



# DataFEWSion 2024 Symposium

When Disciplines Converge  
Innovations Emerge

January 9, 2024  
ISU Alumni Center  
Ames, Iowa



**IOWA STATE  
UNIVERSITY**

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

# DataFEWSion 2024 Symposium

When Disciplines Converge Innovations Emerge

## Blizzard Edition

10:15 am	Arrival, Coffee & Pastries	3 <sup>rd</sup> Floor Reception Area
10:30 am	Welcome: Sarah Ryan, Project Director	Executive Board Room & Zoom
	<b>Keynote</b> <b>"Fireside" Chat with Lisa Schulte Moore</b> Moderator: Elmin Rahic Conversation around innovations that emerge when disciplines converge	
11:30 am	Poster Session & Break	3 <sup>rd</sup> Floor Reception Area
12:00 pm	Lunch	Ballroom
1:00 pm	<b>Workshop I</b> <b>Carbon Removal Programs in Agriculture</b> Introduction: Angelos Lagoudakis Tom Lawler & Brian Bartle Indigo Ag	Executive Board Room & Zoom
2:30 pm	Poster Session (continued) & Break	3 <sup>rd</sup> Floor Reception Area
3:00 pm	Student Collaboration Projects -- FEW	Executive Board Room & Zoom
4:00-6:00 pm	Happy Hour and Networking	Ballroom

# Fireside Chat



## Lisa Schulte Moore

Iowa State University

Dr. Lisa Schulte Moore is a professor in the Department of Natural Resource Ecology and Management and Co-Director of the Bioeconomy Institute at Iowa State University. She conducts research and teaches in the areas of agriculture, ecology, forestry and human-landscape interactions. Her research addresses the strategic integration of perennials into agricultural landscapes to support new agricultural markets and to meet societal goals for healthy soils, clean water, abundant wildlife and inspiring recreational opportunities. She works to return more of the value from agricultural supply chains to rural communities and the land. She develops relationships and institutional capacity so diverse groups of people can more effectively work together. She is a Fellow of the Leopold Leadership Program, Ecological Society of America and the MacArthur Foundation (2021 Fellow).



# Workshop 1



**Brian Bartle**

Partner Enablement  
Indigo Ag



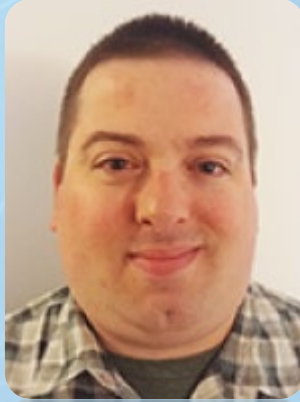
**Thomas Lawler**

Regenerative Ag Specialist  
Indigo Ag

## Carbon Removal Programs in Agriculture

As leaders in the carbon removal space within agriculture, Brian Bartle and Tom Lawler will cover the differences between scope 1 - carbon offset/credit - and scope 3 - carbon inset - programs currently found in agriculture. They will also dive into measurement, reporting and verification (MRV) of those programs, the state of biogeochemical modeling, and what the future holds for carbon removal programs in agriculture.

## Workshop 2



**Josh Obrecht**

GIS Manager - GIS Support and Research Facility  
Iowa State University

## How to Find and Obtain Relevant GIS Data

At times, finding the relevant GIS data for a project can be overwhelming. This workshop will show how data has become easier to find and use through online portals and services. We will also look at the usefulness of the dreaded "metadata."

