2022 DWFI Research Forum Abstracts

Last Updated 4/27/2022

FirstName	LastName	EmailAddress	Title	Abstract
Presentations:				
Xiaochen	Dong	xdong@huskers.unl.edu	Controlling Nitrate leaching in subsoil with Carbon Injection	Due to intensive agricultural activity, drinking water is widely contaminated by nitrate, which is the most common contaminant affecting groundwater quality in the U.S. Although large amounts of nitrate fertilizers are applied during each growing season to maintain yield, public health is influenced by the increasing nitrate level. Nitrate is easily soluble in the water and quickly leaching down to the deep soil, denitrification and plant uptake are two main processes affecting the nitrate removal in subsoil. Denitrification bioreactors is one of the recently developed technologies for practical field nitrate removal. But few researchers are working on a large-scale management. This study will focus on establishing a biologically active layer for removing dissolved nitrate on a large-scale basis as well as bench tests to evaluate the best carbon sources as bioreactor. This study investigates multiple carbon source for denitrification process and compare the nitrate removal efficiency in order to find the best bioreactor for carbon injection. Based on the bench tests results, we can establish field experiment to determine whether carbon injection is an ideal method for nitrate removal on a large-scale crop land. This research is an integrated investigation of in lab bench test and field experiments to test carbon injection nitrate removal method. Based on our data I would like to address an Economical and Environmentally Friendly method to control nitrate leaching on agricultural areas.
Jiaming	Duan	jduan4@huskers.unl.edu	Influence of Fertigation Scheduling Methods with and without Cover Crops on nitrogen leaching in Nebraska	Excessive nitrogen fertilizer is one of the dominating sources of agriculture contamination, which further affects groundwater quality. A joint study was conducted between the University of Nebraska-Lincoln in partnership with four Nebraska Natural Resource Districts to investigate nitrogen leaching to mitigating the environmental damage and sustain food production in Nebraska. The field study sites were established near Creighton and North Platte, NE. Specifically, four treatments were included: lab-based fertigation, sensor based fertigation, lab-based fertigation with cover crop interseeding, and sensor-based fertigation with cover crop interseeding. Lab-based fertigation was determined by the fertigation recommendations from a commercial lab using historical yield records, soil residual nitrogen and other credits; whereas, the sensor-based fertigation was driven by the plant growth status. The recommended fertilizer application was split into four events. Sensor-based treatments were triggered when the, Normalized Difference Red Edge (NDRE) fell below a designated sufficiency threshold. The NDRE was captured by a multispectral sensor mounted on a UAV platform. Arable Mark 2 sensors (Arable Labs, San Francisco, CA, USA) were installed in the treatment plots to collect micro-weather and plant response data for use in monitoring crop growth. Soil water content was measured by TDR315 (Acclima, Meridian, Idaho, USA) and neutron gauge (InstroTek Inc, Raleigh, NC, USA) to estimate the nitrogen movement. The deep soil samples were collected in increments of 12in after sidedress and after harvest. The total above-ground biomass samples were collected before harvest. The primary comparison of plant and soil responses under different fertigation scheduling methods will be presented.
Ethan	Freese	efreese2@unl.edu	Platte Basin Timelapse: A Watershed in Motion	The Platte Basin Timelapse project (PBT) has been working since 2011 to tell the story of water in the Platte River Basin. PBT has more than sixty timelapse cameras throughout the Platte River Basin in Nebraska, Colorado, and Wyoming. These cameras constantly monitor change over time on the landscape and have helped document severe droughts and flooding in the Platte Basin. In addition to our timelapse camera system, PBT has published more than 170 stories on our website including short films, photo essays, and ESRI Story Maps. PBT is currently working with the Nebraska Game and Parks Commission to produce updated educational materials about the wetlands of Nebraska. For more than five years, the Daugherty Water for Food Institute has funded more than 25 students who served as undergraduate interns for PBT. The materials produced by our interns, which includes everything from timelapses to short films, have been valuable tools for science communication throughout the Platte Basin and beyond. Several past interns have gone on to complete graduate degrees through PBT at the University of Nebraska and are now working as full-time employees with the project. Currently, PBT has five undergraduate interns who assist with timelapse production, animation, and storytelling.
Qiao	Hu	qiao@huskers.unl.edu	Artificial intelligence and computer vision facilitate cost-effective wetland mapping	The combination of Unmanned Aerial Vehicle (UAV) data and deep learning, especially, convolutional neural networks (CNNs), offers robust new tools for precision land cover mapping. However, its successful application is highly dependent on local experiences that are rarely documented, resulting in practical limitations during implementation. Cost-effective deep learning frameworks for fast deployment are required. This study presents a deep learning adaptation framework, named Auto-UNet++, trying to streamline wetland mapping tasks. The framework treats mapping tasks as an intact semantic segmentation pipeline and then integrates automatic strategies into each step to reduce human intervention. The framework was tested on playa wetland mapping in the Rainwater Basin, Nebraska, USA, with multispectral UAV datasets. Generally, the multi-scale CNN mapping task achieved a high of 87% overall accuracy and over 90% accuracy in water delineation. The results indicate that the multi-view (MV) and attention strategies have the potential to improve segmentation performance, and together with unsupervised learning, save considerable labor/expertise. Interestingly, evidence shows that the band/scale attention (weight) is adaptively associated with the land cover percentages per input image, indicating spatial contexts captured. This finding highlights the potential usages of the attention rule in automatic feature exploration, selection, and model interpretation. The framework illustrating a highly automated deep learning deployment on small MV datasets facilitates cost-effective wetland cover mapping. Although limitations exist, the study demonstrated the possibility of where/how conventional segmentation pipelines can be improved in typical UAV wetland mapping tasks. The framework and findings are useful for similar applications that only have limited time, labor, and expertise to implement sophisticated semantic segmentation models.

