





Midwest Climate Hub
U.S. DEPARTMENT OF AGRICULTURE

A wide-angle photograph of a sunset over a dark field. The sky is filled with vibrant orange and red clouds, with the sun low on the horizon. In the distance, there are silhouettes of trees and utility poles.

Dealing with a Changing Climate in Agriculture

A close-up, slightly blurred photograph of a cornfield. The green leaves of the corn plants are the primary focus, creating a textured background.

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Topics

- A brief Background of USDA Climate Hubs
 - The need, mission
 - More on the Midwest Climate Hub
- Ag In a Changing Climate
 - Trends
 - Impacts
 - Outlooks
- Resources of the USDA Midwest Climate Hub
 - Website
 - For more Information

USDA Climate Hubs



Providing...

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



Vision and Mission

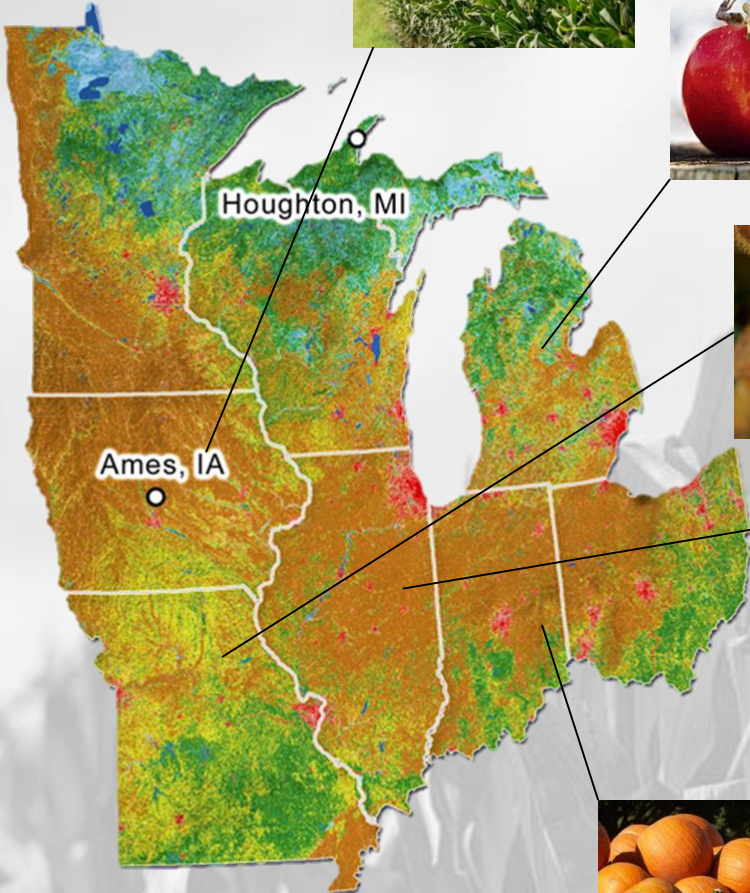
Vision

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.

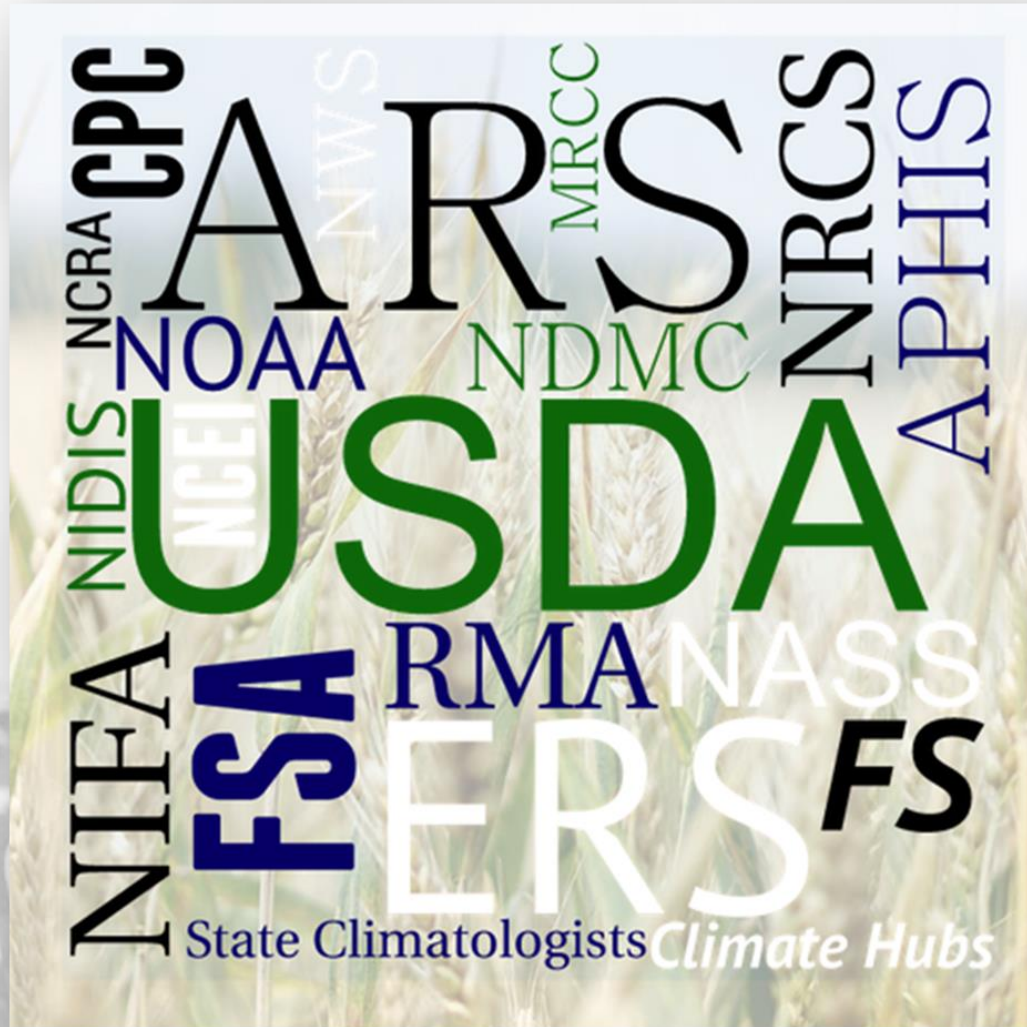
Here in the Midwest...



Our Goal

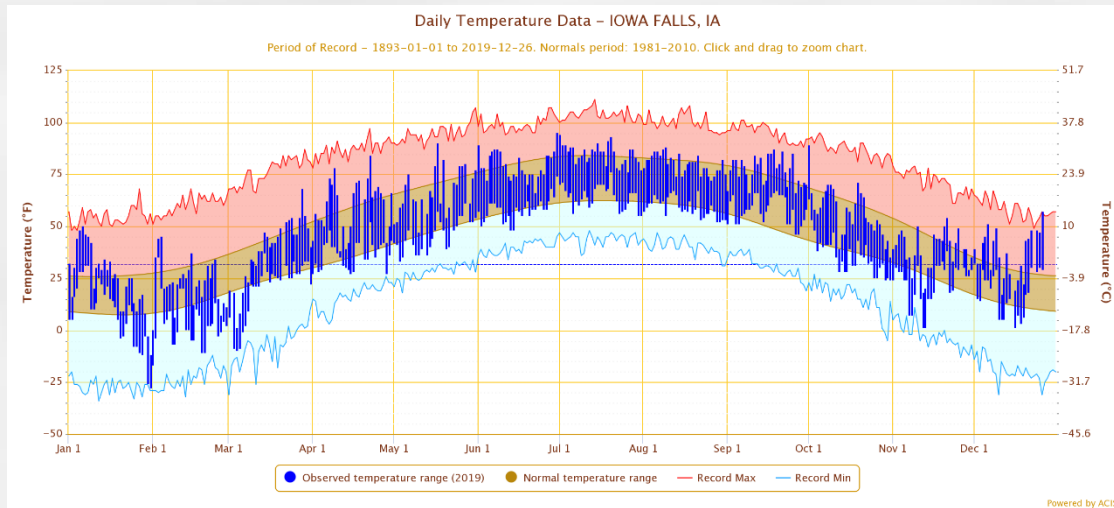
To provide information to help producers cope with climate change through **linkages of research, education and partnerships** in a region that represents one of the **most intense areas of agricultural production** in the world.

Partners



Stakeholders

Crop Consultants
Commodity Organizations
Soil and Water
Conservation Districts
Other USDA Agencies
Cooperative Extension
Land Grant Universities
Farmers
Ranchers
Forest Land Owners
Specialty Crop Growers
...And Many Others



Agricultural Issues

CHANGING CLIMATE

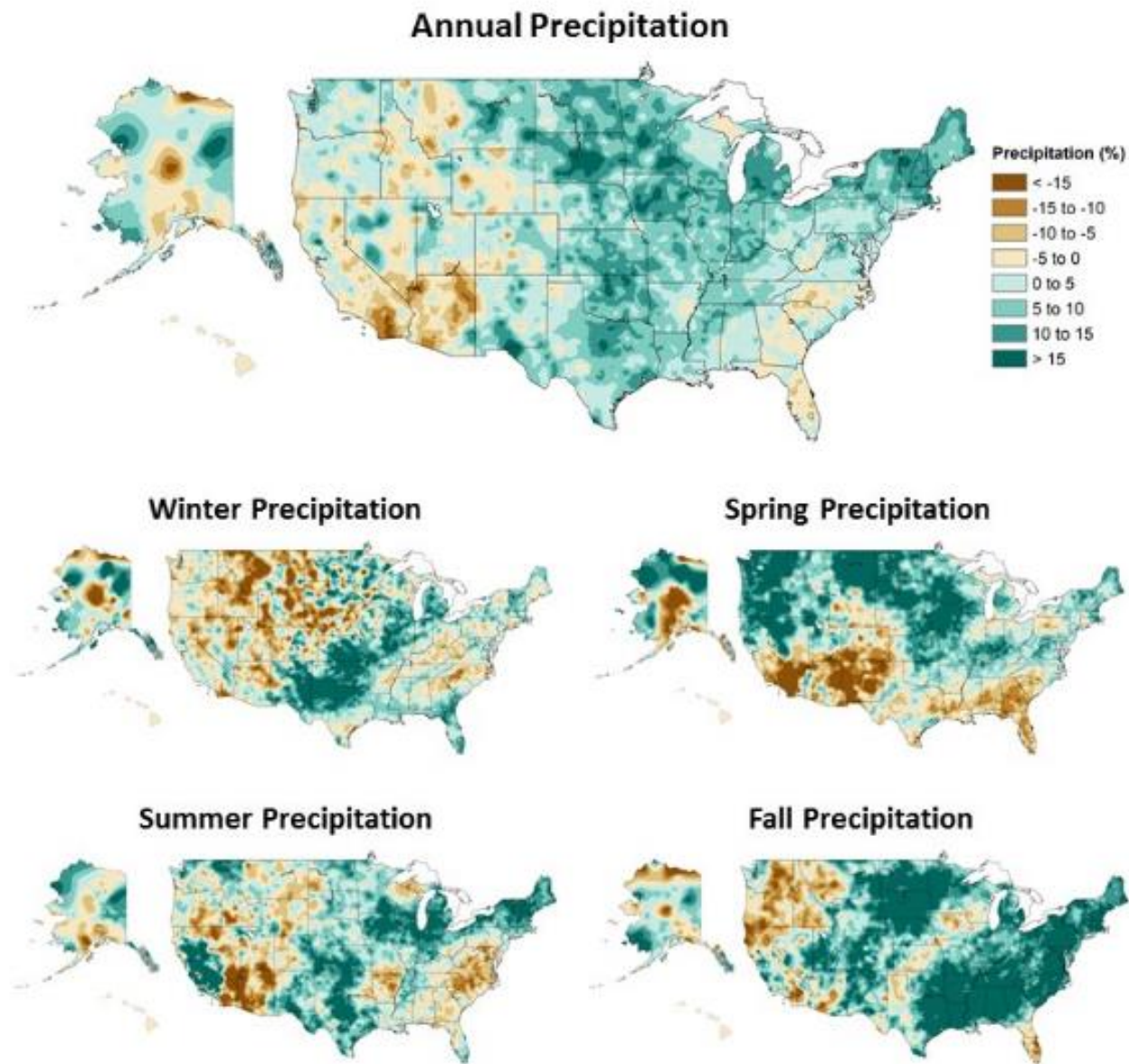
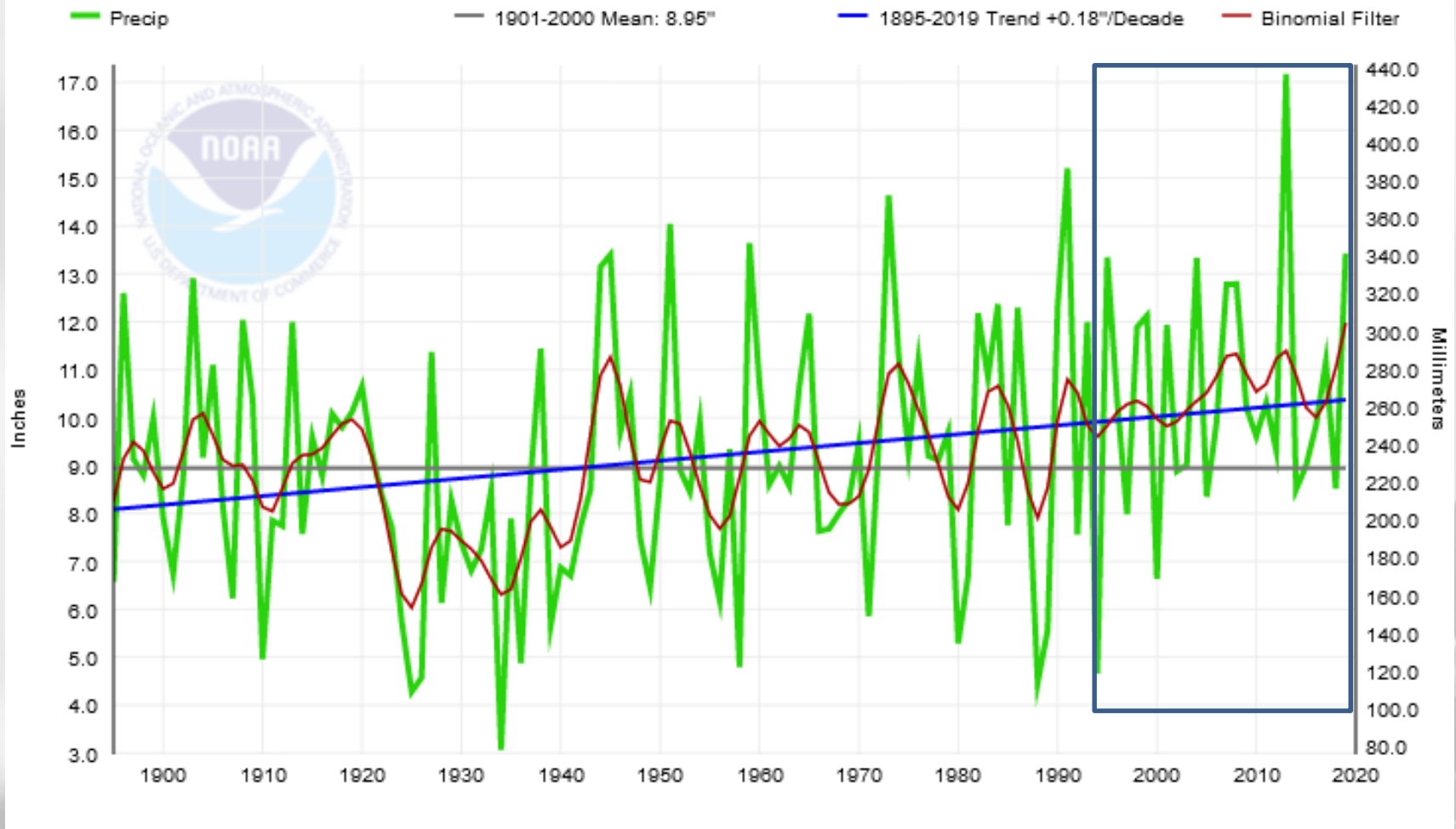


Figure 7.1: Annual and seasonal changes in precipitation over the United States. Changes are the average for present-day (1986–2015) minus the average for the first half of the last century (1901–1960 for the contiguous United States, 1925–1960 for Alaska and Hawai'i) divided by the average for the first 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].

