

1) Nate Dudenhoeffer, M.S., Biological Systems Engineering, 2016 (non-thesis).
2) Joshua Harmon, M.S., Biological Systems Engineering, 2016.
3) Natalie Eisner, M.S., Entomology, 2018 (co-advising with Dr. Shawn Steffan).
4) Emmy Tomforde, Ph.D., Biological Systems Engineering, 2018 (co-advising with Dr. Rebecca Larson).

Graduate Committee Membership

1) Nolan Lacy, M.S., BSE, 2016 (advisor: Kevin Shinners).
2) Steven Vossberg, M.S., Agronomy, 2017 (advisor: Shawn Conley).
3) Jessica Drewry, Ph.D., BSE, 2017 (advisor: Chris Choi).

Extension/Outreach

Activities within Wisconsin:

1) Cuba Club Meeting (Retired Extension Employees): (30 attendees).
2) Western Wisconsin Ag. Lenders Association (Dunn County): (140 attendees).
3) Wisconsin Cranberry Growers Association Cranberry School: (230 attendees).
4) Symposium 2016 (MFA, WCO, Nutrient Applicators) Meeting: (70 attendees).
5) Wisconsin Corn/Soy Expo – Attended only, No Presentation.
6) Portage Co. Vegetable Growers Meeting: (70 attendees).
7) Clark Co. Precision Ag. Meeting: (30 Attendees).
8) JCEP Conference: AgrAbility Poster (~30 contacts).
9) Cranberry Growers Spring Meeting: (100 attendees).
10) Madison West Kiwanis Club: (30 attendees)
11) BASF Field Day: Invited Presentation (175 attendees).
12) Farm Tech. Days Safety Training: (200 attendees).
13) Farm Tech. Days Field Demo Machinery Liaison.
14) AgrAbility Neighbor to Neighbor Meeting: (10 attendees).
15) Cranberry Growers Summer: (50 attendees).
16) Soils/Agronomy Field Day: (40 attendees).
17) Dunn Co. Fall Field Day: (80 attendees).

18) Jackson Co. Ag. Lenders Meeting: (5 attendees).

National Extension Activities:

1. National AgrAbility Training Workshop: (20 attendees).

Funded Research Projects

1) *Image processing based kernel processing score determination via smart device: Smart Device application finalization, testing, and deployment.*
B. D. Luck
Funding: Midwest Forage Association Midwest Forage Research Program
Collaborators: None
Description: Finalization of smartphone application for deployment. Application uses image processing techniques to determine the particle size distribution of corn kernels contained within chopped and processed corn silage.

2) *Remote sensing via unmanned aerial vehicles of cranberry beds (continuation).*
B. D. Luck
Funding: Wisconsin Cranberry Board
Collaborators: None
Description: Develop materials for fitting a UAV with multi-spectral camera for measuring vegetative indices in cranberries. Collect weekly data on cranberry beds in central Wisconsin. Develop training material for analyzing vegetative indices data for cranberry beds.

3) *Quantifying and characterizing digital information technology needs to support Wisconsin Agriculture.*
J. Shutske, **B. D. Luck**, D. Trechter, M. Alverez-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.

4) *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) **B. D. Luck**, J. D. Davis, J. L Purswell, A. S. Kiess, S. J. Hoff. 2017. Assessing the effect of house size and design on air velocity distribution in commercial broiler houses. *Transactions of the ASABE. Accepted with revisions.*
2) **B. D. Luck**, J. D. Harmon, and R. L. Willett. 2017. In-field determination of kernel processing score via image analysis techniques for harvested corn silage. *Computers and Electronics in Agriculture. In Development.*
3) **B. D. Luck**, N. Dudenhoeffer. 2017. A simple model for estimating equipment requirements for optimized forage harvest. *Computers and Electronics in Agriculture. In Development.*
4) J. L. Drewry, C. Y. Choi, J. Mark Powell, and **B. D. Luck**. 2017. Computational model of methane and ammonia emissions from dairy barns: development and validation. Computers and Electronics in Agriculture. Submitted and *In Review.*

Meeting Papers:

1) J. D. Harmon and **B. D. Luck**. 2016. Data recording methods and time-motion analysis of the forage harvest process. *Proceedings from the 2016 ASABE Annual International Meeting.* Paper No. 162462681. Orlando, FL.

Extension Publications:

1) **B. D. Luck**. 2017. Calibrate your yield monitor for greater accuracy during harvest. *In review for publication at UWEX Learning Store.*

Service

BSE Committees:

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

UWEX Committees:

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

ASABE Committees:

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

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

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

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

Teaching

Spring 2016:
BSE 365: 3 credits, 42enrolled (co-teaching)
BSE 699: 2 enrolled for 3 credits,
BSE 990: 1 enrolled for 9 credits and 3 for 3 credits
Summer 2016:
BSE 990: 1 enrolled for 1 credit and 3 for 2 credits
Fall 2016:
BSE 299: 2 enrolled for 2 credits each
BSE 460: 3 credits, 19 enrolled
BSE 699: 1 enrolled for 1 credit
BSE 799: 1 enrolled for 3 credits
BSE 990: 1 enrolled for 1 credit, 2 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 Zhang (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)

Postdocs and Visiting Scholars:
1) Dr. Shirishkumar Harde (Postdoc)
2) Dr. Zongquan Li (Visiting Professor, Qilu University of Technology, China)
3) Dr. Gaojin Lyu (Visiting Professor, Qilu University of Technology, China)
4) Dr. Xiaohui Yang (Visiting Professor, Institute of Chemical Industry of Forestry Products, Chinese Academy of Forestry)
5) Dr. Yuliang Li (Visiting Professor, Chang'an University, China)
6) Dr. Suleman Tahir (Visiting Professor, University of Gujrat, Pakistan)

Research Projects

1) NSF (National Science Foundation) (CBET 1236562), Xuejun Pan (PI), "Fundamental understanding of HDA process: one-step conversion of lignocellulosic biomass to furan-based precursors for drop-in liquid fuel", $336,901 (October 2012 - September 2016).
2) NSF (National Science Foundation) (CBET 1159561), Xuejun Pan (PI), "Fast saccharification of lignocellulosic biomass under mild conditions in the medium of concentrated lithium bromide", 298,686 (July 2012 - June 2016)
3) USDA McIntire Stennis (WIS01861), Xuejun Pan (PI), "Conversion of Forest Residue into High-Value Furan-Based Chemicals and High-Quality Lignin in Biphasic System Involving Molten Salt Hydrate", $160,000 (October, 2015- September, 2019)
4) UW Bridge Funding, Xuejun Pan (PI), "Design and synthesis of cellulase-mimetic bifunctional solid acids for hydrolyzing cellulose", $36,600 (June. 2015 – Jun. 2017)
5) UW Graduate School, Xuejun Pan (PI), "Direct Conversion of Cellulose into Chemicals and Fuel Precursors in a Biphasic Organosolv System", $36,953 (Jul. 2015 – Jun. 2016)

Grant Proposals

1) NSF (PD 16-1440): Xuejun Pan (PI). SusChEM: Fabrication of functionalized mesoporous biosorbent from whole biomass and application in indoor air purification. Budget $359,630, submitted October 20, 2016. (Pending)

2) NSF (PD 16-7644): Xuejun Pan (PI). Fabrication and fundamental understanding of cellulase-mimetic bifunctional solid acids for hydrolyzing cellulose. Budget $368,165, submitted October 20, 2016. (Pending)
3) Y2018 Hatch: Xuejun Pan (PI) and Krishnapuram Karthikeyan (Co-PI). Fabrication and functionalization of whole biomass aerogels from forest residue as biosorbents for heavy metals. Budget $163,576, submitted September 2, 2016. (Funded)
4) 2016 UW Graduate School: Xuejun Pan (PI). Fabrication and functionalization of whole biomass aerogel as a biosorbent to remove toxic formaldehyde from indoor air. Budget: $44,337, submitted September 2, 2016. (Not funded)
5) USDA AFRI (A1531 – Bioprocessing and Bioengineering): Xuejun Pan (PI). Fabrication of low-cost and functionalized aerogel from whole biomass of forest residue for removal of formaldehyde from air. Budget $499,358, submitted July 13, 2016. (Not funded)
6) DOE EERE: Xuejun Pan, John Ralph, and Robert Anex, One-pot process for converting lignocellulosic biomass to furan-based precursors for hydrocarbon fuel and high-quality lignin for value-added coproducts. Submitted on Feb 16, 2016. (Not funded)

Patents

1) Shuai, L. and X.J. Pan. Method for producing liquid hydrocarbon fuels directly from lignocellulosic biomass. US 9,487,712B2, Nov. 8, 2016.

Publications

Google Scholar: citations, 5920; H index, 36; i10, 62.

Peer-Reviewed Journal Articles

1) Xiaohui Yang, Ning Li, Xuliang Lin, Xuejun Pan, and Yonghong Zhou. Selective cleavage of the aryl ether bonds in lignin for depolymerization by acidic lithium bromide molten salt hydrate under mild conditions. *Journal of Agricultural Food and Chemistry*, 2016, 44, 8379-8387.
2) Qiang Yang and Xuejun Pan. Bifunctional porous polymers bearing boronic and sulfonic acids for hydrolysis of cellulose. *ACS Sustainable Chemistry and Engineering*, 2016, 4, 4824-4830.
3) Ning Li, Xuejun Pan, and Jane Alexander. A facile and fast method for quantitating lignin in lignocellulosic biomass using acidic lithium bromide trihydrate (ALBTH). *Green Chemistry*, 2016, 18, 5367-5376.
4) Qiang Yang and Xuejun Pan. Synthesis and application of bifunctional porous polymers bearing chloride and sulfonic acid as cellulase-mimetic solid acids for cellulose hydrolysis. *BioEnergy Research*, 2016, 9, 578-586.
5) Qiang Yang and Xuejun Pan. Correlation between lignin physicochemical properties and inhibition to enzymatic hydrolysis of cellulose. *Biotechnology and Bioengineering*, 2016, 113, 1213–1224.
6) Hongdan Zhang, Ning Li, Xuejun Pan, Shubin Wu, and Jun Xie. Oxidative conversion of glucose to gluconic acid by iron (III) chloride in water under mild conditions. *Green Chemistry,* 2016, 18, 2308-2312.
7) Chang Geun Yoo, Hoon Kim, Fachuang Lu, Ali Azarpira, Xuejun Pan, Kyeong Keun Oh, Jun Seok Kim, John Ralph, and Tae Hyun Kim. Understanding the physicochemical characteristics and the improved enzymatic saccharification of corn stover pretreated with aqueous and gaseous ammonia. *BioEnergy Research*, 2016, 9 (1), 67-76.
8) Shirishkumar Harde, Zening Wang, Maxwell Horne, Junyong Zhu, and Xuejun Pan. Microbial lipid production from SPORL-pretreated Douglas fir by *Mortierella isabellina*. *Fuel*, 2016, 175, 64-74.
9) Zhiqiang Pang, Cuihua Dong, and Xuejun Pan. Enhanced deconstruction and dissolution of lignocellulosic biomass in ionic liquid at higher water content by lithium chloride. *Cellulose*, 2016, 23, 323-338.

