USDA Midwest Climate Hub
U.S. DEPARTMENT OF AGRICULTURE

# Weather/Climate Issues for Ag 2019 and Beyond

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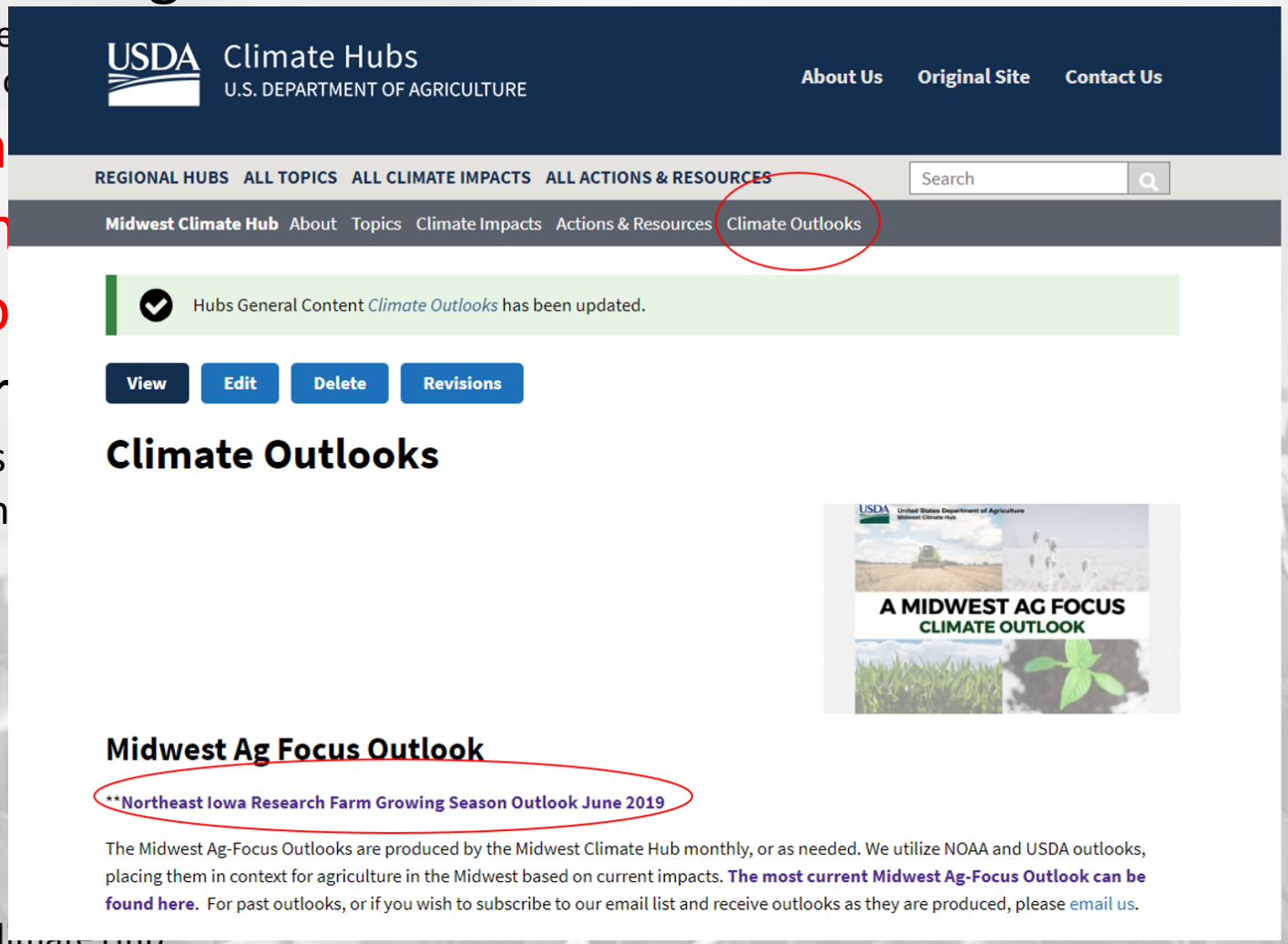
# Topics

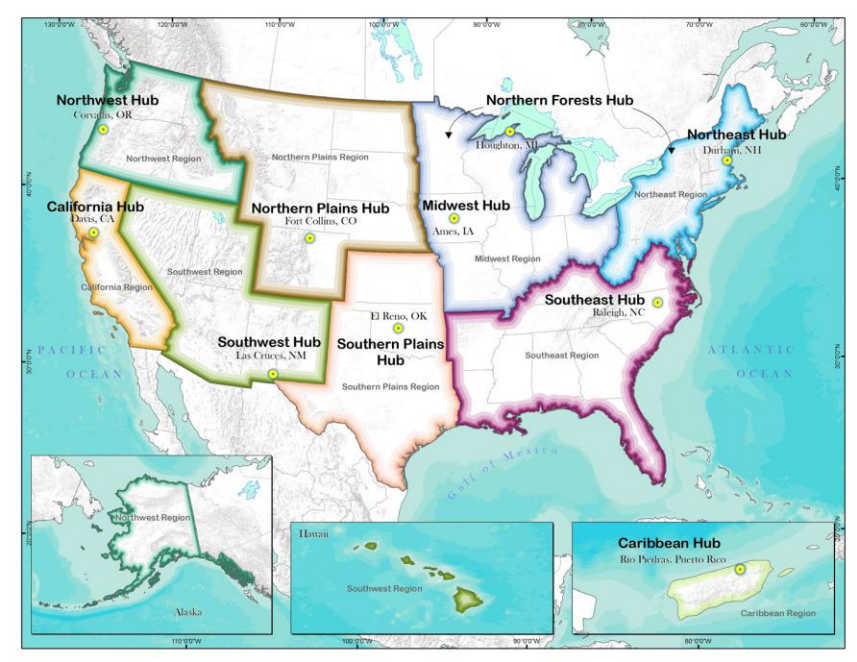
- A brief Background of USDA Climate Hubs
  - The need, mission
  - More on the Midwest Climate Hub
- Tools
- Long Term Crop Impacts
- Monitoring
- Outlooks
- Resources of the USDA Midwest Climate Hub
  - Website
  - For more Information

# Topics

- A brief Background of USDA Climate Hubs
  - The ne
  - More
- Curren
- Crop In
- Outloo
- Resour
  - Webs
  - For m



# Intro to Climate Hub Work




**Assessments and Syntheses**
*delivering relevant information*

**Outreach and Education**
*enabling climate-informed decisions*

**Technical Support**
*facilitating engagement, discovery and exchange*

Agricultural Research Service

NRCS

# 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.

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# MCH Thematic Areas

**Assessments and Syntheses**
*delivering relevant information*

USDA NIFA
United States Department of Agriculture
National Institute of Food and Agriculture


AMERICAN FRUIT GROWER

U.S. Global Change Research Program
National Climate Assessment

AMERICAN Vegetable GROWER

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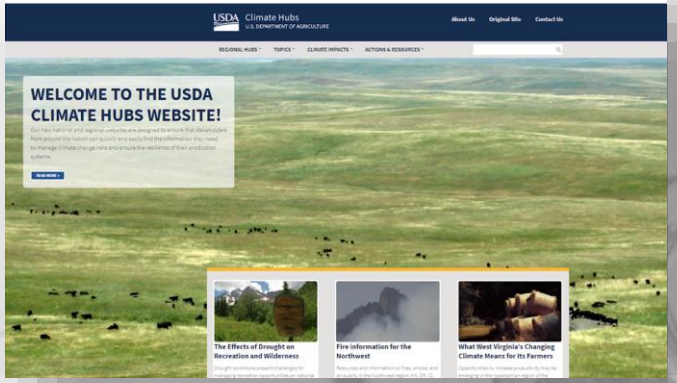
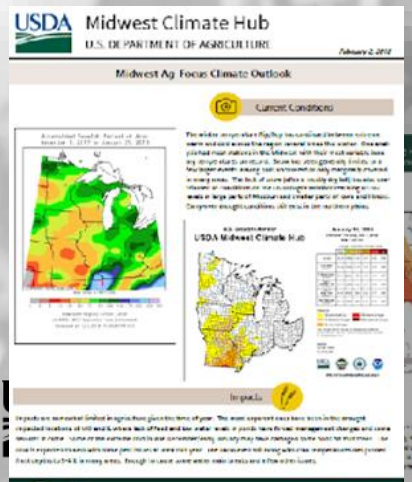
# MCH Thematic Areas

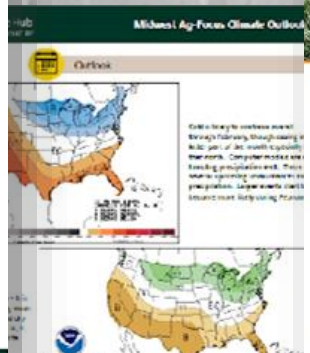
**Outreach and Education**
*enabling climate-informed decisions*

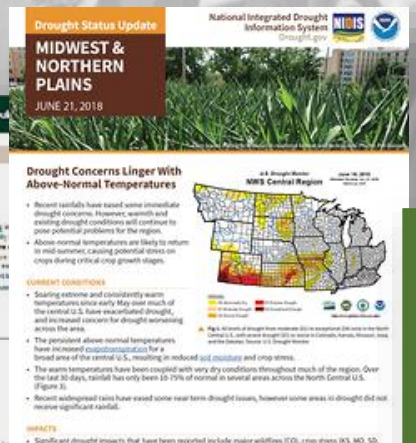
## MAC-T

**Midwest Agriculture and Climate Team**

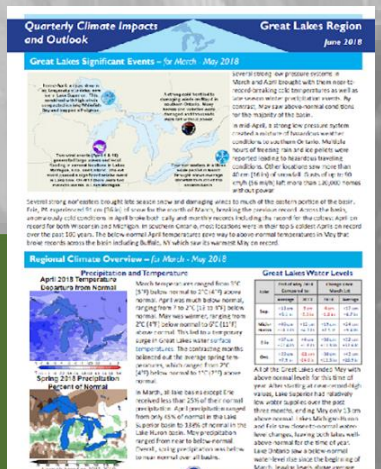


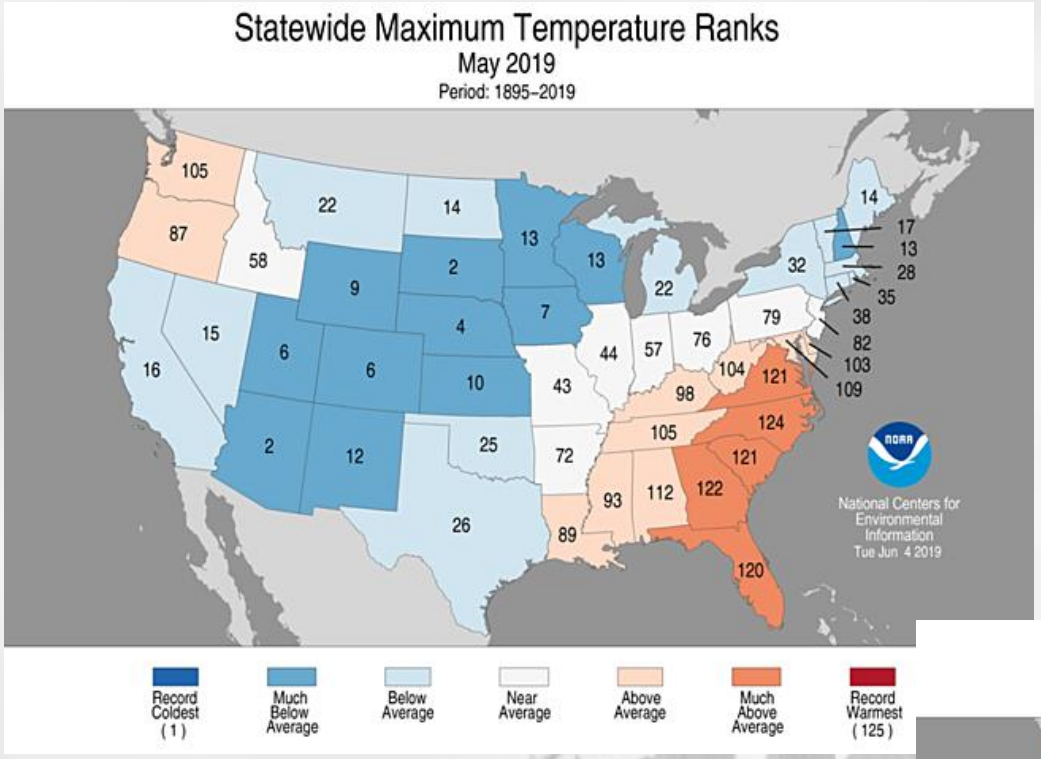



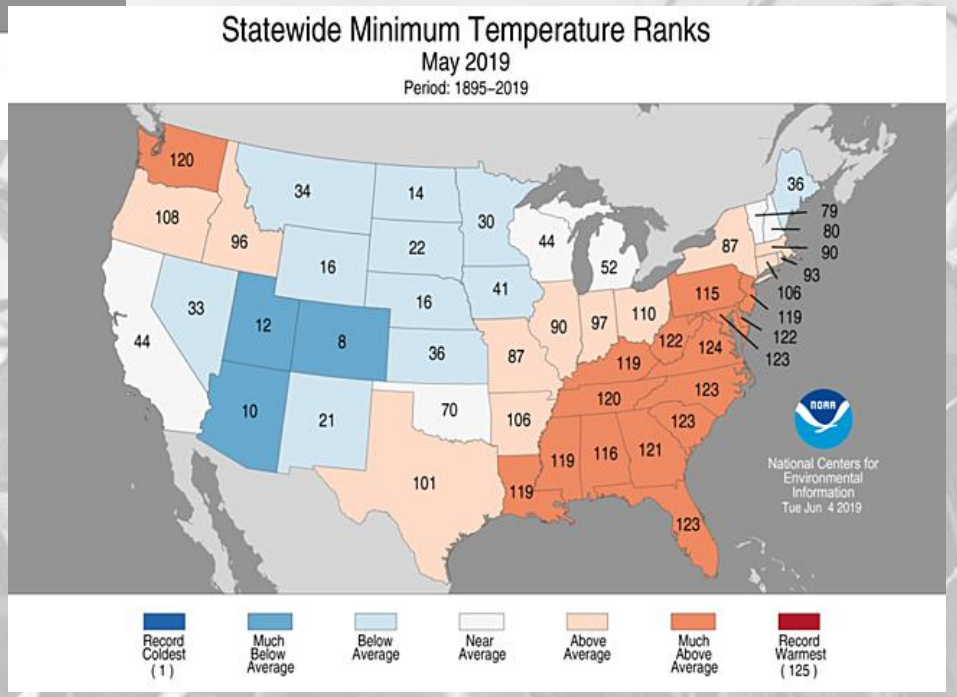







# May Temperature

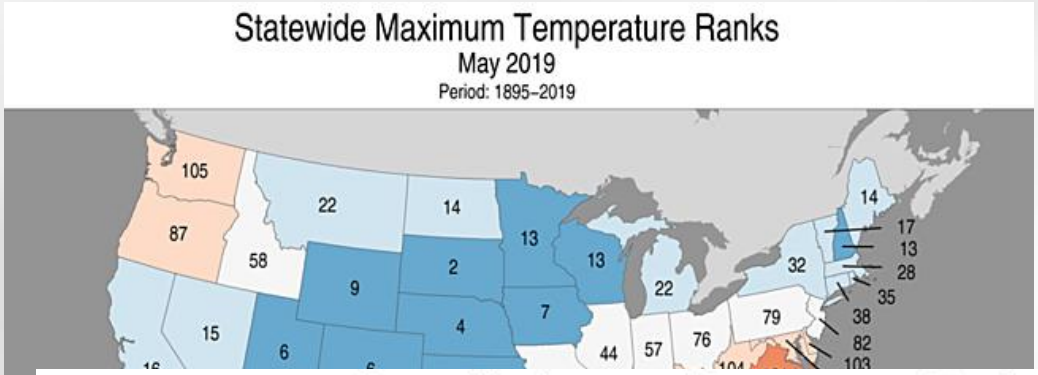


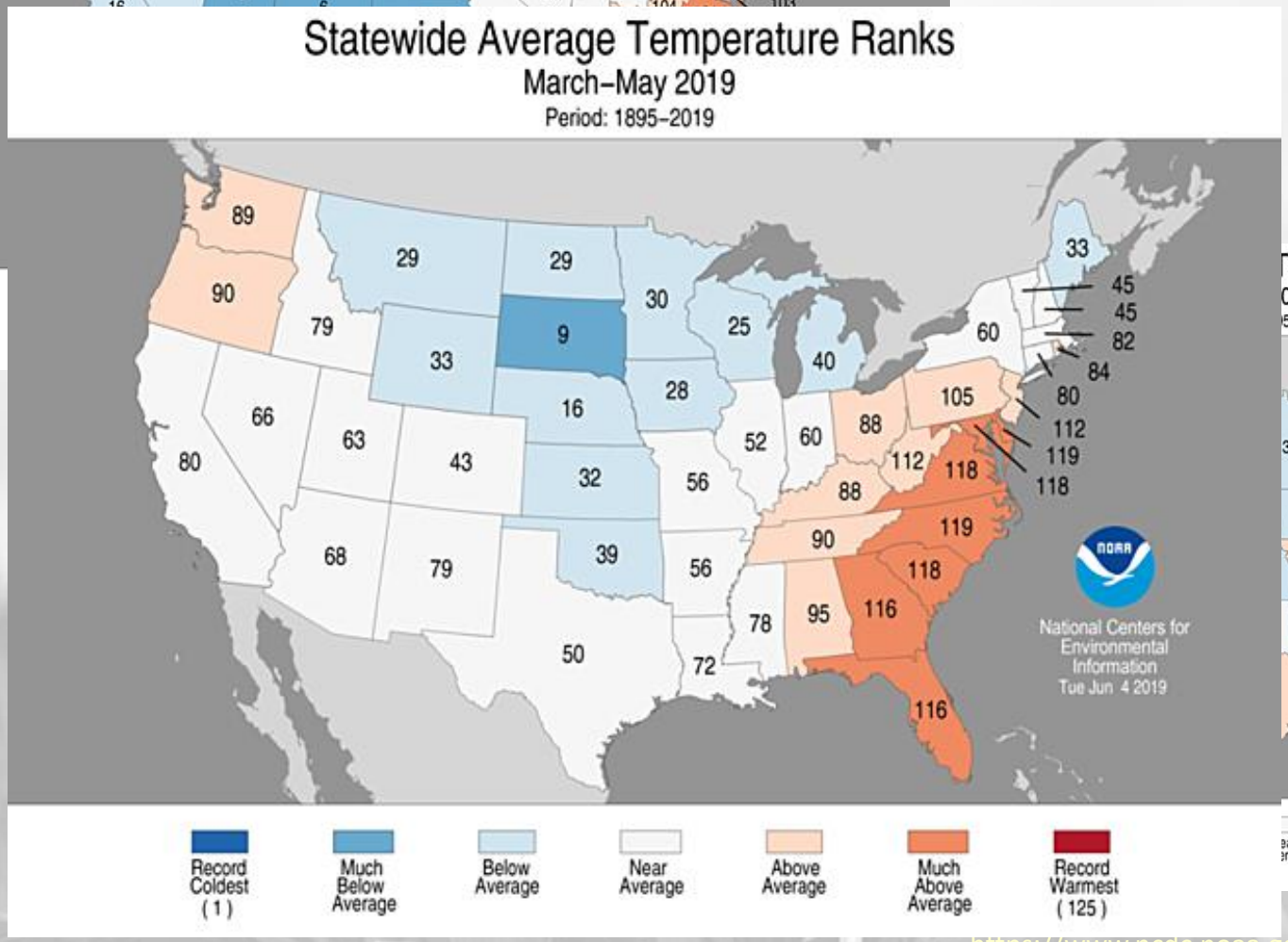



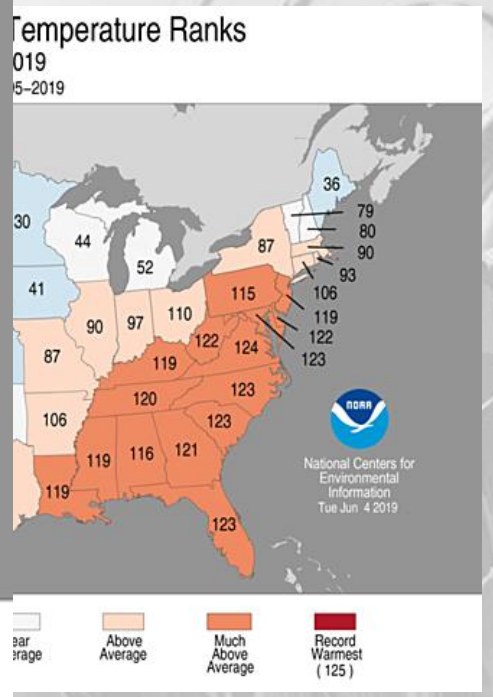

- May temperatures mostly colder than average. Signal more in the max temps.
- Top 10 coldest average highs central/western US.
- Warmer minimums eastern US

