Drought Monitoring, Mitigation and Preparedness in the U.S.:

An End to End Approach

Dr. Donald A. Wilhite, Director

National Drought Mitigation Center

International Drought Information Center

University of Nebraska

Lincoln, Nebraska U.S.A.

WMO Task Force on Social-Economic Application of Public Weather Services, Geneva 15-18 May 2006

National Drought Mitigation Center

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

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Why the concern?

- Drought is a normal part of climate but . . . . .
- Water supplies in many river basins (west and east) are over-appropriated
- Population growth, urbanization, land use changes, environmental degradation, and changes in environmental values are placing more pressure on water/natural resources
- Outdated water policies and institutions
- Climate change/global warming . . . Are climate extremes becoming more frequent, more severe and of longer duration?

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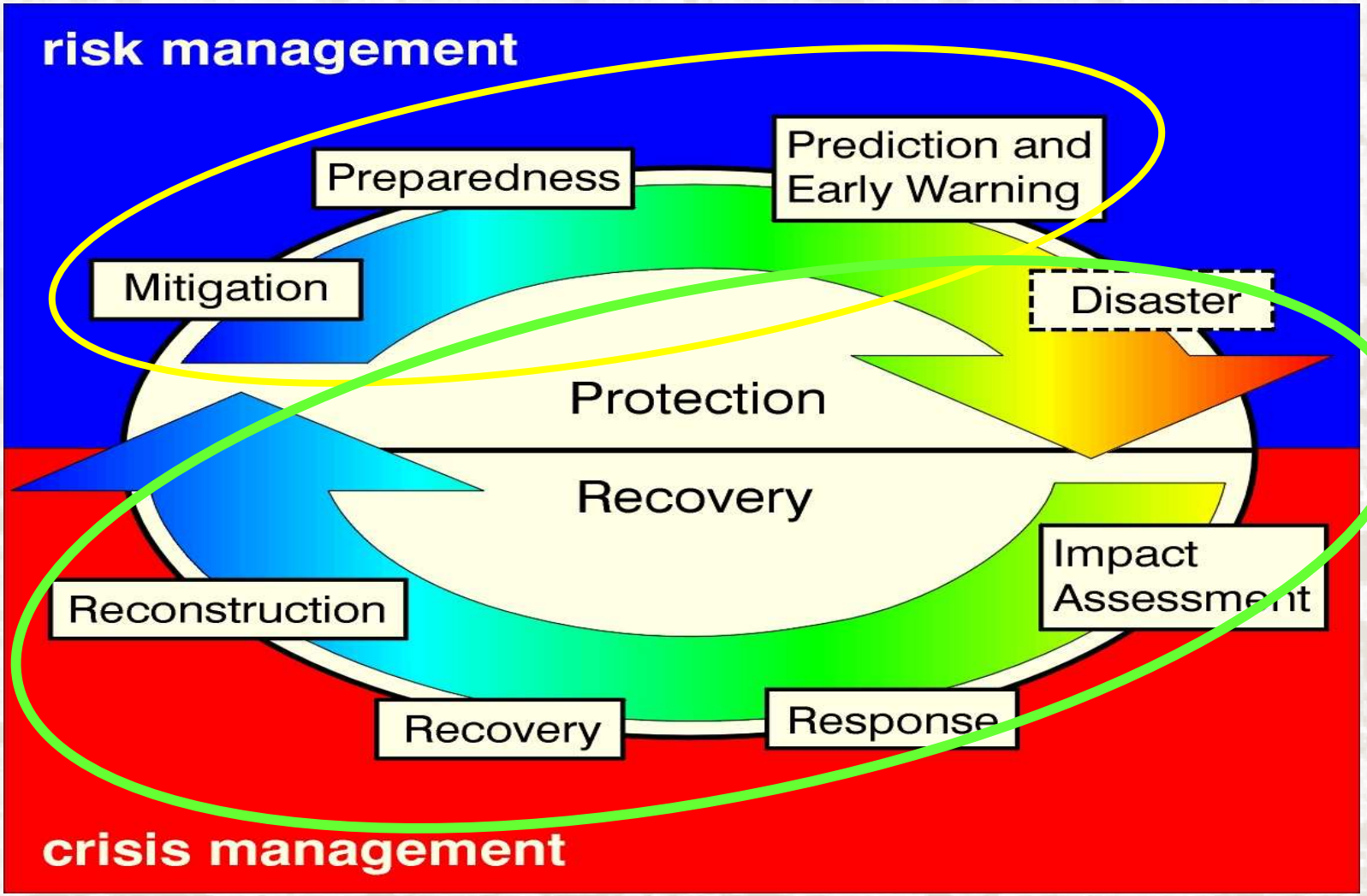
The Cycle of Disaster Management



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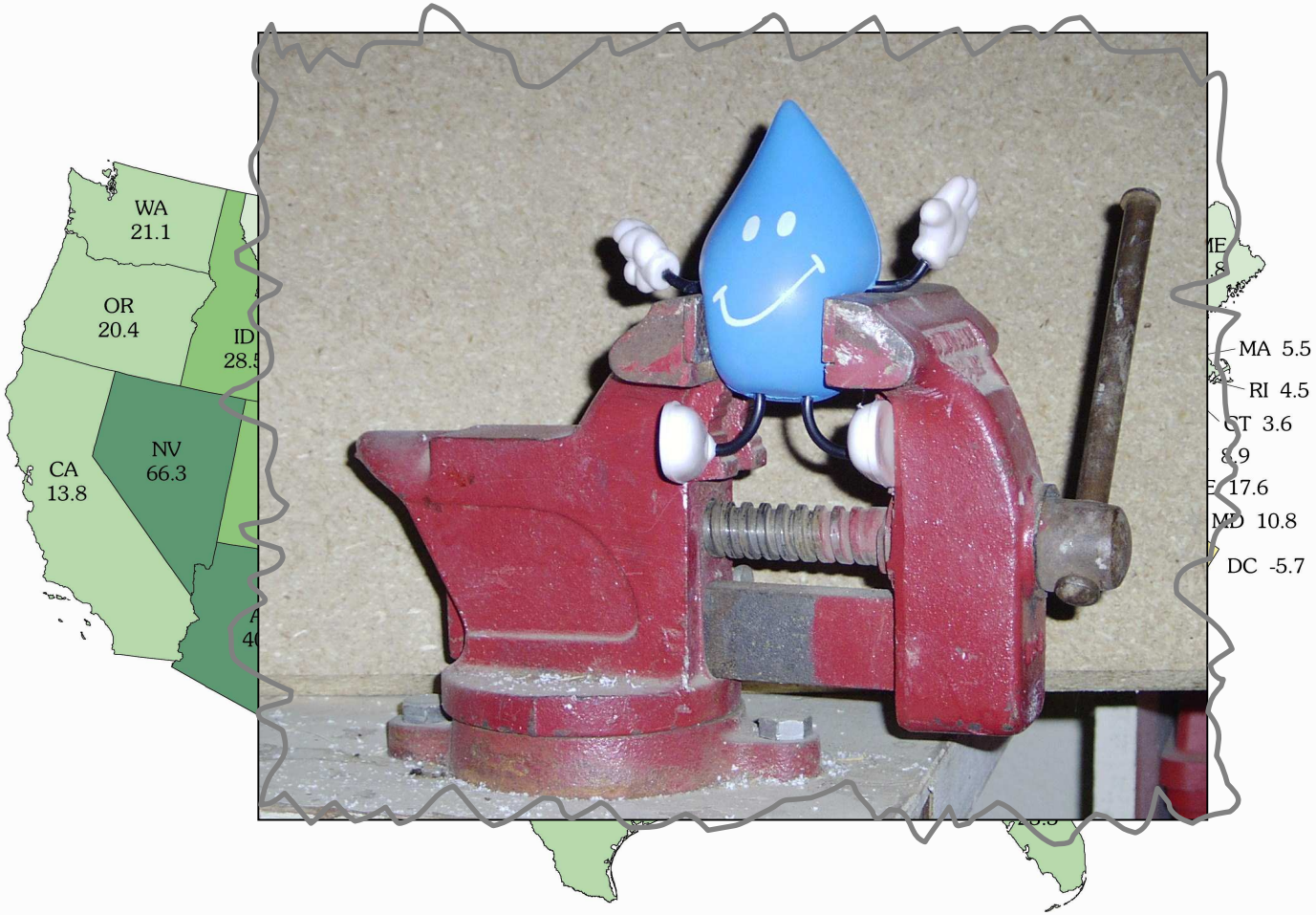
Components of Drought Risk Management

