Drought of 2012: A Look Back and a Look Forward

Mark Svoboda, Climatologist
Monitoring Program Area Leader

National Drought Mitigation Center
School of Natural Resources
University of Nebraska-Lincoln

Association of Western State Engineers, Omaha, NE, September 25, 2012

Agenda

- About the NDMC
- Current Conditions
- Drought Impacts
- Outlooks
- Questions/Comments

National Drought Mitigation Center

Mission: To lessen societal vulnerability to drought by promoting planning and the adoption of appropriate risk management techniques.


IDIC Technical Report Series 94-1

Proceedings of the Conference

Drought Management in a Changing West:
New Directions for Water Policy

Palmer Drought Severity Index
September 3, 1994

Edited by

Donald A. Wilhite
Deborah A. Wood

International Drought Information Center
Department of Agricultural Meteorology
University of Nebraska-Lincoln

NIDIS
NATIONAL INTEGRATED DROUGHT INFORMATION SYSTEM

University of Nebraska Lincoln

National Drought Mitigation Center

National Drought Mitigation Center

- 1995
- Founder: Don Wilhite
- Director: Mike Hayes
- International Drought Information Center (IDIC)
- Staff: 16 people, tremendous diversity
- ***Bridge and translate science*** to policy-decision makers, resource managers, media and the public
- ***3 Program Areas***: Monitoring, Planning and Social Science, GIScience

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National Drought Mitigation Center

NDMC Program Objectives

- ***Improve the science*** of drought monitoring, planning, and mitigation
- ***Build awareness*** of drought and its ***impacts*** on society and the environment, and how human actions affect our ***vulnerability*** to drought
- Focus the attention of policy makers on the importance of ***drought policy and planning*** in the wise stewardship of natural resources

"End-to-End": Research-Applications-Operations-Outreach Continuum

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National Drought Mitigation Center

NDMC International Activities

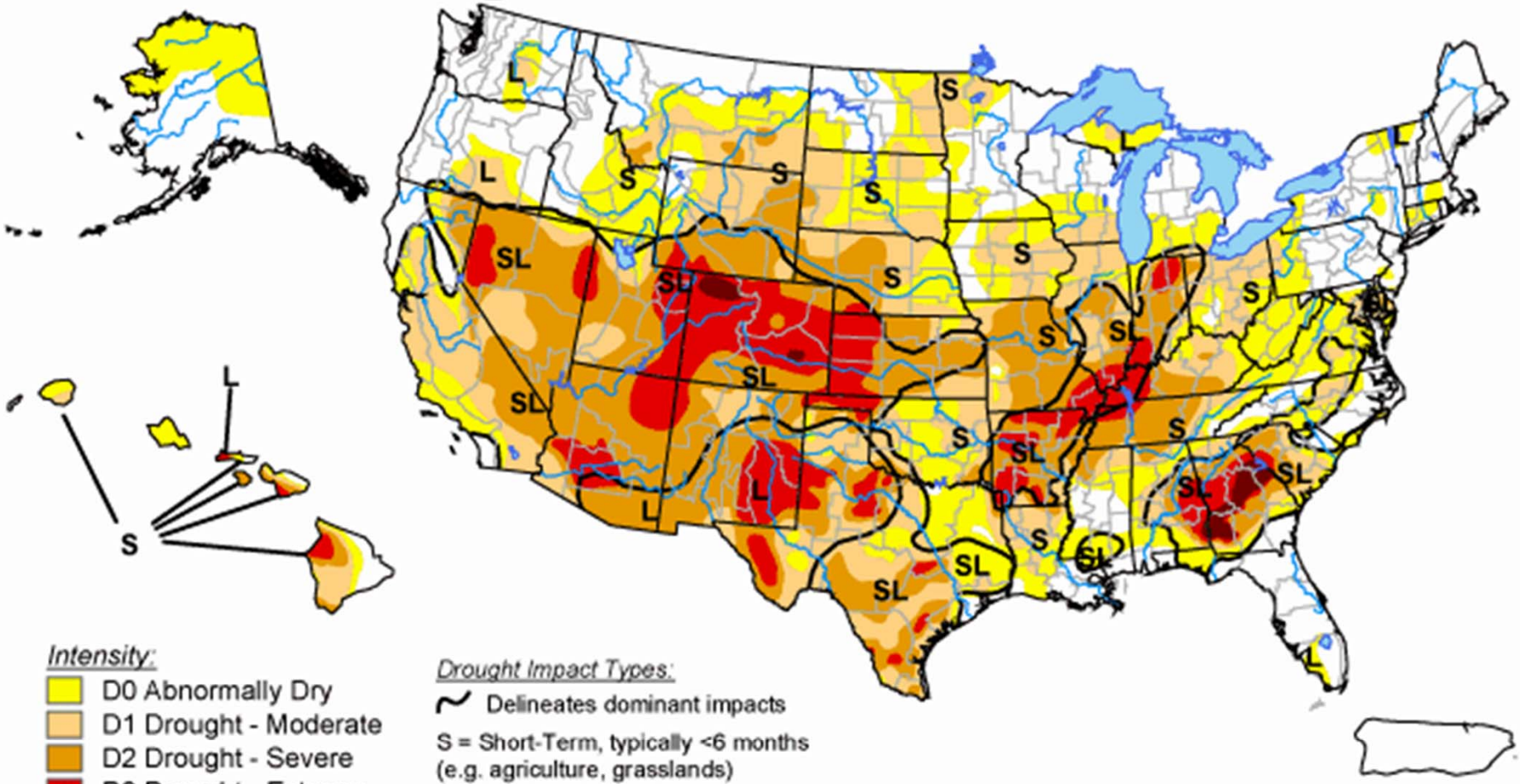
- ***UN organizations***: **FAO, ISDR, and CCD**
- ***World Meteorological Organization (WMO)***
- ***USAID***
- **Various regional and national drought centers**
- **Numerous government agencies and universities in different countries**
- **Visiting scientists/workshops/training**

Activities 2005–2011

Australia • **Austria** • Brazil • Cambodia • **Canada** • Chile • **China** • **Czech Republic** • Egypt • **Ethiopia** • European Union • **India** • Iraq • Italy • Japan • Jordan • Mali • **Mexico** • Morocco • Mozambique • Namibia • **Netherlands** • Saudi Arabia • **Slovakia** • Slovenia • **South Korea** • Spain • Switzerland • Syria • Tunisia • **Turkey** • **United States** • Vietnam • **Zambia**

U.S. Drought Monitor

July 3, 2012
Valid 7 a.m. EDT



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

Drought Impact Types:

Delineates dominant impacts

S = Short-Term, typically <6 months (e.g. agriculture, grasslands)

L = Long-Term, typically >6 months (e.g. hydrology, ecology)

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

http://droughtmonitor.unl.edu/

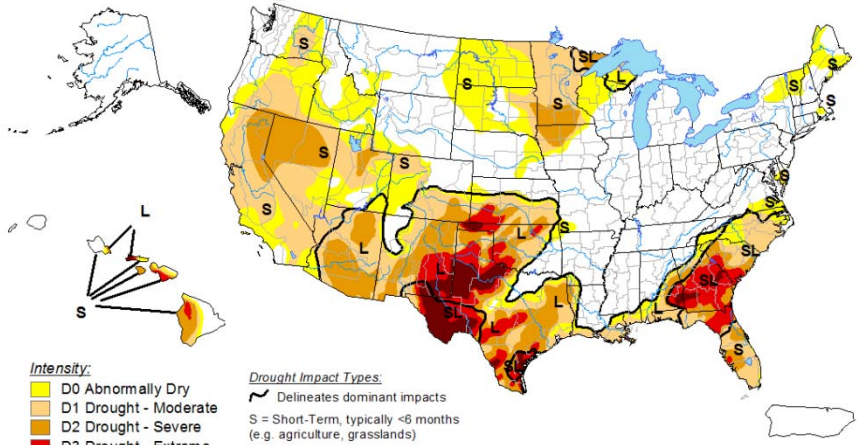
USDA National Drought Mitigation Center

Released Thursday, July 5, 2012

Author: Rich Tinker, NOAA/NWS/NCEP/CPC

U.S. Drought Monitor

March 6, 2012
Valid 7 a.m. EST



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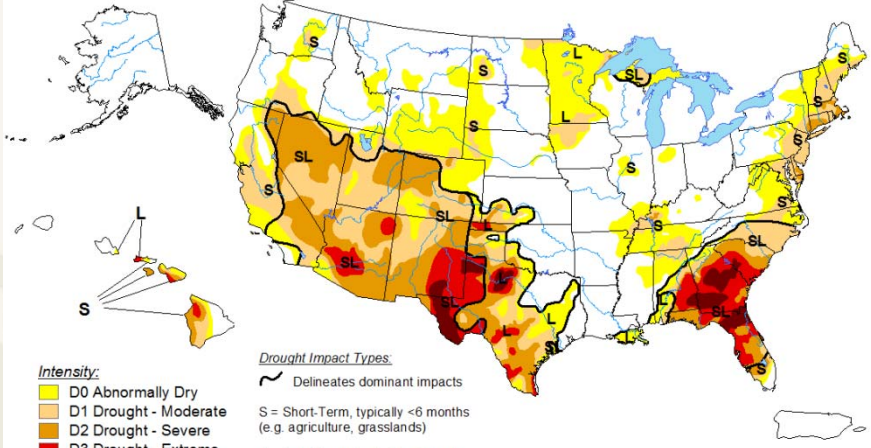
http://droughtmonitor.unl.edu/

Released Thursday, March 8, 2012
Author: Michael Brewer/Liz Love-Brotak, NOAA/NESDIS/NCDC

U.S. Drought Monitor

May 8, 2012
Valid 8 a.m. EDT



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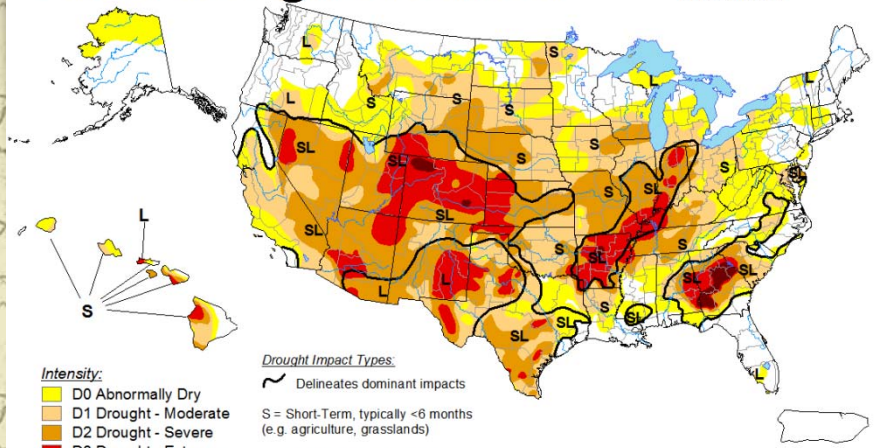
http://droughtmonitor.unl.edu/

Released Thursday, May 10, 2012
Author: Matthew Rosencrans, NOAA/NWS/NCEP/CPC

U.S. Drought Monitor

July 10, 2012
Valid 8 a.m. EDT



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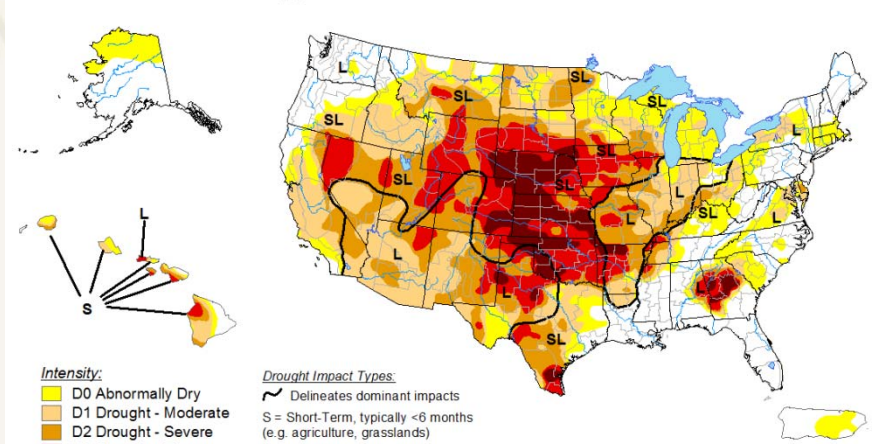
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

http://droughtmonitor.unl.edu/

Released Thursday, July 12, 2012
Author: Rich Tinker, NOAA/NWS/NCEP/CPC

U.S. Drought Monitor

September 11, 2012
Valid 8 a.m. EDT



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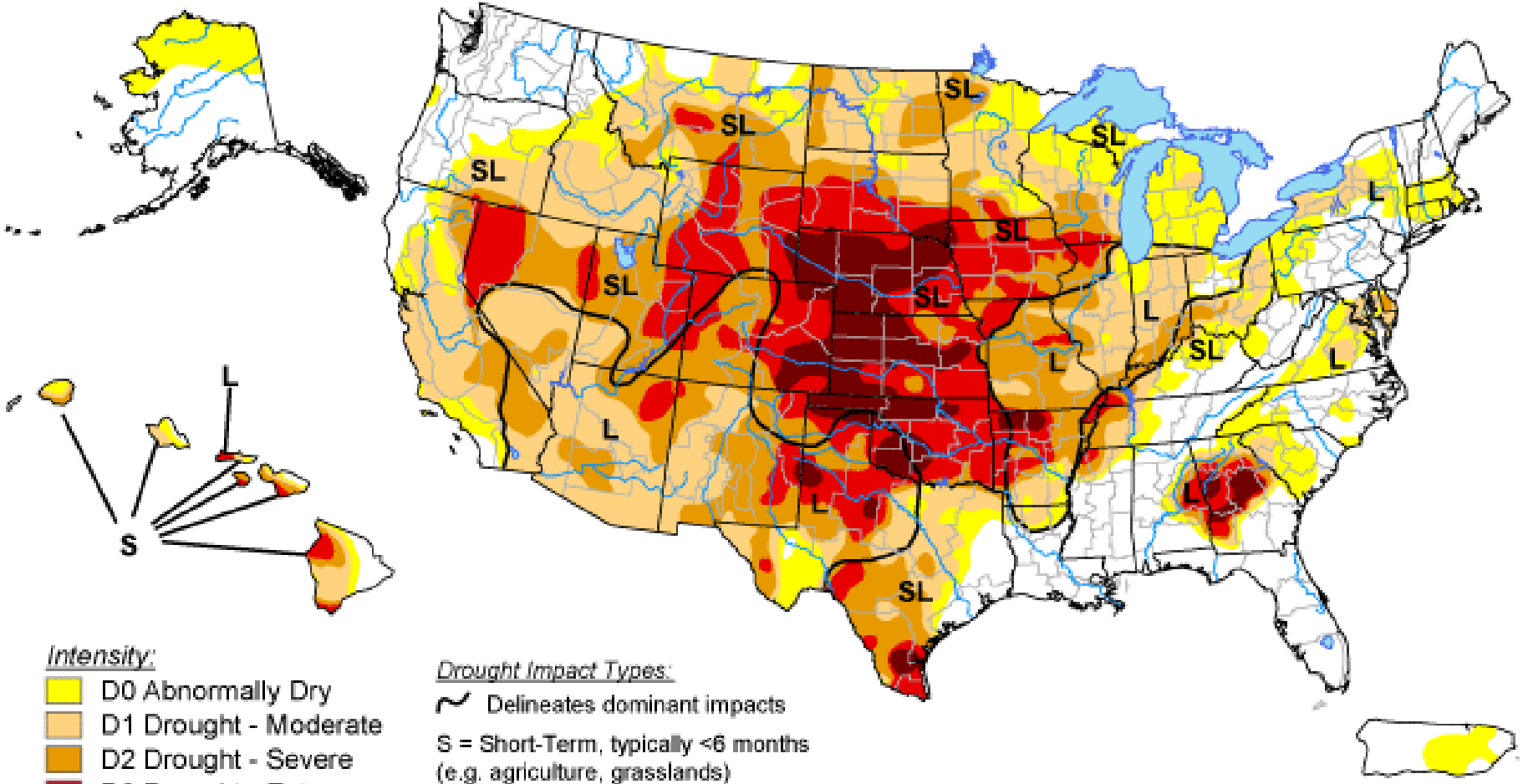
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

http://droughtmonitor.unl.edu/

Released Thursday, September 13, 2012
Author: David Simeral, Western Regional Climate Center
Acknowledgement: Laura Edwards, WRCC and SDSU

U.S. Drought Monitor

September 18, 2012
Valid 7 a.m. EDT



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

http://droughtmonitor.unl.edu/

Released Thursday, September 20, 2012

Author: David Simeral, Western Regional Climate Center

Drought Condition (Percent Area): United States

Conditions for the U.S., including Alaska, Hawaii and Puerto Rico

Week	Date	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
One Year Ago	09/13/11	62.08	37.92	25.85	20.16	15.48	9.81
Start of Water Year	09/27/11	63.45	36.55	24.42	19.61	14.87	9.50
Start of Calendar Year	12/27/11	58.88	41.12	23.89	15.88	8.37	2.76
3 Months Ago	06/19/12	39.42	60.58	39.12	20.32	4.35	0.24
Last Week	09/11/12	29.48	70.52	53.70	34.97	17.63	5.20
Current	09/18/12	29.80	70.20	54.25	34.35	17.35	4.98

Conditions for the Contiguous U.S.

Week	Date	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
One Year Ago	09/13/11	55.36	44.64	30.86	24.10	18.54	11.75
Start of Water Year	09/27/11	56.45	43.55	29.13	23.44	17.80	11.37
Start of Calendar Year	12/27/11	50.89	49.11	28.49	18.95	10.01	3.31
3 Months Ago	06/19/12	31.22	68.78	46.72	24.27	5.19	0.29
Last Week	09/11/12	21.47	78.53	64.16	41.81	21.09	6.23
Current	09/18/12	21.85	78.15	64.82	41.07	20.74	5.96

Why So Dry?

