Northern Great Plains Research Laboratory LTAR, Mandan, ND

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The Northern Great Plains Research Laboratory (NGPRL; www.mandan.ars.usda.gov) has a 100-year legacy of addressing critically important natural resource issues affecting agricultural sustainability. The NGPRL has crop, soils, rangeland, and livestock research capacity at the field and herd scale, complemented by a multidisciplinary scientific team with expertise in ecology, economics, agronomy, and rangeland and soil science. The mission of the NGPRL is to develop environmentally sound practices and add value to agricultural systems in the Great Plains in terms of food, feed, and biomass via team-focused, systems-oriented research and technology transfer. Research is conducted in three CRIS projects: Rangeland and livestock resource management; Soil and gas flux response to improved management in cold, semiarid agroecosystems; and Integrated agricultural systems for the northern Great Plains. Research is primarily associated with national programs 212 (Climate Change, Soils, and Emissions), 215 (Pasture, Forage, and Rangeland Systems), and 216 (Agricultural System Competitiveness and Sustainability), and also affiliated with programs 211 (Water Availability and Watershed Management) and 213 (Bioenergy).

The NGPRL has unique long-term data sets on: (i) grazing management effects on soils and plants (>70 years); (ii) a soils archive dating back 90 years; (iii) a 12-year integrated crop-livestock project; and (iv) an 18-year cropping systems trial. NGPRL scientists participate in the GRACEnet, CEAP, and REAP ARS national projects and are key contributors to NSF's National Ecological Observatory Network (NEON). The NGPRL collaborates with partners at land grant and tribal colleges in ND and surrounding states, as well as with other national institutions and ARS locations. Approximately 9.7 km^2 of land, including rangeland, cropland, and pastures, are available for research at NGPRL. Moreover, the NGPRL land base includes on-going long-term trials addressing grazing management (est. 1916) and cropping system diversity (est. 1984). Partnership with North Dakota's Area 4 Soil Conservation Districts provides field-scale research at the Area 4 SCD Cooperative Research Farm, a 154-ha working farm, and extensive opportunities for technical transfer of research results to farm and ranch customers.

The Northern Plains LTAR site is centrally located within the Northern Great Plains farm resource region (46º 46' 12" N, 100º 55' 59" W). Agricultural land use in the area includes a diverse mix of annual crops, hay, and grazing lands, and this is reflected in the land uses at the research site. . The site is within the Missouri river water resource region (HUC Region 10) near the mouth of the Lower Heart Watershed (HUC 10130203). The site is within the NEON eco-climatic domain 9 - Northern Plains. The NGPRL is situated within the Temperate Steppe Ecoregion of the U.S., which has a semiarid continental climate, with evaporation typically exceeding precipitation. Average annual precipitation at the site is 410 mm and long-term growing season precipitation (Apr – Sep) is 330 mm. Average annual temperature is 4°C, though daily averages range from 21°C in summer to -11°C in winter. The average frost-free period is 131 days. Gently rolling uplands (0-3% slope) characterize the prevalent topography of NGPRL land, and most soils have a silty loess mantle overlying Wisconsin age till. Predominant soil types include Temvik-Wilton silt loams. In contrast, a small area (<50 ha) of alluvial outwash near the NGPRL campus is dominated by Parshall fine sandy loam.

The principal research emphases at NGPRL related to LTAR goals include:

1. Quantifying the ability of integrated crop-livestock systems to sustainably increase food production
2. Developing cost-effective and environmentally sound strategies to address land-use change
3. Quantifying potential changes in soil functions resulting from anticipated climate effects
4. Assessing agroecosystem trajectory through key soil-based metrics at multiple scales
5. Developing dynamic agricultural systems that include food, fiber, and biofuels