The U.S. Drought Monitor: Current and Future Soil Moisture Inputs

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National Drought Mitigation Center
School of Natural Resources
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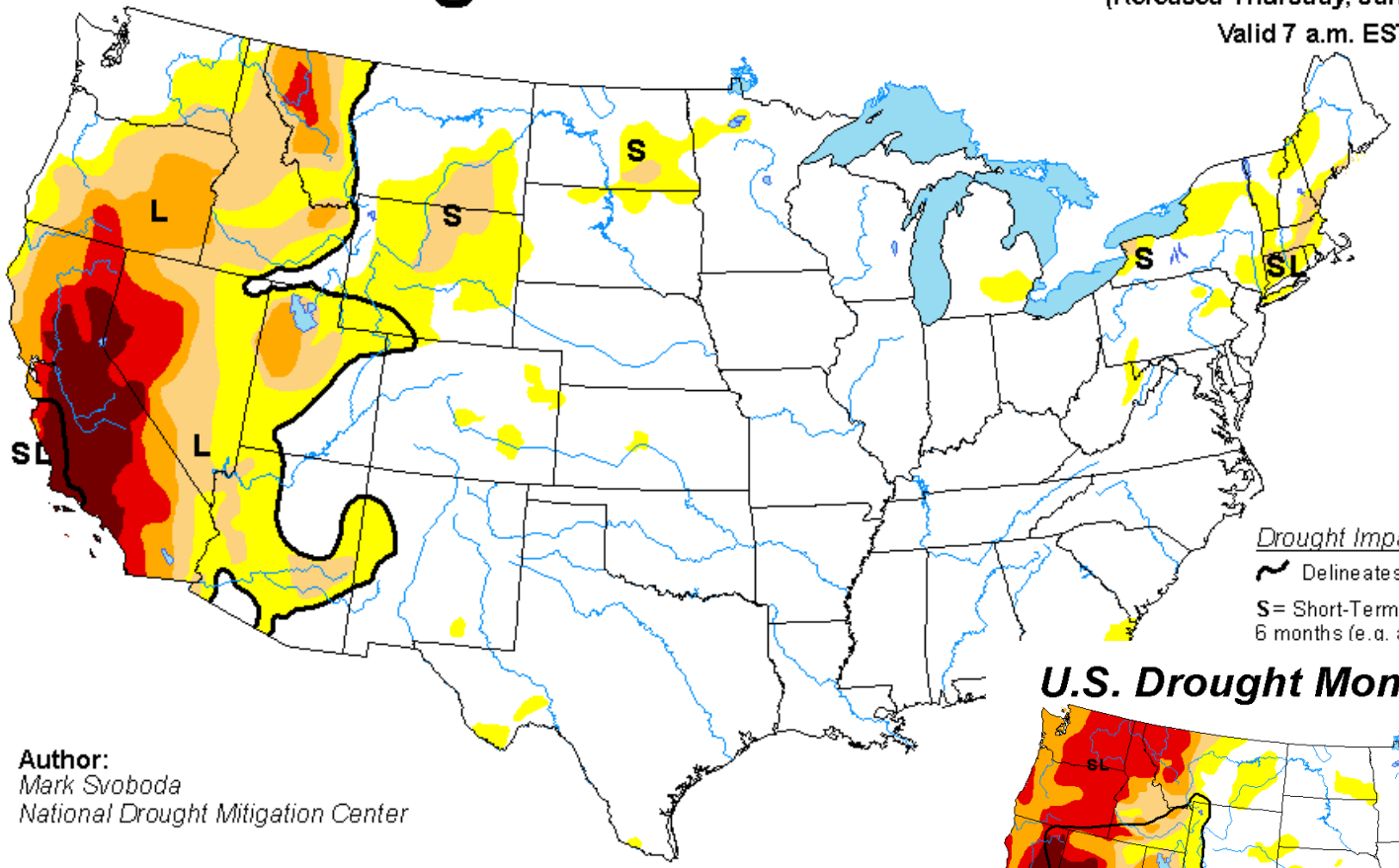
NIDIS Soil Moisture Network Workshop, Boulder, CO
May 24-26, 2016

U.S. Drought Monitor

January 26, 2016

(Released Thursday, Jan. 28, 2016)

Valid 7 a.m. EST

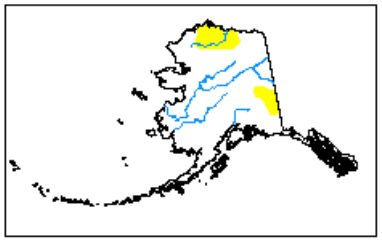


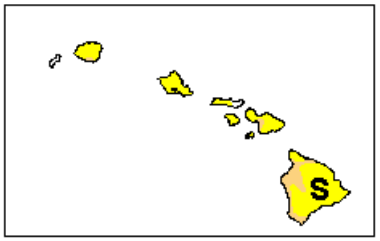
Drought Impact Types:

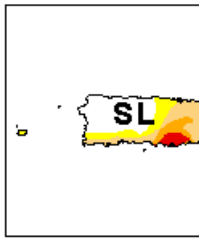
Delineates dominant impacts

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

Author:
Mark Svoboda
National Drought Mitigation Center





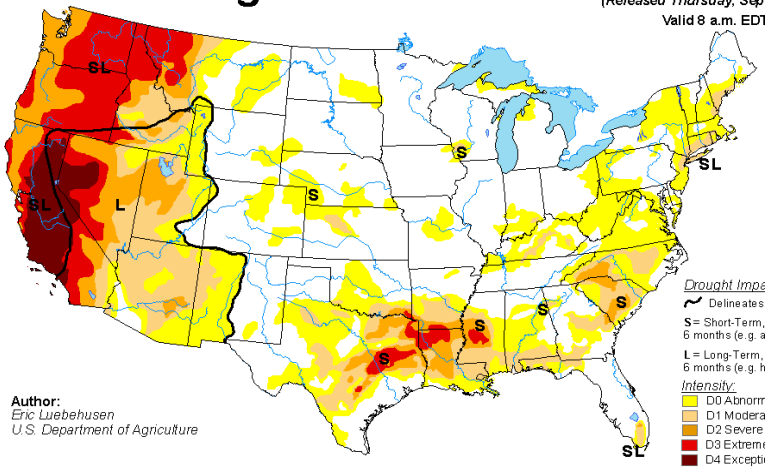


U.S. Drought Monitor

September 22, 2015

(Released Thursday, Sep. 24, 2015)

Valid 8 a.m. EDT



Drought Impact Types:

Delineates dominant impacts

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

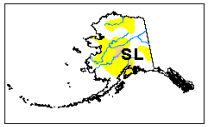
L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

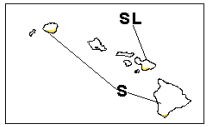
Intensity:

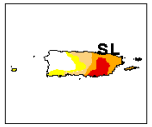
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

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

Author:
Eric Luebehusen
U.S. Department of Agriculture







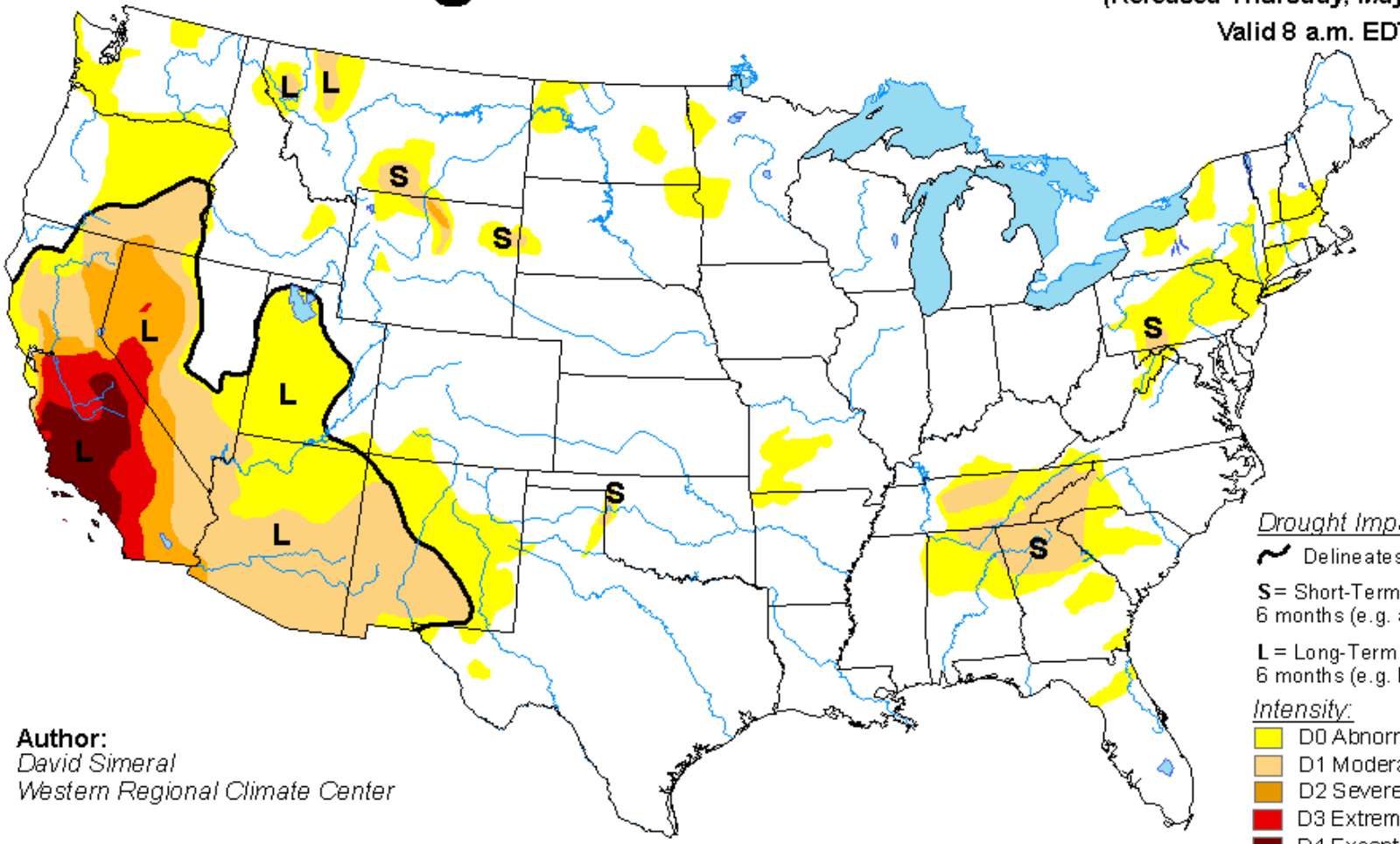
http://droughtmonitor.unl.edu/

U.S. Drought Monitor

May 17, 2016

(Released Thursday, May. 19, 2016)

Valid 8 a.m. EDT



Author:
David Simeral
Western Regional Climate Center

Drought Impact Types:

Delineates dominant impacts

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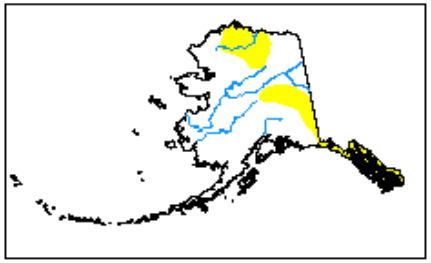
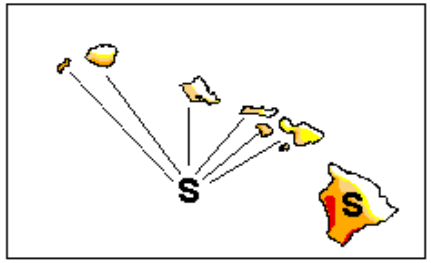
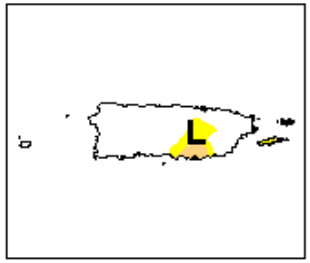


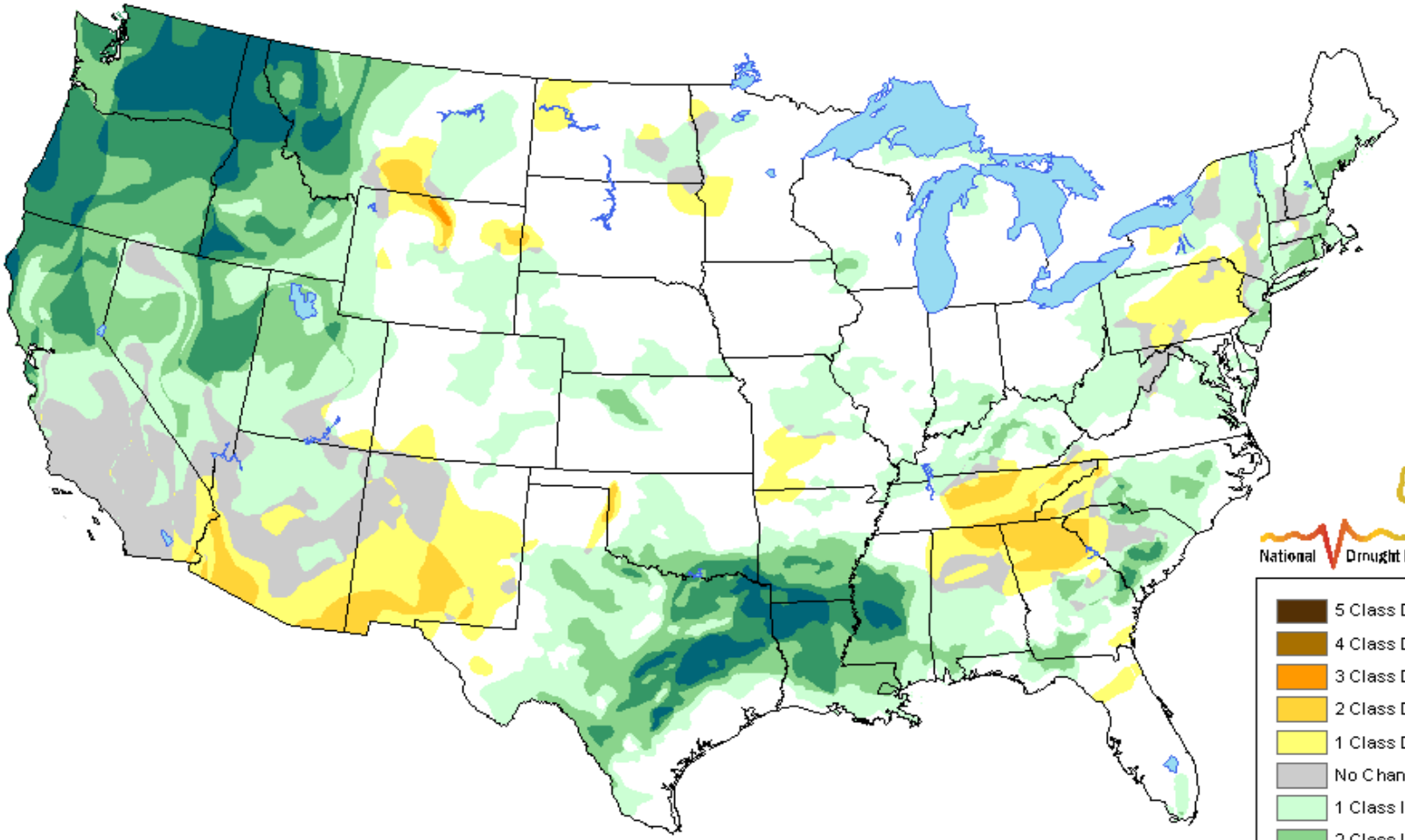




http://droughtmonitor.unl.edu/

U.S. Drought Monitor Class Change

Start of Water Year



May 17, 2016
compared to
September 29, 2015

National Drought Mitigation Center

- 5 Class Degradation
- 4 Class Degradation
- 3 Class Degradation
- 2 Class Degradation
- 1 Class Degradation
- No Change
- 1 Class Improvement
- 2 Class Improvement
- 3 Class Improvement
- 4 Class Improvement
- 5 Class Improvement

http://droughtmonitor.unl.edu

PERCENTILES

Percentiles and the U.S. Drought Monitor

Advantages of percentiles:

- Can be applied to any parameter

The drought categories are associated with historical occurrence/likelihood (percentile ranking)

It is not anecdotal or subjective, like "It's really, really dry!!" ….or, "I don't remember it ever being this dry, we have to be D4!!"

- D4, Exceptional Drought: 1 in 50+ years **(2 %tile)**
- D3, Extreme Drought: 1 in 20 to 50 years **(5)**
- D2, Severe Drought: 1 in 10 to 20 years **(10)**
- D1, Moderate Drought: 1 in 5 to 10 years **(20)**
- D0, Abnormally Dry: 1 in 3 to 5 years **(30)**

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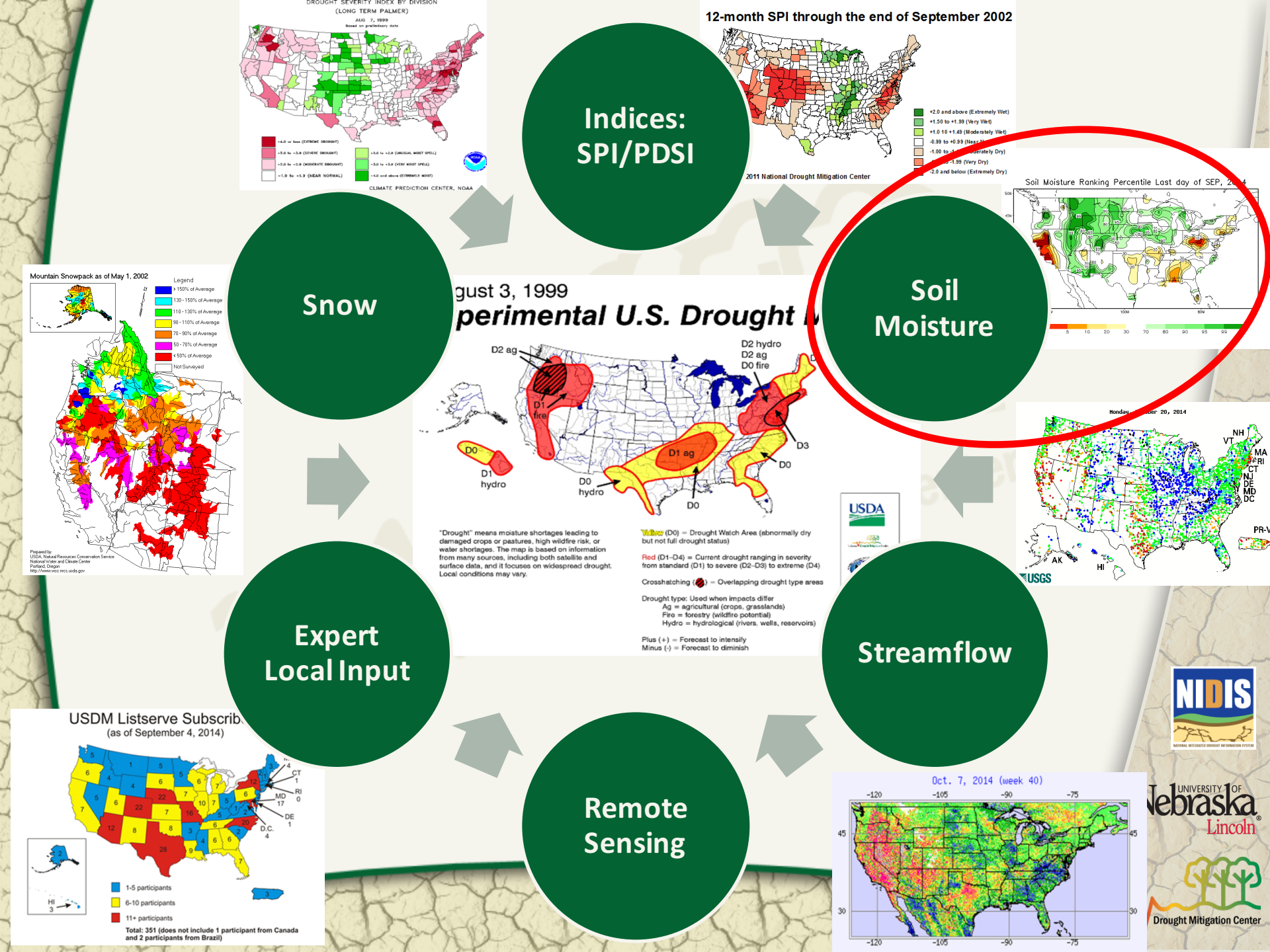
USDM SOIL MOISTURE INPUTS


Indices: SPI/PDSI
DROUGHT SEVERITY INDEX BY DIVISION (LONG TERM PALMER)
CLIMATE PREDICTION CENTER, NOAA
12-month SPI through the end of September 2002
2011 National Drought Mitigation Center
Soil Moisture
Soil Moisture Ranking Percentile Last day of SEP, 2014
Streamflow
USGS
Remote Sensing
Oct. 7, 2014 (week 40)
Expert Local Input
USDM Listserve Subscrib
(as of September 4, 2014)
1-5 participants
6-10 participants
11+ participants
Total: 351 (does not include 1 participant from Canada and 2 participants from Brazil)
Snow
Mountain Snowpack as of May 1, 2002
Legend
Not Surveyed
Prepared by
USDA, Natural Resources Conservation Service
National Water and Climate Center
Portland, Oregon
http://www.wcc.nrcs.usda.gov
gust 3, 1999
perimental U.S. Drought
D2 ag
D1 fire
D0
D1 hydro
D0 hydro
D1 ag
D0
D2 hydro
D2 ag
D0 fire
D3
D0
"Drought" means moisture shortages leading to damaged crops or pastures, high wildfire risk, or water shortages. The map is based on information from many sources, including both satellite and surface data, and it focuses on widespread drought. Local conditions may vary.
Yellow (D0) = Drought Watch Area (abnormally dry but not full drought status)
Red (D1–D4) = Current drought ranging in severity from standard (D1) to severe (D2–D3) to extreme (D4)
Crosshatching = Overlapping drought type areas
Drought type: Used when impacts differ
Ag = agricultural (crops, grasslands)
Fire = forestry (wildfire potential)
Hydro = hydrological (rivers, wells, reservoirs)
Plus (+) = Forecast to intensify
Minus (-) = Forecast to diminish
USDA
NIDIS
University of Nebraska Lincoln
Drought Mitigation Center

