Drought Fusion: A Union of Past and Present Drought Characteristics and their Impacts

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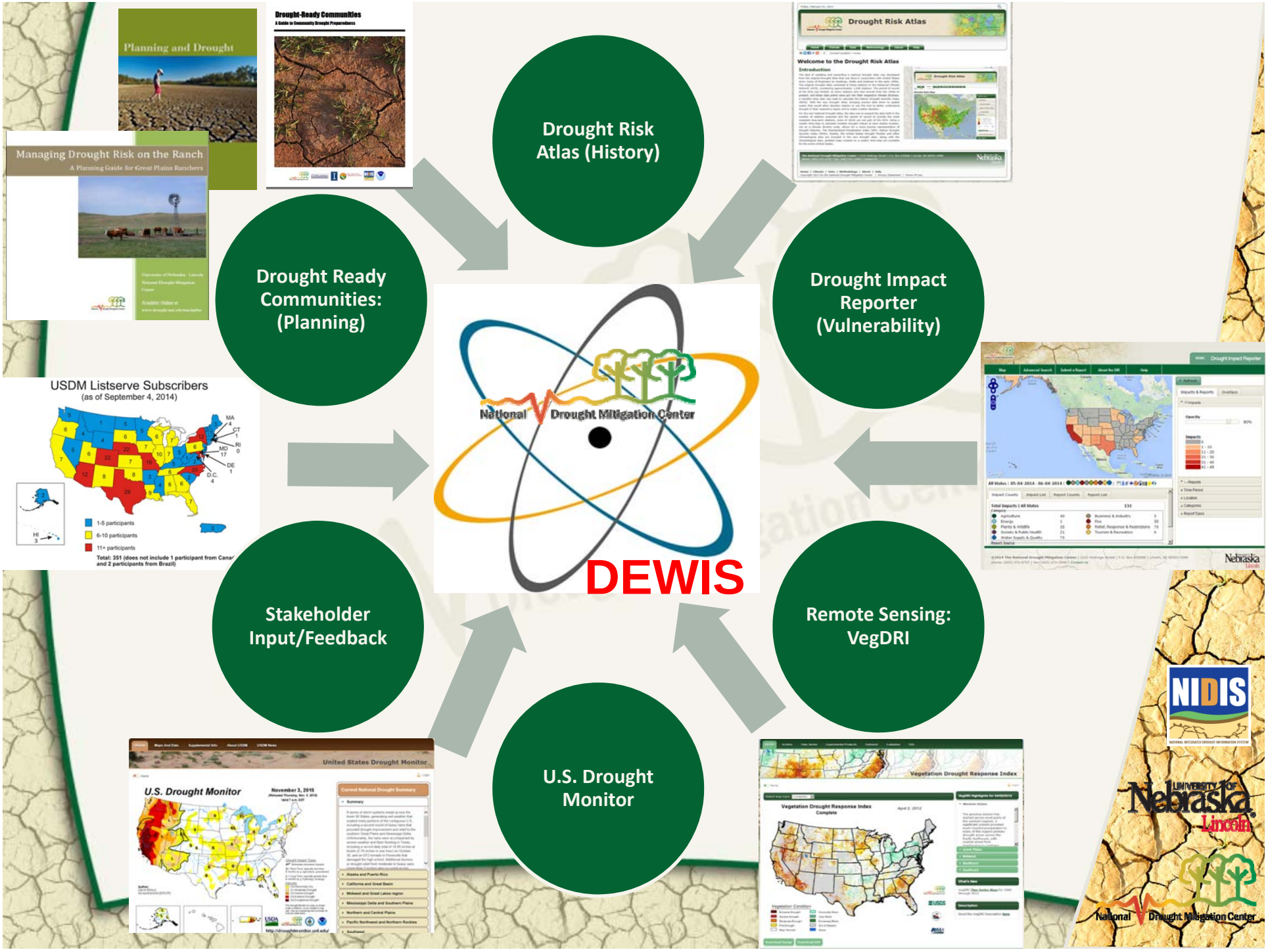
Photo courtesy of the Cimarron County (OK) Conservation District, January 2014

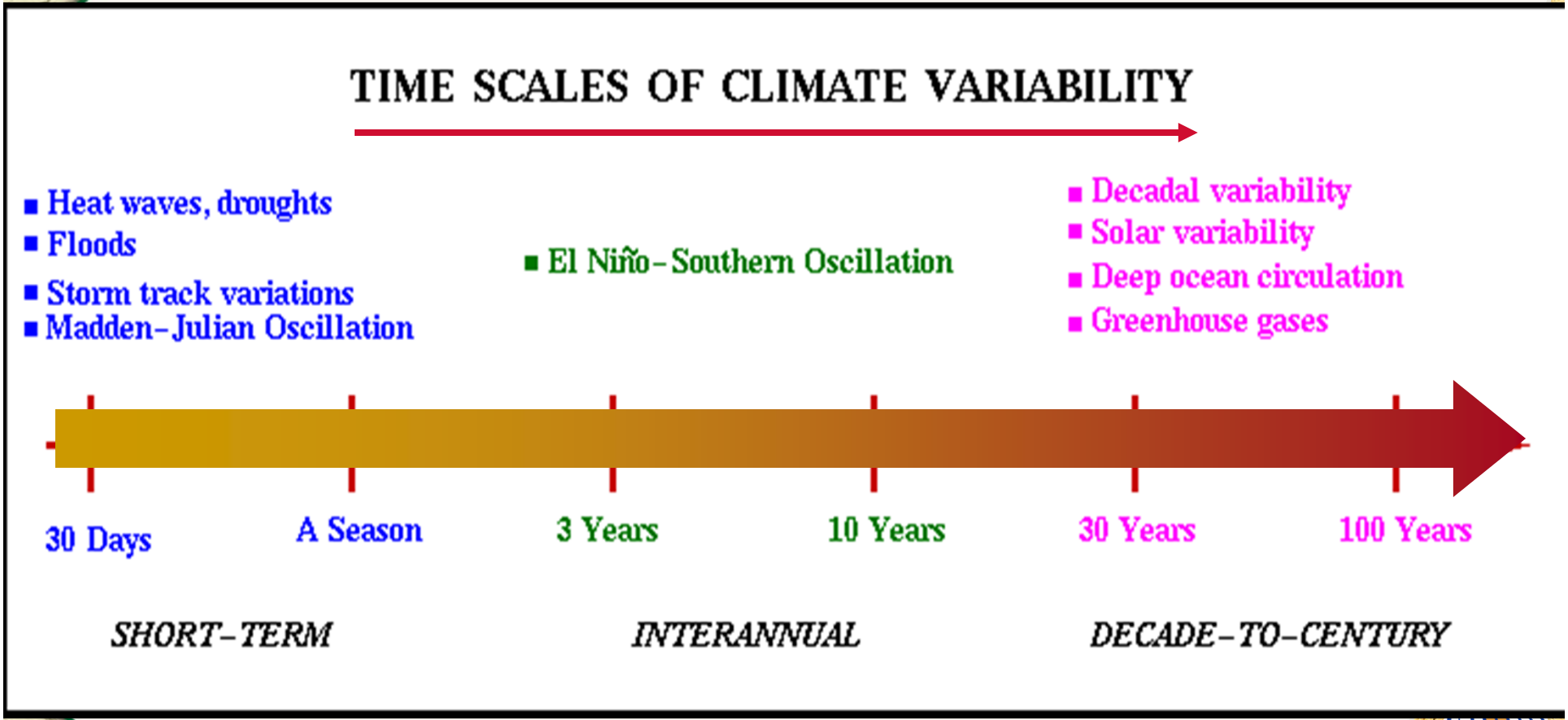
Linkages: Drought and Climate

- “Societies will manage climate variability and potential changes in the same way that they manage droughts (for better or worse).”
  - Daniel Connell, Australian National University, 2010

- If we can better prepare and plan for drought, we can better prepare to face many of the potential climatic challenges facing us in the future

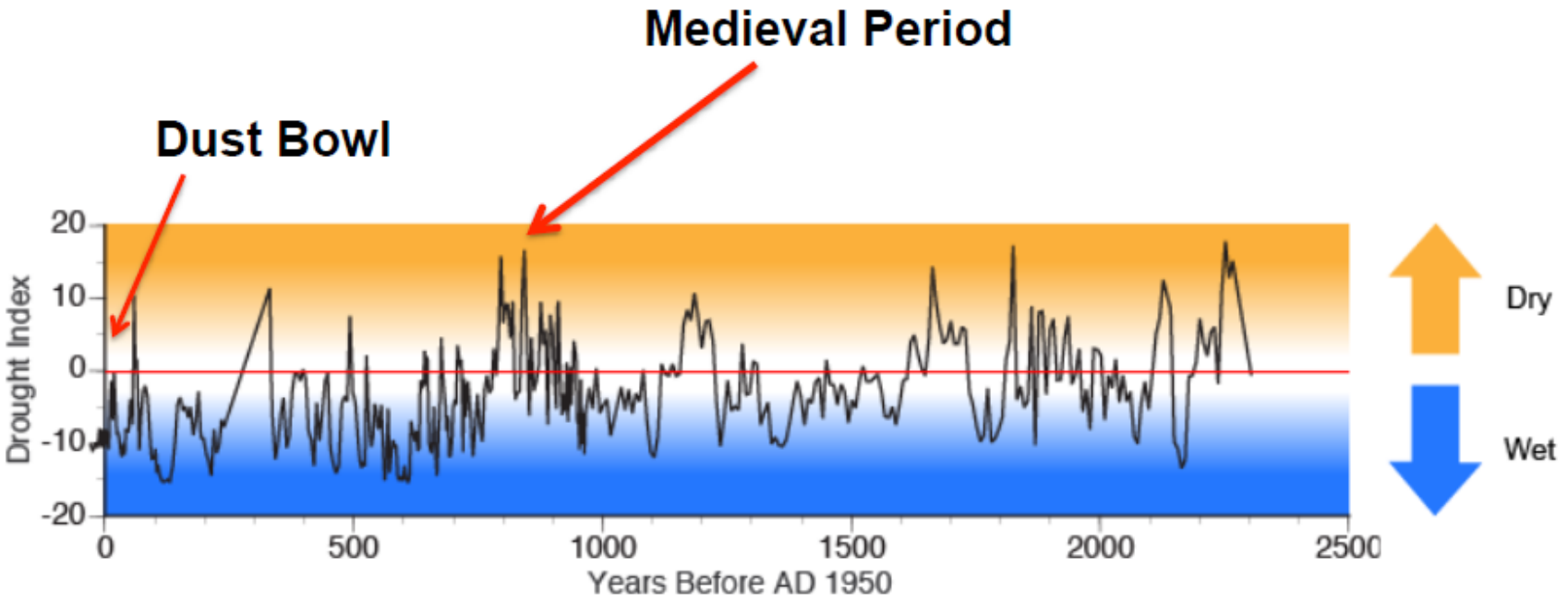

Planning and Drought
Drought-Ready Communities
A Guide to Community Drought Preparedness
Managing Drought Risk on the Ranch
A Planning Guide for Great Plains Ranchers
Drought Risk Atlas
Welcome to the Drought Risk Atlas
Introduction
Drought Risk Atlas (History)
Drought Ready Communities: (Planning)
Drought Impact Reporter (Vulnerability)
USDM Listserve Subscribers
(as of September 4, 2014)
1-5 participants
6-10 participants
11+ participants
National Drought Mitigation Center
DEWIS
Drought Impact Reporter
Stakeholder Input/Feedback
Remote Sensing: VegDRI
U.S. Drought Monitor
United States Drought Monitor
November 3, 2015
Vegetation Drought Response Index
NIDIS
University of Nebraska Lincoln
National Drought Mitigation Center

Why Drought?



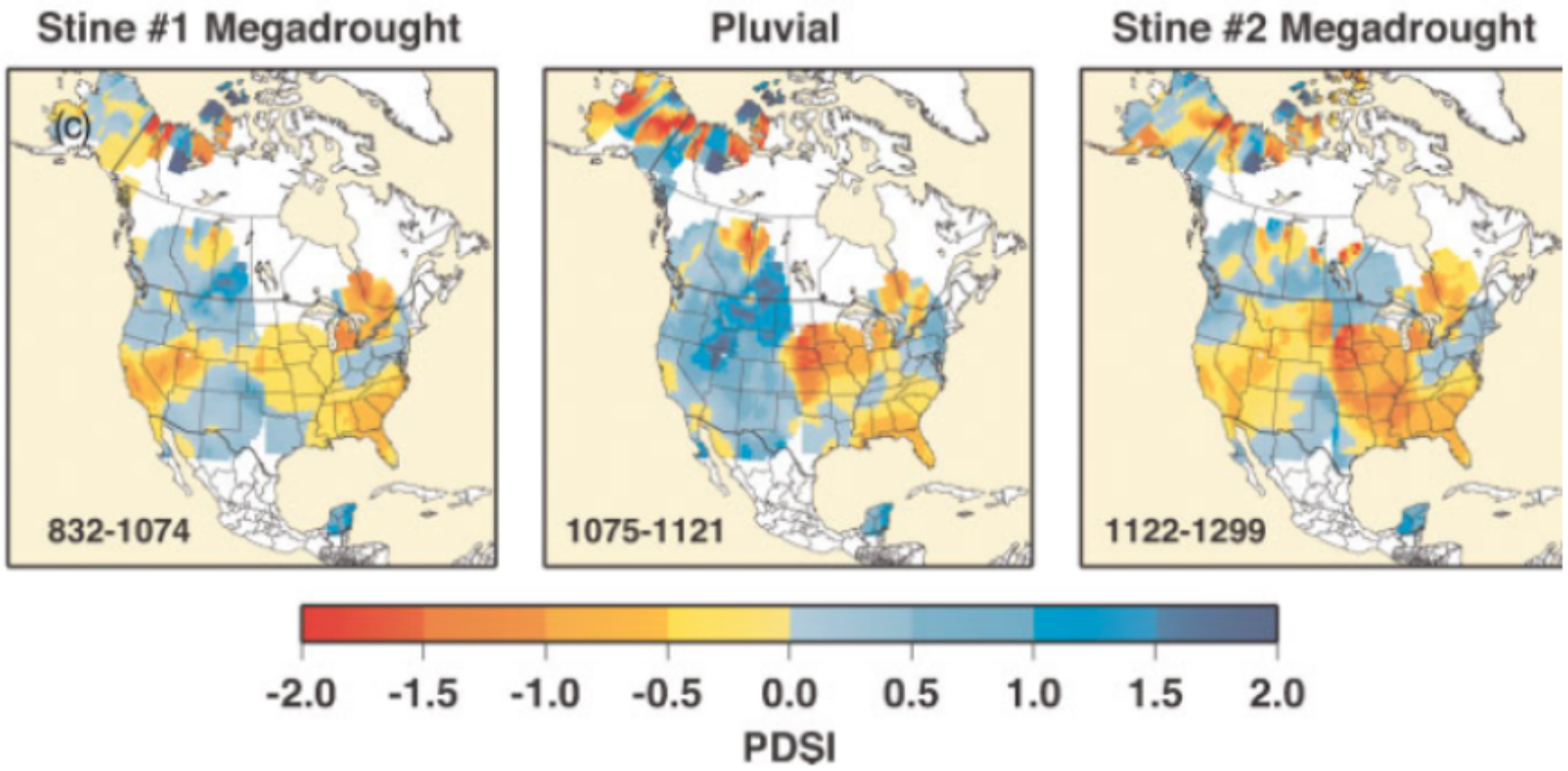
Droughts span an enormous range of temporal and spatial scales…

Major and Prolonged Drought
Medieval "Mega-droughts"



