2022 NREC Funded Research Projects
Click on project title to read the objectives

Project Title	Institution	Principal Investigator	2022 Project Budget
New for 2022			
Intensification of corn-soybean rotation with wheat to improve water quality, soil health and farm profit	SIU	Sadeghpour	$ 176,430.00
Assessing Illinois WASCoB's - water quality, legacy P and sediment trapping	SIU	Schoonover	$ 79,802.00
Double-Dipping P Loss Reductions: Integrating and stacking struvite in P BMP's	UI	Margenot	$ 83,027.00
Improve the N rate calculator and MRTN for Illinois farmers by leveraging NREC historical N trials and new computing tools	UI	Guan	$ 149,443.00
Evaluating streambank and in-stream erosion as a source of P and sediment in two agricultural watersheds	SIU	Williard	$ 99,854.00
Do Soil Caps Enhance Bioreactor Performance and Increase Woodchip Longevity?	UI	Gentry	$ 39,000.00
Ongoing projects			
Integrating livestock grazing into the western Illinois corn-soybean cropping system to enhance farm profitability and reduce nutrient loss	WIU	Bernards	$ 84,242.00
Watershed-scale response of agricultural systems to drainage water management in Central Illinois	UI	Bhattarai	$ 105,400.00
Knowledge is power: Powering up bioreactors and saturated buffers in Illinois	UI	Christianson	$ 83,871.00
Characterizing sub-field variability for efficient phosphorus management: targeting hotspots	UI	Fraterrigo	$ 48,997.00
Reducing Nutrient Loads in WASCOBs in Southern Illinois	UI	Gentry	$ 112,237.00
Nitrogen Management Systems in Tile-Drained Fields: 4R Plus – Rate, Source, Time, Place and Cover Crops (Douglas County)	UI	Gentry	$ 257,788.00
Integrating Tillage, Soil Carbon Dynamics, and Tile Nitrate Loss (Eric Miller)	UI	Gentry	$ 166,802.00
Managing the maize microbiome for sustainable nutrient retention in Illinois agricultural soils	UI	Kent	$ 129,412.00

Precision Nitrogen Management of Corn for Improving Farm Profitability and Water Quality in Southern Illinois	SIU	Sadeghpour	$ 216,733.00
Next Generation Cover Cropping in Corn-Soybean Rotation to Improve Farm Benefits and Decrease Environmental Losses in South and Central Illinois	SIU	Sadeghpour	$ 183,522.00
Water and Sediment Control Basins (WASCoBs) influence on Crop Yields and Water Quality	SIU	Schoonover	$ 148,418.00
Modelling and Designing Saturated Buffers for Nitrogen and Phosphorus Mitigation in Illinois	SIU	Schoonover	$ 134,854.00
Minimizing phosphorus and nitrogen loss from agricultural systems with cover crops and tillage in Southern Illinois	SIU	Williard	$ 179,436.00
Sources and cycling of nitrate in tile-drained corn-soybean rotation systems: A stable isotope approach	UI	Yu	$ 122,064.00
Designer Biochar to Capture and Recycle Phosphorous from Tile Drainage Systems	UI	Zheng	$ 95,132.00
Capitalizing on 150 Years of Soil Samples to Determine Legacy P and Improve Water Quality in Illinois	UI	Margenot	$ 285,667.00
Nitrogen Rate Research & NREC Project Partnership	IFCA	Schaefer	$ 335,210.00
A Long-term Evaluation of Nitrogen Application Timing and Cover Crops Impacts on the Fate and Availability of Nitrogen Fertilizer and Crop Production on Tile Drained Fields	Purdue	Armstrong	$ 215,082.00
The effect of cover crops on surface water quality: A paired watershed experiment in the Lake Bloomington watershed	Purdue	Armstrong	$ 177,865.00
Nitrogen placement and application timing for best efficiency, growth, and yield of corn across Illinois	UI	Below	$ 28,495.00
Evaluating nutrient loss reduction strategies: longer rotation with cover crops and bioreactor (Miller Project)	UI	Gentry	$ 135,890.00
Water quality and agronomic impacts of gypsum applications in Southern Illinois	SIU	Williard	$ 37,826.00

Project Objectives of Newly Funded Projects

Intensification of corn-soybean rotation with wheat to improve water quality, soil health and farm profit	SIU	Sadeghpour

Objectives:

1. Evaluate whether intensifying corn-soybean rotation with winter wheat as double crop can decrease nutrient losses, improve soil quality and farm profit.
2. Assess whether the inclusion of wheat as a double crop in rotation with soybean decreases or increases nutrient leaching
3. Determine whether N management in wheat itself can decrease or increase nutrient losses.
4. Compare corn-wheat-soybean (double cropping scenario) with a corn-winter cereal rye cover crop-soybean system (best nutrient loss reduction scenario).
5. Compare soil health, weed pressure, and economic benefits of corn-soybean rotation with and without rye with double cropping wheat-soybean in different wheat management scenarios.