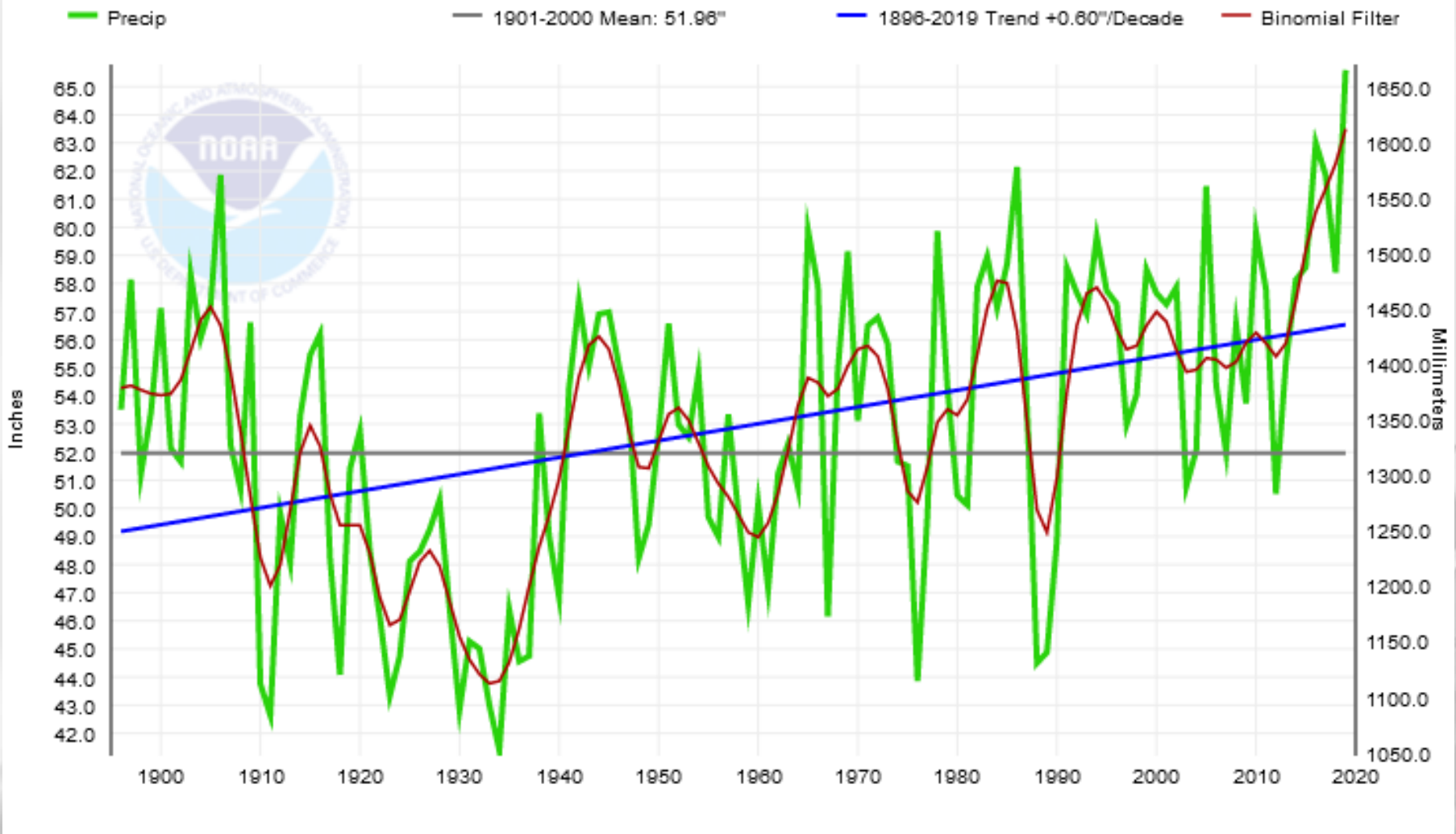
Iowa, Precipitation, March-May



Only 6 of last 25 years below long term average.

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

Minnesota, Precipitation, 24-Month Period Ending in December



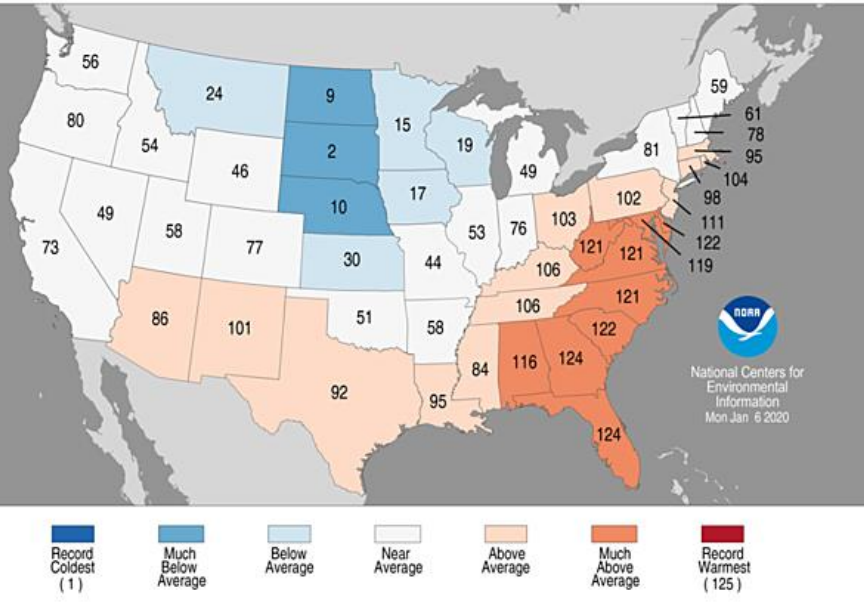
Records for last 24 months outstripping previous highs

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

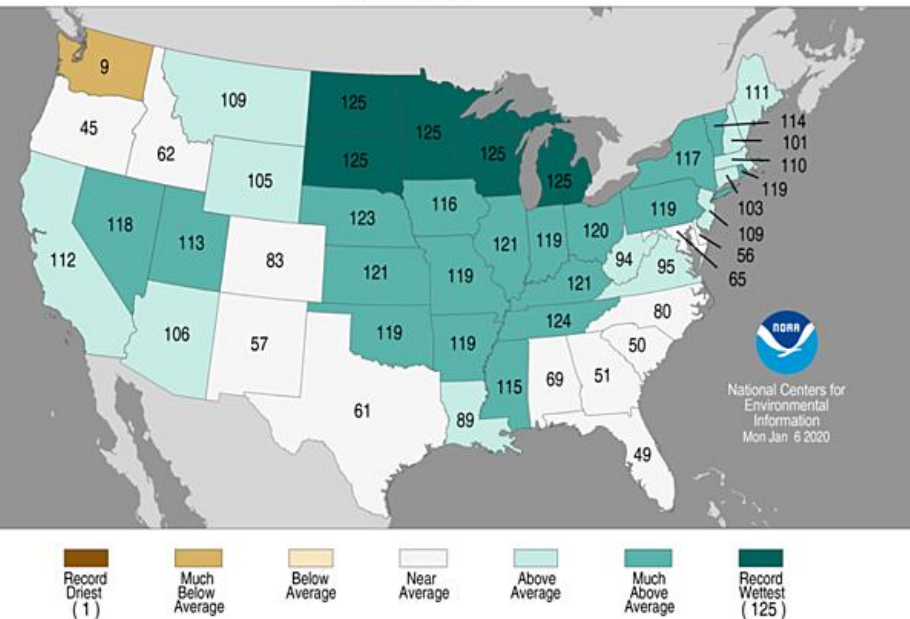


State 2019 Rankings

Statewide Maximum Temperature Ranks
January–December 2019
Period: 1895–2019



Statewide Precipitation Ranks
January–December 2019
Period: 1895–2019

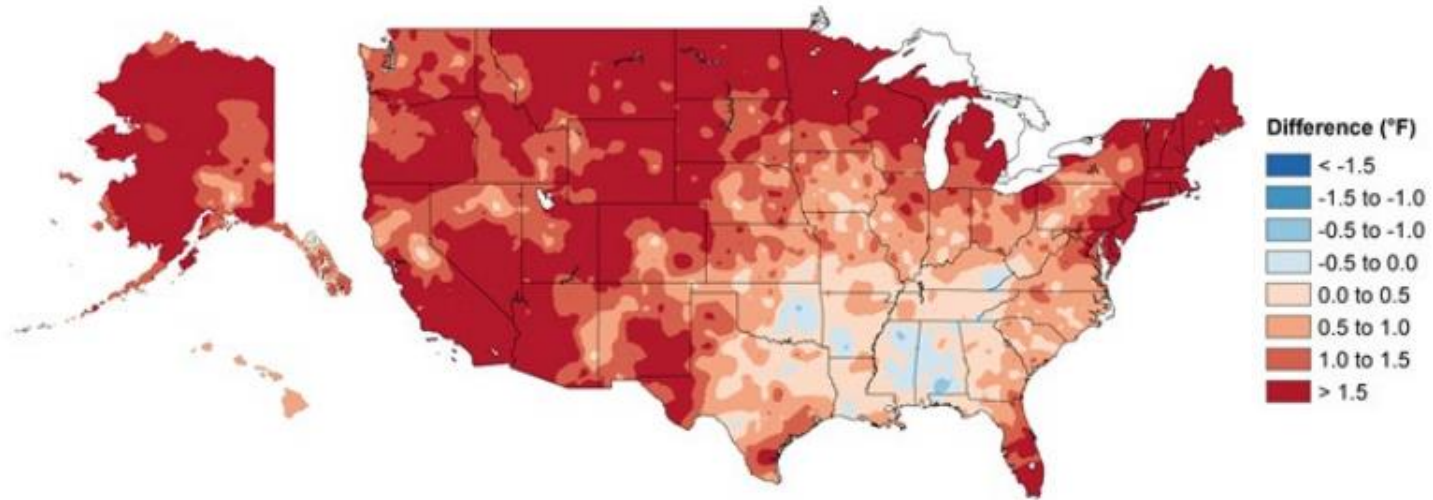


Issues from Precip Changes

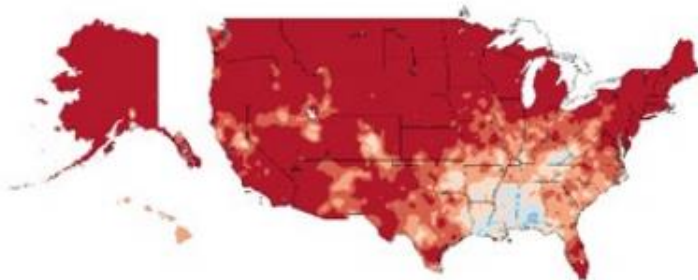
- Variable across the corn belt
- Increasing precip intensity (especially off-season)
- More soil/nutrient loss potential
- Soil loss
 - Reducing tillage
 - Cover crops
- Nutrient loss
 - 4Rs
- Increased drainage usage



