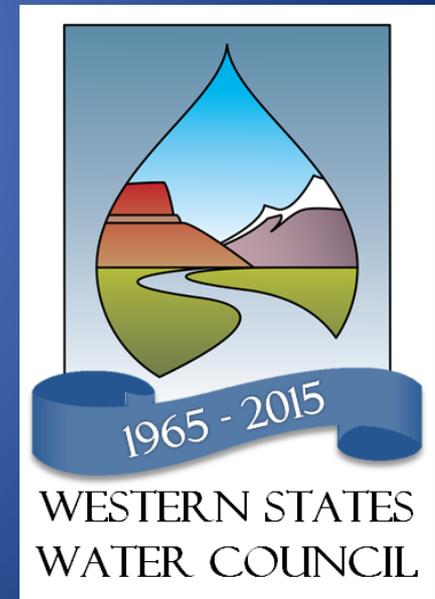


Water Resources Management in the West

National Water Center
NASA Water Team

April 26-27, 2016

Tony Willardson
Executive Director

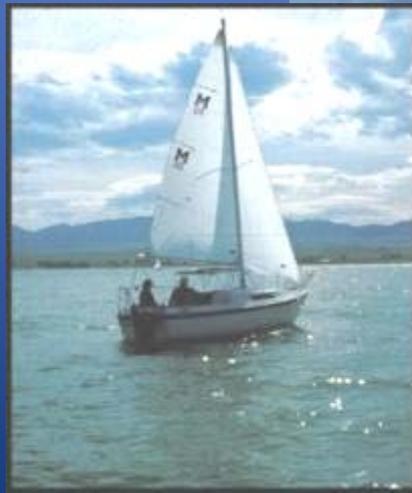


Western States Water Council



- Advisory body to 18 western Governors on water policy issues
- Provides states collective voice
- Fosters collaboration
- Working with the Western Governors' Association (WGA)

The future growth and prosperity of the western states depend upon the availability of adequate quantities of water of suitable quality



Water Needs and Strategies for a Sustainable Future



1. Growth and Water Policy
2. Meeting Future Water Demands
3. Water Infrastructure Needs and Strategies
4. Resolution of Indian Water Rights Claims
5. Climate Change Impacts
6. ESA & Protecting Aquatic Species

Water Needs and Strategies for a Sustainable Future



Western Governors' Association ♦ June 2006

Water Needs and Strategies for a Sustainable Future: *Next Steps*



Western Governors' Association ♦ June 2008



Western States Federal Agency Support Team

A Declaration of Cooperation

*Working Together for the Sustainable and
Efficient Use of Western Water Resources*

We, as representatives of our respective Federal agencies, do hereby declare our intent to cooperate as members of a Western States Federal Agency Support Team (WESTFAST) partnership. We will work together whenever and wherever possible throughout the 17 Western States to promote and educate the public on the benefits of sustainable and efficient use of water resources.

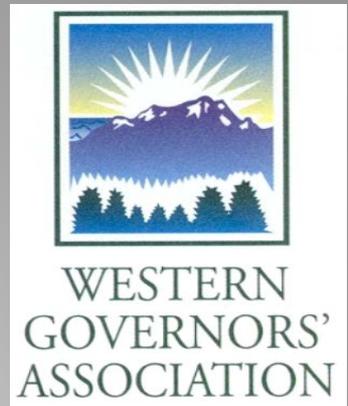
We declare that WESTFAST supports a continued commitment on the part of Federal, and State organizations; working with local, Tribal, and other stakeholders; to improve the effectiveness of collaboration to seek watershed solutions to water issues in the Western States. This effort emphasizes proactive, voluntary, participatory and incentive-based approaches to water resource management and conservation assistance programs throughout the Western States.

We hereby declare that we as WESTFAST partners will collaborate with the Western States Water Council to guide the development of an appropriate action plan for this partnership.

We hereby declare to support, in concept, the establishment of a Federal liaison position to work with the WESTFAST members and the Western States Water Council in developing a collaborative work plan to carry forward joint water resource initiatives. Contributory cost-sharing such a position will be based on authorized and available funds.