# FEW Collaboration Project Presentations

## Food Production

*Harvesting Harmony: A Data-Driven Inquiry into Food Inequity and Climate Impacts in Iowa*

Logan Johnson\*  
Nicole Kling  
Angelos Lagoudakis  
Júlia Brittes Tuthill

## Renewable Energy

*Piggybacking on the Sun: Examining the Efficiency and Economic Viability of Solar-based Microgrid Systems in Iowa*

Alexandra Jean  
Elmin Rahic  
Luke Soko  
Connor Thorpe\*

## Water Quality

*Weather Extremes in Iowa: Tracing the Impacts of Climate Change on Flooding and Drought*

Fatemeh Ganji  
Matt Kavanaugh\*  
Emmanuel Padmore Mantey  
Taylor Vroman

# Harmonizing Iowa's Resources: Modeling, Tool Development, and Data Synthesis for the IFEWs

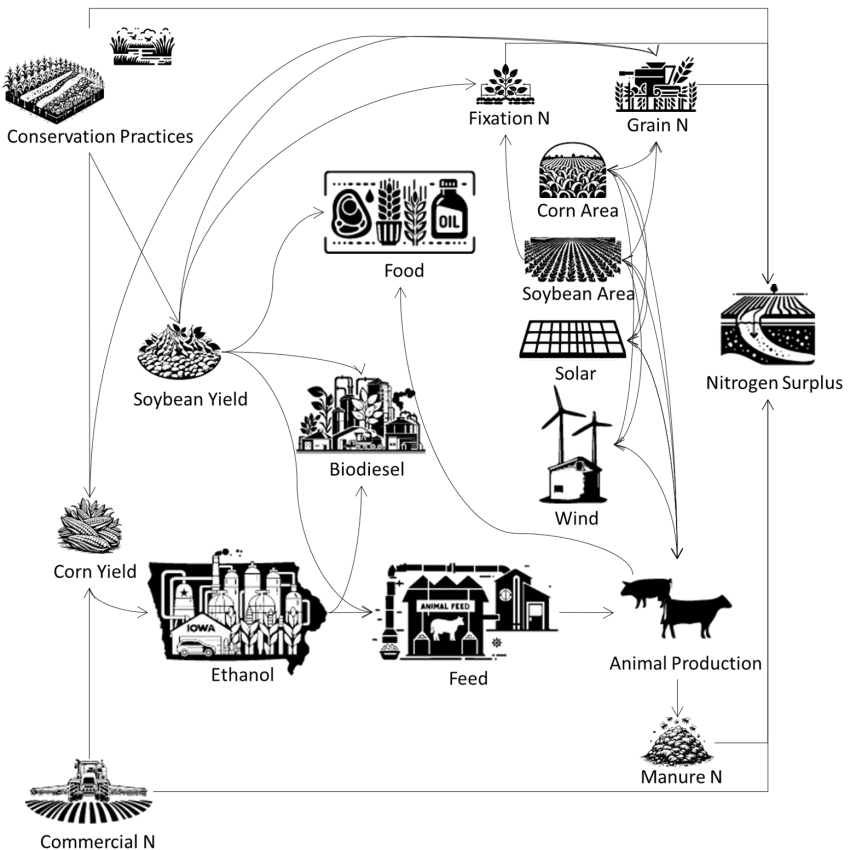


My research is in collaboration with the IFEWs research group, a project which is developing an Iowa Food-Energy-Water simulation model, to create the model database and develop a visualization tool to observe the relationship between agricultural products (food, feed, biofuels) and water quality through nitrogen export for decision-making facilitation.

