# 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
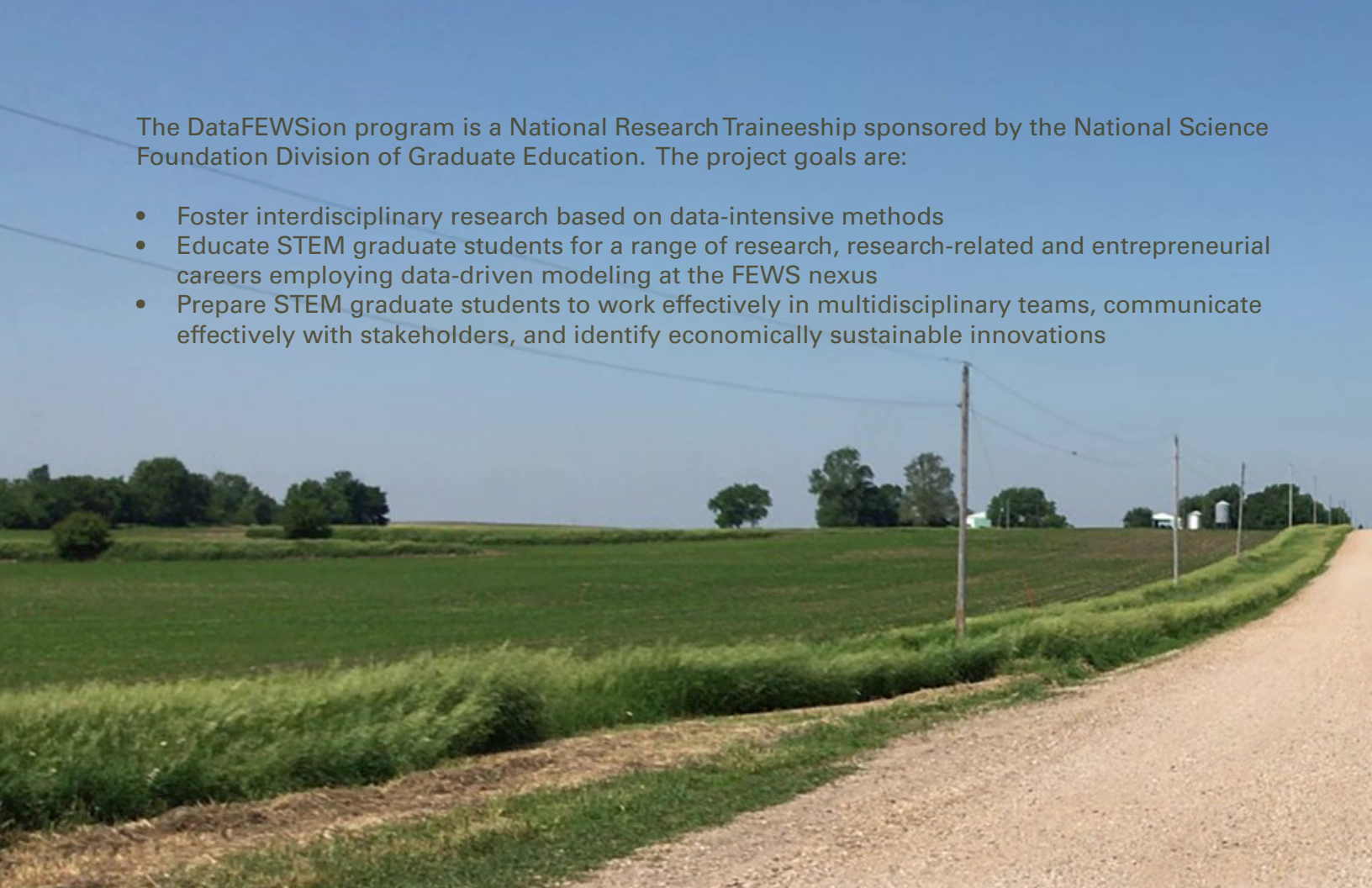
## Notes from the Program Director

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.
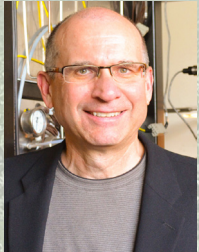
# Leadership Team



