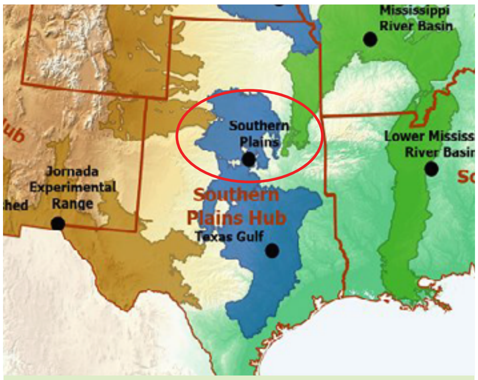
EL RENO EXPERIMENTAL WATERSHEDS (EREW)

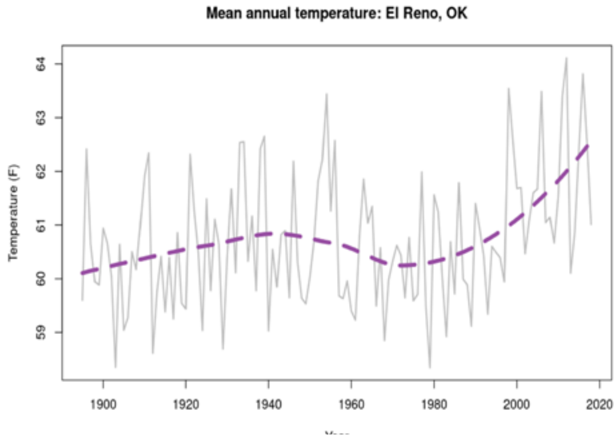


LTAR Network and USDA Climate Hubs are working to develop knowledge and technology for sound resource management **via research with partners**. The goal is to ensure **sustained crop and livestock production and ecosystem services** from agroecosystems, and to forecast and verify the effects of environmental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

Location and Climate

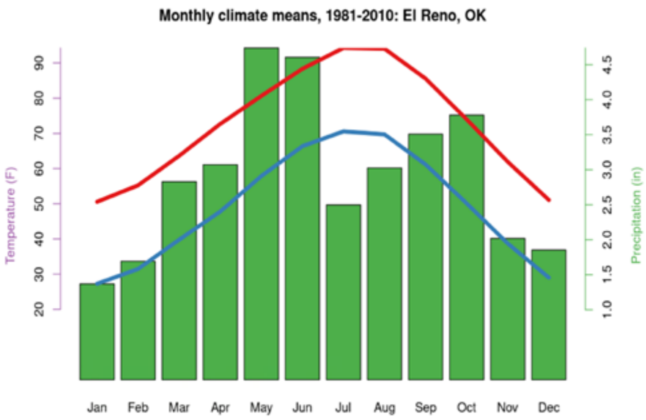
The Southern Plains El Reno site has two experimental research watersheds: Fort Cobb Reservoir and Little Washita River, which lie within the USDA Southern Plains Climate Hub region. The climate is typical of temperate semi-arid to sub-humid.

Annual temperature variation as compared to mean temperature trend (1900-2020).



Historic Temperature

Historic average annual temperature in Canadian County, OK, is 60°F. Average annual maximum and minimum temperatures are 72°F and 48°F, with record high and low of 115°F and –15°F. Average temperature since 1980 has increased considerably.



Max and Min temperature and mean precipitation 1981 -2010.

Historic Precipitation

Average annual precipitation in the county is 33 in, with record high and low of 54 and 15 in. The annual average number of days with precipitation is 68. Average monthly precipitation ranges from 1 to 5 in in a bimodal mode with the primary rainy season in May-June and a secondary peak in Sept.-Oct.

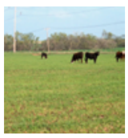
Growing Season

The length of growing season is 210 days, with average last freeze in spring on April 3 and average first freeze in fall on Nov. 1. (credit: Oklahoma Mesonet)

Measuring Weather and Climate

The sub-humid climate is characterized by short, mild winters and long, hot and dry summers. The local climate is often referred to as droughts punctuated by flood, with extremes of heavy downpours and wide temperature swings. Southerly winds prevail year round, bringing moisture from the Gulf of Mexico in the form of convective thunderstorms that are highly localized and of short duration. The highest daily rainfall is 8.6 in. Annual average wind speed is 10 mile/h, average humidity is 71%, and sunshine is 55-80%.

Impacts to Agriculture



Agricultural production in the region is challenged by both large variability and long term climate change. Droughts, grass fires, floods, and other extremes like late freeze have plagued dominant crop-livestock systems. High winds lead to wind erosion in spring and heavy rains cause severe soil erosion in summer, degrading soil health and land productivity. Highly variable climates pose a threat to the rainfed production systems in the region.

