New Tools for Monitoring and Assessing Drought

Mark Svoboda and Brian Fuchs
National Drought Mitigation Center
University of Nebraska-Lincoln

North American Drought Monitor Forum
Mexico City, Mexico. October 18-19, 2006

Overview

- **Work at the NDMC**
  - **USDA/RMA 3-YR Projects (2006-2008)**
    - Remote sensing (VegDRI/VegOUT)
    - Enhance Drought Impact Reporter Database/Tool
    - Quantify (Methodology) Economic Impact Reporting
    - Electronic Drought Risk Atlas
    - Drought Monitor/DSS
    - Ranch/Farm Drought Planning for the Producer
- **Work at NOAA/USDA/USGS to enhance the DM**
- **National Integrated Drought Information System**
- **Future challenges**

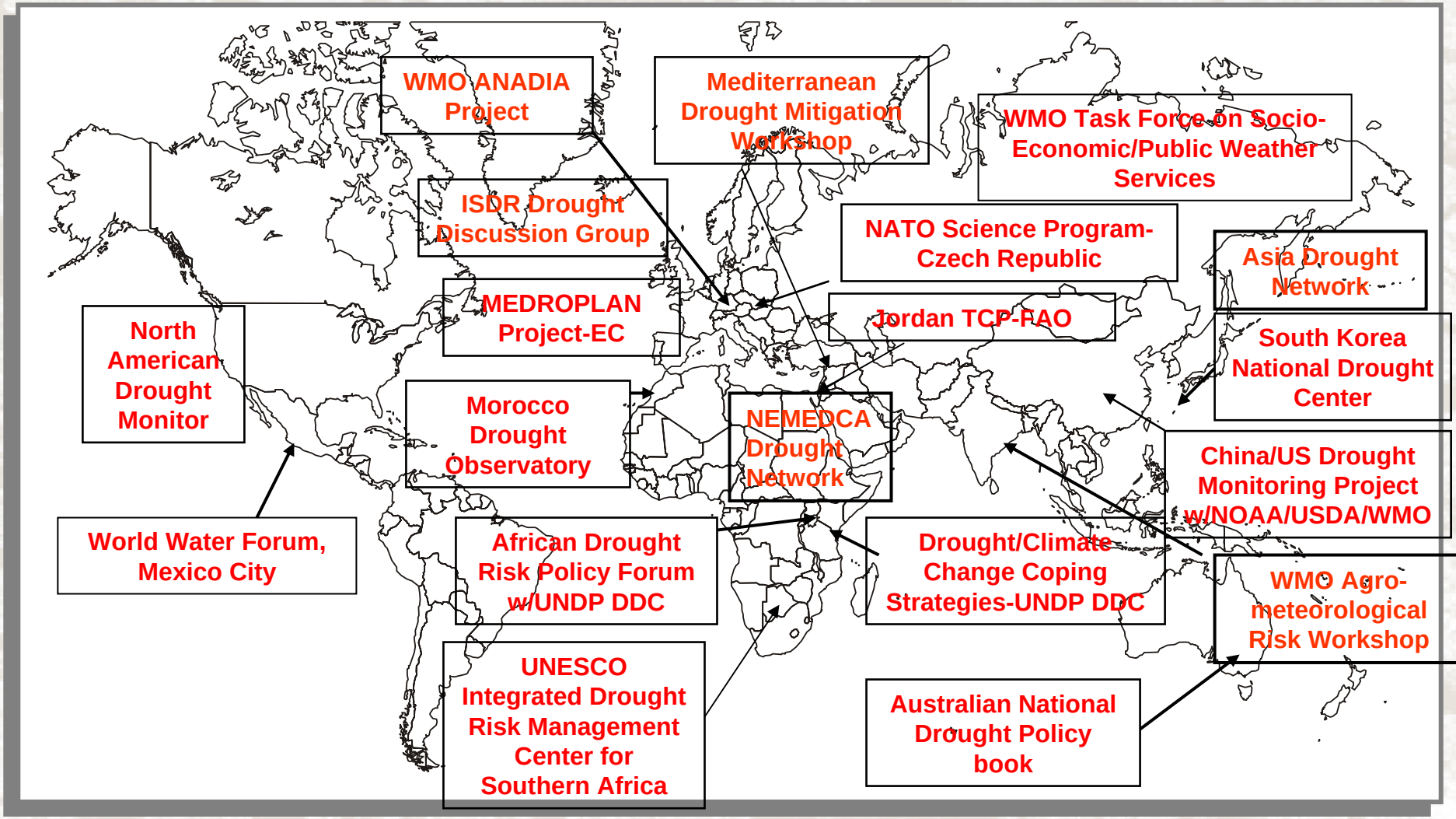
National Drought Mitigation Center

National Drought Mitigation Center

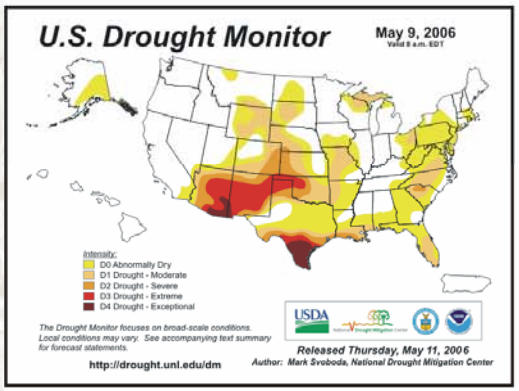
Mission: To lessen societal vulnerability to drought by promoting planning and the adoption of appropriate risk management techniques.

National Drought Mitigation Center

NDMC International Activities



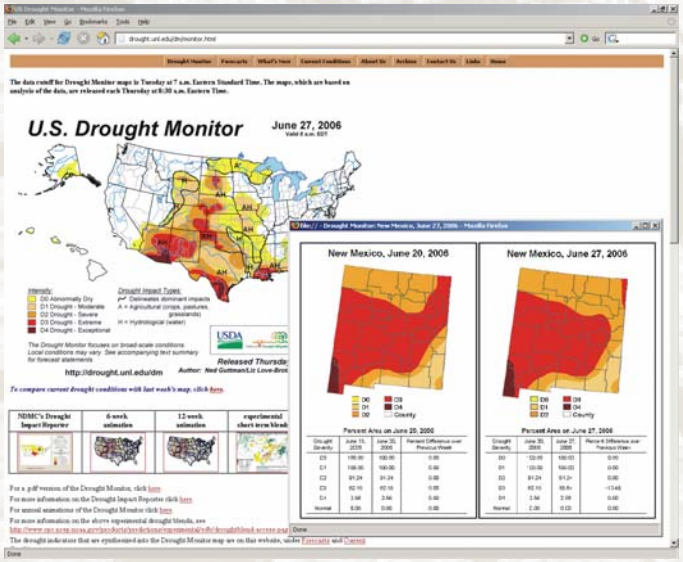
National Drought Mitigation Center



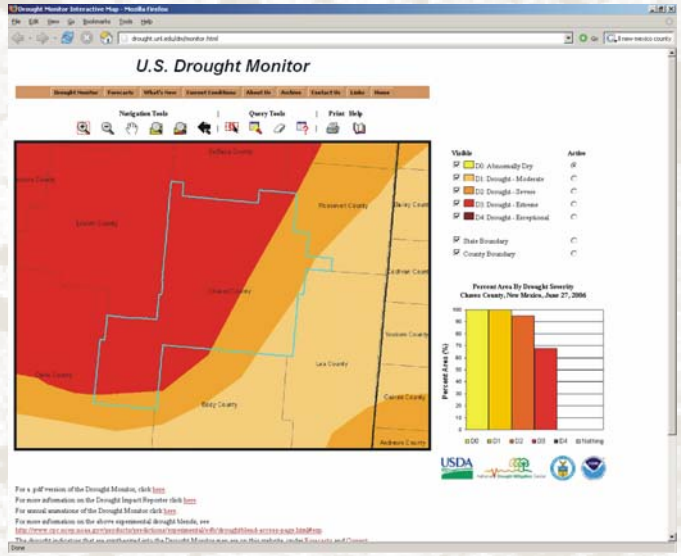
Drought Monitor Decision Support System (DM-DSS):

A Web-based Assessment Tool for Decision Makers

Mark Svoboda, Brian Fuchs, Dr. Michael Hayes, Dr. Jae Ryu, Soren Scott, and Ian Cottingham



Moving toward state-level trend analysis capabilities (left) and providing more county-level drought assessment information (right).



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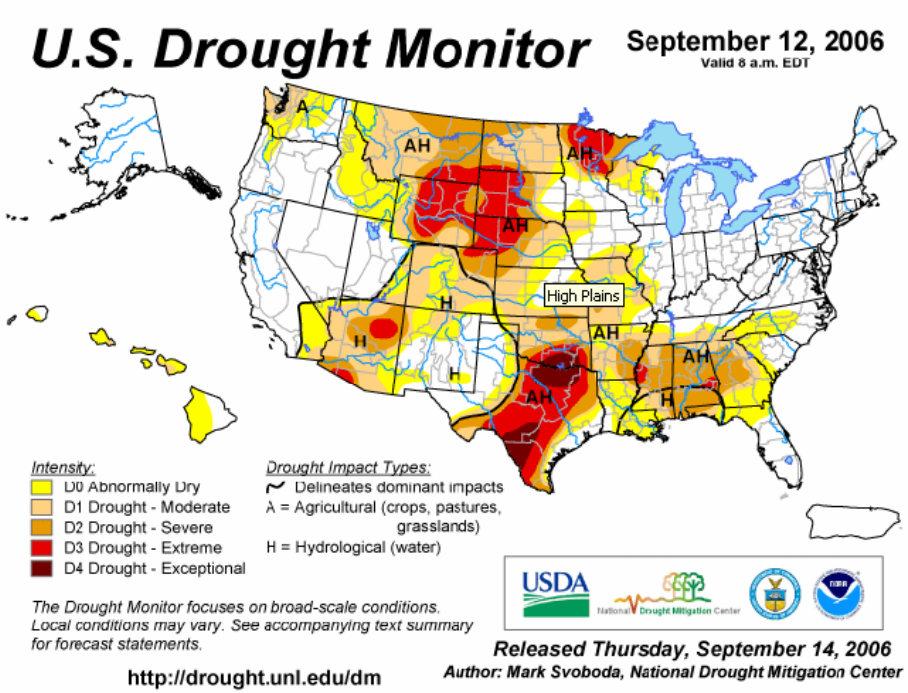
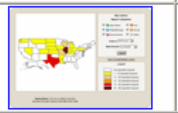
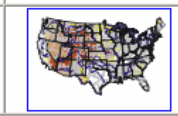
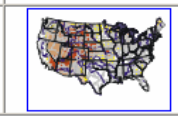
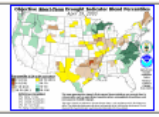
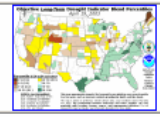
RMA

The data cutoff for Drought Monitor maps is Tuesday at 7 a.m. Eastern Standard Time. The maps, which are based on analysis of the data, are released each Thursday at 8:30 a.m. Eastern Time.



To compare current drought conditions with last week's map, click here.