Army Corps of Engineers
Bureau of Land Management
Bureau of Reclamation
Environmental Protection
Agency
National Oceanic & Atmospheric
Administration
Natural Resources
Conservation Service
U.S. Fish & Wildlife Service
U.S. Forest Service
U.S. Geological Survey
U.S. Department of Energy
National Aeronautics and Space
Administration
U.S. Department of Defense
National Park Service

WGA Policy Resolution 2015-8



Western Governors:

- Collect, maintain & enhance use of basic data
- Support critical federal programs that provide important basic water supply information – snow, precipitation, streamflow, groundwater, ET, etc.
- Recognize the essential role of federal partnerships and need for coordination on water data.
- Potential water impacts of extreme weather events
- Communicate & share best management practices



Western Governors' Drought Forum

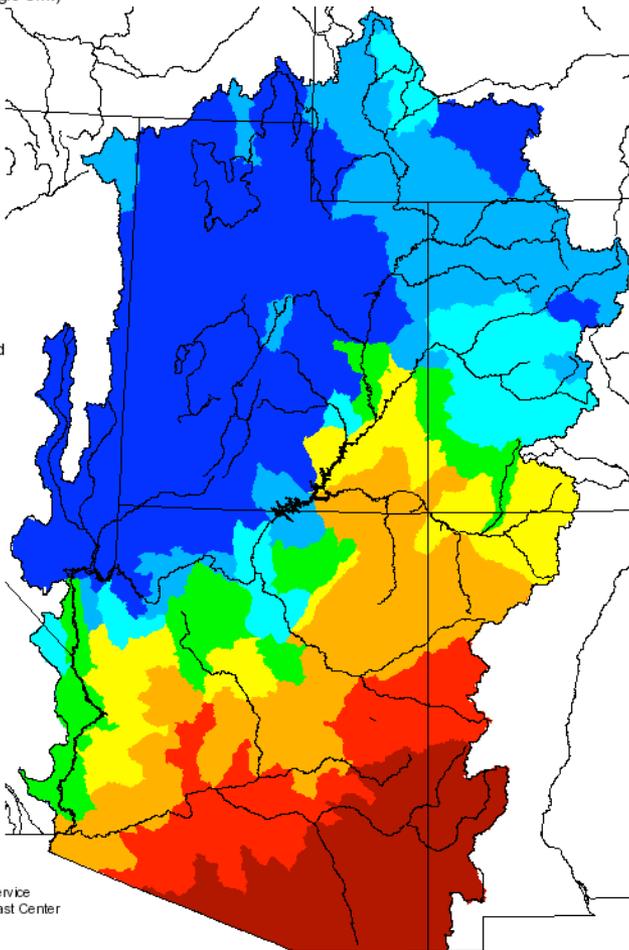
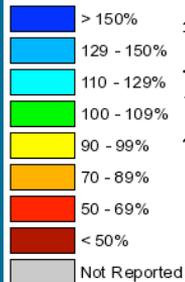
- KEY THEMES
- Data and Analysis
- Produced, Reused and Brackish Water
- Forest Health and Soil Stewardship
- Water Conservation and Efficiency
- Infrastructure and Investment
- Working within Institutional Frameworks
- Communication and Collaboration

Very wet to very dry year...

Seasonal Precipitation, October 2010 - May 2011

(Averaged by Hydrologic Unit)

