



Colorado Drought Mitigation & Response Plan

Taryn Finnessey

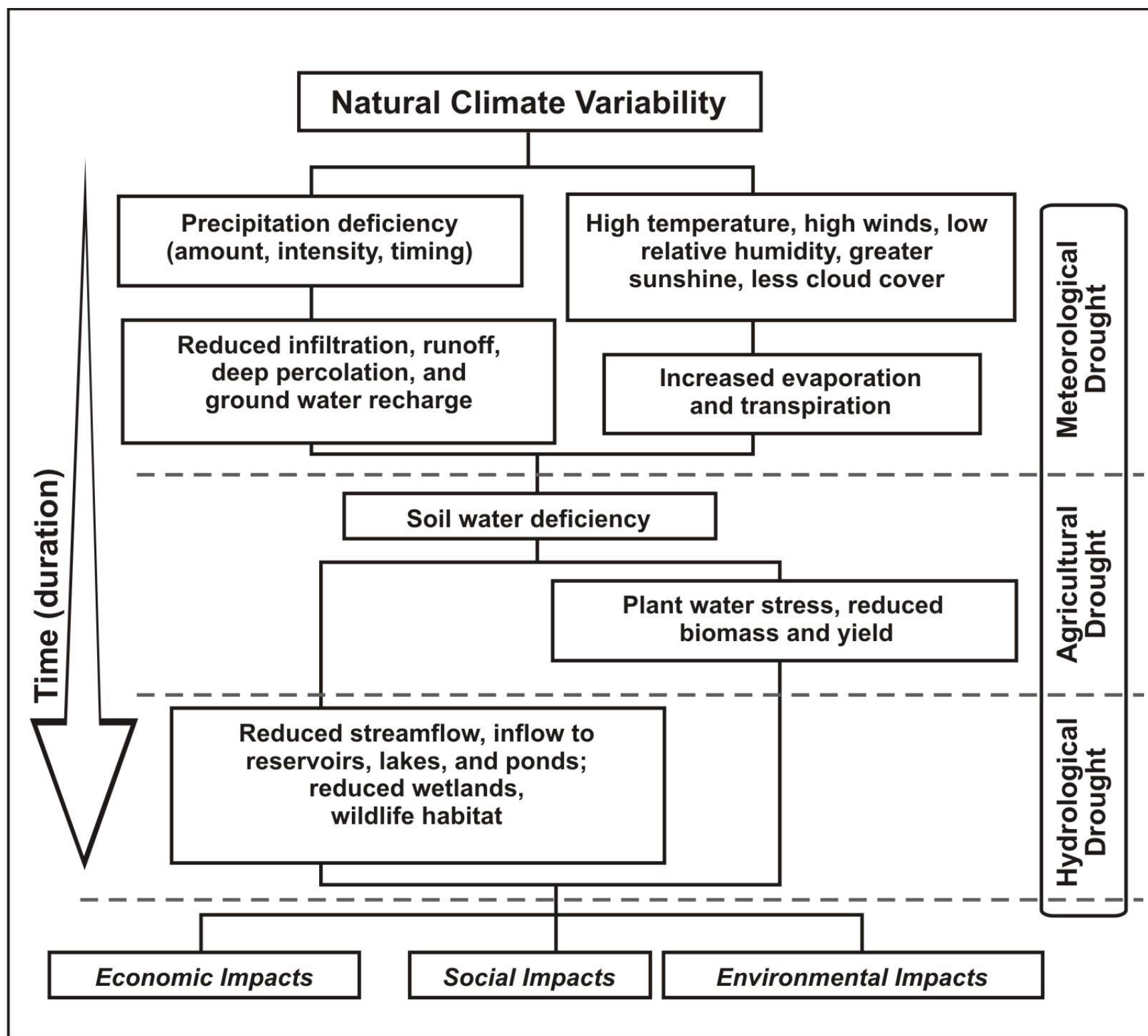
Senior Climate Change Specialist



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Types of Drought



Benefits of the Drought Plan

Reduced Losses (economic, social, physical, etc..)

Efficient, Coordinated Government

Reduced Liability

Reduced State and Local Expenditures

Includes Continued Eligibility for Mitigati

Increased Collaboration



Integration of Mitigation Planning with other State Planning Efforts

Colorado River Water Availability Study

Colorado Inter Basin Compact Committee planning efforts

Basin Needs Decision Support System

Non-Consumptive Needs Toolbox (Draft 2013)

Statewide Water Supply Initiative (various reports)

Colorado Energy Assurance Emergency Plan

Colorado Forest Resource Assessment Plan

Local multi-hazard mitigation plans

Local drought management plans

Local water conservation plans

Colorado Climate Plan

Colorado Water Plan



Plan Elements

- Drought Mitigation
- Drought Response Plan
- Drought Vulnerability Assessment

- State Assets
- Agriculture
- Energy
- Environmental

- Municipal & Industrial
- Recreation
- Socioeconomic

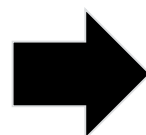
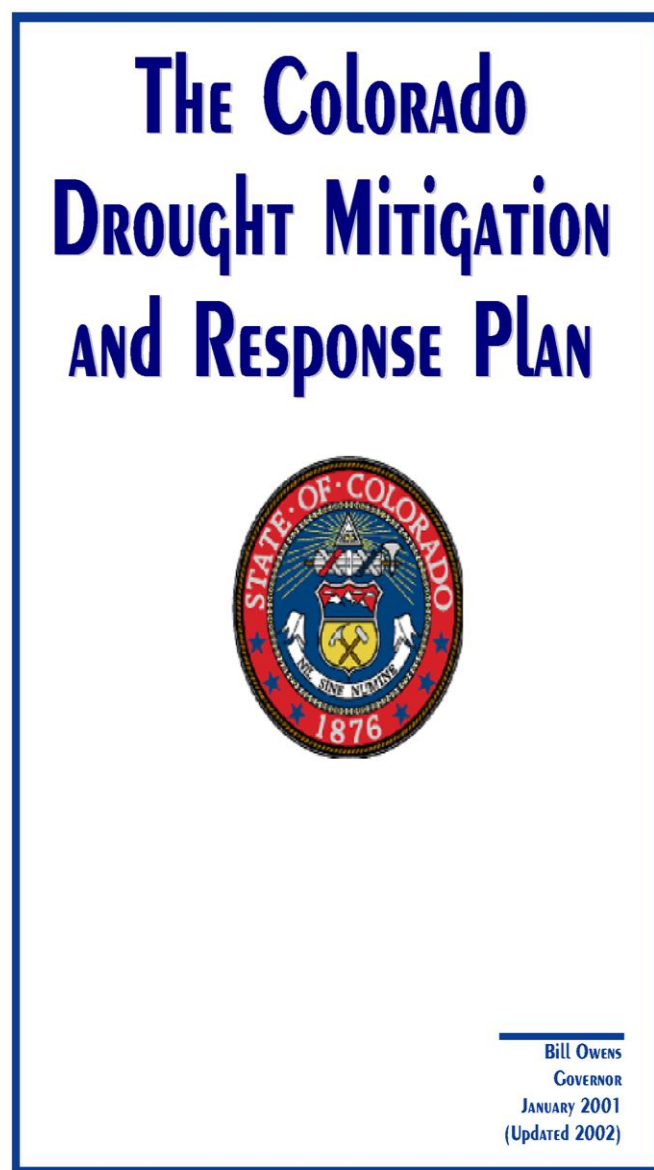


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Drought Plan Revisions

2002-2013



COLORADO DROUGHT MITIGATION AND RESPONSE PLAN



September 2010

Prepared Pursuant to
Disaster Mitigation Act 2000 & Section 409, PL 93-288

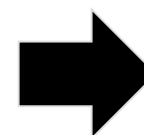
Prepared by
Colorado Water Conservation Board
Department of Natural Resources

In Cooperation with
The Department of Local Affairs
Division of Emergency Management

State of Colorado
Drought Mitigation and Response Plan
September 2010

FINAL

i



COLORADO DROUGHT MITIGATION AND RESPONSE PLAN



August 2013

Prepared Pursuant to
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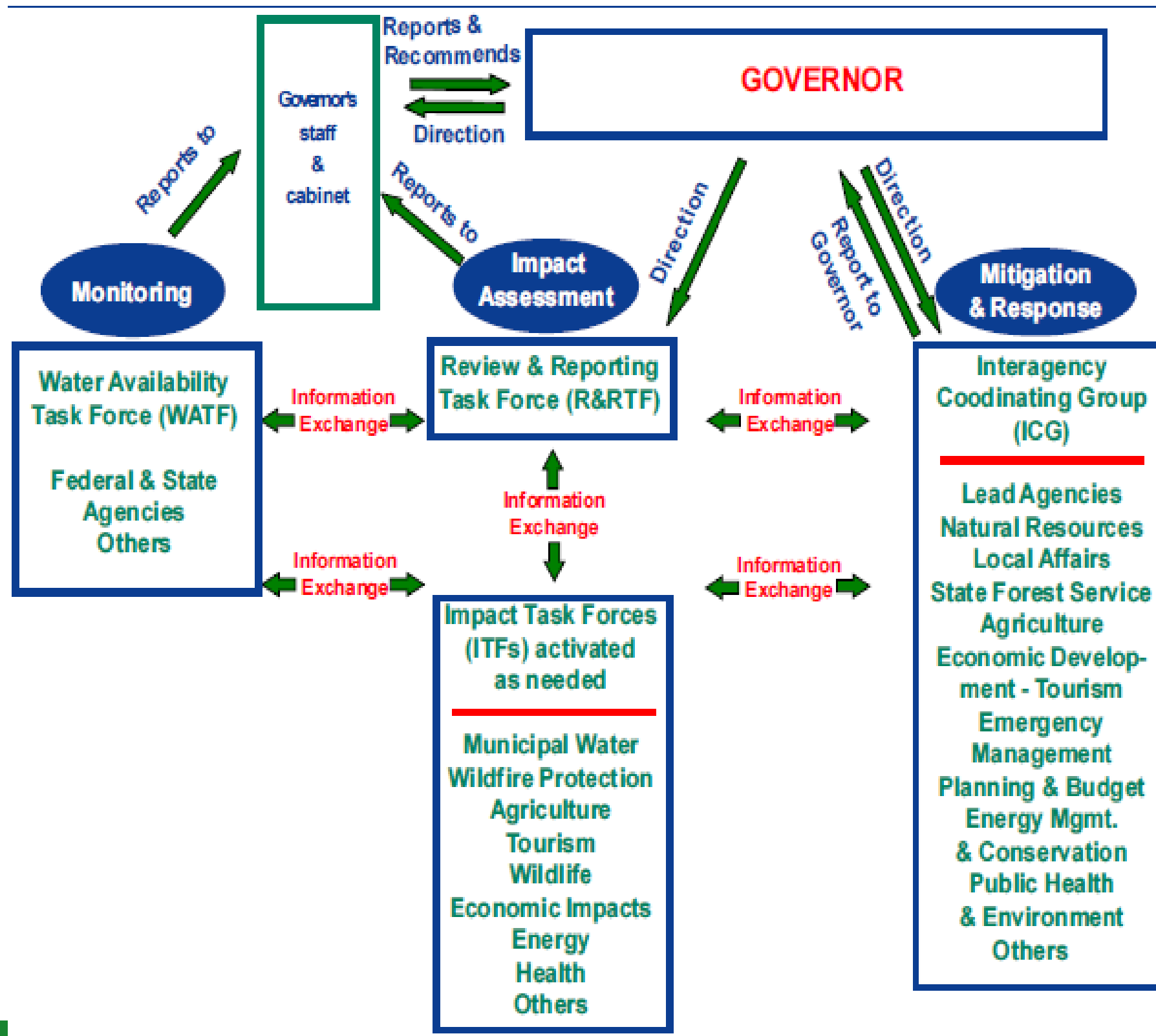
Prepared by
Colorado Water Conservation Board
Department of Natural Resources

