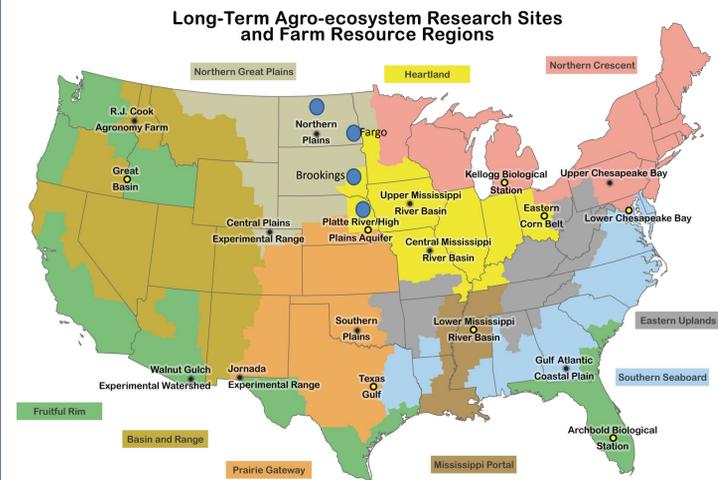


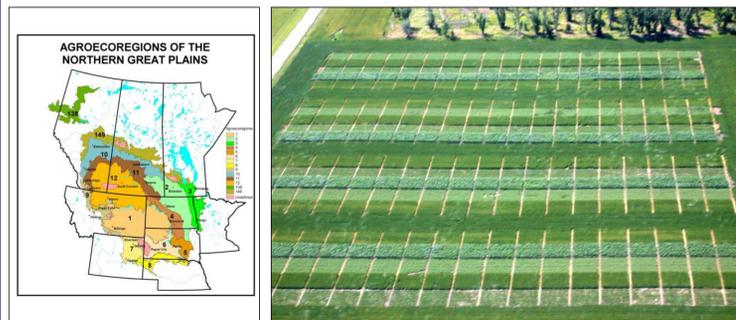
Long-Term Agro-Ecosystem Research in the Northern Great Plains

Matt A. Sanderson, Mark A. Liebig, USDA-ARS, Mandan, ND; Brian Wienhold and Marty Schmer, USDA-ARS, Lincoln, NE
Tala Awada and Jane Okalebo, University of Nebraska, Lincoln; Sharon Papiernik, Shannon Osborne, and Walt Riedell, USDA-ARS, Brookings, SD
Bill Kemp, USDA-ARS, Fargo, ND

The Northern Plains long-term agroecosystem research (LTAR) site at Mandan, ND and the Platte River High Plains LTAR site (ARS/University of Nebraska-Lincoln) at Lincoln, NE in collaboration with USDA-ARS research units in Brookings, SD and Fargo, ND are collaborating on research to sustain multiple ecosystem services from Northern Great Plains agroecosystems.



We emphasize sustainable intensification based on the adoption of conservation agriculture principles including reduced soil disturbance, livestock integration, and greater complexity and diversity in the system.



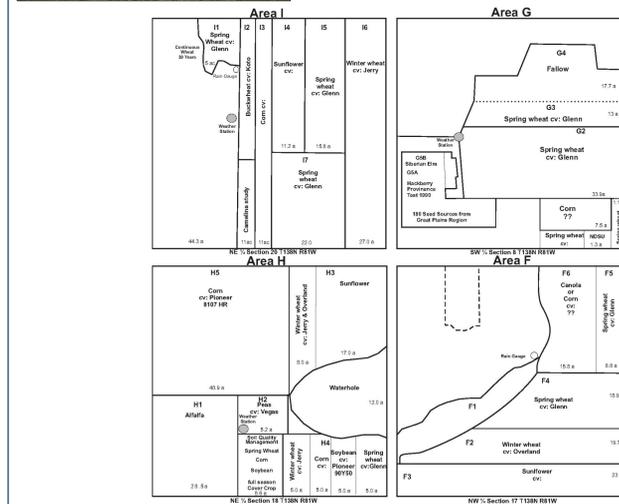
Here, we summarize new concepts these locations have pioneered in dynamic cropping systems, resource use efficiency, and agricultural management technologies. As part of the LTAR network, we will conduct long-term cross-site research to design and assess new agricultural practices and systems aimed at improving our understanding of decision making processes and outcomes across an array of agricultural systems.



