2024 Daugherty Water for Food Global Institute Research Forum Presentation Abstracts

First Name	Last Name	Email	Title	Abstract
Presentations:				
Augustine Kena	Adjei	aadjei2@huskers.unl.edu	Adverse birth outcomes associated with maternal exposure to agrichemicals and their mixtures in personal drinking water. A Nebraska (USA) case-control pilot study	Most epidemiological studies investigating maternal exposure to agrichemicals through drinking water have not considered the impact of mixtures on birth outcomes at the household level. We evaluated the risk for adverse birth outcomes in Nebraska associated with exposure to single agrichemicals and their mixtures through drinking water. Forty-seven Nebraska women with a recent live birth or fetal death (21 controls, 26 cases) were recruited. Water samples were collected from participants' residences and agrichemical compounds were quantified. Pregnancy outcome data were retrieved from state registries. We calculated the proportions of cases and controls exposed to the agrichemicals and their mixtures, and estimated odds ratios (OR) and 95% confidence intervals (CI). Weighted Quantile Sum regression (WQS) was used to assess the weighted impact of each compound on adverse birth outcomes when present with others in the overall mixture. Nitrite was the only single contaminant associated with adverse outcomes [unadjusted OR 3.6; CI: 1.1-13.5]. Income-adjusted risks for agrichemical mixtures were highest for nitrite combined with: alachlor oxanilic acid (OA) (OR: 11.4; CI: 1.2-112.9), alachlor ethane sulfonic acid (ESA) (OR: 5.2; CI: 1.1-27.2), atrazine (OR: 5.1; CI: 1.1-25.2), acetochlor ESA (OR: 5.1; CI: 1.1-25.2), and deethylatrazine (OR: 5.1; CI: 1.1-25.2). A WQS plot showed simazine, alachlor OA, acetochlor ESA, nitrite, propazine and nitrate to be the predominant agrichemicals associated with adverse birth outcomes. Findings from this pilot study merit further evaluation of the compounds identified in the WQS plot in a fully powered case-control study.
Shara	Akat	sakat2@huskers.unl.edu	Drought's Impact on Cattle Stocking Density and Land Use	Livestock producers heavily rely on pastures and ranges to sustain adequate feed for their livestock, with stocking density being a crucial measure of grazing efficiency. Recent data shows a consistent trend towards reduced grazing efficiency nationwide (i.e. higher stocking density). Our research aims at evaluating how drought, land use changes, and market dynamics influence the changes in stocking density using regression analys of county-level stocking density and climate data. Understanding the impact of climate on stocking density is essential for ensuring sustainable and resilient livestock farming practices. By comprehending how climate variables interact with livestock production systems, farmers can implement adaptive strategies to mitigate risks associated with climate variability and extreme weather events. This knowledge enables farmers to optimize resource management, ensuring efficient utilization of available land and water resources while maintaining the health and welfare of their livestock. Moreover, policymakers can use insights into the climate-stock density relationship to develop supportive policies and incentives that promote climate-smart agricultural practices and enhance the resilience of the livestock sector to climate change. We have placed significant efforts on collecting beef cattle inventory data at the county level from USDA NASS Census of Agriculture reports since 1974, alongside county-level pasture land data covering pastureland variables (cropland used for pasture or grazing, woodland passtured, and other pastureland areas) since 1978. While data from 1997 to 2017 is easily accessible, retrieving earlier data necessitates extraction from PDF files using coding tools. The process involved multiple steps including data acquisition through the Census website, text extraction from respective PDFs, parsing and structuring, error correction and final aggregation. For county-level climate data, we used the Standardized Precipitation Index (SPI) from the National Integrated Drought Information System, available since January 1985. This index quantifies precipitation deviations from the long-term average over a specified timeframe. We have then merged them together to create an analysis-ready dataset. We found that the average stocking density, which is a ration of beef cattle inventory (heads) to pasture land (acres), in the US has indeed risen, from 0.15 in 1978 to 0.23 (head of cattle per acre of pasture land) in 2017. Additionally, stocking densities across regions have increased over the years as well, with the Midwest experiencing the most significant rise (from 0.17 in 1978 to 0.33 in 2017). Spacial representation indicates that Mideast states including Kentucky, Tennessee, Alabama, Missouri, and Georgia, have higher density compared to other states. There are several competing theories on why stocking density has increased. First, cattle are harvested at heavier weights. Fewer feeder cattle are needed to produce the same amount of beef and thus a trend towards larger but fewer cows. Second, the amount and quality of grazing land and pasture have changed. The quality of land could change particularly in the Northern Plains where good pasture that is tillable could be converted to grain production given high corn and soybean prices. Third, historical increases in temperatures and variable precipitation patterns could be making existing plant species suited for certain environments less productive. In the future, we will further conduct regression analysis to estimate the impact of climate and other variables on stocking density.