Suresh Pradhyun	Kashyap	skashyap3@unl.edu	High - Frequency Unmanned Aircraft Flights for Crop Canopy Imaging During Diurnal Moisture Stress	Unmanned Aerial Vehicle (UAV) technology for identifying crop water stress have been used in the context of irrigation scheduling collected usually around solar noon. A significant limitation with these CWSI values is that the UAV thermal imagery captured at this point in time can be affected by various factors like atmospheric air temperature, sun radiation, wind speed, relative humidity, and other micrometeorological disturbances in the air. In order to address these temporal effects, high-frequency UAV flights were conducted over different daylight hours to analyze and compare the CWSI values to create a better understanding of the crop dynamics to irrigation events. In addition, another stress index which requires fewer input data, the Degrees Above Non-Stressed (DANS), were also compared to CWSI values. This research was carried out at three different field research sites in Nebraska: Two at the Eastern Nebraska Research and Extension Center (ENREC), Mead, NE and one at the Irmak Research Laboratory (IRK) in South Central Agricultural Laboratory (SCAL), Clay Center, NE. All fields were growing soybean with various levels of irrigation and rainfed treatments. In order to calculate CWSI and DANS, a thermal calibrated linear regression model developed by NU-AIRE Lab, UNL, NE, was also used to improve the accuracy of the thermal imagery data. NDVI and NDRE values were also computed to find any correlation between affecting CWSI values. Both thermal and multispectral imagery is used to analyze the spatiotemporal dynamics of the crop.
Latorre	LeBeaux	tlebeaux2@huskers.unl.edu	Ana Mendieta and the Universal Fluid	
Ben	Ndayambaje	ben1@huskers.unl.edu	Investigating differences in drinking water quality among surface water sources, public taps, and household water storage containers in rural communities in Rwanda.	Water contaminants including bacteria and heavy metals can adversely impact animal and human health. Heavy metals can be toxic to aquatic organisms and humans and can accumulate in food chains. Bacterial contamination from human and animal waste in water sources also poses health threats to humans and animals. To understand potential exposure to contaminants in drinking water at the human-animal-environment interface in rural communities, we examined water quality in surface water sources, public taps (piped water), and household water storage containers in western Rwanda. We collected 47 water samples from these sources in Karongi District in August 2021 and February 2022. We measured basic water quality parameters (PH, temperature, conductivity, TDS, and salinity) in the field using a portable water quality meter. Using Colilert test kits, we assessed total coliform bacteria and E. coli in water. Heavy metals, nitrates, and trace metals were analyzed at the UNL Water Sciences Laboratory, with 2022 results pending. Non-metallic compounds and most trace metals across water sources were below World Health Organization and U.S. Environmental Protection Agency potable water safety guideline values. However, iron and manganese levels exceeded recommended values across sites. The prevalence of coliform bacteria was highest in surface water samples (53.33%), followed by household water samples (20%). No fecal indicator bacteria were detected in public taps. Our results highlight the need to investigate the sources of high iron and manganese and for broader research and outreach on bacterial contamination in drinking water sources and home storage containers in rural Rwanda.
Daniel	Rico	daniel.rico05@gmail.com	Toward an Online Optimal Control Algorithm for the TAUS	Power-over-tether aircraft is an effective tool for persistent spatiotemporal monitoring of environmental phenomena. We have previously developed the tethered aircraft unmanned system (TAUS), which is a novel power-over-tether-based unmanned aerial system (UAS) configured for long-term, high throughput atmospheric monitoring. The design, simulation, and evaluation of theoretical flight trajectories for the TAUS have been conducted, but the physical control of the system has been ignored thus far. The TAUS is a prototypical cyber-physical system (CPS) that is composed of numerous physical and intelligent sub-systems. This produces a large yet constrained design space with many conflicting objectives and performance metrics, a multi-objective optimization problem (MOOP). We present our work toward the formulation, implementation, and validation of an online optimal control algorithm for the TAUS.
