DataFEWSion Traineeship for Innovations at the Nexus of Food Production, Renewable Energy, and Water Quality

2020 Annual Report
The DataFEWSion program is a National Research Traineeship sponsored by the National Science Foundation Division of Graduate Education. The project goals are:

- Foster interdisciplinary research based on data-intensive methods
- Educate STEM graduate students for a range of research, research-related and entrepreneurial careers employing data-driven modeling at the FEWS nexus
- Prepare STEM graduate students to work effectively in multidisciplinary teams, communicate effectively with stakeholders, and identify economically sustainable innovations

Notes from the Program Director

As we complete our first year of traineeship activities, I am grateful to the leadership team, faculty advisors, project manager Cynthia Lidtke and, most importantly, our first cohort of trainees for their hard work and creativity. The Covid19 pandemic has underscored the importance of connection and the privilege of collaboration to solve important problems. Human health requires nutrition, hydration, and many forms of energy. These future engineers and scientists inspire me by their commitment to finding ways to sustainably provide for all of these needs.
Leadership Team

Amy Kaleita, Co-PI
Ag & Biosystems Engineering
Ag land and water resources conservation engineering

Robert Brown, Co-PI
Bioeconomy Institute
Biomass energy

Michelle Soupir, Co-PI
Ag & Biosystems Engineering
Water quality and watershed management

Sergio Lence, Co-PI
Economics
Ag economics, welfare and market analysis

Sarah Ryan, PI
Industrial & Mfg. Sys. Engineering
Operations research; data-driven decision models
What is a Traineeship?

The DataFEWSion traineeship is composed of three core components. The foundation is the student’s dissertation or thesis research. Layered on top of that is a new graduate certificate with a focus on data analytics and decision making. And finally, the heart of the traineeship is the learning community, which we’ve adapted from the very successful undergraduate learning communities at ISU.

Up to six PhD trainees per year receive assistantships that cover tuition, living expenses, and health insurance for a year. We also have unfunded trainees who are mostly international students not eligible for this funding.

The most important part of a traineeship is the trainees. Here is our first cohort, who are completing their first year of the two-year program.
Matthew Nowatzke
Crop Prod. & Physiology
Research Interest:
The intersection of data science, agriculture, and human-centered design to identify models and systems that couple human decision-making with sound agricultural and environmental practices
Co-Advisors:
Dr. Emily Heaton & Dr. Andy VanLoocke

Virginia “Gina” Nichols
Crop Prod. and Physiology
Research Interest:
Quantifying the benefits of diverse crop rotations on environmental, social, and economic scales.
Co-Advisors:
Dr. Matt Liebman & Dr. Satirios Archontoulis

Timothy Neher
Ag & Biosystems Eng.
Research Interest:
Antibiotic resistance indicators as they relate to quantities used by livestock owners; evaluation of in-field or edge-of-field practices that may reduce resistance indicators; and economic benefits to farmers
Advisor:
Dr. Michelle Soupir

Lindsey Murry
Ag & Biosystems Eng.
Research Interest:
Agricultural practices to improve water quality through agricultural engineering methods.
Advisor:
Dr. Michelle Soupir

Chin-Yuan “Jeff” Chu
Industrial Engineering
Research Interest:
Data analytic tools that manage supply chain risk in the FEWS nexus to help farmers, companies, and policymakers develop innovative and sustainable solutions
Advisor:
Dr. Gül Kremer

Virginia “Gina” Nichols
Crop Prod. and Physiology
Research Interest:
Quantifying the benefits of diverse crop rotations on environmental, social, and economic scales.
Co-Advisors:
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Timothy Neher
Ag & Biosystems Eng.
Research Interest:
Antibiotic resistance indicators as they relate to quantities used by livestock owners; evaluation of in-field or edge-of-field practices that may reduce resistance indicators; and economic benefits to farmers
Advisor:
Dr. Michelle Soupir

Görkem Emirhüseyinoğlu
Industrial Engineering
Research Interest:
Investigating land use and management decisions to reduce nutrient runoff while maximizing agricultural profit under market and precipitation uncertainty
Advisor:
Dr. Sarah Ryan

Garrison Gunter
Chemical Engineering
Research Interest:
Developing pyrolysis plants, capable of effectively converting waste biomass into biofuel and value added chemicals
Advisor:
Dr. Robert Brown

Charlie Labuzzetta
Statistics
Research Interest:
Statistical analysis of satellite imagery for monitoring natural resources and best management practices
Advisor:
Dr. Zhenguan Zhu
Diverse Disciplines, Domains, Demographics, and Directions