https://www.ncdc.noaa.gov/temp-and-precip/us-maps/

# Spring Temperature

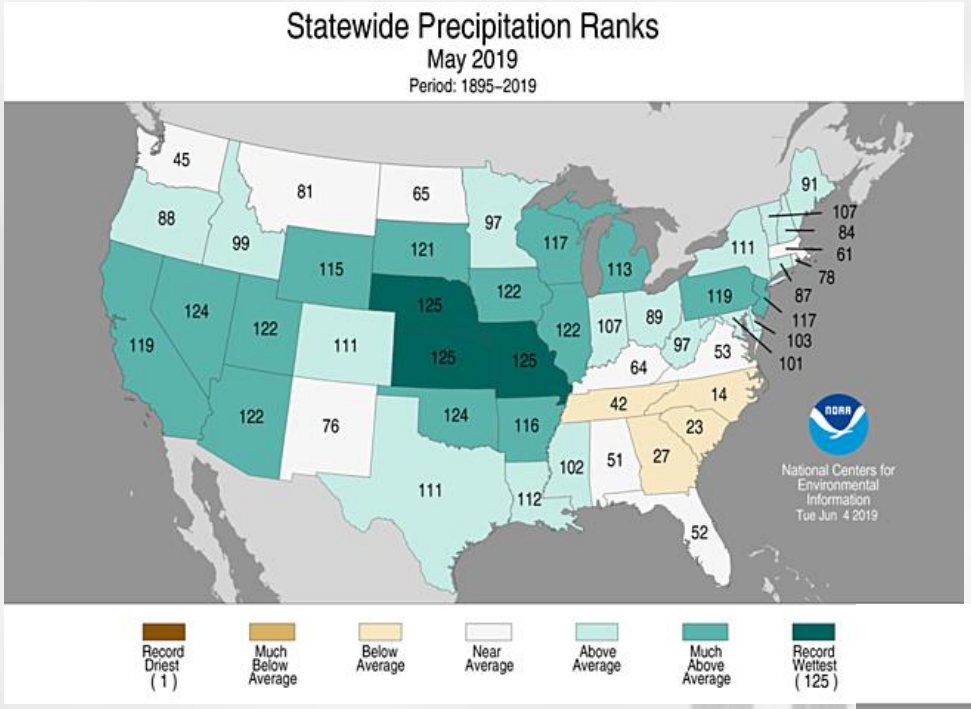


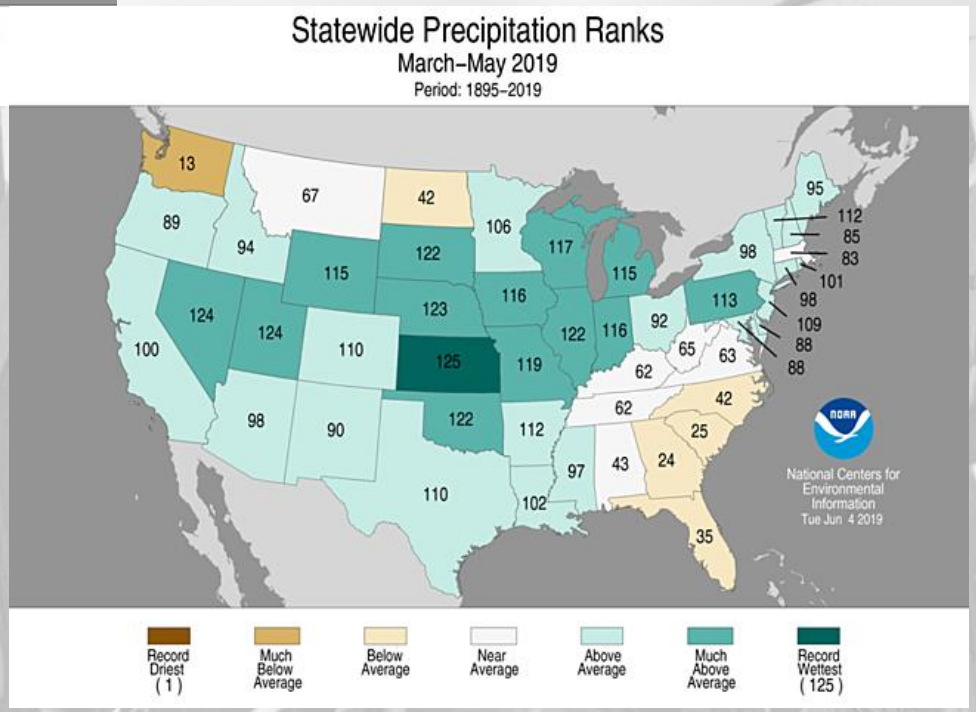




https://www.ncdc.noaa.gov/temp-and-precip/us-maps/

# May/Spring Precipitation

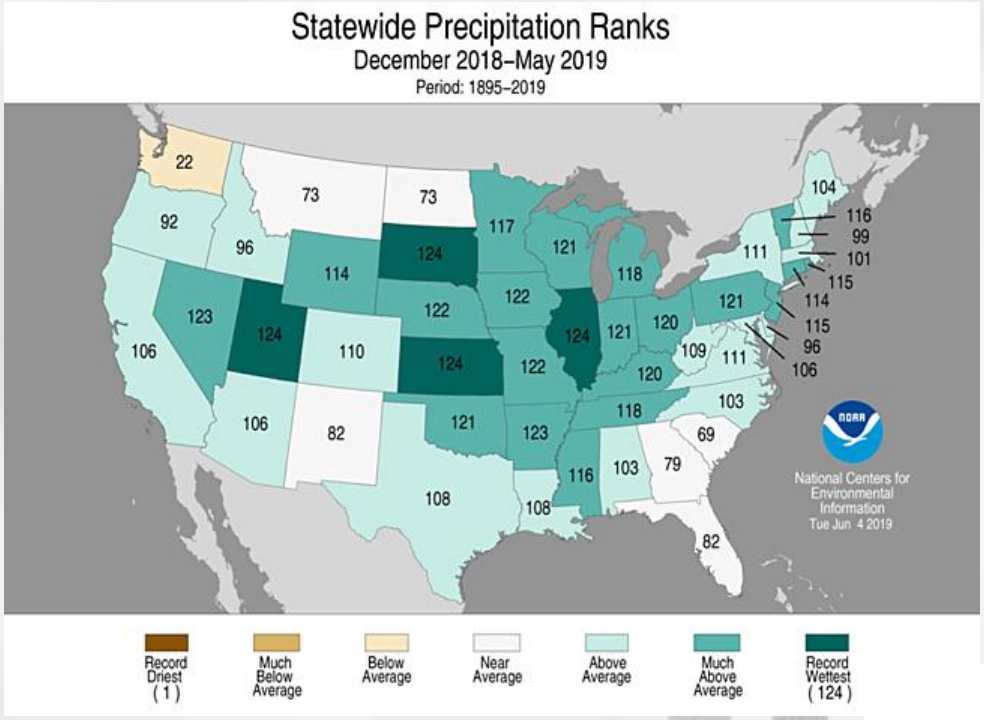


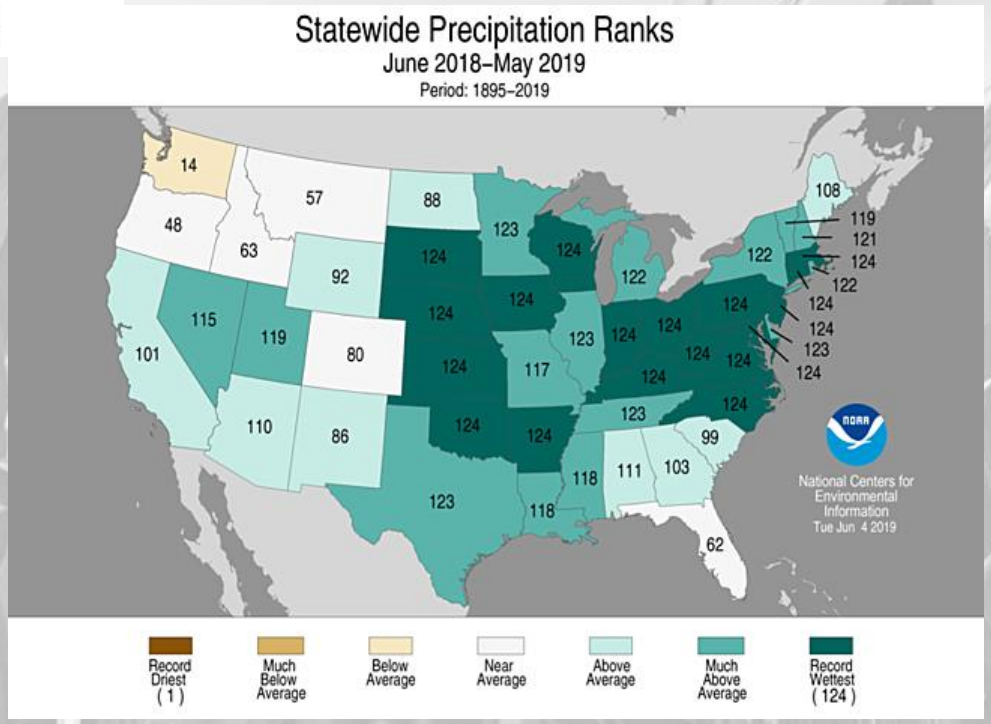




- May and spring precipitation well above average through middle US
- Top 10 and wettest all time for a few states at these time scales

https://www.ncdc.noaa.gov/temp-and-precip/us-maps/

# 6/12 Month Precipitation




- Extended period of wetness back to a year.
- Top 10/record wettest in states back to a year.
- Wetness problems are long term issues.
- Iowa wettest June-May period on record (124 years)

https://www.ncdc.noaa.gov/temp-and-precip/us-maps/

Using data to make decisions

# TOOLS

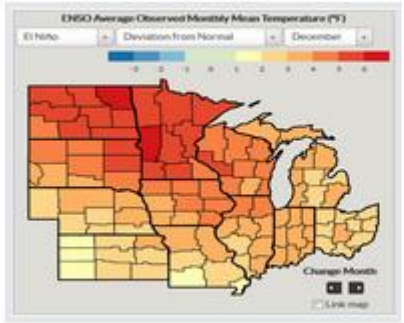
# Decision Support Tools

U2U to useful

## U2U$_{DST}$ SUITE

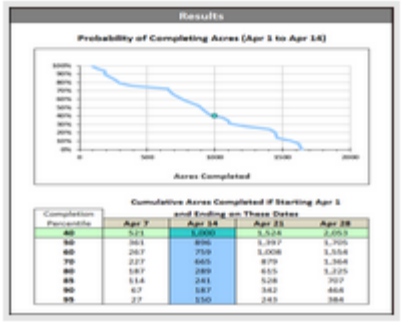
### AgClimate View$_{DST}$

A convenient way to access customized historical climate and crop yield data for the U.S. Corn Belt. View graphs of monthly temperature and precipitation, plot corn and soybean yield trends, and compare climate and yields over the past 30 years.




### Climate Patterns Viewer$_{DST}$

Discover how global climate patterns like the El Niño Southern Oscillation (ENSO) and Arctic Oscillation (AO) have historically affected local climate conditions and crop yields across the U.S. Corn Belt.

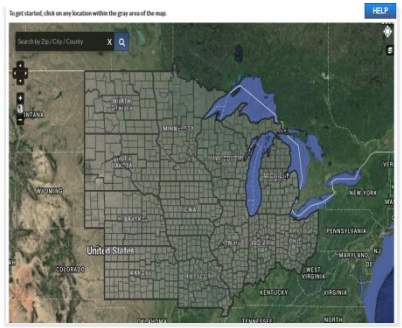



### Probable Fieldwork Days$_{DST}$

This spreadsheet-based tool uses USDA data on Days Suitable for Fieldwork to determine the probability of completing in-field activities during a user-specified time period. This product is currently available for Illinois, Iowa, Kansas, and Missouri. (Hosted by the University of Missouri)

### Corn GDD$_{DST}$

Track real-time and historical GDD accumulations, assess spring and fall frost risk, and guide decisions related to planting, harvest, and seed selection. This innovative tool integrates corn development stages with weather and climate data for location-specific decision support tailored specifically to agricultural production.




### Corn Split N$_{DST}$ (NEW!)

Determine the feasibility and profitability of using post-planting nitrogen application for corn production. This product combines historical data on crop growth and fieldwork conditions with economic considerations to determine best/worst /average scenarios of successfully completing nitrogen applications within a user-specified time period.

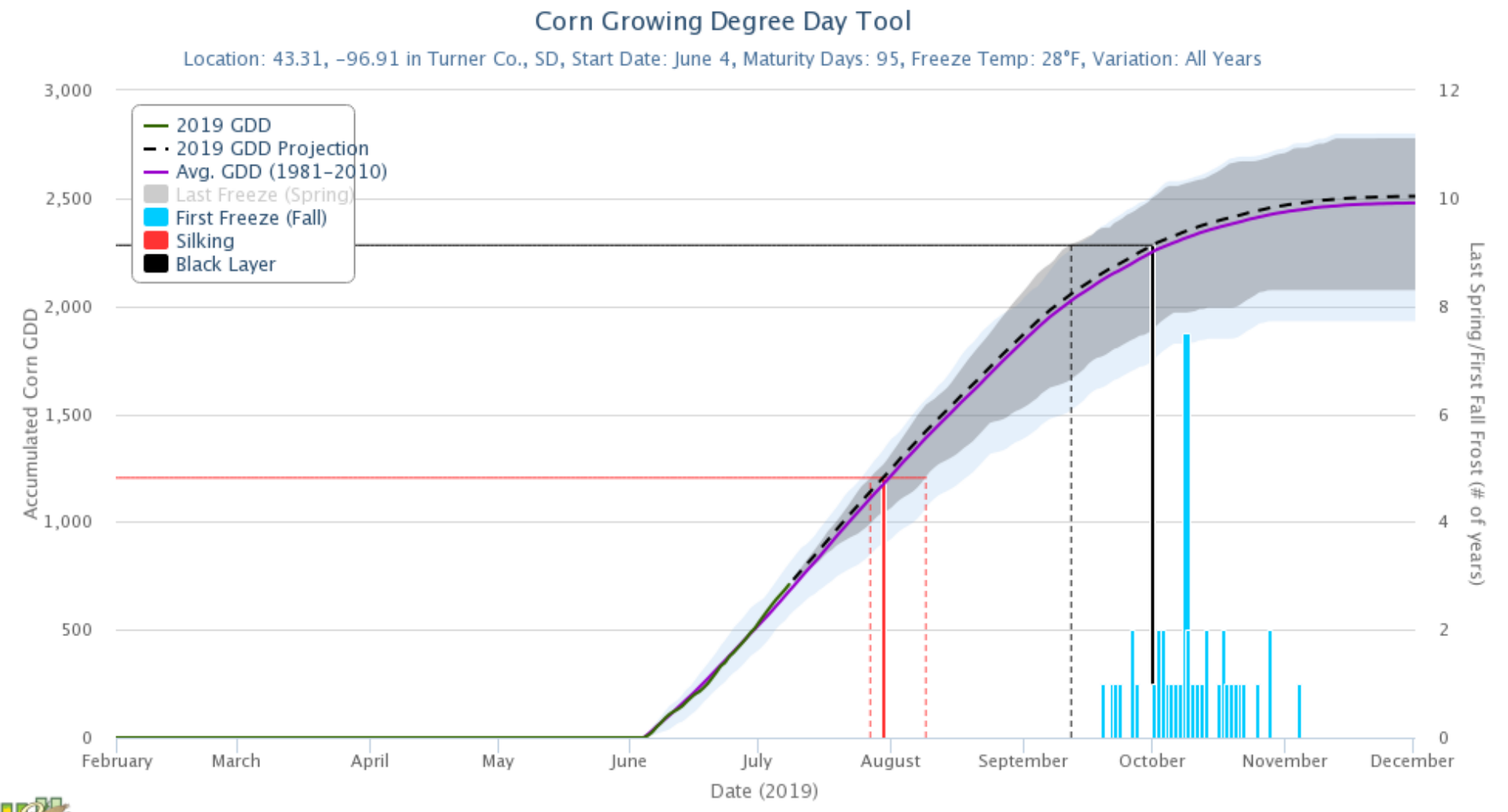
www.AgClimate4U.org

# Corn Growing Degree Days

This tool puts current conditions into a 30-year historical perspective and offers trend projections through the end of the calendar year. Growing Degree Day (GDD) projections, combined with analysis of historical analog data, can help you make decisions about:

- Climate Risks – Identify the likelihood of reaching maturity before frosts/freezes.
- Activity Planning – Consider corn hybrid estimated physiological maturity requirements, along with GDD projections when making seed purchasing and other growing season decisions.
- Marketing – Look at historical and projected GDD when considering forward pricing and crop insurance purchases.

# GDD Graph


Corn Growing Degree Day Tool
Location: 43.31, -96.91 in Turner Co., SD, Start Date: June 4, Maturity Days: 95, Freeze Temp: 28°F, Variation: All Years
2019 GDD
2019 GDD Projection
Avg. GDD (1981-2010)
Last Freeze (Spring)
First Freeze (Fall)
Silking
Black Layer
Accumulated Corn GDD
Last Spring/First Fall Frost (# of years)
3,000
2,500
2,000
1,500
1,000
500
0
12
10
8
6
4
2
0
February
March
April
May
June
July
August
September
October
November
December
Date (2019)
GDD Base 50/86 (degrees F); Created: 07/09/2019
GDD Base 50/86 (degrees F); Created: 10/09/2015