Gonzalo	Rizzo	gonrizzo@gmail.com	Climate and agronomy, not genetics, underpin recent maize yield gains in favorable environments	Quantitative understanding of factors driving yield increases of major food crops is essential for effective prioritization of research and development. Yet previous estimates had limitations in distinguishing among contributing factors such as changing climate and new agronomic and genetic technologies. Here, we distinguished the separate contribution of these factors to yield advance using an extensive database collected from the largest irrigated maizeproduction domain in the world located in Nebraska (United States) during the 2005-to-2018 period. We found that 48% of the yield gain was associated with a decadal climate trend, 39% with agronomic improvements, and, by difference, only 13% with improvement in genetic yield potential. The fact that these findings were so different from most previous studies, which gave much-greater weight to genetic yield potential improvement, gives urgency to the need to reevaluate contributions to yield advances for all major food crops to help guide future investments in research and development to achieve sustainable global food security. If genetic progress in yield potential is also slowing in other environments and crops, future crop-yield gains will increasingly rely on improved agronomic practices.

Arshdeep	Singh	asingh26@huskers.unl.edu		Abstract: Nitrogen is important for crop production, but two-third of the applied nitrogen is lost to environment as nitrous oxide gas and/or nitrate leaching to groundwater. Excessive nitrate concentrations (>10ppm) are hazardous for human health and biodiversity. Evidence suggests that Nebraskan groundwater exceeds 10 ppm nitrate concentration limit. Therefore, selecting an economic optimum nitrogen rate (EONR) is necessary to decrease the environmental nitrogen footprint while maximizing economic returns. Various nitrogen models consider the hydrological, biogeochemical, and biophysical soil processes to predict EONR. During 2021 growing season, we evaluated different models N rate recommendations - by comparing three university and two commercial N models to EONR computed at six N rates. Site specific economic optimum N rate (EONR) calculated from six N rates (14 to 314 lb N/acre) was 230 lbs N/acre, with the grain yield at 259 bu/acre. Nitrate leaching increased exponentially with increase in nitrogen rate. Nitrogen recommendation from UNL-calculator (237 lb N/are) was within the EONR range, while Maize-N recommendation rate (253 lb N/acre) was above the EONR. Corn grain yield and nitrate leaching with UNL-N and Maize-N were statistically similar to grain yield and nitrate leaching at EONR. Adapt-N, and Granular-N nitrogen recommendations (164 lb N/acre for each) were lower than EONR and reduced nitrate leaching by ~ 40%, and crop grain yield by 9-16 bu/acre. Sensor based fertigation nitrogen rate using Solari algorithm (171 lb N/acre) was lower than EONR and reduced nitrate leaching by ~50% and corn yield by 55 bu/acre. We suggest using UNL-N algorithm and/or process-based industrial models (Granular and Adapt-N) for efficient use of nitrogen and decreasing nitrate leaching. This study will continue in year 2022. Nitrogen is important for crop production, but two-third of the applied nitrogen is lost to environment as nitrous oxide gas and/or nitrate leaching to groundwater. Excessive nitrate concentrations (>10ppm) are hazardous for human health and biodiversity. Evidence suggests that Nebraskan groundwater exceeds 10 ppm nitrate concentration limit. Therefore, selecting an economic optimum nitrogen rate (EONR) is necessary to decrease the environmental nitrogen footprint while maximizing economic returns. Various nitrogen models consider the hydrological, biogeochemical, and biophysical soil processes to predict EONR. During 2021 growing season, we evaluated different models N rate recommendations - by comparing three university and two commercial N models to EONR computed at six N rates. Site specific economic optimum N rate (EONR) calculated from six N rates (14 to 314 lb N/acre) was 230 lbs N/acre, with the grain yield at 259 bu/acre. Nitrate leaching increased exponentially with increase in nitrogen rate. Nitrogen recommendation from UNL-calculator (237 lb N/are) was within the EONR range, while Maize-N recommendation rate (253 lb N/acre) was above the EONR. Corn grain yield and nitrate leaching with UNL-N and Maize-N were statistically similar to grain yield and nitrate leaching at EONR. Adapt-N, and Granular-N nitrogen recommendations (164 lb N/acre for each) were lower than EONR and reduced nitrate leaching by ~ 40%, and crop grain yield by 9-16 bu/acre. Sensor based fertigation nitrogen rate using Solari algorithm (171 lb N/acre) was lower than EONR and reduced nitrate leaching by ~50% and corn yield by 55 bu/acre. We suggest using UNL-N algorithm and/or process-based industrial models (Granular and Adapt-N) for efficient use of nitrogen and decreasing nitrate leaching. This study will continue in year 2022.
Shivendra	Srivastava	ssrivastava2@huskers.unl.edu	Flood Risk in Nebraska in Context to Public Health	Flood is one of the most devastating hazards occurring worldwide; the ever increase in the number of flooding events in the recent decades has caused immense losses in terms of lives and property. This study reviews the literature on flood risk estimation and its implications on public health. Assessment of risk associated with the flood is complex and includes mutual interaction among its drivers. In context to public health, flood affects the population by increasing the vulnerability of health infrastructures, raising concerns about food security, and forcing the movement of people. It further leads to numerous consequences spanning different time scales (immediate-, medium-, and long-term). The paper reviews various approaches and measures to control the immediate health consequences such as injuries, drowning, electrocution, and hypothermia, along with the medium- and long-term implications, such as the occurrence of diseases, skin infections, chemical poisoning, disabilities, low-birth rate, malnutrition, and mental illness. Further, we also aim to come up with a framework that will provide a qualitative and quantitative analysis of flood risk in context to public health across scales that can help in subduing the health consequences. The assessment has been conducted for Nebraska with open data, which can be considered as a case study before expanding the framework across the United States. The framework will include the interactions among the drivers of hazard, vulnerability, exposure, and response. It will aim to identify the complexity of different bridges such as food security and health infrastructures which connect flood risk to health consequences.