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Sophia	Becker	sbecker14@huskers.unl.edu	Advancing non-invasive, passive measurement of root zone soil water content at the subfield scale using gamma-ray spectroscopy	Hydrological applications including hyper-resolution land surface models and precision agricultural decision making could greatly benefit from reliable soil water content (SWC) information at the subfield scale (10s of meters). Gamma-ray spectroscopy (GRS) makes continuous, non-invasive SWC monitoring at subfield scale possible. However, few studies have applied the theoretical relationship between SWC and gamma-ray intensity to quantify SWC from GRS in the field. We conducted a robust three-year field validation study at a well-instrumented agricultural site in Nebraska, United States with the objective of narrowing this gap between theory and application. The study involved 27 gravimetric water content sampling campaigns in maize and soybean and 40K specific activity (Bq kg-1) measurements from a stationary GRS sensor. Our analysis showed that the current method for biomass water content correction is appropriate for our field site, but that the ratio of soil mass attenuation to water mass attenuation used in the theoretical equation must be adjusted to satisfactorily describe the field data. We propose a calibration equation with two free parameters: the theoretical 40K intensity in dry soil and a, which creates an â€œeffectiveâ€�mass attenuation ratio. Based on statistical analyses of our data set we recommend calibrating the GRS sensor for SWC estimation using 10 profiles within the footprint and 5 calibration sampling campaigns to achieve a cross validation root mean square error below 0.035 g g-1. We believe that the validation, advancements, and opportunities for accurate estimation of SWC with GRS demonstrated here strongly support the future of hydrological monitoring.
Moriah	Brown	mbrown136@huskers.unl.edu	Watershed Monitoring of Shell Creek for Antibiotics and Antibiotic-Resistant Bacteria	Runoff from agricultural fields poses a significant threat to water bodies, carrying sediments, nutrients, and chemicals, including antibiotics and antibiotic-resistant bacteria (ARBs), which degrade water quality. Despite their crucial role in disease prevention and growth promotion in agriculture, antibiotics' presence in watersheds raises environmental and health concerns, particularly regarding the spread of antibiotic resistance. This study focuses on the Shell Creek watershed in east-central Nebraska, an agriculturally dominated area, where antibiotics are extensively used in farming practices. Bi-weekly grab samples are collected from four locations along Shell Creek and are processed for bacteria and antibiotics. Results indicated infrequent antibiotic detections, mostly below quantification limits, while ionophores, notably monensin, were more frequently detected. The presence of antibiotic-resistant bacteria highlights the potential risks associated with agricultural practices and antibiotic use in the watershed, highlighting the need for sustainable management strategies to mitigate water contamination and safeguard public health and ecosystems.
Bruno	Chaves Morone Pinto	bpinto2@huskers.unl.edu	A Dynamic Model for the Ogallala Aquifer: Analyzing the Effectiveness of Different Groundwater Management Policies	Irrigation plays an important role in the Ogallala aquifer region. Garcia-Suarez, Fulginiti, and Perrin (2019) estimated groundwater irrigation from the Ogallala aquifer to increase revenue by $196 per acre in 2007. Because of this high return of irrigation, agents may overuse water in the absence of a constraining groundwater management policy. Therefore, we aim to construct a dynamic model for the Ogallala aquifer in selected counties in order to identify the optimal path of irrigation, and to compute the effect of different groundwater management policies on countyâ€™s net present value of agricultural profits. We assume the county planner seeks to maximize the net value of agricultural profits over an infinite horizon of time by choosing the share of planted land that is irrigated each period. We then derive the Bellman equation that shows the amount of irrigation that should be chosen today, given current and future (expected) levels of precipitation. Then, by imposing restriction in our dynamic model, we capture the cost of different groundwater management policies at achieving a given target of aquiferâ€™s saturated thickness. As preliminary results, we estimated a yield function of biomass that showed that an increase of 1 percentage point of share of land that is irrigated increases production by 0.81%. We then plug this yield function in our objective function to calculate the optimal path of irrigation and the net value of profit (with and without any groundwater management policies). We are currently working on the dynamic model solution using Matlab and R.
