The National Drought Mitigation Center

Building a Conduit to bring Science to Citizens

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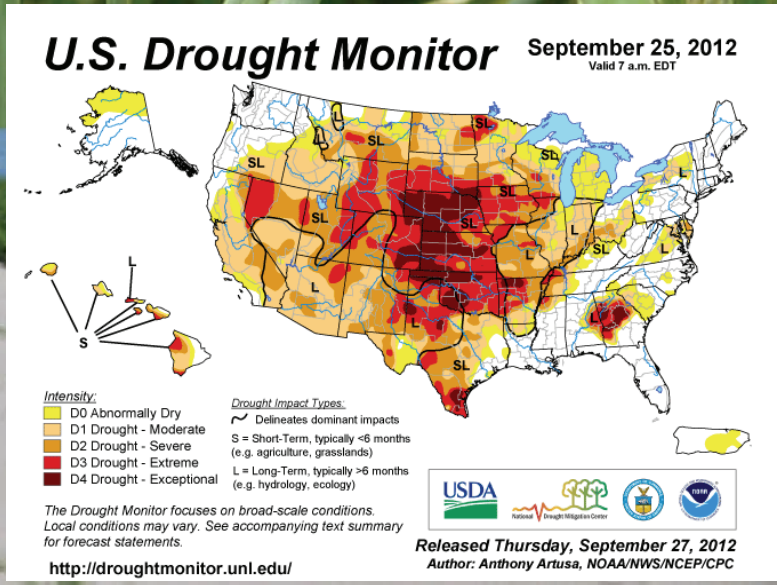
School of Natural Resources
University of Nebraska-Lincoln

International Conference on Data, Information and Knowledge for Water Governance in the Networked Society

June 9-11, 2014
Seville, Spain

National Drought Mitigation Center



Outline

- Background: The National Drought Mitigation Center
- The United States Drought Monitor
- New Drought Risk Atlas for the U.S.
- Questions

Types of Rain Gages

National Drought Mitigation Center

- Established in 1995
- Founder: Dr. Don Wilhite
- Current Director: Dr. Mike Hayes
- The NDMC is a *soft money*, grant funded organization
- Current staff: 16 people, tremendous diversity of expertise

National Drought Mitigation Center

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

www.drought.unl.edu

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National Drought Mitigation Center

The NDMC is a ***critical National resource!***

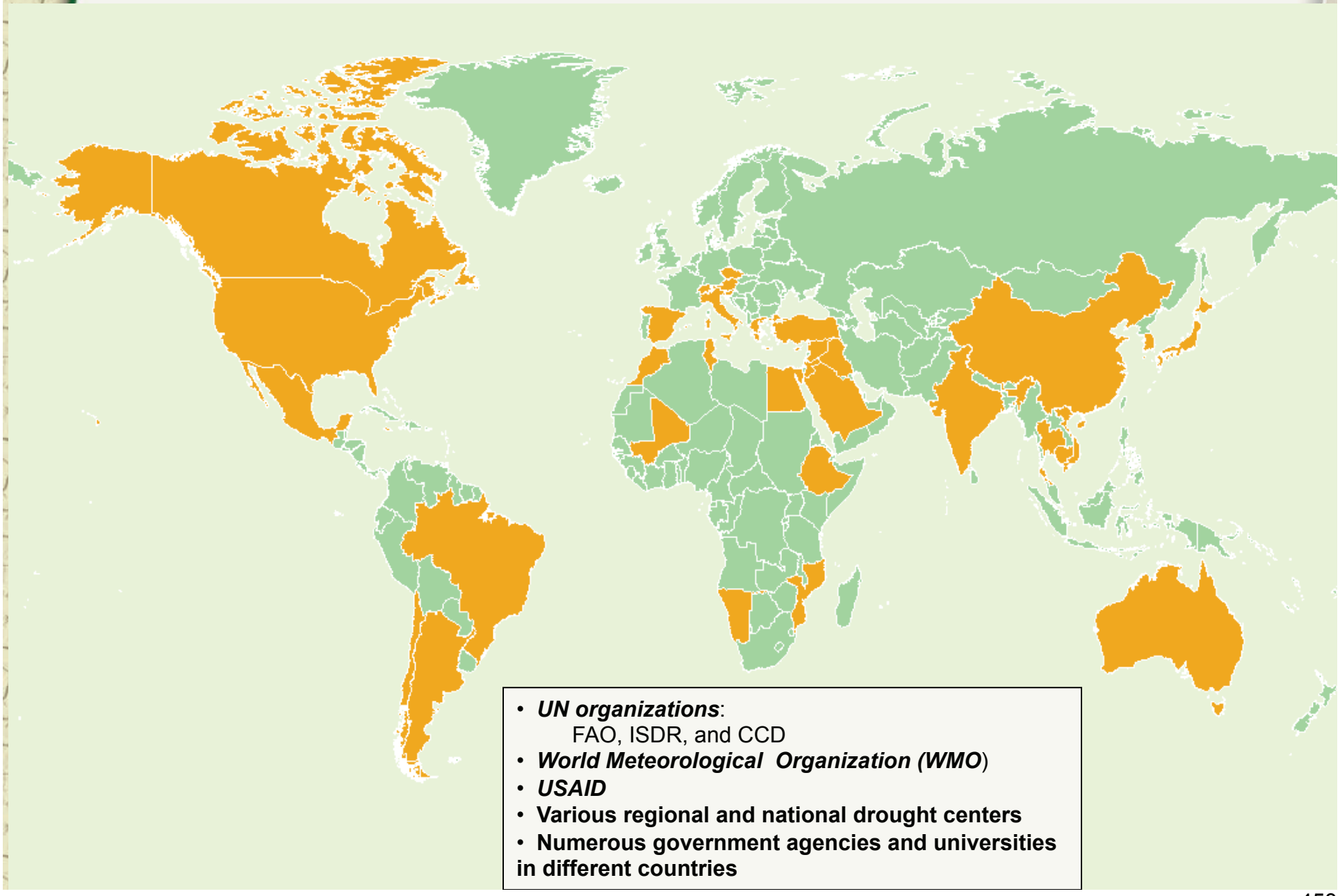
- "***Go-to"*** resource of drought-related information (example: 750 media contacts in 2012, over 1,000 in 2013)
- Drought monitoring (home of U.S. Drought Monitor and many other tools)
- "Boundary organization" that bridges the gap between *science and stakeholders*
- Provides leadership at the state and national level on drought preparedness
- International reputation, international resource
- Only center in U.S. that focuses on drought

NDMC Program Objectives

- ***Improve the science*** of drought monitoring, planning
- Build ***av*** ***npacts*** on socie ow human ***y*** to drought
- Focus th n the importance of ***drought policy and planning*** in the wise stewardship of natural resources
- Conduct and maintain operational tools, research, outreach and training

Bringing ALL information associated with Drought to the public via various means and techniques.

NDMC International Activities

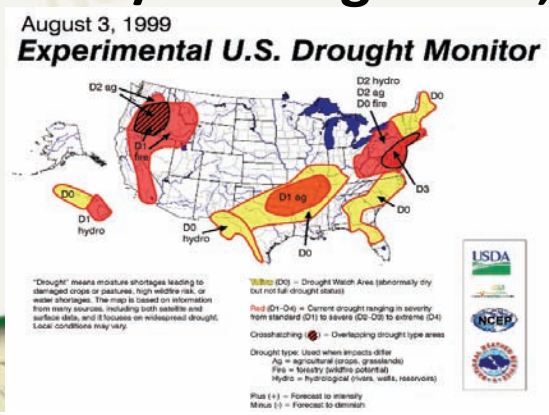


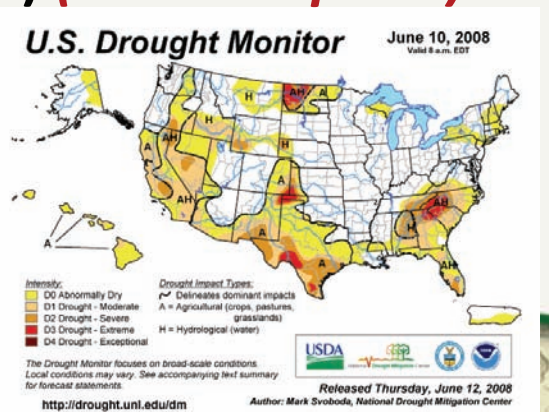
- ***UN organizations***:
  FAO, ISDR, and CCD
- ***World Meteorological Organization (WMO)***
- ***USAID***
- **Various regional and national drought centers**
- **Numerous government agencies and universities in different countries**

The U.S. Drought Monitor

Since 1999, NOAA (CPC, NCDC, WRCC), USDA, and the NDMC have produced a weekly composite drought map -- the U.S. Drought Monitor -- with input from numerous federal and non-federal agencies

- **Western Region Climate Center on board 2008**
- **11 authors in all**
- **No direct "line item" funding in any budget**
- **Incorporate relevant information and products from all entities (and levels of government) dealing with drought (Regional Climate Center's, State Climatologists, federal/state agencies, etc.) *(~350+ experts)***





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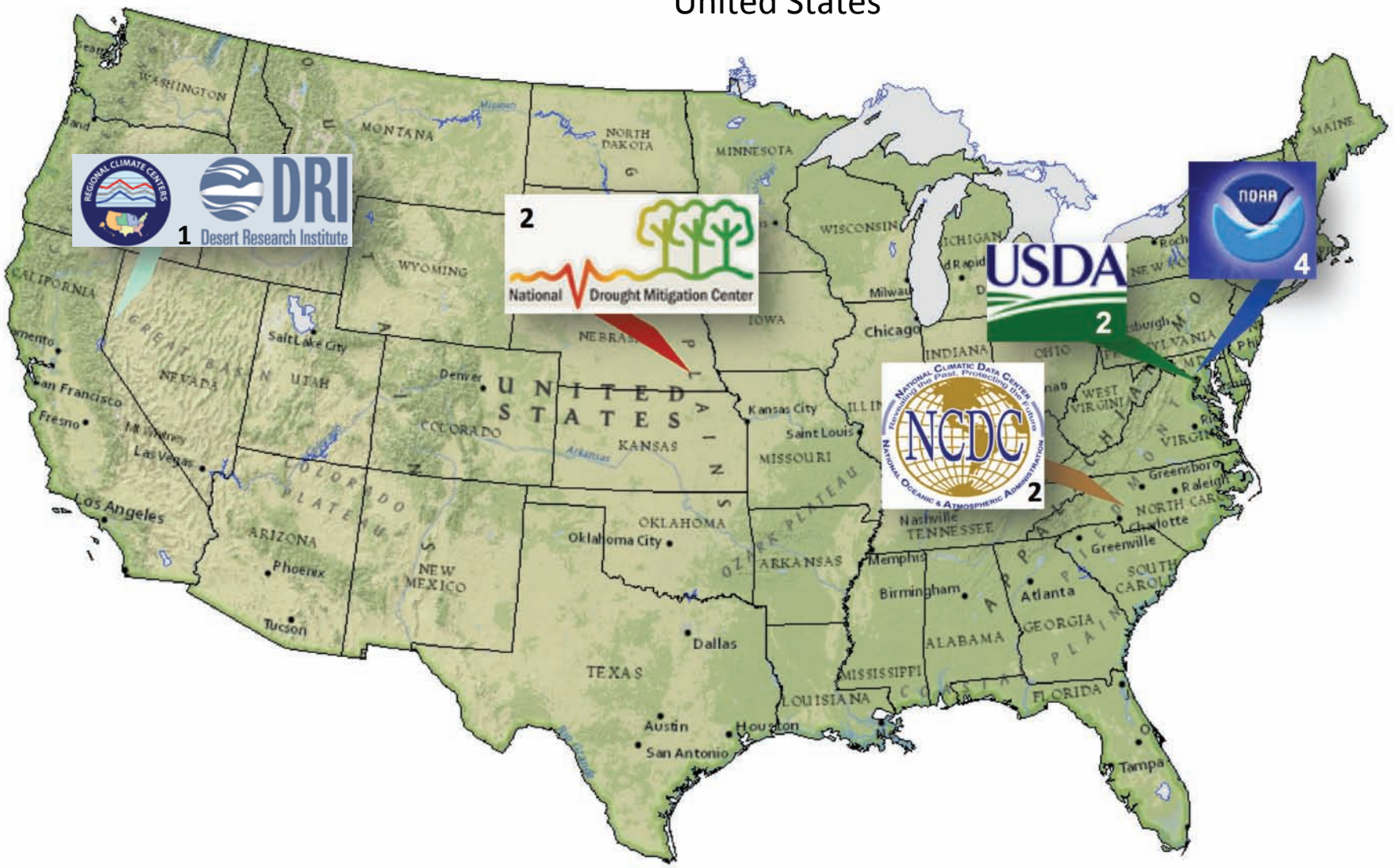
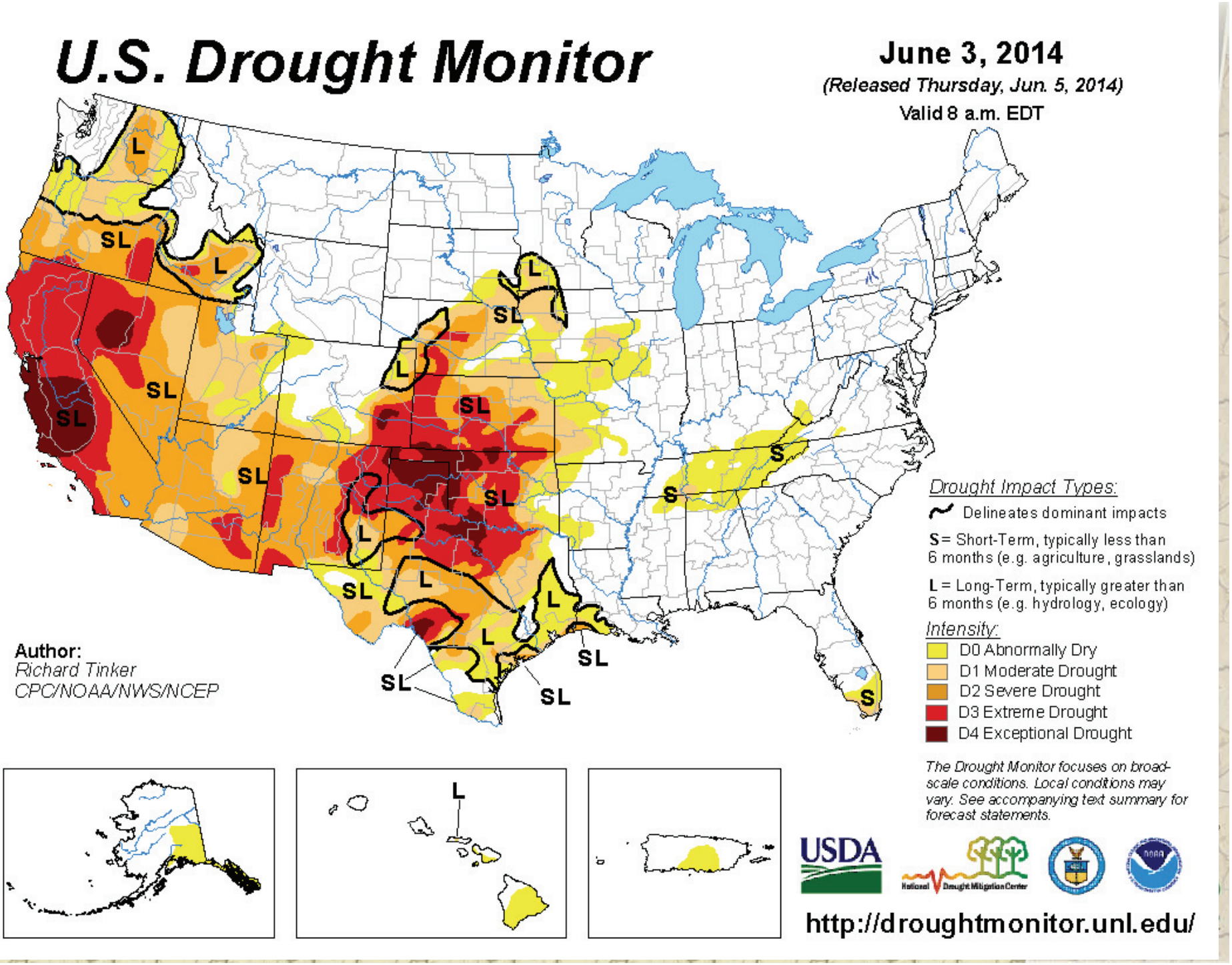
The 11 Drought Monitor Authors are located within various partnering agencies throughout the United States