Armando	Zarco	AZarco2@huskers.unl.edu	Outreach, Education, and Efficiency on the Omaha Reservation Farmlands	My name is Armando Zarco and I am currently a master's graduate student at the University of Nebraska-Lincoln with the Department of Biological Systems Engineering focusing on water management and planning. My journey at UNL began in January 2021 with Dr. Francisco Munoz-Arriola focusing on outreach and education. My research introduced me to residents of the Omaha Reservation in early 2021 looking to adapt new water practices for water efficiency and improving economics. In the past year, I have met with tribe members and other irrigators on the Omaha Reservation lands to listen to their concerns and provide education on irrigation alternatives. My primary engagement is working with a farmer and his family that irrigate crops near the city of Macy, NE. Dr. Munoz -Arriola and I are working to assist in providing better irrigation practices and develop a predictive irrigation system on crop water needs with the use of Landsat, Sentinel, and other remote sensing satellite platforms, as well as climate forecast modeling tools. The objective of my research in coming months is to provide aid in making new irrigation decisions for water efficiency with use of readily available near real-time field data open to the public. I believe that further steps for water conservation can be fulfilled with use of near real-time NDVI, ET, and soil moisture monitoring in conjunction with climate forecast, which may lead to reduced costly inputs improving the local economy.
Posters:				
Anthony	Amori	amori_anthony@yahoo.com	Calibration, multiple-parameter optimization, and performance evaluation of crop simulation model in simulating soil moisture and maize grain yield under variable seeding rate in a Farmer's Fields.	A well calibrated decision support tool can be used in combination with conventional crop management practices employed by growers to improve crop yield while saving irrigation water, Nitrogen-fertilizer, and protecting the environmental quality. In this study, the background Hybrid-Maize model of both CornSoywater and Maize-N decision support tools was calibrated based on multi-parameter optimization (MPO) approach using field observations of soil moisture and grain yield under varying seeding rates across two climatic conditions. The calibrated model significantly improved the grain yield simulation by reducing the ME, RMSE, and NRMSE of the default values (GY-PC1) by 84%, 74%, and 74% respectively, while the simulation of soil water dynamics was also improved by reducing ME, RMSE, and NRMSE of the default value by 84%, 74%, and 74% respectively for the topsoil depth of 1m (SD3) during validation. In addition, although the decision support tool showed great potential of saving some amount of irrigation water and nitrogen fertilizer when logically used in combination grower's experience in crop management, there is still need for caution and further improvement of the soil moisture simulation function with the inclusion of more soil specific properties as model input for effective irrigation and nitrogen management at field scale.
Katie	Bathke	kbathke3@huskers.unl.edu	Economic and input-use efficiency impacts of nitrogen management techniques in non-irrigated maize production	The efficiency of nitrogen (N) management has become a main concern in agricultural cropping systems for understanding the optimal N rate to help producers improve economically and reduce the exhaustion of the natural resources environmentally. Nitrogen rates vary both temporally and spatially by the interactions of the soil environment and rainfall through a growing season. Thus, a site-specific approach can further optimize this variability with the performance of active canopy crop sensors in relation to crop stress. The objective of this study was to evaluate the performance of active crop canopy sensors for the improvement of N management in a non-irrigated site. The experimental design was arranged in a randomized complete block design including the following treatments of application: grower, sensor-based, NH3 (100, 140, 180, 220 lb-N/acre), side-dress (24, 63, 100, 140 lb-N/acre), and a zero-control strip. Equipment (i.e., precision ag) data of target nitrogen rate, applied nitrogen rates, and yield data were collected for further analysis of the relationship occurring between total N applied and yield per treatment plan. Data of NDRE reflectance measurements were also collected throughout the growing season to then be converted to geospatial imagery for analysis of crop stress, temporally and spatially throughout the field. Based on the Nitrogen Use Efficiency (NUE) the active sensor management treatment-based approach had a better average efficiency (0.558 NUE < 0.683 NUE) with a corresponding increase in Partial Profit Factor (PFP) (100.749 > 8.2035) when compared to grower management application. The results indicate the opportunity for high levels of crop productivity coupled with efficient N management under non-irrigated cropping systems.

