2023 DWFI Research Forum Abstracts

First Name	Last Name	Email Address	Title	Abstract
Presentations:				
Jiaming	Duan	jduan4@huskers.unl.edu	Nitrogen application decision-making using the multispectral sensor with UAV	Nitrogen input is essential in maximizing crop yield. But it can also lead to many environmental issues such as nitrate leaching due to over-irrigation and over-fertigation. The development of UAV technology provides new solutions in precise agriculture. This research was conducted in North Platte, Nebraska to investigate the possibility of UAV systems in the nitrogen management process. There were four treatments under two different irrigation levels and two fertigation levels: sufficient irrigation with soil-based fertigation, excessive irrigation with soil-based fertigation, sufficient irrigation with sensor-based fertigation, and excessive irrigation with sensor-based fertigation. The rate and schedule of soil-based fertigation depended on the prescription from the soil sample before planting. Though the sensor-based fertigation followed the same schedule and rate as soil-based fertigation, each event was triggered when the sufficiency index (SI) of The Normalized Difference Red Edge (NDRE) was below the designated threshold. The NDRE was computed in the Pix4Dfields using UAV images collected from a multispectral UAV camera (Altum, MicaSense, Dania Beach, FL, USA). The leaf tissue samples were collected at V12, VT, R3 and R4 stages. The above biomass samples were collected after R6. The deep soil samples were collected before planting and after harvest. The nitrate leaching and yield results will be demonstrated to assess the performance of UAV application in nitrate leaching control and production optimization.
Kaouter	Essakkat	kessakkat2@huskers.unl.edu	How much are farmers willing to pay for ecosystem services that promote soil health?	As the global population is expected to reach 11 billion by 2100, maintaining healthy and productive soils is crucial for preserving ecosystem services vital to human well-being. Payment for Ecosystem Services (PES) can enhance the adoption of conservation practices to meet rising demand for food, feed, and fiber sustainably. Estimating willingness-to-pay (WTP) of ES buyers and willingness-to-accept (WTA) of ES sellers is critical to ensure long-term success of PES. While the public's WTP for ES determines the demand for related conservation practices, a participating farmer (an ES seller) receives private benefits via improved soil health. If those private benefits are large, it could reduce the gap between the farmers' WTA and public's WTP, reducing the cost of PES programs. This study aims to estimate farmers' WTP for ES linked to agricultural productivity, water quality, and soil carbon sequestration. Results show that farmers have a positive WTP of $321 for a conservation program that enhances soil health but is unrelated to the listed ES. For the listed ES, they have a positive WTP of $5 for 1% increase in crop yield but are unwilling to pay for carbon sequestration and water quality improvements. Producers have a negative WTP of $25 for a 1% increase in carbon sequestration, and a $4 negative WTP for a 1% increase in water quality, suggesting a request for compensation. Additionally, preliminary results suggest a higher use of cover crops and no-tillage in irrigated farms compared to rainfed ones. These findings have important implications for policymakers seeking to improve soil health using PES.

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Ethan	Freese	efreese2@unl.edu	Platte Basin Timelapse Internship Program	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 recently completed a project working with the Nebraska Game and Parks Commission to produce updated educational materials about the wetlands of Nebraska. Daugherty Water for Food Global Institute has funded more than 30 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 eight undergraduate interns who assist with timelapse production, social media, and storytelling.
Daniel	Gschwentner	dgschwentner2@huskers.unl.edu	Nutrient limitation in chemically diverse Sandhill lakes	Sandhill lakes are chemically diverse ecosystems and are threatened by a changing climate. Water chemistry in these lakes is primarily controlled by evaporation and location of a lake relative to groundwater flow paths. Despite close geographic proximity (<10 km), similar land use and climate, lakes vary considerably in their water chemistry and productivity, generally becoming more conductive, nutrient-rich and productive over the summer period. Over a four-month period in 2022, I investigated how spatiotemporal trends in water chemistry influence the identity of limiting nutrients in four Sandhill lakes with contrasting water chemistries and levels of primary production. Lakes were predominantly limited by nitrogen or phosphorous although the effect of nutrients varied by month. Lake metabolism was strongly controlled by primary production in three of the four study lakes, suggesting autotrophy predominates. Results from this study suggest that changes in climate may alter the identity of limiting nutrients in Sandhill lakes with implication for ecosystem productivity and functioning.
