Climate, Weather and Water Services

Roger S. Pulwarty

The National Integrated Drought Information System
The National Integrated Drought Information System

R. Pulwarty, J. Verdin, C. McNutt, L. Darby and the NIDIS Implementation Team
“No systematic collection and analysis of social, environmental, and economic data focused on the impacts of drought within the United States exists today” Western Governors Association 2004

Public Law 109-430 (The NIDIS Act 2006)

“Enable the Nation to move from a reactive to a more proactive approach to managing drought risks and impacts”

“better informed and more timely drought-related decisions leading to reduced impacts and costs”

(www.drought.gov)
NIDIS Components

1. NIDIS Office (PSD/CPO..)
2. U.S. Drought Portal (NCDC, NDMC..)
3. Climate Test Beds/Drought
   - Integrating data and forecasts (CPC, RFCs..)
4. Coping with Drought
   - Applications and Decision support Research (RISAs, SARP, TRACS..)
5. NIDIS Early Warning Information Systems
   - Design, Prototyping, Implementation (multi-agency, multi-state RCCs, State Climatologists)
NIDIS Governance: Executive Council

NIDIS Program Office

NIDIS Implementation Team: Over 50 Federal, state, tribal and private sector representatives

NIDIS Technical Working Groups

REGIONAL

Public Awareness And Education
Engaging Preparedness Communities
Integrated Monitoring and Forecasting
Interdisciplinary Research and Applications
U.S. Drought Portal

WATERSHED/URBAN/LOCAL

Integrated Drought Information Systems
Drought Early Warning System Design-Information clearinghouse, Pilots, and Implementation
NIDIS Knowledge Assessment Workshops (selected)


- Drought, Climate change and Early Warning on Western Tribal Lands June 09- Columbia, Colorado, Rio Grande, Missouri Basin tribes
The NIDIS U.S. Drought Portal
(www.drought.gov)

Key Clearinghouse Functions:
Credible, Accessible, Timely Information on

Where are drought conditions now?
Does this event look like other events?
How is the drought affecting me?
Will the drought continue?
Where can I go for help?

Portlet example:
NWS River Forecast Center
Ohio River Water Resources Outlook - Ecosystem recovery
NIDIS Regional Early Warning Systems Pilots

Blue - first round prototypes;  Yellow - second round-transferability
Coordinating federal, state, and local drought-related activities (e.g., within watersheds and states)

Monitoring  Prediction  Applications Research

Integrating Tools e.g. Drought Monitor/Portal

Identifying and transferring innovative strategies for drought risk assessment, communication and preparedness-usability experiments

Proactive Planning  Impact Mitigation  Improved Adaptation
Categories of drought information users & scales of analysis

Upper Basin down to Lake Mead

• Coordinated reservoir operations: Low flow shortage triggering criteria (Powell/Mead)

Sub-basin

• Inter- and Intra-basin transfers; Front range urban-agriculture-Changing water demand during drought

• Ecosystem health/services including recreation and tourism impacts
Coordination with Colorado Water Conservation Board

- Revision of the Plan to meet drought requirements of the State Natural Hazard Mitigation Plan, as well as FEMA and EMAP

- Development of indices that incorporate current surface water conditions and a forecast component

- Evaluate trigger points and the responses that they activate
NRCS Revised Surface Water Supply Index (SWSI) for Colorado

Impacts on Native American Lands in the Four-Corners Region

(Nature, 2009)
Drought and Water Resources:
Engaging communities, resources managers as climate varies and changes

(RISAs, Climate and Hydromet Test-Beds, RCCs…….)

Regional Teams, NWS Field Offices, Coastal Services Center,…)

Integrated Climate, Ecosystems, Hydrology: Technical Info & Data

Watershed, state, tribal, local: Experience & Knowledge

Decision Support

**Climate information needs and usability:**
Entry points for proactive Planning-triggers and indicators

**Enabling resilience:**
Best available drought risk & water supply information to inform infrastructure development and ongoing adaptation
NIDIS Relies on ESRL/PSD
(integrated research, development of service prototypes)

- Reconciling CO Basin flow projections
- Attribution: Drought severity
- Low flow impacts on protected species
- Analyses of emerging events
- Drought demise - two week forecasts, Hydromet Test-bed
- Partnerships with WWA

www.drought.gov
NIDIS Newsletter
A NIDIS Goal: Informing Climate Services Development

“If we don’t get NIDIS right, we can’t get a national climate service right”

Kelly Redmond, Western Regional Climate Center

6th Drought Monitor Forum
Austin, Tx Oct. 7-8, 2009
THANK YOU
BACKUP SLIDES
Regional and Watershed Level Applications and Decision Support Research in support of NIDIS (RISA, SARP, TRACS)

- Evaluating Adaptation Policies For Urban Water Resource Management-Short-Term Drought Responses And Long-Term Planning
- Socioeconomic Assessments to Build Community Resilience in Mitigating Drought
- Climate Information System to Enhance Drought Preparedness by Underserved Farmers in the SE U.S.