Josephus	Borsuah	jborsuah2@huskers.unl.edu	Pesticide Occurrence and Loading in Rivers with Varying Land Uses and Precipitation Regimes	Fate and transport mechanisms of pesticides in soil-water environments and their impact on water quality in agriculturally intensive watersheds is an important component in water resources management. Neonicotinoids have been the most used insecticides since the early 1990's, yet the overall load to water resources remains unknown. Therefore, in this study we used a drainage area weighting method to determine insecticide mass loading two distinct watersheds (predominately urban or agricultural) in the Southeastern and Midwestern United States. The aim of this study was to estimate the occurrence, distribution, and mass loading rate of neonicotinoid insecticides in these two distinct watersheds. Neonicotinoids and potential byproducts were measured at upstream and downstream sites in the Elkhorn River in the Nebraska (Midwest United States) and Neuse River in North Carolina (Southeast United States) for two consecutive growing seasons. Neonicotinoids were measured using grab samples and polar organic chemical integrative samplers (POCIS), passive sampling tools used extensively over the last decade to monitor inorganic and organic substances in surface and groundwater environments. In both the urban and agricultural intensive watersheds, the occurrence and distributions of neonicotinoid insecticides were detected with eight potential phototransformation byproducts identified in POCIS and grab samples. This study has direct implications on how pesticide fate and mass transport is predicted in natural water. Findings are anticipated to provide policy guidance to best manage neonicotinoids use in the environment and limit byproduct fate and transport to prevent potential human health and ecotoxicity risks and further water quality deterioration.
Sara	Brock	sbrock2@huskers.unl.edu	Know Your Well: Students and Groundwater Stewardship	The Know Your Well program, launched in 2017, provides high school science classes in Nebraska with training and resources to conduct water quality testing in their community. Students perform pre-field work surveys, groundwater well sampling, and qualitative testing with their class and send split samples to the Water Sciences Lab for quantitative tests. Students can compare their results with the laboratory's results and present their findings to their peers, community, and local decision-makers. Know Your Well researchers collect the data provided by the students and at the lab and can create a geo-located water quality database, regardless of the local or state-wide testing schedules, that includes both registered and unregistered wells. Entering its third phase this year, the program plans to expand to 50 schools by 2025, with a focus on recruiting schools in areas that have not participated previously. Additionally, researchers are interested in the relationship between students' presentation of information and any affect it might have on local policy or voluntary regulatory programs.
Heydi	Calderon	hcalderonambelis2@huskers.unl.edu	Project Title: An integrated framework to account for temporal, spatial, and climate variability in the Corn-Water-Ethanol-Beef nexus system	A nexus approach increases the understanding of the inextricable links across food, energy, and water systems. It also contributes to the sustainable and strategic allocation of resources to secure enough of these three critical elements for the world population. The proposed work aims to develop an integrated modeling framework that will account for different sources of uncertainty and variability in the Corn-Water-Ethanol-Beef (CWEB) in Nebraska. The outcome of the project's first stage is the discussion of critical sources of uncertainty and variability over temporal and spatial scales within the CWEB nexus, for example, emerging technology, public policies, and crop yield variation within seasons and regions. Another outcome is a review of existent models that address variability and uncertainty present in food, energy, and water interactions. The final product of this multi-year project will be a user-oriented framework to account for critical sources of variability over temporal and spatial scales across the water, food, and energy nexus in Nebraska. The framework developed will assess potential scenarios based on the adoption of new technologies and best practices in agricultural productivity and changes in the allocation of available resources. These tools will track water, nitrogen, phosphorus, and energy use within the CWEB nexus for various scenarios to study the system's resilience. This project contributes to the DWFI efforts to close water and agricultural productivity gaps and improve water management for agricultural production.
Justin	Caniglia	caniglia.justin@huskers.unl.edu	Emerging contaminants within urban and rural landscapes in the Midwest	Emerging contaminants are becoming detected ubiquitously throughout our surface waters (SW) within urban and rural landscapes. Within these landscapes, two classes of emerging contaminants of interest are per- and polyfluoroalkyl substances (PFAS) and antibiotics. 18 PFAS were analyzed for within a wastewater treatment plant (WWTP), SW, and after the land application of biosolids to agricultural test plots. The average Î£ PFAS in wastewater influent, effluent and at upstream and downstream SW sites, respectively were 27.9, 132, 37.7, and 71.4 ng L-1. Total Î£14 PFAS in municipal biosolids applied to soils were 22.9 ng g-1 dw. PFAS were detected in both surface soil and runoff after land application of biosolids, but also in control plots consistent with background PFAS contamination. Human antibiotics (HAs) and veterinary antibiotics (VAs) contaminate SWs across the US, each with distinct transport routes. HAs contaminate SWs via WWTP outflows, septic discharge, and urban storm runoff. VAs are found in streams due to leaching or runoff from agricultural fields fertilized with manure from Concentrated Animal Feeding Operations (CAFOs) and, occasionally, directly from CAFOs due to failures in containment, leading to groundwater leaching or direct discharge. To date, we have a limited understanding of how these compounds vary spatially and almost no information on these compounds in Nebraskan streams, where livestock production is a critical economic sector and VA use is substantial. Therefore, the goal of this summer's research is to produce baseline data to compare and contrast spatio-temporal variations in veterinary and human antibiotics in Nebraskan streams.