U.S. Drought Monitor

Integrates Key Drought Indicators:

- Palmer Drought Index
- SPI
- KBDI
- Modeled Soil Moisture
  - LIS/NLDAS
- 7-Day Avg. Streamflow
- Precipitation Anomalies

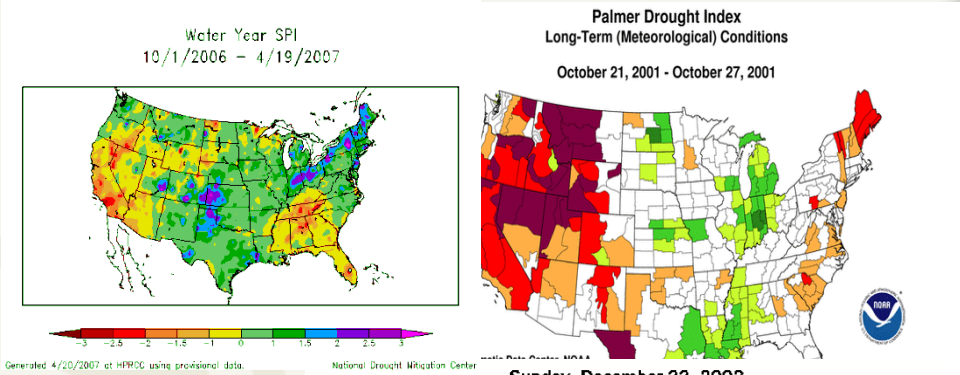
Growing Season:

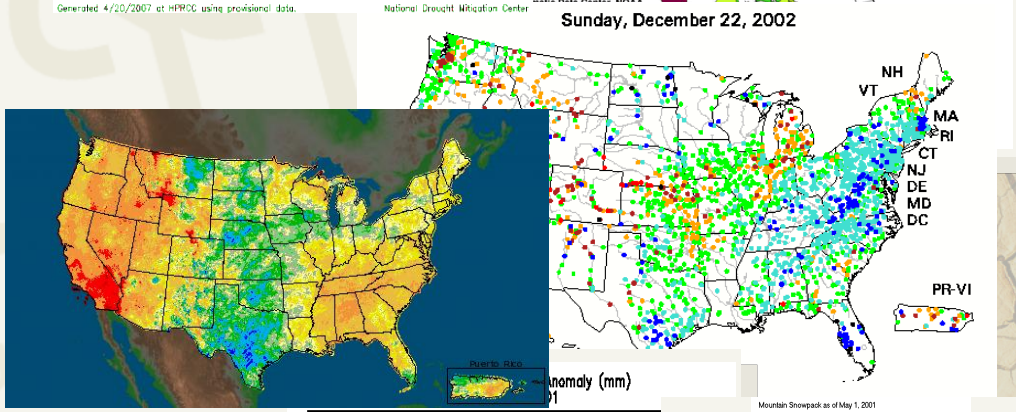
- Crop Moisture Index
- Sat. Veg. Health Index
- VegDRI/ESI/etc.
- Soil Moisture
- Mesonets
- State/Regional

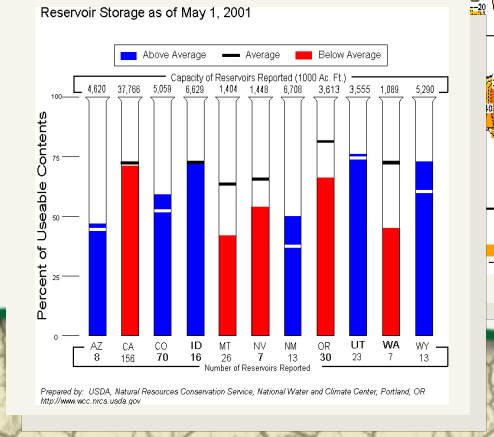
In The West:

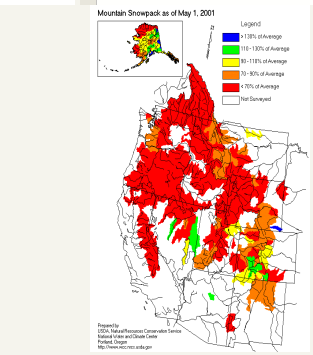
- SWSI
- Reservoir levels
- Snowpack (SNOTEL)
- SWE
- Streamflow

Created in ArcGIS









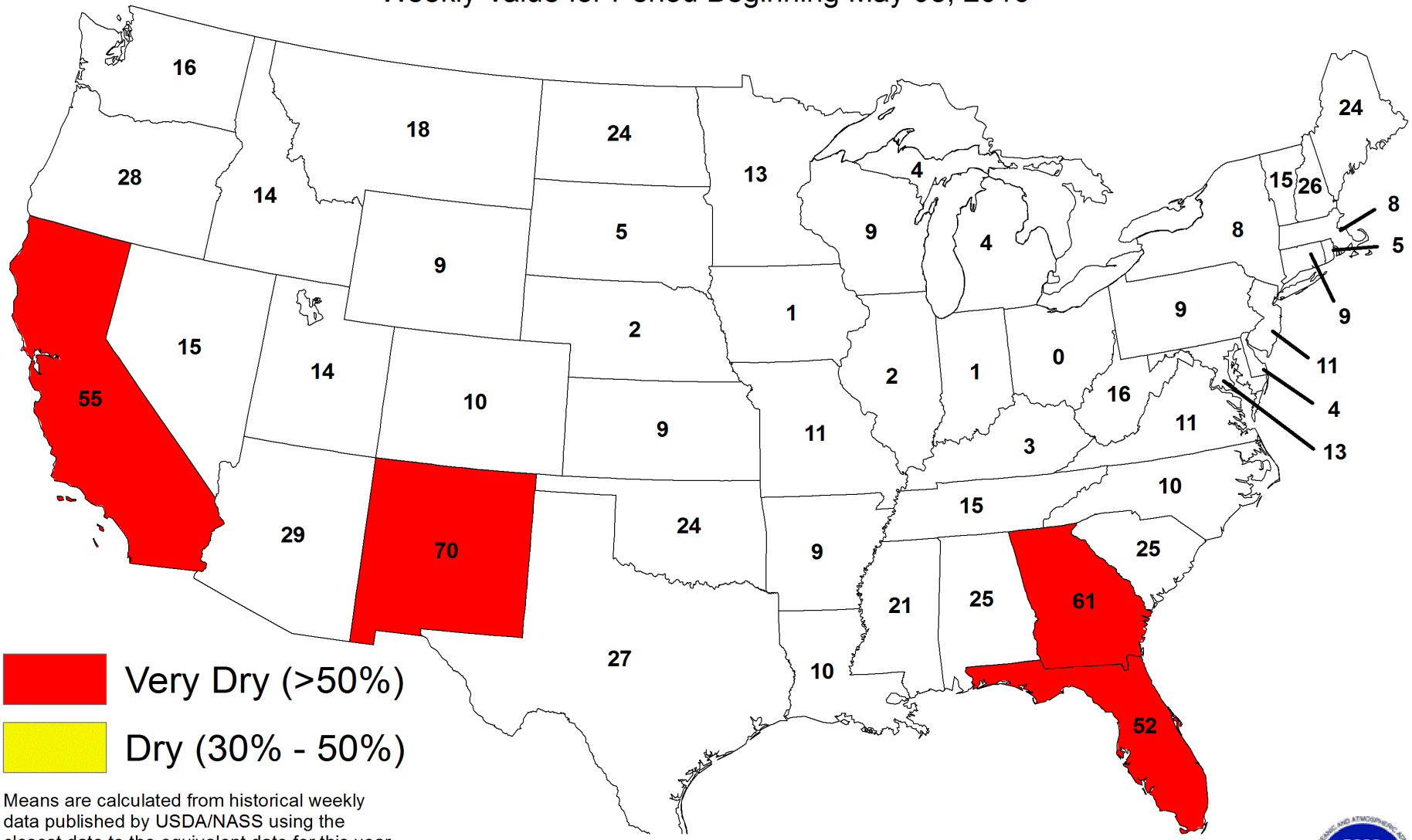
National Drought Mitigation Center

Soil Moisture Sources

- In situ, remotely sensed, modeled
- Federal
  - Automated (SCAN)
  - Manual (probes/weekly crop bulletin)
- State (Mesonets)
- Modeled/Simulated
  - NLDAS
  - Leaky Bucket
- Remotely sensed
  - GRACE
  - SMAP
  - SMOS
  - Others??

USDA Topsoil Moisture Short-Very Short
Percent of State Area

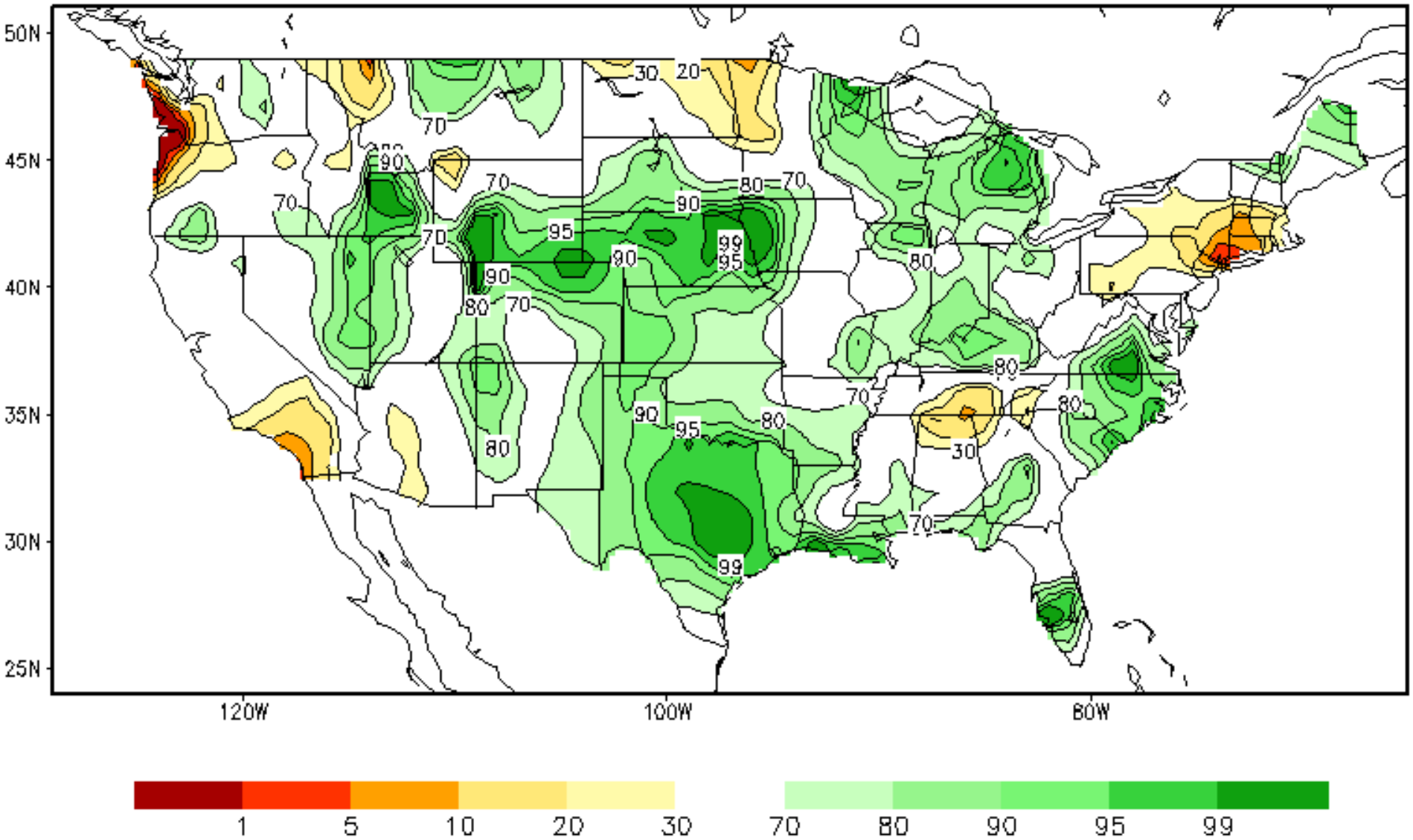
Weekly Value for Period Beginning May 08, 2016