**Júlia Brittes Tuthill**

Agricultural and Biosystems  
Engineering

Iowa FOOD-ENERGY-WATER nexus



Faculty Advisor: Dr. Amy Kaleita

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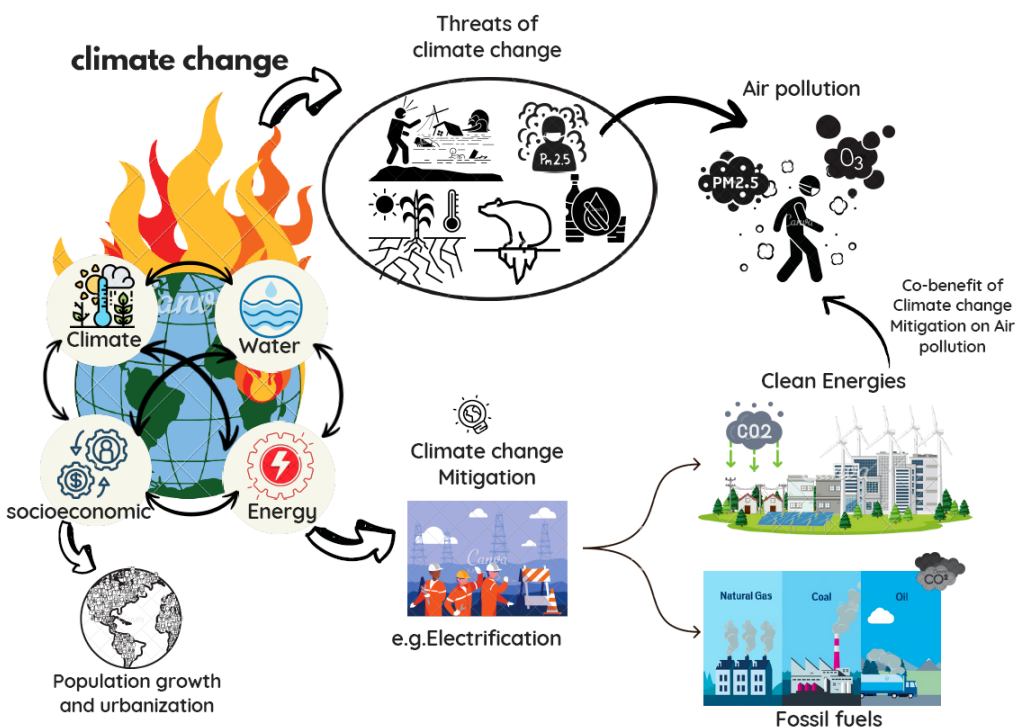
# Implications of Climate Change Mitigation and Socioeconomic Development on the US Electric Power Sector



**Fatemeh Ganji**

Civil, Construction and Environmental Engineering

My interest areas are climate change and its effects, as well as the Water-climate-energy nexus. I worked on investigating climate change's impact on surface water resources in my master's. Currently, I am exploring integrated assessment modeling (e.g., GCAM) to assess future electricity and water demand under different climate change and socio-economic development.





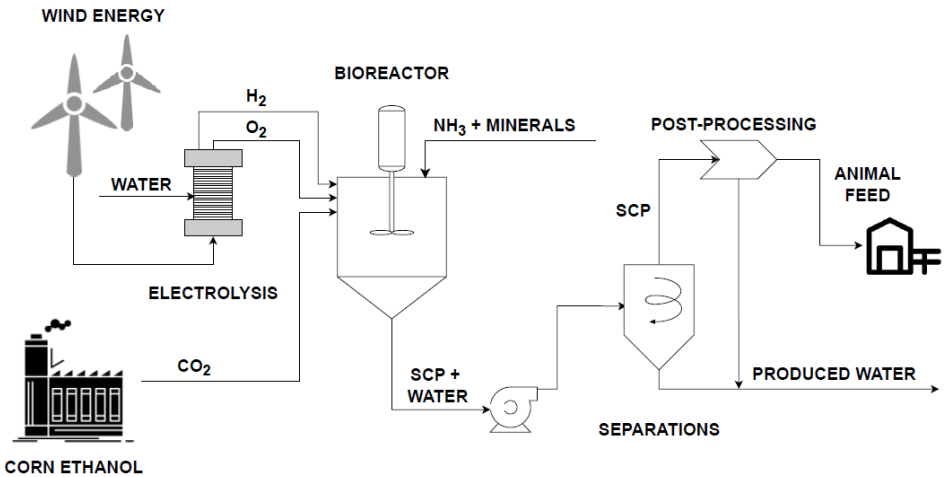
# Enhancing Mass Transfer in Gas Fermenters for Production of Single Cell Protein