Invited Book Chapters (peer-reviewed)

1) C.G. Yoo and X.J. Pan. Pretreatment of lignocellulosic feedstocks. In: "Bioenergy: Principles and Applications", Edited by Y.B. Li and S.K. Khanal, John Wiley & Sons, Inc., 2016, pp. 201-223. (ISBN: 9781118568316)
2) Q. Yang and X.J. Pan. Fabrication and applications of biocompatible graphene oxide and graphene. In: "Handbook of Graphene Science", Edited by Mahmood Aliofkhazraei, Nasar Ali, William I. Milne, Cengiz S. Ozkan, Stanislaw Mitura, Juana L. Gervasoni. CRC Press/Taylor & Francis, 2016, pp. 125-132. (ISBN: 9781466591271)
3) C. Zhang, R. Gleisner, C.J. Houtman, X.J. Pan, and J.Y. Zhu. Sulfite pretreatment to overcome the recalcitrance of lignocelluloses for bioconversion of woody biomass. In: "Biomass Fractionation

Technologies for a Lignocellulosic Feedstock Based Biorefinery", Edited by S. I. Mussatto, Elsevier, 2016, pp. 495-537. (ISBN: 9780128023235)

Technical Report

1) J.Y. Zhu, Chao Zhang, Rolland Gleisner, Carl J. Houtman, and Xuejun Pan. Bioconversion of woody biomass to biofuel and lignin co-product using sulfite pretreatment to overcome the recalcitrance of lignocelluloses (SPORL). USDA Forest Service, Forest Products Laboratory, General Technical Report FPL-GTR-240, September 2016.

Invited Seminars

1) X.J. Pan. Design, synthesis and performance of cellulase-mimetic polymeric solid acid catalysts for cellulose hydrolysis. June 21, 2016, Tianjin University of Science and Technology, Tianjin, China.
2) X.J. Pan. Research, development and production of fuel ethanol in the United States. May 30, 2016, Central South University of Forestry and Technology, Changsha, China.
3) X.J. Pan. Fundamental understanding and removing strategies of the inhibitory effects of lignin on enzymatic saccharification of lignocellulose. May 23, 2016, South China University of Technology, Guangzhou, China.

Oral Conference Presentations

1) Yang Liao and Xuejun Pan. Preparation of whole biomass aerogels from Douglas fir using molten salt hydrate as solvent. 2016 AIChE Annual Meeting, November 13-18, 2016, San Francisco, CA.
2) Xuejun Pan, Ning Li, and Jane Alexander. A new method for fast lignin quantitation of lignocellulosic biomass. 5th ISETPP & 3rd IPEC, November 6-9, 2016, Guangzhou, China.
3) Ning Li, Joseph Kraft, and Xuejun Pan. Enhanced saccharification of biomass to aqueous soluble oligosaccharides and monosaccharides at high biomass loading in molten slat hydrate medium. 251st *ACS National Meeting & Exposition,* March 13-17, 2016, San Diego, CA.
4) Gaojin Lyu, Chang Geun Yoo, and Xuejun Pan. Oxidative cracking of lignin with molecular oxygen for production of aromatics and organic acids under mild conditions. 251st *ACS National Meeting & Exposition,* March 13-17, 2016, San Diego, CA.

Poster Conference Presentations

1) Zening Wang, Shirishkumar M. Harde, J. Y. Zhu, and Xuejun Pan. Microbial lipid production from SPORL-Pretreated Douglas fir by Mortierella isabellina. 38th Symposium on Biotechnology for Fuels and Chemicals. April 25-28, 2016, Baltimore, Maryland.

Award and Honors

1) J.Y. Zhu, G.S. Wang, and X.J. Pan. Nominated for the Marcus Wallenberg Prize (2016)
2) X.J. Pan. Distinguished Visiting Chair Professorship at South China University of Technology, sponsored by the Ministry of Education of China (2016)
3) X.J. Pan. Distinguished Visiting Chair Professorship at Tianjin University of Science and Technology, sponsored by Tianjin municipal government, China (2016)

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 (10 hr)
e) CoE UPRC/ABET Assessment Committee (80 hr)
f) CoE Academic Policy, Curriculum, and Regulation Committee (APCRC) committee (20 hr)
2) Graduate thesis committee
a) Edgardo Ortiz, 2016, PhD in Biological Systems Engineering.
b) Sampath Gunukula, 2016, PhD in Biological Systems Engineering.
c) Wu Lan, 2016, PhD in Biological Systems Engineering.
d) Ville Pihlajaniemi, 2016, PhD in Chemical Technology, Aalto University, Finland.

Civic Service

1) Editorship
a) Associate Editor, *BioEnergy Research*
b) Editorial board member *Journal of Biobased Materials and Bioenergy*
c) Editorial board member of *International Journal of Agricultural and Biological Engineering*
2) Conference Organization
a) Chair of Session 276: Biomass Characterization, Pretreatment and Fractionation. 2016 AIChE Annual Meeting, November 13-18, 2016, San Francisco, CA.

b) Chair of Session 7 at 5th International Symposium on Emerging Technologies of Pulping and Papermaking & 3rd International Papermaking and Environment Conference, November 7-9, 2016, Guangzhou, China.

3) Journal Article Reviewer

a) ACS Sustainable Chemistry and Engineering (x4)
b) Catalysis Letters (x1)
c) ChemSusChem (x3)
d) Energy Technology (x1)
e) Fuel (x1)
f) Green Chemistry (x3)
g) Journal of Physical Chemistry (x1)
h) Journal of Wood Chemistry (x1)
i) RSC Advances (x1)
j) Scientific Reports (x1)

4) Proposal Reviewer

a) USDA NIFA proposals (x7)
b) USDA SBIR proposal (x1)
c) WARF Discover Challenge proposals (x5)

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 2016
BSE/IES 367, Renewable Energy Systems
Team taught with Troy Runge
3 Credits, 113 enrolled
Fall 2016
BSE/IES 367, Renewable Energy Systems,
Team taught with Troy Runge
3 Credits, 92 enrolled
BSE 509: Advised one group of 3 students

Graduate and Post Docs Advisees

1) John Penry, PhD Diary Science, 2016
2) Jack Buchanan, PhD, GNIES, 2016.
3) Dr. John Upton, Post Doctoral Milking Machine Researcher, 100% appointment,
4) Dr. Muireann Ni Chonfhaola, Post DoctoralMilking Machine Researcher, 50% appointment
5) Horacio A. Aguirre-Villegas, Post Doctoral LCA Researcher, Co-advised with Rebecca Larson

Extension / Outreach

Support UWEX agent programs in Milking Machines, Milking Parlors, Robotic Milking, Milking Management, Energy, and Bio-Energy:
Agent Outcome Evaluation: 4.25/5.0
External Stakeholder Programs
Milking Quality web site Development
MilkTech professional development courses
International On-Line curriculum used in USA, Argentina, and China
Midwest Rural Energy Council: Web site development, Annual board meeting and conference planning (2 days), Annual educational conference on rural energy issues (3 days, attendance 120), Stray Voltage Investigators Courses (4 days, attendance 40)

Funded Research Projects

1) Milking Machine Research ($150k/yr) Collaborators: P Thompson, BSE. Funding: Avon Dairy Solutions. Objectives: Advance the science of biomechanics of machine milking and milking management.
2) Climate Change Mitigation and Adaptation In Dairy Production ($60k/yr) Collaborators: R Larson, M Ruark, M Jahn, M Watteaux, B Bland, M Stephenson Funding: AFRI/CAP Objectives: Life Cycle Assessment of Dairy Production Systems.
3) Milking Physiology Research ($64k/yr) Co-Pi with Laura Hernandez, UW Diary Science

4) Automated Pre-Milking Preparation ($30k/yr) Collaborators: P Ruegg, Dairy Science Funding: Future Cow Inc. Objectives: Assess sanitary and stimulation efficacy and of automated pre-milking preparation.

Research Proposals Submitted

1) Factors Affecting Teat Congestion and milking efficiency. Ph.D. Fellowship, 4 years. Collaborator, Dr. John Upton, Teagasc Dairy Research Institute, Moorpark, Ireland (funded)
2) Machine Milking Management Strategies. Collaborators: P Thompson, Avon Dairy Solutions (Funded)

Publications

Google Scholar: Citations 1600, H index-19, i10-41

Peer reviewed Journal Articles

1. Penry, JF, EL Endres, B de Bruijn, A. Kleinhans, PM Crump, DJ Reinemann, LL Hernandez, 2016. Effect of incomplete milking on milk production rate and composition with 2 daily milkings. J. Dairy Sci. Available online 9 December 2016
2. Penry, JF, J Upton, GA Mein, MD Rasmussen, I Ohnstad, PD Thompson, and DJ Reinemann, 2016. Estimating teat canal cross-sectional area to determine the effects of teat-end and mouthpiece chamber vacuum on teat congestion, J. Dairy Sci.
3. Cronin, KR, TM Runge, X Zhang, RC Izaurralde, DJ Reinemann and JC Sinistore, 2016. Spatially Explicit Life Cycle Analysis of Cellulosic Ethanol Production Scenarios in Southwestern Michigan, BioEnergy Research, In press.
4. Upton J, DJ Reinemann, JF Penry, and PD Thompson, 2016. A quarter milking analysis device: Development and demonstration. Biosystems Engineering, 147(2016)259-264.
5. Penry, JF, S Leonardi, J. Upton, PD Thompson and DJ Reinemann, 2016 Assessing liner performance using on-farm milk meters. J. Dairy Sci. 99(1-10)
6. Upton J, JF Penry, MD Rasmussen, PD Thompson and DJ Reinemann, 2016. Effect of pulsation rest phase duration on teat end congestion. Journal of Dairy Science 99:1-8.

Books

1. Reinemann, DJ, and MD Rasmussen, 2016. Milking Parlors. In: Fuquay JW, Fox PF and McSweeney PLH (eds.), Encyclopedia of Dairy Sciences, Third Edition, San Diego: Academic Press

Conference Proceedings

1. Penry, JF, J Upton, MD Rasmussen, I Ohnstad, PD Thompson and DJ Reinemann, 2016. Effects of teat-end vacuum and mouthpiece chamber vacuum on teat-end swelling. 6th IDF Mastitis Conference, Nantes France, 2016.
2. Hernandez, LL, VJ McKeon, EL Endres, A de Bruijn, A Kleinhans, and DJ Reinemann, 2016. Effects of increasing residual milk on milk yield and composition. J. Animal Sci., Vol. 94, Supp. 5, pp. 407-408
3. Rasmussen, MD, A Dzidic, V Tancin, R Ginsberg, R Bruckmaier, DJ Reinemann, 2016. When should the cluster be detached for cows? 6th IDF Mastitis Conference, Nantes France, 2016
4. Penry, JF, PM Crump, J Upton and DJ Reinemann, 2016. Assessment of Changes in Quarter Milk Yield Ranking in Early Lactation. Proceedings of the 55th Annual Meeting of the National Mastitis Council (NMC).

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

Troy is a member of the Wisconsin Energy Institute where his lab group is located. He is working on several manure processing project investigating cost effectives 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 2016	24
BSE 367*	Spring 2016	107
BSE 299	Spring 2016	1
BSE 249	Fall 2016	83
BSE 367*	Fall 2016	88
BSE 509**	Fall 2016	4

* Co-taught with Prof. Reinemann.