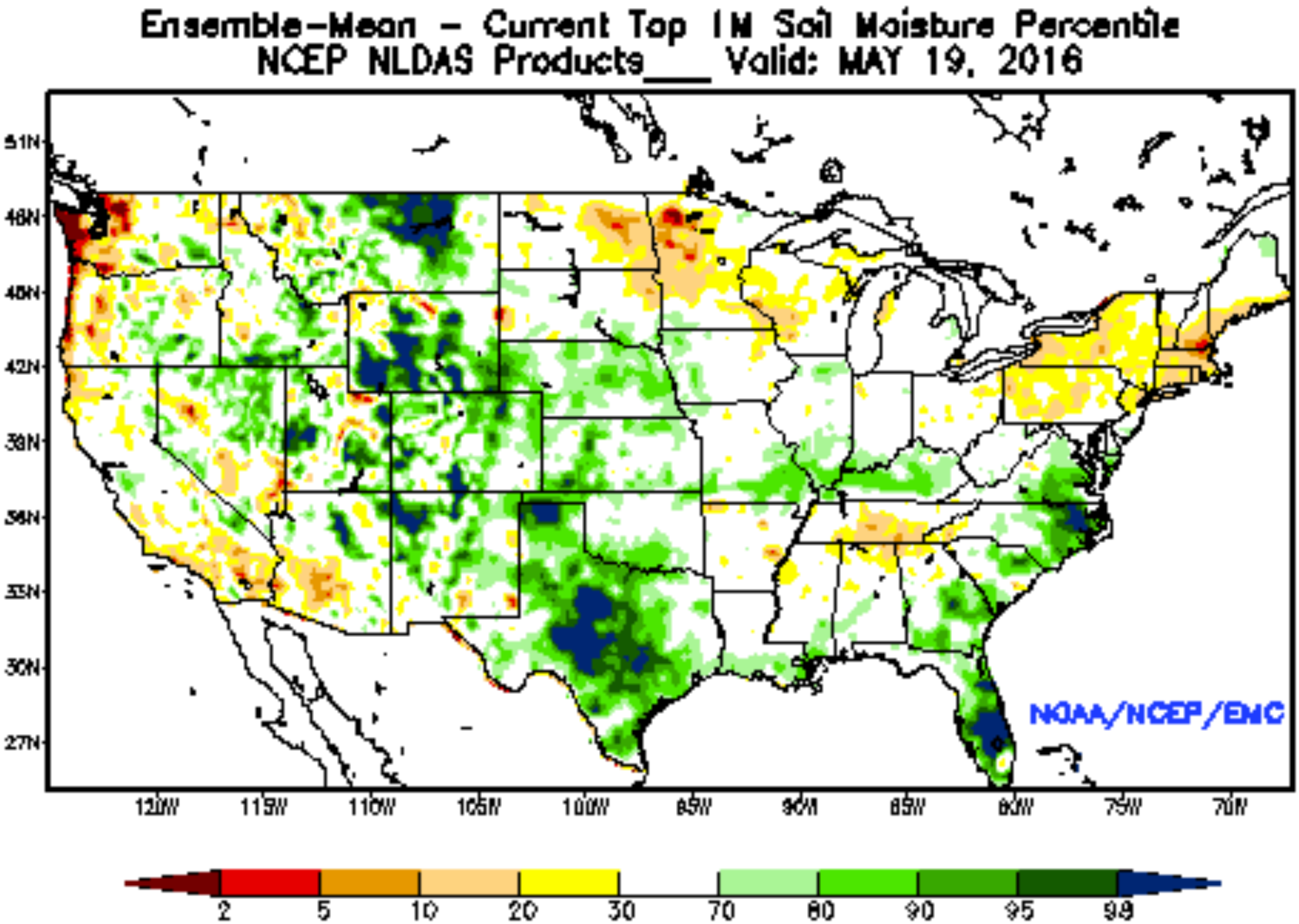


Means are calculated from historical weekly data published by USDA/NASS using the closest date to the equivalent date for this year.

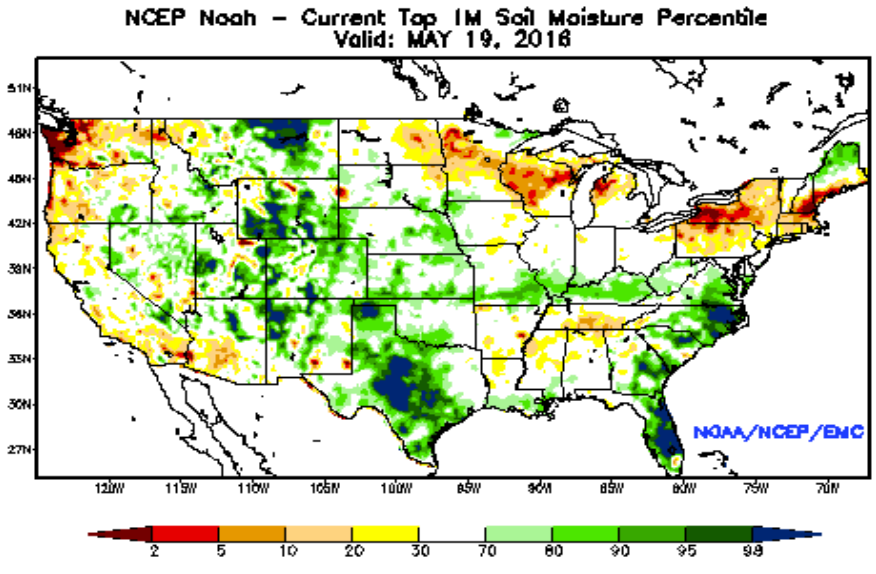
Results are based on the short and very short percentages of topsoil moisture (upper 6 inches) reported by the USDA. Reports are based on subjective observations.

Calculated Soil Moisture Ranking Percentile
MAY 22, 2016

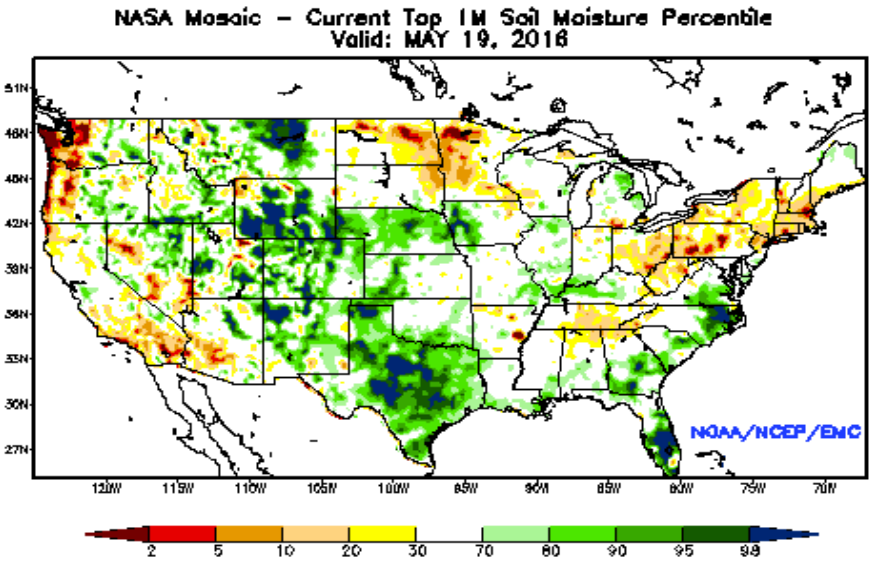



Ensemble-Mean - Current Top 1M Soil Moisture Percentile
NCEP NLDAS Products___ Valid: MAY 19, 2016
51N
46N
40N
42N
38N
36N
35N
30N
27N
120W
115W
110W
105W
100W
95W
90W
85W
80W
75W
70W
NOAA/NCEP/EMC
2
5
10
20
30
70
80
90
95
99

NOAH LSM OUTPUT:

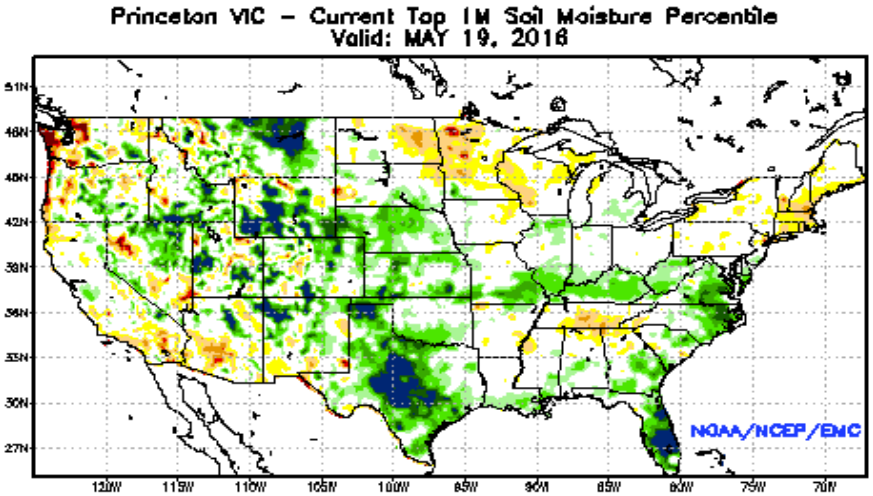


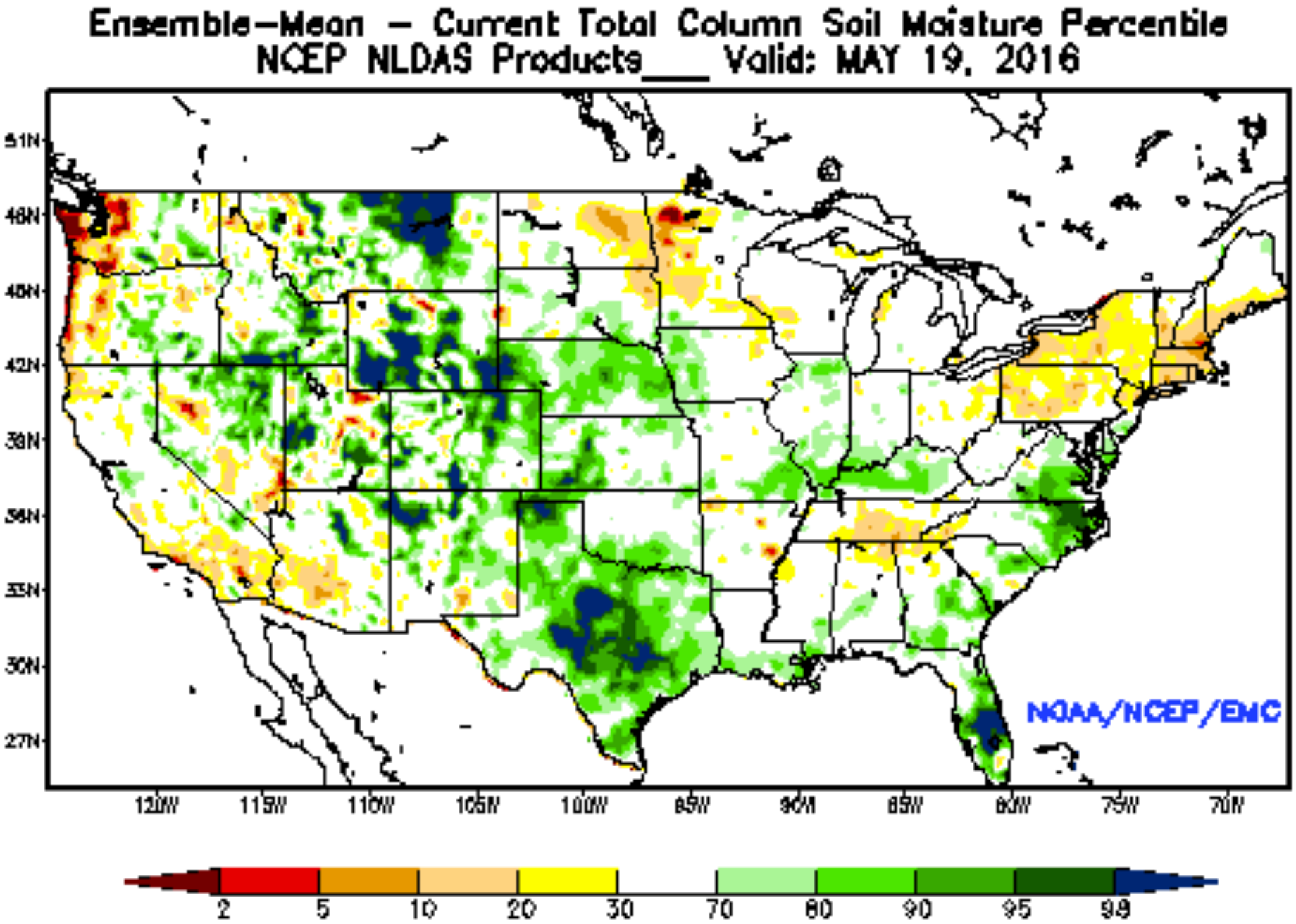
MOSAIC LSM OUTPUT:



SAC LSM OUTPUT:

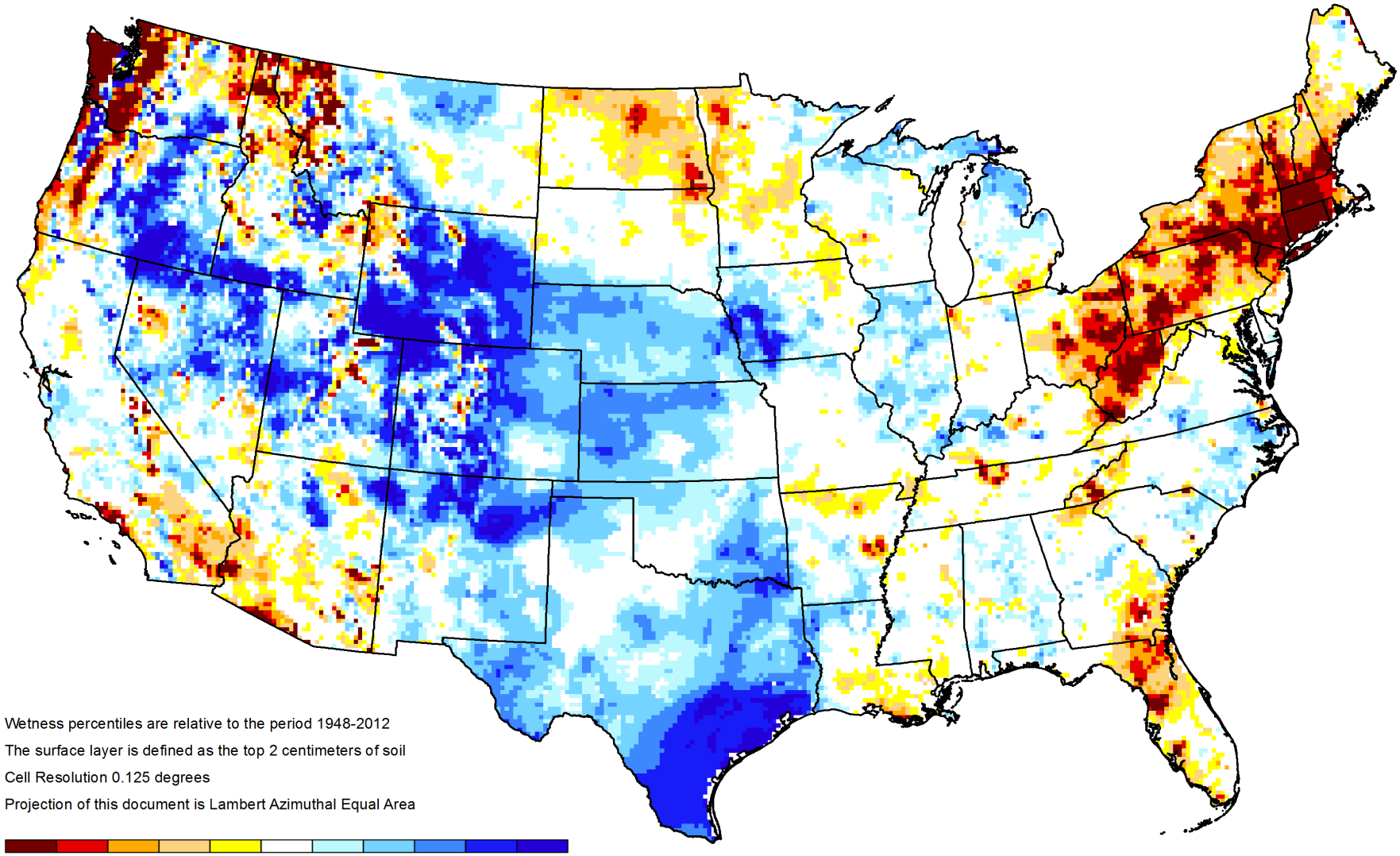
VIC LSM OUTPUT:




Ensemble-Mean - Current Total Column Soil Moisture Percentile
NCEP NLDAS Products___ Valid: MAY 19, 2016
51N
46N
40N
42N
38N
36N
33N
30N
27N
120W
115W
110W
105W
100W
95W
90W
85W
80W
75W
70W
NOAA/NCEP/EMC
2
5
10
20
30
70
80
90
95
99