**Alexandra Jean**

Chemical and Biological  
Engineering

My research focuses on overcoming the mass transfer limitations in gas-liquid systems. Specifically, we are evaluating new methods of gas-liquid contacting to improve commercial systems such as beverage carbonation, gas fermentation, and other applications requiring gases to be dissolved in liquid process streams. My central research project evaluates the viability of growing single cell protein on hydrogen, oxygen, and carbon dioxide as a method of carbon recycling. The low-solubility and explosive nature of this gas system requires a new approach unique from conventional gas fermentation systems, and I hope my proposed system will provide a solution. This single cell protein product would serve as a protein source in animal feed to help reduce the emissions associated with animal protein production.



Faculty Advisor: Dr. Robert Brown

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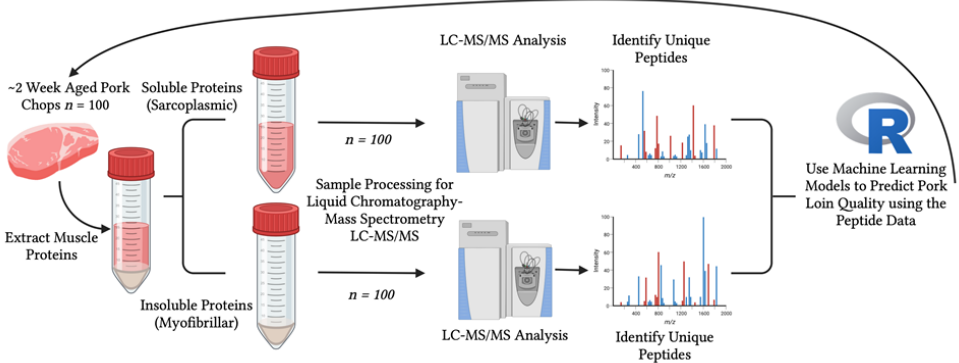
# Using a Machine Learning Approach to Predict Pork Loin Quality from Proteomic Data



**Logan Johnson**

Animal Science

Global livestock production and meat consumption continue to rise, increasingly contributing to climate change and drawing heightened scrutiny. There is an increased desire to produce livestock more efficiently while producing less waste products. My research aims to identify molecular factors—such as specific proteins and metabolites—and associations of these factors to livestock production efficiency and meat product quality. Machine learning techniques have the potential to better determine connections in larger, more complex data sets. By better understanding the molecular factors affecting livestock production efficiency, this research could guide producers towards more sustainable practices, contributing to the broader goal of reducing the environmental footprint of meat production.



Faculty Advisor: Dr. Steven Lonergan

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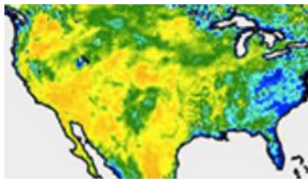
# Developing a Dynamic Planting and Harvesting Algorithm in Order to Improve SMAP Soil Moisture Retrievals



**Matt Kavanaugh**

Agronomy - Agricultural  
Meteorology

My research focuses on using microwave remote sensing to monitor changes in the water content of soil and vegetation throughout the growing season. In particular, the spring planting and fall harvest periods when microwave soil moisture retrievals are influenced by a combination of soil surface roughness as well as the water in plants. In order to distinguish between these two, the goal is to develop an algorithm that enables microwave satellites to determine when crops are planted and harvested. I hypothesize that this will improve soil moisture retrievals throughout regions that are dominated by seasonal agriculture. Better soil moisture measurements will improve weather and climate forecasting, and agricultural lands management in an economically and environmentally responsible manner.