# U2U Tools

- High Plains Regional Climate Center
- https://hprcc.unl.edu/gdd.php

- Other ag tools there
  - Soil T
  - Vegetation/freeze
  - Others

Using data to make decisions

# LONG TERM IMPACTS - AGRICULTURE

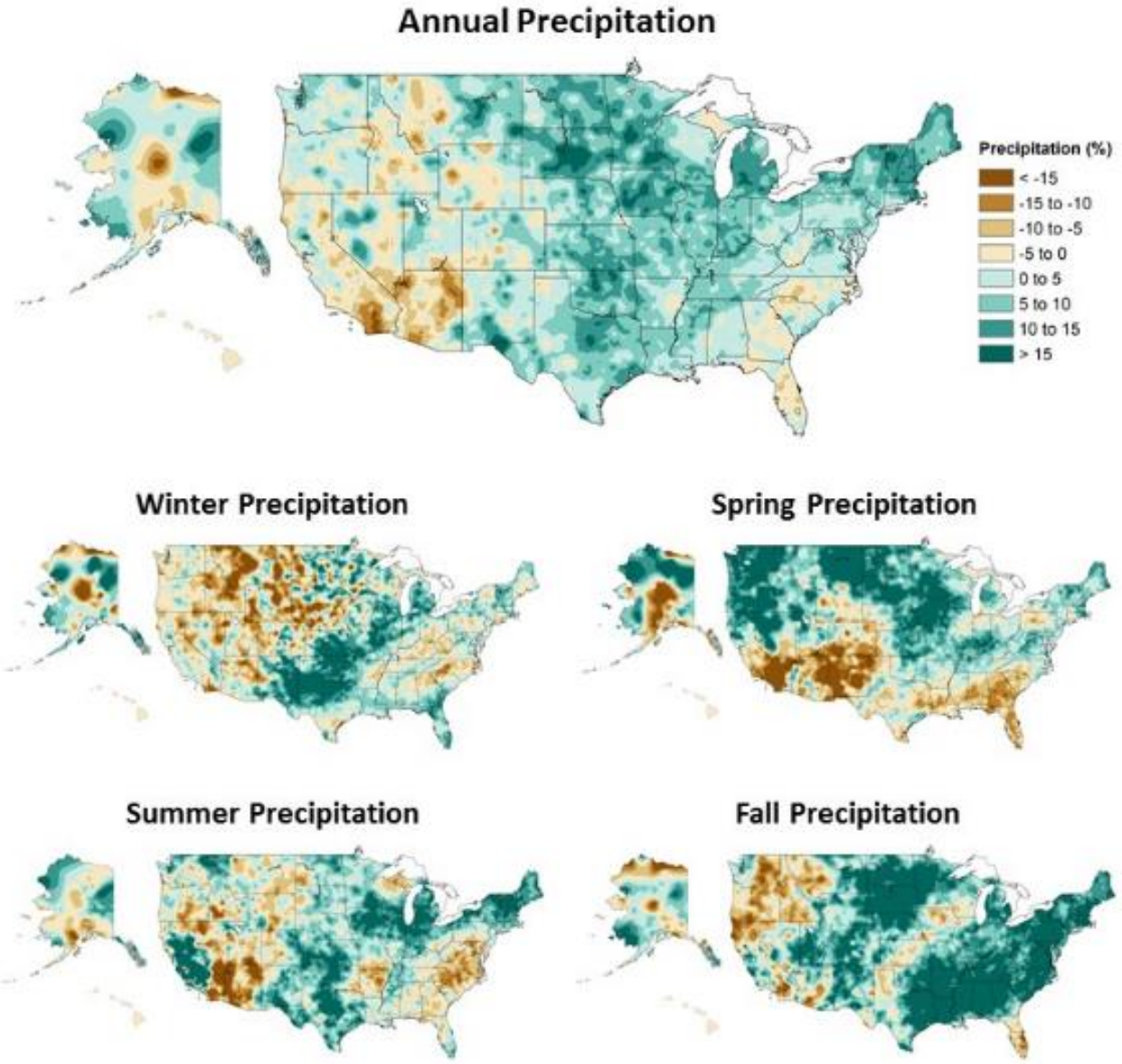
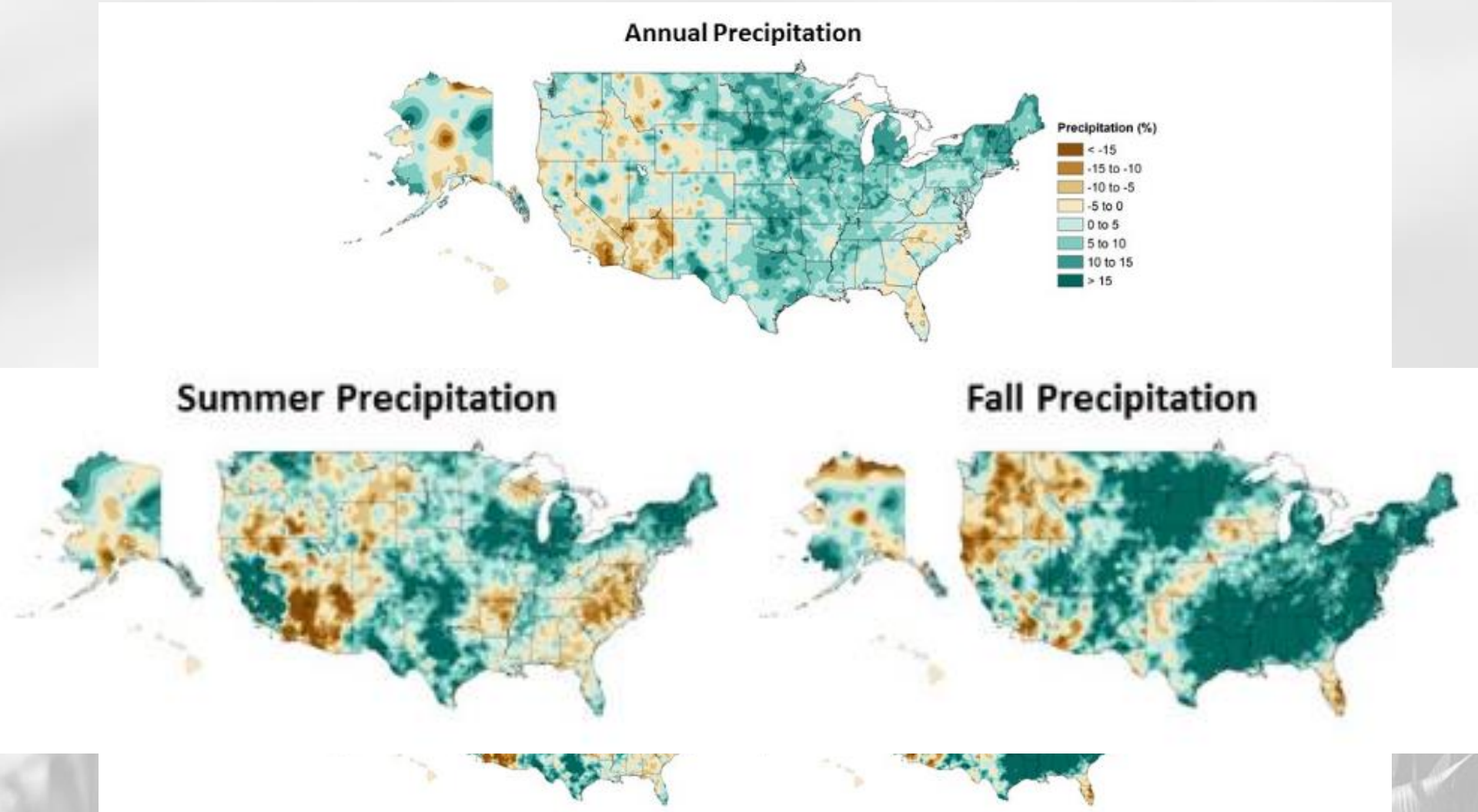



**Figure 7.1:** Annual and seasonal changes in precipitation over the United States. Changes are the average for present-day (1986–2015) minus the average for the first half of the last century (1901–1960 for the contiguous United States, 1925–1960 for Alaska and Hawai'i) divided by the average for the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

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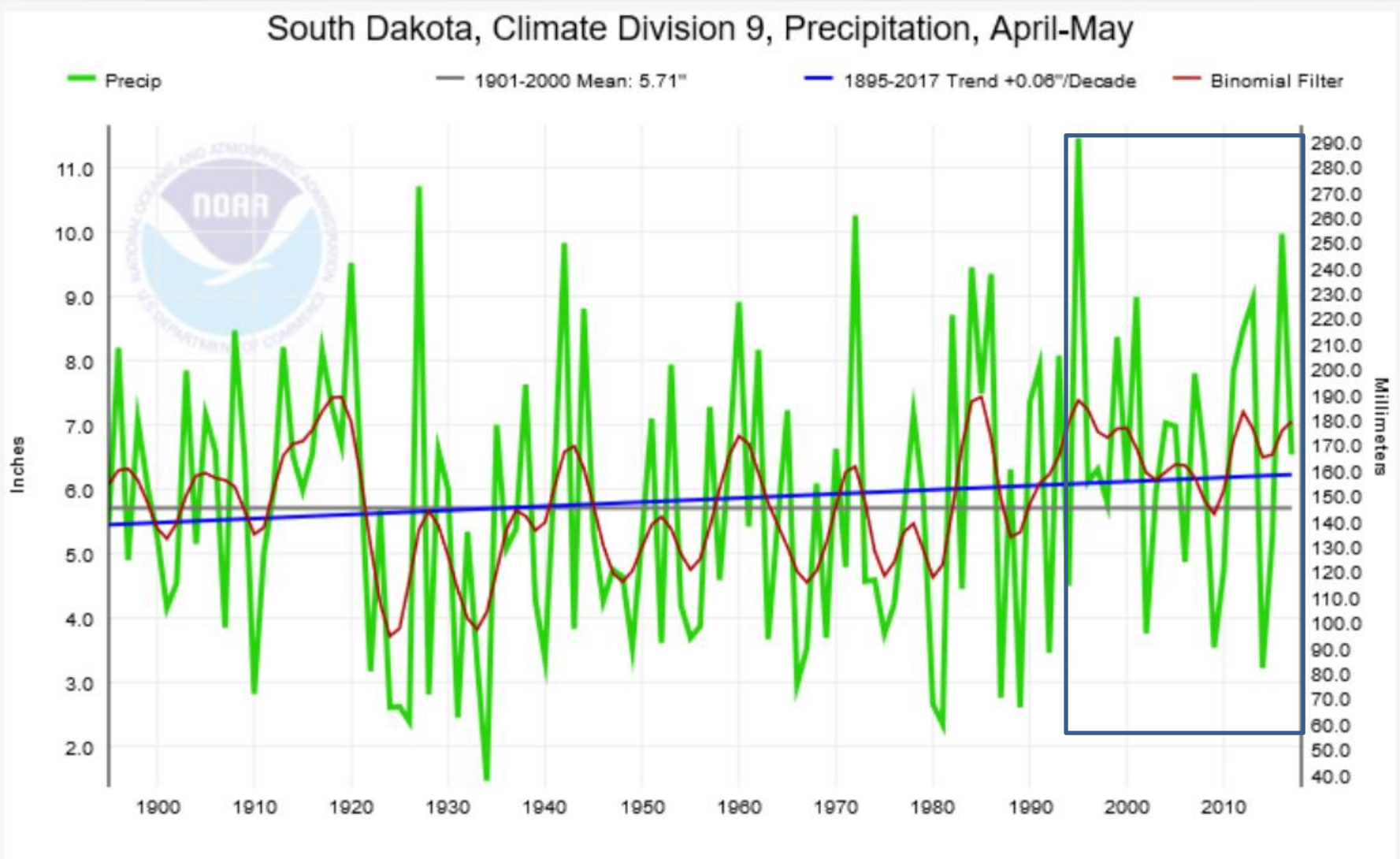
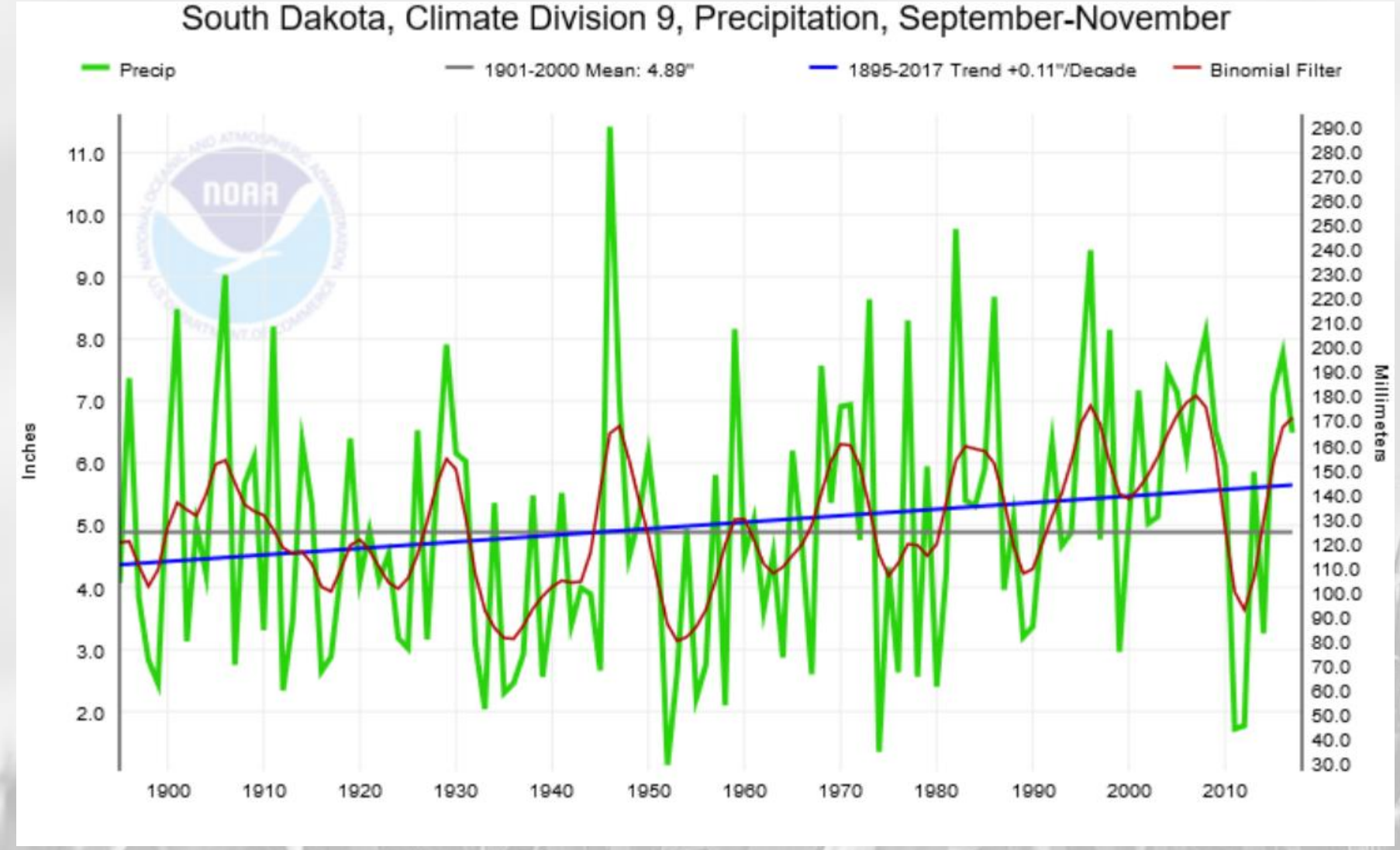



Only 6 of last 25 years below long term average.

https://www.ncdc.noaa.gov/cag/divisional/time-series

USDA



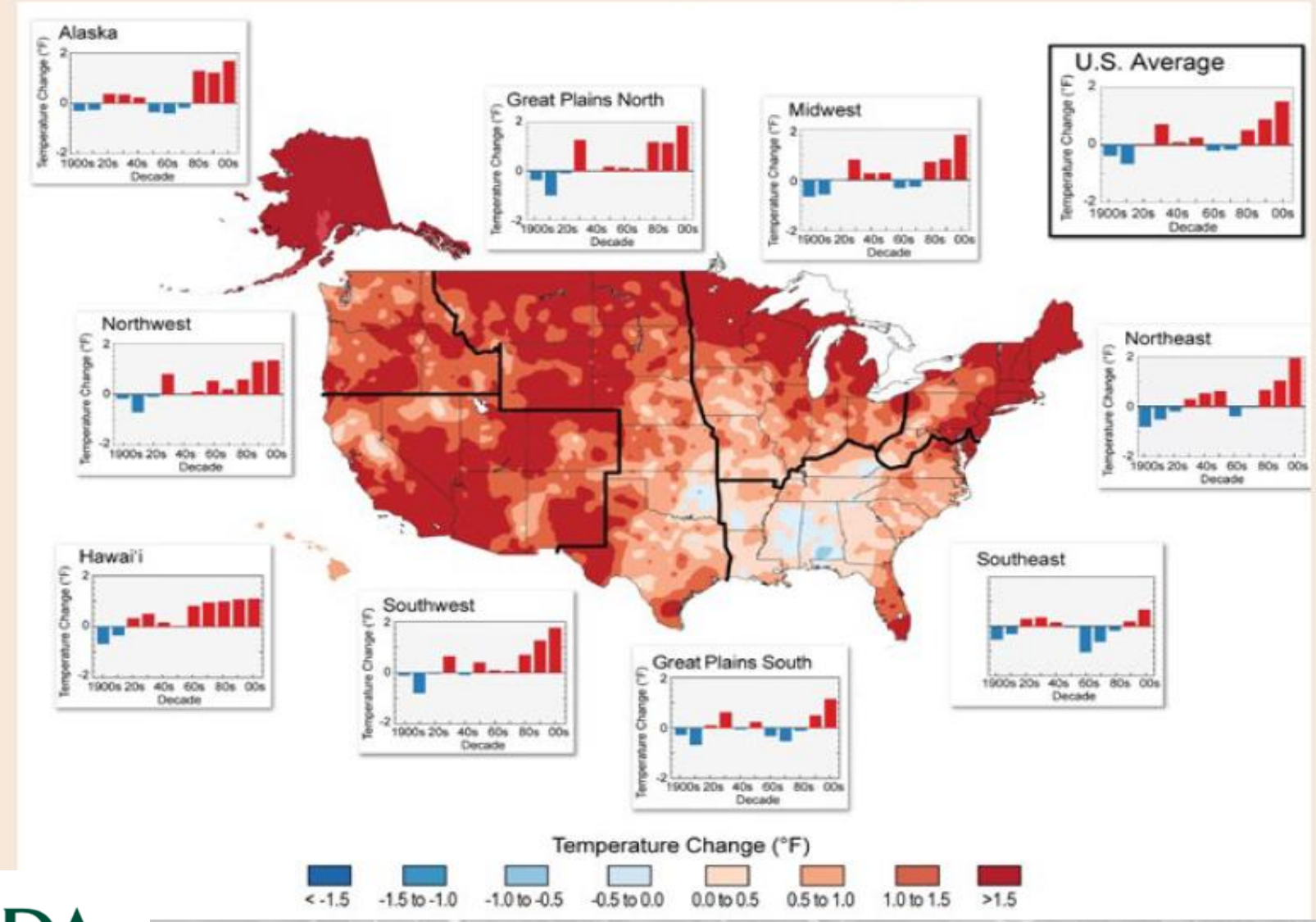

Only 5 of last 25 years below long term average.

https://www.ncdc.noaa.gov/cag/divisional/time-series

# Issues from Precip Changes

- Variable across the corn belt
- Increasing precip totals (especially off-season)
- More soil/nutrient loss potential
- Soil loss
  - Reducing tillage
  - Cover crops
- Nutrient loss
  - 4Rs
- Planting/harvesting issues
- Increased need for drainage

# Observed U.S. Temperature Change



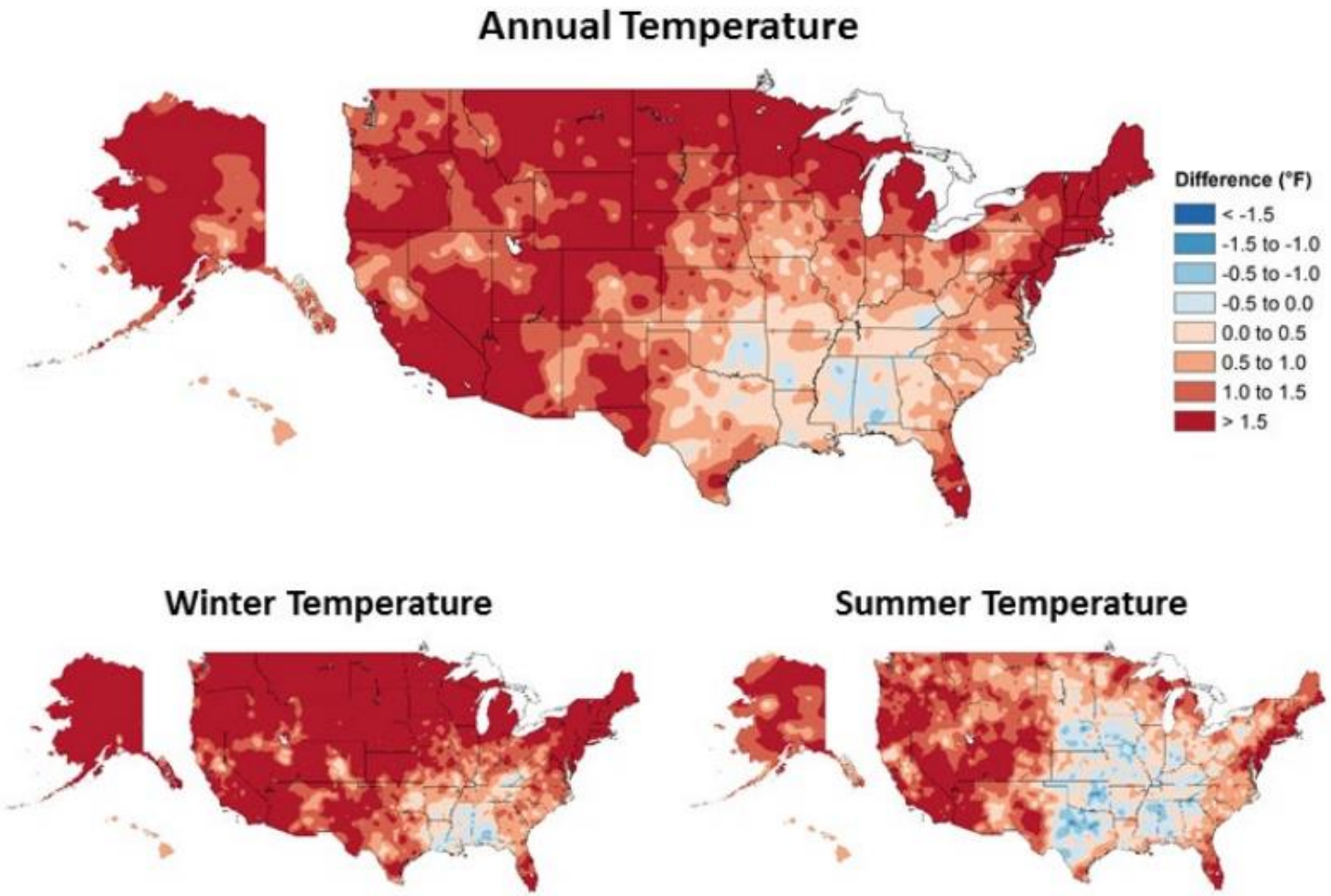
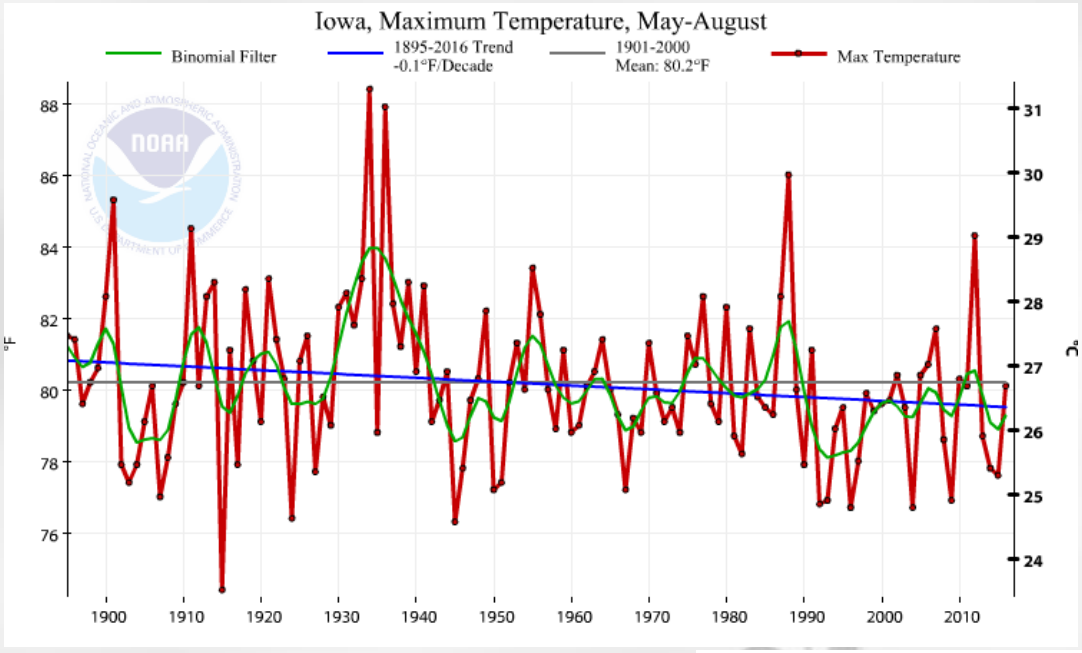
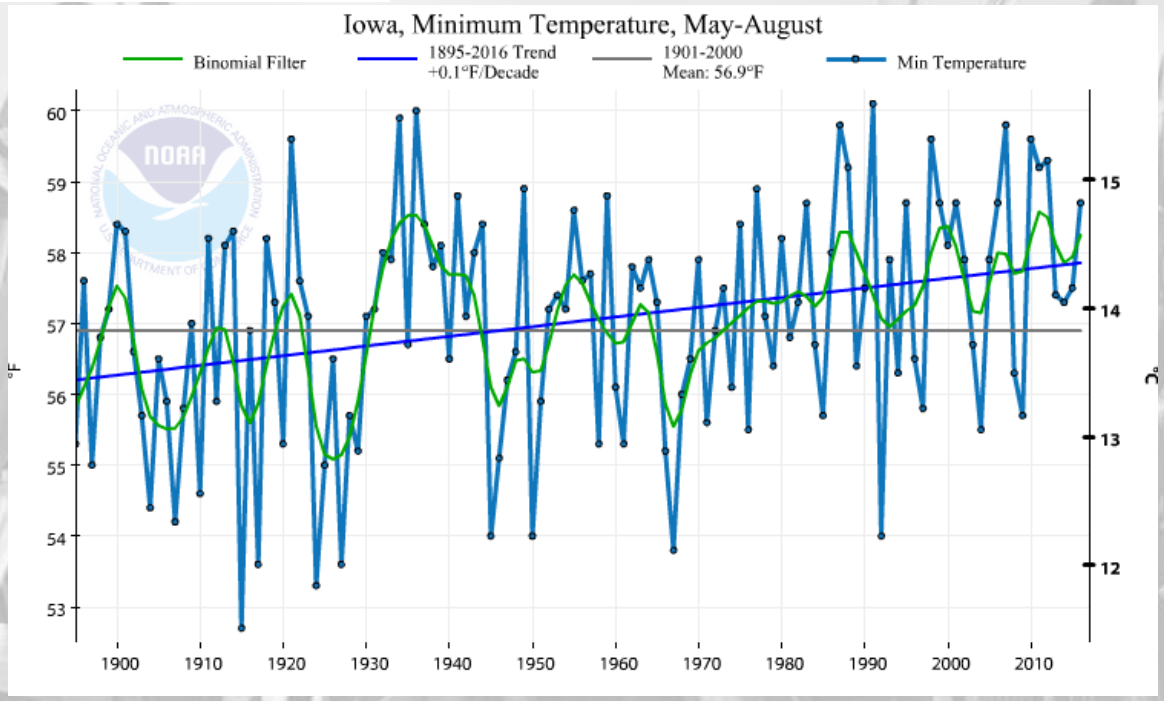



