USDA Midwest Climate Hub
U.S. DEPARTMENT OF AGRICULTURE

Dealing with a Changing Climate in Agriculture

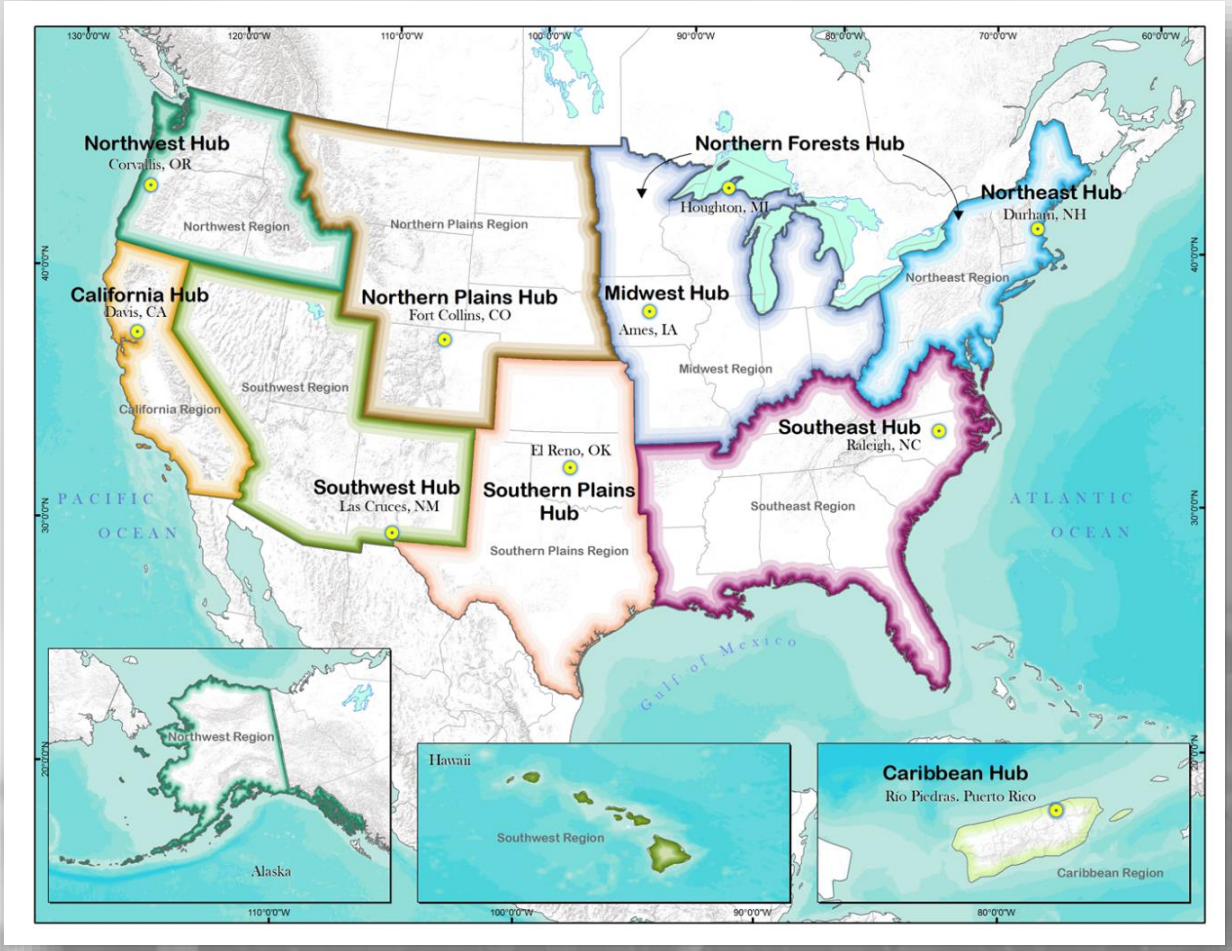
Dennis Todey
Director, Midwest Climate Hub
Dennis.todey@usda.gov

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

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**.

Agricultural Research Service

NRCS

Vision and Mission

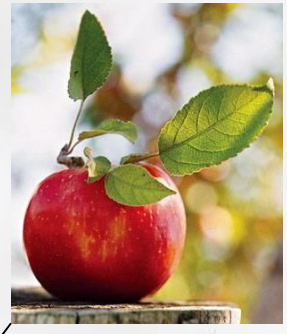
Vision

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…

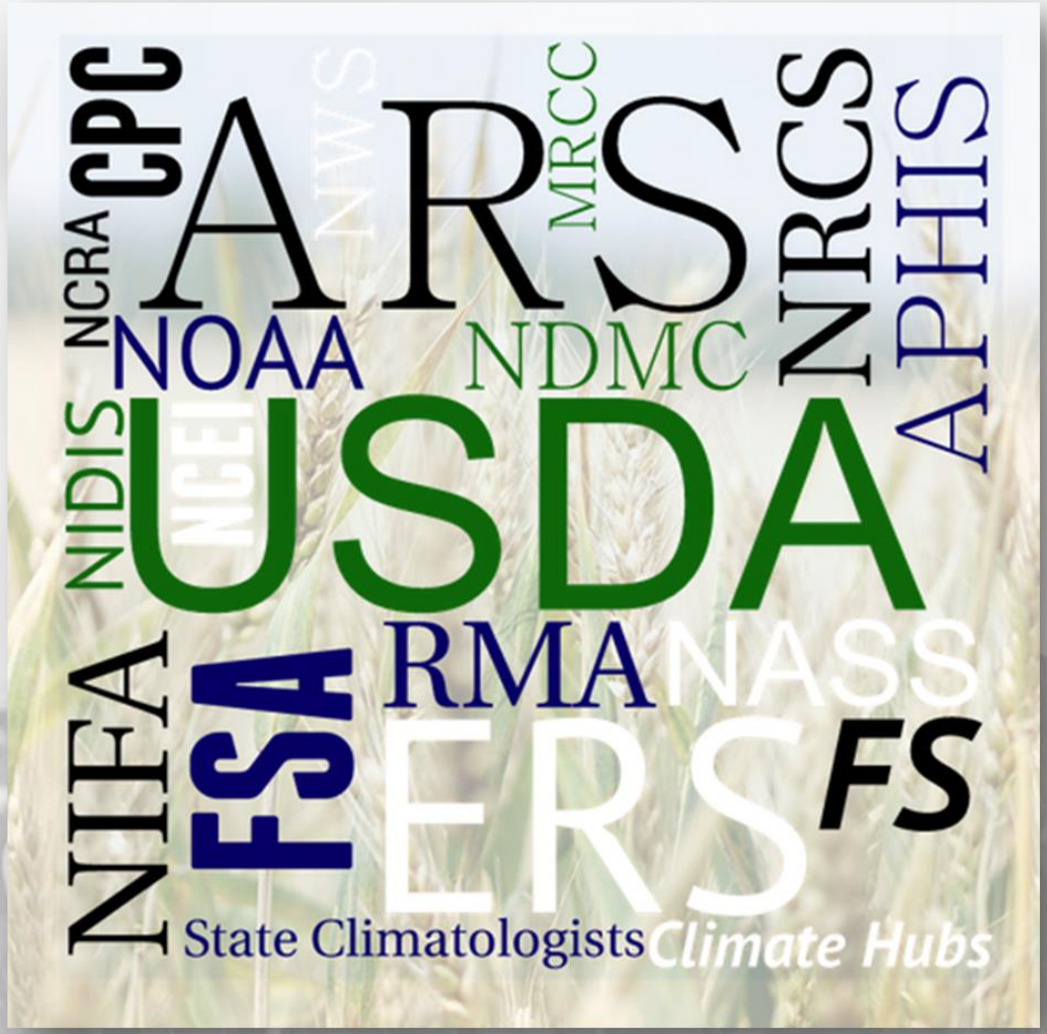


Our Goal

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.

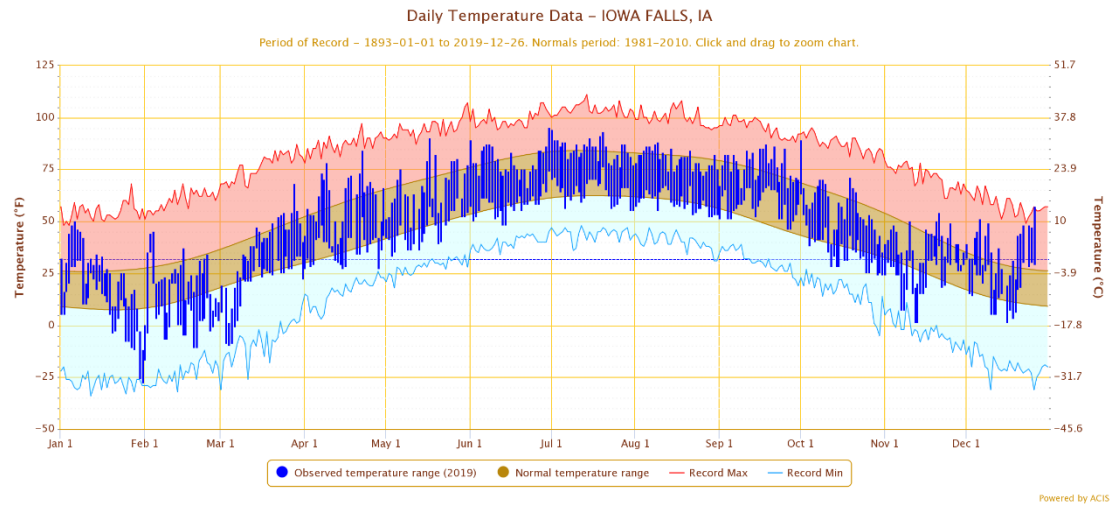
USDA Midwest Climate Hub
U.S. DEPARTMENT OF AGRICULTURE

Partners


CPC
NCRA
ARS
NWS
MRCC
NRCS
APHIS
NOAA
NDMC
NIDIS
NCEI
USDA
NIFA
FSA
RMA
NASS
ERS
FS
State Climatologists
Climate Hubs

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

USDA Midwest Climate Hub
U.S. DEPARTMENT OF AGRICULTURE

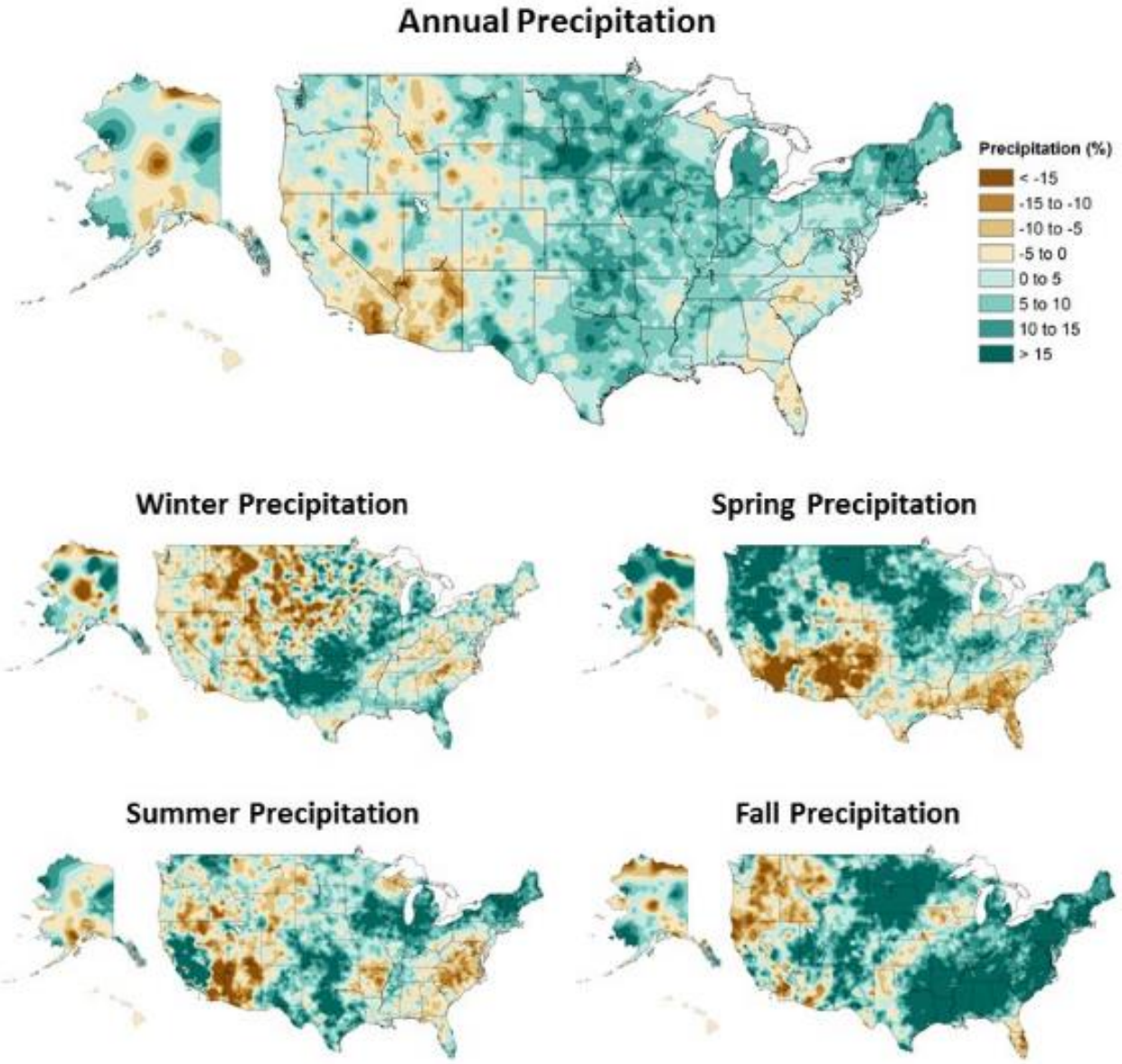
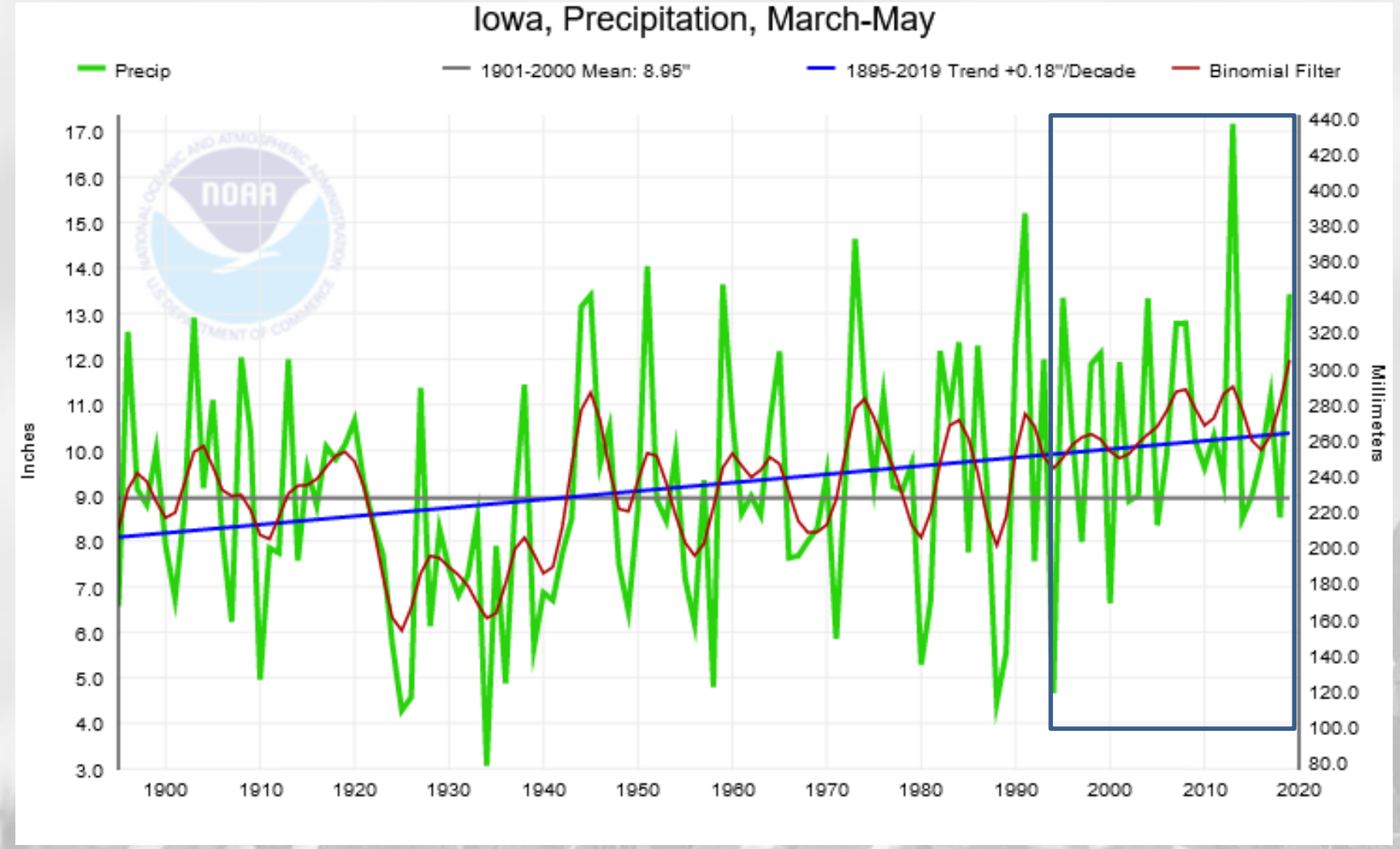
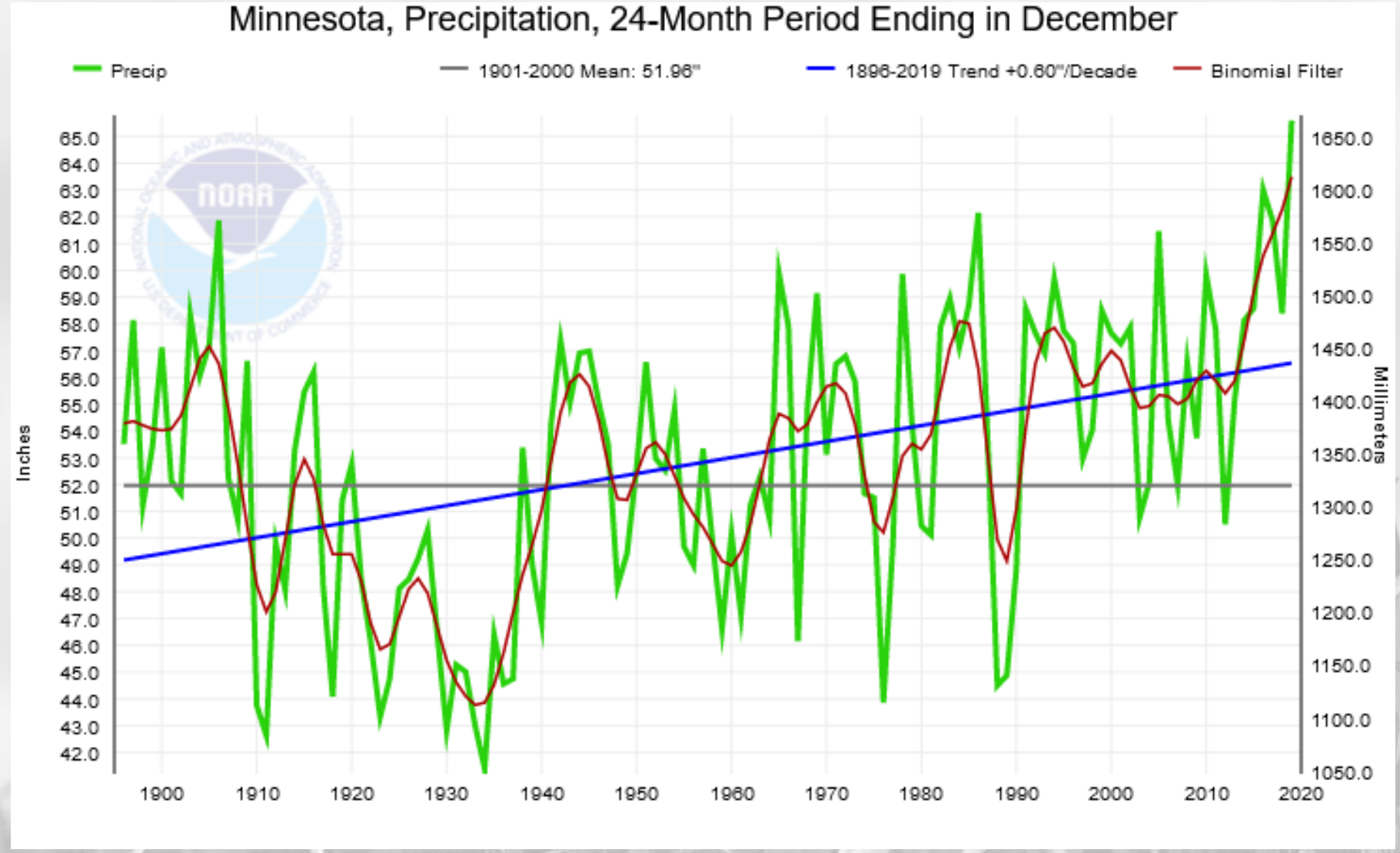