- Ensemble Hydrologic Forecasts
- Drought Index Evaluation and Implementation in a Geospatial Framework Linked to Hydrologic Data Web Services
Year 2 Actions

Prototyping/gaming: Given better data and information coordination, would responses have been improved for past events? Assess:

1. Value of improved information using past conditions
2. Responses for projections/scenarios (seasons, decadal, change)
3. Develop EWS Fora
4. Feedback on priorities (e.g. data gaps) to Executive Council
Mission: Implement a dynamic, accessible, authoritative drought information system

<table>
<thead>
<tr>
<th>NOAA Produces:</th>
<th>With Our Partners:</th>
<th>Used By:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Monitoring and Forecasting</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U.S. Drought Monitor</td>
<td>USDA, National Drought Mitigation Center</td>
<td>USDA, state and local governments</td>
</tr>
<tr>
<td>U.S. Soil Moisture Monitoring</td>
<td>DOE, USDA (NRCS)</td>
<td>USDA, agricultural producers</td>
</tr>
<tr>
<td>Normalized Difference Vegetation Index</td>
<td>USGS, NASA</td>
<td>USAID (FEWS NET)</td>
</tr>
<tr>
<td>Crop Moisture Index</td>
<td>USDA</td>
<td>USDA, agricultural producers</td>
</tr>
<tr>
<td>Ensemble Water Supply Forecasts</td>
<td>USDA</td>
<td>USBR, USACE, state water management agencies, local district water managers</td>
</tr>
<tr>
<td>Soil Moisture Anomaly Forecast</td>
<td>USDA (NRCS)</td>
<td>USDA, agricultural producers</td>
</tr>
<tr>
<td>Products Informing Risk Assessment and Management</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reconciling projections of future Colorado River stream flow in a changing climate</td>
<td>USBR, USGS, University of Washington, University of Colorado, University of Arizona, University of California-San Diego</td>
<td>USBR, state and local water providers, reservoir managers, Water Conservancy Districts</td>
</tr>
<tr>
<td>USGS Circular 1331: Climate Change and Water Resources Management: A Federal Perspective</td>
<td>USGS, USBR, USACE</td>
<td>USBR, USACE, Water Utilities</td>
</tr>
<tr>
<td>Climate Change in Colorado: A Synthesis to Support Water Resources Management and Adaptation</td>
<td>Colorado Water Conservation Board, University of Colorado, Western Water Assessment RISA</td>
<td>Colorado water planners, State Climatologists</td>
</tr>
<tr>
<td>Managing Threatened and Endangered Salmon in Low Water Conditions</td>
<td>USBR, CA Department of Fish and Game, CA Department of Water Resources, University of California Davis, Humboldt State University</td>
<td>NMFS, CA Department of Fish and Game, CA Department of Water Resources, Pacific Fisheries Management Council</td>
</tr>
<tr>
<td>Assessing Drought Indicators and Triggers</td>
<td>USGS, USDA (NRCS), Colorado Water Conservation Board, Colorado State University, Utah State University, University of Wyoming</td>
<td>USGS, USDA, USBR, water planners/providers, reservoir managers, State Climatologists</td>
</tr>
</tbody>
</table>
Pilot Implementation
Upper Colorado River Basin:
Existing mandates, decision cycles, and organizational capacities to guide implementation of the pilot

- Colorado Division of Water Resources (CDWR)
- Colorado State Climatologist
- Colorado River Water Conservation District (CRWCD)
- Colorado Water Conservation Board (CWCB)
- CU – Western Water Assessment, CIRES, and CADSWES
- Denver Water Board
- Northern Colorado Water Conservancy District (NCWCD)
- Wyoming State Engineer
- Wyoming State Climatologist
- Utah State Climatologist
- Desert Research Institute/WRCC
- National Center for Atmospheric Research (NCAR)
- National Drought Mitigation Center (NDMC)
- USDA: Natural Resources Conservation Service
- USFS: Region 2
- USBR: Eastern Colorado Area Office, Great Plains Region, Office of Policy and Programs, Research and Development
- USGS: Colorado Water Science Center, Central Region, Grand Canyon Monitoring and Research Center
- NOAA: Earth System Research Laboratory, National Centers for Environmental Prediction, National Climatic Data Center, National Weather Service
Drought Index System Architecture

**Data Products and Services**
- Web Map Based Display of Index
- WaterOneFlow Web Service(s) for inputs and outputs
- GIS Data Services
  - WMS, WFS, WCS
  - Digital Watershed
  - Drought Index Results

**HIS Data Services**
- WaterML
- WaterOneFlow Web Service
- Data Processing and Index Calculation

**HIS Server**
- ArcGIS Server
- ODM
  - GetSites
  - GetSiteInfo
  - GetVariableInfo
  - GetValues
- WaterML

**HIS Data Sources**
- USGS NWIS
- NRCS SNOTEL
- DAA-NCDC/NWS ASOS

**CUAHSI**
D. Tarboton
J. Horsburgh
Utah State University
Climate, Water and Drought:
A continuum that crosses many time and space scales

The future (2041-2060): where do the models agree?