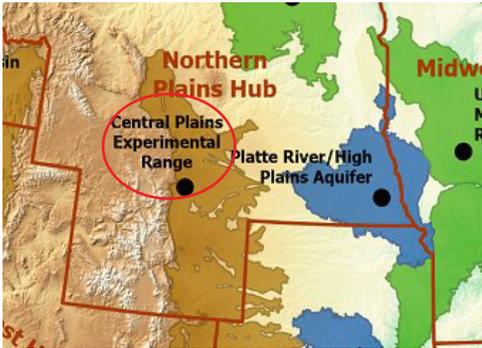




CENTRAL PLAINS EXPERIMENTAL RANGE (CPER)



Location and Climate

The Central Plains Experimental Range (CPER) is located on the northern end of the semi-arid shortgrass steppe in the western Great Plains. At 5,400 feet above sea-level, CPER is located 7.5 miles northeast of Nunn, Colorado, within the [USDA Northern Plains Climate Hub](#) region.

Historic Temperature & Precipitation

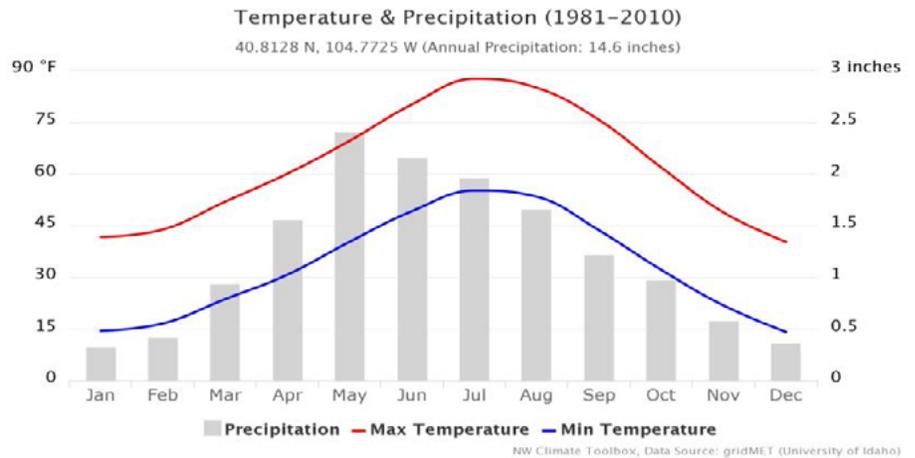
Historic average annual temperature in Weld County, CO, is 47°F (1979-2019). Long-term average [annual precipitation at CPER](#) is 13 inches (1940-2019), but has ranged from 4" (in 1964) to 23" (in 1967). Precipitation in April, May, and June is most important for vegetation growth on the short-grass prairie, but rainfall in late-July and August may stimulate a second pulse of green-up, especially if the spring season was dry. Precipitation across CPER's 15,500 acres is highly variable, through space and time, including both within and across years ([Augustine 2010](#)).

Growing Season at CPER

The growing season, roughly May-Sept, is ~133 days. Rangelands at CPER produce an average of 658 lbs/acre per year (1983-2018), ranging from a 35-year low of 98 lbs/ac (in the 2002 drought) to a high of 1415 lbs/ac (in the wet year of 2009).

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LTAR Network and [USDA Climate Hubs](#) are working to develop knowledge and technology for sound resource management **via research and collaboration with stakeholders**. 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.



Monthly average precipitation and temperature (min & max) at CPER (1981-2010). (credit: [Climate Toolbox](#)).



Scientists and stakeholders tour the CPER in early November (Photo credit: Dannele Peck)



Stocker cattle grazing the Central Plains Experimental Range near Nunn, CO (Photo credit: David Augustine)

Long-Term Data Collection



Photo credit: Mary Ashby

Data has been collected at CPER since 1939. ARS scientists use this long-term data to evaluate relationships among climate, livestock performance, grassland species diversity, and more ([Davis et al. 2020](#), [Derner et al. 2020](#), [Raynor et al. 2020](#)).

