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

Two highlights of this year were our fall networking weekend and annual symposium. The fall weekend was aimed at overcoming pandemic isolation as cohort 3 joined the program and we cautiously returned to physical proximity. We enjoyed:

- Food, in the form of Friday night pizza, s'mores around a bonfire, and Saturday meals prepared by the trainees;
- Water, which we mostly kept out of our canoes; and positive
- Energy, generated by relaxing and playing together.

In January, our second annual and first-ever face-to-face symposium (with some virtual participants) included two data science workshops, nine advisory board members, and a fascinating keynote by John Crespi titled, “The data revolution is not a knowledge revolution. Yet. How interdisciplinary work will help it get there.”

If anyone can pull off a knowledge revolution, it will be this next generation of scholars with their commitment to impactful research. It’s a joy to play a part in their preparation.

The DataFEW$ion 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.

Leadership Team

Sarah Ryan, PI
Industrials and Manufacturing Systems Engineering
Operations research; data-driven decision models

Robert Brown
Bioeconomy Institute
Fuels, chemicals, and power from biomass

Amy Kaleita
Agricultural & Biosystems Engineering
Ag land and water resources conservation engineering

Sergio Lence
Economics
Ag economics, welfare and market analysis

Michelle Soupir
Agricultural & Biosystems Engineering
Water quality and watershed management

Cameron MacKenzie
Industrials and Manufacturing Systems Engineering
Decision and risk analysis
What is a Traineeship?

The DataFEWSion traineeship starts with the strong foundation of the student’s research in the FEWS nexus. Layered on top of that is a graduate certificate with a focus on data analytics and decision making. To augment the certificate, a two-year series of workshops are offered, providing unique opportunities for professional development and interactions with stakeholders. The trainees document their learning in an ePortfolio. And finally, the heart of the traineeship is the learning community, where they practice the skills they learn and look for collaboration opportunities. The most important part of a traineeship is the trainees, who are highly motivated and talented graduate students with a commitment to interdisciplinary collaboration.

Up to six Ph.D. trainees per year receive funding packages that cover tuition, living expenses, and health insurance for a year. We also have unfunded trainees, who are international or master’s students not eligible for this funding.
Diverse Disciplines, Domains, Demographics, and Directions

Demographics
- Under-represented populations
- International work experience
- First generation college students
- International students

College of Engineering (CoE)
College of Agriculture & Life Sciences (CALS)
College of Liberal Arts & Sciences (LAS)

Each dot represents a trainee

Anticipated Career Paths
- Academia
- Industry
- Entrepreneur
- Public Sector
- NGO

FEWS Collaboration Potentials
- Food Production
- Biorenewable Energy
- Water Quality
- Data Analytics
- Policy, Econ. & Soc.

(data represents all cohorts)
Alex Cleveringa  
Agronomy – Crop Production & Physiology  
Advisor: Fernando Miguez

I am interested in developing tools that provide readily accessible statistical analyses of data generated from on-farm trials across the Midwest. I am also creating an ontology to make the dataset I’m working with findable, accessible, interoperable, and reusable by others.

Holly Loper  
EEOB - Microbiology  
Advisor: Steven Hall

My research interests lie in improving the ways we study and monitor microbial processes in the environment to help better minimize our detrimental impacts of agriculture on nature. Currently, I am testing the efficacy and sustainability of a novel method of microbial nitrogen fertilization for corn.

Gabrielle Myers  
Agricultural & Biosystems Engineering  
Advisors: Raj Raman & Daniel Andersen

I use technoeconomic modeling and life cycle analysis approaches on three interrelated food, bioenergy, and cropping systems. I am currently engaged in field work examining the impacts of perennial ground cover systems on water quality from maize production sites.

Jarrett Morrison  
Civil, Construction and Environmental Engineering  
Advisor: Lu Liu

My research focus is on resilience in the water resources sector. I am currently building models to see how implementing new technologies can enhance the resilience of wastewater treatment facilities during increased wet weather events.

Kelly Nascimento Thompson  
Agricultural and Biosystems Engineering  
Advisors: Richard Cruse & Brian Gelder

My research focuses on GIS and Remote Sensing applied to Soil and Water conservation integrating the Daily Erosion Project with the STRIPS project for erosion modeling. Our goal is to ground-truth the Water Erosion Prediction Project (WEPP) model by comparing erosion simulation data collected at the STRIPS h-flumes.

Kyle DeLong  
Agronomy – Agricultural Meteorology  
Advisor: Brian Hornbuckle

I am highly interested in environmental security, specifically related to the sustainability of agriculture for the use of food, feed for livestock, fiber, and fossil fuel alternatives. My current research is to validate soil moisture estimators (i.e., microwave satellites and numerical models) in the Corn Belt.