SMAP provides daily soil moisture measurements worldwide, improving global weather models and land management techniques

Bare soil misinterpreted as VOD due to texture

**Soil Roughness**



**Goal:**

- Enhanced predictability of droughts and floods, which will help protect water quality and the global food/feed/fiber/fuel supply

Water in crops attenuates microwave emissions from the ground

**Vegetation Optical Depth (VOD)**



Faculty Advisor: Dr. Brian Hornbuckle

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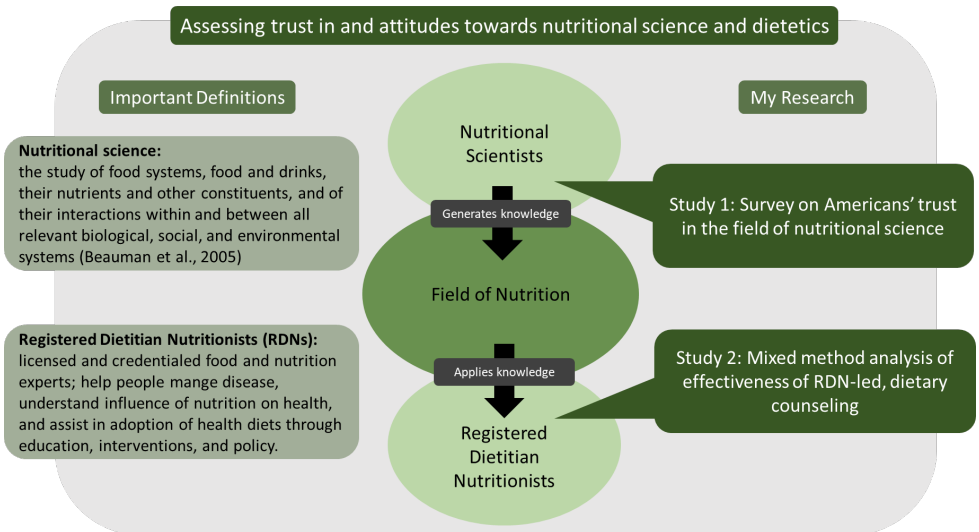
# Assessment and Promotion of Environmentally Sustainable and Healthy Dietary Patterns



**Nicole Kling**

Food Science and Human Nutrition - Nutritional Science

Little is known about Americans' trust in nutritional scientists and registered dietitian nutritionists. This is concerning for two major reasons: (1) trust is essential to effective communication, and (2) trust in science is influenced by various social factors, including political and religious beliefs. Without a clear understanding of how and why people trust professionals and what factors influence said trust, nutrition professionals are less equipped to communicate with their audiences of interest. The goal of my doctoral research is to fill this gap in knowledge through qualitative and quantitative research.



Faculty Advisor: Dr. Lorraine Lanningham-Foster

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# Food Choices and their Effect on Health and Nutrition: An Economic Investigation



Angelos Lagoudakis

Economics

I am an applied microeconomist focusing on food and health economics, consumer and producer behavior, and industrial organization.

I employ applied microeconometrics and experimental economics methods to answer questions relevant to economists, data analysts, and policymakers.



## Where?

At a computer lab  
In a grocery store  
In conferences  
In companies' headquarters  
In policy briefings



angeloslagoudakis.com

@LagoudakisA

## Food Economics

*The principles of economics as applied to food, consumer perceptions, and health outcomes*



## What?

Consumer preferences  
Economic experiments  
Scanner data  
POI data  
Health outcomes  
Policy implications



## Toolkit

Economic theory  
Econometrics  
Data analytics  
Research Design

## Highlights

USDA ERS Co-op  
iFREE grant  
Policy & Data Viz  
Competitions



## Destinations

Collaborations  
Data products  
USDA NIFA grant  
VR simulations



Faculty Advisors: Dr. Dermot J Hayes and Dr. Elizabeth Hoffman

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# Cost Curves: A Novel Decision-Making Tool in The Water Industry with Focus on Water Reuse