Extreme Weather: Droughts & Deluges

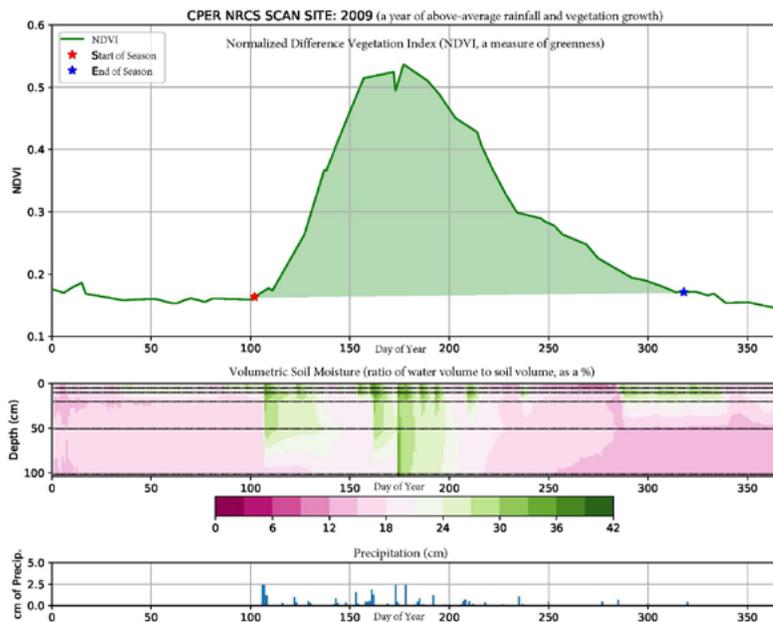
The semi-arid CPER has short, mild summers and long, cold and dry winters. During the summer, convective thunderstorms form regularly over nearby mountains, creating the potential for heavy downpours and severe hail. Drought is also common in the region, as shown in the time-series (2000-2019) below of drought severity in a local watershed.



CENTRAL PLAINS EXPERIMENTAL RANGE (CPER)



Drought Monitor time-series (2000-2019) of proportion of Crow watershed (HUC 10190009), containing much of CPER, experiencing D0 (yellow) to D4 (red) drought.



Jan	Feb	Mar	Apr	May	Jun
Jul	Aug	Sep	Oct	Nov	Dec



Projected precipitation changes (%) for Colorado's Northeastern Plains by 2035-2065 (vs. 1971-2000; RCP 4.5) (Source: [Lukas et al. 2014](#))

Climate and Climate Change

The figure on the left shows 3 variables across the wet growing season of 2009, which produced 1415 lbs/ac of vegetation (215% of the 35-year average, 1983-2018). The 3 variables are: [top panel] NDVI, a measure of greenness and proxy for how well vegetation is growing; [middle panel] soil moisture at various depths; and [bottom panel] precipitation.

The bottom-left figure shows the same 3 variables for 2012, the 4th driest growing season in 35 years (1983-2018), which produced 269 lbs/ac (41% of the average).

Implications for Rangelands

- Precipitation in Colorado's Northeastern Plains is expected to increase in winter, but decrease in summer (see figure above, adapted from [Lukas et al. 2014](#)).
- Warming and elevated CO2 may cause plants to green up, peak, and decline earlier in the season, yet persist longer during dry summer and autumn seasons ([Blumenthal et al. 2018](#)).
- Elevated CO2 may increase forage quantity in this region, but also decrease forage quality, especially in drier years ([Augustine et al. 2018](#)).
- In a warmer climate, invasive plant species (e.g., cheatgrass) may become more competitive ([Blumenthal et al. 2016](#)).
- Rangeland livestock managers will need to become more flexible and adaptive ([Reeves et al. 2017](#), [Derner et al. 2018](#)).

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Websites Referenced

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USDA Northern Plains Climate Hub: <https://www.climatehubs.usda.gov/hubs/northern-plains>
Annual Precipitation at CPER: <https://www.ars.usda.gov/plains-area/fort-collins-co/center-for-agricultural-resources-research/rangeland-resources-systems-research/docs/range/misc-pages/cper-precipitation/>
Drought Monitor time-series: <https://droughtmonitor.unl.edu/Data/Timeseries.aspx>
Climate Toolbox: <https://climatologytoolbox.org/tool/Historical-Climograph>
USDA ARS LTAR CPER (Central Plains Experimental Range): <https://ltar.ars.usda.gov/sites/cper/>

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