



Midwest Climate Hub
U.S. DEPARTMENT OF AGRICULTURE

Key Weather Trends in US Agriculture 2018 Extension Outlook Conference

9 August 2018

Dennis Todey
Director, Midwest Climate Hub
Dennis.todey@ars.usda.gov

Charlene Felkley
Coordinator, Midwest Climate Hub
Charlene.felkley@ars.usda.gov

Topics

- A brief Background of USDA Climate Hubs
 - The need, mission
 - More on the Midwest Climate Hub
- Current Conditions
 - Long term
 - Short term
 - USDM
- Outlooks
 - El Niño
 - Models
 - Trends

USDA Climate Hubs



Providing...

Information and Tools
to Decision Makers
to Build Resilience
to climate variability.



The Need for Climate Hubs



- Increasing climate variability
- An increase in number and intensity of extreme events
- Changing trends in climate and weather
- Added stress to agriculture and other natural resources

**The More you Know...
Information Leads to Action**

Vision and Mission

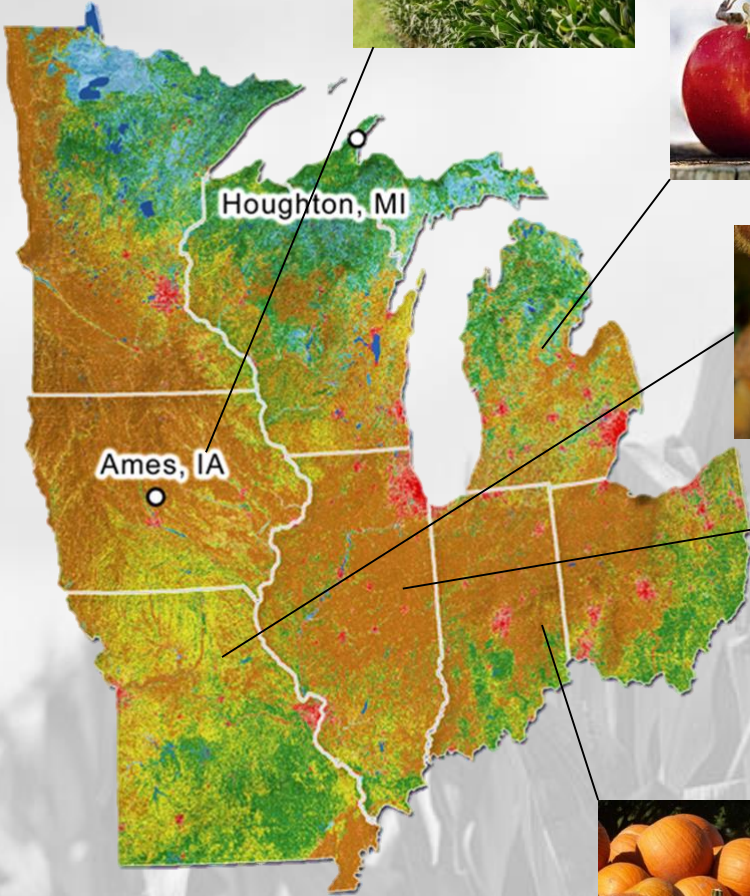
Vision

Agricultural production and natural resources maintained and strengthened under increasing climate and environmental change

Mission

1. Develop and deliver science-based, region-specific information and technologies to agricultural and natural resource managers;
2. enable climate-smart decision-making; and
3. direct land managers to USDA agency programs and regional partners to build resilience to climate change.

Here in the Midwest...

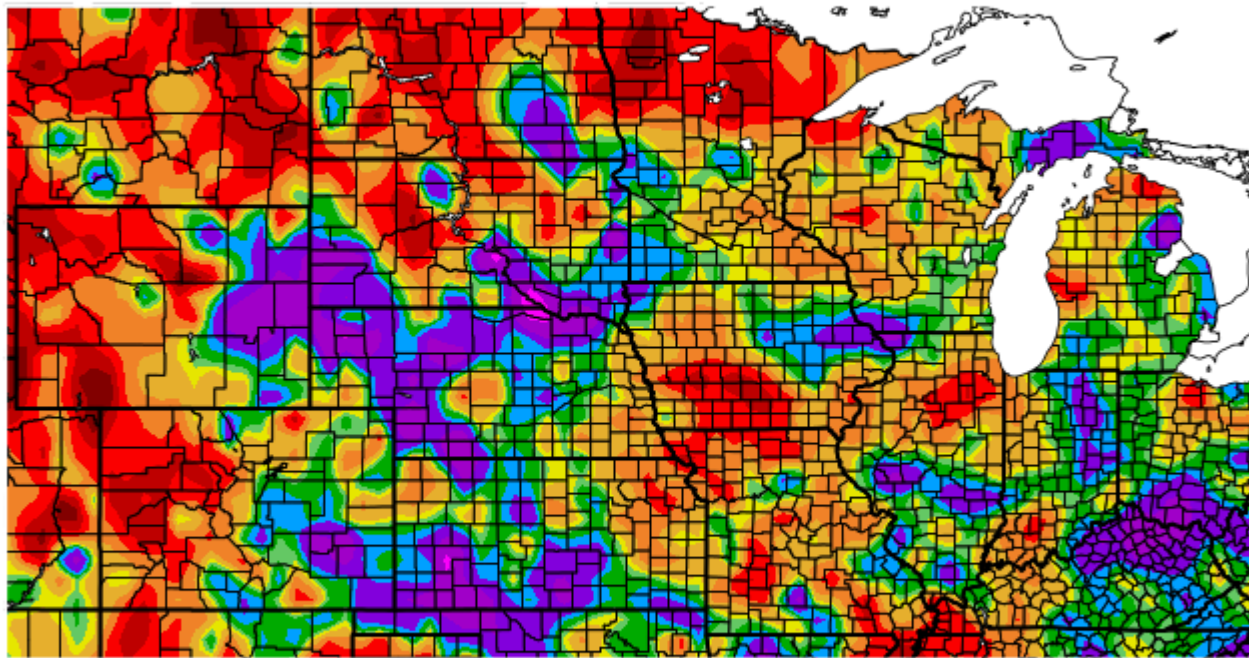


Our Goal

To provide information to help producers cope with climate change through **linkages of research, education and partnerships** in a region that represents one of the **most intense areas of agricultural production** in the world.

30 Day Percent of Avg. Precip.

Percent of Normal Precipitation (%)
7/13/2018 – 8/11/2018



Wetter Plains –
some eastern Corn
Belt

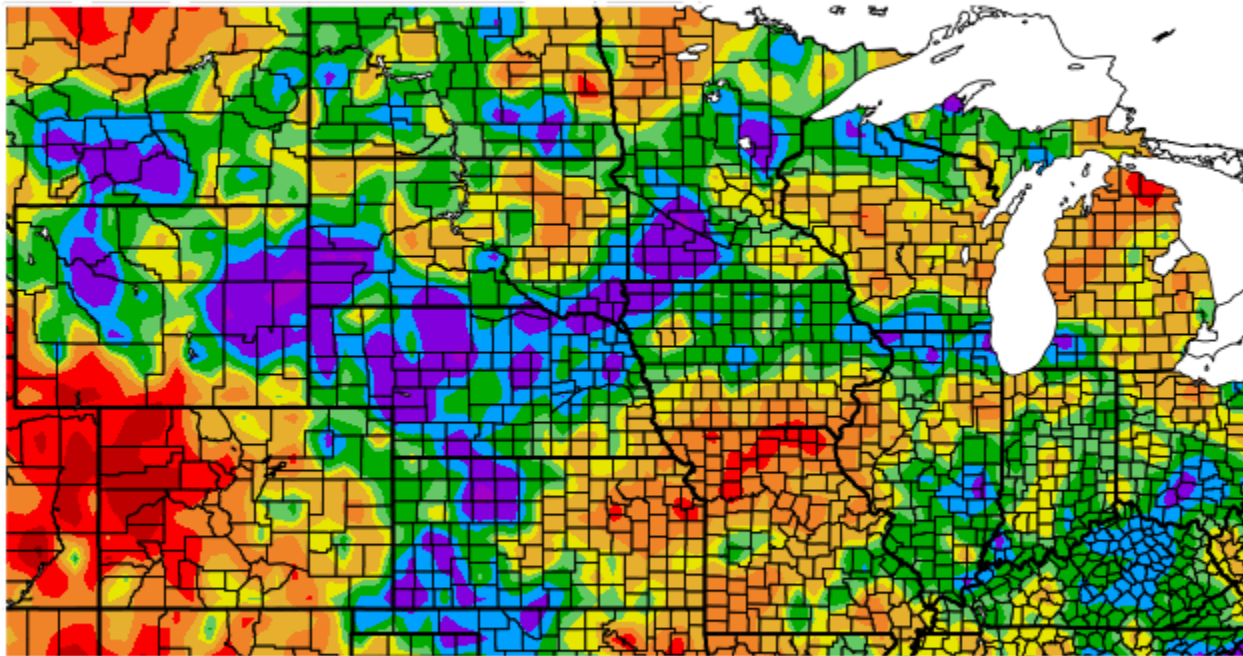


Generated 8/12/2018 at HPRCC using provisional data.

NOAA Regional Climate Centers

90 Day Percent of Avg. Precip.

Percent of Normal Precipitation (%)
5/14/2018 – 8/11/2018



Wetter Plains –
some eastern Corn
Belt – northern
Midwest

Driest Colorado
and KS-MO-IA

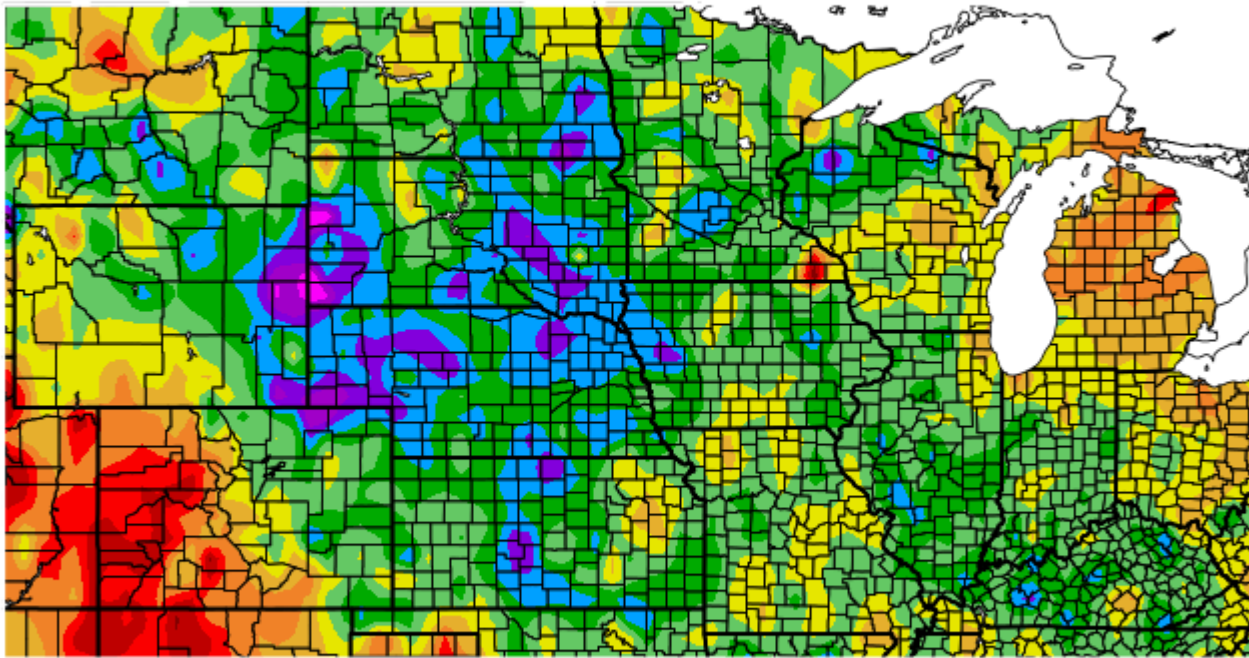


Generated 8/12/2018 at HPRCC using provisional data.

NOAA Regional Climate Centers

30 Day Temperature Departure

Departure from Normal Temperature (F)
7/13/2018 - 8/11/2018



Below avg.
temperature up to
2-4 F below avg.

Good to balance
dryness and slow
crop progress.



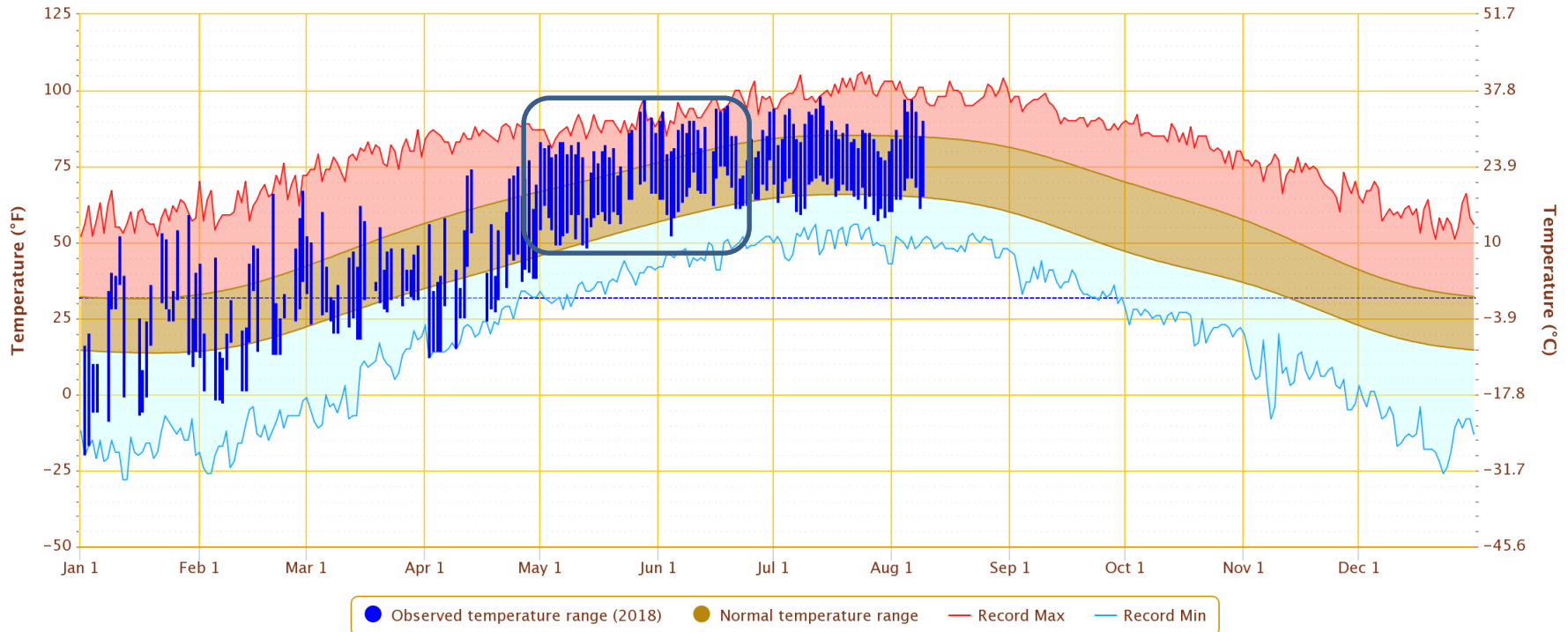
Generated 8/12/2018 at HPRCC using provisional data.