Sarah Ryan, PI

Industrial & Mfg. Sys. Engineering

Operations research; data-driven decision models

Robert Brown, Co-PI

Bioeconomy
Institute

Biomass energy

Amy Kaleita, Co-PI

Ag & Biosystems
Engineering

Ag land and water
resources conservation
engineering

Sergio Lence, Co-PI

Economics

Ag economics,
welfare and market
analysis

Michelle Soupir, Co-PI

Ag & Biosystems
Engineering

Water quality
and watershed
management

# 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.
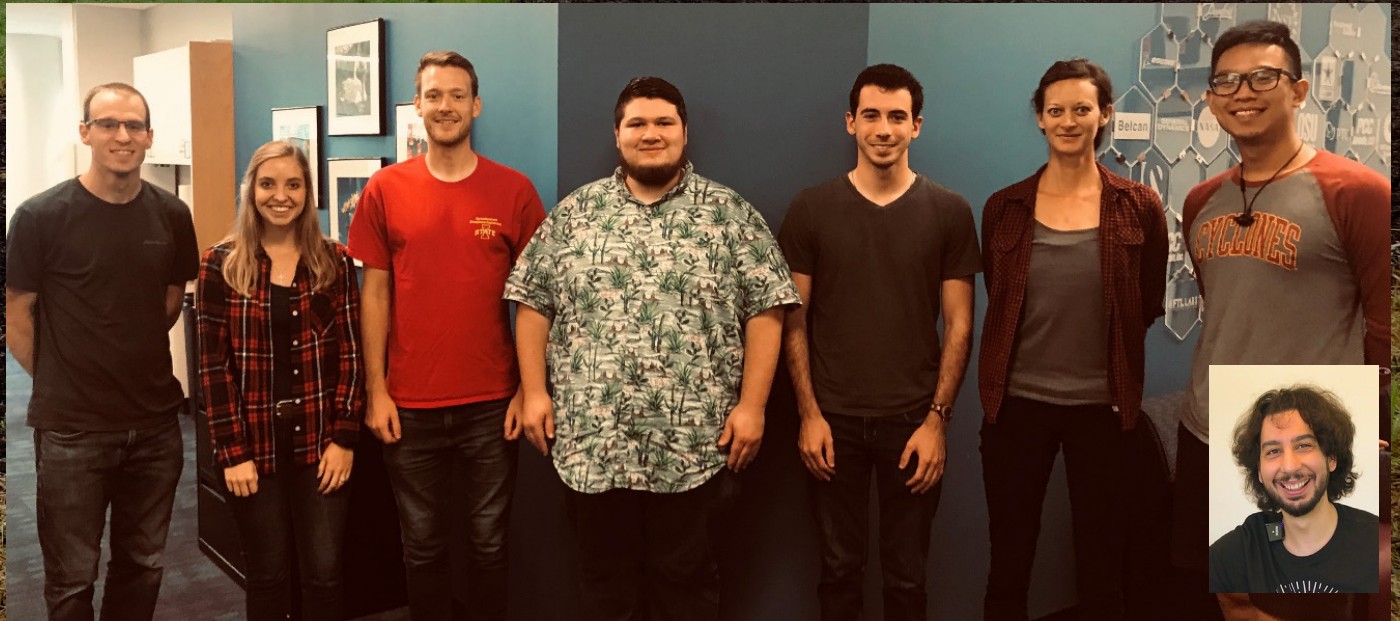
## Garrison Gunter

Chemical Engineering

Research Interest:
*Developing pyrolysis plants, capable of effectively converting waste biomass into biofuel and value added chemicals*

Advisor:
Dr. Robert Brown

## 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

## Lindsey Murry

Ag & Biosystems Eng.

Research Interest:
*Agricultural practices to improve water quality through agricultural engineering methods.*

Advisor:
Dr. Michelle Soupir

## 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

## Virginia "Gina" Nichols

Crop Prod. and Physiology

Research Interest:
*Quantifing the benefits of diverse crop rotations on environmental, social, and economic scales.*

Co-Advisors:
Dr. Matt Liebman
Dr. Satirios Archontoulis



## 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:
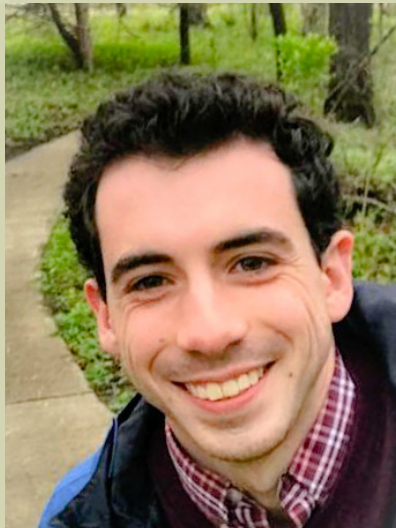Dr. Gül Kremer





## 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



## Charlie Labuzzetta

Statistics

Research Interest:
*Statistical analysis of satellite imagery for monitoring natural resources and best management practices*

