

Drought Monitoring and Early Warning Information Systems (DEWIS): Tools and Techniques

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National Drought Mitigation Center
University of Nebraska-Lincoln, USA**

2012 Caribbean Drought Training Workshop, Kingston, Jamaica May 22-24, 2012

Outline

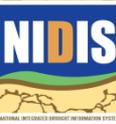
- ▶ **Context**
- ▶ **Drought Monitoring**
- ▶ **Drought Early Warning and Information Systems (DEWIS)**
- ▶ **NIDIS as a model?**
- ▶ **Toward a Global Drought Early Warning and Information System (GDEWIS)**
- ▶ **Summary**



Drought Plan Components

- ▶ **Monitoring and early warning**
 - assess, communicate, and **trigger** action
 - **Foundation** of a drought mitigation plan
- ▶ **Vulnerability assessment**
 - Who and what is at **risk** and why?
- ▶ **Mitigation and response actions**
 - Actions/programs that **reduce risk and impacts** and enhance recovery

Most processes and plans in the past have primarily focused on monitoring and response...

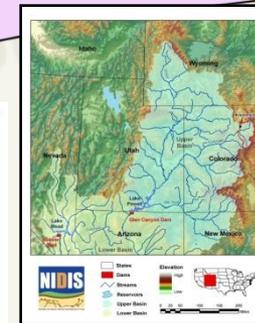


Tools for Planning: NDMC and NIDIS

- All droughts are “local”
- Planning is a “living” process
- Planning should start local
- Planning at all scales
- Now what?



Drought-Ready Communities

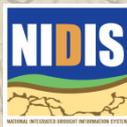


NDMC International Activities

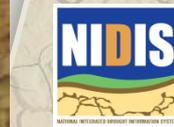
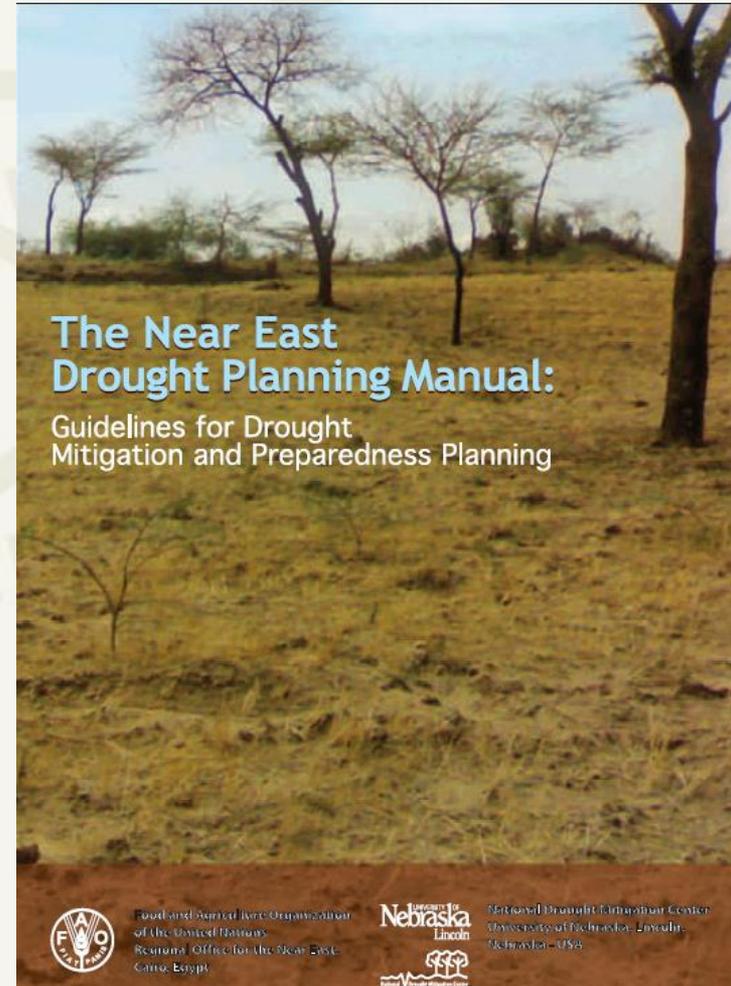
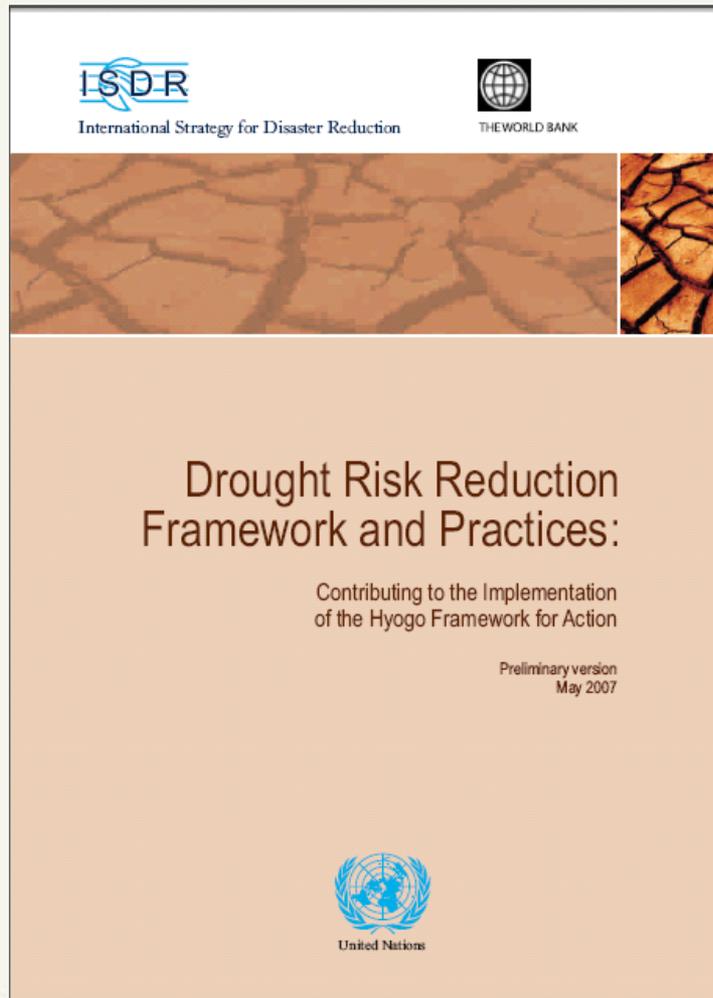


Activities 2005-2010
Czech Republic • Italy • Switzerland • Spain • Slovenia • European Union • Southern Europe/Northern Africa
Morocco • Tunisia • Mali • Ethiopia • Mozambique • Namibia • Egypt • Saudi Arabia • Egypt • India • Jordan •
India • Japan • China • South Korea • Vietnam and Cambodia • Australia • Brazil • Chile • Mexico • Canada

Activities planned in 2011
Turkey • Czech Republic • Slovenia • Austria • Australia • Canada • Mexico • India • Korea • China • Ethiopia •
Nigeria • Zambia



International Drought Planning Guides



"You can't manage what you don't measure.....and you can't measure what you don't monitor...."