Figure 7.1: Annual and seasonal changes in precipitation over the United States. Changes are the average for present-day (1986–2015) minus the average for the first half of the last century (1901–1960 for the contiguous United States, 1925–1960 for Alaska and Hawai'i) divided by the average for the first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



Only 6 of last 25 years below long term average.

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

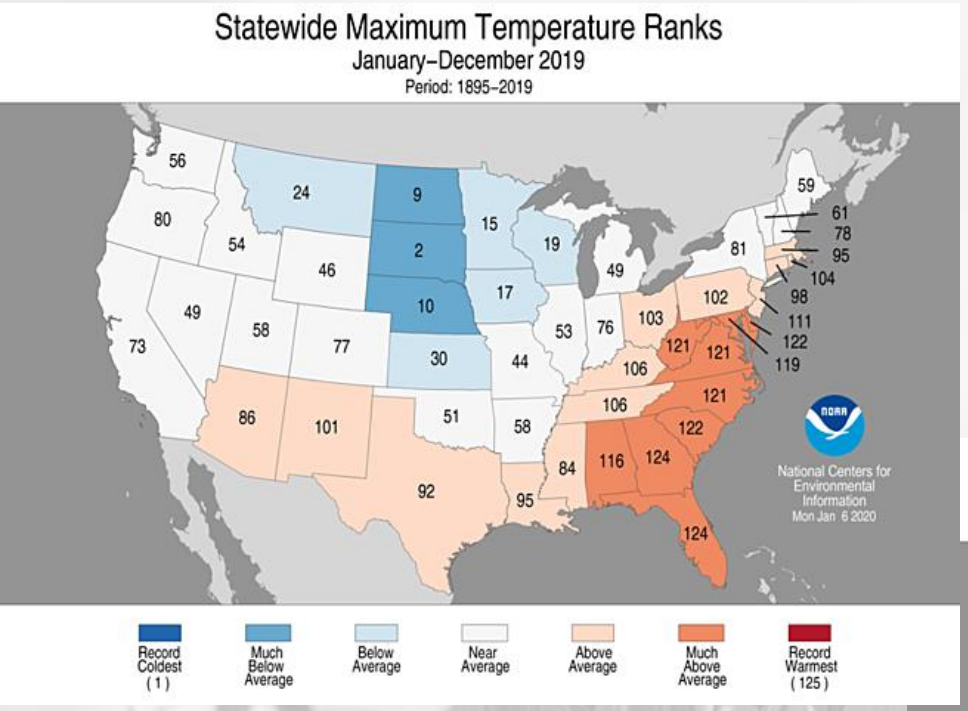


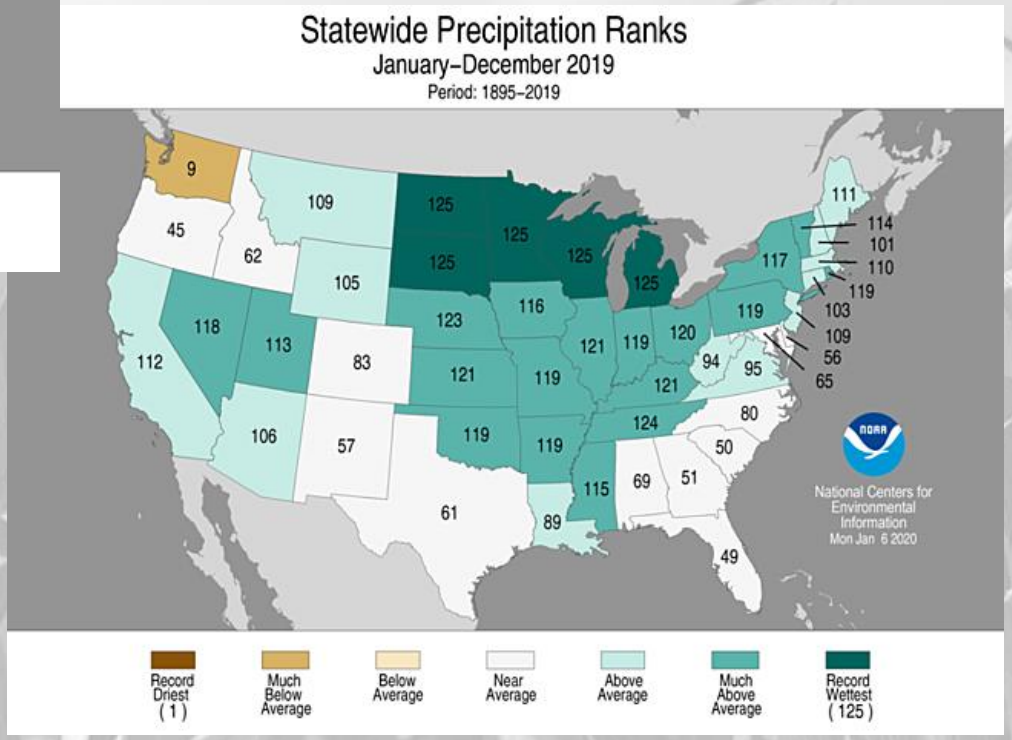
Records for last 24 months outstripping previous highs

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

USDA

State 2019 Rankings





USDA Midwest Climate Hub
U.S. DEPARTMENT OF AGRICULTURE

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

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

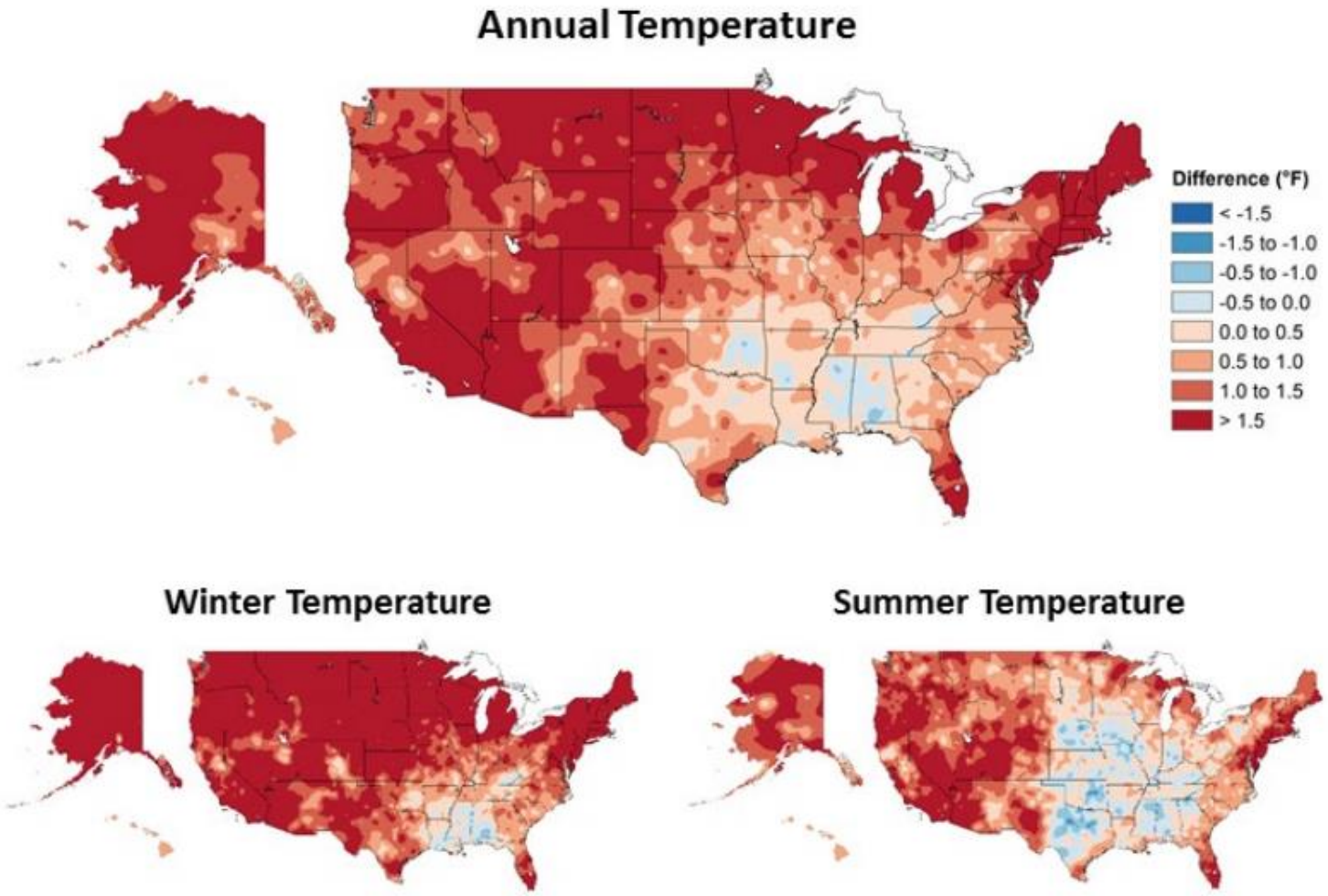
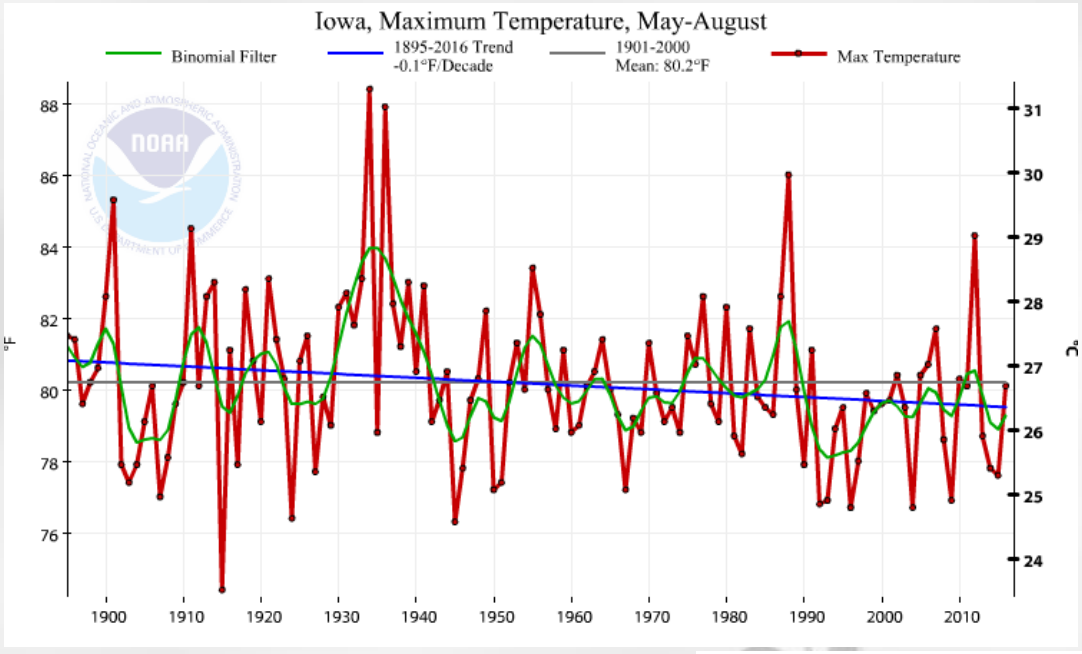
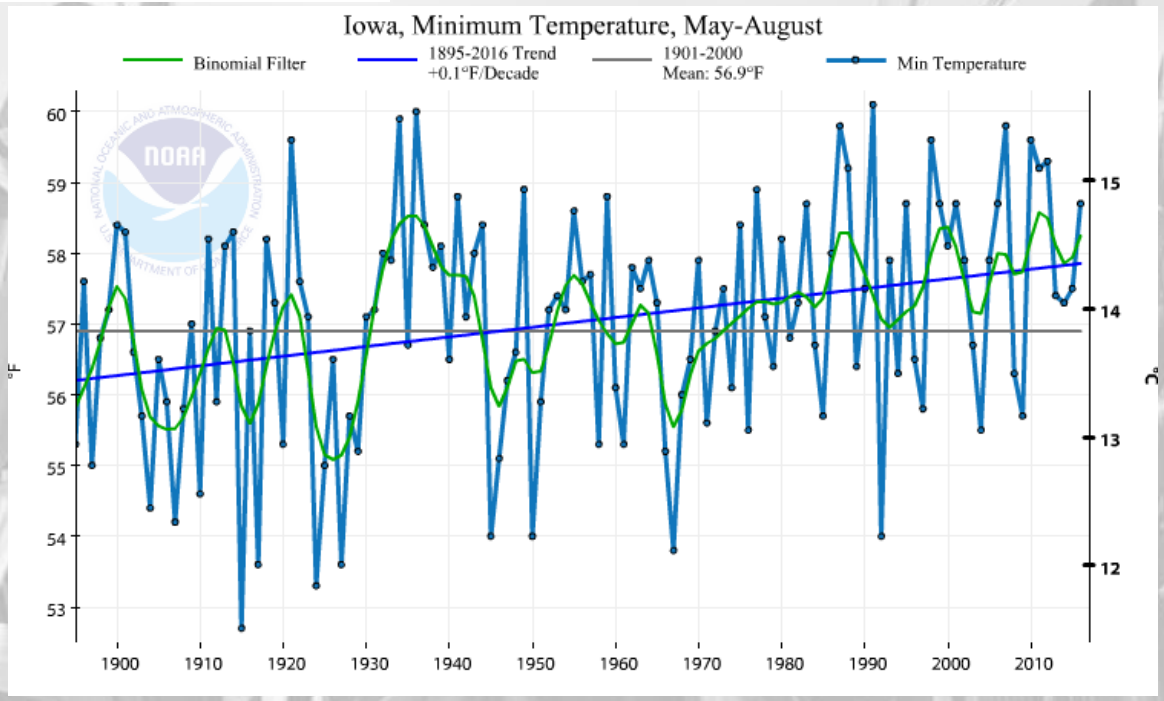