Moon Lake, south-central North Dakota Laird, Fritz et al. 1996

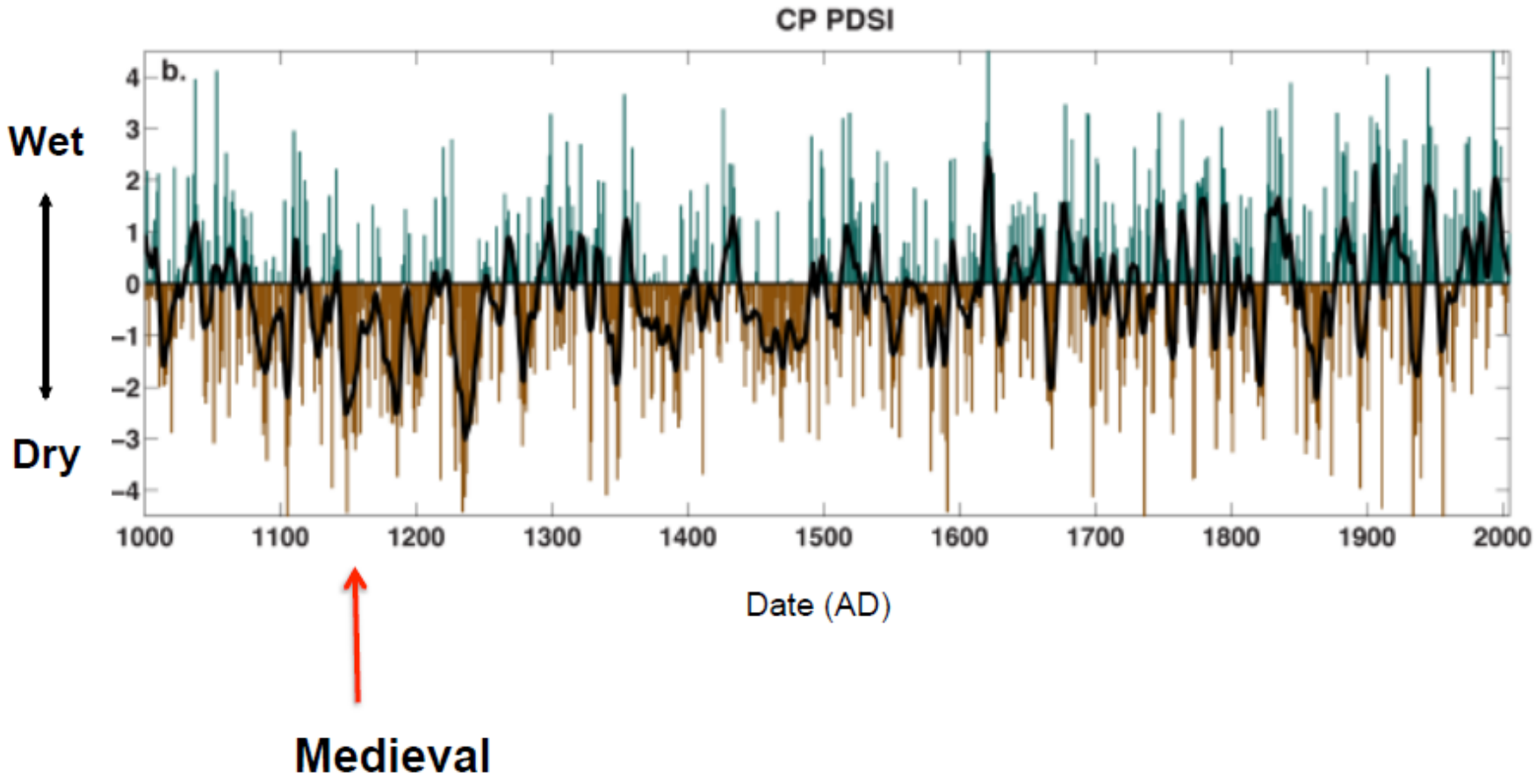
Tree-ring Reconstructions
Medieval "Mega-droughts"
Pan-continental drought



Seager et al., 2009

Tree-ring Reconstructions

Central Plains Palmer Drought Severity Index



Cook et al. 2014

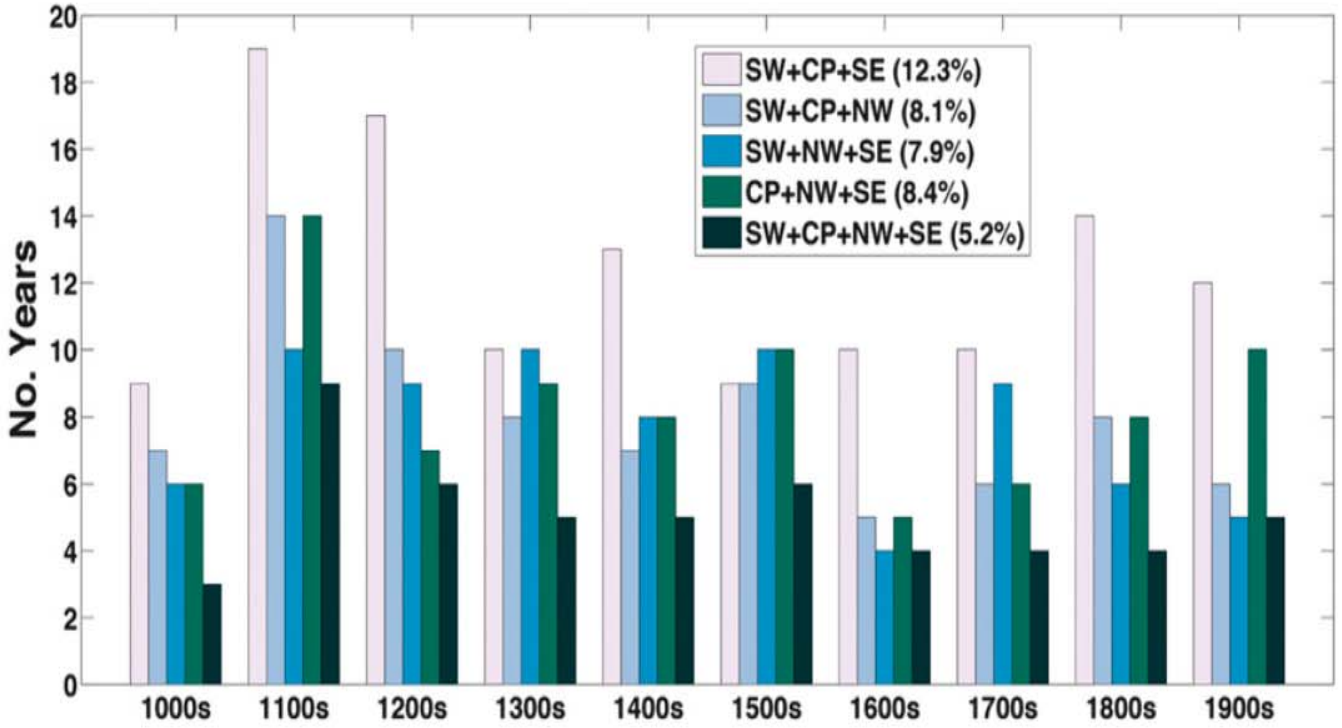
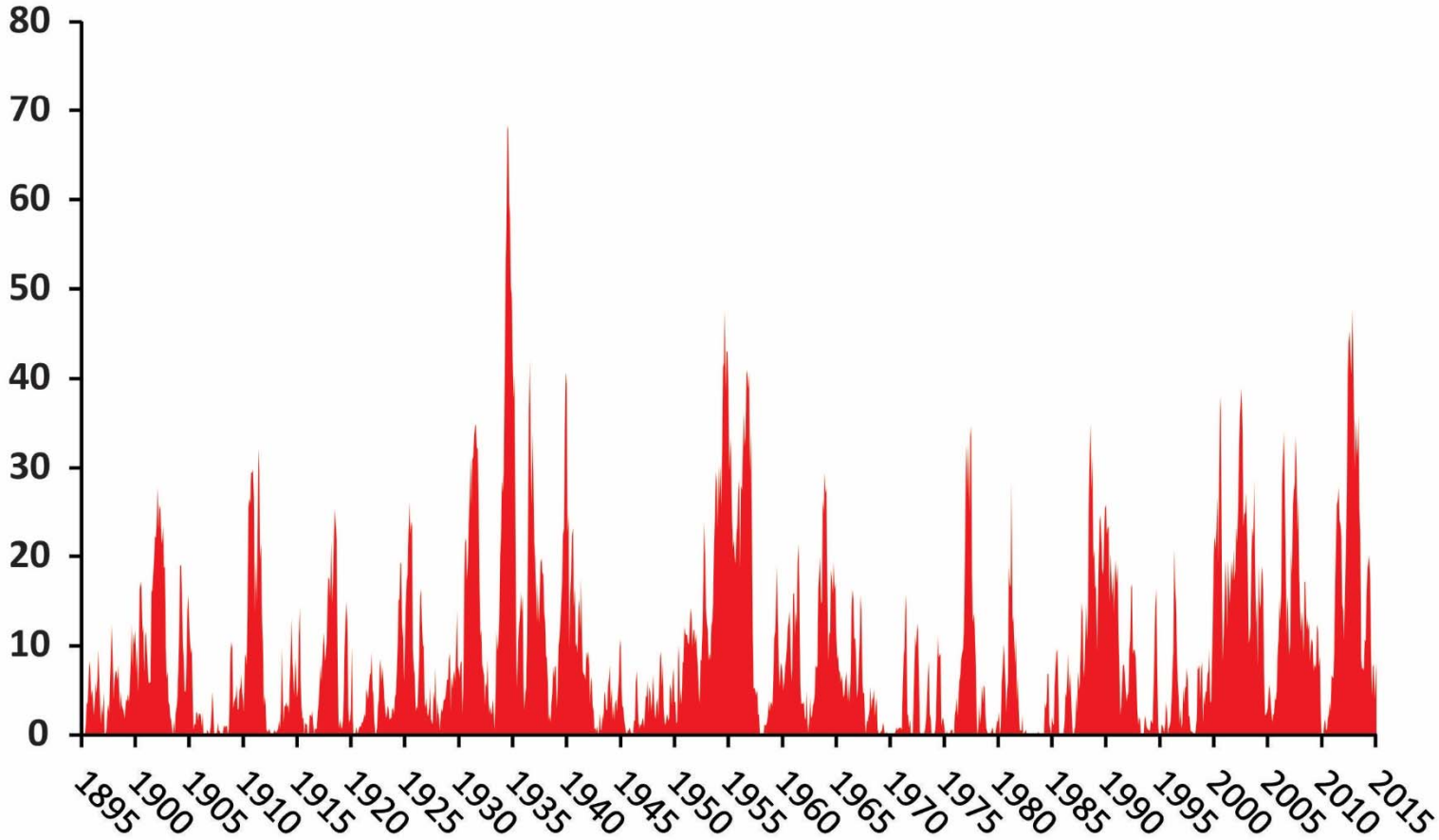


FIG. 6. Number of pan-continental drought years (PDSI ≤ -0.5) in each century, calculated for all possible pan-continental drought patterns. To ensure adequate sampling of events, drought years were allowed to overlap between the three- and four-region drought categories. The total percent occurrences of each drought pattern, calculated over the full time period available (1000–2005 CE), are indicated in the figure legend.

Percent Area of the United States in Severe to Extreme Drought

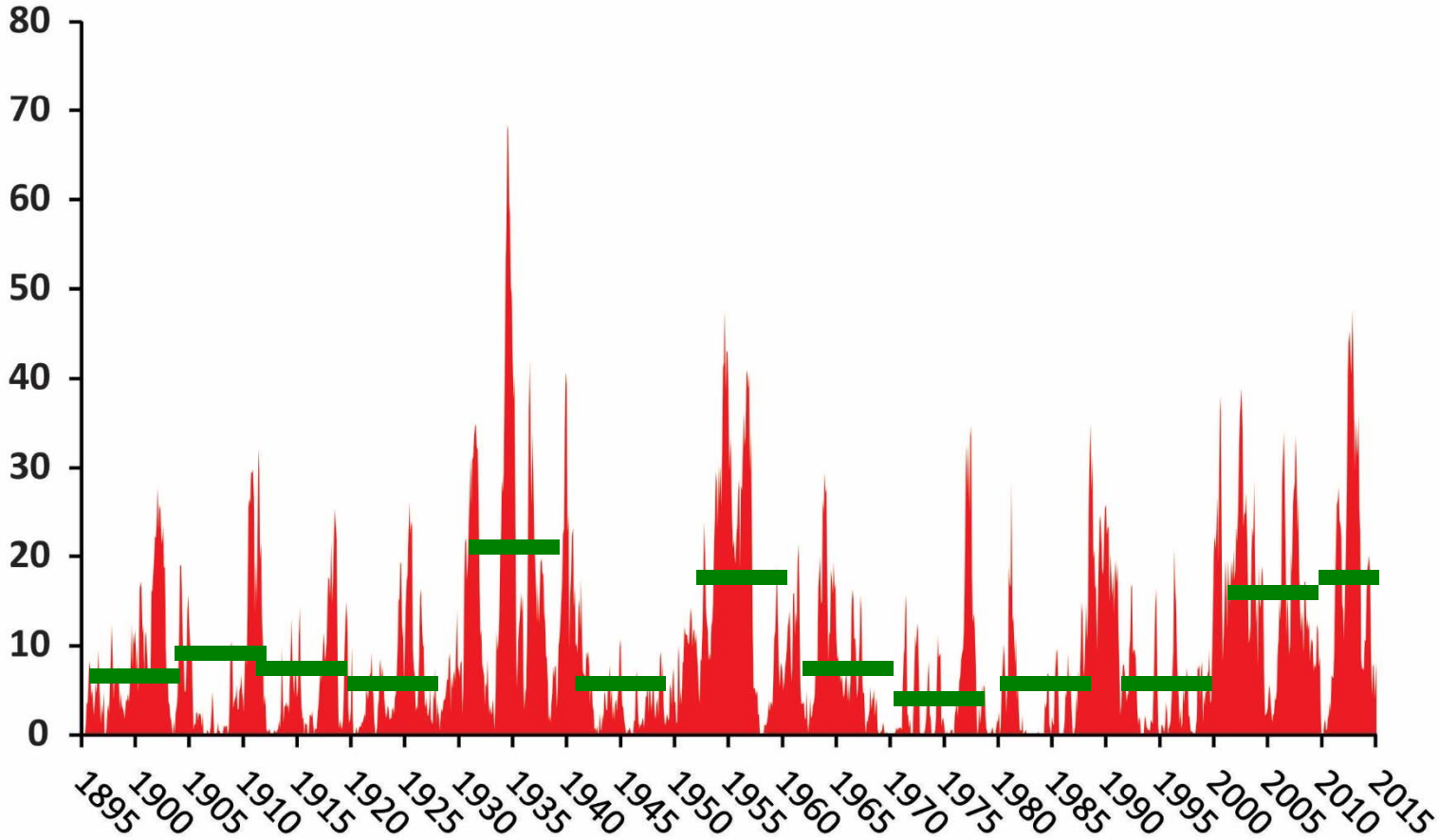
January 1895–February 2015



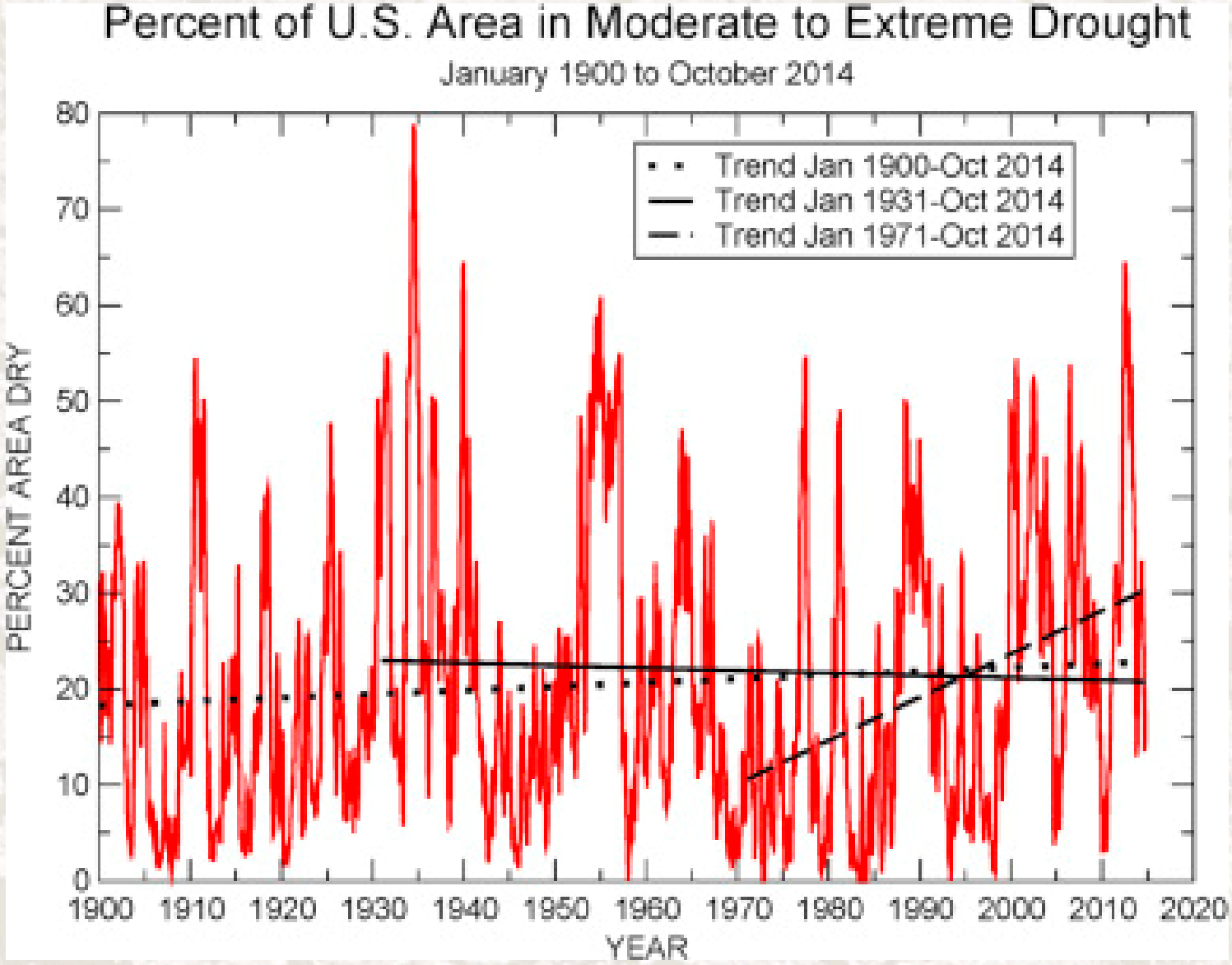
Based on data from the National Climatic Data Center/NOAA

Percent Area of the United States in Severe to Extreme Drought

January 1895–February 2015



Based on data from the National Climatic Data Center/NOAA



Slide courtesy of R. Heim, Jr., 2015, *Weather and Climate Extremes*.