Risk = Hazard x Vulnerability

(natural event) (social factors)

Demographic Changes: Population Has Grown Fastest in the West, Particularly in the "Public Land States"

Percent Change in Resident Population for the 48 States
and the District of Columbia: 1990 to 2000



- Darker areas denote faster growth rates.

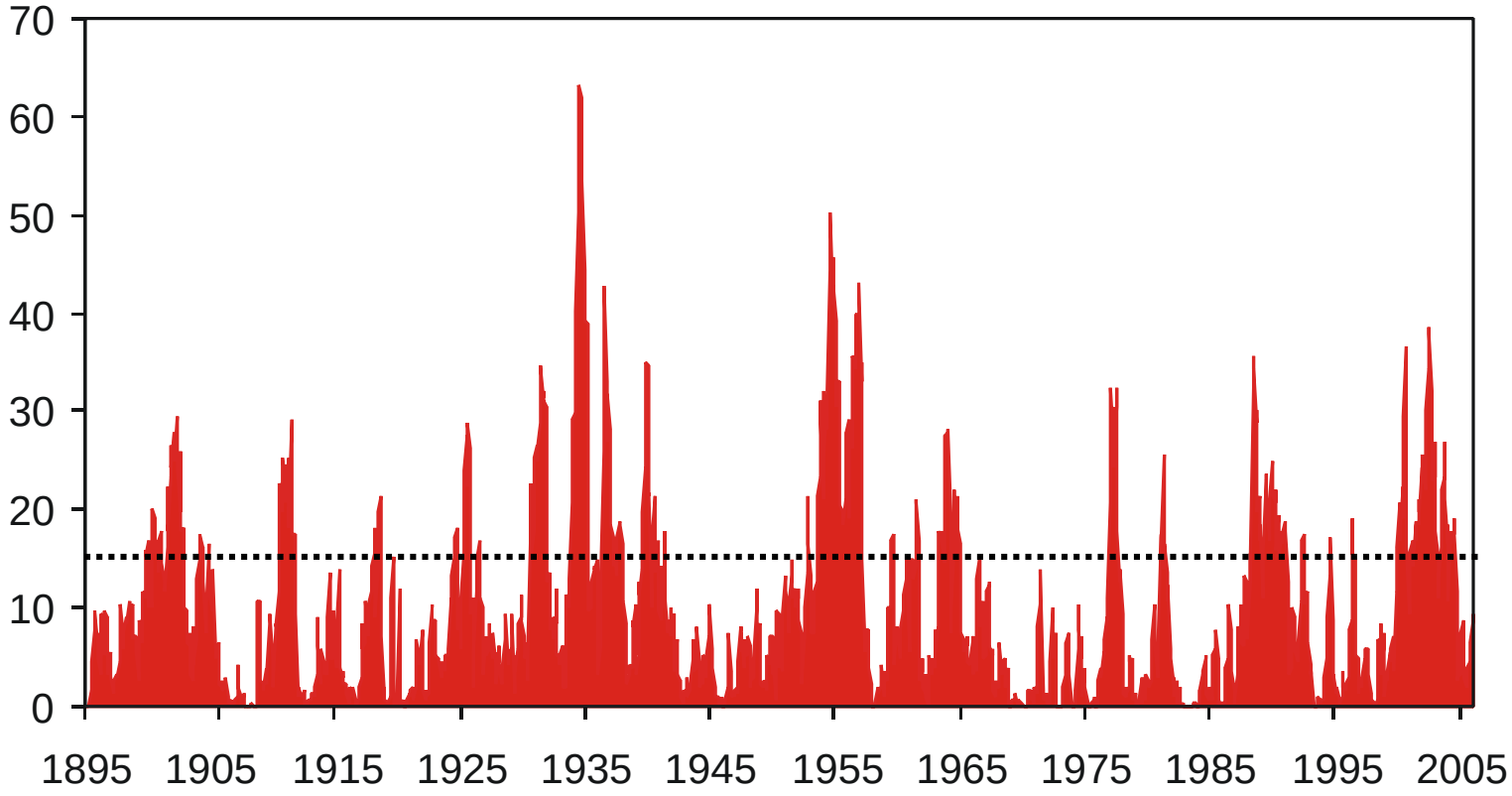
- Nevada (66%) and Arizona (40%) lead the nation.

- Intermountain states average about 30%.

USCENSUSBUREAU
Helping You Make Informed Decisions

Percent Area of the United States in Severe and Extreme Drought

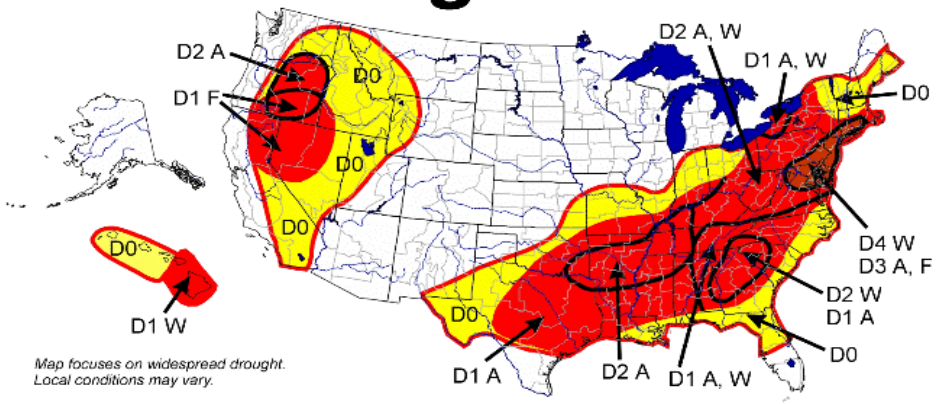
January 1895–January 2006



Based on data from the National Climatic Data Center/NOAA

August 24, 1999

U.S. Drought Monitor



Map focuses on widespread drought.
Local conditions may vary.