**Cohort 1**
- Toxicology
- Chemical Eng.
- Sustainable Ag
- Industrial Eng.
- Soil Science
- Ag & Biosystems Eng.
- Civil Eng.
- Crop Prod & Physiology
- Statistics

**Cohort 2**
- FEWS
- Collaboration Potentials
- Food Production
- Policy, Econ., & Soc.
- Data Analytics
- Water Quality
- Biorenewable Energy
- Industry
- Entrepreneur
- NGO

**Academia/Research**
- Academia/Extension
- NGO

**Forecasted Career Paths**
- Under-represented populations
- International work experience
- First generation college students
- International students

**Demographics**
- Male
- Female
- International students
During our planning year we established a Graduate Certificate, hired a project manager and recruited eight trainees.

Graduate Certificate in Data-Driven Food, Energy, and Water Decision-Making

Year 1 2018-19

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**Workshop Series I**

**Fall: Your Role in the FEWS Nexus**
- Career Paths and Planning
- Establishing Your Brand
- Interdisciplinary Communication

**Spring: Stakeholder Listening Sessions**
- Agriculture & Water Quality
- Agribusiness & Bioenergy
- Policy Impacts (canceled by COVID19)

**Core Courses** (required)
- ABE 615: Biosystems for Sustainable Development
- GR ST 566: Communications in Science

**Data acquisition, visualization & analytics (select 1)**
- ABE 534H: Instrumentation for Ag. & Biosystems Engineering
- ECE 549: Image Processing
- ECE 562X: Analysis Projects for Improved Decision Making in the Service Sector
- ECE 562X: Data Analysis & Machine Learning
- STAT 577: Statistical Methods for Research Workers

**Complex systems modeling for decision support (select 2)**
- ABE 518: Engineering Analysis of Biological Systems
- ECE 562X: Decision Analysis in System Design
- I E 564: Large-Scale Complex Engineering Systems
- I E 565: Optimization Methods for Complex Design
- AGRON 525: Crop & Soil Modeling

**Economics, Policy & Sociology of FEWS**
- BRTPS 510: Biorenewables Law & Policy
- ECON 580: Intermediate Environmental & Resource Economics
- ME 510: Econ. & Policy of Engineering Energy Systems
- SOC 568: Sociology of Food & Ag Systems
- SOC 569: Sociology of the Environment
- JL MC 574: Communication Tech & Social Change
- NREM 570: Advanced Decision-Making in Natural Resource Allocation

Weekly small group sessions form the second component of the learning community. Students conduct peer review on writing projects, discuss their research, and take turns chairing the meetings.

Year 2 2019-20

A two-year alternating series of monthly workshops compose part of the learning community. This past year, we focused on professional development and communication in the fall. In the spring, we brought in panels of experts on water quality and bioenergy.

**Graduate Certificate for Sustainable Development**
- AGRON/BOB/EE/ENG/ME 693: Entrepreneurship for Graduate Students in Science and Engineering

**Data acquisition, visualization & analytics (select 1)**
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- ECE 549: Image Processing
- ECE 562X: Analysis Projects for Improved Decision Making in the Service Sector
- ECE 562X: Data Analysis & Machine Learning
- STAT 577: Statistical Methods for Research Workers

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Year 2 Highlights

1. Creative approaches to connecting and collaborating
2. Alternative symposium format
3. Intellectual closeness with physical distance

Pandemic Challenges
We will welcome six new trainees, offer the graduate communication class for the first time and present the second workshop series to focus on Effecting Change in the FEWS Nexus.

The students will continue to meet in small groups, leading discussions, and providing training to each other in their fields of expertise.
Industry Advisory Board

Akash Vidyadharan
Founder and
Chief Technology Officer

Greg Doonan
Head of Novel Algorithm Advancement

Hassan Loutfi
R&D Manager

Frank Dohleman
Open Innovation Lead

Tom D'Alfonso
President

Kara Hobart
Senior R&D Engineer

Karen Crosby, Southern U and A&M
Zahed Siddique, U of Oklahoma
Tonya Smith-Jackson, N. Carolina A&T
Heidi Taboada, U of Texas at El Paso

Diversity Advisory Board

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College of Engineering
College of Agriculture and Life Sciences
Graduate College Career Services and Center for Communication Excellence
Bioeconomy Institute
Department of Industrial and Manufacturing Systems Engineering
Iowa Nutrient Research Center
Iowa Water Center
Learning Communities
Predictive Plant Phenomics (P3) Traineeship
Reiman Gardens
Workspace
The NSF National Research Traineeship (NRT) program encourages the development of bold, new, & transformative models for STEM graduate education training.

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Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the NSF.

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