In Cooperation with
The Department of Public Safety
Division of Homeland Security and Emergency Management
and the Drought Mitigation and Response Planning Committee

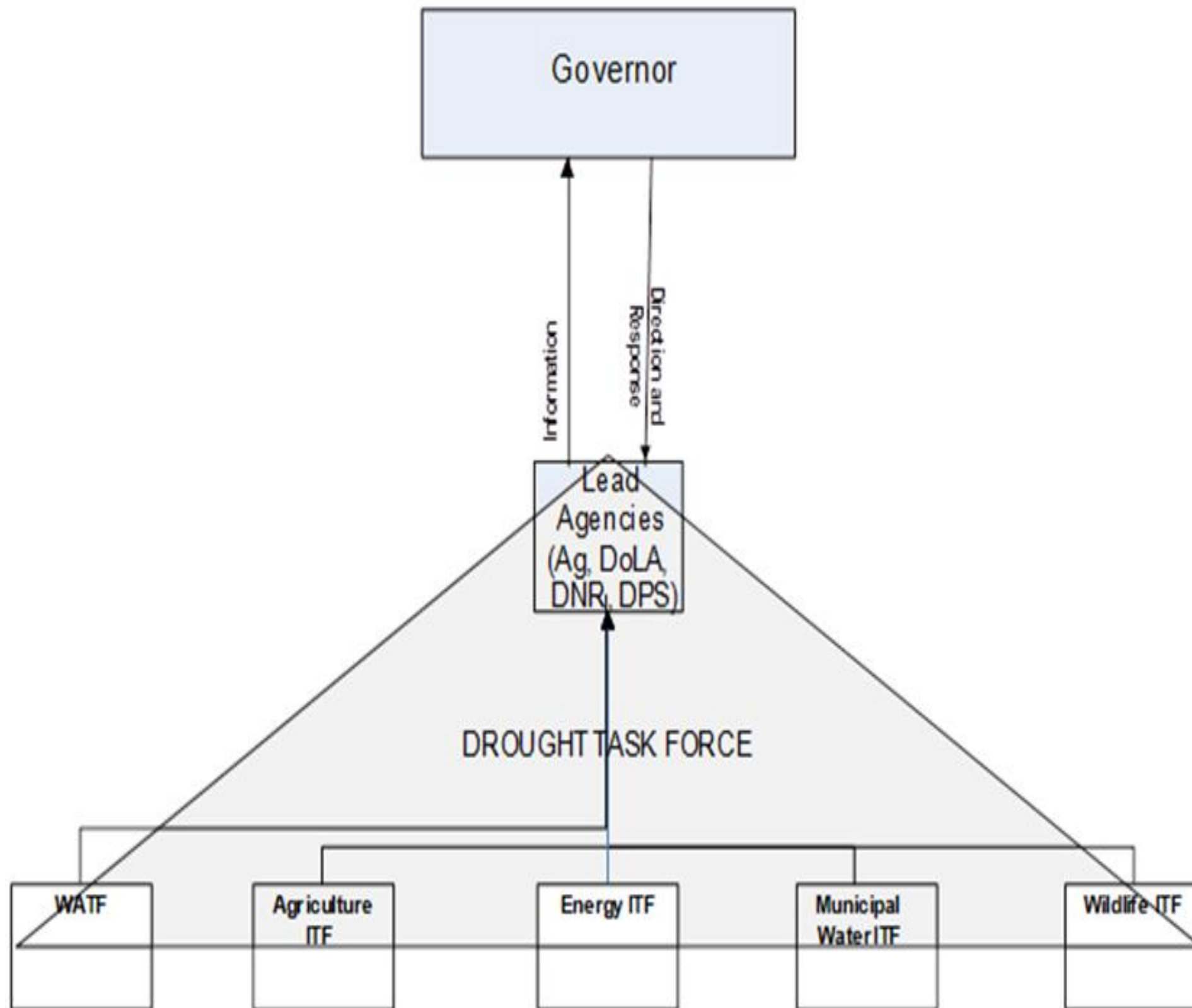
State of Colorado
Drought Mitigation and Response Plan
August 2013

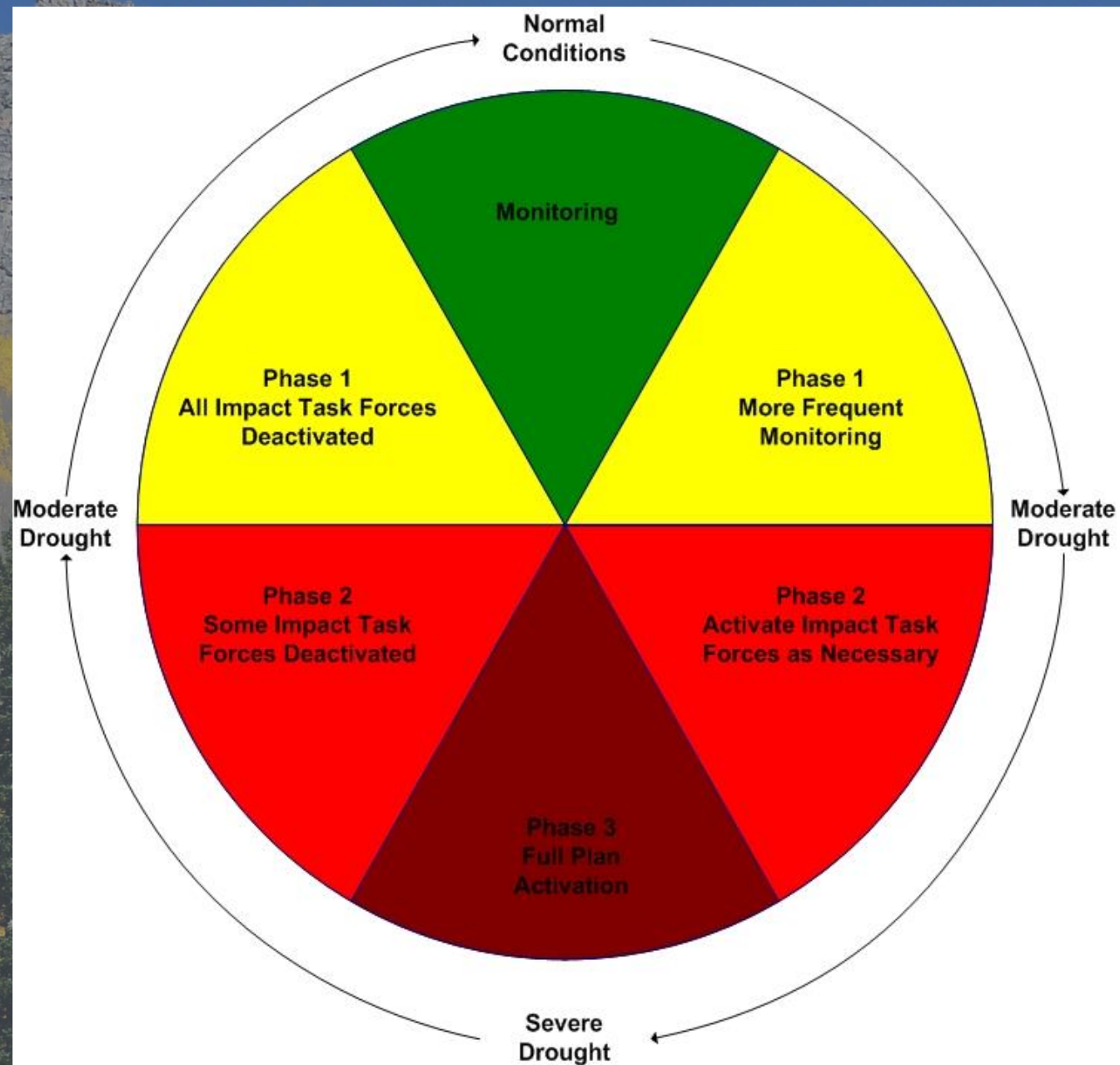
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2002 Drought Response Framework



Current Response Framework





Current Implementation Cycle



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2013 Drought Response Summary Action Table

Severity Indicators and Impacts (U.S. Drought Monitor, Colorado Modified Palmer Drought Index (CMPDI), SWSI, SPI)	Drought Phase and Response Summary	Actions to be Considered
<u>Drought Monitor</u> D0 Abnormally Dry D0 ranges: CMPDI or SWSI¹: +2.0 to -1.9 SPI²: -0.5 to -0.7 Indicator blend Percentile: 21-30 Impacts: short-term dryness slowing planting, growth of crops or pastures. <u>CMPDI</u> -1 to positive indices in all river basins or modified Palmer climate division <u>SPI</u> -0.5 to positive (six month)	Normal Conditions Regular Monitoring	• CWC/WATF monitors situation on monthly basis, discusses trends with National Weather Service (NWS), State Climatologist, State Engineer, Natural Resource Conservation Service (NRCS), and others as appropriate. • Data reviewed for drought emergence and summarized in monthly drought updates. • Implement long-term mitigation actions identified in drought mitigation plan • ITF chairs meet once yearly to monitor progress on long-term drought mitigation and review any lessons from previous drought periods, and review the response plan.
<u>Drought Monitor</u> D1 Moderate Drought D1 ranges: CMPDI or SWSI¹: -2.0 to -2.9 SPI²: -0.8 to -1.2 Indicator blend Percentile: 11-20 Impacts: Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent; voluntary water-use restrictions requested <u>CMPDI</u> -1.0 to -2.0 in any river basin or modified Palmer climate division <u>SPI</u> -0.6 to -1.0 (six month)	Phase 1 More close monitoring of conditions for persisting or rapidly worsening drought; Official drought not yet declared	• ITF chairs alerted of potential for activation, monitoring of potential impacts. • Assess need for formal ITF and DTF activation depending on timing, location, or extent of drought conditions, existing water supply, and recommendation of WATF; DTF is comprised of WATF, ITF chairs, and Lead Agencies. • DTF Lead Agencies (CDA/DOLA/DNR/DPS) notified of need for potential activation.

