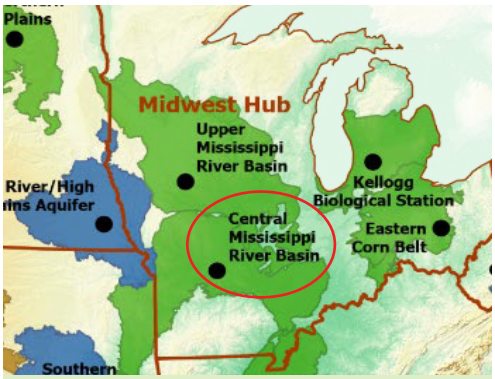
CENTRAL MISSISSIPPI RIVER BASIN (CMRB)



Location and Climate

The Central Mississippi River Basin site (CMRB) is located near Columbia, Missouri, at the southern edge of the southern, not artificially drained Corn Belt. This site is within the USDA Midwest Climate Hub region. The climate is typical of continental with strong seasonality.

Historic Temperature

Historic average annual temperature (1901-2000) in Centralia, Missouri (the location of our Common Experiment) is 54°F. It has increased at the rate of 0.1oF per decade. Over 1981-2010, mean maximum daily temperature was highest in July (88°F) and mean minimum temperature was lowest in January (19°F).

Historic Precipitation

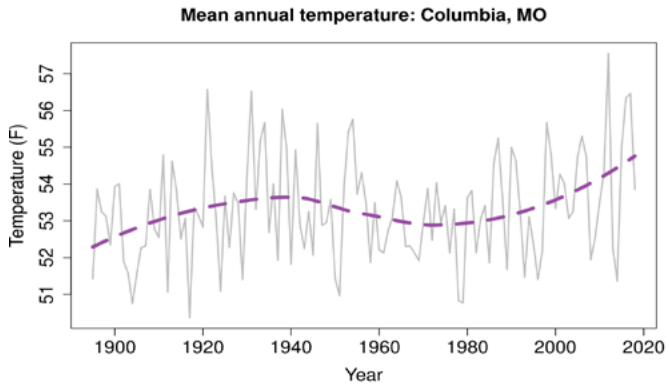
Average annual precipitation from 1970-2010 was 39". Spring rains are the heaviest with the highest intensity. Highest rainfall occurs in May with a monthly historic mean of 5.0" and the lowest rainfall is typically in January with a monthly mean of 1.8".

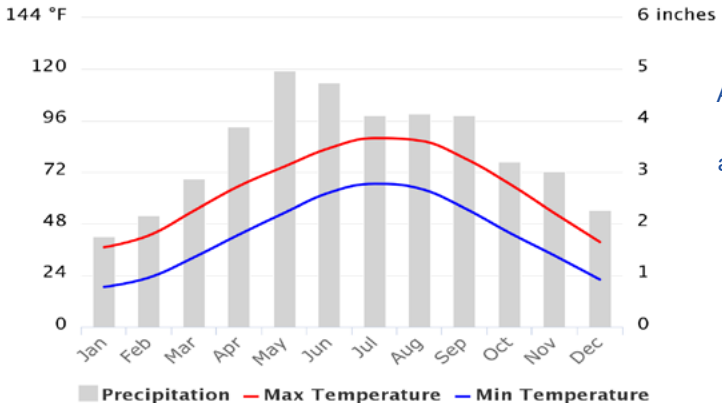
Growing Season

The effective growing season for warm season crops is from April through October. However, cool season crops such as wheat grow from fall until spring with a dormant season from December through mid-March.

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.

Average annual temperatures as compared to mean temperatures (1895-2020)





Average maximum and minimum temperature and mean precipitation 1981-2010 (credit: Climate Toolbox, data source: gridMET.

Measuring Weather and Climate

Air masses cross the region in both winter and summer. In the winter, cold and dry arctic air from the northern Great Plains and Canada brings cold, along with snow or rain. In summer, moist and warm air from the Gulf of Mexico brings rain. Extended droughts can happen. Abrupt changes in temperature, which cause strong storms, can happen during all seasons. Periods of warmer weather occur frequently during winter, meaning that continuous snow or ice cover for more than a month is rare. Similarly, dry and cool weather occasionally interrupts the usual hot and humid summer. (Sadler et al., 2015).

Impacts to Agriculture

The combination of heaviest precipitation at corn planting times (Mid-April to May) and poorly drained soils presents a challenge to producers who need to plant into soils too wet for field operations. This is especially true when corn follows a winter cover crop because additional field operations need to occur. When not able to plant corn during wet springs, producers switch to beans, which can be planted until the beginning of July, or leave the field fallow for the year. Soils also have limited water holding capacity, which reduces the ability of crops to withstand summer droughts.