**Served as senior project advisor

Graduate and Post Docs Advisees

1) Evan Price, M.S. BSE 2017.
2) Anurag Mandalika, PhD BSE, 2018.
3) Shengzhi He, PhD BSE, 2019.
4) Zong Liu, Post-Doctoral Researcher
5) Qiang Yang, Post-Doctoral Researcher
6) Mahmoud Sharara, Post-Doctoral Researcher
7) Shengfei Zhou, Post-Doctoral Researcher

Outreach

1) Supported Wisconsin Energy Institute programs including:
   Meetings with state representatives
   UW Alumni Event Speaker (San Diego, CA)
   Meetings with WI Publics Service Commission
   Meetings with interested industry collaborators
   Provide information to UW Extension specialists.
2) Assisted several farms with manure separation/management issues

Funded Research Projects

1) Dried Distiller Grain Based Polymer Dispersions for Paper Coatings.
   Collaborators: R. Anex, BSE.
   Funding: USDA NIFA Critical Ag
   Objectives: Develop a process to extract hemicelluloses as a gum material from DDG residual at a corn ethanol plant.
2) Accelerated Renewable Energy
   Collaborators: J. Markley, Biochem, T. Cox, AAE, and J. Leverich, UW Ext.
   Funding: USDA BRDI
   Objectives: Assess a process to separate digested manure into value added components and investigate the potential to produce cellulosic ethanol.
3) Improving the Value of Agricultural Residues as Feed through Xylan Extraction and Utilization in Pulp and Paper
   Funding: USDA Hatch
   Objectives: Develop a system to utilize agricultural residual crops to improve the wood pulping process
4) Kewaunee County Biogas Systems
   Funding: Wisconsin PSC
   Objectives: Assess anaerobic digestion potential and environmental impact in Kewaunee County
5) Cellulose materials from GVL
   Funding: GlucanBio LLC

Objectives: Investigate a biorefinery system that using gamma-valerolactone separation process to create high value products from wood feedstocks.

6) GVL Biorefinery
   Funding: NSF
   Collaborators: GlucanBio LLC
   Objectives: Investigate a biorefinery system that using gamma-valerolactone separation process to create viscose pulps and cellulose nanomaterials.
7) 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.
8) Yahara Watershed Manure Management
   Collaborators: Becky Larson, BSE; Laura Good, Soil Science; and Pam Porter, P^2 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.
9) 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
10) 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

Publications

Peer reviewed Journal Articles

1. Karlen, Steven D., Chengcheng Zhang, Matthew L. Peck, Rebecca A. Smith, Dharshana Padmakshan, Kate E. Helmich, Heather CA Free, Seonghee Lee, Bronwen G. Smith, Fachuang Lu, John C. Sedbrook, Richard Sibout, John H. Grabber, Troy M. Runge, Kirankumar S. Mysore, Philip J. Harris, Laura E. Bartley, and John Ralph "Monolignol ferulate conjugates are naturally incorporated into plant lignins." *Science Advances* 2, no. 10 (2016): e1600393.
2. Yang, Qiang, and Troy Runge. "Polyethylenimines as Homogeneous and Heterogeneous Catalysts for Glucose Isomerization." *ACS Sustainable Chemistry & Engineering* (2016).
3. Yang, Qiang, Wu Lan, and Troy Runge. "Salt-promoted Glucose Aqueous Isomerization Catalyzed by Heterogeneous Organic Base." *ACS Sustainable Chemistry & Engineering* (2016).
4. 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* (2016): 1-13.
5. Liu, Zong, Mahmoud Sharara, Sundaram Gunasekaran, and Troy M. Runge. "Effects of Large-Scale Manure Treatment Processes on Pathogen Reduction, Protein Distributions, and Nutrient Concentrations." *Transactions of the ASABE* 59 no. 2 (2016): 695-702.
6. Liu, Zong, Zachary S. Carroll, Sharon C. Long, Sundaram Gunasekaran, and Troy Runge. "Use of cationic polymers to reduce pathogen levels during dairy manure separation." *Journal of Environmental Management* 166 (2016): 260-266.
7. Yang, Qiang, Matthew Sherbahn, and Troy Runge. "Basic Amino Acids as Green Catalysts for Isomerization of Glucose to Fructose in Water." *ACS Sustainable Chemistry & Engineering* 4 no. 6 (2016): 3526–3534.
8. Elumalai, Sasikumar, Bhumica Agarwal, Troy M. Runge, and Rajender S. Sangwan. "Integrated Two-stage Chemically Processing of Rice Straw Cellulose to Butyl Levulinate." *Carbohydrate Polymers* 150 (2016): 286-298.
9. Xiang, Zhouyang, Renil Anthony, Wu Lan, and Troy Runge. "Glutaraldehyde Crosslinking of Arabinoxylan Produced from Corn Ethanol Residuals." *Cellulose*, 23 no. 1 (2016): 307-321.

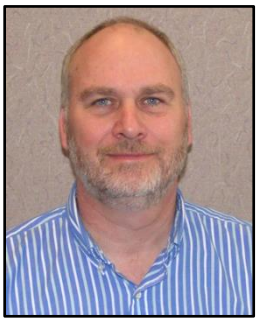
10. Xiang, Zhouyang, Wenhua Gao, Liheng Chen, Wu Lan, J.Y. Zhu, Troy Runge. “A Comparison of Cellulose Nanofibrils Produced from *Cladophora glomerata* Algae and Bleached Eucalyptus Pulp.” *Cellulose*, 23 no. 1 (2016): 493-503.
11. Yang, Qiang, Shengfei Zhou, and Troy Runge, **"Dairy manure as a potential feedstock for cost-effective cellulosic bioethanol."** *BioResources* 11 no. 1(2016): 1240-1254.
12. Xiang, Zhouyang, and Troy Runge. "Emulsifying properties of succinylated arabinoxylan-protein gum produced from corn ethanol residuals." *Food Hydrocolloids* 52 (2016): 423-430.
13. Liu, Zong, Zachary S. Carroll, Sharon C. Long, Sundaram Gunasekaran, and Troy Runge. "Use of cationic polymers to reduce pathogen levels during dairy manure separation." *Journal of Environmental Management* 166 (2016): 260-266.

Conference Proceedings

1. Sharara, Mahmoud; Qiang Yang; Thomas Cox; Troy Runge. Techno-economic assessment of dairy manure granulation. Annual International meeting of the American Society of Agricultural and Biological Engineering (ASABE), Orlando, FL – July 2016
2. Sharara, Mahmoud; Rebecca Larson; Troy Runge Spatially-explicit methodology for manure management at the watershed level. Annual International meeting of the American Society of Agricultural and Biological Engineering (ASABE), Orlando, FL – July 2016
3. Liu, Zong; Sharon Long; Troy Runge. Bacteria antibiotic-resistance evaluation in dairy manure treated using polymer. Annual International meeting of the American Society of Agricultural and Biological Engineering (ASABE), Orlando, FL – July 2016

Service

- Graduate thesis committees
  - Edgardo Ortiz, BSE
  - Sampath, Gunukala, BSE
  - Lei Gu, BSE
- BSE committees
  - Undergrad Instruction (80 hrs)
  - External Relations (20 hrs)
- UW Madison committees
  - SciMed Graduate Research Scholars Advisory Board
  - CALS Facility Committee
- Professional societies
  - American Society of Agricultural and Biological Engineers
  - Technical Association of Pulp and Paper Paper, Non-wood Committee
  - Reviewer for USDA and NSF grant submissions.



Kevin J. Shinners

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

Dr. Shinners has lead responsibilities for the Machinery Systems Engineering teaching and research program in BSE. He has been a member of the BSE faculty since 1985 and he works to create engineering improvements to the machines, practices and processes used to harvest, handle, store, and transport of hay, forage, and biomass crops. His current research focuses on single-pass biomass residue harvesting; improved logistics efficiency for chopped, bulk biomass; reducing costs of perennial grass biomass logistics; and fractional harvest of forage crops for improved animal utilization. Dr. Shinners 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 2016

BSE / ME 476, Off-Road Vehicle Engineering
3 Credits, Enrollment – 38
Instructor Rating – 4.64/5.00

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

Fall 2016

BSE / ME 475, Engineering Principles of Agricultural Machines
3 Credits, Enrollment – 20
Instructor Rating – 4.30/5.00

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

Research Group

Graduate Students Completed in 2016:

1) Chase Walters – MS BSE; MacDon Industries
2) Nolan Lacy – MS BSE; MacDon Industries

Current Graduate Students:

1) Justin Thiede - MS BSE; May 2017
2) Dan Flick – MS BSE; May 2018
3) Josh McAfee – MS BSE; December 2017
4) Cyrus Nigon – MS BSE; December 2017

Visiting Scholar

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

Undergraduate Students Employed in 2016:

Jake Hrebik, Eric Pessig; Reid Christ

Undergraduate USDA Summer Intern:

Rosemary Nicholson – Penn State

Outreach Presentations

Invited Presentations:

1) Wrapped Bale Silage. Presented at the 2016 Sheboygan County Forage Council Annual Meeting, Waldo, WI. January 22nd, 2016.
2) Forage Harvester Operating and Adjustment Principles. Presented at VitaPlus Training Session; Arlington, WI; August 3rd, 2016.
3) Innovative Ways to Preserve Hay Quality. Presented at California Hayd and Forage Symposium. Reno, NV Dec. 4th, 2016.

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) Improving harvest technologies for fractionating alfalfa into leaf and stem fractions.
Collaborators: Ron Hatfield & Rich Muck, 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) Lacy, N.C. and K.J. Shinners. 2016. Reshaping and recompressing round biomass bales. Trans. ASABE. 59(4): 795-802.
2) Nigon, B.J., K.J. Shinners and D.E. Cook. 2016. Harvester modifications to alter composition and dry matter of corn-silage. Applied Engr. Agr. 32(2):157-167.
3) Cook, D.E., R. W. Bender, K. J. Shinners, and D. K. Combs. 2016. The effects of calcium oxide treated whole-plant and fractionated corn-silage on intake, digestion, and lactation performance in dairy cows. 99(7): 5385–5393.

Service

Graduate Committees

1) Josh Harmon
2) Nate Dudenhoffer
3) Jordi Clar

Mentor Committees

1) Brian Luck – Chair

Department

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

College and University

1) CALS Ag Research Stations Oversight Committee

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 (2)
2) Biofuels, Bioproducts and Biorefining (1)

John Shutske

Professor, Ph.D.
10% Teaching / 30% Research / 60% Extension
Safety Engineering & Agricultural Health

On July 1, 2016, Dr. Shutske returned to the Biological Systems Engineering Department after eight years in CALS and UW-Extension administration. Dr. Shutske' s interests and activities include research, outreach, and education to help people apply, design, and evaluate new technologies, including sensors, robotics, automation, and wireless systems especially in ways that can 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.

In the near future, Dr. Shutske will engage students and external stakeholders to explore innovative development and adoption of relatively new concepts in ag and food systems including "big data," the Internet of things (IoT), artificial intelligence, and virtual reality. The focus of this work will always be to help the ag sector apply these new ideas to safely and sustainably grow our food system as we face the many challenges of feeding a growing world population.