Severity Indicators and Impacts (U.S. Drought Monitor, Colorado Modified Palmer Drought Index (CMPDI), SWSI, SPI)	Drought Phase and Response Summary	Actions to be Considered
<u>Drought Monitor</u> D2 Severe Drought D2 ranges: CMPDI or SWSI¹: -3.0 to -3.9 SPI²: -1.3 to -1.5 Indicator blend Percentile: 6-10 Impacts: Crop or pasture losses likely; water shortages common; water restrictions likely to be imposed <u>CMPDI</u> Less than -2.0 in any river basin or modified Palmer climate division <u>SPI</u> Less than -1.0 (six month)	Phase 2 Drought Task Force and Impact Task Forces are activated; Potential Drought Emergency Declared	- DTF Chairs prepare Governor's Memorandum of potential drought emergency based on recommendations from WATF. - Governor's Memorandum activates the Drought Task Force and necessary Impact Task Forces. - The DTF Chairs and CWCB meet with activated Impact Task Force chairs to outline Phase 2 activity. - Activated ITF's make an initial damage or impact assessment (physical and economic). - ITF's recommend opportunities for incident mitigation to minimize or limit potential impacts - Periodic reports are made by the ITF chairs to the DTF Chairs. - ITF chairs designate their respective department Public Information Officer (PIO) to interface with media for their relative area of concern and develop media messages. - Relevant state agencies undertake response and incident mitigation actions with their normal programs with available resources. - The DTF conducts a gap analysis identifying any unmet needs that cannot be handled through normal channels.
<u>Drought Monitor</u> D3 Extreme Drought to D4 Exceptional Drought D 3 Ranges CMPDSI or SWSI¹: -4.0 to -4.9 SPI²: -1.6 to -1.9 Indicator blend Percentile: 3-5 Impacts: Major crop/pasture losses; widespread water shortages or restrictions very likely to be imposed D4 Ranges: CMPDI or SWSI: -5.0 SPI*: -2.0 or less Indicator blend Percentile: 0-2 Impacts: Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies <u>CMPDI</u> Lowest reading at -2.0 to -3.9 in any river basin or modified Palmer climate division <u>SPI</u> Less than -1.0 to -1.99 SPI (six month)	Phase 3 Drought Emergency is declared by Proclamation of the Governor.	- Governor's Memorandum updated to activate additional Impact Task Forces as necessary. - Activated ITFs continue to assess, report, and recommend response measures and incident mitigation. - Unmet needs are reported to the DTF Chairs. - DTF Chairs determine the unmet needs that can be met by reallocation of existing resources. Those which cannot are forwarded to the Governor with recommendations to support a request for a Presidential Drought Declaration. - Governor may request a Presidential Declaration. - If approved, Federal-State Agreement establishes Colorado Office of Emergency Management Director as the State Coordinating Officer (SCO). - Work with the Governor's office on long-term recovery operations

Severity Indicators and Impacts (U.S. Drought Monitor, Colorado Modified Palmer Drought Index (CMPDI), SWSI, SPI)	Drought Phase and Response Summary	Actions to be Considered
Lowest reading at -1.6 in any river basin or modified Palmer climate division -0.8 SPI (six month)	Return to Phase 2	- DTF Chairs determines if all requirements for assistance are being met within the DTF and State agency channels. - DTF briefs the Governor and prepares Proclamation to end drought emergency.
D1 Moderate Drought Coming out of drought: some lingering water deficits; pastures or crops not fully recovered	Return to Phase 1	- Long-term recovery operations continue - ITFs continue assessments. - ITFs issue final report and conclude formal regular meetings. - The DTF issues a final report and is deactivated.
Lowest reading at -1.0 in any river basin -0.5 SPI (six month)	Return to normal conditions	CWCB/WATF resume normal monitoring.



Modernizing Indices for Monitoring

- ★ Surface Water Supply Index (SWSI)
- ★ Palmer Drought Severity Index (PDSI)
- ★ Standard Precipitation Index (SPI)
- ★ USDM
- ★ Forward Looking Indices



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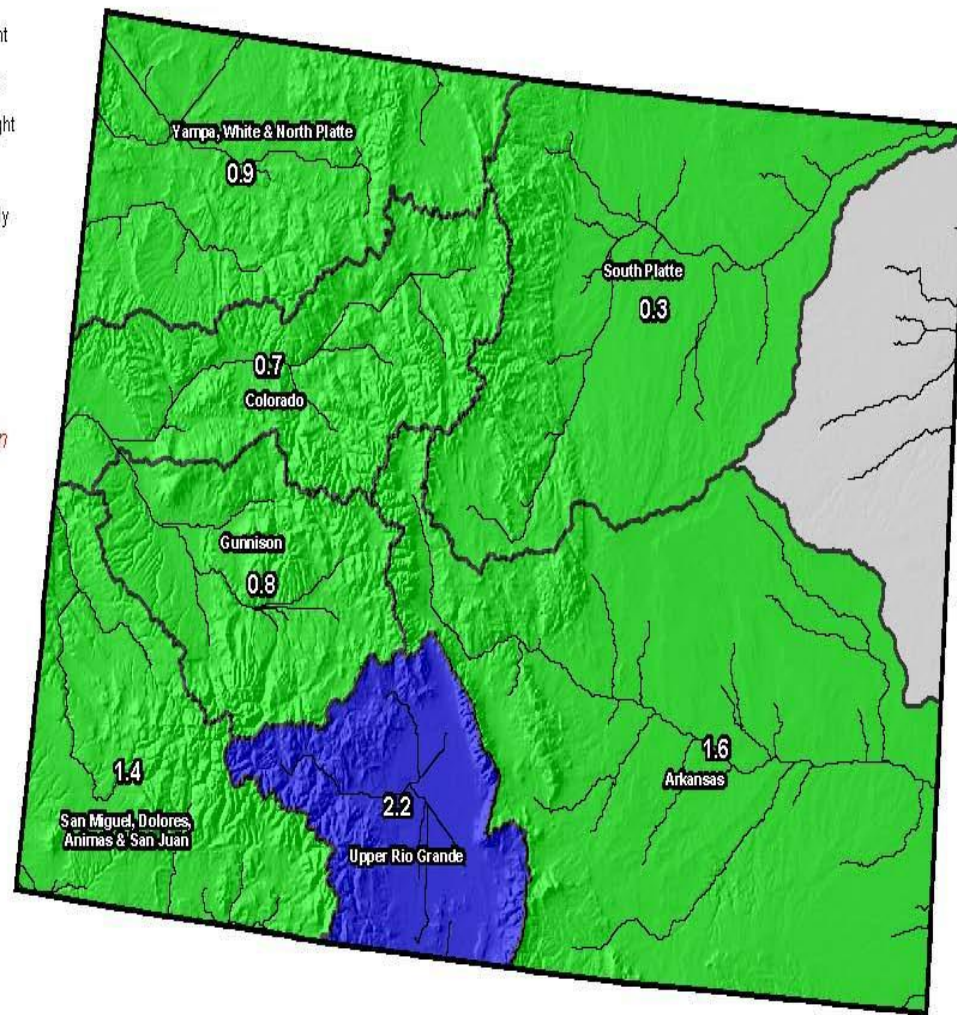
Old SWSI vs New SWSI

