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Climate Change Impacts in the Corn Belt

BY DENNIS TODEY

Melting polar sea ice and rising sea levels are two large-scale impacts of a changing climate that are making the news. However, just as significant and newsworthy are the inland effects of climate change occurring within the Corn Belt that are impacting in-season crop development, where corn is grown, and changing the management decisions farmers face.

Precipitation

In the last 100 years, change in precipitation has been the most influential climate factor affecting the Corn Belt. While all locations in general have seen increased precipitation annually over the last 100 years, the largest increases are occurring in the northern and western Corn Belt. Summer season rainfall has increased nearly everywhere in the region. Fall precipitation has increased the most in the northwestern and far eastern Corn Belt with little change elsewhere. These trends have helped drive corn acreage expansion into the Dakotas and Minnesota, where precipitation has increased by over 15 percent.

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Consistent with long-term climate model projections, precipitation intensity also has increased, resulting in more precipitation occurring in larger events. These events often are detrimental to agricultural production, leading to increased soil erosion, flooding and other structural damage. The increases in precipitation and in-field flooding in recent years also have led to installation of more subsurface drainage tile.

Temperature

Historic temperature changes have been less pronounced and more seasonal. The most widespread temperature trend in the Corn Belt is generally warmer winters, especially over the last 30 years. The overall warmer trend has not eliminated colder winters (such as 2013–14). The trend has simply reduced their likelihood and severity. This increased temperature trend is stronger in the northern and western Corn Belt than elsewhere in the region. Warming winters impact the growing season length and winter-kill of insects. Warmer winters do not kill certain insects effectively and allow insects to overwinter further north, creating an easier path for migrating insects — both beneficial insects and pests — to be reintroduced.

^ Flooded fields and roads near Estelline, SD, April 2009. Extreme precipitation events are causing more frequent flooding.

Summer temperature trends in the region are largely flat overall with some minor upward (in the far east and north) or downward (in the west) trends. While the overall summer temperature trend is flat, there are differences in trends between maximum and minimum temperature. Average maximum temperatures are primarily flat. Average minimum temperatures are consistently rising during the summer and throughout the year across the whole Corn Belt.

The impacts of rising overnight minimum temperatures during the growing season are several. Increasing overnight minimums can lead to additional stress on crops during critical growth periods (as noted in the article by Lori Abendroth on page 6). Increasing frequency of warm overnight temperatures has reduced corn production in southern areas of the Corn Belt over the last 10 years. Warmer temperatures also contribute to disease potential.

Longer growing seasons

The warmer temperatures also are increasing growing season length. While still quite variable, frost-freeze dates are changing in the spring (earlier) and fall (later). Throughout the 20th century, the overall climate shifts have lengthened the growing season by 9-10 days or more across the Corn Belt. Agriculture has adapted to this, utilizing longer-maturity varieties and the extended growing season to create higher yielding crops. The largest impact of this change has been in northern areas of the Corn Belt where a lack of heat and shorter seasons have historically been limiting factors to corn production.

Dew point/humidity

Increased precipitation and changes in cropping system practices have increased the amount of moisture in the atmosphere. Change in atmospheric moisture content has been attributed to cropping changes, such as conversion of pasture/range to row crop and transfer away from wheat to corn/soybean rotation. The causes of overall increases in dew point still are being studied. Regardless of the causes, higher dew points create more humid conditions overall. For corn, higher humidity increases the potential for disease by allowing dew to form more frequently on the plant and to remain for longer periods of time, creating a longer disease potential period. The dew point increase also likely contributes to the rising overnight minimum temperature trend.

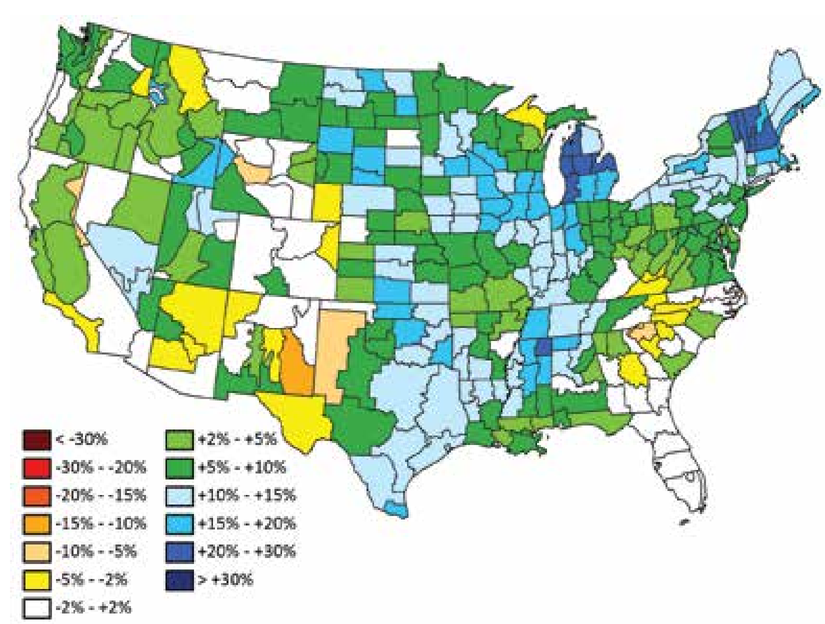
Final thoughts

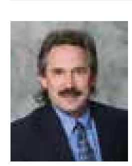
There is much more research needed to fully understand the role of local climate as a key factor in corn, soybean, and other cropping systems growth and development, and unintended poor environmental outcomes when climate patterns are not factored into farm management decisions. Increases in carbon dioxide and other greenhouse gases are larger scale climate drivers globally. However, local and regional changes in cropping practices and management are causing changes in temperature, soil and air moisture content and precipitation timing during the year.

^ Impact of 2012 drought in South Dakota. Corn near Beresford, SD, in early August.

FIGURE 1 | ANNUAL PRECIPITATION BY CLIMATE DIVISION

Linear trend changes in annual precipitation by climate division across the continental United States from 1895–2013. Values are percent changes over time. All of the Corn Belt has seen changes ranging from a few percent to 20+%. Image contributed by Brent McRoberts and John Nielsen-Gammon, Office of the State Climatologist, Texas A&M University.





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