NOAA Regional Climate Centers

30 Day Temperature Departure

Daily Temperature Data – RATHBUN DAM, IA

Period of Record – 1970-04-06 to 2018-08-09. Normals period: 1981-2010. Click and drag to zoom chart.



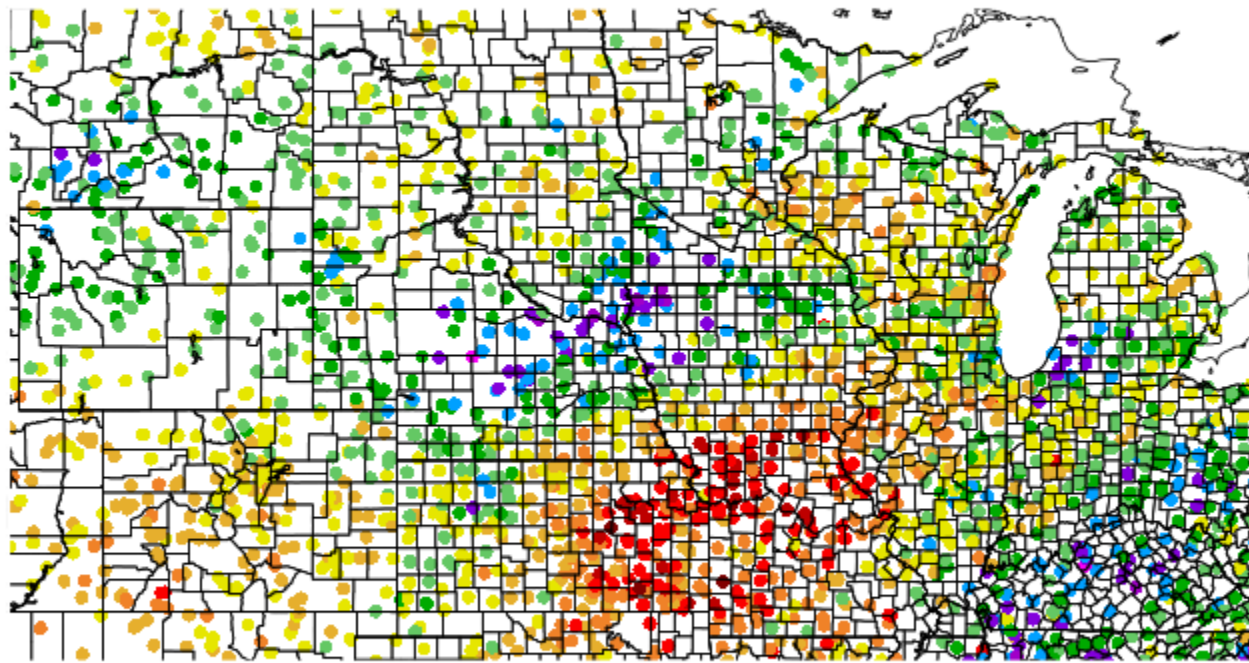
Powered by ACIS

May 1 – mid-June
nearly every day
above average
temperature

May 1- June 15
2nd warmest
period ever
behind 1934

1 Year Departure Avg. Precip.

Departure from Normal Precipitation (in)
8/12/2017 – 8/11/2018



12 month deficits.
16-20" deficits in
the last year.



Generated 8/12/2018 at HPRCC using provisional data.

NOAA Regional Climate Centers

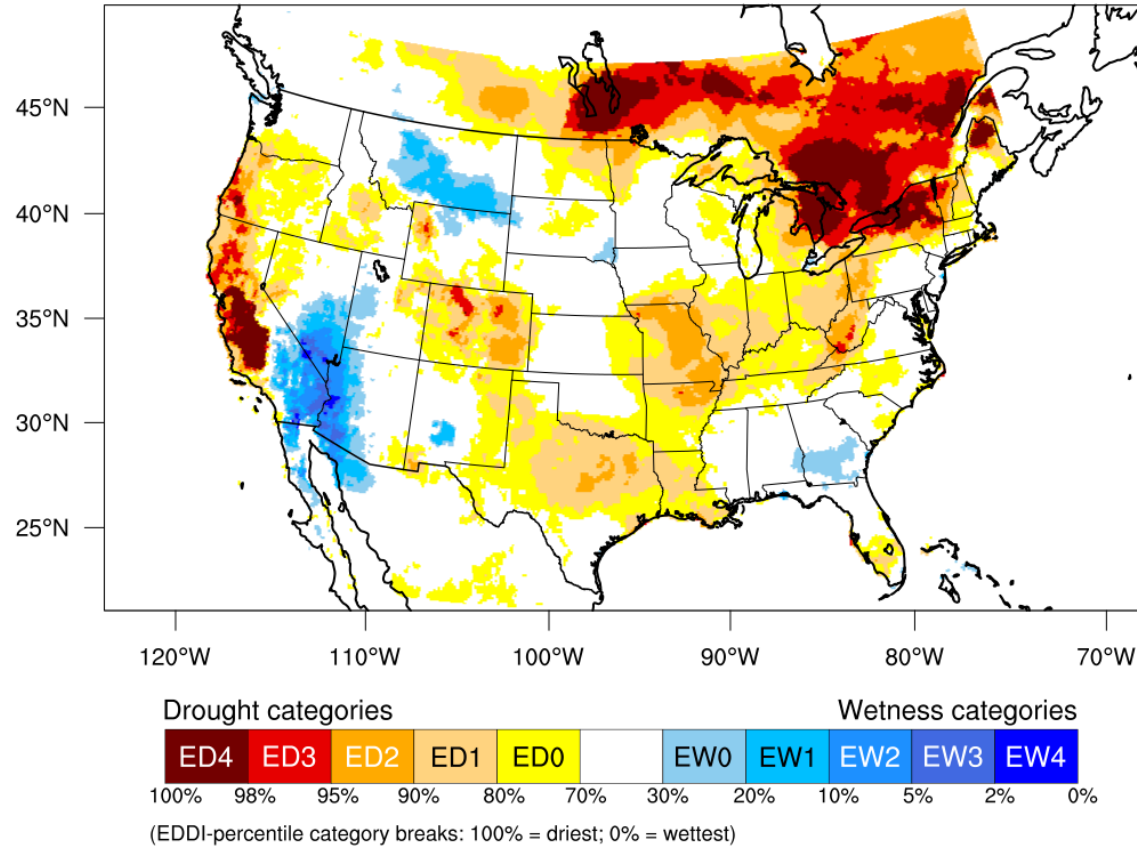
1 Month Evaporative Demand (EDDI)

Incorporates how much water “could” be used by crops.

Early indicator of potential for flash drought

Shows increased demand in southern IA

1-month EDDI categories for July 26, 2018

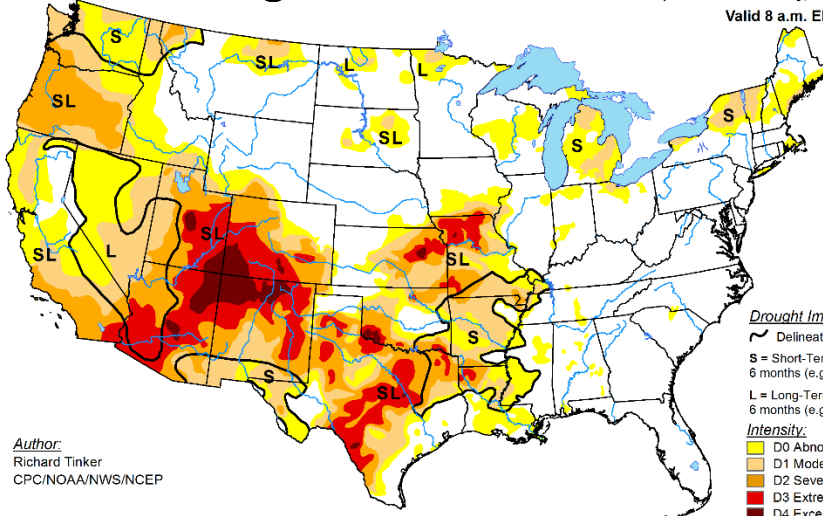


Generated by NOAA/ESRL/Physical Sciences Division

US Drought Monitor

U.S. Drought Monitor

August 7, 2018
(Released Thursday, Aug. 9, 2018)
Valid 8 a.m. EDT



Drought Impact Types:

- ~ Delineates dominant impacts
- S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)
- L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.



<http://droughtmonitor.unl.edu/>

D3 Colorado and Kansas-Missouri-Iowa. Pockets of D4 in each state.

S. Drought Monitor Central Region

August 7, 2018
(Released Thursday, Aug. 9, 2018)
Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	63.49	36.51	20.28	11.16	5.01	0.87
Last Week 07-31-2018	64.61	35.39	18.72	10.29	5.61	0.98
3 Months Ago 05-08-2018	64.63	35.37	18.12	8.96	4.72	1.18
Start of Calendar Year 01-02-2018	44.74	55.26	22.30	7.69	2.03	0.00
Start of Water Year 09-26-2017	50.80	49.20	24.09	12.89	6.13	2.26
One Year Ago 08-08-2017	56.66	43.34	24.26	13.63	6.18	1.98

Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

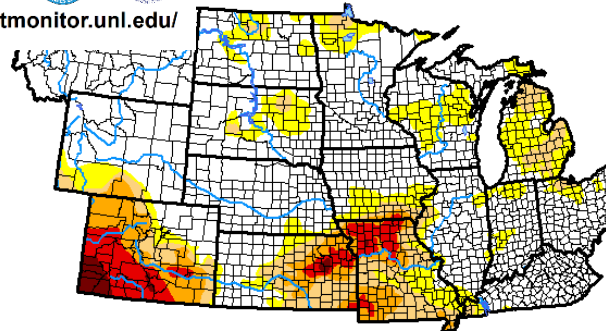
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:

Richard Tinker
CPC/NOAA/NWS/NCEP



<http://droughtmonitor.unl.edu/>

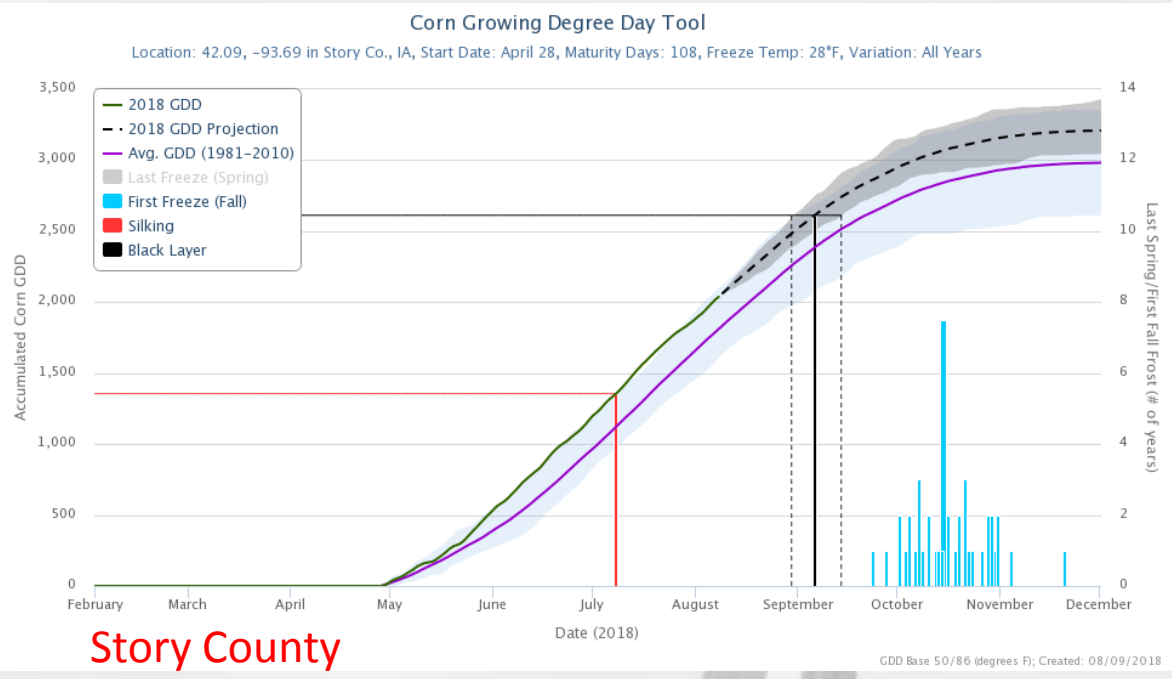


<http://droughtmonitor.unl.edu/>

Impact Issues

- Stressed corn and now beans
- Limited forage/pasture
- Limited water for livestock (quantity/quality)
- Other issues?