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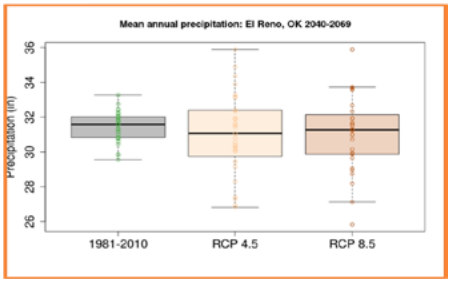
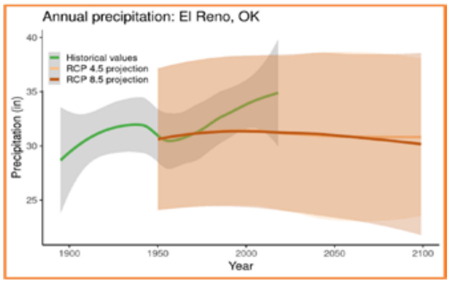
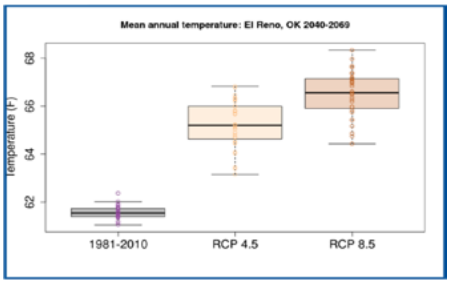


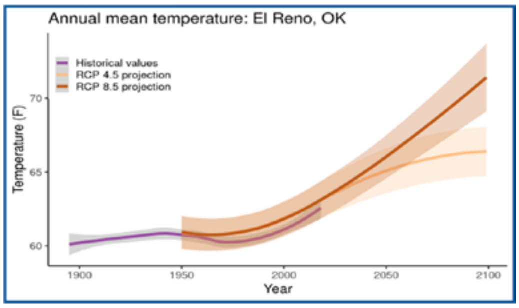
Projection of mean annual precipitation (in) for 1981-2010 and 2040-2069 by a suit of GCMs



Projection of annual precipitation (in) 1950-2100 at RCP 4.5 and 8.5.



Mean temperature projections for 2040-2069 for RCP 4.5 and 8.5.



Future temperature projections by a suit of GCMs for RCP 4.5 and 8.5.

Climate and Climate Change

(a) Average annual precipitation is projected to decrease slightly in the future while precipitation variability would increase for both Representative Concentration Pathways (RCPs) at El Reno, central OK.
(b) Average and extreme temperatures are projected to increase considerably for both RCPs. Despite the mismatch between the present climate and projections during 1950-2020, the slightly decreasing trend for mean precipitation is clear. Although mean precipitation decreases, a shift to more intense rainfall leads to more surface runoff and soil erosion. Overall, plant available water will decrease due to decrease in precipitation, increases in runoff and plant evapotranspiration in response to elevated temperature.

To manage land sustainably, consider weather and climate.

Vegetation

- Stable crops in the region like winter wheat and soybeans will likely suffer decreased yields from reduced total precipitation, increased runoff due to more intensive rains, and elevated temperature (Zhang and Nearing, 2005).
- Compared with the present climate, winter wheat should be planted later and harvested earlier due to elevated temperature and shortened active growing seasons (Zhang, 2011).
- Highly variable weather and climate require more adaptive wheat and livestock management practices to mitigate adverse impact of climate variation while yet to take advantage of favorable conditions. The traditional dual purpose wheat (winter grazing and grain harvest) affords an opportunity for making climate-smart management decisions.
- Given increased inter-annual precipitation variability, dry years are more profitable for wheat graze out by cattle; while wet years for both grazing and grain production. In addition, increased summer rainfall in wet year could support a summer opportunistic cover crop following wheat (Zhang, 2010).
- Fertilization rate and timing should be adjusted based on pre-plant and growing season precipitation. For example, low fertilizer rates can be applied at planting and additional fertilizer be top dressed in the next spring based on winter precipitation as well as the spring precipitation outlook to improve fertilizer use efficiency and to protect surface water quality. (Zhang et al., 2012).

Water Resoucres

- Future storm intensification would increase frequency and magnitude of floods, requiring upgrading or better maintenance of >2000 flood retardation structures in OK. Heavy storms often cause severe erosion. Cropping and tillage systems need to be adapted to counter erosion. Conservation tillage practices, especially no-till, have been found effective to keep soil losses low in the region based on future projections (Garbrecht and Zhang, 2015).

Livestock

- Heat and/or drought adapted cattle may offer an effective means of minimizing climate impacts. Cattle that can better utilize both wheat forage and native grass would be advantageous in future.

Decision Support

- Applications of climate downscaling tools, seasonal climate outlook, hydrological and soil erosion models, and wheat grazing models provide a much needed support for climate-smart decision making in the region in future Zhang et al., 2008).

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Figure Credit: Dr. Sarah Goslee