USDA Agricultural Weather Assessments
World Agricultural Outlook Board


U.S. Drought Monitor
June 3, 2014
(Released Thursday, Jun. 5, 2014)
Valid 8 a.m. EDT
Author:
Richard Tinker
CPC/NOAA/NWS/NCEP
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/

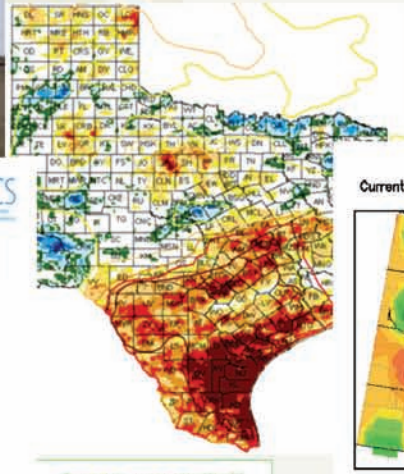
NDMC's Role in the "*Process*"

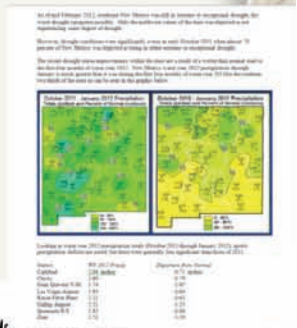
- **2 of 11 authors:** Brian Fuchs and Mark Svoboda (Mike Hayes is a past author)
- **Hosting the USDM Listserver**
  - 350+ participants contributing each week
- **Dissemination of data/information** to stakeholders (media, govt. agencies, public etc)
  - Official Archive of all USDM related data and products
- **Hosting the USDM webpage and archive**
  - **~3.5M**+page views & **~2M**+visitors each year

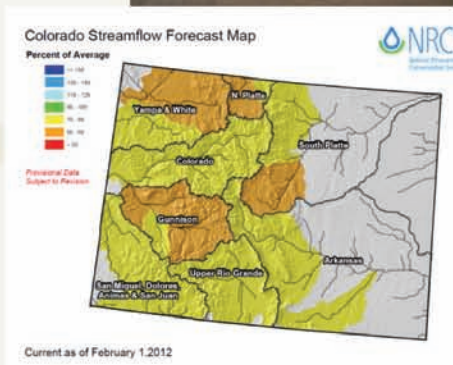
The Importance of Local Expert Input

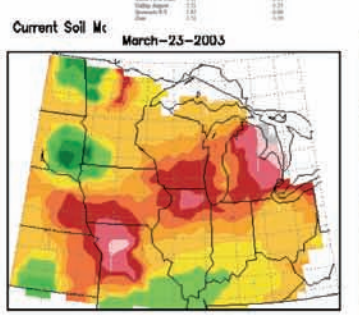
- **The U.S. Drought Monitor Team Relies on Field Observation Feedback from the Local Experts for Impacts Information & "Ground Truth"**
  - ***Listserver (350+ Participants: 2/3 Federal, 1/3 State/Univ.)***

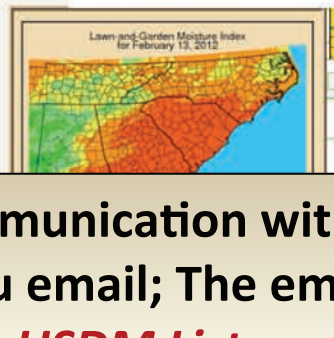
- **Local NWS & USDA/NRCS Offices**
- **State Climate Offices**
- **State Drought Task Forces**
- **Regional Climate Centers**

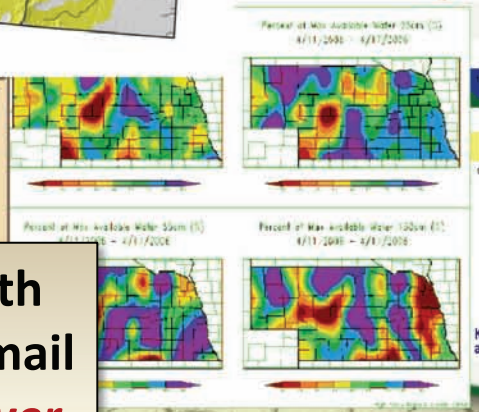


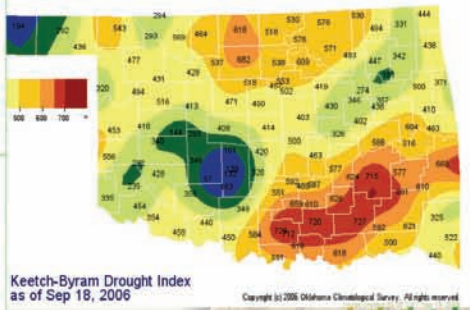










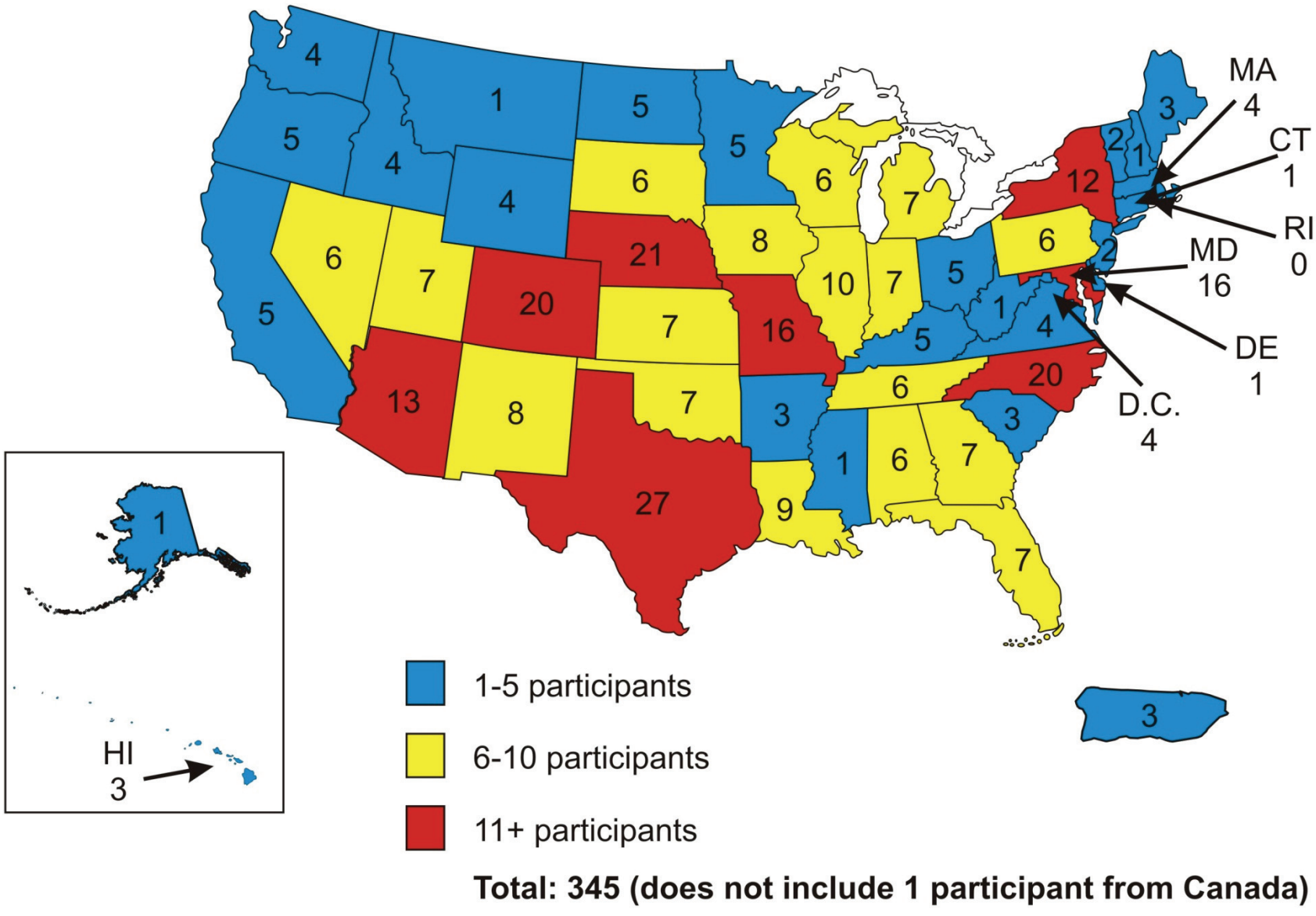


The primary means of communication with our "eyes in the field" is thru email; The email "Expert Group" is called the *USDM Listserver*

National Drought Mitigation Center

USDM Listserve Subscribers

(as of November 1, 2013)



The Drought Monitor Concept

- A ***consolidation*** of indices and indicators into one comprehensive national drought map.

  A "*Convergence of Evidence*" approach

- Trying to capture these drought characteristics:
  - the drought's magnitude (duration + intensity)
  - spatial extent
  - probability of occurrence
  - Impacts

- Rates drought intensity by **percentile rankings**

U.S. Drought Monitor Map

Drought Intensity Categories

D0 **Abnormally Dry** (30%tile)

D1 Drought – **Moderate** (20%tile)

D2 Drought – **Severe** (10%tile)

D3 Drought – **Extreme** (5%tile)

D4 Drought – **Exceptional** (2%tile)

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Open data sharing:
Very important to the process

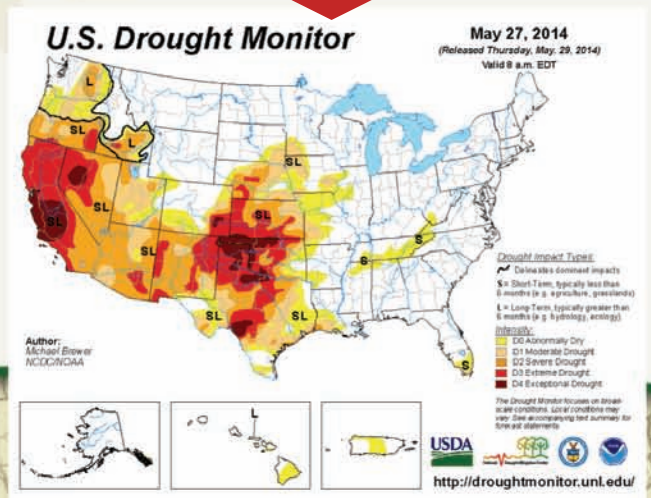
Local Experts:
contributing data, knowledge, and impact information