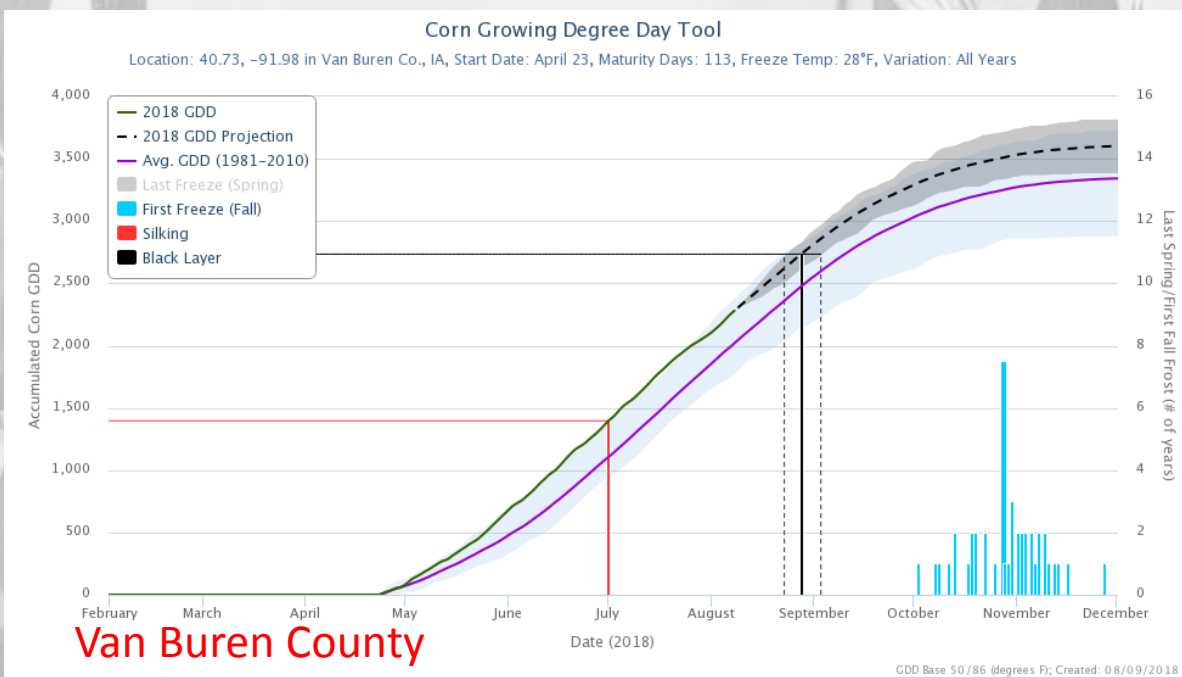
GDD Accumulation and Forecast



Story County

Parts of southern-central IA could reach black layer by first week of September/late August

<https://mrcc.illinois.edu/U2U/gdd/>

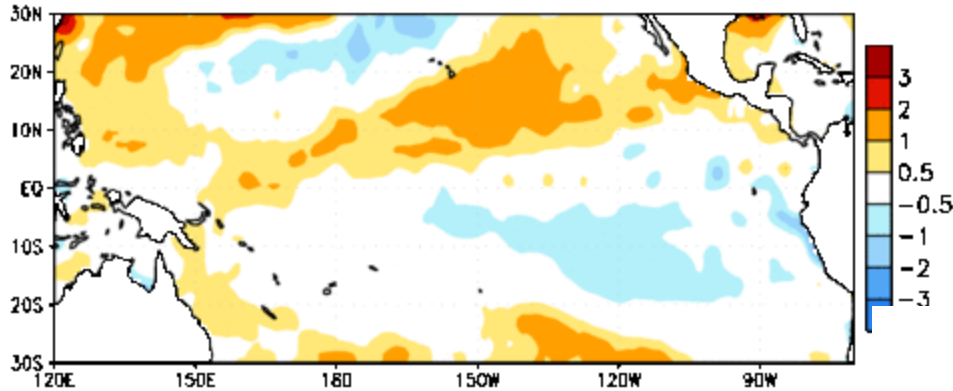


Van Buren County

OUTLOOK

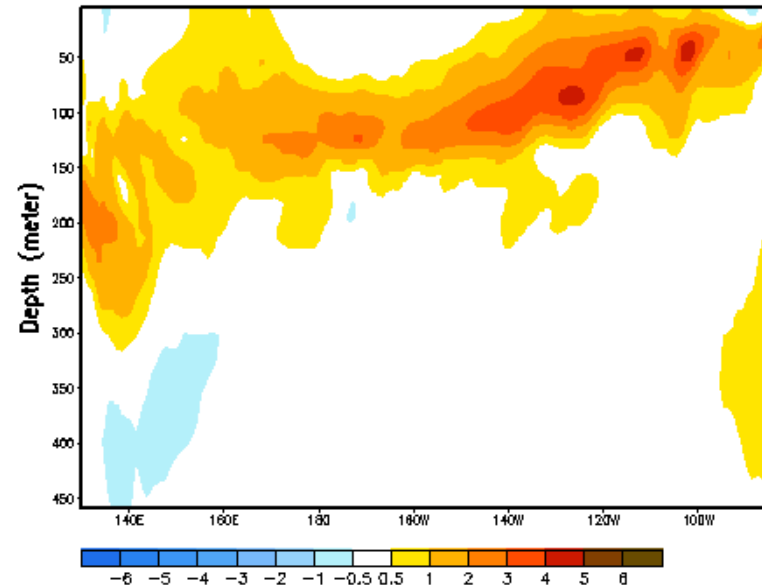
Pacific Sea-Surface Temps/El Niño

Week centered on 16 MAY 2018
SST Anomalies (°C)



Warm SSTs Pacific
– pending El Niño

Equatorial Temperature Anomaly (°C)
Pentad centered on 07 JUN 2018

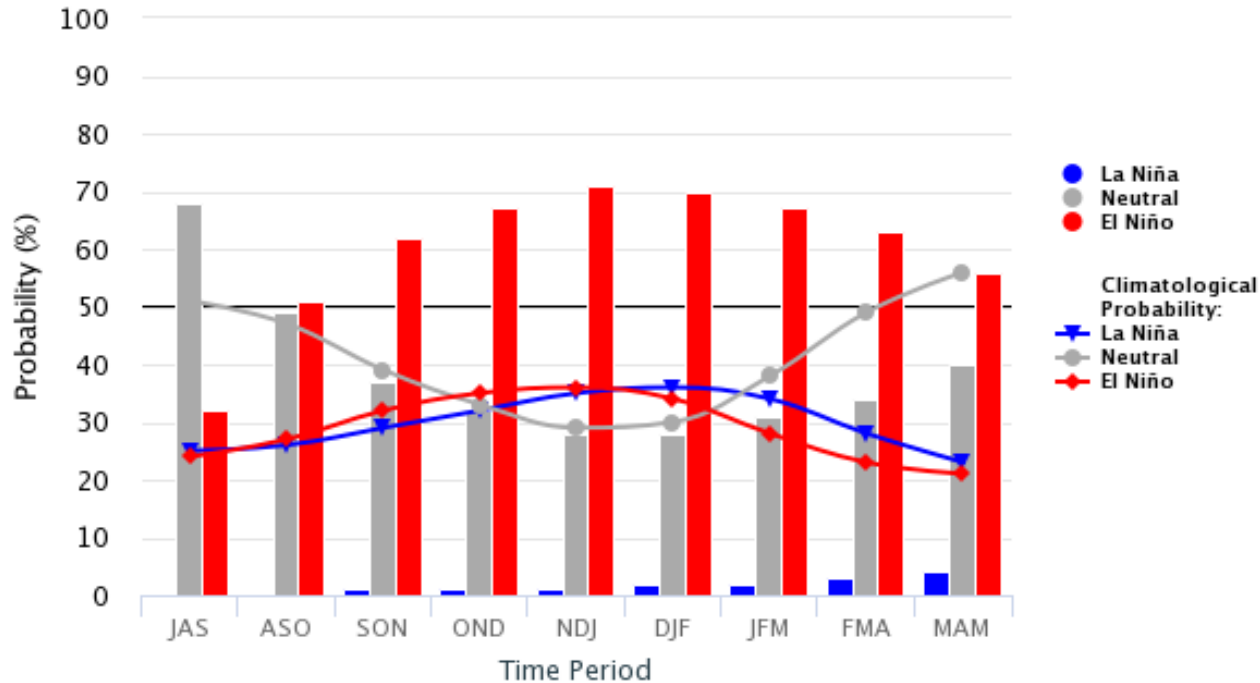


El Niño events are not perfect forecasts. But they can give additional information

El Niño Probability into 2019

Early-Aug CPC/IRI Official Probabilistic ENSO Forecasts

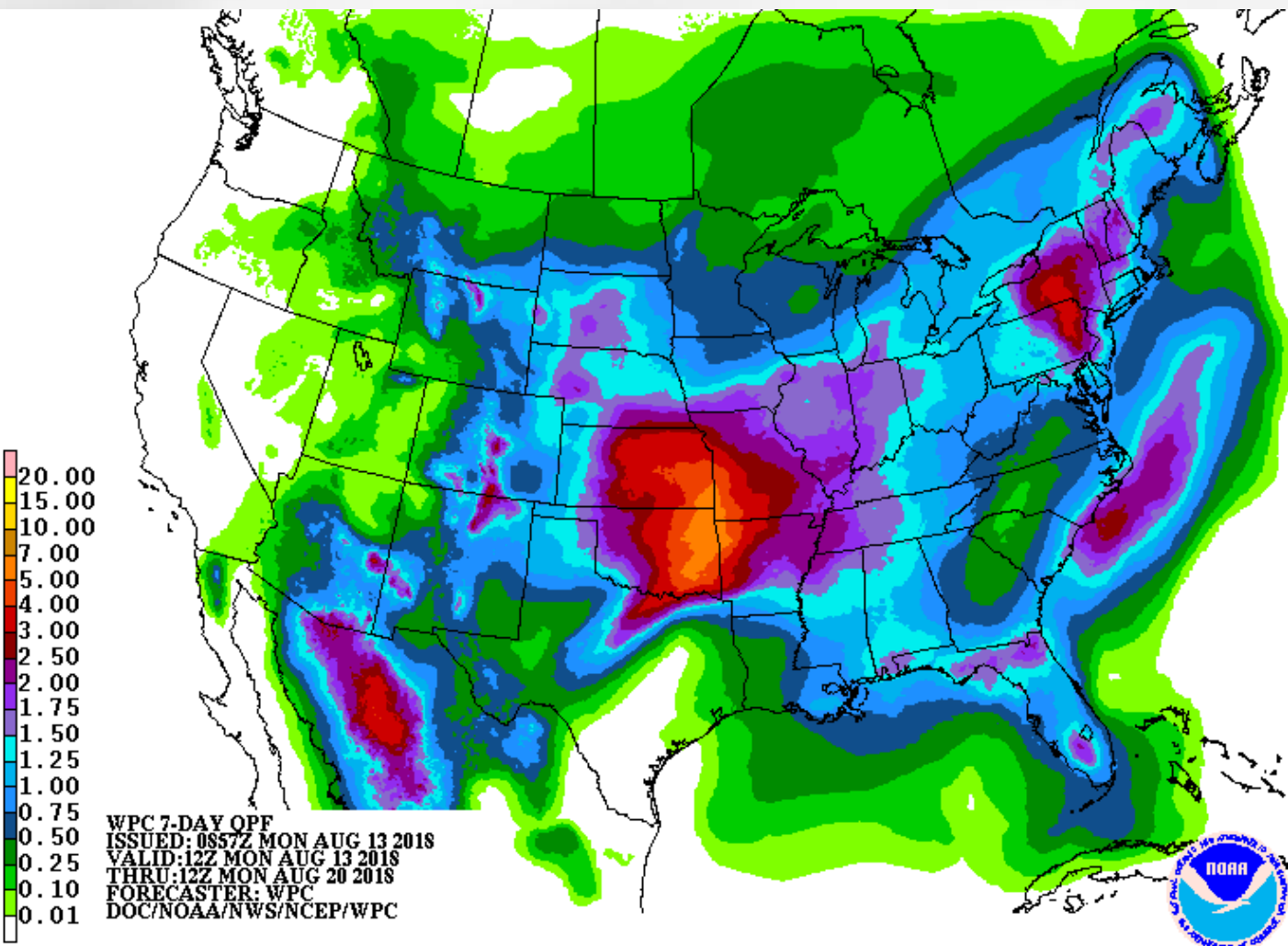
ENSO state based on NINO3.4 SST Anomaly
Neutral ENSO: -0.5 °C to 0.5 °C



El Niño likely into 2019.

Some question on end period – can it influence 2019 growing season?

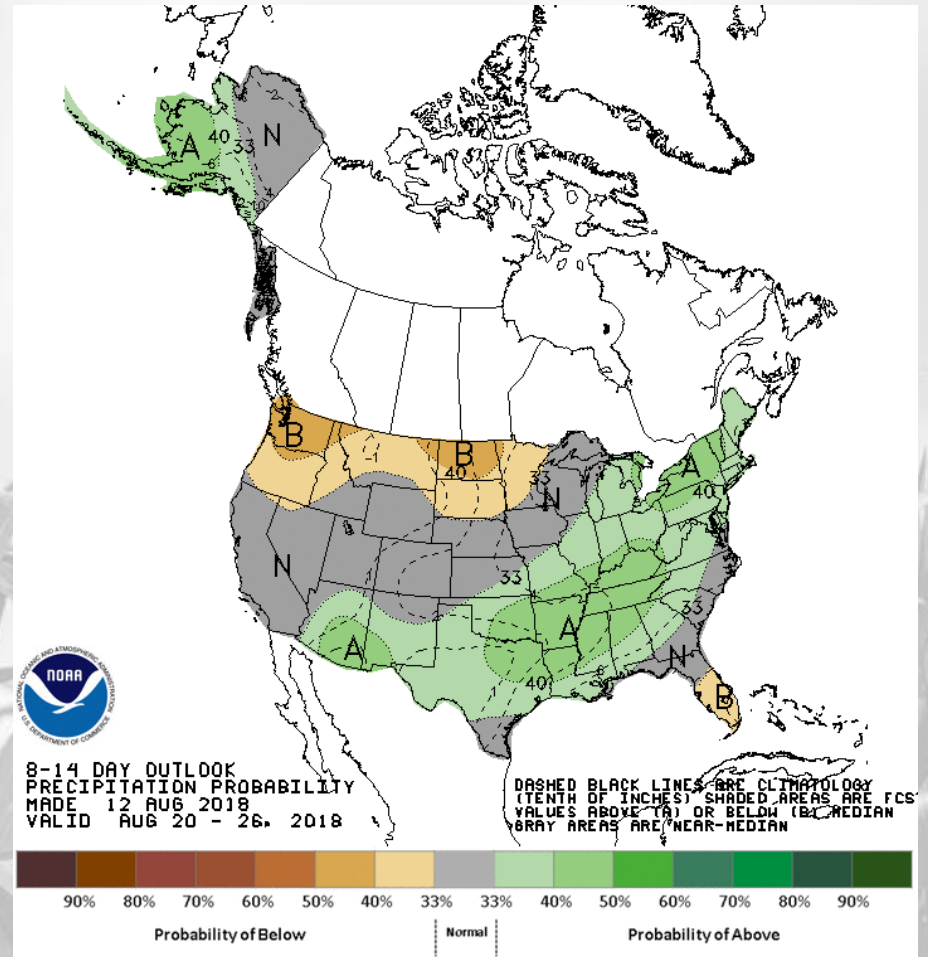
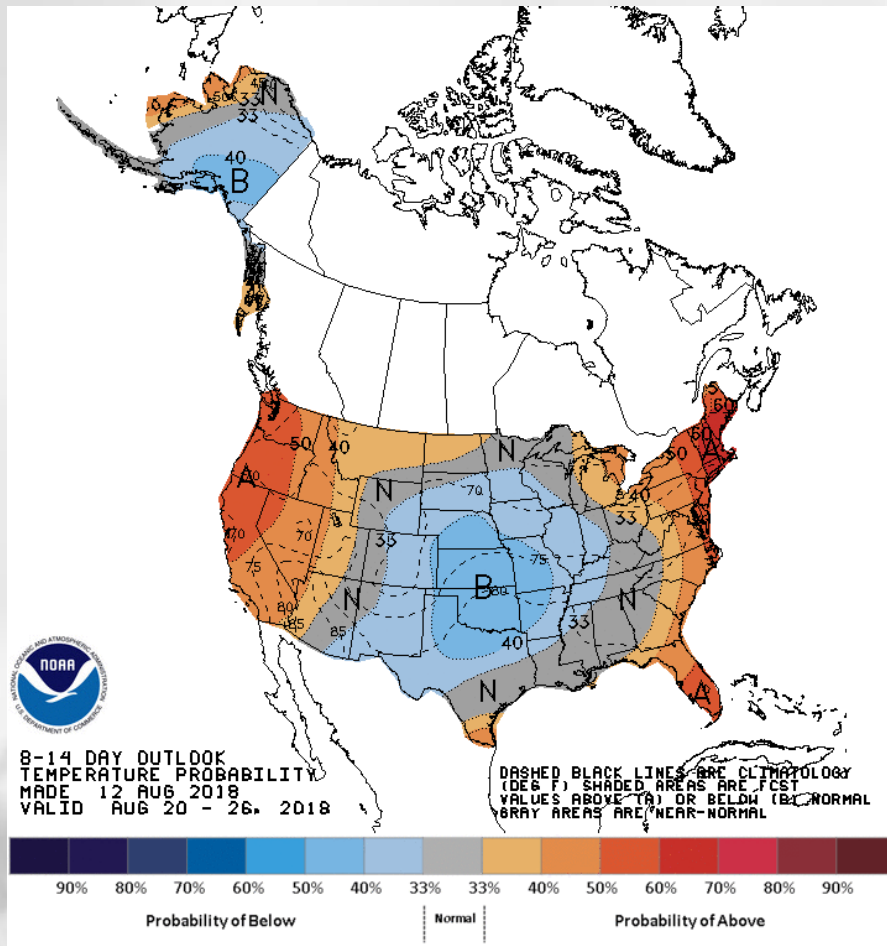
7 Day Forecast Precip.