Advisor:
Dr. Zhenguan Zhu

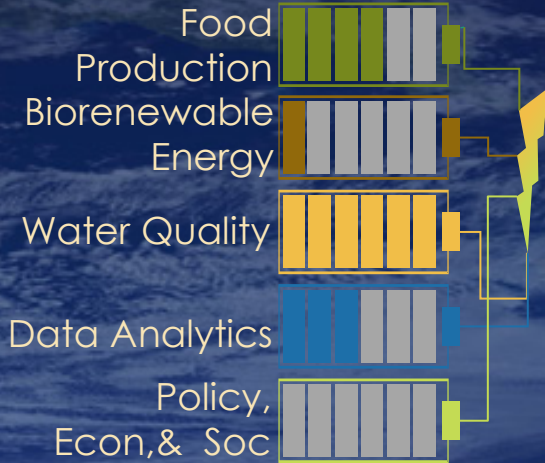# Diverse Disciplines, Domains, Demographics, and Directions

Cohort 1 ● Cohort 2 ●
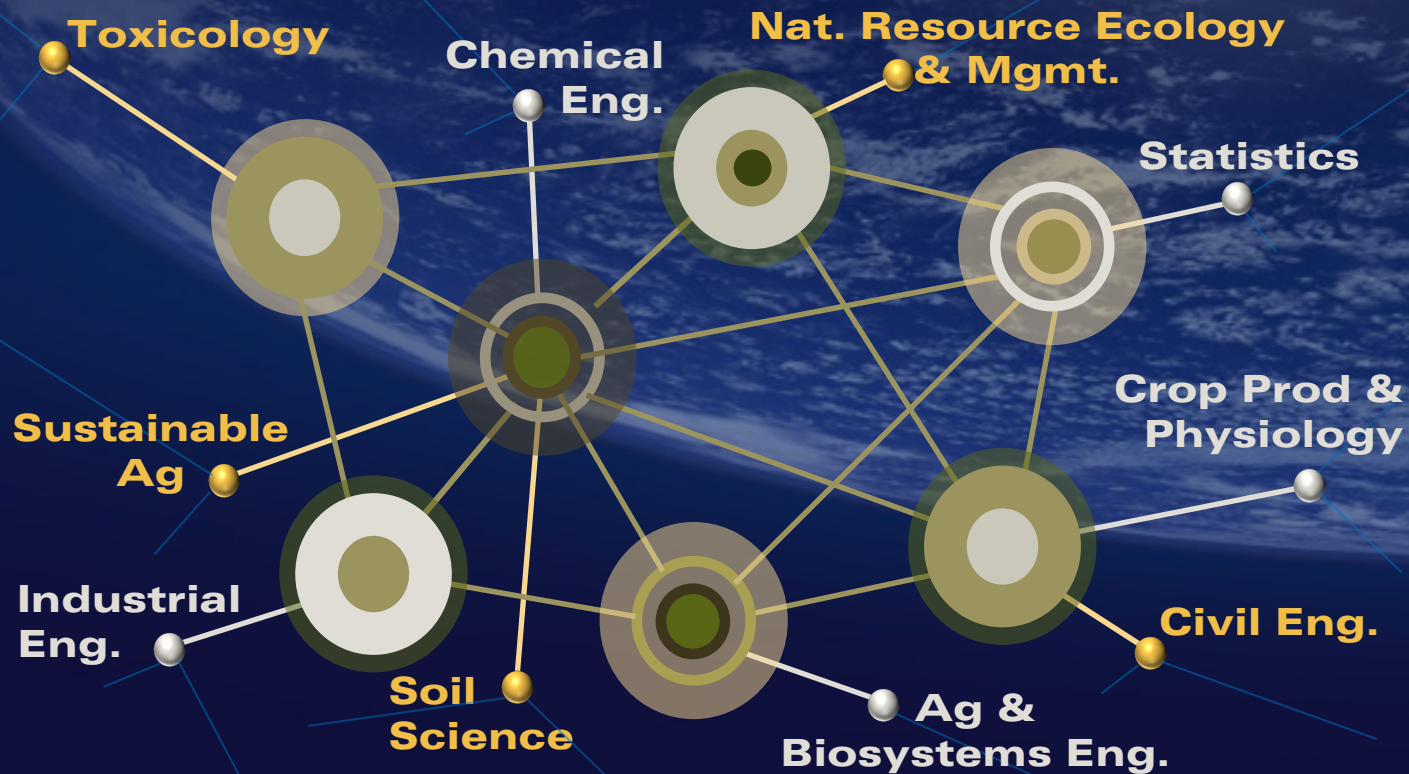
Toxicology

Chemical Eng.

Nat. Resource Ecology & Mgmt.

Statistics

Sustainable Ag

Crop Prod & Physiology

Industrial Eng.

Soil Science

Ag & Biosystems Eng.

Civil Eng.

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

## Core Courses
*(required)*

ABE 615: Biosystems for Sustainable Development

GR ST 566: Communications in Science

AGRON/BCB/EE/ENGR/ME 693: Entrepreneurship for Graduate Students in Science and Engineering

## Data acquisition, visualization & analytics
*(select 1)*

A B E 504: Instrumentation for Ag. & Biosystems Engineering

E E 525X: Data Analytics in Elect. & Comp. Engineering

I E 583: Data Mining

I E 592X: Analytics Projects for Improved Decision Making in the Service Sector

M E 592X: Data Analytics & Machine Learning for Cyber-Physical Syst App.