- ***La Niña*** in 2010-11 ***and*** 2011-12 contributed to the historic 2011 drought across the southern Plains and then in the Midwest and central Plains in 2012.
- During the 2011-12 cold season, a ***strong jet stream across the North Atlantic Ocean*** drew cold air and moisture away from the U.S.
- Around Memorial Day 2012, a ***blocking high pressure system in the North Atlantic*** locked in hot, dry weather.
  - Subsequent heat waves in June and July

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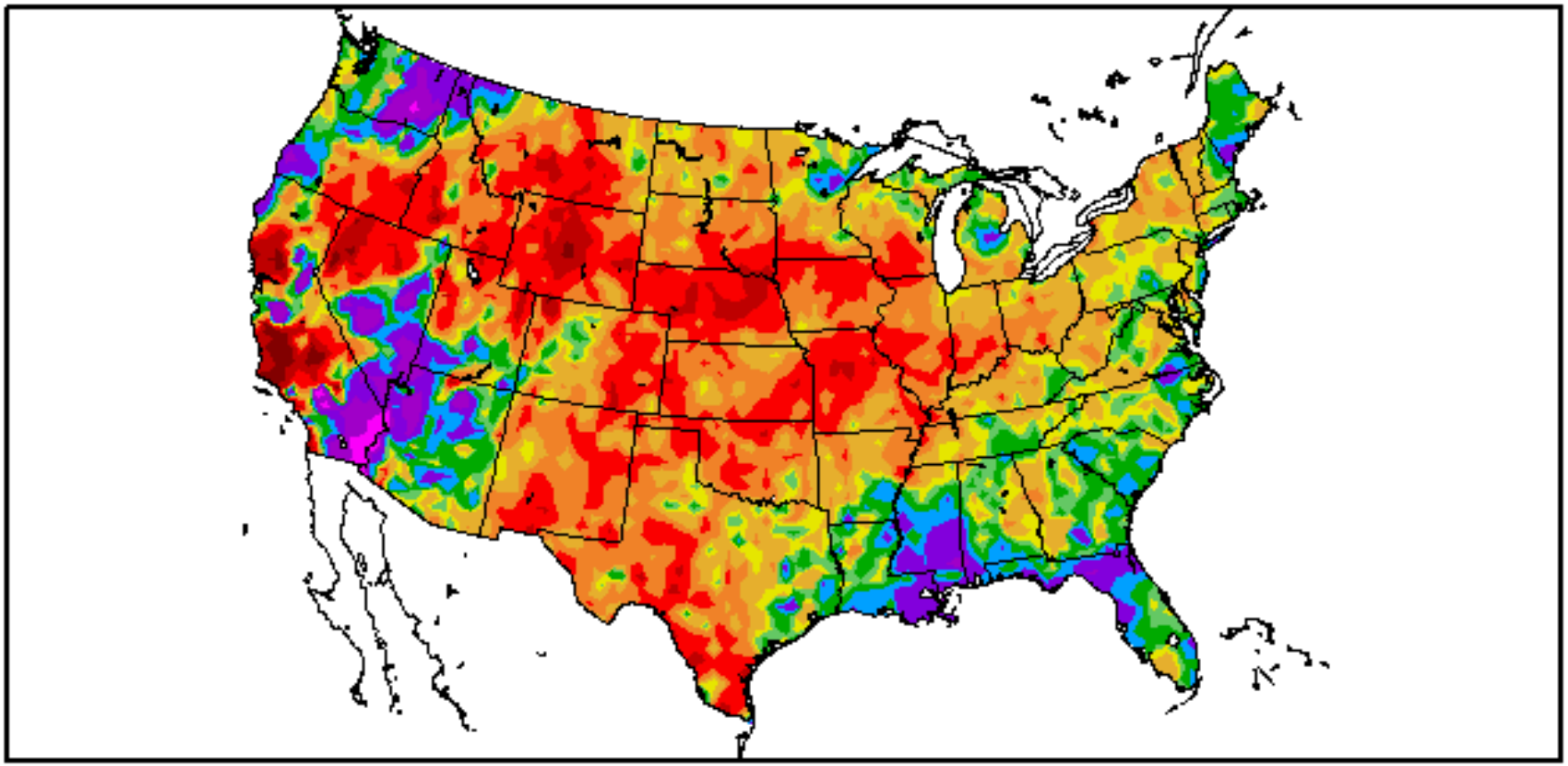
Percent of Normal Precipitation (%)
6/1/2012 – 8/31/2012

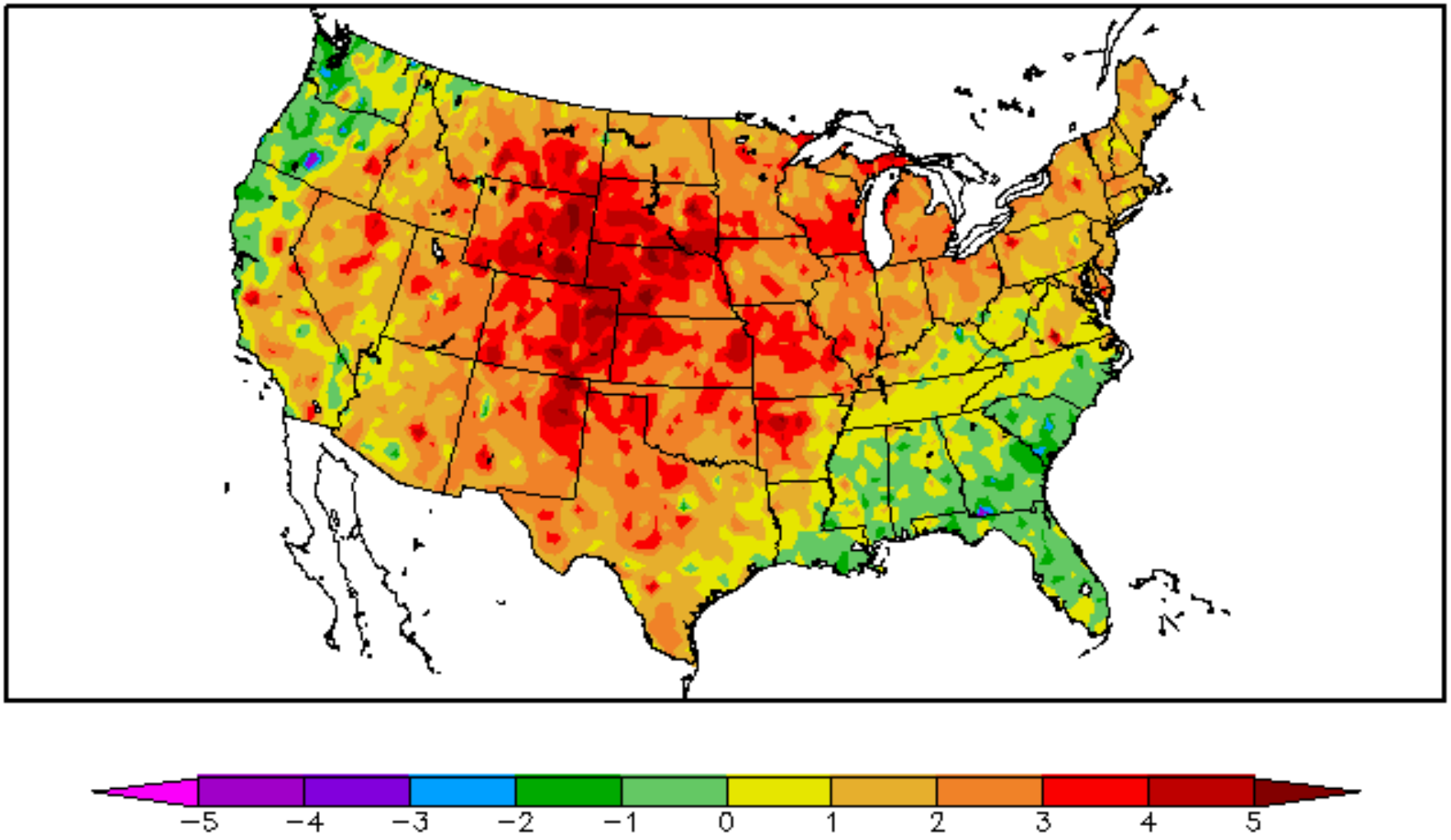


5 25 50 70 90 100 110 130 150 200 300

Generated 9/18/2012 at HPRCC using provisional data.

Regional Climate Centers

Departure from Normal Temperature (F)
6/1/2012 – 8/31/2012

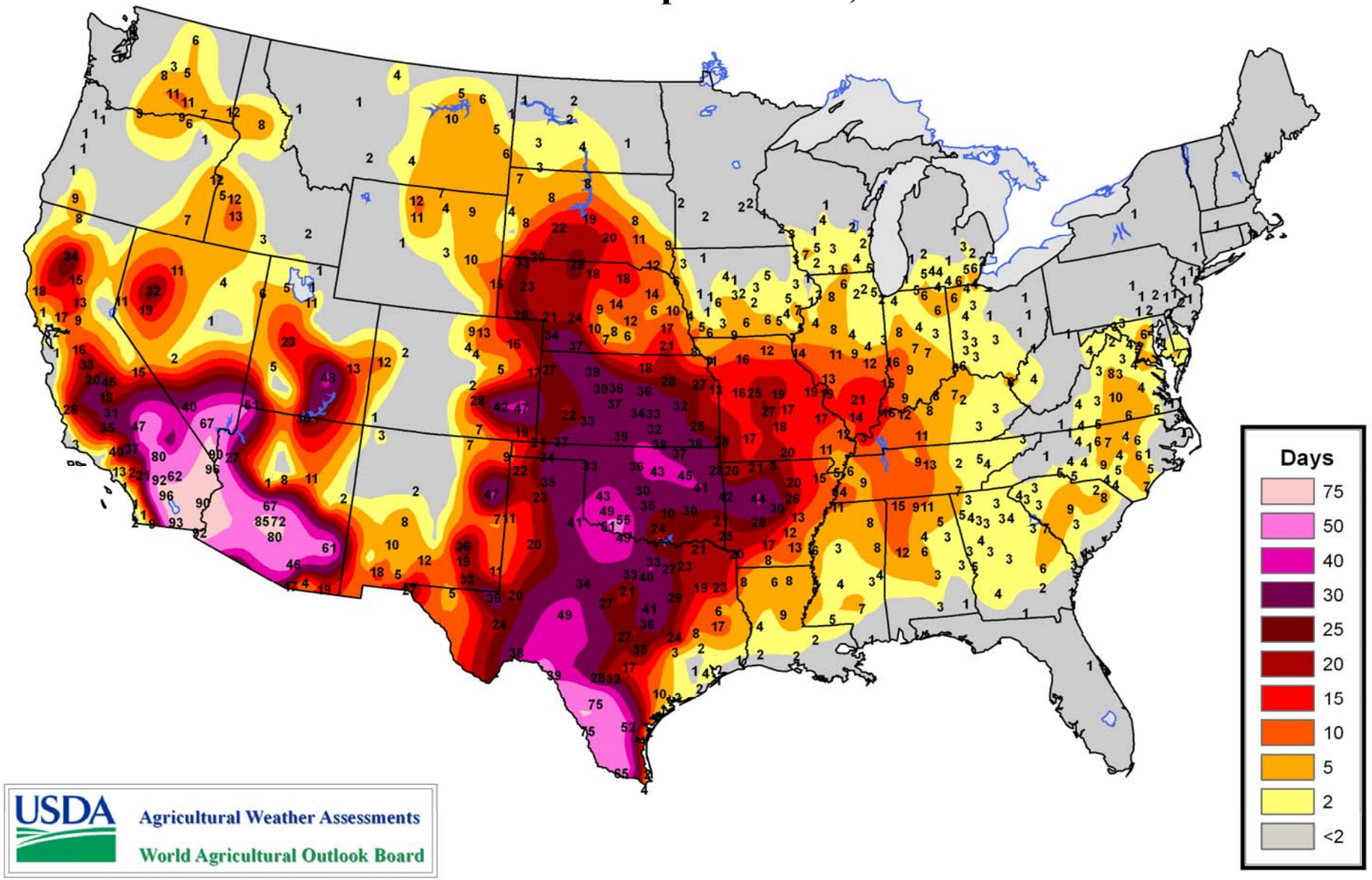


Generated 9/5/2012 at HPRCC using provisional data.

Regional Climate Centers

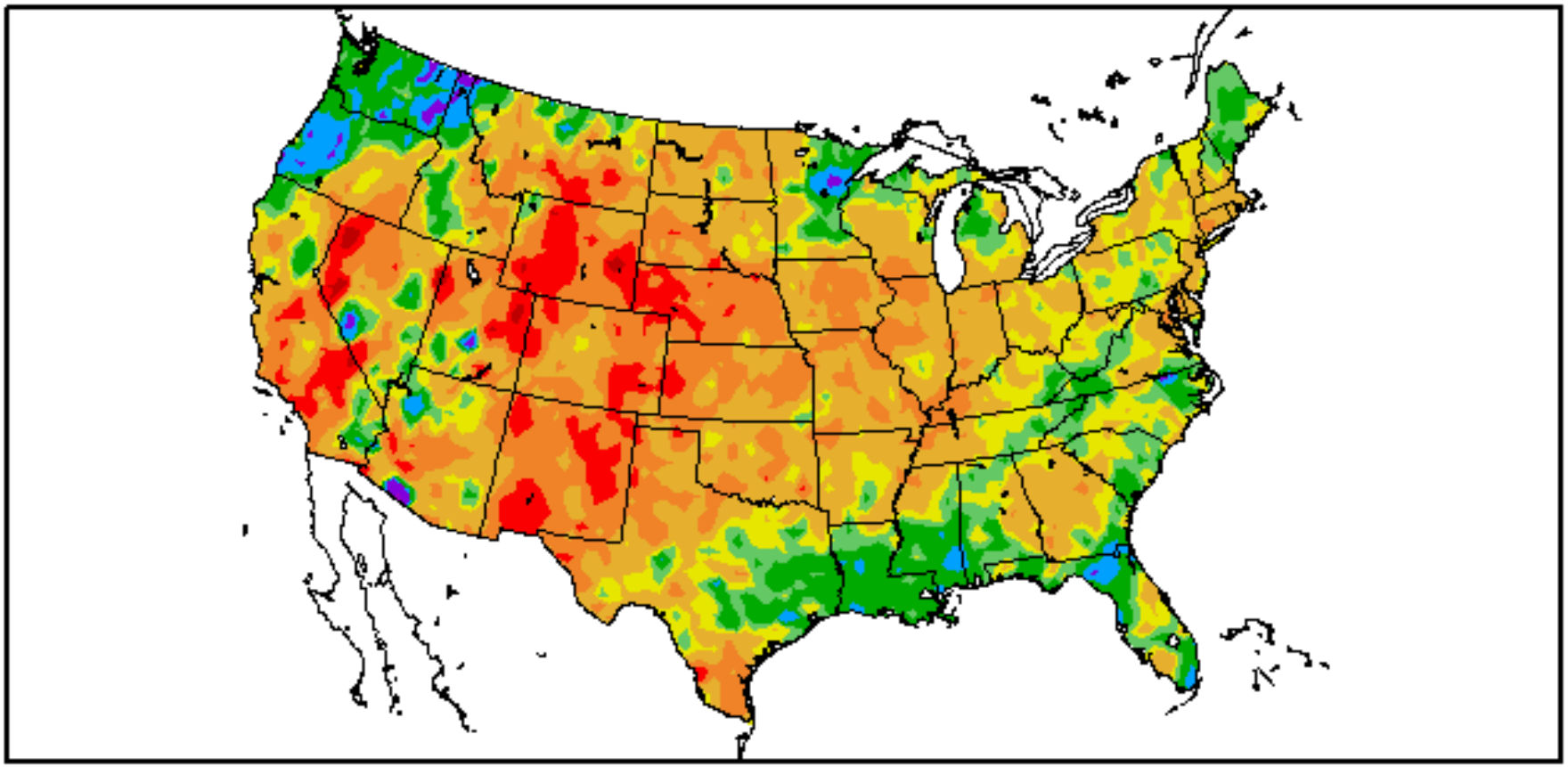
Number of Days >= 100°F

June 1 - September 15, 2012



USDA Agricultural Weather Assessments
World Agricultural Outlook Board

Percent of Normal Precipitation (%)
1/1/2012 – 9/22/2012

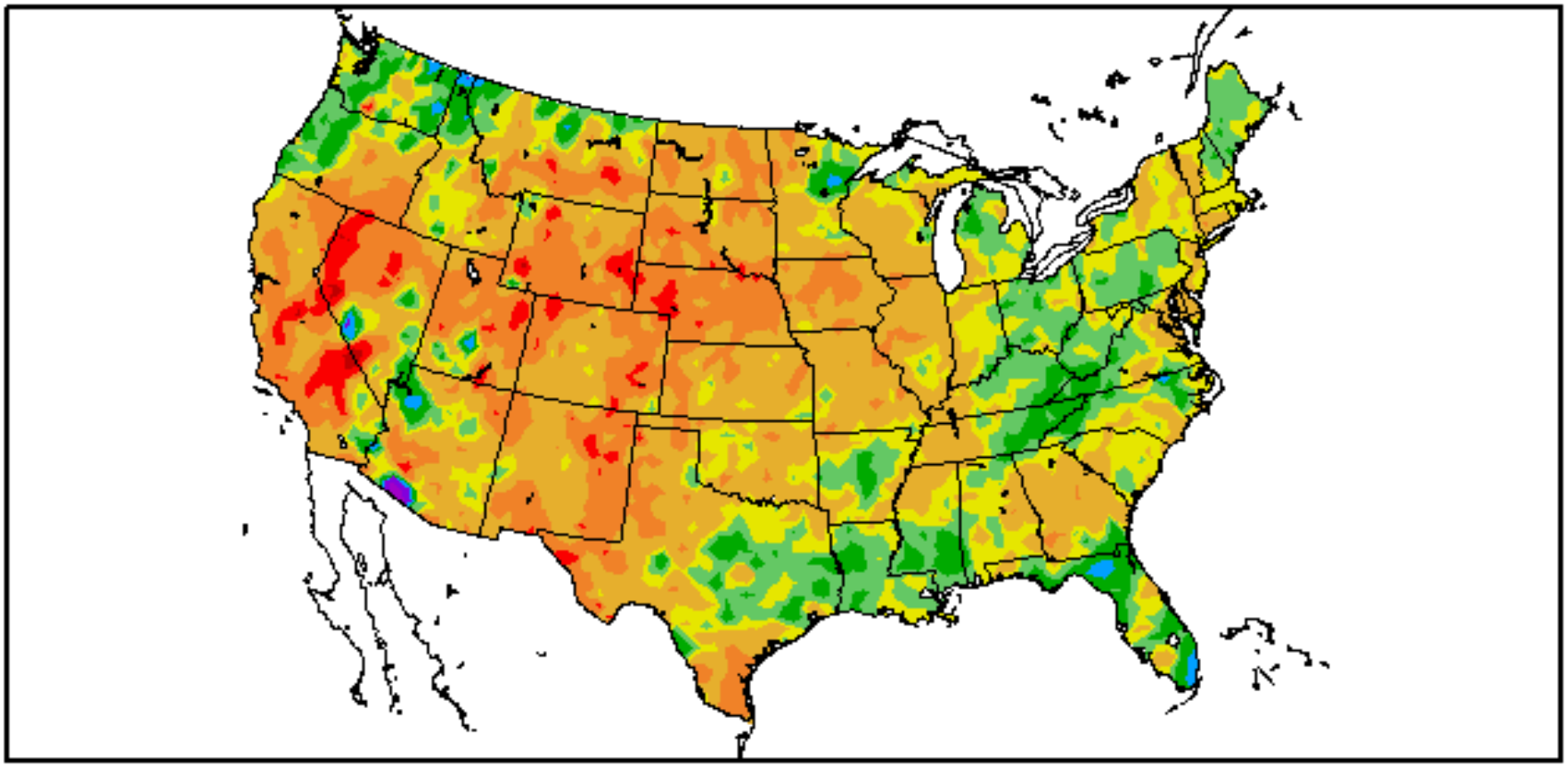


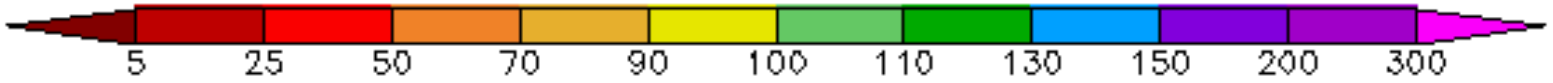
5 25 50 70 90 100 110 130 150 200 300

Generated 9/23/2012 at HPRCC using provisional data.