**Figure 6.1.** Observed changes in annual, winter, and summer temperature (°F). Changes are the difference between rage for present-day (1986–2016) and the average for the first half of the last century (1901–1960 for the con- United States, 1925–1960 for Alaska and Hawai'i). Estimates are derived from the nClimDiv dataset.[1,2] (Figure NOAA/NCEI).

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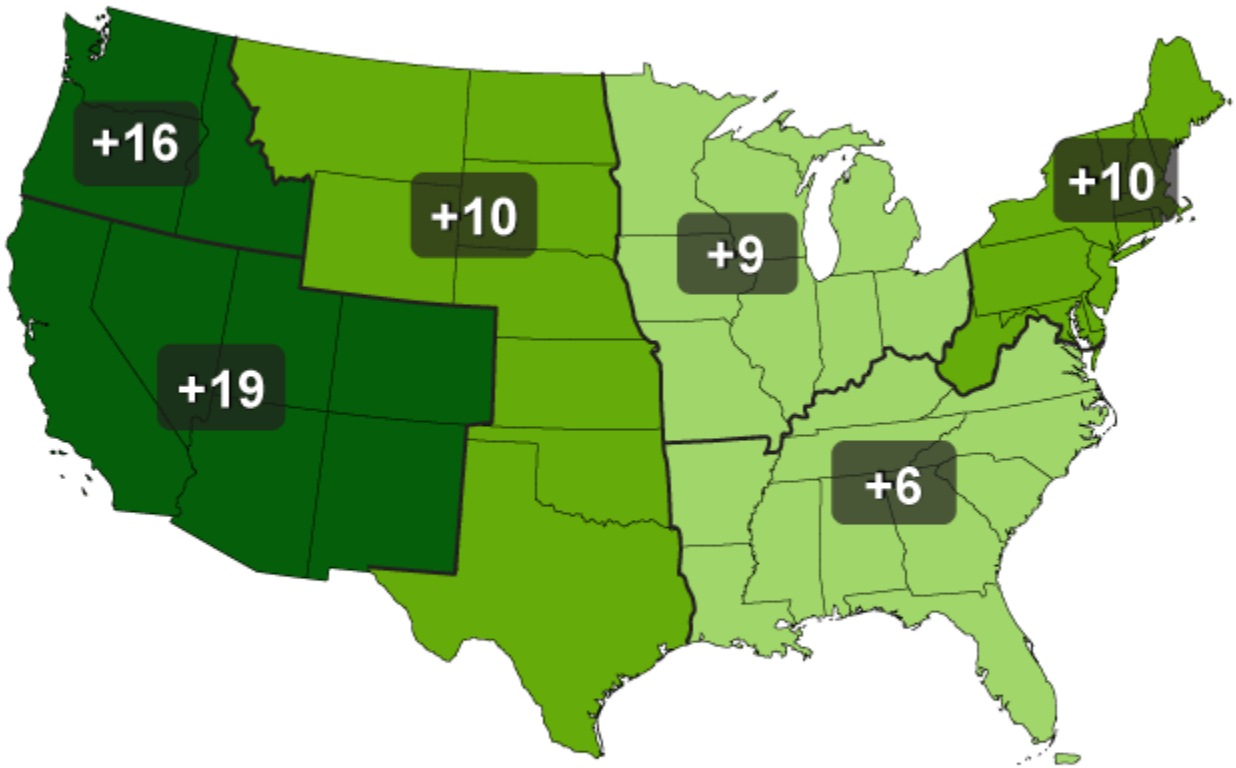
ncdc.noaa.gov/cag

# Observed Increase in Frost-Free Season Length



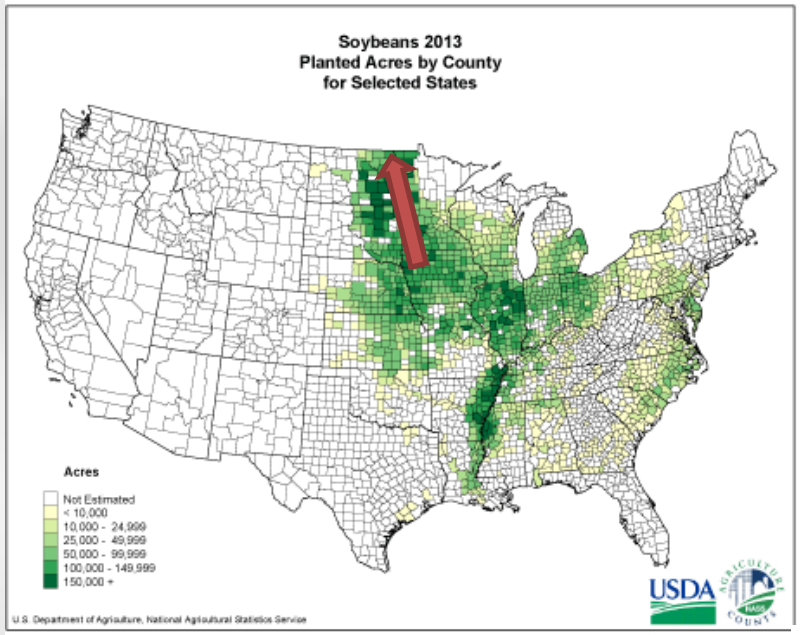

Change in Annual Number of Days

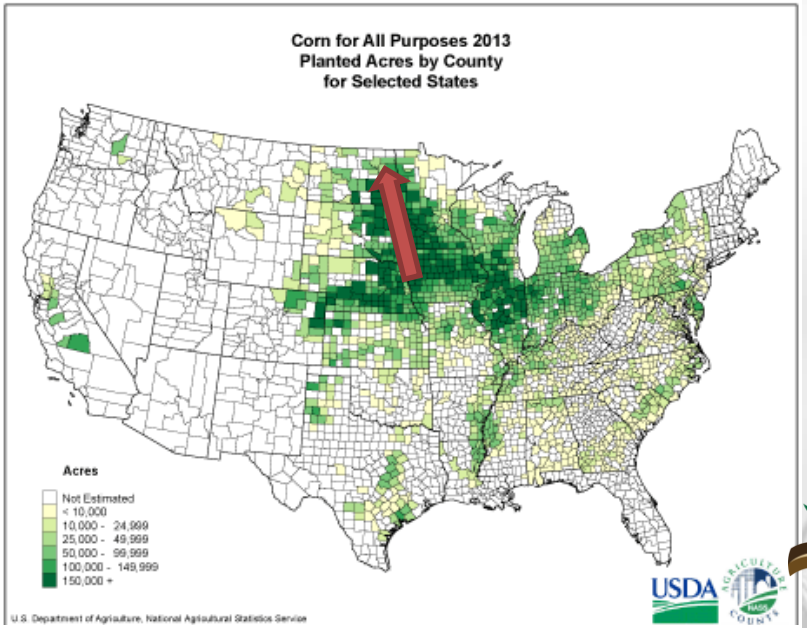
0-4 5-9 10-14 15+

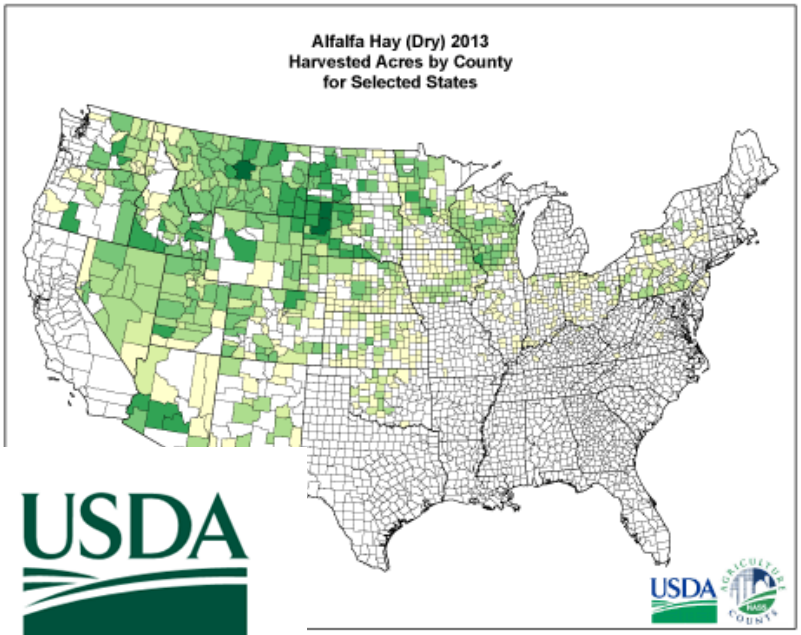
The frost-free season length, defined as the period between the last occurrence of 32°F in the spring and the first occurrence of 32°F in the fall, has increased in each U.S. region during 1991-2012 relative to 1901-1960. Increases in frost-free season length correspond to similar increases in growing season length. (Figure source: NOAA NCDC / CICS-NC).

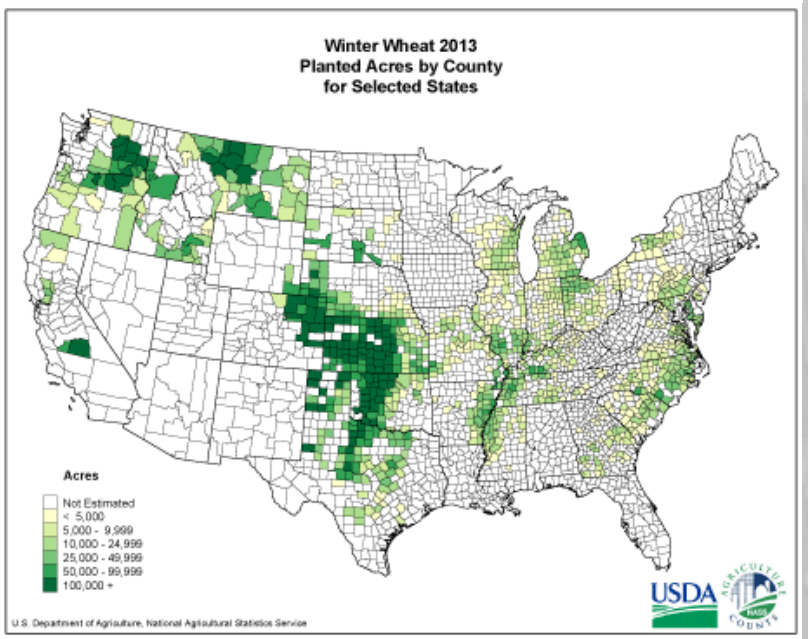
http://nca2014.globalchange.gov/

# Crop Production

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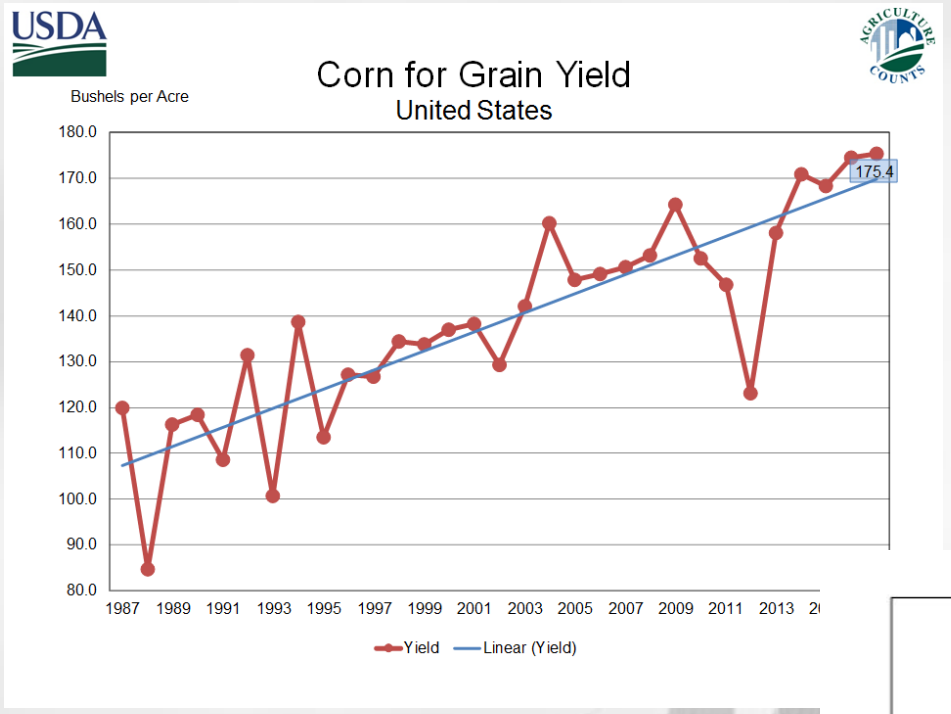
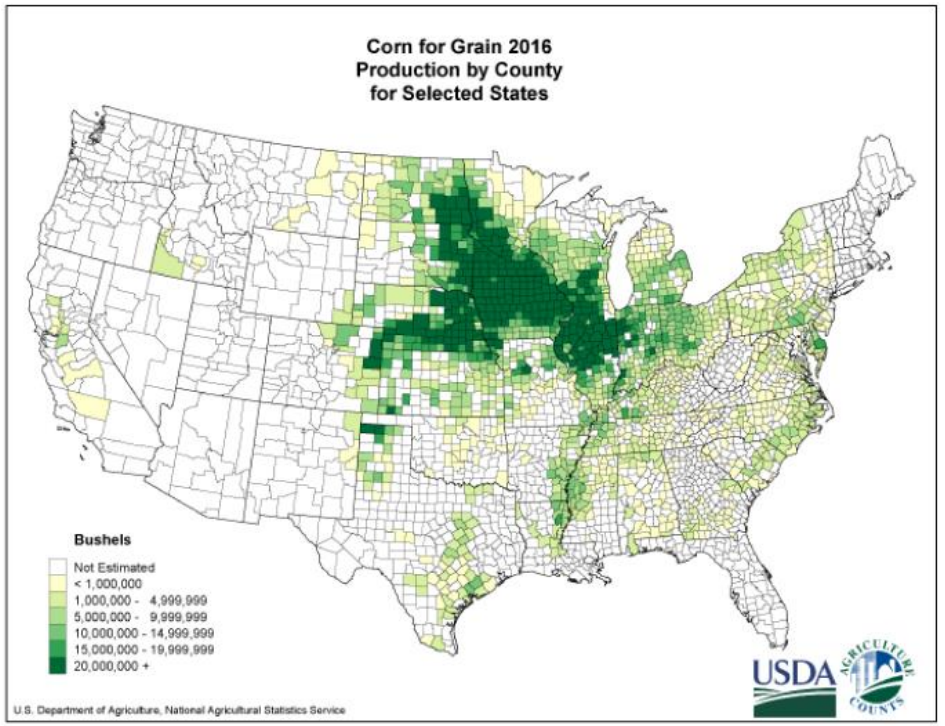
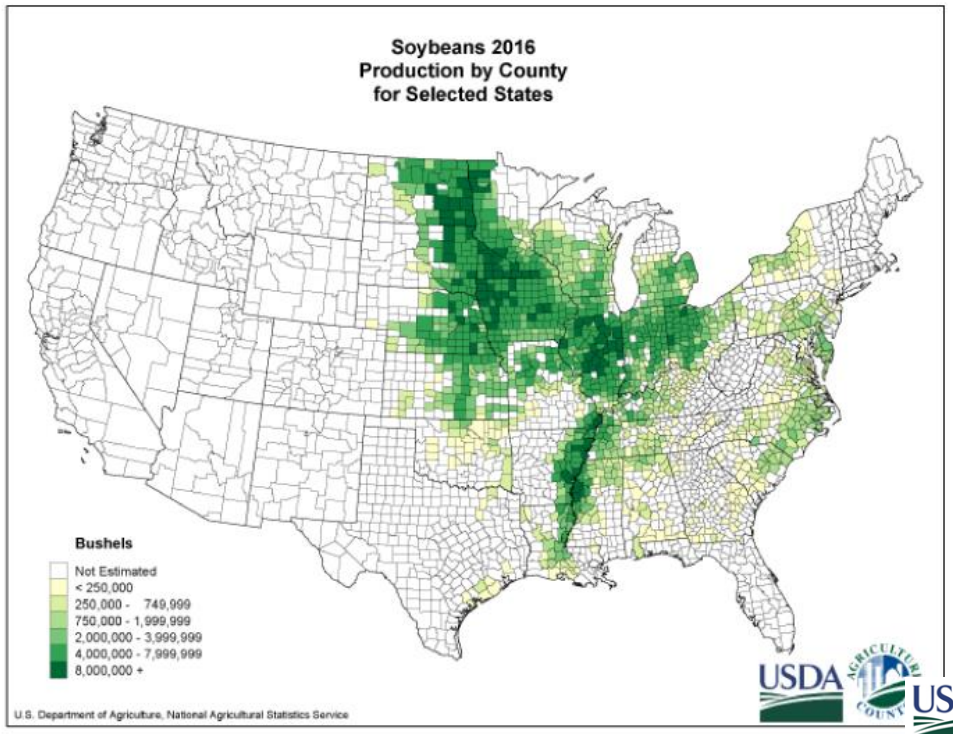
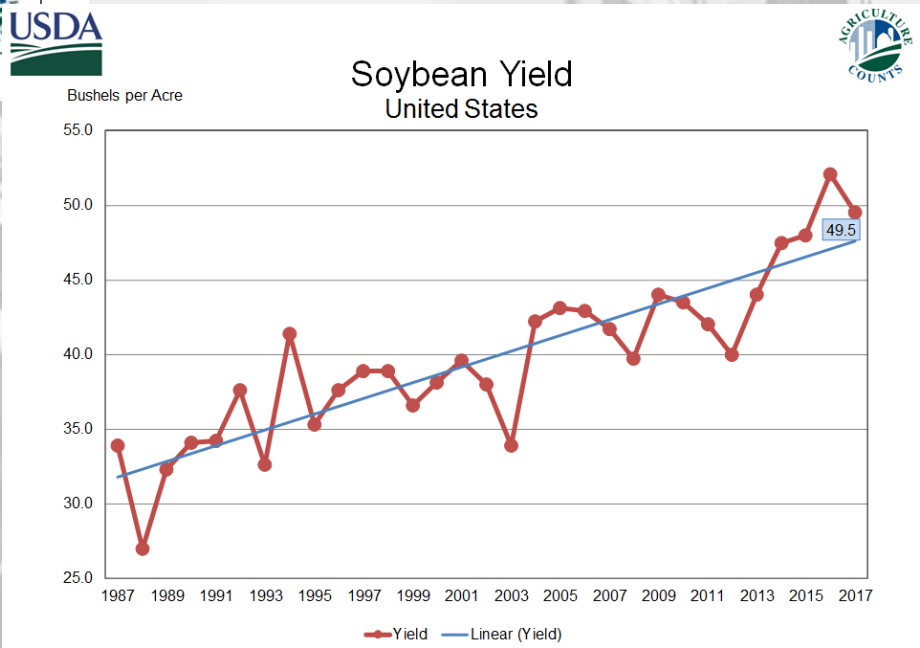
NLAE
National
Laboratory
for Agriculture
and the Environment