Heydi	Calderon-Han	hcalderonambelis2@huskers.unl.edu	The value of circularity for a corn-based ethanol biorefinery.	This presentation serves as an update on the development of a framework that accounts for the variability and uncertainty within the Corn-Water-Ethanol-Beef nexus system (CWEB). Given the increasing interest in circular economies as a strategy for sustainability, specifically in biorefineries, the framework has been initially developed to simulate the transition from a linear to a circular system centered in a corn-based ethanol biorefinery as part of a CWEB nexus system. The case study focuses on the circularity around a corn-based ethanol biorefinery in Nebraska. The model measures the effects of the absence/presence of elements within a simulated circular system and compares these effects under partial stages of circularity. Considerable progress has been made to simulate the transition to circularity by integrating new elements, including manure as a nitrogen source for corn crops and distilled grains as a feed source for livestock. The simulation has been developed using multimethod modeling that integrates Agent-Based and Systems Dynamics modeling. We acknowledge a limitation on data available with higher granularity to model the precise operation of a biorefinery; thus, the estimated parameters are based on several assumptions to create different scenarios and do not pretend to reflect the actual environmental footprint of the biorefineries operating in Nebraska. This tool contributes to the understanding of the complex interactions across food, water, and energy under a nexus perspective that provides the case for a circular bioeconomy and contributes to decision-making and strategic planning toward resilience.

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Shannon	Bartelt-Hunt	sbartelt@unl.edu	Fate of microplastics from land applied biosolids	Land-applied municipal biosolids contributes to microplastics contamination in agroecosystems. The impacts of biosolids on microplastic concentrations in agricultural soil has been previously investigated, however, the potential for microplastics transport from biosolid-amended croplands has not been previously quantified. In this study, manure and biosolids were applied to field plots and runoff was collected following natural precipitation events. Higher concentrations of microplastics were detected in runoff from plots with land-applied biosolid in comparison with manure amended and control plots. Concentrations detected in runoff were consistent with concentrations observed in stormwater, which is known to be a significant source of microplastics to urban and suburban waters. Fibers and fragments were the most frequently detected plastic morphologies in runoff, which was correlated with their decreased surface roughness. An analysis was performed to quantify the potential for land application of biosolids to contribute to microplastic contamination to U.S. surface waters adjacent to corn and soy production areas. This study is the first to quantify the potential for nonpoint source microplastic contamination of surface waters located in agricultural production areas.
Ishani	Lal	ilal2@huskers.unl.edu	Irrigation-as-a-service for smallholder farmers	Irrigation is an important management practice that can help increase food security among smallholders globally while mitigating climate change impacts. High-efficiency irrigation technologies such as drip kits and sprinkler systems are relatively expensive for smallholder farmers. Instead, in many developing countries, farmers participate in robust informal markets for renting and sharing of irrigation equipment. Such services may be operated by farmers or via third parties such as irrigation start-ups, water users associations, non-governmental organizations, or even government agencies. These services are collectively referred to as irrigation-as-a-service (IaaS). IaaS is ubiquitous among smallholders, with many previous studies on farmer-to-farmer equipment sharing. However, no economic research exists on entrepreneurial approaches involving non-farmer businesses renting irrigation equipment to multiple farmers. The objective of this study is to develop and analyze a decision-making model for IaaS. I consider a decision maker who must choose an optimal strategy to provide occasional and mobile irrigation service across multiple possible fields when there are constraints that prevent all fields from being irrigated fully. I use a crop water production function to model the crop yield resulting from a given irrigation application. This establishes a mathematical relationship between crop yield and variable irrigation water inputs for a given set of climate conditions and farm management practices. I analyze how the optimal irrigation service strategy varies as a function of field-level parameters (soil type, crop type, and field size), regional parameters (weather), physical parameters (pump and pipe capacities), and economic parameters (fuel cost, labor cost, and crop prices). Results reveal that decision-making under IaaS is complex, with solutions ranging from irrigating all, some, or only one field depending on key parameters. Analyzing the crop water production function and understanding the value of marginal irrigation is crucial to determining the optimal irrigation strategy for each field to maximize yield and profit. Asset utilization rates of irrigation equipment may increase or decrease in IaaS compared to permanent irrigation systems. The results have policy implications regarding the cost-effectiveness of donor funds; IaaS can increase water-use efficiency, returns on invested funds, and asset utilization rates in most cases. By incentivizing IaaS providers, governments can generate higher returns per pump compared to fixed systems.