Creating the map
openly with the data and methods available to anyone

Flexibility:
Being able to change as information changes

Listening:
to stakeholders and accommodating their needs

11 Authors with various expertise producing a weekly product



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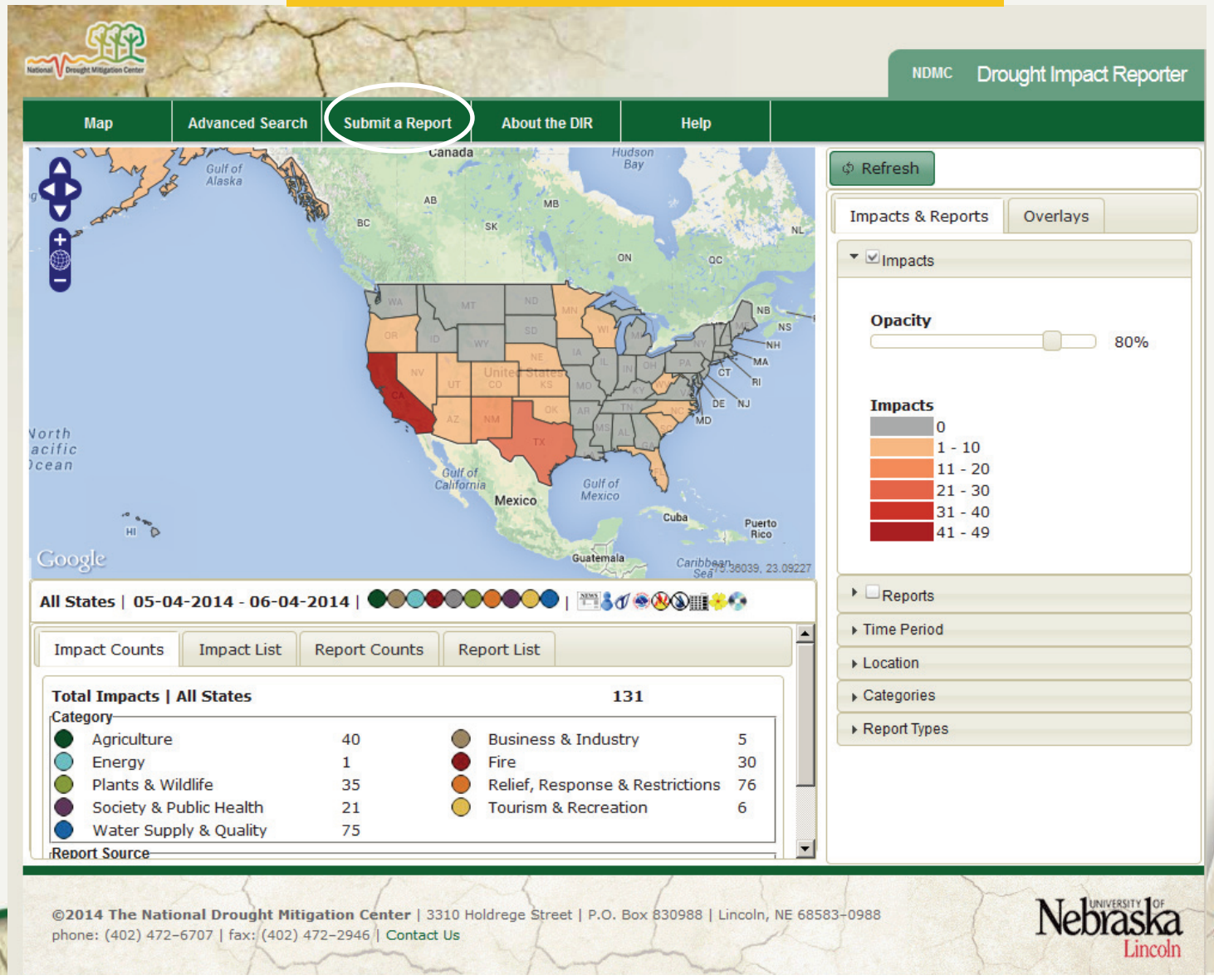
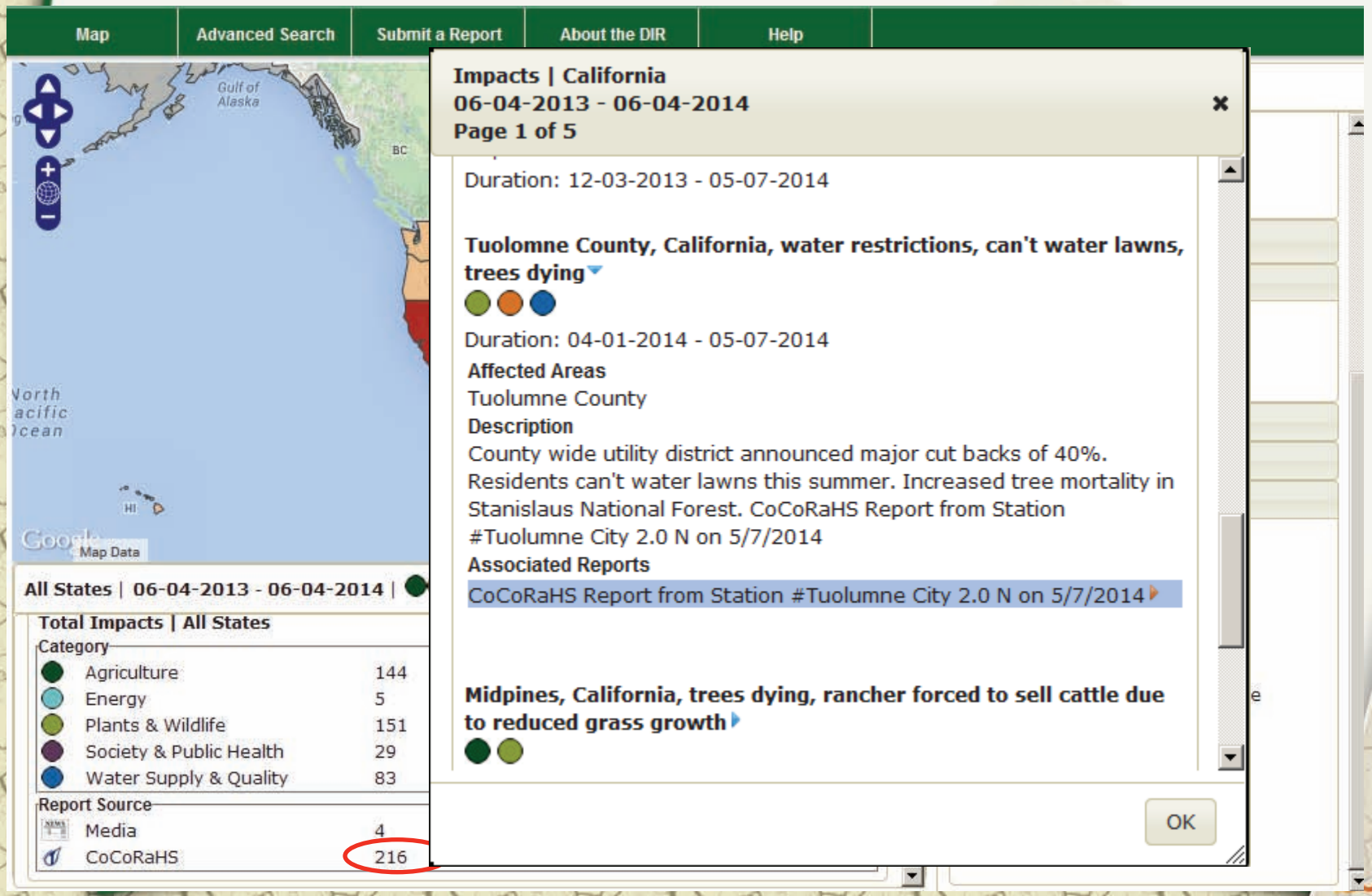
Drought Impact Information

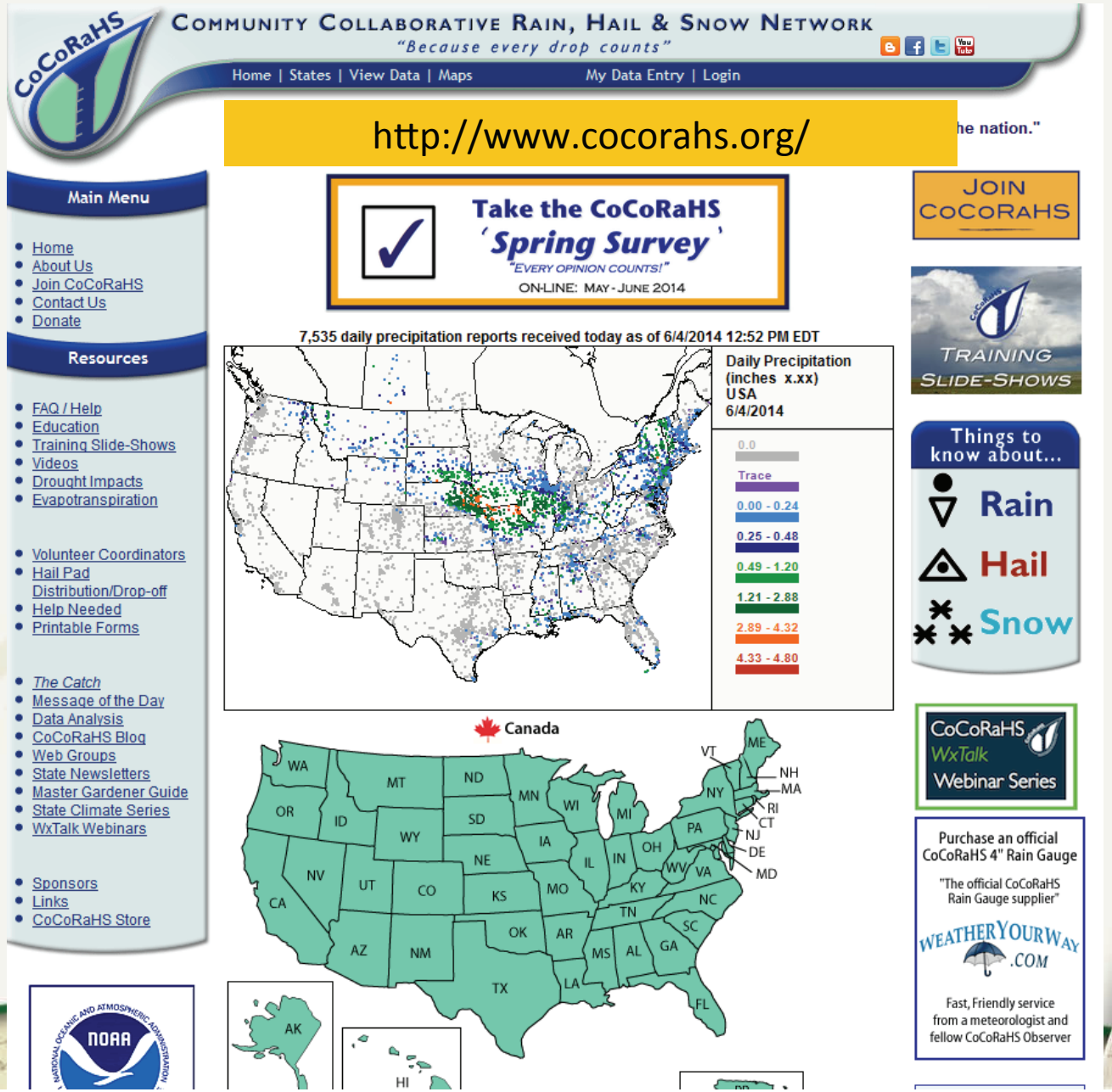
http://droughtreporter.unl.edu/

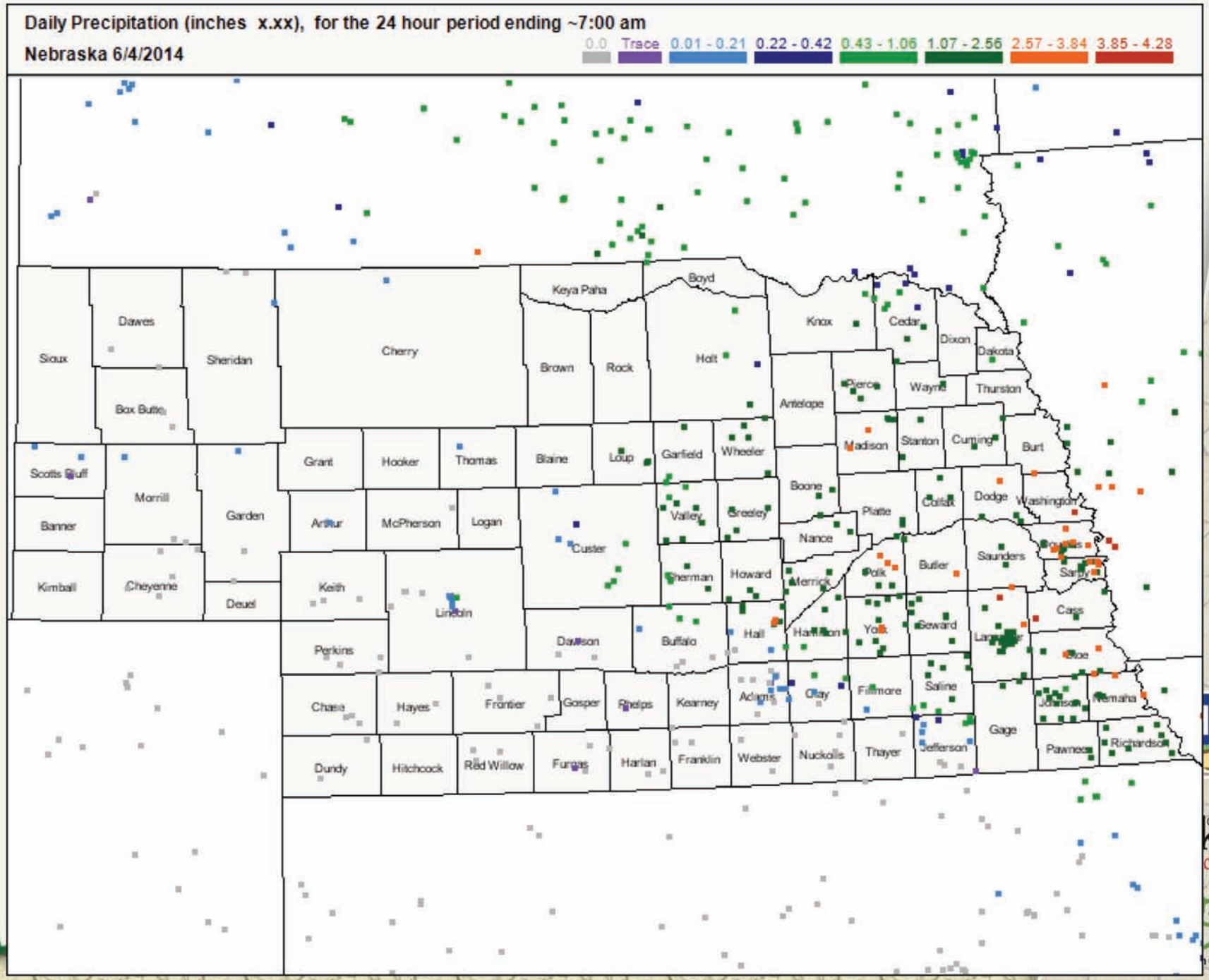


Citizens Providing Impact Information



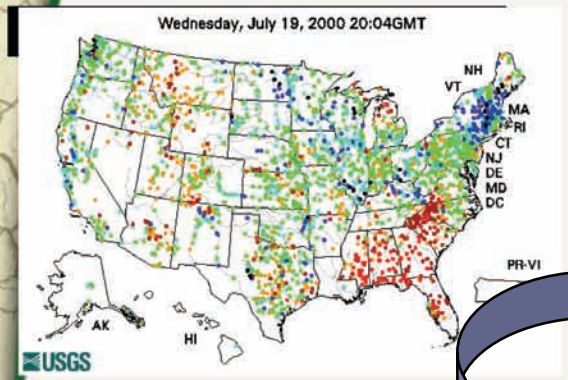
Citizens Providing Data



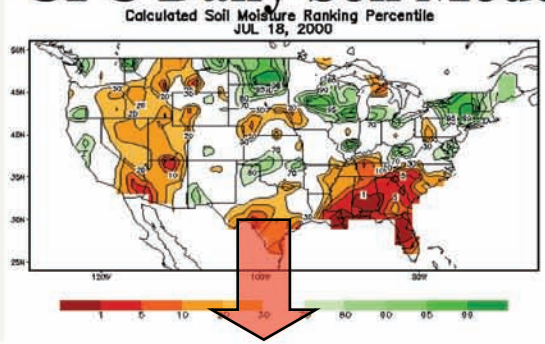

Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am
Nebraska 6/4/2014
0.0 Trace 0.01 - 0.21 0.22 - 0.42 0.43 - 1.06 1.07 - 2.56 2.57 - 3.84 3.85 - 4.28
Sioux
Dawes
Sheridan
Cherry
Keya Paha
Boyd
Brown
Rock
Holt
Knox
Cedar
Dixon
Dakota
Box Butte
Antelope
Pierce
Wayne
Thurston
Scotts Bluff
Morrill
Grant
Hooker
Thomas
Blaine
Loup
Garfield
Wheeler
Madison
Stanton
Cuming
Burt
Banner
Garden
Arthur
McPherson
Logan
Valley
Greeley
Boone
Platte
Colfax
Dodge
Washington
Kimball
Cheyenne
Deuel
Keith
Custer
Sherman
Howard
Nance
Merrick
Polk
Butler
Saunders
Sarpy
Perkins
Lincoln
Dawson
Buffalo
Hall
Hamilton
York
Seward
Lancaster
Cass
Chase
Hayes
Frontier
Gosper
Phelps
Kearney
Adams
Clay
Fillmore
Saline
Johnson
Nemaha
Gage
Dundy
Hitchcock
Red Willow
Furnas
Harlan
Franklin
Webster
Nuckolls
Thayer
Jefferson
Pawnee
Richardson