(An old business adage applied to drought early warning!)

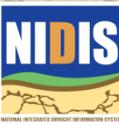
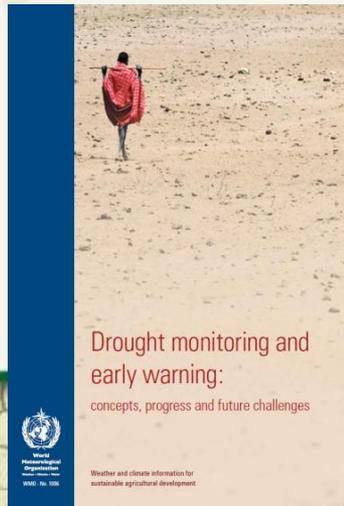
National Drought Mitigation Center



What are Drought Monitoring and Early Warning Systems?

A **drought monitoring system** will *track, assess and report* climate and water supply trends and current conditions (e.g., rainfall, reservoirs, impacts, etc.) (modified from WMO – No. 1006e)

An **early warning system** facilitates “the *provision of timely and effective information*, through identifying institutions, that allow individuals exposed to a hazard to take action to avoid or reduce their risk and prepare for effective response” (ISDR, 2003).



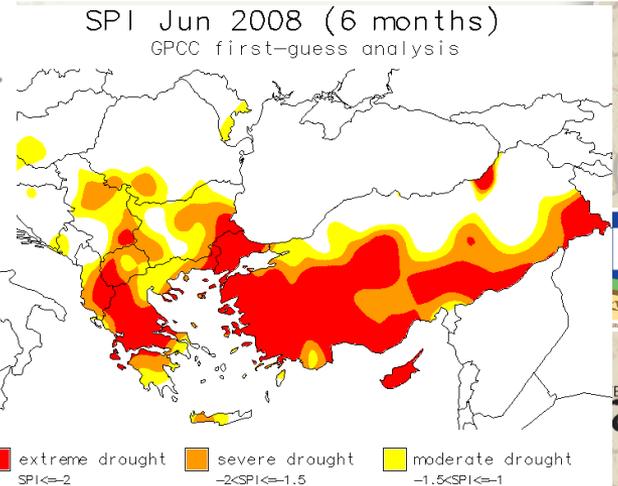
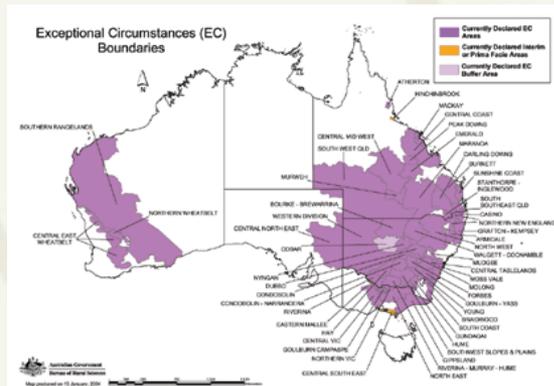
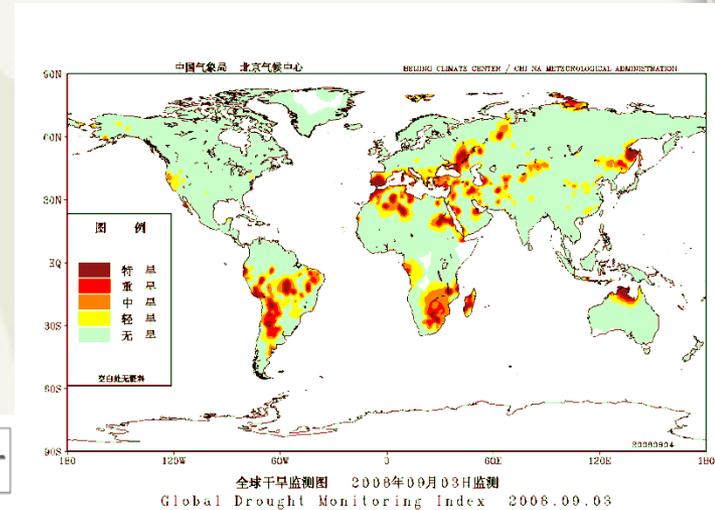
Drought Monitoring State of the Science: Where are we now?

- ▶ WMO/WCC-3, GSDPN/GEOSSE is a way to **learn/leverage** from one another
 - Canada/Mexico/United States/Africa/EDO
 - UN/WMO/GEOSSE/others
- ▶ Many regions/countries are **working together** to better monitor drought
- ▶ Monitoring of **impacts** globally is virtually non-existent
- ▶ Early warning/monitoring just one key: **THEN WHAT?** Need linkages to risk/vulnerability assessment and planning for adaptation
- ▶ Many **indicators/indices don't reflect reality** in various regions, or for various seasons...or for both. Must tie to **impacts!**