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Daniel	Rico	daniel.rico05@gmail.com	Tracking of the Tethered Aircraft Unmanned System to Derive Atmospheric Wind and Gaseous Carbon Transport	Gaseous carbon in the form of carbon dioxide (CO2) and methane (CH4) plays a major role in human-influenced climate change. The transport of these chemical compounds throughout the column of the lower atmospheric boundary layer (ABL) via wind over agroecosystems is not well understood. The wind is an important atmospheric variable in the field of agriculture because it is used to calculate latent heat flux, also known as evapotranspiration (ET), a key variable for agricultural practitioners. Field-level measurements of ET are leveraged by precision agriculture to inform real-time irrigation schemes. Wind speed and direction help atmospheric scientists forecast mesoscale phenomena (i.e. severe storms) more accurately in space and time. Retrofitting the Tethered Aircraft Unmanned System (TAUS) with gaseous carbon and inertial sensors along the power tether enabled simultaneous physical localization of the tether and gaseous carbon measurements. While the TAUS is in quasi-static operation any perturbations exceeding sensor noise and vehicle drift relative to the power tetherâ€™s expected catenary behavior are contributed to the wind. The performance of the system was validated against instrumented, calibrated, and well-maintained Eddy Covariance field tower installations at 2m and 10m above ground level (AGL).
Arshdeep	Singh	asingh26@huskers.unl.edu	Nitrate Leaching Potential Under Continuous Corn and Alfalfa-Based Cropping System in Nebraska	Rotation of perennial alfalfa (Medicago sativa L.) with annual crops has the potential to reduce nitrate-nitrogen (NO3-N) in the vadose zone and increase soil organic carbon (SOC) sequestration. The objective of this study was to determine the long-term effects on soil C, nitrate (NO3)-N, ammonium (NH4)-N, and soil water in the 7.2-m depth with an alfalfa rotation compared with continuous corn (Zea mays L.). Soils from six pairs of alfalfa rotation versus continuous corn observation points were sampled to 7.2m depth in 0.3 m increments. The upper-most 0.3 m was divided into 0 â€“ 0.15 and 0.15 â€“ 0.30 m. For the 0-7.2 m depth, the alfalfa rotation compared with continuous corn had 36% less soil water, 457 kg ha-1 less NO3-N with 368 compared with 824 kg ha-1, 490 compared with 413 Mg ha-1 SOC, and 59.0 compared with 53.0 Mg ha-1 soil total N (STN). Cropping system and NO3-N concentration did not affect NH4-N in the vadose zone. The SOC in the 0â€“0.15 m depth was 7.61 Mg ha-1 more with the alfalfa rotation than with continuous corn. The greater depletion of soil water and NO3-N with alfalfa rotation was primarily below the rooting zone of corn suggesting no negative implications for corn following alfalfa but greatly reduced potential of NO3-N leaching to the aquifer with the alfalfa rotation. Alfalfa rotation compared with continuous corn is a means to greatly reduce leaching of NO3-N to the aquifer and improve the surface soil with potential to increase SOC sequestration.