Regional Climate Centers

Percent of Normal Precipitation (%)
10/1/2011 – 9/22/2012

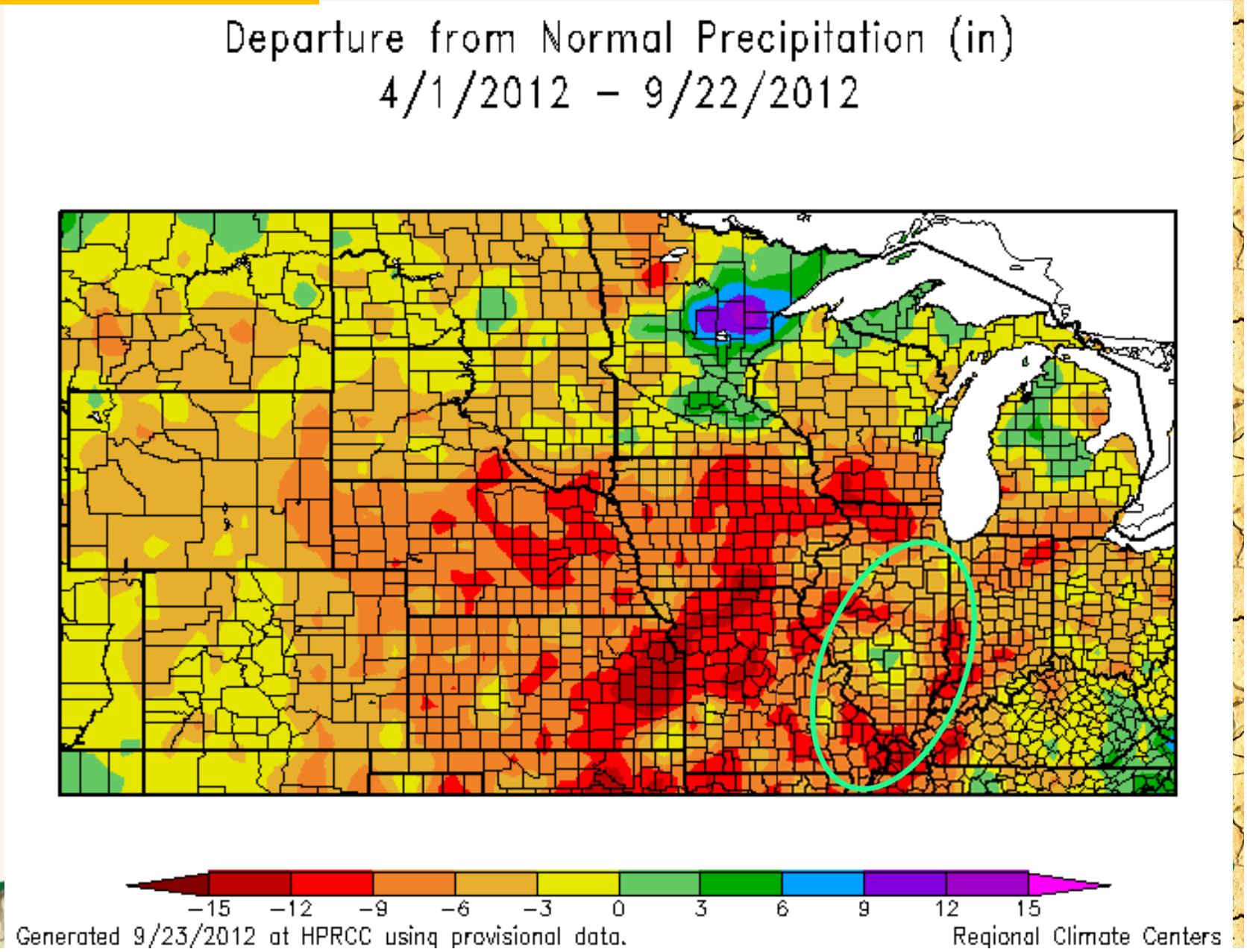




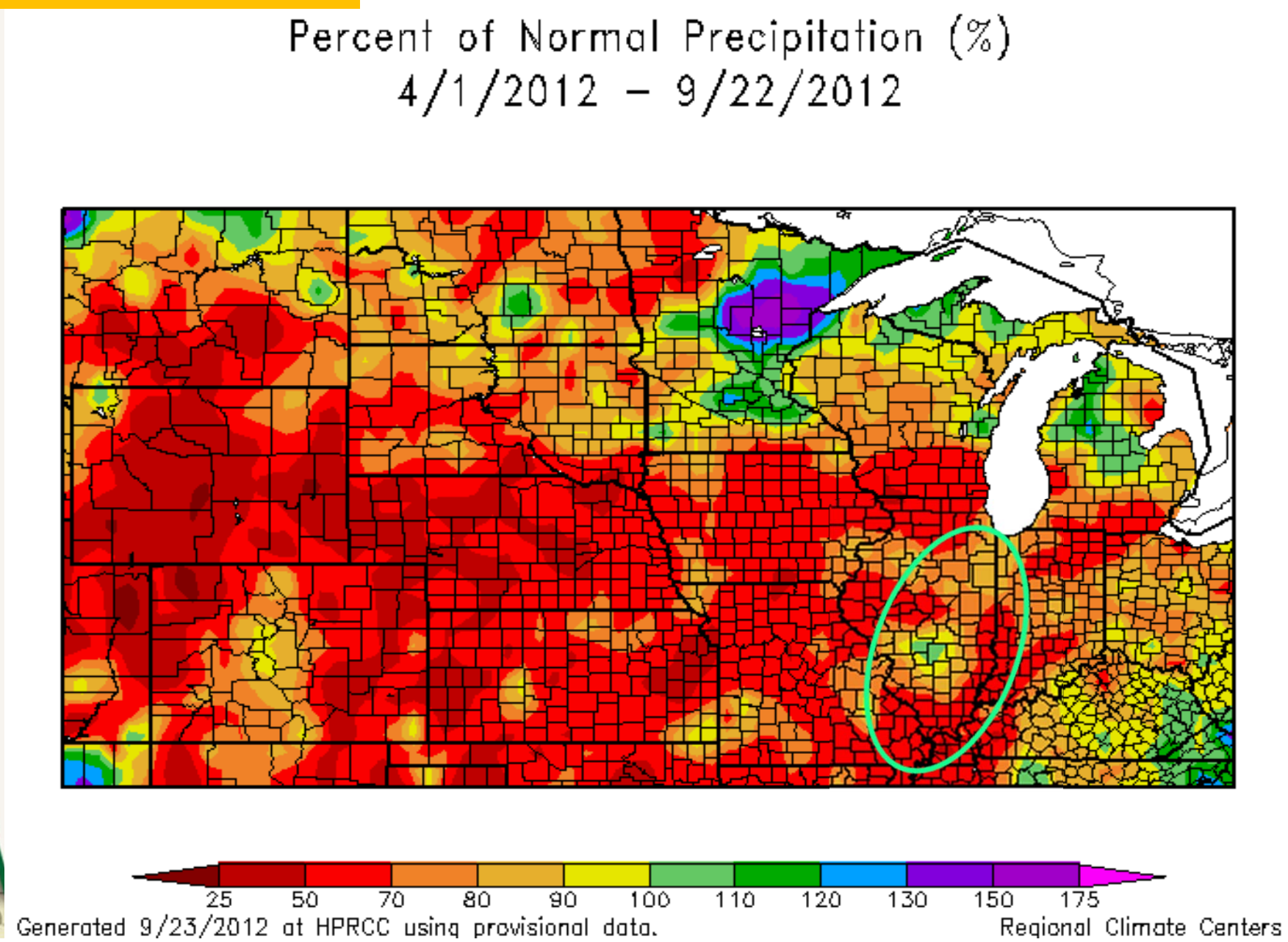
Generated 9/23/2012 at HPRCC using provisional data.

Regional Climate Centers

Growing Season ACIS Departure from Normal

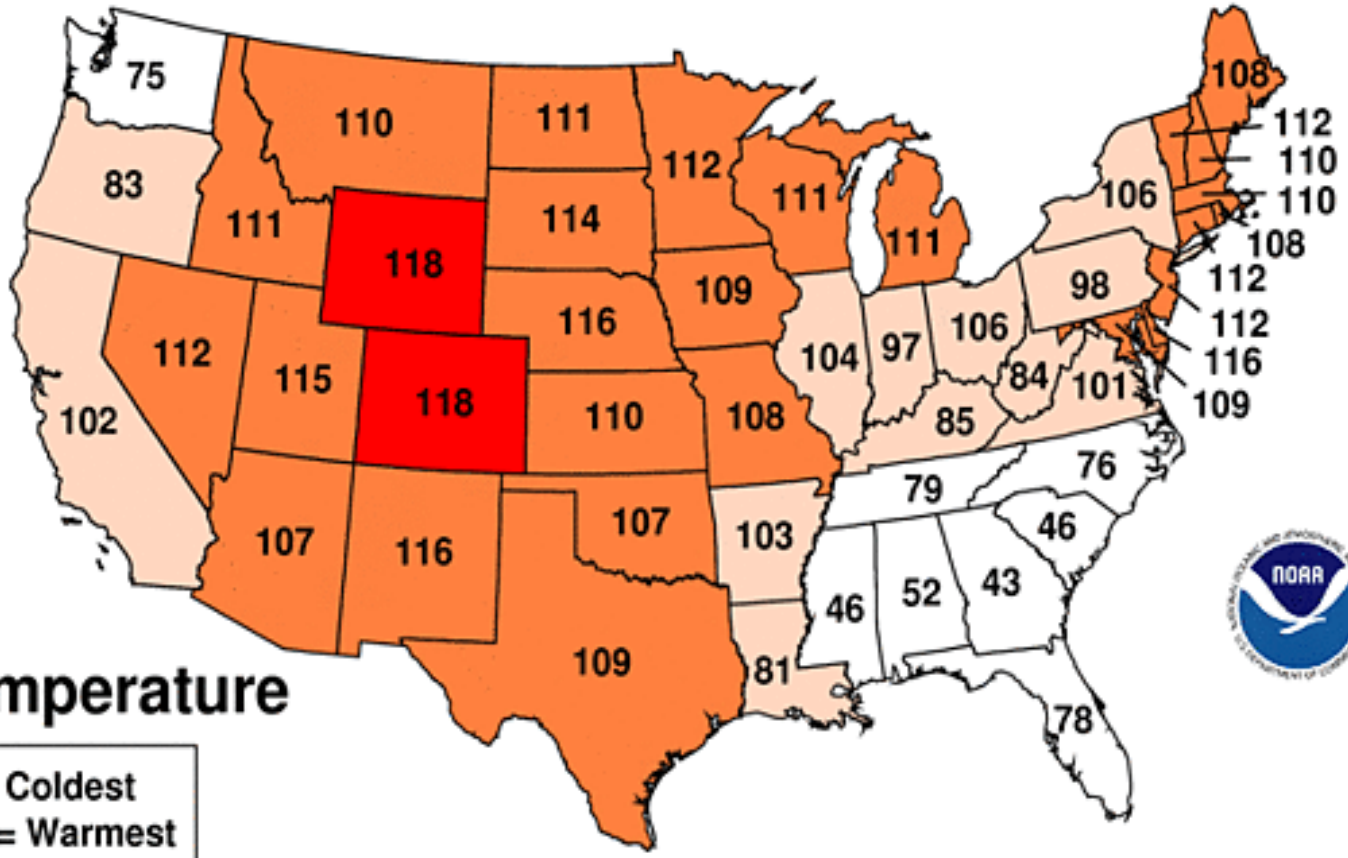


Growing Season ACIS Percent of Normal



June-August 2012 Statewide Ranks

National Climatic Data Center/NESDIS/NOAA



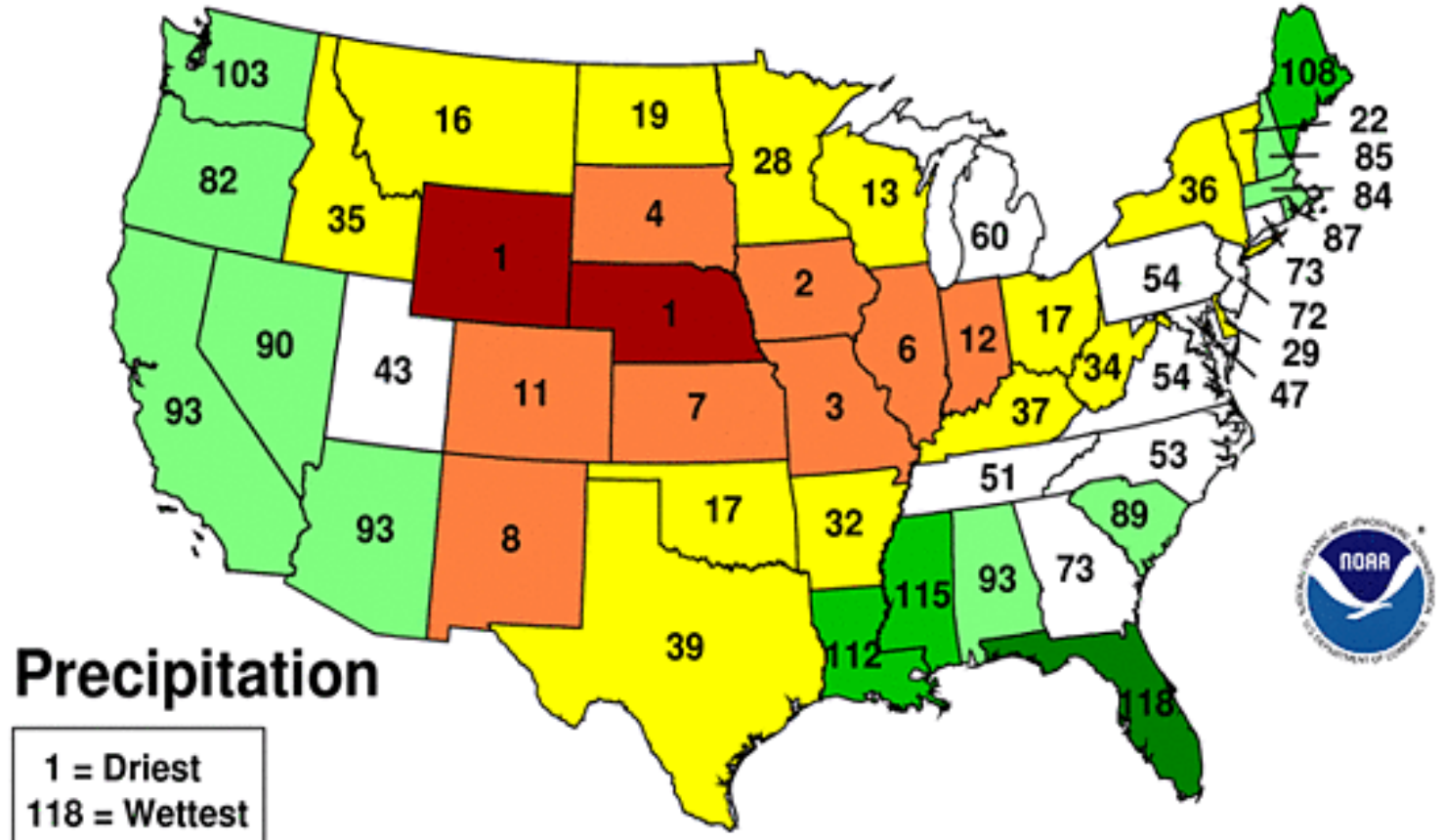
Temperature

1 = Coldest
118 = Warmest

Record Coldest	Much Below Normal	Below Normal	Near Normal	Above Normal	Much Above Normal	Record Warmest

June-August 2012 Statewide Ranks

National Climatic Data Center/NESDIS/NOAA



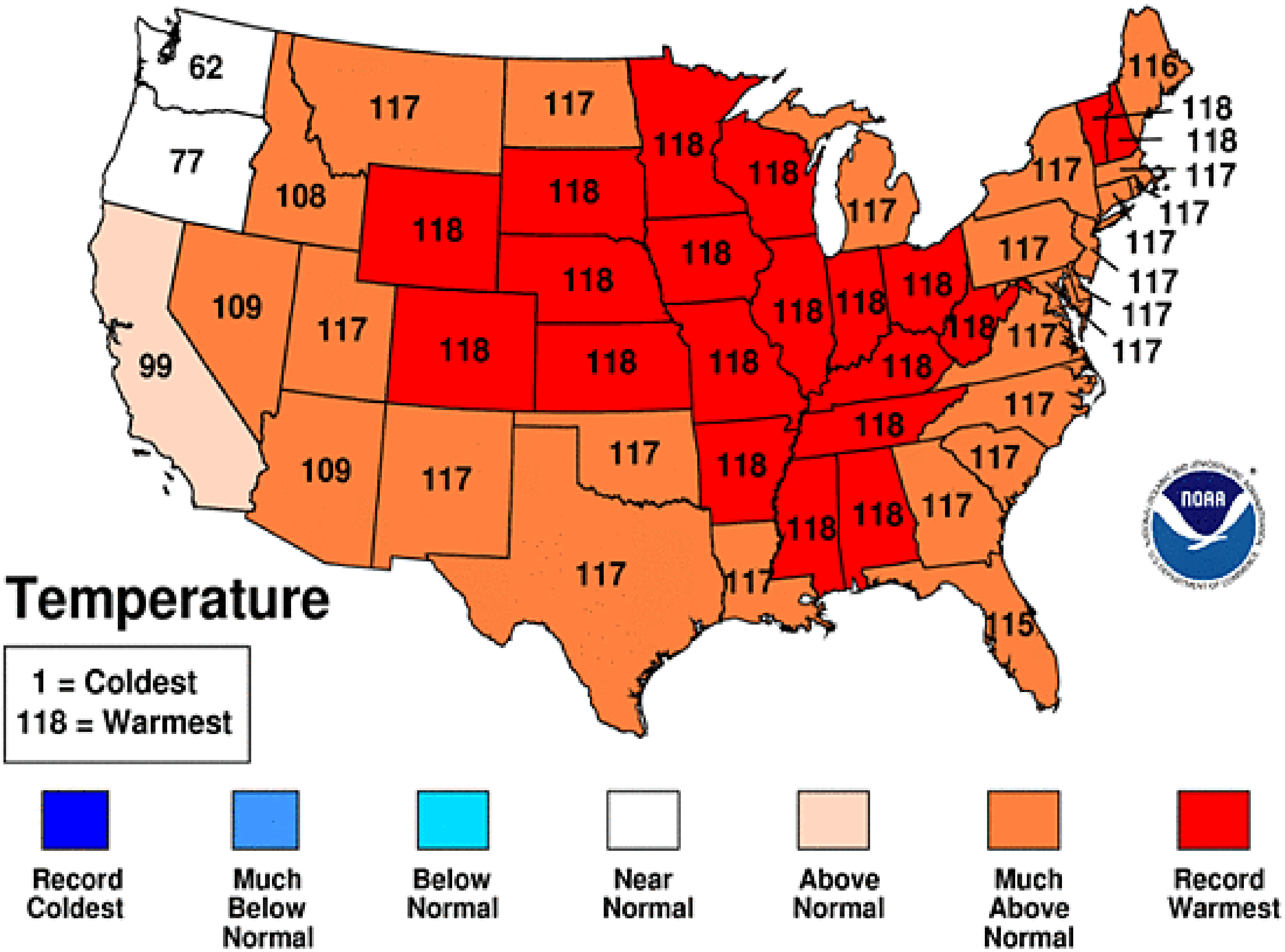
Precipitation

1 = Driest
118 = Wettest

Record Driest	Much Below Normal	Below Normal	Near Normal	Above Normal	Much Above Normal	Record Wettest

March-August 2012 Statewide Ranks

National Climatic Data Center/NESDIS/NOAA



March-August 2012 Statewide Ranks

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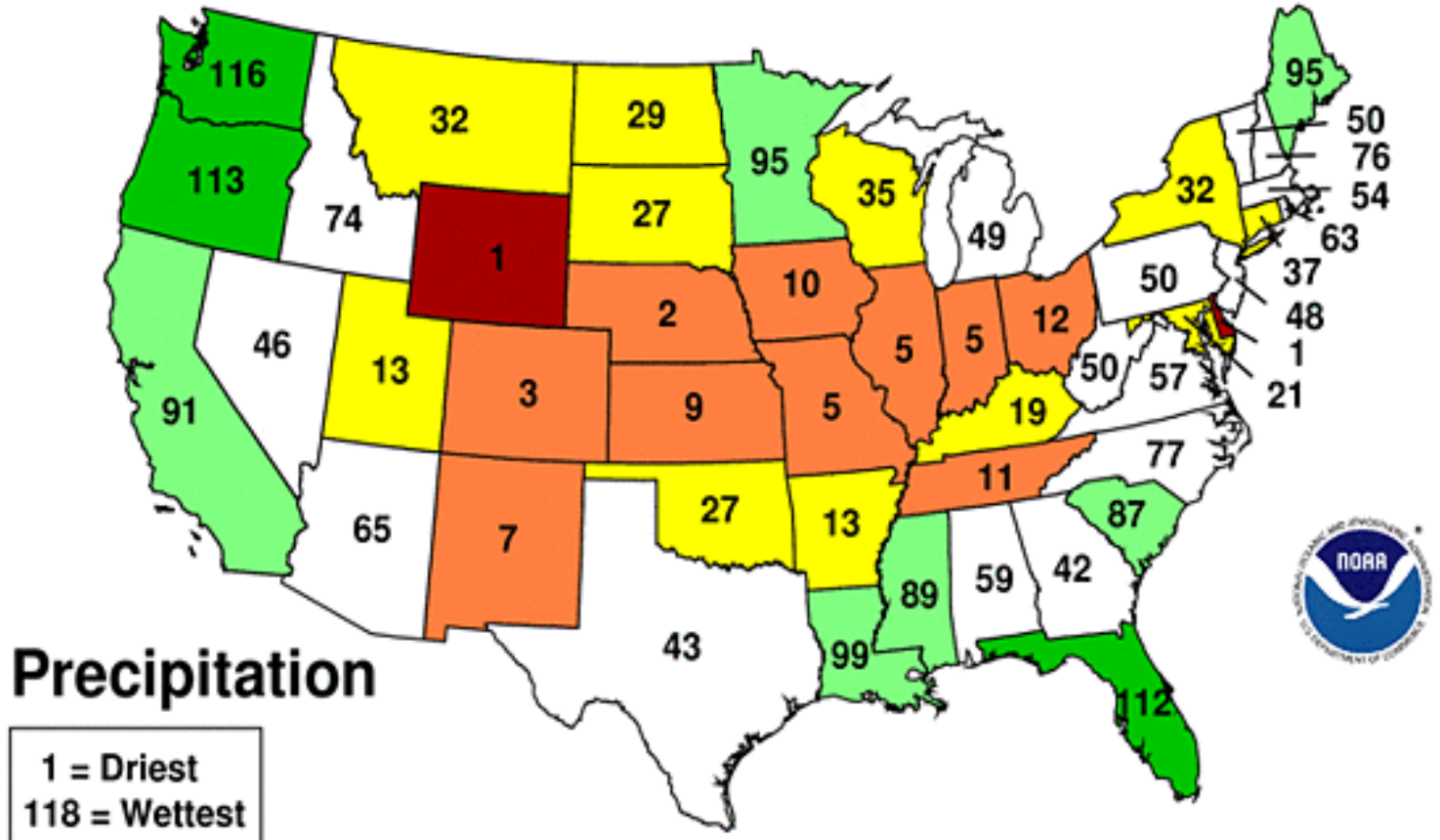