Colorado Surface Water Supply Index (SWSI) Map

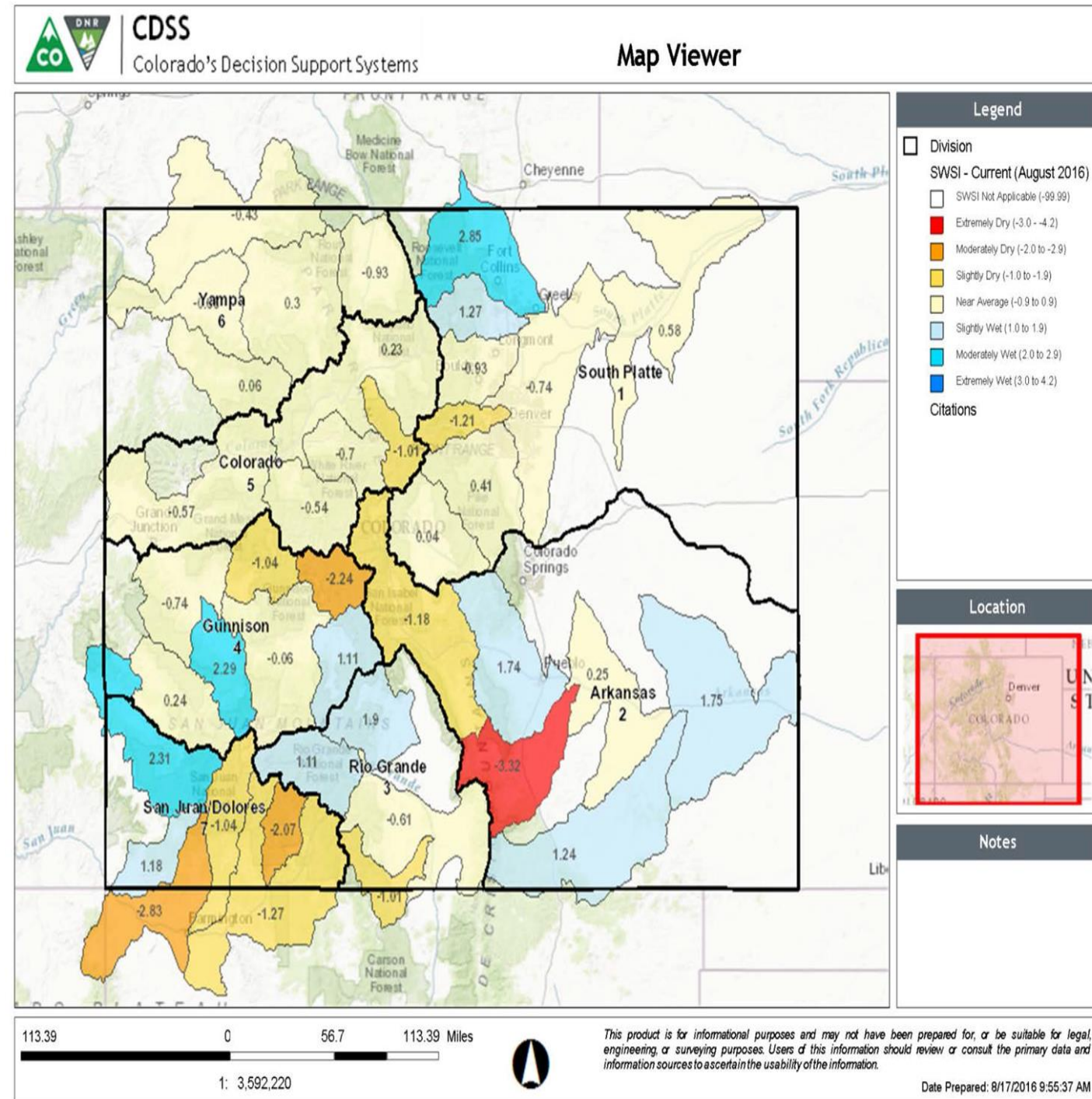
Legend



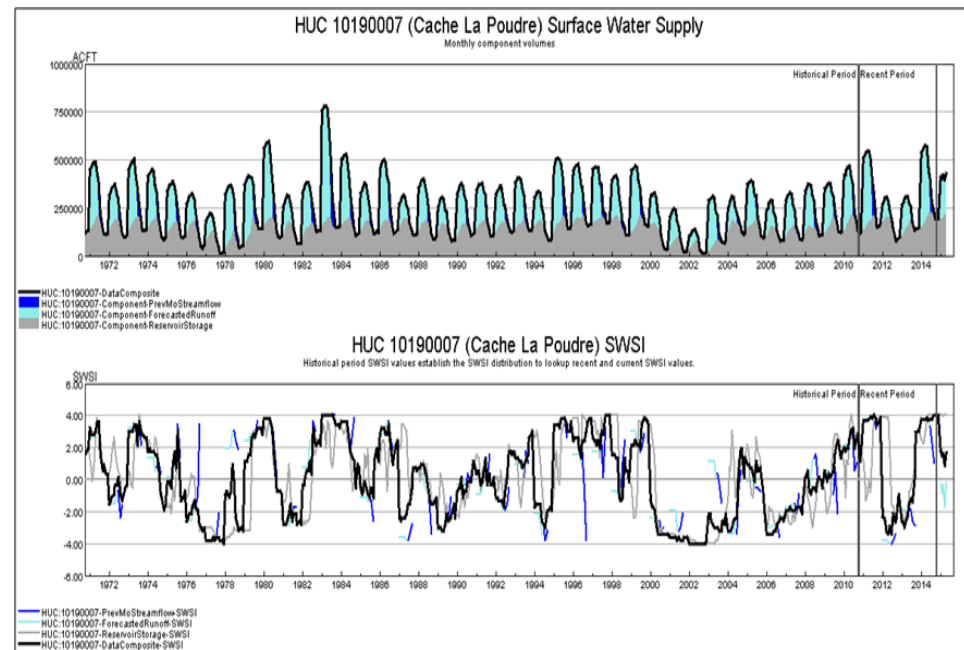
Provisional Data
Subject to Revision



Current as of February 1, 2009

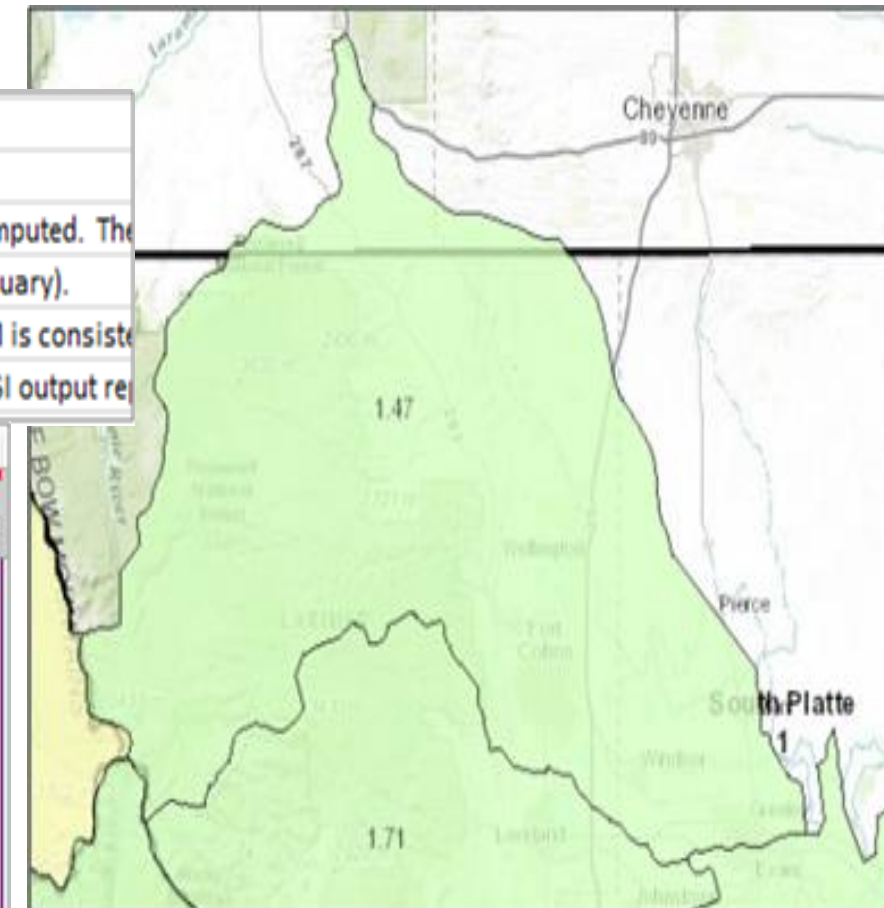


SWSI Automation Tool (2015)



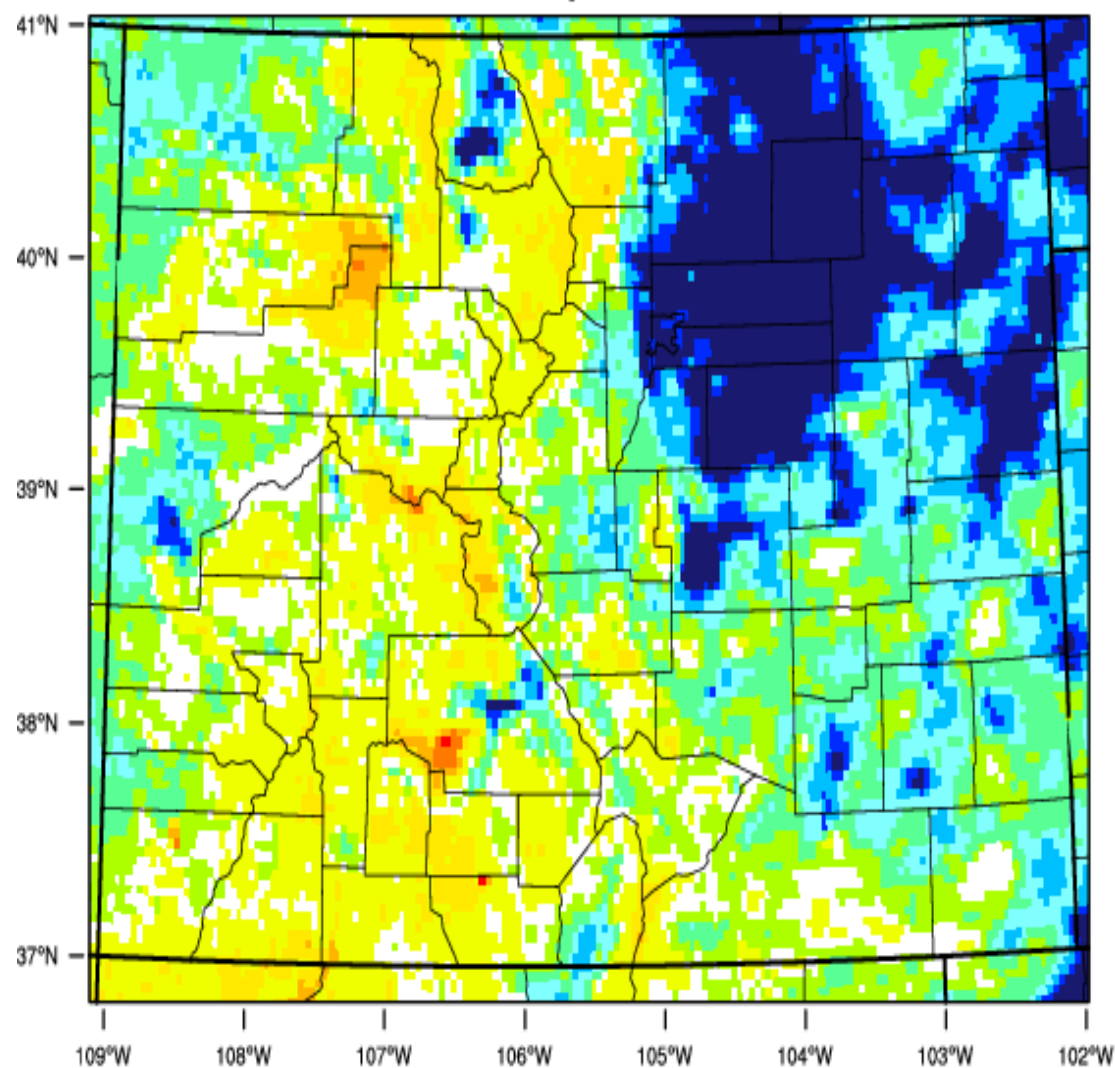
TSTool Configuration	Property Name	Property Value	Property Value (Text)	Property Description
	CurrentMonthDate	2015-09	2015-09	Current month (as date) for which SWSI is being computed. The
	CurrentMonth	9	09	Current month (as month number 1-12, where 1=January).
	PreviousMonthDate	2015-08	2015-08	Previous month (as date). The date format YYYY-MM is consist
	PreviousYearMonthDate	2014-09	2014-09	Previous year (as date). This date is used in the SWSI output re

Data Type	ID	Station Name	State	Datastore	Datastore ID	Source	Type
ForecastedNaturalFlow	06707500	SOUTH PLATTE RIVER AT SOUTH PLATTE	CO	NrcsAwdb	CO-06707500	USGS	SRVO
ForecastedNaturalFlow	06710385	BEAR CREEK ABV EVERGREEN	CO	NrcsAwdb	CO-06710385	USGS	SRVO
ForecastedNaturalFlow	06719505	CLEAR CREEK AT GOLDEN	CO	NrcsAwdb	CO-06719505	USGS	SRVO
ForecastedNaturalFlow	06724000	SAINT VRAIN CREEK AT LYONS	CO	NrcsAwdb	CO-06724000	USGS	SRVO
ForecastedNaturalFlow	06727000	BOULDER CREEK NEAR ORODELL	CO	NrcsAwdb	CO-06727000	USGS	SRVO
ForecastedNaturalFlow	06729500	SOUTH BOULDER CK NR ELDORADO SPRINGS, CO	CO	NrcsAwdb	CO-06729500	USGS	SRVO
ForecastedNaturalFlow	06738000	BIG THOMPSON R AT MOUTH, NR DRAKE, CO	CO	NrcsAwdb	CO-06738000	USGS	SRVO
ForecastedNaturalFlow	06752000	CACHE LA POUDE R AT CANYON MOUTH	CO	NrcsAwdb	CO-06752000	USGS	SRVO