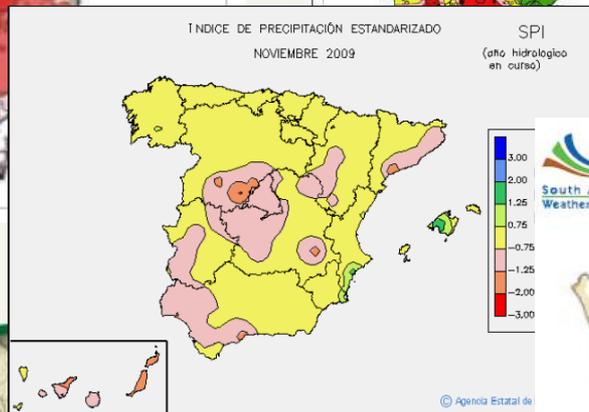
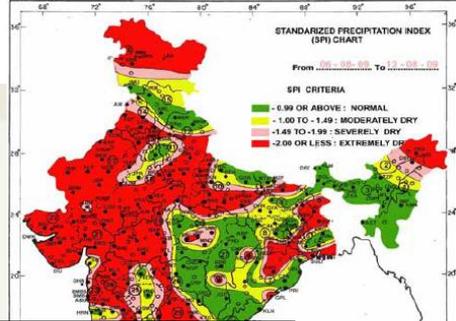
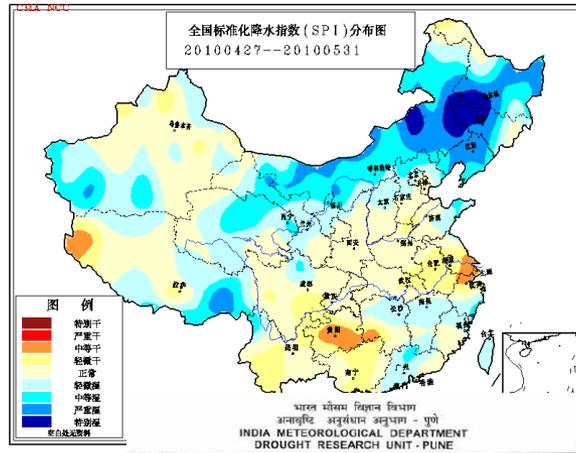
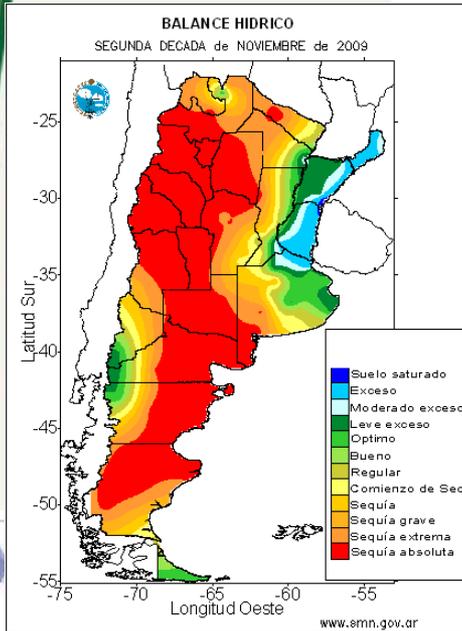


.....the *rapid onset* of National Drought Centers/Strategies

- ▶ Australia
- ▶ South Africa
- ▶ Canada
- ▶ United States
- ▶ Slovenia/Southeast Europe
- ▶ Spain
- ▶ EU/JRC
- ▶ Turkey
- ▶ Portugal
- ▶ South Korea
- ▶ China
- ▶ India
- ▶ Pakistan
- ▶ Morocco
- ▶ Syria
- ▶ Brazil (Sao Paulo state)
- ▶ Jordan
- ▶ Iran



Drought Monitoring/Reporting Systems



North American Drought Monitor

April 30, 2010
Released: Friday, May 21, 2010

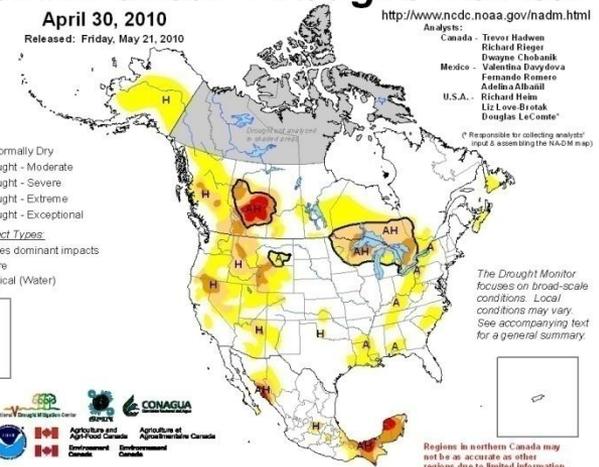
<http://www.ndbc.noaa.gov/nadm.html>

Intensity:

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

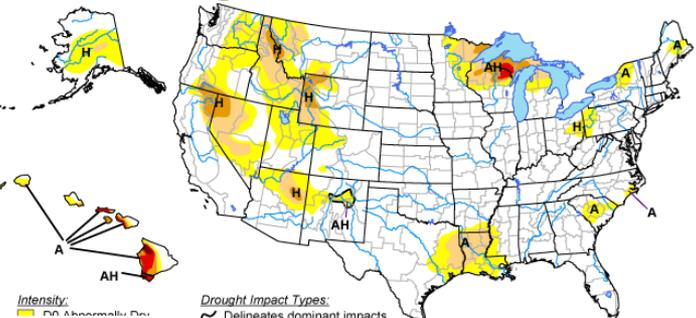
Drought Impact Types:

- Delimitates dominant impacts
- A = Agriculture
- H = Hydrological (Water)



U.S. Drought Monitor

May 25, 2010
Valid 8 a.m. EDT



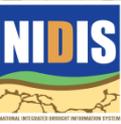
Released Thursday, May 27, 2010
Author: Eric Luebbehusen, U.S. Department of Agriculture

u/dm

Rainfall deficiencies: 10 months
1 April 2002 to 31 January 2003
Distribution based on gridded data
Product of the National Climate Centre



How to Develop a Drought Monitoring and Early Warning System?



The Importance of Drought Early Warning and Information Systems (DEWIS)



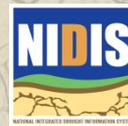
- ▶ Allows for **early** drought detection
- ▶ Improves response (**proactive**)
- ▶ Data and tools for **decision support**
- ▶ **"Triggers"** actions within a drought plan
- ▶ A critical **mitigation** action
- ▶ **Foundation** of a drought plan



Components of a Drought Early Warning and Information System (DEWIS)



- ▶ Monitoring **AND** Forecasting
- ▶ Access to **timely** data (including **impacts**) and value added **information**
- ▶ **Synthesis/analysis** of data used to “trigger” set actions within a drought plan
- ▶ **Tools** for decision makers
- ▶ Efficient **dissemination/communication** (WWW, media, extension, etc.)
- ▶ Drought risk **planning**
- ▶ **Education** and Awareness



Monitoring the Drought Hazard: Many Parameters and Indices to Choose from:

Parameters (Indicators) to measure:

temperature, precipitation, soil moisture, reservoir/lake levels, streamflow, ground water, snow pack, ET, vegetation health/stress, short and long-term/seasonal forecasts, **impacts!**

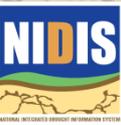
Assessing Drought:

Meteorological

- Aridity Index (AI)
- Deciles
- Standardized Precipitation Index (SPI + SPEI)
- Palmer Drought Severity Index (PDSI, scPDSI)