Kaouter	Essakkat	kessakkat2@huskers.unl.edu	The relationship between irrigation usage and cover crop adoption: Evidence from a survey of rain-fed and irrigated crop producers	Despite the clear advantages of cover crops (CCs) in enhancing soil health, water quality, and agricultural sustainability, their uptake among farmers is minimal, with a mere 5.1% adoption rate as of 2017. This study delves into the complex barriers hindering CC integration, particularly focusing on water availability concerns. Historical evidence underscores CCs' efficacy in soil erosion prevention, pest suppression, and yield stability enhancement. Yet, financial, structural, and managerial obstacles, coupled with the perception of CCs as competitors for soil moisture, impede their widespread adoption. This research utilizes a survey from Iowa, Kansas, and Nebraska farmers, analyzing 634 responses to understand the dynamics influencing CC adoption. Contrary to the initial hypothesis, findings indicate that water availability concerns, such as precipitation levels or irrigated acreage, do not significantly deter CC adoption. Instead, engagement in conservation practices and program enrollments emerged as positive predictors of CC use. Through Principal Component Analysis (PCA), the study identifies six principal components explaining 70% of the variance in CC adoption factors, with one component emphasizing the role of irrigation and income. This suggests that farmers with greater irrigation resources and higher incomes are more inclined towards CC adoption, possibly due to a better capacity for effective water management. This study contributes significantly to agricultural research by clarifying the role of water availability in CC adoption decisions. It highlights that while direct statistical links between water availability and CC adoption are absent, the perception of water competition crucially influences farmer decisions. This underscores the necessity for policies that address water management concerns to encourage broader CC adoption, proposing integrated approaches to overcome environmental and resource management challenges in agriculture.

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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 60 timelapse cameras throughout Nebraska, Colorado, and Wyoming. These cameras constantly monitor changes over time on the landscape and have helped document severe droughts and flooding. In addition to our timelapse camera systems, PBT has published more than 170 stories on our website, including short films, photo essays, and ESRI Story Maps. Daugherty Water for Food Global Institute has funded more than 30 students who have served as undergraduate interns for PBT. The materials produced by our interns, which include everything from timelapses to short films, have been valuable tools for our science communication and storytelling efforts. 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 seven undergraduate interns who assist with timelapse production, social media, and storytelling. Our DWFI-supported interns are critical to the continued success of PBT.
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, nitrate leaching, causes potential threat to groundwater contamination with nitrate and such contamination poses a public-health threat. Irrigated fields are prone to nitrate leaching, with a greater risk in furrow-irrigated croplands compared to fields under drip or sprinkler irrigation. Precise rates and the right source of fertilizer nitrogen (N) can help reduce nitrate leaching. This three-year study evaluated the effects of urea and two enhanced efficiency fertilizers (controlled-release and urea with inhibitors) on grain yield and nitrate leaching in furrow-irrigated corn at Panhandle Research, Extension, Education Center. 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.â€¯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.
Mercy	Kipenda	mkipenda2@huskers.unl	Remotely Sensed Early Warning of Algal Blooms in an Eastern Nebraska Reservoir: A comparison of Temporal and Spatial Indicators	Remotely sensed early warning of algal blooms in inland lakes could help inform water quality monitoring and management for improved human, animal, and ecosystem health. Various temporal and spatial early warning indicators have been developed to detect undesirable changes in ecosystems before the manifestation of their detrimental effects. Freely available remote sensing imagery at increasingly fine spatial, temporal, and spectral resolutions provides new opportunities to develop and compare approaches for detecting sudden decreases in water quality in inland lakes. This study compares temporal and spatial early warning indices of algal activity in an eastern Nebraska lake, using Normalized Difference Chlorophyll Index (NDCI) imagery derived from Sentinel 2 satellite imagery and field observations of Microcystin levels. Preliminary results show increasing trends in both mean NDCI and Microcystin over time. Temporal early warning tests were ineffective for anticipating documented decreases in water quality and results of spatial indicators are forthcoming. Findings are important for informing the continued exploration and understanding of the potential for different remote sensing datasets, metrics, and temporal and spatial early warning indicators for monitoring algal bloom activity in small inland lakes.