Principal Drought Monitor Inputs

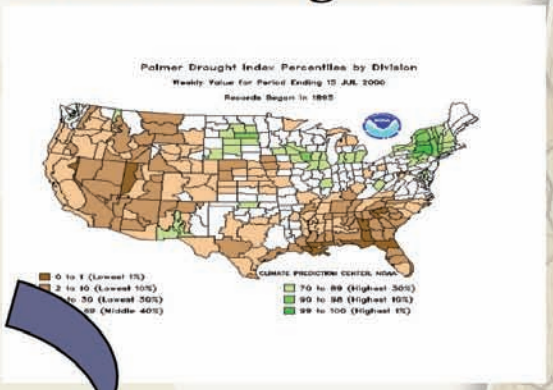
USGS Streamflow



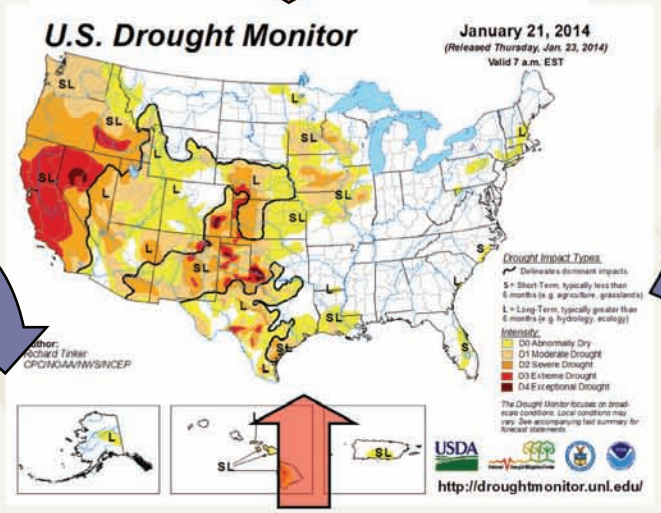
CPC Daily Soil Model



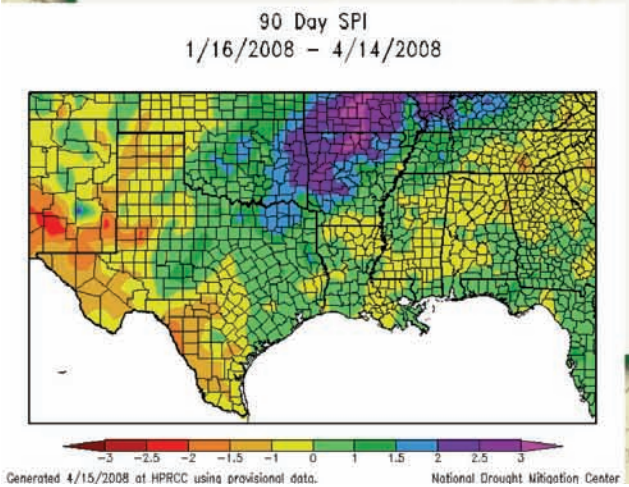
Palmer Drought Index



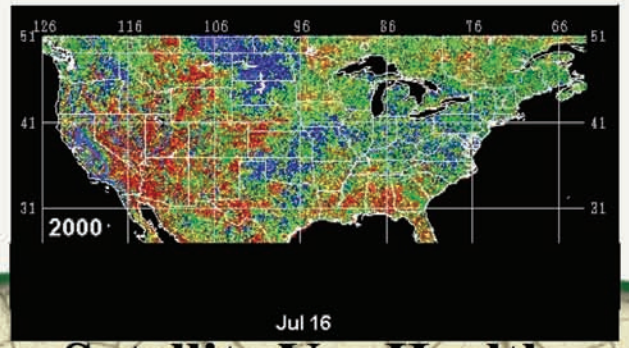
U.S. Drought Monitor



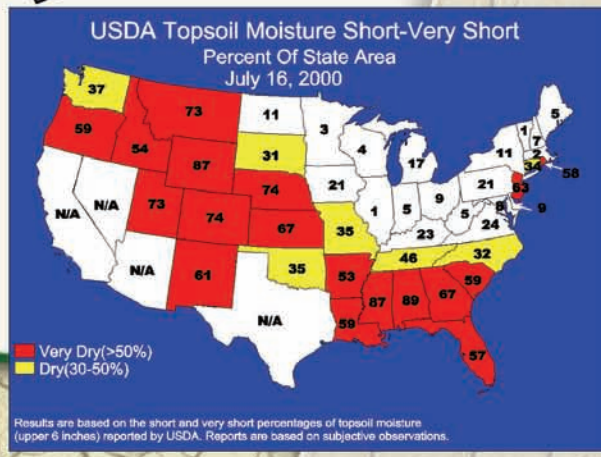
SPI Drought Index



Satellite Veg Health



USDA Soil Ratings



U.S. Drought Monitor

Integrates Key Drought Indicators:

- Palmer Drought Index
- SPI (1 month to 36 months)
- KBDI
- Modeled Soil Moisture
  - NLDAS
- 7-14 Day Avg. Streamflow
- Precipitation Anomalies

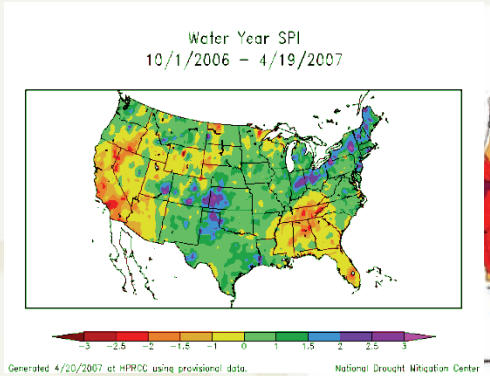
Growing Season:

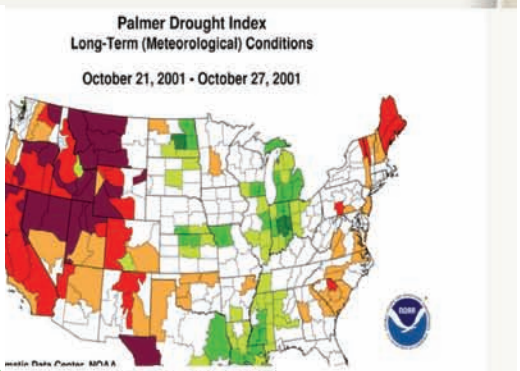
- Crop Moisture Index
- Sat. Veg. Health Index
- VegDRI/ESI/etc.
- Soil Moisture
- Mesonets
- State/Regional

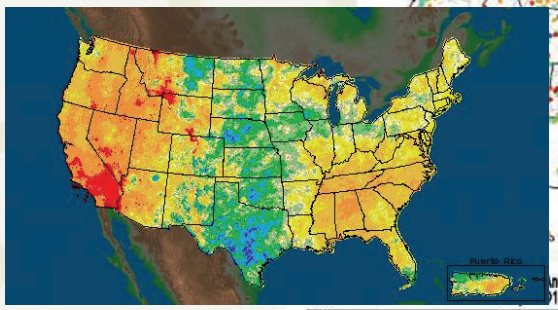
In The West:

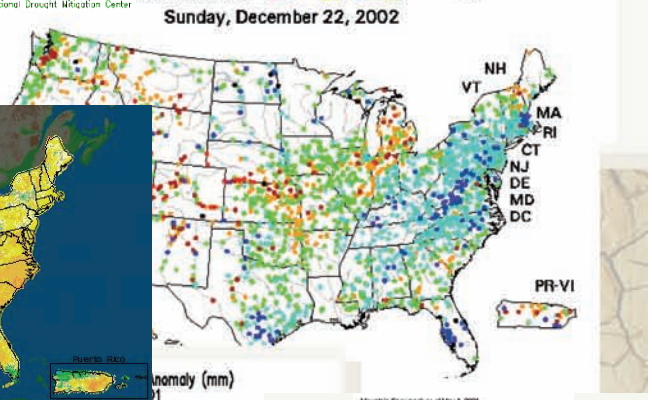
- SWSI
- Reservoir levels
- Snowpack (SNOTEL)
- SWE
- Streamflow