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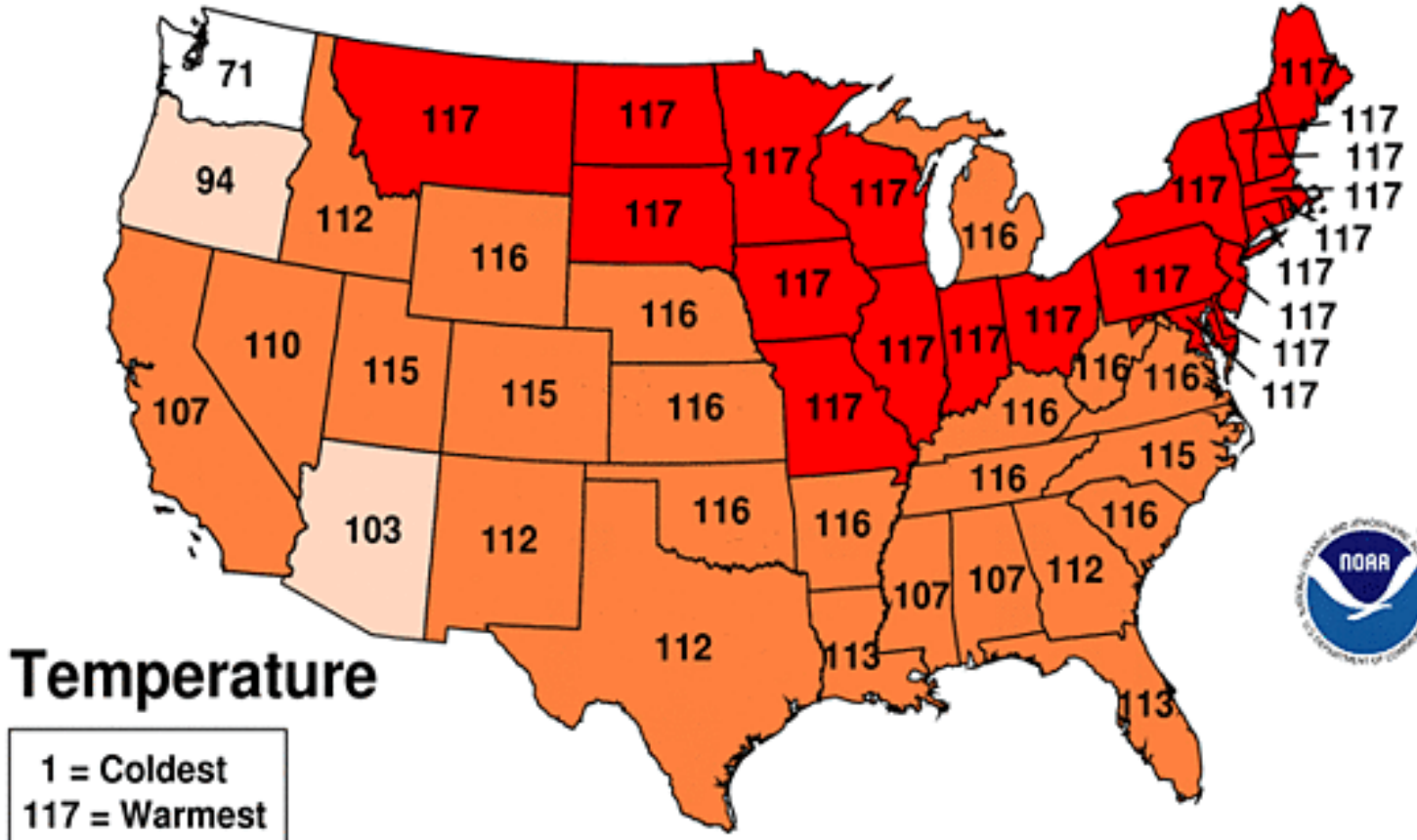
Sep 2011-Aug 2012 Statewide Ranks

National Climatic Data Center/NESDIS/NOAA



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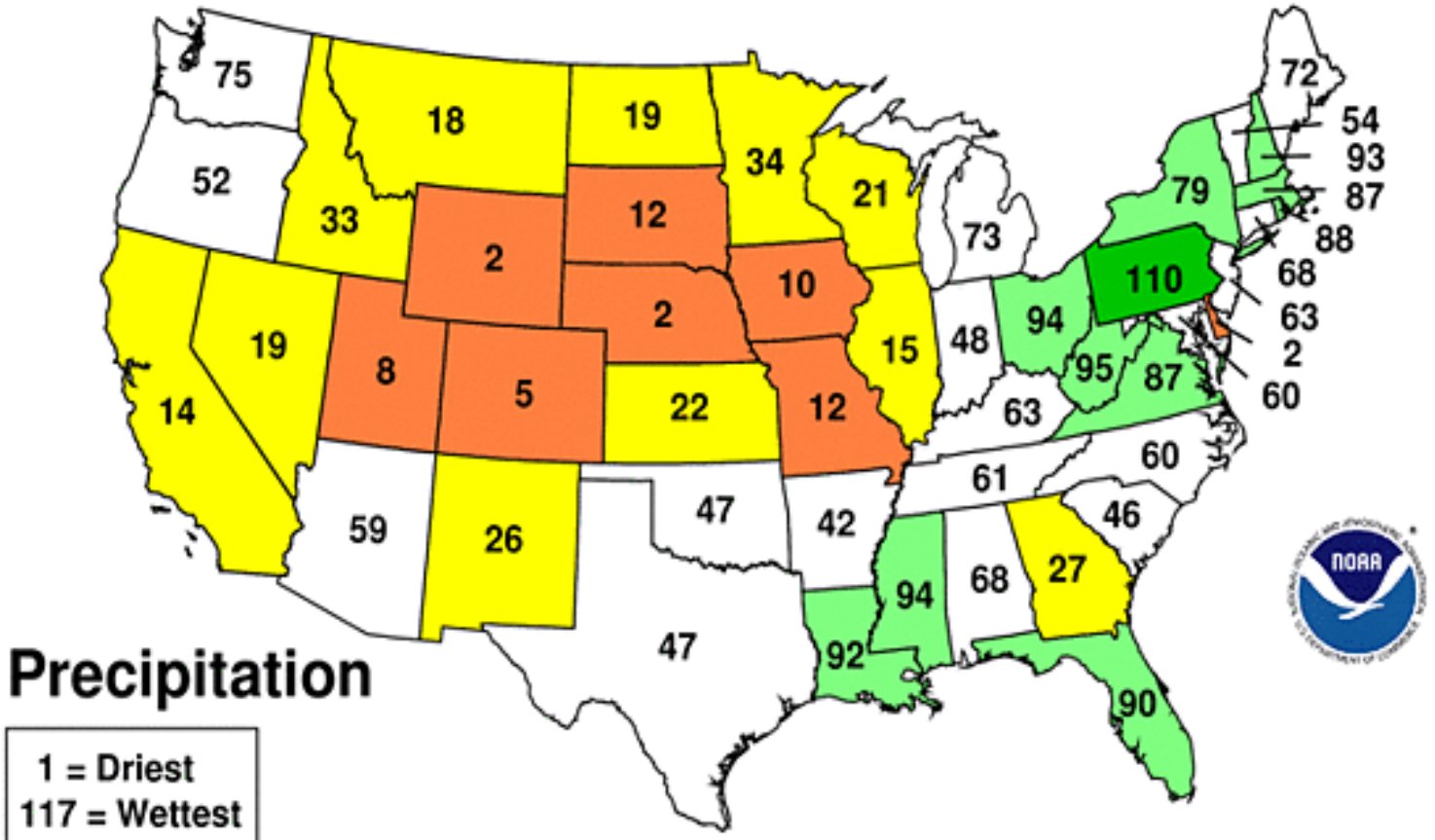
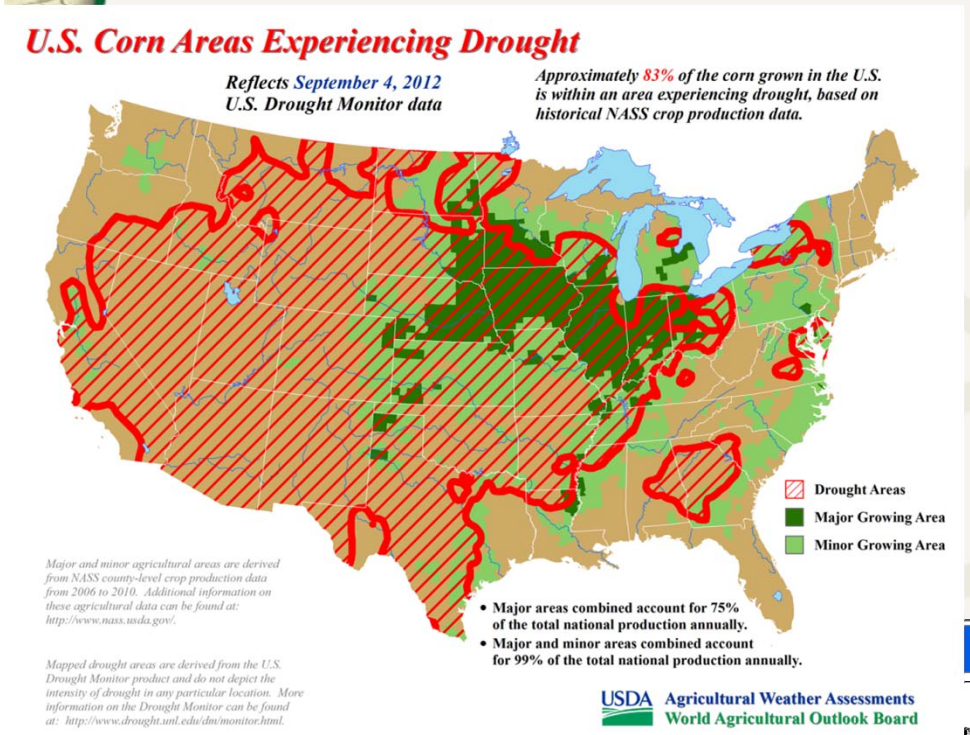
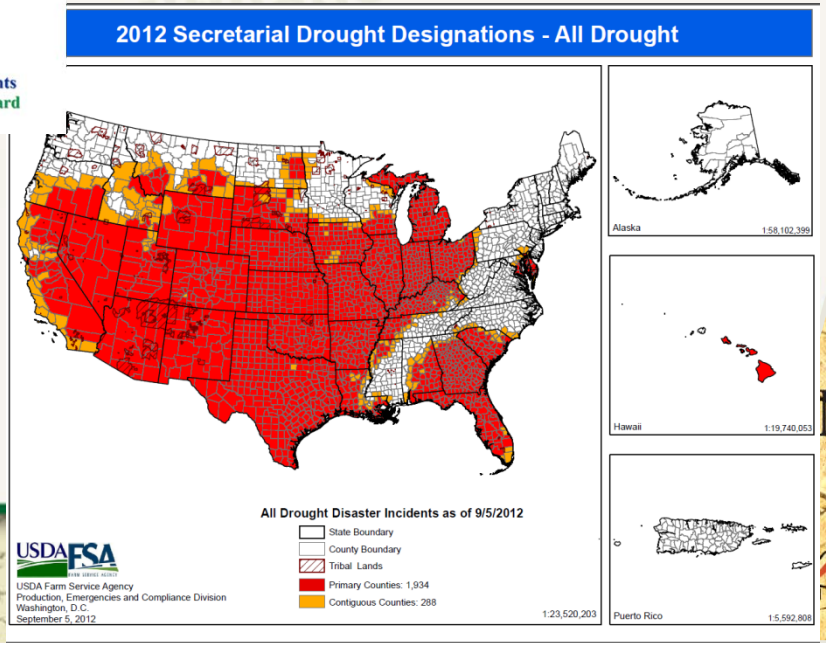


Drought Impacts: Agriculture

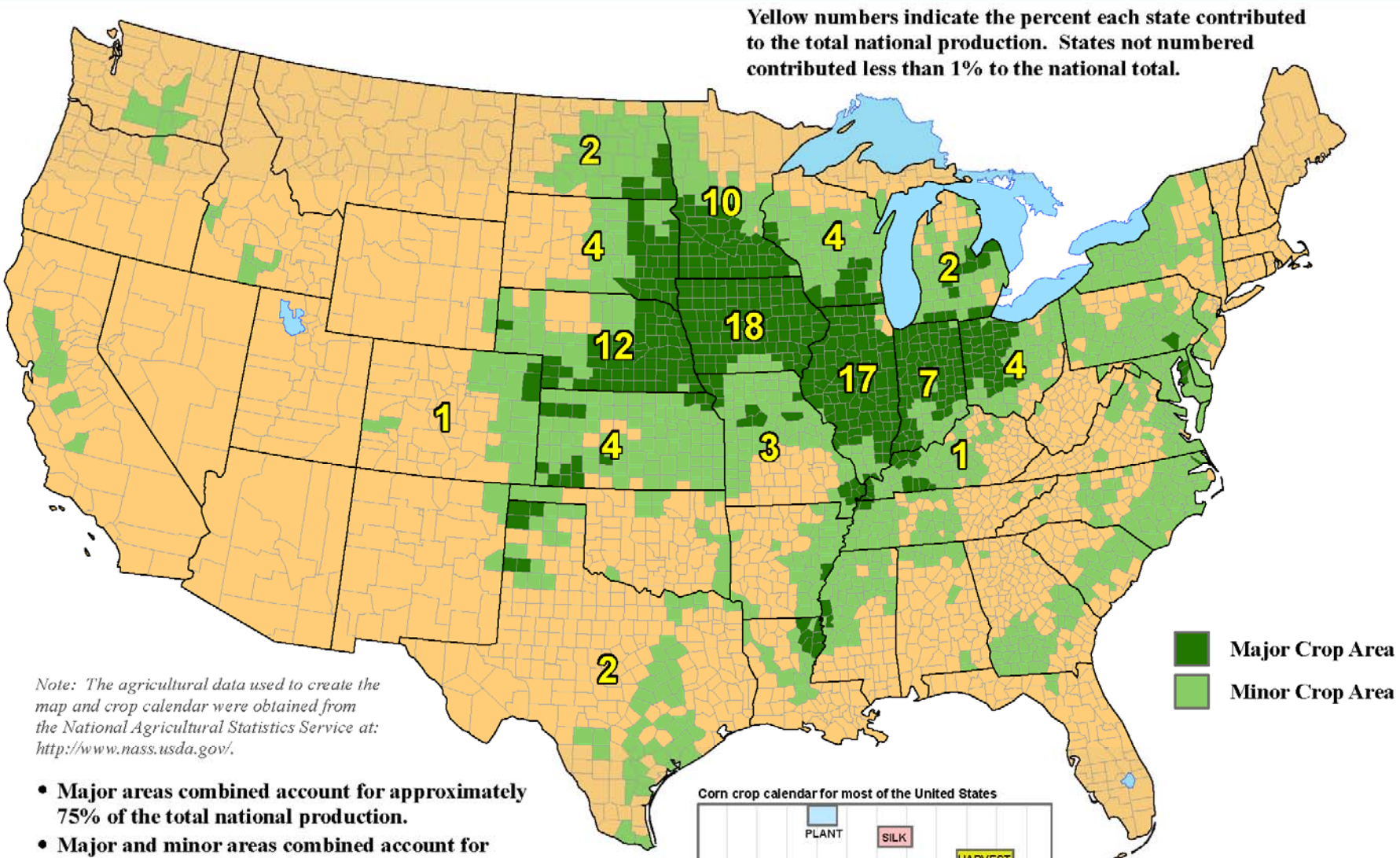


On July 11, USDA's World Agricultural Outlook Board cut the estimate for the 2012 U.S. corn crop by 1.82 billion bushels. The 12% cut left the projected U.S. corn production at 12.97 billion bushels.

On August 10, 2012 USDA/WAOB adjusted the crops down again by 2.17 billion bushels (16.7%):
Corn: 123.4 bushels/acre (10.8 billion bushels), down from 146.0 in July and 166.0 in June.
Soybeans: 36.1 bushels/acre (83.4 million tons), down from 40.5 in July and 43.9 in June.



United States: Corn



Note: The agricultural data used to create the map and crop calendar were obtained from the National Agricultural Statistics Service at: http://www.nass.usda.gov/.

- **Major areas combined account for approximately 75% of the total national production.**
- **Major and minor areas combined account for approximately 99% of the total national production.**
- **Major and minor areas and state production percentages are derived from NASS county- and state-level production data from 2006-2010.**

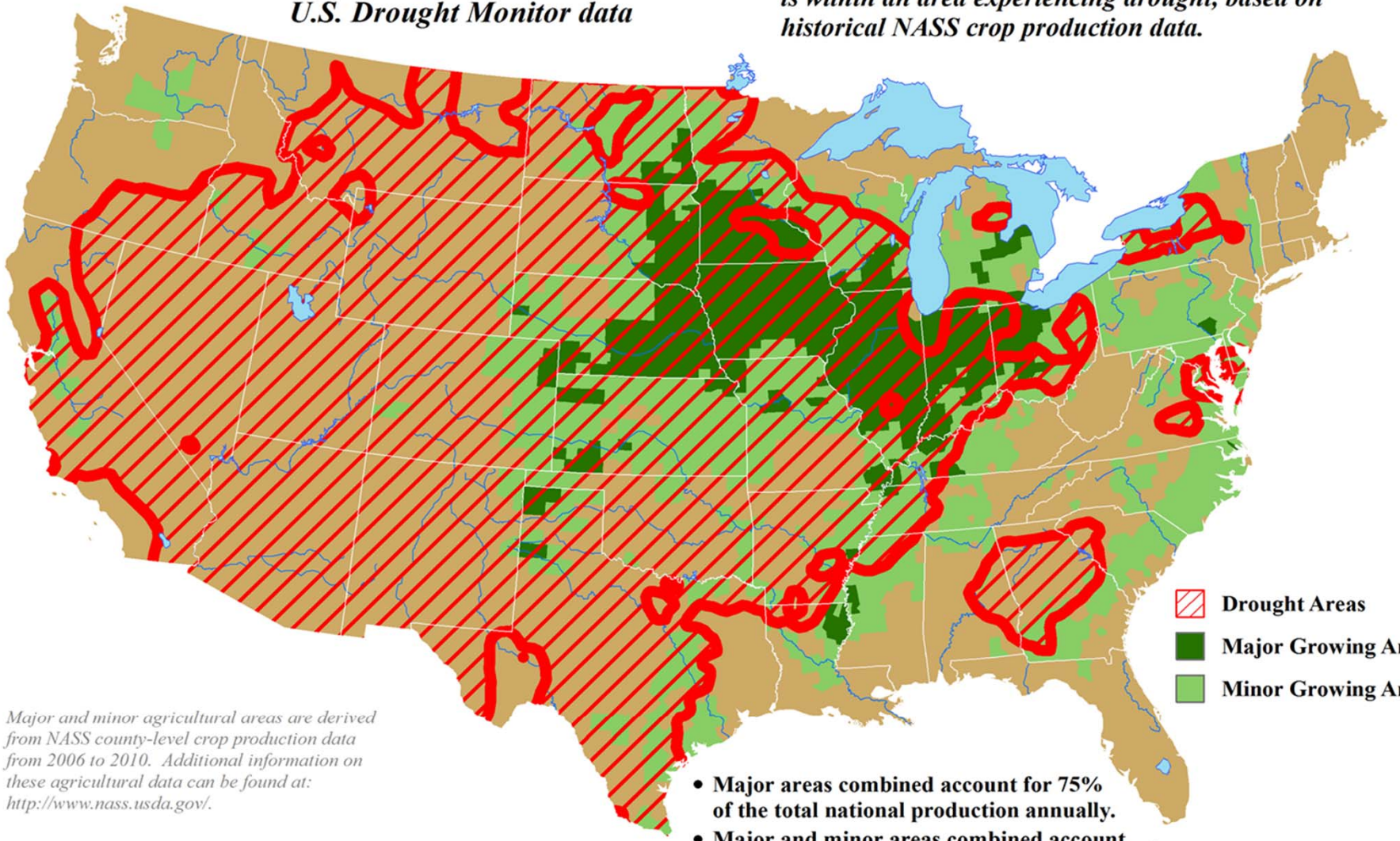
Crop calendar dates are based upon NASS crop progress data from 2006-2010. The field activities and crop development stages illustrated in the crop calendar represent the average time period when national progress advanced from 10 to 90 percent.