Figure 6.1. Observed changes in annual, winter, and summer temperature (°F). Changes are the difference between rage for present-day (1986–2016) and the average for the first half of the last century (1901–1960 for the con- United States, 1925–1960 for Alaska and Hawai'i). Estimates are derived from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





USDA

ncdc.noaa.gov/cag

Warm Nights

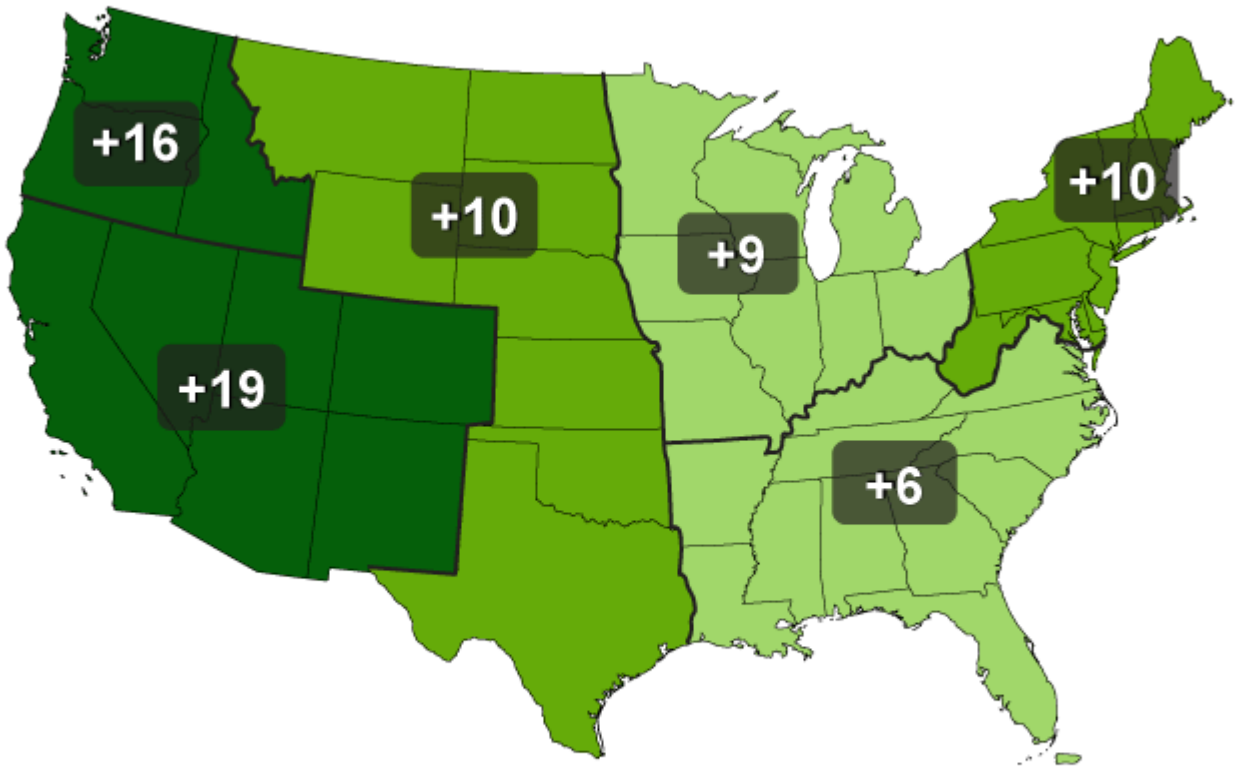
- Added livestock/human stress
- Additional cooling needed (humans/livestock)
- Push GDD accumulation/phenological state

- 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

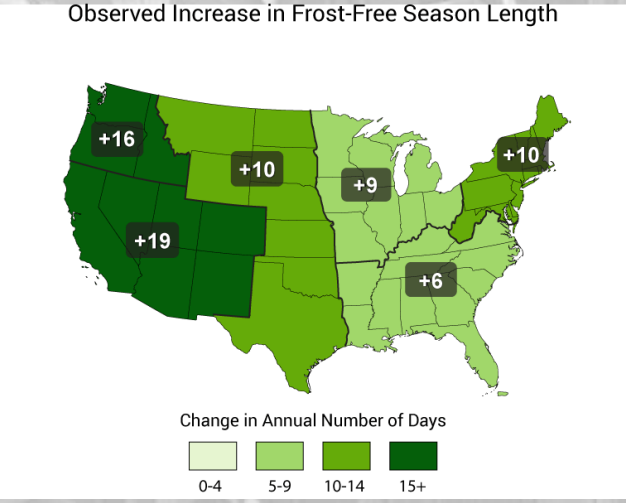


The frost-free season length, defined as the period between the last occurrence of 32°F in the spring and the first occurrence of 32°F in the fall, has increased in each U.S. region during 1991-2012 relative to 1901-1960. Increases in frost-free season length correspond to similar increases in growing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

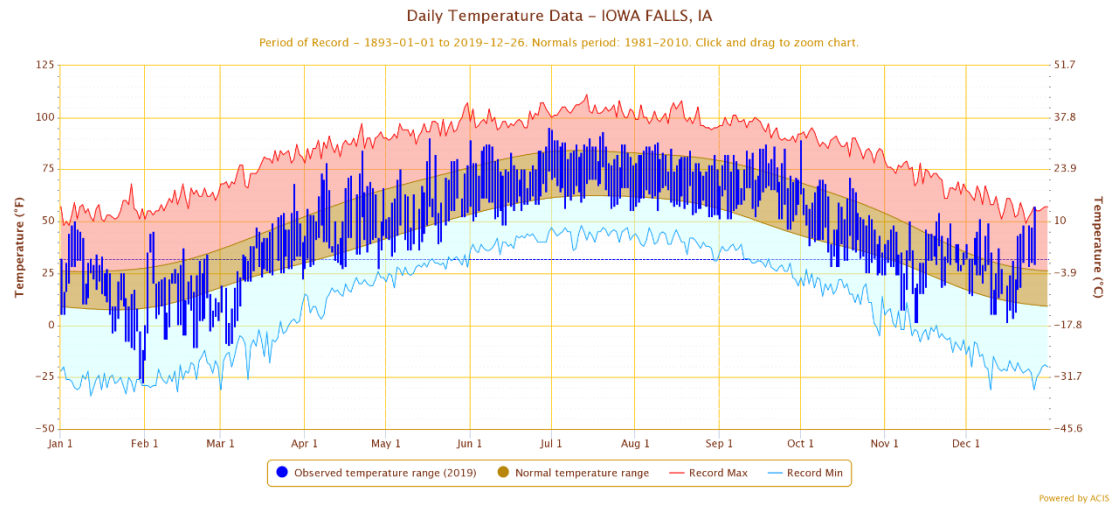


Climate-Impacted Issues for Agriculture

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

Thoughts looking ahead

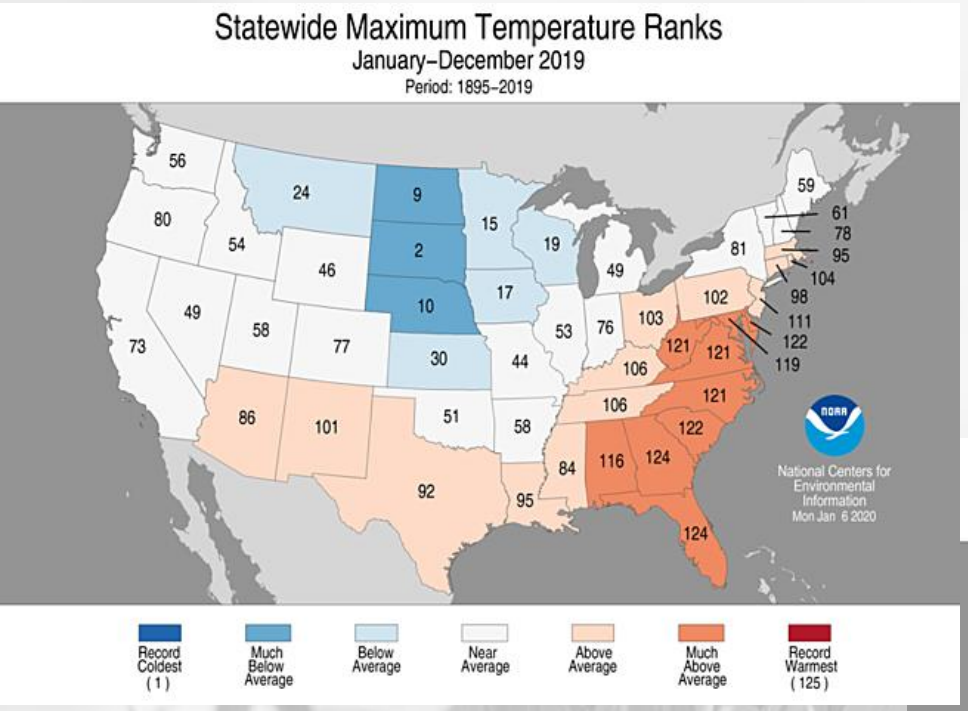
- Short term – improve decision-making
- Care for soils – always
- Adaptation
- Are there other crops? – looking long term