Shivendra	Srivastava	ssrivastava2@huskers.unl.edu	Flood Risk Assessment in Nebraska using Hazard, Exposure, Vulnerability, and Response as Drivers	We use open-source datasets to assess the risk associated with flooding at the county scale in Nebraska. The framework considers risk as a function of hazard, exposure, vulnerability, and response. Information about hazard was included in the assessment through properties exposed to flooding. We considered population density, housing units, agriculture and livestock for quantifying exposure. The study quantified vulnerability under four subsections social, ecological, economic, and health. The response, a relatively newer dimension in risk assessment, was quantified for three distinct categories: structural, non-structural, and emergency. In this presentation, we will discuss the overall flood risk across different counties in Nebraska, along with the role of the four individual risk components, i.e., hazard, exposure, vulnerability, and response. Results from this assessment are expected to guide water managers and policymakers in devising more effective and locally relevant measures and policies to reduce flood risk.

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Beichen	Zhang	beichen@huskers.unl.edu	Application of Machine Learning in Monitoring and Assessing Drought Impacts in the U.S.	Drought is a common but costly natural disaster. Because of its characteristics, drought affects several spheres, including but not limited to the hydrosphere, biosphere, and anthroposphere, over various periods and spatial scales. The complexity of drought impacts makes it challenging to be monitored and predicted. With the rapid development of machine learning (ML) and data science, there is potential to quantitatively understand and assess drought impacts better from multiple aspects based on data-driven models and geospatial techniques, such as remote sensing. Hence, several research projects on studying drought impacts based on ML models were proposed and developed in the past year. In this presentation, a brief overview will be given to introduce the current work and collaboration on the application of ML in climate (drought) impacts and assessment. The current work will cover one study of using the explainable ML (XML) to predict drought impacts based on hydrometeorological indicators and another one that applies large language models (LLMs) based on deep learning (DL) to detect drought impacts from the text data. In addition, a collaboration has developed with the Water, Climate, and Health program (WCH) at the University of Nebraska Medical Center (UNMC) focused on studying the impacts of climate extremes related to environmental health. Overall, our studies reveal promising future of better assessments and predictions of drought impacts based on state-of-the-art ML, DL, and geospatial techniques.
Posters:				
Augustine Kena	Adjei	aadjei2@unl.edu	Exploring the Multifactorial Nature of Birth Defects in the Birth Outcomes and Water Pilot Study: The Impacts of Agrichemical Exposure, Maternal Age and Lifestyle.	Introduction: Birth defects are a major public health concern and can have long-lasting physical and psychological effects on affected individuals, families and society. Understanding the multifactorial nature of birth defects is critical for developing effective prevention strategies. The objective of this case-control pilot study is to assess the impacts of maternal exposure to agrichemicals through drinking water on the risk for birth defects. Methods: Women with at least one birth recorded in Nebraska databases were recruited for this study. Demographic and pregnancy information was collected as well as water, saliva, and blood samples. SPSS was used to evaluate the impacts of maternal age, agrichemical exposure, and lifestyle on the risk of birth defects. Results: Of 47 total participants, 26 women gave birth to infants with birth defects and 21 women gave birth to healthy infants. Agrichemical exposure through drinking water, applying pesticides, maternal age at the time of birth, lifestyle factors and the use of contraceptives or fertility drugs contribute to the risk of giving birth to infants with birth defects ($p<0.05$). The most common birth defects observed were spina bifida, hypospadias, Down syndrome and congenital heart defect. Conclusions: This small study of Nebraska women suggests that exposure to agrichemicals through drinking water increases risk for birth defects. To our knowledge, this is the first study to evaluate individual exposure to agrichemical mixtures in drinking water as a risk factor for birth defects. Further investigation in a larger study is warranted.