At Mandan, the LTAR research focuses on ecosystem services in a dryland cropping system and a livestock grazing system compared with an alternative dynamic integrated cropping system. Our hypothesis is that agricultural production systems characterized by conservation agriculture principles will enhance ecosystem services compared to 'business as usual' management.



Area IV Research Farm (2-25-14)

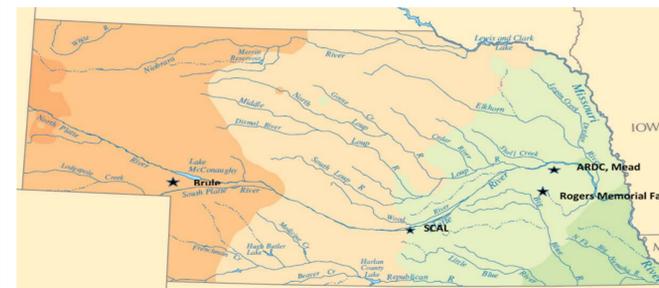


The Mandan location is also host to a NEON relocatable site situated in a long-term (100 year) grazing experiment.



At the Platte River-High Plains site, LTAR research includes irrigated and rainfed cropping systems and livestock production under grassland systems across several sites of climatic diversity in Nebraska. Selected research includes: Carbon and water fluxes

- Irrigated continuous maize (Ithaca, NE)
 - Irrigated maize-soybean rotation (Ithaca, NE)
 - Rainfed maize-soybean rotation (Ithaca, NE)
- Season long pasture grazing with yearling steers.
Grazing corn stalk residue by beef cattle
Crop rotation and tillage impacts on soil carbon



The main ecosystem services that have been evaluated since 2001 include:

- Crop and livestock production,
- Mitigation of greenhouse gas fluxes,
- Nutrient and water use efficiency.

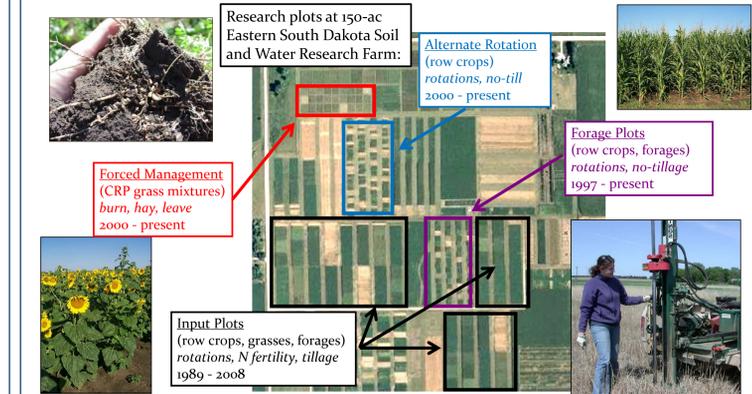


Aspirational experiments will include precision agricultural management (e.g. variable irrigated and nitrogen application), integrated cover cropping systems. Livestock management characterized by rotation grazing of fertilized paddocks with improved forage cultivars. Additional ecosystem services that will compliment "business as usual" discussed above will include:

- Water quality management (reduced nutrients and water runoff),
- Microbial activity and biodiversity,
- Economic and sustainability of cropping and livestock systems,
- Adaptation to climate change in agroecosystems.

At Brookings, research focuses on integration of multiple management practices into resilient agricultural systems.

Research targets multiple ecosystem services:
*increased soil health, *natural resource conservation,
*improved crop yields and quality, *development of insect and wildlife habitat, *improved economic sustainability.



Brookings will partner with LTAR sites in North Dakota and Nebraska to provide a more complete assessment of agroecosystems in the Northern Great Plains. Brookings is also part of the Resilient Economic Agricultural Practices project with the goal to revitalize soil health and resiliency.



The northern Great Plains provide critical habitat to both native and domestic pollinators. In 2014, North Dakota produced 19 million kg of honey (valued at \$84 million) from nearly 500,000 colonies in 14,000 apiaries. At Fargo, research will assess how landscape attributes or crop production influence health or productivity of pollinators and develop a better understanding of pollinator biology and ecology.

