NORTHERN PLAINS (NP)

LTAR Network and USDA Climate Hubs are working to develop knowledge and technology for sound resource management **via research with partners**. The goal is to ensure **sustained crop and livestock production and ecosystem services** from agroecosystems, and to forecast and verify the effects of environmental changes, public policies, and emerging technologies.

Location and Climate

The Northern Plains (NP) site is located within the Northern Great Plains farm resource region and within the USDA Northern Plains Climate Hub (NPCH). The climate is semiarid continental.

Historic Temperature

Historic average annual temperature is 39°F, though daily averages range from 70°F in summer to 12°F in winter.

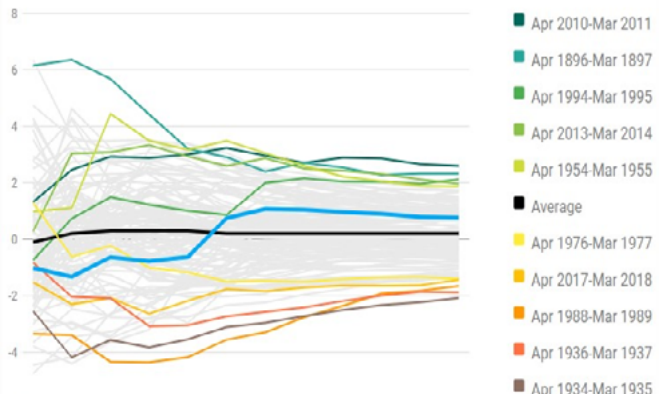
Historic Precipitation

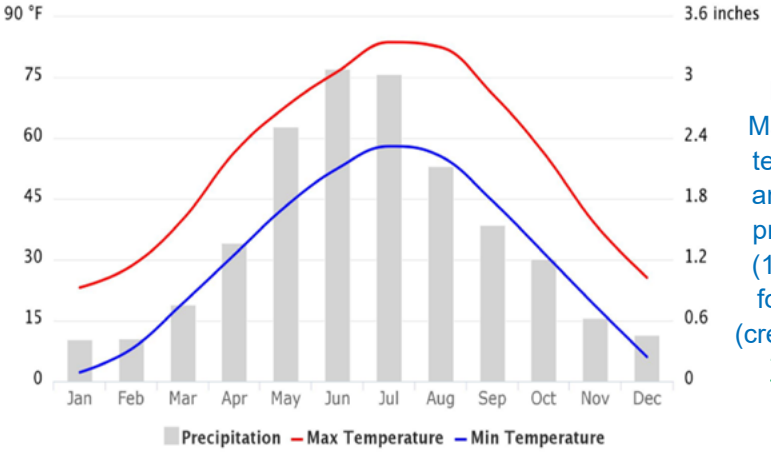
Long-term mean annual precipitation is 18 inches with 14 inches (78%) received during the growing season (Apr-Sep).

Growing Season

The average frost-free period is 131 days which approximates the length of growing season for crops (~ late-Apr to early-Sep).

Cumulative Palmer Z-index in North Dakota for Apr-Mar (12-month period) in the period of record, 1948-2019 (NOAA NCEI Climate at a Glance - Divisional Haywood Plots).





Historical Max and Min temperature and monthly precipitation (1981-2010) for Mandan (credit: Climate Toolbox).

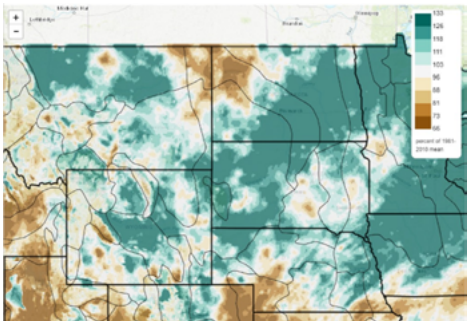
Measuring Weather and Climate

Instrumentation at study sites of the Northern Great Plains Research Laboratory (NGPRL) at Mandan, ND consists of three eddy covariance towers providing continuous measurements of key meteorological variables and heat/water/carbon fluxes under crop (LTAR) and pasture (NEON) land uses. A map of meteorological stations in the NGPRL research farm depicts participation in weather networks - NWERN, NWS, NDAWN, and NRCS-SCAN.