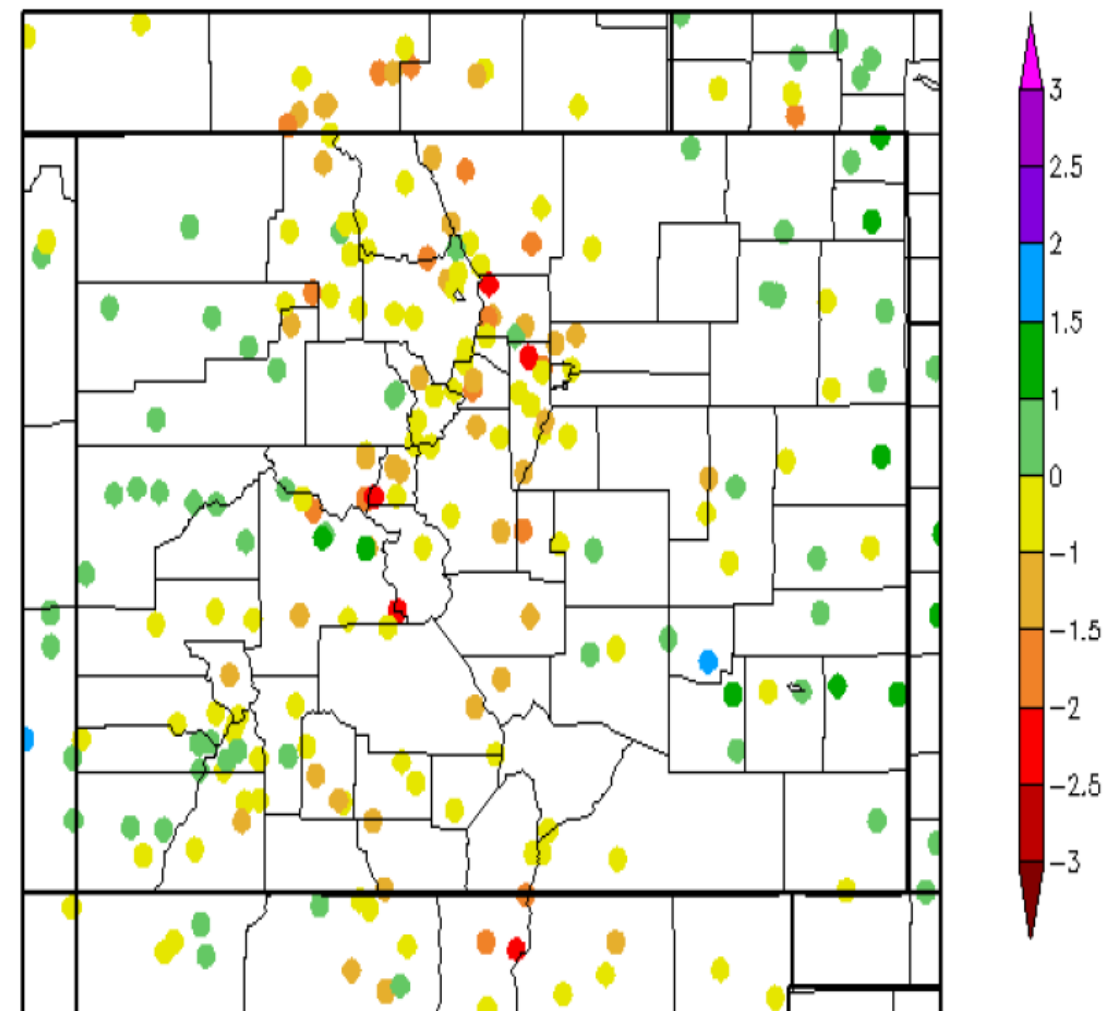
PDSI & SPI

Colorado - PDSI
July 2016



WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 16 AUG 2016

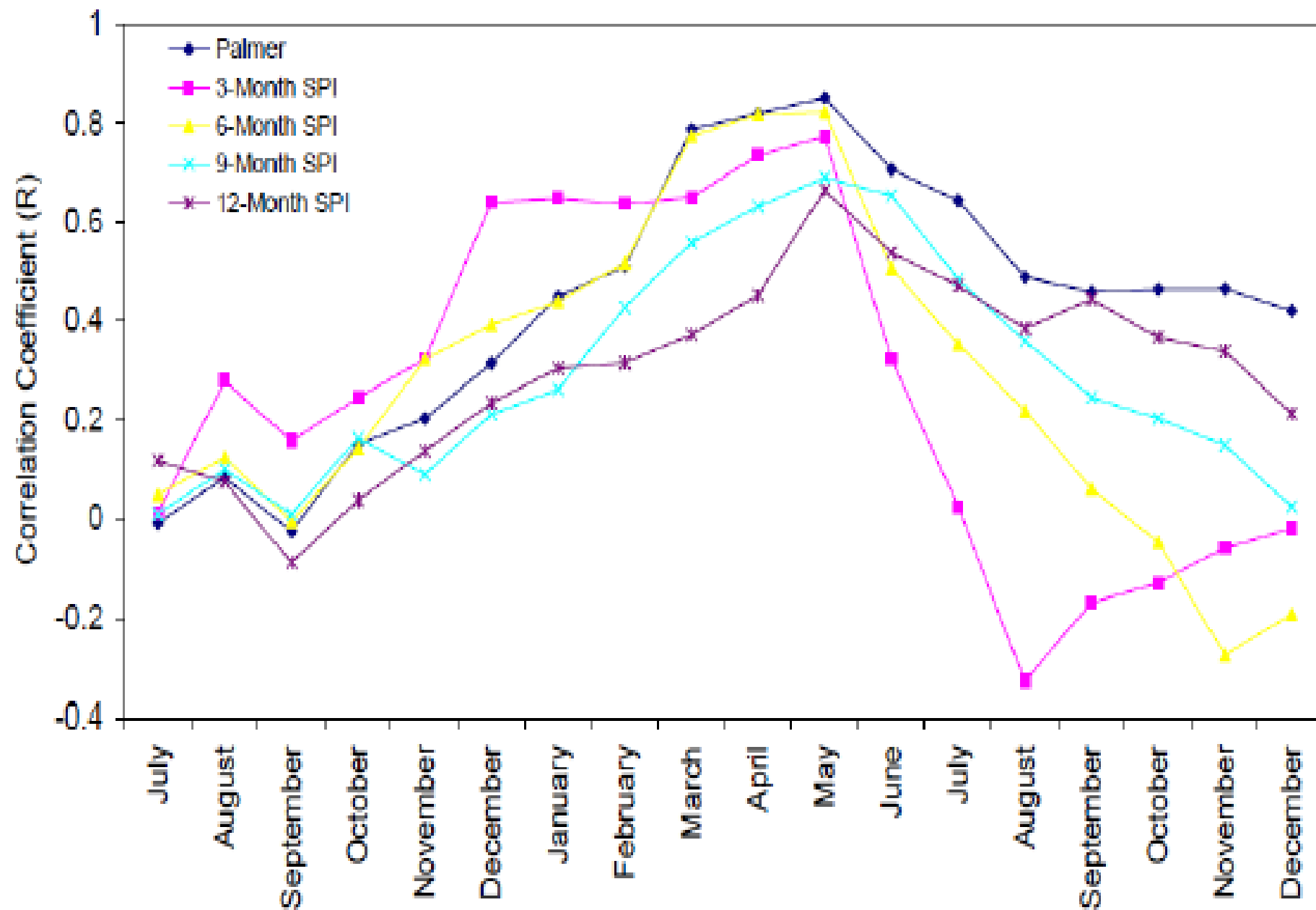
Monthly SPI
7/1/2016 - 7/31/2016



Generated 8/11/2016 at HPRCC using provisional data.

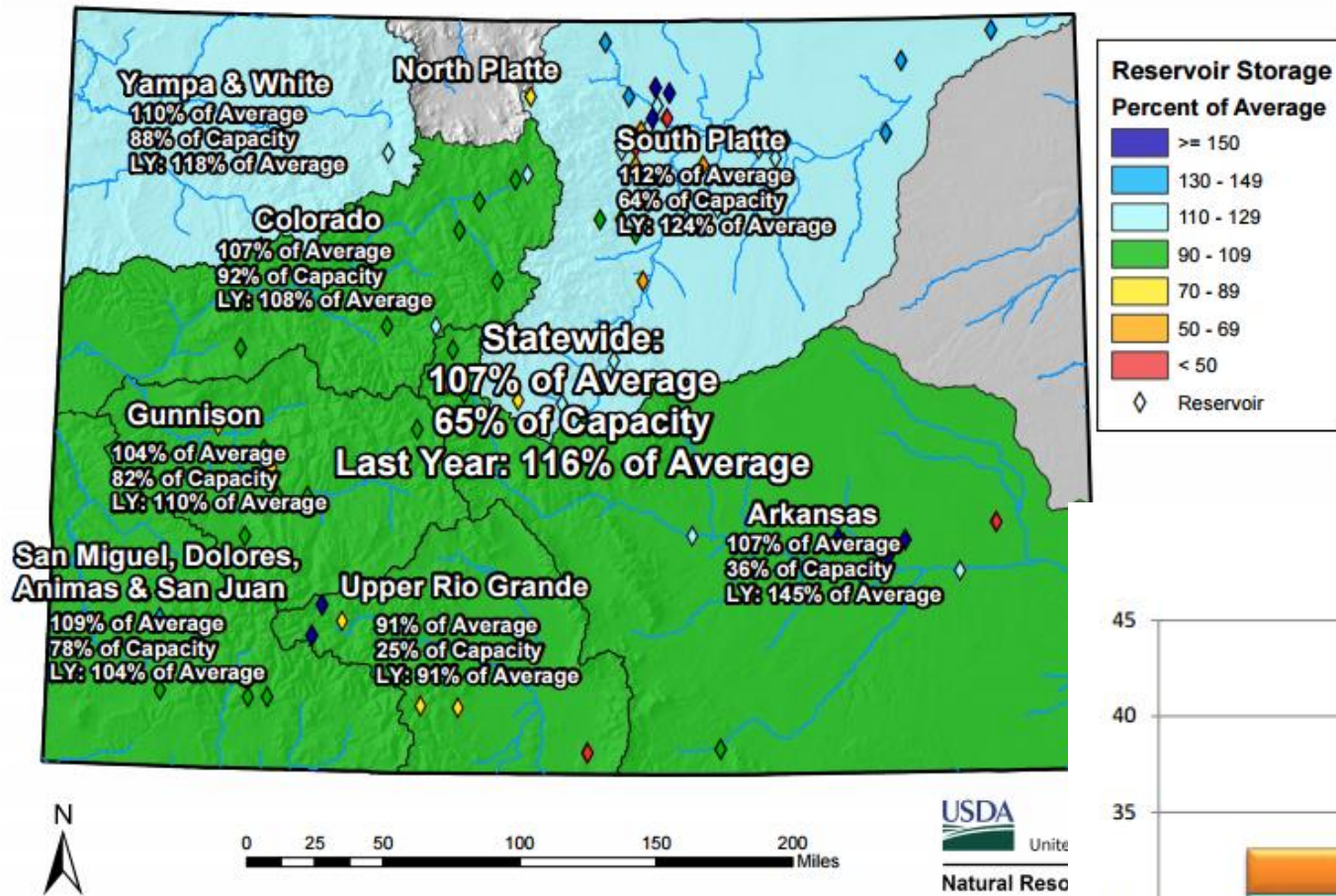
Regional Climate Centers

PDSI Proves Its Worth



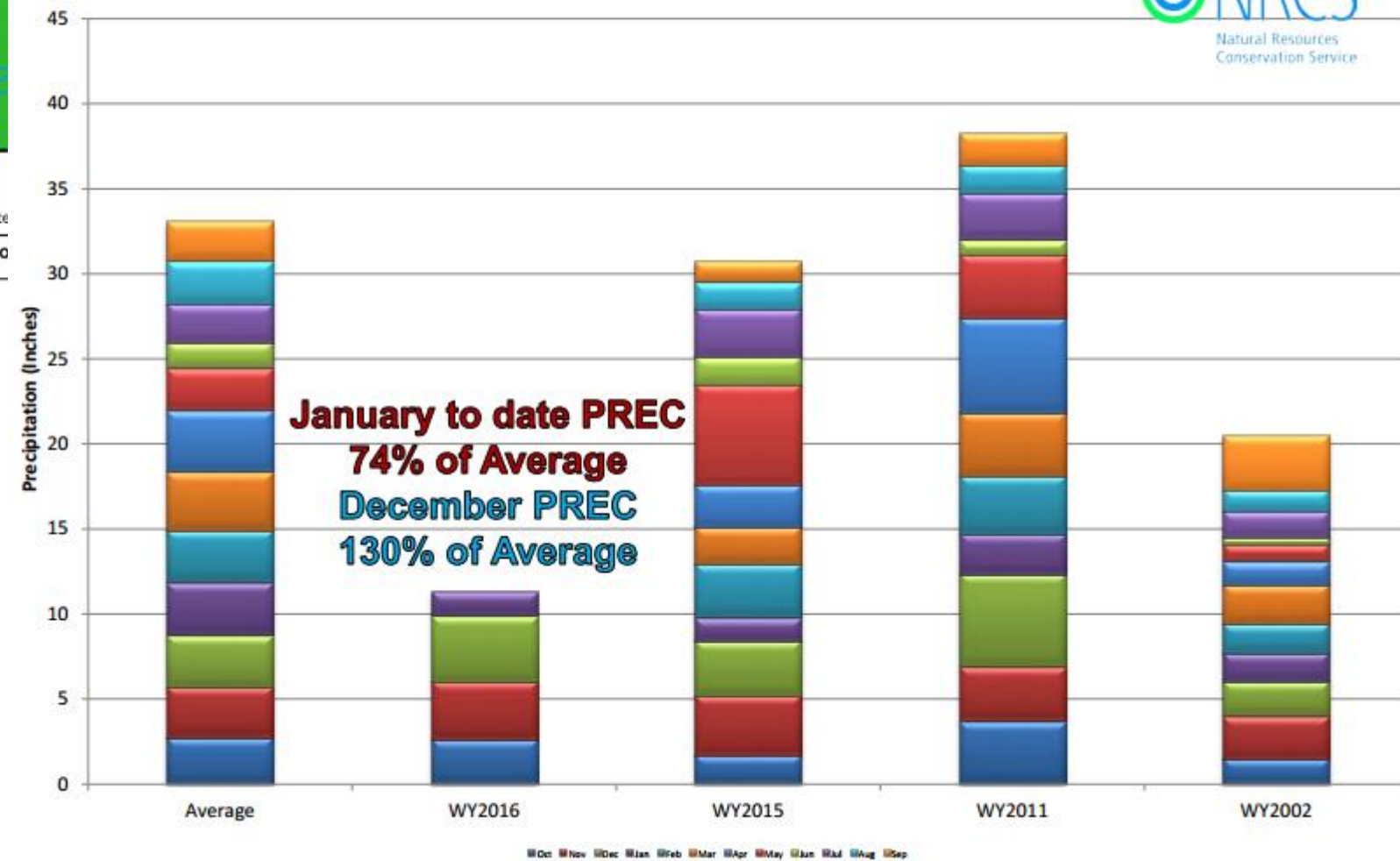
Colorado Monthly Reservoir Storage Summary