Friday, February 01, 2013

Drought Risk Atlas

National Drought Mitigation Center

Home | Climate | Data | Methodology | About | Help

0 Current Location » Home

Welcome to the Drought Risk Atlas

Introduction

The idea of updating and expanding a national drought atlas was developed from the original Drought Atlas that was done in conjunction with United States Army Corps of Engineers by Hoskings, Wallis and Guttman in the early 1990s. The original Drought Atlas consisted of those stations in the Historical Climate Network (HCN), numbering approximately 1,000 stations. The period of record at the time was limited, as many stations only had records from the 1940s to present, and these data points were put into their respective climate divisions. A monthly time step was used to calculate the Palmer Drought Severity Index (PDSI). With the new Drought Atlas, bringing precise data down to spatial scales that would allow decision makers to use this tool to better understand drought in their respective region and to make a better decision.

For the new National Drought Atlas, the idea was to expand the data both in the number of stations analyzed and the period of record to include the most complete long-term stations, some of which are not part of the HCN. Using a weekly time-step to calculate multiple drought indices at each station location, not on a climate division scale, allows for a more precise representation of drought histories. The Standardized Precipitation Index (SPI), Palmer Drought Severity Index (PDSI), Deciles, the United States Drought Monitor and other Climatological data are included in the new drought atlas. Along with the Climatological data, gridded maps created on a weekly time-step are available for the entire United States.

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phone: (402) 472-6707 | fax: (402) 472-2946 | Contact Us

University of Nebraska Lincoln

- Launched in March 2014
- Over 3,100 high quality stations
- Multiple drought indices and gridded maps back to the early 1900s

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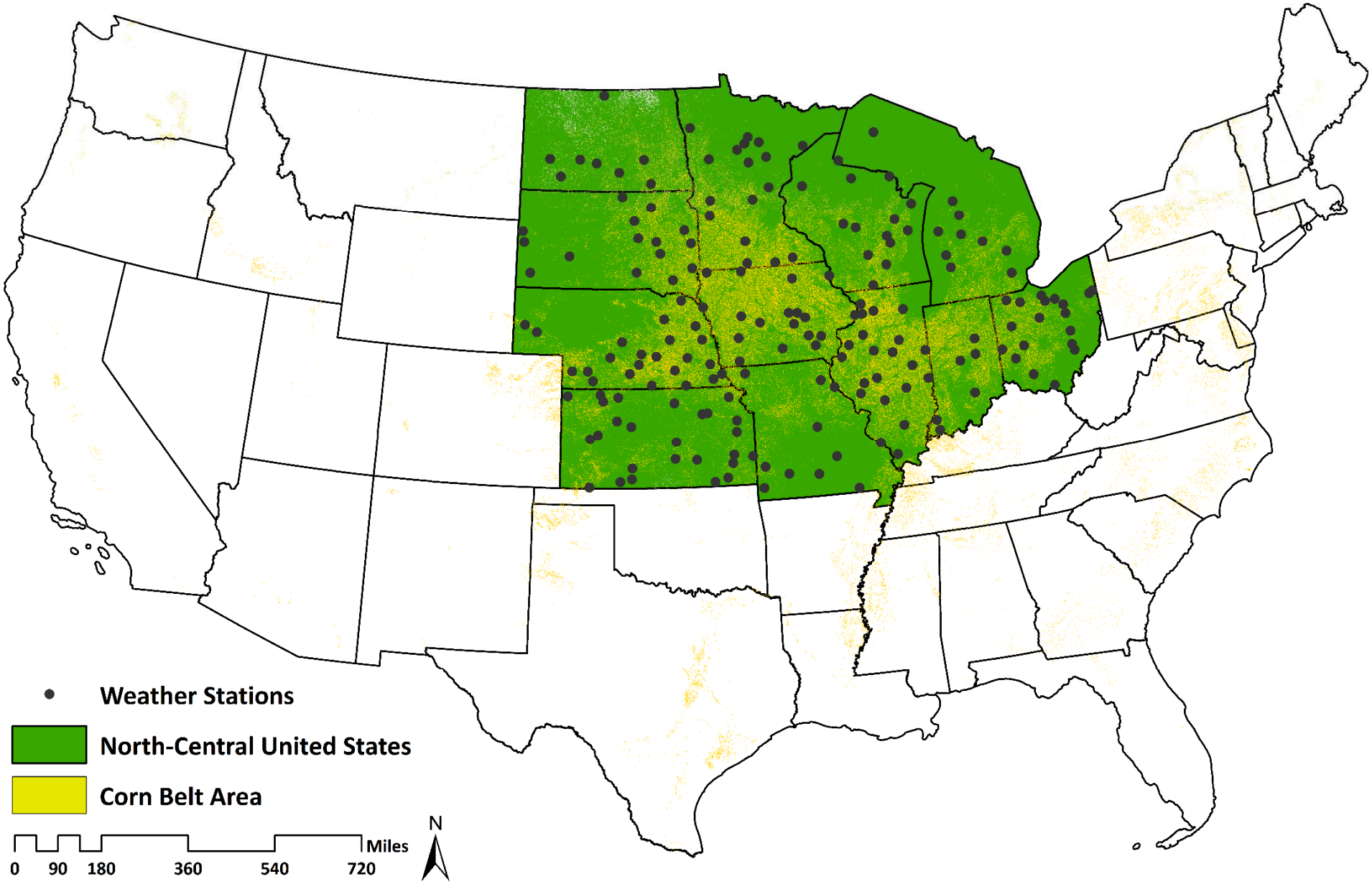
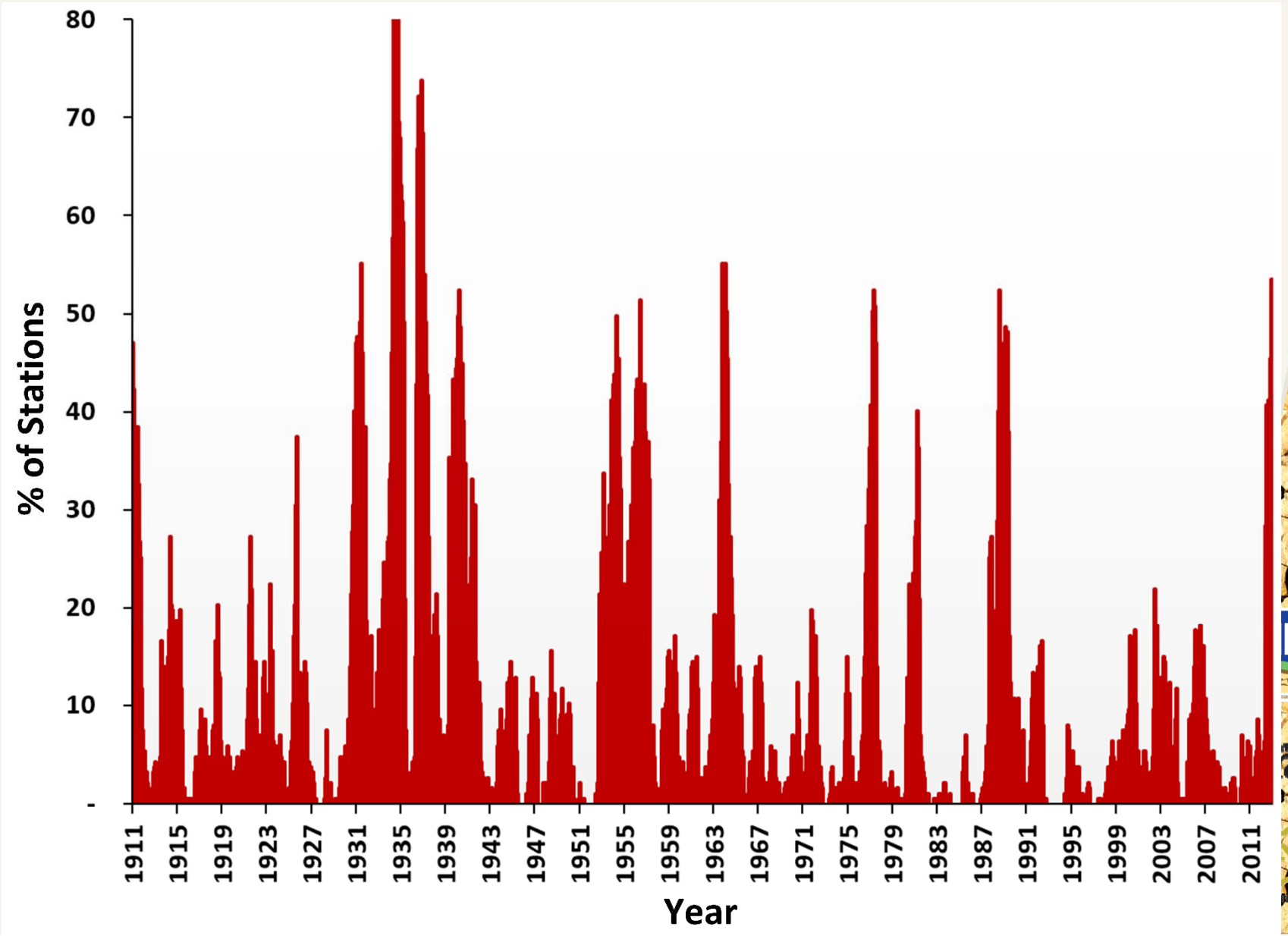
The Drought Risk Atlas will help answer:

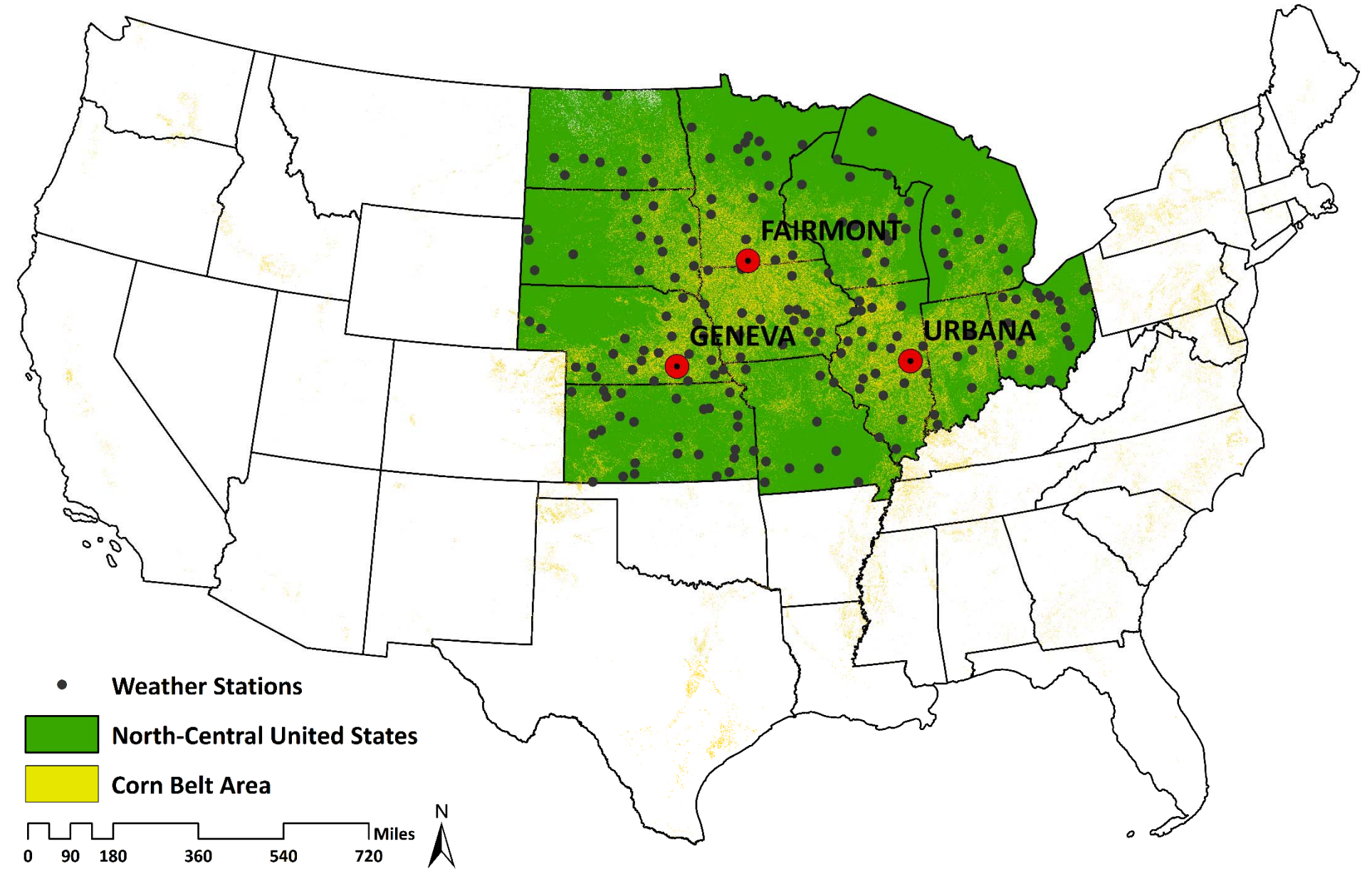
- How does the drought *compare* to other droughts *historically*?
- When was the *last time* a drought like this happened?
- *How often* (frequency) does a drought of this magnitude happen?
- Are we seeing *any trends* in drought frequency, duration, severity?
- What did the *spatial footprint* of the last drought look like?



