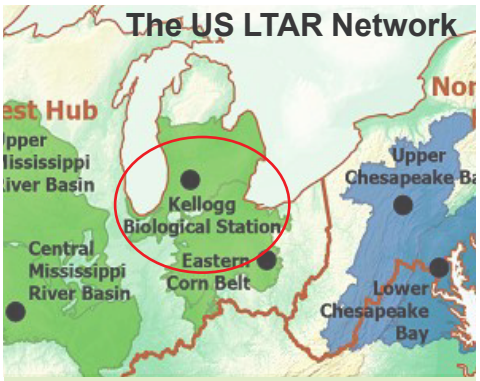
KELLOGG BIOLOGICAL STATION (KBS)



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 **Kellogg Biological Station (KBS)** lies on the northeastern end of the Corn Belt in Michigan, within the USDA Midwest Climate Hub region. Soils developed on glacial deposits. The climate is humid with warm summers and cold winters.

Agricultural landscapes in the region often are mosaics of cropland, old fields, successional forest, and lakes and wetlands. Native vegetation was deciduous forest with some oak savanna and prairie.

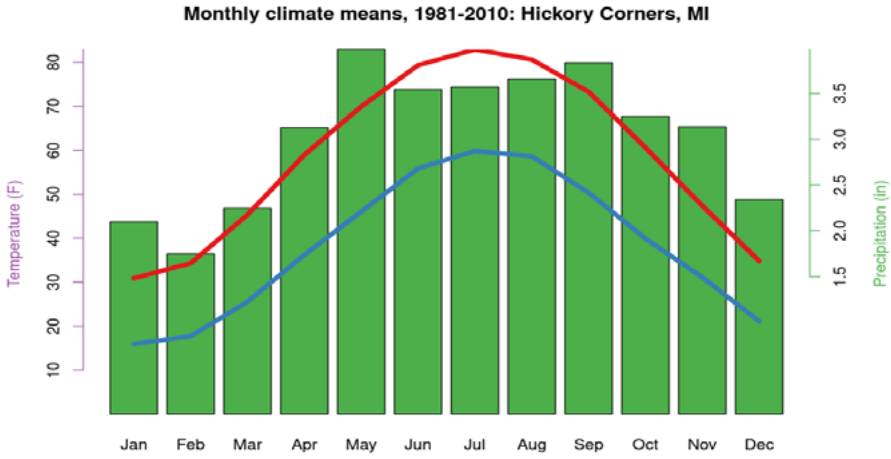
Temperature and Precipitation

Historic mean annual temperature at KBS (1950-2015) is 48°F. Mean maximum temperature is highest in June (85°F). Mean minimum temperature is lowest in January (17.5°F). See chart above.

Long-term average precipitation is 37 inches, with about half falling as snow. Since 1950 precipitation has increased by around 10-20% in Michigan.

Growing Season

The growing season is variable but usually in the range of 160-180 days, constrained by spring and autumn frosts.



Monthly maximum and minimum temperature and mean precipitation 1981 -2010 (credit: Climate Toolbox).

Rainfed agriculture

The humid climate of southern Michigan supports rainfed agriculture. However, in spite of an equitable distribution of rainfall during the growing season on average, rainfed crops are subject to variable soil water availability, and crop yields decrease in drier summers.

Annual crops—particularly corn and soybean—predominate in southern Michigan. Confined animal feeding operations are common.

On particularly well-drained soils irrigation is increasingly employed during dry summers, often using water drawn from groundwater.

Tile drainage is common in southern Michigan but is not needed at KBS, where the soils are very well drained.