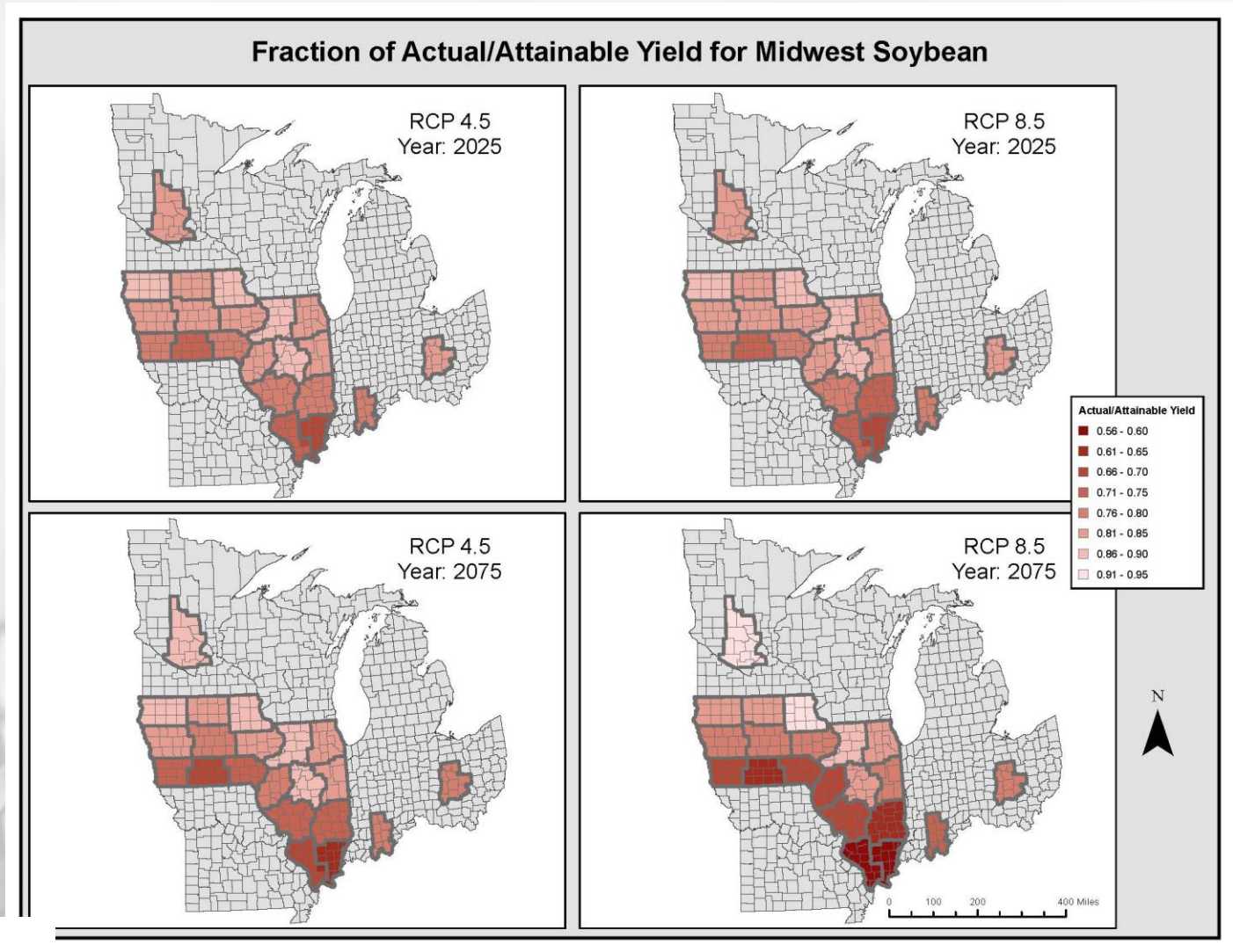

Corn for Grain Yield
United States
Bushels per Acre
180.0
170.0
160.0
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
175.4
1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013
Yield
Linear (Yield)


Corn for Grain 2016
Production by County
for Selected States
Bushels
Not Estimated
< 1,000,000
1,000,000 - 4,999,999
5,000,000 - 9,999,999
10,000,000 - 14,999,999
15,000,000 - 19,999,999
20,000,000 +
U.S. Department of Agriculture, National Agricultural Statistics Service

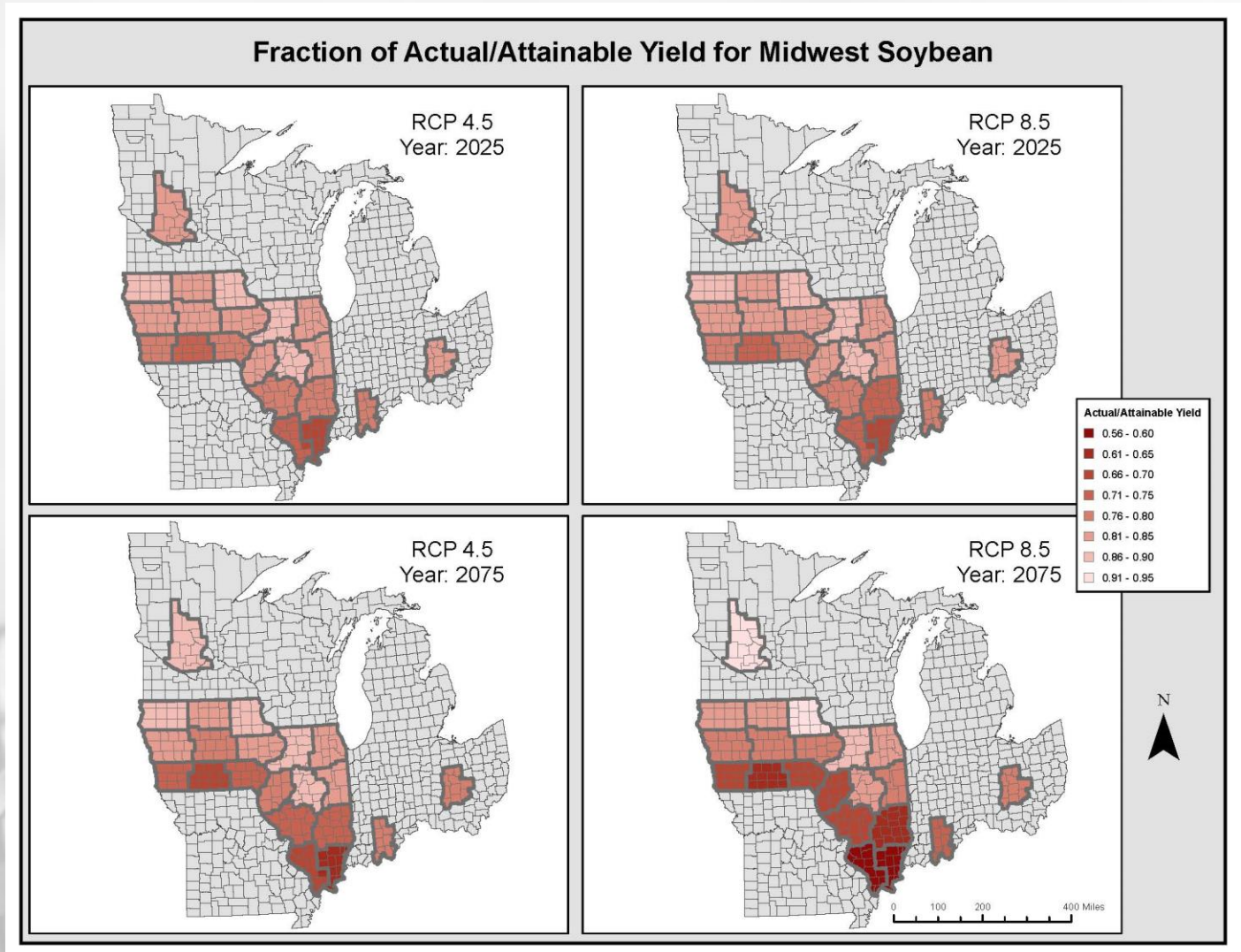



USDA-NASS
11-9-17


Fraction of Actual/Attainable Yield for Midwest Soybean
RCP 4.5
Year: 2025
RCP 8.5
Year: 2025
RCP 4.5
Year: 2075
RCP 8.5
Year: 2075
Actual/Attainable Yield
0.56 - 0.60
0.61 - 0.65
0.66 - 0.70
0.71 - 0.75
0.76 - 0.80
0.81 - 0.85
0.86 - 0.90
0.91 - 0.95
N
0
100
200
400 Miles

USDA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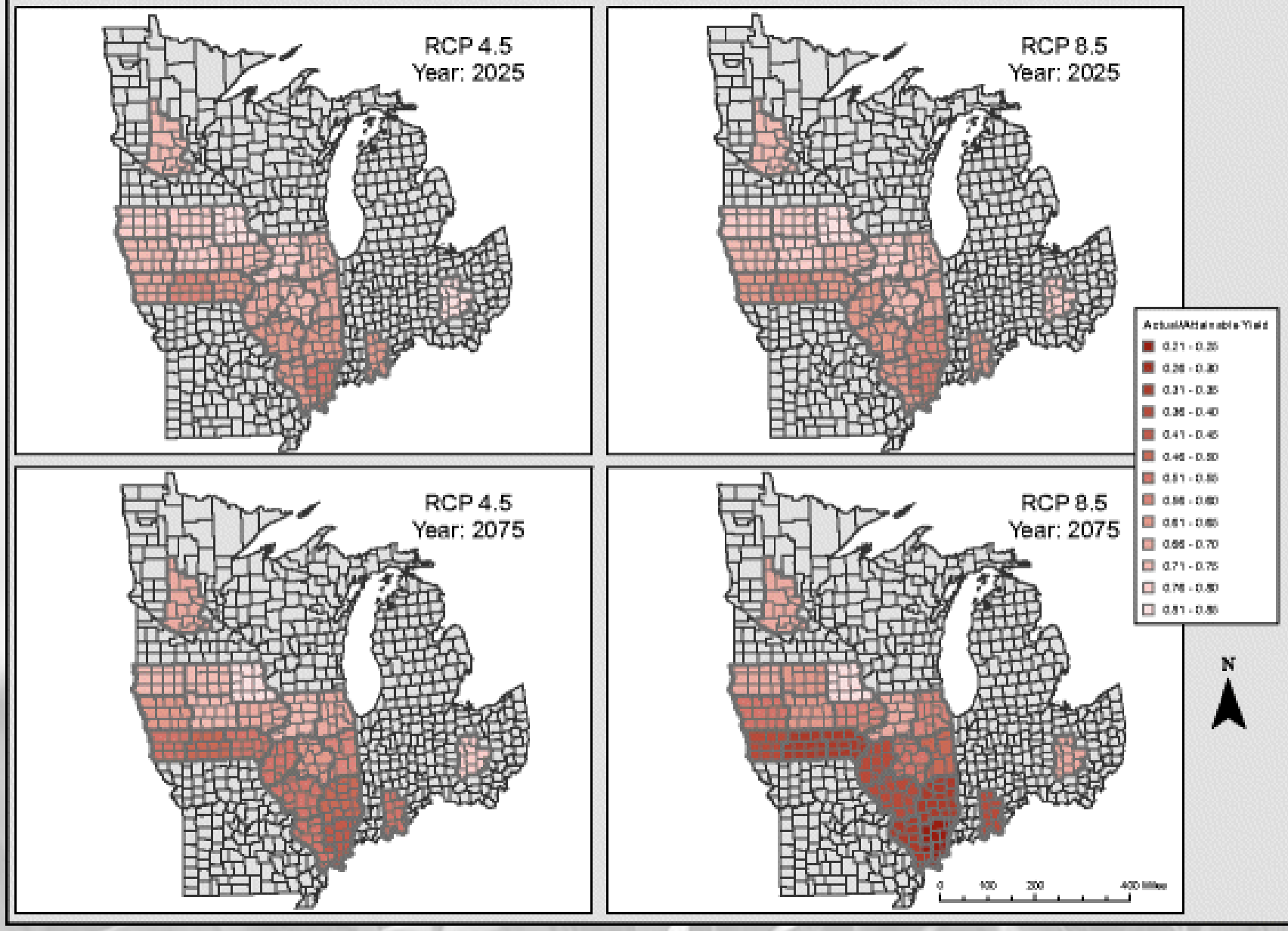
N
0
100
200
400 Miles

# Fraction of Actual/Attainable Yield for Midwest Maize



# Climate Change and Agricultural Pests

1)Expanding geographic ranges northward

2) Reducing winter die offs

3)Earlier spring emergence

4) Increased generations per year

- Invasive insects are of particular concern since they often limited more by climate in their non-native ranges (no natural enemies and abundant food)

# But can $CO_2$ affect herbicide efficacy?

Ambient CO2 | Future CO2

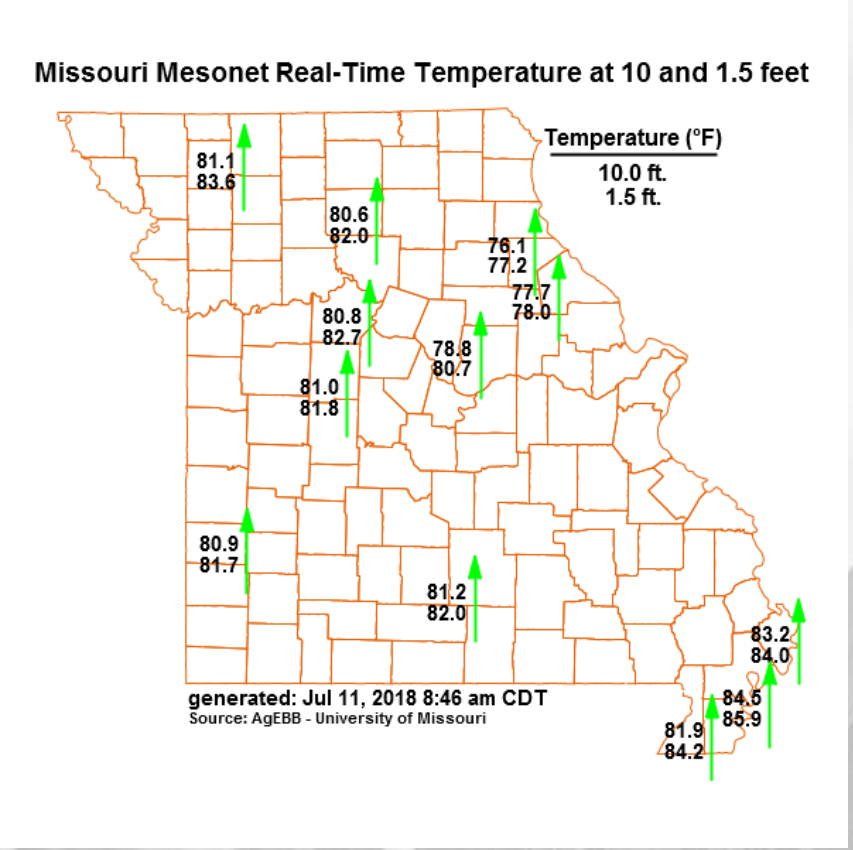
**As carbon dioxide increases, glyphosate efficacy is reduced**

Ziska et al. 1999. Weed Science. 47:608-615, inter alia

USDA

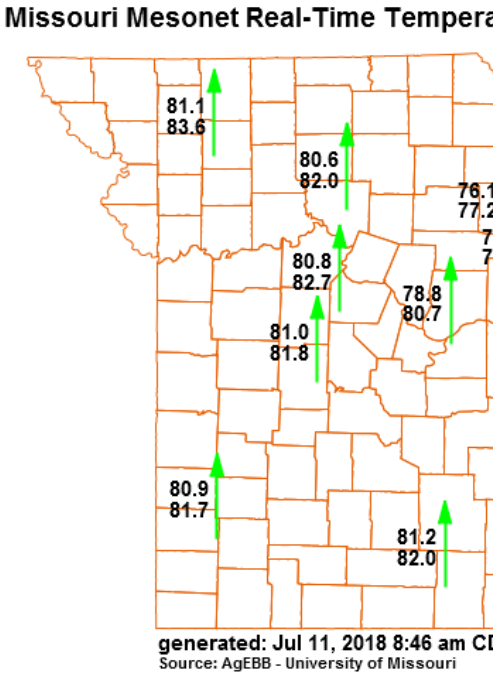

Real data around you
MONITORING

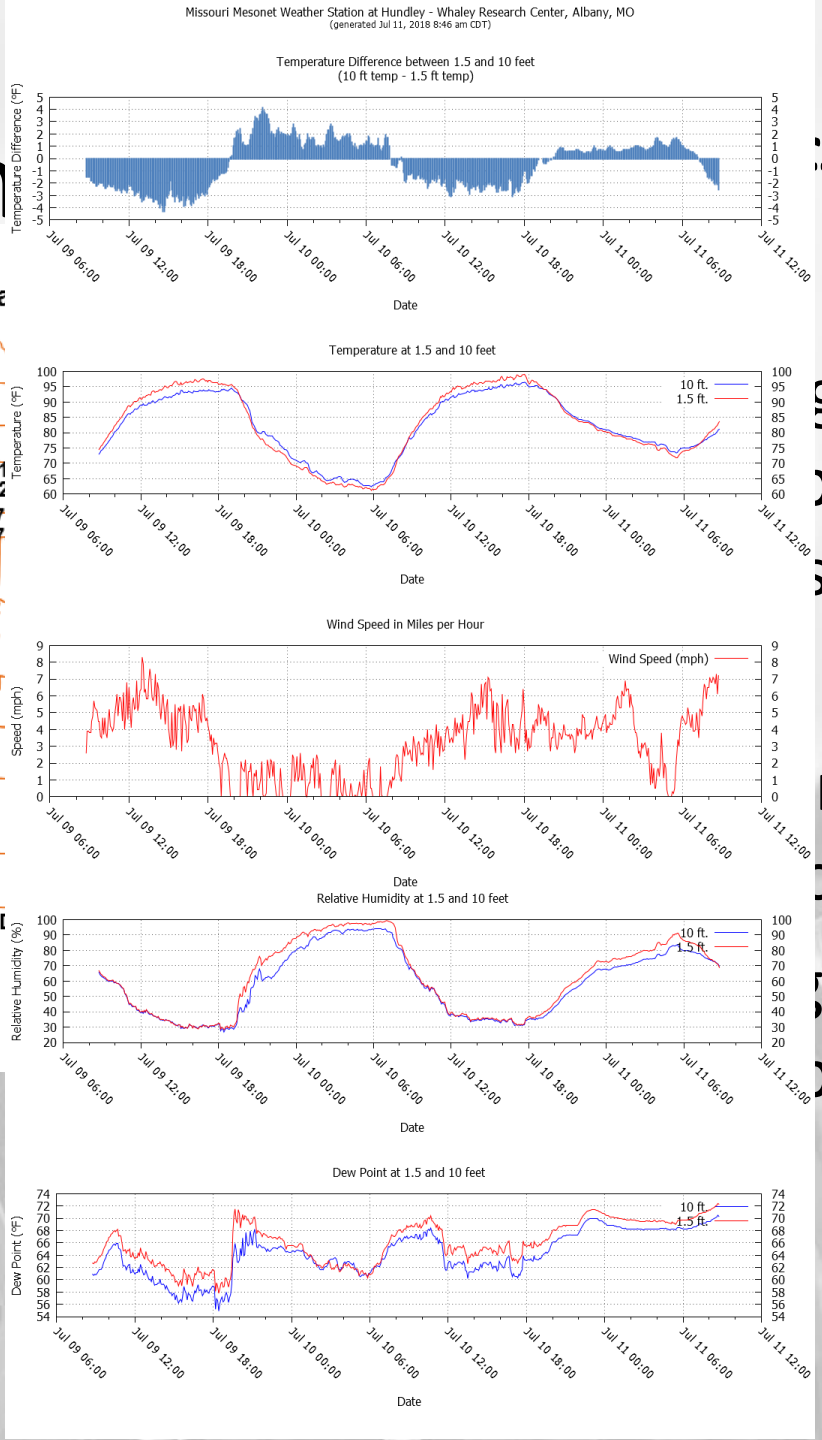
# Inversions and Drift




- Developing regional inversion potential for drift issues
- Missouri first
- Six additional states and Dakotas now adding
- Measuring low level inversion potential and timing