Teaching

Fall 2016

BSE 409: Career Management for Engineers

Presentations, Workshops, Seminars

1. Feeding Nine Billion People in a Changing World. InterAg 165 – Issues in Agriculture, Environment, and Life Sciences (30 people)
2. Wisconsin Agriculture and Extension – to Wisconsin Cranberry Grower's Association Leadership Development cohort (20 people)
3. Farm Injury and Illness Prevention – to Wisconsin Academy of Rural Medicine (WARM) participants. (25 people)
4. Changes in Cooperative Extension and the College of Ag & Life Sciences – to WI Nutrient/Pest Management and Integrated Pest Management Technical Advisory Council (20 people)
5. Changes, Updates, and Feedback for WFTD. – to external industry advisory group to Wisconsin Farm Technology Days (20 people).
6. Cooperative Extension, a Vision for the Future – to UWEX/CALS retiree group (35 people)
7. Digital Technology in Wisconsin Agriculture – What Are You Doing? (…and what more do you need?) - – to WI Nutrient/Pest Management and Integrated Pest Management Technical Advisory Council (20 people)
8. Being Digital: ANRE's Needs & How Do We Get There? – Presented to ANRE annual professional development conference colleagues (35 people)
9. Our Brain on Stress – Keynote talk (90 minute workshop at) Coaching Your Clients Through This Rough Patch professional development sessions – presented five times at Tomah, Chippewa Falls, Appleton, Oconomowoc, and Dodgeville. Audience was financial consultants; the media; ag organization leaders; clergy; health professionals; educators. (105 people total in five sites).
10. Agriculture online: Getting on, Growing, Profiting- (with Kara O'Connor, Wisconsin Farmer's Union) – Presented to Wisconsin rural leaders at UWEX Broadband Bootcamp. (45 people)
11. Manure Gas Monitoring and Safety – National webinar (75 minutes) coordinated by Cheryl Skjolass, done with Becky Larson, Jeff Nelson and National e-Xtension Network (90 people).
12. This is Our Brain on Stress – National webinar done by AgriSafe Network (90 people)
13. Feeding Nine Billion People in a Rapidly Changing World – Presented to general session of Farm and Industry Shortcourse (75 people)

Podcasts & Videos

1. Corn Silage: Equipment Settings and Safety
2. Corn Silage: Feed Out Safety
3. Corn Silage: Signs of Proper Processing, Packing, and Storage Plus Safety Tips

Articles

1. New Technologies Give Rise to New Safety Opportunities – and Hazards
2. Farm Progress Show - Autonomous Tractor, Drones, Data Products
3. Companies Aggressively Pursue Artificial Intelligence in Agriculture
4. 12 Technological Forces That Will Shape Our Future
5. Technology in Extension - a Future Vision
6. Agritourism Health and Safety Guidelines for Children
7. Stress, Fatigue, and the Custom Applicator
8. Don't Get Beat by the Heat!
9. Fall Harvest Ag Safety Public Service Announcements
10. Keep People Healthy at Fairs, Shows, and Ag-Tourism Venues
11. Silage Season Safety - General Safety Info
12. Silage Season Safety - Processing & Packing
13. Silage Season Safety - Pre-Season Preparation
14. Update info on Manure Basin Fatality in Portage County
15. Manure Handling Safety Webinar - Focus on Recent Deaths and Incidents & Practical Solutions
16. Prepare for a Safe Harvest
17. Silo Gas - An Important Airborne Hazard
18. Combine Fire Prevention & Preparedness
19. Farm Safety & Connections to Stress
20. Financial Worries Connected to Sleep Loss & Possible Injury Risk
21. National Farm Safety & Health Week – 2016
22. Respiratory Health with Dusty & Moldy Grain
23. Coaching Your Clients - Coping with Stress During Difficult times
24. Farm Stress & Decision Making During Challenging Times
25. Our Brain on Stress: An Introduction
26. Part 2. Acute Stress, the HPA, and the Chase on the African Savannah

Coverage by Media and Popular Press

1. How To Avoid The Risks Of Heat Stress
2. The Hidden Dangers of Farming
3. Getting Through Tough Times
4. Be Prepared for Combine Fires
5. Safety First During Harvest
6. Experts Urge Farmers To Put Safety First During Fall Harvest
7. Fatal fumes lurk in manure storage facilities
8. Farm stress: Something to fear or a call to action?

Awards Received

1. Program Innovation Award - The Agricultural Podcasts Team, with other recipients including Liz Binversie (primary), Kevin Jarek, Tina Kohlman, Matt Lippert, Mark Mayer, Sarah Mills-Lloyd, Heather Schlesser, Trisha Wagner, Matt Akins, Paul Fricke, Brian Holmes, David Kammel, Joe Lauer, and Randy Shaver
2. Special Career Recognition Award – UWEX and ANRE
3. 2016 Award for Excellence from the University of Wisconsin Colleges and University of Wisconsin-Extension

Service Activities

1. Chair, West Madison Agricultural Research Station Visioning Committee.
2. Chair, Wisconsin Farm Technology Days, Inc.
3. UW-Extension, Cooperative Extension, Statewide Organizational Structure (co-chair of primary committee and also member of an overarching steering committee) – note, this represented a MAJOR time commitment during much of the second half of 2016.
4. UW-Extension, Cooperative Extension, Integrated Working Group (ad-hoc member in late 2016, ongoing)
5. Advisory Board of Upper Midwest Agricultural Safety and Health Center (UMASH) http://umash.umn.edu/advisory-board/
6. Wisconsin Farm to School Advisory Council
7. Board of Directors – AgSource Cooperative
8. UWCC Advisory Committee - UW Center for Cooperatives
9. UW Extension Broadband Adoption and Utilization Advisory Council (council ended its work mid-2016)
10. UniverCity Advisory Group (ended appointment on June 30, 2016)
11. North Central Education/Extension Research Activity (NCERA 197): Agricultural Safety and Health Research and Extension –

12. American Farm Bureau Federation (AFBF) Technical consultant and advisor – Comprehensive youth agricultural safety and health curriculum.

Articles in ANRE Update Administrative Newsletter

- Thank You Colleagues (in ANRE and Beyond)
- What's Up with nEXT Generation Planning?
- A Farewell to CALS and UW-Extension Administration
- Six Reasons Why We Cannot Be Replaced By Google
- nEXT Generation Work Group Update
- Transitions in Wisconsin Farm Technology Days
- New ANRE Things to Watch For & Learn More About
- Financial and Other Challenges in a Changing World
- Telling Your Story – Scholarship, Outcomes, Value
- The Value of ANRE in the Eyes of our Clientele and Stakeholders
- Changes in the Works for Wisconsin Farm Technology Days
- The Meaning of Digital
- The E-mail River
- ANRE Professionals Fulfill Dreams for Wisconsin
- FAA Registration – Drones
- Digital Tools that Facilitate Change

Funded Projects

- USDA-NIFA. Project: Mitigating transmission of antimicrobial resistance on large dairy farms by reducing behavioral pathways of exposure. Ruegg, Pamela L.(PI); Shutske, John; Sethi, Ajay; Goldberg, Tony; Suen, Garret; Safdar, Nasia. Funding Total: $1,200,000.
- 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
Recipient, Certificate in Honor of Service as an Outstanding Mentor, The Ronald E. McNair Post-Baccalaureate Achievement Program, University of Wisconsin – Madison, 2016

Teaching

Spring 2016:
BSE 508: Advisor to NR&E Group, 4 Enrolled
BSE 571: 3 credits, 16 Enrolled
BSE 699: 4 credits, 1 Enrolled
BSE 990: Various Research Credits, 1 Enrolled
ENVIR ST 718: 2 credits, 11 Enrolled
Summer 2016:
BSE 299: 3 credits, 1 Enrolled
BSE 699: 3 credits, 1 Enrolled
BSE 990: Various Research Credits, 3 Enrolled
ENVIR ST 719: 4 credits, 10 Enrolled
Fall 2016:
BSE 399: 1 credits, 1 Enrolled
BSE 509: Advisor to NR&E Group, 4 Enrolled
BSE 990: Various Research Credits, 2 Enrolled
ENVIR ST 717: 1 credit, 17 Enrolled
ENVIR ST 999: 1 credit, 10 Enrolled

Advising

Graduate Students:
Thesis
- Ed Boswell (Ph.D. in Soil Science, Expected December 2017)
- Elizabeth Buschert (M.S. in BSE and Nelson Institute Environment &Resources, Expected May 2017)
- Andrew Skog (M.S. in BSE, Expected December 2017)
- Sarah Fuller (M.S. in BSE and Nelson Institute Water Resources Management, Expected May 2018)
- Andrew Powers (M.S. in BSE, Expected May 2018)

Practicum
- Lucas Treutel (M.S. in Nelson Institute Water Resources Management, May 2016)
- Abigail Cook (M.S. in Nelson Institute Water Resources Management, Expected May 2017)
- Bridget Faust (M.S. in Nelson Institute Water Resources Management, Expected May 2017)
- Katherine Hanson (M.S. in Nelson Institute Water Resources Management, Expected May 2017)
- Eric Mortensen (M.S. in Nelson Institute Water Resources Management, Expected May 2017)
- Amanda Smith (M.S. in Nelson Institute Water Resources Management, Expected May 2017)
- Sean Spencer (M.S. in Nelson Institute Water Resources Management, Expected May 2017)
- Kevin Banas (M.S. in Nelson Institute Water Resources Management, Expected May 2018)

- Haley Briel (M.S. in Nelson Institute Water Resources Management, Expected May 2018)
- Jack Cotrone (M.S. in Nelson Institute Water Resources Management, Expected May 2018)
- Alex Delvoye (M.S. in Nelson Institute Water Resources Management, Expected May 2018)
- Marty Dillenburg (M.S. in Nelson Institute Water Resources Management, Expected May 2018)
- Sarah Fanning (M.S. in Nelson Institute Water Resources Management, Expected May 2018)
- Yiyi Hu (M.S. in Nelson Institute Water Resources Management, Expected May 2018)
- Alex Jeffers (M.S. in Nelson Institute Water Resources Management, Expected May 2018)
- Thor Jeppson (M.S. in Nelson Institute Water Resources Management, Expected May 2018)
- Yu Li (M.S. in Nelson Institute Water Resources Management, Expected May 2018)
- Ryan McGuire (M.S. in Nelson Institute Water Resources Management, Expected May 2018)
- Tom Pearce (M.S. in Nelson Institute Water Resources Management, Expected May 2018)
- Catherine Schumak (M.S. in Nelson Institute Water Resources Management, Expected May 2018)
- Yi Wang (M.S. in Nelson Institute Water Resources Management, Expected May 2018)

Post Master's and Post-Doctoral:

- Zach Zopp (Assistant Researcher)

McNair Postbaccalaureate Achievement Program:

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

Undergraduate Research Advisees:

- Anita Liu (B.S. Biological Systems Engineering, Expected May 2017)

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) "Implications of Climate Change and Biofuel Development for Great Lakes Regional Water Quality and Quantity."
Funding: U.S. Geological Survey – National Institute for Water Resources.
P.I.s: A.M. Thompson, B.J. Lepore, R. Jackson, K.G. Karthikeyan, D. Hyndman, A. Kendall, B. Basso, M. Feinen
Objectives: 1) collect detailed surface and subsurface water quality and quantity measurements to better understand the nutrient dynamics of biofuel crop systems, 2) enhance a recent SALUS and ILHM coupling, and parameterize the models for plot-scale simulations of biomass production and water/nutrient dynamics, 3) validate SALUS-ILHM at the regional scale and investigate the implications of climate change and intensive biofuel production in Great Lakes Basin watersheds in a range of hydrogeological settings.