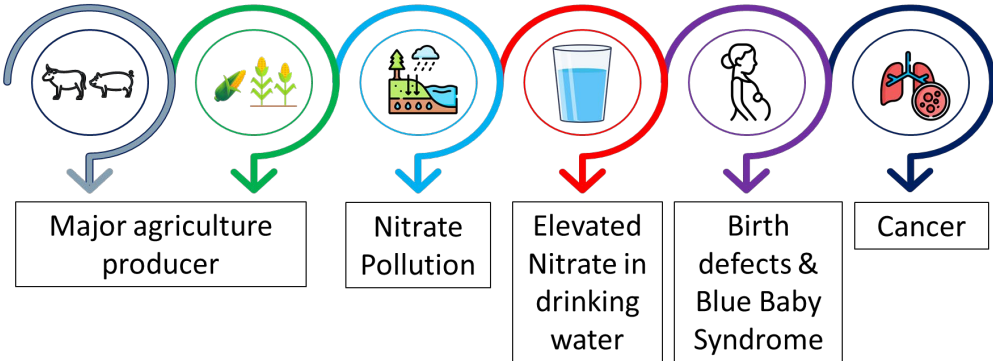
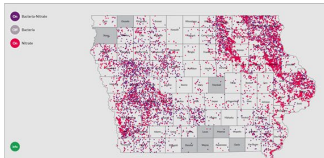


**Emmanuel  
Padmore Mantey**

Civil, Construction and  
Environmental Engineering

My current research aims to build an inventory that quantifies the water available for reuse. Data will be collected from sources like storm water, agricultural runoff and return flow, municipal wastewater, and rainwater. The end goal of the research is to combine these data into one body across attributes like spatial and temporal resolution for consistency and level of detail in a data structure.

## Iowa's nitrate problem



Faculty Advisor: Dr. Lu Liu

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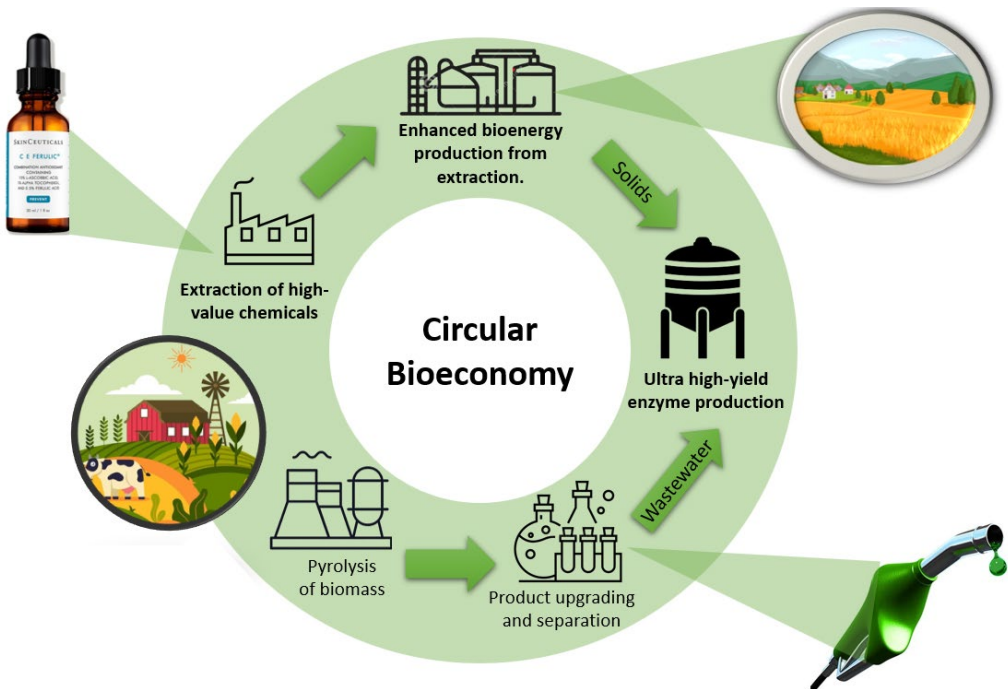
# Bioprocessing strategies to valorize perennial biomass



**Elmin Rahic**

Agricultural and Biosystems  
Engineering

My research investigates various bioprocessing strategies to valorize perennial biomass crops. These biomass crops provide important environmental and ecological services on the landscape, but often come at a cost to farmers. I'm currently looking at two strategies: anaerobic digestion (codigestion) strategies with animal manure and a novel enzyme fermentation process. My work incorporates a mixture of experimental data collection and model generation, as well as techno-economic and life cycle analyses.