Taylor	Rosso	trosso2@huskers.unl.edu	Microbial Iron and Nitrate Reduction in Unsaturated Soils Following Rewetting	Microbial metal redox cycling has been well studied in saturated systems and is coupled to nitrogen cycling, but few studies have investigated these processes in unsaturated systems. Here we collected soil from an agricultural field. Homogenized soils served as the inoculum in a series of anoxic batch reactors containing simulated groundwater medium and synthetic Fe(III) oxide or no Fe(III) oxide amendment to simulate metal/radionuclide redox cycling following soil rewetting. Prior to nitrate amendment (0 mM, 0.25 mM, or 2 mM), no significant increase in Fe(II), indicative of Fe(III) reduction, was observed. Following nitrate amendment, simultaneous nitrate and Fe(III) reduction was observed in all treatments. Most probable number enumeration revealed that microorganisms capable of dissimilatory iron reduction (4.59x105 cellsâ€¢g-1), fermentative iron reduction (2.62x107 cellsâ€¢g-1), and nitrate reduction (4.62x109 cellsâ€¢g-1) were abundant in the soils. Given the abundance of fermentative iron reducing bacteria, a subsequent experiment was conducted with an electron transport chain inhibitor, sodium azide (0.65 mM). Batch reactors in which azide was omitted were observed to reduce nitrate and Fe(III). Azide amended treatments inhibited nitrate reduction and diminished Fe(III) reduction. Together these data suggest that fermentative metal/radionuclide reduction could play a significant role in the reduction of metal/radionuclides in unsaturated soils.

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Arshdeep	Singh	asingh26@huskers.unl.edu	Enhanced Efficiency Fertilizers Improve Groundwater Water Quality in the Bazile Groundwater Management Area of Nebraska	The increasing groundwater nitrate (NO3-N) contamination in irrigated sandy soils poses significant economic, environmental, and health threats. The objectives of this study were to evaluate the impact of conventional nitrogen (N) split vs. pre-plant N application, with and without EEFs [Agrotain (urease inhibitor), SuperU (urease and nitrification inhibitor)] on NO3-N leaching, corn yield, and return to N with (RTNEnv) and without environmental cost (RTN) in irrigated sandy soils of Bazile Groundwater Management Area in Nebraska. The 2-year (2021-2022) on-farm study included a zero N control and following six treatments at a sub-optimal N rate of 180 lb N ac-1: 1) Urea-preplant (Urea PP), 2) Urea-urea ammonium-nitrate (UAN) split (Usplit), 3) Agrotain pre-plant (Agrotain PP), 4) Agrotain-UAN split (AUsplit), 5) SuperU pre-plant (SuperU PP), and 6) SuperU-UAN split (SUsplit). Compared to Usplit, EEF PP decreased nitrate leaching by 75% (by 24 lb NO3-N ac-1) and increased RTNEnv by $217 ac-1, having no considerable effect on corn yield in 2022. There were no significant differences between Urea PP and Usplit on NO3-N leaching, corn yield, and RTN. However, EEF PP significantly reduced NO3-N leaching more than Urea PP by 71%, increasing grain yield by 13% and RTN by $154 ac-1. Furthermore, EEFsplit significantly reduced NO3-N leaching by 31% (by 18 lb NO3-N ac-1) and increased grain yield by 9.6% than the Urea PP in 2021, but EEFsplit (26 lb NO3-N ac-1) significantly increased NO3-N leaching by 139% (2.4 times) than EEF PP (11 lb NO3-N ac-1) with no effect on grain yield in both years. Notably, NO3-N leaching from EEF PP had similar NO3-N leaching than control in both years. These findings suggest that pre-plant application of EEFs can substantially reduce nitrate leaching without impacting corn yield but with higher economic returns in groundwater-contaminated areas.
Shivendra	Srivastava	ssrivastava2@huskers.unl.edu	Analyzing Flood Risk Across U.S. Counties: A Comprehensive Mapping Study	This study considered hazard, exposure, vulnerability, and response as integral parts of a flood risk framework in the context of properties and associated populations. We calculated the flood risk for the United States at the county scale. Self-Organizing Map (SOM), an unsupervised clustering algorithm, was applied to see the interactions among the vulnerability and risk components. Results show that counties in the eastern and around the coastal belt of the United States are most susceptible to flooding. To validate our findings, we compared our vulnerability map with the existing Social Vulnerability Index (SoVI), a part of the National Risk Index (NRI) developed by the Federal Emergency Management Agency (FEMA), where we found a strong correlation of 0.76. Our study aims to inform about the existing risk and their pattern across the different regions of the United States, which can help in making tailored policies based on each county's requirements.