Decent rainfalls in
central plains to
central Corn Belt.

Would help
drought issues.

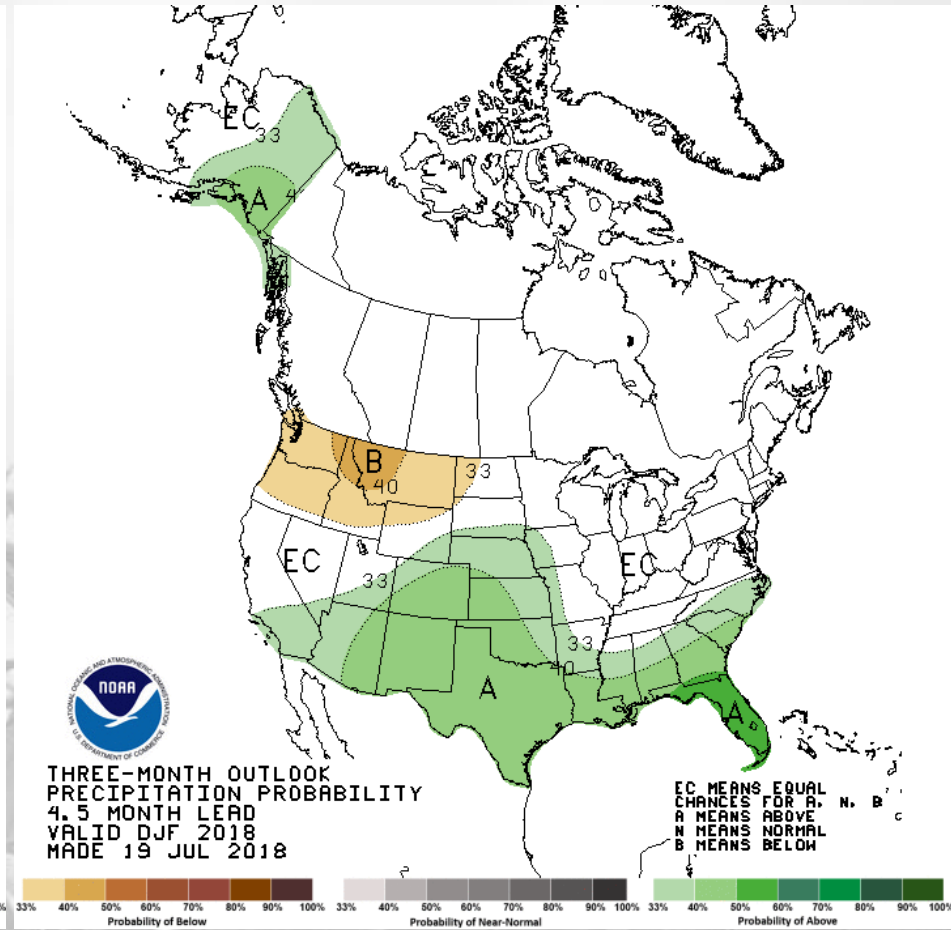
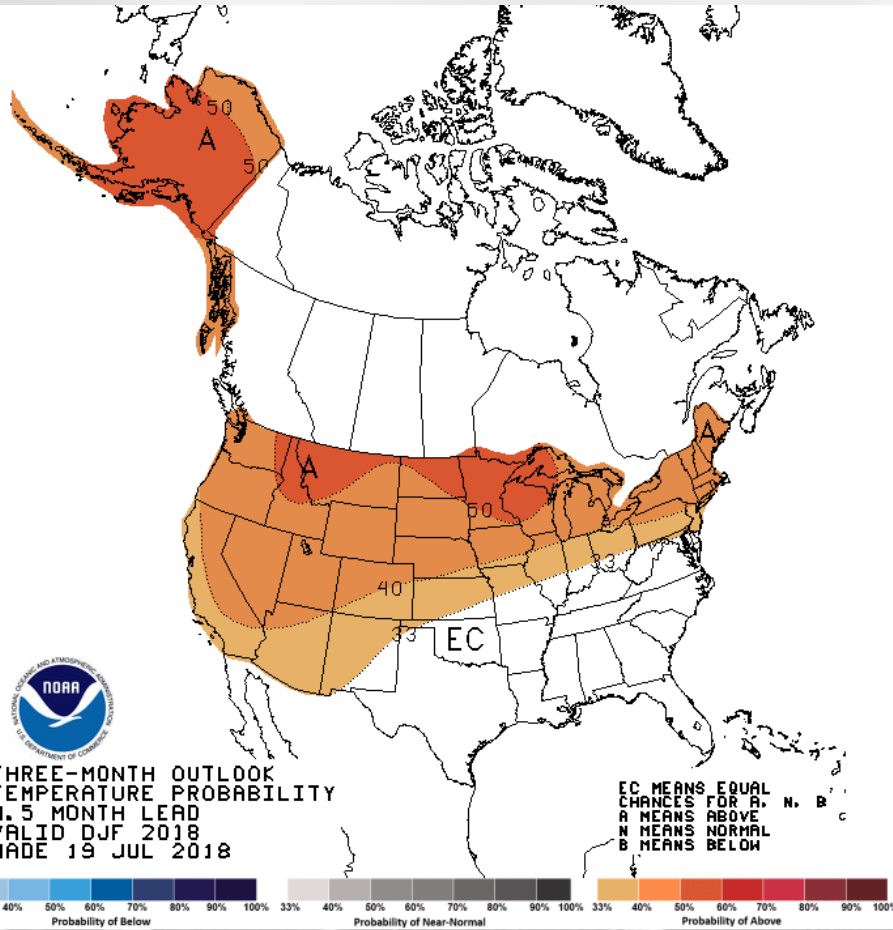
8-14 Day Outlook Temp./Precip.



<http://www.cpc.ncep.noaa.gov/>

Warmer than average likely to stay into August. Decent chances for precipitation.

Dec-Feb. Outlook Temp./Precip.



<http://www.cpc.ncep.noaa.gov/>

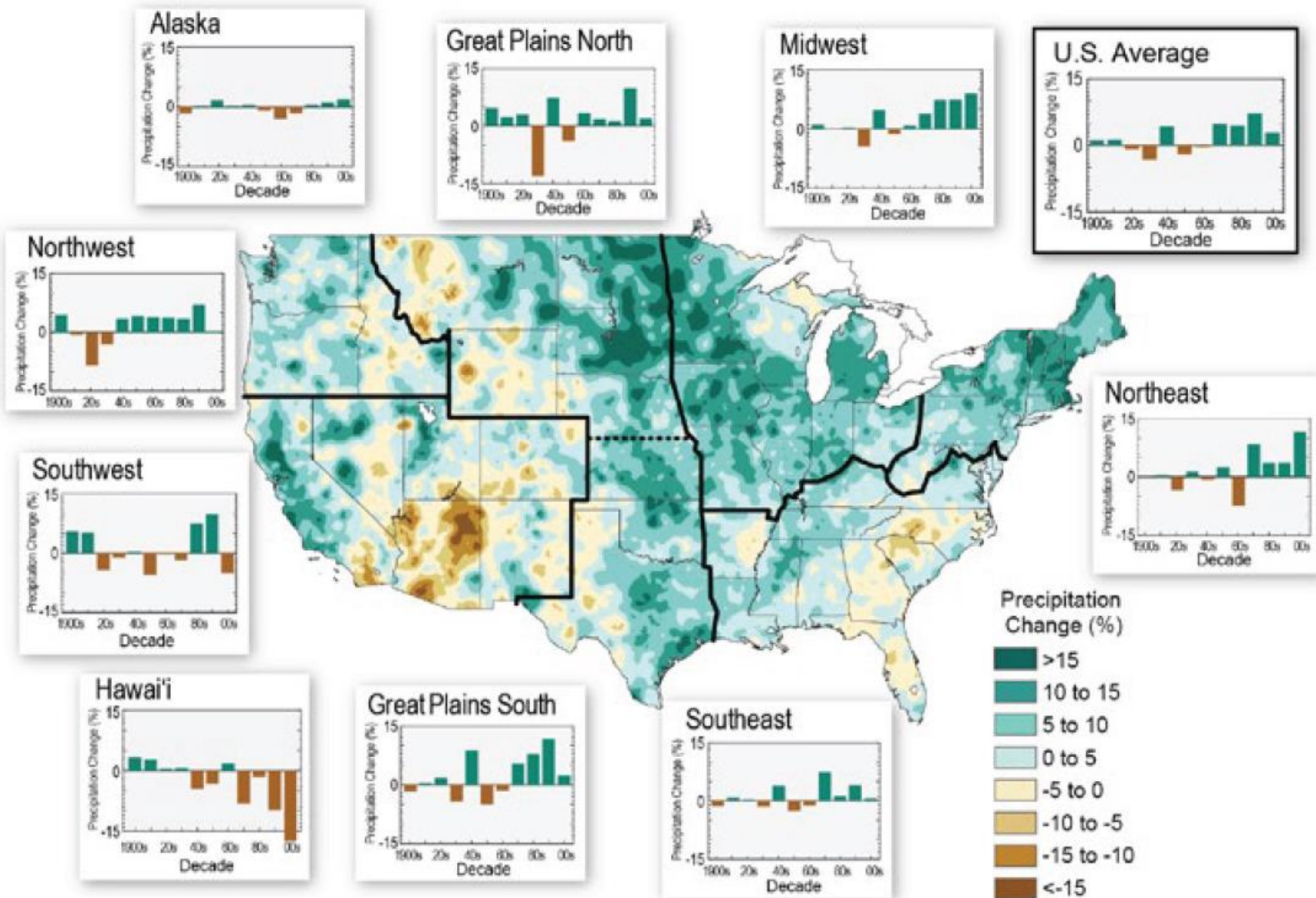
Largely El Niño influenced outlook

CHANGING CLIMATE ISSUES



Midwest Climate Hub
U.S. DEPARTMENT OF AGRICULTURE

Observed U.S. Precipitation Change

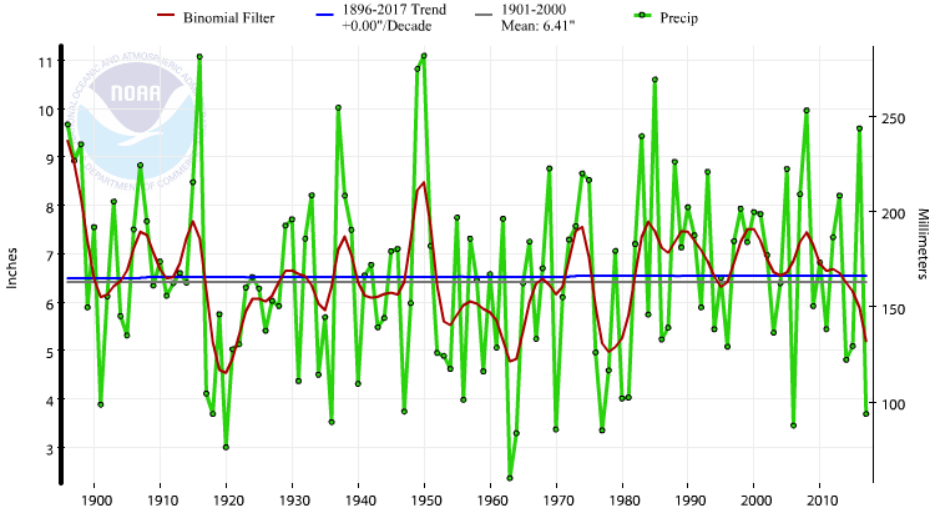


Time of Year

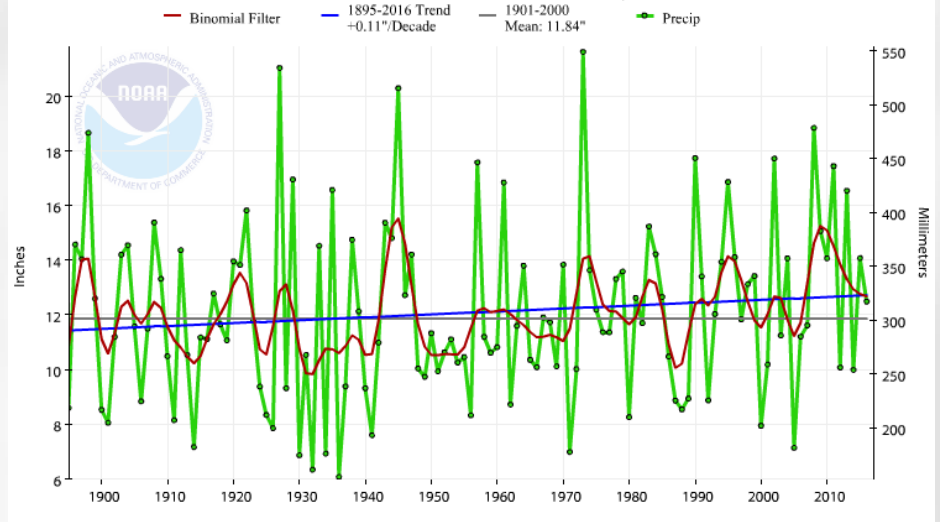
- Variable across the Corn Belt
- Precip intensity
- Larger events
- Transition seasons more prevalent