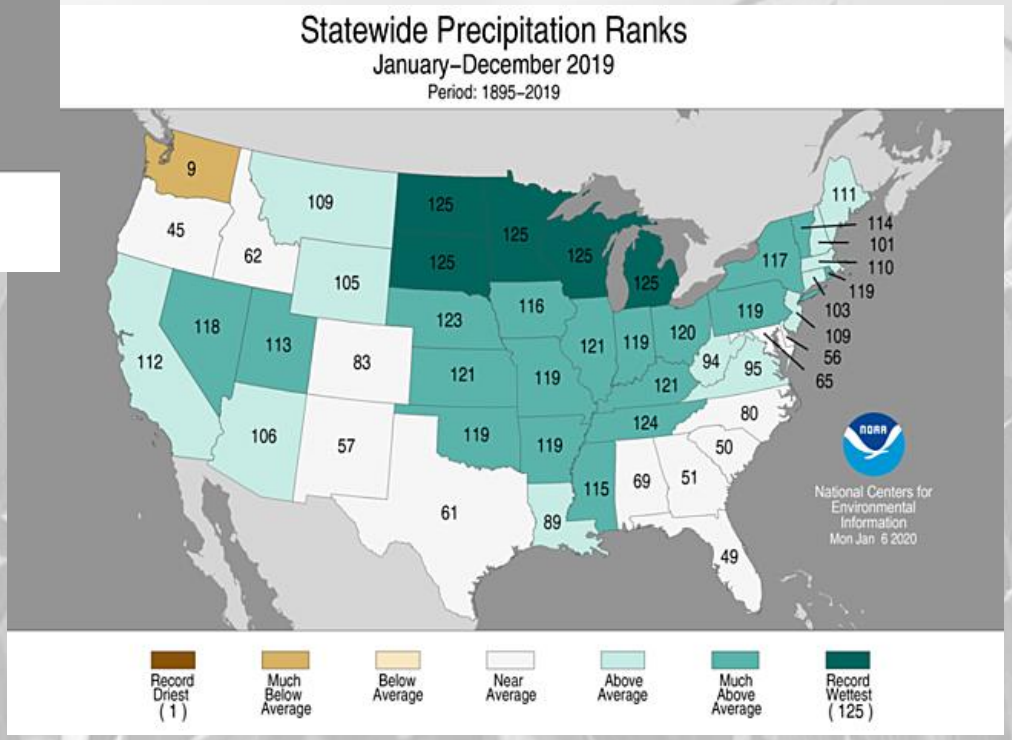


Always check for recent context

RECENT CONDITIONS

State 2019 Rankings

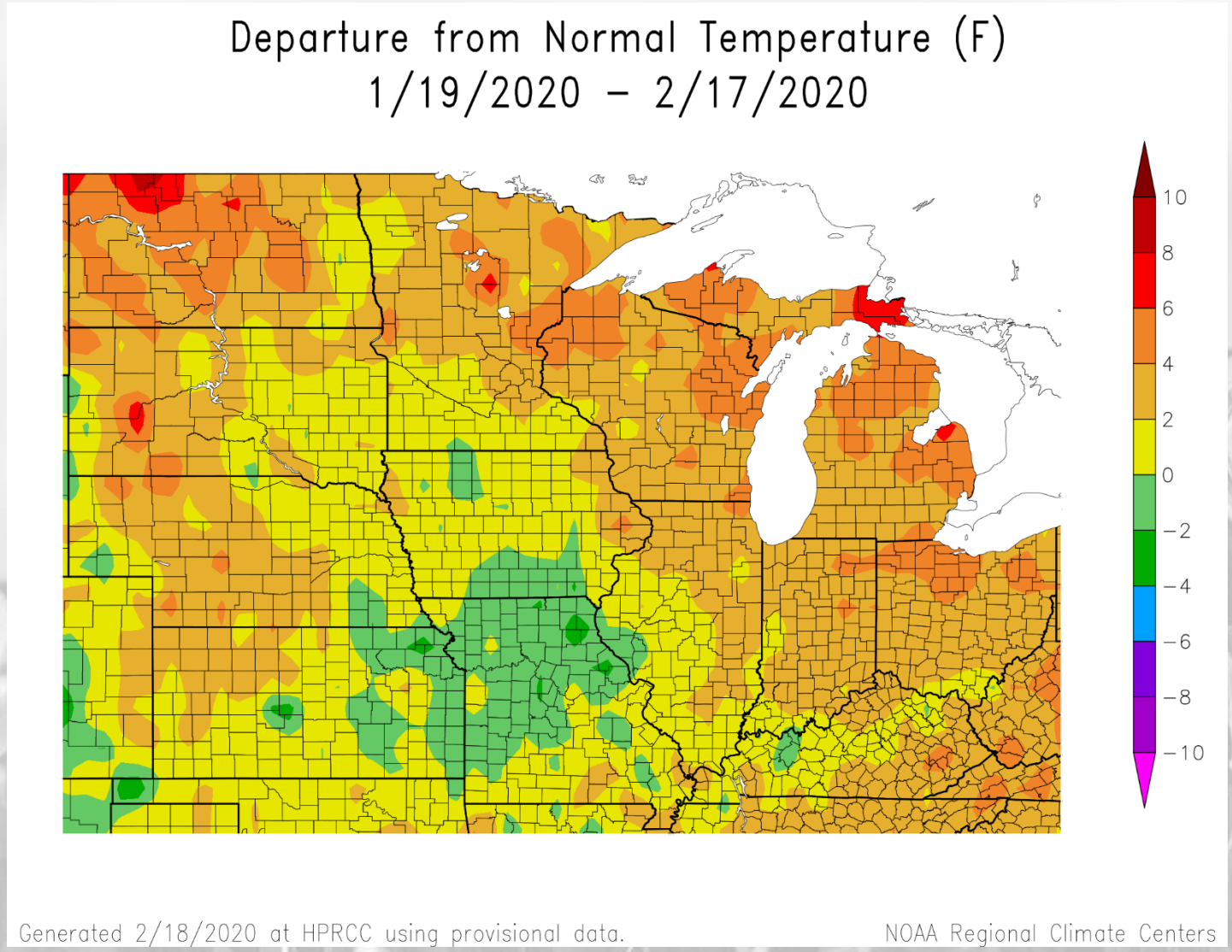




USDA Midwest Climate Hub
U.S. DEPARTMENT OF AGRICULTURE

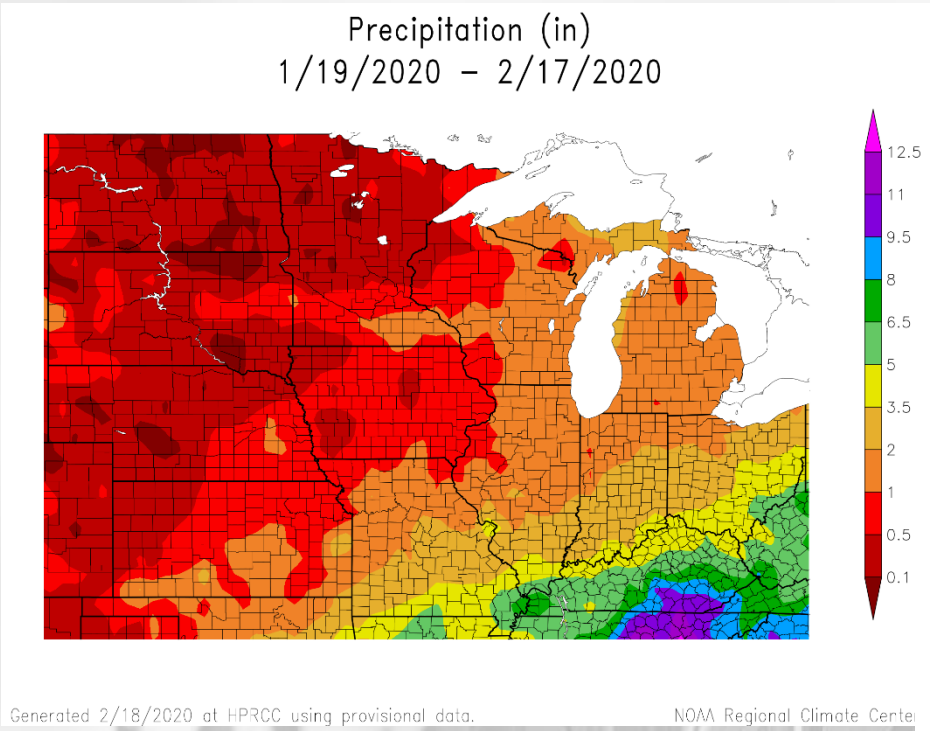
https://hprcc.unl.edu/maps.php?map=ACISClimateMaps

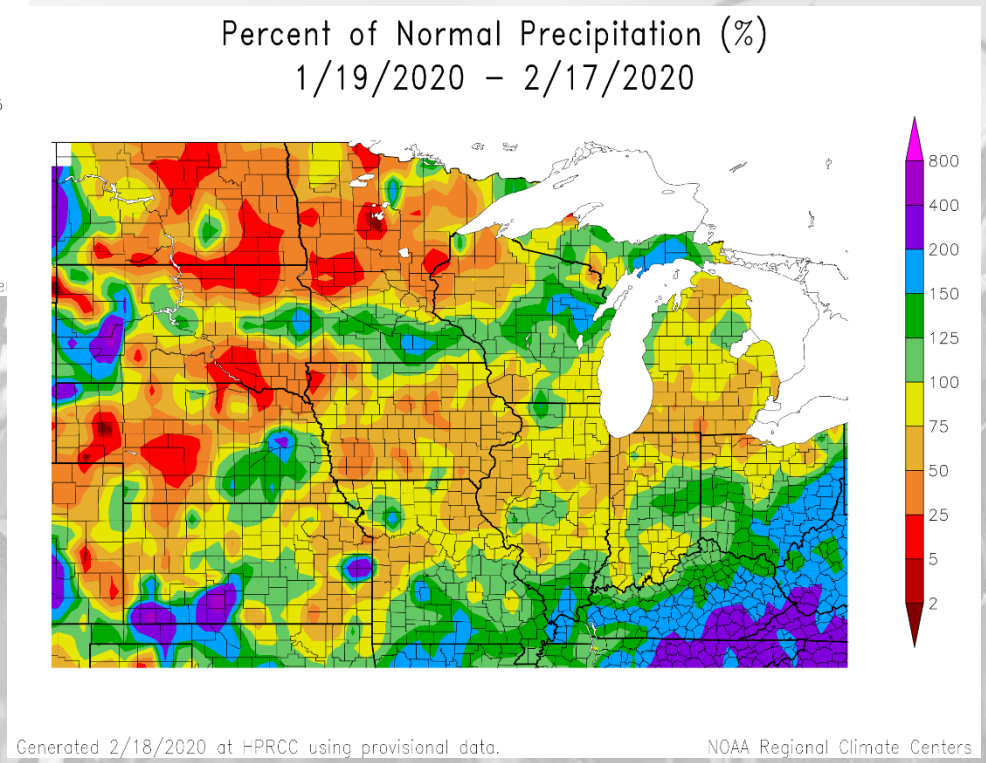
Iowa Last 30 Day Temperature



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

Iowa Last 30 Day Precipitation

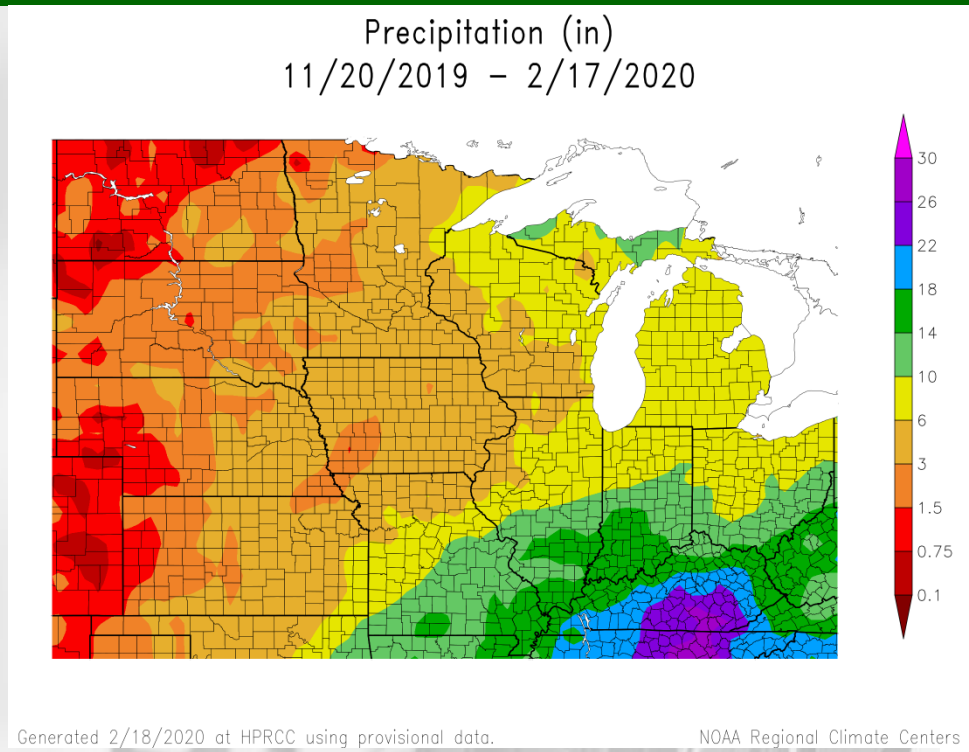


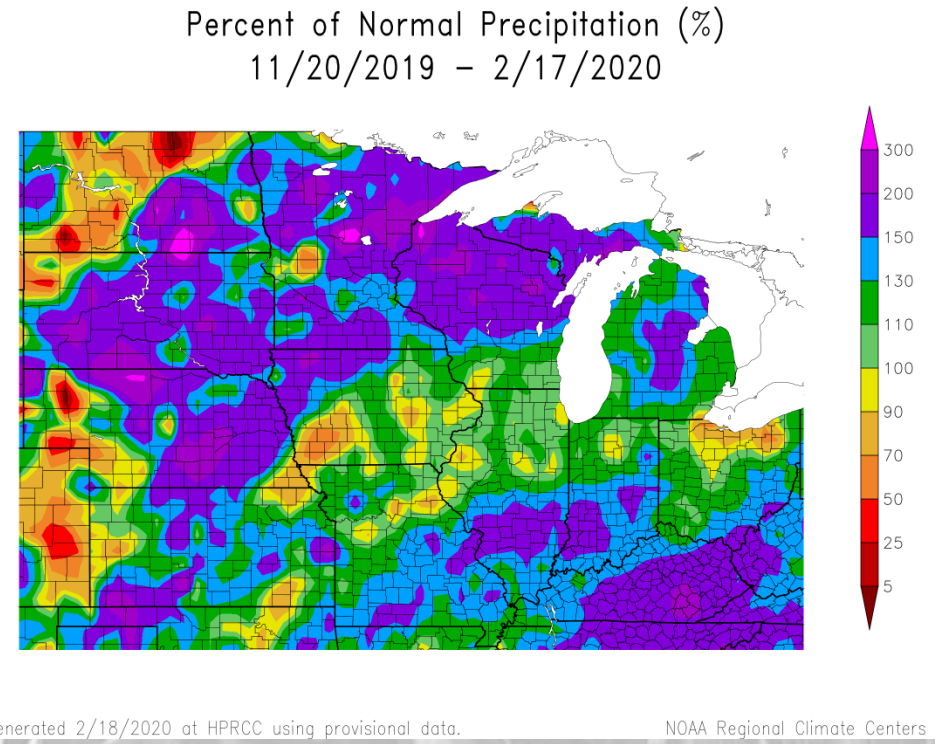


USDA Midwest Climate Hub
U.S. DEPARTMENT OF AGRICULTURE

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

Iowa Last 90 Day Precipitation





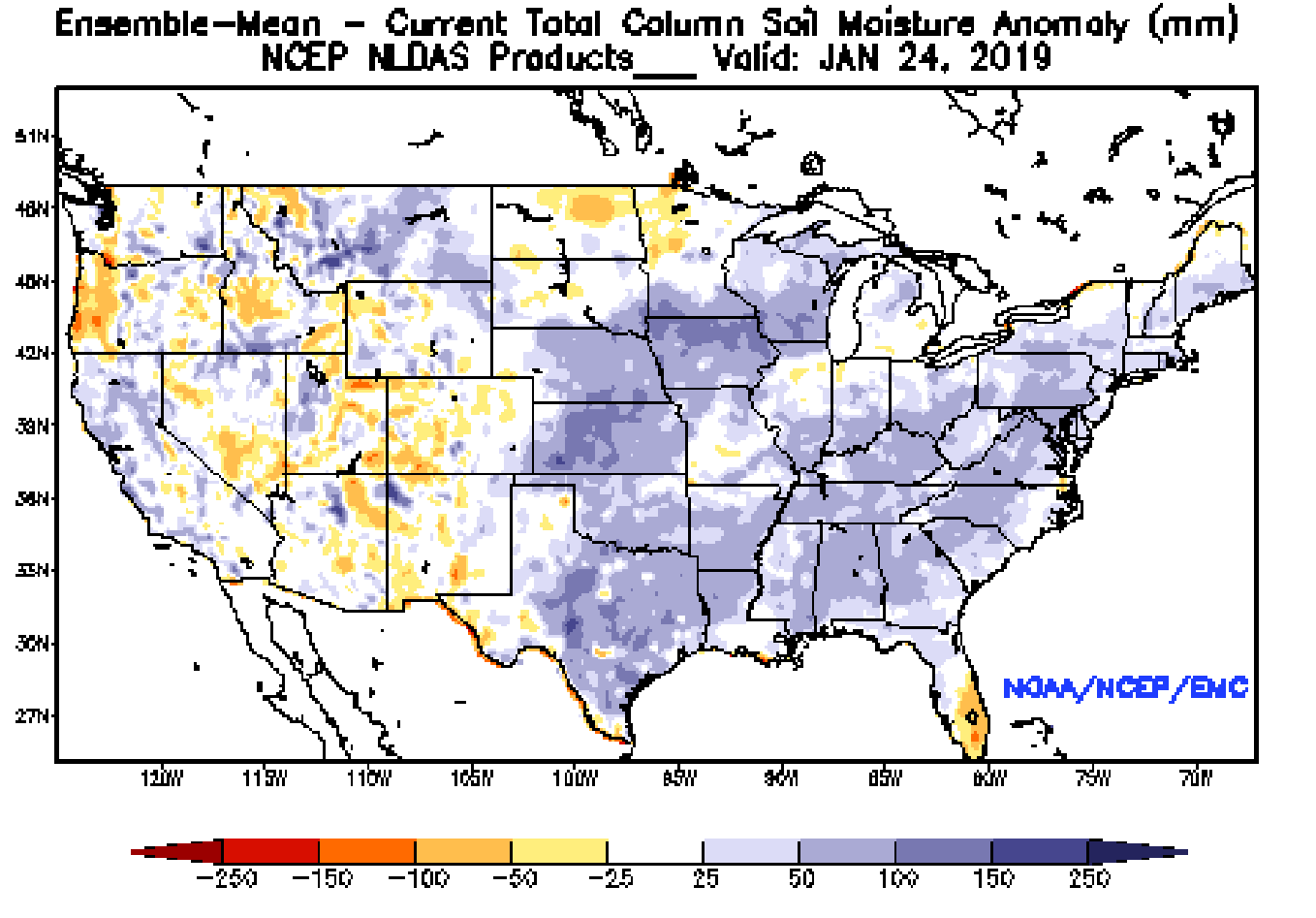
USDA Midwest Climate Hub
U.S. DEPARTMENT OF AGRICULTURE