Dominic	Cristiano	dcristiano2@huskers.unl.edu	An investigation of the attitudes and behavioral outcomes of Nebraskan hunters toward tick-borne disease	As changes in climate, land-use, and vegetation alter the landscape of the Great Plains, new threats to public health are emerging. Incidences of tick-borne disease contraction in Nebraska have increased nearly 250% over the past two decades; newly established species like Ixodes scapularis may introduce challenges for health practitioners, including more cases of Lyme disease. Strategies for tick-borne disease prevention must incorporate effective health messaging. Audience segmentation may be a useful technique to provide health communication, as it allows for targeted messaging that speaks to specific attitudes and beliefs of a given population. One tool for usefully segmenting populations is the Risk Perception Attitude Framework (RPAF); this groups individuals into four categories based on their perceived risk towards a threat and their efficacy in protecting themselves from the threat. We applied the RPAF to a sample of hunters in Nebraska to assess differences in level of intention to perform preventative behaviors between the four RPAF groups. Our ANOVA model found significantly higher behavior intent among individuals in the RPAF group with highest perceived risk and self-efficacy, backing up previous RPAF literature. This information can be used to identify clusters of individuals with similar beliefs towards tick-borne disease and provide more effective health messaging about this threat.

Deepak	Ghimire	deepak@huskers.unl.edu	Effects of Nitrogen Management on Grain Yield and Nitrate Leaching in Furrow-Irrigated Corn Field	Groundwater nitrate contamination is a major environmental concern, particularly in an irrigated farmland. Furrow-irrigation still accounts for a significant number of acres and leaches more nitrate than fields irrigated with drip or sprinkler system. Selection of right source and application rates of fertilizer nitrogen (N) can help reduce nitrate leaching. A 3-yr experiment was initiated to evaluate the effects of controlled- or slow-release N fertilizer on grain yield and nitrate leaching in furrow-irrigated corn at the UNL Panhandle Research and Extension Center, Scottsbluff in 2021. The main treatment included combinations of three N sources (Polymer coated urea, urea with urease and nitrification inhibitors, and urea) and four N rates (50%, 75%, 100%, and 125% of recommended rate). There were two additional N treatments based on crop canopy sensing at V6-V8 and V10-12 crop growth stages. Water samples were collected periodically using suction-cup lysimeters installed at five feet depth in selected plots and analyzed for nitrate concentration. This paper discusses the corn yield and nitrate concentration in leachate samples collected using lysimeter as affected by different sources and rates of N fertilizer
Daniel	Gschwentner	dgschwentner2@huskers.unl.edu	Do environmental drivers of lake nutrients and stoichiometry in the Great Plains vary by spatial-scale, ecoregion and lake hydrologic connectivity?	Large-scale studies have improved our understanding of factors regulating lake nutrient dynamics and revealed how climate, land use and hydrology govern mass transfers across the terrestrial:aquatic interface. It remains unclear how environmental factors relate to stochiometric ratios of carbon:nitrogen:phosphorous (C:N:P) in lakes and whether their influence varies across spatial scales, ecoregions and systems of contrasting hydrology. As stoichiometric ratios of C:N:P underpin biological processes, it is essential to quantify their relationship to environmental parameters. This study utilises publicly available lake water chemical and environmental data sets to investigate the roles of climate, land use spatial scale, regionality and hydrology on lake nutrient stoichiometry in the Great Plains, a region characterised by pronounced gradients in climate and land use. The importance of spatial scale and environmental drivers was assessed using random forest models to account for non-linear relationships between variables. Influential parameters were further investigated with a hierarchical linear-mixed effect modelling framework while accounting for the influence of ecoregions and hydrology. Preliminary results indicate that the importance of spatial scale varies for environmental variables, although lake depth emerges as a master variable controlling the fate of nutrients in lake systems. The effect of ecoregions on nutrient stoichiometry was pronounced, in contrast to hydrology. Finally, nutrient concentrations were more predictable than their stoichiometric ratios. Understanding how spatial scale interacts with climate, land use and hydrology to influence lake nutrient dynamics is critical to our ability to predict lake response to future climatic and environmental changes.
Nafyad	Kawo	nkawo2@huskers.unl.edu	3-D Probabilistic Modeling of Glacial Aquifer Framework using Multiple-point Statistics and Deep Neural Network	
Mercy	Kipenda	mkipenda2@huskers.unl.edu	Early detection of harmful algal blooms in Nebraskan lakes	Harmful algal blooms (HABs) in water systems threaten the health of humans and animals. In the U.S., Nebraska is one of the 14 states that have reported HABs events that have led to the temporary closing of lakes and beaches. Warmer climatic conditions and excessive nutrient offloads into water systems from agricultural practices have created environments where toxic algae can thrive. Traditional field-based monitoring approaches, such as collecting water samples, alone do not provide early warning for unwanted transitions in surface water quality. Hence, we are evaluating the feasibility of a remotely sensed early warning system for harmful algal blooms in Nebraska Lakes. Advances in remote sensing such as the development of atmospheric correction models, band algorithms, and datasets with highlight spatial and temporal resolution provide new opportunities for early detection of HABs across lake networks. The objectives of this research are to: 1) assemble a database of past HABs events across a network of Nebraska lakes; 2) compile remote sensing imagery of HABs-affected lakes at different spatial, temporal, and spectral resolutions and extents; 3) compute HABs-detection indices; and 4) assess the potential for early detection of HABs with remote sensing. Results will be useful for gauging the efficacy of utilizing publicly available remote sensing datasets for early detection of HABs, to better mitigate the health consequences of agricultural surface water pollution for people and animals in a cost and time effective manner, increase public awareness and understanding of HABs, and supporting quick responses to HABs events.