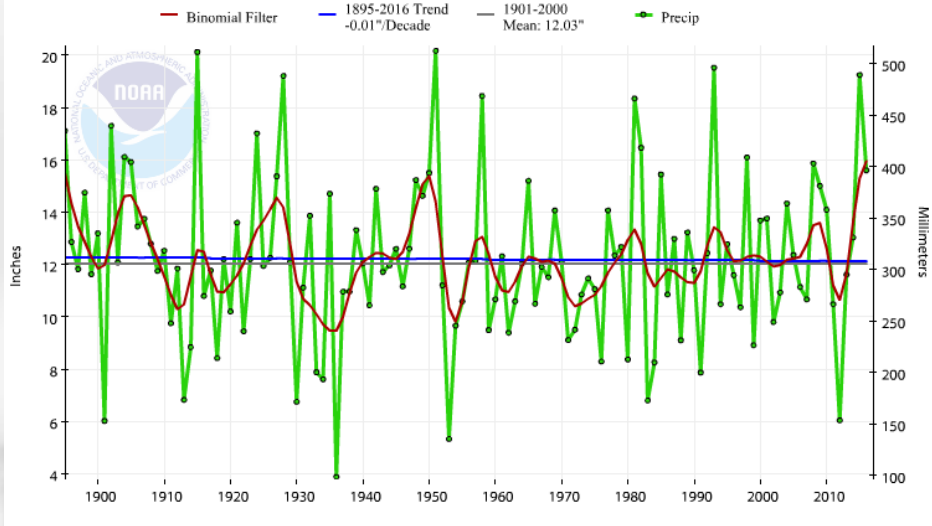
Missouri, Precipitation, December-February



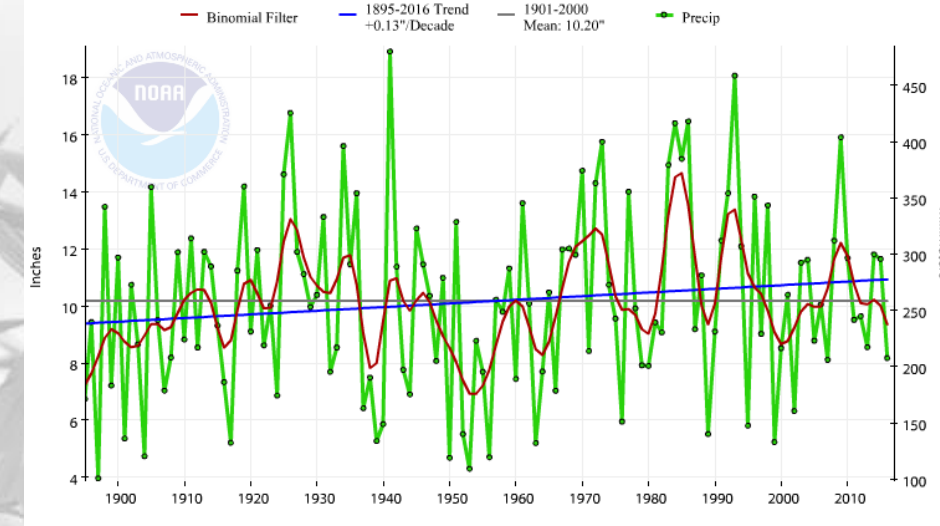
Missouri, Precipitation, March-May



Missouri, Precipitation, June-August



Missouri, Precipitation, September-November



Spring and Fall biggest increases in MO

<https://www.ncdc.noaa.gov/cag>

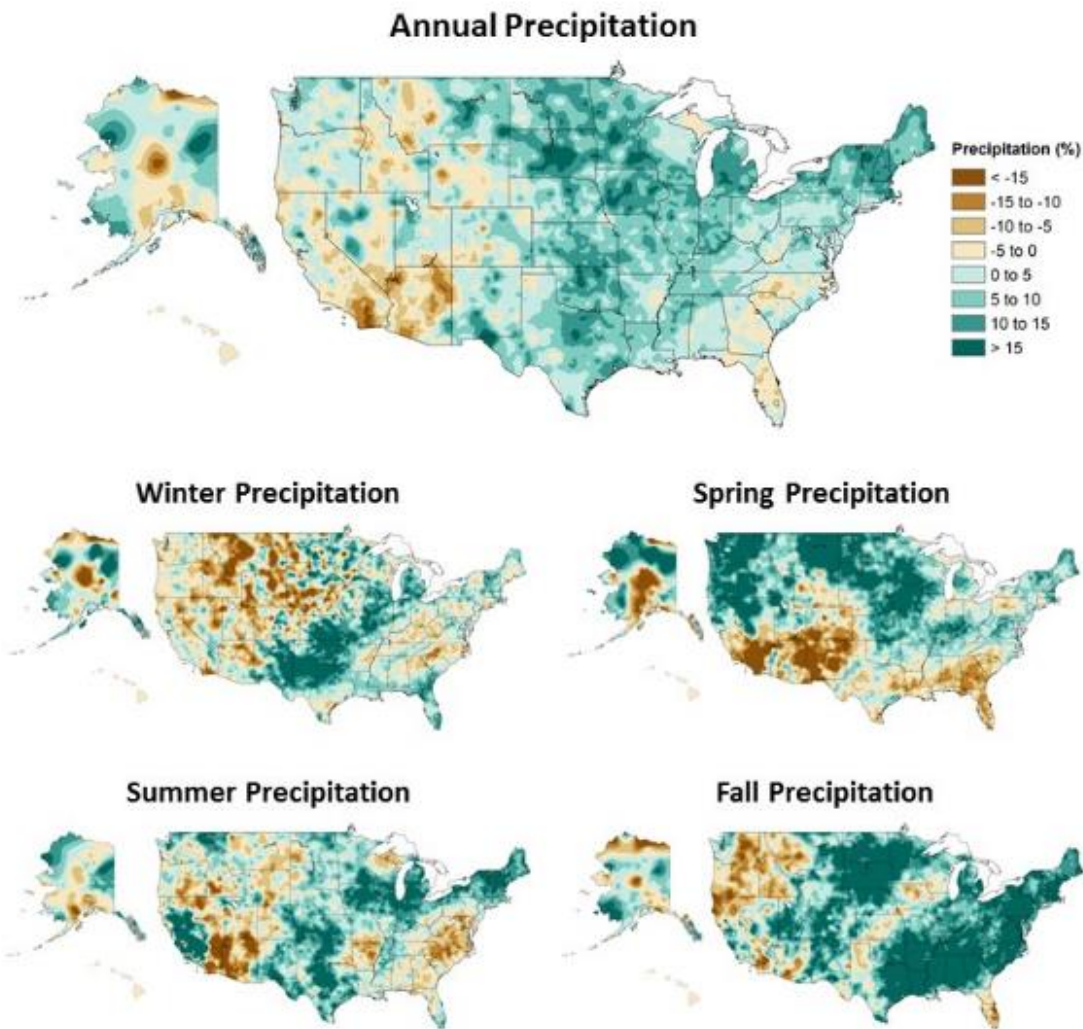
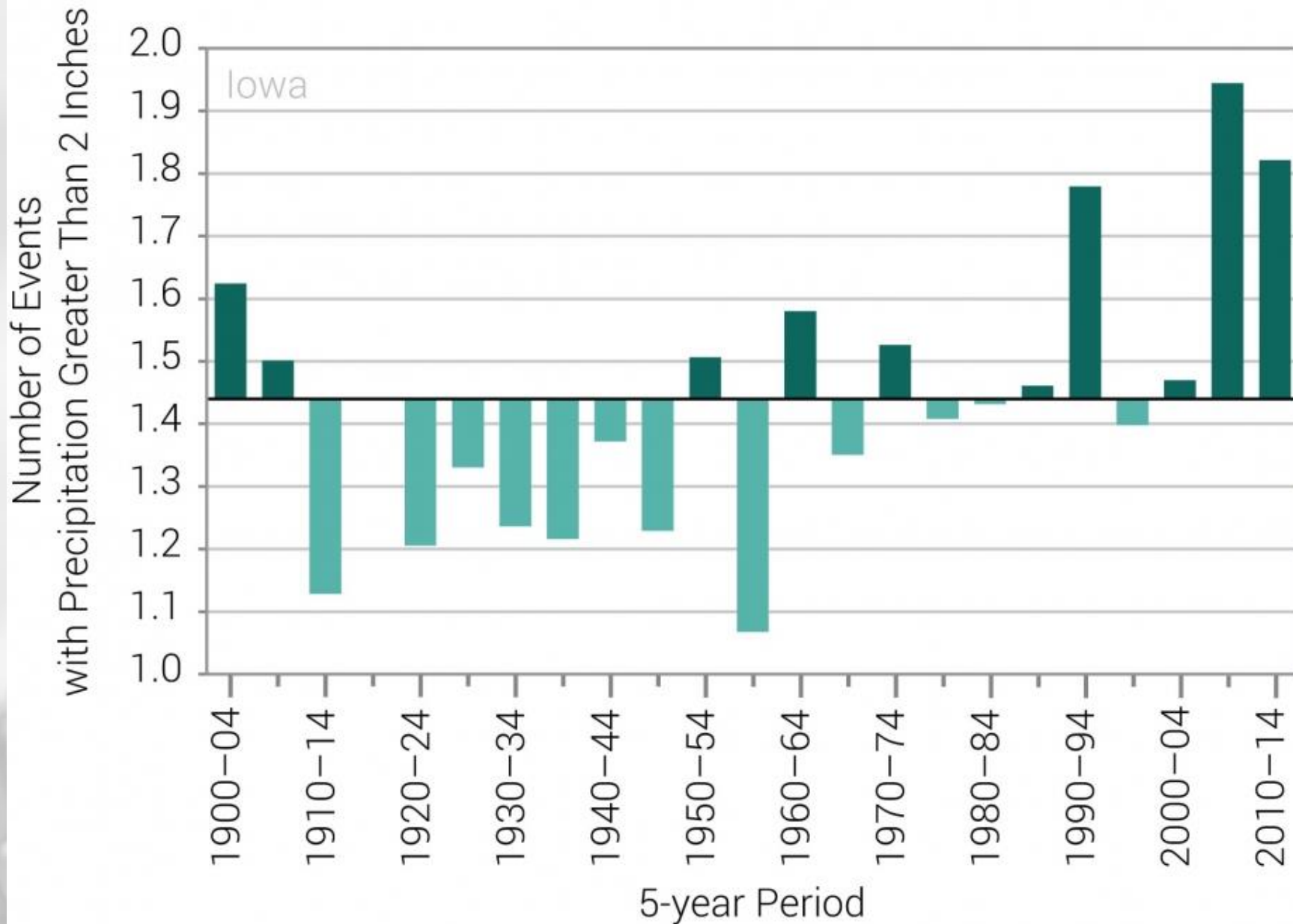
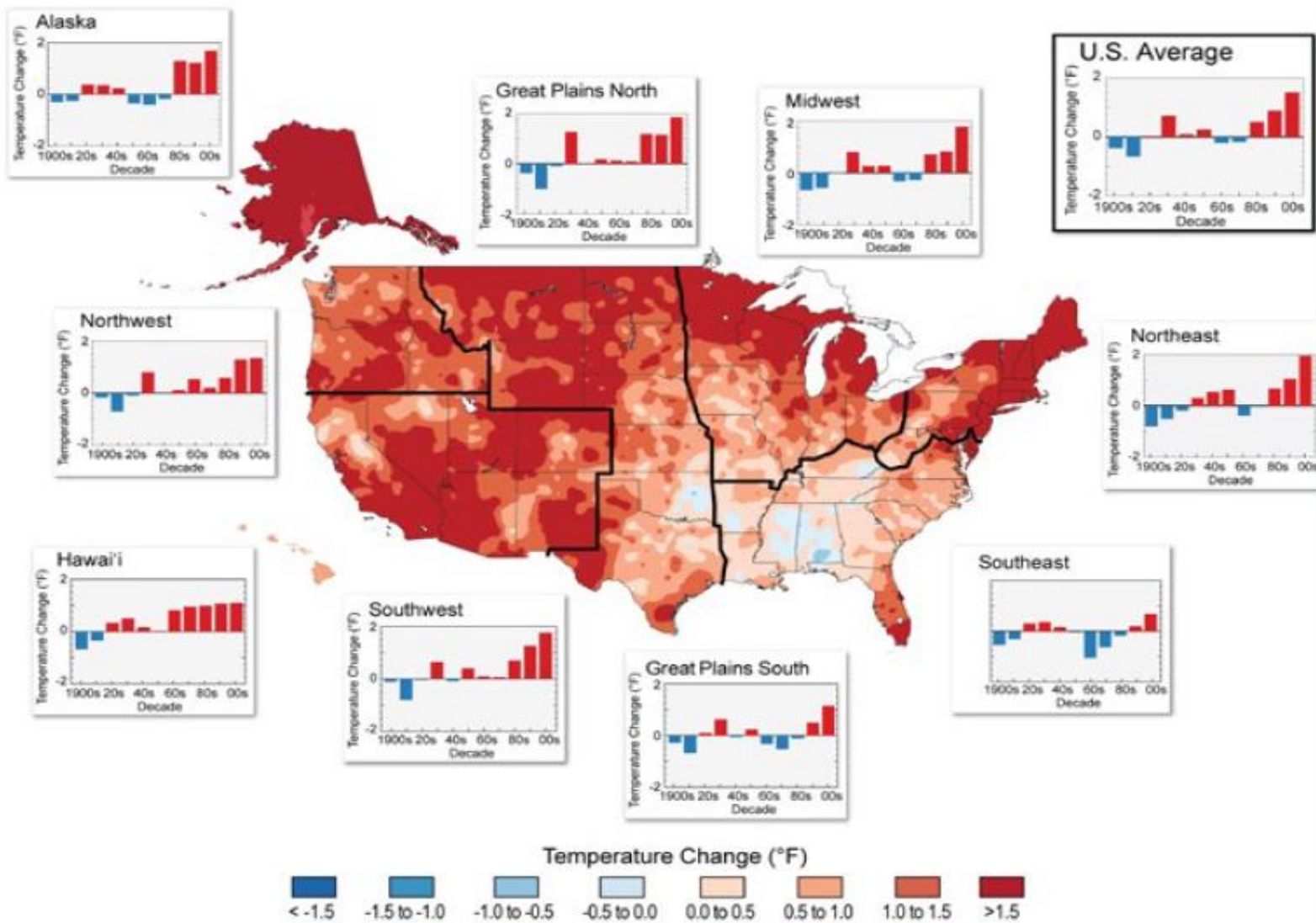


Figure 7.1: Annual and seasonal changes in precipitation over the United States. Changes are the average for present-day (1986–2015) minus the average for the first half of the last century (1901–1960 for the contiguous United States, 1925–1960 for Alaska and Hawai'i) divided by the average for the first half of the century. (Figure source: [top adapted from Peterson et al. 2013,⁷⁸ © American Meteorological Society. Used with permission; [bottom four NOAA NCEI, data source: nCLIMDiv].