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Jamila	Bajelan	bajelanj@lopers.unk.edu	Water Quality Monitoring at the Kearney Outdoor Learning Area	The Kearney Outdoor Learning Area (KOLA) is adjacent to Kearney High School along a tributary of the Platte River in south-central Nebraska. KOLA offers a space for place-based learning in a natural area near the river. We have initiated ecohydrological monitoring at KOLA to support research, education, and communication. Here we present an overview of water quality monitoring at KOLA from August 2022 to present. We use a portable instrument that measures parameters such as temperature, dissolved oxygen, conductivity, and pH. We sample three water bodies at KOLA, a drainage ditch, pond, and creek, approximately monthly and examine how parameters change across time and vary among water bodies. Descriptions of changes in water quality give insight into the health of aquatic ecosystems and their surroundings. Long-term monitoring also can offer possible explanations for patterns observed in person or with passive monitoring equipment. Furthermore, consistent data collection can lead to the creation of a long-term database of natural features of KOLA that, when combined with other monitoring from the site, can create something bigger. Water quality is one of several datasets being collected at KOLA, along with observations of sights and sounds, natural history, and ecohydrology phenomena, to help us better understand this place in the Platte River watershed. Finally, this research increases awareness of KOLA as a local site for ecological monitoring and place-based education. Students at all levels may benefit from monitoring at KOLA as they learn the methodology, practice data collection, and share findings.
Sophia	Becker	sbecker14@huskers.unl.edu	Theoretical vs experimental relationship between K-40 counts and gravimetric water content at a well instrumented agricultural research station in Nebraska, USA	Detection of gamma-rays emitted by K-40 decay demonstrates potential for reliable soil moisture estimation for agricultural and hydrological applications. Gamma-ray spectroscopy (GRS) provides a continuous, non-invasive average measurement that fills the scale gap between point and satellite data. Current theoretical models of gamma-ray spectra and soil moisture have not been extensively tested with empirical data. We hypothesize that testing existing theoretical models with thorough empirical data over a range of soil moisture and vegetative conditions will increase our understanding of the relationship between gamma-ray spectra, soil moisture, and biomass, and will allow us to validate and/or improve the theoretical models. In this study we conduct a robust calibration of a stationary CsI gamma-ray soil moisture sensor (gSMS, Medusa Radiometrics) against gravimetric water content samples at a long term agricultural experimental field in eastern Nebraska, United States. In total, 18 soil sampling campaigns were conducted between June 2021 and October 2022 under bare soil, maize, and soybean conditions. Additional measurements include an Eddy Covariance tower, a Cosmic-Ray Neutron Sensor, in-situ soil moisture sensors, and destructive vegetation sampling. Comparison of the experimental data with the existing theoretical calibration functions shows large deviations. Cosmic-ray Neutron Sensor data recorded at the site shows a high degree of correlation ($R > 0.7$ for hourly data) with the K-40 counts under changing biomass conditions. Lastly, comparison of the GRS derived soil moisture data with the in-situ soil moisture sensors, rainfall, and evapotranspiration result in good correspondence with soil moisture state and water fluxes at the site.

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Deepak	Ghimire	deepak@huskers.unl.edu	Evaluation of Effects of Enhanced Efficiency Fertilizers on Grain Yield and Nitrate Leaching in Furrow-Irrigated Corn Field	Loss of nitrogen as nitrate from the plant root zone causes a potential threat to groundwater quality, and such contamination poses a public-health threat. Irrigated fields are prone to nitrate leaching, with a greater risk in furrow-irrigated croplands than in fields under drip or sprinkler irrigation. Optimal rates and the right fertilizer nitrogen (N) source can help reduce nitrate leaching. This three-year study evaluated the effects of different fertilizer treatments on grain yield and nitrate leaching in furrow-irrigated corn at the Panhandle Research, Extension, and Education Center in Scottsbluff, NE. 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). Water samples were collected periodically using suction-cup lysimeters installed at five feet depth in selected plots and analyzed for nitrate concentration. Grain yield data was obtained from the combine after harvest. This paper discusses two-year results on the corn yield and nitrate concentration in leachate samples as affected by different sources and rates of N fertilizer.