4) "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) "Subsurface Fate and Transport of Cryptosporidium in Soils of Wisconsin's Carbonate Aquifer Region."
Funding: Wisconsin Groundwater Coordinating Council.
P.I.s: K.G. Karthikeyan, A.M. Thompson, B.J. Lepore, S. Long
Objectives: 1) Determine whether irradiated C. parvum is an effective surrogate soil surface-to-groundwater tracers for future field studies of C. parvum transport, and 2) Determine the C. parvum fate and transport potential for several Wisconsin soils which have developed overlying NE Wisconsin's vulnerable carbonate aquifer.

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) Zopp, Z., J.M. Olstadt, K.G. Karthikeyan, A.M. Thompson, S. Long. 2016. *Cryptosporidium* Soil Extraction by Filtration/IMS/FA Compatible with USEPA Method 1623.1. *Agricultural & Environmental Letters*. doi:10.2134/ael2016.08.0031
2) Singh, H., A.M. Thompson, B. Gharabaghi. 2016. Event runoff and sediment-yield neural networks models for assessment and design of management practices for small agricultural watersheds. *Journal of Hydrologic Engineering*. doi:10.1061/(ASCE)HE.1943-5584.0001457
3) Lamba, J., A.M. Thompson, K.G. Karthikeyan, J. Panuska, and L. Good. 2016. Effect of best management practice implementation on sediment and phosphorus load reductions at subwatershed and watershed scale using SWAT model. *International Journal of Sediment Research*. 31(4):386–394. doi:10.1016/j.ijsrc.2016.06.004
4) Sabouri, F., B. Gharabaghi, A. Sattar, A.M. Thompson. 2016. Event-Based Stormwater Management Pond Runoff Temperature Model. *Journal of Hydrology*. 540:306-316. doi: 10.1016/j.jhydrol.2016.06.017.
5) Mailapalli, D.R., and A.M. Thompson. 2016. Effect of Polyacrylamide Coated Biosolid on Phosphorus Movement in Soil-Plant-Water System. *Journal of Solid Waste Technology and Management*. 42(4):260-271
6) Zopp, Z., A.M. Thompson, K.G. Karthikeyan, F. Madison, S. Long. 2016. Subsurface transport of Cryoptosporidium in soils of Wisconsin's carbonate aquifer region. *Journal of Environmental Quality*. 45(5):1607-1615

In Review:

7) Sattar, A., B. Gharabaghi, F. Sabouri, A.M. Thompson. 2016. Event-Based Thermal Assessment Tool for Urban Stormwater Management. *Hydrologic Processes*. (Revisions Requested)
8) Gocman, A., A. Wells, K. Nixon, N. Balster, D. Drake, J. Silbernagel, A.M. Thompson. 2016. Are All Conservation Subdivision the Same? A Comparative Assessment of Conservation Subdivision Landscape Structures. *Landscape and Urban Planning* (Revisions Requested)
9) Singh, H., A.M. Thompson, J.C. Panuska. 2016. Estimating sediment delivery ratios for grassed waterways using WEPP. *Land Degradation and Development*. (Revisions Requested)
10) Stenjem, R., A.M. Thompson, K.G. Karthikeyan, B.J. Lepore, A. Kendall, D. Hyndman. 2016. Subsurface water and nutrient dynamics of cellulosic biofuel cropping systems. *Agriculture, Ecosystems and Environment*.

Peer-Reviewed Conference Proceedings:

11) Boswell, E.P., A.M. Thompson, and N.J. Balster. 2016. Can the Cohesive Strength Meter be used to Estimate Critical Shear Stress in an Agricultural and Prairie Soil? MS #1105. AgroEnviron 2016: 10th International Symposium on Agriculture and the Environment. May 23-27, 2016.

Written Media Program Participation:

"A Tale of Two Estuaries", Article in *Times & Tides: The Voice of Green Lake*, 43(2): 2016

Abstracts/Papers/Presentations (Natural Resources & Environment)

1) Smith, A., S. Fuller, and A.M. Thompson. 2016. A Stricker's Pond Assessment. Poster Presentation. Student Research Symposium-Riveredge Nature Center, Saukville, WI. November 12, 2016. *Best Poster – Runner Up.
2) Boswell, E. A.M. Thompson, and Balster, N. 2016. Application of the cohesive strength meter to estimate critical shear stress and sediment detachment. Water @UW-Madison. University of Wisconsin-Madison. October 28, 2016.
3) Boswell, E.P., A.M. Thompson, and N.J. Balster. 2016. Can the Cohesive Strength Meter be used to Estimate Critical Shear Stress in an Agricultural and Prairie Soil? Poster Presentation. AgroEnviron 2016: 10th International Symposium on Agriculture and the Environment. May 23-27, 2016.
4) Boswell, E., A.M Thompson, and N. Balster. 2016. The influence of restored prairie vegetation on freeze-thaw cycles and soil aggregate stability in an agricultural landscape. Oral Presentation. AWRA Wisconsin Section Conference, Wisconsin Dells, Wisconsin, March, 10-11, 2016.

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 Aquatic Sciences Center Review Committee, Spring 2016
d) Member, UW Committee on Undergraduate Recruitment, Admissions, and Financial Aid, 2013-2017
e) Member, UW FPM Campus Master Plan Green Infrastructure Technical Coordinating Committee, 2015-2016
f) Member, Water@UW Steering Committee, 2016-Present
g) Member, UW CALS Equity and Diversity Committee, 2014-Present
h) Member, BSE Development and External Relations Committee, 2013-Present
i) Member, BSE Undergraduate Instruction and Program Committee, 2002-Present
j) Member, BSE Awards Committee 2007-Present
k) Faculty Senator Alternate, 2012-16
l) Member, Biology in Engineering Certificate Program Committee 2009-Present
m) Member, The Nelson Institute for Environmental Studies, Water Resources Management Program Committee 2010-Present
n) Member, The Nelson Institute for Environmental Studies, Water Resources Management Program Graduate Admissions Committee 2014-Present
o) Chair, R. Larson Mentor Committee 2011-Present
p) Mentor, Women Faculty Mentor Program 2010-Present
q) Proposal Reviewer, USDA-CSREES Hatch

Professional

r) Member, Organizing Committee for 2021 ASABE International Soil Erosion Symposium, 2016-2021
s) Associate Editor, Transactions of the ASABE, 2008-Present
t) Representative, Consortium of Universities for the Advancement of Hydrologic Sciences, Inc., 2011-Present
u) Chair, ASABE SW-223, Soil Erosion Research Committee, 2015-present
v) Vice-Chair, ASABE SW-223, Soil Erosion Research Committee, 2013-2015
w) Member, American Society of Agricultural and Biological Engineers, 1996-Present
x) Member, American Water Resource Association, 2008-Present
y) Member, American Geophysical Union, 2007-Present
z) Member, ASABE SW-21 Hydrology Committee, 2004-Present
aa) Member, ASABE SW-22 Erosion Control Committee, 2004-Present
bb) Member, ASABE BE-22 Ecological Engineering Committee, 2003-Present
cc) Technical Reviewer, Transactions of ASABE; Journal of Soil and Water Conservation Journal of Environmental Management

Affiliate and Emeritus Faculty Activity Reports

John Ralph

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

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

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

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

Teaching

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

Graduate Students and Post Docs Advised

Degree program and expected completion date:

Ph.D. Students

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

Postdocs Advised

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

Techs Advised
Matt Regner
Sarah Liu
Assistant, Associate, or Senior Scientists Advised
Yuki Tobimatsu (Assistant)

Steven Karlen (Assistant > Associate)

Fachuang Lu (Senior)
Hoon Kim (Senior)
Yukiko Tsuji (Assistant)

Vitaliy Tymokhin (Assistant)
Maggie Phillips (Research Coordinator, GLBRC)
Eva Ziegelhoffer (Research Coordinator, GLBR

Research

1) Lignin management: optimizing yield and composition in lignin-modified plants.
C. Chapple, W. Boerjan, C. Halpin, X. Li
Stanford U. GCEP (Global Climate and Energy Program)
This project aims to maximize the utility of plant lignocellulosic biomass as an abundant, sustainable, and carbon-neutral energy feedstock by optimizing both its yield and composition to facilitate downstream conversions to fuel and electricity. We have discovered novel genes that mitigate the growth defects seen in severely lignin-depleted plants. Revealing the mechanism(s) by which this mitigation occurs is crucial to fundamental understanding and useful manipulation of how plants partition carbon and may enable biomass manipulation for carbon sequestration in the future.
2) Regulation and predictive modeling of lignin biosynthesis.
V.L. Chiang, F. Islk, J. Ducoste , R.R. Sederoff, H. Kim
NSF
Our role is to structurally characterize the entire set of transgenic aspens downregulated in 20 lignin-pathway-related genes, and to provide the comparative data used for modeling lignin biosynthesis.
3) Plants Designed for Improved Processing
S.D. Mansfield, C.G. Wilkerson, J.C. Sedbrook, F. Lu
GLBRC (DOE Office of Science BER)
The goal is To understand lignification and cell wall crosslinking, and the limits to cell-wall-phenolics metabolic plasticity, to alter composition and structure in ways that significantly improve biomass processing energetics. The major success this year was a *Science* paper describing the culmination of our long-term effort to engineer monolignol ferulate conjugates into poplar lignification to produce lignins with weak bonds in the polymer chain backbone, facilitating pulping and biomass pretreatment.
4) Plant Cell Wall Profiling Facility
H. Kim
GLBRC (DOE Office of Science BER)
This project was to address the need to support the to NMR instruments and the facility, to enable the processing of samples from within (and ultimately beyond) GLBRC. The major work involves profiling plant cell wall structure, for both polysaccharides and lignin, in biomass lines with altered cell wall traits.
5) Development of Crucial Tools for Lignin Research
M.G. Hahn, F. Chen, S. Decker (F. Lu, Y. Zhu, H. Kim, J. Grabber)
DOE Office of Science BER
The aim is to generate for the research community a series of crucial tools to help address the current pressing issues. The prime objectives are to: develop a set of monoclonal antibodies to specific structures in lignins – for structural and localization studies; develop a system for producing polymer-supported lignin monomers and oligolignols – for additional antibody screens, reactivity determination, elucidation of cross-coupling propensities, and beyond; develop fluorescent-tagged monolignols – to aid in lignin localization studies and to help elucidate monolignol transport mechanisms.
6) Biodegradative oxidant production by fungi in lignocellulose
K.E. Hammel, C.G. Hunt
DOE Office of Science BER
An attempt to provide the tools to determine: the spatial range over which ligninolytic oxidants are produced by a fungal cell; whether brown rot and white rot fungi differ from each other in the quantity of oxidants produced; which genes with proposed roles in the generation of reactive oxygen species by each fungus are highly expressed at the time of maximum oxidant production, i.e., which are physiologically important.