Annual Temperature



Winter Temperature



Summer Temperature

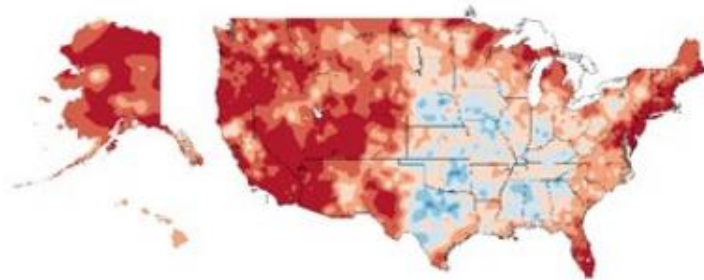
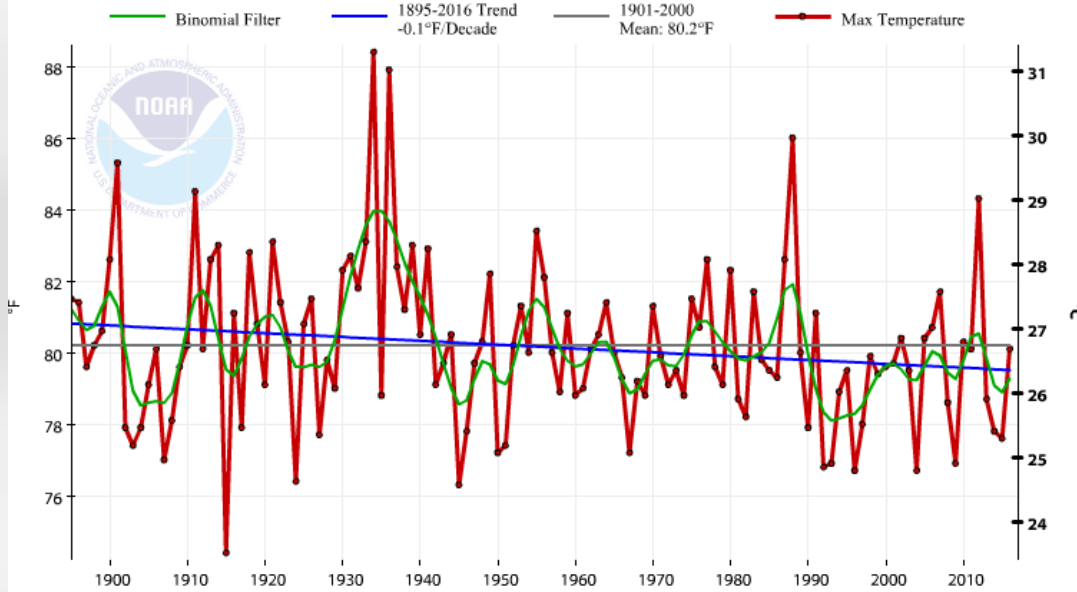
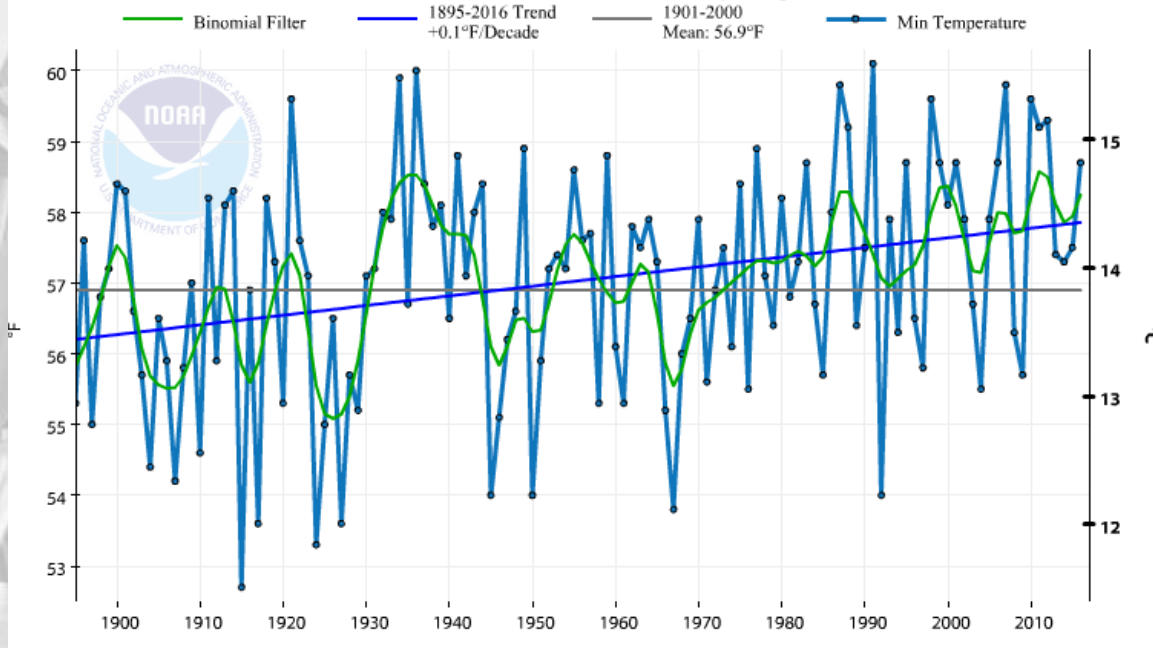


Figure 6.1. Observed changes in annual, winter, and summer temperature (°F). Changes are the difference between range for present-day (1986–2016) and the average for the first half of the last century (1901–1960 for the con-United States, 1925–1960 for Alaska and Hawai'i). Estimates are derived from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

Iowa, Maximum Temperature, May-August



Iowa, Minimum Temperature, May-August



ncdc.noaa.gov/cag

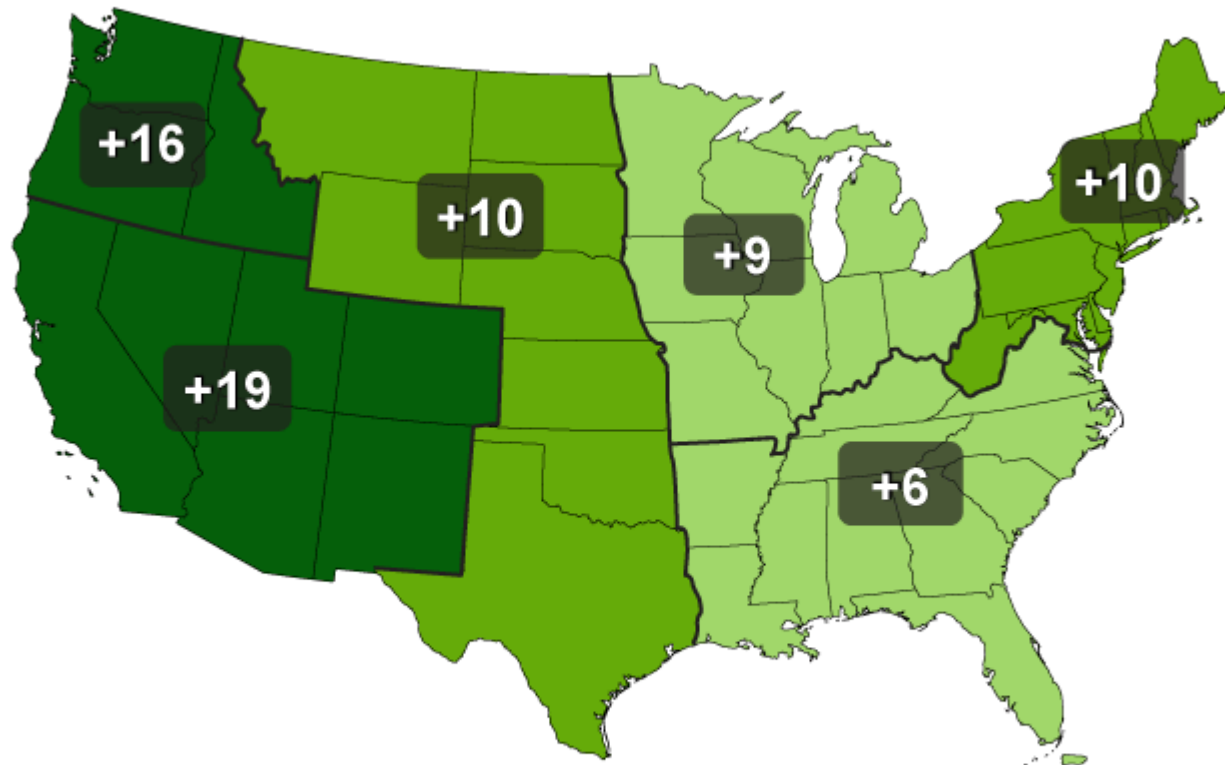
Warm Nights

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

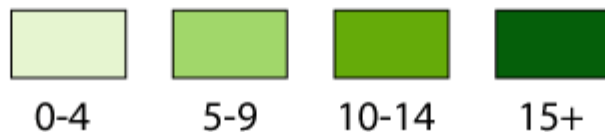
Increasing moisture in the atmosphere

- Complicated issues
 - Warmer nights/not as warm days
 - Changing disease potential
 - Adds to livestock stresses

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).

<http://nca2014.globalchange.gov/>

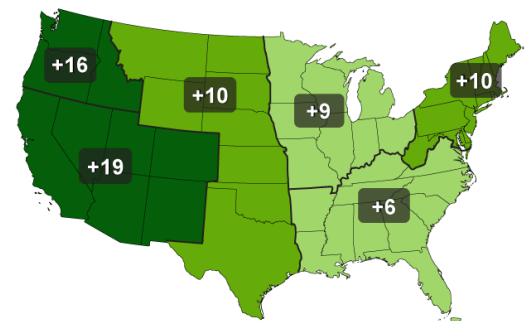


Frost Free Season Change

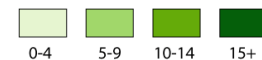
- Longer hybrid
- Earlier spring (confounded)
- Earlier planting not always possible/soil conditions
- Average dates change – not always a solid guarantee



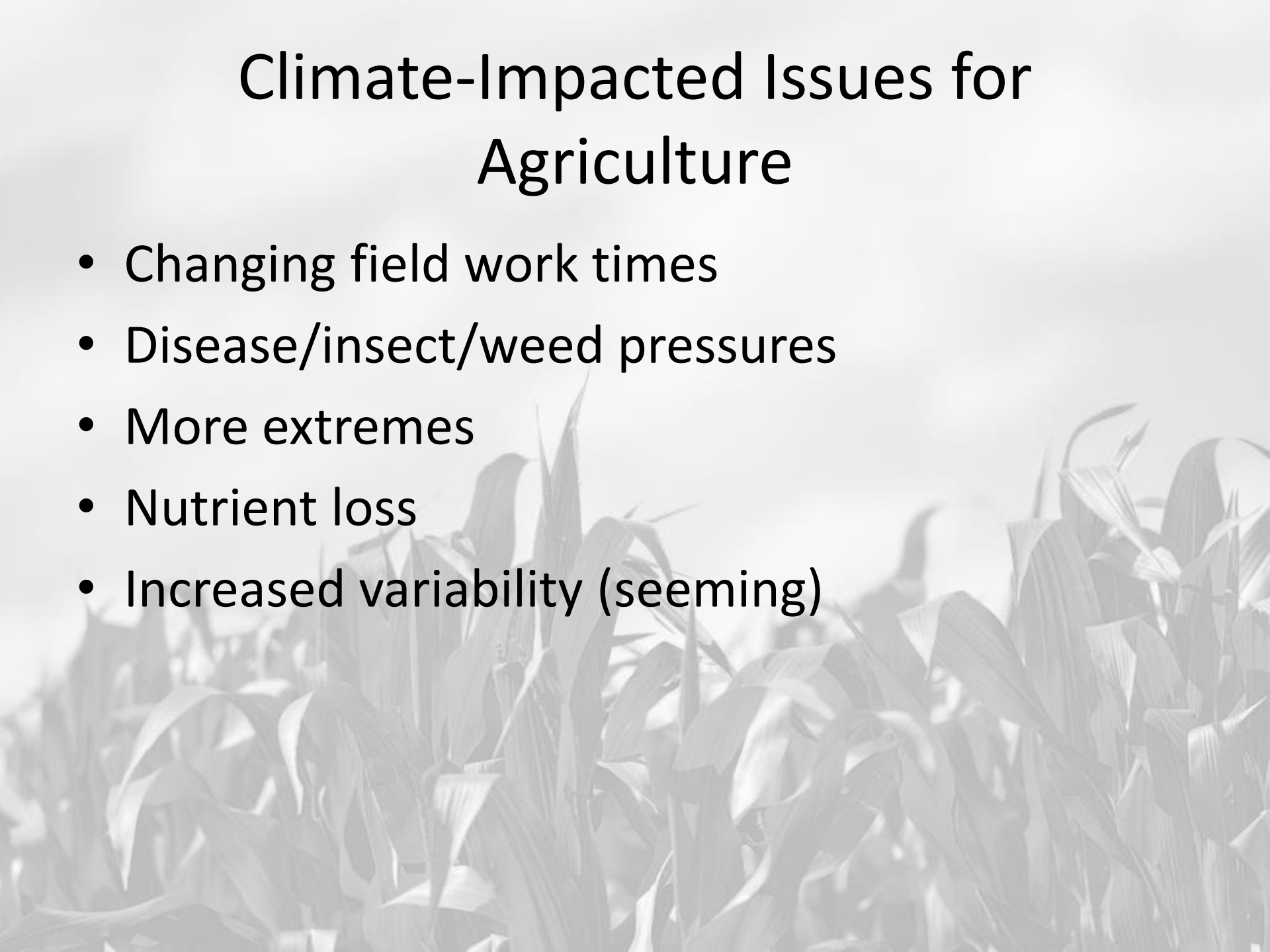
Observed Increase in Frost-Free Season Length



