TRANSFORMATIONAL AGRICULTURE FOR A FOOD AND WATER SECURE WORLD

OVERVIEW

To feed an expected population of 9.7 billion in 2050, the world will need to produce 70 percent more food with less water than we use today. The University of Nebraska's ability to tackle this global challenge rests on 150 years of leadership in agriculture, water, and natural resources. As the nation's 3rd largest agricultural economy, Nebraska is a unique agricultural laboratory with seven climate zones; wide variation in soils, precipitation, and elevation which mirror growing conditions across the world; one of the largest mixed-grass, native prairie landscapes; and a unique track record of locally managed land and water stewardship.

The farm of the future cannot operate with the tools of the past. Our ability to agriculturally thrive will depend on developing and adopting climate-adaptive, data-driven, resilient, and regenerative precision agriculture practices to advance American agriculture while nourishing our landscapes, natural resources, and rural communities. These practices and tools will impact: crop and livestock production; irrigation and water management; calibration of inputs to get desired outputs; measurement of carbon, methane, and other variables in soils; evaluation of tipping points in management of agricultural working lands for more effective stewardship through extreme weather and greater uncertainty.

Nebraska can be a national hub through the proposed U.S. Department of Agriculture (USDA) Agricultural Research Service National Center for Resilient and Regenerative Precision Agriculture, which will create innovations through research that will be validated and demonstrated at testbeds on the SmartFarm of the Future and shared across a network of land-grant universities collaboratively working to support the diversity of American agriculture.

Nebraskans know this work is critical to maintaining the agricultural productivity that supports our state and feeds a growing world population. Our research covers the entire spectrum from the lab to the field, from new technologies to new foods. We partner with public and private sector organizations, commodity groups, and federal agencies like USDA, National Science Foundation, National Oceanic and Atmospheric Administration, U.S. Agency for International Development, and Department of Energy with possibilities in the Department of Defense and Department of Homeland Security who are increasingly interested in water and food security.

The following capabilities and expertise uniquely position UNL to provide a holistic approach for research on resilient and regenerative agroecosystems.

Center for Advanced Land-Management Information Technologies (CALMIT) and high throughput plant phenomics facilities at UNL provide capabilities ranging from leaf to satellite sensing, advanced proximal sensing (Lemnatec, Spidercam, tractor, UAV, aircraft systems), and satellite imagery to advance understanding and precision application of resilient and regenerative practices in agriculture and grassland systems.

Center for Agricultural Profitability provides expertise in agricultural economics, business, and production for the economic well-being of producers through a systems approach to promote financially astute on-farm decision-making.

Center for Agricultural and Food Industrial Organization - Policy Research Group employs behavioral and experimental economic methods to empirically analyze and develop agroecosystem policies for improved policy design, enhanced efficiency, and effectiveness.

Center for Plant Science Innovation conducts fundamental and applied research, including new genotypes resistant to stress, sorghum for biofuel, salt-tolerant rice varieties, and beta-carotene cassava with the potential to reduce vitamin A deficiency.

Center for Resilience in Agricultural Working Landscapes integrates agricultural expertise with resilience in complex social-ecological systems and agricultural landscapes, helping farmers and ranchers cope with rapid change.

Daugherty Water for Food Global Institute – Working in Nebraska and around the globe, DWFI utilizes research, education, and policy analysis to secure sufficient food and water supplies for current and future generations.

Global Yield Gap and Water Productivity Atlas – A unique local to global web-based modeling and mapping tool to identify areas where existing farmland has the capacity to produce much higher, sustainable yields. It now covers major crops in 60 countries, including Indonesia, the 4th most populous country globally.

High Plains Regional Climate Center, 1 of 6 Regional Climate Centers supported by NOAA, provides climate tools and information for producers and stakeholders across the upper Great Plains.

National Drought Mitigation Center produces the U.S. Drought Monitor and is internationally known for training scientists and governments across the globe in drought preparedness and risk management.

Nebraska Food for Health Center brings together research on agricultural production, food processing, and medicine to develop foods with proven health benefits and improve the health of people suffering from obesity, cancer, and digestive diseases.

Nebraska Integrated Beef Systems Initiative uses advanced precision digital techniques to evaluate the profitability and sustainability of beef production within a multi-functional system and address workforce shortages, environmental footprint, and GHG emissions.

Platte River-High Plains Aquifer Long-Term Agroecosystem Research (LTAR) is 1 of 18 national sites supported by USDA ARS focused on agroecosystems productivity, profitability, sustainability, and resilience. Nebraska's LTAR develops climate-smart agricultural practices: irrigation systems, nutrient management, high-efficiency fertilizers, crop rotations, cover crops, and assessment of multiscale greenhouse gas emissions and mitigation management.

University of Nebraska On-Farm Research Network engages producers in research through regenerative agriculture to increase adoption of climate-smart solutions, increase carbon sequestration, reduce greenhouse gases, increase efficiency and profitability, and improve soil health. In 2020, the Network conducted nearly 90 on-farm research studies across 2.4 million crop acres, with producers typically seeing yield increases while saving $11-$15 per acre.