Publications

Peer reviewed Journal Articles

1) Anderson NA, Tobimatsu Y, Ciesielski PN, Ximenes E, Ralph J, Donohoe BS, Ladisch M, Chapple C (2015) Manipulation of guaiacyl and syringyl monomer

synthesis in an Arabidopsis Cinnamyl Alcohol Dehydrogenase Mutant results in atypical lignin biosynthesis and modified cell wall structure. Plant Cell 27(8): 2195-2209

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

Books & Chapters

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

Conference Proceedings

Bartley LE, Peck ML, Lin F, Karlen SD, Ebert B, Zhang C, Sykes R, Gjersing E, Thibivilliers S, Lee S and others (2015) Genetic analysis reveals acyltransferases that incorporate hydroxycinnamates into grass cell walls. Gordon Research Conference on Plant Metabolic Engineering. Waterville Valley, NH.

Helmich KE, Pereira JH, Heins RA, Gall D, McAndrew RP, Bingman C, Donohue TJ, Noguera DR, Simmons BA, Sale KL and others (2015) Structural sties of β-aryl ether lignin degradation. 2015 DOE Genomic Sciences Meeting. Washington, DC.

Karlen SD, Lu F, Padmakshan D, Regner M, Pearson T, Zhu Y, Rencoret J, Smith RA, Withers S, Frankman E and others (2015) Introducing readily cleavable bonds into the lignin backbone: The Zip-Lignin™

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

CA, SIMB. Paper 31515

Smith RA, Gonzales-Vigil E, Karlen SD, Park J-Y, Lu F, Wilkerson CG, Samuels L, Ralph J, Mansfield SD (2015) Engineering monolignol *p*-coumarate conjugates into Poplar and Arabidopsis lignins. Gordon Research Conference on Plant Metabolic Engineering. Waterville Valley, NH.

Yue F, Lu F, Ralph J (2015) Synthesis of lignin-derived dimers from thioacidolysis followed by Raney nickel desulfurization and their uses as GC quantitation standards. American Chemical Society National Meeting. Boston, MA.

Awards

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

Service

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

Editorial Boards:

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

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

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

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

Reviewer: some 50 journal article reviews for some 20 journals; Peer review panels, 5; Grant Reviewer, 4; Other Faculty evaluations, 5.

Ferencz S. Denes

Professor Emeritus, Ph.D.
Research
Food Safety

Research

1) Synthesis and Characterization of Carbon-host, Magnetic Nanoparticle Systems for Biotech Applications (potential sensor, *"in vivo"* magnetic imaging, and vaccine developments), using Original Submerged-arc Atmospheric-pressure Plasma Tools.
   Collaborators: Professor Sundaram Gunasekaran, BSE, UW, Sorin Manolache , Assistant Scientist Scientist
2) Development of benzene- and acetonitrile-origin nanoparticle systems (NPs) under Dense Medium Plasma (DMP) environments, and characterization of NPs using advanced analytical techniques (GC-MS, ATR-FTIR, particle size distribution, SEM, TEM, ESR) Evaluation of the potentials of these complex NPs for potential biotech applications.
3) Characterization of Carbon-based and Iron/iron-oxide-based NPs and their activity *"in vitro"* and *"'in vivo"* environments for the generation of enhanced immunological response.
   Collaborators: Professor Matyas Sandor and Professor Zsuzsa Fabry Medical School, University of Wisconsin, Madison 5468 Medical Sience Center

Publications

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

Patents

1) Dentrin Cell Targeting Compositions and Uses Thereof
   Inventors:
   Ferencz S. Denes, Madison, WI (US)
   Zsuzsanna Fabry, Madison, WI (US)
   Matyas Sandor, Madison, WI (US)
   Patent # US 9,107,858 B2
   Date of Patent: August 18, 2015

Roger Rowell

Professor Emeritus, Ph.D.
Research:
Forestry, Composite Agricultural Materials

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

Teaching

Spring 2015
PhD course in wood chemistry – 30 students, KTH, Stockholm, Sweden
Fall 2015
PhD course in bio-materials, 9 students, KTH, Stockholm, Sweden

Publications

Peer Reviewed Journal Articles

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

Conference Proceedings

1) Rowell, R.M. 2015. Understanding decay resistance, dimensional stability and strength changes in acetylated wood. In: Proceedings 58th International convention of society of Wood Science and Technology, Jackson, WY, June 8-12, 641-651.
2) Laine, K., Segerholm, K. Wålinder, M., Rautkari, L., Hughes, M. and Rowell, R. 2015. Acetylation and densification of wood. In: Proceedings, Northern European Network for Wood Science and Engineering, 11th Annual Meeting, 14-15 September, Poznan, Poland.
3) Rowell, R.M. 2015. Performance of exterior windows and doors made from acetylated wood In Proceedings: North American wood window and door symposium, September 23-25, Madison, WI.
4) Rowell, R.M. 2015. Dimensional Stability and Fungal Durability of Acetylated wood: A new sustainable building material. Iin proceedings: 1st International Scientific Conference WOOD – SCIENCE – ECONOMY, Oct 5-7, Poznan, Poland.
5) Rowell, R.M. 2015. Correlation between equilibrium moisture content and resistance to decay by brown-rot fungi on acetylated wood In Proceedings: 8th European conference on wood modification, Oct 26-27, Helsinki, Finland.

Invited Conferences

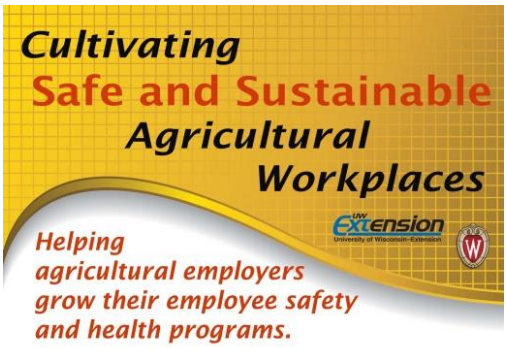
1. 1st International Conference 'Innovations in Wood Materials and Processes',InWood
2. 2015,"Understanding decay resistance, dimensional stability and strength
3. changes acetylated wood", May 19-22, 2015, Brno, Czech Republic.
4. 58th International convention of society of Wood Science and Technology, "Understanding decay resistance, dimensional stability and strength changes in acetylated wood", June 8-12. 2015, Jackson, WY,
5. 11th Annual Meeting Northern European Network for Wood Science and Engineering, "Acetylation and densification of wood", 14-15 September, 2015 Poznan, Poland.
6. North American wood window and door symposium, "Performance of exterior windows and doors made from acetylated wood", September 23-25, 2015, Madison, WI.
7. 5th Accoya world conference, "Can wood that is not toxic be resistant to attack by fungi", September 13-16, 2015, Noordwijk, Netherlands.
8. 1st International Scientific Conference WOOD – SCIENCE – ECONOMY, "Dimensional Stability and Fungal Durability of Acetylated wood: A new sustainable building material", Oct 5-7, 2015, Poznan, Poland.
9. 8th European conference on wood modification, "Correlation between equilibrium moisture content and resistance to decay by brown-rot fungi on acetylated wood", Oct 26-27, 2015, Helsinki, Finland.

BSE Centers Activity Reports

UW Center for Ag Safety and Health

Cheryl Skjolaas

Senior Outreach Specialist
100% Extension
Program affiliations: UW Center for Agricultural Safety and Health; Extension Disaster Education Network



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

Addressing the issue of agricultural equipment on public roads was a significant part of Cheryl's programming efforts in 2015. She serves as the co-chair for the education and outreach subgroup of the DOT/DATCP Road Study Committee. In early 2015, her educational efforts focused on assisting the agricultural industry with understanding proposed legislation. After 2013 Wisconsin Act 377 was enacted, she has made significant contribution to the educational efforts. She assisted with the development of educational resources and taught 37 programs reaching over 2000 participants. Resource materials that she collaborated on developing have been widely distributed to farmers, agri-businesses, equipment dealers, law enforcement officers and local government officials. She provided leadership for a publication on Lighting and Marking for Implements of Husbandry that is being used to inform farmers, dealers and manufacturers, agri-business, insurance, local government officials, highway commissioners, agricultural educators and UW Extension educators.

Teaching

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

Extension programs

- Provided administrative assistance for the Wisconsin Safe Operation of Tractor and Machinery Certification Program for Youth Operators. Approximately 400 youth are trained each year in these programs that require 24 hours of instruction. Currently on this program Cheryl is working to update the teaching resources with agricultural instructors and UW Extension agents. Information is available to instructors on http://fyi.uwex.edu/tractorcert.
- Professional development presentation to 200 Wisconsin FFA Advisors on requirements of this program and other parts of the Fair Labor Standard Act related to minors working in agriculture.
- In collaboration with Wisconsin Farm Bureau Federation, Wisconsin Department of Instruction worked to clarify requirements of minors operating skid steer loaders with the Wisconsin Department of Workforce Development and Federal Department of Labor Wage and Hour.
-

- Responded to programming requests resulting from Wisconsin OSHA outreach and enforcement efforts. **OSHA Related Activities** included:
- Continued to update OSHA Dairy LEP resource materials and populate the fyi.uwex.edu/agsafety website.
- Assisted 3 dairy farms with their safety and health programs.
- Collaborated in the development a safety program for

Wisconsin Custom Operator members that wasbe recognized by insurance providers for reduced premiums to members. . Program was offered in March 2015 for 50 members and non-members. Co-taught session on Road Safety with Lt. Klingenberg, Wisconsin State Patrol.

- Administered $19,200 for use with 2014-15 County Farm Safety Grants.
- Continued to provide technical assistance and resources to Agricultural, 4-H and Youth Development, and high school and technical college agricultural instructors on all aspects of agricultural safety.
- Continued work with the Professional Nutrient Applicators Association of Wisconsin (PNAAW) on confined space and road safety issues in conjunction with the workgroup for the UW Extension Nutrient Management Team. A new educational effort in 2015 related to the safe use of draglines and related technologies.
- Continued to develop and enhance the UW Center for Agricultural Safety and Health website (http://fyi.uwex.edu/agsafety)

Extension Disaster Education Network and Emergency Preparedness

- Continued as EDEN POC for UWEX.
- Serving as secretary for Executive Committee, 2014-2016.
- Served on annual conference planning committee for 2015.
- Participated in EDEN Strategic Planning Process.
- Serving on the Wisconsin Emergency Management All Hazards Mitigation Team and Radiological Emergency Program Recovery Team.
- Serving as an UWEX representative to Wisconsin Animal Health Emergency Management System (WAHEMS) and participated in a Foot and Mouth Preparedness Exercise, November, 2015.
- Assisted with development of educational materials related to stress for employers and employees in response to the Avian Influenza outbreak in collaboration with Wisconsin Public Health and the Wisconsin Farm Center, DATCP.

Other

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

Publications

Maintain websites:

- http://fyi.uwex.edu/agsafety
- http://fyi.uwex.edu/ioh
- http://fyi.uwex.edu/tractorcert

Service

Epsilon Sigma Phi member, 1995 – present

Center Goals

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

- The program curriculum and resources need to be updated including modification to allow for a blended learning option using eXtension on-line resources. New materials need to be developed to reflect the changes to safe operation on public roads resulting from 2013 Wisconsin Act 377 and 2015 Wisconsin Act 15. In addition, program risk management needs to be reviewed for instructor and volunteer qualification and requirements for safe operation of tractors and machinery by the youth during training.