- D0 Watch
- D1 Drought
- D2 Drought–Severe
- D3 Drought–Extreme
- D4 Drought–Exceptional

Drought type: used only when impacts differ

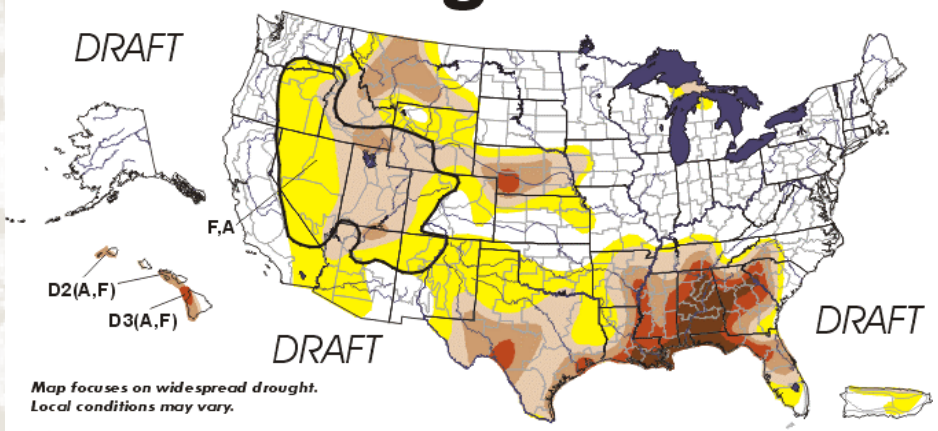
A = Agriculture
W = Water
F = Forest fire danger

Plus (+) = Forecast to intensify next two weeks
Minus (-) = Forecast to diminish next two weeks
No sign = No change in drought classification forecast

• *Updated every Thursday morning* •

August 29, 2000 Valid 8 a.m. EDT

U.S. Drought Monitor



Map focuses on widespread drought.
Local conditions may vary.

- D0 Abnormally Dry
- D1 Drought–First Stage
- D2 Drought–Severe
- D3 Drought–Extreme
- D4 Drought–Exceptional
- Delineates Overlapping Areas

Drought type: used only when impacts differ

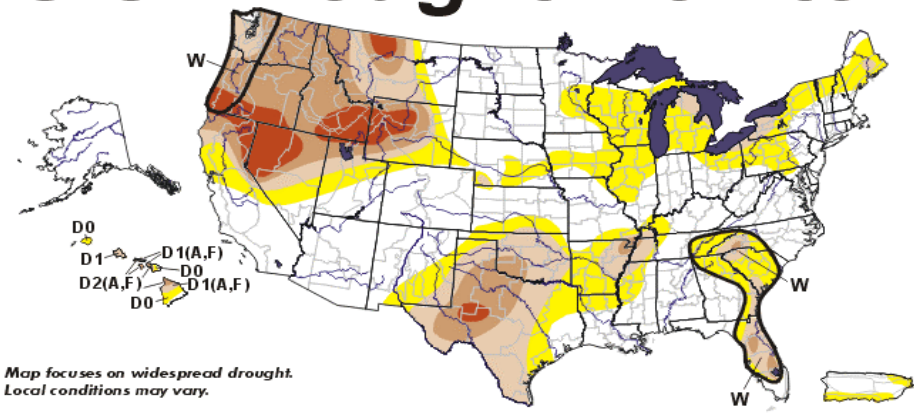
A = Agriculture
W = Water
F = Wildfire danger

See accompanying text summary for forecast statements

• *Released Thursday, August 31, 2000* •

July 31, 2001 Valid 8 a.m. EDT

U.S. Drought Monitor



Map focuses on widespread drought.
Local conditions may vary.

- D0 Abnormally Dry
- D1 Drought–Moderate
- D2 Drought–Severe
- D3 Drought–Extreme
- D4 Drought–Exceptional
- Delineates Overlapping Areas

Drought Impact Types:
A = Agriculture
W = Water (Hydrological)
F = Fire danger (Wildfires)
(No type = All 3 impacts)

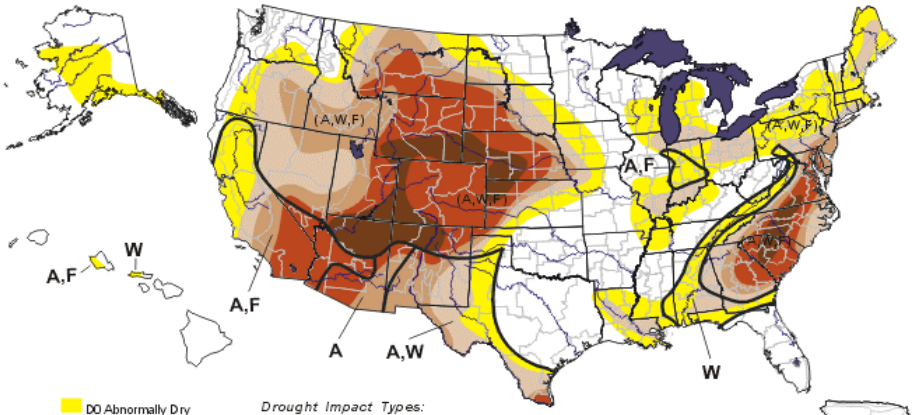
See accompanying text summary for forecast statements
http://enso.unl.edu/monitor/monitor.html

• *Released Thursday, August 2, 2001* •

Author: *Michael Hayes, NDMC*

U.S. Drought Monitor

July 30, 2002
Valid 8 a.m. EDT



- D0 Abnormally Dry
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- D2 Drought—Severe
- D3 Drought—Extreme
- D4 Drought—Exceptional

Drought Impact Types:
A = Agriculture
W = Water (Hydrological)
F = Fire danger (Wildfires)
Delineates dominant impacts
(No type = All 3 impacts)

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

http://drought.unl.edu/dm

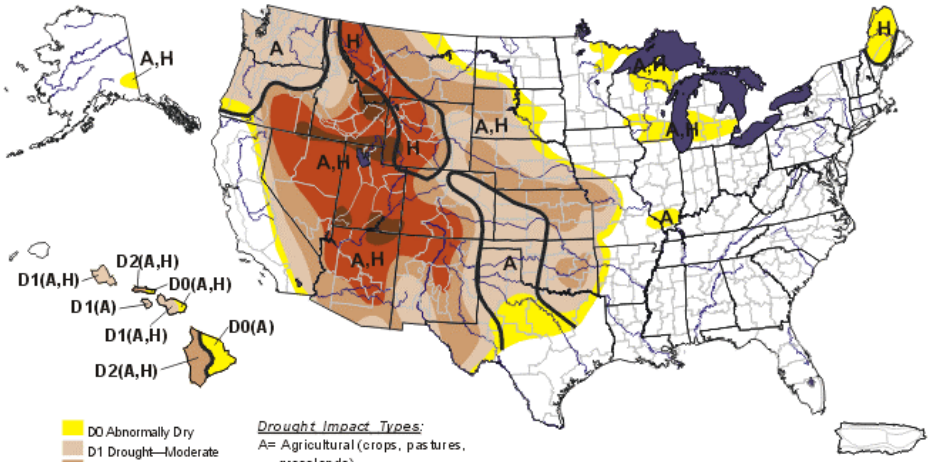
Released Thursday, August 1, 2002

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

National Drought Mitigation Center

U.S. Drought Monitor

July 29, 2003
Valid 8 a.m. EDT



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

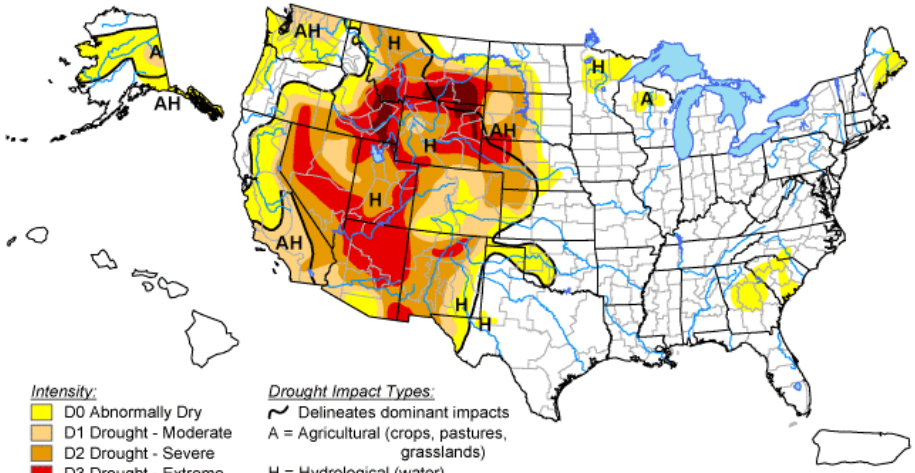
Drought Impact Types:
A= Agricultural (crops, pastures, grasslands)
H= Hydrological (water)
No type = both impacts
Delineates dominant impacts

The Drought Monitor focuses on broad-scale conditions.