GRACE-Based Surface Soil Moisture Drought Indicator

May 16, 2016



Wetness percentiles are relative to the period 1948-2012

The surface layer is defined as the top 2 centimeters of soil

Cell Resolution 0.125 degrees

Projection of this document is Lambert Azimuthal Equal Area

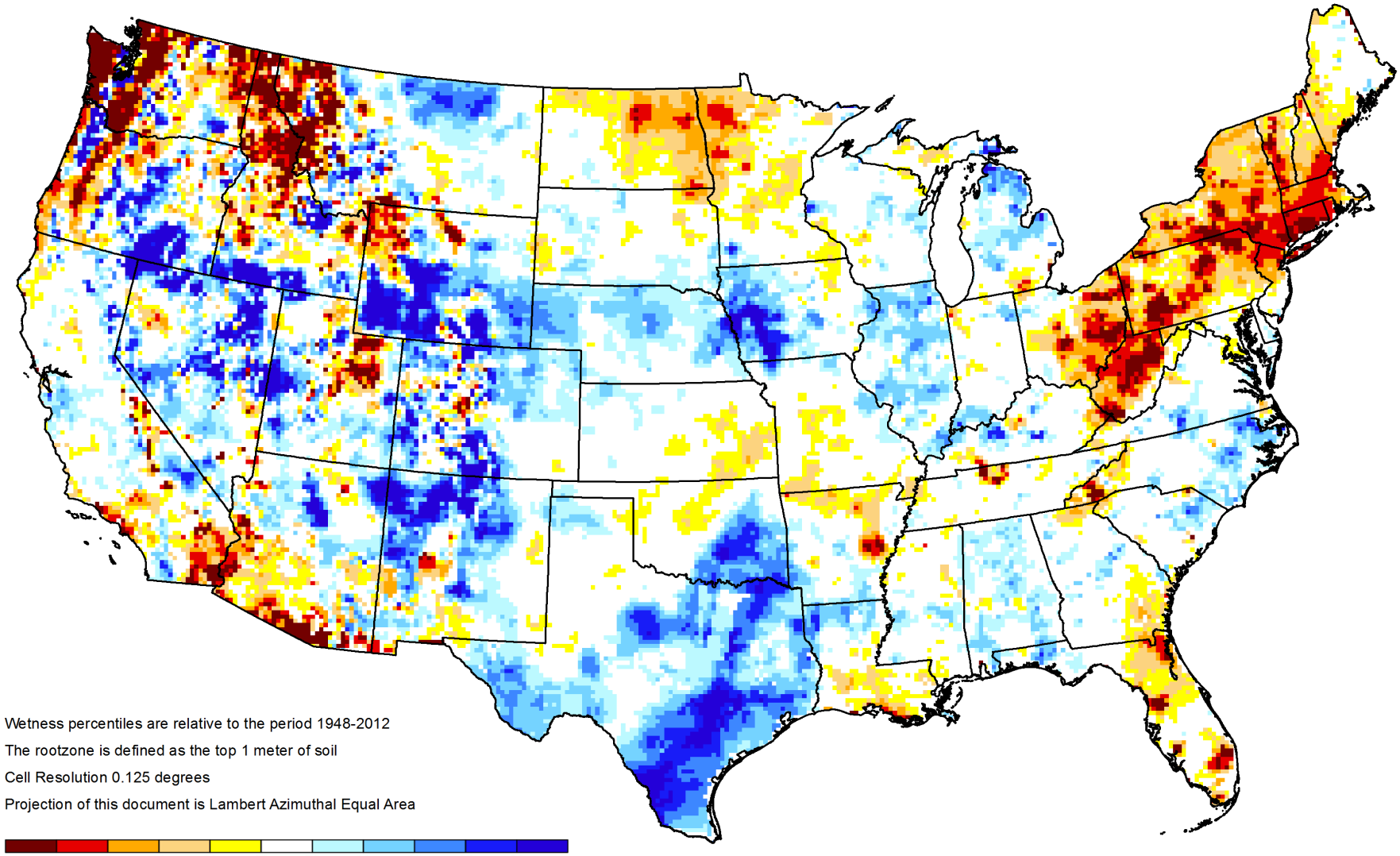
2 5 10 20 30 70 80 90 95 98

Wetness Percentile

http://drought.unl.edu/MonitoringTools/NASAGRACEDataAssimilation.aspx

GRACE-Based Root Zone Soil Moisture Drought Indicator

May 16, 2016



Wetness percentiles are relative to the period 1948-2012

The rootzone is defined as the top 1 meter of soil

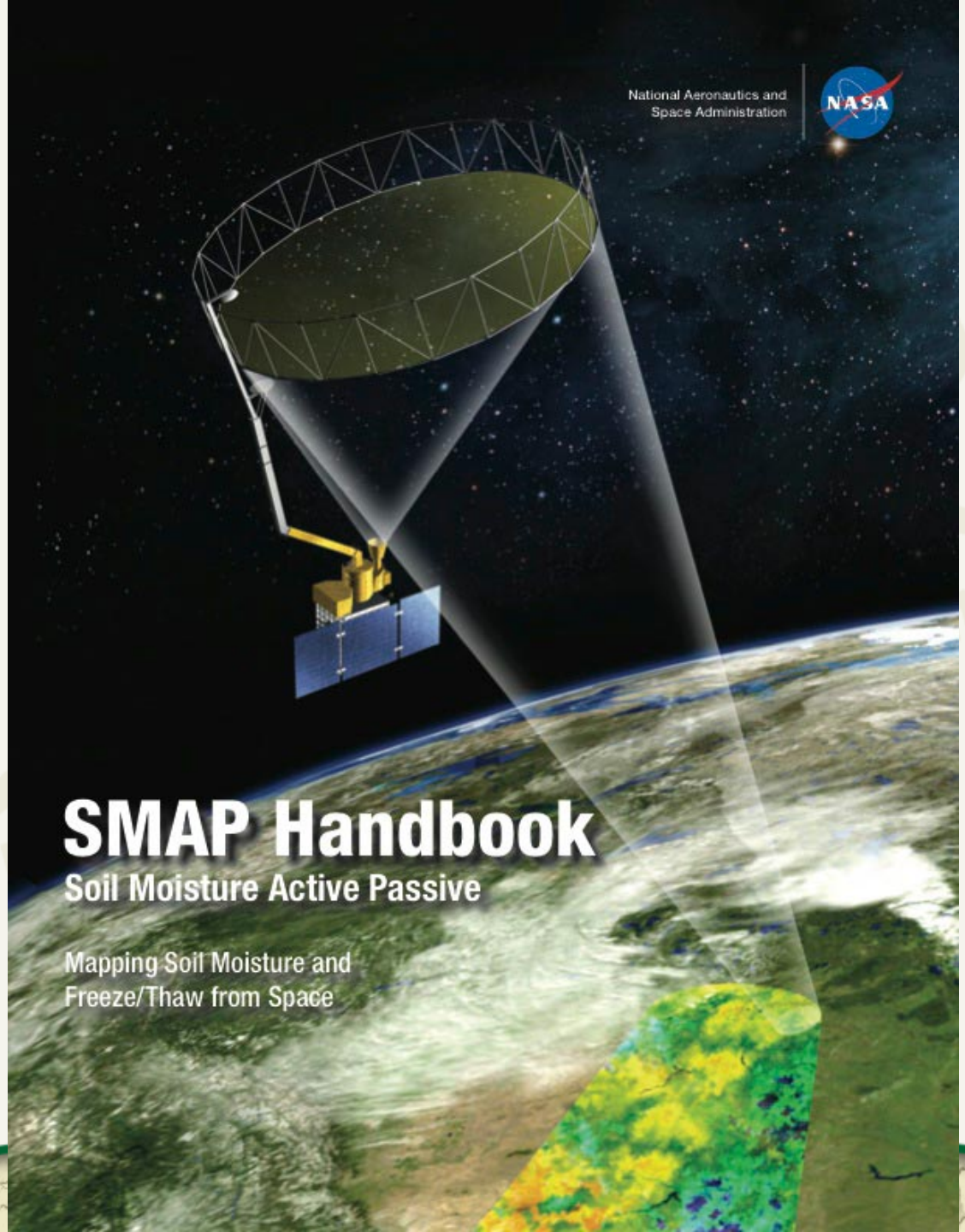
Cell Resolution 0.125 degrees

Projection of this document is Lambert Azimuthal Equal Area

2 5 10 20 30 70 80 90 95 98

Wetness Percentile

http://drought.unl.edu/MonitoringTools/NASAGRACEDataAssimilation.aspx



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NDMC/USDA Coop Agreement

- **Develop and integrate derivative products from the USDA SCAN Network**
- **219 SCAN sites (20 have issues)**
- **Have computed 14- and 28-day average percentiles from SCAN data**
  - At 2”, 4”, 8” and 20” depths
  - Using USDM percentiles: 30 (DO)/20 (D1)/10 (D2)/5 (D3)/2 (D4)
- **Symbology in GIS layers for USDM authors:**
  - <2 years
  - 2-5 years
  - 5-10 years
  - > 10 years

http://www.wcc.nrcs.usda.gov/webmap/index.html#elements=&networks=SCAN&states=!&counties=!&hucs=&r

Mail - Mark Svoboda - ... | droughtmonitor.unl.edu | NRCS National Water a... | Waiting for wcc.nrcs....

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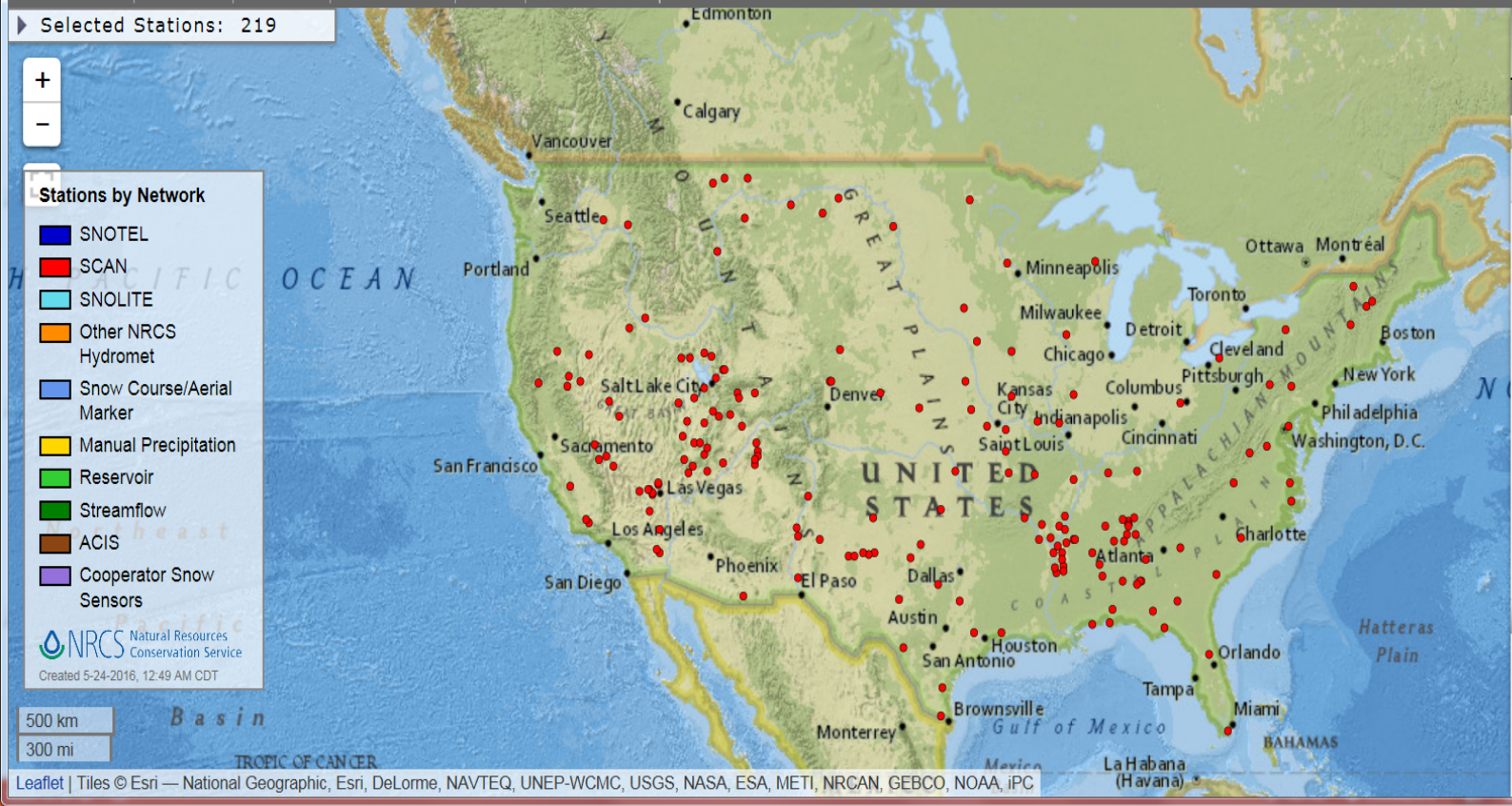
United States Department of Agriculture

NRCS Natural Resources Conservation Service

National Water and Climate Center

NWCC Home | About Us | Products | Publications | News | Partnerships | Contact Us | Map Help | Give us Feedback | A A A

Selected Stations: 219



MAP CONTROLS

View: Station Inventory | Conditions

Station Selection

Elements

- Stations with *all* checked elements
- Stations with *any* checked elements

Check All | Uncheck All

Snow
- Snow Water Equivalent
- Snow Depth

Precipitation
- Precipitation

Soils
- Soil Moisture
- Soil Temperature

Reservoir
- Reservoir Storage

Streamflow
- Adjusted Volume
- Observed Volume
- Diversion Discharge
- Forecast Point

Location

States All None: Alabama, Alaska, Arizona, Arkansas, California, Colorado, Florida

Counties All None: --Alabama--, Baldwin, Colbert, Cullman, Dallas, Escambia, Houston