# In ft




g regional

otential for

s

rst

nal states and

ow adding

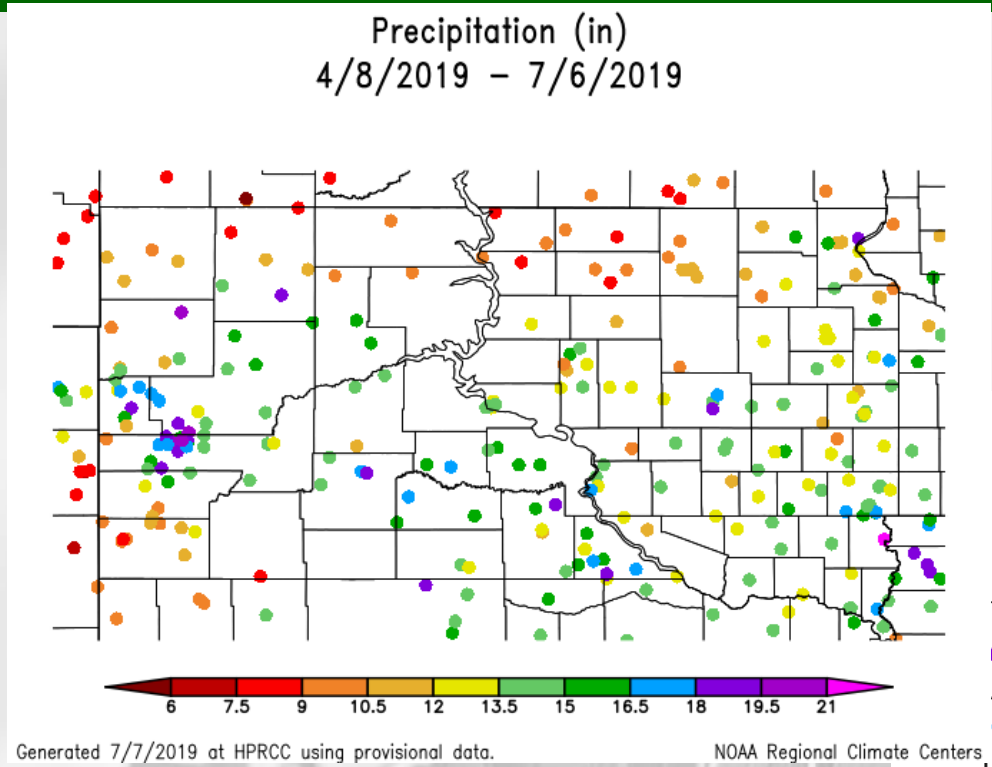
g low level

otential and

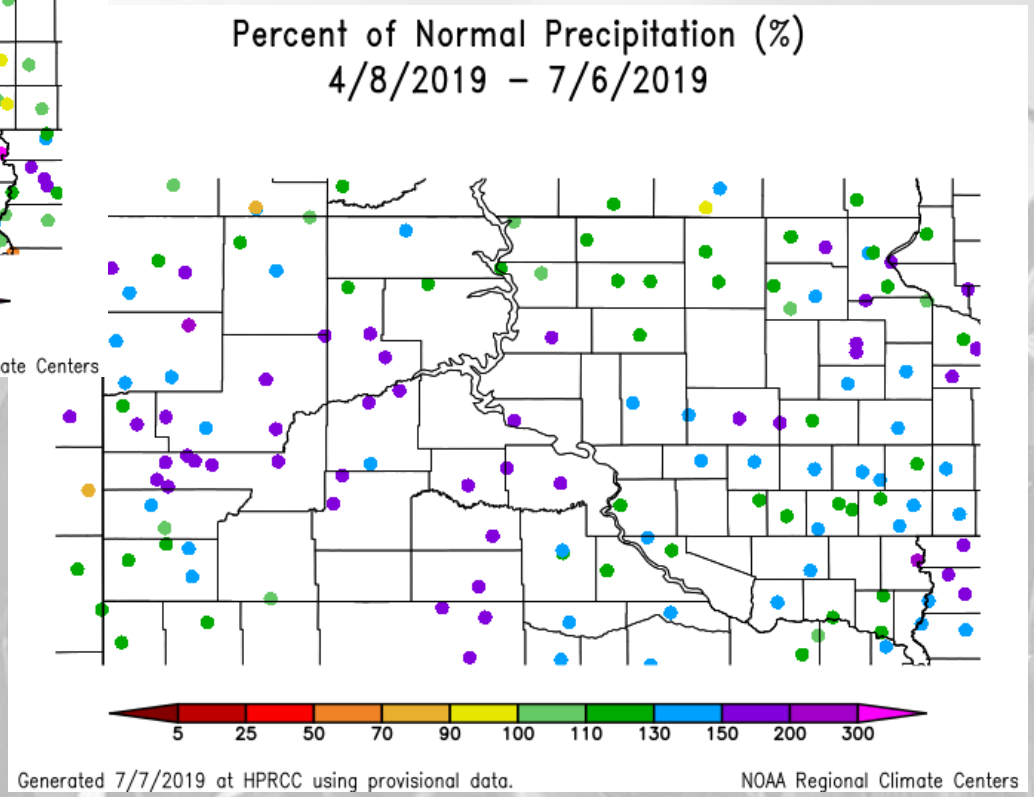
What about this season?

# CURRENT CONDITIONS/OUTLOOKS

# 90 Day Precip. Total/% Avg.



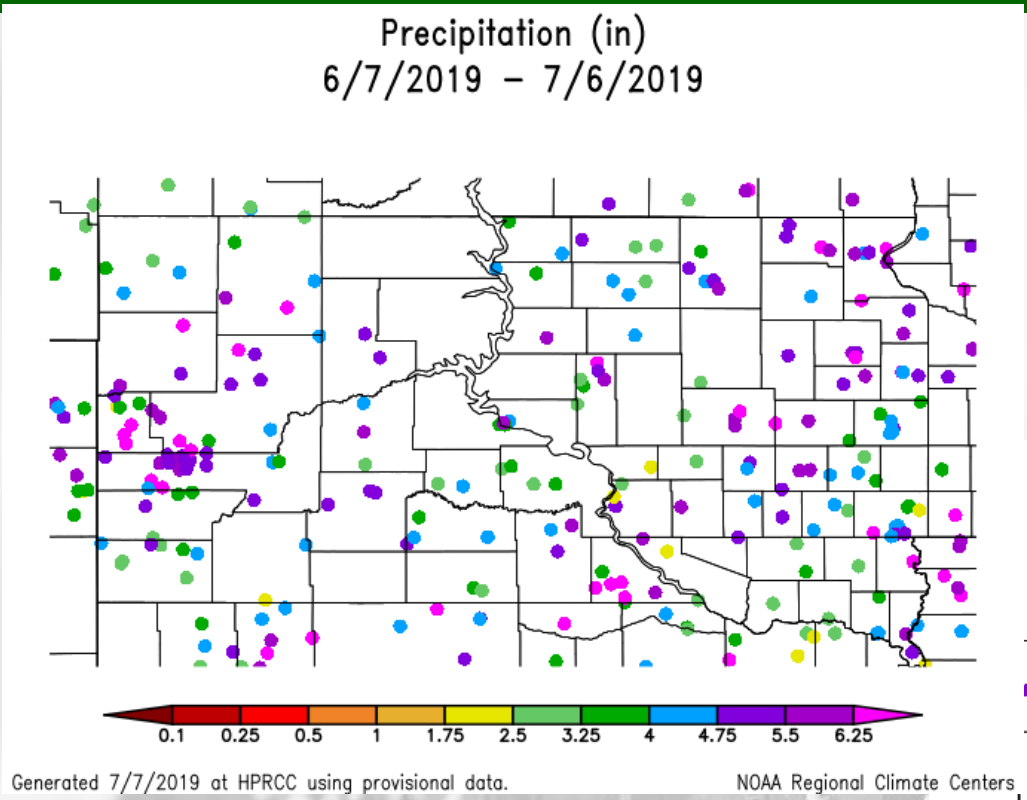

Above avg. precip most SE SD.



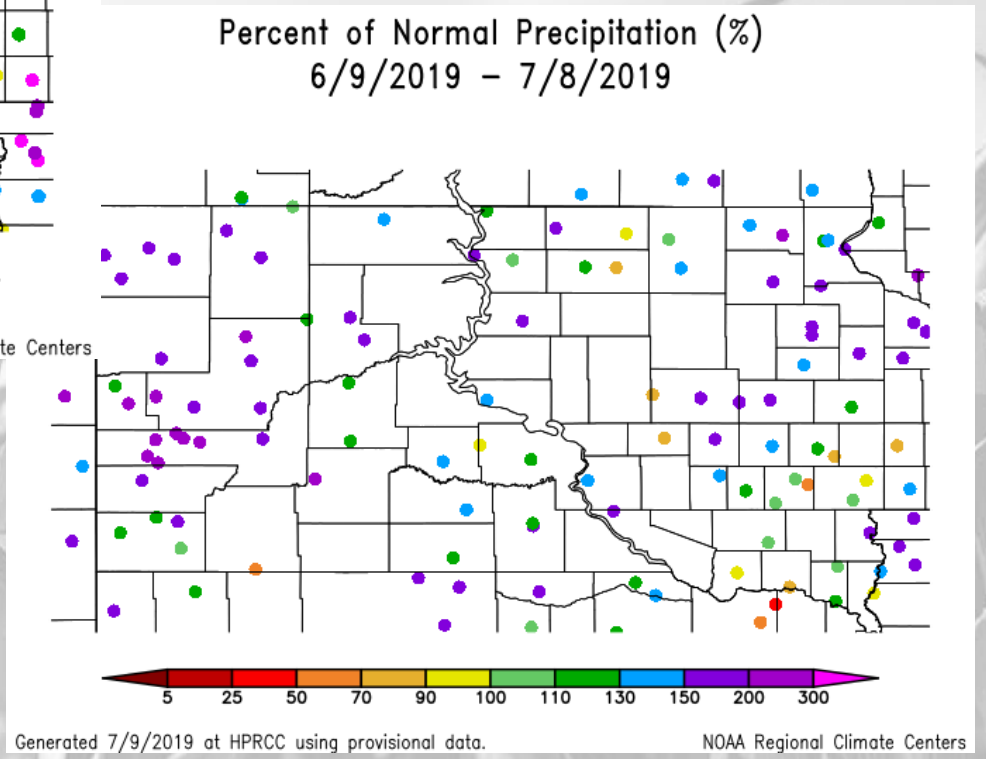

USDA Midwest Climate Hub
U.S. DEPARTMENT OF AGRICULTURE

https://hprcc.unl.edu/maps.php?map=ACISClimateMaps

# 30 Day Precip. Total/% Avg.



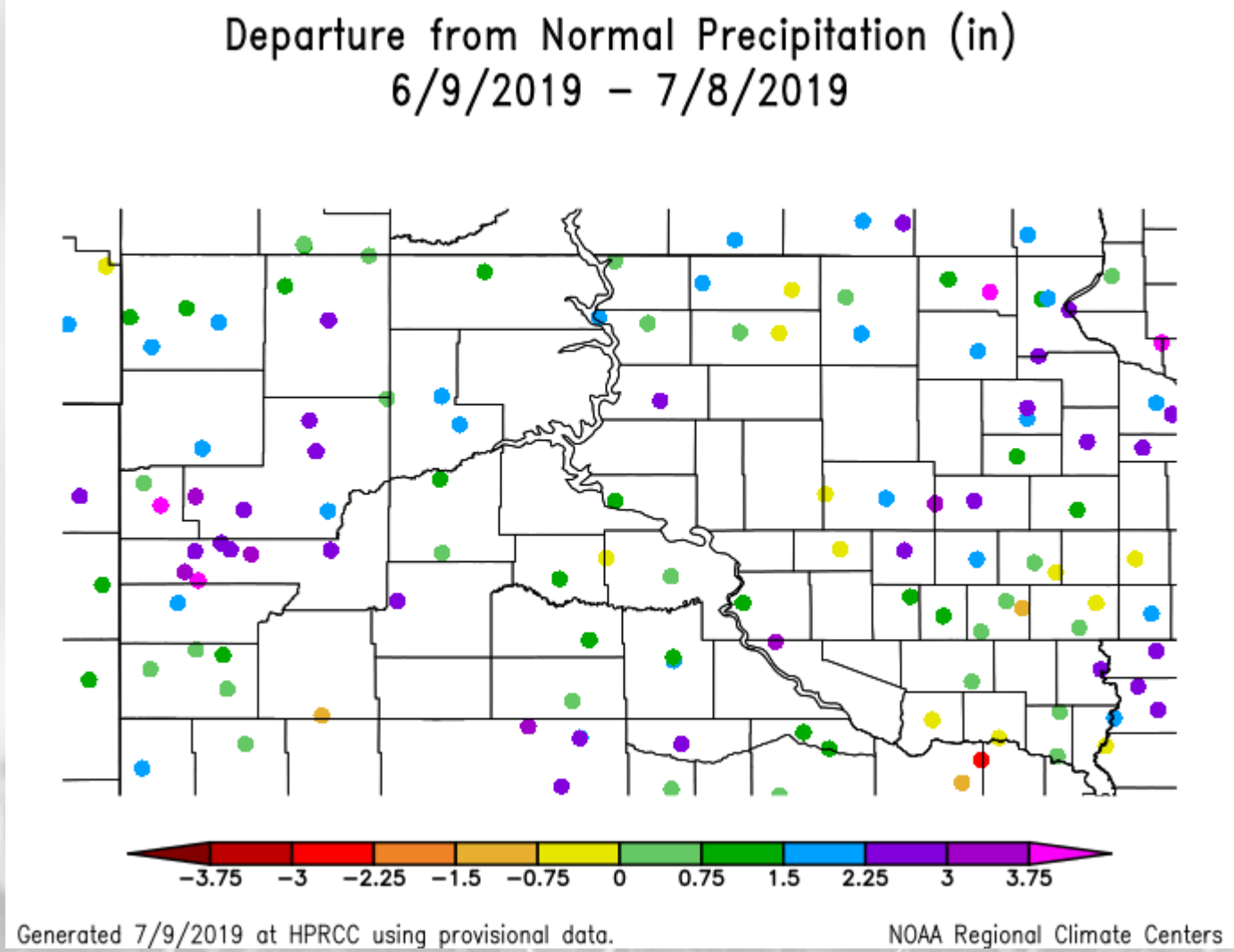

Still above avg. but more pockets of dryness showing up.






https://hprcc.unl.edu/maps.php?map=ACISClimateMaps

# 30 Day Temperatures

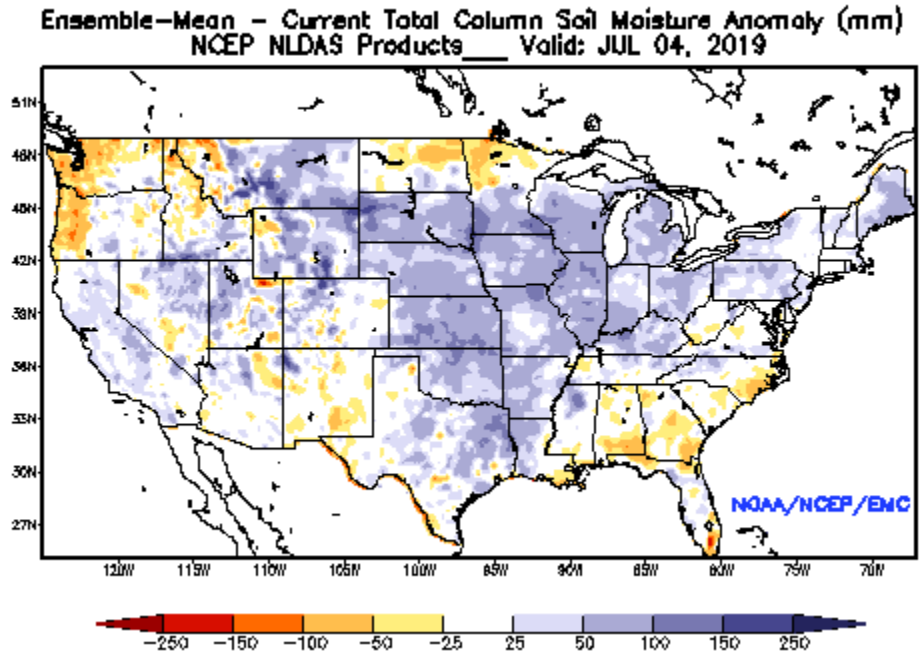



Slightly below average (1-2 F) for much of the state. Mostly slightly below avg.