USDA National Drought Mitigation Center

U.S. Drought Monitor

July 27, 2004
Valid 8 a.m. EDT



Intensity:
D0 Abnormally Dry
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Drought Impact Types:
Delineates dominant impacts
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(No type = Both impacts)

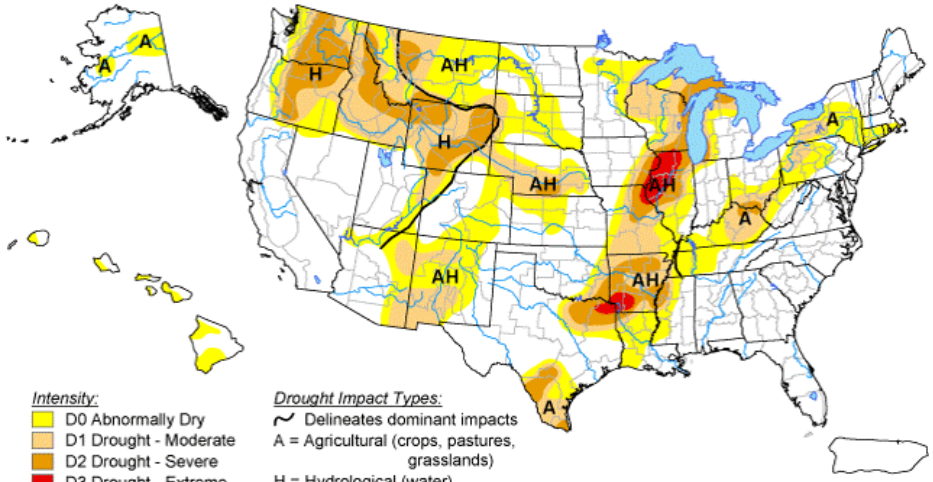
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

USDA National Drought Mitigation Center

Released Thursday, July 29, 2004

U.S. Drought Monitor

August 16, 2005
Valid 8 a.m. EDT



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Delineates dominant impacts
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(No type = Both impacts)

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

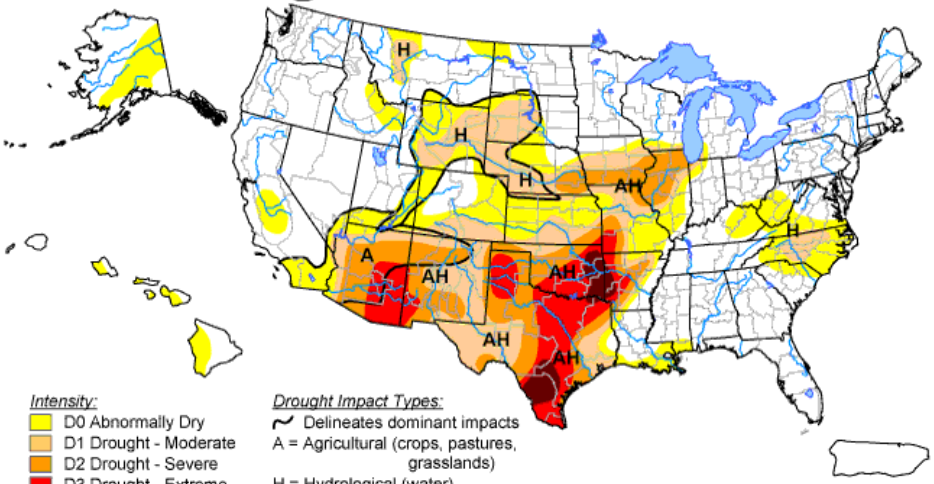
http://drought.unl.edu/dm

USDA National Drought Mitigation Center

Released Thursday, August 18, 2005
Author: David Miskus, JAWF/CPC/NOAA

U.S. Drought Monitor

February 28, 2006
Valid 7 a.m. EST



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

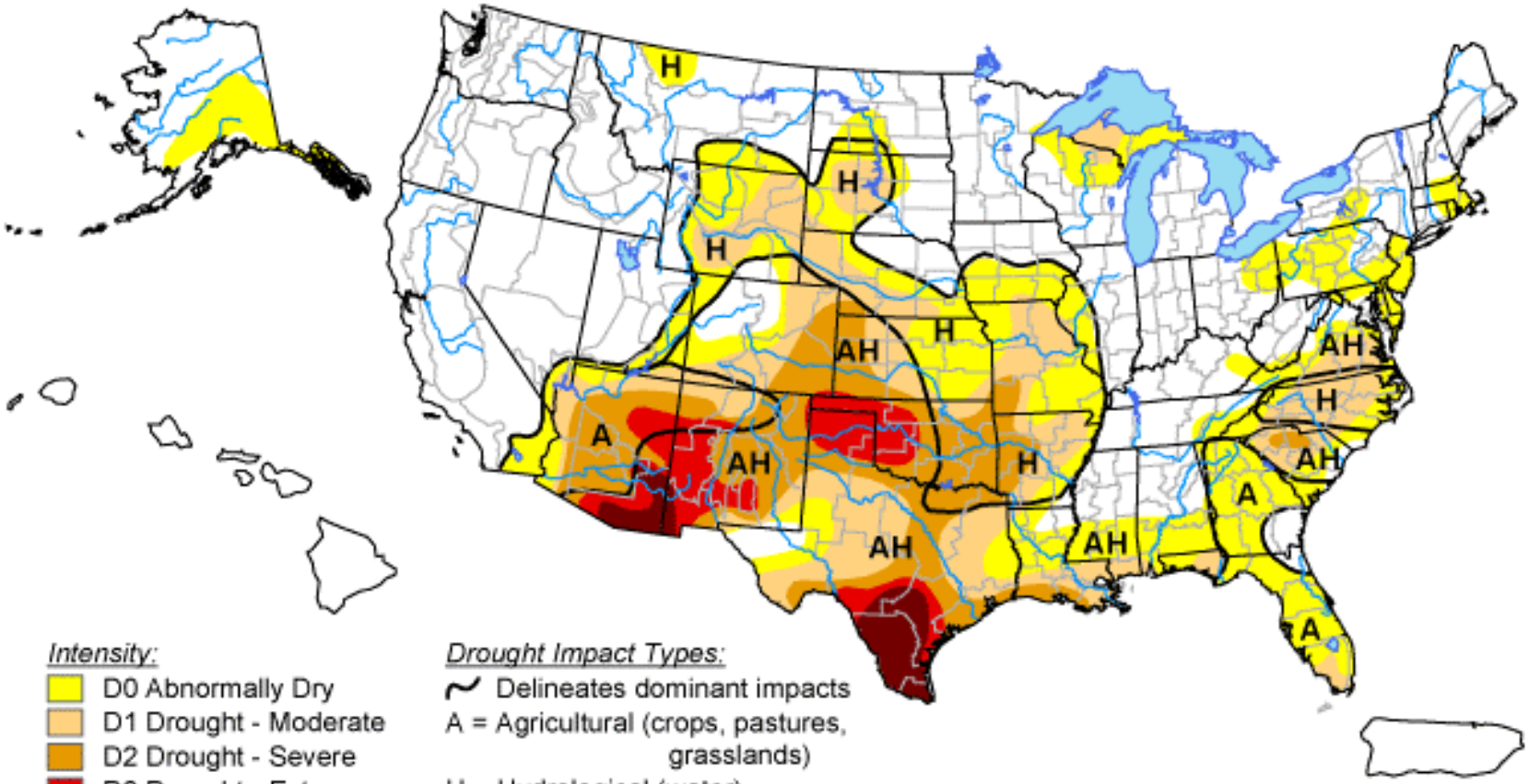
http://drought.unl.edu/dm

USDA National Drought Mitigation Center

Released Thursday, March 2, 2006
Author: Brian Fuchs, National Drought Mitigation Center