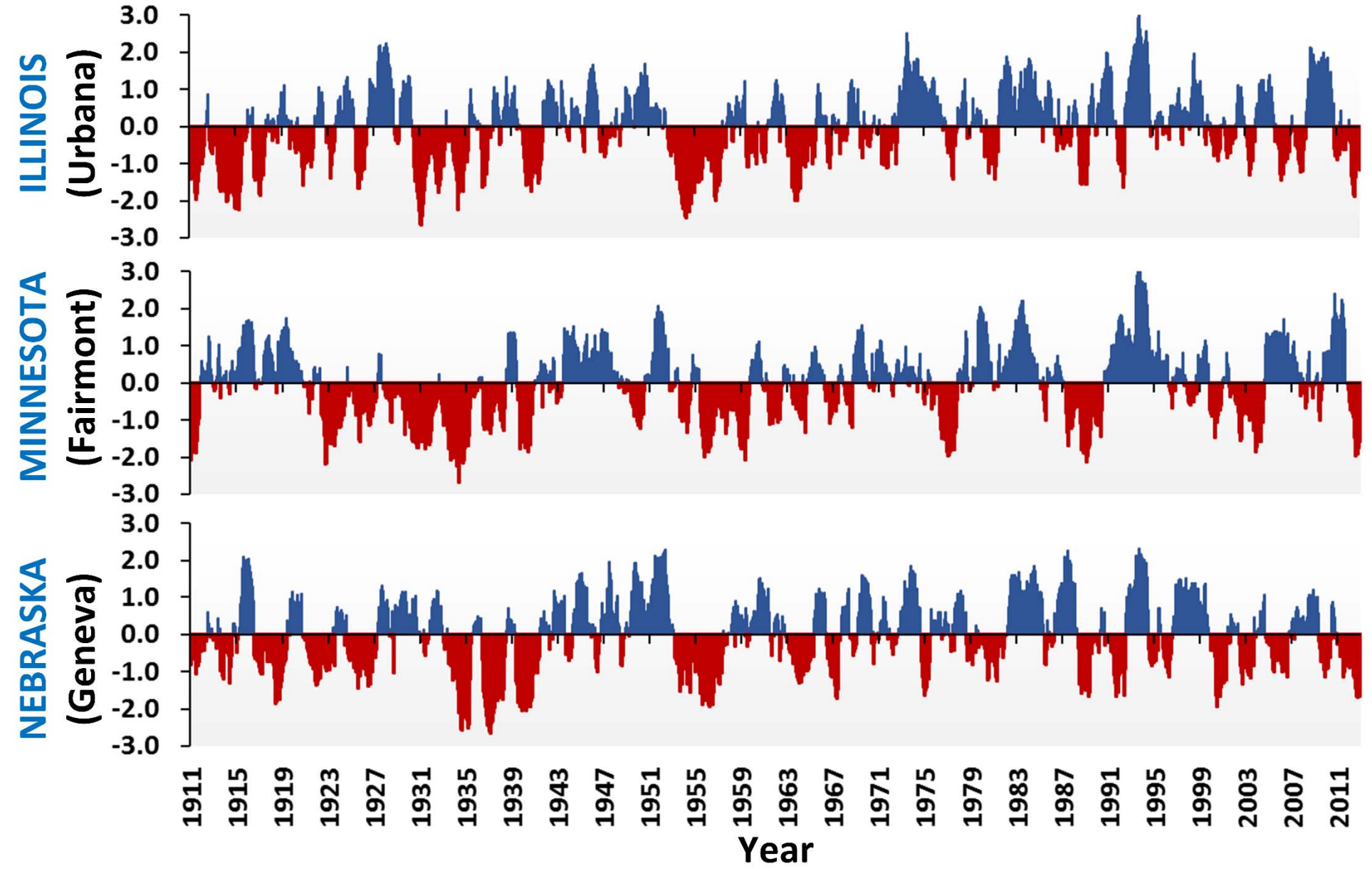
National Drought Mitigation Center

% of stations in severe to extreme drought as determined by the SPEI (12-month) for 186 weather stations in the North-Central U.S. during 102 years (1911-2012) of historical record

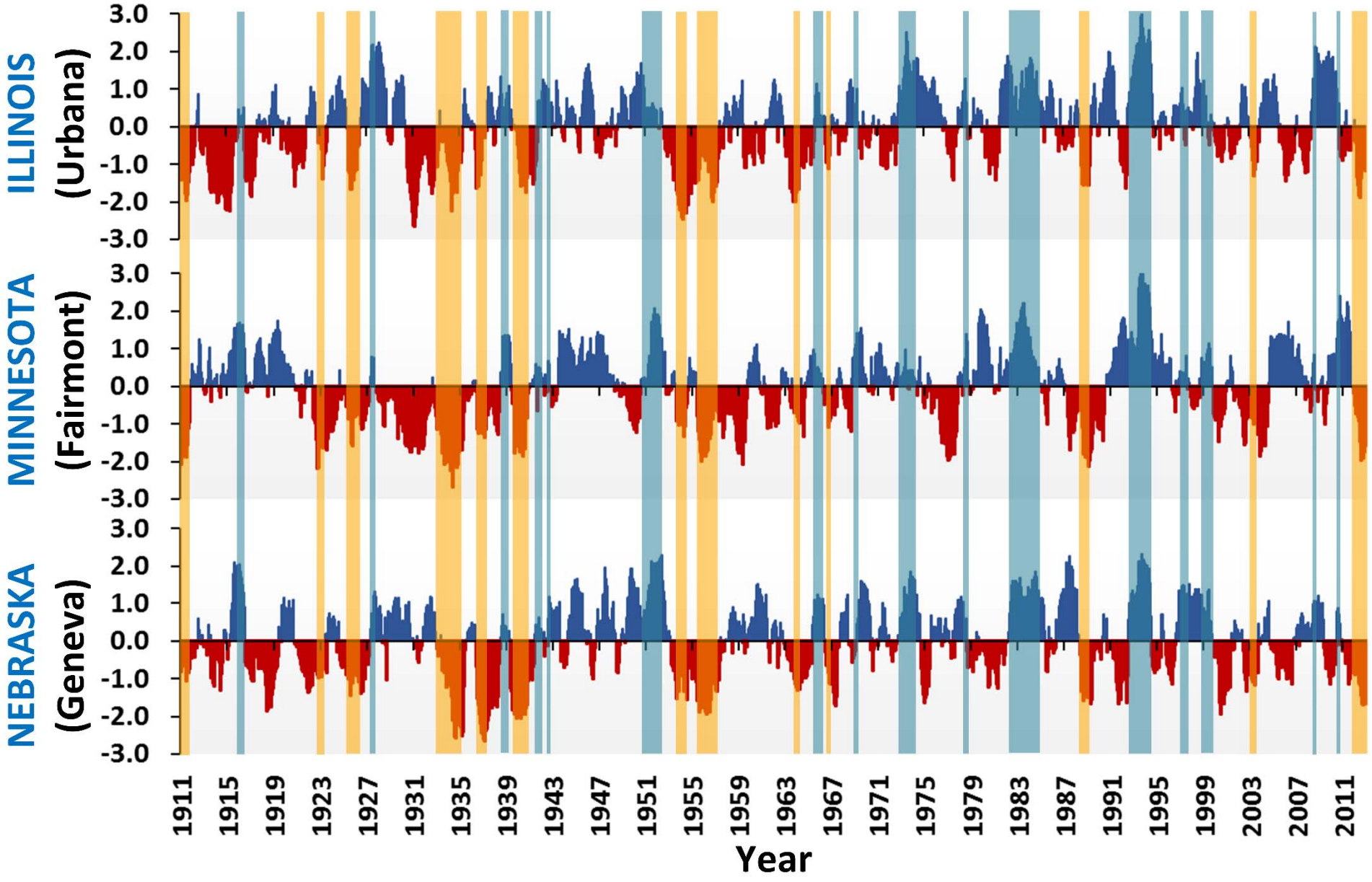



FAIRMONT
GENEVA
URBANA
Weather Stations
North-Central United States
Corn Belt Area
N
Miles
0 90 180 360 540 720

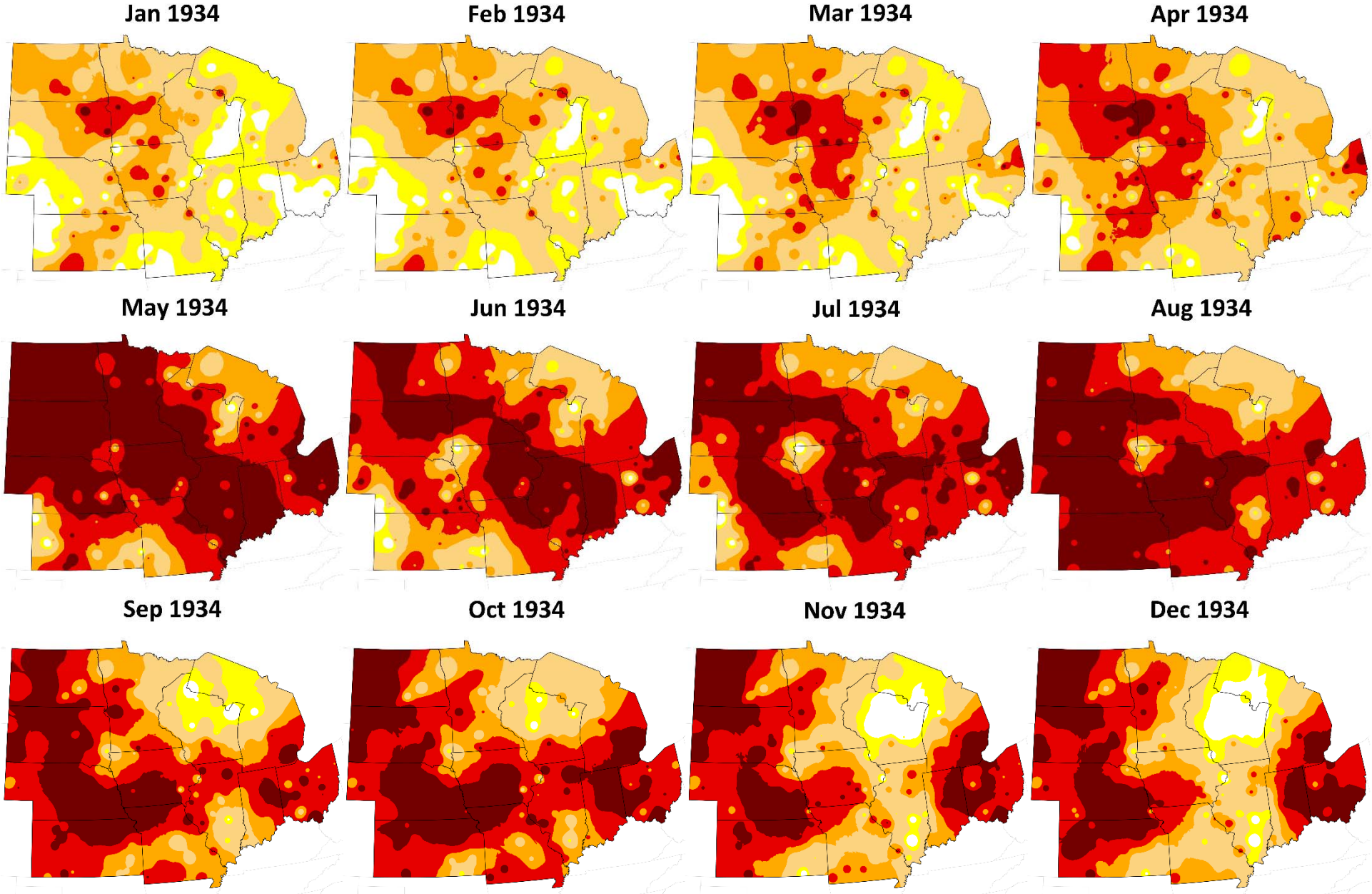
Drought indices as determined by the SPEI (12-month) in the North-Central U.S. (3 STATES) during 102 years (1911-2012) of historical record



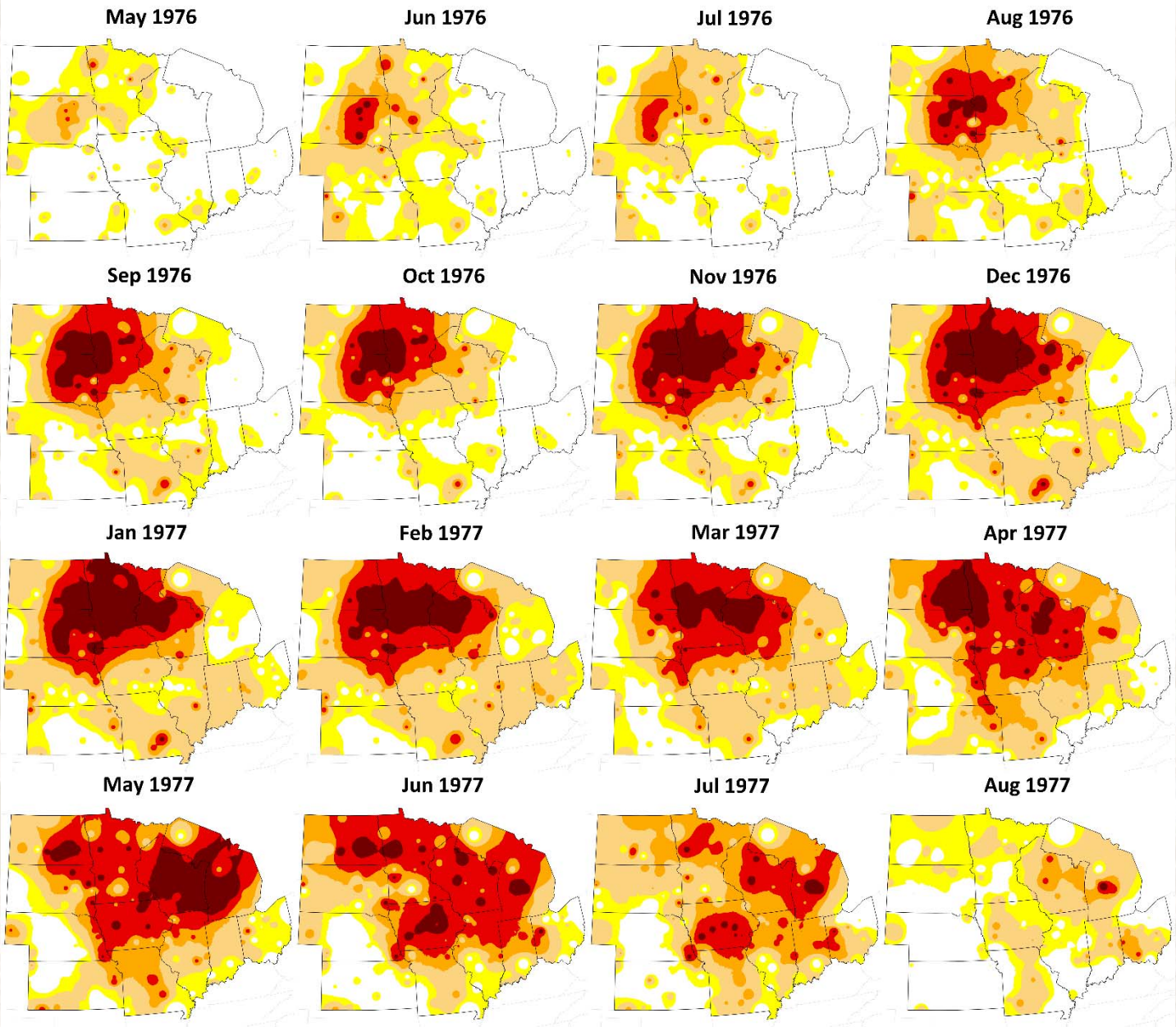
Drought indices as determined by the SPEI (12-month) in the North-Central U.S. (3 STATES) during 102 years (1911-2012) of historical record