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

Modeled Soil Moisture

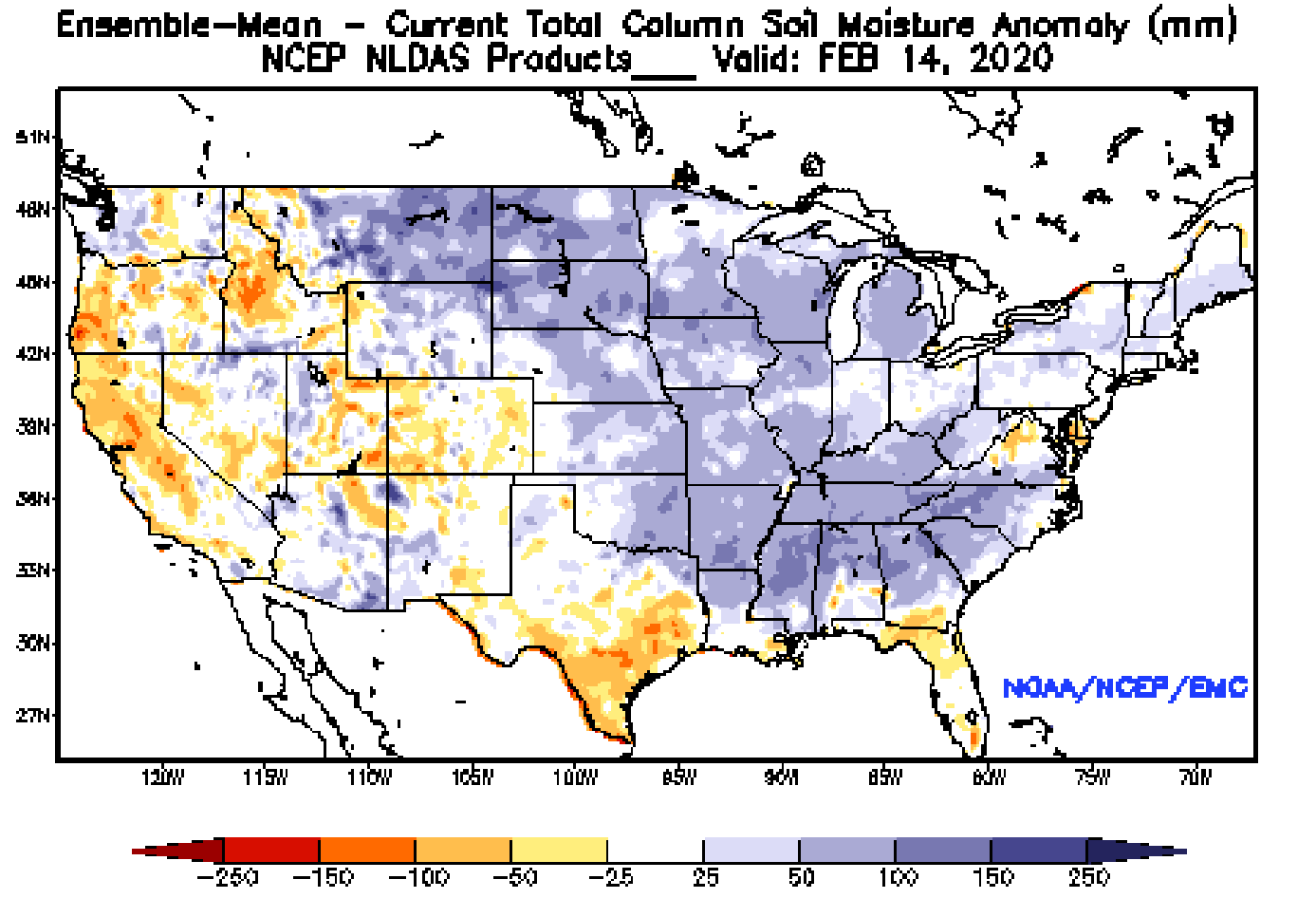
National Land Data Assimilation System

Last year – Jan 2019



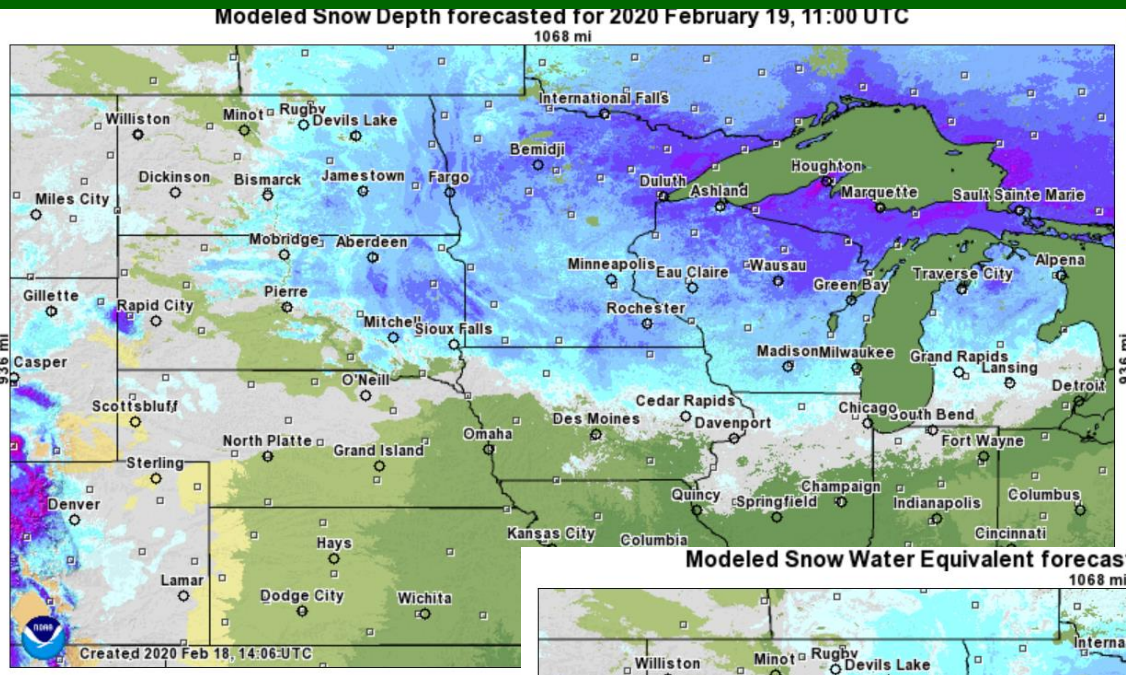
Modeled Soil Moisture

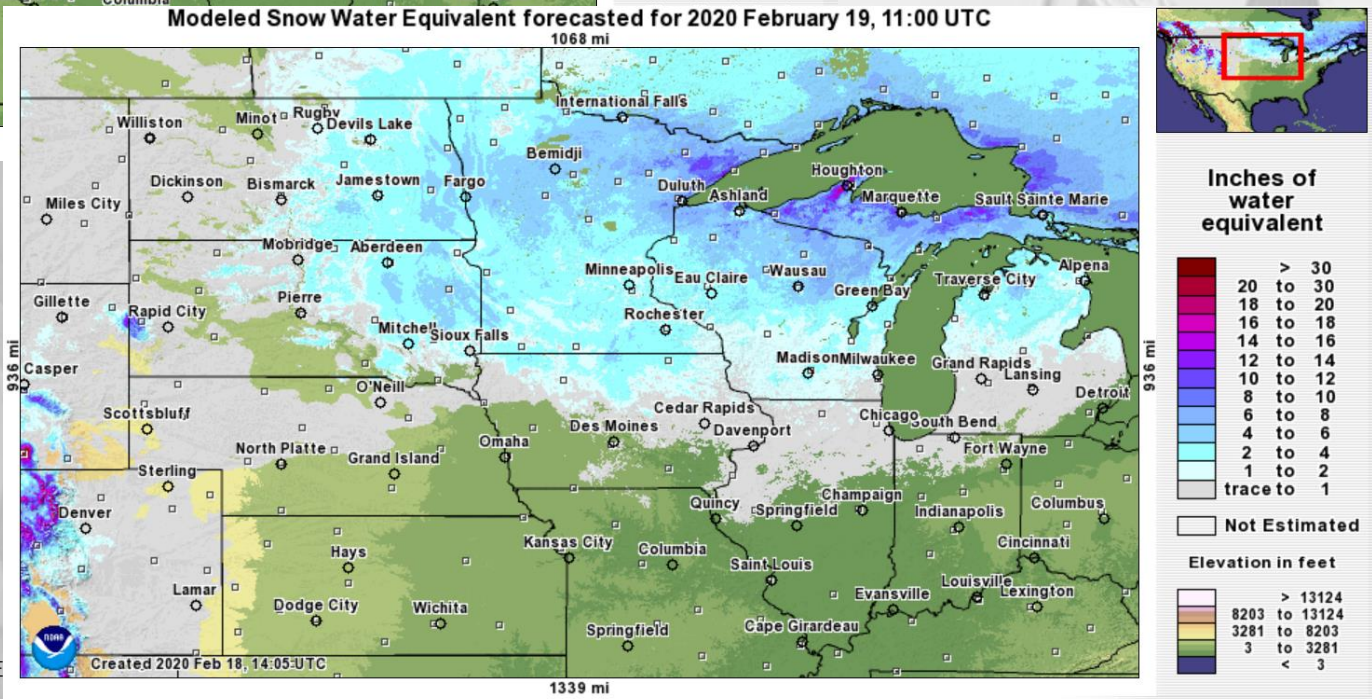
National Land Data Assimilation System



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

Midwest Snow Water Equiv.

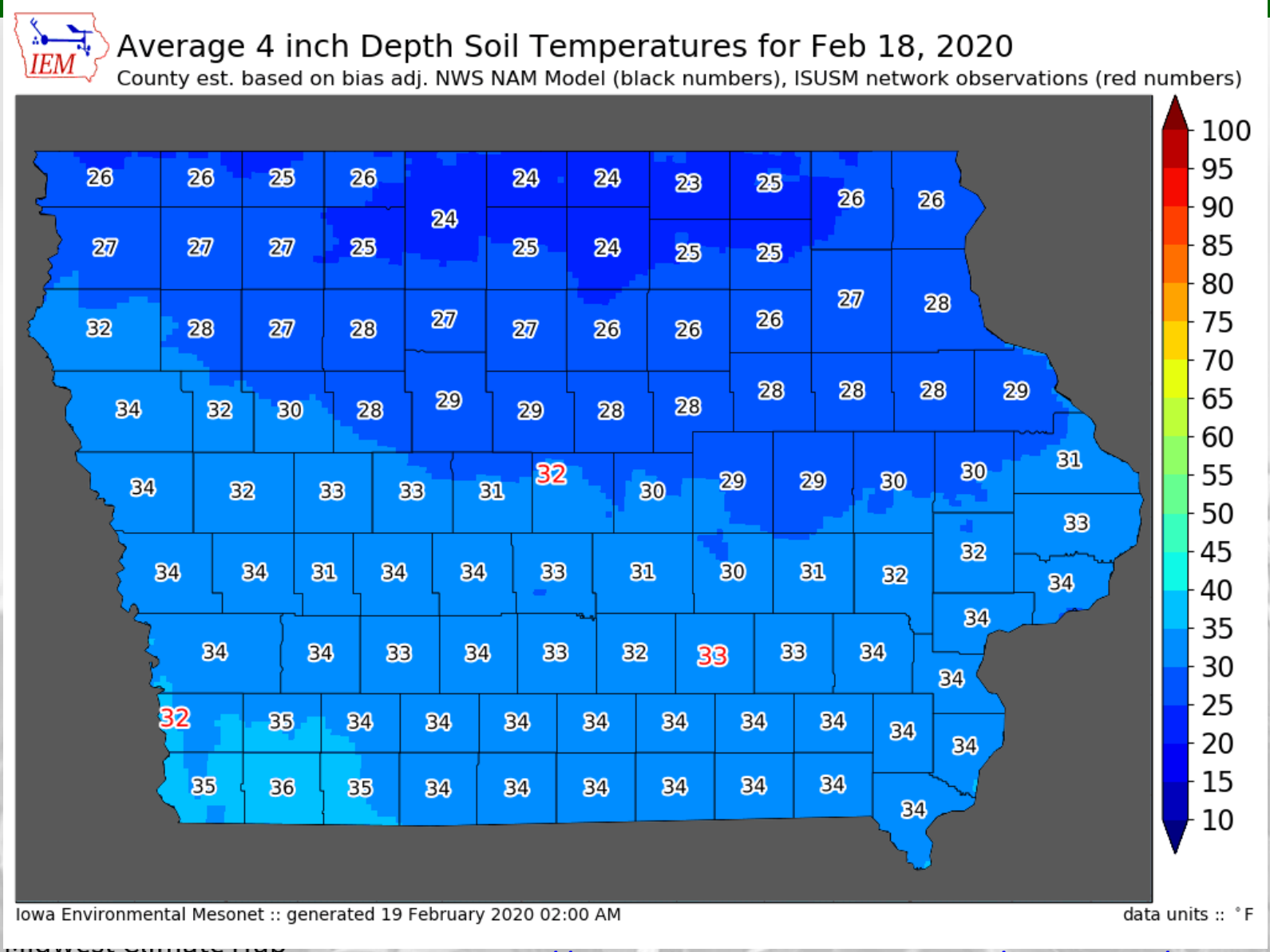




http://www.nohrsc.noaa.gov/interactive/html/map.html

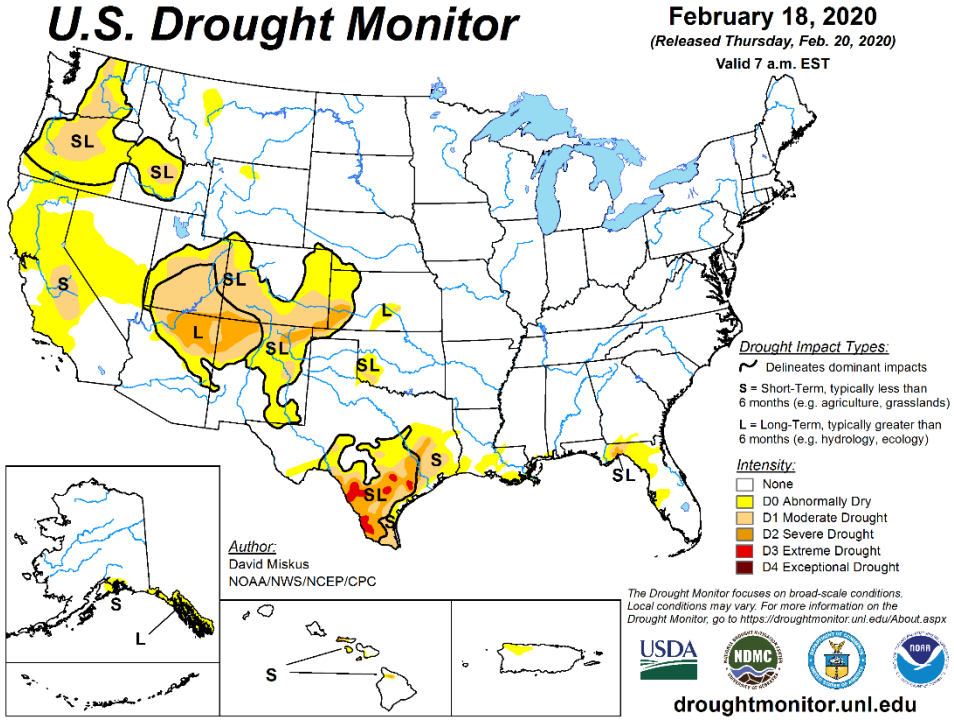
USDA Midwest Climate Hub
U.S. DEPARTMENT OF AGRICULTURE

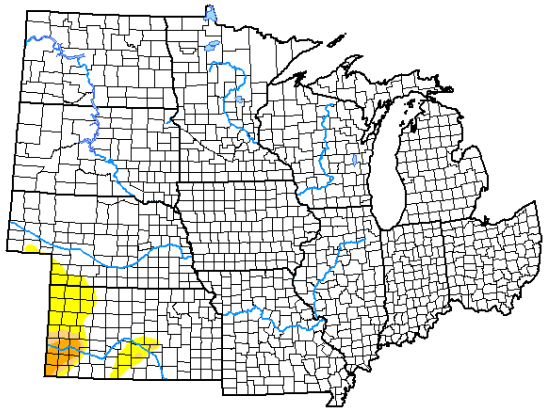
Iowa Soil Temps

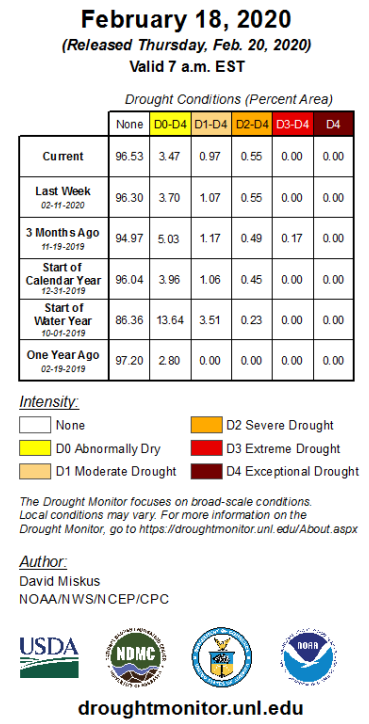


U.S. DEPARTMENT OF AGRICULTURE

https://mesonet.agron.iastate.edu/agclimate/soilt.php







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

https://droughtmonitor.unl.edu

USDA

noaa.gov/products/Drought/

What is useful?