End of August 2016



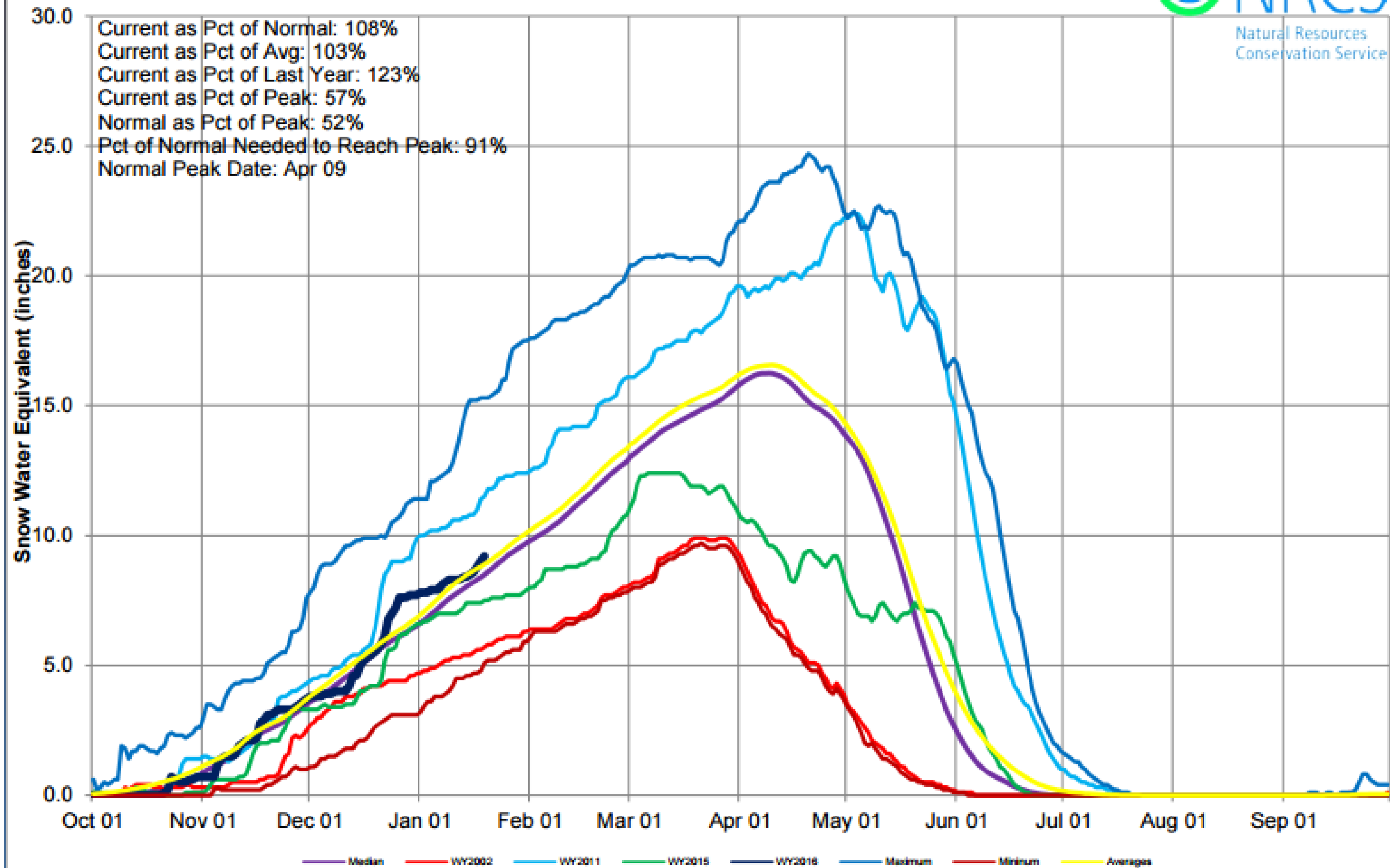
Colorado Statewide High/Low Monthly Precipitation Summary

Based on Provisional SNOTEL data as of Jan 19, 2016



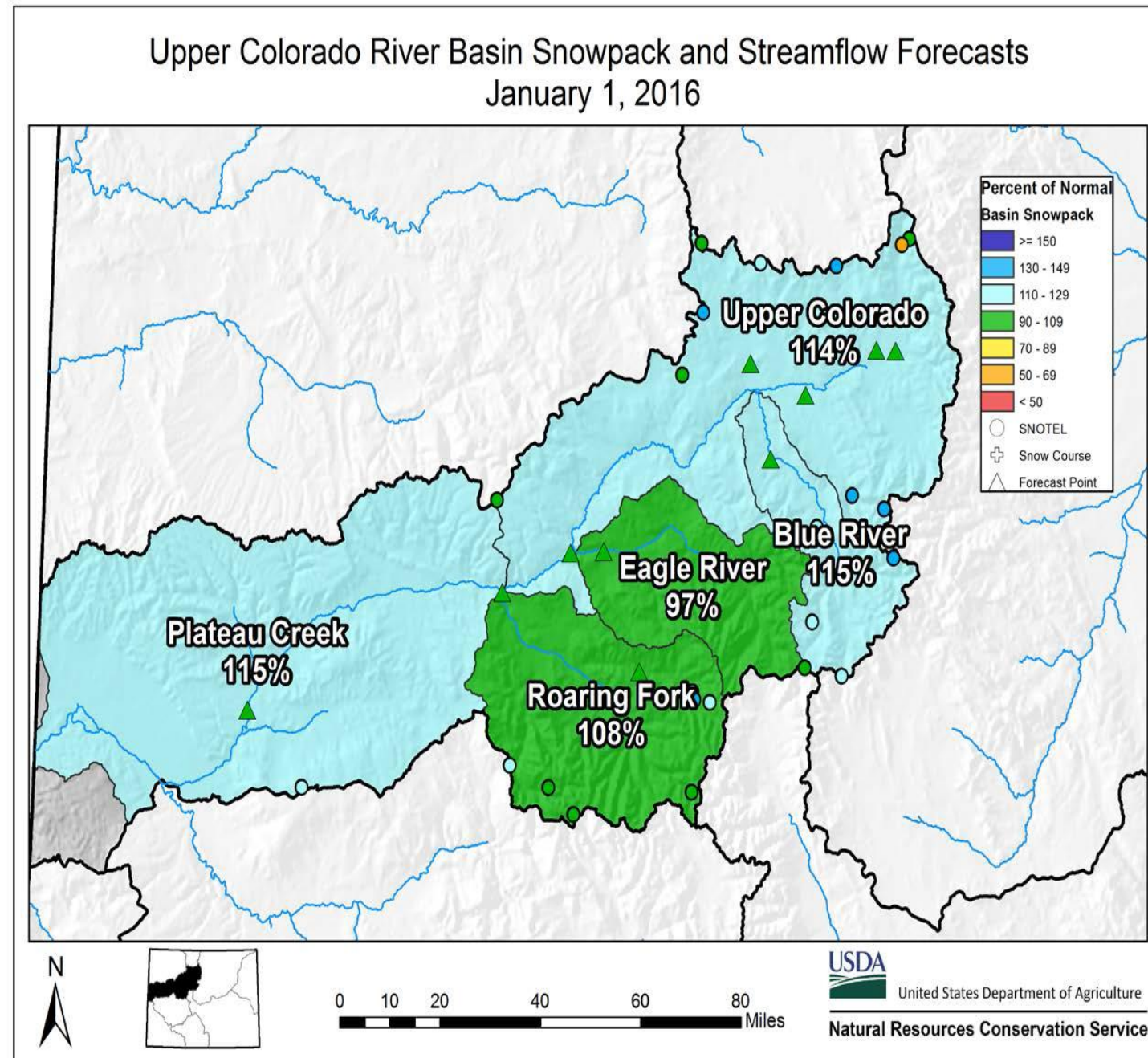
Colorado Statewide High/Low Snowpack Summary

Based on Provisional SNOTEL data as of Jan 19, 2016



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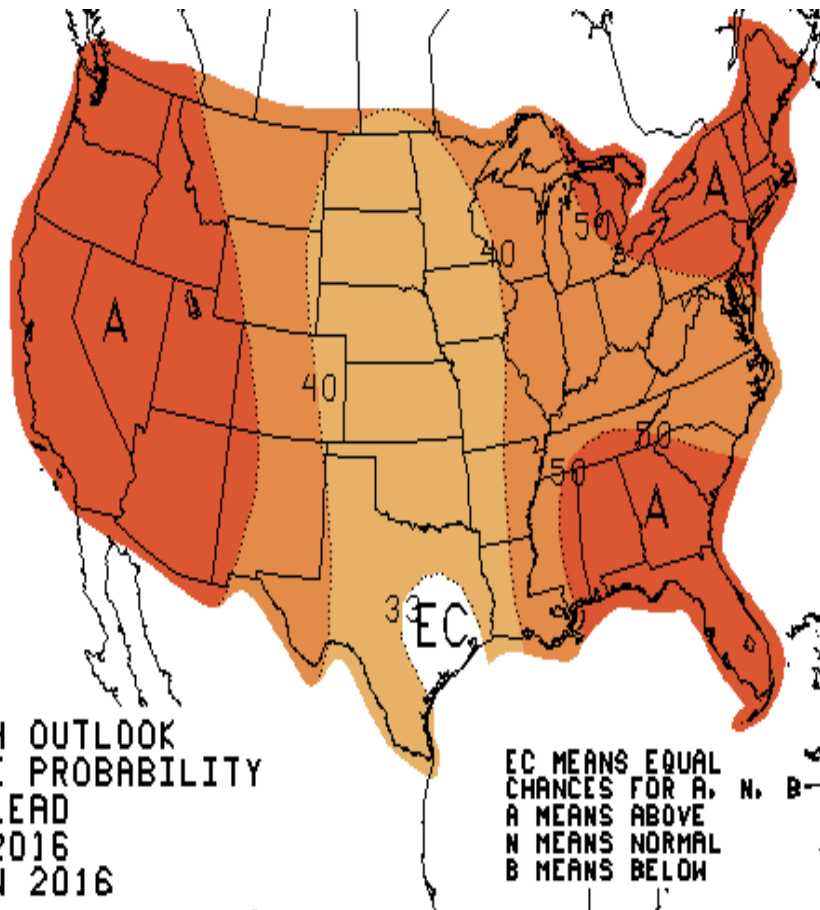
Forward Looking Indices - Short Term



Forward Looking Indices: Long Term Forecasting



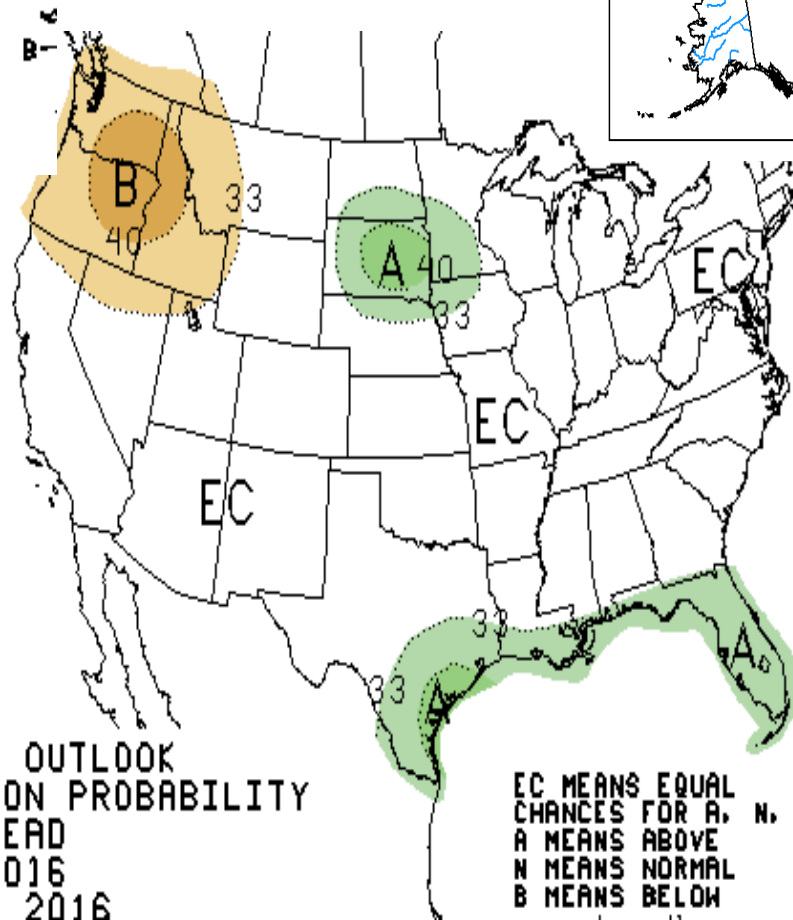
THREE-MONTH OUTLOOK
TEMPERATURE PROBABILITY
0.5 MONTH LEAD
VALID JAS 2016
MADE 16 JUN 2016