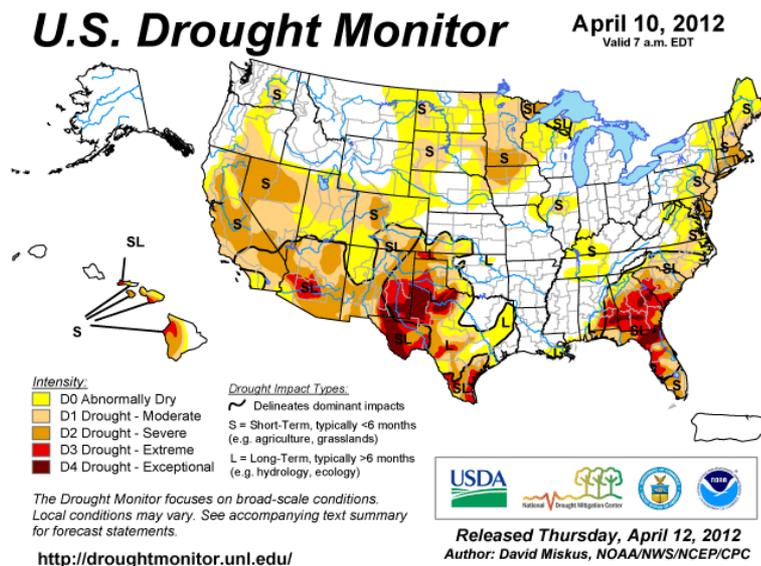
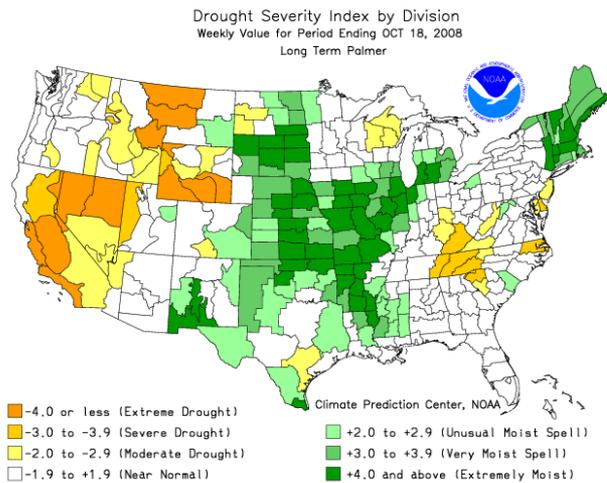
Hydrologic Drought Index

- Surface Runoff Index (SRI)
- Surface Water Supply Index (SWSI)



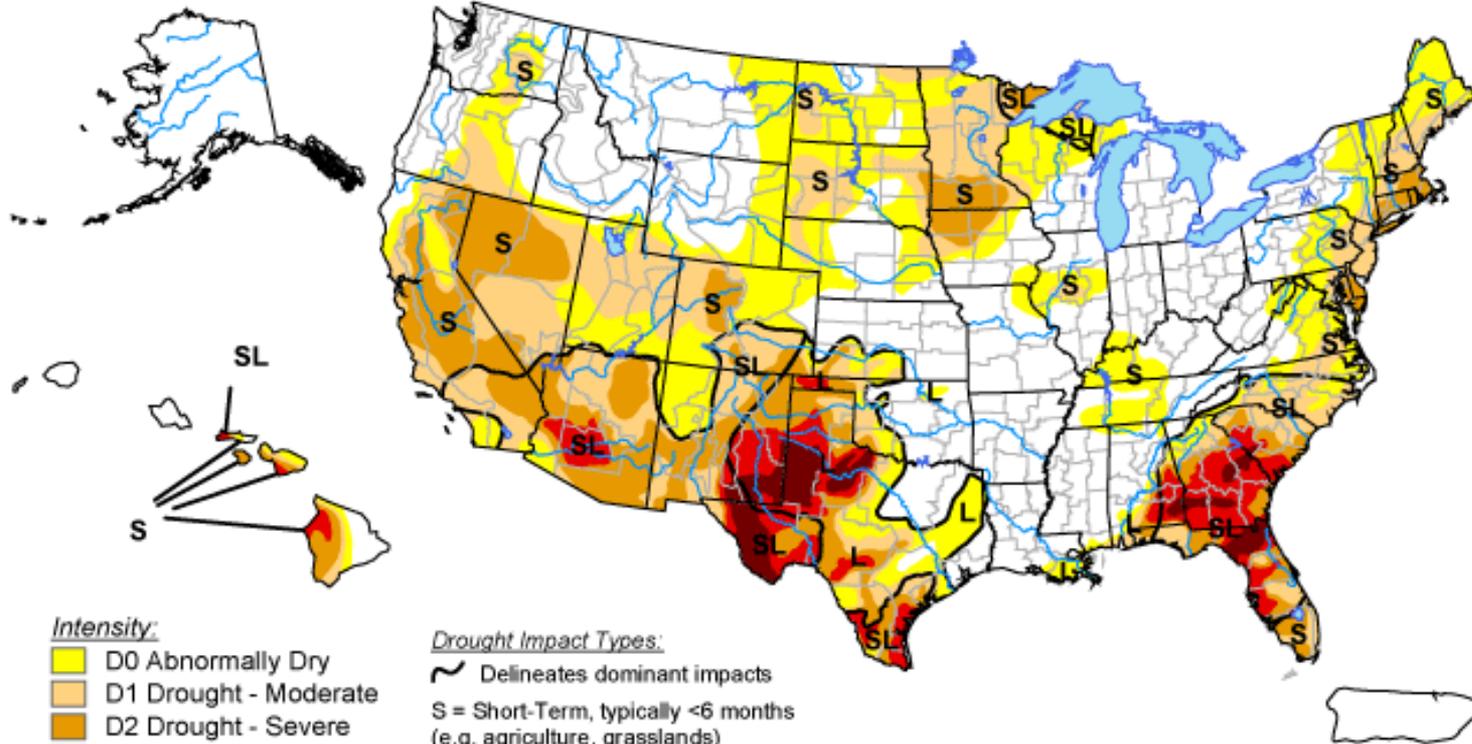
Approaches to Drought Assessment

- ▶ **Single index or indicator (parameter)**
- ▶ **Multiple indices or indicators**
- ▶ **Composite (or "hybrid") Indicator**



U.S. Drought Monitor

April 10, 2012
Valid 7 a.m. EDT



Intensity:

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

Drought Impact Types:

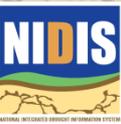
-  Delineates dominant impacts
- S = Short-Term, typically <6 months (e.g. agriculture, grasslands)
- L = Long-Term, typically >6 months (e.g. hydrology, ecology)

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

<http://droughtmonitor.unl.edu/>

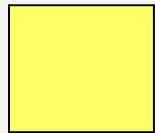


Released Thursday, April 12, 2012
Author: David Miskus, NOAA/NWS/NCEP/CPC



U.S. Drought Monitor

Drought Intensity Categories (by ranking percentile)



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)



North American Drought Monitor

February 29, 2012

Released: March 13, 2012

<http://www.ncdc.noaa.gov/nadm.html>

Analysts:

Canada - Trevor Hadwen*
Richard Rieger
Mallory MacDonald
Mexico - Reynaldo Pascual
Adelina Albanil
U.S.A. - Mark Svoboda