Motahareh Kashanian  
Industrial and Manufacturing Systems Engineering  
Advisor: Sarah M Ryan

I am interested in mathematical programming and uncertainties in sustainable energy systems. As an industrial engineer, I want to continue to fill the gaps between Artificial Intelligence, Operations Research, Theories, and Real-World Applications.
Year 1
During our planning year, we established a graduate certificate, hired a project manager and recruited eight trainees.

9/1/2018

Year 2
The first cohort developed professional skills and built interdisciplinary relationships through the learning community and Workshop Series 1: Your role in the FEWS Nexus.

9/1/2019

Year 3
The second cohort of six new trainees joined cohort 1 in the learning community, Workshop Series 2: Embracing Change in the FEWS Nexus, the first Symposium, and the newly developed communication course. During COVID, meetings were held through Zoom. Cohort 1 completed the program, with one taking a job in industry, one in academia, and the others continuing in their doctoral programs.

9/1/2020

Year 4
The third cohort of seven new trainees joined cohort 2. The students took more ownership of the Learning Community, by leading trainings and topical discussions. The second round of Workshop Series 1: Your role in the FEWS Nexus had exceptional presenters. A networking weekend was added in the fall to address the lack of connections during COVID. Nine external advisory board members joined students and faculty in person at our second annual symposium.

9/1/2021

Year 5
Cohort 4 will join cohort 3 in the learning community and workshop activities. The leadership team will focus on planning for the sustainability of program elements.

9/1/2022

Year 6
Wrap up training cohort 4 and implement plans for institutionalization.

9/1/2023

2022 Symposium: Harnessing the Data Revolution: Informed Policy for Society and the Environment

The Symposium began with a thought-provoking keynote by John Crespi, Director of the Center for Agricultural and Rural Development, followed by student presentations and posters, two workshops on data science, and many networking opportunities. Most participants welcomed the opportunity to attend in person, but we also had an online option to include remote participants. Five new external advisory board members joined the event along with four continuing ones.

9/1/2022

New and Improved Learning Community
As the program evolved, the students took ownership of the learning community by presenting “teachable topics,” leading topical discussions and helping to select workshop and symposium speakers.

Topics Led by Students
Finding connections in our research
Data sharing principles/ontologies
The logic of scientific discovery
Life cycle assessment: Some of the basics
Dimensional analysis for understanding relationships between variables
Students share IE 690 Experience “Incorporating social equity into food-energy-water system assessments across scales: A review”
Building a website for a GitHub depository
Tips and tricks with R
Writing reports with LaTeX

Other Engagement
Screening & discussion of film “Kiss the Ground”
Author Beth Hoffman discussed her book “Bet the Farm”.
ISU Librarian Megan O’Donnell discussed the ethics of data

View the Year 5 flyer.
Cohort 3 Orientation

Orientation
Cohort 3 began the year with a one day program orientation. Jen Liepten from CELT guided them through the results of the Clifton Strengths Finder. Science communication with Sara Merritt from Reiman Gardens was next, and for lunch, they met up with their faculty advisors. And finally, they spent the afternoon finding each other’s offices and taking pictures with props.

Networking Weekend
The connections continued during the networking weekend near Pine Lake State Park. Games, a campfire, cooking and canoeing provided opportunities to become better acquainted. They also learned more about each others’ research to explore collaboration potentials, and got a little more clarification on the DataFEWSion program expectations. Fortunately, everyone went home dry and happy.
### Workshop Series 1: Your Role in the FEWS Nexus

<table>
<thead>
<tr>
<th>Fall 2021</th>
<th>Topic</th>
<th>Presenters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct</td>
<td>Branding &amp; Social Media</td>
<td>Panel: Julianne Kellogg (Ph.D. Candidate, Washington State U.) &amp; Adam Janke (NREM)</td>
</tr>
<tr>
<td>Nov</td>
<td>Collaboration: Your Role</td>
<td>Melissa Miller (NIAMRRE Associate Director of Operations)</td>
</tr>
<tr>
<td>Spring 2022</td>
<td>Water Quality Roundtable</td>
<td>Rick Cruse (IA Water Ctr.) &amp; Matt Holmers (IA Nutrient Research Ctr.) &amp; Sean McMahon (IA Ag Water Alliance)</td>
</tr>
<tr>
<td>Mar</td>
<td>Renewable Energy Roundtable</td>
<td>Anne Kimber (Dir. ISU’s Electric Power Research Ctr.) &amp; Bernie del Campo (ISU PhD grad, who started a biochar company in Iowa)</td>
</tr>
<tr>
<td>Apr</td>
<td>Data Science: Advanced Topics</td>
<td>Brian Gelder (ABE)</td>
</tr>
</tbody>
</table>

The workshops began as hybrid meetings, with Drs. Erin Webb on Zoom and Lawrence Mosely attending in person.

The conversations after the presentations are the best!

Everyone enjoyed meeting fully in person during the spring semester in the new Student Innovation Center.

Erin Webb, Oak Ridge National Laboratory.