U.S. Drought Monitor

May 2, 2006
Valid 8 a.m. EDT



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- (No type = Both impacts)

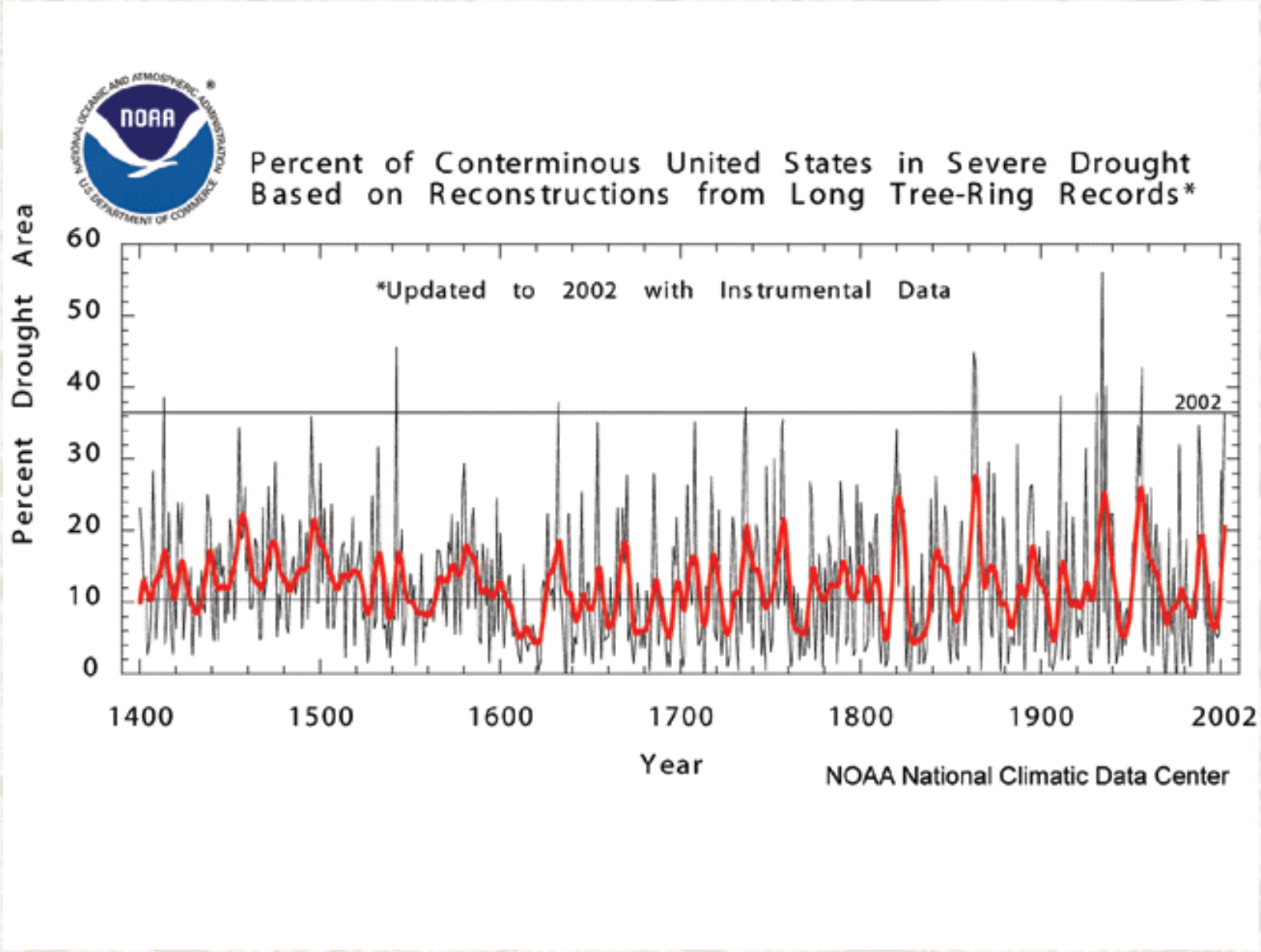
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

http://drought.unl.edu/dm

Released Thursday, May 4, 2006

Author: Mark Svoboda, National Drought Mitigation Center

National Drought Mitigation Center



www.ncdc.noaa.gov/oa/climate/research/2002/ann/paleo-drought.html

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Drought: a deficiency of precipitation (**intensity**) from expected or "normal" that extends over a season or longer period of time (**duration**) . . .

Meteorological drought

and is insufficient to meet the demands of human activities and the environment (**impacts**).

Users

- **Agricultural drought**
- **Hydrological drought**
- **Socio-economic drought**

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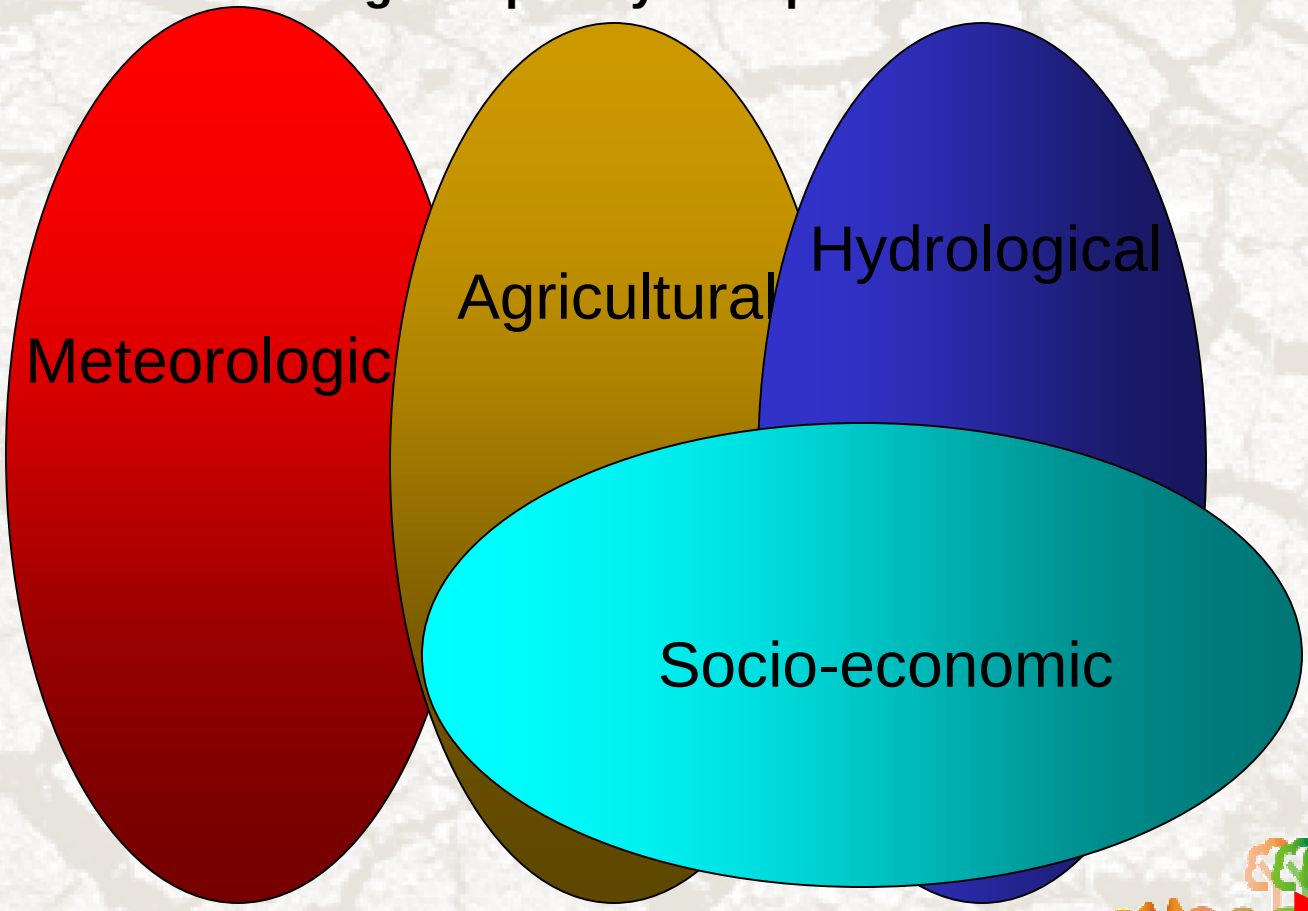
Natural and Social Dimensions of Drought