Impacts to Agriculture

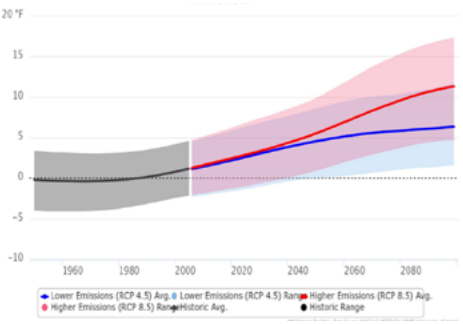
The Northern Great Plains agriculture has recently benefited from longer growing seasons and recent climatic changes. But rising temperatures and changes in extreme weather events are very likely to have negative impacts on parts of the region. Adaptation to climate changes will likely require transformative adjustments in agricultural management, including regional shifts of agricultural practices and enterprises 4th NCA.

NORTHERN PLAINS (NP)

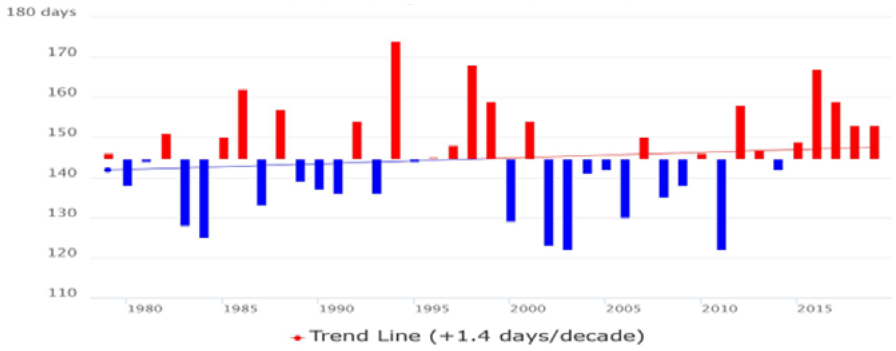


Precipitation anomaly (% of 1981-2010 mean) since Oct 2019 to Mar 2020 in the Northern Plains. Polygons represent Bailey ecoregions (Climate Toolbox - Climate Mapper).

Historical and projected annual precipitation at lower emissions (RCP 4.5) in 30-year periods for Mandan (Climate Toolbox - Future Boxplots).



Temperature anomalies from 1950-2005 average of historical models (Climate Toolbox - Future Time Series).



Length of frost-free growing season for Mandan, bars represent anomalies from 1979-2019 average (credit: Climate Toolbox - Historical Climate Tracker).

Climate Change

- Climate models predict a warmer future in the NGP
- Less snow and large variations in annual water availability
- Greater uncertainties (risks) due to high interannual variability, e.g., 2011 flood and 2012 drought
- Increased probability of very hot days (> 90°F) with potential impacts on agriculture

To manage land sustainably, consider weather and climate.

Vegetation

- Agricultural shifts, pasture to corn and soybean, or small grains (wheat, barley, millet) to corn and soybeans due to changing climate and economy
- Important crops include alfalfa, hay, sunflower, potato, sugar beet, dry bean
- Reductions in grassland area of the Prairie Pothole Region
- Increased abundance and competition by weeds and invasive species

Water Resources

- Water is the lifeblood of the NGP, thus efficient water management is crucial to the region's livelihood, agroecosystems, and energy resource
- Large annual precipitation variabilities provide risks and challenges in agricultural management
- Earlier snowmelt/runoff effects on management practices and stream flow throughout growing season
- Increased water demand due to population growth and agricultural change
- Soil water availability in the growing season is increased in the NP region

Livestock

- The NGP is important for U.S. food security - beef, dairy, and pork production are prevalent in the region
- Despite having only 1.5% of the U.S. population, the region provides 12.7% of the market value of all agricultural commodities sold nationally
- Increased animal production and efficiency due to higher net primary production and longer growing season, but adverse effects with hotter summer
- Warmer and wetter conditions may decrease quality of forage, which may reduce nutrients in livestock products

Decision Support

- The Cover Crop Chart (v3.0) is designed to assist producers with decisions on the use of cover crops in forage and crop production systems.
- The Crop Sequence Calculator (v3.1) is designed to assist agricultural managers to determine optimal crop sequences for the NGP.

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