Posters:				
Ally	Barry	abarry7@unl.edu	Challenges and Opportunities to Reduce Nitrate Consumption through Drinking Water in Nebraska	Nitrate is a naturally occurring compound, however, its concentrations in groundwater can increase in response to certain human activities (e.g., fertilizing crops and recreational areas) and threaten human health when consumed in high concentrations. Surrounding studies focus on the contributing factors to nonpoint-source pollution of nitrate and adverse health outcomes of nitrate consumption respectively. This solution-based study aims to identify and understand the relevant stakeholders, at-risk populations, and potential actions and their associated barriers to reducing nitrate consumption via drinking water in Nebraska. Stakeholder interviews were conducted with agricultural professionals, policymakers, public health officials, water quality experts, educators, community leaders, and economists to gain insight into the status of nitrate contamination in the state along with its repercussions on human health and wellbeing. The findings, supplemented by background literature, suggest a disproportionate risk of nitrate exposure in rural areas of Nebraska, particularly among residents who rely on private wells for drinking water as they lack the testing and treatment mandates of Nebraska's public water systems. The primary solutions for this population include regular water testing and investment in water treatment options. However, these populations may face a bevy of barriers to ensuring safe drinking water such as their status of property ownership, a lack of awareness of adverse health risks, and difficulty to access appropriate medical care. Consequentially, the team produced a graphic informing decision-makers at various levels.
Britt	Fossum	bfossum2@huskers.unl.edu	Field experimental evidence for biochar surface functionalization with iron oxides and links to nitrate retention mechanisms.	Researchers, producers, and policymakers have increased their efforts towards improving the efficiency and sustainability of agricultural systems. A key management strategy can be the use of biochar which has shown some efficacy as a method to improve water and nutrient retention in agricultural systems, although further elucidation of how desired properties are influenced by crop system and water management is needed. High temperature, wood derived biochar at a rate of 70 Mg ha-1 was disked to a depth of 10 cm at two locations managed with and without irrigation. Soil was sampled 6 months post-application from 0-10 cm, 10-30 cm, 30-60 cm, and 60-90 cm. Biochar particles were isolated by hand. Soil samples were analyzed for organic carbon, total nitrogen, and residual nitrate and ammonia. The surface of biochar particles were characterized using X-Ray Photoelectron spectroscopy (XPS). Nitrate retention in topsoil was significantly higher in the uppermost 30 cm of soil at the rainfed site for cover crop plots amended with biochar with an increase of 31 Â±8.0 kg ha-1 nitrate relative to cover crop alone. Under irrigated conditions nitrate retention in topsoil increased with biochar application 11.0 kg ha-1 regardless of use of cover crops. XPS analysis showed for 95% of analyzed biochar particles a co-localization of nitrogen and iron species for irrigated soil and only 50% of biochar particles from soils under rainfed conditions. Iron functionalization of biochar surfaces under field conditions appears to be affected by seasonal soil moisture conditions more so than by other management choices.

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Troy	Gilmore	gilmore@unl.edu	GRIME-AI: Open-source Software for Ecohydrological Science using Ground-based Time-lapse Imagery	Imagery is rich in qualitative and quantitative information that can replace or complement traditional water sensors. Time-lapse imagery from ground-based cameras is available from an increasing number of sources. National networks, including PhenoCam (700 cameras) and U.S. Geological Survey (500 cameras), and the smaller Platte Basin Timelapse project network have each recorded millions of images at important hydrological-ecological interfaces. Trail cameras (game cameras) are becoming increasingly common in shorter-term, grant-funded projects. Regardless of the source, data management and extraction of ecohydrological information from imagery becomes more challenging as the number of sites and size of image datasets grows. To take full advantage of available archives and increase scientific discoveries, it is critical to enable a broad range of end users to bring their creativity and disciplinary knowledge to image-based projects. GaugeCam Remote Image Manager Educational – Artificial Intelligence (GRIME-AI) is a free, open-source (Apache 2.0) software package being developed to facilitate the full data science workflow, including data management, data cleaning (image triage), image processing, and model testing and training. This poster will describe the past, current and future development of GRIME-AI and provide example applications underway.