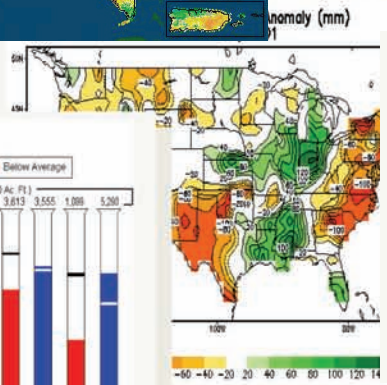
Created in ArcGIS

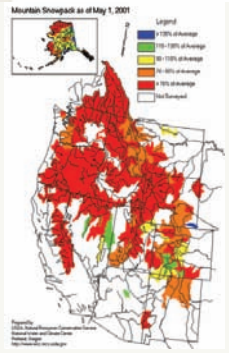


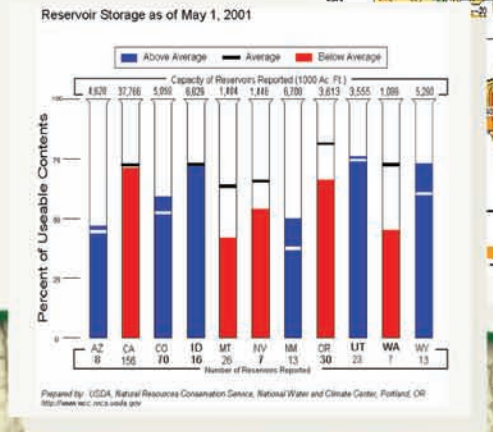












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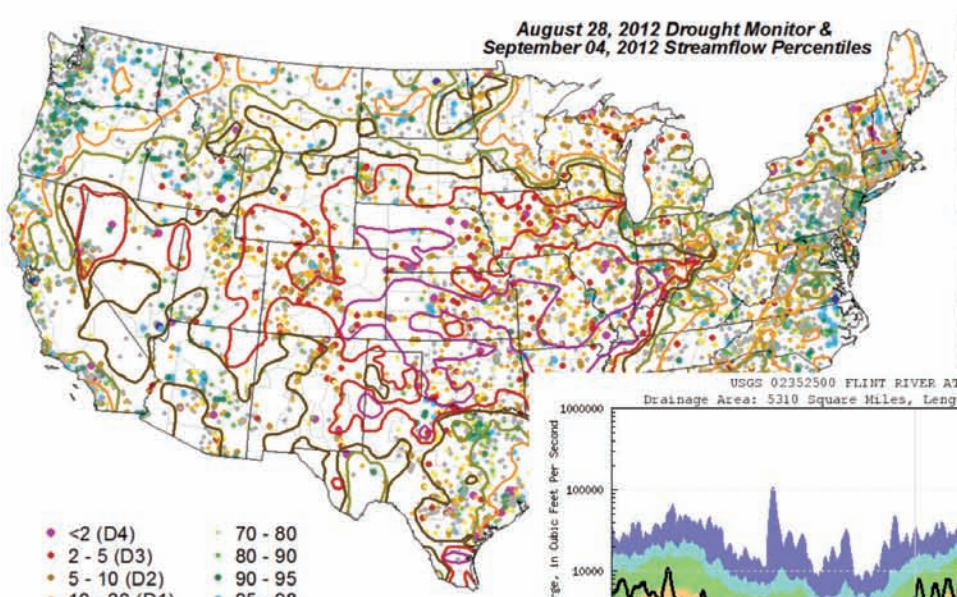
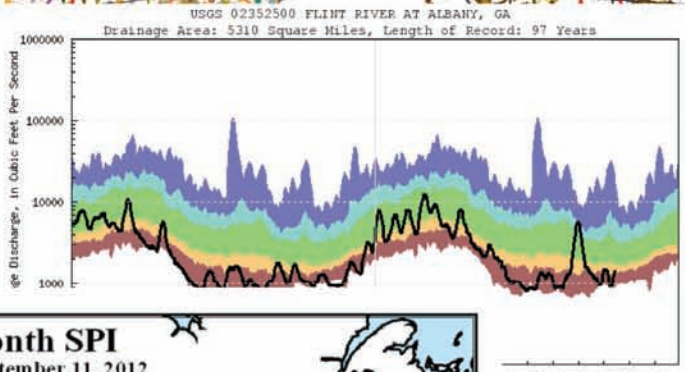
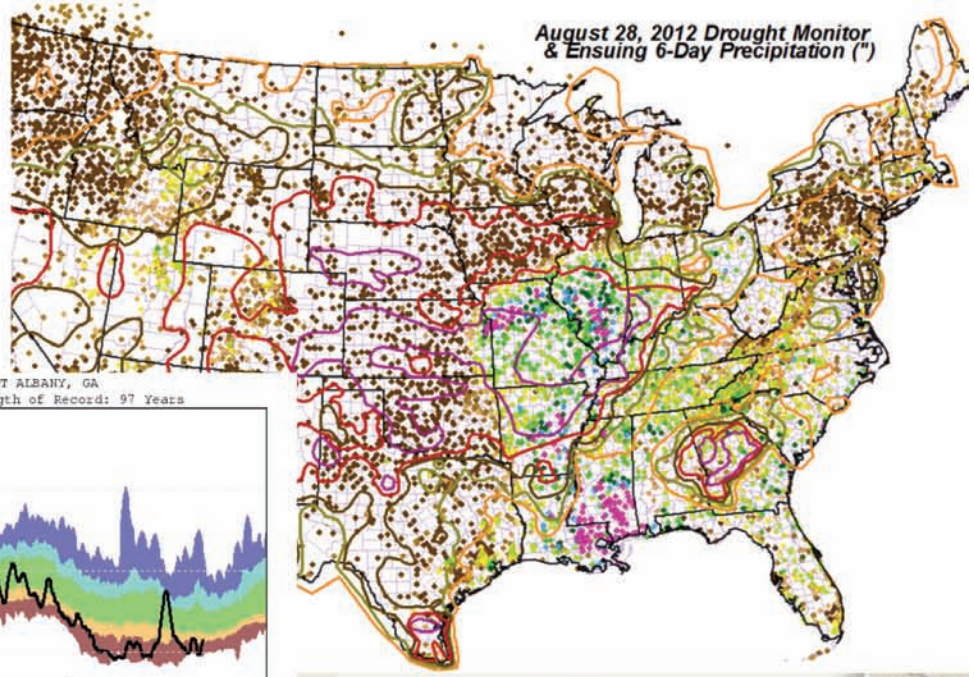
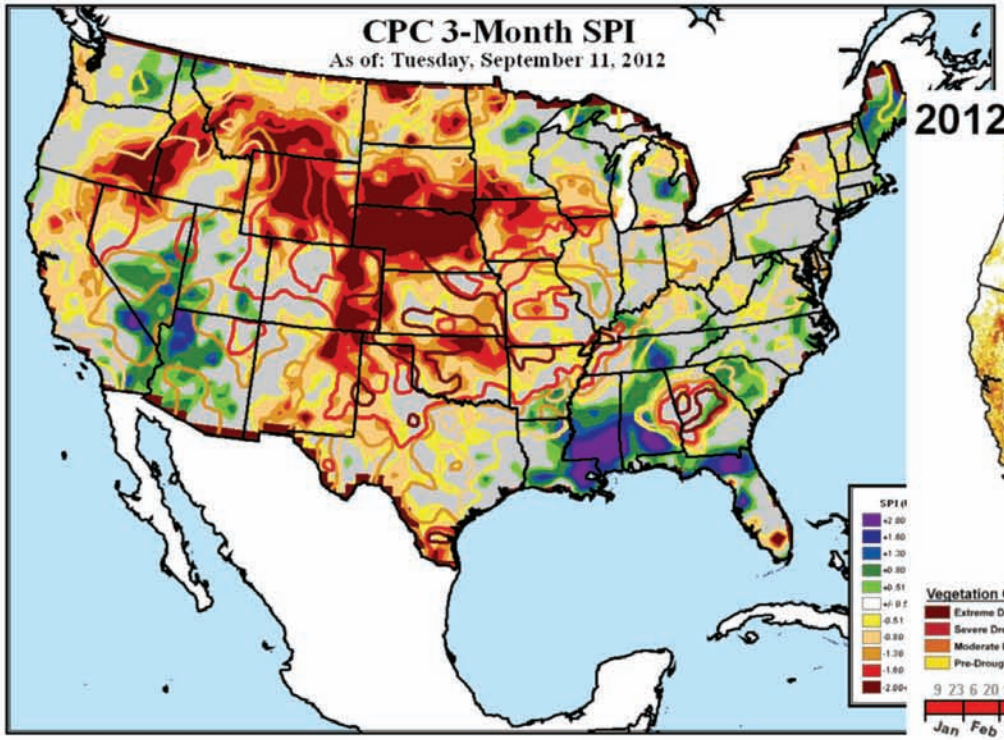
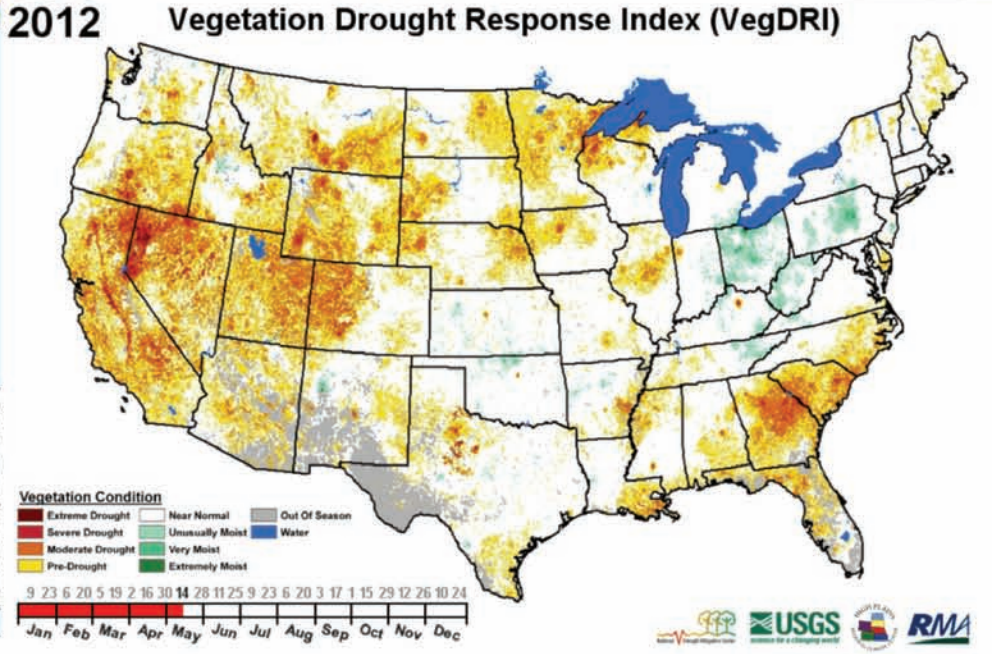
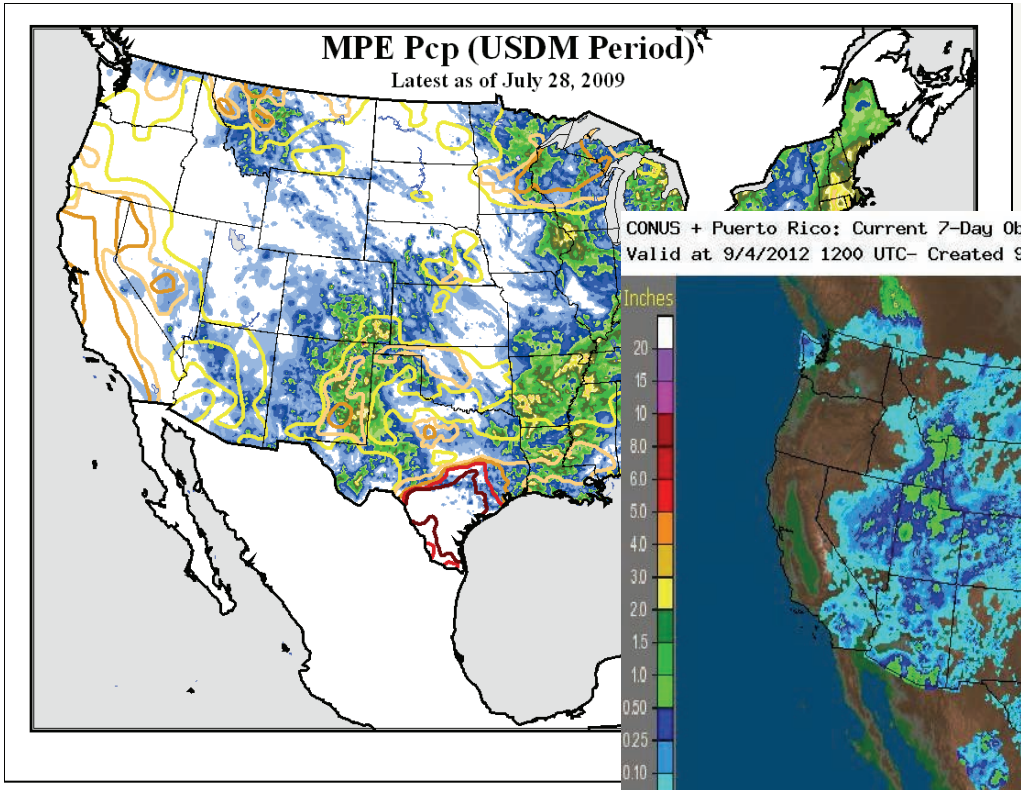

August 28, 2012 Drought Monitor &
September 04, 2012 Streamflow Percentiles
<2 (D4)
2 - 5 (D3)
5 - 10 (D2)
10 - 20 (D1)
20 - 30 (D0)
30 - 70
70 - 80
80 - 90
90 - 95
95 - 98
> 98

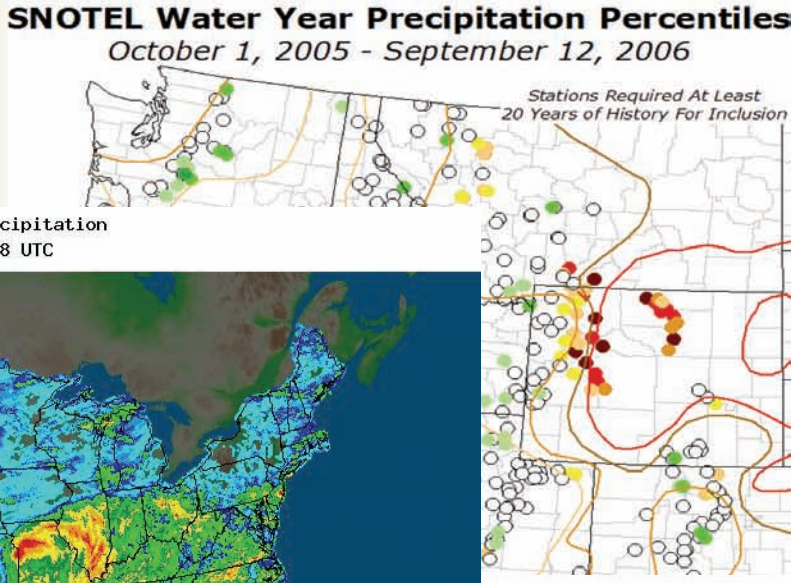

USGS 02352500 FLINT RIVER AT ALBANY, GA
Drainage Area: 5310 Square Miles, Length of Record: 97 Years
ge Discharge, in Cubic Feet Per Second
1000000
100000
10000
1000
Jun Jul Aug Sep Oct Nov Dec
2008

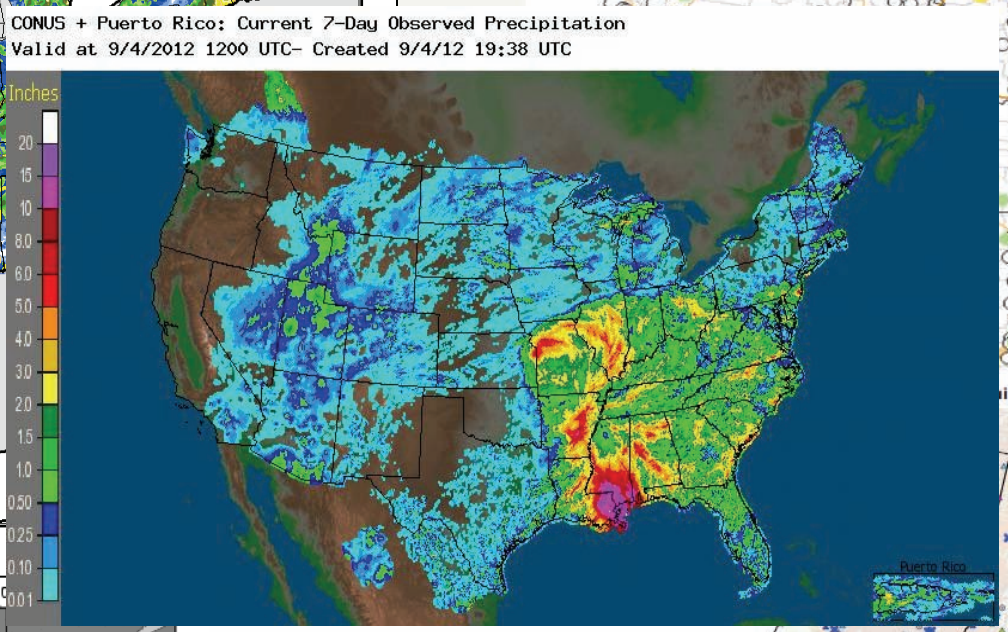

August 28, 2012 Drought Monitor
& Ensuing 6-Day Precipitation (")

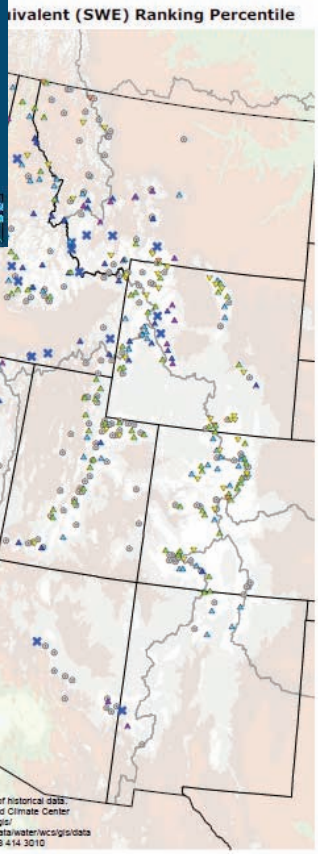

CPC 3-Month SPI
As of: Tuesday, September 11, 2012

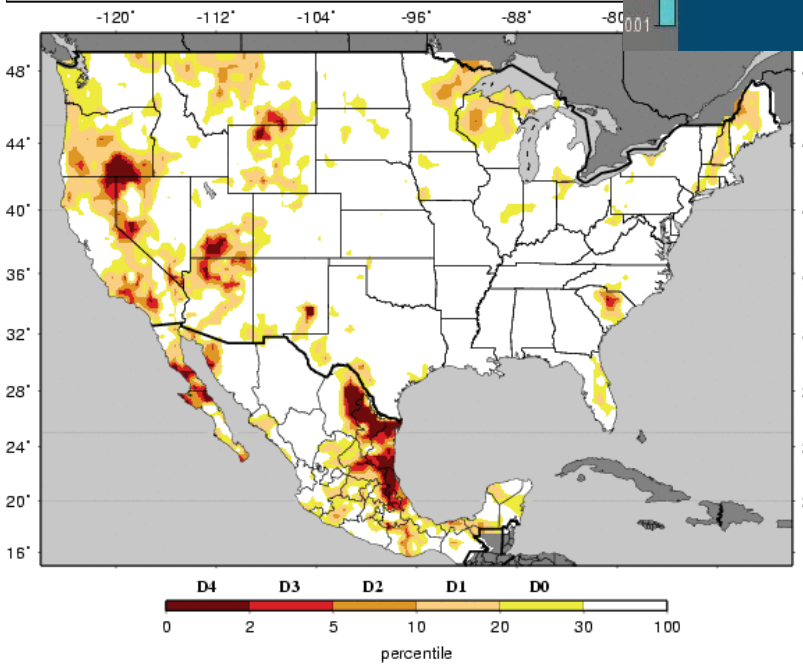

2012
Vegetation Drought Response Index (VegDRI)
Vegetation Condition
Extreme Drought
Severe Drought
Moderate Drought
Pre-Drought
Near Normal
Unusually Moist
Very Moist
Extremely Moist
Out Of Season
Water
9 23 6 20 5 19 2 16 30 14 28 11 25 9 23 6 20 3 17 1 15 29 12 26 10 24
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
USGS
RMA