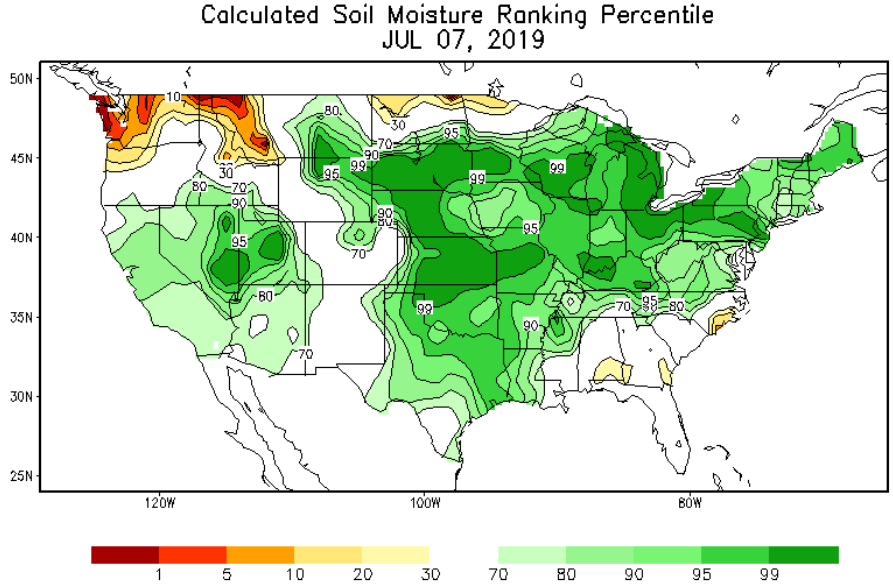


https://hprcc.unl.edu/maps.php?map=ACISClimateMaps

# Soil Moisture



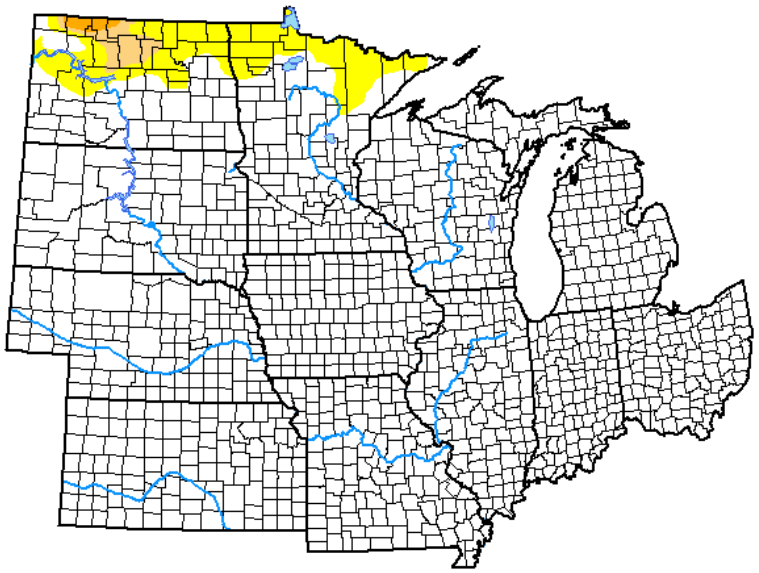

Soil moisture several inches above average – 95th percentile (basically still very wet)




https://www.emc.ncep.noaa.gov/mmb/nldas/drought/

https://www.cpc.ncep.noaa.gov/products/Soilmst_Monitoring/US/Soilmst/Soilmst.shtml

# US Drought Monitor



***U.S. Drought Monitor***

## North Central

**July 2, 2019**

***(Released Wednesday, Jul. 3, 2019)***

**Valid 8 a.m. EDT**

*Drought Conditions (Percent Area)*

| | None | D0-D4 | D1-D4 | D2-D4 | D3-D4 | D4 |
|---|---|---|---|---|---|---|
| **Current** | 93.80 | 6.20 | 0.99 | 0.22 | 0.00 | 0.00 |
| **Last Week** *06-25-2019* | 94.22 | 5.78 | 1.34 | 0.35 | 0.00 | 0.00 |
| **3 Months Ago** *04-02-2019* | 100.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Start of Calendar Year** *01-01-2019* | 95.93 | 4.07 | 1.43 | 0.00 | 0.00 | 0.00 |
| **Start of Water Year** *09-25-2018* | 73.15 | 26.85 | 12.92 | 4.07 | 0.97 | 0.05 |
| **One Year Ago** *07-03-2018* | 74.72 | 25.28 | 12.00 | 5.21 | 0.61 | 0.00 |

*Intensity:*

- None
- 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

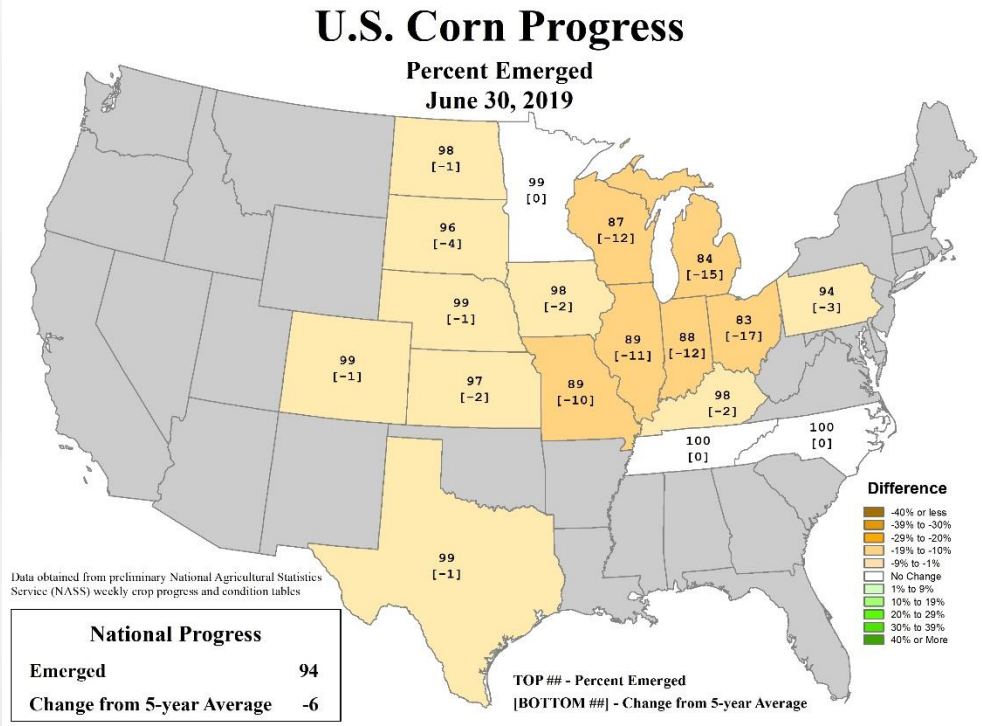
**droughtmonitor.unl.edu**

D0 pockets in Minnesota. Northern North Dakota in D1/D2.

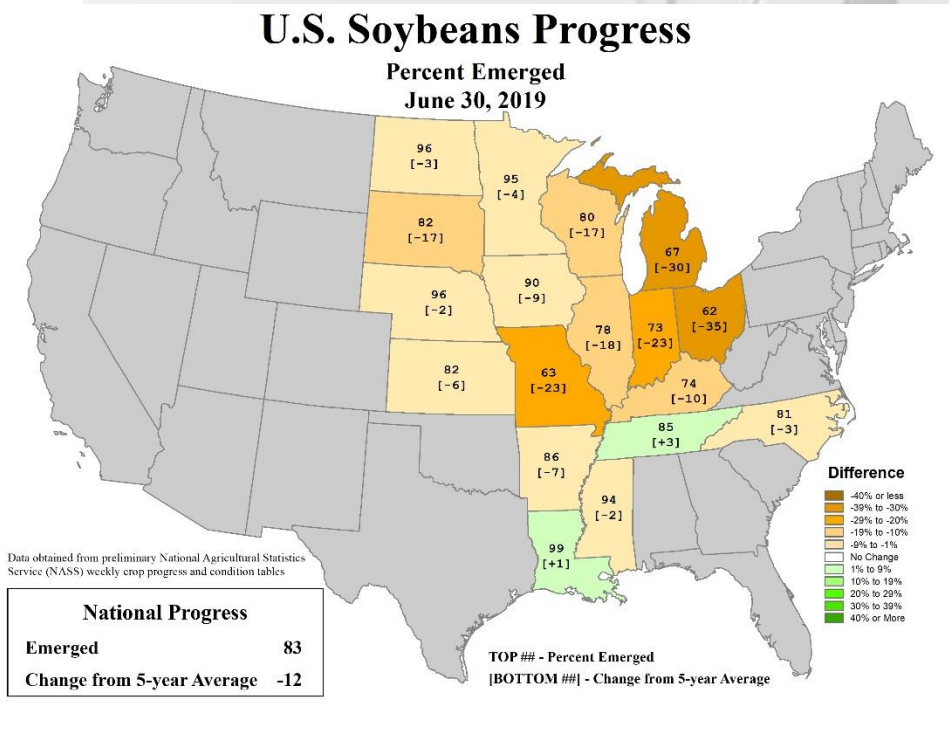


http://droughtmonitor.unl.edu/

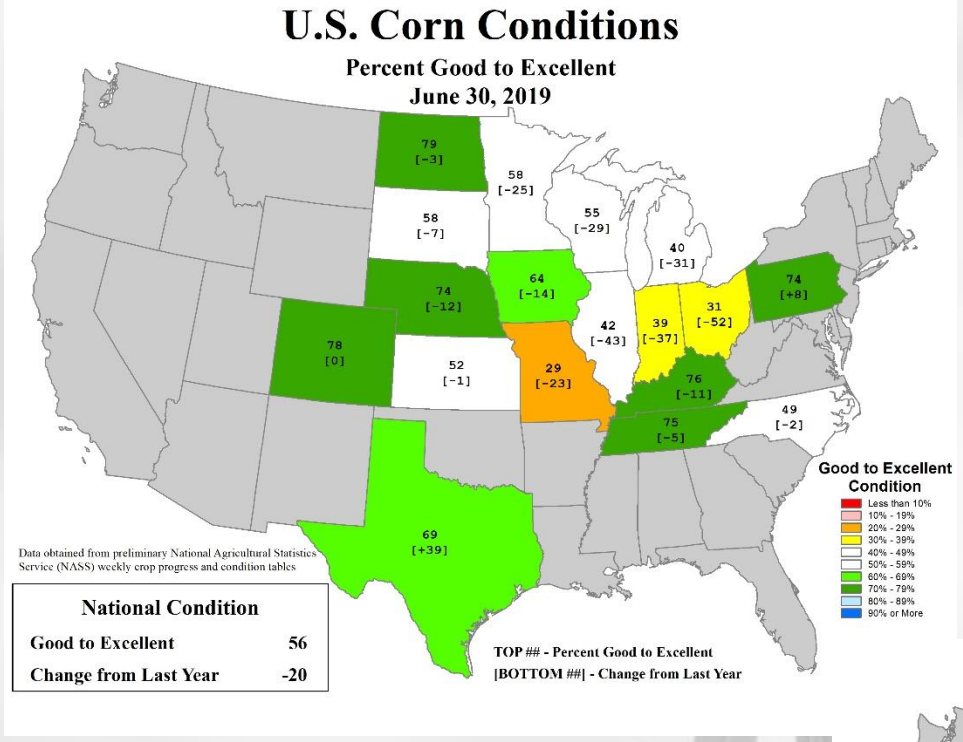
# USDA NASS Crop Progress (through June 30)

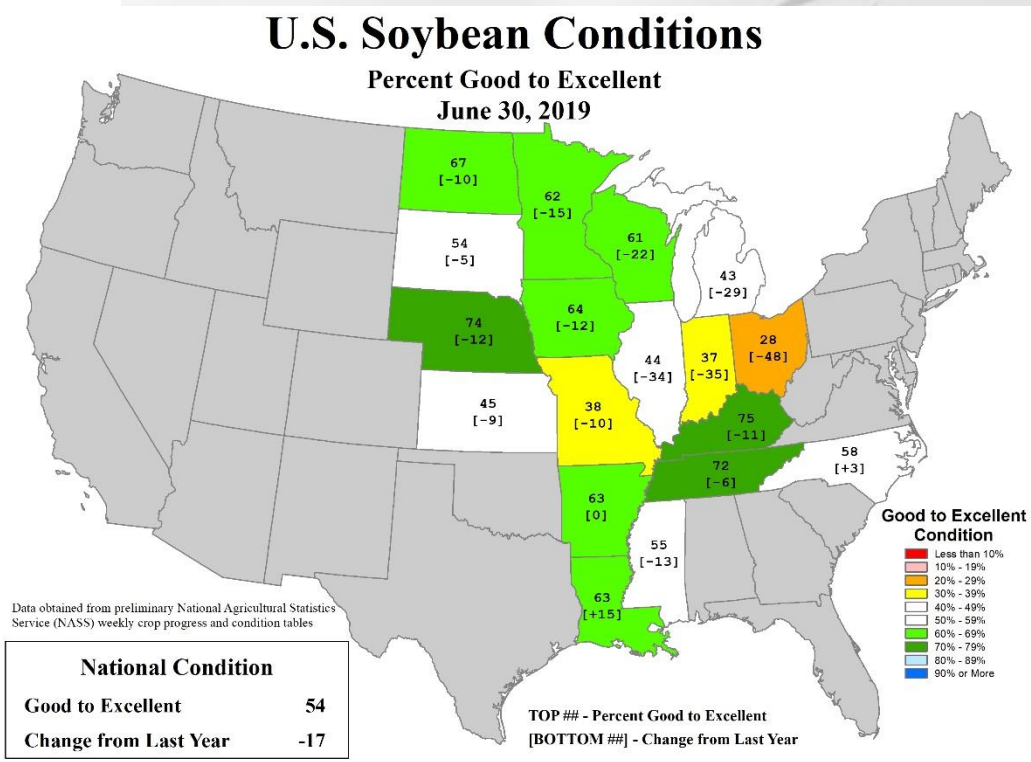



Corn and bean emergence progress nationally through June 30 (corn 94% -6%; beans 83% -12%). Iowa still better than many states (corn 98% -2%; beans 90% -9%).

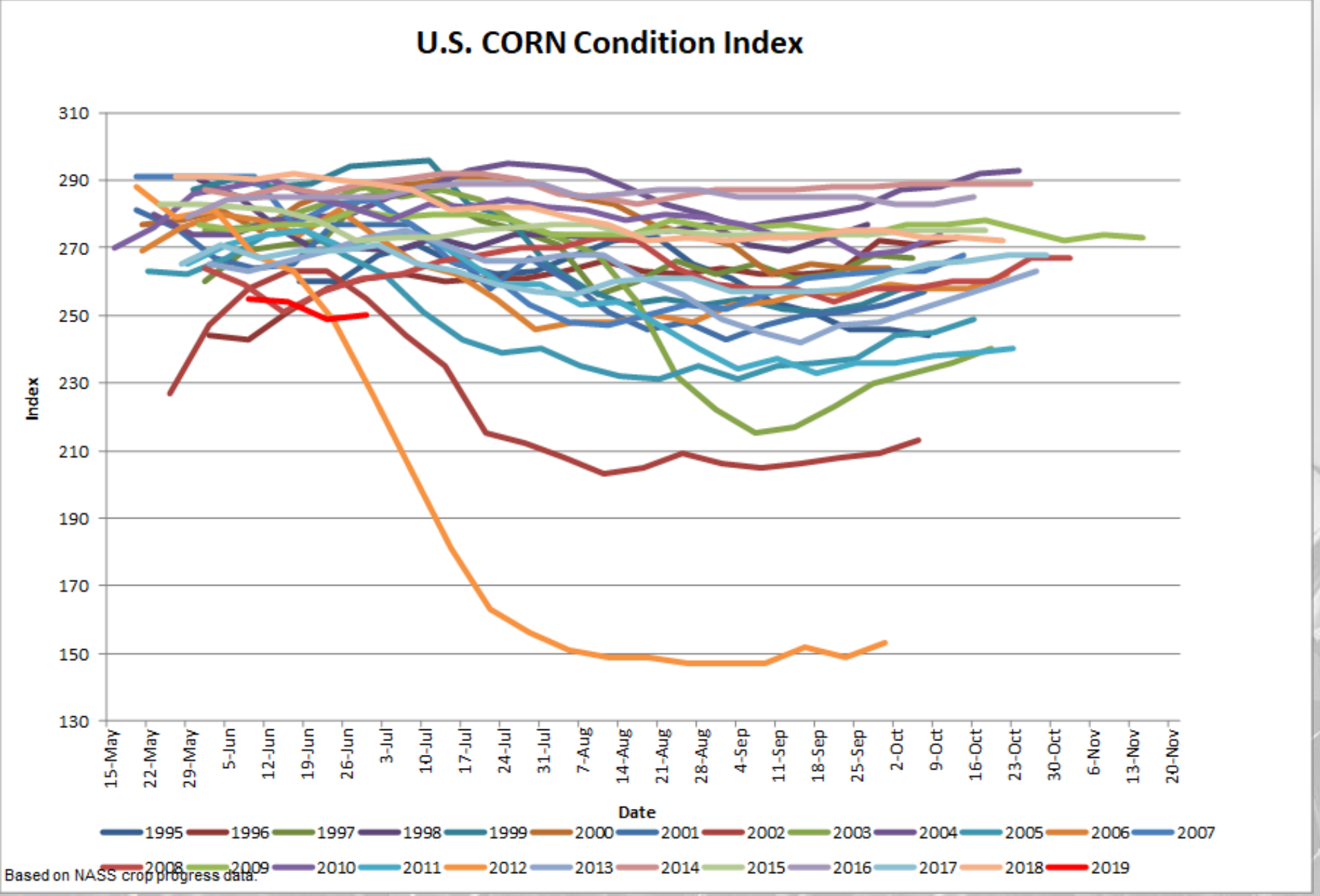


# USDA NASS Crop Progress (through June 30)




Crop condition (G-E) nationally through June 30 compared to 2018 (corn 56% -20%; beans 54% -17%). Iowa still better than many states (corn 64% -14%; bean 64% -12%).




Corn condition index. Currently 2019 is only better than 2012 and similar to 1993 (not pictured).

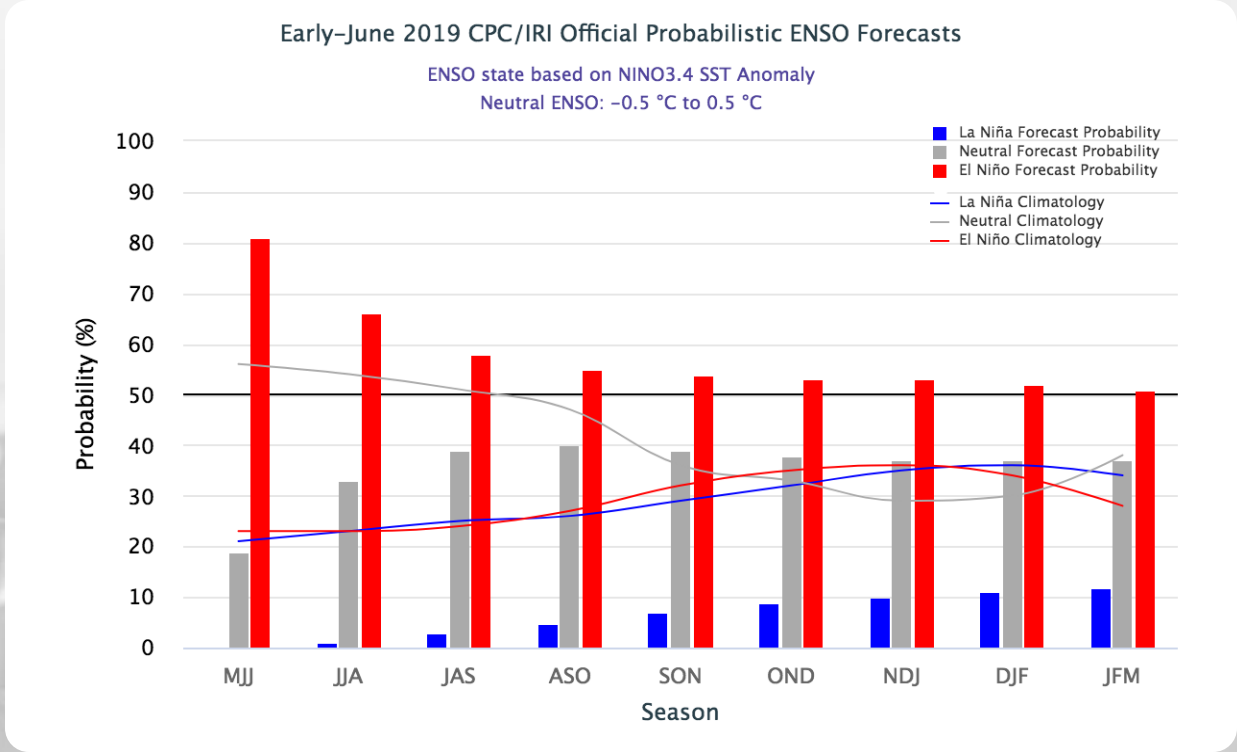
# Crop/Harvest issues

- Growing season:
  - Slow development
  - Disease
  - Weed issues
  - Lack of sunlight (don’t have good data on this)
- Harvest:
  - Some potential freeze concerns
  - More likely lots of immature high moisture corn
- GDD Tool - Keep checking back on progress