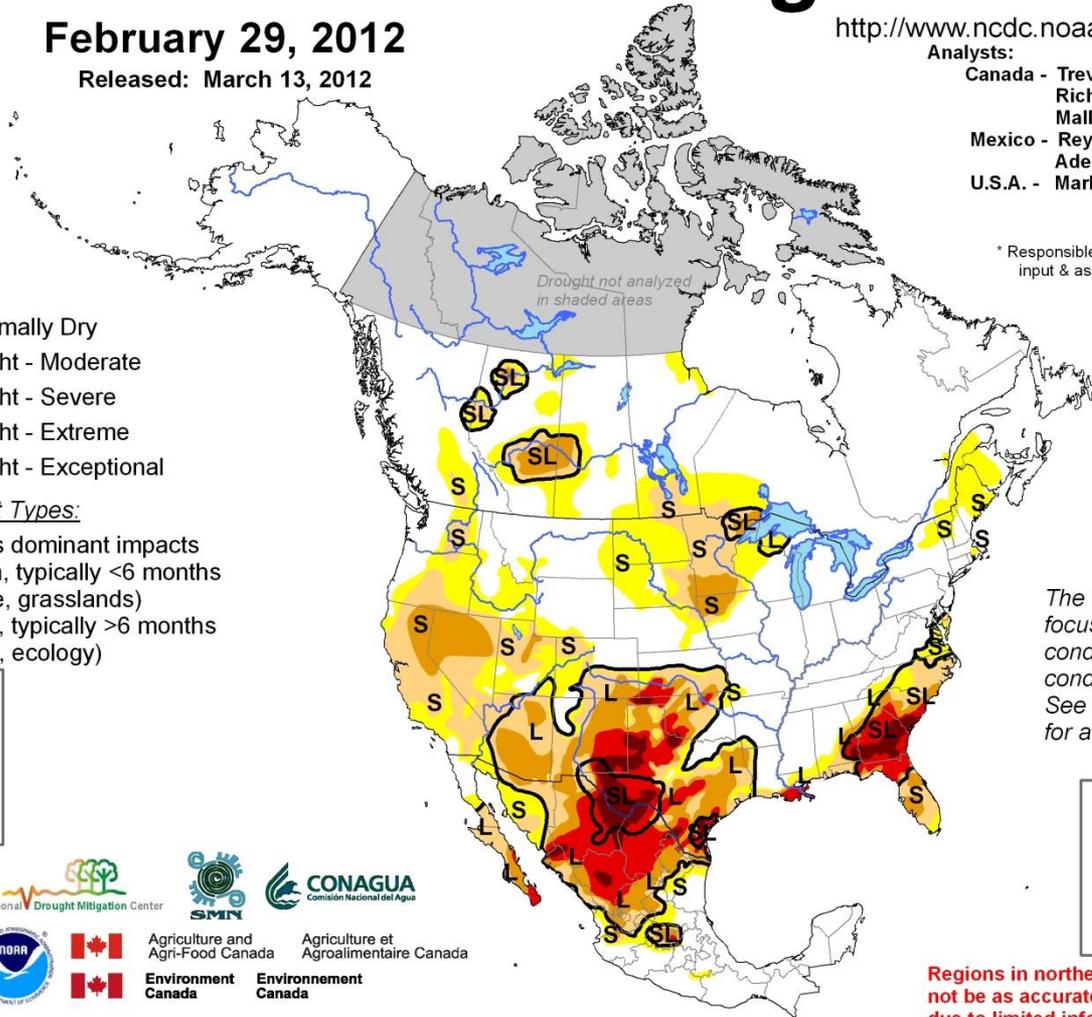
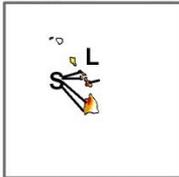
* Responsible for collecting analysts' input & assembling the NA-DM map

Intensity:

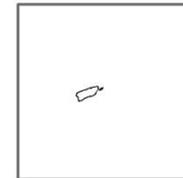
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Regions in northern Canada may not be as accurate as other regions due to limited information.



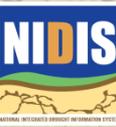
Agriculture and Agri-Food Canada

Agriculture et Agroalimentaire Canada



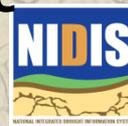
Environment Canada

Environnement Canada



U.S. Seasonal Drought Outlook

- ▶ Issued every **two weeks**
- ▶ CPC **monthly precipitation** outlook
- ▶ CPC long-lead seasonal **90-day** forecasts
- ▶ Various medium- and short-range forecasts and models such as the **6-10 day and 8-14 day forecasts**
- ▶ **Soil moisture tools** based on the GFS model and the Constructed Analogue on Soil (**CAS**) moisture, the Climate Forecast System (**CFS**) **seasonal precipitation forecasts, climatology, and initial conditions.**