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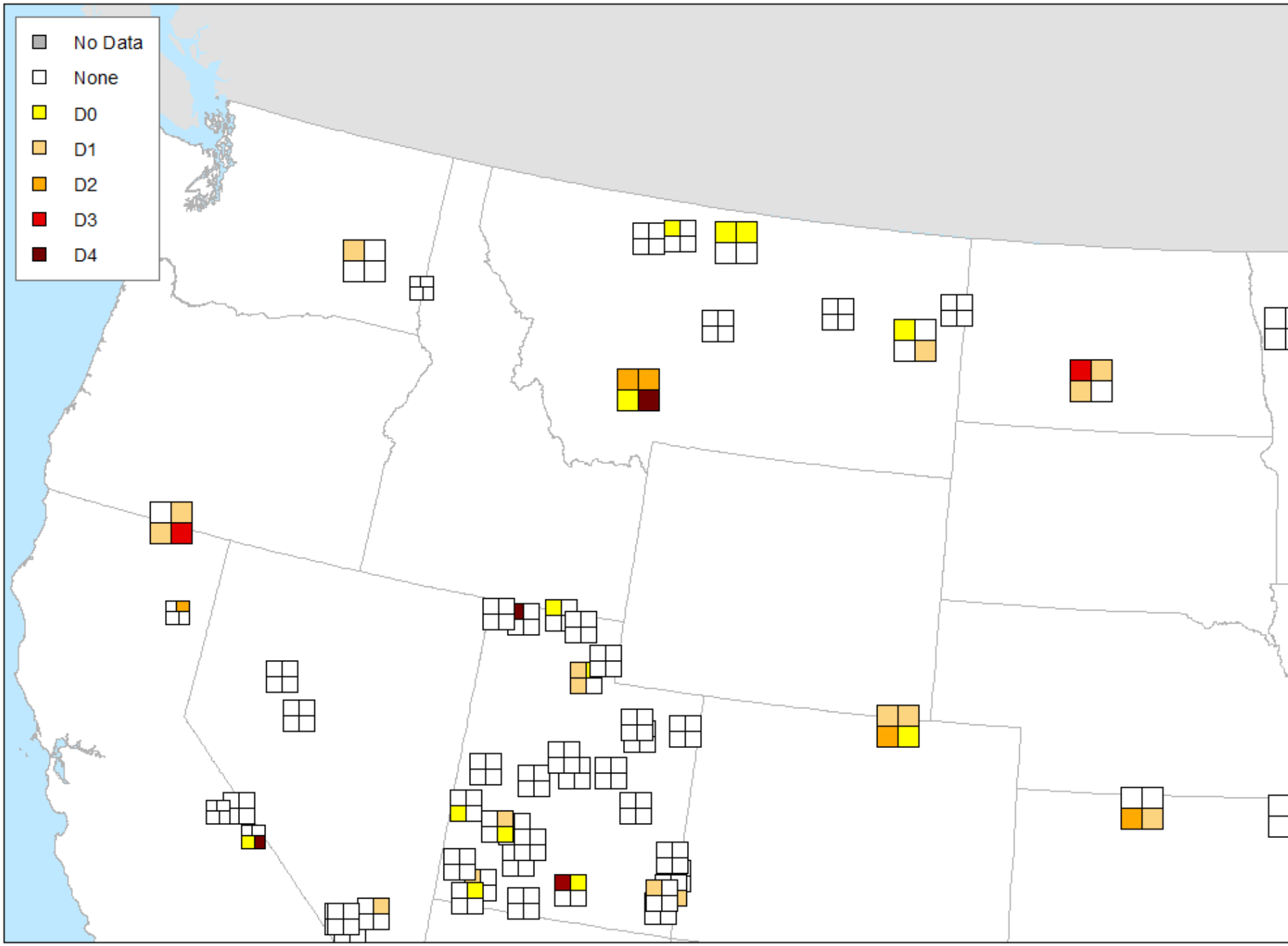
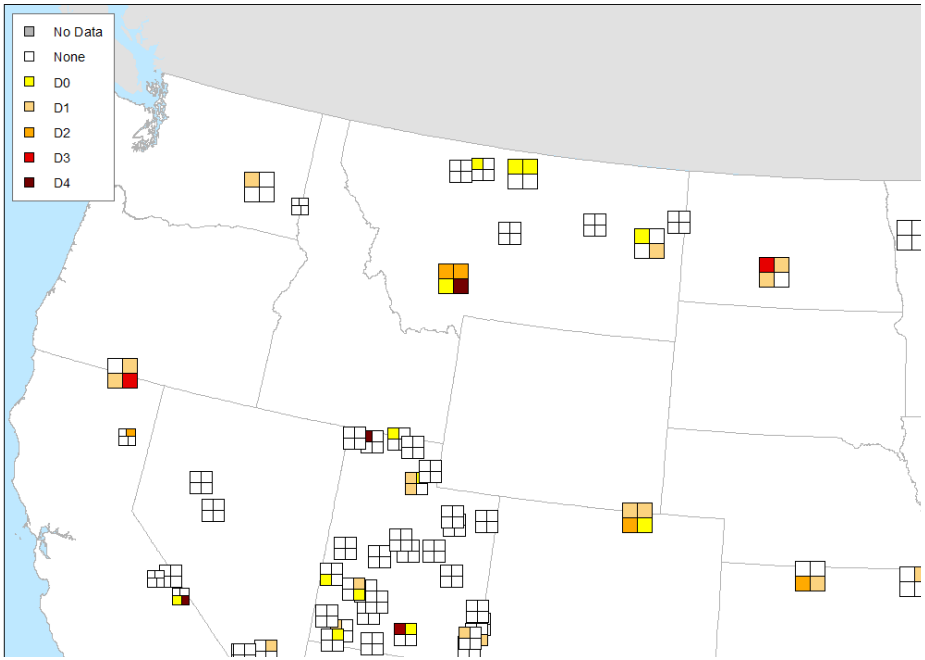
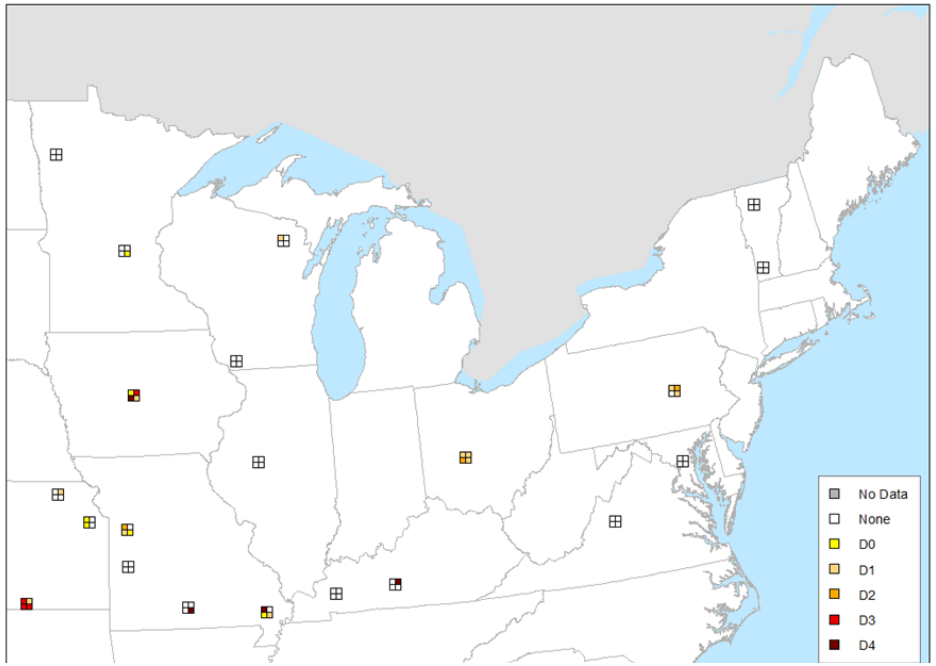