Observed Number of Extreme Precipitation Events

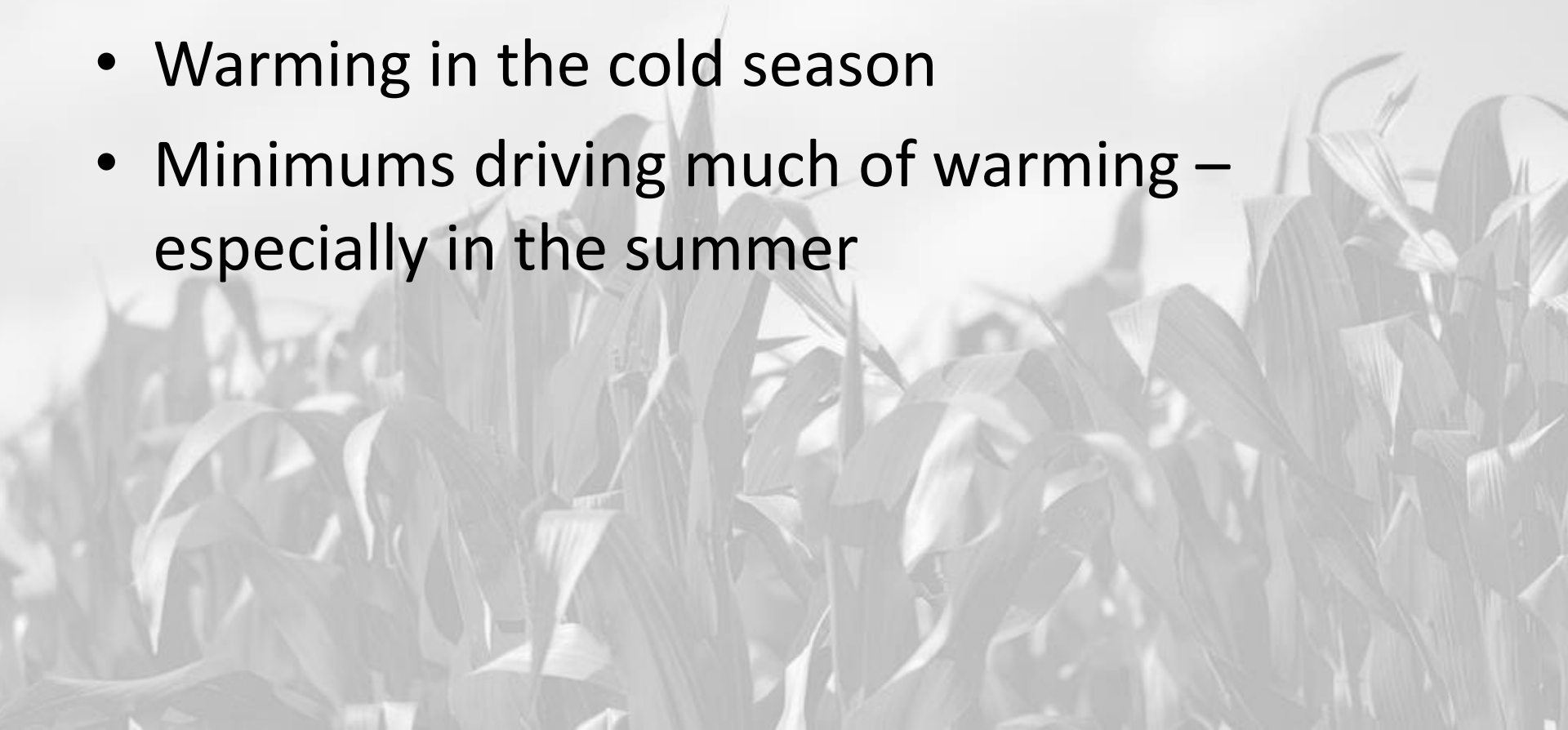


Observed U.S. Temperature Change

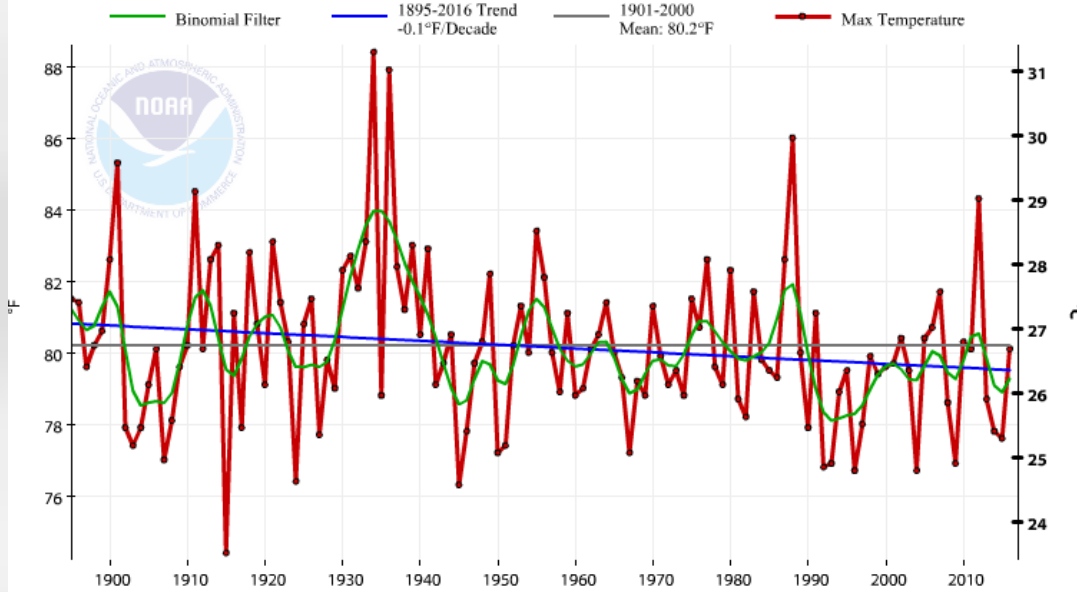


Getting warmer

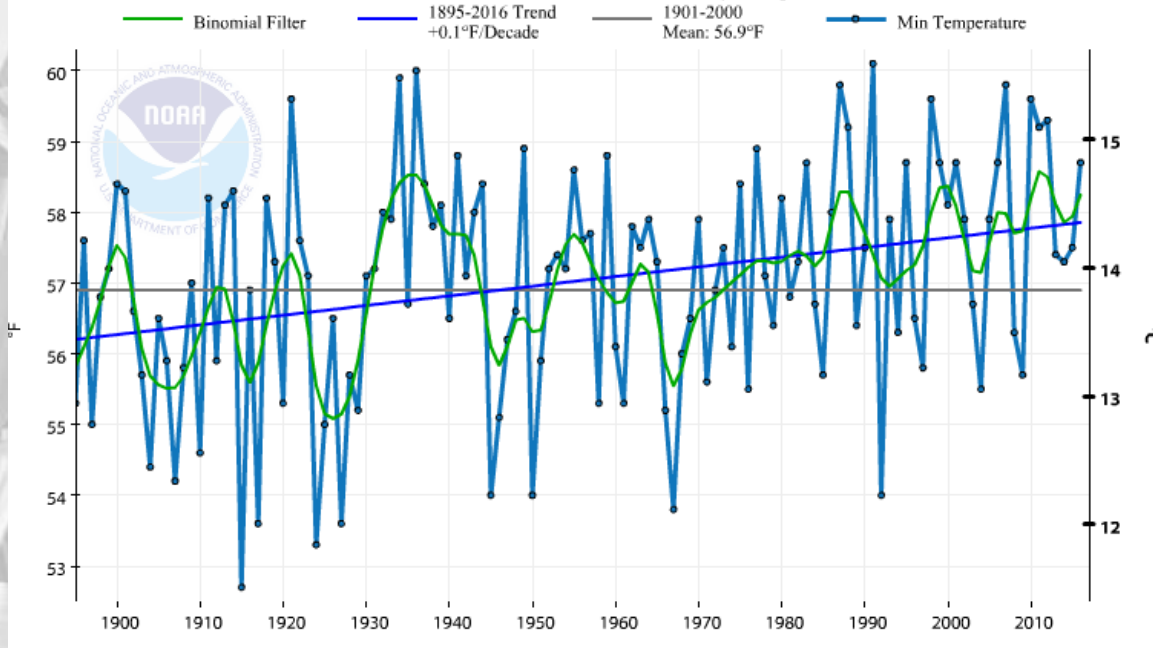
- The whole Corn Belt is getting warmer. But occurring in different ways/times of year
- Warming in the cold season
- Minimums driving much of warming – especially in the summer

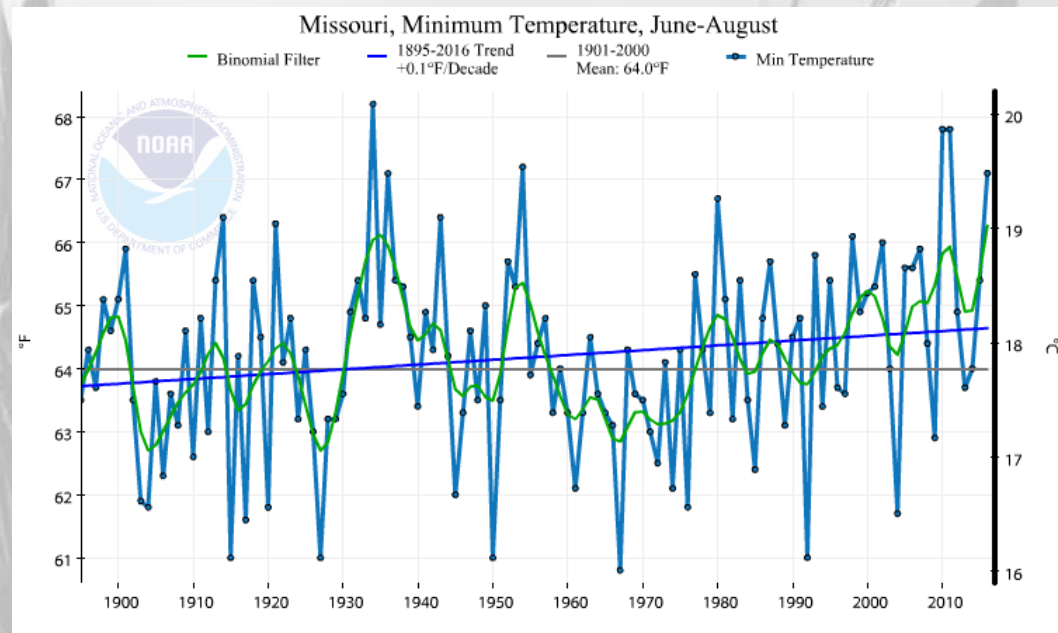
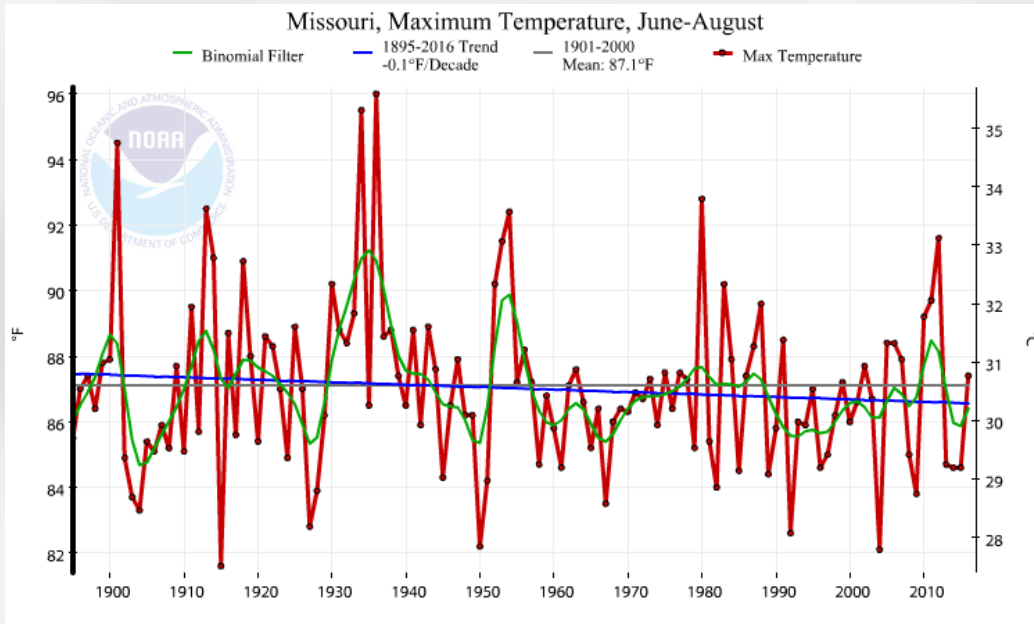


Iowa, Maximum Temperature, May-August



Iowa, Minimum Temperature, May-August





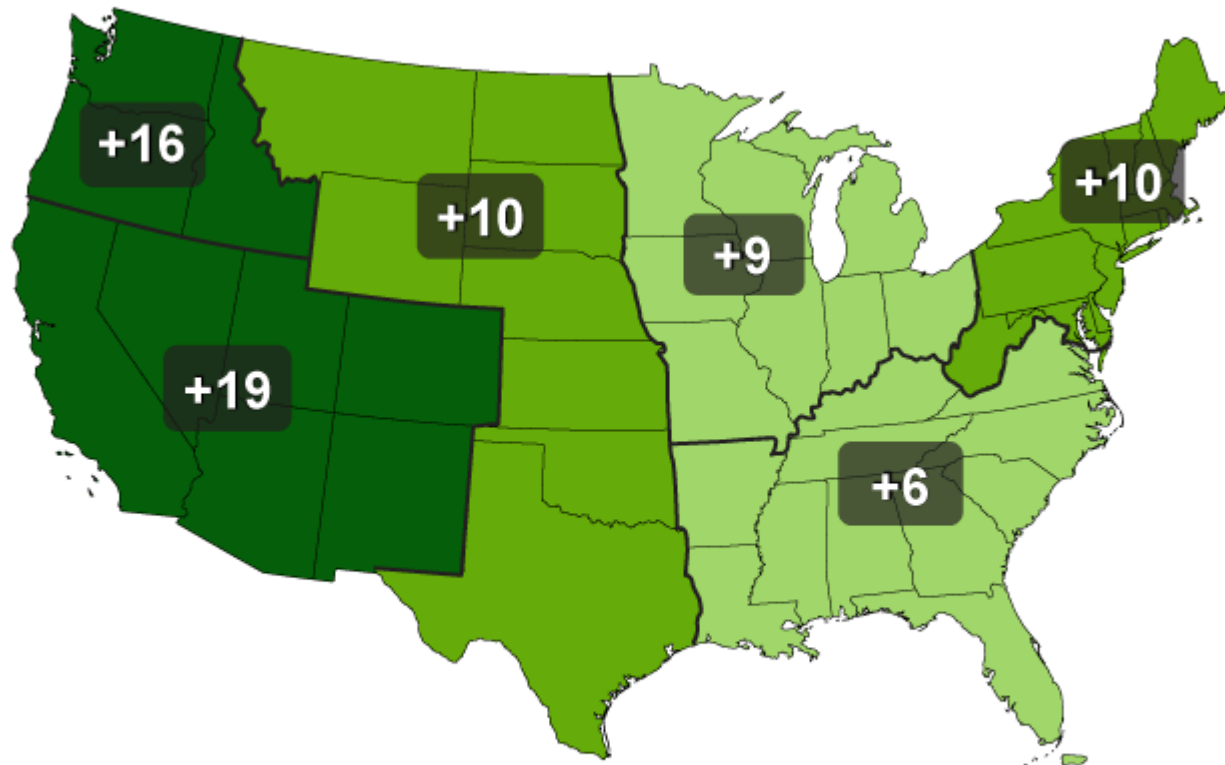
Summer getting warmer

Driven by overnight lows not by daily highs

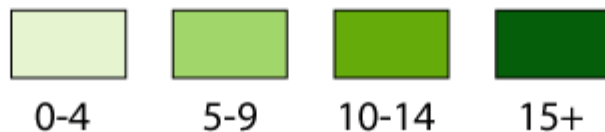
Warm Nights

- Added livestock/human stress
- Additional cooling needed
- Push GDD accumulation/phenological state
- Does help increase frost free season period