Faculty Advisors: Drs. Zhiyou Wen and Robert Brown

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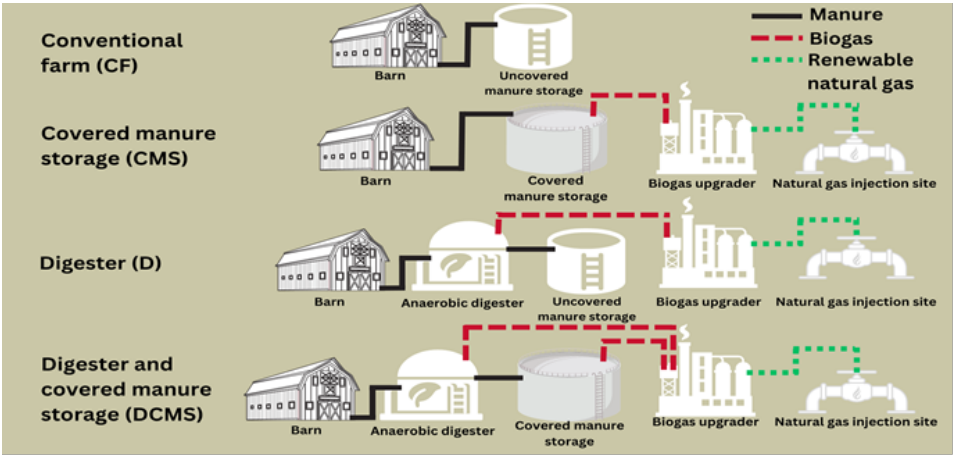
# Farm Size Impacts Profitability of Anaerobic Digestion Renewable Natural Gas Projects



**Luke Soko**

Agricultural and Biosystems Engineering

My research includes analyzing the economic feasibility of biogas projects. Specifically, I investigate how different farm sizes, livestock, travel distances, conveyance methods, digester types, and feedstocks impact project profitability. I create models to determine the costs and revenues of anaerobic digester projects in different scenarios.



Faculty Advisor: Dr. Dan Andersen

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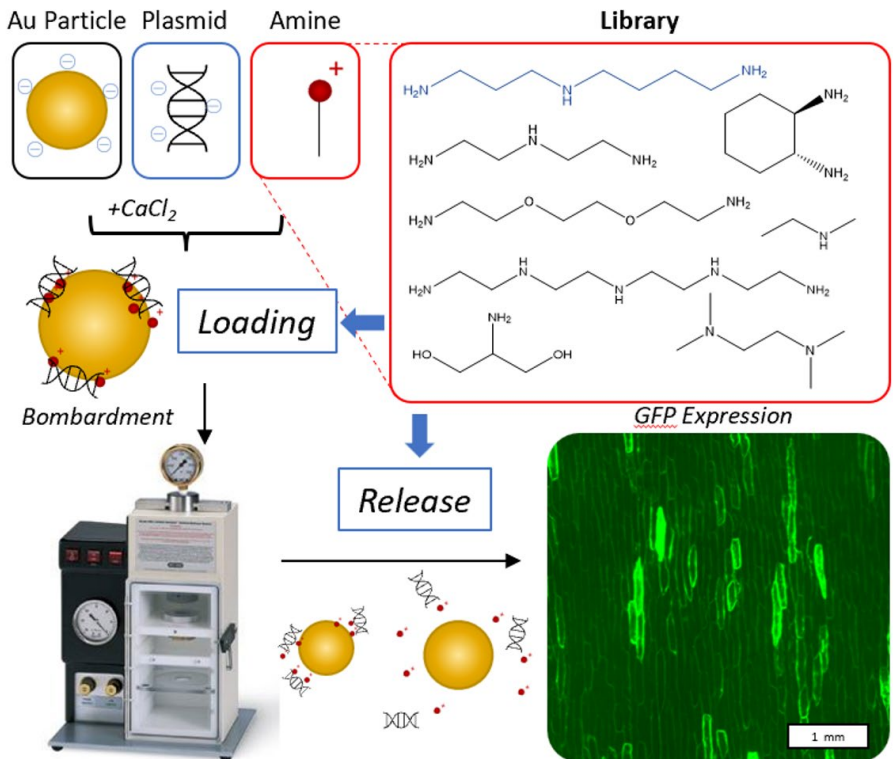
# Identifying Factors that Determine Effectiveness of Delivery Agents in Biolistic Delivery Using a Library of Amine-Containing Molecules