USDA **Agricultural Weather Assessments**
World Agricultural Outlook Board

U.S. Corn Areas Experiencing Drought

Reflects September 18, 2012 U.S. Drought Monitor data

Approximately 85% of the corn grown in the U.S. is within an area experiencing drought, based on historical NASS crop production data.



Major and minor agricultural areas are derived from NASS county-level crop production data from 2006 to 2010. Additional information on these agricultural data can be found at: http://www.nass.usda.gov/.

Mapped drought areas are derived from the U.S. Drought Monitor product and do not depict the intensity of drought in any particular location. More information on the Drought Monitor can be found at: http://www.drought.unl.edu/dm/monitor.html.

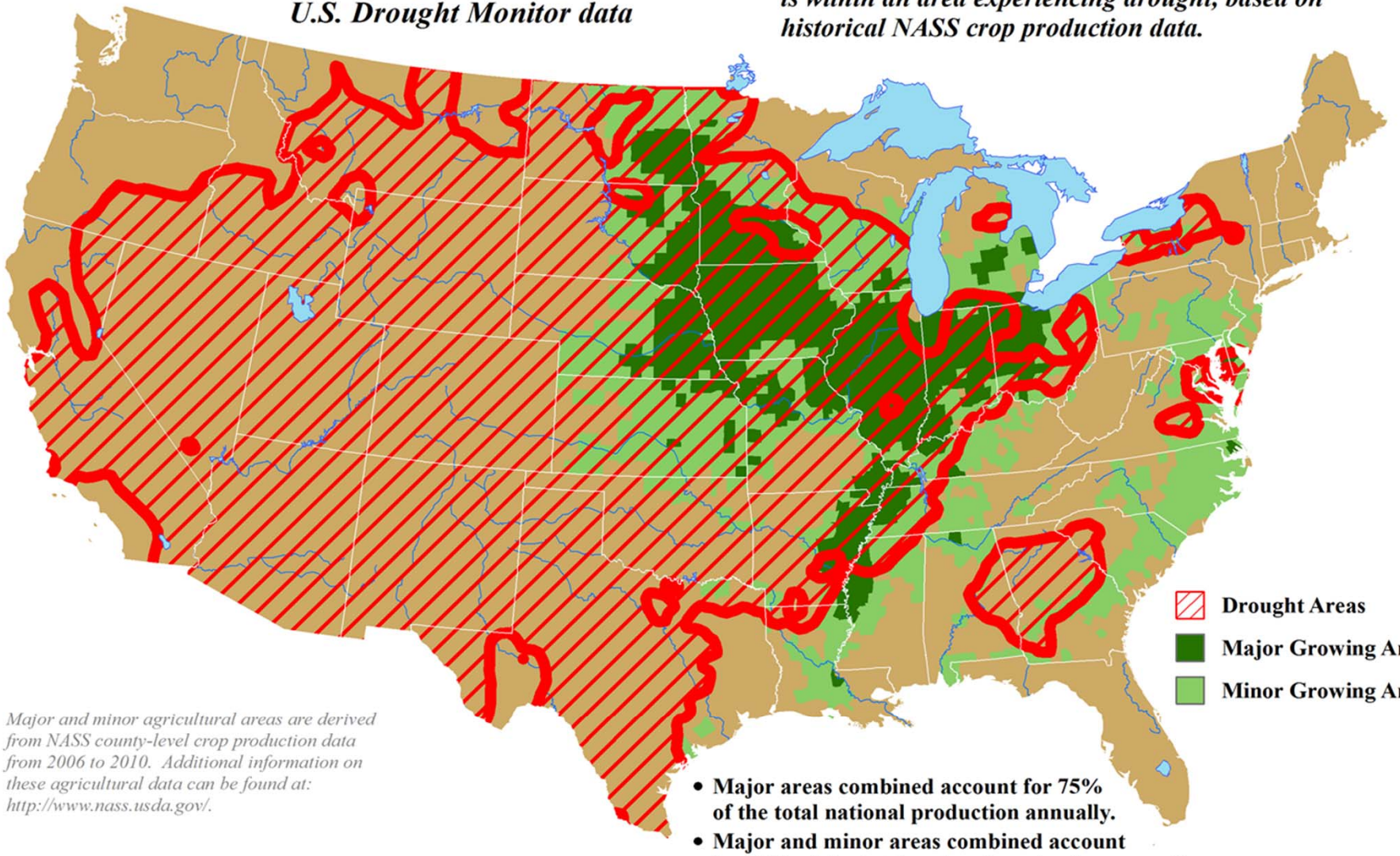
- **Major areas combined account for 75% of the total national production annually.**
- **Major and minor areas combined account for 99% of the total national production annually.**

USDA Agricultural Weather Assessments
World Agricultural Outlook Board

U.S. Soybean Areas Experiencing Drought

Reflects September 18, 2012
U.S. Drought Monitor data

Approximately 82% of the soybeans grown in the U.S. is within an area experiencing drought, based on historical NASS crop production data.



- **Major areas combined account for 75% of the total national production annually.**
- **Major and minor areas combined account for 99% of the total national production annually.**

Major and minor agricultural areas are derived from NASS county-level crop production data from 2006 to 2010. Additional information on these agricultural data can be found at: http://www.nass.usda.gov/.

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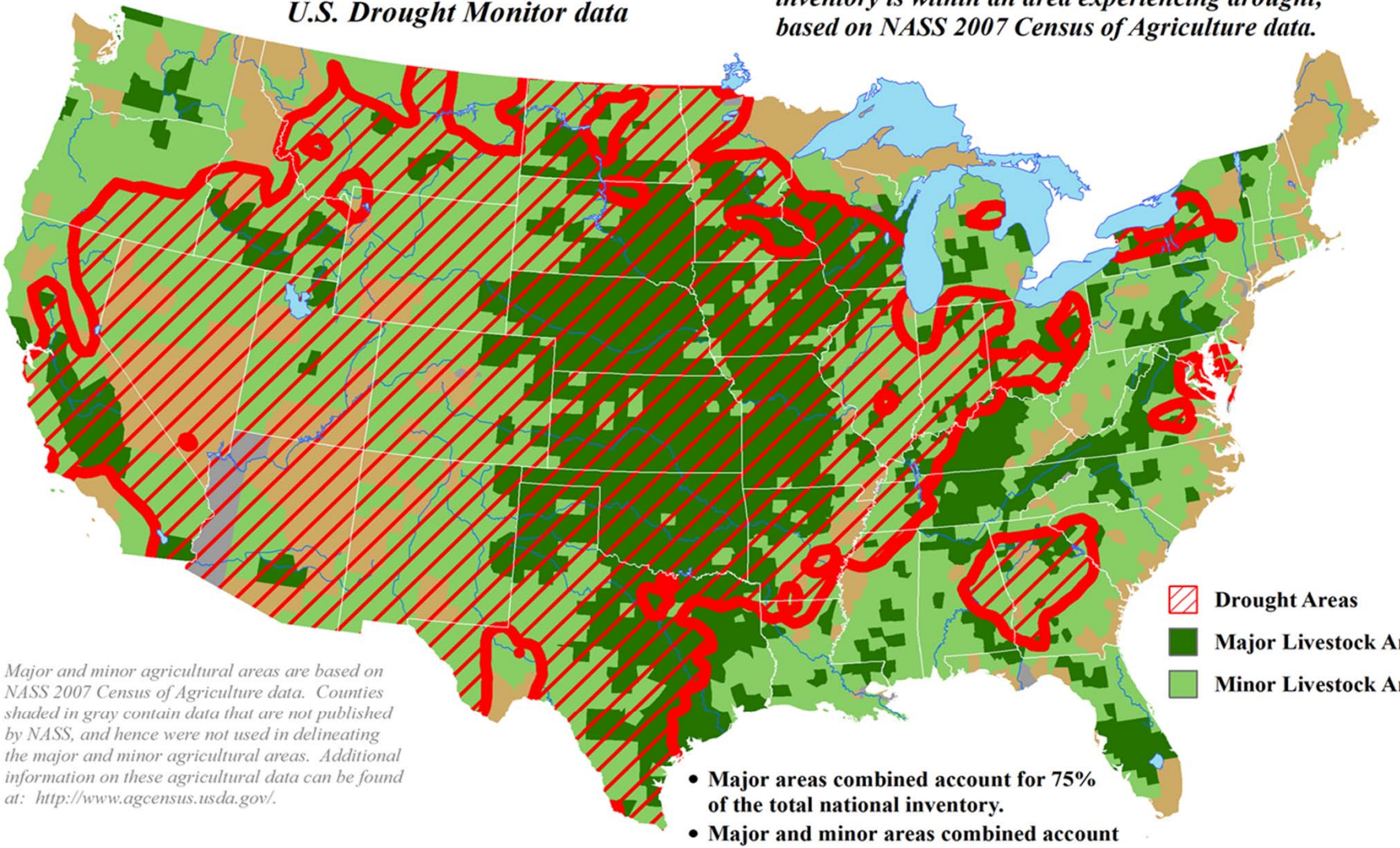
USDA **Agricultural Weather Assessments**
World Agricultural Outlook Board

U.S. Cattle Areas Experiencing Drought

Reflects September 18, 2012
U.S. Drought Monitor data

Approximately 75% of the domestic cattle inventory is within an area experiencing drought, based on NASS 2007 Census of Agriculture data.



- **Major areas combined account for 75% of the total national inventory.**
- **Major and minor areas combined account for 99% of the total national inventory.**

Major and minor agricultural areas are based on NASS 2007 Census of Agriculture data. Counties shaded in gray contain data that are not published by NASS, and hence were not used in delineating the major and minor agricultural areas. Additional information on these agricultural data can be found at: http://www.agcensus.usda.gov/.

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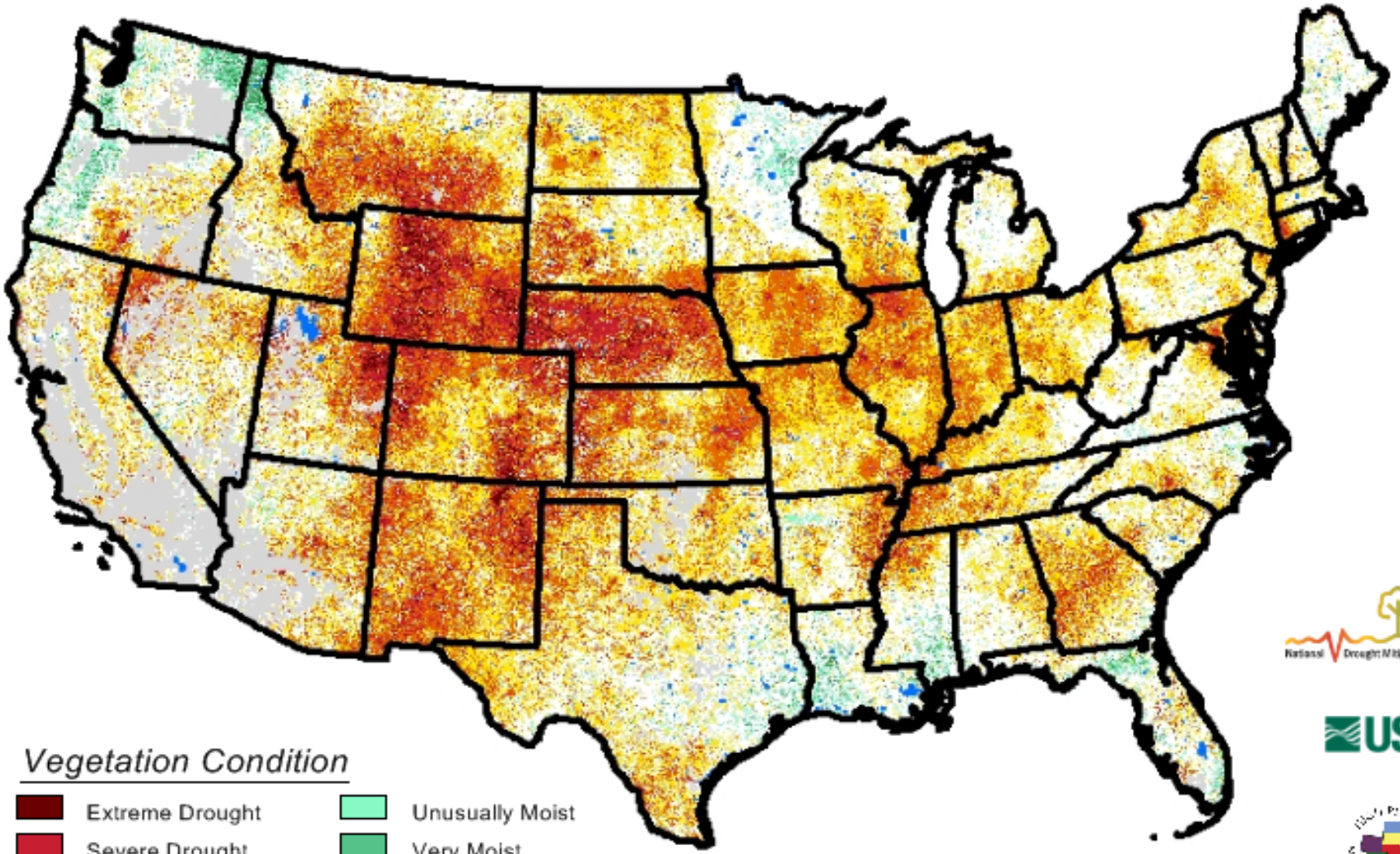
USDA **Agricultural Weather Assessments**
World Agricultural Outlook Board

Vegetation Drought Response Index
Complete

September 17, 2012



Vegetation Condition

- Extreme Drought
- Severe Drought
- Moderate Drought
- Pre-Drought
- Near Normal
- Unusually Moist
- Very Moist
- Extremely Moist
- Out of Season
- Water

National Drought Mitigation Center

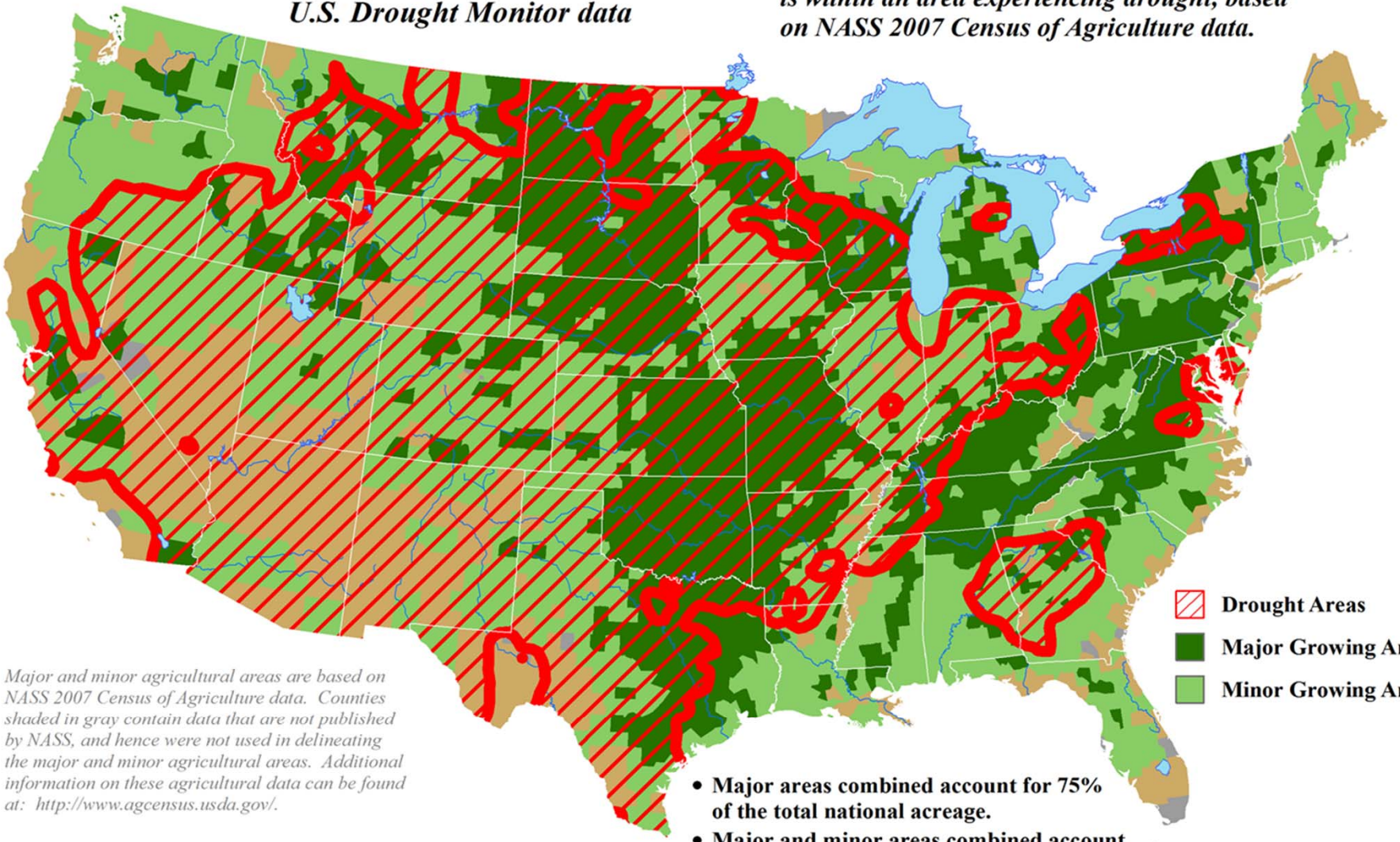
USGS

RMA

U.S. Hay Areas Experiencing Drought

Reflects September 18, 2012
U.S. Drought Monitor data

Approximately 67% of the domestic hay acreage is within an area experiencing drought, based on NASS 2007 Census of Agriculture data.