Observed Increase in Frost-Free Season Length



Change in Annual Number of Days

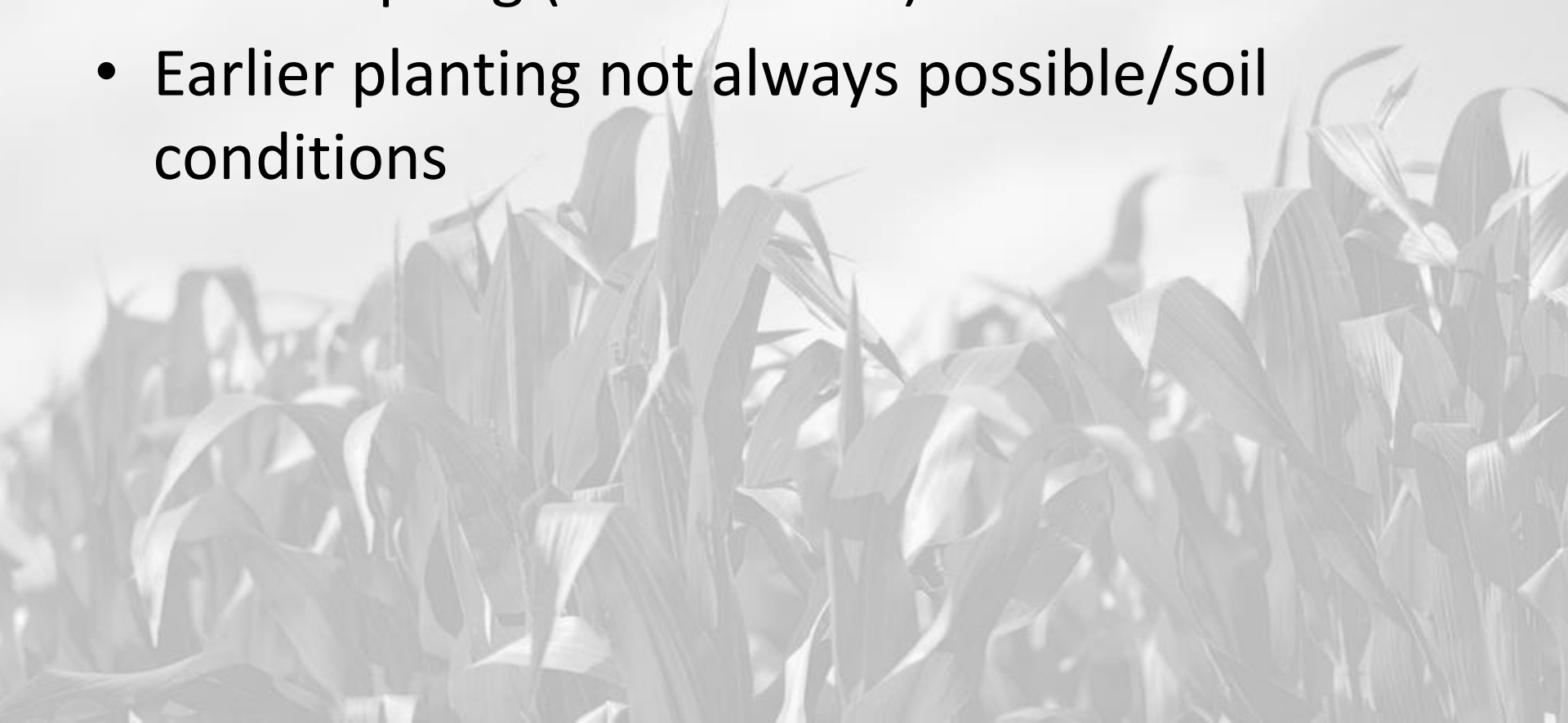


The frost-free season length, defined as the period between the last occurrence of 32°F in the spring and the first occurrence of 32°F in the fall, has increased in each U.S. region during 1991-2012 relative to 1901-1960.

Increases in frost-free season length correspond to similar increases in growing season length. (Figure source: NOAA NCDC / CICS-NC).

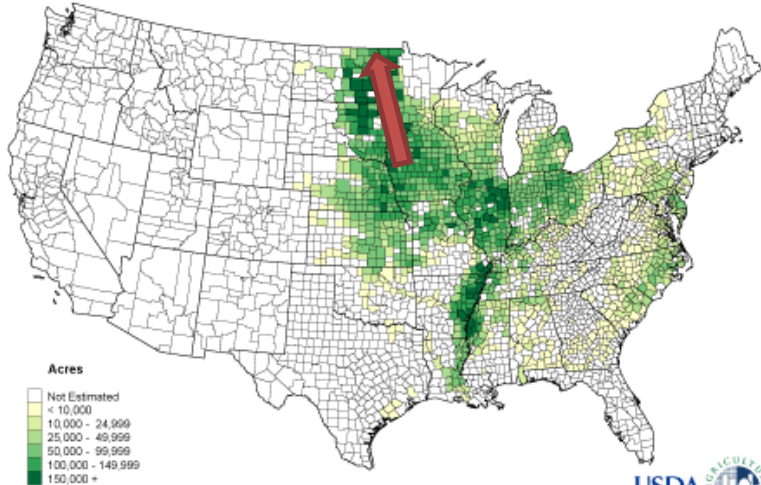
Frost Free Season Change

- Longer hybrid
- Earlier spring (confounded)
- Earlier planting not always possible/soil conditions

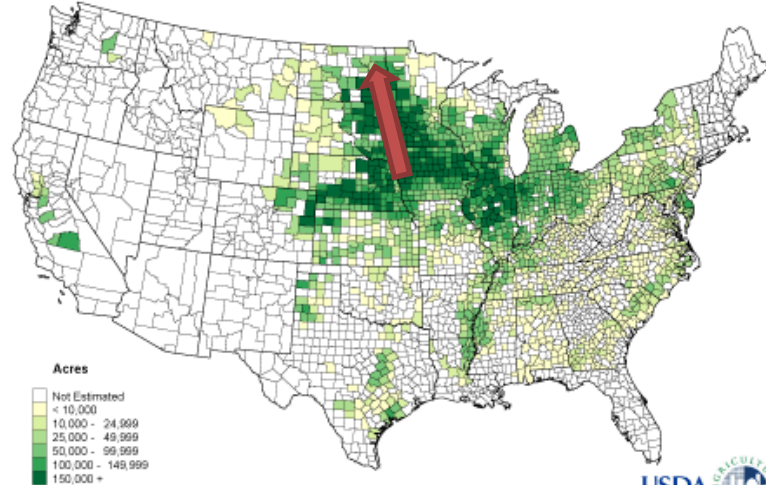


Crop Production

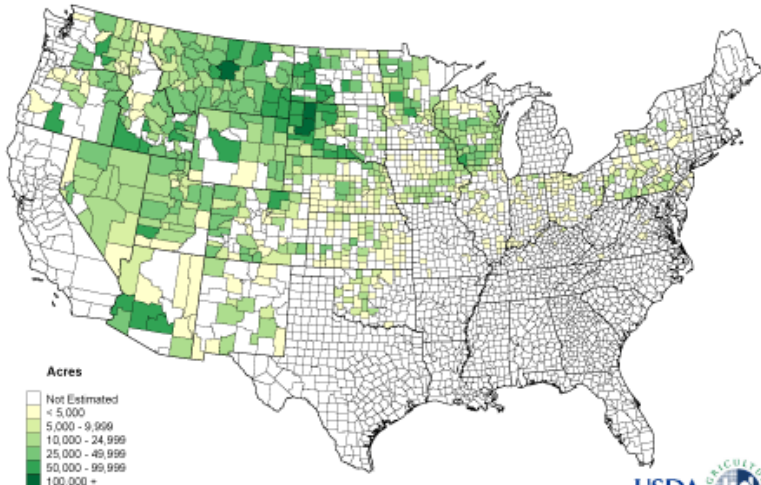
**Soybeans 2013
Planted Acres by County
for Selected States**



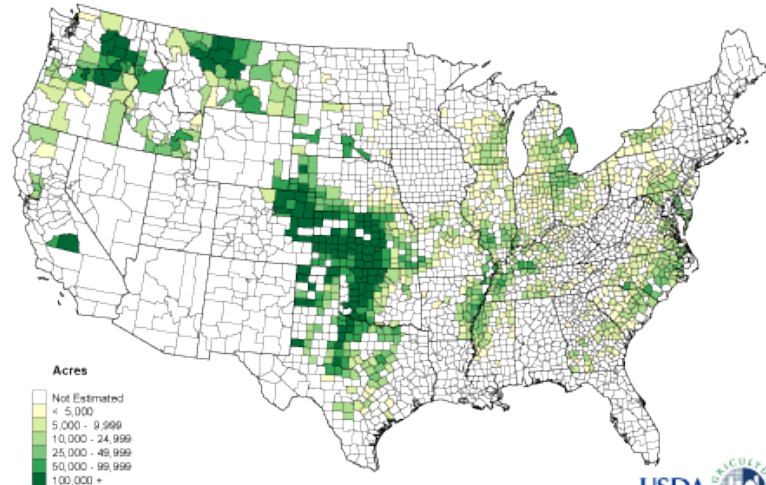
**Corn for All Purposes 2013
Planted Acres by County
for Selected States**



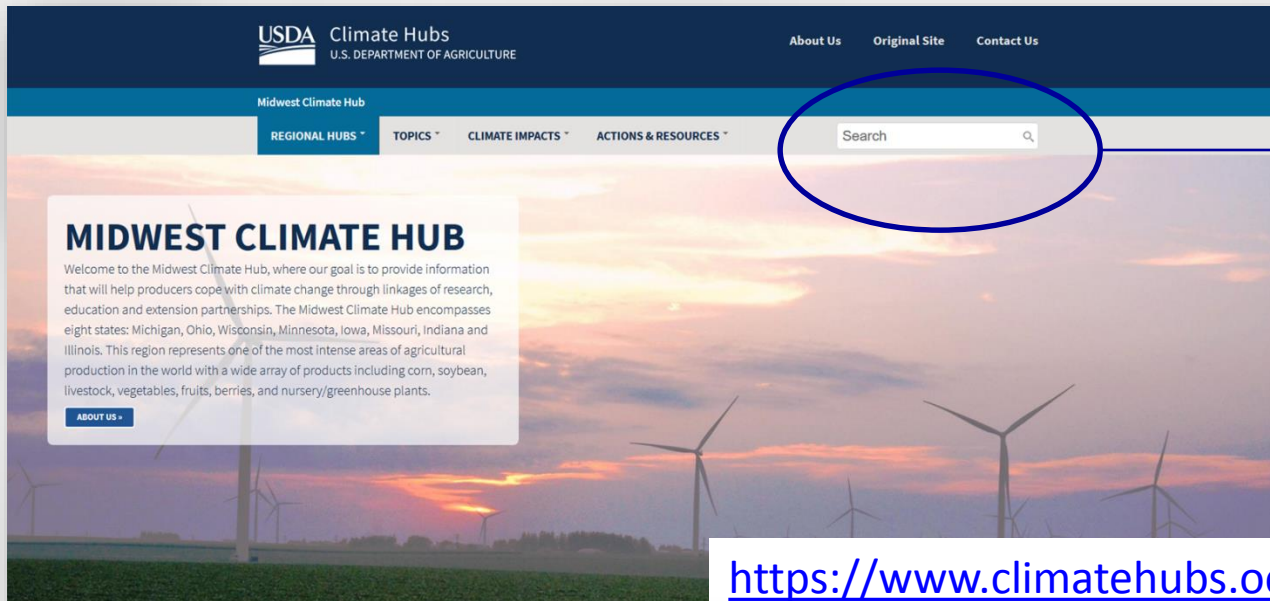
**Alfalfa Hay (Dry) 2013
Harvested Acres by County
for Selected States**



**Winter Wheat 2013
Planted Acres by County
for Selected States**



Resources: Website



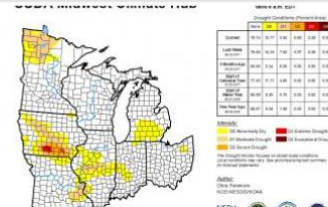
Search for tools, research and events by Region, Topic, type of crop, or climate Impact.

<https://www.climatehubs.oce.usda.gov/hubs/midwest>



Agriculture in the Midwest

The Midwest represents one of the most intense areas of agricultural production in the world and consistently affects the global economy. Agriculture is impacted by climate. Find out how and how best to adapt agricultural practices to maintain yields here.



Climate and Agriculture


Agriculture is indelibly connected to surrounding weather and climate conditions, which impact crop growth along with diseases and soils. Understanding current weather and climate issues is imperative to supporting sustainable crop production in the Midwest.



Additional Resources and Tools

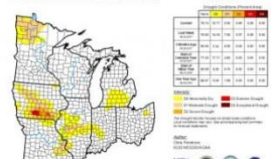
For the most up to date newsletters, research publications and events, check out this Additional Resources page. Access to the Midwest Climate Hub archives and additional Tools can also be found here.

Resources: Operational Products




Agriculture in the Midwest

The Midwest represents one of the most intense areas of agricultural production in the world, and consistently affects the global economy. Agriculture is impacted by climate. Find out how and how best to adapt agricultural practices to maintain yields here.



Climate and Agriculture


Agriculture is indelibly connected to surrounding weather and climate conditions, which impact crop growth along with diseases and soils. Understanding current weather and climate issues is imperative to supporting sustainable crop production in the Midwest.



Additional Resources and Tools


For the most up to date newsletters, research publications and events, check out this Additional Resources page. Access to the Midwest Climate Hub archives and additional tools can also be found here.