STAT 575: Methods of Multivariate Analysis

STAT 585: Methods of Multivariate Analysis

STAT 587: Stat. Methods for Research Workers

## Complex systems modeling for decision support
*(select 1)*

A B E 580: Engineering Analysis of Biological Systems

I E/E E/AER E 565: Systems Engineering & Analysis

I E 564: Decision Analysis in System Design

I E/AER E 568: Large-Scale Complex Engineered Systems

M E 525: Optimization Methods for Complex Design

AGRON 525: Crop & Soil Modeling

## Economics, Policy & Sociology of FEWS
*(select 1)*

BRT/POL S 516: Biorenewables Law & Policy

ECON 580: Intermediate Environmental & Resource Economics

M E 510: Econ. & Policy of Engineering Energy Systems

SOC 544: Sociology of Food & Ag Systems

SOC 549: Sociology of the Environment

JL MC 574: Communication Tech & Social Change

NREM 570: Advanced Decision-Making in Natural Resource Allocation

# 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)

## 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.

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 Highlights
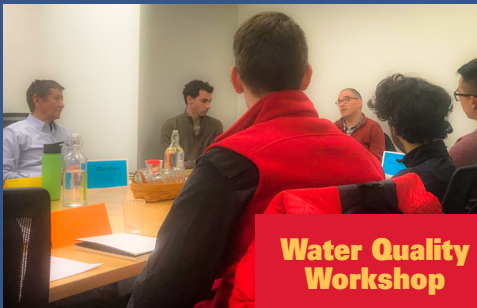
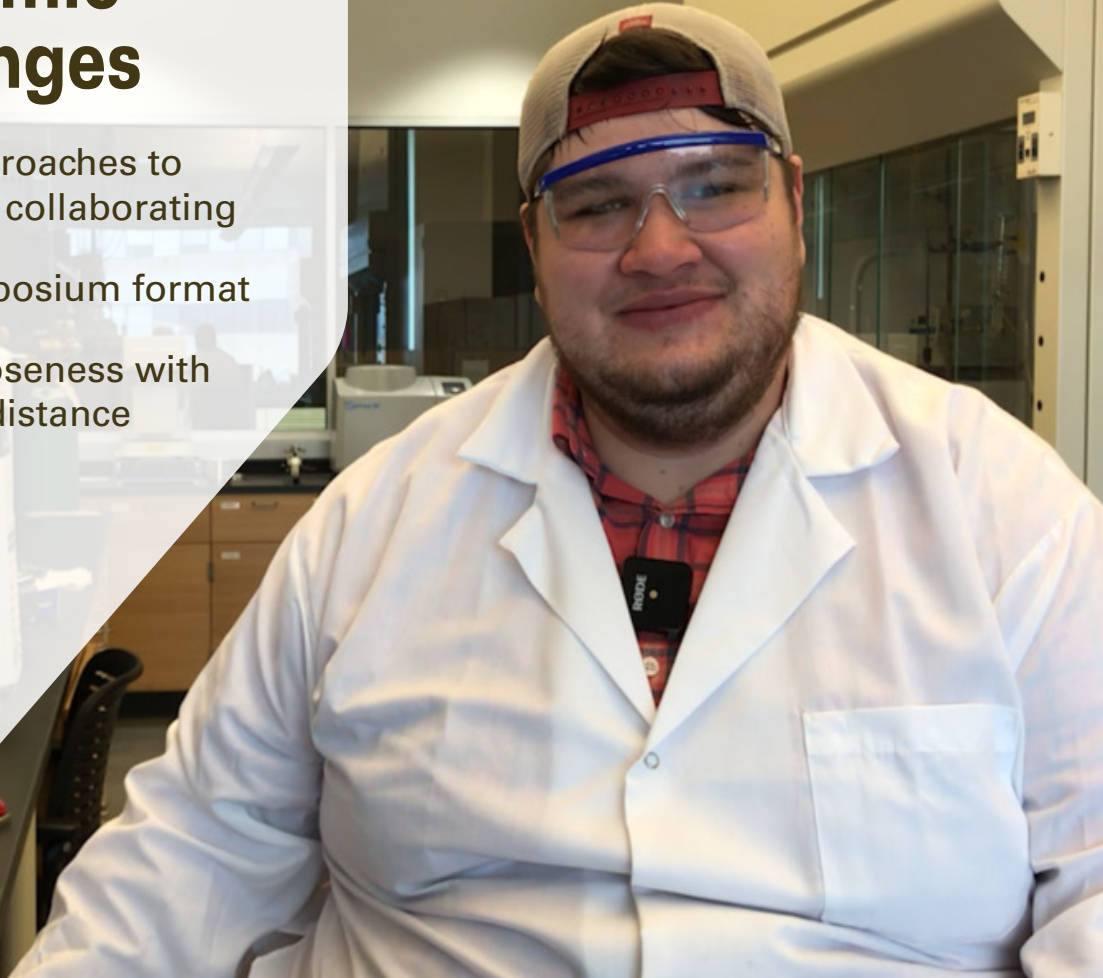Water Quality Workshop

Stakeholder Meetings

Branding Workshop

Orientation Team Building

BioEnergy Workshop

# Pandemic Challenges

1. Creative approaches to connecting and collaborating

2. Alternative symposium format

3. Intellectual closeness with physical distance

## Cohort 2 interests

different algorithms social work industry
energy data toxicity precision
unique focuses policies development global maps system
learned able nexus background both graduate
natural model production economic society midge