Change in Annual Number of Days

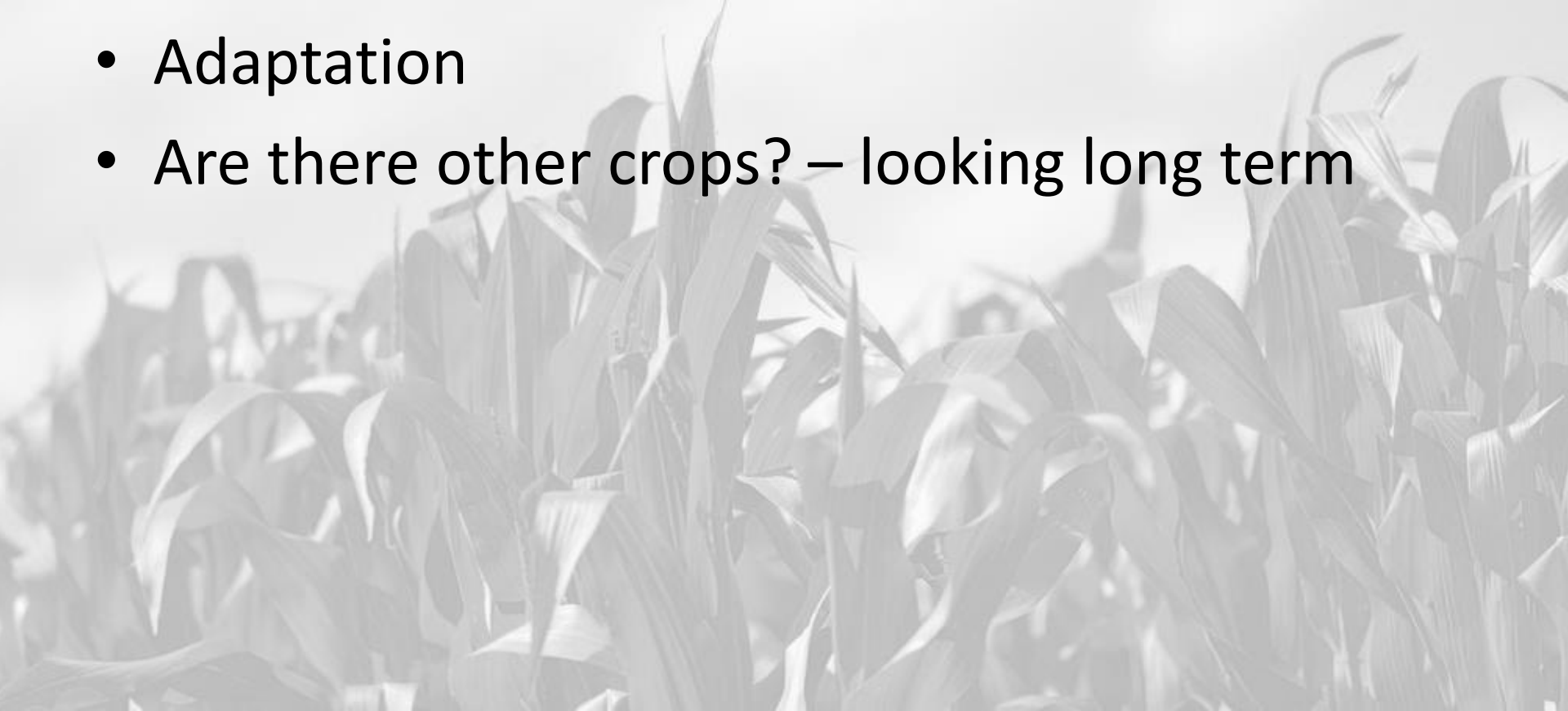


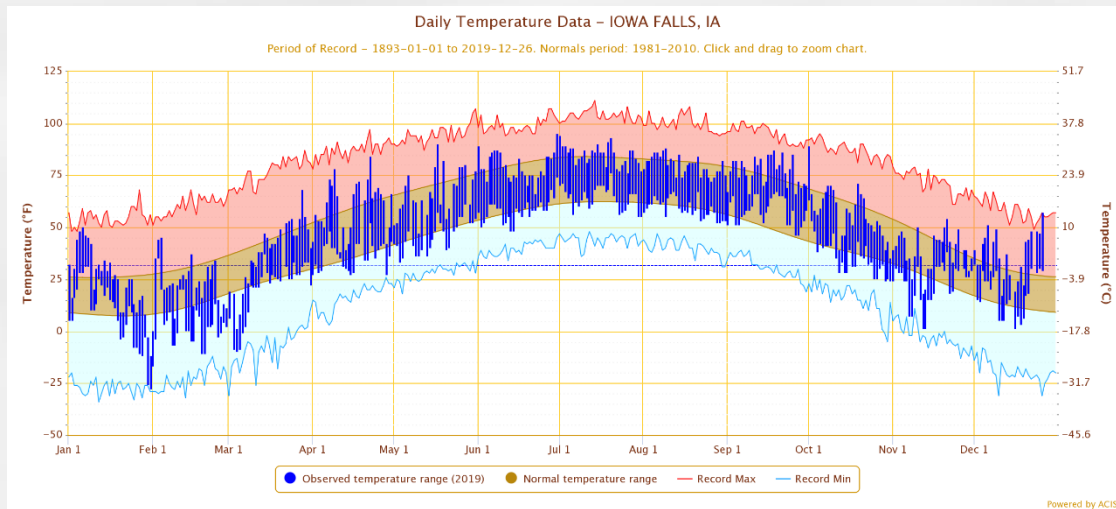
Climate-Impacted Issues for Agriculture

- Changing field work times
 - Disease/insect/weed pressures
 - More extremes
 - Nutrient loss
 - Increased variability (seeming)
- 

Thoughts looking ahead

- Short term – improve decision-making
- Care for soils – always
- Adaptation
- Are there other crops? – looking long term



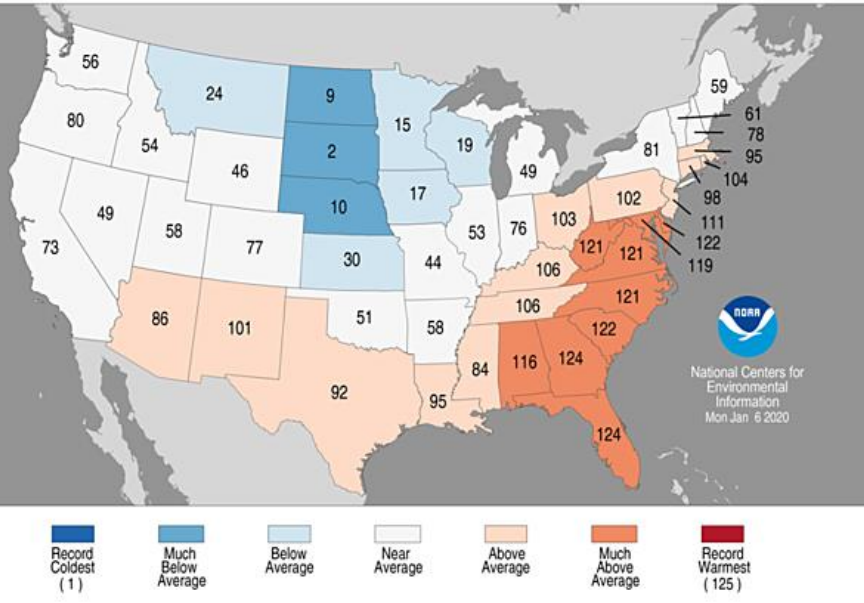


Always check for recent context

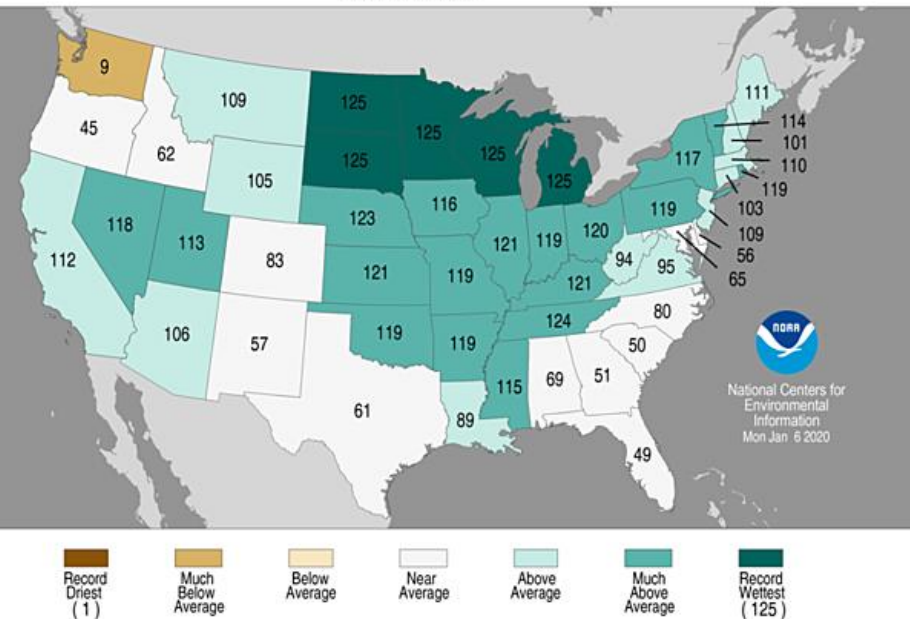
RECENT CONDITIONS

State 2019 Rankings

Statewide Maximum Temperature Ranks
January–December 2019
Period: 1895–2019

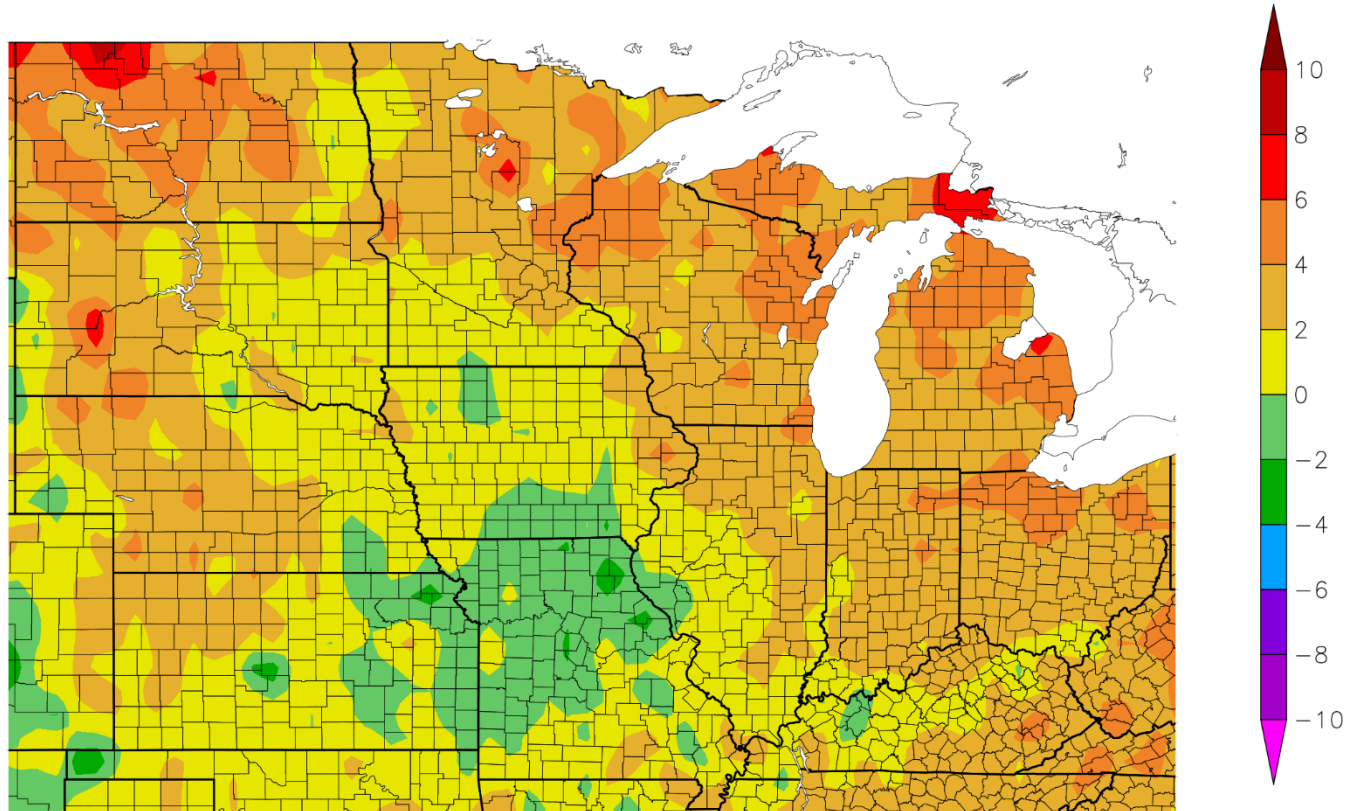


Statewide Precipitation Ranks
January–December 2019
Period: 1895–2019



Iowa Last 30 Day Temperature

Departure from Normal Temperature (F)
1/19/2020 – 2/17/2020

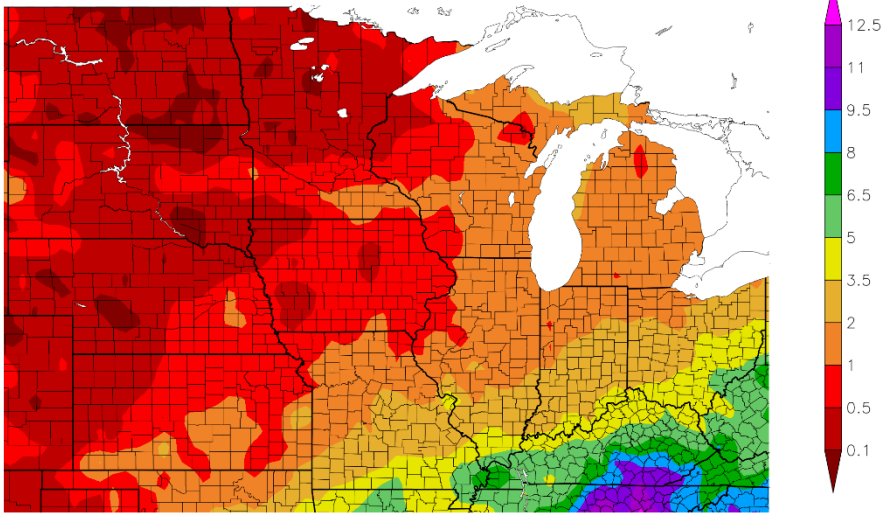


Generated 2/18/2020 at HPRCC using provisional data.

NOAA Regional Climate Centers

Iowa Last 30 Day Precipitation

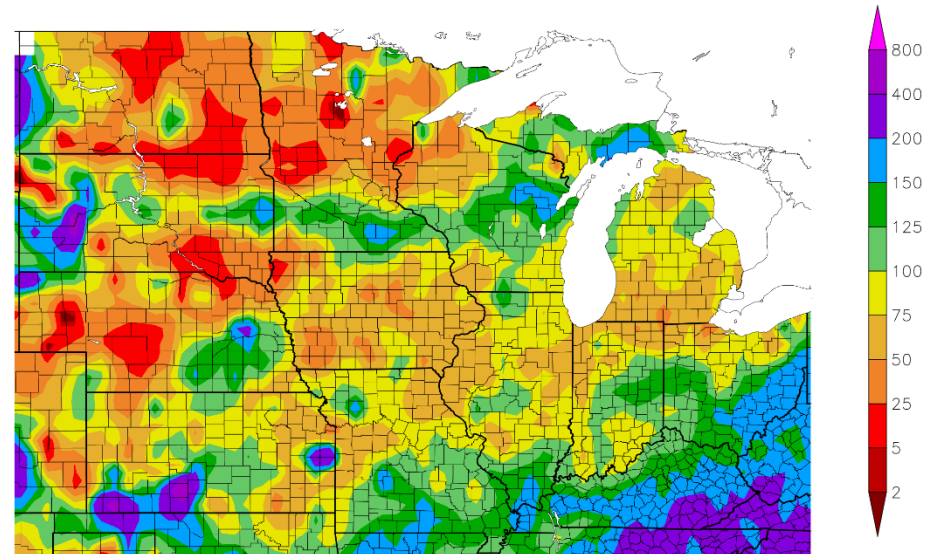
Precipitation (in)
1/19/2020 - 2/17/2020



Generated 2/18/2020 at HPRCC using provisional data.