To view tabular statistics of this week's Drought Monitor, click here.

NDMC's Drought Impact Reporter	6-week animation	12-week animation	experimental short-term blends	experimental long-term blends
				

For a .pdf version of the Drought Monitor, click here.

For more information on the Drought Impact Reporter click here.

For annual animations of the Drought Monitor click here.

Return to U.S. Drought Monitor

The data cutoff for Drought Monitor maps is Tuesday at 7 a.m. Eastern Standard Time. The maps, which are based on analysis of the data, are released each Thursday at 8:30 a.m. Eastern Time.

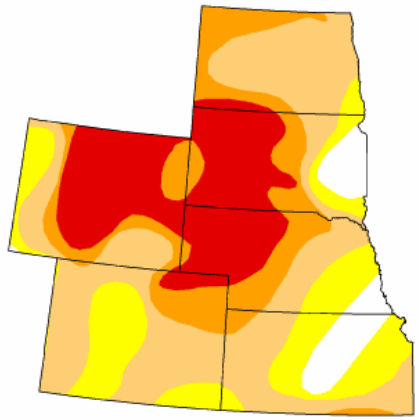
U.S. Drought Monitor

High Plains

September 12, 2006
Valid 8 a.m. EST

Drought Conditions (Percent Area)

	D0-D4	D1-D4	D2-D4	D3-D4	D4	None
Current	93.9	75.5	39.9	23.3	0.0	6.1
Last Week (9/5/2006 map)	95.0	77.4	43.8	20.7	0.0	5.0
Year to Date (1/3/2006 map)	53.1	20.5	0.2	0.0	0.0	46.9
Water Year to Date (10/4/2005 map)	54.8	26.5	6.8	0.0	0.0	45.2
One Year Ago (9/13/2005 map)	52.6	26.6	8.5	0.0	0.0	47.4



Intensity:

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

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

http://drought.unl.edu/dm

Released Thursday, September 14, 2006
Author: Mark Svoboda, National Drought Mitigation Center

For a .pdf version of the High Plains Region Drought Monitor, click here.

To view tabular statistics for the High Plains Region, click here.

For more information on the Drought Impact Reporter click here.

For local details and impacts, please contact your State Climatologist or Regional Climate Center.

Return to U.S. Drought Monitor Return to Region

The data cutoff for Drought Monitor maps is Tuesday at 7 a.m. Eastern Standard Time. The maps, which are based on analysis of the data, are released each Thursday at 8:30 a.m. Eastern Time.

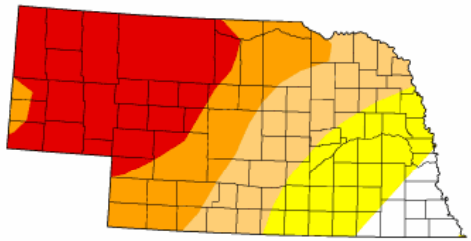
U.S. Drought Monitor

Nebraska

September 12, 2006
Valid 8 a.m. EST

Drought Conditions (Percent Area)

	D0-D4	D1-D4	D2-D4	D3-D4	D4	None
Current	94.3	76.7	55.9	34.8	0.0	5.7
Last Week (9/5/2006 map)	99.2	86.3	64.4	34.8	0.0	0.8
Year to Date (1/3/2006 map)	87.0	34.5	0.2	0.0	0.0	13.0
Water Year to Date (10/4/2005 map)	72.5	40.5	0.0	0.0	0.0	27.5
One Year Ago (9/13/2005 map)	74.4	37.7	0.0	0.0	0.0	25.6



Intensity:

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

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

http://drought.unl.edu/dm

Released Thursday, September 14, 2006

Author: Mark Svoboda, National Drought Mitigation Center

For a .pdf version of the Nebraska Drought Monitor, click here.

To view tabular statistics for Nebraska, click here.

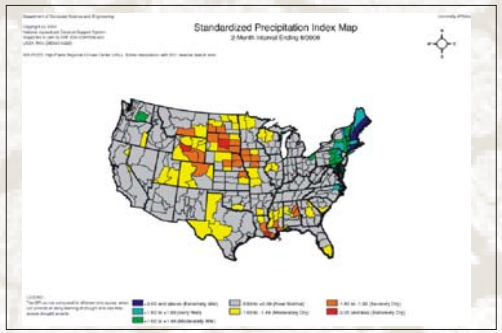
For more information on the Drought Impact Reporter click here.

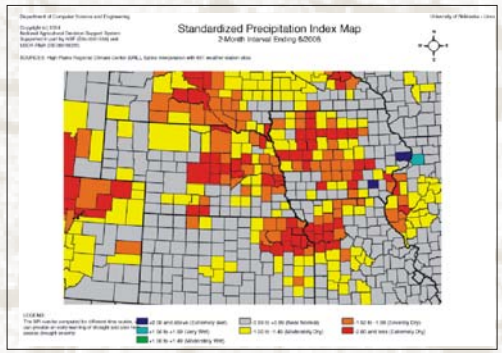
For local details and impacts, please contact your State Climatologist or Regional Climate Center.

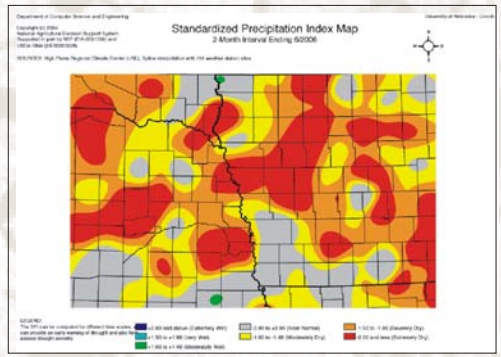
Drought Atlas:

Understanding Past and Present Droughts and Future Risk

Mark Svoboda, Brian Fuchs, Dr. Michael Hayes, Dr. Jae Ryu, Soren Scott, Ian Cottingham, Sandra Jones, and Jeff Nothwehr





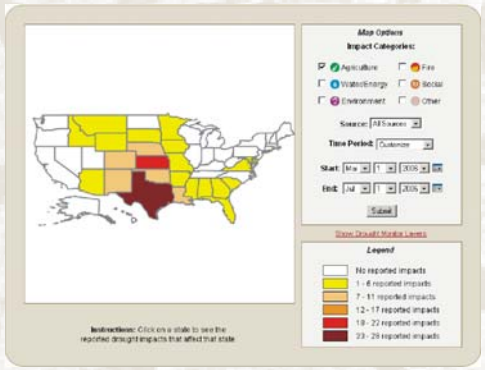


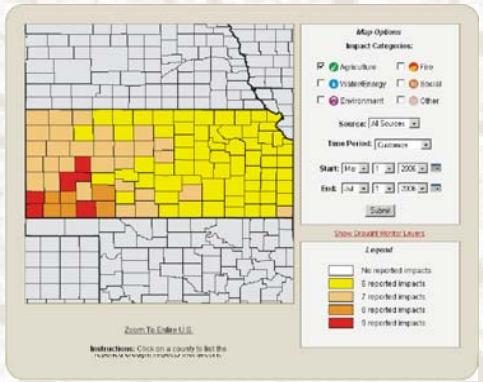
The goal of the atlas is to provide usable tools and products for users at all levels by giving them the ability to visualize and assess their drought risk through a variety of web-based options. The example above shows how producers and other decision makers can assess drought at a variety of time scales and at user-defined spatial levels.

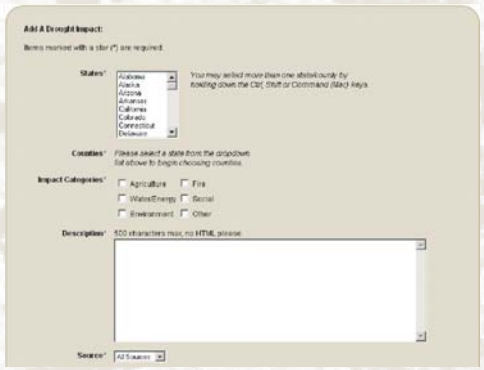
University of Nebraska — National Drought Mitigation Center — RMA

The Drought Impact Reporter:
A Web-based National Drought Impact Reporting Tool

Dr. Michael Hayes, Mark Svoboda, Dr. Cody Knutson, Brian Fuchs, Deborah Wood, Melissa Higgins, Dr. Gregg Garfin, Melissa Melvin, and Jeff Nothwehr







The Drought Impact Reporter, showing impacts at the national and state level, and the tool's "Add a Drought Impact" feature.

Drought Impact Reporter - Microsoft Internet Explorer

File Edit View Favorites Tools Help

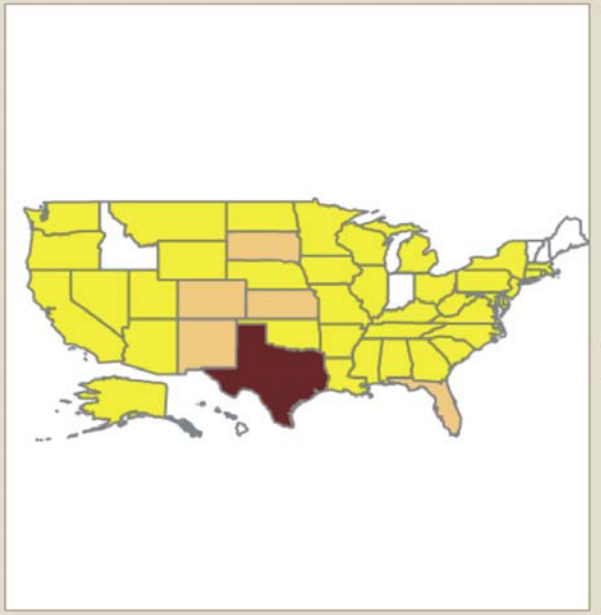
Back Search Favorites

Address http://droughtreporter.unl.edu/?Cmd=filter&scn=nv&c_ag=on&c_fi=on&c_wa=on&c_so=on&c_en=on&c_ot=on&src=&daterange=6months Go Links

Drought Impact Reporter

National Drought Mitigation Center

View Drought Impacts | Add A Drought Impact | Time-Lapse Animation | About | Help | User Login



Map Options

Impact Categories:

- ☑ Agriculture
- ☑ Fire
- ☑ Water/Energy
- ☑ Social
- ☑ Environment
- ☑ Other

Source: All Sources

Time Period: Last 6 Months

Submit

Show Drought Monitor Layers

Legend

- No reported impacts
- 1 - 49 reported impacts
- 50 - 98 reported impacts
- 99 - 146 reported impacts
- 147 - 195 reported impacts
- 196 - 244 reported impacts

Instructions: Click on a state to see the reported drought impacts that affect that state.

created by GIS Workshop

University of Nebraska Lincoln

Internet

Drought Impact Reporter - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Search Favorites

Address http://droughtreporter.unl.edu/?Cmd=filter&scn=nv&c_ag=on&c_fi=on&c_wa=on&c_so=on&c_en=on&c_ot=on&src=&daterange=6months Go Links