WEATHER/CLIMATE OUTLOOKS

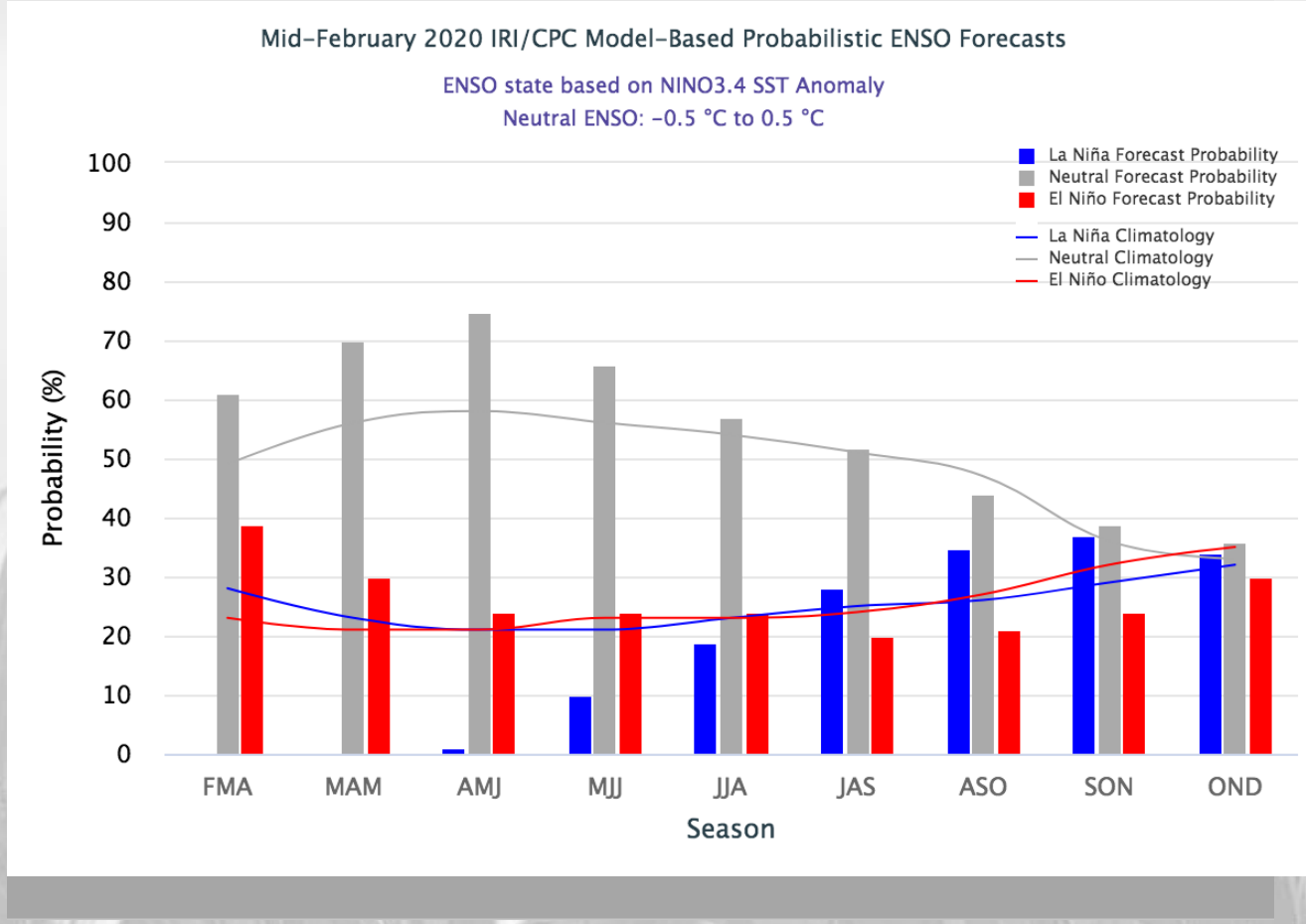
Climate Outlooks

- 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.

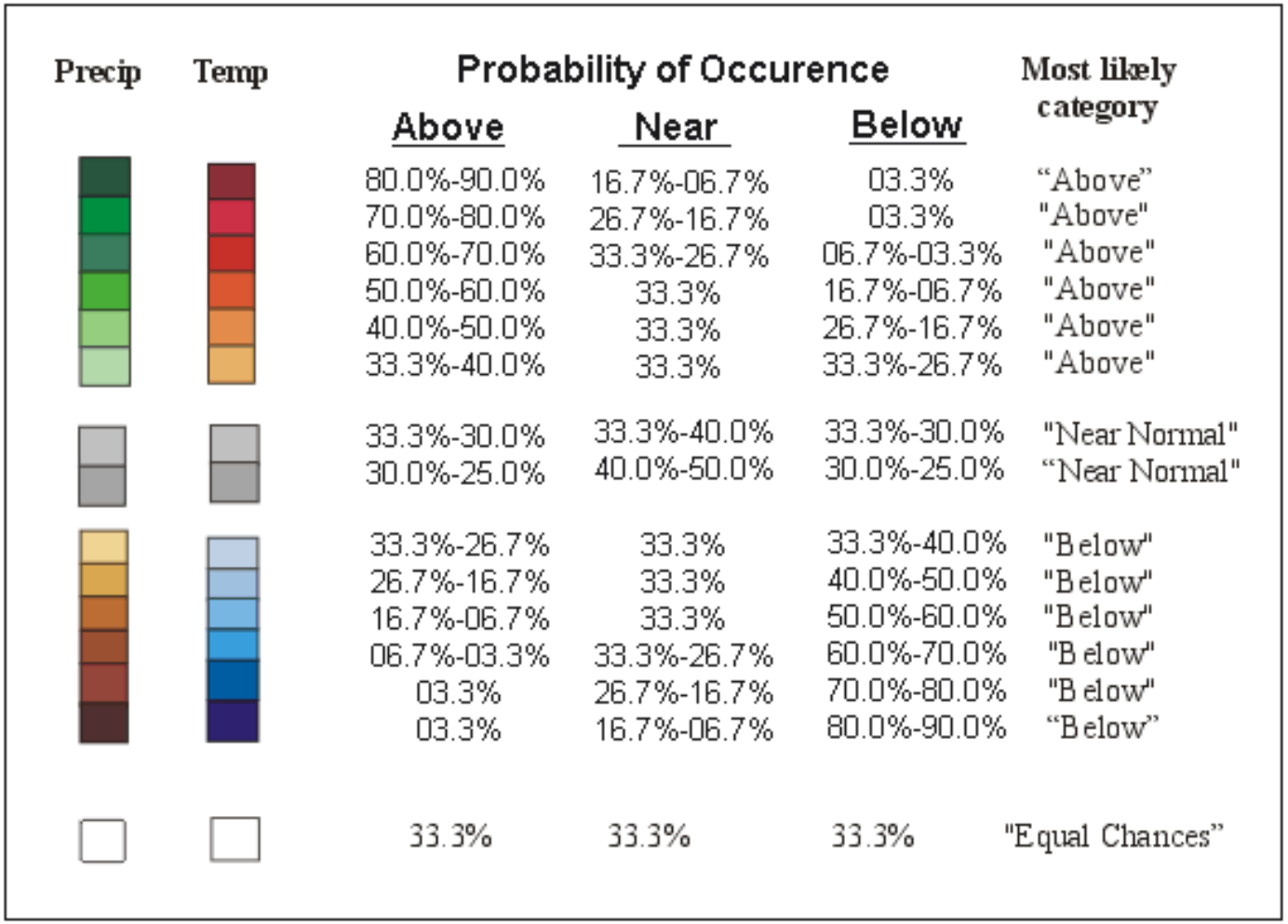


https://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/

Some additional information

TRENDS

Understanding Probability Outlooks



Precip	Temp	Probability of Occurence			Most likely category
		Above	Near	Below	
		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%-40.0%	33.3%	33.3%-26.7%	"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"

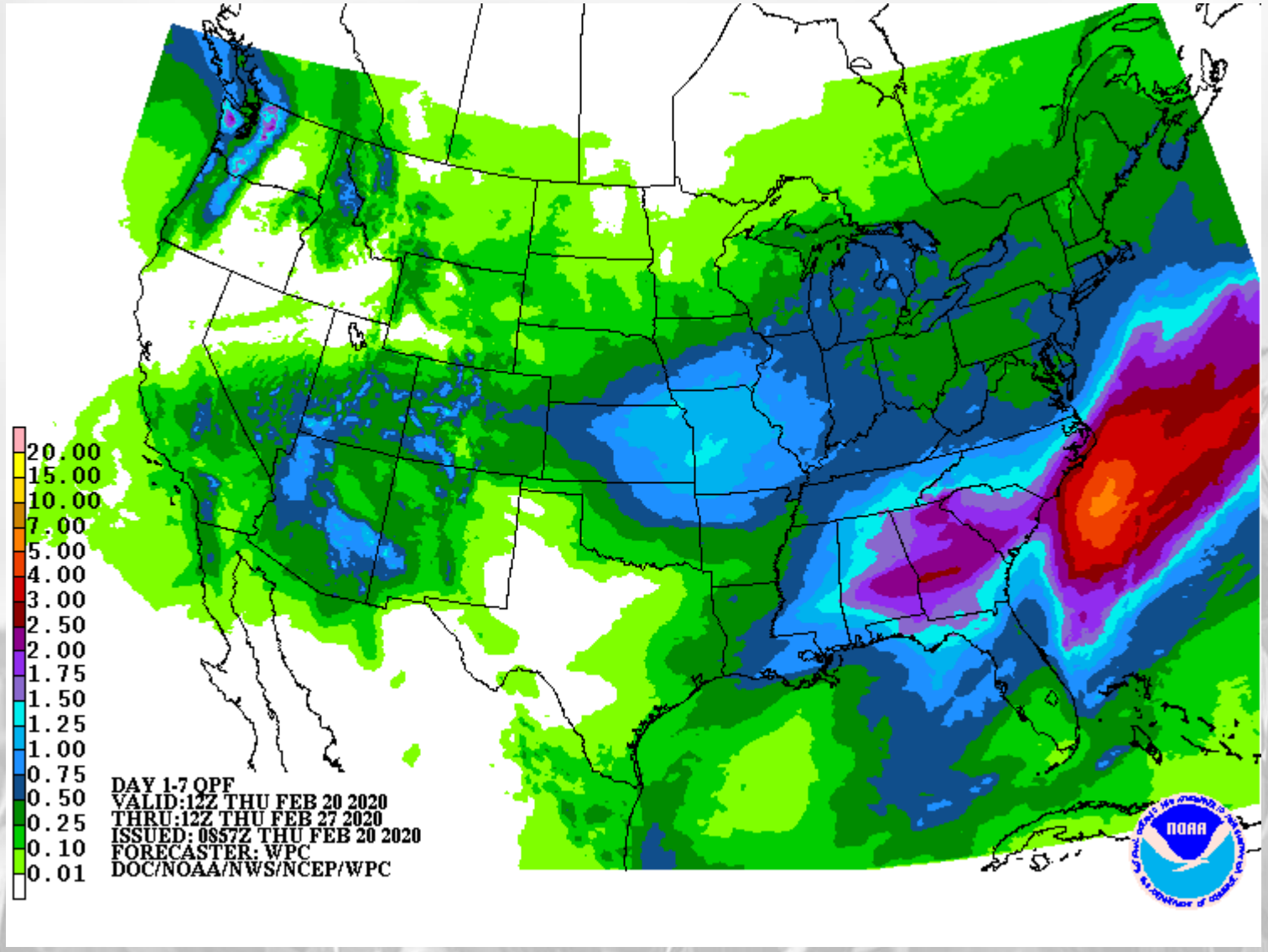
https://www.cpc.ncep.noaa.gov/products/predictions/long_range/seasonal_info.php

Climate Outlooks

- 6-10 and 8-14 day updated daily
- Monthly updated 2x/month
- Longer range updated monthly

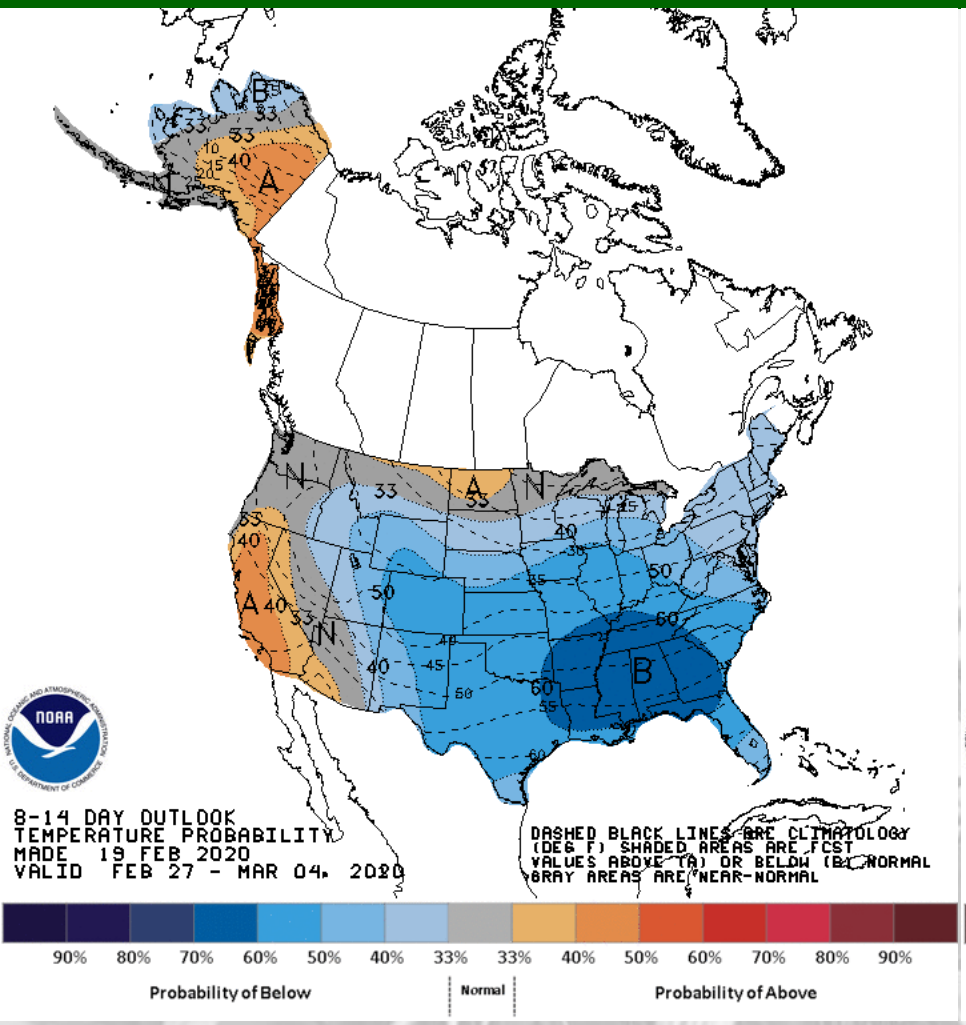
- Based on probabilities
- Good to have ag interpretation

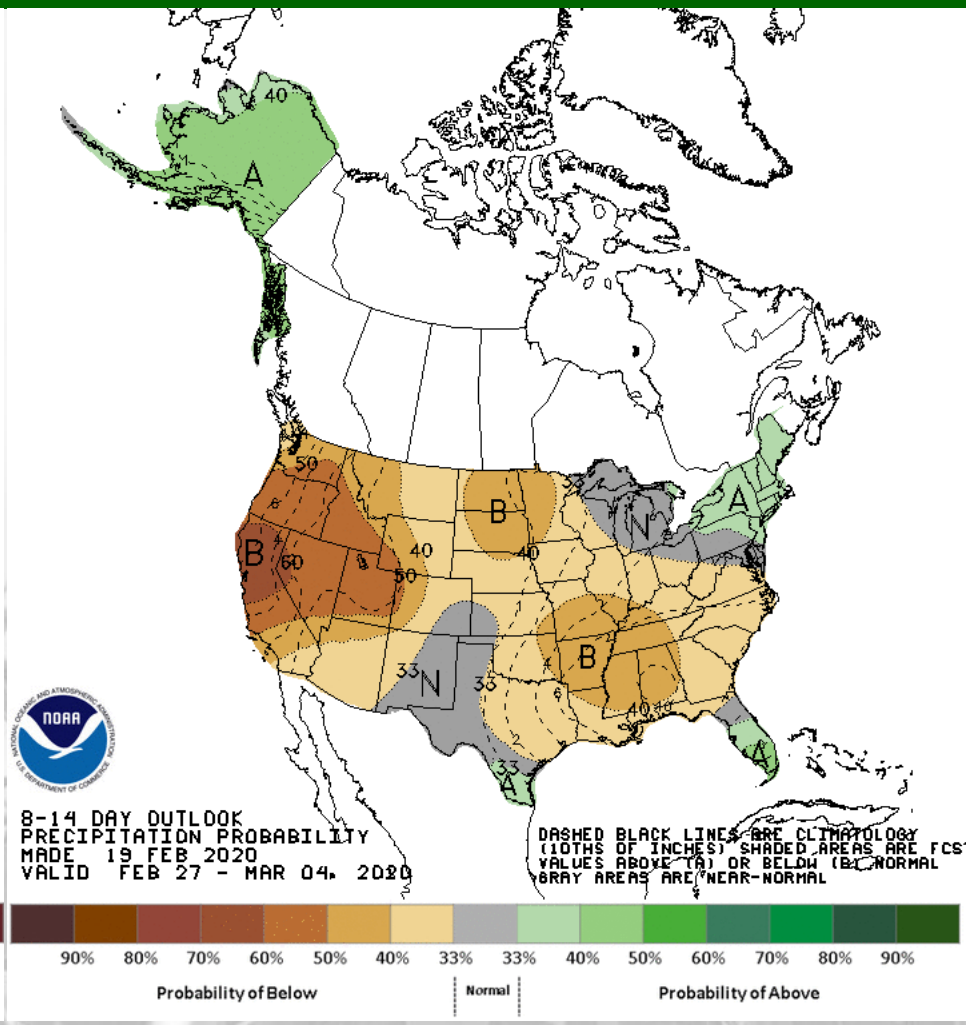
7-day Quantitative Precipitation Forecast