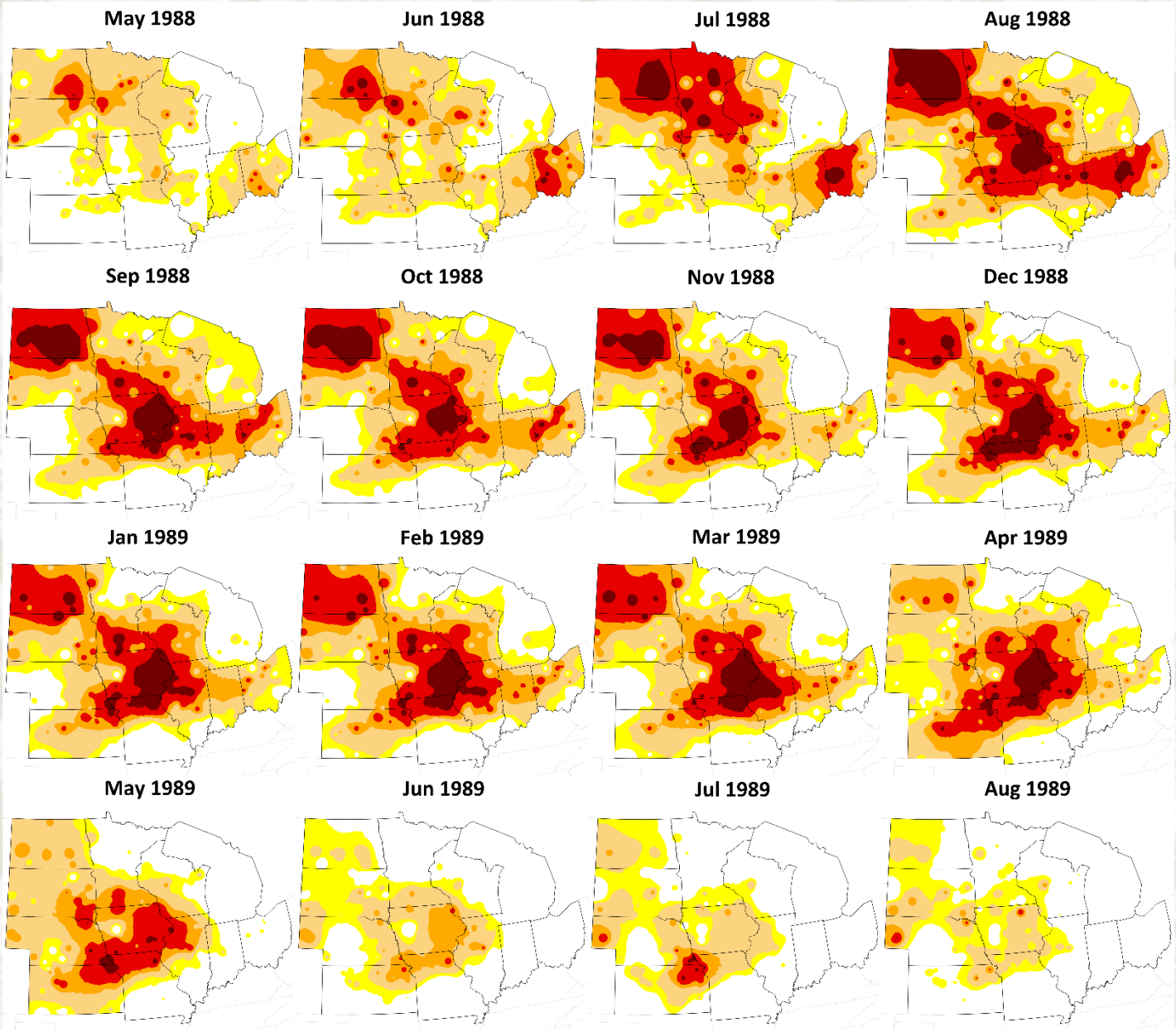
Drought maps as determined by the SPEI (12-month) for 186 weather stations in the North-Central U.S. during 1934



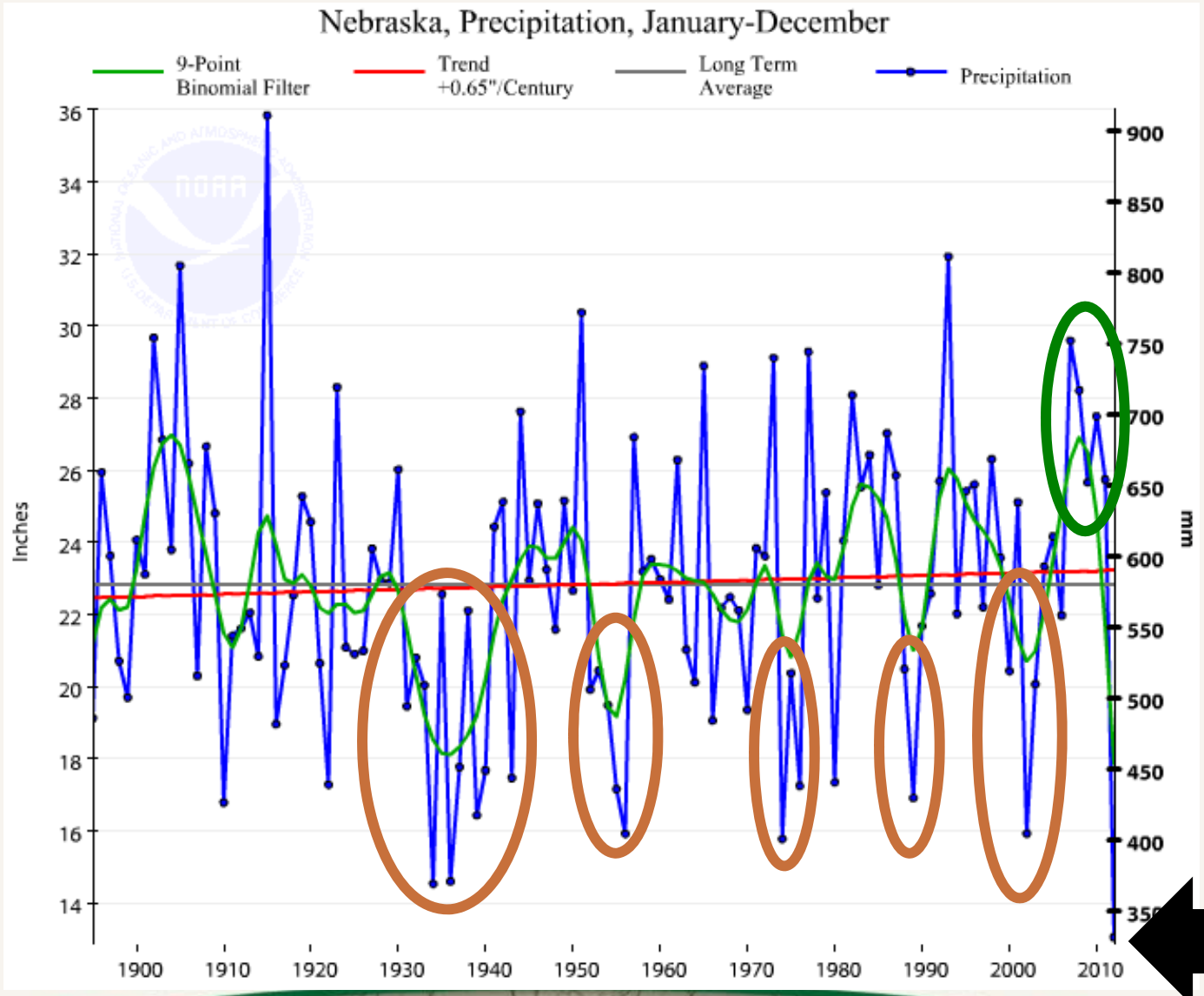
Drought maps as determined by the SPEI (12-month) for 186 weather stations in the North-Central U.S. during 1976-1977



Drought maps as determined by the SPEI (12-month) for 186 weather stations in the North-Central U.S. during 1988-1989



Nebraska Annual Precipitation (1895-2012)



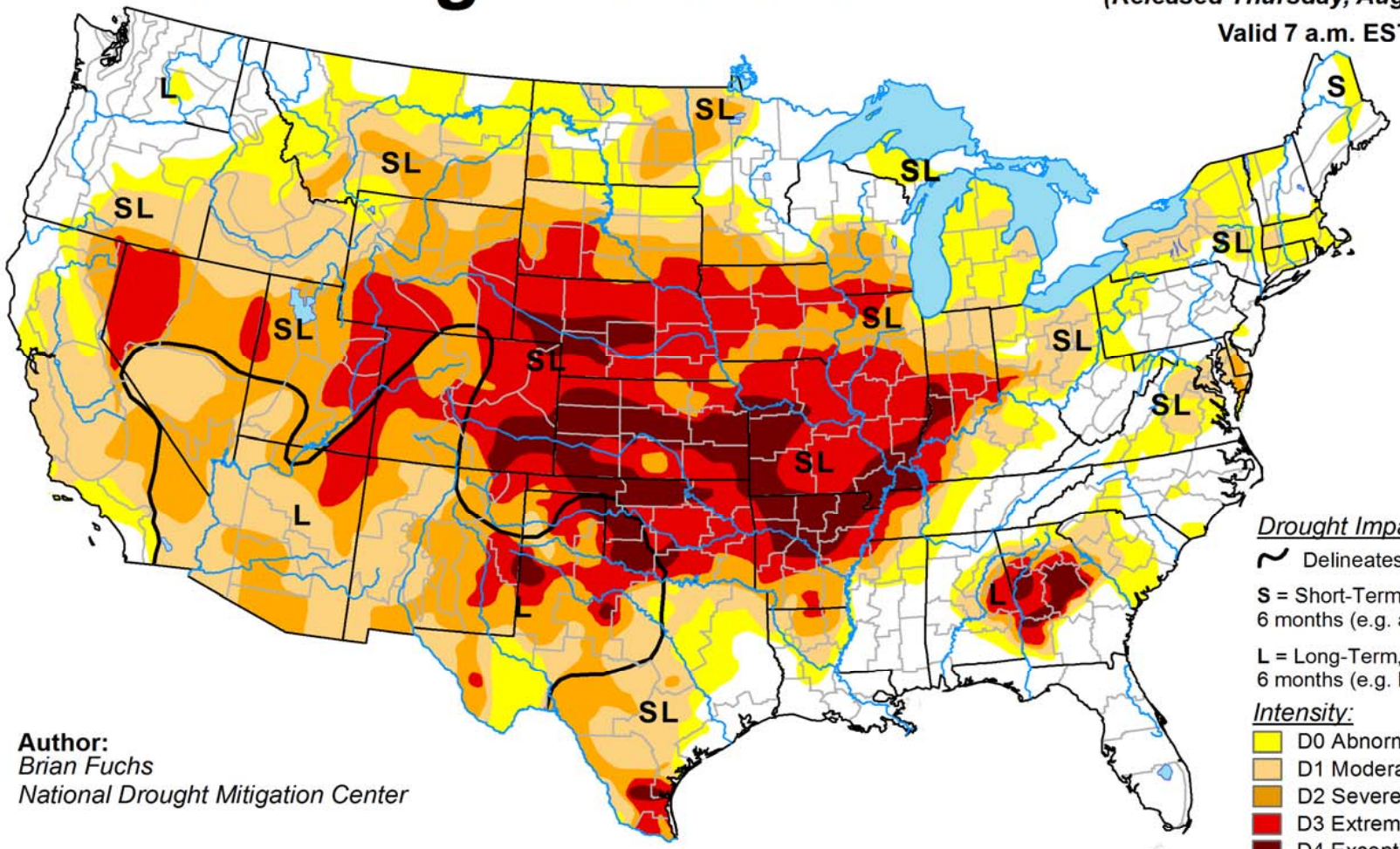
Courtesy: National Climatic Data Center/NOAA

U.S. Drought Monitor

August 28, 2012

(Released Thursday, Aug. 30, 2012)

Valid 7 a.m. EST



Author:
Brian Fuchs
National Drought Mitigation Center

Drought Impact Types:

~ Delineates dominant impacts

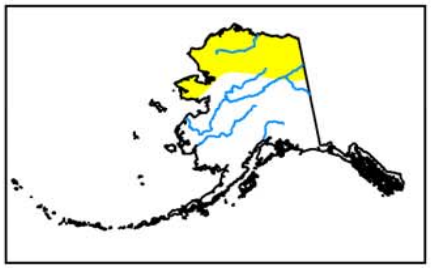
S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)

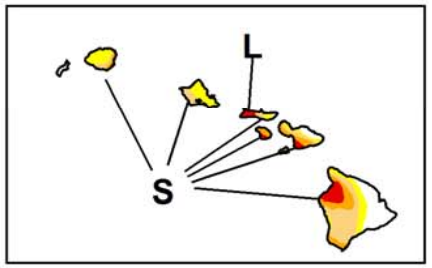
L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

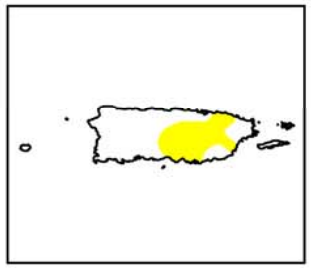
Intensity:

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

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





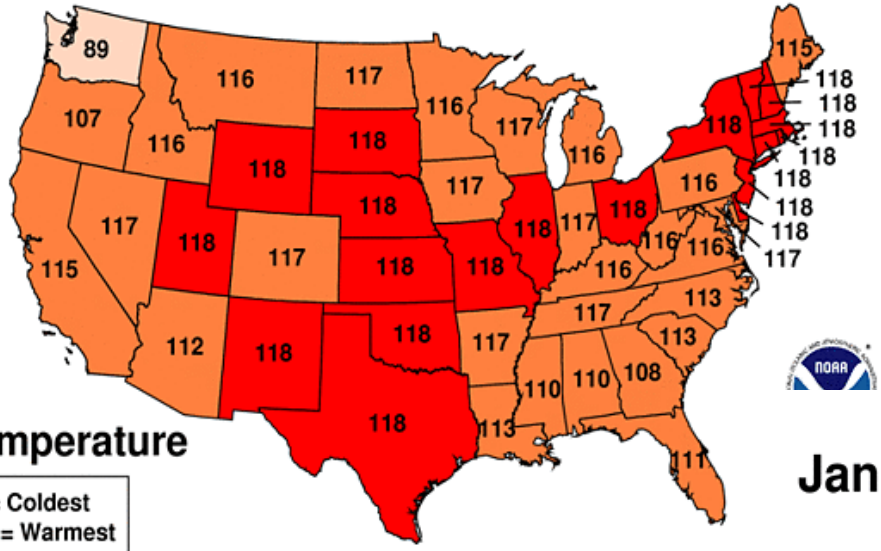


USDA National Drought Mitigation Center

http://droughtmonitor.unl.edu/

January-December 2012 Statewide Ranks

National Climatic Data Center/NESDIS/NOAA



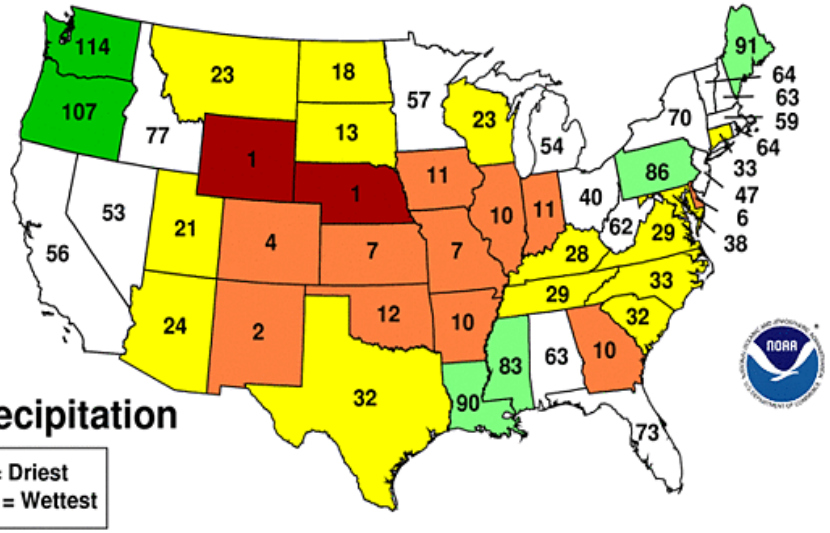
Temperature

1 = Coldest
118 = Warmest

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

January-December 2012 Statewide Ranks

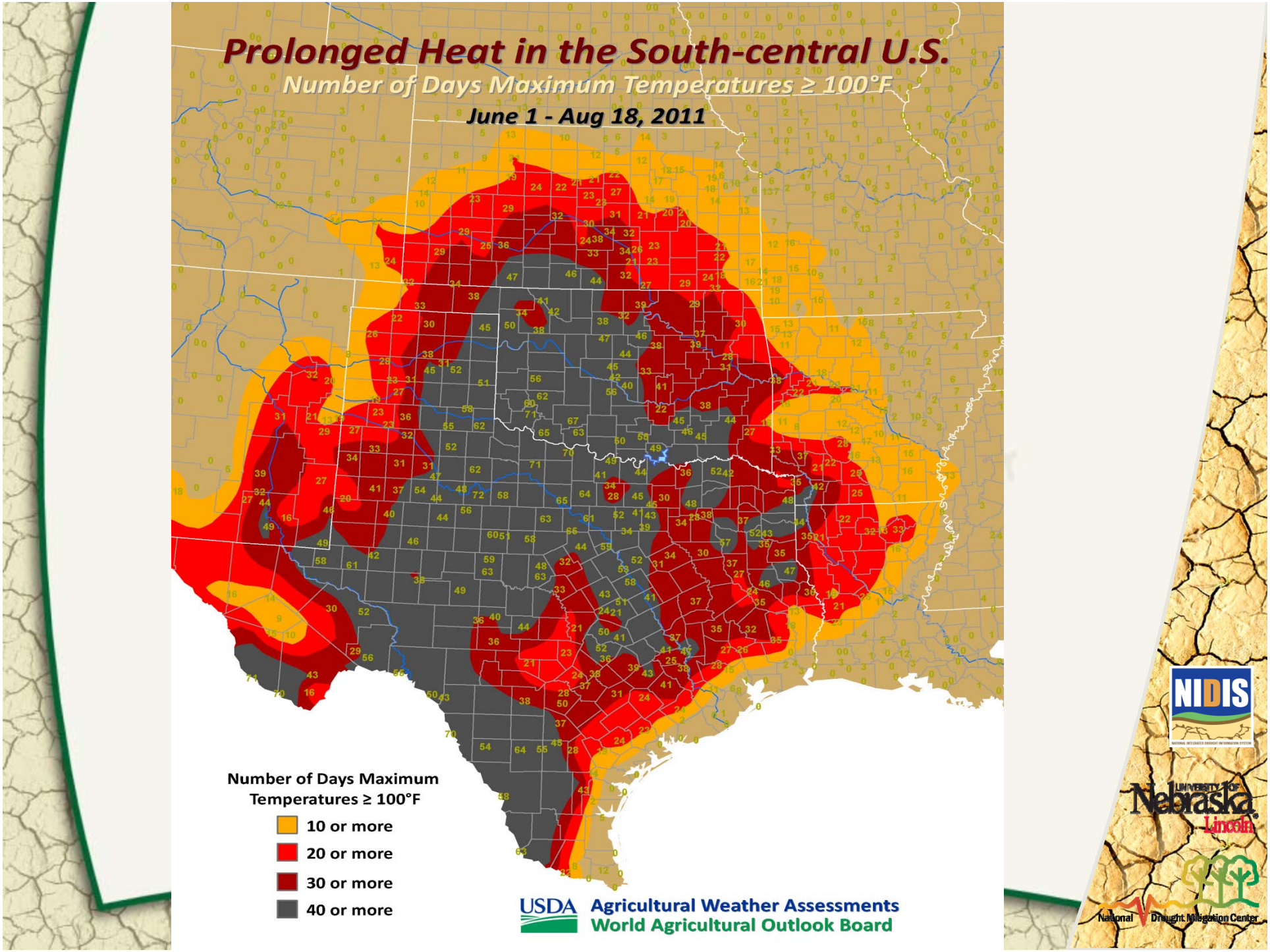
National Climatic Data Center/NESDIS/NOAA



Precipitation

1 = Driest
118 = Wettest

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


Prolonged Heat in the South-central U.S.
Number of Days Maximum Temperatures ≥ 100°F
June 1 - Aug 18, 2011
Number of Days Maximum Temperatures ≥ 100°F
10 or more
20 or more
30 or more
40 or more
USDA Agricultural Weather Assessments
World Agricultural Outlook Board
NIDIS
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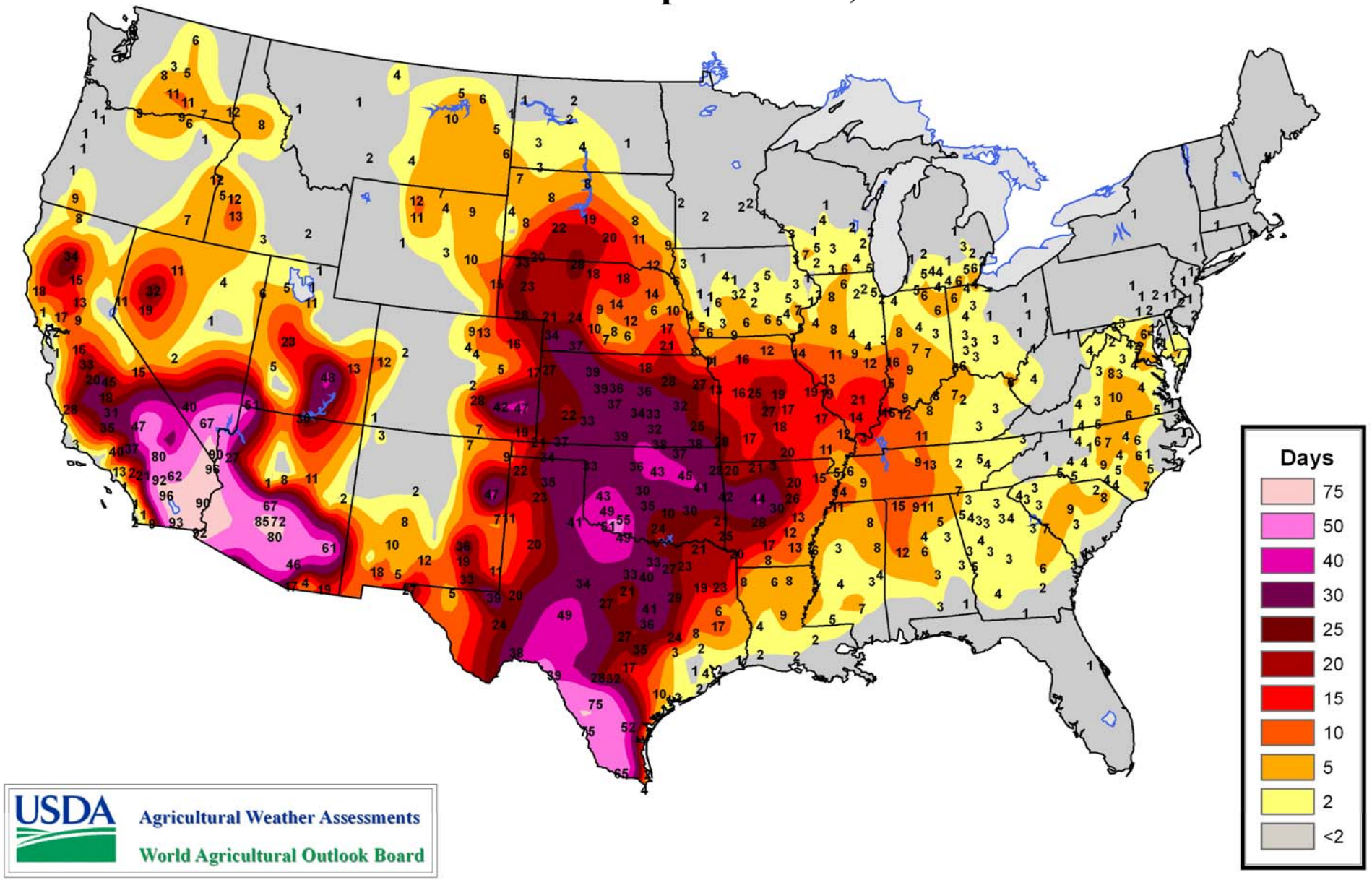
National Drought Mitigation Center

Number of Days >= 100°F

June 1 - September 15, 2012

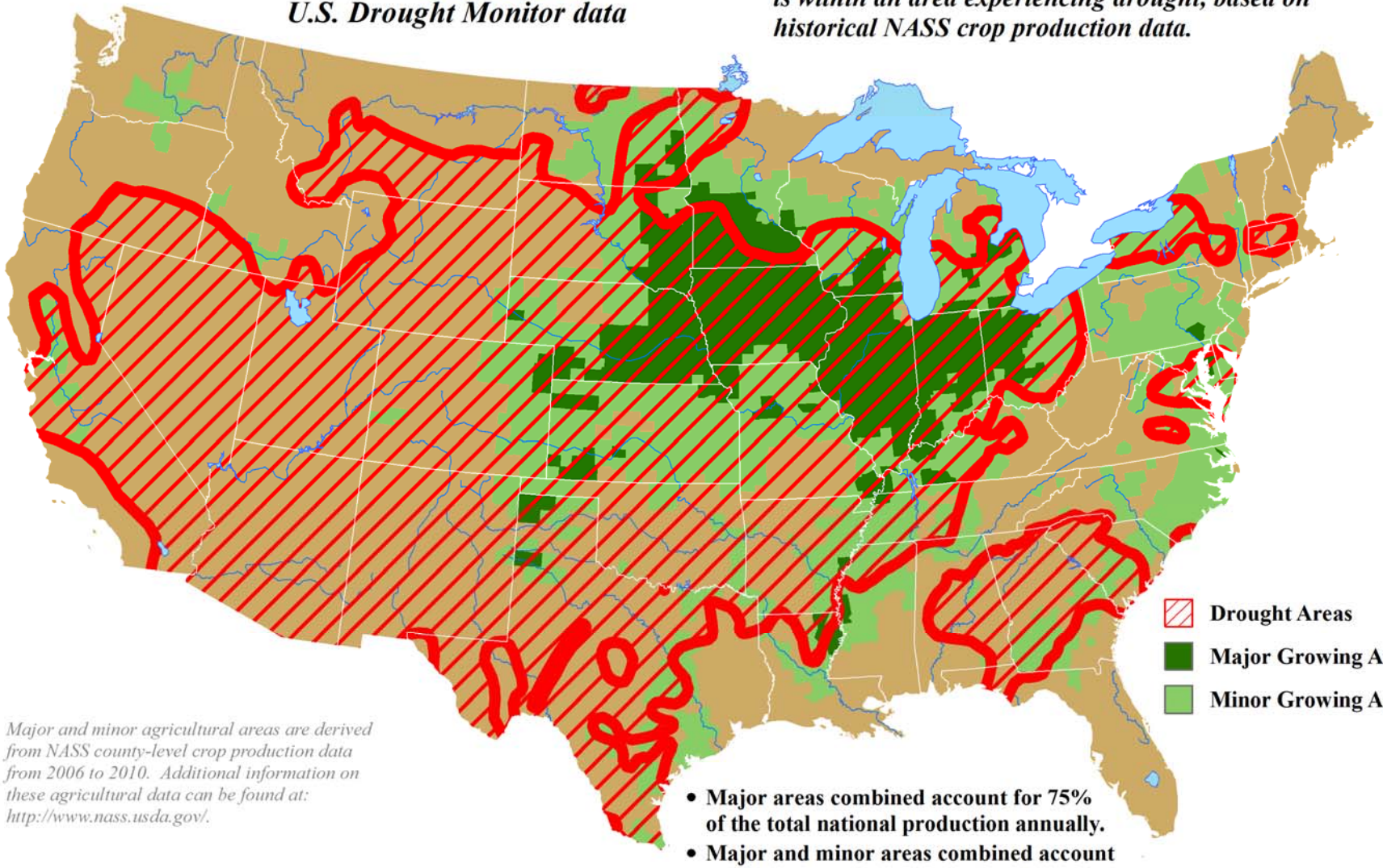


USDA Agricultural Weather Assessments
World Agricultural Outlook Board

U.S. Corn Areas Experiencing Drought

Reflects July 31, 2012
U.S. Drought Monitor data

Approximately 88% of the corn 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/.

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.

USDA Agricultural Weather Assessments
World Agricultural Outlook Board

2012 U.S. 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 25***
    - ***Most since the USDM began production in 1999***
    - ***2012 areal coverage most since the 1930's and 1950's***
  - ***Heat waves*** in March, 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**
  - **A *harbinger* of droughts to come?**