Goal 2: Development of Worker Safety Resources for Dairy Farms

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

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

- Resources are being requested to help agricultural producers understand these new lighting and marking requirements for their IoH and what the changes in the Rules of the Road statutes mean when operating agricultural equipment on highways. These materials are being developed in collaboration with the Wisconsin State Patrol and Wisconsin Farm Bureau Federation.

Areas of Concerns/Challenges

Addressing Worker Safety in Agriculture

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

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 504 clients with 78 of those individuals being first time clients in our 2015-16 grant year. In its 25 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 13-14
2) Rock County Ag Showcase- Janesville, Jan 28
3) Wisconsin Farmers Union Conference, Jan 28-29
4) Marshfield Mall Farm Show- Marshfield, Feb 17-18
5) MOSES Organic Farming Conference, Feb 25-27
6) Eau Claire Farm Show- Eau Claire, Mar 8-9
7) PDPW Business Conference- Madison, Mar 17
8) AgrAbility Annual Summit- Cashton, March 23
9) WPS Farm Show- Oshkosh, Mar 29-31
10) Midwest Horse Sale, Apr 6-8
11) AgrAbility National Training Workshop, Apr 11-14
12) JCEP Conference, Apr 19
13) Kewaunee County Rural Safety Day- Kewaunee, May 25
14) WI FFA Convention, Jun 13-16
15) Health Fair and Wheelchair Wash, Jun 18
16) WI Farm Tech Days, Jul 19-21

17) Neighbor to Neighbor Meeting, Jul 27
18) Skip Ellenbecker Golf Outing, Aug 5
19) UW-Extension Day at State Fair, West Allis, Aug 9
20) Neighbor to Neighbor Meeting, Aug 10
21) CALS Career Fair, Sept 19
22) AgrAbility 25th Anniversary Celebration, Arlington, Sept 29
23) World Dairy Expo, Madison, Oct 1-4
24) AgrAbility Advisory Council Meeting- Madison, Nov 2

Teaching:

1) UW Madison Marketing class presentation
2) FFA Classroom presentations
3) UW Madison Rural Health class presentation

Publications:

1. Agriview: 2/17/16- "AgrAbility Summit offers tours, planning help"
2. Wisconsin State Farmer: 3/29/16- "WPS farm show draws big crowd"
3. Successful Farming: 4/12/16- "Keeping Ag Accessible"
4. Dairy Star: 4/13/16- "Providing Assistive Technology"
5. Dairy Star: 4/13/16- "Preparing for Then, Now"
6. Daily Union: 4/29/16- "Helenville Dandelion Dash Sunday to benefit AgrAbility"
7. Agriview: 5/17/16 – "Education Square to be abuzz with learning"
8. Wisconsin State Farmer: 7/13/16 – "Geneva Lake featured in Innovation Square"
9. Agriview: 7/14/16 – "Innovation Square showcases today's innovations"
10. Wisconsin Ag Connection: 9/2/16 – "AgrAbility of Wisconsin Celebrating 25 Years of Service"
11. Wisconsin State Famer 9/12/16 "AgrAbility helps farmers stay on the farm"
12. Country Today: 9/30/16 "Kudos aplenty at AgrAbility 25th celebration"
13. Wisconsin State Farmer: 11/9/16 "AgrAbility changes farmers' lives"
14. Wisconsin State Farmer: 11/9/16 "Keeping those with disabilities on the farm"

Professional Development

1) WI Business Plan Development

Professional Service

1) Professional (ASABE/Other)
   a. National AgrAbility National Training Workshop Farmer Luncheon committee member
   b. National AgrAbility National Training Workshop Farmer Stipend committee member
   c. National AgrAbility National Training Workshop Hospitatlity committee member
   d. National AgrAbility National Training Workshop Farm Luncheon committee member
   e. National AgrAbility National Training Workshop Exhibitors committee member

2) Civic Service
   a. Walworth County Farm Bureau- member
   b. Church Council member, Call Committee member
   c. World Dairy Expo Volunteer
   d. Olbrich Botanical Gardens Volunteer
   e. S.M.I.L.E.S. Volunteer
   f. UW Madison LSC Mentor

Academic Staff Activity Reports

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, 17 Enrolled
Precision Agriculture Short Course: 2 Credits, 20 Enrolled
Farm Machinery Short Course: 3 Credits, 29 Enrolled
Lab sections (2) of BSE 365: 42 enrolled

Interviewed for promotional videos for the Farm and Industry Short Course
https://www.youtube.com/watch?v=1oq479fg28k
https://www.youtube.com/watch?v=EMdMt-FRpQs

Won a Professional Development Grant to attend a three-day class – "Fundamentals of Engine Systems Controls". Valued at $1600

Guest lectures / demonstrations for department courses:
1) Fundamentals of GPS for BSE 201.
2) 3D printing and scanning for BSE 365 labs
3) Tillage Equipment and Residue Management for BSE 472

Extension/Outreach Activities

1) Provided a presentation I created called "Expect the Unexpected – Handling Emergencies" to Jeff Breuer to be given to ARS staff.
2) Provided a Farm Safety talk to the International Farmers Aid Association group on campus. Presented to 7 people through an interpreter.
3) Presented "Preparing for Emergencies" to a safety training day for Wisconsin Custom Operators. Approx. 50 attendees
4) Helped staff a booth for Agrability of Wisconsin at the WPS Farm Show in Oshkosh
5) Talked to a Camp Badger group. 33 students. Camp Badger is a one-week residential program for Wisconsin and Minnesota teenagers who will be entering 8th grade in the fall. Camp Badger provides an opportunity to survey many types of engineering fields and to begin to see the study of science and math as a path that can lead to great careers
6) Assisted Cheryl Skjolaas with a Farm Safety / Rescue presentation on a farm in Chippewa Falls. Talked to approx. 60 fire/rescue personnel about manure storage and handling emergencies
7) Assisted with a Manure Gas Safety webinar. Presented on Pre-planning and Emergency Response.
   157 registered and 124 attended webinar. Handled the technical setup in the Conference Room.
   Webinar press - Country Today, Wednesday September 21 2016, "Webinar offers manure pit safety info", by Sara Bredesen. The story mentions The Manure Gas Safety webinar was recorded and can be viewed for free.
8) Assisted Cheryl Skjolaas with a Farm Safety / Rescue presentation on a farm in Green County. Talked to approx. 20 fire/rescue personnel about manure storage and handling emergencies
9) Assisted Cheryl Skjolaas with teaching a farmer how to do air monitoring. He was agitating a new manure storage under the barn. First time he had done that. Afraid of killing cattle with hydrogen sulfide

Information Technology Support

1) BSE purchased a DJI Vision2+ UAV in 2015. Maintain the UAV and train people in its use.
2) 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. Major activity this summer was the replacement of all computers in the lab. Old machines were cleaned up and given new uses within the department.

3) Department-wide activities include troubleshooting problems, consulting on purchases, installing new software, updating old computers, maintaining the departmental server, and attending various training seminars on campus.
4) Maintain the department's network infrastructure as a DoIT Authorized Agent.
5) Represent the department on a CALS Info Tech user group.
6) Local support contact for the 101 classroom AV system (liaison with Classroom Media Services).
7) Maintain an AV system in the B25 and 118 classrooms.
8) Maintain the Main Hall Information monitor. Create announcements and maintain hardware.
9) Set up, maintain, and trained students in the use of the department's 3D printer and 3D scanner.

Service

BSE Committees

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

Farm and Industry Short Course Committees

1) Appointed to the Farm and Industry Short Course Program Committee. The Committee works with the FISC Director to determine policies and procedures for the FISC program.

Departmental Support Activities

1) Attend various seminars related to Instructional Technology and campus computing issues
2) Produced 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) Recorded presentations for the Shop Manager position and made them available on-line for people who could not attend in person.
5) Assisted Brian Luck with advising the Quarter Scale Tractor Pulling Team.
6) Maintain the department's large format printer. Assist with poster design and production for conferences and meeting.
7) Met with a student working in the shop over the summer. Worked with him on learning fabrication skills and completing various projects of interest to the department

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

Provide advisory help with Doug Reinemann for a team of students enrolled in the BSE 509 Design Practicum II class (Senior Design). The design was for a low cost, energy efficient hoophouse irrigation system for fresh market vegetable or flower crops. Course was taught by K.G. Karthikeyan.

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 2016, fully upgraded the website and created a new poster and new brochure for the council.
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.
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) Distribute information and research from previous projects on workplace safety and ergonomics to farmers, researchers, farm advisors, funders, government agencies, and non-profits. In 2016, for example, the director of the Center for Worker Health at Wake Forest School of Medicine in North Carolina wanted information on musculoskeletal injuries of youth in Wisconsin's fresh market vegetable industry. An engineering student at EIA University in Medellín, Columbia wanted plans for a lay-down ergonomic workstation for flower growers.
5) Work within the department as an ad-hoc Senior Scientist.
6) Guest speaker on Larry Meiller's WHA radio call-in show, "Garden Talk", Dec. 2, 2016.

Publications:

Website

In 2016, completely reviewed, updated and improved the website of the Midwest Rural Energy Council and curated the website's media library. This is a University of Wisconsin Cooperative Extension website. http://mrec.org/

Poster

UW-Extension and Dairy Farms, a display for the 2016 Rural Energy Conference

Brochure

The Midwest Rural Energy Council information brochure, new in 2016

Professional Development Activities:

1) Participated in meetings of the Agriculture and Natural Resources Education Program Area
2) Participated in CALS Communicators Meetings

3) Participated in CALS All College Meetings

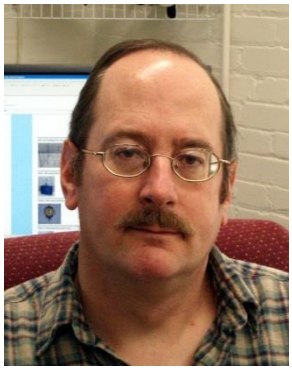
Service

Departmental Committees

1) Extension Committee
2) Social Committee

Other

1) Guest on WI Public Radio
2) 4-H County Fair Judge
3) 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 and nutrient management. His work includes outreach programing and the development tools as well as advising local, state and Federal agencies in ways to improve water and nutrient use efficiency in agricultural production. These tools include the Wisconsin Irrigation Scheduling Program (WISP 2012) and research to support the SNAP Plus nutrient management planning software. Dr. Panuska also teaches BSE courses, maintains the Department's land surveying laboratory and provides training and equipment to students, faculty and staff for land surveying projects.