Nafyad	Kawo	nkawo2@huskers.unl.edu	Comparison of 3D Hydrofacies Models for Improved Groundwater Flow Model Parameterizations: A Glacial Aquifer Case Study	Spatial variation in aquifer properties can affect groundwater flow systems and recharge rates. The spatial variability of glacial aquifer properties is often difficult to determine accurately using only limited pumping and borehole data and typically requires a combination of methods. Parameterizing groundwater models can be done using pilot points, cell-based, or zone-based methods. However, accurately parameterizing heterogeneous glacial aquifer properties necessitates an appropriate parameterization method. A single conceptual aquifer model is often employed to evaluate and parameterize the groundwater flow model. Relying solely on a single methodology to create 3D hydrofacies models and derive aquifer properties may result in inaccurate structural and property variations. Our study employed voxel, Multiple-Point-Statistical (MPS), ensemble machine learning and artificial neural network (multilayer perceptron, MLP) techniques to generate a high-resolution 3D models of hydrofacies heterogeneity. We compared the models in terms of their ability to detect thin permeable hydrofacies and lateral continuity and vertical contrast between hydrofacies units. We derived hydraulic properties from hydrofacies probabilities. Thin permeable and more laterally continuous hydrofacies are better detected by machine learning algorithms than by MPS and voxel models. MLP and stacking machine learning predict sharper vertical contracts between fine and coarse hydrofacies than MPS and random forest models. Our findings highlight the importance of comparing 3D models to reduce parameter uncertainty and determine optimal locations for strategic zones or pilot points during inverse groundwater flow calibration. Furthermore, employing various 3D aquifer modeling techniques can provide valuable insights for recharge area mapping and it can aid in comprehending the effect of aquifer heterogeneity parameterizations on the groundwater flow model predictions.

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Mercy	Kipenda	mkipenda2@huskers.unl.edu	Comparison of remotely sensed datasets and metrics for detection of harmful algal bloom in Nebraska, U.S.A. lakes	Harmful algal blooms (HABs) have been increasing in frequency due to climate change and have been attributed to agricultural runoff, warmer climates, and other environmental factors. Monitoring of HABs has been attempted at both large- and small-scale levels. The official system, OHHABS, collects information about HABs and associated illnesses, using methods such as field sampling and laboratory analysis. Additionally, remote sensing indices such as the cyanobacteria index product (CI-cyano) and satellite estimation of chlorophyll-a concentration are used to detect algae blooms in waters. This research proposes the use of two satellite datasets and the CI and NDCI algorithms to detect and quantify the chlorophyll concentration estimates of Harmful Algae blooms of 5 public lakes and reservoirs in Nebraska. The study will focus on the detection of Harmful Algae Blooms (HABs) in lakes using comparable datasets and metrics. Specifically, the study compares the detection of HABs among different datasets to create a timeline around a known bloom event. This timeline allows for more accurate and timely predictions and alerting of potential outbreaks. By comparing datasets, the research also aims to provide an overview on which dataset and metric are most reliable for detecting HABs. Ultimately, the research aims to provide a better understanding of HAB outbreaks in Nebraska lakes and supplement management strategies in planning for bloom events.
Muili	Lawal	mlawal2@huskers.unl.edu	Multi-Model Assessment of Nitrate Leaching from Manure and Commercial Fertilizer Application in East Central Nebraska	The groundwater nitrate (NO3-N) concentration in groundwater of Water Quality Area 30 (WQA 30) within the Lower Loup Natural Resources District (LLNRD) has been increasing since the 1970s. Recent studies have found the average concentration (3.38 to 38.8 mg/L) to be two to three times higher than the maximum contaminant level (MCL) in drinking water. Nitrate concentrations in over 50% of sampled wells exceeded the allowable limit (10 mg/L) set by the US Environmental Protection Agency (USEPA). The primary sources of nitrate in the area include manure and commercial fertilizer. The objective of this project is to use a multi-model approach using the Root Zone Water Quality Model (RZWQM2) and HYDRUS-1D to predict the effects of changes in nitrogen and irrigation water management on nitrate leaching. In this study, 20 cores (4 deep and 16 shallows) will be collected and analyzed for physical and chemical properties. Composites from representative cores will be processed and analyzed for sediment carbon and total Kjeldahl nitrogen to evaluate organic nitrogen storage, loading, and potential nitrate source. Nitrate-stable isotopes will also be measured on selected core samples to characterize nitrogen sources and potential for denitrification. The collected data will be used to develop a multi-model approach and evaluate the area's nitrate amount and transport rates. This project is anticipated to generate a standardized protocol for estimating nitrate occurrence and transport potential, allow for a more precise assessment of vadose zone storage, occurrence, and potential leaching rates in specific land uses, improve accuracy in estimating vadose zone nitrate transport rates, and assist landowners and water resource managers in identifying areas where fertilizer application and irrigation practices need to be managed more effectively.