% Average

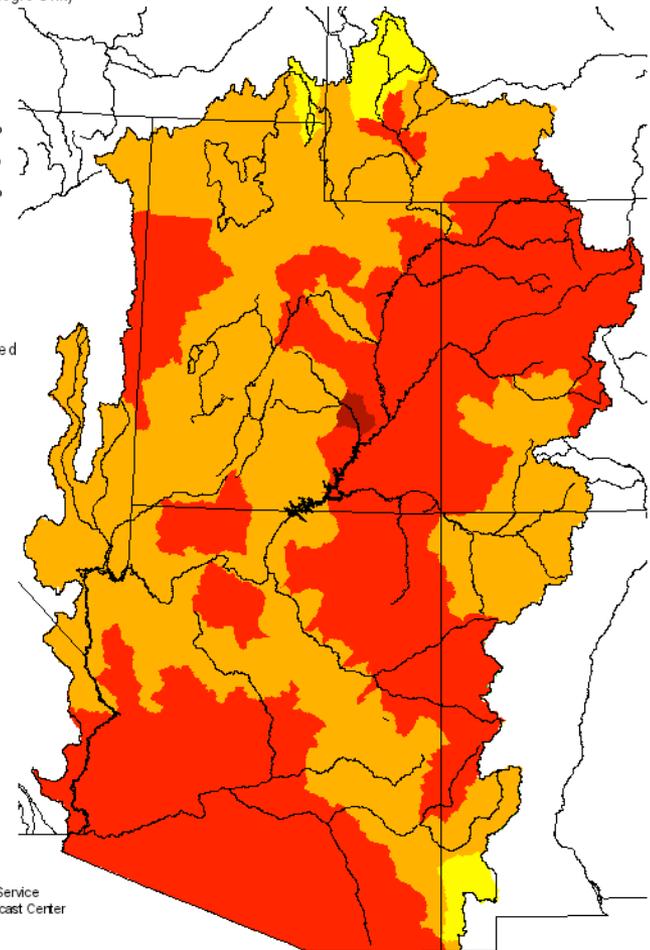
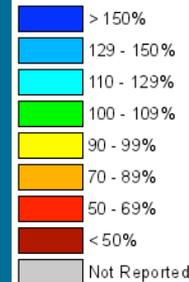


Prepared by
NOAA, National Weather Service
Colorado Basin River Forecast Center
Salt Lake City, Utah
www.cbafc.noaa.gov