**Connor Thorpe**

Materials Science and  
Engineering

My research focuses on improving the ability to deliver biological reagents into plant cells using biolistic delivery. I am currently designing and developing new tools that improve cell transfection rates significantly while reducing the overall error in the system commonly attributed by experiments with biological tissues. I also use advanced computation fluid dynamic simulations to better understand the effects of the new devices by studying the dynamics of the system.



Faculty Advisor: Dr. Shan Jiang

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# Microbial Communities as a Pathway to Improved Woodchip Bioreactor Design and Performance

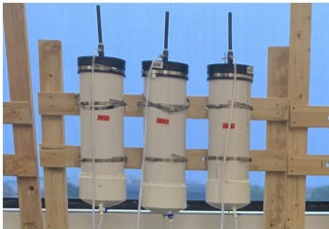


**Taylor Vroman**

Environmental Science/  
Agricultural and Biosystems  
Engineering

My research focuses on analyzing the microbial communities within corncob and woodchip bioreactors to optimize the performance of the edge-of-field conservation practice. I am currently using nitrate removal, greenhouse gas production, water chemistry, and gene presence to determine performance in laboratory upflow columns. My research will allow for optimization of field bioreactors.

## Laboratory upflow columns



Methods of analysis to  
determine performance level

### Greenhouse gas production

- $\text{CO}_2$
- $\text{N}_2\text{O}$
- $\text{CH}_4$

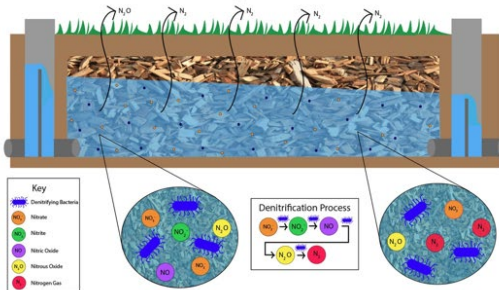
### Water chemistry

- $\text{NO}_2$
- $\text{NO}_3$
- TOC
- pH
- DO

### Microbial communities

- 16S
- Denitrifying genes

## Denitrification in a woodchip bioreactor



Faculty Advisor: Dr. Michelle Soupir

Contact: [tvroman@iastate.edu](mailto:tvroman@iastate.edu)

# Thanks to our Advisory Board

**Brian Campbell**

*Physicians for Social Responsibility*

**Frank Dohleman**

*Climate, Agriculture & Partnership Solutions Consulting*

**Ross Evelsizer**

*Northeast Iowa Resource Conservation & Development*

**Kara Hobart**

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*Roeslein Alternative Energy*

**Brent Myers**

*Corteva Agriscience*

**Shawn Richmond**

*Iowa Farm Bureau*

**Keith Schilling**

*State Geologist - Iowa*

**Akash Vidyadharan**

*Infralytics*

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**ISU College of Engineering**

**ISU College Agriculture and Life Sciences**

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