EC MEANS EQUAL
CHANCES FOR A, N, B
A MEANS ABOVE
N MEANS NORMAL
B MEANS BELOW

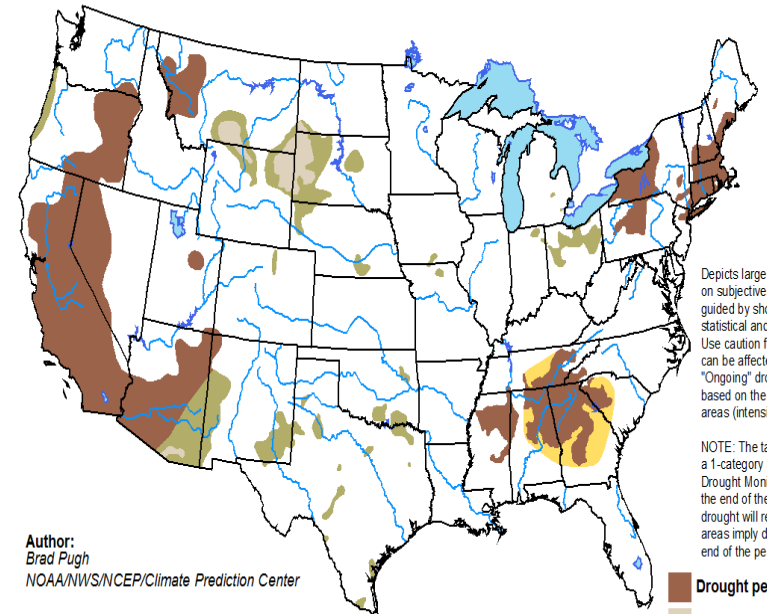


THREE-MONTH OUTLOOK
PRECIPITATION PROBABILITY
0.5 MONTH LEAD
VALID JAS 2016
MADE 16 JUN 2016



EC MEANS EQUAL
CHANCES FOR A, N, B
A MEANS ABOVE
N MEANS NORMAL
B MEANS BELOW

U.S. Seasonal Drought Outlook Valid for August 18 - November 30, 2016
Drought Tendency During the Valid Period Released August 18, 2016



Author:
Brad Pugh
NOAA/NWS/NCEP/Climate Prediction Center

Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Use caution for applications that can be affected by short lived events. "Ongoing" drought areas are based on the U.S. Drought Monitor areas (intensities of D1 to D4).
NOTE: The tan areas imply at least a 1-category improvement in the Drought Monitor intensity levels by the end of the period, although drought will remain. The green areas imply drought removal by the end of the period (D0 or none).

- Drought persists
- Drought remains but improves
- Drought removal likely
- Drought development likely

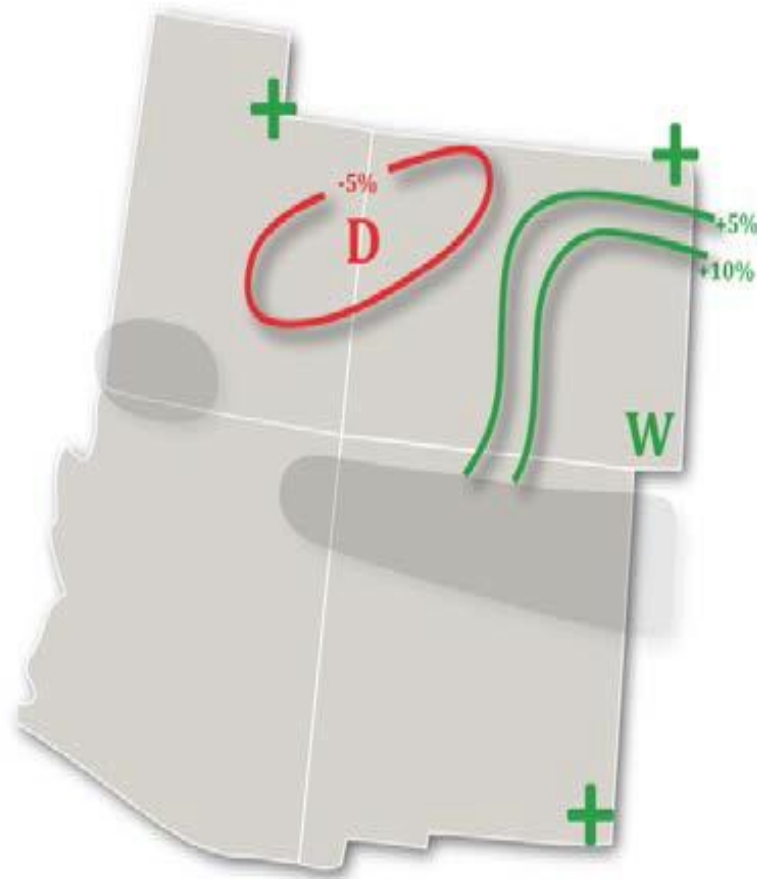


<http://go.usa.gov/3eZ73>

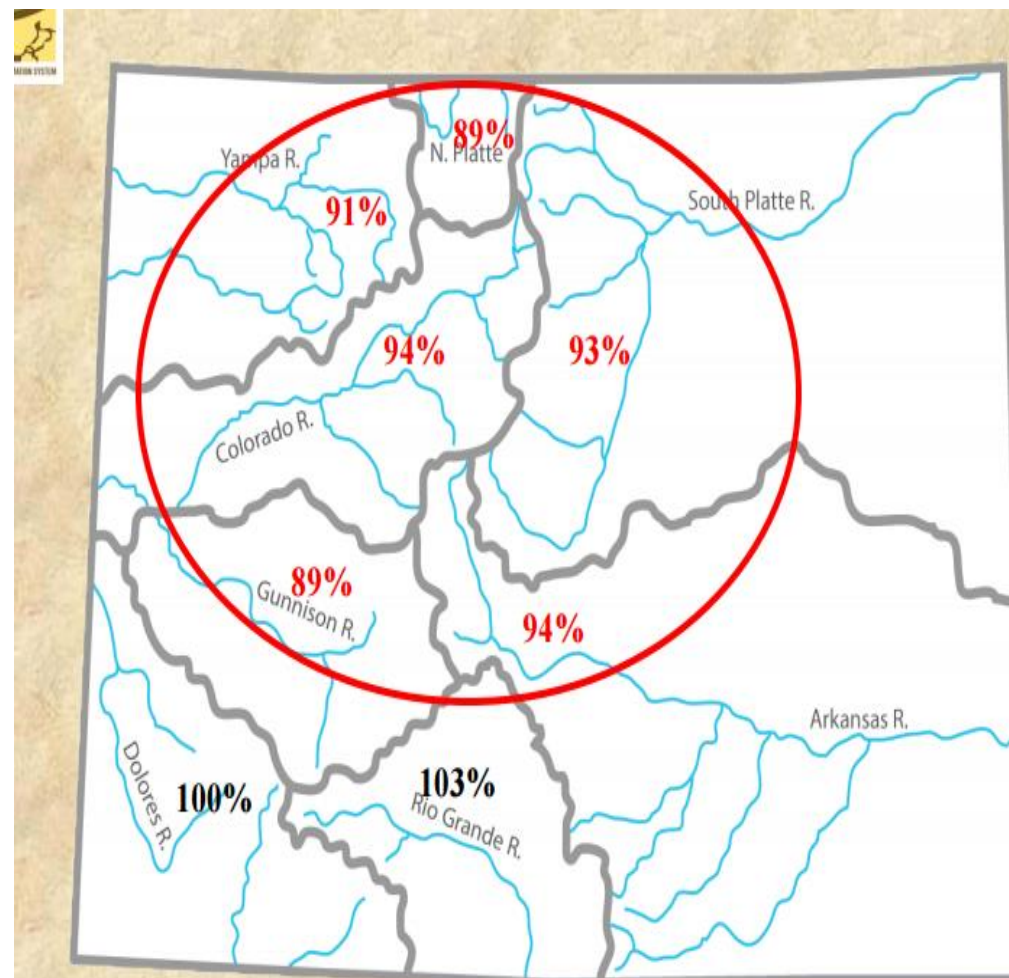
Experimental Long Term Forecasting

Experimental PSD Precipitation Forecast Guidance

APR –JUN 2016 (Issued April 14, 2016) – Skill Masked

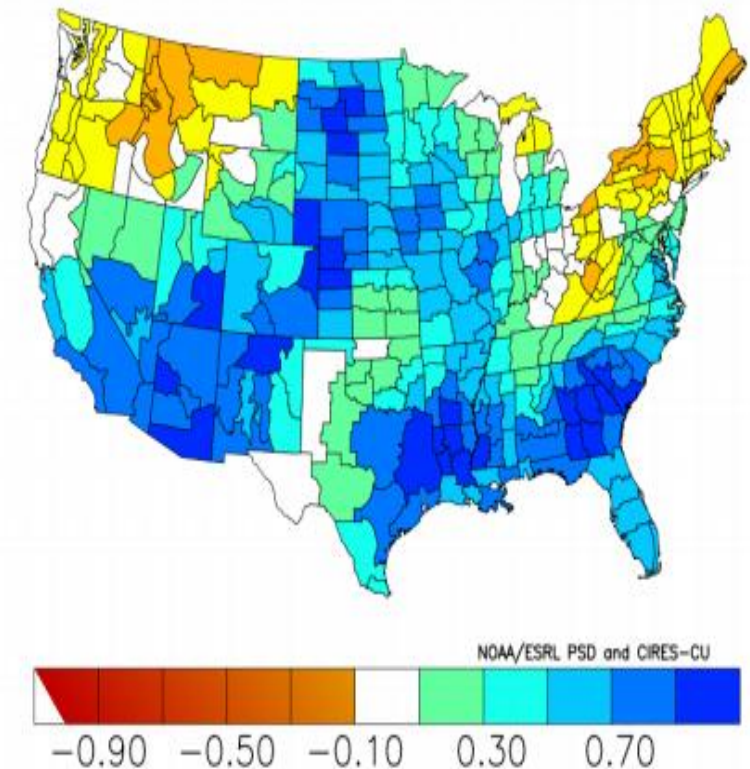


March 1 SWE forecast based on Fall El Nino Composites



Median outcome for strong Los Niños since 1968
(after fall seasons: '72, '82, '87, '94, '97)

NOAA/NCDC Climate Division Composite Standardized Precipitation Anomalies
Oct to Dec 1957,1965,1972,1982,1994,1997,2009
Versus 1951–2010 Longterm Average