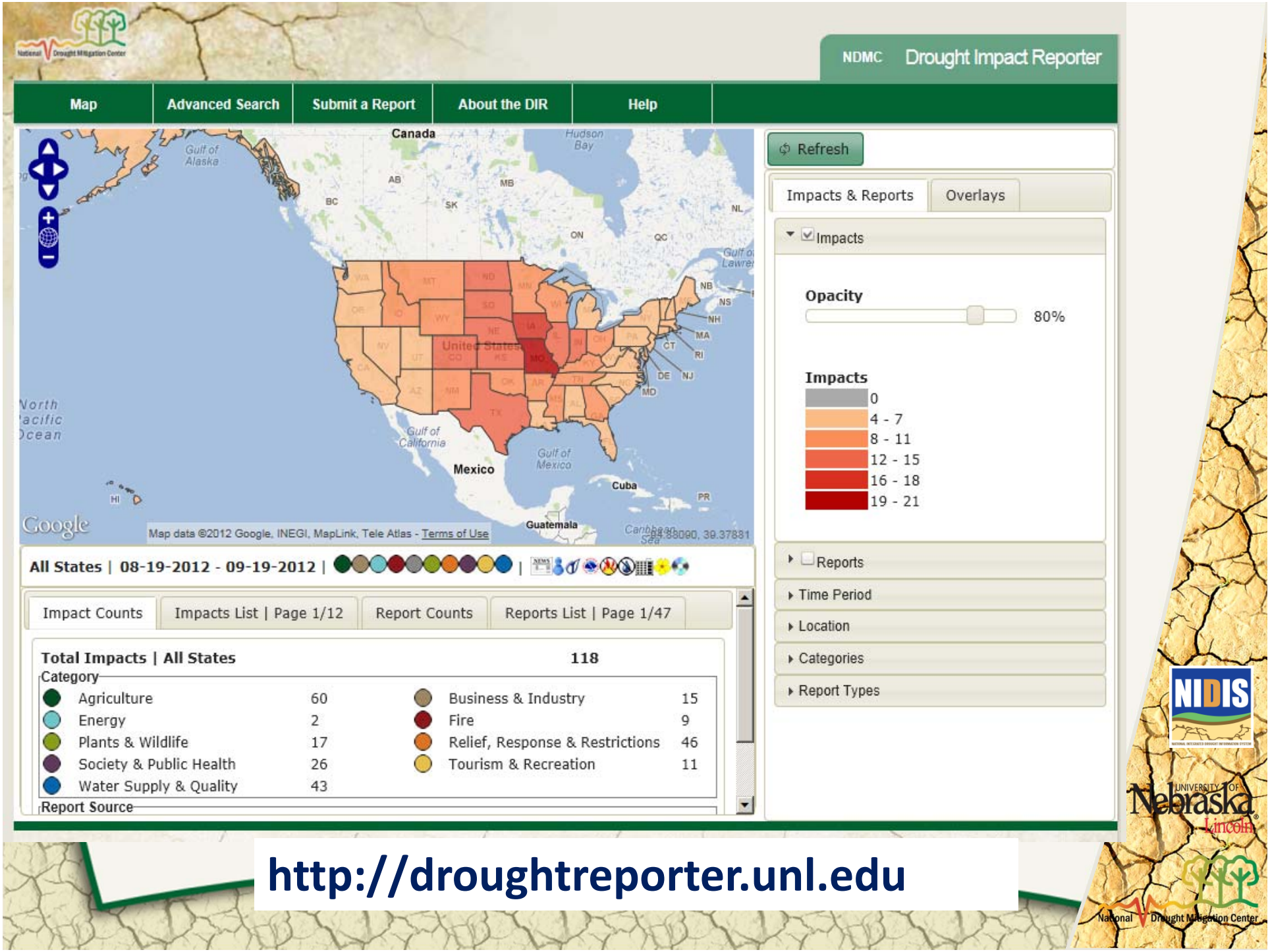


Major and minor agricultural areas are based on NASS 2007 Census of Agriculture data. Counties shaded in gray contain data that are not published by NASS, and hence were not used in delineating the major and minor agricultural areas. Additional information on these agricultural data can be found at: http://www.agcensus.usda.gov/.

Mapped drought areas are derived from the U.S. Drought Monitor product and do not depict the intensity of drought in any particular location. More information on the Drought Monitor can be found at: http://www.drought.unl.edu/dm/monitor.html.

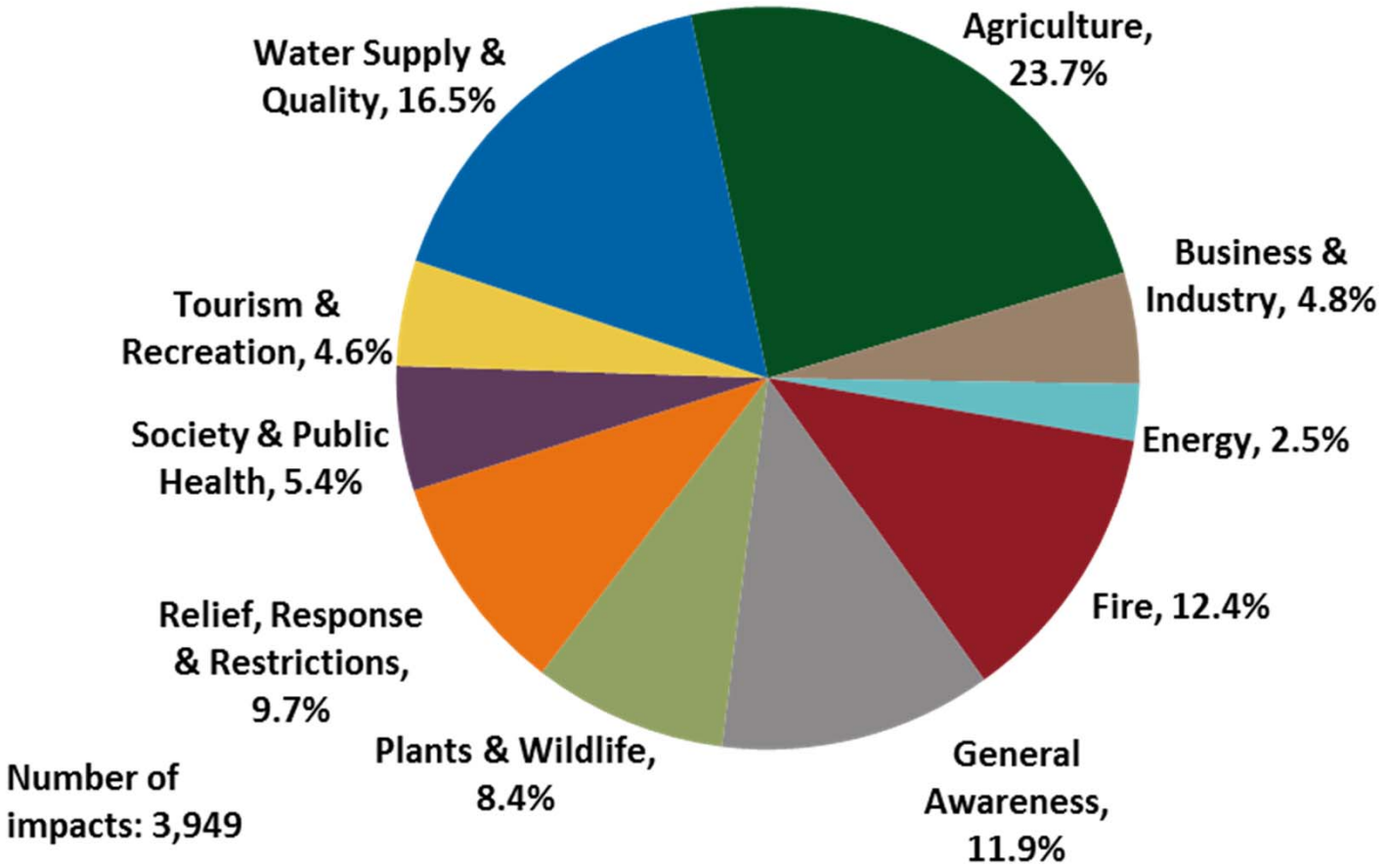
- **Major areas combined account for 75% of the total national acreage.**
- **Major and minor areas combined account for 99% of the total national acreage.**

USDA Agricultural Weather Assessments
World Agricultural Outlook Board

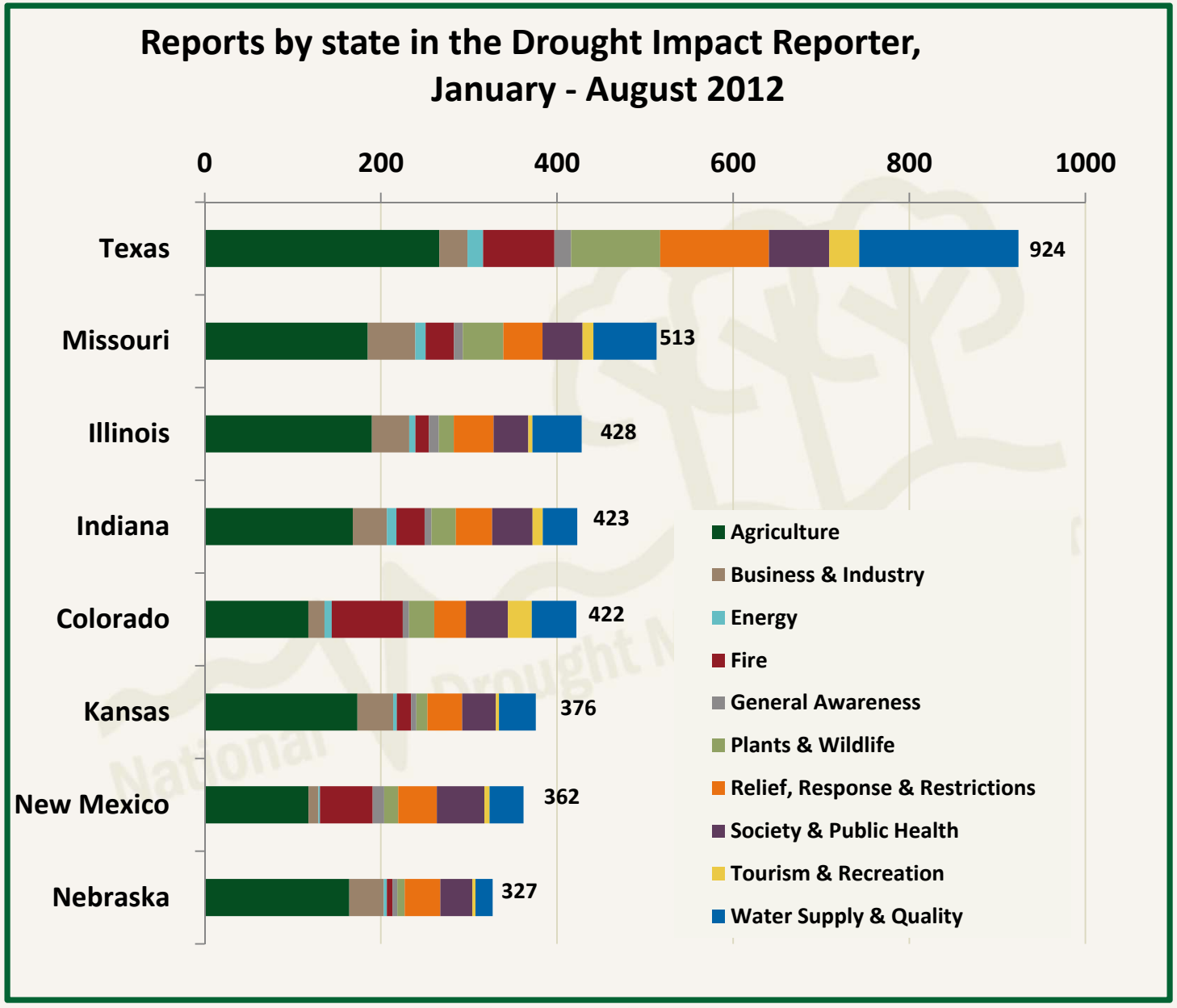


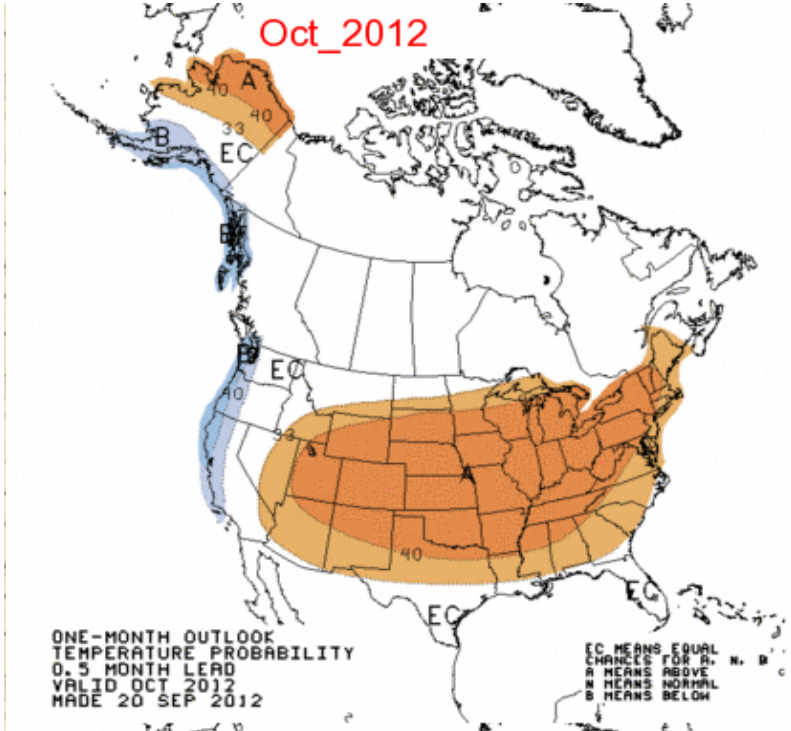
http://droughtreporter.unl.edu

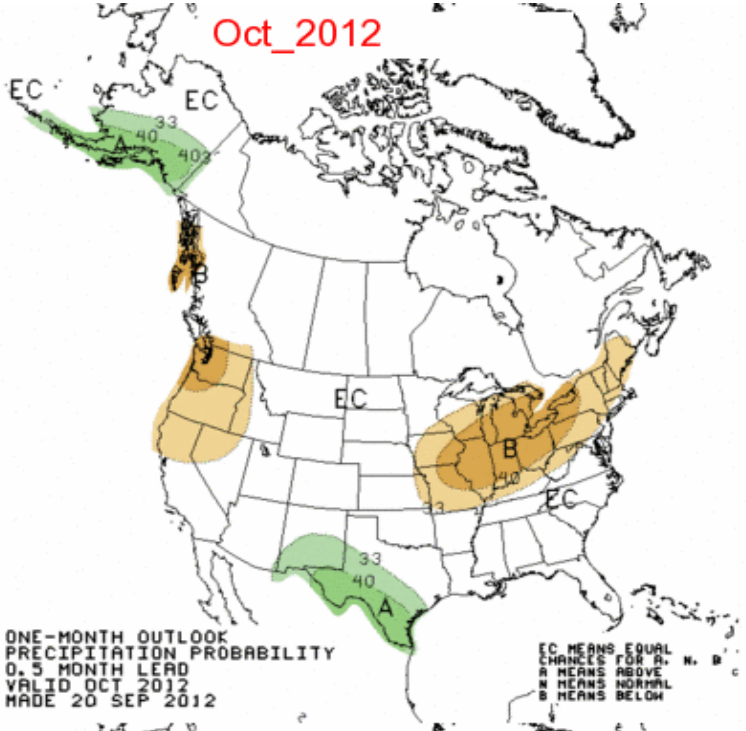
Reports by category in the Drought Impact Reporter, January - August 2012



Number of impacts: 3,949


Reports by state in the Drought Impact Reporter, January - August 2012
0
200
400
600
800
1000
Texas
924
Missouri
513
Illinois
428
Indiana
423
Colorado
422
Kansas
376
New Mexico
362
Nebraska
327
Agriculture
Business & Industry
Energy
Fire
General Awareness
Plants & Wildlife
Relief, Response & Restrictions
Society & Public Health
Tourism & Recreation
Water Supply & Quality


Oct_2012
ONE-MONTH OUTLOOK
TEMPERATURE PROBABILITY
0.5 MONTH LEAD
VALID OCT 2012
MADE 20 SEP 2012
EC MEANS EQUAL CHANCES FOR A, N, B
A MEANS ABOVE
N MEANS NORMAL
B MEANS BELOW


Oct_2012
ONE-MONTH OUTLOOK
PRECIPITATION PROBABILITY
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VALID OCT 2012
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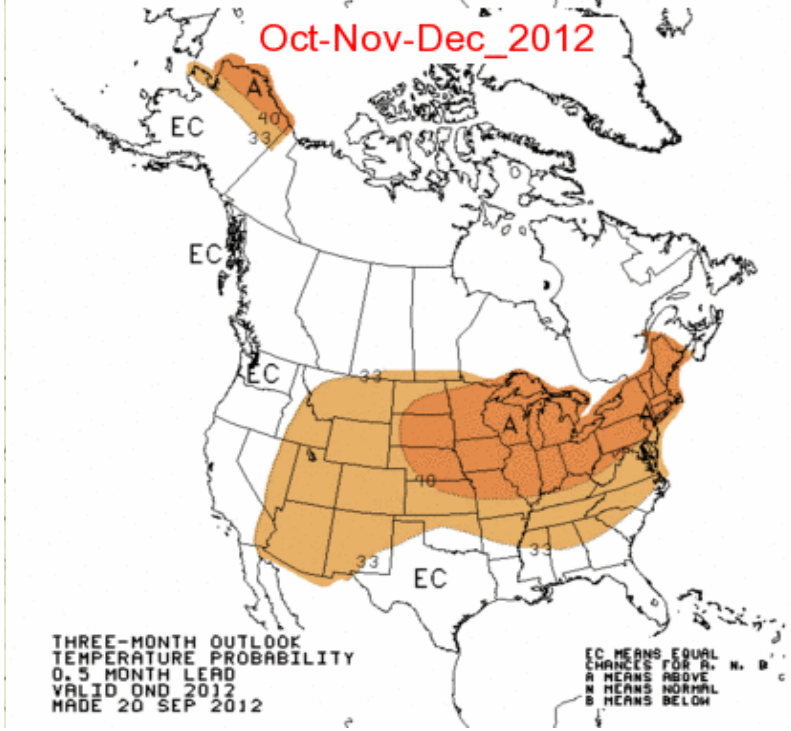
Oct-Nov-Dec_2012
THREE-MONTH OUTLOOK
TEMPERATURE PROBABILITY
0.5 MONTH LEAD
VALID OND 2012
MADE 20 SEP 2012
EC MEANS EQUAL CHANCES FOR A, N, B
A MEANS ABOVE
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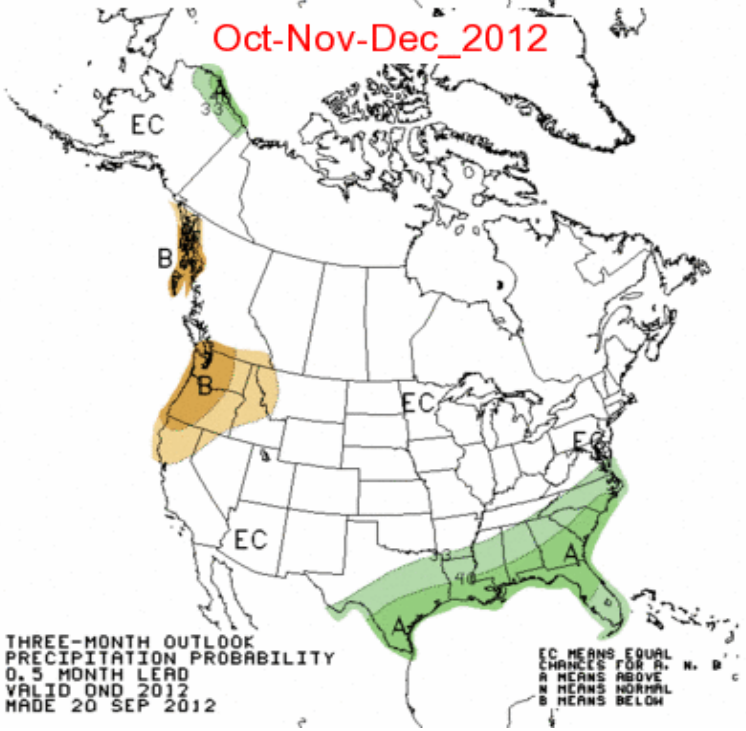
B MEANS BELOW