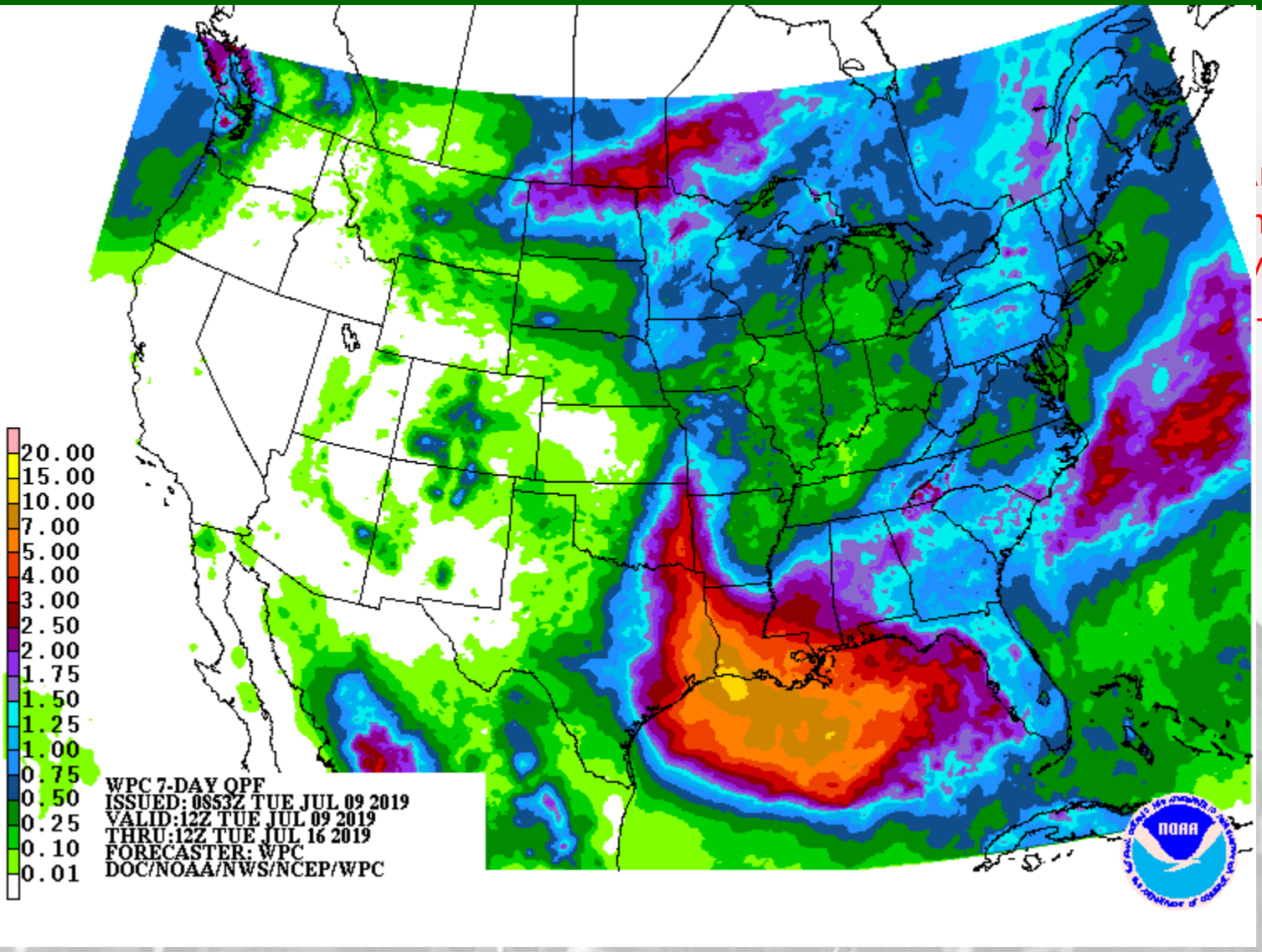
# CPC/IRI Probabilistic ENSO Outlook

## Updated: 13 June 2019

**El Niño is favored to continue with chances nearing 50% in Northern Hemisphere fall and winter.**



# 7 Day Forecast Precip.

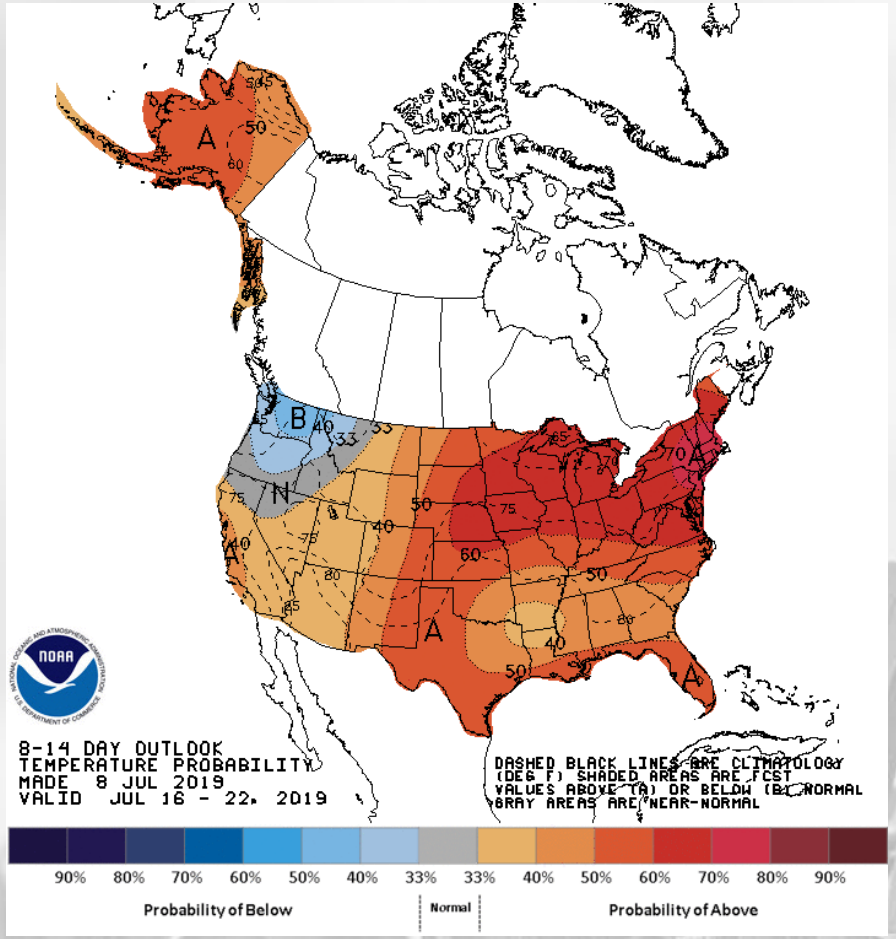


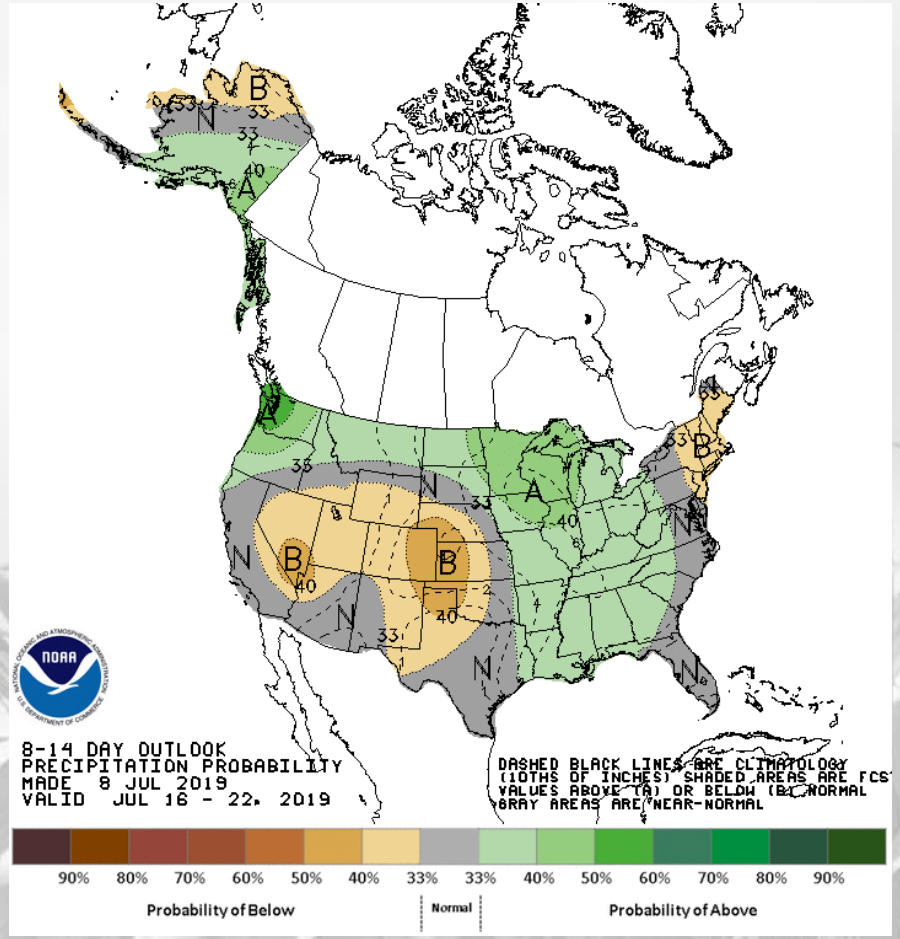

reas of heavy rain
ore northern
Midwest. Pockets of
-4" possible.



http://www.wpc.ncep.noaa.gov/qpf/p168i.gif?1484935973

# 8-14 Day Temp and Precip. Outlook

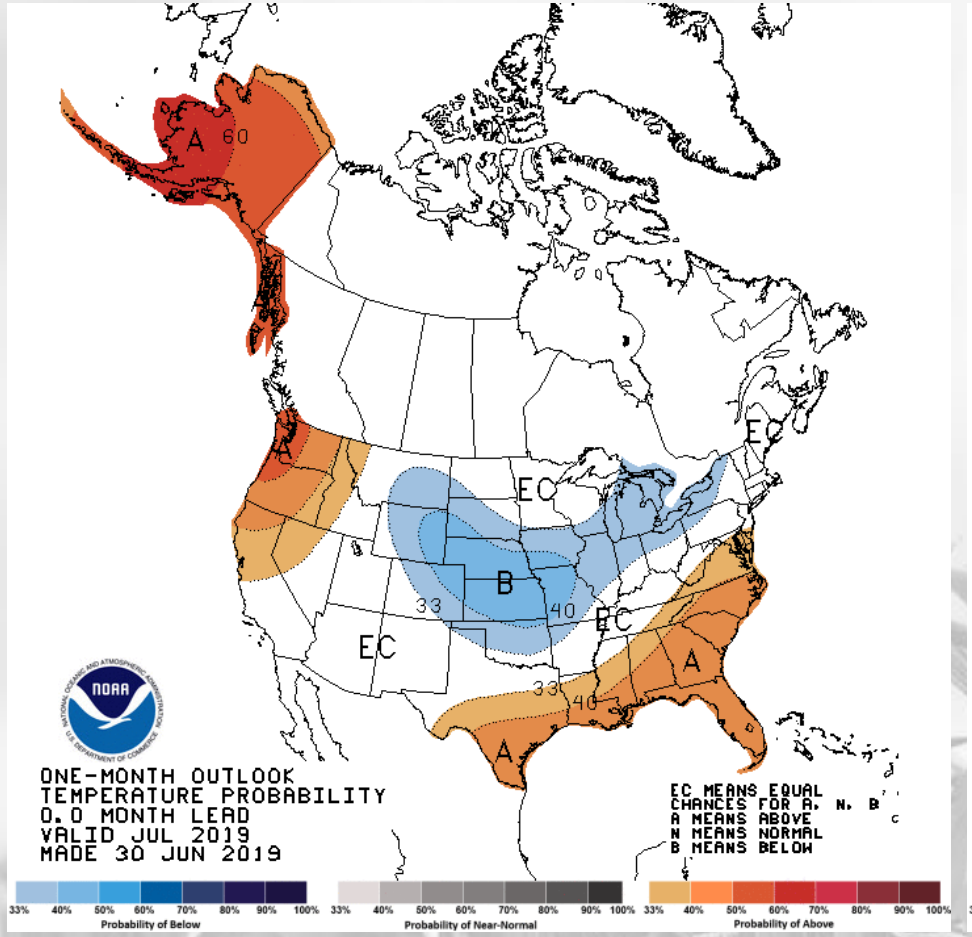


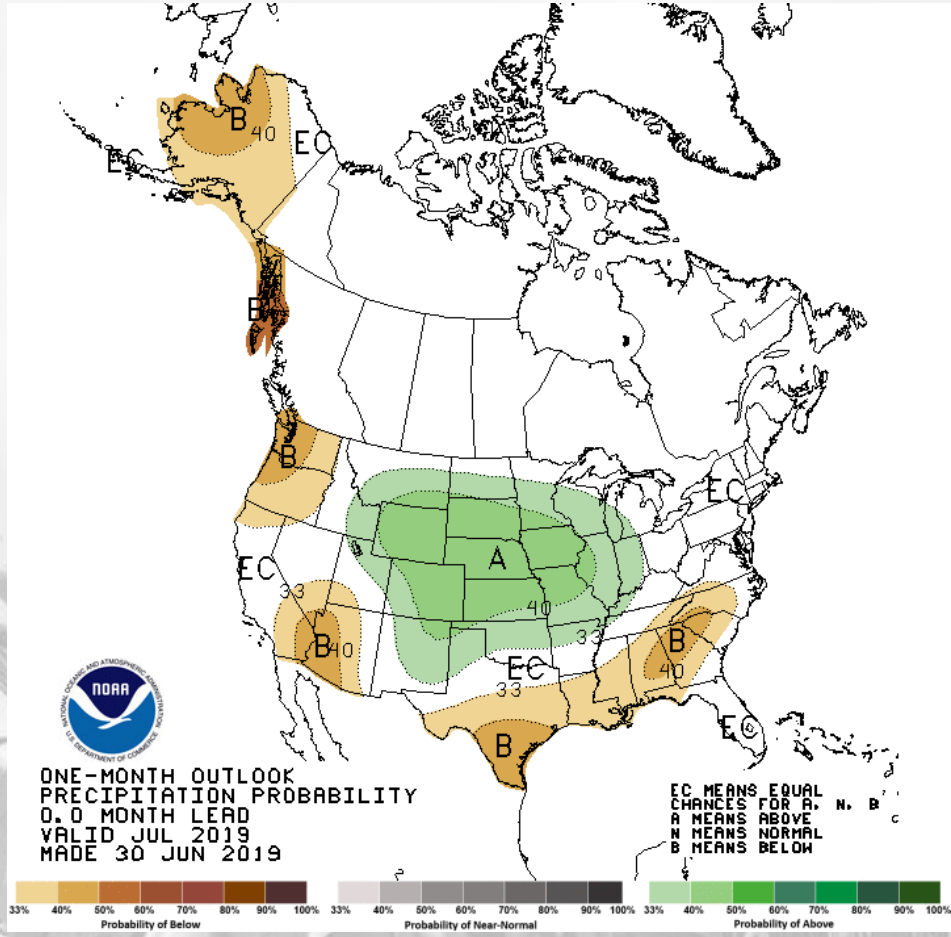




http://www.cpc.ncep.noaa.gov/

Mid-July – warmer than avg. much more likely. Add needed GDD. But likely stressful conditions for crops – especially with compromised root systems.

# 30 Day Temp and Precip. Outlook




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

Mid-month shift seems significant enough to move chances for the month to cooler and wetter after an early warm start to July.

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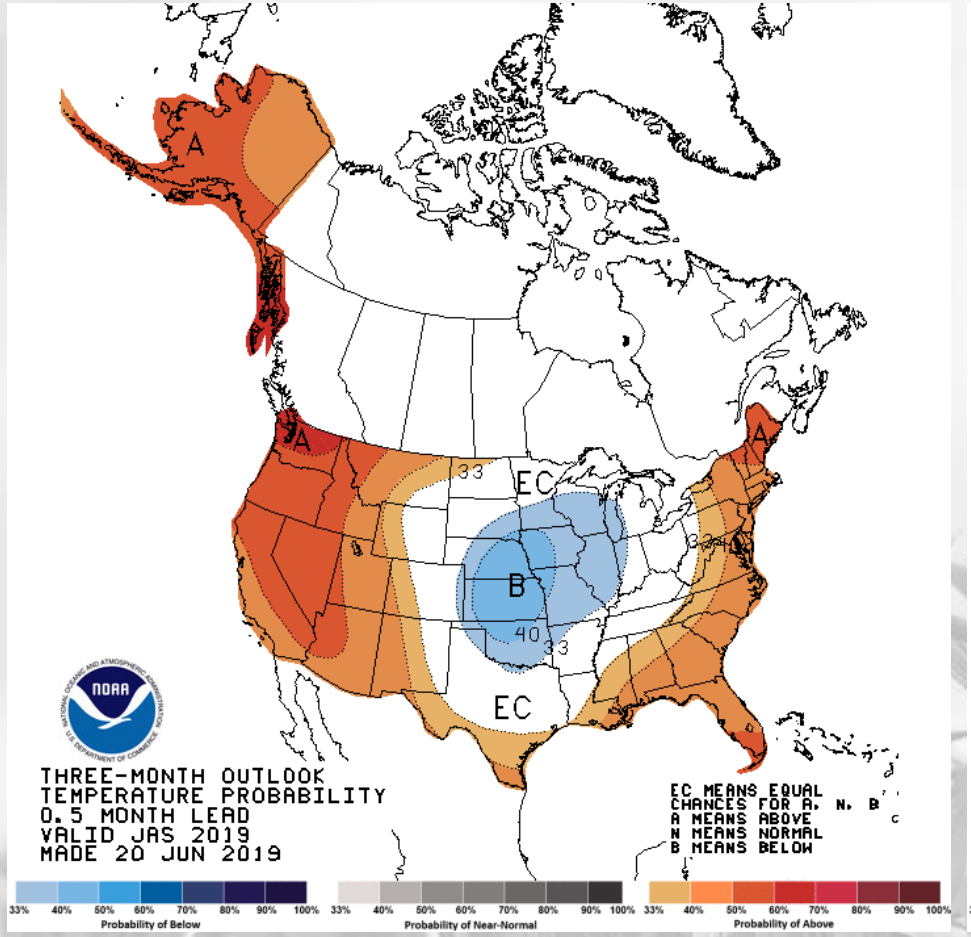
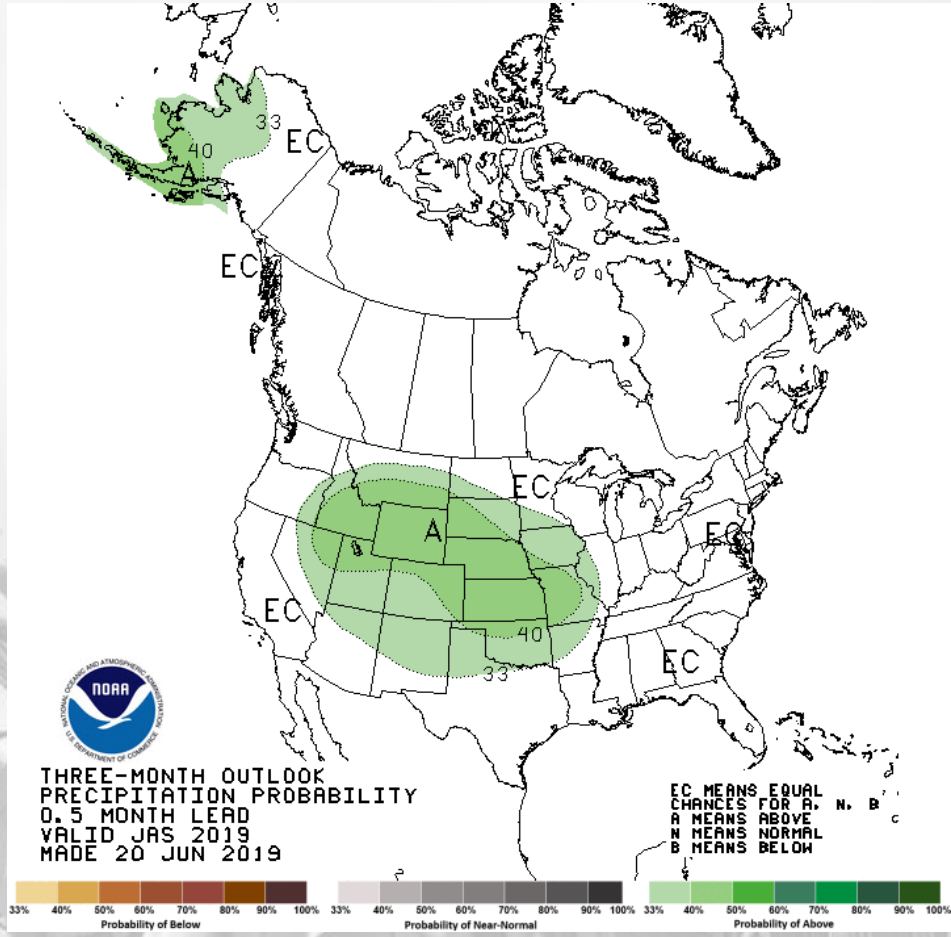
# 90 Day Temp and Precip. Outlook




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

Persistence of cooler and wetter still more likely through the summer.

Soil moisture, El Niño and persistence from spring are main drivers.

# Take Home

- Current conditions:
  - Drier conditions more recently
  - Precip totals varying 30 and 90 days – mostly wet.
  - Temperatures close to avg. last 30 days
  - Crop conditions overall still weak . Overall national crop condition index similar to this time in 1993 and slightly better than 2012.

- Outlook info:.
  - Rain issues more likely north. But convective chances statewide next week.
  - Temperatures warm into mid- July. Need some above average to push crop development.
  - Longer concerns about cool/wet staying with us.

  - Crop issues still developing
    - Delayed development
    - Disease
    - Weeds
    - Insects

And the fall……

Some concern on wetness persisting into fall
Nothing on early freeze

# Take Home

- Current conditions:
  - Drier conditions more recently
  - Precip totals widely ranging 30 and 90 days.
  - Temperatures close to avg. last 30 days
  - Crop conditions overall still weak – better in IA. Overall national crop condition index similar to this time in 1993 and slightly better than 2012.

- Outlook info:.
  - Rains more limited with warming trend
  - Warmth and drier into mid-July
  - Could introduce some issues for poorly rooted crops

# Midwest and Great Plains Climate-Drought Outlook 15 September 2016

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515-294-2013

Sign up:
https://www.drought.gov/drought/dews/midwest
Archives:
http://mrcc.isws.illinois.edu/multimedia/webinars.jsp.

National Drought Mitigation Center

NOAA National Oceanic and Atmospheric Administration U.S. Department of Commerce

Regional Climate Centers

AASC American Association of State Climatologists

USDA United States Department of Agriculture Midwest Climate Hub

# For More Information

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


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