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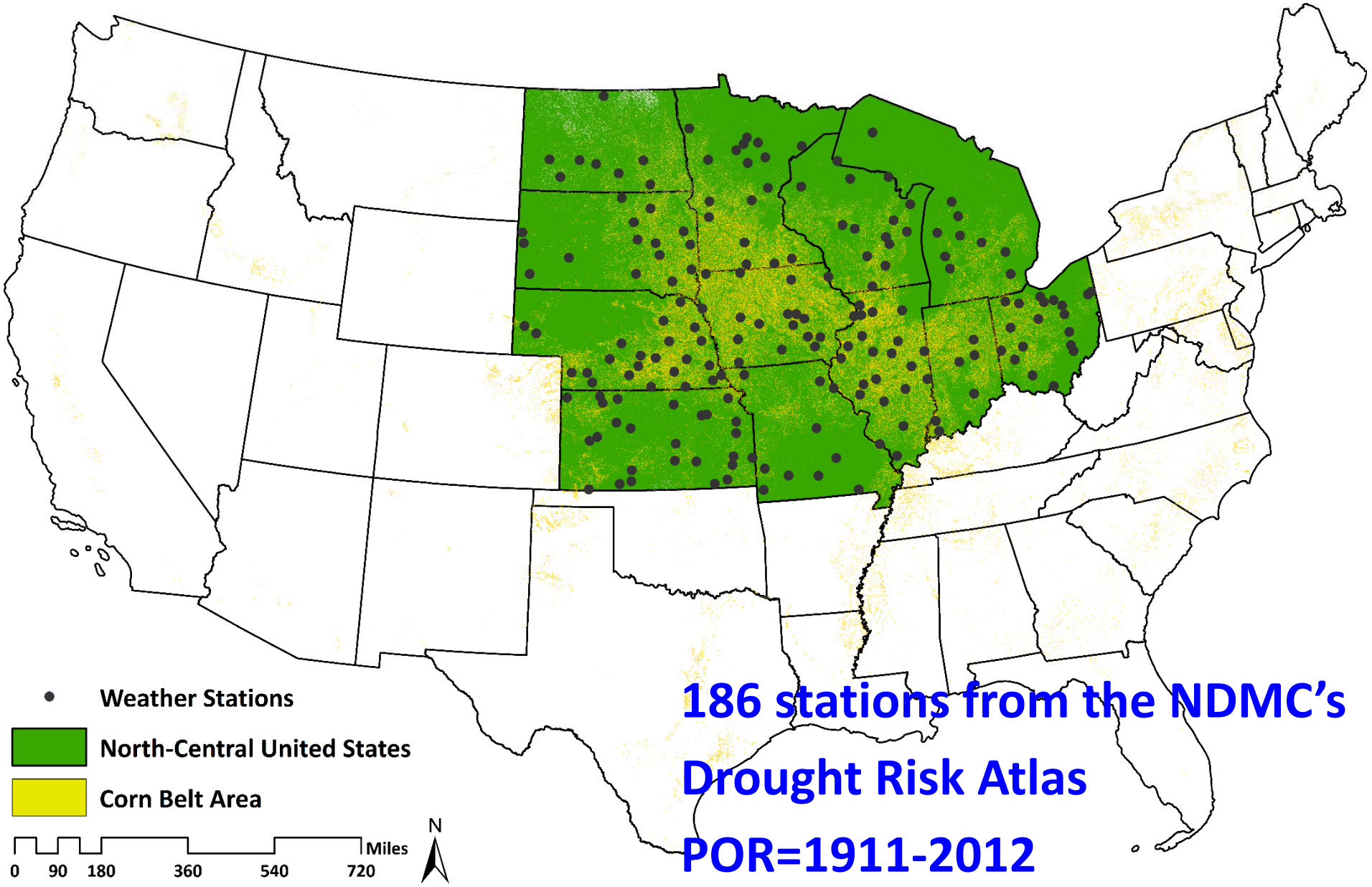
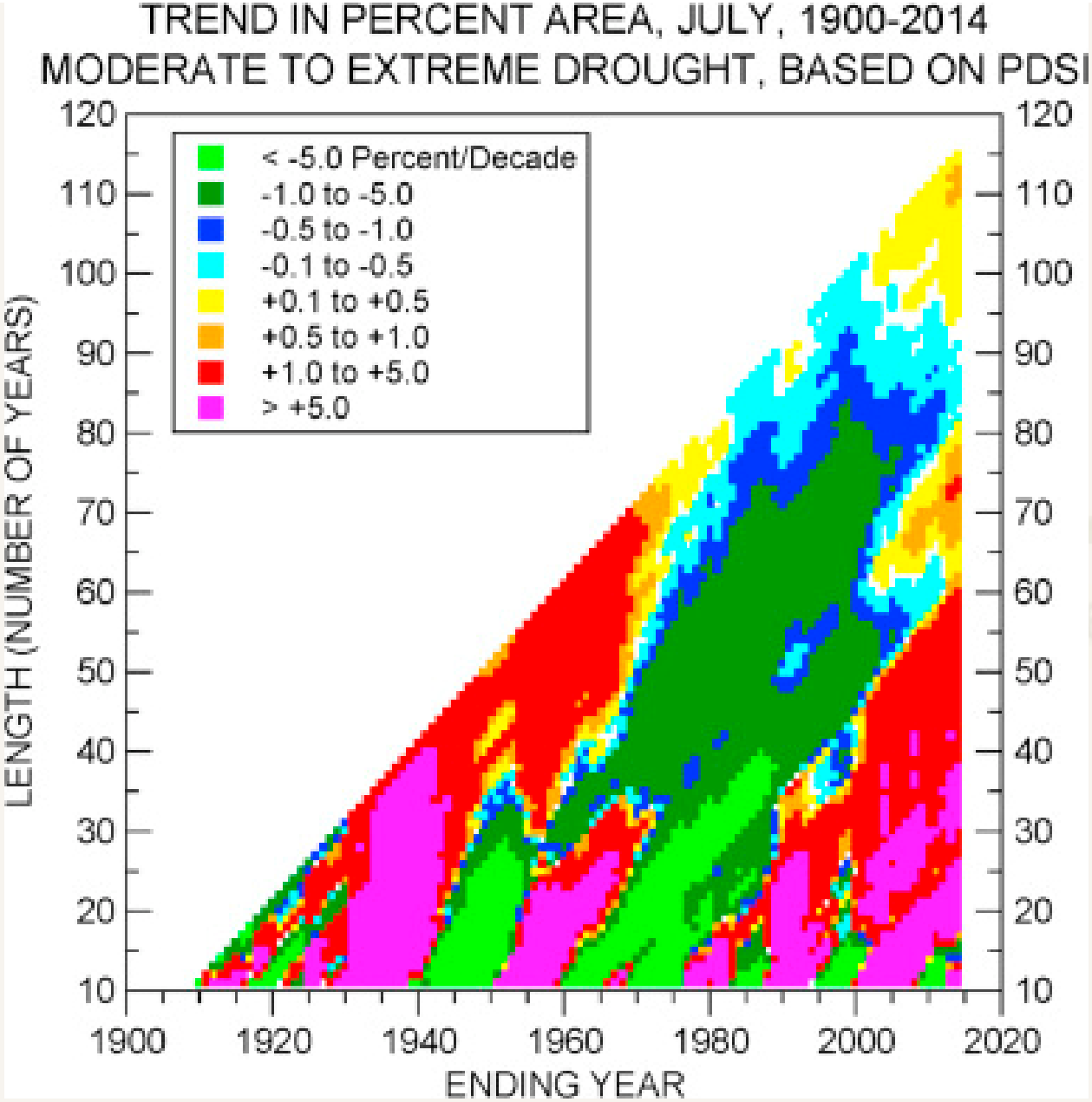
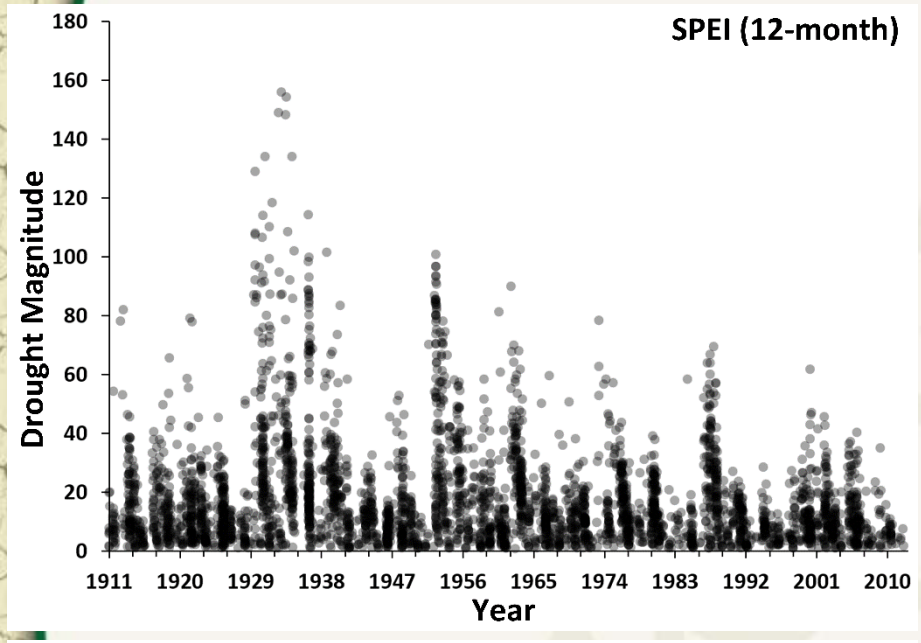
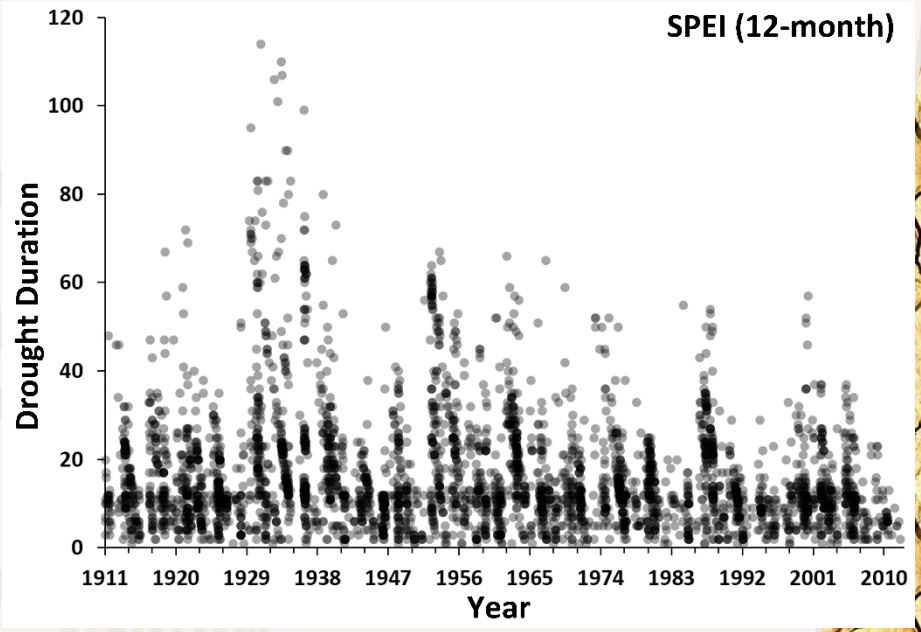

Weather Stations
North-Central United States
Corn Belt Area
Miles
0 90 180 360 540 720
N
186 stations from the NDMC's
Drought Risk Atlas
POR=1911-2012

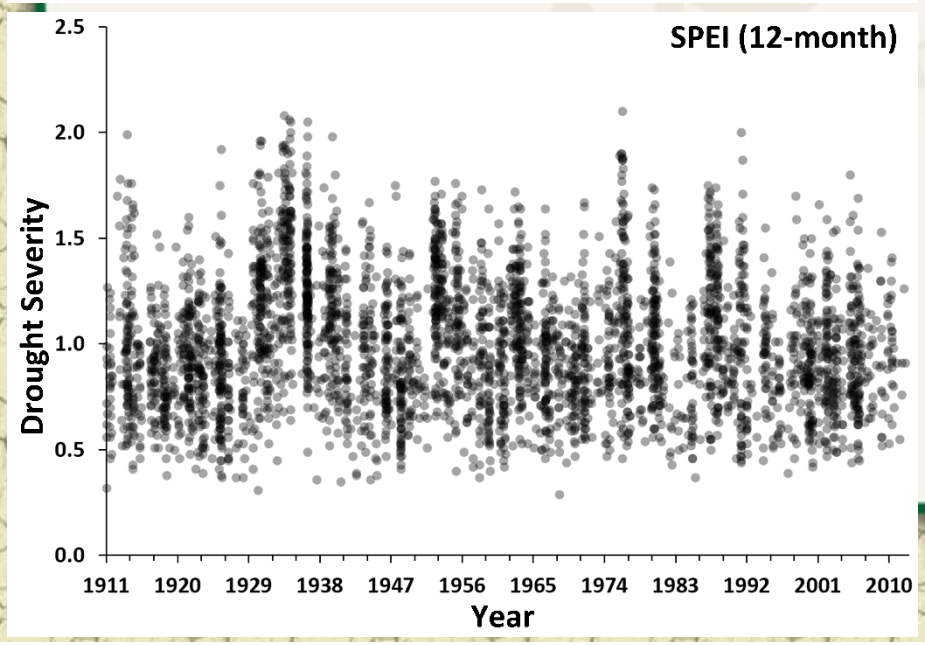


Heim, 2015 In press: WACE

Drought M, D, S for all drought events as determined by the SPEI (12-month) in the North-Central U.S. between 1911-2012







3952 drought events for 186 stations

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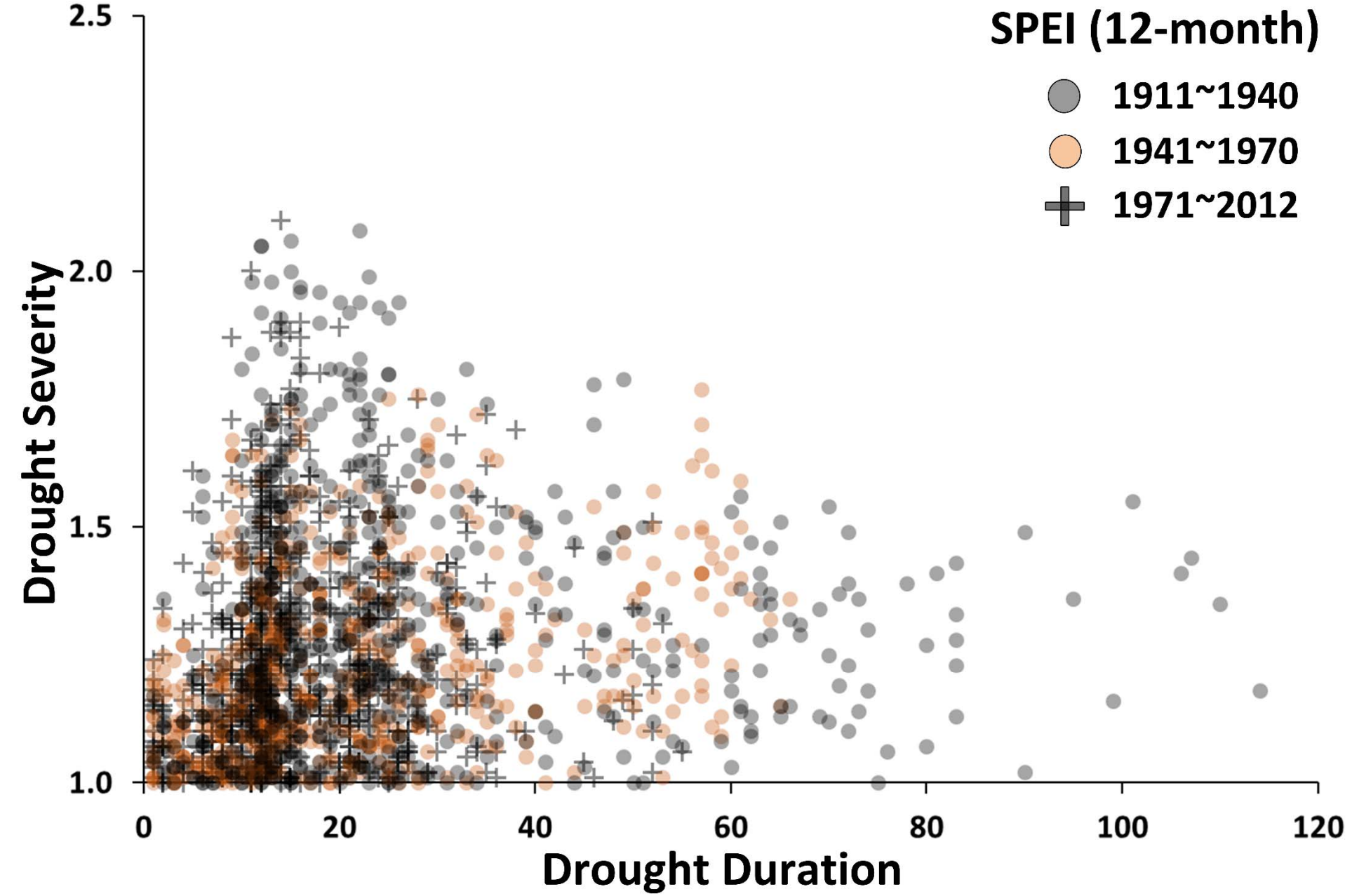
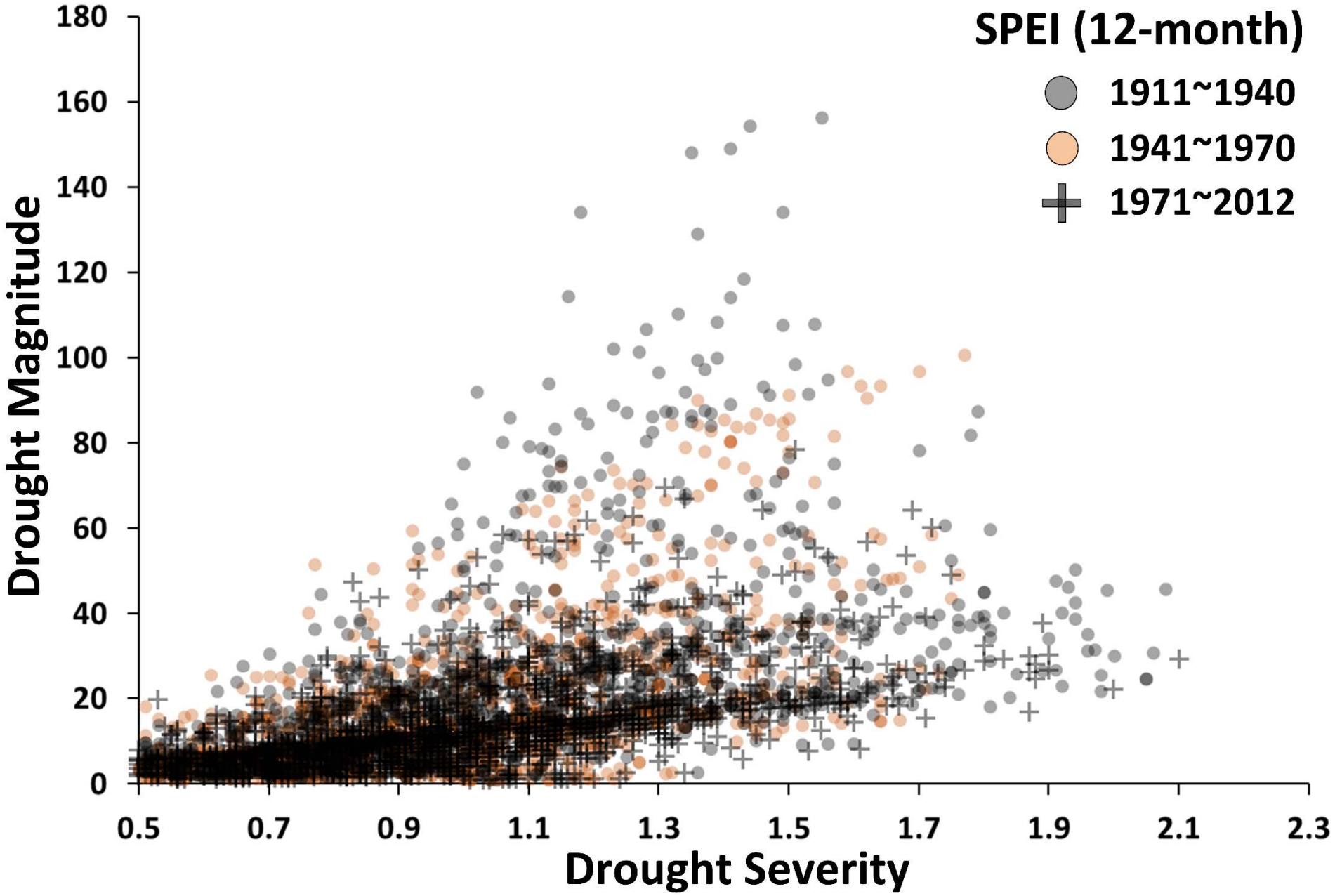
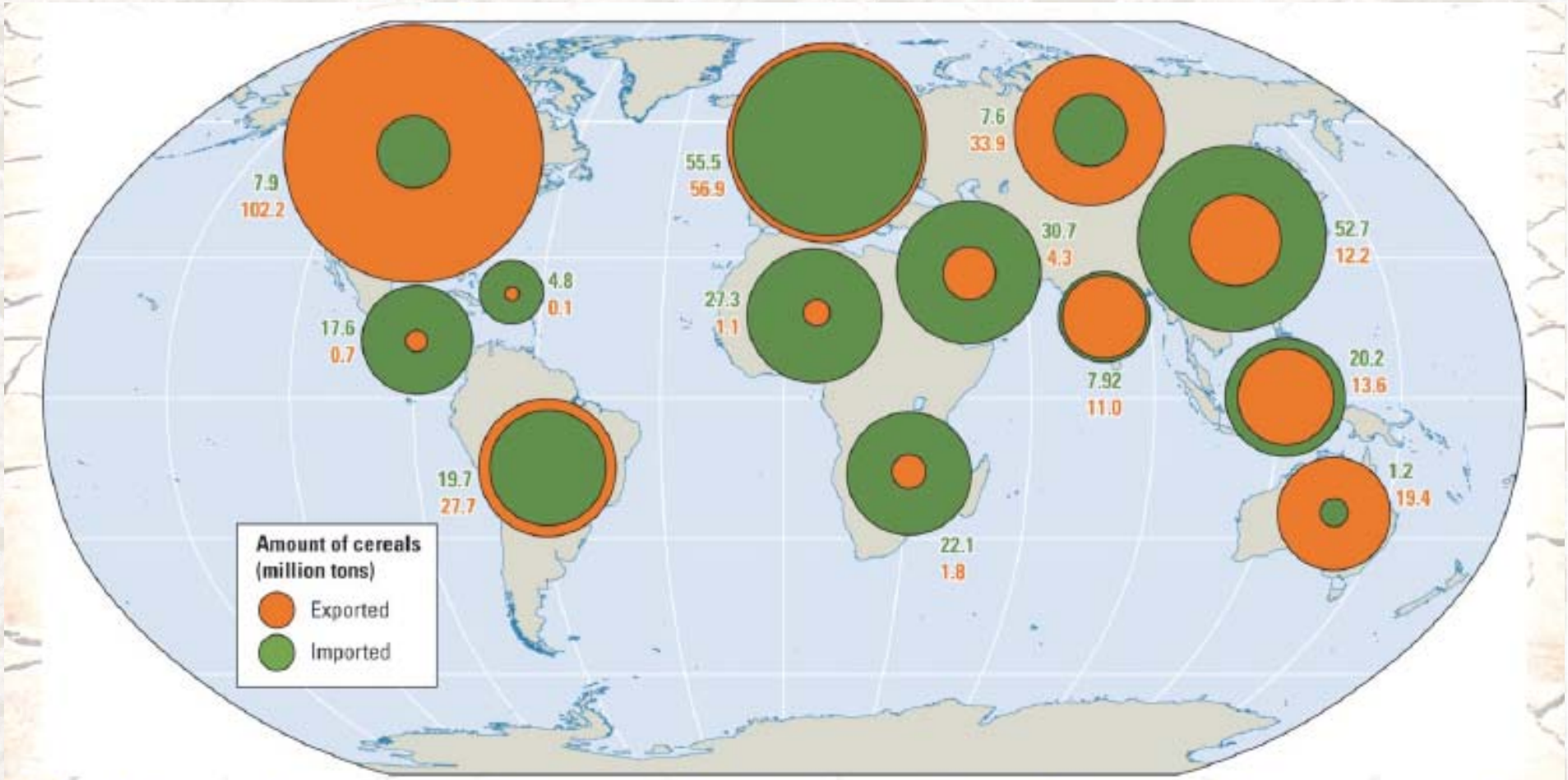
D and S in all drought events as determined by the SPEI (12-month) in the North-Central U.S. between 1911-2012