Decreasing emphasis on the natural event (precipitation deficiencies)

Increasing emphasis on water/natural resource management

Increasing complexity of impacts and conflicts



Time/Duration of the event

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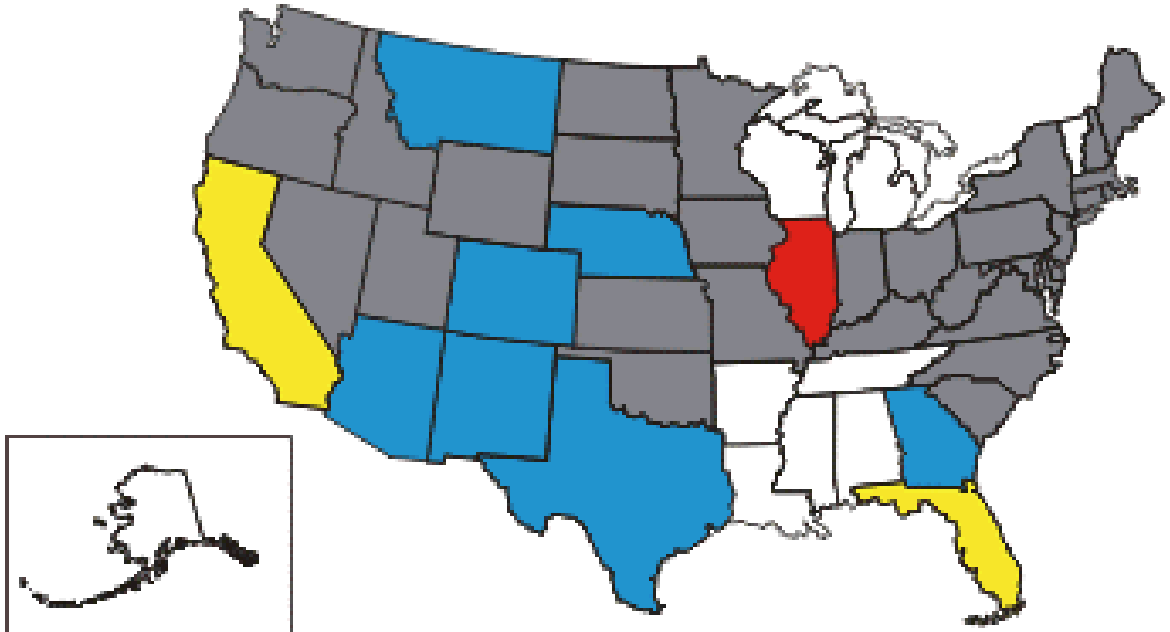
Status of Drought Planning
January 2006



States with plans emphasizing response
States with plans emphasizing mitigation
States developing long-term plans
States delegating drought planning to local authorities
States without drought plans

University of Nebraska Lincoln

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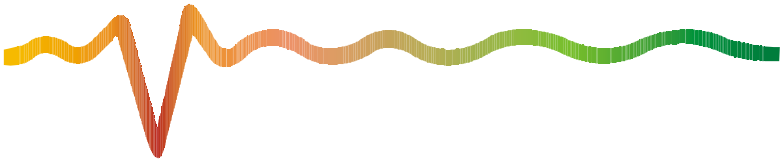
Components of Drought Plans



- **Monitoring/early warning**
  - Foundation of a drought mitigation plan
  - Indices linked to impacts and triggers
- **Risk and impact assessment**
  - Who and what is at risk and why
- **Mitigation and response**
  - Actions/programs that reduce risk and impacts and enhance recovery

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Drought Planning Continuum

Response → **Mitigation**

Increasing need for more reliable seasonal forecasts/outlooks

Increasing need for timely and reliable climate/water supply assessments

Increasing need for higher resolution analysis for policy decision support

Drought differs from other natural hazards—complicates monitoring, early warning and . . . .

- slow onset, “creeping phenomenon”, a non-event
- difficult to determine drought onset and end
- absence of a precise, universal definition
- impacts are nonstructural and spread over large areas—makes assessment and response difficult
- severity and impacts best defined by multiple indicators
- no consistent methodology for assessing impacts or data base for archiving impacts
- impacts are complex, affect many people, and vary on spatial and temporal timescales, multiple and migrating epicenters
- mitigation interventions are less obvious
- water shortages increase conflict—regulatory, legal authority (interstate and transboundary issues)

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How is the NDMC addressing the drought management issue?

- Interacting with multiple users at various levels through workshops, listening sessions
- Conducting research on behavioral change
- Developing/enhancing decision-support tools aimed at better and more timely risk assessment
- Evaluating tools and user adoption rates—are tools changing behaviors?
- Collaborating with partners
  - US Drought Monitor/North American Drought Monitor
  - US Department of Agriculture
  - NOAA—impact assessment, National Integrated Drought Information System (NIDIS)
  - US Geological Survey—vegetation indices
  - NASA—satellite-based soil moisture products

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Managing Drought and Water Scarcity in Vulnerable Environments

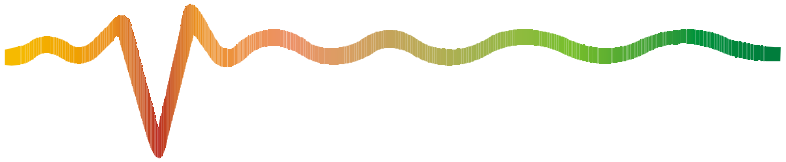
Creating a Roadmap for Change in the United States

18-20 September 2006

Longmont, CO

Drought-related impacts are expected to increase in the twenty-first century. This participatory conference will evaluate current drought-related problems and anticipate future issues.