Fernanda	Krupek	krupek@huskers.unl.edu	Aerial imagery of cash crops following cover crops: implications for use as an in-season diagnostic tool	Winter cover crops have the potential to add rotational diversity to improve the overall productivity of maize-soybean-small grain systems in the Midwestern U.S. Four main mechanistic pathways are currently proposed to explain how cover crops can affect cash crop growth and yield in Midwest agroecosystems: soil water content, soil N concentration, soil O2 concentration, and soil temperature. Hyperspectral data validated with in-situ measurements from on-farm experiments across diverse conditions provide an effective tool to understand such mechanistic pathways of cash crop growth responses following cover crop. In this study, we evaluated optical and thermal reflectance of maize, soybean, and small grain (e.g., wheat and winter rye) following different field-scale cover crop-related practices using remotely sensed canopy temperature and multispectral imagery. Hyperspectral data were taken at different developmental stages of cash crop to account for the timing of physiological crop variable determinations across 17 site-years in Nebraska characterized by both low and high rainfall seasons. Our results indicated that when following greater biomass-producing cover crop mixtures, cash crops had lower NDVI and higher surface temperature during vegetative periods of the growing season. The observed reductions in vegetation index expressing the intensity of the leaf greenness accompanied by the warmer surface temperature of cash crop following spring growth cover crops is indicative of delayed cash crop senesce compared to low spring green vegetation cover (e.g., no winter cover crop or winter-terminated cover crops). Under this scenario, soil water content and soil temperature are the most likely pathways by which cover crop is impacting cash crop growth. However, for some site-year combinations trends were inconclusive, with a lack of either in-season hyperspectral data or end-of-season yield impacts from cover crops. Our results emphasize the inherent variability present in field-scale on-farm data (particularly topographic complexity causing subfield variation in soil resources such as water and nutrients) and the potential of remote sensing as an in-season diagnostic or monitoring tool for cash crop growth stress identification following cover crop.
Nasrin	Naderi Beni	nasrin.naderi7@gmail.com	Evaluating agricultural runoff from land-applied biosolids and manure as an under-reported transport route for terrestrial microplastics	Terrestrial sources of microplastics include agricultural inputs such as soil amendments, however, there is a knowledge gap in investigating the contribution of runoff from agricultural areas on microplastics occurrence and transport. In this study, municipal biosolids and manure were land applied at agronomic rates to agricultural experimental plots (3.6 m by 10 m) where sorghum crops were planted. Runoff was collected following natural precipitation events and microplastic concentrations in soil were measured before and after biosolid and manure application. More microplastics were detected in runoff collected from plots with land-applied biosolids in comparison with that of control plots and plots with manure application. Fibers and fragments were the most commonly detected particles at concentrations of up to 35 microplastic/L. The presence of crops minimized the transport of microplastics. Scanning electronic microscope imaging determined that particles with preferential transport had less surface roughness. Microplastics were minimally transported vertically. Chemical analysis techniques were used to characterize the detected microplastics.
Balkissa	Ouattara	balkissa.ouattara@unmc.edu	Age-adjusted pediatric cancer incidence related to nitrate concentration measured through citizen science in Nebraska watersheds	We conducted this study to calculate the mean nitrate concentration, the age-adjusted pediatric cancer incidence across Nebraska watersheds and determine the geospatial relationship between nitrate concentration and pediatric cancer. Methods: We used secondary pediatric cancer data collected in the Nebraska Department of Health and Human Services Cancer Registry from 1987-2014. We collected nitrate data from 2018 to 2019 during four sessions, through a citizen science project. We calculated the age-adjusted pediatric cancer incidence in Nebraska. Results: The mean nitrate concentrations in surface water and groundwater were 4.5 and 3.8 mg/L, respectively. Twenty percent of all groundwater measurements were above 10 mg/L. The computed age-adjusted incidence for brain and other central nervous system (CNS) cancers in Nebraska was 4.16 per 100,000 population between 1987 and 2014. This incidence was higher than the national average age-adjusted incidence for brain and other CNS cancers, reported to be 3.05 per 100,000 population between 2010 and 2014. We also found that all of the watersheds with high nitrate concentration (above 10 mg/L) in surface and groundwater also had pediatric CNS cancer incidence above the national average. Conclusions: These results suggest a possible association between groundwater nitrate concentrations and childhood CNS cancer incidence. Further study is needed to evaluate the validity of this association as compared to causation by other factors. Children living in farming and rural areas are more exposed to adverse environmental factors, such as nitrates in the water and soil, as the result of agricultural practices.