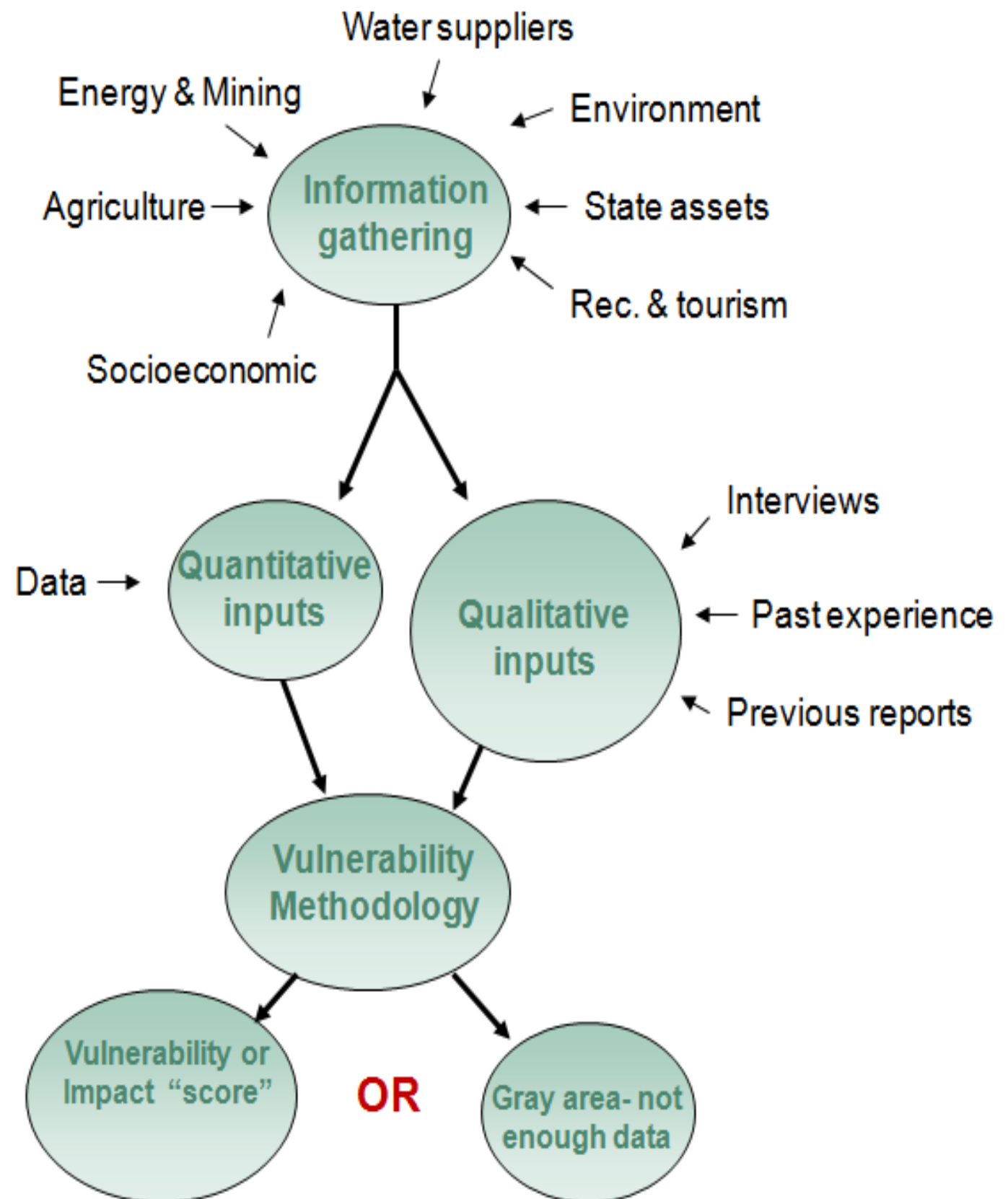


Vulnerability Assessment Tool

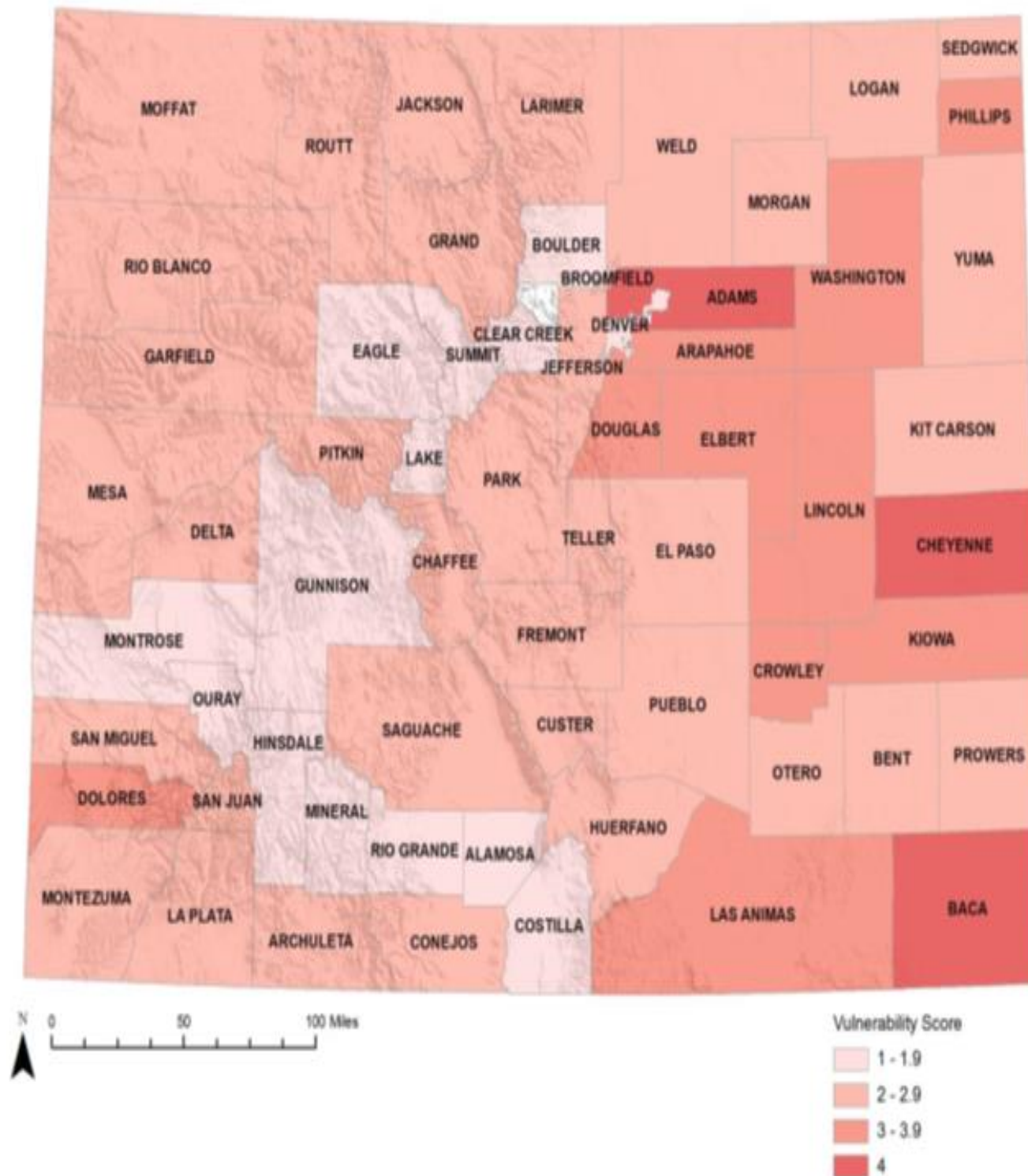


Methodological Framework

- Research sectors, publications, previous drought studies
- Quantitative data
 - What we have
 - What we need
- Qualitative
 - Interviews
 - Past experiences
 - Specific knowledge of the area
- Methodology
- Vulnerability “score” OR framework for future data collection



Agricultural Vulnerability



Role of Climate Change in Long Term Water Planning

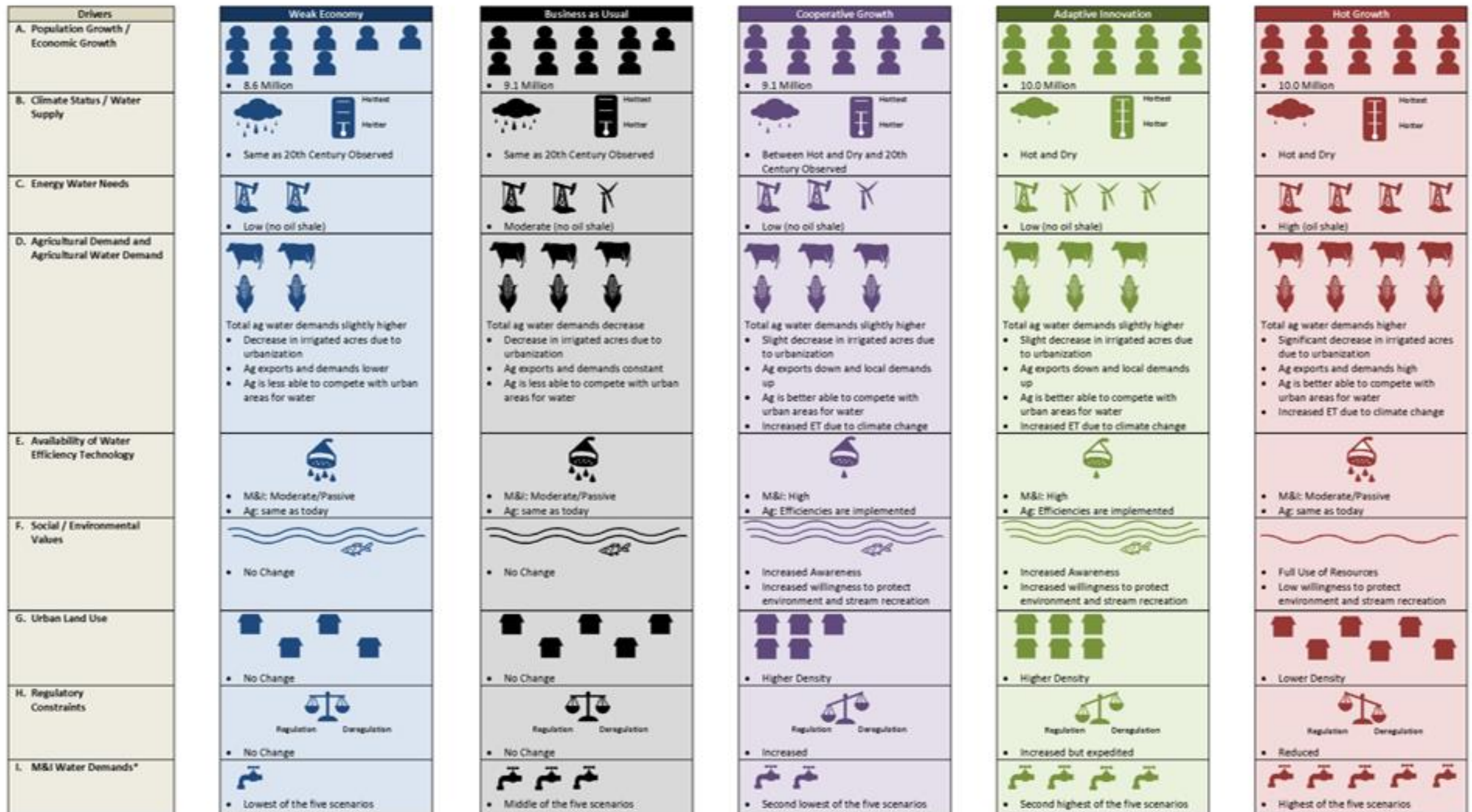


Figure 1. State of Colorado Future Water Supply Scenarios



Questions?

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