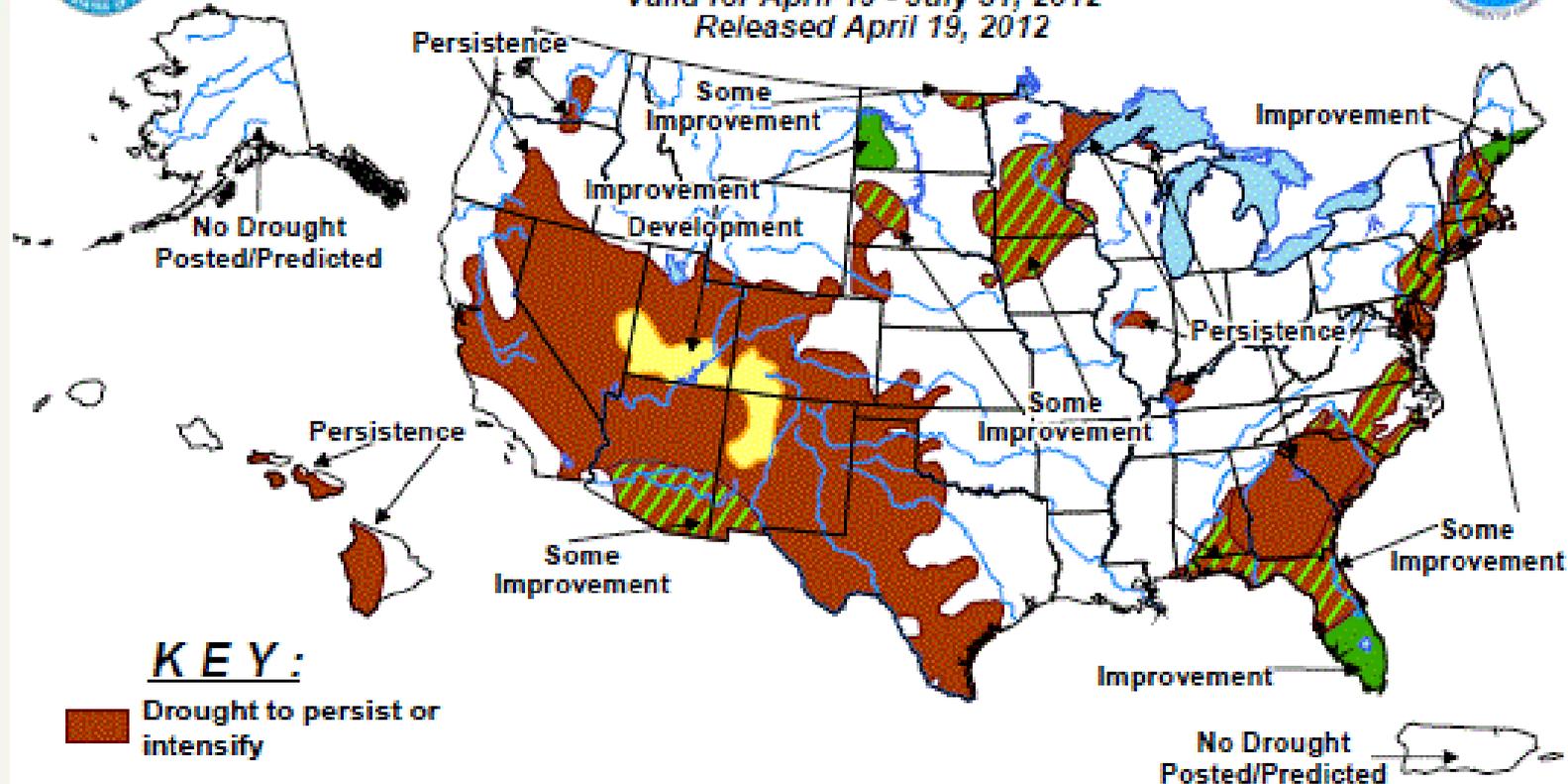


U.S. Seasonal Drought Outlook

Drought Tendency During the Valid Period

Valid for April 19 - July 31, 2012

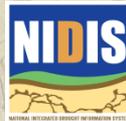
Released April 19, 2012



KEY:

-  Drought to persist or intensify
-  Drought ongoing, some improvement
-  Drought likely to improve, impacts ease
-  Drought development likely

Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Short-term events – such as individual storms – cannot be accurately forecast more than a few days in advance. Use caution for applications – such as crops – that can be affected by such events. “Ongoing” drought areas are approximated from the Drought Monitor (D1 to D4 Intensity). For weekly drought updates, see the latest U.S. Drought Monitor. NOTE: the green Improvement areas imply at least a 1-category Improvement in the Drought Monitor Intensity levels, but do not necessarily imply drought elimination.

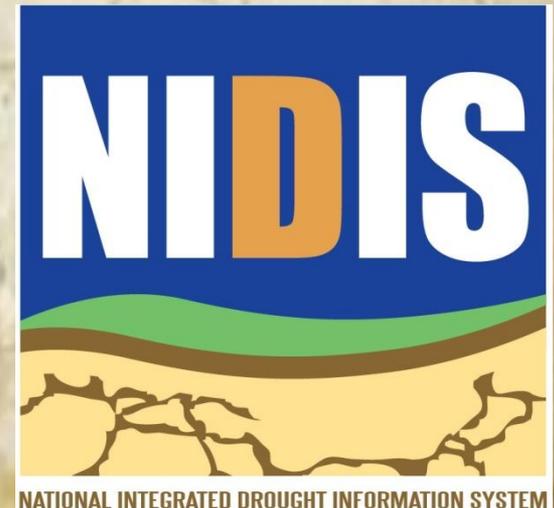


National Integrated Drought Information System (NIDIS)

A NOAA-led Federal, State, Tribal and Local Partnership

(Public Law 109-430, 2006)

Goal of NIDIS: Improve the nation's capacity to 'proactively' manage drought-related risks by **providing decision makers with the best available information and tools** to assess the impact of drought and to better prepare for and mitigate the effects of drought.



NATIONAL INTEGRATED DROUGHT INFORMATION SYSTEM

www.drought.gov

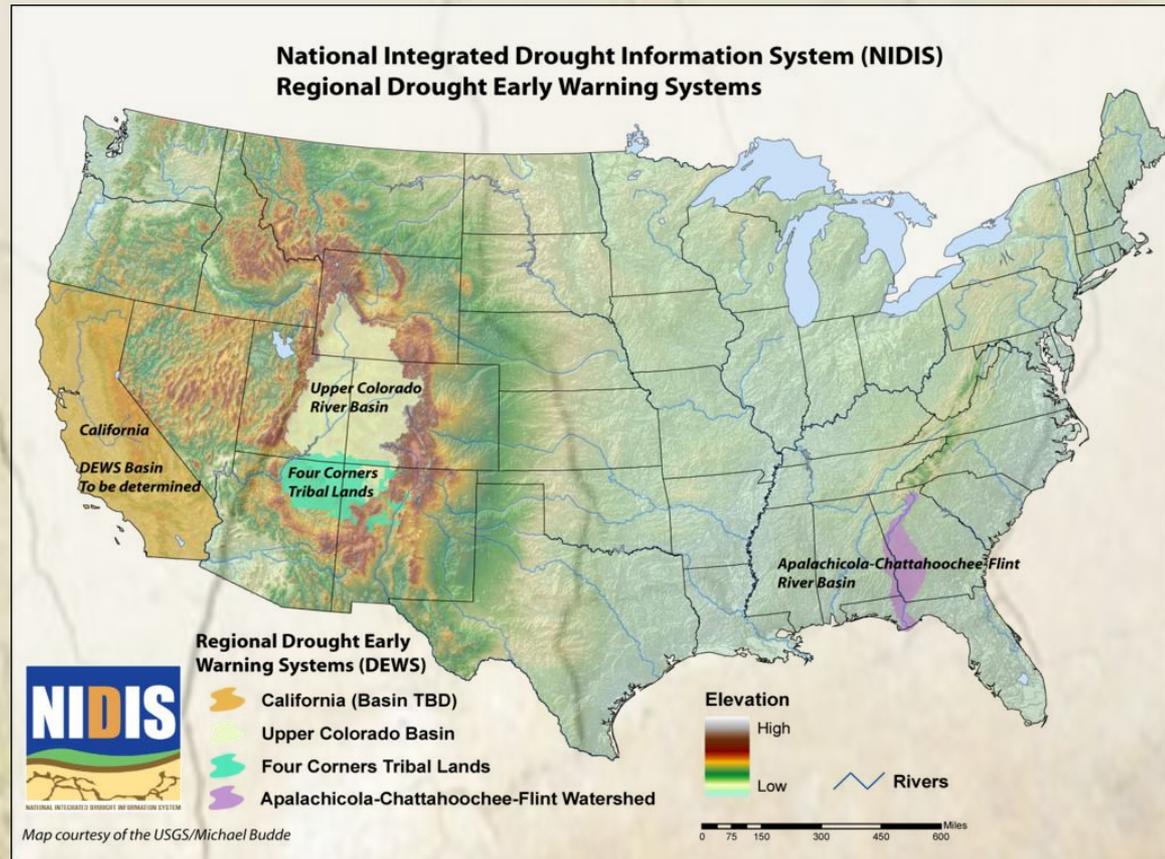
National Integrated Drought Information System (NIDIS)