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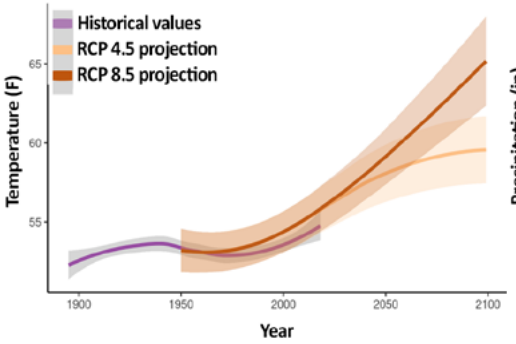
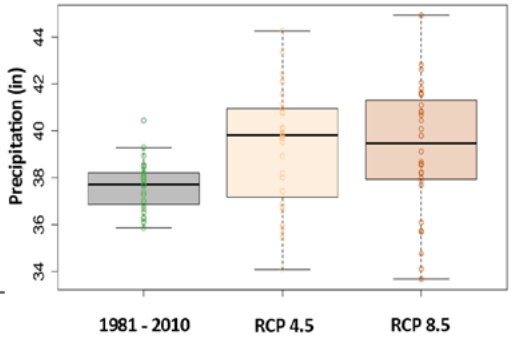
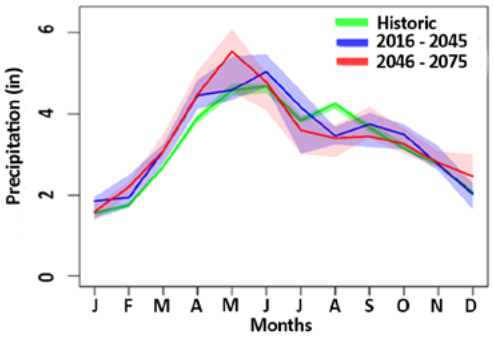


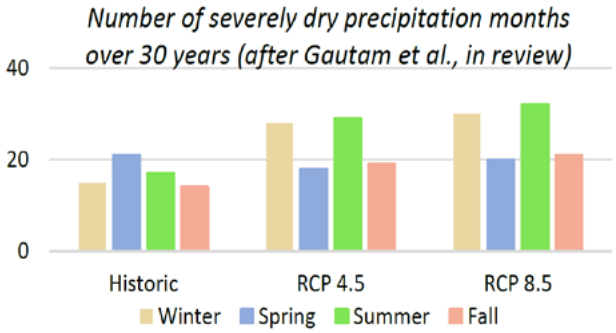
Mean temperature projections for Columbia, Missouri



Annual precipitation 2040-2069 projections for Columbia, Missouri



Monthly Precipitation for Centralia, Missouri under RCP 8.5 (Gautam et al., 2018).



Climate and Climate Change

Average and extreme temperatures are projected to increase in the CMRB. While projections for mean annual precipitation show a marginal 5-10% increase, expectations are that it will be more variable. Seasonal analysis projects more precipitation earlier in the spring and drier conditions in summer. Drought risks (number of severely dry months over 30 years) are projected to increase in the winter, summer, and fall while severely wet conditions are projected to increase in the spring. The reduction of precipitation in summer months and increased precipitation and evapotrans-piration in late spring imply adapting management for producing crops.

To manage land sustainably, consider field as well as regional adaptations.

Water Resources

Future seasonal variations of precipitation in the CMRB will further challenge farming operations because of the reduced number of suitable days for field operations and seedling growth in the spring and longer and more severe summer droughts. While irrigation could be used to adapt to these changing conditions, the high mineral content of groundwater makes it unsuitable for this use. A reliance on irrigation would require long-term regional planning of surface water needs (Quang et al., 2019) for crop production, livestock, and municipal water. These future precipitation changes will also accentuate risks of spring flooding and wet conditions in the fields, which prevent field work for timely planting of crops. Field adaptations may include perennial crops and crops that have a longer planting time window.

More frequent wet field conditions at planting time prevent timely spring field operations.

Sorghum, a crop with a longer planting window, is more drought and heat tolerant than corn and may be a suitable alternative.

Sadler et al., 2015. J. Env. Quality. doi: 10.2134/jeq2013.12.0515.
Gautamet al., 2018. Water. doi:10.3390/w10050564
Quang et al., 2919. J. Am. Water Resources Association. doi: 10.1111/1752-1688.12764

Land Use

Increases of cropland area to meet future demand for food products is expected to accentuate the effects of climate change on stream flow. Surface runoff is expected to increase as a result of more intense events and more cropland in the watershed while base flow is expected to decrease. Conversely, conversion of cropland and pasture to wooded land is projected to mitigate the effects of climate change (Quang et al. 2019). Under such land use change scenario, surface runoff would decrease below historical levels, and base flow would increase, which may provide opportunities for irrigation withdrawals during summer.

USDA Midwest Climate Hub
U.S. Department of Agriculture

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Figure Credit: Sarah Goslee