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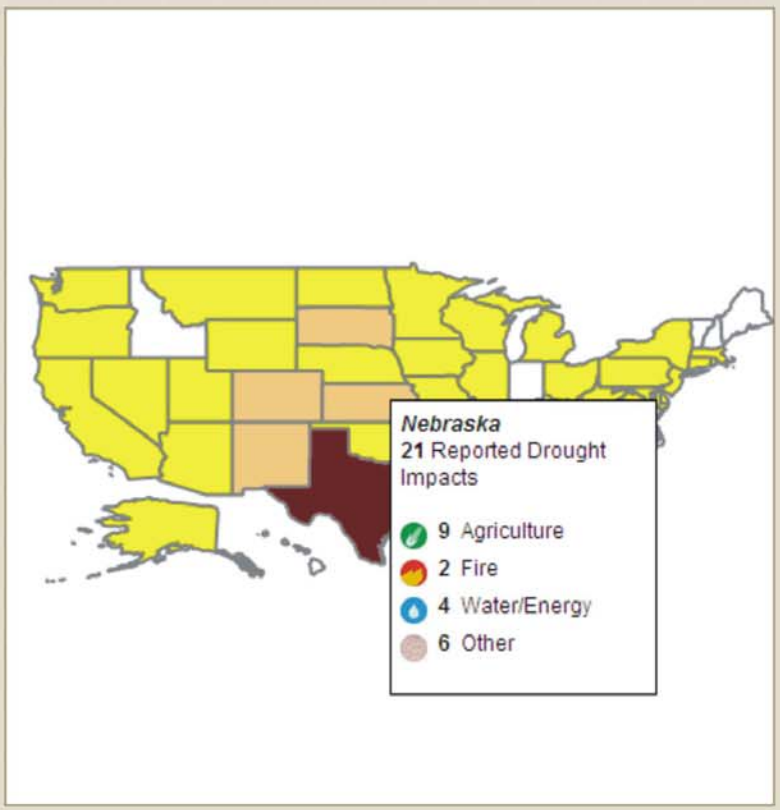

Map Options

Impact Categories:

☑ Agriculture ☑ Fire

☑ Water/Energy ☑ Social

☑ Environment ☑ Other

Source: All Sources

Time Period: Last 6 Months

Submit

Show Drought Monitor Layers

Legend

- No reported impacts
- 1 - 49 reported impacts
- 50 - 98 reported impacts
- 99 - 146 reported impacts
- 147 - 195 reported impacts
- 196 - 244 reported impacts

Internet

Drought Impact Reporter - Microsoft Internet Explorer

File Edit View Favorites Tools Help

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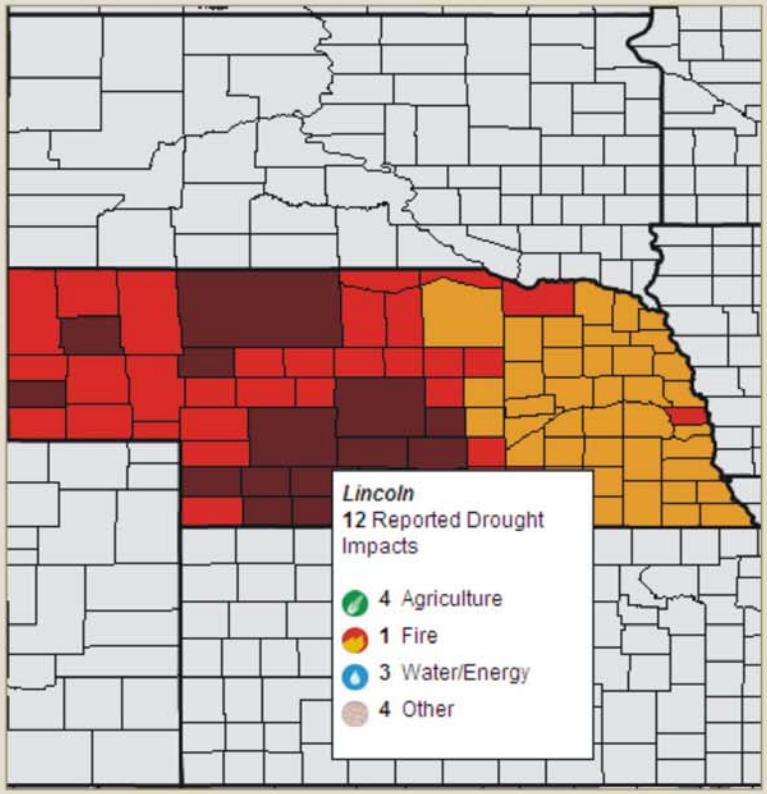
Address http://droughtreporter.unl.edu/map.jsp?&src=&daterange=year&c_ot=on&c_wa=on&year2=2006&year1=2005&c_ag=on&day2=14&day1=14&scn=nv&c_fi=

Go Links

Drought Impact Reporter

National Drought Mitigation Center

View Drought Impacts | Add A Drought Impact | Time-Lapse Animation | About | Help | User Login



Map Options

Impact Categories:

- ☑ Agriculture
- ☑ Fire
- ☑ Water/Energy
- ☑ Social
- ☑ Environment
- ☑ Other

Source: All Sources

Time Period: Last Year

Submit

Show Drought Monitor Layers

Legend

- No reported impacts
- 1 - 3 reported impacts
- 4 - 5 reported impacts
- 6 - 7 reported impacts
- 8 - 9 reported impacts
- 10 - 12 reported impacts

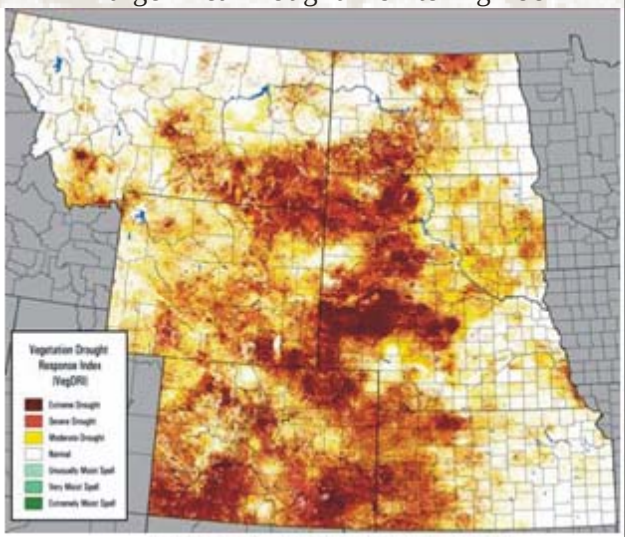
Internet

National Drought Mitigation Center–RMA Partnership Agreement Projects

Geospatial Drought Monitoring Tools for Livestock and Forage Producers

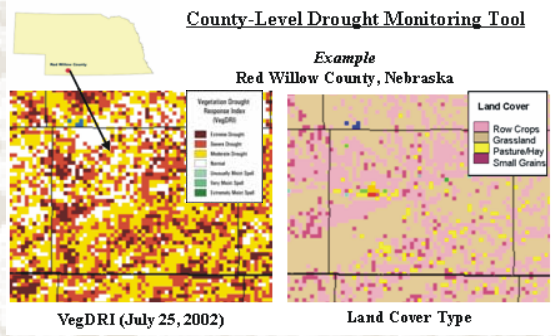
Dr. Brian Wardlow, Dr. Tsegaye Tadesse, Dr. Michael Hayes, Mark Svoboda, and Jesslyn Brown

Large-Area Drought Monitoring Tool



VegDRI map for July 25, 2002

The VegDRI and VegOut tools produce maps that present the spatial patterns and relative severity of drought-induced vegetation stress over large areas such as this seven-state region of the northern U.S. Great Plains (left). The 1-km^2 resolution of the maps generated by these tools allows sub-county level assessments of drought (right).



County-level Drought Assessment Statistics from VegDRI

- 168,000 acres of grassland affected by drought (25% severe and extreme, 53% moderate)
- 376,000 acres of row crops affected by drought (68% severe and extreme, 23% moderate)
- 41,800 acres of pasture/hay affected by drought (40% severe and extreme, 40% moderate)

University of Nebraska

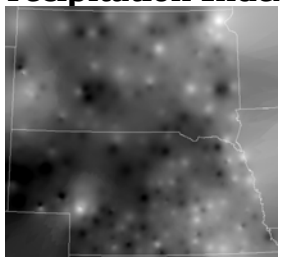
National Drought Mitigation Center

RMA

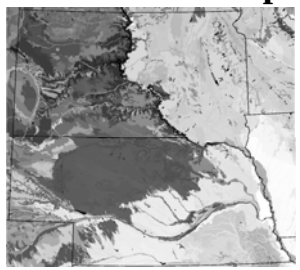
VegDRI: Methodological Approach

Model Input

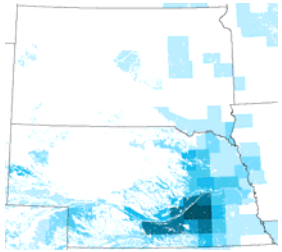
Standardized Precipitation Index



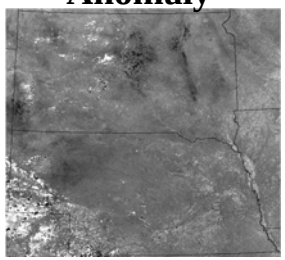
Available Water Capacity



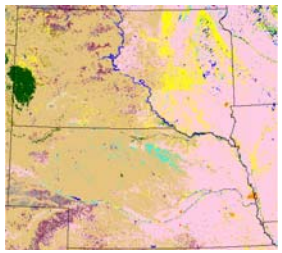
% Irrigated Farmland



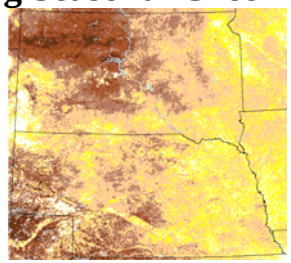
Start of Season Anomaly



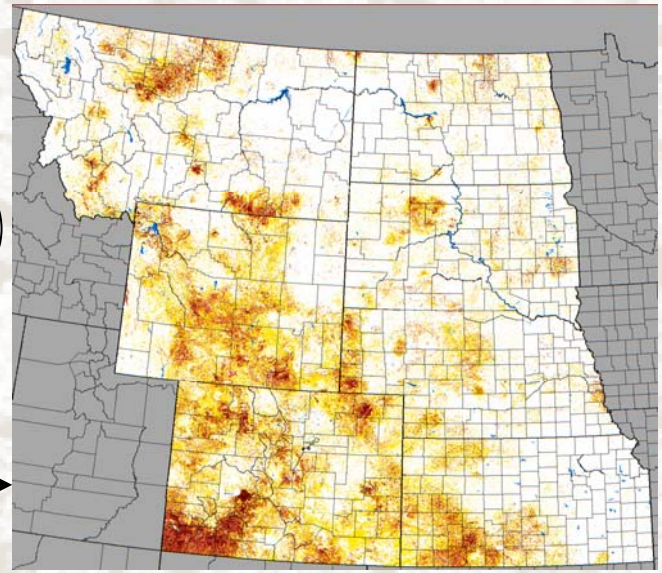
Land Cover



% Avg Seasonal Greenness



Regression Tree Modeling

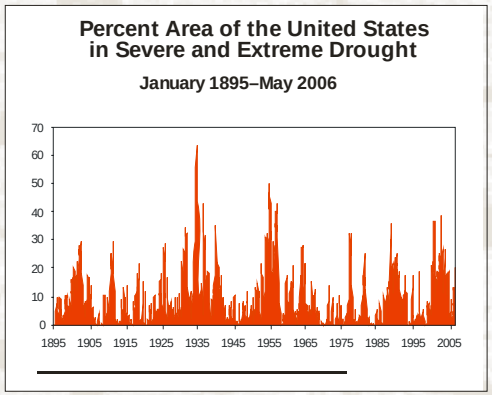


VegDRI (Vegetation Drought Response Index)

National Drought Mitigation Center

Economic Impacts of Drought: Developing Methodologies to Estimate Drought Losses

Dr. Michael Hayes, Dr. Ya Ding, Dr. Roger Pulwarty, Dr. Chuck Howe, Dr. Ray Supalla, Dr. Karina Schoengold, Dr. Janie Chermak, and Prabhakar Shrestha



The percent area of the United States in severe to extreme drought, 1895–2006; newspaper headlines showing the variety of drought impacts; drought's impact on a marina on Lake Mead.