For more information visit https://ltar.ars.usda.gov/sites/kbs/

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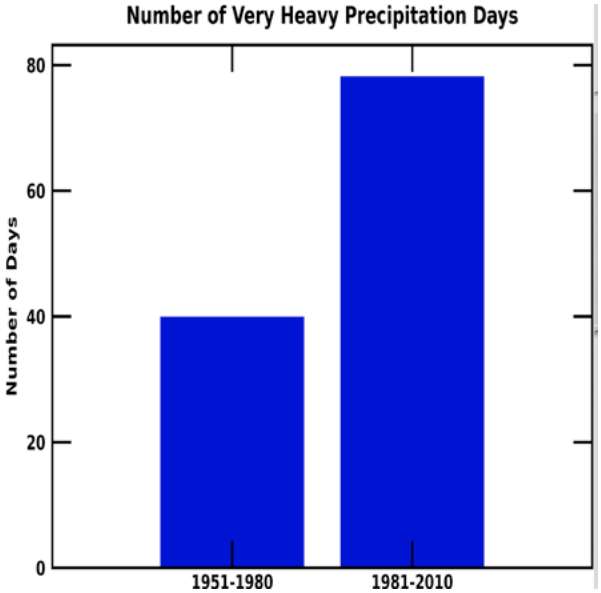
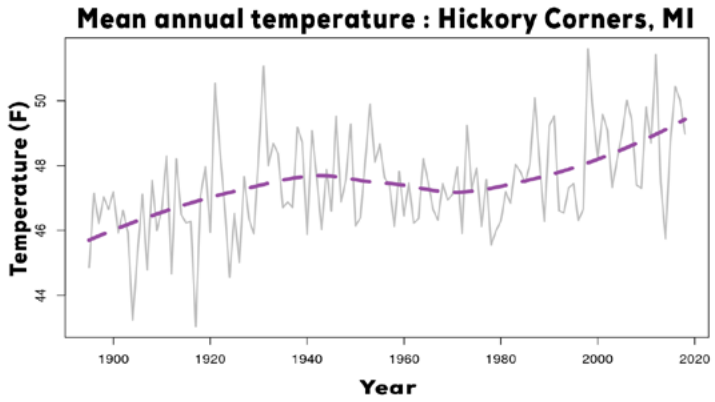
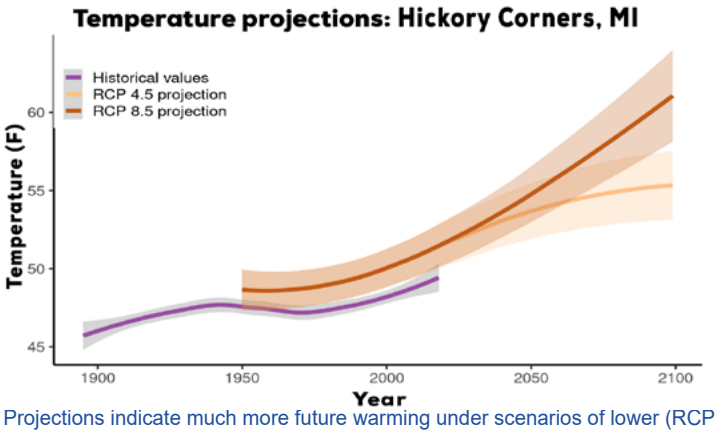


Heavy rainfalls are already becoming more frequent, consistent with climate change model projections (credit: Jeff Andresen, Michigan State University).



Mean annual air temperature has increased by about 2°F during the past century, increasing the length of the growing season by over a week.



Projections indicate much more future warming under scenarios of lower (RCP 4.5 and higher (RCP 8.5) greenhouse gas emissions.

Agriculture will have to adapt to changing weather and climate

Agriculture, climate and water resources

Locally important issues may be exacerbated by greater climate variability:

- Phosphorus runoff and consequent eutrophication of lakes, which are culturally important in the region
- Nitrate leaching and contamination of groundwater, an important source of drinking water
- Pathogens carried into surface waters from manure applications to cropland
- Groundwater and surface water withdrawals for irrigation could increasingly draw down water levels in lakes and streams

Climate Change Projections

Models indicate that the changes already being observed will continue, with the magnitude dependent on future greenhouse gas emissions:

- Warming will continue, with more frequent hot weather
- Precipitation will increase during the cool season, with less snow and more rain
- Precipitation during the growing season will become increasingly erratic, with more heavy rainfalls interspersed with dry spells

How these changes will matter

- Warmer, longer growing seasons may increase the likelihood of drought and heat stress for crops and livestock
- Wetter springs will increasingly interfere with planting activities
- Heavy rainfalls can damage crops, wash away fertilizers and erode soils
- Responses of pests and pathogens to the changing climate are highly uncertain

USDA Midwest Climate Hub
U.S. Department of Agriculture

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