Muili	Lawal	mlawal2@unl.edu	Assessment of Nitrate Leaching Risks in East Central Nebraska Through Comprehensive Soil Analysis	Since the 1970s, Water Quality Area 30 (WQA 30) within the Lower Loup Natural Resources District (LLNRD) has experienced an upward trend in groundwater nitrate (NO3-N) concentrations. Recent studies indicate that the nitrate levels range from 3.38 to 38.8 mg/L, significantly exceeding the US Environmental Protection Agency's (USEPA) maximum contaminant level (MCL) of 10 mg/L in over half of the sampled wells. These elevations are attributed primarily to the use of manure and commercial fertilizers. The objective of this study is to evaluate the effects of changes in nitrogen management, irrigation practices, and other agricultural management strategies on nitrate leaching in the study area. To this end, the research team collected and analyzed 20 soil cores (4 deep and 16 shallow) for physical and chemical properties, including bulk density, water content, hydraulic conductivity, pH, nitrate, organic carbon, and nitrogen. The findings of this study will help identify the most effective management practices for reducing nitrate contamination in the region's groundwater, which is crucial for protecting water quality and public health.
Thais	Murias Jardim	tmuriasjardim2@huskers.unl.edu	Response of variably irrigated maize hybrids to water availability	Maize hybrid genetics continuously improve over time, resulting in increased yield without increasing water usage. Therefore, irrigation water production functions (IWPF) need to be updated for the latest hybrids to account for potential increases in water productivity. This study aimed to investigate the response of 63 maize hybrids under variable irrigation management to water availability. The dataset, collected from 2017 to 2023 as part of the University of Nebraska-Lincoln Testing Ag Performance Solutions (UNL-TAPS) competition, was used to develop IWPFs for all hybrids, the three most selected hybrids, and the wettest and driest years. A curvilinear relationship between yield and irrigation was observed for all hybrids, with an intercept of 10.16 Mg ha-1. The IWPF for the three hybrids also resulted in a curvilinear pattern. Although the intercept resulted in a yield of 9.42 Mg ha-1, the three hybrids have the potential to achieve greater yield under optimum irrigation compared to all hybrids. A stronger correlation between grain yield and irrigation was observed in the driest year. The IWPF intercepts indicated an increase in dryland yield by 6.03 Mg ha-1 in the wettest year. However, there was a greater potential to achieve higher yields in the dry year. The narrower range in irrigation applied in the wet year suggests that growers account for precipitation in their irrigation decisions. Therefore, this study highlights the potential of the latest maize hybrids for non-irrigated production and the possibility of achieving greater yields under optimum irrigation in dry years despite lower precipitation.
Shohei	Oguro	soguro2@huskers.unl.edu	Effect of heat stress on arsenic accumulation during vegetative stage in rice	Rice (Oryza sativa) is the most widely consumed crop and supplies on average 520 kcal/capita/day (over 20%) for humans. Arsenic (As), a toxic metalloid, is widespread in the environment and its contamination in soil and water has been reported in many countries. Compared to other cereals, rice is known to accumulate As more efficiently in the grains. Furthermore, recent studies demonstrates that high temperature stress can increase As concentration in rice tissue, intensifying an existing threat, climate change to rice quality and human health. In this study, we aim to explore the relationship between heat stress and As accumulation by examining genotypic variations in As accumulation in response to heat stress in rice. Our physiological analysis of root and shoot during the early vegetative stage from hydroponics experiment will be presented.
Kaitlin	Steinauer	ksteinauer2@unl.edu	Measuring Seasonal Fluctuations in Nebraska's Groundwater Levels with a Relative Gravimeter	Nebraska relies heavily on groundwater to sustain ecosystems, provide drinking water, and support the agricultural industry. Currently, groundwater modeling is used to manage this resource; however, it requires data from wells. If no well is present at a desired location, it can be a costly and time-consuming process to measure changes in the water level. Satellites can determine large-scale changes in groundwater storage using gravity data but lack the ability to measure at a small-scale. This project serves as proof of concept that a relative gravimeter can measure seasonal fluctuations in Nebraskaâ€™s groundwater Starting in April 2024, monthly gravity measurements will be collected. Once irrigation begins, gravity readings will be taken twice a month to better track the decline and subsequent recharge in the water level. At each location is a well that will allow for comparison of water level change with the gravity data. Oakland, Nebraska has been selected due to shared data from several wells monitored by the Eastern Nebraska Water Resource Assessment. In these wells, water levels range up to 12 meters (39.4 ft) within a year. It is hypothesized that this large change is due to the pressure effect in the confined system, or is the actual effect of depletion due to excessive pumping during the irrigation season. To test these hypotheses, an unconfined site will be measured to correlate differences. The anticipated results are that the gravity data will correlate with well data in unconfined conditions and correlate poorly with potentiometric levels in confined conditions.