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Ranching Drought Plan:

A Drought Planning Tool for Livestock and Forage Producers

Dr. Cody Knutson, Dr. Michael Hayes, Dr. Pat Reece, Dr. Matt Stockton,
Dr. Dick Clark, Dr. Terry Klopfenstein, Dr. Lowell Moser, and Ryan Bjerke

Taking drought planning to the producer level

University of Nebraska

National Drought Mitigation Center

RMA

Monitoring Drought

Daily Gridded Standard Precipitation Index

Select a map from one of the following lists:

Updated Daily	Last Month / Season / Year	Previous Month / Season / Year
--- Select a map ---	--- Select a map ---	--- Select a map ---
		-Month-
		-Year-

Select an area: United States

Select map type: Shaded

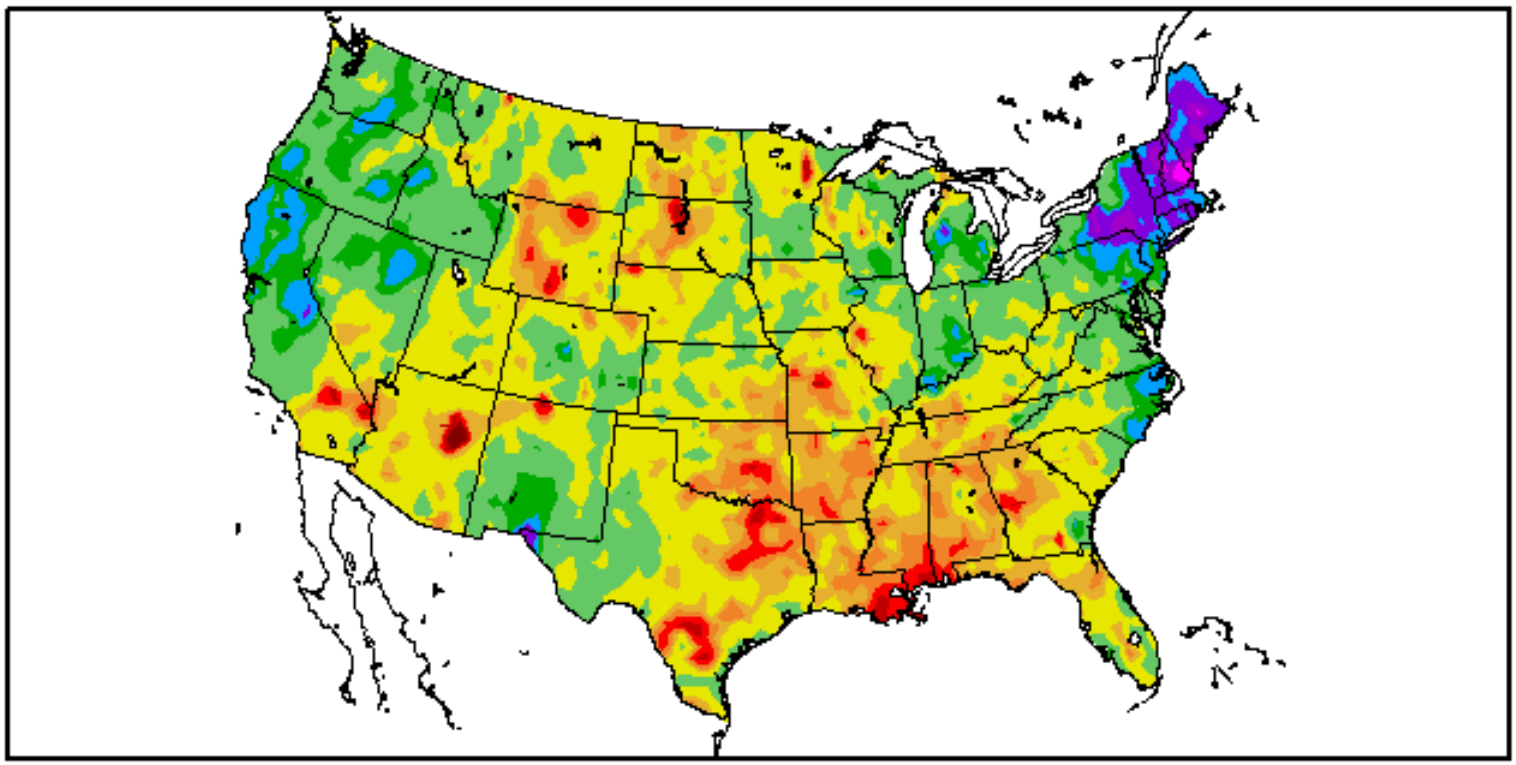
Powered by ACIS
NOAA Regional Climate Centers

View Map Clear

This is an **Experimental Climate Product!** These maps include provisional, preliminary and final data. Very limited quality control is performed on provisional data, and these products should be used with caution. The best available data is incorporated as it becomes available. For more information, please click here

30 Day SPI

Water Year SPI
10/1/2005 – 9/14/2006



−3 −2.5 −2 −1.5 −1 0 1 1.5 2 2.5 3

Generated 9/15/2006 at HPRCC using provisional data. National Drought Mitigation Center

−3 −2.5 −2 −1.5 −1 0 1 1.5 2 2.5 3

Generated 9/15/2006 at HPRCC using provisional data. National Drought Mitigation Center

Daily Precipitation Analysis - Microsoft Internet Explorer

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Address http://www.cpc.ncep.noaa.gov/products/precip/realtime/GIS/USMEX/USMEX-precip.shtml Go Links

Google Search 147 blocked Check Look for Map AutoFill Options

Adobe Search Web Upgrade Now! Mail My Yahoo! Answers

HOME > Daily Precipitation Analysis > US & Mexico

CPC Search
CPC search Go

US and Mexico

Daily Precipitation

7-Days Precipitation Accumulation - loop

About the Gridded Analysis

Download Real-Time Gridded Data

Download Historical Gridded Data

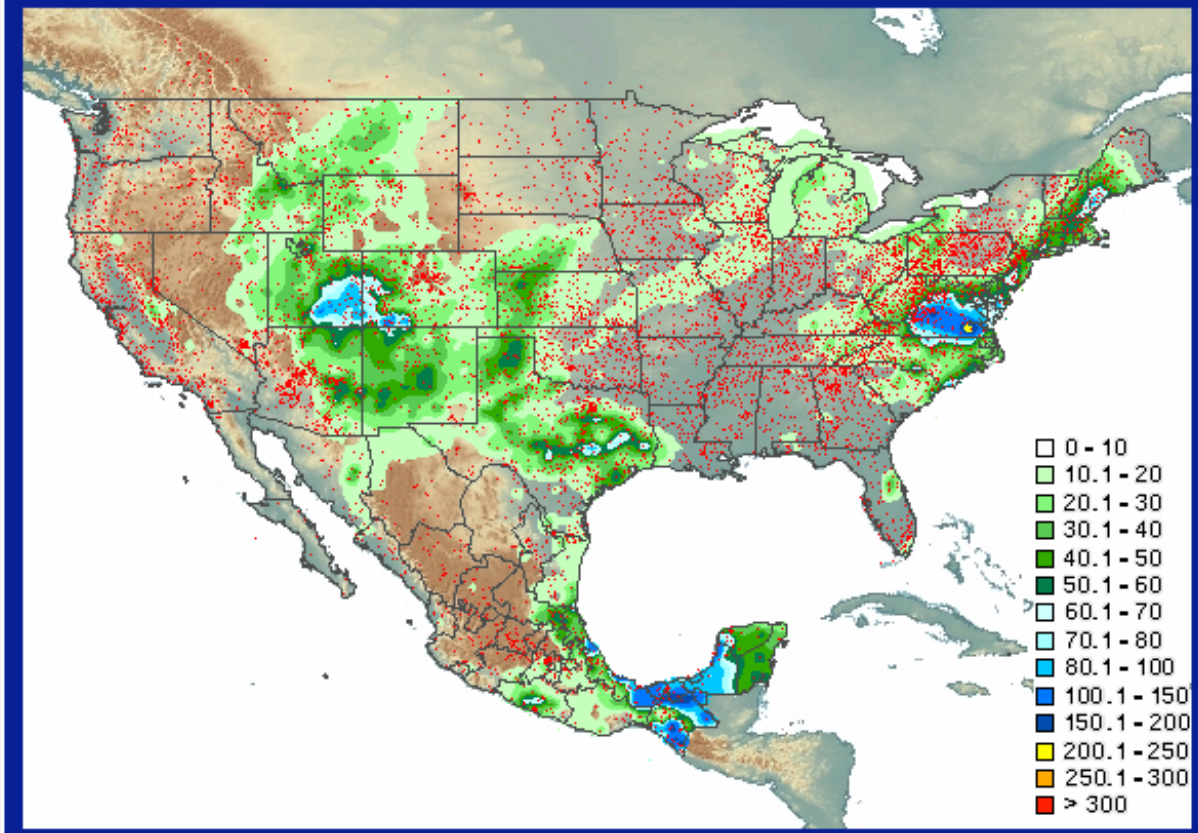
30, 90, 180 & 365-Day Monitoring Maps

Monitoring Weather and Climate

Daily Maps Archive

FIRSTGOV.gov The U.S. Government's Official Web Portal

7-Day Accumulation (mm)
12Z October 05 2006 - 12Z October 12 2006



Topo Precip 7-Day Stations Boundaries Cities Roads Rivers
Legend

Done Internet

NOAA-CPC

.25 x .25 degree

~8000+ stations

Daily Precipitation Analysis - Microsoft Internet Explorer

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Address http://www.cpc.ncep.noaa.gov/products/precip/realtime/GIS/USMEX/USMEX-precip.shtml