Midwest Ag-Focus Climate outlook

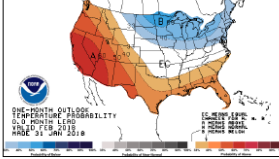


Midwest Climate Hub
 U.S. DEPARTMENT OF AGRICULTURE

Midwest Ag-Focus Climate Outlook



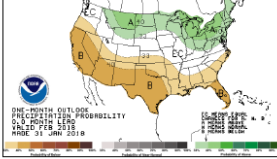
Outlook



OUTLOOK
 Q1 - MONTH OUTLOOK
 TEMPERATURE PROBABILITY
 0-10° WARMER
 10-20° WARMER
 20-30° WARMER
 30-40° WARMER
 40-50° WARMER
 50-60° WARMER
 60-70° WARMER
 70-80° WARMER
 80-90° WARMER
 90-100° WARMER
 100-110° WARMER
 110-120° WARMER
 120-130° WARMER
 130-140° WARMER
 140-150° WARMER
 150-160° WARMER
 160-170° WARMER
 170-180° WARMER
 180-190° WARMER
 190-200° WARMER
 200-210° WARMER
 210-220° WARMER
 220-230° WARMER
 230-240° WARMER
 240-250° WARMER
 250-260° WARMER
 260-270° WARMER
 270-280° WARMER
 280-290° WARMER
 290-300° WARMER
 300-310° WARMER
 310-320° WARMER
 320-330° WARMER
 330-340° WARMER
 340-350° WARMER
 350-360° WARMER
 360-370° WARMER
 370-380° WARMER
 380-390° WARMER
 390-400° WARMER
 400-410° WARMER
 410-420° WARMER
 420-430° WARMER
 430-440° WARMER
 440-450° WARMER
 450-460° WARMER
 460-470° WARMER
 470-480° WARMER
 480-490° WARMER
 490-500° WARMER
 500-510° WARMER
 510-520° WARMER
 520-530° WARMER
 530-540° WARMER
 540-550° WARMER
 550-560° WARMER
 560-570° WARMER
 570-580° WARMER
 580-590° WARMER
 590-600° WARMER
 600-610° WARMER
 610-620° WARMER
 620-630° WARMER
 630-640° WARMER
 640-650° WARMER
 650-660° WARMER
 660-670° WARMER
 670-680° WARMER
 680-690° WARMER
 690-700° WARMER
 700-710° WARMER
 710-720° WARMER
 720-730° WARMER
 730-740° WARMER
 740-750° WARMER
 750-760° WARMER
 760-770° WARMER
 770-780° WARMER
 780-790° WARMER
 790-800° WARMER
 800-810° WARMER
 810-820° WARMER
 820-830° WARMER
 830-840° WARMER
 840-850° WARMER
 850-860° WARMER
 860-870° WARMER
 870-880° WARMER
 880-890° WARMER
 890-900° WARMER
 900-910° WARMER
 910-920° WARMER
 920-930° WARMER
 930-940° WARMER
 940-950° WARMER
 950-960° WARMER
 960-970° WARMER
 970-980° WARMER
 980-990° WARMER
 990-1000° WARMER

Cold is likely to continue overall through February, though easing in the latter part of the month especially further north. Computer models are not handling precipitation well. There are several upcoming small chances for precipitation. Larger events start to become more likely during February.

Looking ahead to planting season - It is still early to say too much. Mostly moderate to dry soils should warm and dry reasonably well. Dry soils in MO, IA, IL, the Dakotas and western Minnesota could still be a problem.



OUTLOOK
 Q1 - MONTH OUTLOOK
 PRECIPITATION PROBABILITY
 0-10% MORE
 10-20% MORE
 20-30% MORE
 30-40% MORE
 40-50% MORE
 50-60% MORE
 60-70% MORE
 70-80% MORE
 80-90% MORE
 90-100% MORE
 100-110% MORE
 110-120% MORE
 120-130% MORE
 130-140% MORE
 140-150% MORE
 150-160% MORE
 160-170% MORE
 170-180% MORE
 180-190% MORE
 190-200% MORE
 200-210% MORE
 210-220% MORE
 220-230% MORE
 230-240% MORE
 240-250% MORE
 250-260% MORE
 260-270% MORE
 270-280% MORE
 280-290% MORE
 290-300% MORE
 300-310% MORE
 310-320% MORE
 320-330% MORE
 330-340% MORE
 340-350% MORE
 350-360% MORE
 360-370% MORE
 370-380% MORE
 380-390% MORE
 390-400% MORE
 400-410% MORE
 410-420% MORE
 420-430% MORE
 430-440% MORE
 440-450% MORE
 450-460% MORE
 460-470% MORE
 470-480% MORE
 480-490% MORE
 490-500% MORE
 500-510% MORE
 510-520% MORE
 520-530% MORE
 530-540% MORE
 540-550% MORE
 550-560% MORE
 560-570% MORE
 570-580% MORE
 580-590% MORE
 590-600% MORE
 600-610% MORE
 610-620% MORE
 620-630% MORE
 630-640% MORE
 640-650% MORE
 650-660% MORE
 660-670% MORE
 670-680% MORE
 680-690% MORE
 690-700% MORE
 700-710% MORE
 710-720% MORE
 720-730% MORE
 730-740% MORE
 740-750% MORE
 750-760% MORE
 760-770% MORE
 770-780% MORE
 780-790% MORE
 790-800% MORE
 800-810% MORE
 810-820% MORE
 820-830% MORE
 830-840% MORE
 840-850% MORE
 850-860% MORE
 860-870% MORE
 870-880% MORE
 880-890% MORE
 890-900% MORE
 900-910% MORE
 910-920% MORE
 920-930% MORE
 930-940% MORE
 940-950% MORE
 950-960% MORE
 960-970% MORE
 970-980% MORE
 980-990% MORE
 990-1000% MORE


Partners and Contributors

- [United States Department of Agriculture \(USDA\)](#)
- [National Oceanic and Atmospheric Administration \(NOAA\)](#)
- [Climate Prediction Center \(CPC\)](#)
- [National Weather Service \(NWS\)](#)
- [National Center for Environmental Information \(NCEI\)](#)
- [National Drought Mitigation Center \(NDMC\)](#)
- [National Integrated Drought Information System \(NIDIS\)](#)
- [Midwestern Regional Climate Center \(MRCC\)](#)
- [Midwest State Climatologists](#)

For More Information


Charlene Felkey, Coordinator
 USDA Midwest Climate Hub
 1015 N University Blvd., Ames, IA 50011
 515-284-6158
midwestclimatehub@ars.usda.gov

For more information, please visit:
<http://www.midwestclimatehub.usda.gov/midwest>

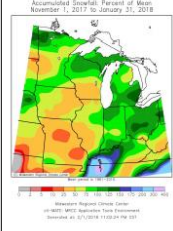


Midwest Climate Hub
 U.S. DEPARTMENT OF AGRICULTURE

Midwest Ag-Focus Climate Outlook

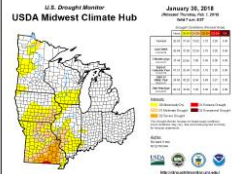


Current Conditions



Accumulated Snowfall: Percent of Mean
 November 1, 2017 to January 21, 2018

The winter temperature flip/flop has continued between extreme warm and cold across the region several times this winter. One analysis had most stations in the Midwest with their most warmest January temperatures on record. Snow has been generally limited to a few larger events leaving soils uncovered or only marginally covered in many areas. The lack of snow (after a mostly dry fall) has also contributed to conditions on the US Drought Monitor reading 5-10 levels in large parts of Missouri and smaller parts of Iowa and Illinois. Carry-over drought conditions still exist in the northern plains.



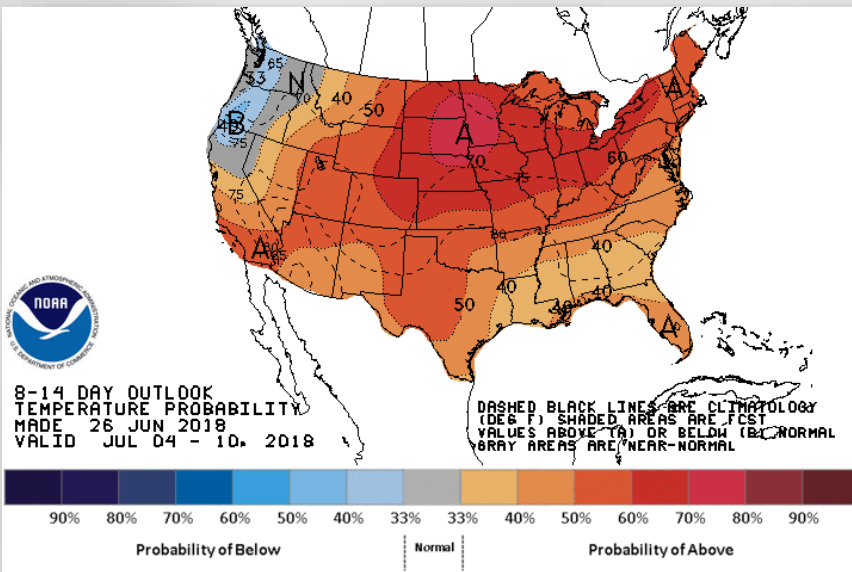
U.S. Drought Monitor
 January 30, 2018
 Official Reporting Date: Feb 02, 2018

Impacts

Impacts are somewhat limited in agriculture given the time of year. The most apparent ones have been in the drought-impacted locations of MO and IL, where lack of feed and low water levels in ponds have forced management changes and some sell-offs in cattle. Some of the extreme cold in late December/early January may have damaged some buds on fruit trees. The cold is expected to help with some pest issues at least this year. The uncovered soil along with cold temperatures has pushed frost depths to 3-4 ft in many areas. Enough to cause some water main breaks and a few other issues.

For more information, please visit:
<http://www.midwestclimatehub.usda.gov/midwest>

Sample information-outlooks



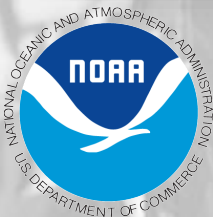
- High probability of above avg. temperatures
- Corn reaching reproductive stage
 - High water use – ET (very humid conditions likely)
 - More potential stress on corn
 - Livestock stress and potentially loss.
- Recent rains help part but also add to humidity

Monthly Climate-Drought Outlook Webinars

Midwest and Great Plains Climate- Drought Outlook 17 May 2018

Photo:
Pete
Boulay

Dr. Dennis Todey
Director – USDA Midwest
Climate Hub
Nat'l Lab. for Ag. and Env.
Ames, IA
dennis.todey@ars.usda.gov
515-294-2013



Drought Status Updates

Drought Status Update
MIDWEST & NORTHERN PLAINS
JUNE 21, 2018

National Integrated Drought Information System
drought.gov

Drought Concerns Linger With Above-Normal Temperatures

- Recent rainfalls have eased some immediate drought concerns. However, warmth and existing drought conditions will continue to pose potential problems for the region.
- Above-normal temperatures are likely to return in mid-summer, causing potential stress on crops during critical crop growth stages.

CURRENT CONDITIONS

- Soaring extreme and consistently warm temperatures since early May over much of the central U.S. have exacerbated drought, and increased concerns for drought worsening across the area.
- The persistent above-normal temperatures have increased evapotranspiration for a broad area of the central U.S., resulting in reduced soil moisture and crop stress.
- The warm temperatures have been coupled with very dry conditions throughout much of the region. Over the last 30 days, rainfall has only been 10-75% of normal in several areas across the North Central U.S. (Figure 3).
- Recent widespread rains have eased some near-term drought issues, however some areas of drought did not receive significant rainfall.

IMPACTS

- Significant drought impacts that have been reported include major wildfires (CO), crop stress (IL, MO, SD, ND, IA) and some water supply issues (ND). Corn leaves have been rolling in many states, which is a sign of water deficiency.
- Crop phenology in all of these states is entering a time where crop water use will increase quickly, which increases the potential for more crop issues.
- In addition, streamflows have fallen below average in some areas from Colorado to western Illinois.

For more information about NIDIS, visit www.nidis.gov

- Partnered with other federal agencies to create a drought update
- Will continue updating when conditions warrant

<https://www.drought.gov/drought/node/58356>

Resources: Website

Agriculture in the Midwest
The Midwest represents one of the most intense areas of agricultural production in the world and consistently affects the global economy. Agriculture is impacted by climate. Find out how and how best to adapt agricultural practices to maintain yields here.

Climate and Agriculture
Agriculture is indelibly connected to surrounding weather and climate conditions, which impact crop growth along with diseases and soils. Understanding current weather and climate issues is imperative to supporting sustainable crop production in the Midwest.

Additional Resources and Tools
For the most up to date newsletters, research publications and events, check out this Additional Resources page. Access to the Midwest Climate Hub archives and additional Tools can also be found here.

To our Newsletter, Resources, Publications and One-Pagers

USDA Midwest Climate Hub
U.S. DEPARTMENT OF AGRICULTURE

Midwest CHU

Climate Hub Update
Winter 2018

Promoting Climate-Informed Decisions Since 2014.

USDA
United States Department of Agriculture

ADAPTATION RESOURCES FOR AGRICULTURE

Responding to Climate Variability and Change in the Midwest and Northeast

DECEMBER 2017 - VOL. 45 - NO. 6

ENVIRONMENTAL ENTOMOLOGY

ACADEMIC.DUP.COM/EE
INSECTSCIENCE.ORG

OXFORD
UNIVERSITY PRESS

USDA United States Department of Agriculture
Midwest Climate Hub

Potential Geographical Range & Abundance of the Invasive Brown Marmorated Stink Bug under Climate Change Scenarios

By Gina J. Keller, Professor, Research Fellow, USDA Midwest Climate Hub

Climate change is predicted to exacerbate agricultural losses from crop pests and pathogens by 1) expanding their geographic ranges, 2) reducing water use-eff, and 3) increasing the number of generations produced per year. For example, numerous crop pests and pathogens have expanded their range northward since the 1900s due, in part, to warming annual temperatures.

A Case Study with a Recent Invader

The brown marmorated stink bug, *Halyomorpha halys* (BMGB), is native to East Asia where it is a minor pest of fruit trees with occasional outbreaks. In less than twenty years, BMGB has become a major specialty crop pest in the U.S. due to lack of natural enemies and an abundance of food. Since its initial discovery in Pennsylvania in 1996, BMGB has been detected in 49 U.S. states. It is which currently reports reports agricultural losses from this invasive pest. Alarmingly, BMGB populations in many U.S. states are continuing to grow and spread.

BMGB is not a picky eater with > 300 known host plants including economically important crops like apples, sweet corn, tomatoes and soybeans. BMGB is also a nuisance pest as it will enter into human-made structures. This highly adaptable pest poses a serious threat to the United States specialty crop industry. Specialty crop losses from BMGB are expected to increase under ongoing climate change as rising temperatures, especially in the winter, will likely enable BMGB to further expand its range northward as well as enhance BMGB survival and reproduction.

1975 Projected BMGB Distribution

For more information on the Midwest Climate Hub, please visit:
<https://www.fsmathub.usda.gov/publications>

Summary

- Current conditions
 - Drought issues still pervasive – slow recovery likely
 - Decent conditions much of Corn Belt
- Outlook
 - Early harvest likely
 - Watch El Niño coming this winter
 - Longer issues – continue with similar trends (w/variability)
 - Overall changes likely

For More Information



Midwest Climate Hub



@dennistodey



<https://www.climatehubs.ocs.usda.gov/hubs/midwest>



Charlene Felkley, Coordinator

515-294-0136

Charlene.felkley@ars.usda.gov

Dennis Todey, Director

515-294-2013

Dennis.todey@ars.usda.gov

Erica Kistner, Fellow

515-294-9602

Erica.kristner@ars.usda.gov

National Laboratory for Agriculture and the Environment

Attn: Midwest Climate Hub

1015 N University Blvd

Ames, Iowa 50011-3611



Midwest Climate Hub

U.S. DEPARTMENT OF AGRICULTURE