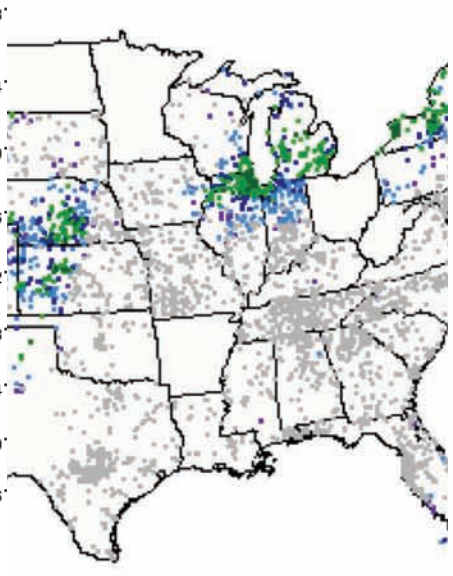

MPE Pcp (USDM Period)
Latest as of July 28, 2009


SNOTEL Water Year Precipitation Percentiles
October 1, 2005 - September 12, 2006
Stations Required At Least
20 Years of History For Inclusion


CONUS + Puerto Rico: Current 7-Day Observed Precipitation
Valid at 9/4/2012 1200 UTC- Created 9/4/12 19:38 UTC
Inches
20
15
10
8.0
6.0
5.0
4.0
3.0
2.0
1.5
1.0
0.50
0.25
0.10
0.01
Puerto Rico


ivalent (SWE) Ranking Percentile


-120°
-112°
-104°
-96°
-88°
48°
44°
40°
36°
32°
28°
24°
20°
16°
D4
D3
D2
D1
D0
0
2
5
10
20
30
100
percentile



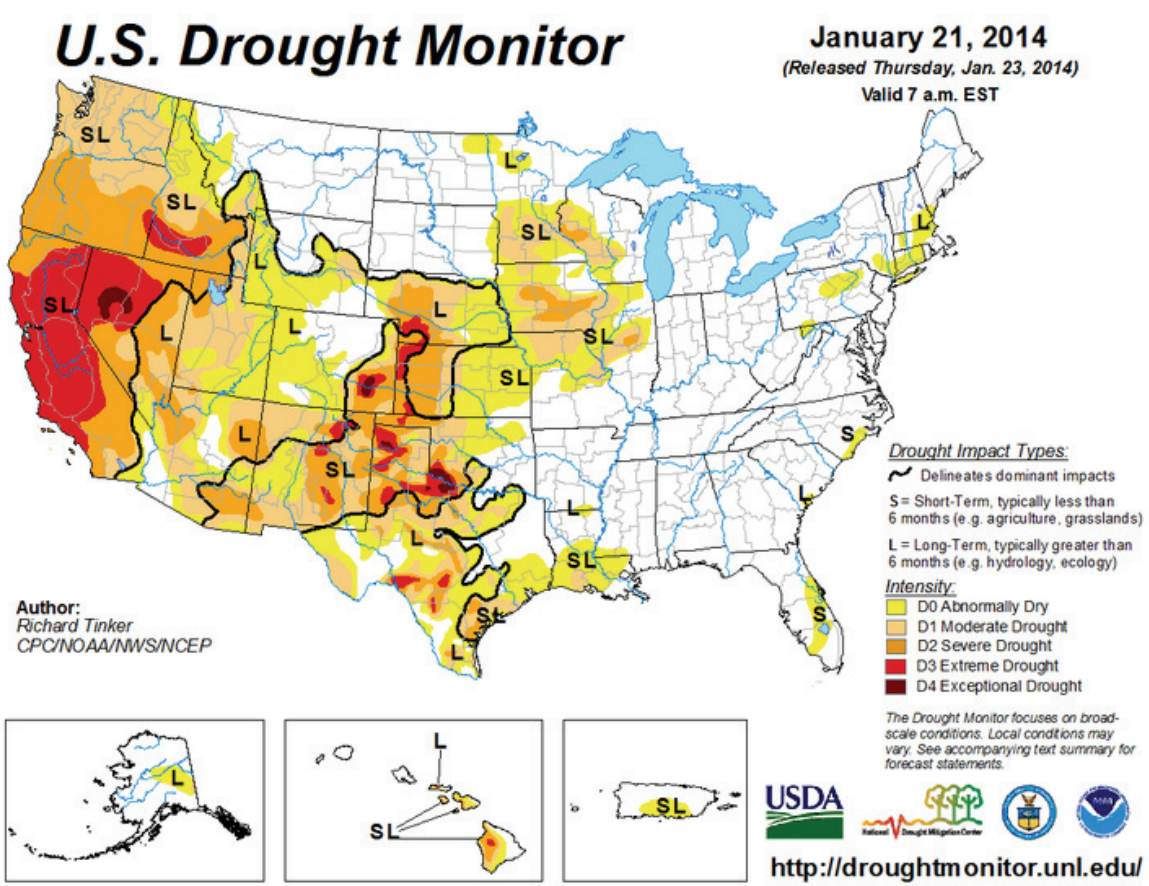
Current
Snow Water
Equivalent (SWE)
Ranking
Percentile
wettest 5%
91% - 95%
81% - 90%
71% - 80%
51% - 70%
31% - 50%
21% - 30%
11% - 20%
6% - 10%
driest 5%
snow free
Provisional Data
Subject to Revision
USDA
NRCS
Analysis includes sites with more than 20 years of historical data.
Prepared by the USDA/NRCS National Water and Climate Center
Portland, Oregon http://www.wcc.nrcs.usda.gov/gis/
Based on data from ftp://ftp.wcc.nrcs.usda.gov/data/water/wcs/gis/data
Science contact: Tom.Pagano@por.usda.gov 503 414 3010

droughtmonitor.unl.edu

Home | Data Archive | Current Conditions | Forecasts | What's New | About USDM | FAQ | Links | Maps and Data Services

United States Drought Monitor

Home



National Drought Summary for Jan 21, 2014

Hawaii, Alaska, and Puerto Rico

Through most of the dry areas in Alaska, Puerto Rico, and Hawaii, light to locally moderate precipitation fell. A small area in south-central Puerto Rico reported more than one inch of rain. Dryness and drought classifications were unchanged.

The Northeast

The Rest of the Contiguous 48 States

Looking Ahead

Author(s):
Richard Tinker, NOAA/NWS/NCEP/CPC

View a printable narrative here.

NOTE: To view regional drought conditions, click on map above. State maps can be accessed from regional maps

US Drought Monitor Map Archive

Home | Data Archive | Current Conditions | Forecasts | What's New | About USDM | FAQ | Links | Maps and Data Services

United States Drought Monitor

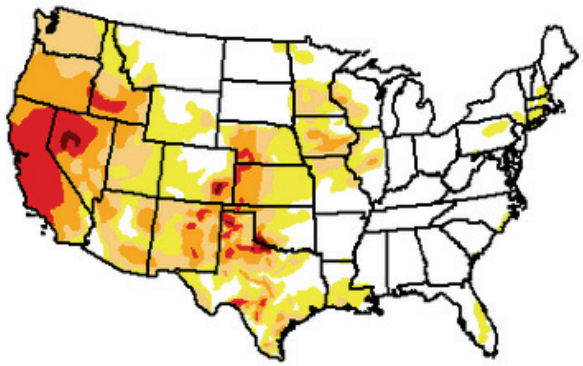
Data Archive

U.S. Drought Monitor Data Archive

Contiguous U.S.

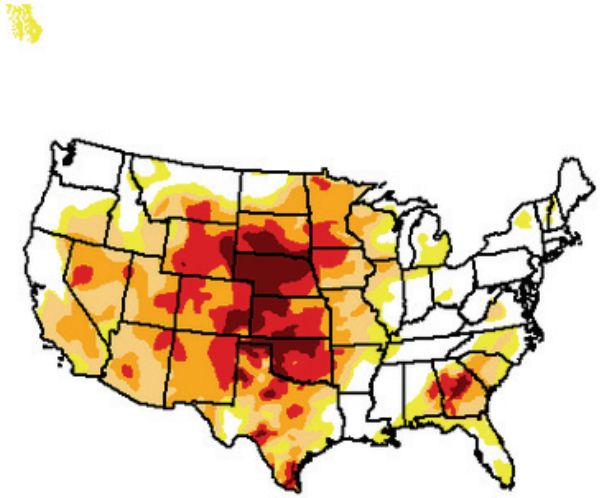
Drought Severity

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



PNG PDF JPG

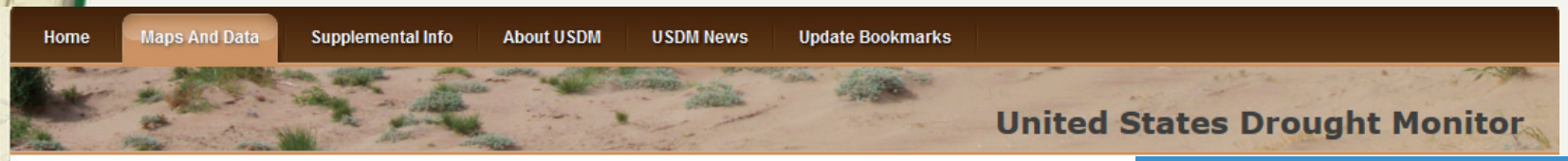
January 21, 2014



PNG PDF JPG

January 22, 2013

US Drought Monitor Data Archive



All the data associated with the US Drought Monitor is available freely to the public.

Maps And Data 〉 GIS Data

GIS Data Archive

Contact for GIS Data Requests

For more information regarding the Drought Monitor datasets, please contact Brian Fuchs at the NDMC via e-mail.

For those individuals interested in obtaining DM data for a period of time longer than a few weeks, please e-mail your request to Brian Fuchs. Include the date range, for example 2005-2009, and the state or county names. We will make every effort to respond to your request as soon as possible.

Current Drought Monitor Files

Combined Shapefiles | KMZ | WMS

Metadata

Shapefiles | KML Files | GML files | OGC WMS files | Excel files | DM Colors

Please cite the Drought Monitor by including the National Drought Mitigation Center (NDMC), the U.S. Department of Agriculture (USDA) and the National Oceanic and Atmospheric Administration (NOAA).

Data

2014 | 2013 | 2012 | 2011 | 2010 | 2009 | 2008 | 2007 | 2006 | 2005 | 2004 | 2003 | 2002 | 2001 | 2000

Download all Drought Monitor shapefiles for 2014.

Date	KMZ	Shapefiles		GML	WMS	Statistics		
2014-06-03	KMZ	SHP	Impacts	GML	WMS	U.S.	State	County
2014-05-27	KMZ	SHP	Impacts	GML	WMS	U.S.	State	County
2014-05-20	KMZ	SHP	Impacts	GML	WMS	U.S.	State	County
2014-05-13	KMZ	SHP	Impacts	GML	WMS	U.S.	State	County
2014-05-06	KMZ	SHP	Impacts	GML	WMS	U.S.	State	County
2014-04-29	KMZ	SHP	Impacts	GML	WMS	U.S.	State	County
2014-04-22	KMZ	SHP	Impacts	GML	WMS	U.S.	State	County
2014-04-15	KMZ	SHP	Impacts	GML	WMS	U.S.	State	County
2014-04-08	KMZ	SHP	Impacts	GML	WMS	U.S.	State	County
2014-04-01	KMZ	SHP	Impacts	GML	WMS	U.S.	State	County

NIDIS
University of Nebraska Lincoln
National Drought Mitigation Center

The National Drought Mitigation Center's Drought Risk Atlas

Brian Fuchs
Mark Svoboda
Chris Poulsen
Jeff Nothwehr

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

This work is funded under a grant from the Sectoral Applications Research Program (SARP) of the NOAA-Climate Program Office. Additional Funding was provided by the NIDIS Program Office and the USDA- Risk Management Service (RMA).

The Drought Risk Atlas will answer:

- How does the drought compare historically?
- How often does a drought of this magnitude happen (frequency)?
- When was the last time a drought like this happened?
- What is the likelihood of the drought continuing?
- What did the spatial footprint of the last drought look like?

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The Drought Risk Atlas Methodology

- Using the best, most complete, long-term weather stations from the COOP network.
- Calculating the climatology and various drought indices (SPI, SPEI, Deciles, PDSI, SC-PDSI, Drought Monitor) for each station.
- Providing the data for various time steps (weekly, monthly, annually)
- Gridded maps of each index for each aggregated timestep.