NOAA Regional Climate Center

Percent of Normal Precipitation (%)
1/19/2020 - 2/17/2020



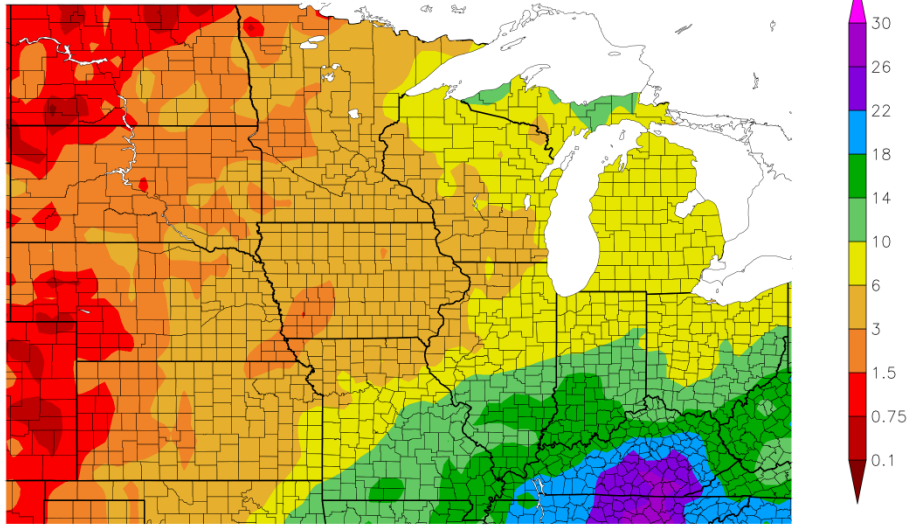
Generated 2/18/2020 at HPRCC using provisional data.

NOAA Regional Climate Centers

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

Iowa Last 90 Day Precipitation

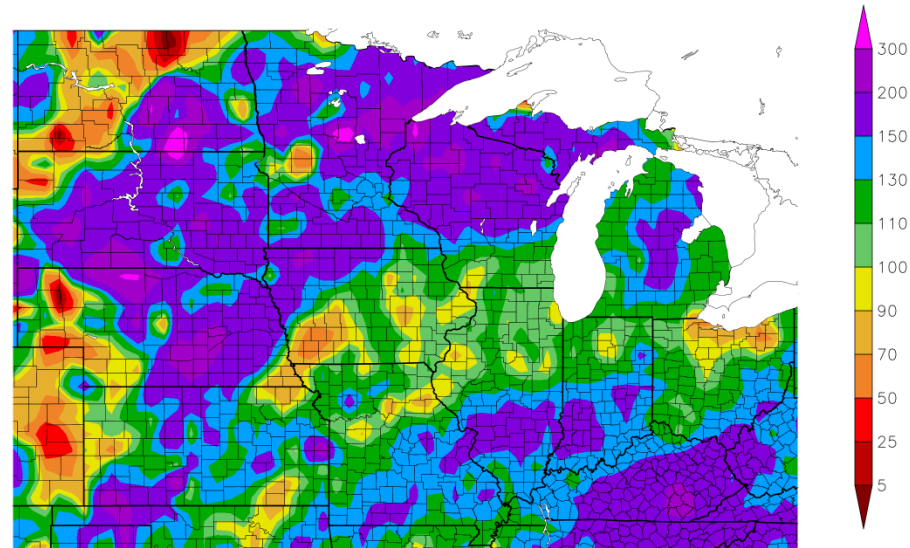
Precipitation (in)
11/20/2019 - 2/17/2020



Generated 2/18/2020 at HPRCC using provisional data.

NOAA Regional Climate Centers

Percent of Normal Precipitation (%)
11/20/2019 - 2/17/2020



Generated 2/18/2020 at HPRCC using provisional data.

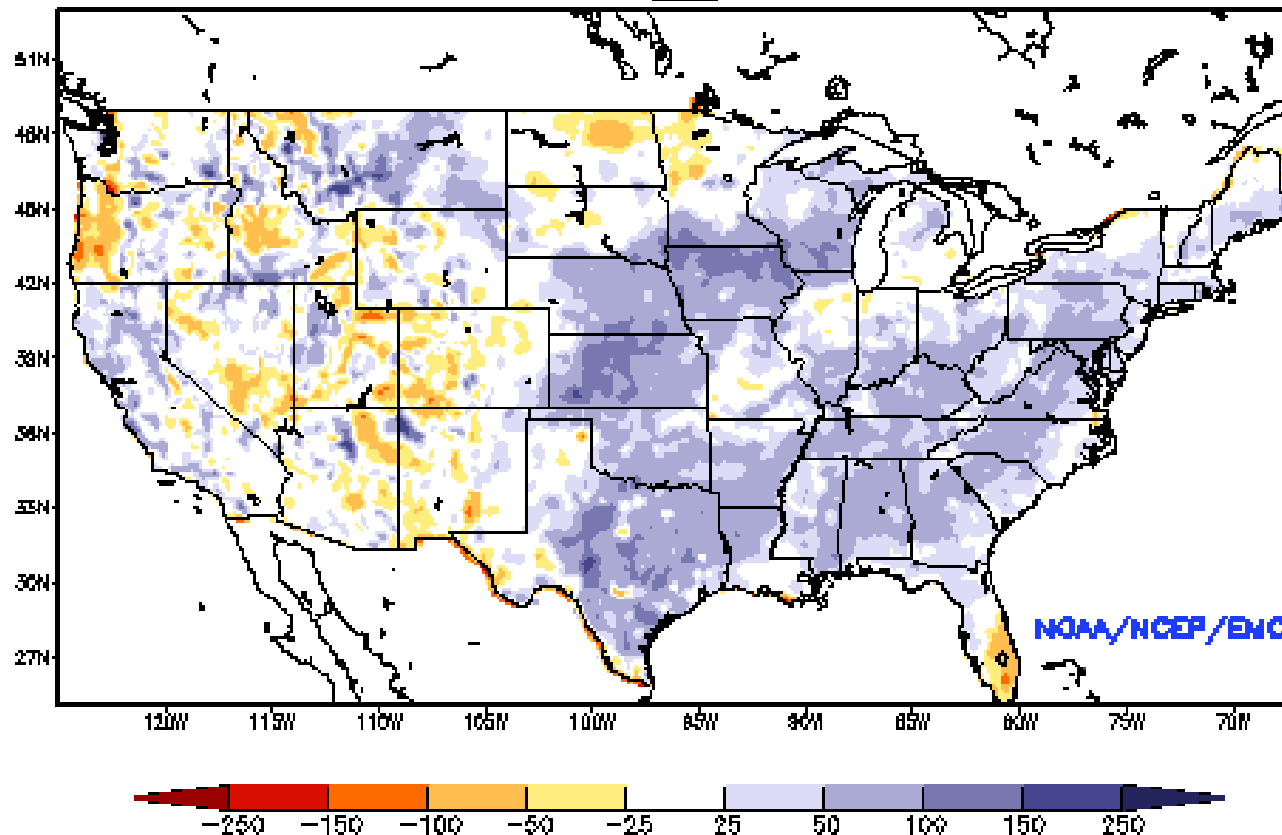
NOAA Regional Climate Centers

Modeled Soil Moisture

National Land Data Assimilation System

Last year – Jan 2019

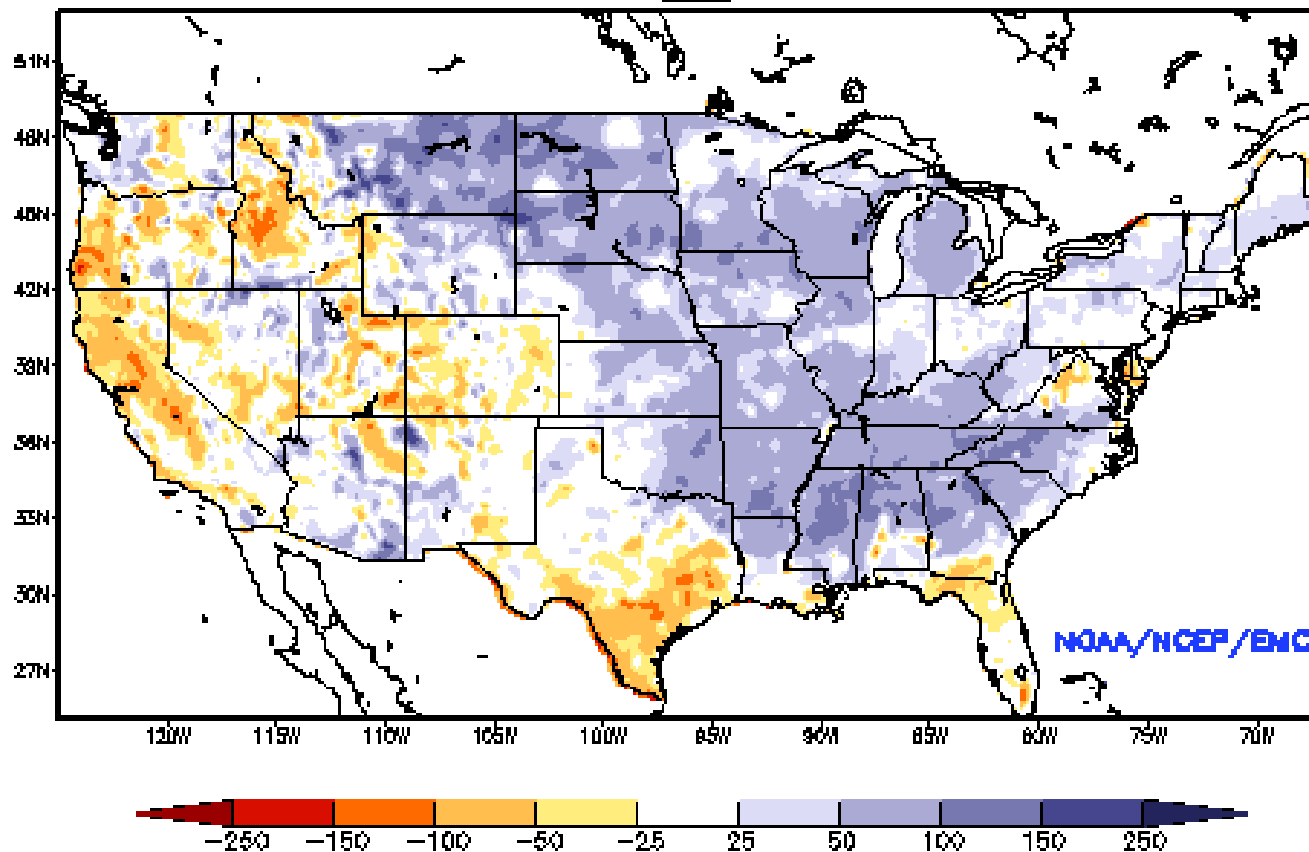
Ensemble-Mean – Current Total Column Soil Moisture Anomaly (mm)
NCEP NLDAS Products Valid: JAN 24, 2019



Modeled Soil Moisture

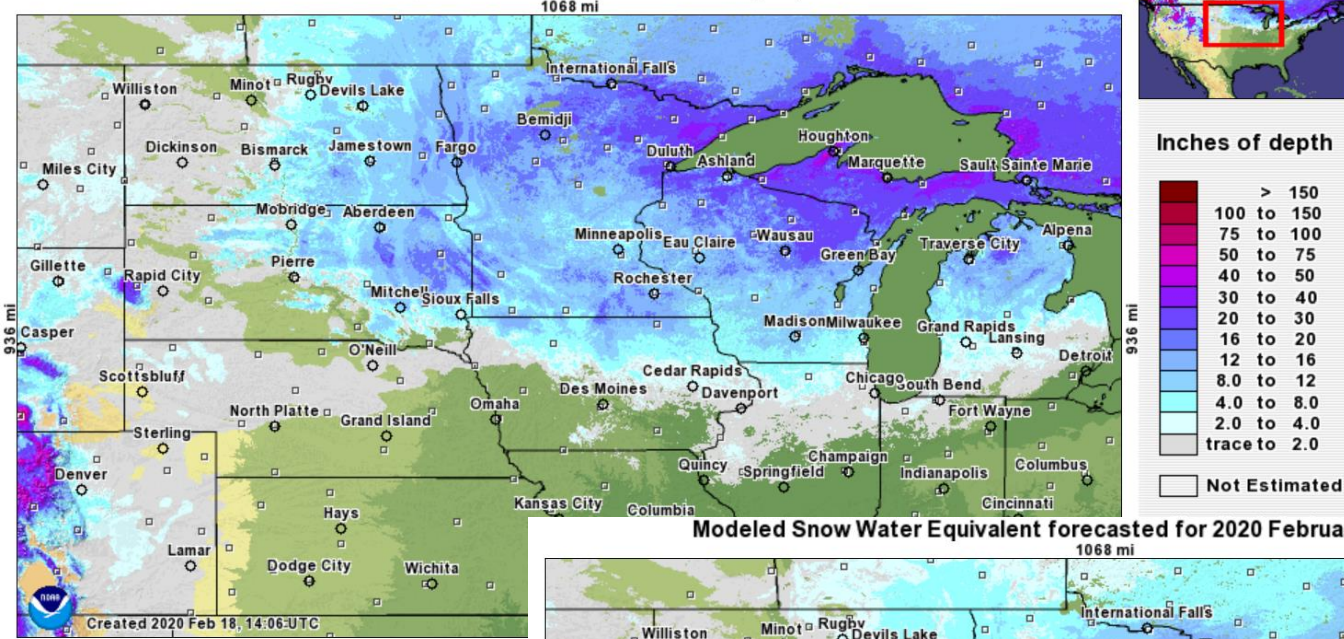
National Land Data Assimilation System

Ensemble-Mean - Current Total Column Soil Moisture Anomaly (mm)
NCEP NLDAS Products Valid: FEB 14, 2020

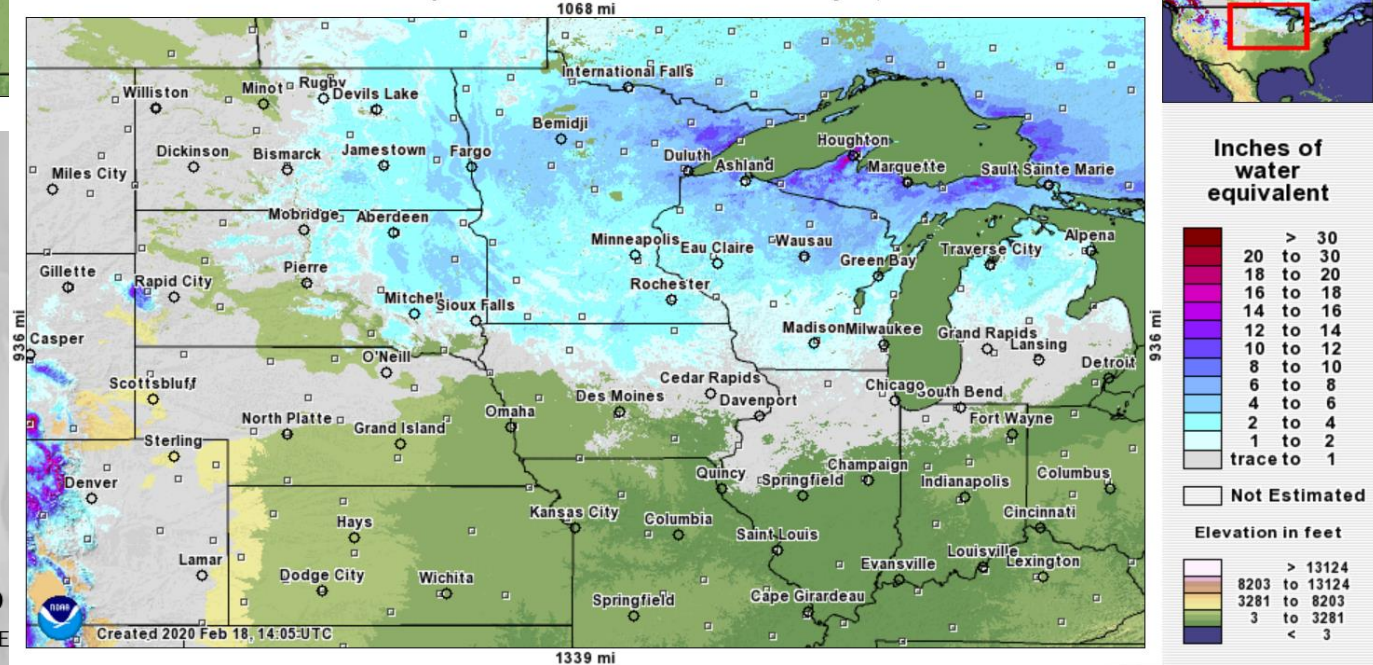


Midwest Snow Water Equiv.