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US and Mexico

Daily Precipitation

7-Days Precipitation Accumulation - loop

About the Gridded Analysis

Download Real-Time Gridded Data

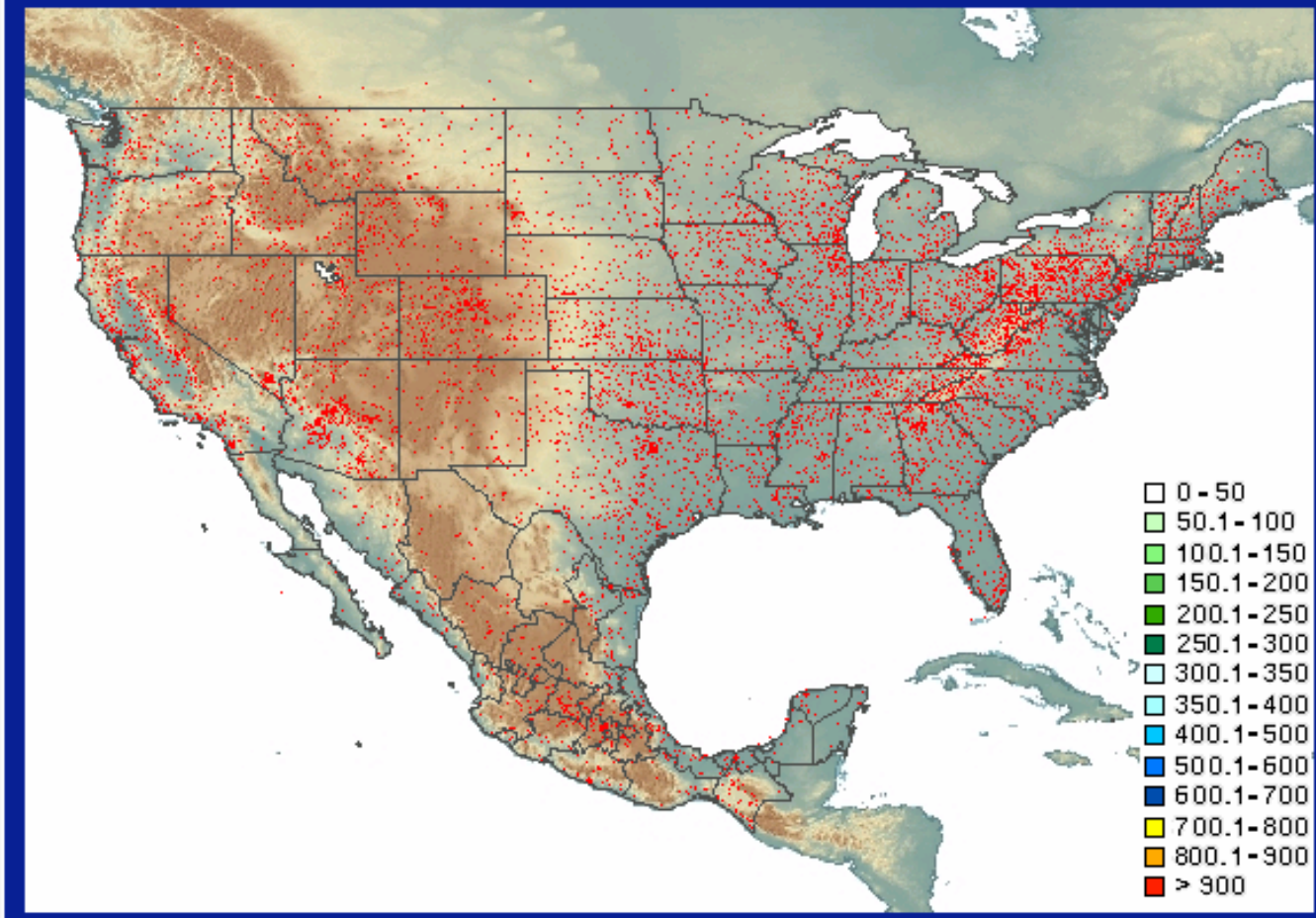
Download Historical Gridded Data

30, 90, 180 & 365-Day Monitoring Maps

Monitoring Weather and Climate

Daily Maps Archive

90-Day Accumulation (mm)
12Z July 14 2006 - 12Z October 12 2006



Temp Precip 90-Day Stations Boundaries Cities Roads Rivers

NOAA's National Weather Service

New Precipitation Analysis Web Page

Victor Murphy
NWS Southern Region Climate Service Focal Point
March 8, 2006

New Precipitation Analysis Pages - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Search Favorites

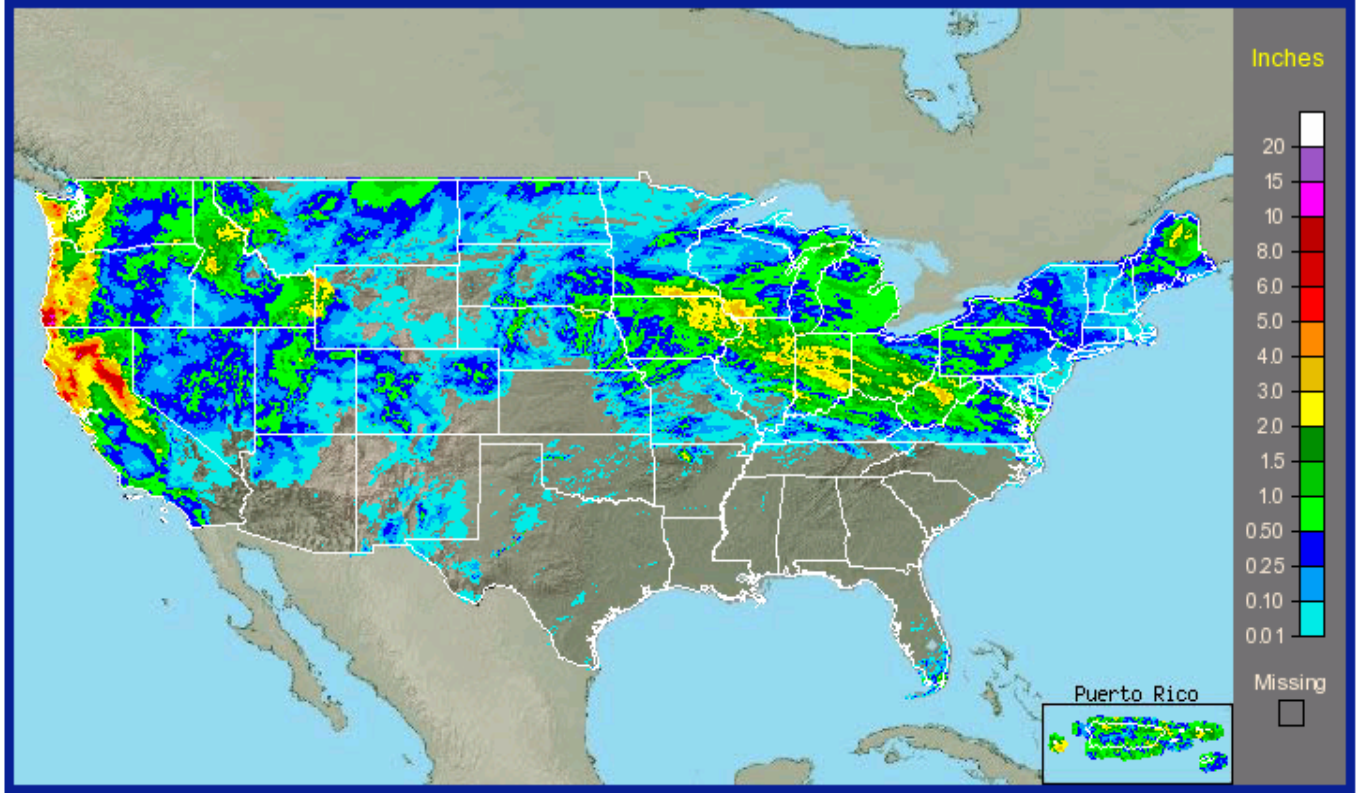
Address http://www.srh.noaa.gov/rfcshare/precip_analysis_new.php Go Links

Google Search 73 blocked Check AutoLink AutoFill Options

Adobe Search Web My Web Mail My Yahoo! Games Baseball Music

Continental United States
7-Day Observed Precipitation - Valid 4/17/2006 1200 UTC

Click on the image to zoom in
Click on "States" to zoom out



☑ Topo ☑ Pcpn Amount ☐ Counties ☐ Rivers ☑ States ☐ Highway/City ☐ RFC Boundary Last Update: 4/17/2006 1731 UTC

1. Timeframe » **2. Product** » **3. Location** » **4. Units**

- ◉ Current Data
- ○ Archive: Month/Year
- ○ Archive: Daily

- ◉ States
- ○ NWS RFC/Regions

- ◉ English
- ○ Metric

April 17, 2006
April 17, 2006 - Last 7 Days

Observed
Normal

Continental United States
Alabama

National Weather Service • Since 1870

Internet

New Precipitation Analysis Pages - Microsoft Internet Explorer

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Address http://www.srh.noaa.gov/rfcshare/precip_analysis_new.php Go Links

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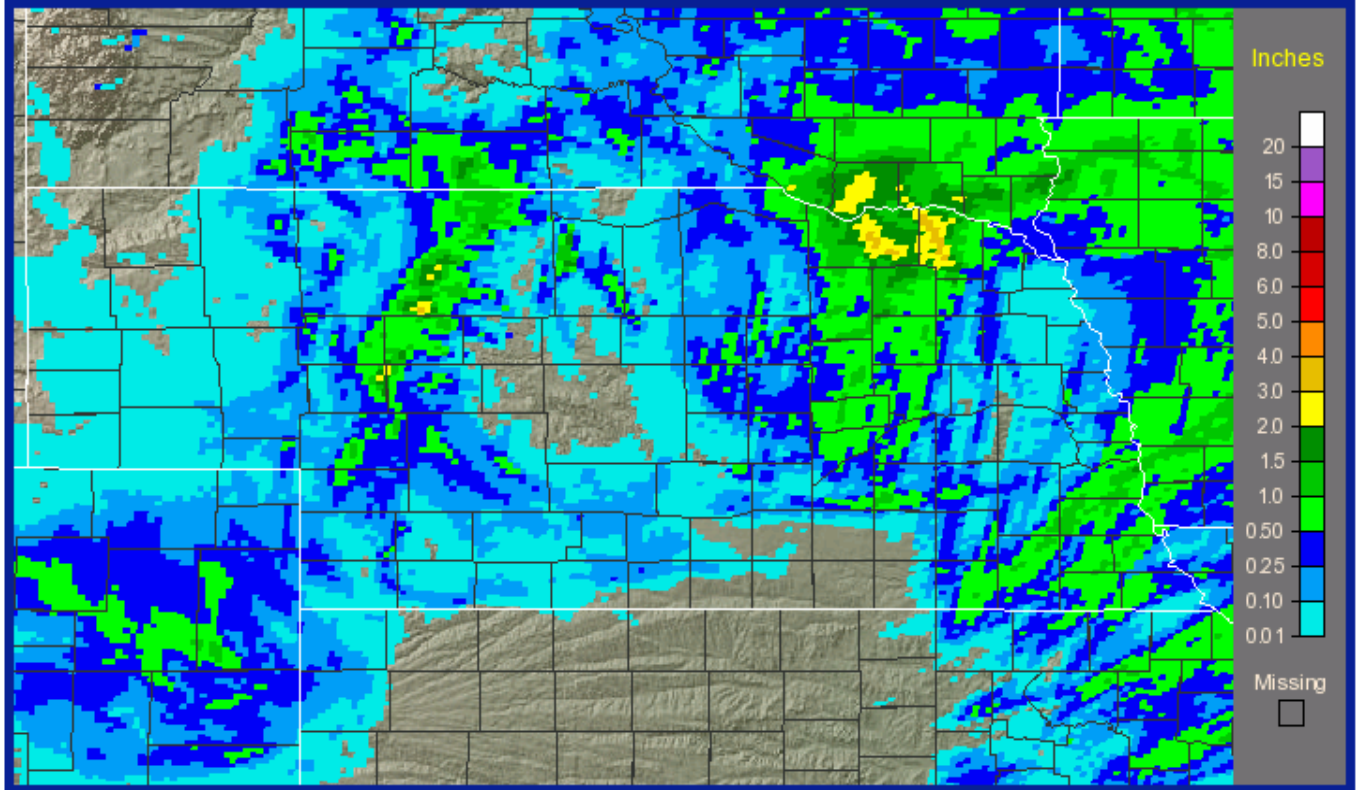
Nebraska
7-Day Observed Precipitation - Valid 4/17/2006 1200 UTC