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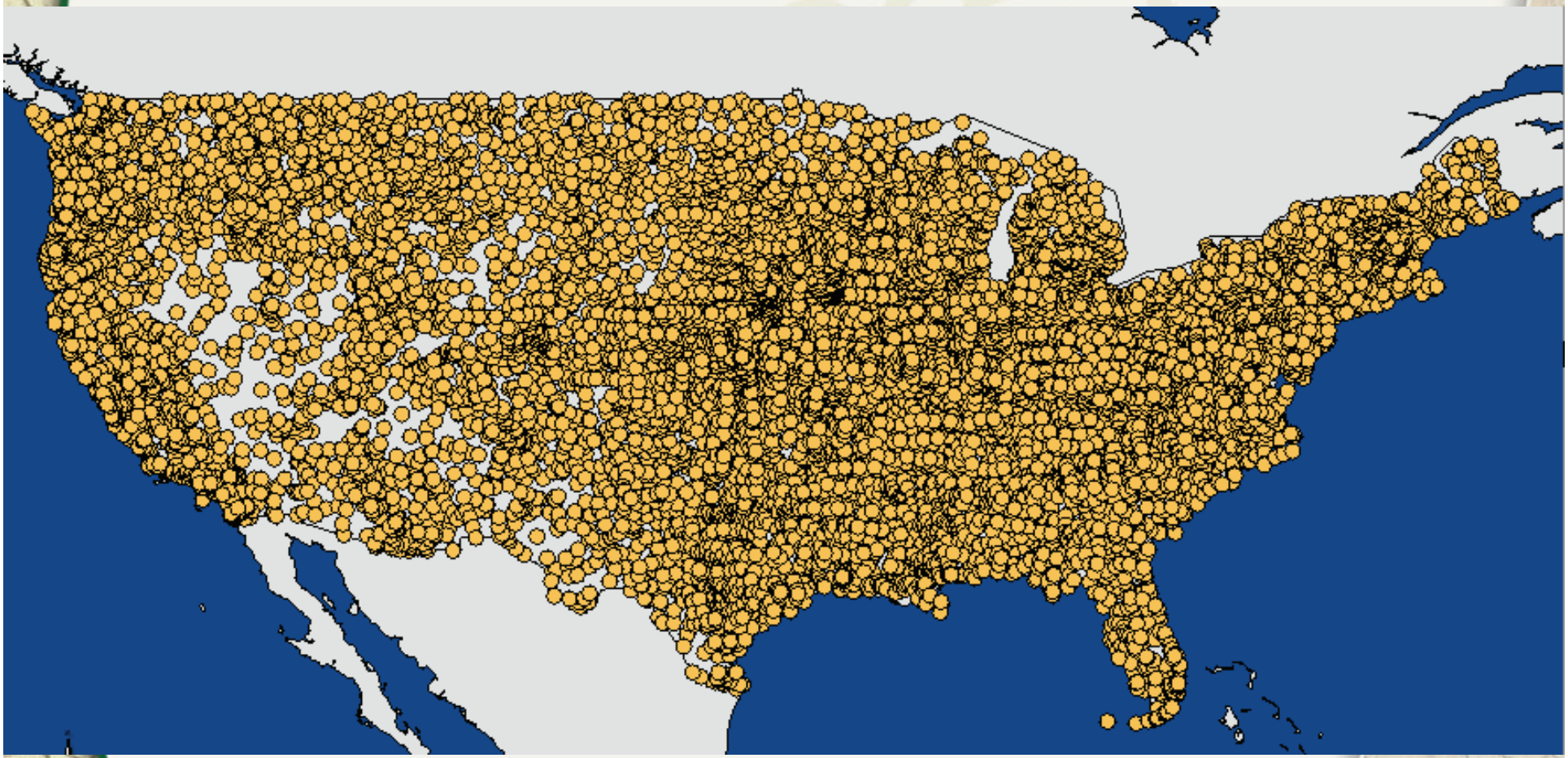
Over 12,000 Cooperative Observing Network Stations (COOP)



National Drought Mitigation Center

COOPERATIVE OBSERVERS' METEROLOGICAL RECORD:

Month of Feb, 1933; Station, Hagerman; County, Chaves

State, N Mex.; Latitude, 32° 37'; Longitude, 104° 24'; Hour of Observation, 7.30 AM; Time used on this form, Boston

DATE	TEMPERATURE				PRECIPITATION					PREVAILING WIND DIRECTION	CHARACTER OF DAY, SUNRISE TO SUNSET	‡ MISCELLANEOUS PHENOMENA
	MAXIMUM	MINIMUM	RANGE	*SET MAX.	TIME OF BEGINNING	TIME OF ENDING	†AMOUNT	SNOWFALL, IN INCHES	DEPTH OF SNOW ON GROUND AT TIME OF OBSERVATION			
	1	2	3	4	5	6	7	8	9	10	11	
1	62	16		24						S W	Clear	7 32 / 3 6 6
2	64	17		22						N W	Clear	
3	54	21		23						N E	Clear	Feb 1933
4	57	23		32						N W	Clear	
5	49	25		33						N W	P Cloudy	
6	65	30		39						S W	Clear	
7	60	10		10			T			S W	Cloudy	
8	10	-34		-10	9.30 PM	Mid	.13	3.	3.	N E	Cloudy	
9	16	-10		-2					3.	N	Clear	
10	22	-7		8					2'	N	Clear	
11	27	5		13					1.67	N	Clear	
12	53	13		18						N	Clear	
13	60	18		24						S W	P Cloudy	
14	69	25		35						S W	Clear	
15	62	19		19						N	Clear	
16	48	18		26						S E	P Cloudy	
17	72	18	SH	26						S W	Clear	
18	47	22		34						S W	Clear	
19	65	28		34						S W	P Cloudy	
20	56	20		30						N	Clear	
21	60	12		24						N	Clear	
22	65	24		35						S	Clear	
23	74	23		23						S E	Clear	
24	76	23		59						S E	P Cloudy	
25	72	39		49	Mid	Mid	.18			S E	Cloudy	
26	46	33		36			T			S E	Cloudy	
27	39	28		31	Mid	Mid	.13			S E	Cloudy	
28	68	28		34						S E	P Cloudy	
29												
30												
31												
SUM	1558	492					0.44	3.0				
MEAN	55.6	17.6										

* Reading of maximum thermometer immediately after setting.
† Including rain, hail, sleet, and melted snow.
‡ Thunderstorms, halos, auroras, etc.

(IN TRIPLICATE) See cover for instructions.

8—253

W E Bowen, Cooperative Observer.

Post Office Address, Hagerman N M

TEMPERATURE

Mean maximum, 55.6 /

Mean minimum, 17.6 /

Mean, 36.6 /

Maximum, 76 /; date, 24 /

Minimum, -34 /; date, 8 /

Greatest daily range, 54 /

PRECIPITATION

Total, .44 /; inches; greatest in 24 hours .18 /

Date, 4 25 /

SNOW

Total snowfall, 3.0 / inches

On ground 15th, 0 inches

At end of month, 0 inches

NUMBER OF DAYS—

With .01 inch or more precipitation, 3 /

Clear, 17; partly cloudy, 6 /

Cloudy, 5 /

DATES OF—

Fog { Light,
Dense,

Killing frost,

Thunderstorms,

Hail { Light,
Moderate,
Heavy,

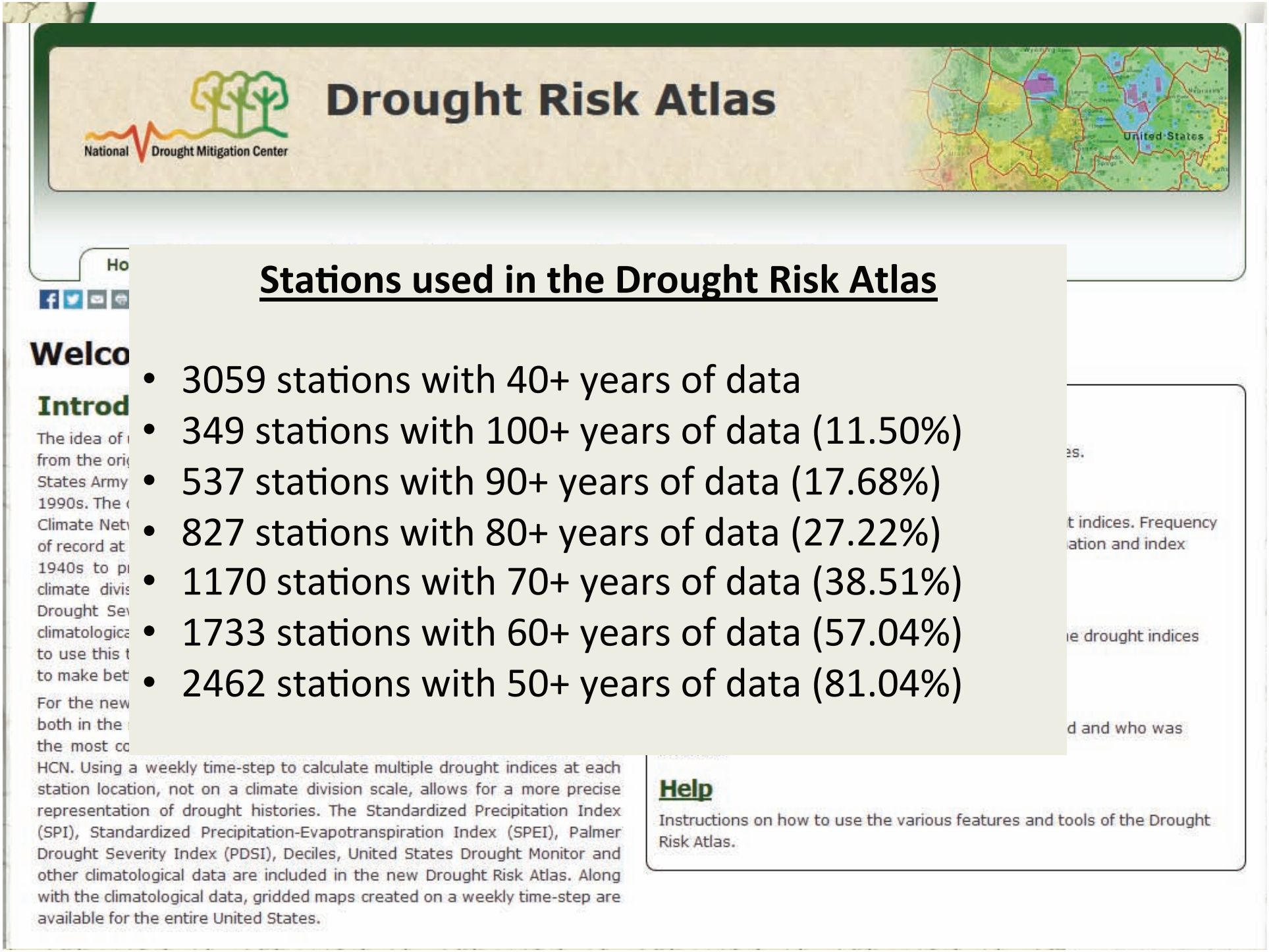
Sleet,

Auroras,

REMARKS:

Data Criteria for the Drought Atlas

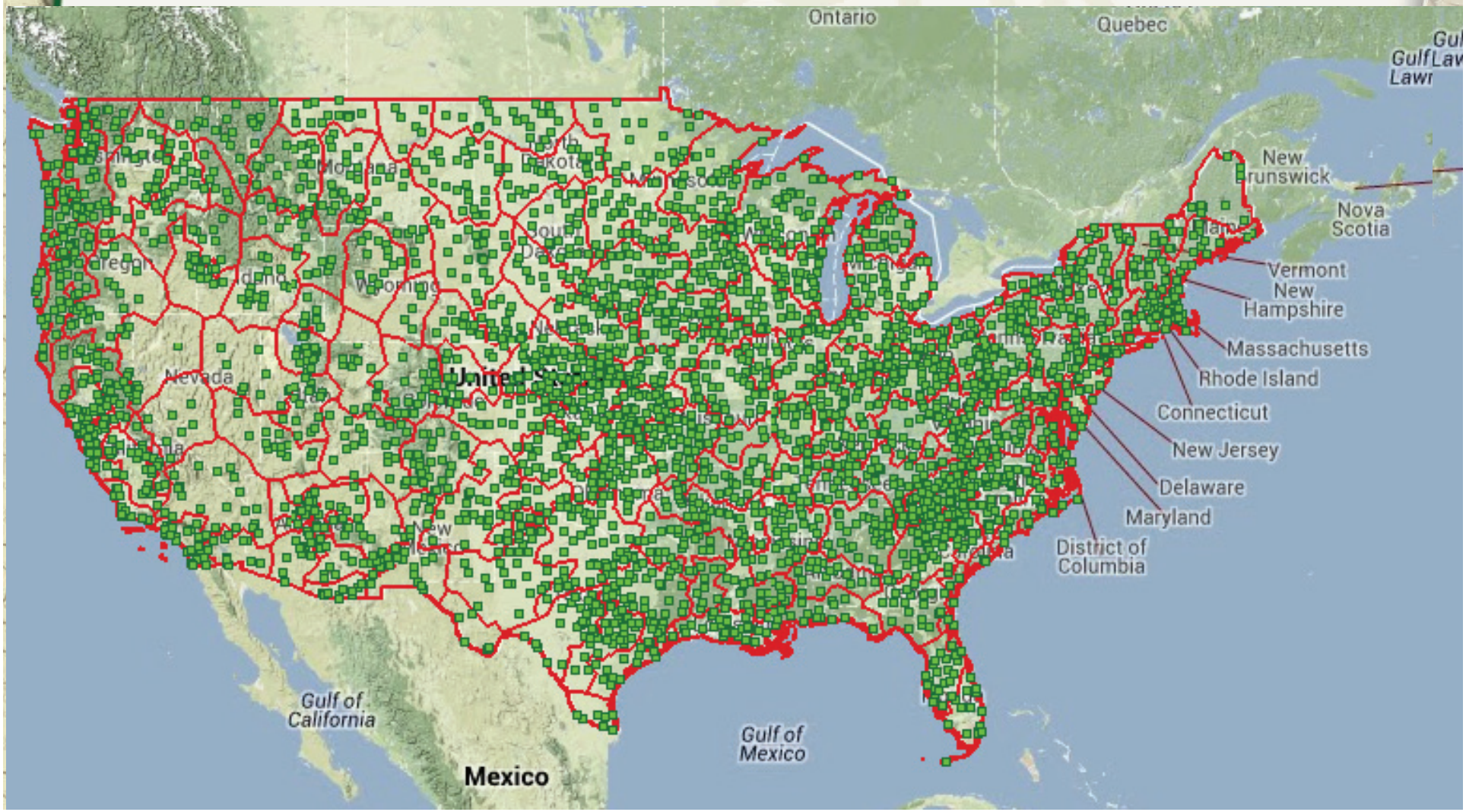
- Minimum of 40 years of data available at each station.
  - Most have longer periods of record.
- No more than 2 consecutive months of missing data at any time in the period of record.
- A unique start date was established for each station.