Sarah	Tucker	stucker@unmc.edu	Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Nebraska Drinking Water	Per-and polyfluoroalkyl substances (PFAS) are a class of synthetic compounds that are ubiquitous in the environment. These compounds threaten water quality as emerging contaminants of concern. Studies have shown that PFAS are associated with several target organs of toxicity including the liver, kidneys, cardiovascular, reproductive, and immune systems. Water consumption is the primary exposure route of PFAS to humans. Despite ongoing nationwide monitoring of drinking water by many different government agencies, there is limited information on the concentrations of PFAS in Nebraska drinking water. We have identified seven sites (4 landfill sites and 3 military training sites) to conduct tap water sample collection. We will measure the concentration of PFAS in residential drinking water to determine the relationship to residential location, as well as other variables obtained from household- and individual-level surveys. Finally, we will conduct an exposure assessment using the US Environmental Protection Agency (USEPA) hazard index approach (HI) to identify households with elevated risk of PFAS exposure through drinking water. The primary objective is to identify households with PFAS contaminated drinking water and characterize the risk of PFAS exposure to human health in order to reduce the risk of PFAS exposure through residential drinking water. This project will provide data on concentrations of PFAS in drinking water throughout the state of Nebraska, data on health conditions, household drinking water, and diet related behaviors. Finally, the exposure assessment resulting in HI will provide data to inform public health decisions regarding the risk of PFAS exposure through Nebraska drinking water.
Qu	Wen	qwen3@huskers.unl.edu	Defluorination of PFOA/PFOS using a denitrifying anaerobic methane oxidation (DAMO) enrichment culture	Per- and polyfluoroalkyl substances (PFAS), such as perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) are widely detected in water and known to resist biodegradation due to the strong carbon-fluorine bond. These compounds pose a great threat to public health and environment because of their bioaccumulation, persistence, and toxicity. The objective of this study is to explore the potential of a DAMO enrichment culture in defluorinating PFOA/PFOS in water. The experiment was conducted in batch reactors with a 5-day cycle. Results show that the DAMO enrichment maintained its nitrate reduction capacity despite the high doses of PFOA/PFOS, completely utilizing 6 mg/L NO3--N within each cycle. Accumulation of fluoride ion, an indication of defluorination, was observed in the treatment reactors from 7.0 Î¼M on Day 0 to 9.7 Î¼M on Day 25 (i.e., after 5 cycles), while there was no increase in fluoride concentration in the abiotic controls. The underlying mechanism of defluorination by the DAMO enrichment culture requires further investigation, such as identification of biotransformation products. The purging procedure used to supply methane gas as the organic substrate turned out to cause loss of PFOA and PFOS compounds to the gas phase. To address this issue, in subsequent experiments, we will use an anaerobic chamber to provide an anaerobic environment and supply methane to the headspace of the bioreactors. Overall, these preliminary findings highlight the promising potential of employing DAMO microbes to remediate PFAS-contaminated water and offer valuable insights for research on PFAS treatment.
Hongfeng	Yu	hfyu@unl.edu	Unveiling Soil Mapping through 3D Hyperspectral Imaging and Visualization	Hyperspectral imaging offers unparalleled insights into soil characteristics crucial for various applications such as crop health assessment, nutrient management, and precision agriculture. However, the inherent complexity of hyperspectral data, with its multitude of spectral bands, poses challenges for meaningful visualization and interpretation. Volume visualization techniques, renowned for their efficacy in depicting three-dimensional data, present a promising avenue for addressing these challenges. In this study, we introduce a novel approach to visualizing 3D hyperspectral datasets tailored specifically for soil mapping. Our methodology integrates a web-based interactive tool for volume visualization, leveraging a deep learning-based autoencoder for dimensionality reduction and subsequent clustering to unveil the intricate spatial distribution of soil characteristics. This work represents a significant advancement in the visualization and analysis of 3D hyperspectral soil mapping data, offering valuable insights for agricultural research and decision-making processes.