Click on the image to zoom in
Click on "States" to zoom out



Topo Pcpn Amount Counties Rivers States Highway/City RFC Boundary Last Update: 4/17/2006 1731 UTC

1. Timeframe » **2. Product** » **3. Location** » **4. Units**

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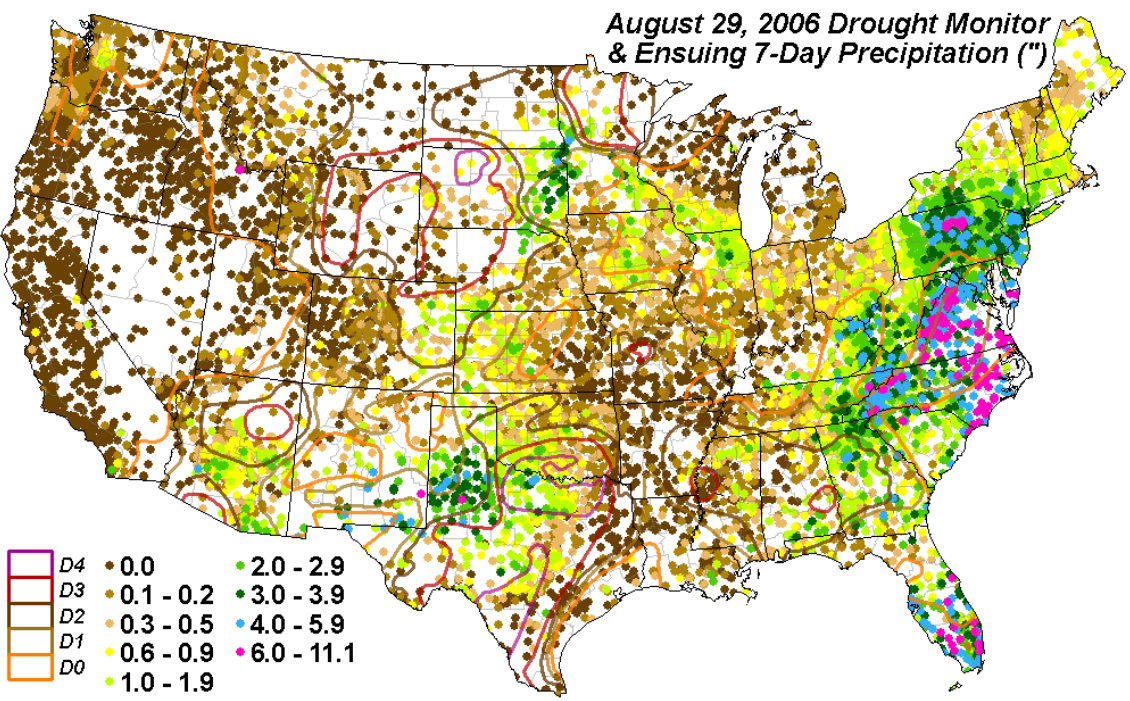
April 17, 2006 - Last 7 Days