Maria	Oviedo Ventura	moviedoventura2@huskers.unl.edu	Evaluation of geospatial data for livestock operation location and estimation of manure nutrient utilization capacity in five Nebraska counties	Livestock and poultry manure can be valuable sources of organic material and nutrients for crop and pasture growth, but the trend toward diversification of farms has disrupted the natural nutrient recycling of manure-fertilized cropping-systems. Meanwhile, inorganic fertilizer sales in Nebraska during 2020 reached a thirty-year high. This importation of nitrogen and phosphorus fertilizers to areas rich in organic fertilizer products creates a nutrient imbalance, whereby reliance on highly mobile inorganic nutrients and excess organic nutrients that still must be utilized leads to greater risk for nutrient contamination of surface and groundwater sources. Thus, there are economic and environmental incentives to increase manure utilization in cropping systems throughout the state. However, in areas where there is a high density of livestock production, utilization of manure nutrients may require access to additional cropland outside the livestock operations. At the same time, barriers to manure use remain often related to logistical challenges of manure application and transportation. One critical aspect of motivating the local recycling of organic nutrient amendments by crop producers is identifying economical solutions for transporting manure to maximize its value. Therefore, this project seeks to bridge the knowledge and experience gap by providing crop farmers with spatially specific analyses of manure accessibility and benefit. This work uses publicly available geospatial data to visualize nutrient sources and utilization potential within individual counties in Nebraska, and produce and assess maps of country livestock inventories, manure production, inorganic fertilizer imports, and potential crop nutrient utilization in order to determine nutrient surplus or deficits and describe potential actions within each of the target counties for achieving sustainable nutrient balance. The resulting ability to identify areas of organic nutrient surpluses and deficiencies is expected to provide a basis for identifying and evaluating potential movements of manure from areas of surplus nutrients to nutrient-deficient areas and identify economically feasible manure transfer scenarios that would motivate crop farmers to accept manure as a fertility input in their cropland

Matthew	Thompson	mthompson2@huskers.unl.edu	Environmental sustainability assessment of small Nebraska water resource recovery facilities: water reuse opportunities	Small water resource recovery facilities serve an essential function of treating wastewater to protect public health and the environment but exhibit significant environmental burdens associated with their built infrastructure, electricity use, and direct operating emissions. These facilities can play a crucial role in the Food-Energy-Water nexus by treating and recycling valuable resources to agriculture systems. The goal of this research was to evaluate the environmental life cycle resource impacts of implementing an agriculture water reuse system for small complete retention lagoons. The objectives of the study were: (1) to assess the environmental profile tradeoffs of 7 non-discharge lagoons that reuse treated water for non-direct human food consumption agricultural crops; (2) use historic climate and crop data to model the long-term resource use and environmental impact tradeoffs of operating agriculture water reuse systems for small community lagoons. In all case studies, adopting agriculture water reuse systems exhibited a net emission reduction. Benefits from excavation reductions, fertilizer reductions, and improvements in crop productivity offset impacts from water reuse infrastructure and operating resources. Crop water demands and effective lagoon water storage capacity were both rate limiting factors in how much water is land applied. The quantity of water land applied is highly dependent on the relative size of the lagoon and agriculture land. The effects of low precipitation rates both reduces lagoon reuse supply capacity and increases that cropland water demands. The net global warming potential of the water reuse systems was highly sensitive to changes in dinitrogen oxide air emissions.
Qu	Wen	qwen3@huskers.unl.edu	Converting the Organics in Cattle Manure Wastewater into the Precursors for Sustainable Aviation Fuels	Beef cattle manure wastewater presents an opportunity to recover water for onsite reuse and produce value-added compounds. Holding ponds on open feedlots are used to store runoff that carries cattle manure, and the manure decomposes in the holding ponds at a slow rate. The objective of this study is to develop an engineered anaerobic digestion (AD) system to produce medium chain carboxylic acids (MCCAs) and clean water from manure wastewater. MCCAs are precursors that can be converted to sustainable aviation fuels and other industrial products. In this work, a two-stage AD platform was developed to convert manure organics to short chain fatty acids (SCFAs) and then to MCCAs. In the first stage, after 6 days acetic acid and propionic acid were formed at the concentrations of 6.24 g/L and 1.22 g/L, representing 59.3% and 16.4% of the SCFAs produced, respectively. In the second stage, the SCFAs from the first stage were converted to caproic acid ($C_6H_{12}O_2$), a MCCA, through chain elongation at pH 5.5 following the addition of 9.0 g/L ethanol. At day 11, caproic acid reached the highest concentration of 7.0 g/L and then kept steady until the end, accounting for 77.5% of all chain elongation products. This study achieved a relatively high concentration of caproic acid compared to previous studies using other feedstocks. These results demonstrate the new system as an excellent alternative to treat beef cattle manure wastewater for water and resource recovery.