NIDIS:

(TASK 1): Provide an effective *drought early warning system* that:

(a) *collects and integrates* information on the key indicators of drought and drought severity; and

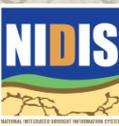
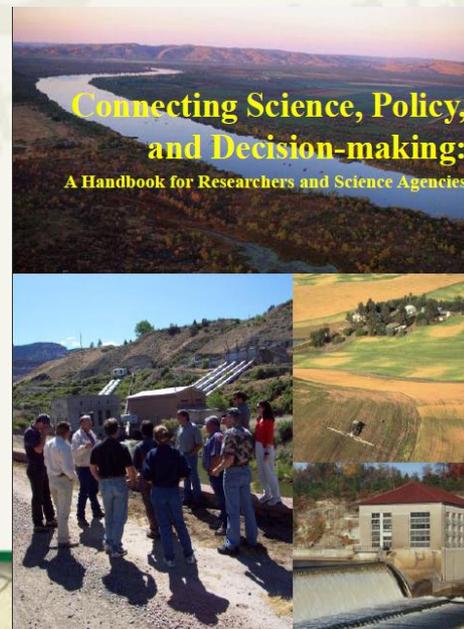
(b) *provides timely information* that reflect state and regional differences in drought conditions



Providing Useful Services and Products: Information Delivery

- ▶ *"To increase the impact of scientific information, there should be a focus on **usability**, not just **availability** of information. This means moving to **"value added"** products, where findings are provided in a format that allows for policy applications"*

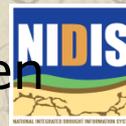
Taken from: *(Jacobs/NOAA OGP)*
Connecting Science, Policy and Decision Making: A Handbook for Researchers and Science Agencies



Providing Useful Services and Products: Information Delivery

- ▶ Qualities of Good Science Integrators and Translators:
 - **Outside the box** mentality
 - Willingness to **work across disciplines** and think creatively
 - **Fostering** long-term relationships and trust between scientists and decision makers
 - **Credibility** in the science community, capability of understanding and translating complex information correctly
 - Providing mechanisms for **evaluation and feedback**
 - Expertise in a particular sector
 - Understanding of the institutions and the cultures/constraints of the particular user involved
 - Ability to facilitate, rather than replace, relationship between the principals (scientists and user groups)

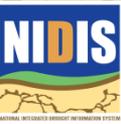
Taken from: (Jacobs/NOAA OGP) *Connecting Science, Policy and Decision Making: A Handbook for Researchers and Science Agencies*



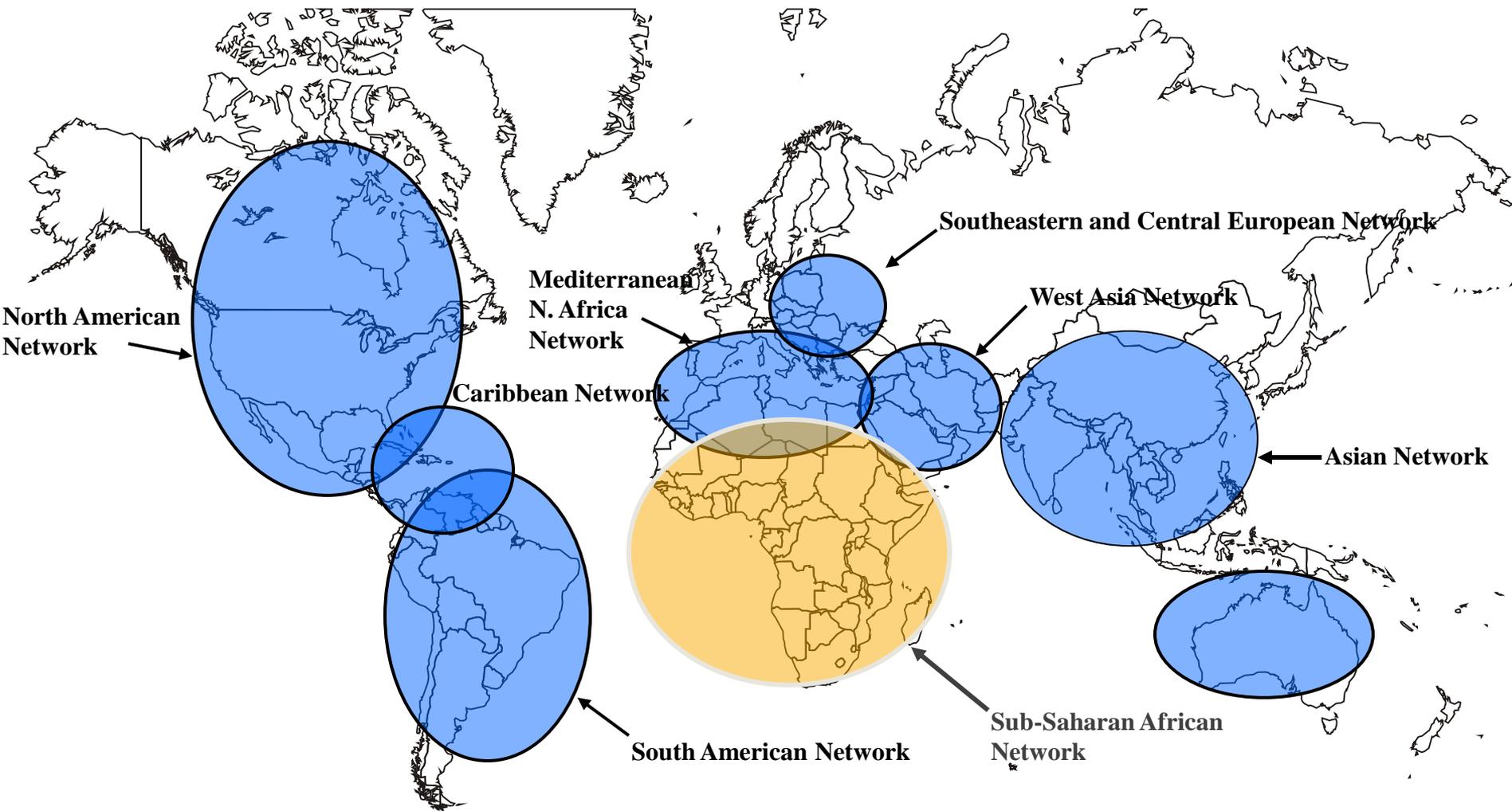
Global Drought Preparedness Network

Individually, many nations will be unable to improve their drought coping capacity.