Modeled Snow Depth forecasted for 2020 February 19, 11:00 UTC



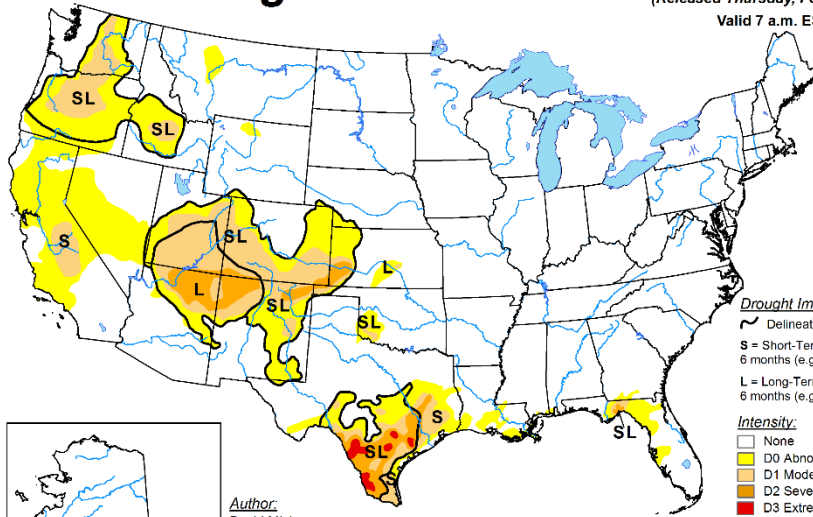
Modeled Snow Water Equivalent forecasted for 2020 February 19, 11:00 UTC



<http://www.nohrsc.noaa.gov/interactive/html/map.html>

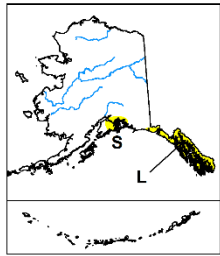
U.S. Drought Monitor

February 18, 2020
 (Released Thursday, Feb. 20, 2020)
 Valid 7 a.m. EST

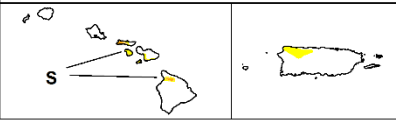


Drought Impact Types:
 - Delineates dominant impacts
 S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)
 L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

Intensity:
 - None
 - D0 Abnormally Dry
 - D1 Moderate Drought
 - D2 Severe Drought
 - D3 Extreme Drought
 - D4 Exceptional Drought



Author:
 David Miskus
 NOAA/NWS/NCEP/CPC



The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>



U.S. Drought Monitor North Central

February 18, 2020
 (Released Thursday, Feb. 20, 2020)
 Valid 7 a.m. EST

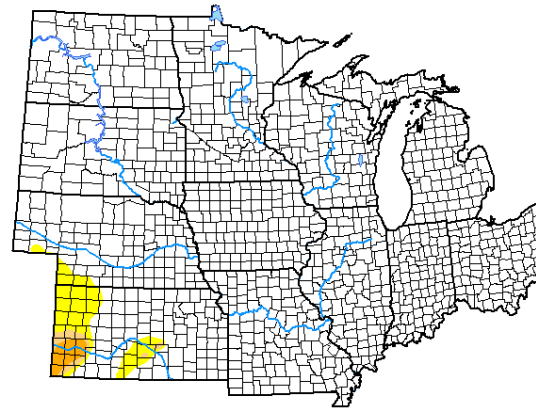
Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	96.53	3.47	0.97	0.55	0.00	0.00
Last Week 02-11-2020	96.30	3.70	1.07	0.55	0.00	0.00
3 Months Ago 11-19-2019	94.97	5.03	1.17	0.49	0.17	0.00
Start of Calendar Year 12-31-2019	96.04	3.96	1.06	0.45	0.00	0.00
Start of Water Year 10-01-2019	86.36	13.64	3.51	0.23	0.00	0.00
One Year Ago 02-19-2019	97.20	2.80	0.00	0.00	0.00	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. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>

Author:
 David Miskus
 NOAA/NWS/NCEP/CPC



- Weekly map – drought conditions
- Snapshot of current conditions
- Always looking for local impact

<https://droughtmonitor.unl.edu>



noaa.gov/products/Drought/



What is useful?

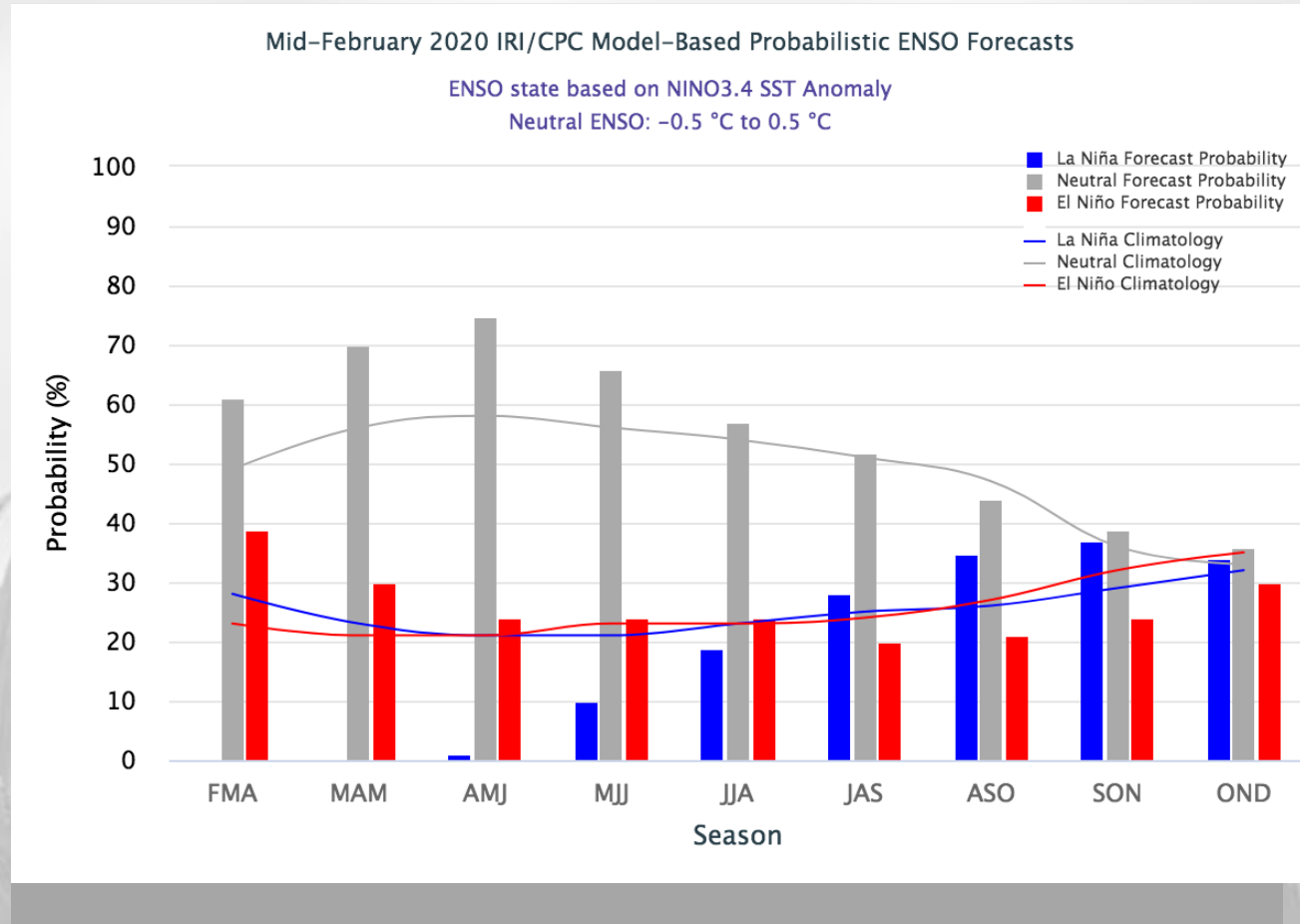
WEATHER/CLIMATE OUTLOOKS


Climate Outlooks

- Current conditions
- El Niño/La Niña status
- Other oscillations (not always forecastable)
- Trends
- Computer models (interpreted)
- *Things that don't work:*
- Walnuts
- Onions
- Farmers Almanac
- Sun spots

ENSO Probabilistic Forecast

- Current status - neutral
- Marginal El Niño cond.
- Expected to be neutral through summer.





Some additional information

TRENDS



Midwest Climate Hub
U.S. DEPARTMENT OF AGRICULTURE

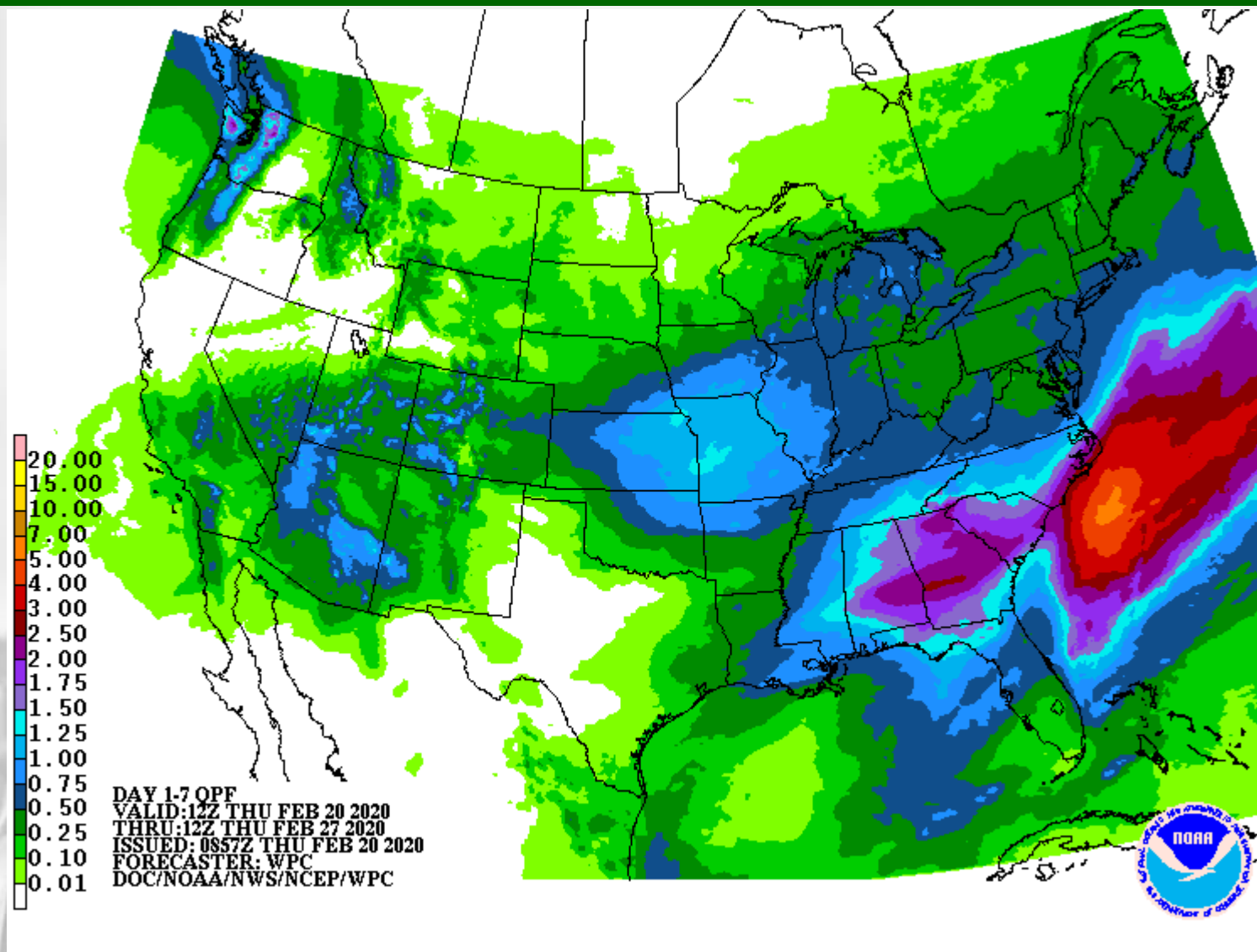
Understanding Probability Outlooks

Precip	Temp	Probability of Occurrence			Most likely category
		<u>Above</u>	<u>Near</u>	<u>Below</u>	
		80.0%-90.0%	16.7%-06.7%	03.3%	"Above"
		70.0%-80.0%	26.7%-16.7%	03.3%	"Above"
		60.0%-70.0%	33.3%-26.7%	06.7%-03.3%	"Above"
		50.0%-60.0%	33.3%	16.7%-06.7%	"Above"
		40.0%-50.0%	33.3%	26.7%-16.7%	"Above"
		33.3%-30.0%	33.3%-40.0%	33.3%-30.0%	"Near Normal"
		30.0%-25.0%	40.0%-50.0%	30.0%-25.0%	"Near Normal"
		33.3%-26.7%	33.3%	33.3%-40.0%	"Below"
		26.7%-16.7%	33.3%	40.0%-50.0%	"Below"
		16.7%-06.7%	33.3%	50.0%-60.0%	"Below"
		06.7%-03.3%	33.3%-26.7%	60.0%-70.0%	"Below"
		03.3%	26.7%-16.7%	70.0%-80.0%	"Below"
		03.3%	16.7%-06.7%	80.0%-90.0%	"Below"
		33.3%	33.3%	33.3%	"Equal Chances"