http://www.wpc.ncep.noaa.gov/qpf/day1-7.shtml

8-14 Day Temperature and Precipitation

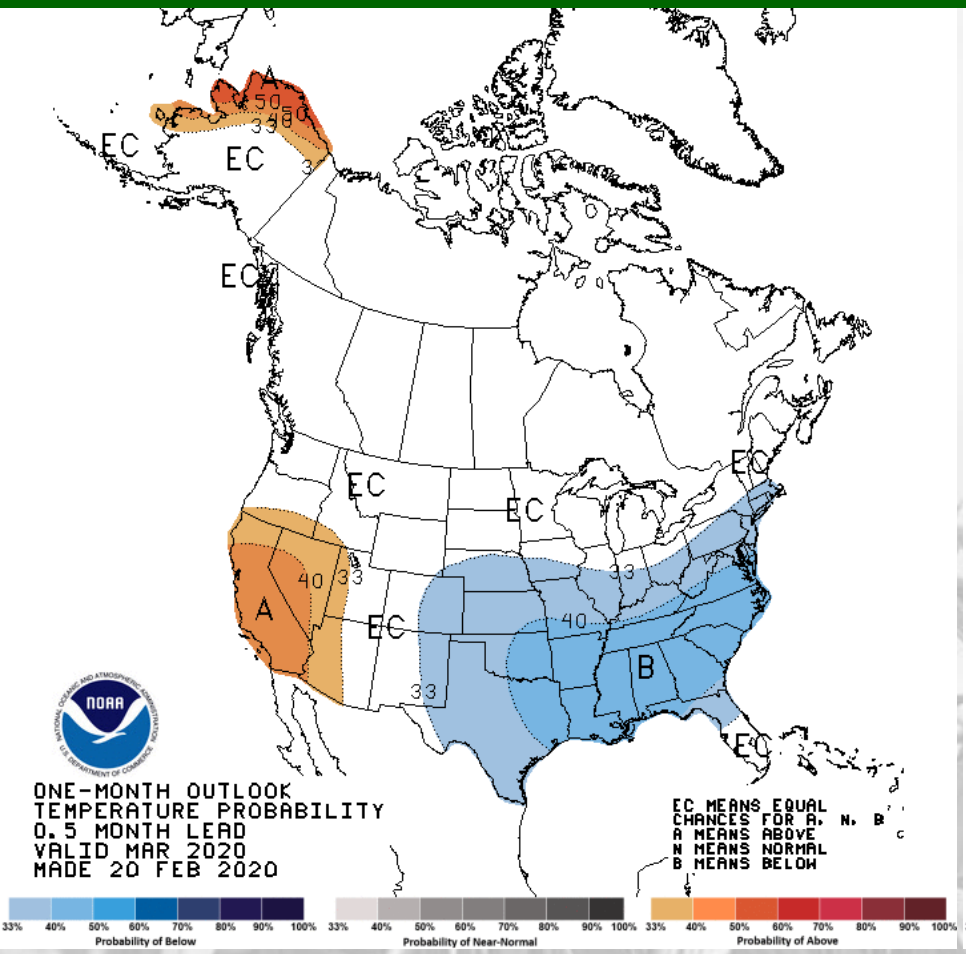


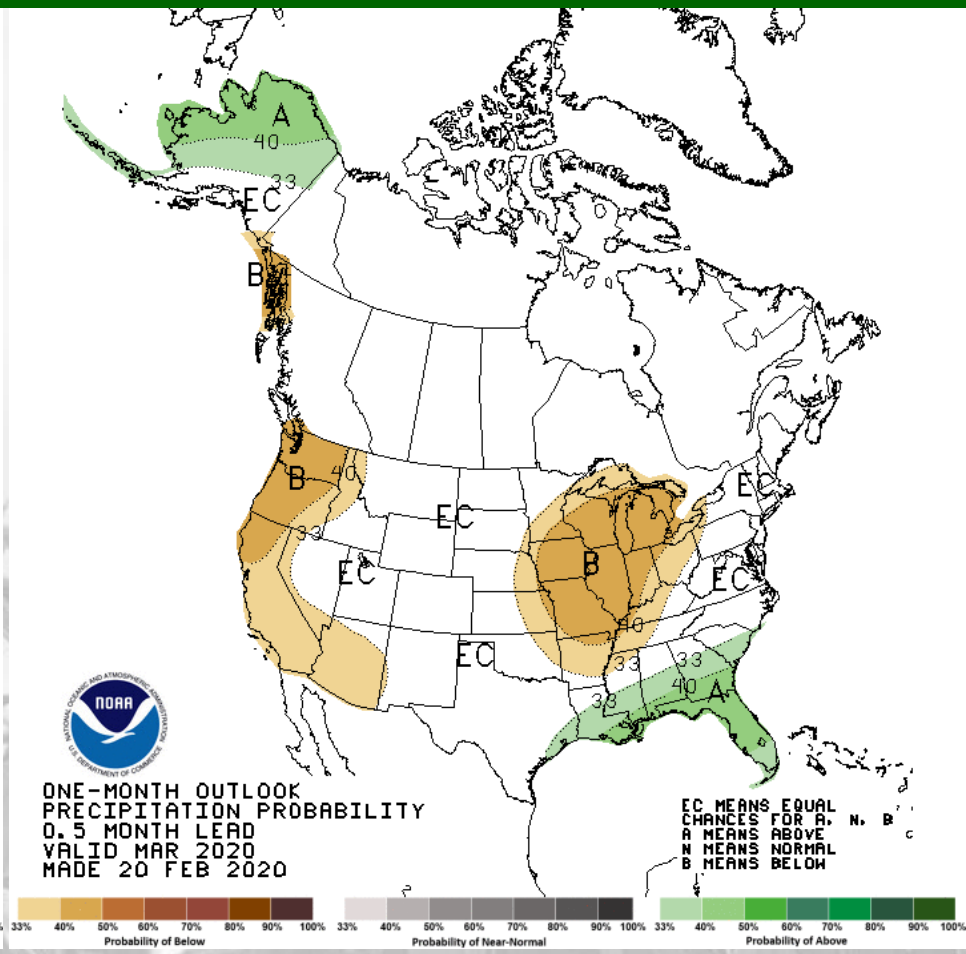


USDA Midwest Climate Hub
U.S. DEPARTMENT OF AGRICULTURE

http://www.cpc.ncep.noaa.gov/products/predictions/814day/index.php

Monthly Outlook for March
NWS Climate Predication Center

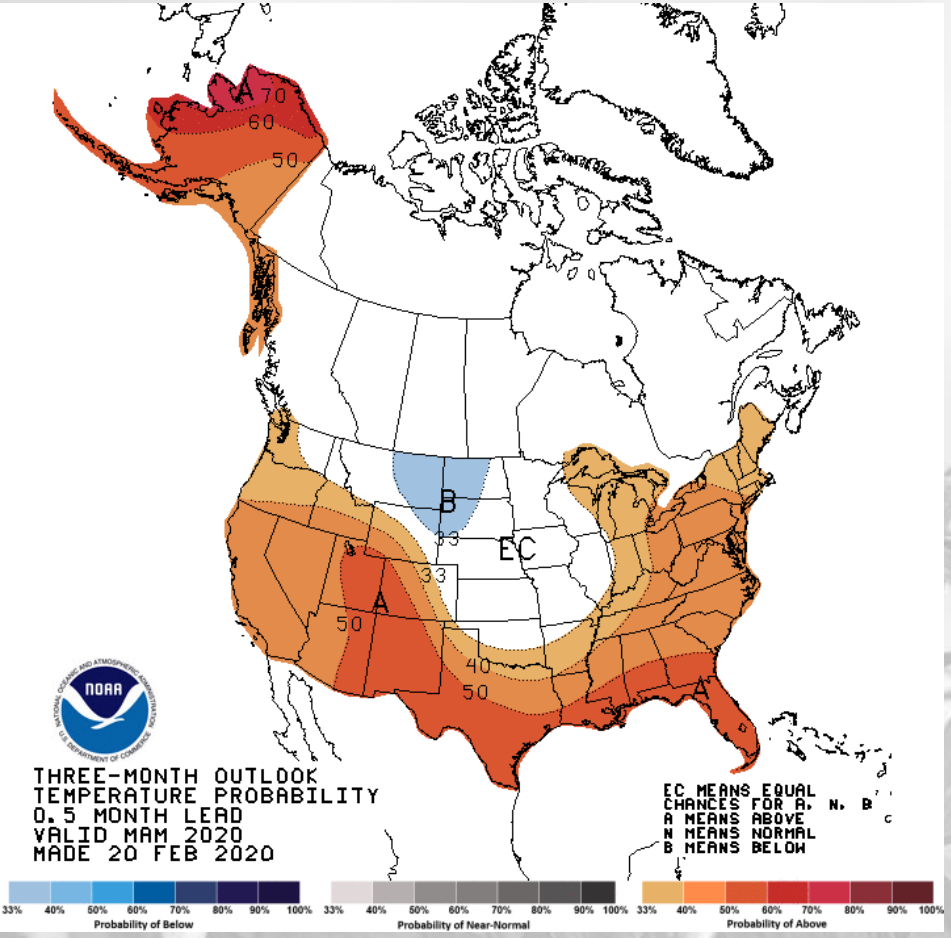


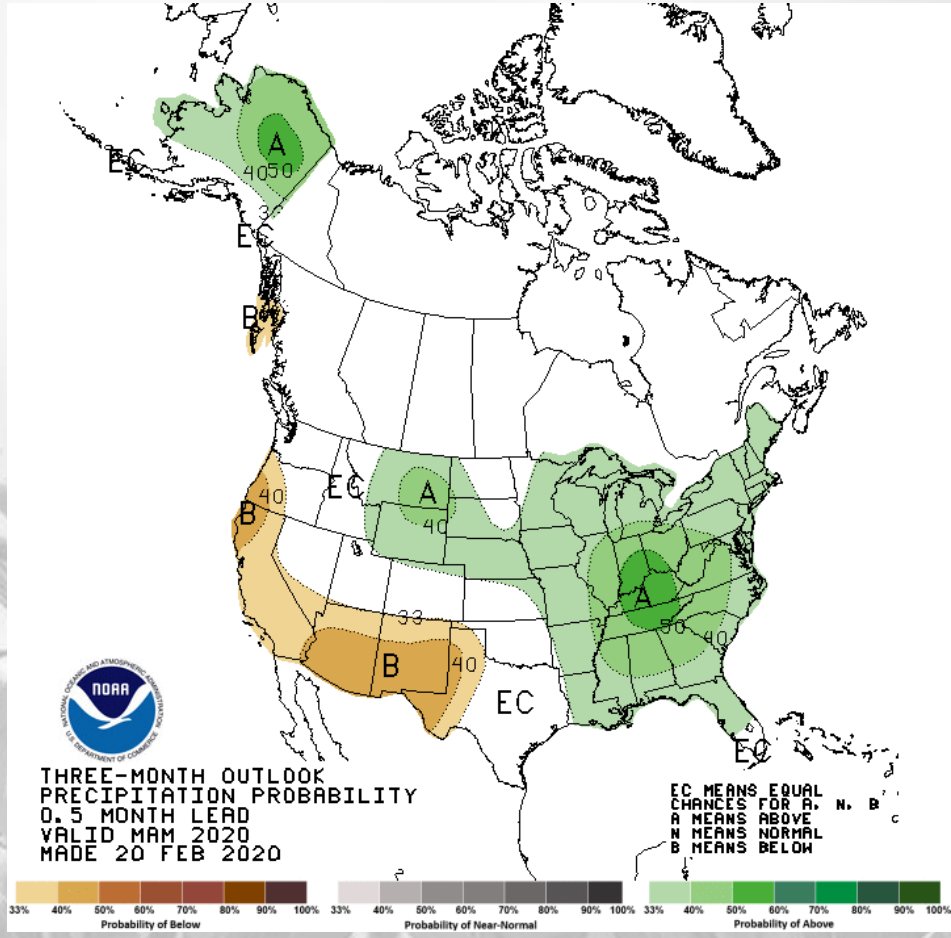


USDA Midwest Climate Hub
U.S. DEPARTMENT OF AGRICULTURE

http://www.cpc.ncep.noaa.gov/products/predictions/long_range/lead14/

Seasonal Outlook for March-May
NWS Climate Predication Center

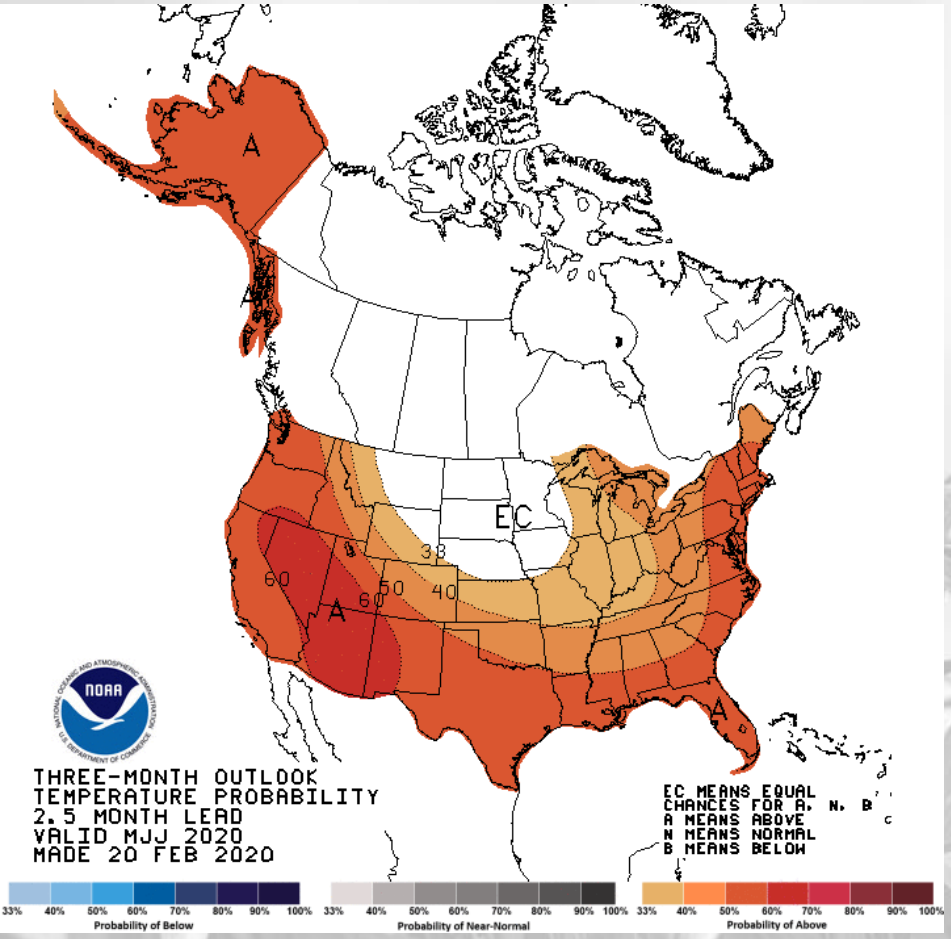


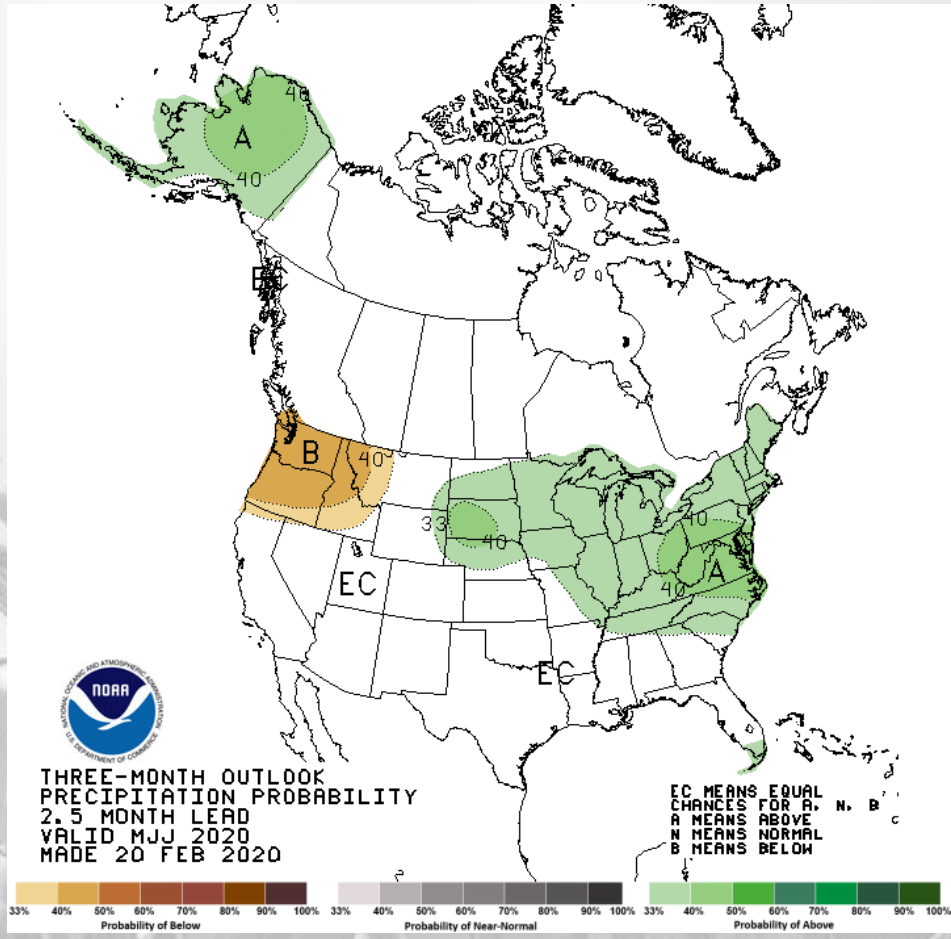


USDA Midwest Climate Hub
U.S. DEPARTMENT OF AGRICULTURE

http://www.cpc.ncep.noaa.gov/products/predictions/long_range/seasonal.php?lead=1

Seasonal Outlook for May-July
NWS Climate Predication Center





http://www.cpc.noaa.gov/products/predictions/long_range/seasonal.php?lead=4

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

National Drought Mitigation Center

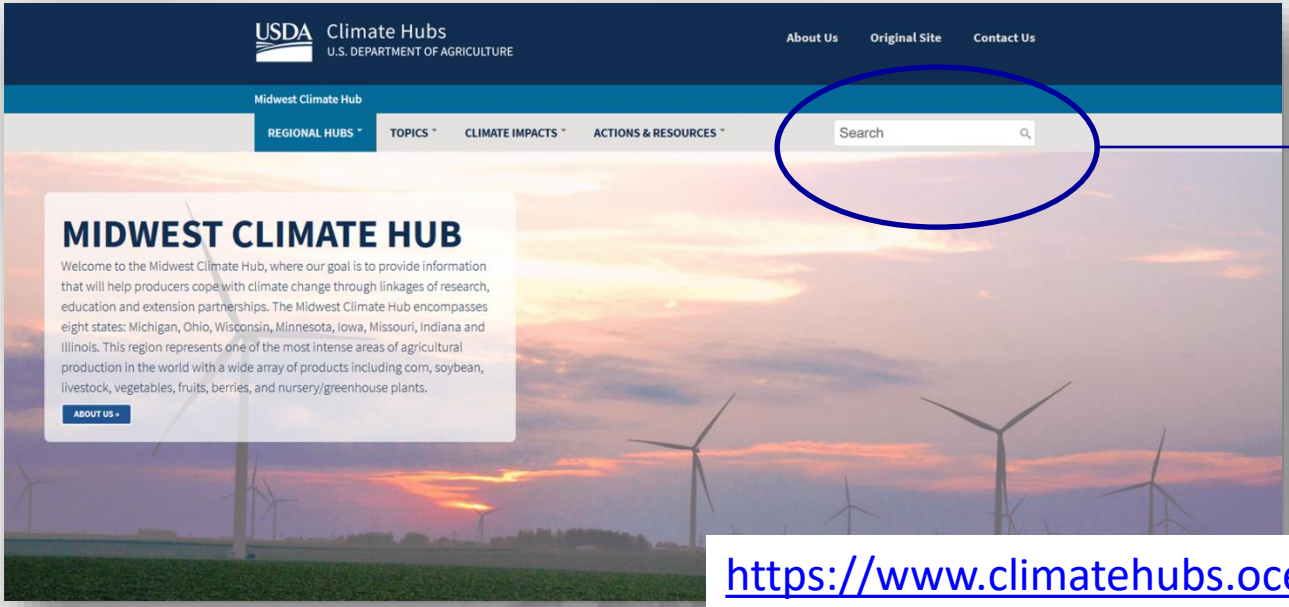
NOAA National Oceanic and Atmospheric Administration U.S. Department of Commerce

Regional Climate Centers

AASC American Association of State Climatologists

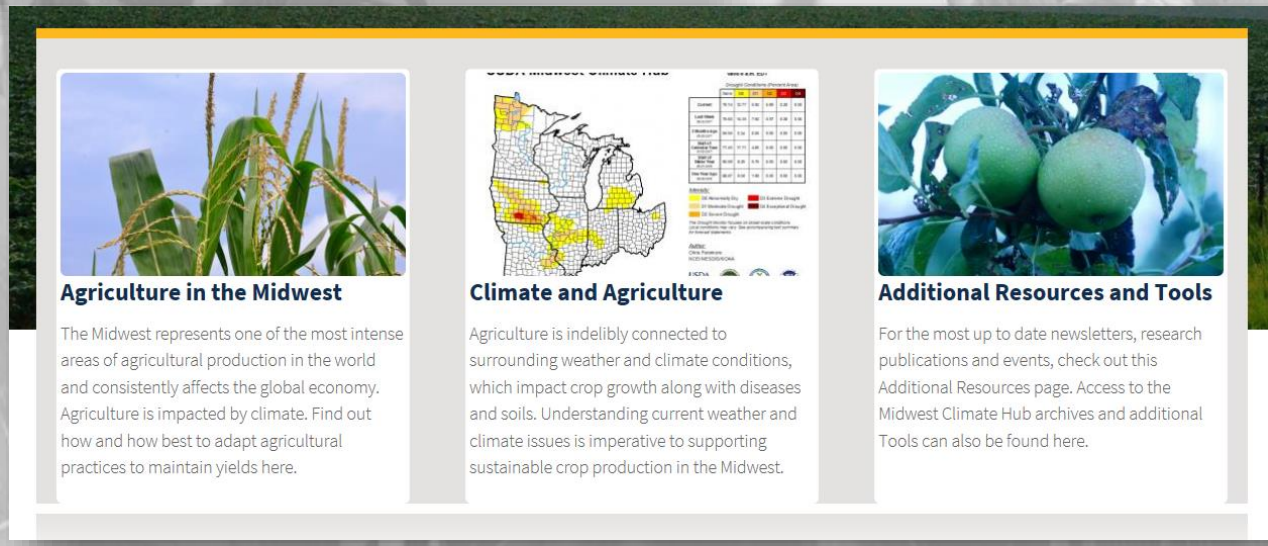
USDA United States Department of Agriculture Midwest Climate Hub