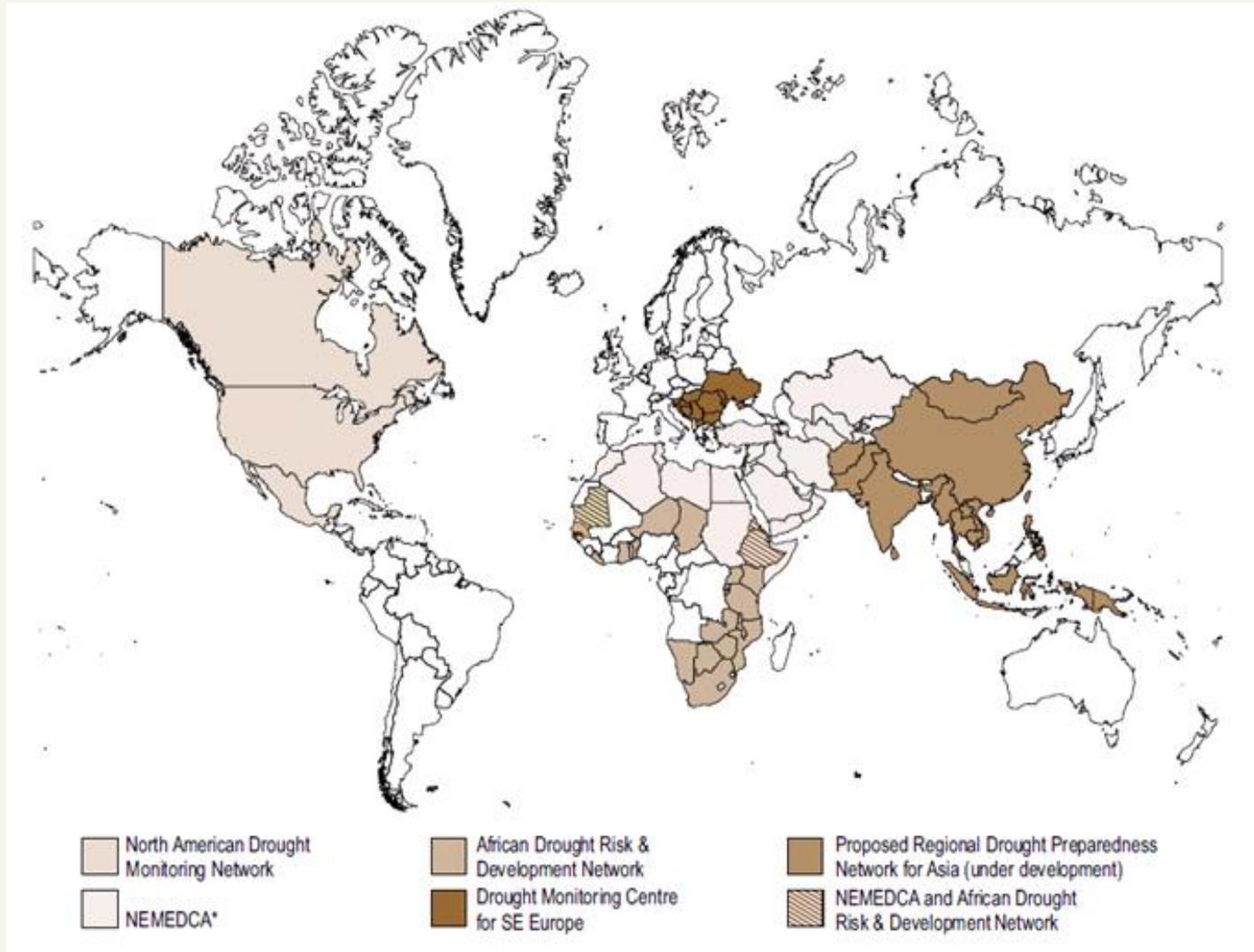
Collectively, through global, regional, and national **partnerships**, we can share information and experiences to reduce the impacts of drought.



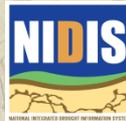
Potential Regional Networks



Regional DEWS Networks



Global Drought Preparedness Network - UNISDR

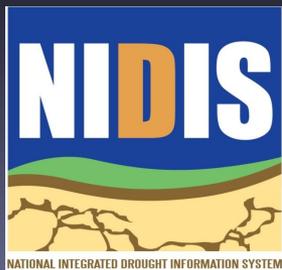




World Meteorological Organization
Working together in weather, climate and water



- ✓ The growing problem of drought and its impact on long-term sustainability of Earth's water resources has been recognized for many years. At a 2007 GEO Ministerial Summit, the event concluded with a U.S. proposal that technical representatives from participating countries build upon existing programs to work toward establishing a **Global Drought Early Warning System (GDEWS)** within the coming decade to provide:
 - A system of systems for data & information sharing, communication, & capacity building to take on the growing worldwide threat of drought
 - Regular drought warning assessments issued as frequently as possible with increased frequency during a crisis



Future Drought Monitoring Challenges

The Big Five:

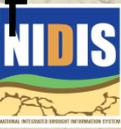
- ▶ **Impact** collection/quantification
- ▶ **Soil moisture** (especially *in situ*)
- ▶ **Hydrology** (surface *and* groundwater)
- ▶ Application of **remotely sensed/modeled** products operationally (trust)
- ▶ **Ecological/Environmental** (D-x E?)
 - *Managed vs. Unmanaged systems (rangeland/pastureland or irrigated vs. non-irrigated)*
 - *"If a drought occurs in the desert, does anybody see it?" What about a tropical island climate regime?*



Lessons Learned



- ▶ Monitoring is the **foundation** of risk management planning
 - Trigger to who does what and when!
 - One can not manage what is not monitored!
- ▶ **Impact collection must be an integral part** of any drought early warning information system
- ▶ Tool development should be an **iterative process** in partnership with the users
- ▶ **Dissemination** is needed through a variety of media and educational materials in order to reach a variety of audiences



Takeaway Thoughts on DEWIS

▶ **Collaboration**

- Leverage resources
- Leverage skills/products
- Data sharing—real time (derivative and/or joint products)

▶ **Ownership** (including stakeholders)

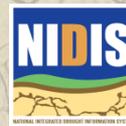
- **U2U---user to usable**

▶ **Attribution** for all (share the success)

▶ **Transparency/Accessibility/Communication**

▶ The "**I's**" have it! **DEWIS**

- **I**mpacts
- **I**ntegration
- **I**nformation





Thanks!

Contact Information:

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