S and M in all drought events as determined by the SPEI (12-month) in the North-Central U.S. between 1911-2012

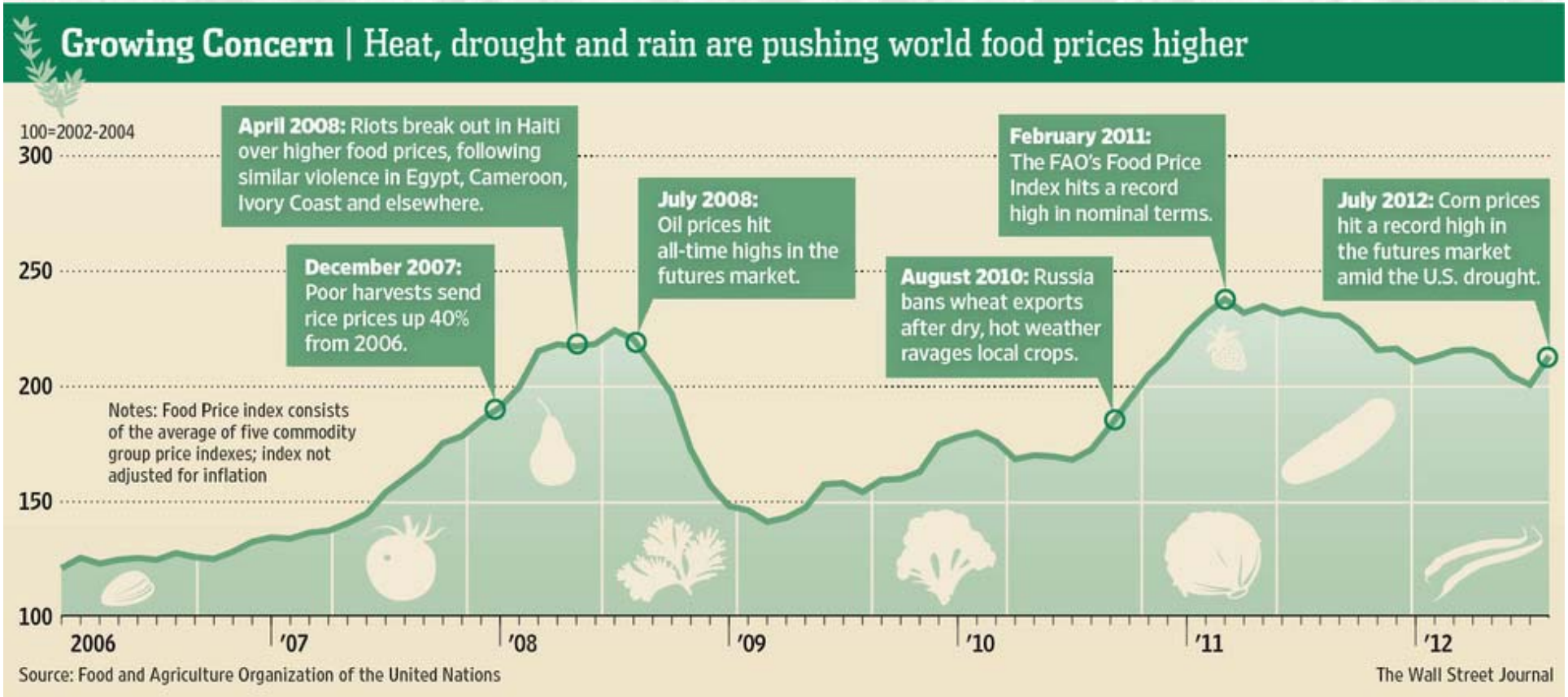


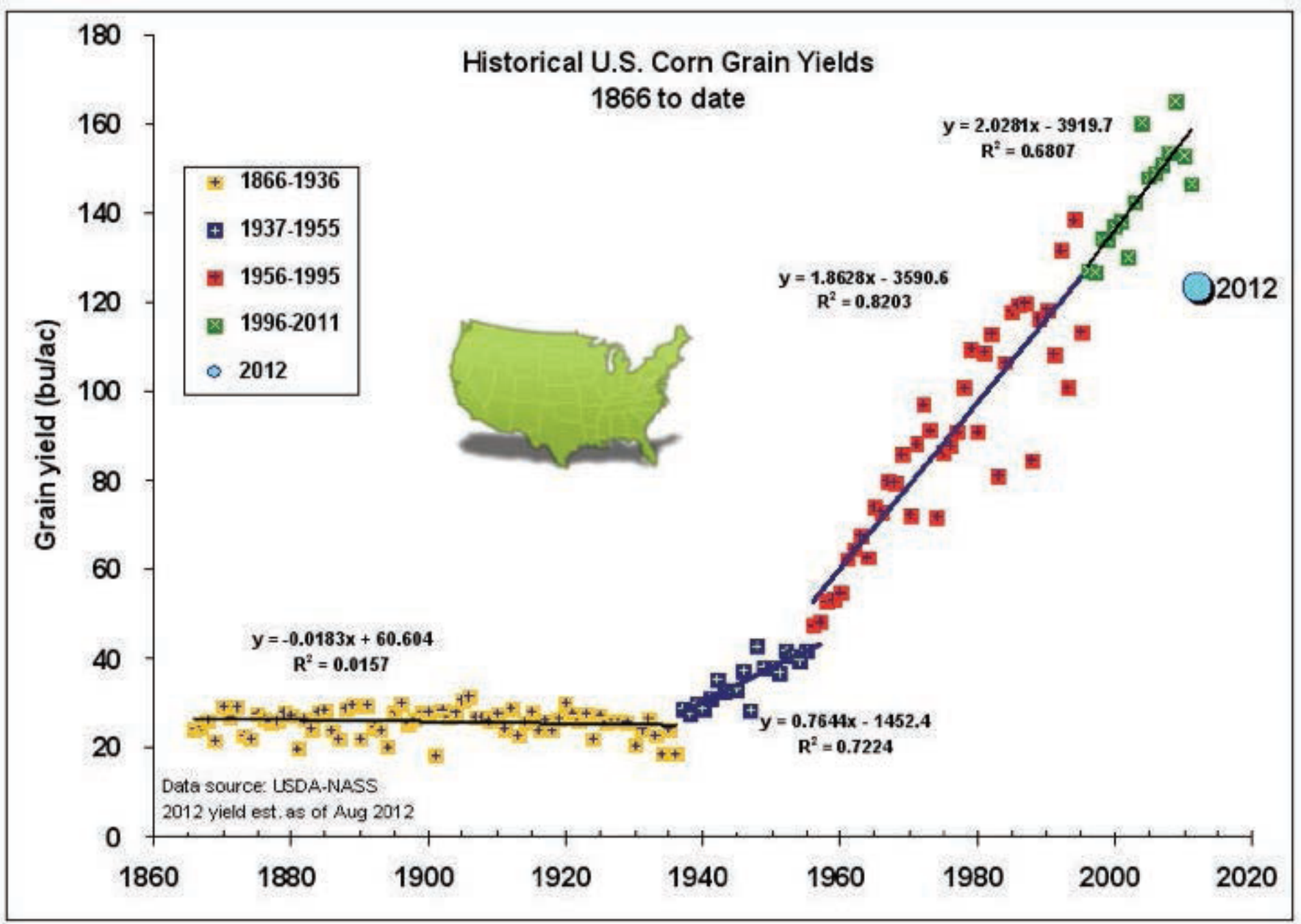
Drought and Food Security



World grain trade-depends on exports from a few countries

FAO 2009


Growing Concern | Heat, drought and rain are pushing world food prices higher
100=2002-2004
300
250
200
150
100
April 2008: Riots break out in Haiti over higher food prices, following similar violence in Egypt, Cameroon, Ivory Coast and elsewhere.
December 2007: Poor harvests send rice prices up 40% from 2006.
July 2008: Oil prices hit all-time highs in the futures market.
August 2010: Russia bans wheat exports after dry, hot weather ravages local crops.
February 2011: The FAO's Food Price Index hits a record high in nominal terms.
July 2012: Corn prices hit a record high in the futures market amid the U.S. drought.
Notes: Food Price index consists of the average of five commodity group price indexes; index not adjusted for inflation
2006
'07
'08
'09
'10
'11
'12
Source: Food and Agriculture Organization of the United Nations
The Wall Street Journal

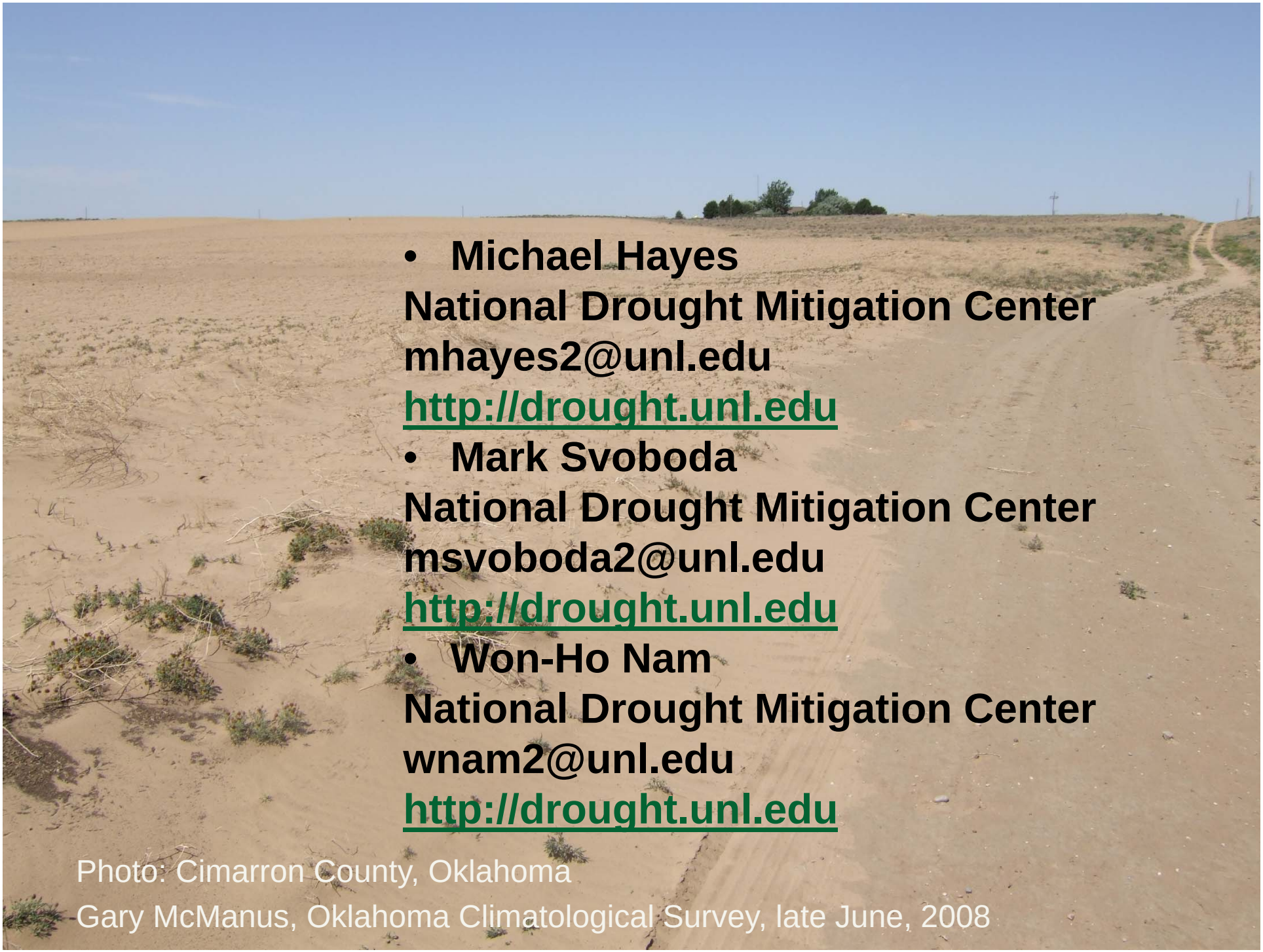


Courtesy: Marty Hoerling et al., NOAA, 2013

National Drought Mitigation Center

Final Thoughts

The linkages between drought, water, food security, and climate change illustrate complex problems, and solutions are going to depend on the information and integration that partnerships and networks provide.



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- **Won-Ho Nam**

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http://drought.unl.edu

Photo: Cimarron County, Oklahoma
Gary McManus, Oklahoma Climatological Survey, late June, 2008