Resources: Website



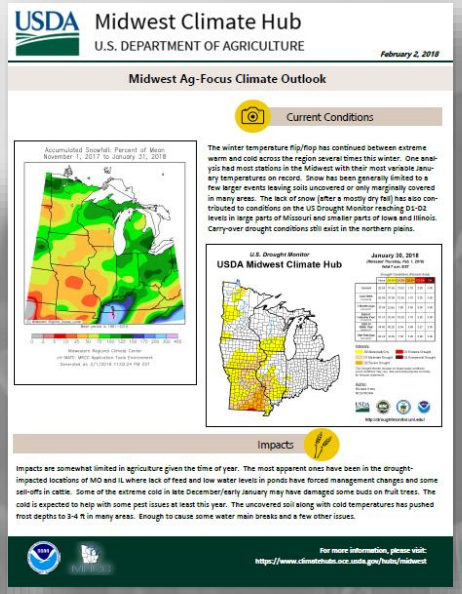
Search for tools, research and events by Region, Topic, type of crop, or climate Impact.

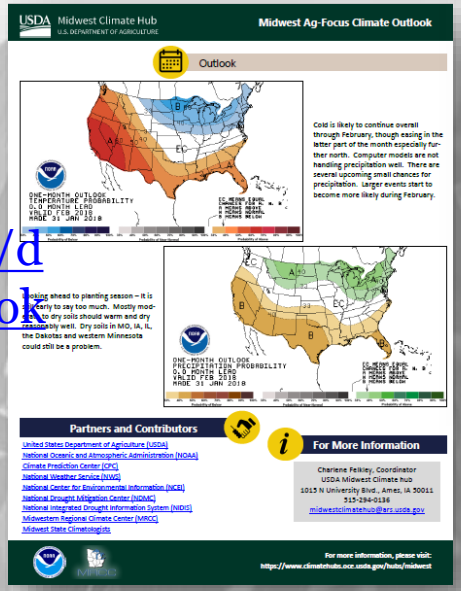
https://www.climatehubs.oce.usda.gov/hubs/midwest



Resources: Operational Products

Midwest Ag-Focus Climate outlook

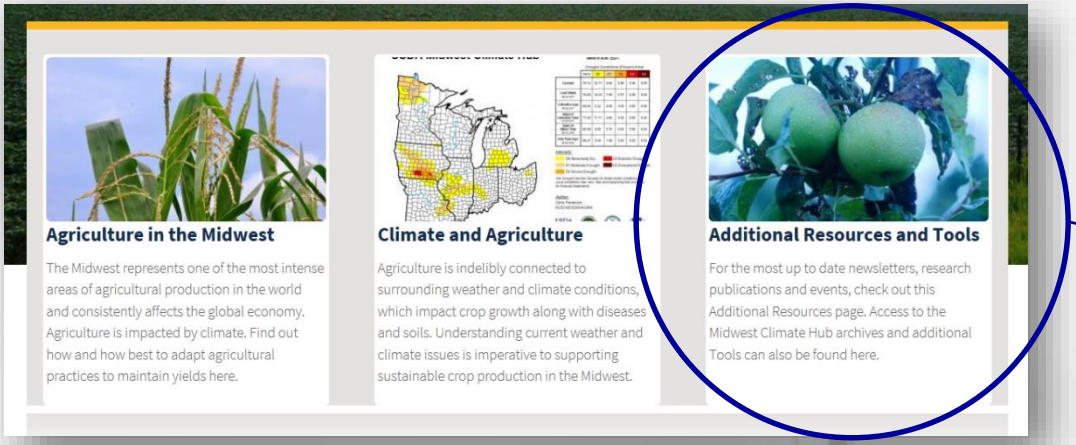




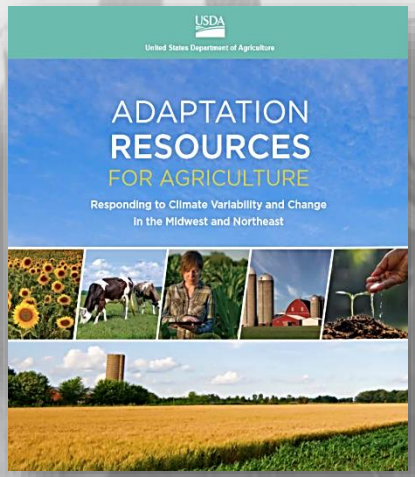
https://www.climatehubs.usda.gov/sites/default/files/1.3.20MidwestFocusAgOutlook.pdf

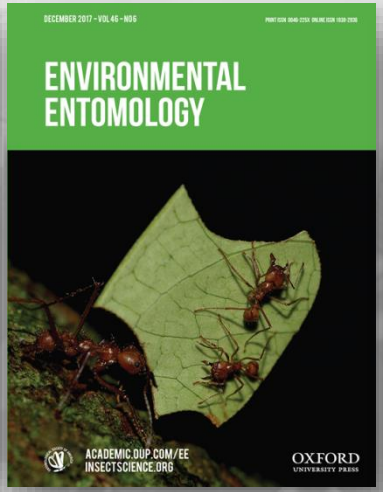
USDA Midwest Climate Hub
U.S. DEPARTMENT OF AGRICULTURE

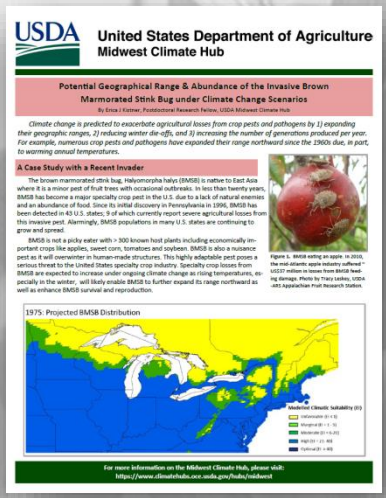
Resources: Website



To our Newsletter, Resources, Publications and One-Pagers







For More Information

Midwest Climate Hub

@dennistodey
@USDAClimateHubs

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

Charlene Felkley, Coordinator
515-294-0136
Charlene.felkley@usda.gov

Dennis Todey, Director
515-294-2013
Dennis.todey@usda.gov

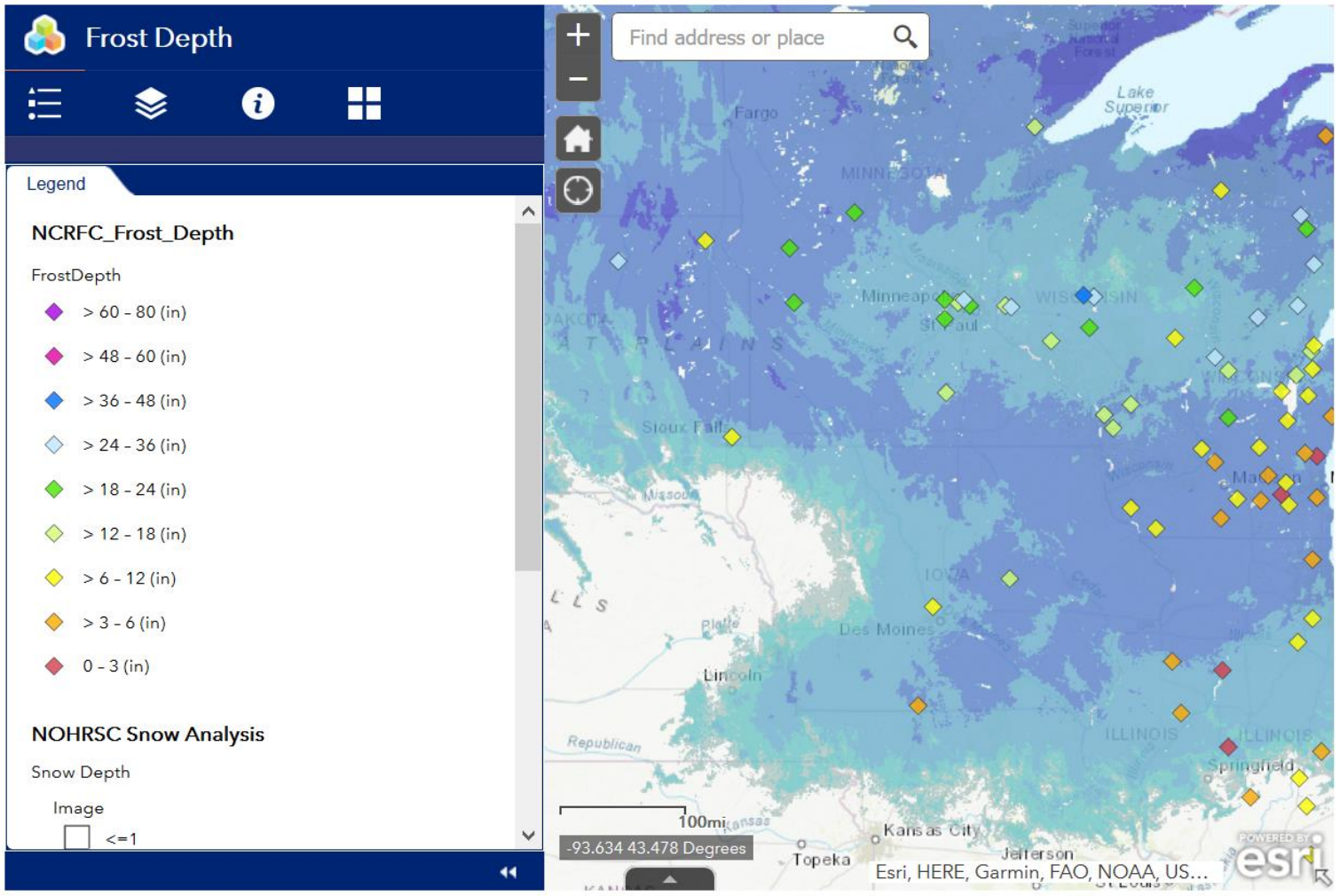
Erica Kistner-Thomas, Fellow
515-294-9602
Erica.kristner@usda.gov

National Laboratory for Agriculture and the Environment
Attn: Midwest Climate Hub
1015 N University Blvd
Ames, Iowa 50011-3611

Measured data

WHAT HAPPENED IN 2018-19?

Midwest Frost Depth



USDA Midwest Climate Hub
U.S. DEPARTMENT OF AGRICULTURE

https://www.weather.gov/ncrfc/LMI_FrostDepthMap