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Ben	Ndayambaje	ben1@huskers.unl.edu	Investigating Drinking Water Quality and Shared Zoonotic Pathogens in Rural Communities in Rwanda	Water contaminants including zoonotic pathogens and heavy metals can adversely influence aquatic ecosystem, animal, and public health outcomes. Globally, Campylobacter species, E. coli and Salmonella species are significant zoonotic pathogens that can cause bacterial infectious diarrhea and gastroenteritis. As part of a larger One Health, we investigated chemical and biological aspects of drinking water quality as well as the presence of zoonotic pathogenic bacteria in drinking water sources and livestock in rural communities of Rwanda. 47 samples were collected at drinking water sources, including untreated surface water, public taps, and household water storage containers, in the dry-wet seasons of 2021 and 2022 respectively. Basic water quality parameters were measured in the field using a portable water quality meter. Nitrate, metals and metalloids, and anions were analyzed in the Nebraska Water Sciences laboratory at UNL. Established bacterial culture methods were used to identify and isolate Campylobacter species, E. coli and Salmonella species from water and livestock fecal samples. Nitrates and most dissolved trace metals across water sources were below WHO and U.S. EPA potable water safety guideline values. However, iron and manganese levels exceeded recommended values across all tested samples. The prevalence of total coliform bacteria was highest in surface water samples (53%), followed by household water container samples (20%). The prevalence of Campylobacter was over 90% in livestock and 65% in drinking water samples. Further investigation on the sources of iron and manganese, and whole genome sequencing for extracted DNA culture positives is recommended.
Shohei	Oguro	soguro2@huskers.unl.edu	Physiological and molecular analysis of drought-stress traits in wheat	Wheat (Triticum spp.) is the worldâ€™s most widely grown crop and supplies on average 526 kcal/capita/day (~20 %) for humans. The demand for wheat grain is expected to rise to nearly a billion tons by the middle of the century. Wheat production is often limited by low seasonal rainfall and high temperature stress, frequently resulting in reduced yields and lower quality. To address this issue, we are examining the physiological and molecular impact of drought and heat stress in wheat. Our results from the drought stress experiment using a set of wheat introgression lines (from wild wheat) will be presented. We have used image-based phenomics and transcriptome analysis to determine a range of drought stress responses in the shoot with some strong association with roots (depth and architecture). We will present the role of plasticity in shoot and root growth in response to drought stress.