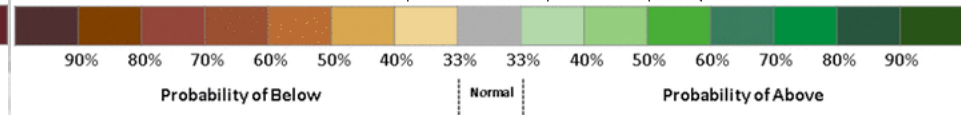
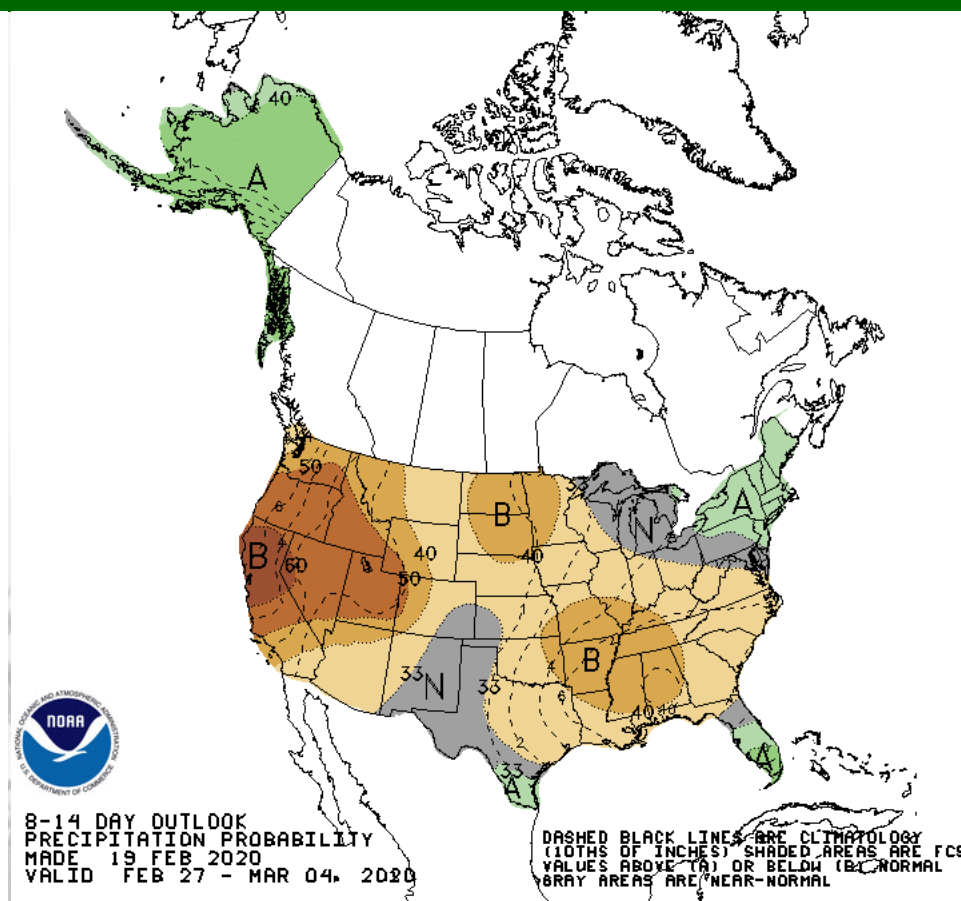
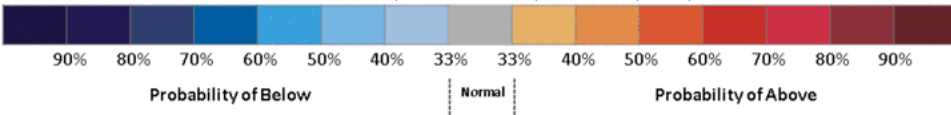
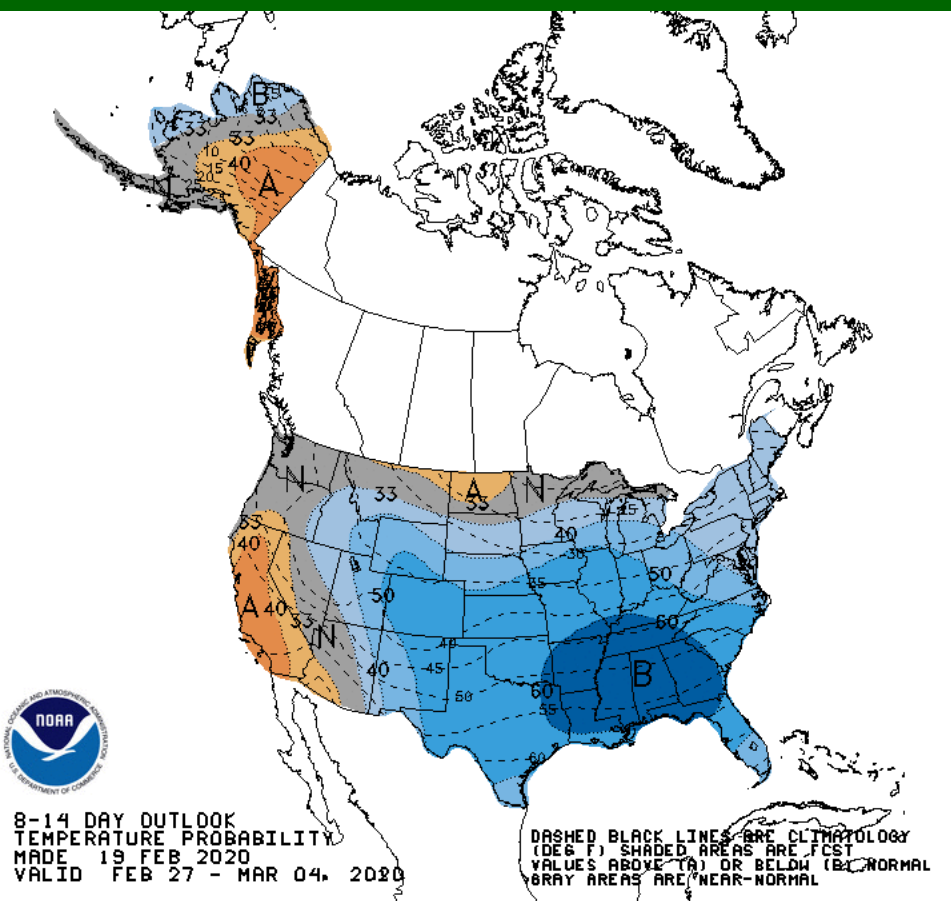
Climate Outlooks

- 6-10 and 8-14 day updated daily
- Monthly updated 2x/month
- Longer range updated monthly
- Based on probabilities
- Good to have ag interpretation

7-day Quantitative Precipitation Forecast

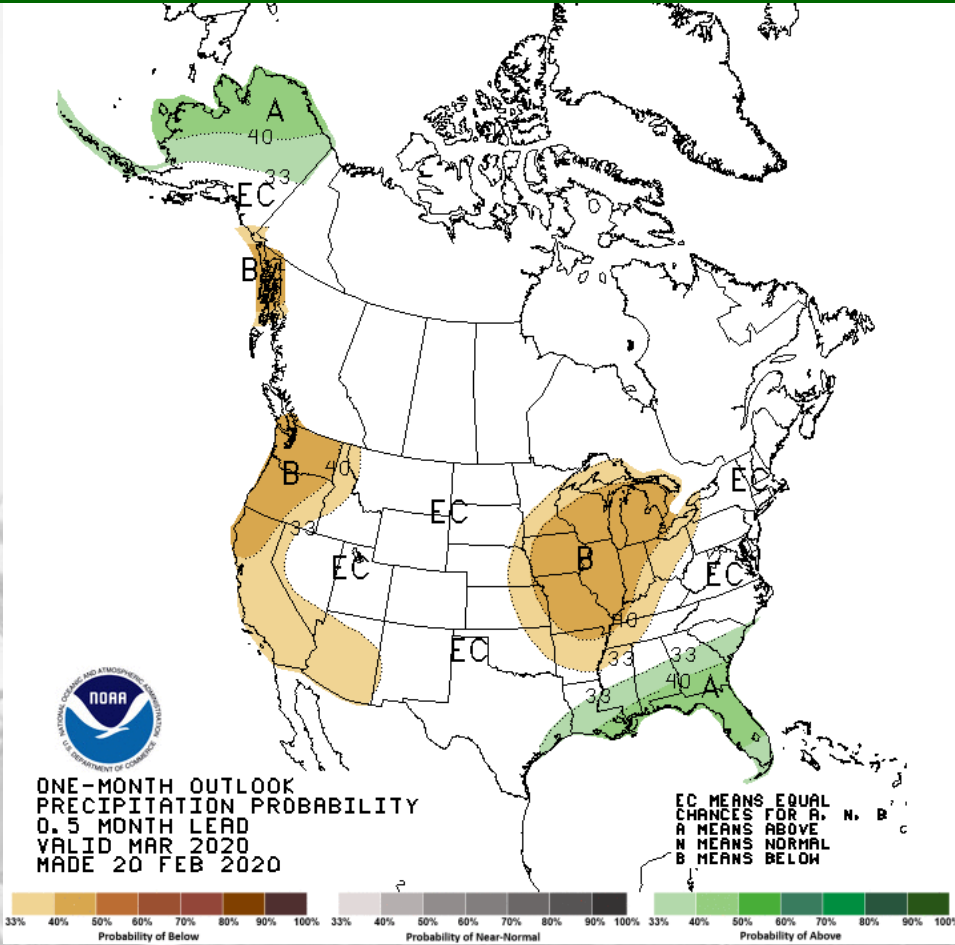
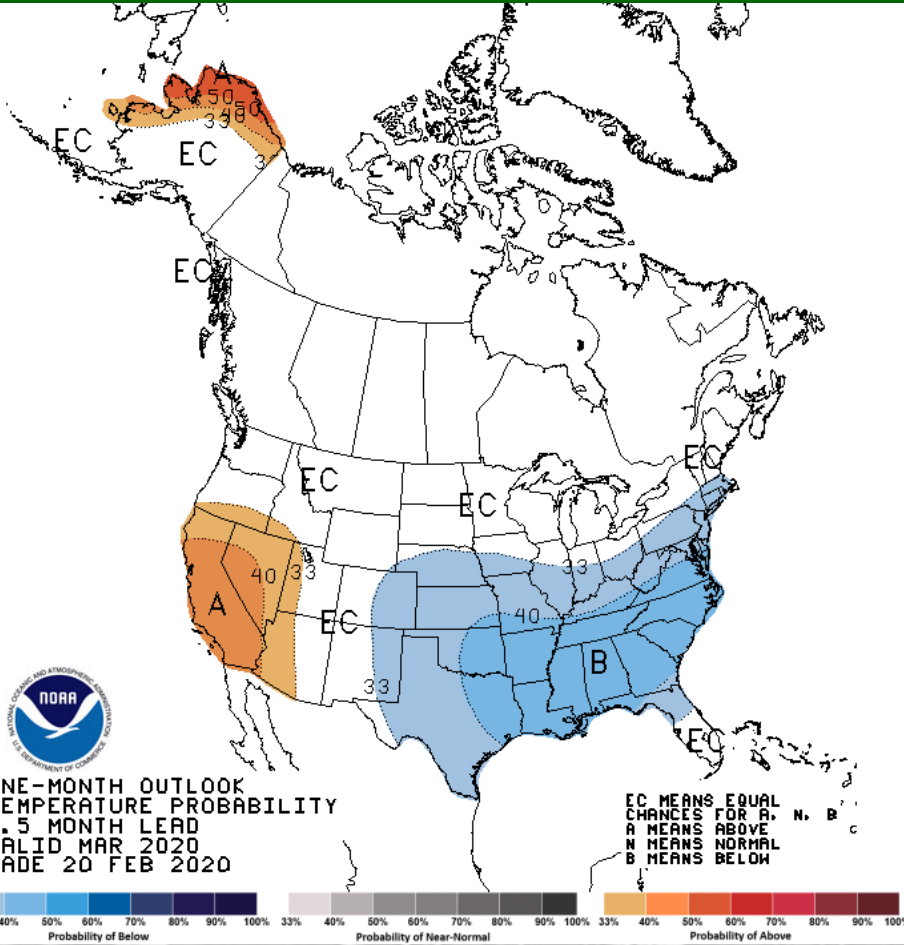