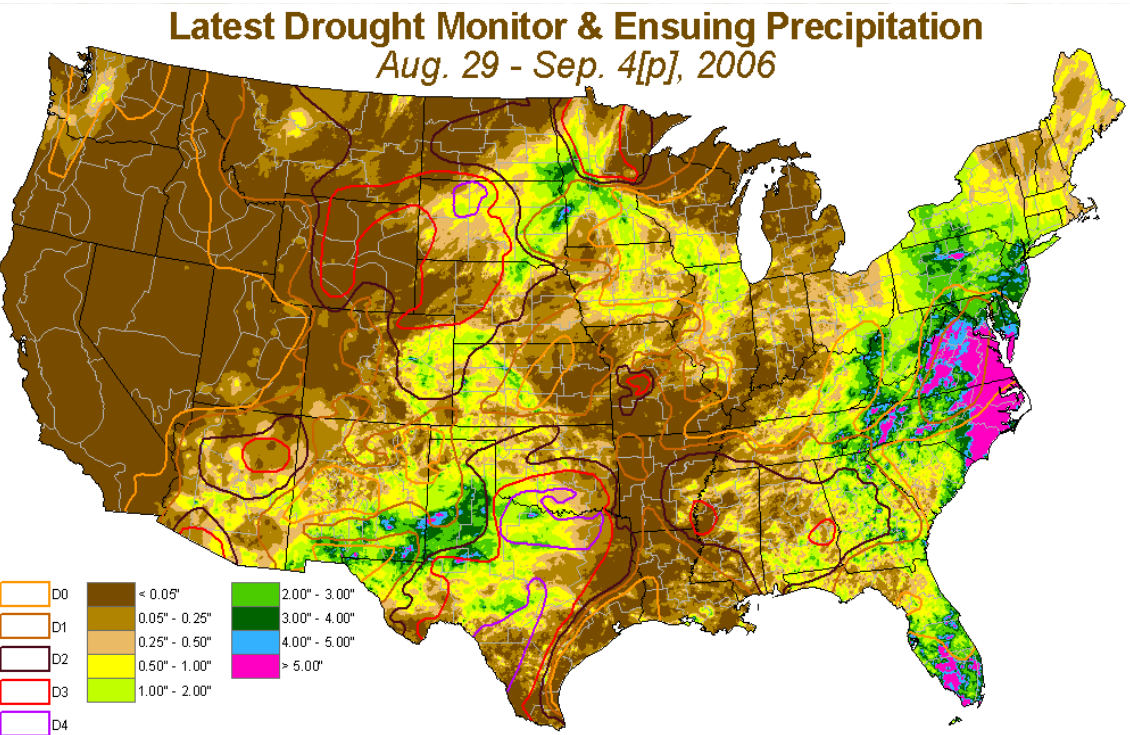
Observed
Normal

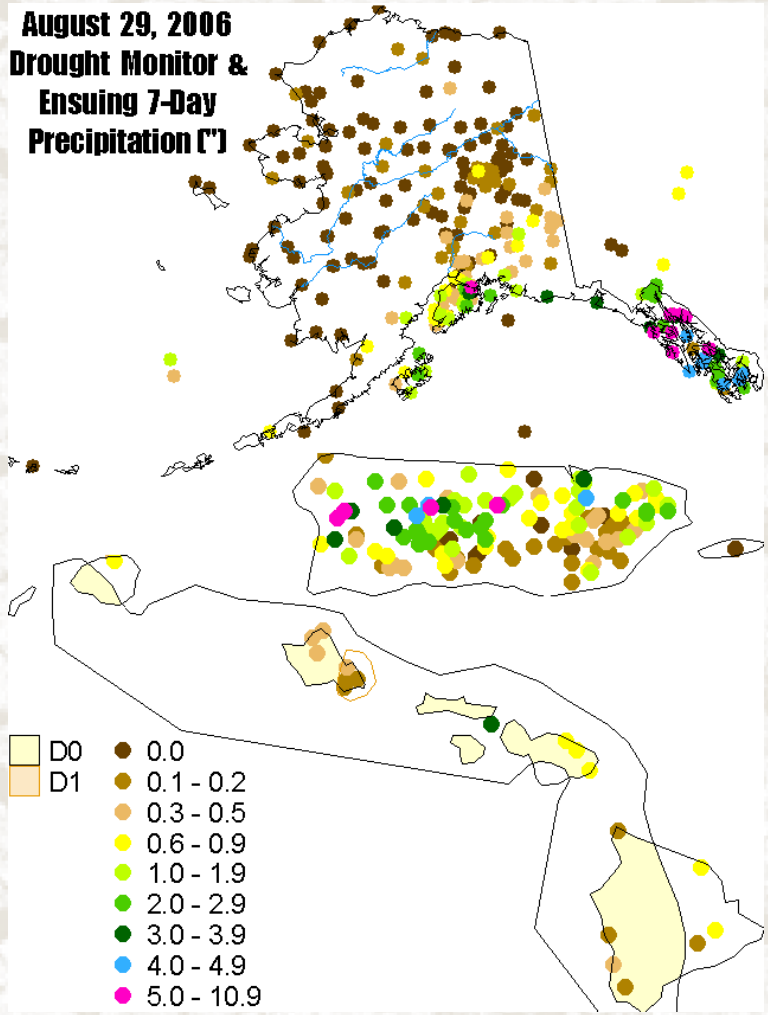
Nebraska
Nevada

National Weather Service · Since 1870

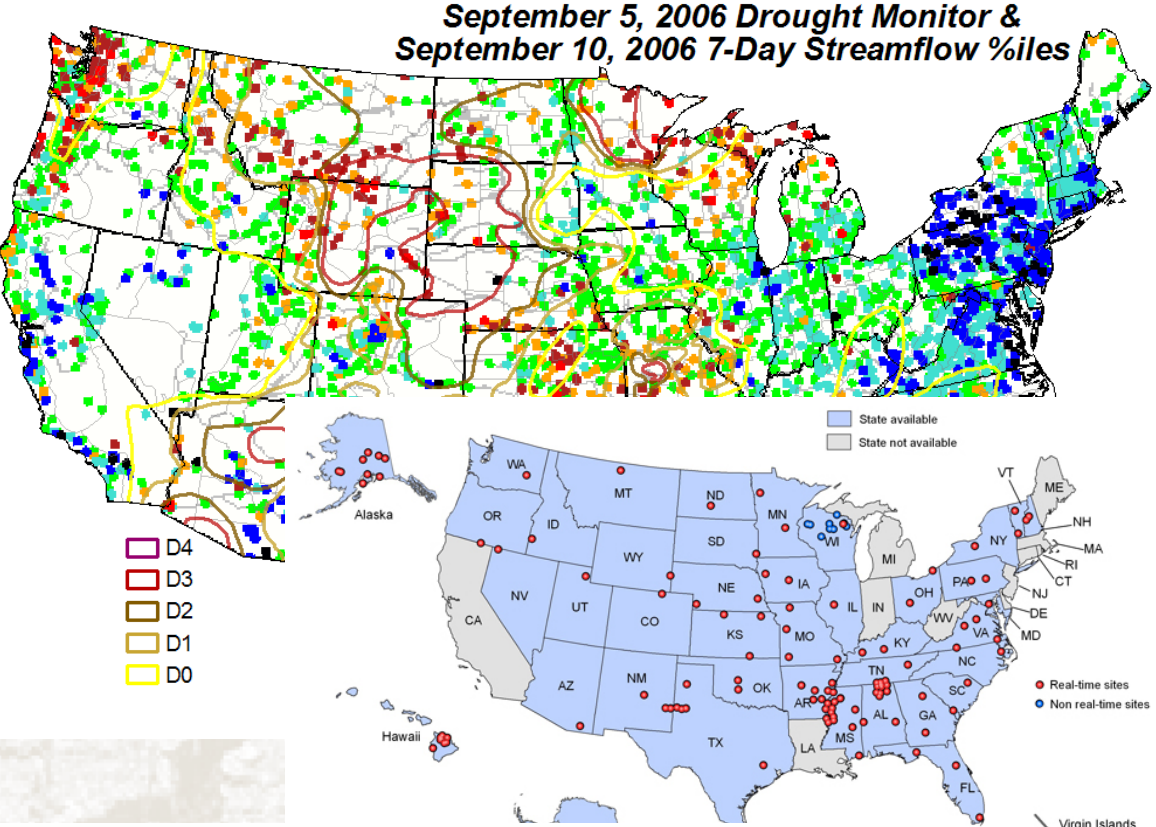
Internet


August 29, 2006 Drought Monitor
& Ensuing 7-Day Precipitation (")
D4
D3
D2
D1
D0
0.0
0.1 - 0.2
0.3 - 0.5
0.6 - 0.9
1.0 - 1.9
2.0 - 2.9
3.0 - 3.9
4.0 - 5.9
6.0 - 11.1


Latest Drought Monitor & Ensuing Precipitation
Aug. 29 - Sep. 4[p], 2006
D0
D1
D2
D3
D4
< 0.05"
0.05" - 0.25"
0.25" - 0.50"
0.50" - 1.00"
1.00" - 2.00"
2.00" - 3.00"
3.00" - 4.00"
4.00" - 5.00"
> 5.00"

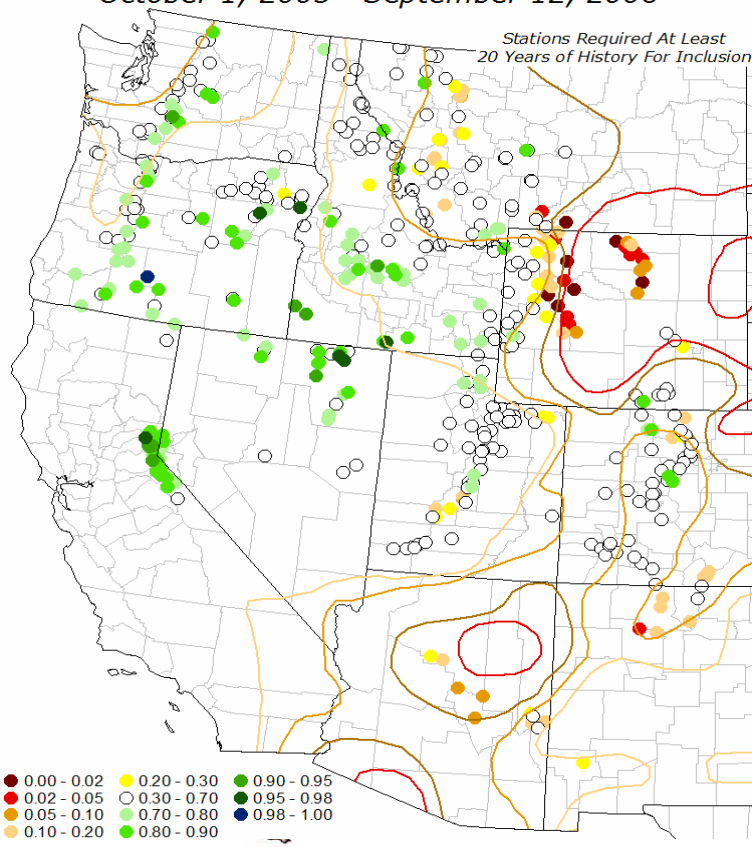

August 29, 2006
Drought Monitor &
Ensuing 7-Day
Precipitation (")
D0
D1
0.0
0.1 - 0.2
0.3 - 0.5
0.6 - 0.9
1.0 - 1.9
2.0 - 2.9
3.0 - 3.9
4.0 - 4.9
5.0 - 10.9