Oct-Nov-Dec_2012
THREE-MONTH OUTLOOK
PRECIPITATION PROBABILITY
0.5 MONTH LEAD
VALID OND 2012
MADE 20 SEP 2012
EC MEANS EQUAL CHANCES FOR A, N, B
A MEANS ABOVE
N MEANS NORMAL
B MEANS BELOW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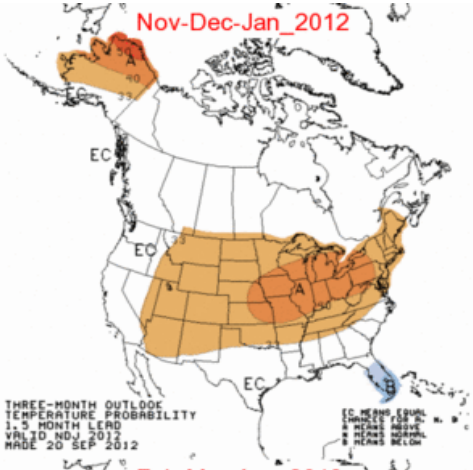
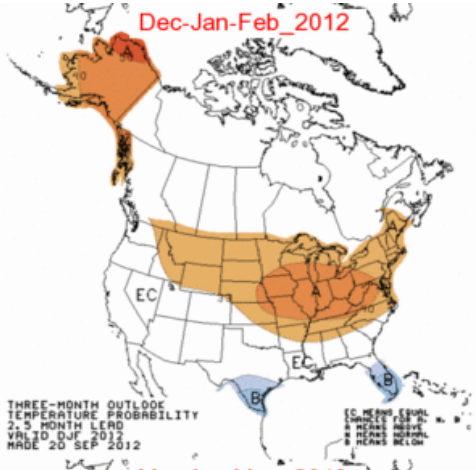
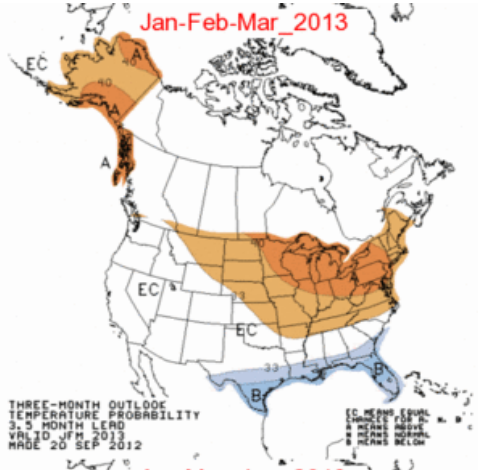
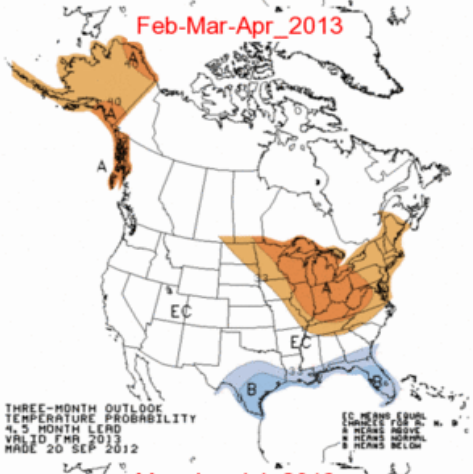
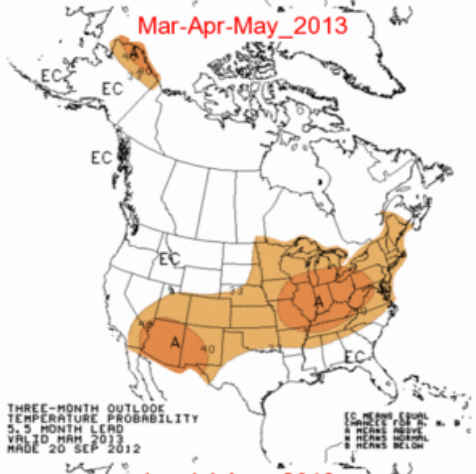
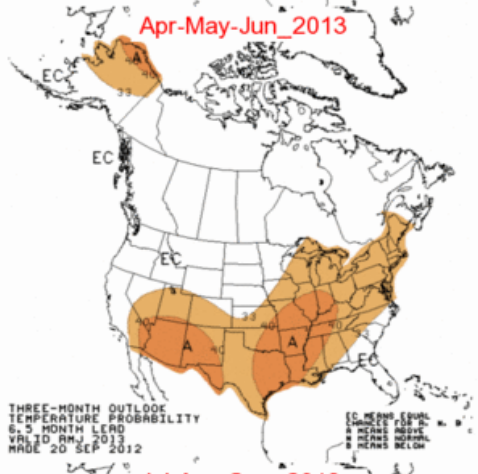

Nov-Dec-Jan_2012
THREE-MONTH OUTLOOK
TEMPERATURE PROBABILITY
1.5 MONTH LEAD
VALID NDJ 2012
MADE 20 SEP 2012

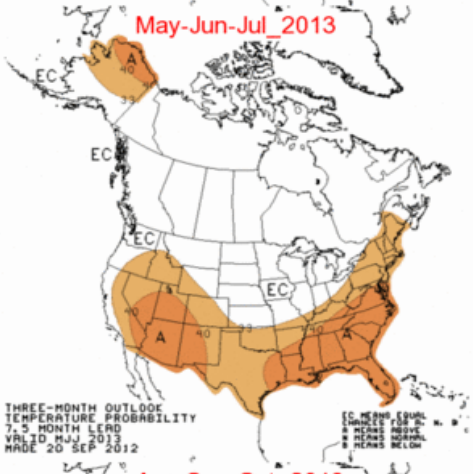

Dec-Jan-Feb_2012
THREE-MONTH OUTLOOK
TEMPERATURE PROBABILITY
2.5 MONTH LEAD
VALID DJF 2012
MADE 20 SEP 2012

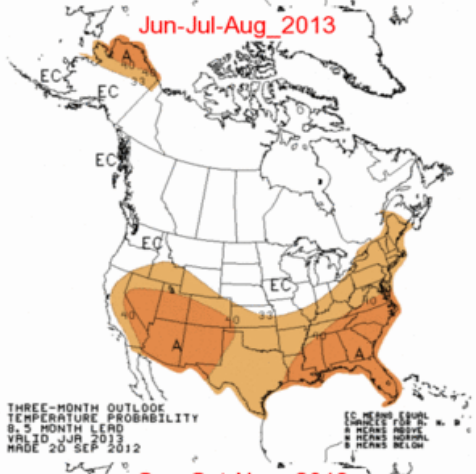

Jan-Feb-Mar_2013
THREE-MONTH OUTLOOK
TEMPERATURE PROBABILITY
3.5 MONTH LEAD
VALID JFM 2013
MADE 20 SEP 2012

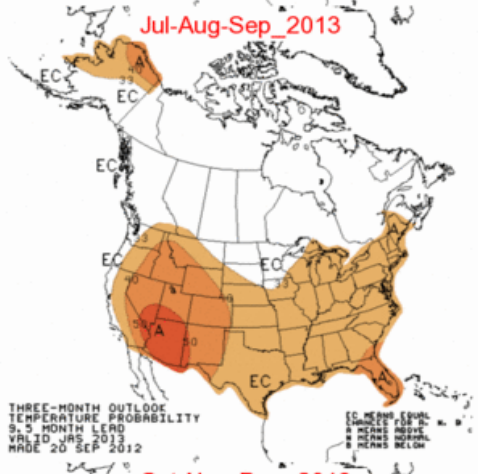

Feb-Mar-Apr_2013
THREE-MONTH OUTLOOK
TEMPERATURE PROBABILITY
4.5 MONTH LEAD
VALID FMA 2013
MADE 20 SEP 2012


Mar-Apr-May_2013
THREE-MONTH OUTLOOK
TEMPERATURE PROBABILITY
5.5 MONTH LEAD
VALID MAM 2013
MADE 20 SEP 2012


Apr-May-Jun_2013
THREE-MONTH OUTLOOK
TEMPERATURE PROBABILITY
6.5 MONTH LEAD
VALID AMJ 2013
MADE 20 SEP 2012


May-Jun-Jul_2013
THREE-MONTH OUTLOOK
TEMPERATURE PROBABILITY
7.5 MONTH LEAD
VALID MJJ 2013
MADE 20 SEP 2012


Jun-Jul-Aug_2013
THREE-MONTH OUTLOOK
TEMPERATURE PROBABILITY
8.5 MONTH LEAD
VALID JJA 2013
MADE 20 SEP 2012


Jul-Aug-Sep_2013
THREE-MONTH OUTLOOK
TEMPERATURE PROBABILITY
9.5 MONTH LEAD
VALID JAS 2013
MADE 20 SEP 2012


Aug-Sep-Oct_2013


Sep-Oct-Nov_2013


Oct-Nov-Dec_2013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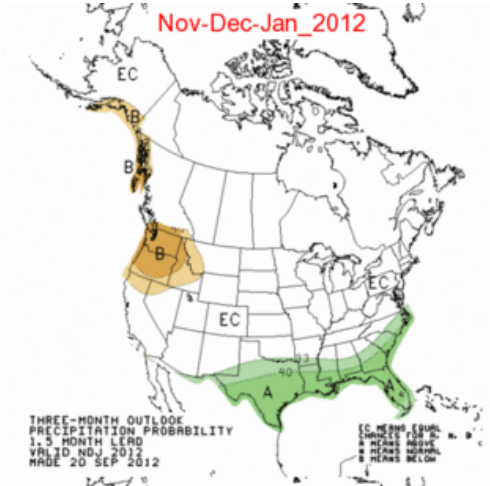
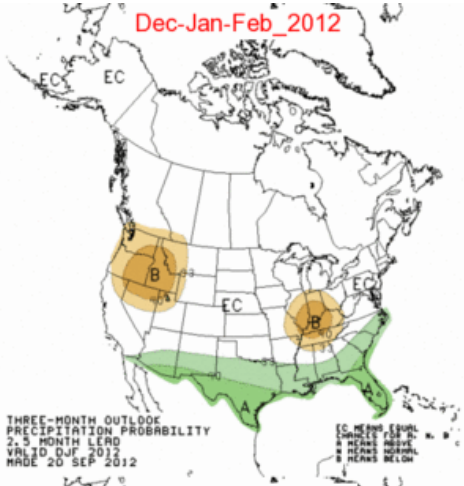
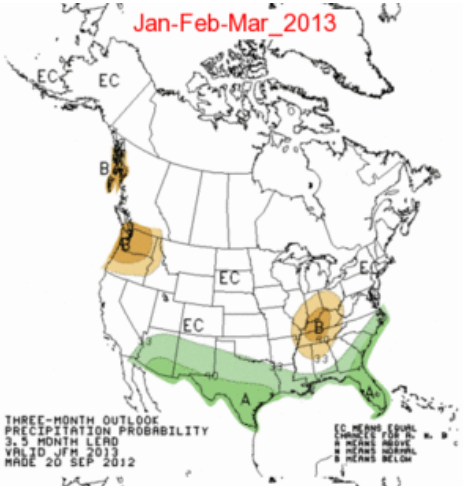
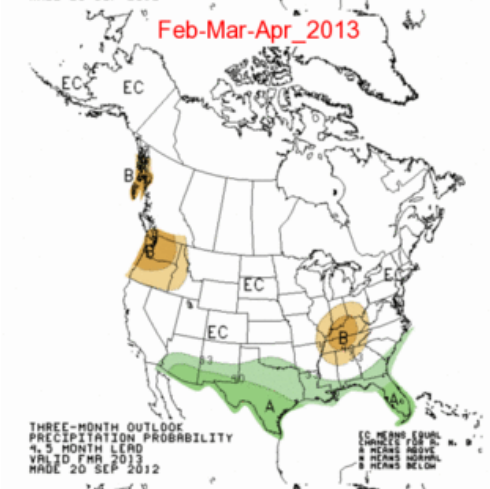

Nov-Dec-Jan_2012
THREE-MONTH OUTLOOK
PRECIPITATION PROBABILITY
1.5 MONTH LEAD
VALID NDJ 2012
MADE 20 SEP 2012


Dec-Jan-Feb_2012
THREE-MONTH OUTLOOK
PRECIPITATION PROBABILITY
2.5 MONTH LEAD
VALID DJF 2012
MADE 20 SEP 2012


Jan-Feb-Mar_2013
THREE-MONTH OUTLOOK
PRECIPITATION PROBABILITY
3.5 MONTH LEAD
VALID JFM 2013
MADE 20 SEP 2012


Feb-Mar-Apr_2013
THREE-MONTH OUTLOOK
PRECIPITATION PROBABILITY
4.5 MONTH LEAD
VALID FMA 2013
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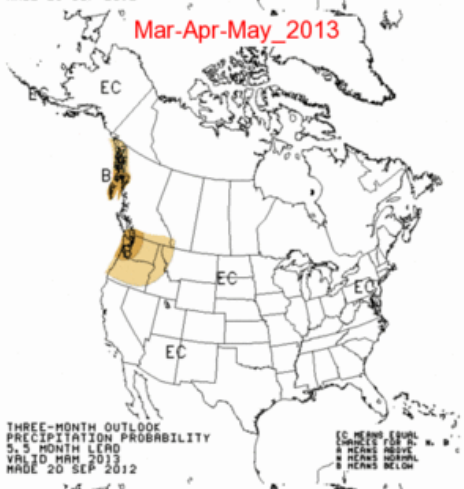
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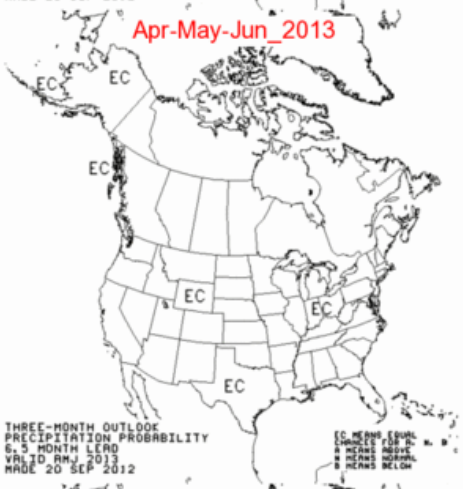
THREE-MONTH OUTLOOK
PRECIPITATION PROBABILITY
5.5 MONTH LEAD
VALID MAM 2013
MADE 20 SEP 2012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THREE-MONTH OUTLOOK
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6.5 MONTH LEAD
VALID AMJ 2013
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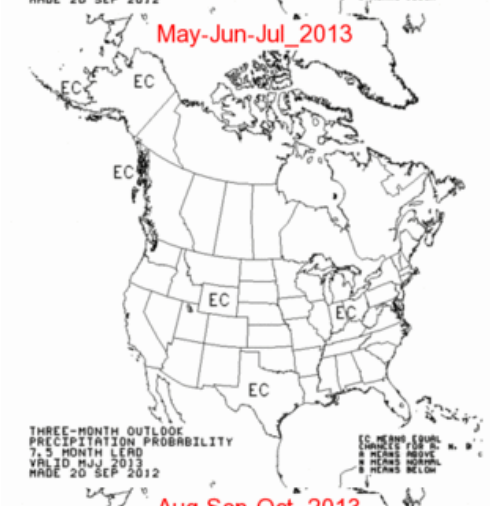
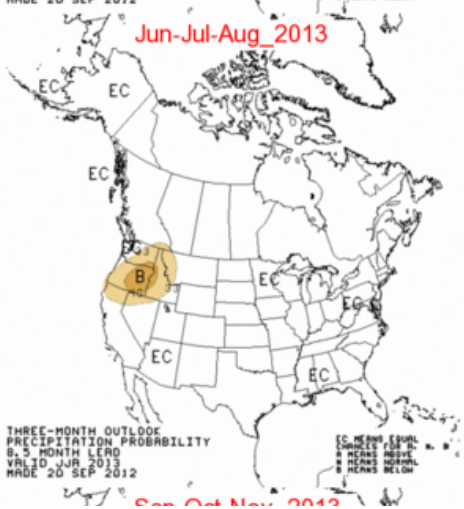
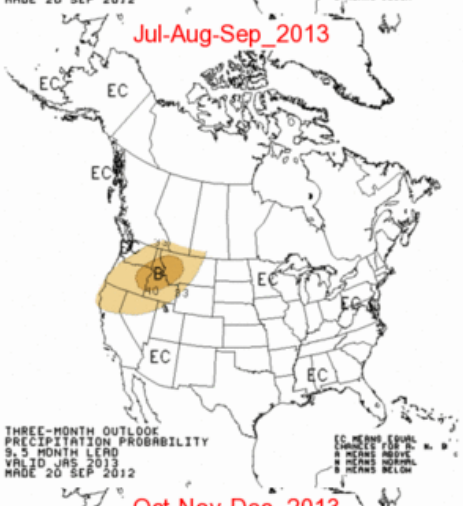