Approaches to Drought Monitoring and Early Warning



- Single index or parameter
- Multiple indices or parameters
- Composite index

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Key Indicators For Monitoring Drought

- climate data (precipitation, temperature)
- soil moisture
- stream flow
- ground water
- reservoir and lake levels
- snow pack
- short, medium, and long range forecasts
- vegetation health/stress and fire danger

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An integrated drought monitoring system needs to:

- be comprehensive in scope (coupling climate, soil and water data)
- incorporate local and regional scale data
- use the best available (multiple) indices and triggering tools
- link index values or thresholds to impacts
- be flexible and incorporate the needs of users

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U.S. Drought Monitor

The Drought Monitor Concept

- A ***partnership*** between the NDMC, USDA and NOAA's CPC and NCDC ***(authors)***
- Incorporate relevant information and products from all entities (and levels of government) dealing with drought (RCC's, SC's, federal/state agencies, etc.) ***(experts)***
- The **Drought Monitor** is ***updated weekly*** and provides a general up-to-date summary of current drought conditions across the 50 states, Puerto Rico and the Pacific possessions
- Annual **user forums** provide feedback and interaction opportunities

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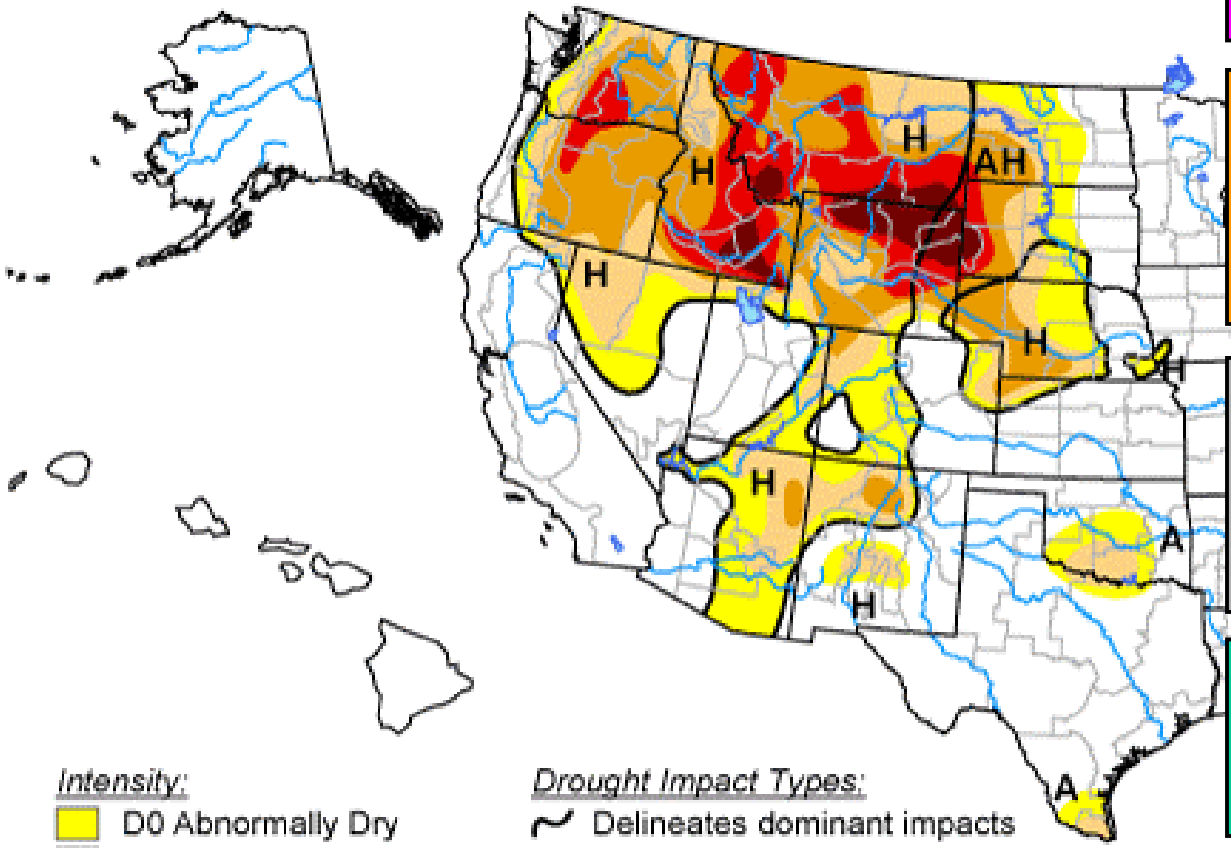
http://drought.unl.edu/dm

National Drought Mitigation Center

U.S. Drought Monitor



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

Drought Impact Types:
- ~ Delineates dominant impacts
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- (No type = Both impacts)

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http://drought.unl.edu/dm

USDA National Drought Mitigation Center

Release
Author: Rich

Weekly snapshot of drought severity and spatial extent

Definition of drought severity classes based on probability of occurrence

Use of multiple indicators, indices, and impacts to define drought severity & type

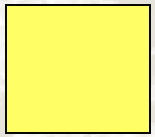
Coordination between government agencies and a university