products laws master's help FEWS land
about policy complex goals problem begin knowledge
topics community research used
future over student models studies chemicals
because technology sustainability crop between
affect disciplines soil mapping
iowa gain life project modeling ecology aspect
quality science part statistics more
FEWSion results management
insects water major environment
allow

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.

## Year 3
### 2020-21

# Faculty Advisors

(Cohort 1)

Robert Brown
BEI

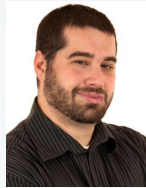Michelle Soupir
ABE

Emily Heaton
Agronomy

Gül Kremer
IMSE

Matt Liebman
Agronomy

Sarah Ryan
IMSE

Andy VanLoocke
Agronomy

Sotirios Archontoulis
Agronomy

Zhengyuan Zhu
Statistics

# Industry Advisory Board

**INFRALYTIKS**
Making Data Meaningful

Akash Vidyadharan
Founder and
Chief Technology Officer

**syngenta®**

Greg Doonan
Head of Novel Algorithm
Advancement

**ROESLEIN**
ALTERNATIVE ENERGY, LLC

Hassan Loutfi
R&D Manager

**THE CLIMATE CORPORATION**

Frank Dohleman
Open Innovation Lead

**Agmine™** Solutions for Modern Agriculture

Tom D'Alfonso
President

**General Mills**
Making Food
People Love

Kara Hobart
Senior R&D
Engineer

# Diversity Advisory Board

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

## With gratitude:

Vice President for Research

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

# IOWA STATE UNIVERSITY



*The NSF National Research Traineeship (NRT) program encourages the development of bold, new, & transformative models for STEM graduate education training.*

For more information
Email: datafewsion@iastate.edu
Website: datafewsion.iastate.edu

Photo by Jack and June Schmidt