8-14 Day Temperature and Precipitation



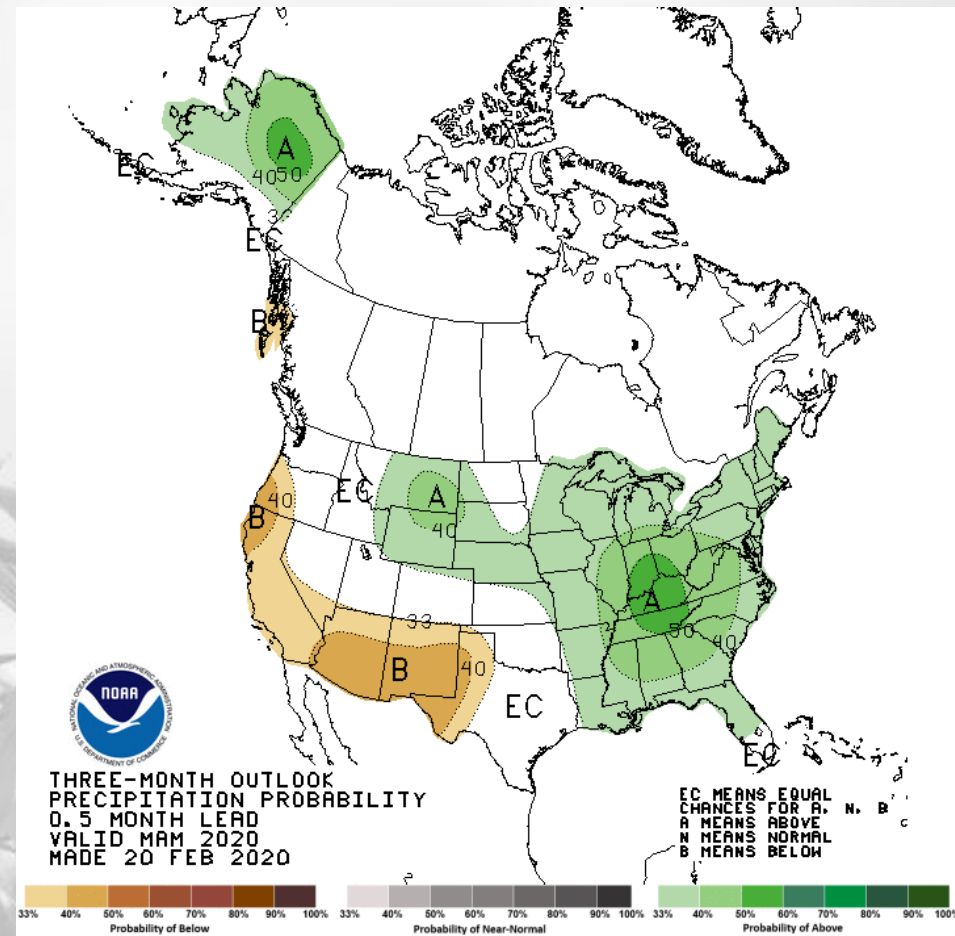
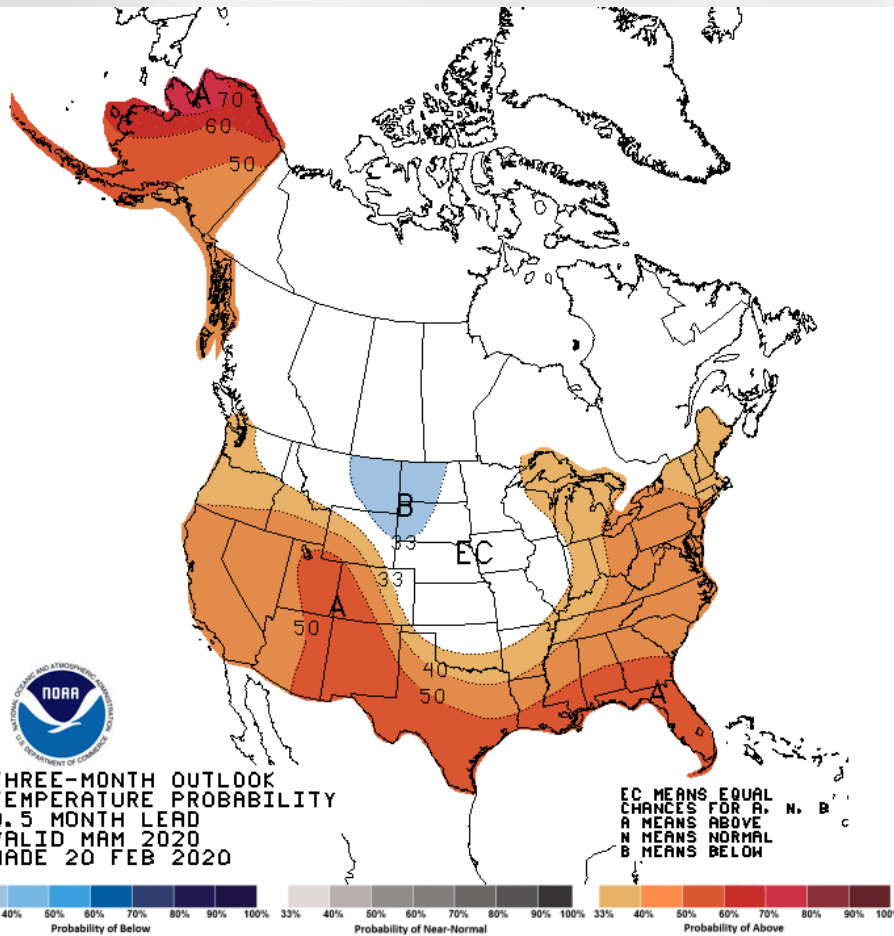
Monthly Outlook for March

NWS Climate Prediction Center



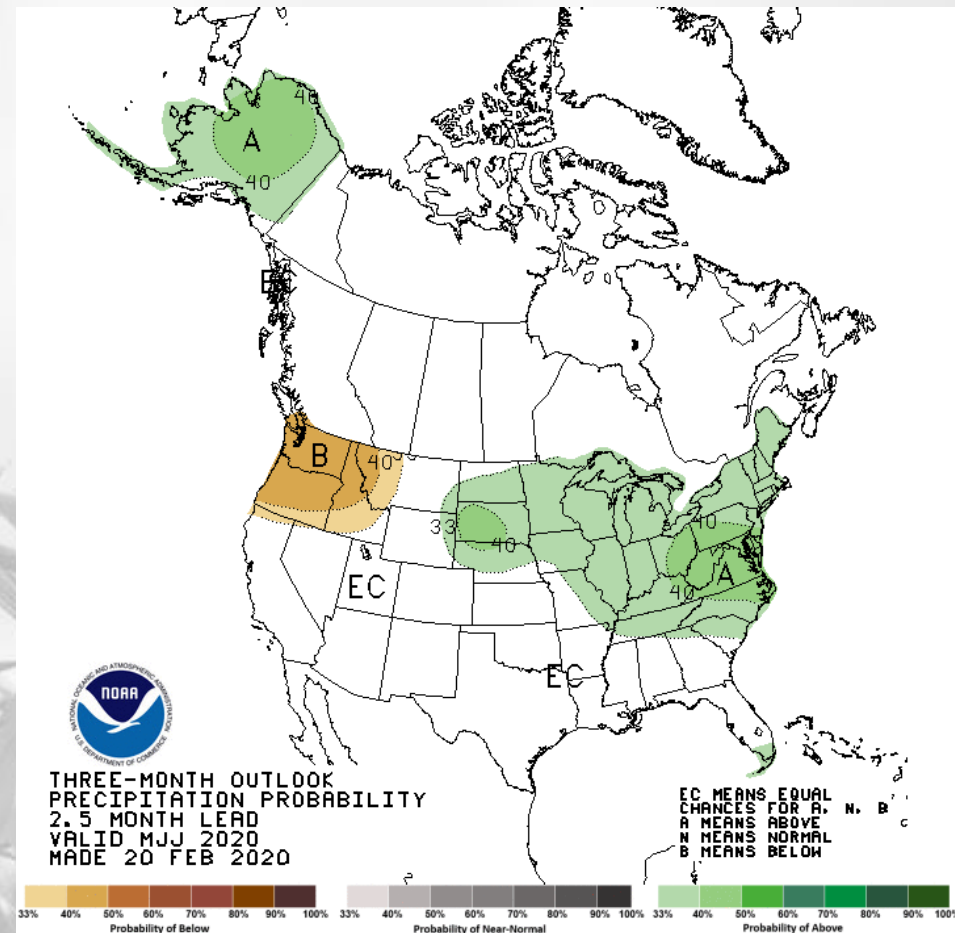
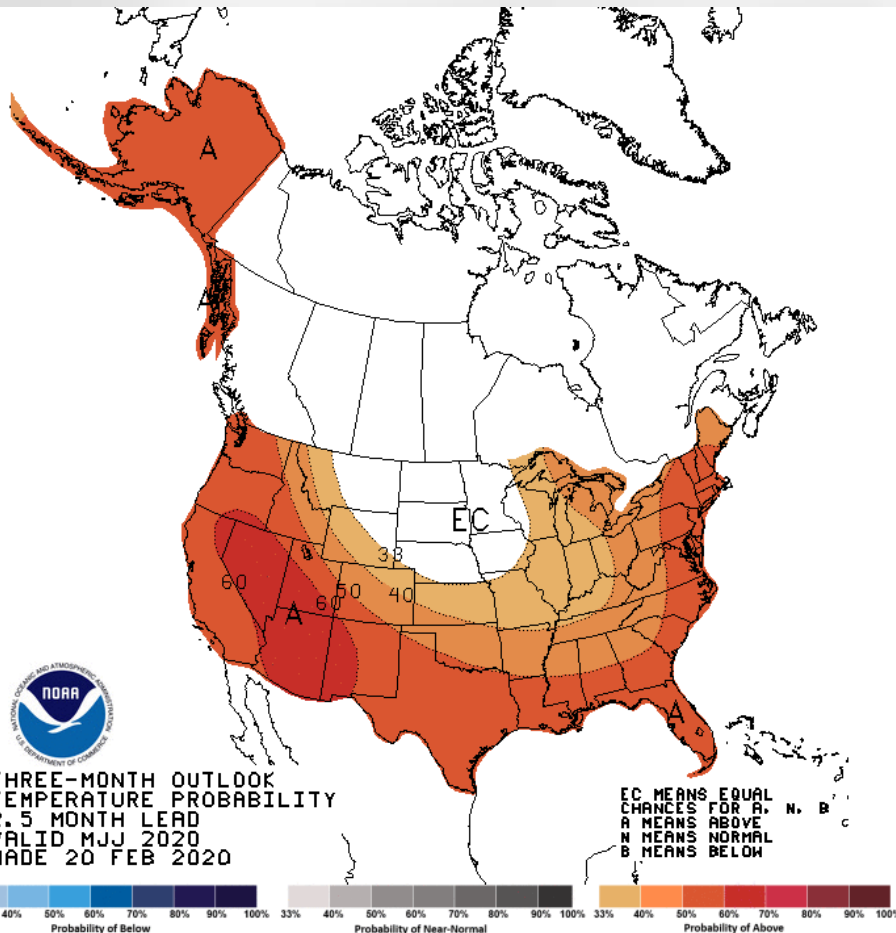
Seasonal Outlook for March-May

NWS Climate Prediction Center



Seasonal Outlook for May-July

NWS Climate Prediction Center



Summary

- Spring
 - Wetness issues persist – wet soils (some recent drying helpful – but does not solve issue)
 - Trend indicates wet springs more frequent
 - Outlooks lean wet also – slight chance of cooler conditions.
 - Spring planting problems probably – likely not as bad as last year
- Summer
 - Not much to say about season overall – so stick with trend.
 - Monitor for shift to dryness – had some last year. Models show something worth monitoring mid/late-summer

Summary (addn'l)

- Delayed planting likely – crops will start behind in development
- Con't compaction issues (soils)
- Possible delayed fall harvest/drying (some time to monitor this)
- Limited drought possibilities overall (there will be some in the Midwest somewhere).
- Probably not enough issue to cut into production much.

Summary (addn'l-2)

- Forages look good so far (ample moisture – seemingly few winter issues)
- Likely have some typical periods of summer stress (more moisture than heat driven).

<https://www.drought.gov/drought/dews/midwest/reports-assessments-and-outlooks>

Midwest and Great Plains Climate- Drought Outlook 15 September 2016

Dr. Dennis Todey

Director – USDA Midwest Climate Hub

Nat'l Lab. for Ag. and Env.

Ames, IA

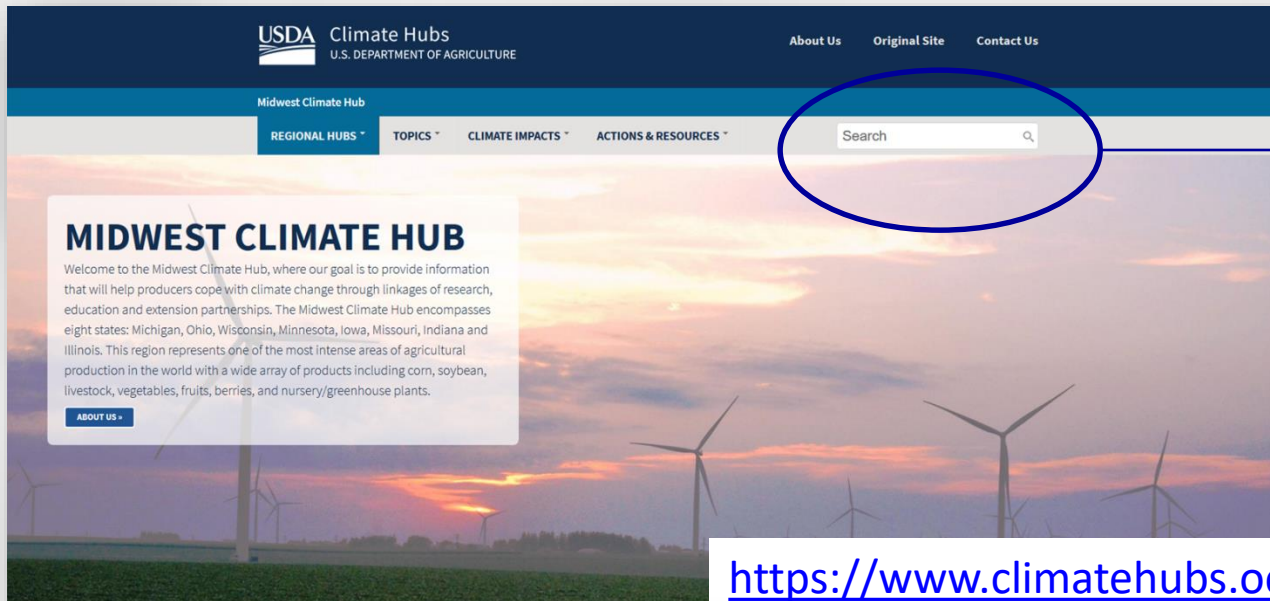
dennis.todey@ars.usda.gov

515-294-2013



United States Department of Agriculture
Midwest Climate Hub

Resources: Website



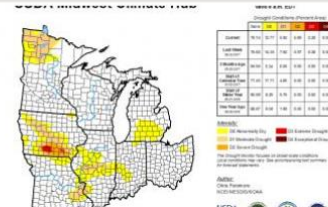
Search for tools, research and events by Region, Topic, type of crop, or climate Impact.

<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

USDA Midwest Climate Hub
U.S. DEPARTMENT OF AGRICULTURE
February 2, 2018

Midwest Ag-Focus Climate Outlook

Current Conditions

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 warm 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 U.S. 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
Midwest Climate Hub

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

USDA Midwest Climate Hub
U.S. DEPARTMENT OF AGRICULTURE
January 30, 2018

Midwest Ag-Focus Climate Outlook

Outlook

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

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

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For more information, please visit:
<https://www.climatehubs.usda.gov/midwest/>

<https://www.climatehubs.usda.gov/sites/default/files/1.3.20MidwestFocusAgOutlook.pdf>

Resources: Website

Agriculture in the Midwest
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To our Newsletter,
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Publications and
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USDA Midwest Climate Hub
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Midwest CHU
Climate Hub Update
Winter 2018

Promoting Climate-Informed Decisions Since 2014.

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ADAPTATION RESOURCES FOR AGRICULTURE
Responding to Climate Variability and Change in the Midwest and Northeast

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Potential Geographical Range & Abundance of the Invasive Brown Marmorated Stink Bug under Climate Change Scenarios
By Gina J. Keller, Plantation 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 40 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 soybean. 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>

For More Information



Midwest Climate Hub



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



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Midwest Climate Hub

U.S. DEPARTMENT OF AGRICULTURE



Measured data

WHAT HAPPENED IN 2018-19?

Midwest Frost Depth