No Data
None
D0
D1
D2
D3
D4

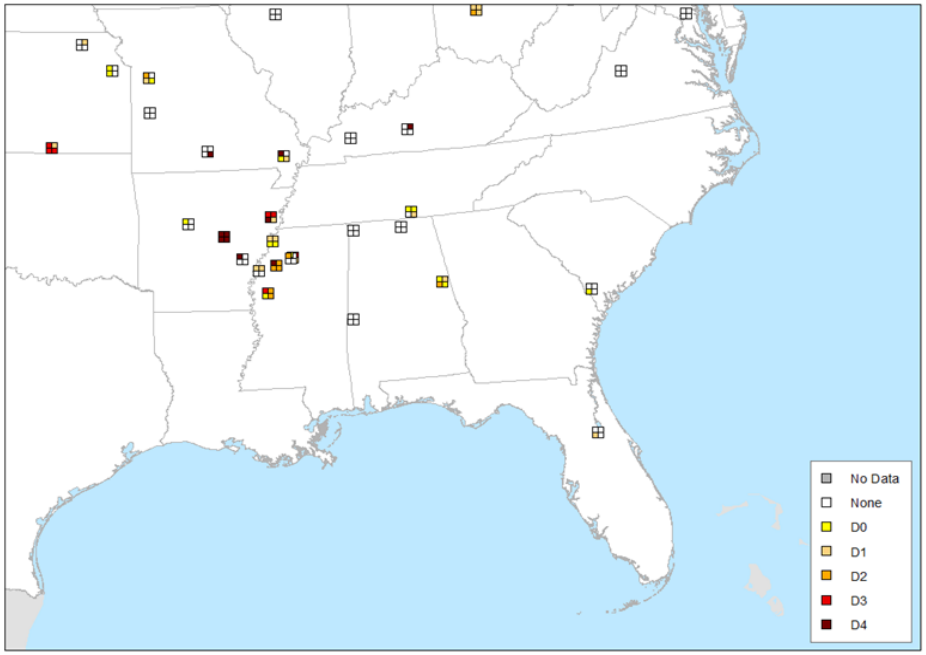
SCAN Data - Northwest



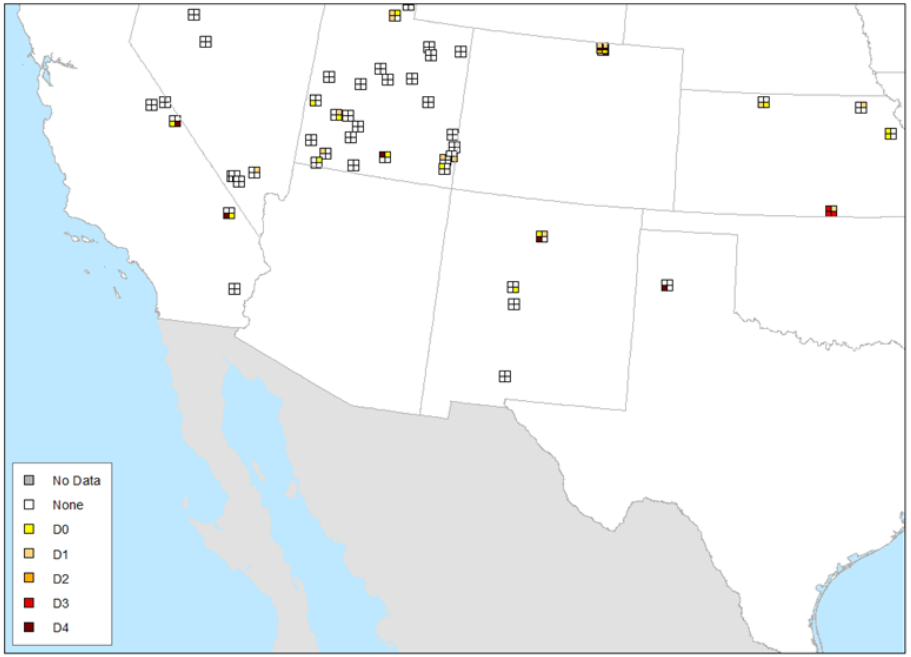
SCAN Data - Northeast



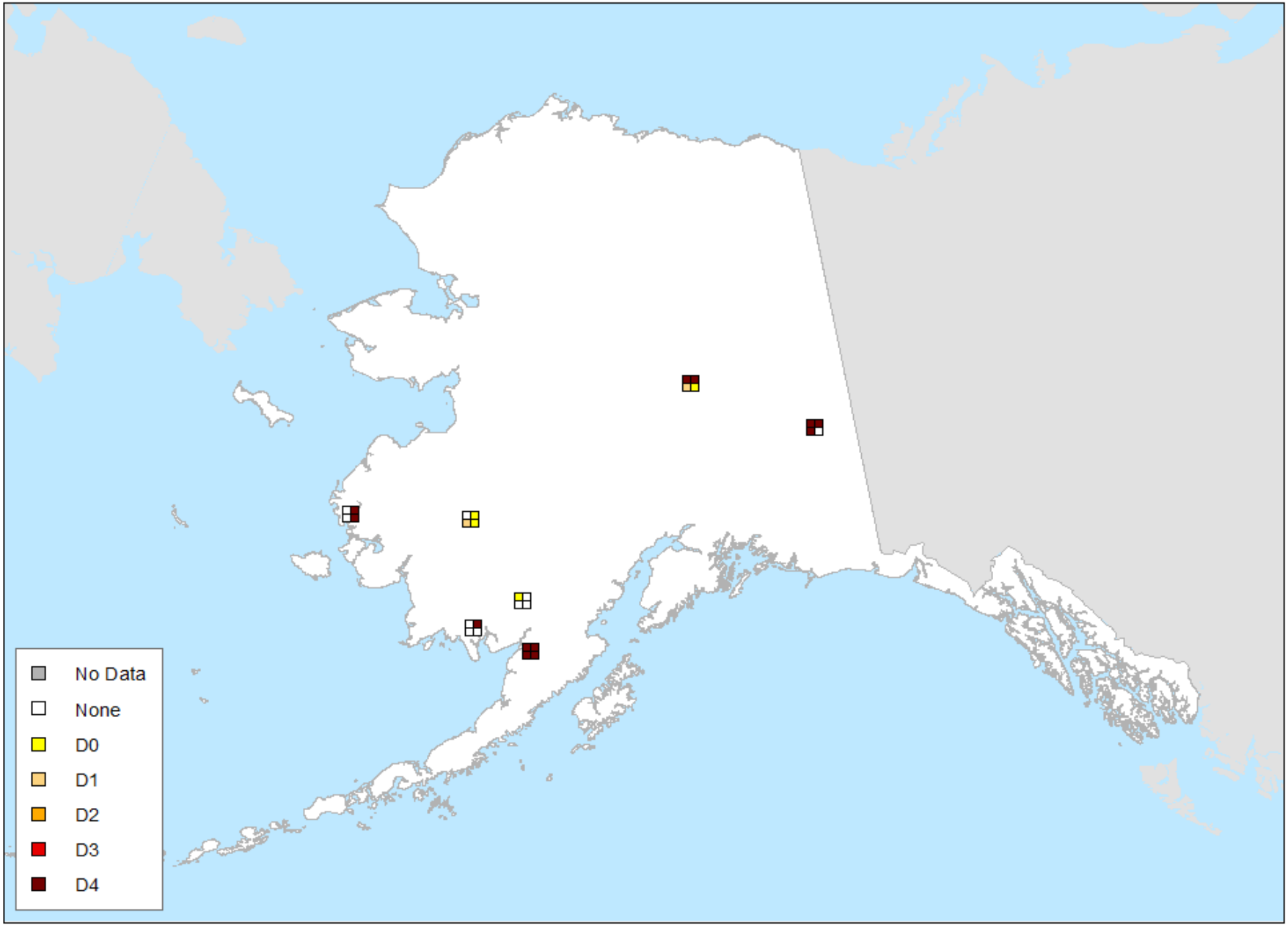
SCAN Data - Southeast

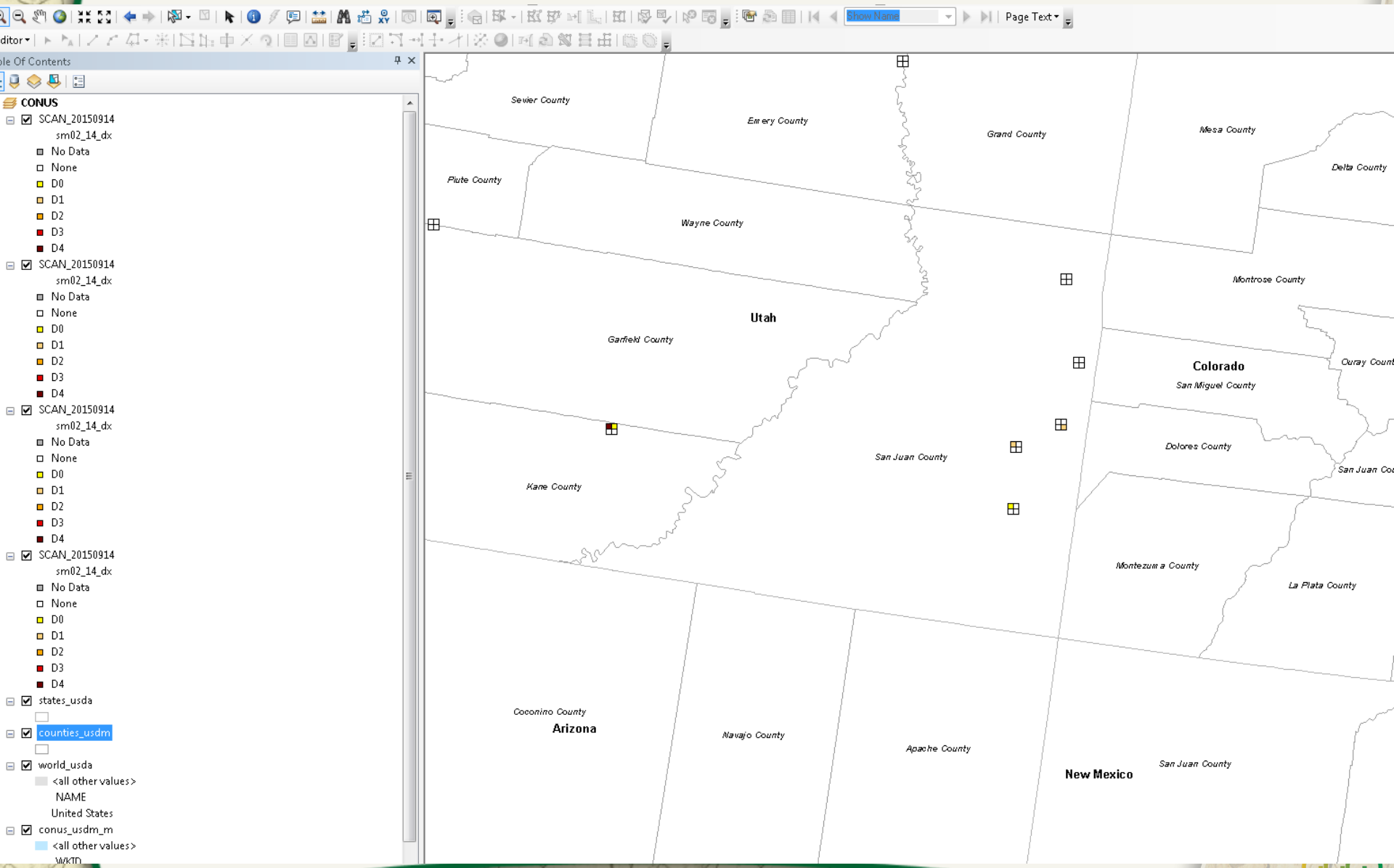


SCAN Data - Southwest



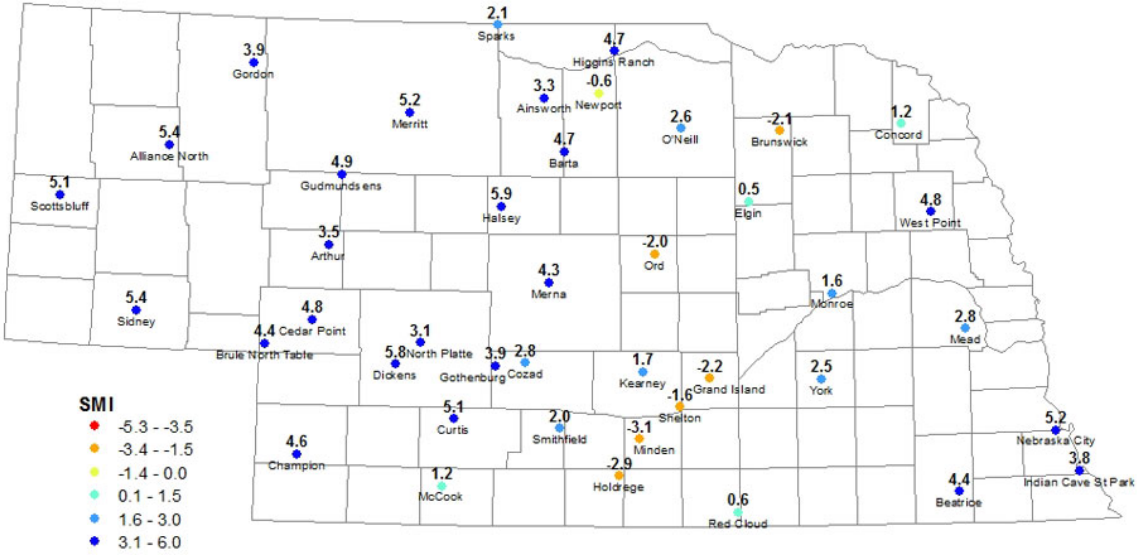
SCAN Data - Alaska

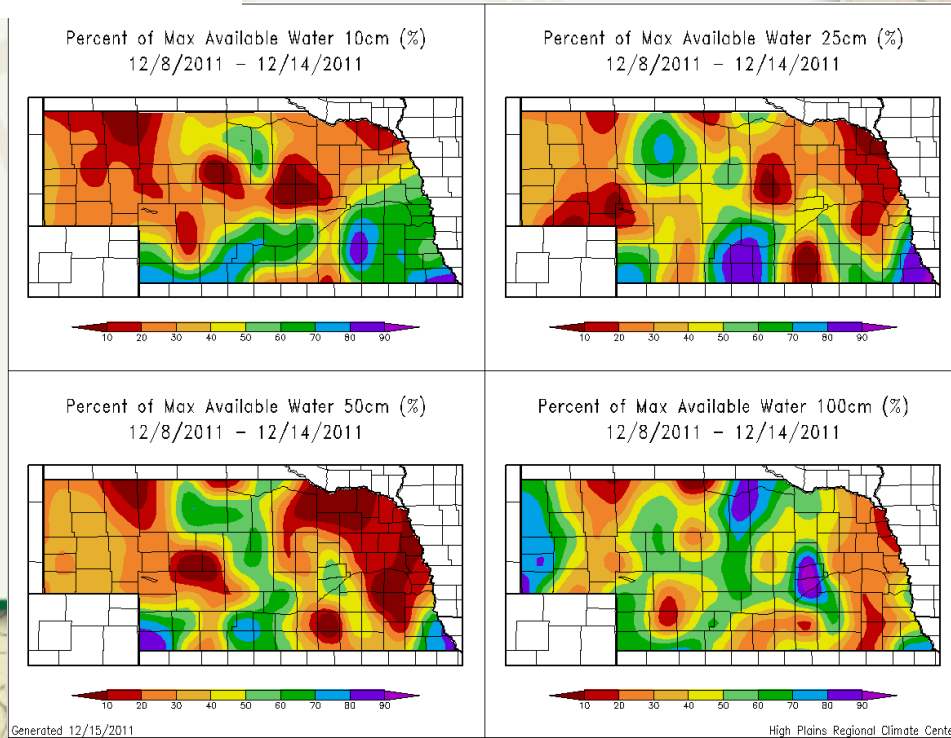




National Drought Mitigation Center

Soil Moisture Index (SMI): 1 June 2015





Next Steps

- **Continue to encourage and incorporate *new/enhanced/innovative products via GIS*:**
  - **Vett USDA Cooperative derivative products for use in the USDM**
  - **Integrate SNOTEL/SCAN SM data into new generation of gridded Objective Indicator *Blends/high resolution/region-season specific***
  - **NLDAS, LIS, Composite Drought Indices**
- **Explore more ways to apply and use SM data to *validate remotely sensed and modeled data* to build trust in those products**
- **Integrate other SM data streams/products?**
  - **CRN**
  - **S. Plains pilot ingest**
- **National SMI/FWI/WP percentile-based input**

Questions?

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