Taylor	Rosso	trosso2@huskers.unl.edu	Nitrate Controlled Metal Reduction in Unsaturated Soils	Nitrate commonly contaminates groundwater due to leaching from surface applications and anthropogenic activity. Based on research on saturated soils and sediments, the current paradigm is that influxes of an oxidant, including nitrate, into reduced regions of alluvial aquifers stimulates the oxidation of reduced chemical species (i.e. iron). Prior DWFI-funded research challenges this paradigm as influxes of an oxidant stimulated reducing conditions in alluvial floodplain sediments. To test the environmental ubiquity of these interactions, soil was collected following irrigation and homogenized. Enumeration of heterotrophic iron reducing bacteria revealed 3.3 x 104 cells/g. A series of soil slurries were initiated in simulated porewater medium under anoxic conditions to follow Fe(III) reduction in the presence of nitrate. Following pre-incubation, soil slurries were amended with nitrate to a final concentration of 0.3 mM (low), 50 mM (high), or remained unamended. In all treatments Fe(III) reduction was observed after 24 hours. Interestingly, high nitrate amendment resulted in the most Fe(III) reduced, 6.4 mmol L-1, relative to the low (1.2 mmol L-1) and unamended (1.7 mmol L-1) treatments. Nitrate reduction was observed concurrent with Fe(III) reduction. In the unamended and low amendment treatments, minimal, transient accumulation of N2O was observed, compared to high amendment, which reached 47 umol/L by the end of the incubation. The results of this study begin to elucidate the coupled biogeochemical cycling that underpins the fate and transport of nitrogen and iron in soils. Future work will apply these findings to uranium, a geogenic contaminant that is controlled by similar biogeochemical processes.

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Maria	Oviedo Ventura	moviedoventura2@huskers.unl.edu	Evaluation of Nebraska's potential nutrient utilization capacity for manure application	Livestock and poultry manure are utilized as organic sources for nutrients as nitrogen (N) and phosphorus (P) in cropland production. However, changes in the agriculture structure from integrated farms to specialize enterprises eliminated the process of nutrient recycling from manure to cropland in the same operation. Meanwhile, importation of nutrients keeps increasing in areas rich in organic nutrients, presenting a risk for ground and surface water quality. Therefore, a quantitative nutrient balance analysis was made at five counties. In addition, this analysis was integrated to a geospatial analysis of suitable land for manure application in Nebraska as a state and in detail at five target counties (Scotts Bluff, Cuming, Nemaha, Custer, Antelope), both utilizing government publicly available data. The factors selected for the geospatial analysis were scored using an Analytic Hierarchy Process and a pairwise comparison, and then analyze with the weighted overlay tool to obtain the suitable land. Results presented Scotts Bluff with nutrient surpluses (N and P), while Cuming and Antelope have P surpluses. Other counties, even though did not present surpluses, are close to meet their nutrient assimilation capability. Total area for high suitable land for manure application represented at state level 26.75 % (N based) and 31.39% (P based). Moreover, at county level Antelope and Nemaha (N based) have the highest percentage of high suitable land. Therefore, these analysis need to be interpreted according to the farmersâ€™ objectives and current field conditions.
Qu	Wen	qwen3@huskers.unl.edu	Producing Caproate from Cattle Manure Wastewater using Co-Fermentation with Corn Silage	Converting the organics in cattle manure wastewater into bioproducts, such as medium chain carboxylic acids (MCCAs, i.e., carboxylic acids with 6-12 carbons, or C6-C12), can be an important pathway to achieve circular economy in animal agriculture. The objective of this research is to produce MCCAs from cattle manure wastewater (CM) using a two-stage co-fermentation with corn silage (CS) without pH control or external electron donor supplement. In Stage 1, mixing CM and CS at the ratio of 9:3 resulted in pH ~5.0, which completely inhibited methanogenesis. Acetate (C2) and butyrate (C4) were the dominant acidogenic products at concentrations of 22.0 g/L and 5.5 g/L at Day 36, accounting for 53.5% and 25.4% (COD basis) of all the carboxylic acids produced, respectively. Only 1-2 g/L caproate (C6) was formed in Stage 1. In Stage 2, acetate and butyrate were further converted to caproate through chain elongation following a second round of CS addition, which resulted in CM to CS ratios of 9:9 and 9:18. Caproate concentration reached 8.0 g/L in the reactors with CM to CS ratio of 9:18. The genera Caproiciproducens (a chain elongator) and Lactobacillus (a lactic acid producer) were enriched in Stage 2, suggesting that their cooperation could be responsible for the high caproate production. These results demonstrate two-stage co-fermentation of CM and CS as a feasible way to obtain high titer caproate through microbial carboxylate platforms without pH control or exogenous electron donor input (e.g., ethanol or lactate).