Created electronically, incorporating expert input from field sources

Timely delivery to users via the Internet

U.S. Drought Monitor Map

Drought Intensity Categories



D0 **Abnormally Dry**

D1 Drought – **Moderate (20%)**

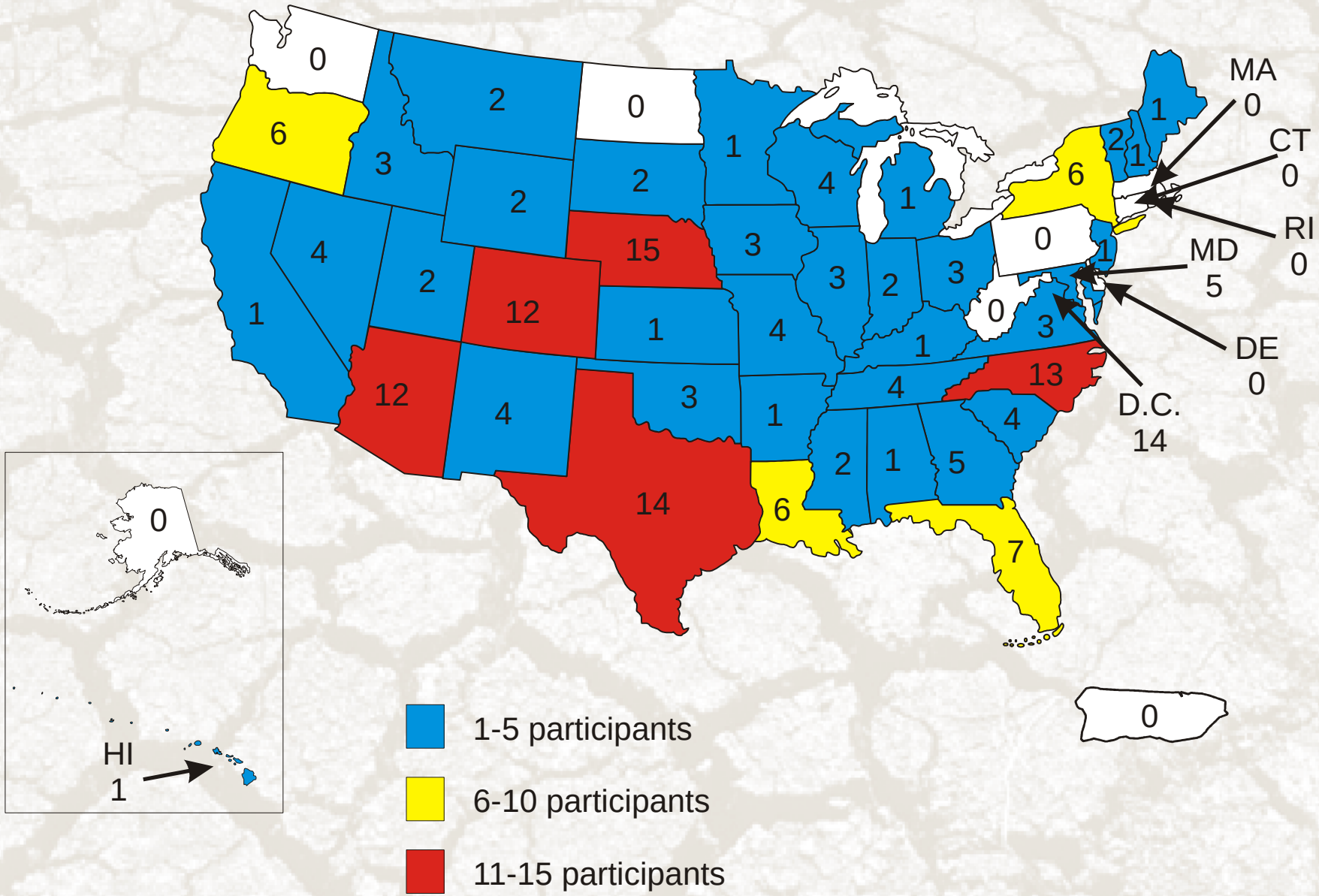
D2 Drought – **Severe (10%)**

D3 Drought – **Extreme (5%)**

D4 Drought – **Exceptional (2.5%)**

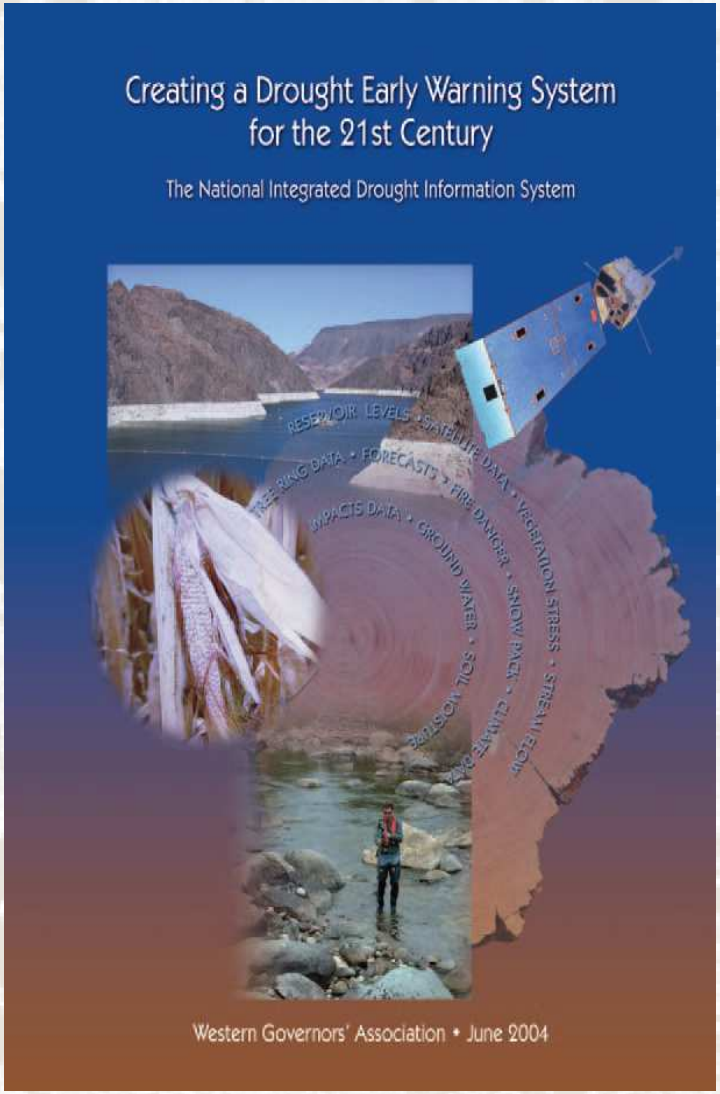
USDM Listserve Participants

(as of January 2006)



National Initiatives

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



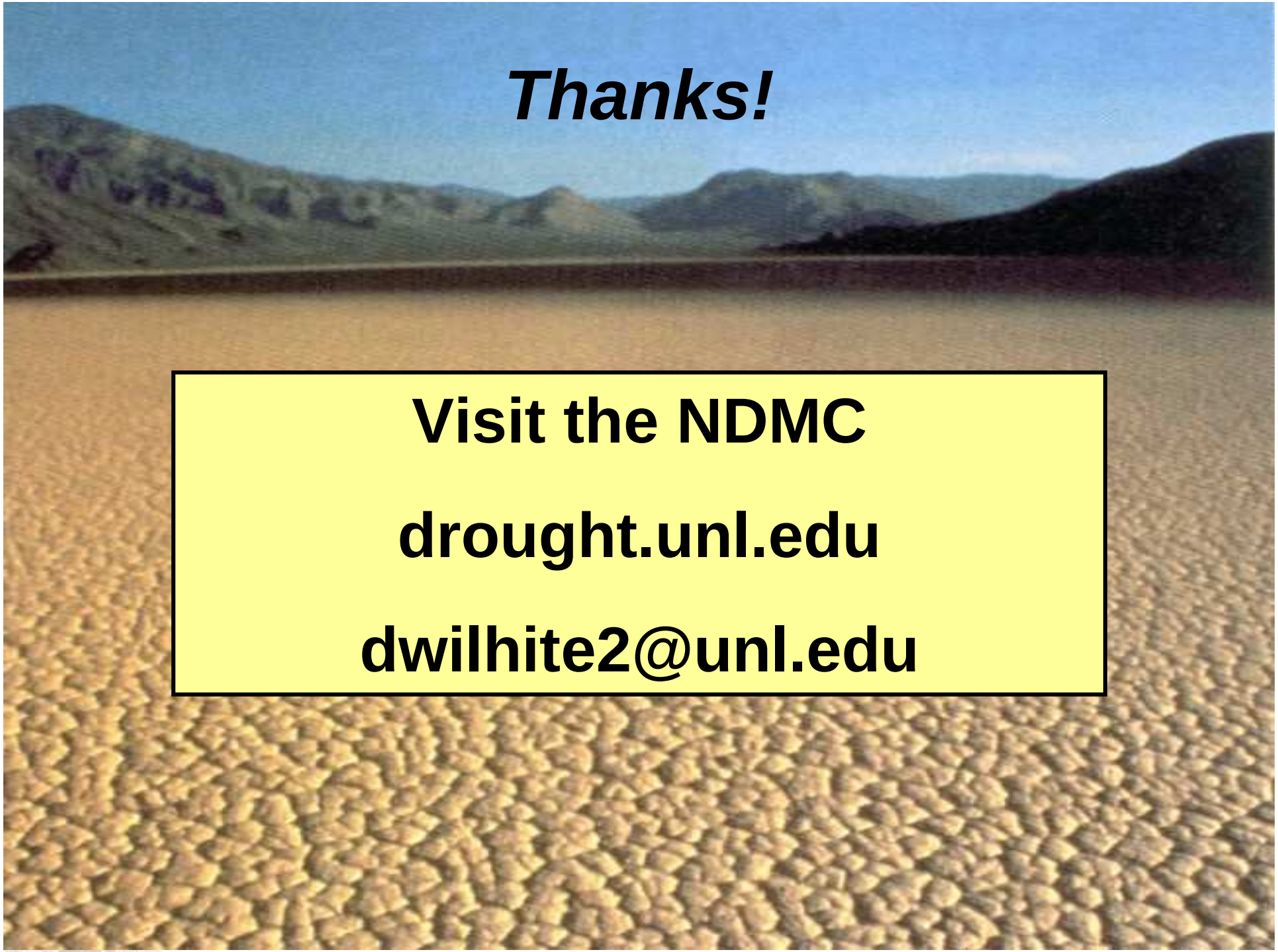
NIDIS Vision

A dynamic and accessible drought information system that provides users with the ability to determine potential drought impacts and associated risks and the decision support tools needed to better prepare for and mitigate the effects of drought.

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
- Provide a framework for interacting with and educating decision makers and the public

N • I • D • I • S


Thanks!
Visit the NDMC
drought.unl.edu
dwilhite2@unl.edu