Teaching

Fall 2016
BSE 201 Land Surveying Fundamentals
2 Credits, 41 Enrolled
BSE 509, Design Practicum II
3 Credits, 4 students advised
Guest lectures in BSE 571 and BSE 372

Graduate and Post Docs Advisees

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

10) Joe Sanford; (MS); Biological Systems Engineering (2013 – 2016)

11) Elizabeth Buschert, MS
Nelson Institute (2014-2016)

Extension / Outreach

Irrigation Water Management

1. Oversee software version update and operational bug fixes for the WISP 2012 irrigation scheduling software tool. Includes testing and migrating the new tool into production for the 2017 growing season.
2. Restore the evapotranspiration (ET) data service and ET email function to the web-based Ag. Weather Data Service after an unexpected total system failure in June 2016.
3. Completed background research and evaluation of options to maintain equipment and data services for the weather monitoring towers at the Hancock and Arlington research stations.
4. Provide technical support on soil moisture management to Ag. Agents and growers as needed.
5. Provide technical support and equipment for soil moisture management to Jerry Pierce, irrigation manager, Hancock Agricultural Research Station.
6. Served on the search committee to hire a new irrigation manager for the Hancock Agricultural Research Station.
7. Irrigation workshops & programs –

a. Central WI Processing Crops Mtg., speaker, 53 attendees. Talk title "Recent Updates to the WI Crop Irrigation Web Site.".
b. WI Potato & Veg. Growers Ed. Mtg., speaker, 50 attendees. Presentation titled: "Precision Irrigation Technologies and Irrigation Scheduling".

Nutrient Management/Water Quality

a. On-going technical advisor to develop a new barnyard runoff phosphorus loss evaluation model.
b. Technical advisor to the Standards Oversight Council for vegetated stormwater treatment swales to develop supplemental modeling guidance to apply the new standard.
c. Provide technical assistance to the model development team working on the web-based Runoff Risk Advisory Forecast (RRAF) tool.

Publications

Peer reviewed Journal Articles

Received a Superior Paper Award at the 2016 ASABE Annual Meeting for the paper: Vadas, P. A., L.W. Good, **J. C. Panuska,** D. L. Busch and R.A. Larson. A New Model for Predicting Phosphorus Export in Runoff from Outdoor Cattle Lots. *Trans. ASABE*, 58, 1035-1045.

Lamba, Jasmeet, A.M. Thompson, K.G. Karthikeyan, **J.C. Panuska** and L.W. Good. Effect of best management practice implementation on sediment and phosphorus load reductions at subwatershed and watershed scale using SWAT model. International Journal of Sediment Research. (In Press).

Funded Research Projects

The Effects of Surface Roughness on Snowmelt Runoff.
Funding: USDA / CIG
Objectives: Quantify the impacts of surface roughness on snowmelt runoff to improve the SNAP Plus nutrient management model.

Restore the ET email functionality to the UWEX Ag. Weather Data Service.
Funding: WPVGA
Objective: Restore the automated web-based service that emails daily evapotranspiration data to subscribers.

Restore the evapotranspiration capabilities to the UWEX Ag. Weather site.
Funding: USDA/ Specialty Crop Block Grant
Objective: Rebuild the entire data processing portion of the software after the June 2016 system failure.

WISP software update and bug fixes
Funding: WPVGA
Objective: Update the software running the WI Irrigation Scheduling Program (WISP) to the current version. The old version was a server security risk.

Professional Development

Attended several technical presentations at the American Water Resources Assoc. Annual Meeting.

Completed on-line training in engineering ethics. (2 cr.)

Service

Land surveying technical assistance to graduate student Malika Nocco for Chris Kucharik, the Dept. of Agronomy, 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

Serve on the UW Arboretum Board as a stormwater technical advisor

Scott Sanford

Distinguished Outreach Specialist (M.Engr)
Rural Energy Program
30% Extension, 70% Gift/Grant

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

Teaching

Spring 2016
HORT 334: Greenhouse Energy Efficiency
– guest lecture, March 3
DSci – 234: Milking Systems, March 2
Milking Parlor Design & Parlor Planning Lab, March 7

Fall 2016
BSE 509 – Senior Design
DSci – 233: Milking machines – Nov 16.
SC_BSE_095 – Livestock Housing – Lecture on milking parlor design – Nov 30

Extension/Outreach Activities

1) DNR Forestry Meeting, Statewide Wood Energy Team – Who are we & Mission, Wisconsin Dells, Jan 13, 2016 – about 70 attendees.
2) Wisconsin Crop Management Conference, Grain Storage Management, Alliant Energy Center, Madison, WI, Jan 14, 2016 – about 80 attendees.
3) WI Food Hub Cooperative, Cold Storage Facilities and Management, Waunakee, WI, Feb 10, 1016 – 30 attendees.
4) Wisconsin Fresh Market Vegetable Growers Association – Spring Field Day, Managing Irrigation, Sauk City, WI, April 8, 2016, 30 attendees.
5) Irrigation workshop for growers, Irrigation Management & WISP training, Hancock, WI, March 4, 2017, 6 attendees
6) Midwest Poultry Federation, Wood Heating for Poultry Housing, St Paul, MN, March 16, 2016, 25 attendees.
7) Heating the Midwest Conference, Wisconsin SWET Summary of Activities, Harris, MI, October 13, 2017, 70 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

Proposal Submitted

1) Mint oil Distillation using a continuous flow microwave oven, S.A. Sanford, Test using an industrial microwave drying oven for the distillation of mint oil. Testing would occur at an manufacturer's application lab. Mint Industry Research Council (Requested $19,119) Feb 2017 to Dec 2017. (Pending)
2) On-Farm Packing Shed Design, Equipment and Operation, S.A. Sanford and John Hendrickson, There is a lack of information to aid growers in the planning, design and building of on-farm packing shed for cleaning, sorting, packing and storing produce. This project will develop a design manual to help growers build or renovate facilities to make them labor efficient, easy to maintain, and minimize food contamination risks. Both permanent and portable or low cost facilities will be discussed. An outreach emphasis in the second year will offer to provide presentations to state or regional vegetable and fruit growers meetings in the NC region. We will also develop a train-the-trainer workshop/webinar for educators so they feel comfortable providing training for local growers. A resource website will be developed to collect available information into one convenient location for growers. The site will have links to resources, presentations, publications and tools. USDA-SARE, (pre-proposal pending), Requesting $103,237, Oct 2017 to Sept 2019.
3) Hazelnut Cluster Harvester and Husker Equipment Development, 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 involucres from the bushes. It will also look at the requirements for dehusking the nut so it can be sold as a whole nut or further processed. USDA – Specialty Crops Research Initiative grant, Requesting $463,660, Oct 2017 to Sept 2021 (Pending).

Publications

Peer Reviewed Publications

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

Awards

1) ASABE 2016 Educational Blue Ribbon Award – On-Farm Cold Storage of Fall Harvested Fruit and Vegetable Crops, Scott Sanford and John Hendrickson, A4105, UW Extension, 2015.

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
2) Heating the Midwest conference – Oct 11-13, Harris, MI – Planning committee.

Paul Thompson

Distinguished Scientist, Ph.D.
100% Research
Adjunct Professor in Biomedical Engineering

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

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

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

Teaching

Spring 2016

- BME 402, 1 Credit, 16 Enrolled
  - Instructor Rating 4.9/5.0
- BME 300, 1 Credit, 2 Enrolled
  - Instructor rating: 5.0/5.0
- BME 399 (no students enrolled)

Fall 2016

- BME 400, 3 Credits, 16 Enrolled
  - Instructor Rating: 4.11/5.0
- BME 300, 1 Credit, 1 Enrolled
  - (No evaluations for courses with one student.)
- BME 399 (no students enrolled)

Graduate and Post Doc Advisees

1) John Penry, Ph.D. Dairy Science (member of his committee). Graduated Dec, 2016.

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, GA Mein, MD Rasmussen, I Ohnstad, PD Thompson, and DJ Reinemann, 2016. Estimating teat canal cross-sectional area to determine the effects of teat-end and mouthpiece chamber vacuum on teat congestion. In press and published on line, J. Dairy Sci.

2) Upton J, DJ Reinemann, JF Penry, and PD Thompson, 2016. A quarter milking analysis device: Development and demonstration. Biosystems Engineering, 147(2016)259-264.

3) Penry, JF, S Leonardi, J. Upton, PD Thompson and DJ Reinemann, 2016 Assessing liner performance using on-farm milk meters. J. Dairy Sci. 99(6609-6618)

4) Upton J, JF Penry, MD Rasmussen, PD Thompson and DJ Reinemann, 2016. Effect of pulsation rest phase duration on teat end congestion. J. Dairy Sci. 99:1-8.
5) Penry, J.F., J. Upton, S. Leonardi, P.D. Thompson, D.J Reinemann, 2016. A method for assessing liner performance during the peak milk flow period. Submitted, J. Dairy Sci.

Conference Proceedings

1) Penry, JF, J Upton, MD Rasmussen, I Ohnstad, PD Thompson and DJ Reinemann, 2016. Effects of teat-end vacuum and mouthpiece chamber vacuum on teat-end swelling. 6th IDF Mastitis Conference, Nantes France, 2016.

Service

1) Departmental:
Social Committee, approximately 20 hours annually

2) ASABE:
a. PAFS-403/1, Milk Handling Equipment Committee
b. T-11, Energy Committee

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 Assistant 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 2015
BSE 201 Land Surveying Fundamentals. Co-instructed laboratory session in 2 credit course

Spring 2016
BSE 365, Measurements and Instrumentation for Biological Systems. Provide guest lecture in 3 credit course.

Funded Research Projects

1) Title: Multi-scale Investigation of Winter Runoff and Nutrient Loss Processes in Actively Managed Dairy Agroecosystems
   Funding: USDA-NIFA (AFRI)
   PI's: P Vadas, USDA-ARS, F. Arriaga and L.W. Good, Soils.
   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: P Index and Snowmelt Runoff Risk Assessment: Demonstration and Refinement
   Funding: USDA-Conservation Innovation Grant
   PI'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
3) Title: Subsurface Fate and Transport of *Cryptosporidium* in Soils of Wisconsin's Carbonate Aquifer Region
   Funding: Wisconsin Groundwater Coordinating Council.
   PI's: K.G. Karthikeyan, A.M. Thompson, B.J. Lepore, S. Long
   Objectives: 1) Determine whether irradiated C. parvum is an effective surrogate soil surface-to groundwater tracers for future field studies of C. parvum transport, and 2) Determine the C. parvum fate and transport potential for several Wisconsin soils which have developed overlying NE Wisconsin's vulnerable carbonate aquifer.

Research Proposals Submitted

1) Using Vegetated Compost Blankets to Achieve Highway Runoff Volume and Pollutant Reduction. 4 years.
   Collaborators: A. Thompson, S. Loheide, B. Selbig, J. Horwatich, J. Voorhees. Transportation Research Board, Washington, DC. USA. (In review)

Publications

Peer Reviewed Journal Publications

1) Zopp, Z., A.M. Thompson, K.G. Karthikeyan, F. Madison, S. Long. 2016. Subsurface transport of *Cryptosporidium* in soils of Wisconsin's carbonate aquifer region. *Journal of Environmental Quality*. 45(5):1607-1615
2) Zopp, Z.P., J. Olstadt, K.G. Karthikeyan, A.M. Thompson, S. Long. 2016. *Cryptosporidium* soil extraction by filtration/IMS/FA compatible with USEPA Method 1623.1. *Agricultural and Environmental Letters.* 1:160031

Service

BSE committee: Facilities & Operations
Riveredge Nature Sanctuary: 4th Annual Student Research Symposium volunteer