May-Jun-Jul_2013
THREE-MONTH OUTLOOK
PRECIPITATION PROBABILITY
7.5 MONTH LEAD
VALID MJJ 2013
MADE 20 SEP 2012


Jun-Jul-Aug_2013
THREE-MONTH OUTLOOK
PRECIPITATION PROBABILITY
8.5 MONTH LEAD
VALID JJA 2013
MADE 20 SEP 2012


Jul-Aug-Sep_2013
THREE-MONTH OUTLOOK
PRECIPITATION PROBABILITY
9.5 MONTH LEAD
VALID JAS 2013
MADE 20 SEP 2012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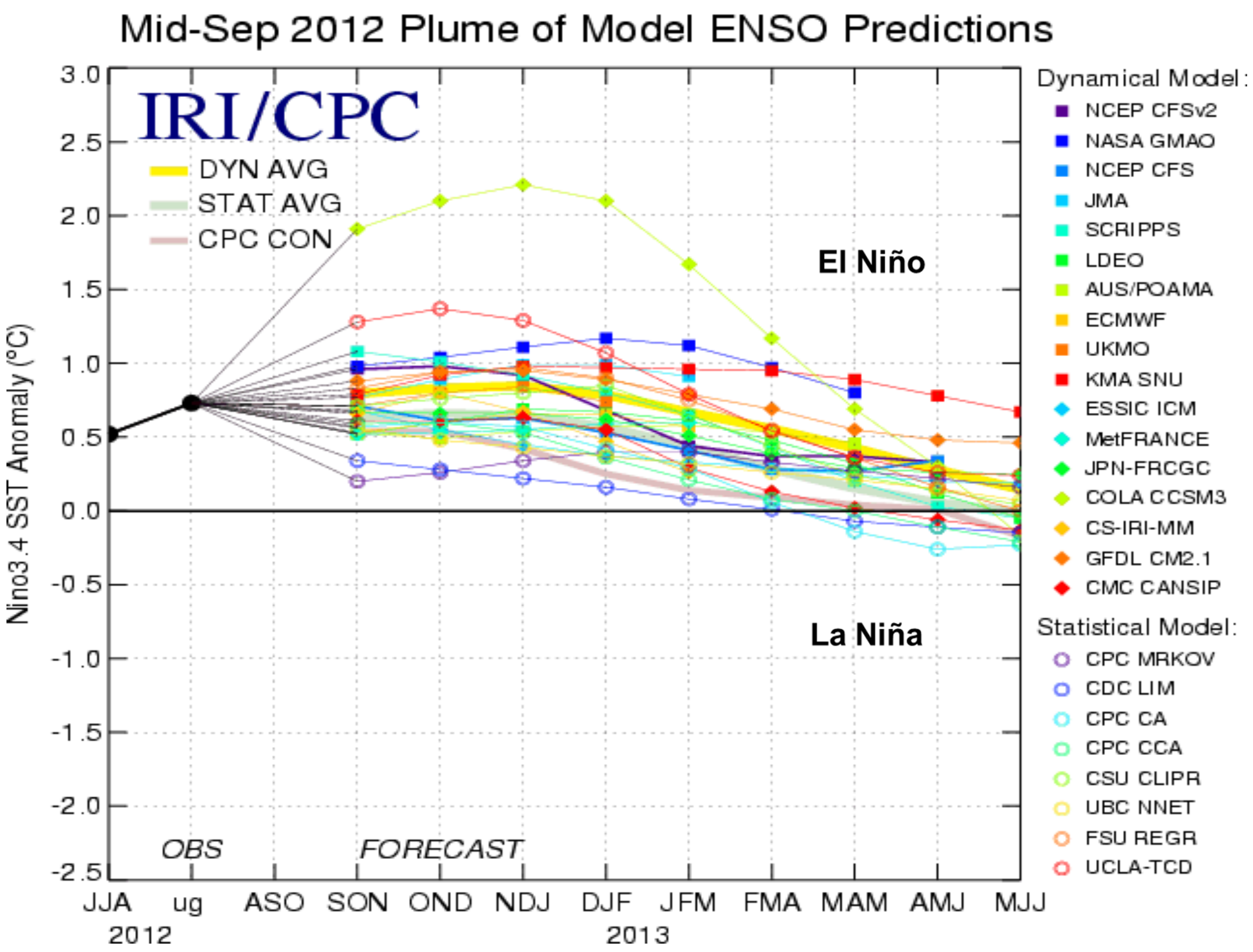
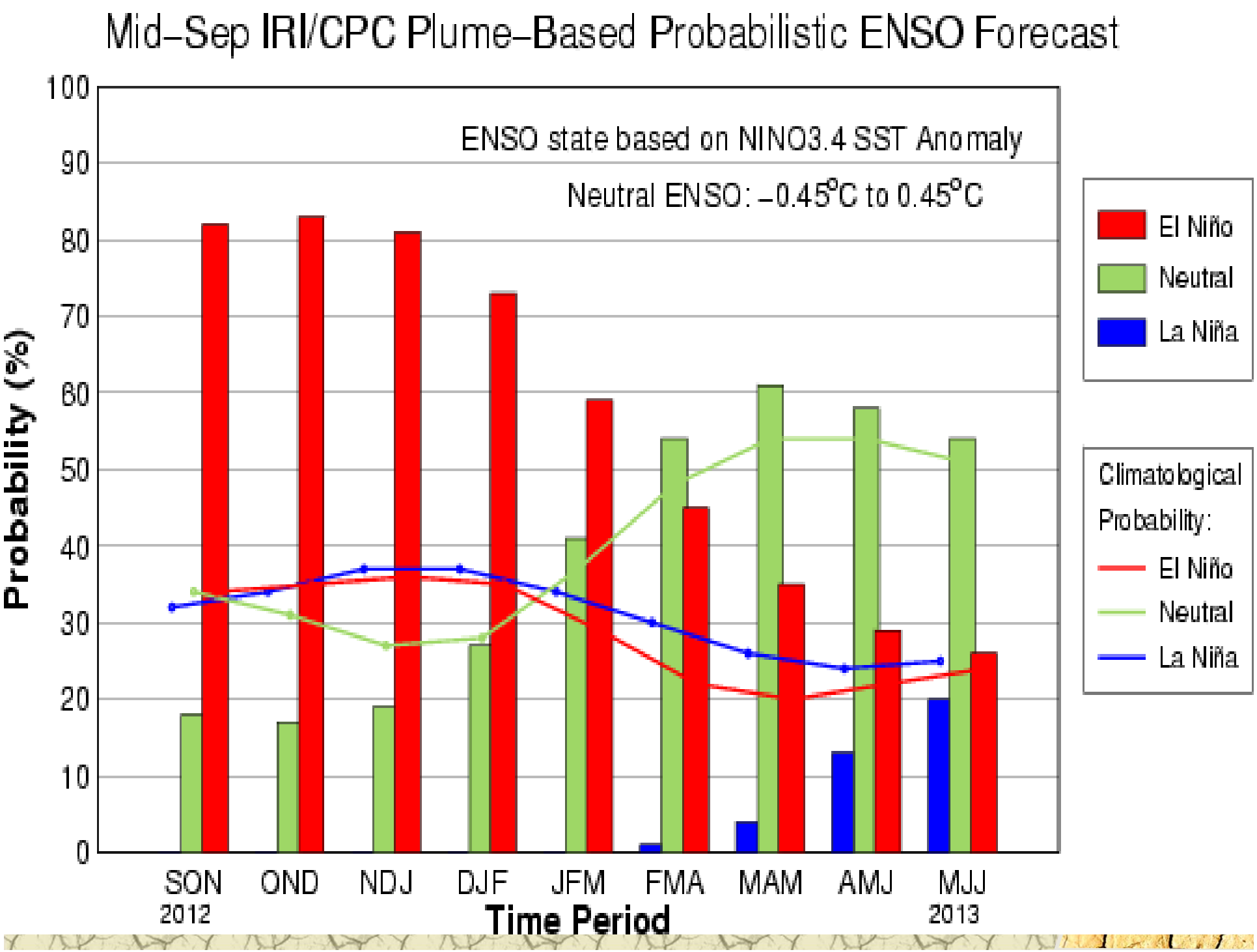
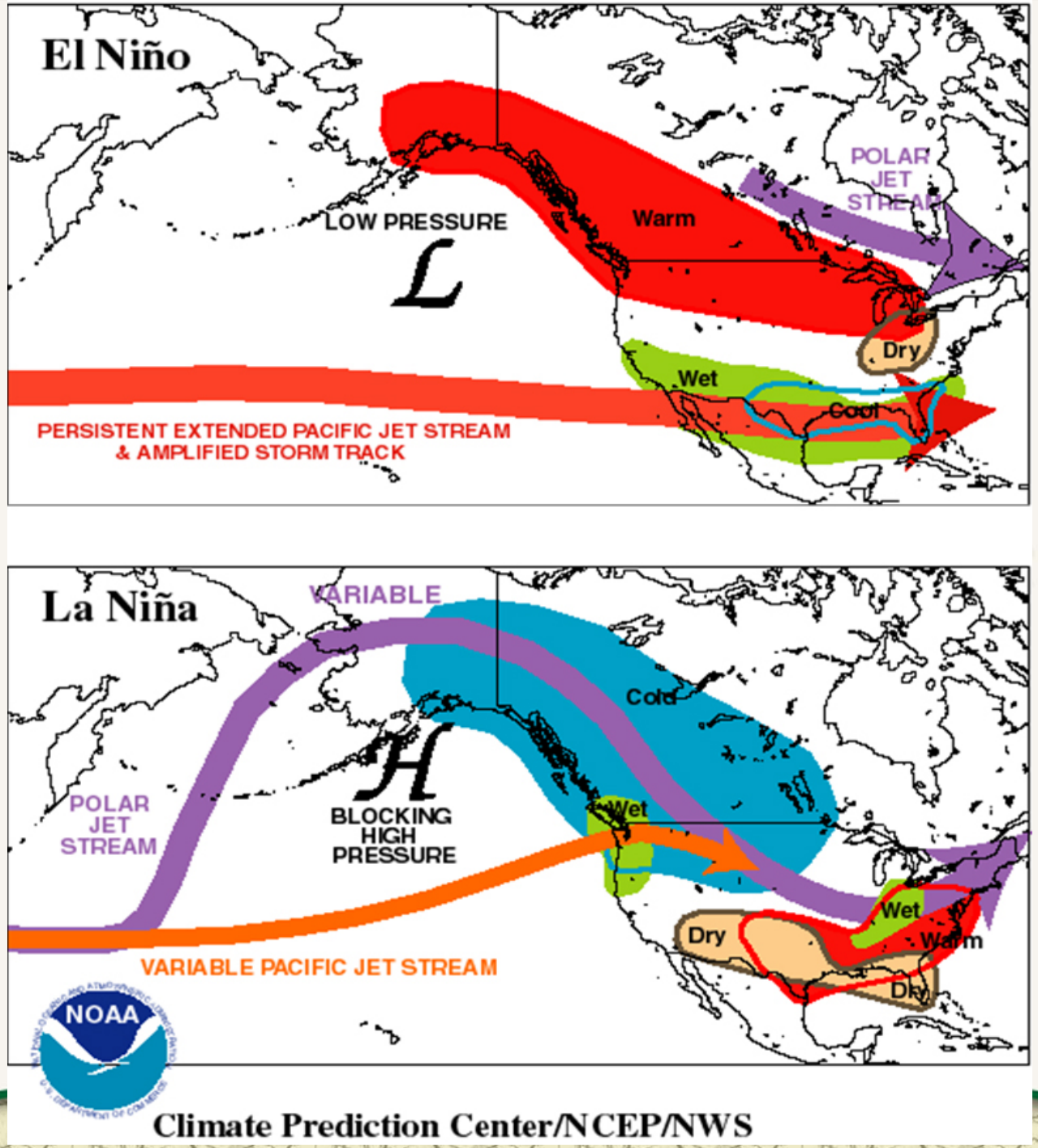

Mid-Sep 2012 Plume of Model ENSO Predictions
IRI/CPC
DYN AVG
STAT AVG
CPC CON
El Niño
La Niña
OBS
FORECAST
Nino3.4 SST Anomaly (°C)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
JJA
ug
ASO
SON
OND
NDJ
DJF
JFM
FMA
MAM
AMJ
MJJ
2012
2013
Dynamical Model:
NCEP CFSv2
NASA GMAO
NCEP CFS
JMA
SCRIPPS
LDEO
AUS/POAMA
ECMWF
UKMO
KMA SNU
ESSIC ICM
MetFRANCE
JPN-FRCGC
COLA CCSM3
CS-IRI-MM
GFDL CM2.1
CMC CANSIP
Statistical Model:
CPC MRKOV
CDC LIM
CPC CA
CPC CCA
CSU CLIPR
UBC NNET
FSU REGR
UCLA-TCD


Mid–Sep IRI/CPC Plume–Based Probabilistic ENSO Forecast
ENSO state based on NINO3.4 SST Anomaly
Neutral ENSO: –0.45°C to 0.45°C
Probability (%)
100
90
80
70
60
50
40
30
20
10
0
SON
2012
OND
NDJ
DJF
JFM
FMA
MAM
AMJ
MJJ
2013
Time Period
El Niño
Neutral
La Niña
Climatological Probability:
El Niño
Neutral
La Niña

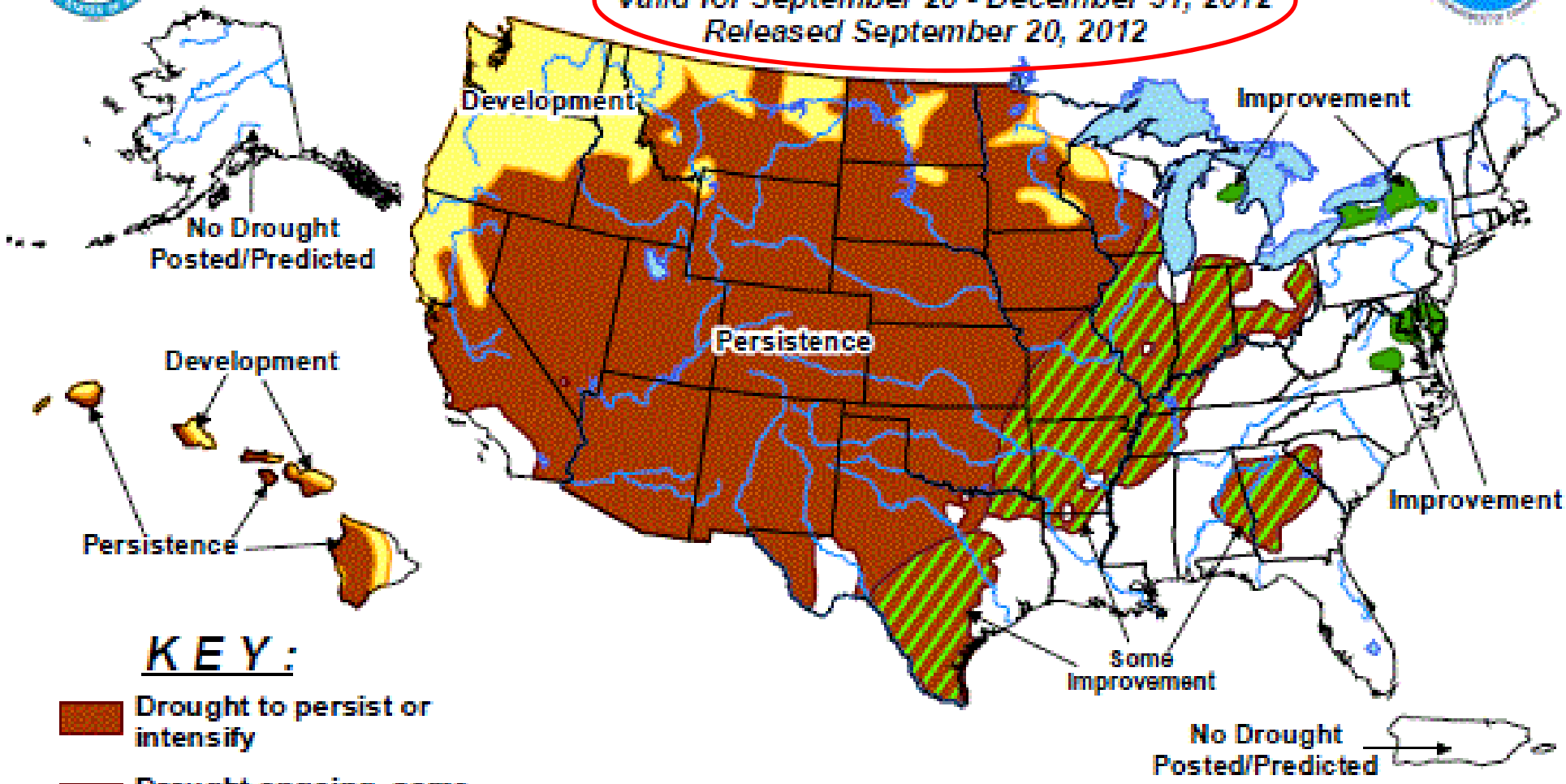

El Niño
LOW PRESSURE
L
Warm
POLAR
JET
STREAM
Dry
Wet
Cool
PERSISTENT EXTENDED PACIFIC JET STREAM
& AMPLIFIED STORM TRACK
La Niña
VARIABLE
Cold
H
POLAR
JET
STREAM
BLOCKING
HIGH
PRESSURE
Wet
Dry
Wet
Warm
Dry
VARIABLE PACIFIC JET STREAM
NOAA
Climate Prediction Center/NCEP/NWS
NIDIS
University of Nebraska Lincoln
National Drought Mitigation Center

U.S. Seasonal Drought Outlook

Drought Tendency During the Valid Period

Valid for September 20 - December 31, 2012

Released September 20, 2012

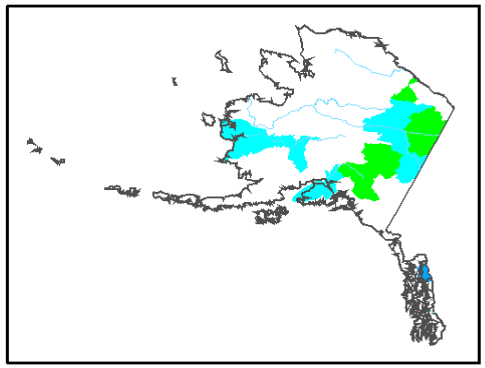


KEY:

- Drought to persist or intensify
- Drought ongoing, some improvement
- Drought likely to improve, impacts ease
- Drought development likely

Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Short-term events – such as individual storms – cannot be accurately forecast more than a few days in advance. Use caution for applications -- such as crops -- that can be affected by such events. "Ongoing" drought areas are approximated from the Drought Monitor (D1 to D4 intensity). For weekly drought updates, see the latest U.S. Drought Monitor. NOTE: the green improvement areas imply at least a 1-category improvement in the Drought Monitor intensity levels, but do not necessarily imply drought elimination.

Spring and Summer Streamflow Forecasts as of May 1, 2012



Percent
1971 to 2000 Average

- > 180
- 150 - 180
- 130 - 149
- 110 - 129
- 90 - 109
- 70 - 89
- 50 - 69
- 25 - 49
- < 25
- No Forecast

Prepared by
USDA, Natural Resources Conservation Service
National Water and Climate Center
Portland, Oregon
http://www.wcc.nrcs.usda.gov

NIDIS
National Integrated Drought Information System

University of Nebraska Lincoln

National Drought Mitigation Center

2012 Drought Summary

- **After a relatively dry/warm winter/spring, heat and dryness persisted and intensified during the summer**
  - ***65% of Contiguous U.S. in D1-D4 as of September 18***
    - ***Most since the USDM began production in 1999***
    - ***2012 areal coverage most since the 1930's and 1950's***
  - ***Heat waves* in June + July led to rapid expansion over the Midwest and Central Plains….classic *"flash drought"* (timing, timing, timing)**
    - **Major impacts on corn, soybeans, hay and livestock**
- ***Pasture/range* conditions took a beating too**
- **Upcoming *winter critical* for snowpack/water supply and soil moisture recharge….**
- **Climate Prediction Center's Seasonal Drought Outlook calls for *general persistence of drought in current drought areas* between now and the end of November**
  - **Models trending toward *El Niño (>70%)* later this fall/winter (IRI/CPC)….**

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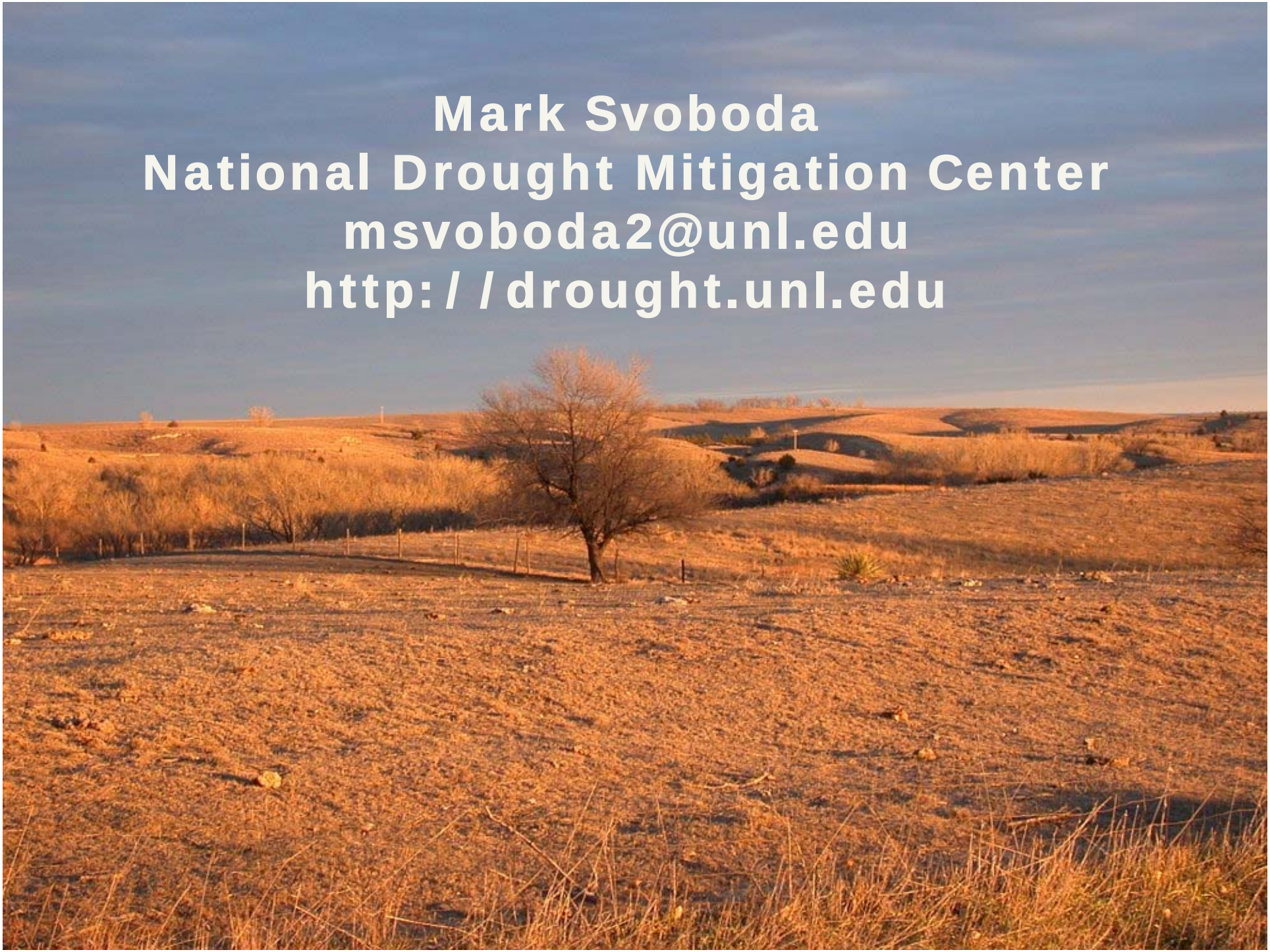

Mark Svoboda
National Drought Mitigation Center
msvoboda2@unl.edu
http://drought.unl.edu