United States Department of Agriculture
Midwest Climate Hub

An Introduction to the Midwest Climate Hub

What are the Climate Hubs?

Climate Hubs are regional-based centers located at an Agricultural Research Service (ARS) or Forest Service (FS) location. USDA's Climate Hub's **mission** is to develop science-based, region-specific information and technologies alongside USDA agencies and partners. Climate Hub's then deliver this information and technologies to agricultural and natural resource managers to enable climate-informed decision-making, and to provide access to assistance to implement those decisions. This aligns with the USDA mission to provide leadership on food, agriculture, natural resources, rural development, nutrition, and related issues based on sound public policy, the best available science, and efficient management.

The Midwest Climate Hub

The Midwest Climate Hub is located within ARS in Ames, Iowa. Our goal is to provide information to help producers cope with climate change through the innovative linkages of research, education and extension partnerships.

Objectives

1. Assemble research information on crop and livestock production systems across the Midwest to determine their response to weather and climate variation;
2. Assemble research information on soil and water resources of the Midwest to determine the natural resource response to weather and climate variation;
3. Conduct stakeholder meetings with different commodity groups to gather information on their potential use of weather and climate information in agricultural decision making;
4. Partner with research, education and extension to develop strategies for the identification of adaptation tools and delivery of information to producers and agribusiness across the Midwest; and
5. Provide information to producers which will increase climate resilience of agricultural systems across the Midwest.

The Midwest Climate Hub covers Michigan, Ohio, Indiana, Wisconsin, Illinois, Iowa, Missouri, and Minnesota. **This area represents one of the most intensive agricultural areas in the United States with a diversity of crop, forest, and animal production systems.**

Midwest Agriculture

A wide variety of crops are produced across the Midwest although the perception is that corn and soybeans are the only crops grown. There are over 127 million acres of agricultural land in the Midwest and in addition to 75% of that area in corn and soybeans, the other 25% is used to produce alfalfa, apples, asparagus, green beans, blueberries, cabbage, carrots, sweet and tart sherries, cranberries, cucumbers, grapes, oats, onions, peaches, plums, peas, bell peppers, potatoes, pumpkins, raspberries, strawberries, sweet corn, tobacco, tomatoes, watermelon, and wheat. The diversity of the annual and perennial crops across the Midwest creates a range of responses to climate and weather. Midwestern agriculture is dominated by rain fed agricultural systems so that crop production is determined by the amount of rain which occurs during the growing season and is stored in the soil profile; however, many of the specialty crops are irrigated. Part of the focus on crop production is to determine how production systems can be made more water efficient by improving the soil to capture and retain more water and reduce the amount of runoff.

The area covered by the Midwest Climate Hub is not only cropland, fruit trees, and forest but it also contains over 16 mil-

lion acres of pastureland. Pastureland in the Midwest contains area used for grazing livestock with some of the area used for hay production. Pastureland is contained on land area generally not suited for crop production and often classified as highly erodible. When the land is used for grazing, the water supply is often through the capture of surface water captured in ponds as the result of surface runoff during heavy precipitation events. During years with limited precipitation water supply in the ponds can become limited and grass production limited. The hay which is harvested from these areas is often used as feed for the livestock during the winter months.

Livestock production in the Midwest is comprised of a mixture of different species ranging from hogs, beef cattle, milk cows, sheep, layers, broilers, turkeys, goats, and horses. There are other animals such as ducks and geese and game animals which add to the diversity of animal production systems. Most of the animal production systems are in confined operations; however, there is a still an impact from a changing climate mainly due to the warmer temperatures. Animals have a narrow range of temperatures where they have optimal meat, milk, or egg production and when exposed to conditions outside of that range begin to reduce their productivity. Livestock producers need to understand the potential impacts of warmer temperatures and temperature extremes on livestock production in order to reduce the climate impacts. One aspect in animal production from climate which is overlooked is the potential effect from the changing climate on insect and disease populations which will also affect productivity.

Soil is one of the most critical natural resources for the Midwest and its ability to store water for crop and pasture production. Increased intensity of precipitation events in the spring is causing soil erosion and degrading the soil resource in fields with tillage and minimal crop residue cover. This is one of the vulnerable areas in agricultural which efforts to work with producers to increase the quality of the soil resource will provide a foundation for climate resilience. The Midwest is also one the most extensively and intensively subsurface drained areas in the United States. This creates a challenge for water management because of the need to drain lands in the spring with the excess precipitation and store water for late summer crop use.

Climate Signals and Variability

One of the major changes in climate is the shift in seasonality in precipitation with more precipitation in the spring and reduced amounts late in the summer with a tendency toward more intense precipitation events during the spring and summer. The shifts in seasonality and intensity need to be understood relative to current cropping systems and conservation practices that protect the soil surface from water and wind erosion. The Midwest is extensively subsurface drained and increased precipitation in the spring will cause additional flow leading to increased water movement in the landscape.

The largest climate signal is the increased variability in the temperature among years and during the year. The past four years (2011-2014) have shown some of the largest variation in temperature and precipitation patterns experienced in recent decades and the expectation is for this trend to continue. Analysis of the trends in maximum and minimum temperatures has shown the minimum temperatures are increasing more rapidly than the maximum.

Relative humidity and dewpoint temperatures are increasing and this may affect both ranges of insects and disease prevalence across the Midwest. An analysis of the trends in atmospheric water content and dew points is being evaluated across the Midwest to determine the potential impact on agricultural systems, especially insect and disease occurrences.

Extreme events in temperature and precipitation across the Midwest are projected to increase. These occurrences will impact agriculture production systems throughout the year. The impact of extreme precipitation events will be magnified in areas with more degraded soil resources and down-scaled climate signals will be critical for refinement of the climate signals. The extreme temperature events will impact crop and animal production systems and production efficiency and the potential for these occurrences will have to be quantified.

Agricultural Research Service

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