6. Conduct an LCA to comprehensively evaluate ecosystem benefits for each system.

Assessing Illinois WASCoB's - water quality, legacy P and sediment trapping	SIU	Schoonover

Objectives:

1. Utilize drone photography with Real-Time Kinematic (RTK) data to create detailed elevation maps to assess annual sediment accumulation in southern Illinois WASCoBs.
2. Perform a detailed soil assessment of multiple southern Illinois WASCoBs to correlate WASCoB age with phosphorus accrual in sediment basins to estimate short-term legacy phosphorus deposition.
3. Correlate water chemistry (N&P) data with WASCoB age and other land use variables.
4. Investigate crop yields associated with WASCoBs in relation to time since practice installation.
5. Organize a final report at the conclusion of the project to address the objectives.

Double-Dipping P Loss Reductions: Integrating and stacking struvite in P BMP's	UI	Margenot

Objectives:

1. Quantify P loss mitigation as surface run-off from using struvite as a P fertilizer compared to DAP, and when stacked with two additional BMPs: placement (broadcast vs subsurface banding) and tillage (no-till vs strip till vs conventional) practices.
2. Determine relative importance of erosion-based vs fertilizer sources of P loss *and their relative mitigation* under the two placement and tillage BMPs, to test the hypothesis that the majority of off-field P losses are *directly* due to erosion of soil, vs DRP from fertilizer.
3. Determine crop P use efficiency of struvite and DAP, to provide agronomic (yield) context, balance agronomic goal with water quality benefits, and calculate yield-scaled losses for P specifically (e.g. unit P lost per unit yield produced).
4. Conduct comprehensive economic evaluation of “double dipping” benefits of struvite for point- and non-point source P loss reductions, as well as tillage and fertilizer placement BMPs, to determine cost-effectiveness of adding struvite BMPs to the Illinois Nutrient Loss Reduction Strategy.
5. Communicate and disseminate findings to farmer, stakeholder, and policy makers.

Improve the N rate calculator and MRTN for Illinois farmers by leveraging NREC historical N trials and new computing tools	UI	Guan

Objectives:

1. Compile the historical NREC Nitrogen trial data across Illinois into a database, collect new nitrogen trial data with a modified on-farm trial design, and use the new data to update the original MRTN calculator.
2. Update the current MRTN tool with new trial data and develop the next-generation MRTN method by incorporating soil and weather information at the agricultural district level. Calibrate an agroecosystem model using historical and newly collected N trial data and use the constrained model to simulate crop yield under different N rates as well as soil and climate conditions. The new MRTN rate will be determined based on the simulation results.
3. Develop a web-based platform to expand and improve MRTN tools. The platform will contain both an updated original version MRTN and next generation version MRTN calculators.
4. Training and outreach with the users’ community (e.g. farmers, agronomy advisors) and work with NREC, IFCA, Illinois Farm Bureau, and University of Illinois Extension to disseminate our research results and promote changes in the web-based N rate calculator.

Evaluating streambank and in-stream erosion as a source of P and sediment in two agricultural watersheds	SIU	Williard

Objectives:

1. To determine if streambank and in-stream erosion are contributing significant amounts of sediment and phosphorus to downstream waters in two agricultural watersheds in Illinois.
2. Quantify the in-stream (including streambank) erosion occurring in two streams in southern Illinois through annual UAV (Unmanned Aerial Vehicle) surveys. Additionally, one-meter grid points will be surveyed at three cross-sections with 40 erosion pins installed in the eroding banks to quantify the soil loss.
3. Determine the proportion of total phosphorus and sediment loads from each watershed that is due to in-stream erosion. Total phosphorus and sediment loads will be measured by the Illinois State Water Survey intensive water quality monitoring program in the two streams.
4. Estimate the landscape contributions of total phosphorus and sediment to the 2 streams through Soil and Water Assessment Tool (SWAT) watershed modeling conducted by the Illinois State Water Survey. The proposed subcontract project objectives are: (1) to develop, calibrate and validate hydrologic and water quality models, (2) quantify the in-stream and landscape P and sediment contributions in the study watersheds, incorporating field stream survey sediment and P data into the watershed simulation models, and (3) contribute to the progress and final reports addressing each of the stated objectives.
5. To include a final report at the conclusion of this project to address each of the objectives stated above.

Do Soil Caps Enhance Bioreactor Performance and Increase Woodchip Longevity?	UI	Gentry

Objectives:

1. Investigate if a soil cap will lower the redox potential which favors the microbial conversion of nitrate to N_2 gas
2. Determine if a soil cap can slow woodchip degradation.
3. Determine if a soil cap can improve nitrate removal as well as extend the life of the woodchips and therefore, delay the next recharge.