Lawrence Mosely, Omni Analytics Group

Sean MacMahon, Iowa Water Alliance, talks with Loulou Dickey & Tiffanie Stone.

Rick Cruse, Iowa Water Center, talks with Alex Cleveringa and Kyle Delong.
In August, 2022, we will welcome DataFEWSion’s fourth and final funded cohort. These trainees come to us from agricultural & bioystems engineering, animal science, chemical and biological engineering, civil engineering, environmental science, industrial engineering and materials science & engineering.

Research Interests

Cohort 4 Faculty Advisors

- Sarah Ryan
  - IMSE
- Brian Hornbuckle
  - Agronomy
- Fernando Miguez
  - Agronomy
- Dan Andersen
  - ABE
- Janette Thompson
  - NREM
- Bradley Miller
  - Agronomy
- Raj Raman
  - ABE
- Emily Zimmerman
  - NREM
- Lisa Schulte Moore
  - NREM
- John Tyndall
  - NREM
- Brian Gelder
  - ABE
- Steven Hall
  - EEB
- Chris Rehmann
  - CCEE
- Steven Hall
  - EEOB
- Lu Liu
  - CCEE
- Raj Raman
  - ABE
- Lisa Schulte Moore
  - NREM
- Janette Thompson
  - NREM
- John Tyndall
  - NREM
- Emily Zimmerman
  - NREM
2021 Publications


2020 Publications


2020 Conference Presentations / Papers


2019 Conference Presentations / Papers


Cost Assessment of Centralizing a Swine Manure and Corn Stover Co-Digestion System

Univariate Analysis of End-of-Season Corn Stalk Nitrile Test Dataset

Enhancing the Resilience of Houston’s Wastewater System Under Wet Weather Using Emerging Technologies

Supply chain design for chemicals from biomass

Soil Block Mesocosms: A New Approach for Quantifying Nitrate Leaching and Nitrous Oxide Emissions from Maize Cropping Systems

Site-Specific Digital Soil Maps Inputs in Simulating Maize Biomass and Yield VS. the SSURGO Database

The Daily Erosion Project Going Global: Analyzing Distinct Precipitation Datasets

Modeling Ecosystem Services for a New Education Paradigm

Stormwater management opportunities and challenges

Validation of Three Microwave Satellite and Three Reanalysis Soil Moisture Products in the U.S. Corn Belt Considering the Periods when Farmers Make Key Management Decisions Driven by Crop Development Stages.

Examining the Potential of Conservation Practices to Maximize Subfield Profitability and Environmental Benefits

Modeling Metropolitan Food Systems in the Midwest US: Life Cycle Assessment of Current and Local Scenarios

NOTE: more information and videos of each poster or presentation can be found at www.datafewsion.iastate.edu

2022
Brown Graduate Fellowships
Tiffanie Stone, cohort 2
Guy Graduate Fellowship
Tim Neher, cohort 1
ISU Graduate College 3MT: Finalist
Holly Loper, cohort 3
Rachel Sorensen, cohort 2

2021
Sposito Computing Award
Charles Labuzetta, cohort 1
Brown Graduate Fellowships
Meyer Bohn, cohort 2

2019
Guy Graduate Fellowship
Tim Neher, cohort 1
Brown Graduate Fellowships
Virginia Nichols, cohort 1

2022 Symposium Student Posters and Presentations

Travel Grants Awarded

<table>
<thead>
<tr>
<th>Year</th>
<th>Student</th>
<th>Name of Conference</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>2022</td>
<td>Gabrielle Myers</td>
<td>ASABE 2022 Annual International Meeting</td>
<td>Presenting Houston, Texas</td>
</tr>
<tr>
<td>2022</td>
<td>Timothy Neher</td>
<td>American Society of Microbiology - Microbe</td>
<td>Presenting Washington D.C.</td>
</tr>
<tr>
<td>2022</td>
<td>Gina Nichols</td>
<td>5 trainees</td>
<td>ISU campus</td>
</tr>
<tr>
<td>2021</td>
<td>Lindsey Hartfiel</td>
<td>OpEd Project’s ‘Write to change the world’ seminar</td>
<td>Virtual</td>
</tr>
<tr>
<td>2021</td>
<td>3 trainees</td>
<td>GeneralR workshop</td>
<td>Virtual</td>
</tr>
<tr>
<td>2020</td>
<td>Loulou Dickey</td>
<td>ISlorm 2020</td>
<td>Participant Virtual</td>
</tr>
<tr>
<td>2020</td>
<td>Virginia Nichols</td>
<td>Directed Acyclic Graphs for Causal Inference</td>
<td>Training Virtual</td>
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Keith Schilling
State Geologist - Iowa

Akash Vidyadharan
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Graduate College Career Services and Center for Communication Excellence
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Department of Industrial and Manufacturing Systems Engineering
ISU Learning Communities
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