Stations used in the Drought Risk Atlas

- 3059 stations with 40+ years of data
- 349 stations with 100+ years of data (11.50%)
- 537 stations with 90+ years of data (17.68%)
- 827 stations with 80+ years of data (27.22%)
- 1170 stations with 70+ years of data (38.51%)
- 1733 stations with 60+ years of data (57.04%)
- 2462 stations with 50+ years of data (81.04%)

3,059 Stations in the DRA
139 Unique Climate Regimes



Climate Data

Options Available for Each Station

Selected Atlas Station: **253395 (GRAND ISLAND AP)**

Select New Station

Station | Climate | Deciles | SPI | SPEI | PDSI | SC-PDSI | Drought Monitor | Drought Periods | Compare Indices | Frequencies

Similar Stations

253395: GRAND ISLAND AP

Latitude
40.961

Longitude
-98.314

Elevation (ft)
1840

State
Nebraska

County
Hall

Climate Division
5

Time Period
1/1/1908 - 12/31/2012

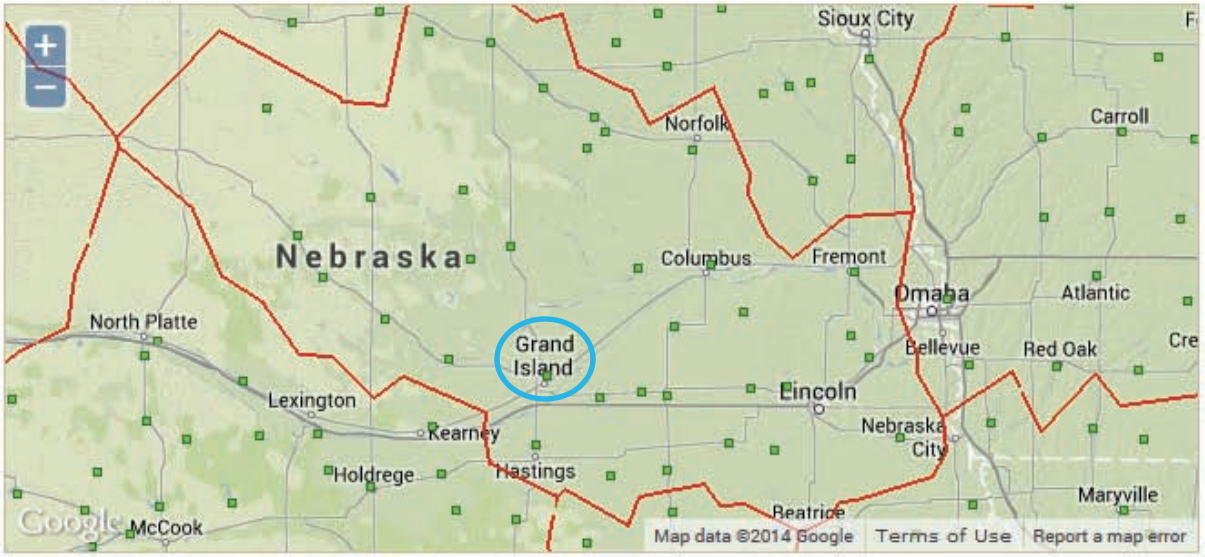
Years on Record
104

Precipitation Only
No

Download Metadata

The Atlas period of record can and will vary from the ACIS period of record. Stations may have had data periods that did not meet the criteria used in the Atlas. Those data periods are not included here. More information

Atlas Region



252805: EWING

253050: FREMONT

253065: FRIEND 3E

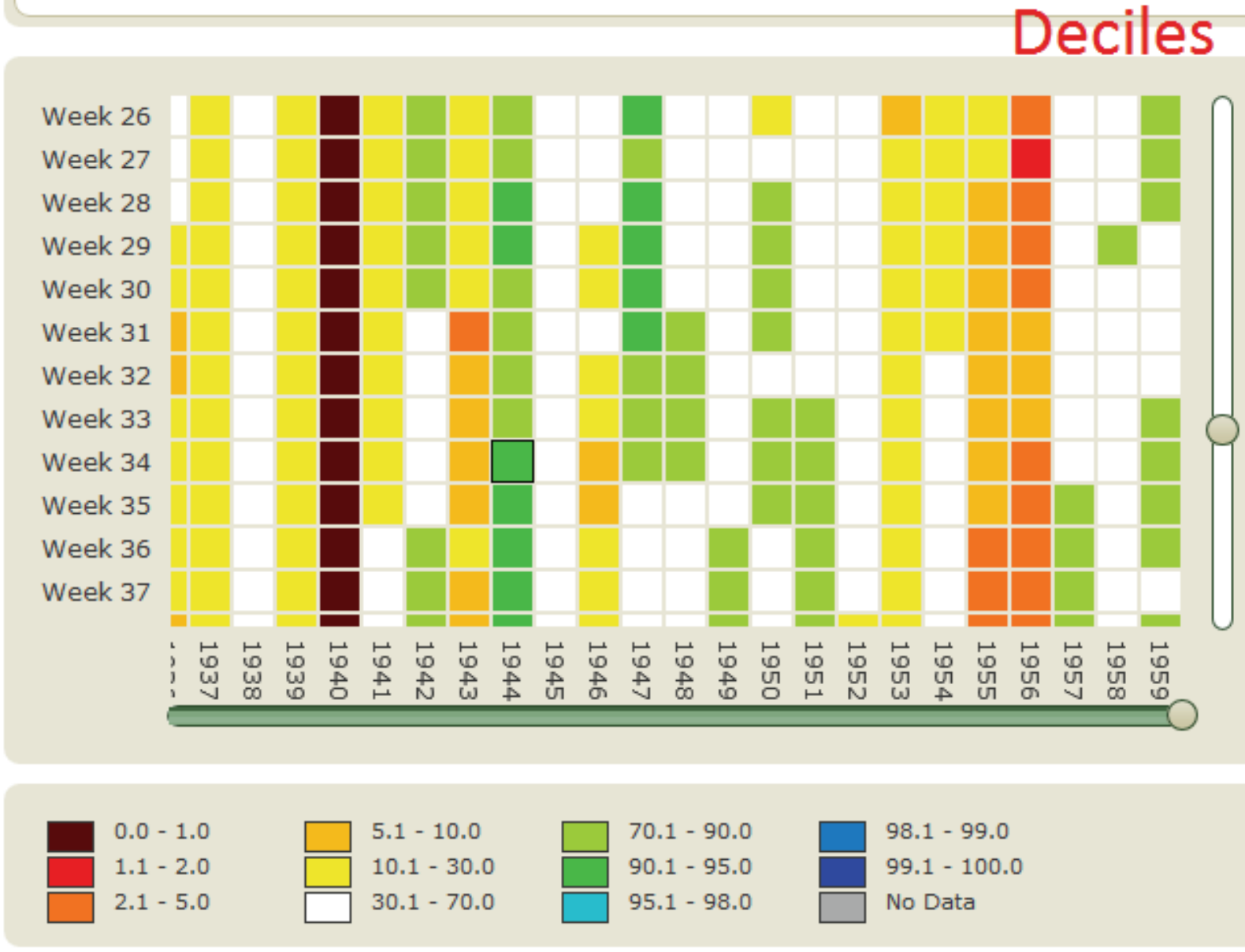
253175: GENEVA

253185: GENOA 2 W

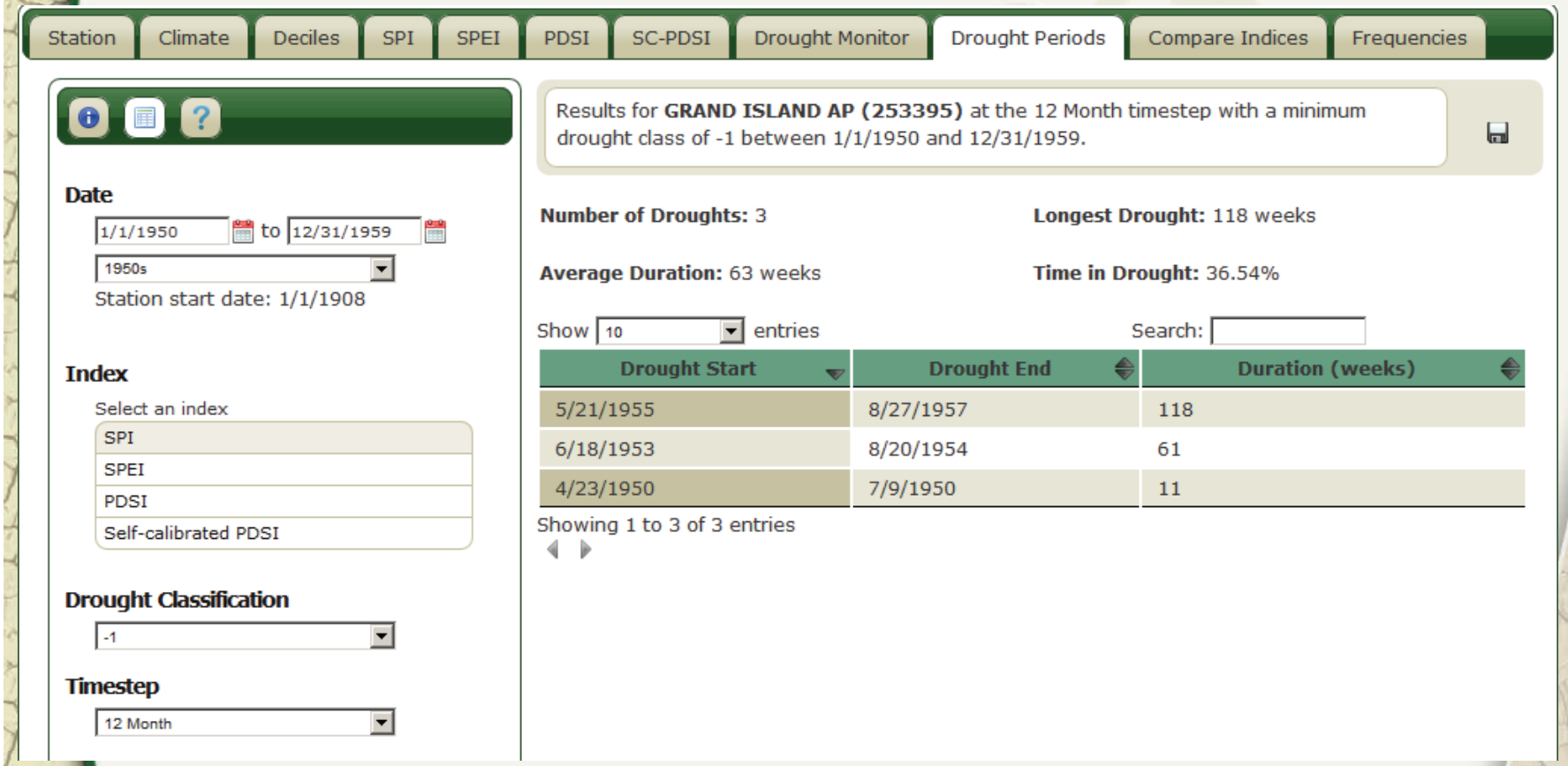
253395: GRAND ISLAND AP

253425: GREELEY

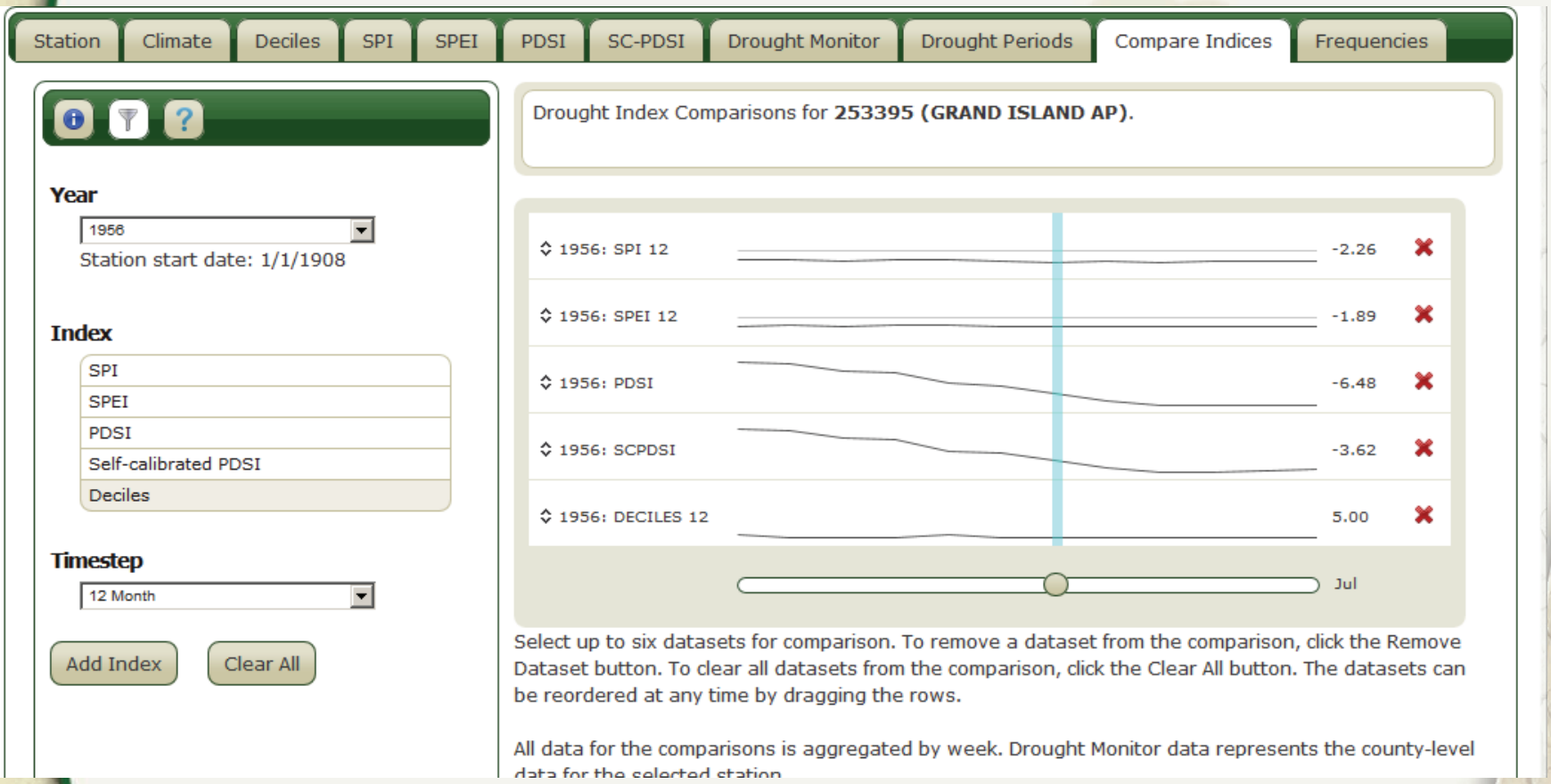
Results for **GRAND ISLAND AP (253395)** between 1/1/1930 and 12/31/1959 for the 12 Month timestep and aggregated by week.



Drought Periods



Compare Indices



Frequencies

Station | Climate | Deciles | SPI | SPEI | PDSI | SC-PDSI | Drought Monitor | Drought Periods | Compare Indices | Frequencies

Index

SPI

Aggregate

Week

Timestep

12 Month

Results for **GRAND ISLAND AP (253395)** for the 12 Month timestep and aggregated by week.

Show 50 entries Search:

Threshold	Frequency	Return Period (Years)
-3.7	1	104.1
-3.6	1	104.1
-3.5	2	52.04
-3.4	1	104.1
-3.3	2	52.04
-3.2	5	20.81
-3.1	7	14.87
-3	10	10.4
-2.9	9	11.56
-2.8	11	9.46
-2.7	10	10.4
-2.6	9	11.56
-2.5	6	17.35
-2.4	11	9.46
-2.3	14	7.42
-2.2	30	3.46
-2.1	37	2.81
-2	61	1.69
-1.9	19	5.46
-1.8	36	2.88
-1.7	35	2.96
-1.6	47	2.21
-1.5	53	1.96
-1.4	64	1.62

NIDIS

University of Nebraska Lincoln

National Drought Mitigation Center

The Drought Atlas: Bringing a great deal of **DATA** to the **Citizens**

- Over **1 Billion** Drought Index calculations currently in the Atlas
- Almost every location in the United States is 75 miles or less from a station
- Approximately 500,000 gridded maps of drought indices available on weekly/monthly time steps (coming soon)

Any Questions ?

Contact Information:

Brian Fuchs

bfuchs2@unl.edu
402-472-6775

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