September 5, 2006 Drought Monitor & September 10, 2006 7-Day Streamflow %iles

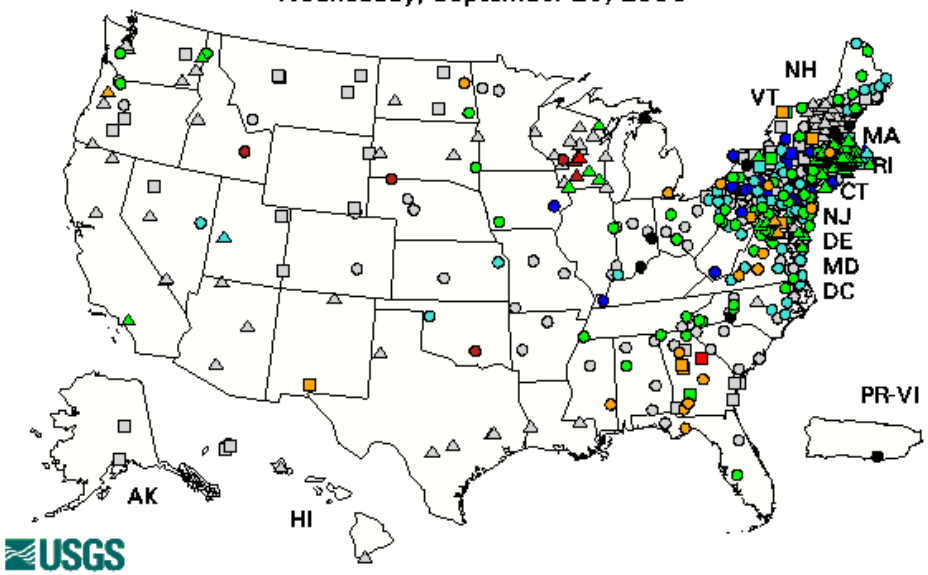


SNOTEL Water Year Precipitation Percentiles

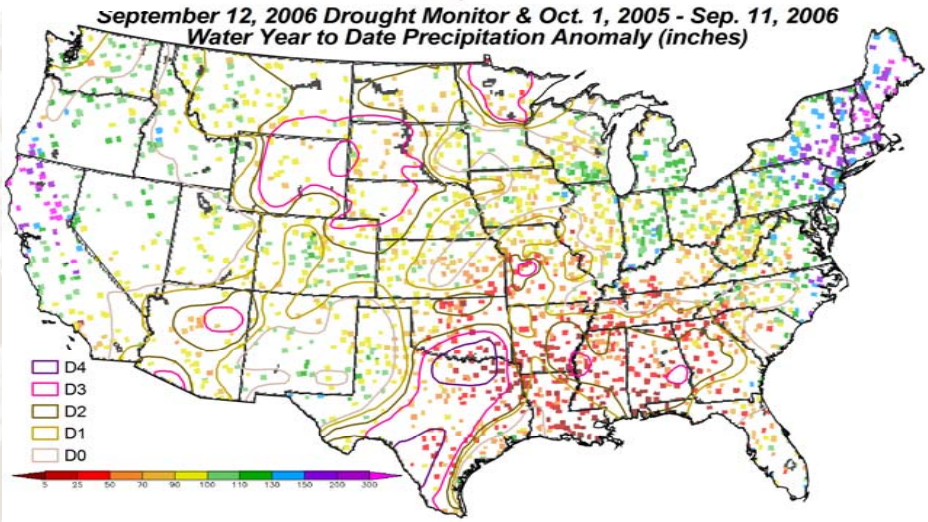
October 1, 2005 - September 12, 2006



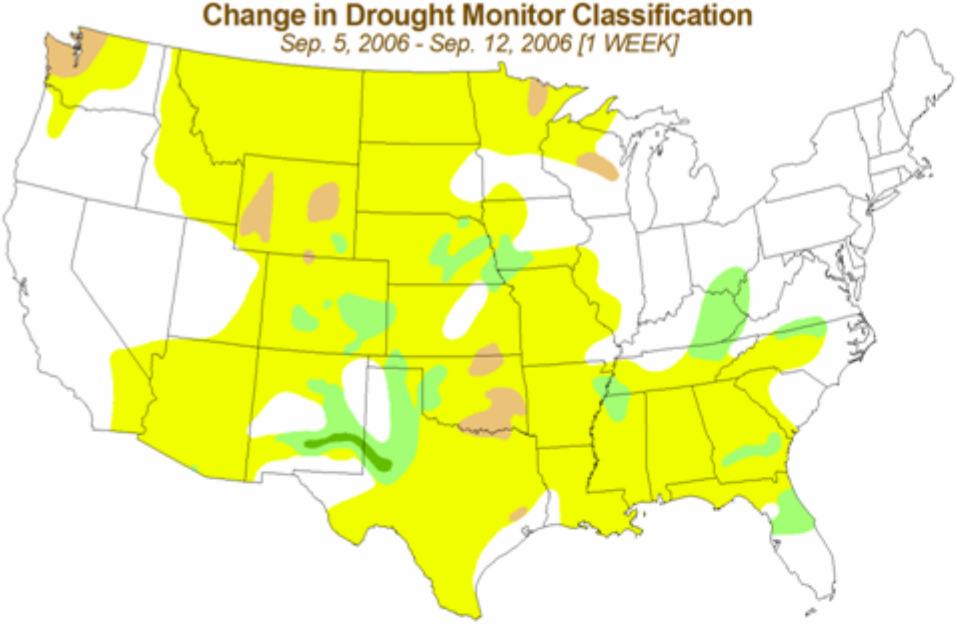
Wednesday, September 20, 2006

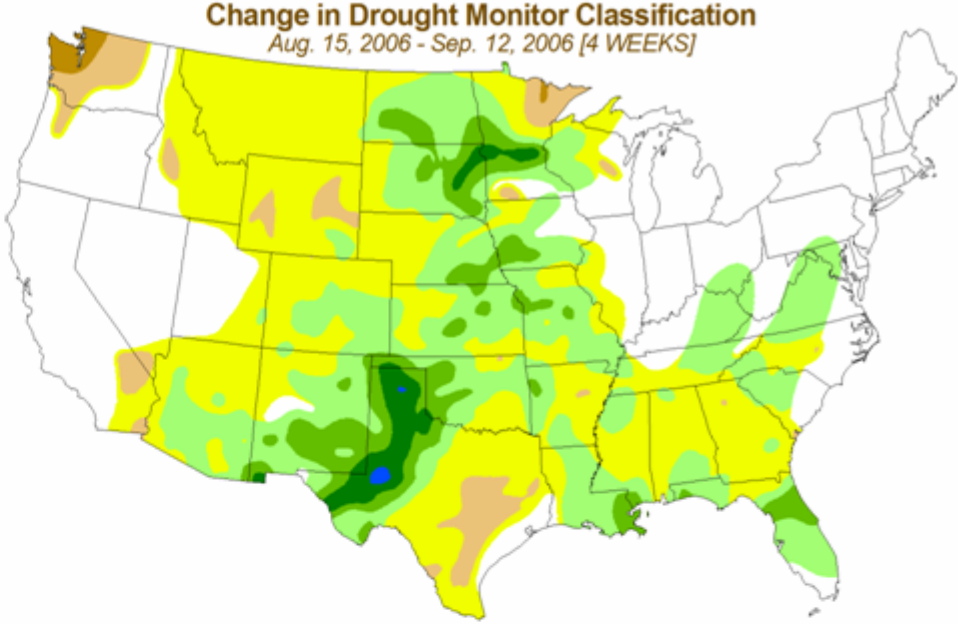


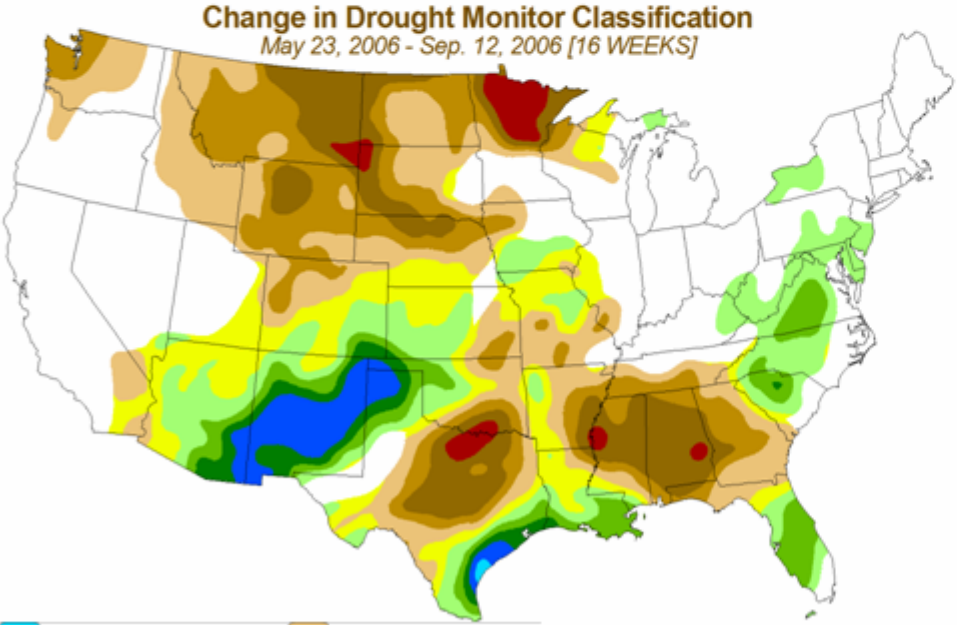
September 12, 2006 Drought Monitor & Oct. 1, 2005 - Sep. 11, 2006 Water Year to Date Precipitation Anomaly (inches)

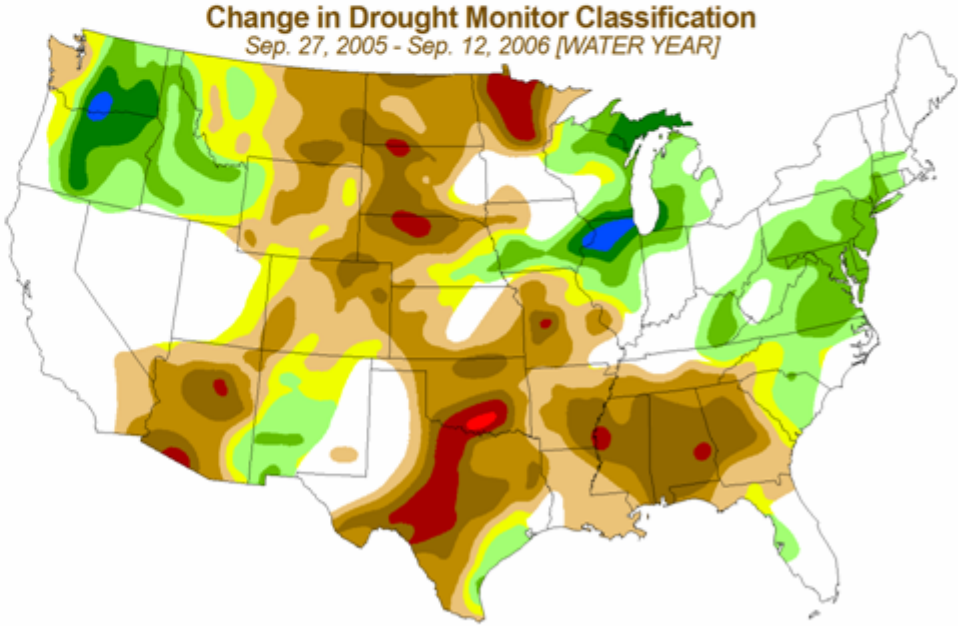


USGS







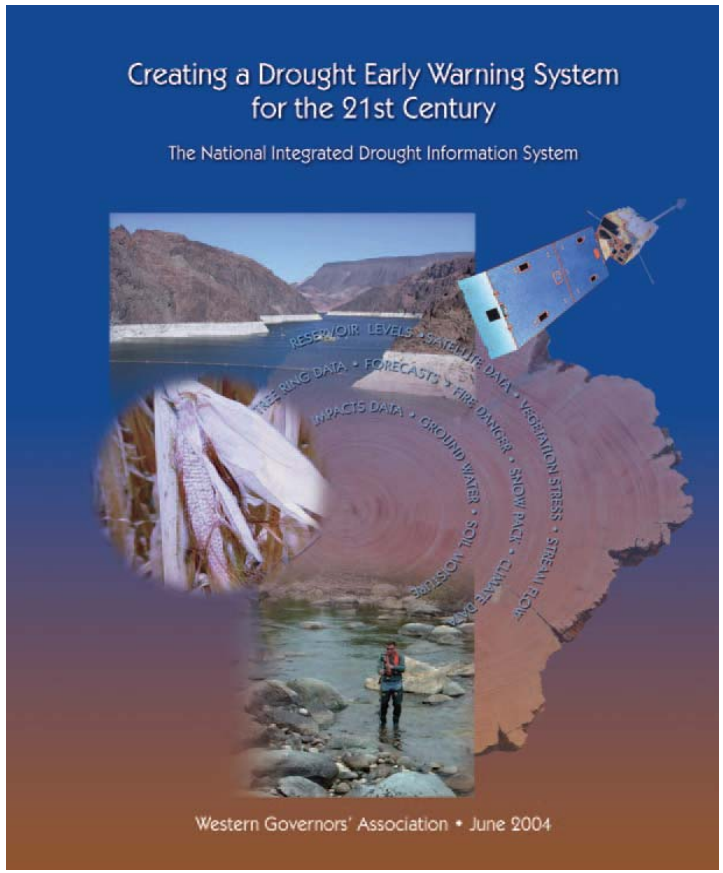


- 5 class improvement
- 4 class improvement
- 3 class improvement
- 2 class improvement
- 1 class improvement
- unchanged
- 1 class deterioration
- 2 class deterioration
- 3 class deterioration
- 4 class deterioration
- 5 class deterioration

These maps depict approximate changes in drought intensity from selected initial times to the current week, with no consideration given to intervening weeks. The difference calculations are based on interpolated 4 km grids of Drought Monitor classifications, and as a result, will be smoother than would similar products based directly on the published versions of the Drought Monitor.

National Initiatives

- National Drought Preparedness Act
- National Integrated Drought Information System (NIDIS)
  http://www.westgov.org/wga/publicat/nidis.pdf



National Drought Mitigation Center

National Integrated Drought Information System (NIDIS) Goals

- Develop leadership and partnerships to ensure implementation of NIDIS
- Foster and support a research environment
- Create a drought early warning system
- Provide interactive delivery systems (Portal)
- Provide a framework for interacting with and educating decision makers and the public (Portal)

NIDIS Recommendations

- Establish NIDIS (NOAA as lead agency)
- Integrate data and tools (identify and fill gaps)
- Develop an impact reporting/methodology tool
- Establish an integrated federal drought research program
- Facilitate drought preparedness programs
- Provide a framework for education/outreach and user feedback/interaction

Future Drought Monitoring Challenges

- **"No County Left Behind" (customer needs vs. scientific comfort)**
- **Support, maintain and expand on the momentum of the current "Resolution Revolution" (near real-time) and address our gaps:**
  - **ACIS**
  - **NOAA/COOP Modernization (NERON)/gridded suites**
  - **Satellite vegetation/SM (USGS, NOAA, NDMC, USDA-ARS)**
  - **Radar hybrids**
  - **USGS (more real-time groundwater)**
  - **USDA/NRCS/ AgACIS (SCAN/SNOTEL)**
  - **Regional/State Mesonet Networks and others…….**
- **Can we transfer tools/methods to increase both spatial and temporal resolution for the NADM in a dynamic NADM/DSS (Decision Support System)??**
  - **Watershed based?**
  - **Zoom in capability?**
  - **Inventory what's available at the next level in Canada, Mexico and the U.S.**

National Drought Mitigation Center

Next Steps

- NIDIS---meeting customer needs
- Robust IMS/GIS query/analysis (DM DSS) (Portal)
- ACIS---Applied Climate Information System. Efforts underway to take daily climate data from NOAA's COOP network, SCAN, SNOTEL, along with state and regional Mesonet data
- Incorporate new tools: ACIS gridded SPI/PDSI, remote sensing, NWS Precipitation Analysis, etc…
- Taking the DM Blends from a climate division base to a station-based or gridded layer
- Continue to grow our expert group

National Drought Mitigation Center

National Drought Mitigation Center

University of Nebraska–Lincoln

The National Drought Mitigation Center (NDMC) helps people and institutions develop and implement measures to reduce societal vulnerability to drought. The NDMC, based at the University of Nebraska–Lincoln, stresses preparation and risk management rather than crisis management.

What is Drought?	*An overview of drought • Climographs • Historical Palmer Drought index maps and graphs • Drought and El Niño • The Dust Bowl*
Planning for Drought	*How (and why) to plan for drought • The 10-Step Planning Process • Directory of drought planning contacts*
Monitoring Drought	*How to select monitoring tools • The SPI, the U.S. Drought Monitor, and links to tools elsewhere on the web*
Understanding Your Risk	*Understanding drought's impacts • Drought Impacts in the United States • Drought impacts around the world*
Mitigating Drought	*Putting a drought plan together • Existing drought plans and studies • Drought mitigation tools/initiatives • Water conservation*

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Drought for Kids | *For Media* | *Other Drought-related Sites* | *U.S. Drought Monitor* | *NDMC's Drought Impact Reporter*

Thank you!

Please visit us at:
http://drought.unl.edu/

Please contact me at:
msvoboda2@unl.edu

National Drought Mitigation Center