Seasonal Precipitation, October 2011 - May 2012

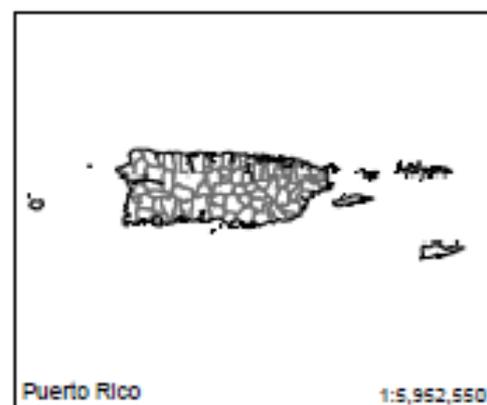
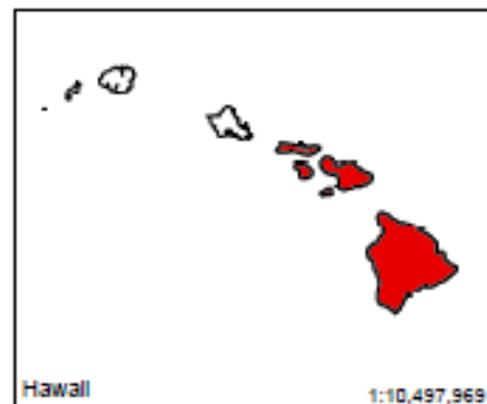
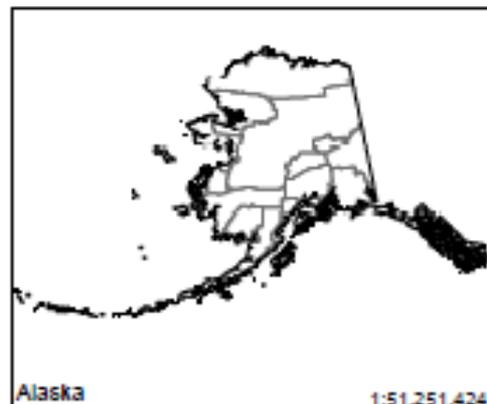
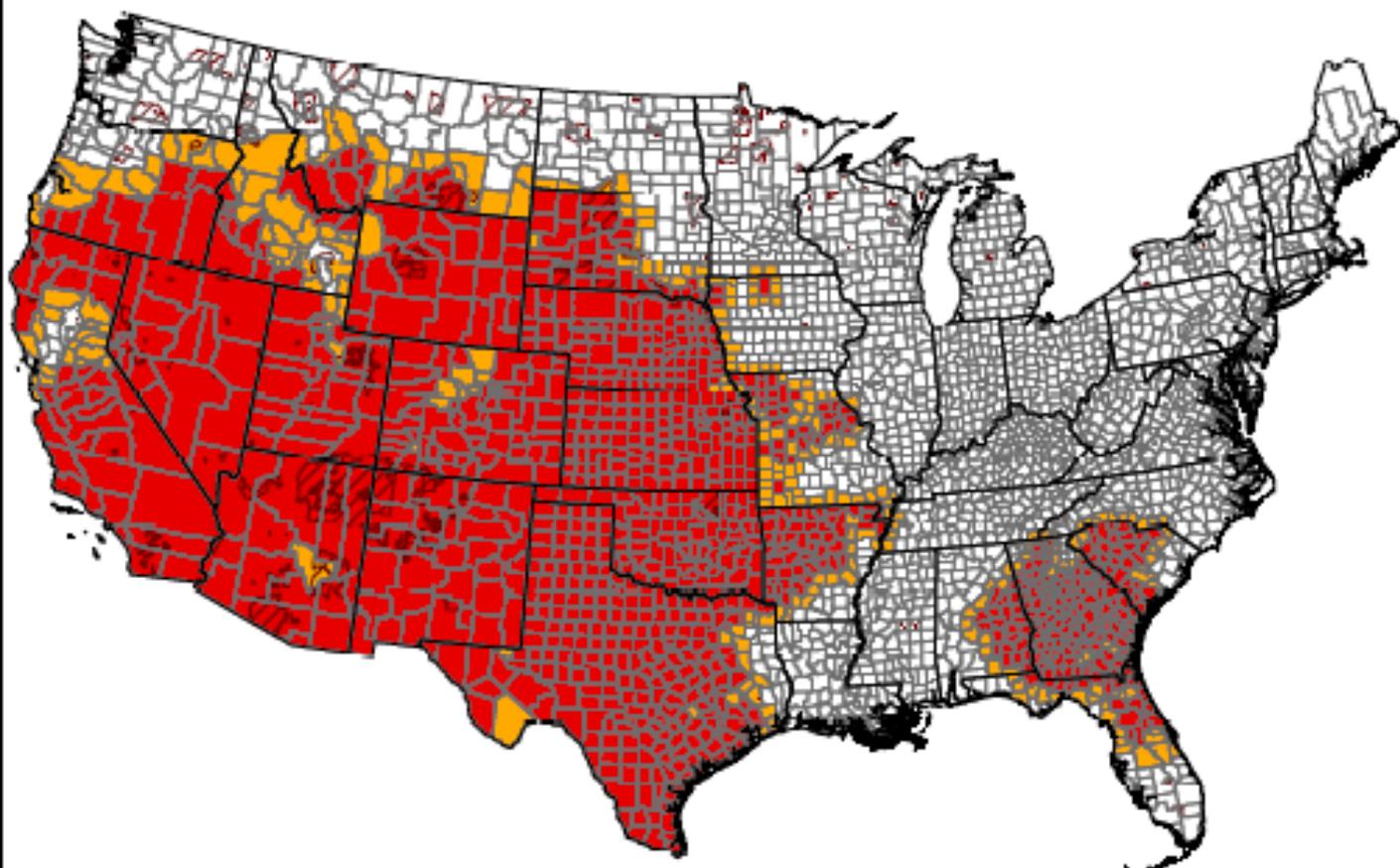
(Averaged by Hydrologic Unit)

% Average



Prepared by
NOAA, National Weather Service
Colorado Basin River Forecast Center
Salt Lake City, Utah
www.cbafc.noaa.gov

2013 Secretarial Drought Designations - All Drought



Secretarial Drought Designations for 2013

Disaster Incidents as of August 14, 2013

-  State Boundary
-  County Boundary
-  Tribal Lands
- August 14, 2013
-  Primary Counties: 1037
-  Contiguous Counties: 280



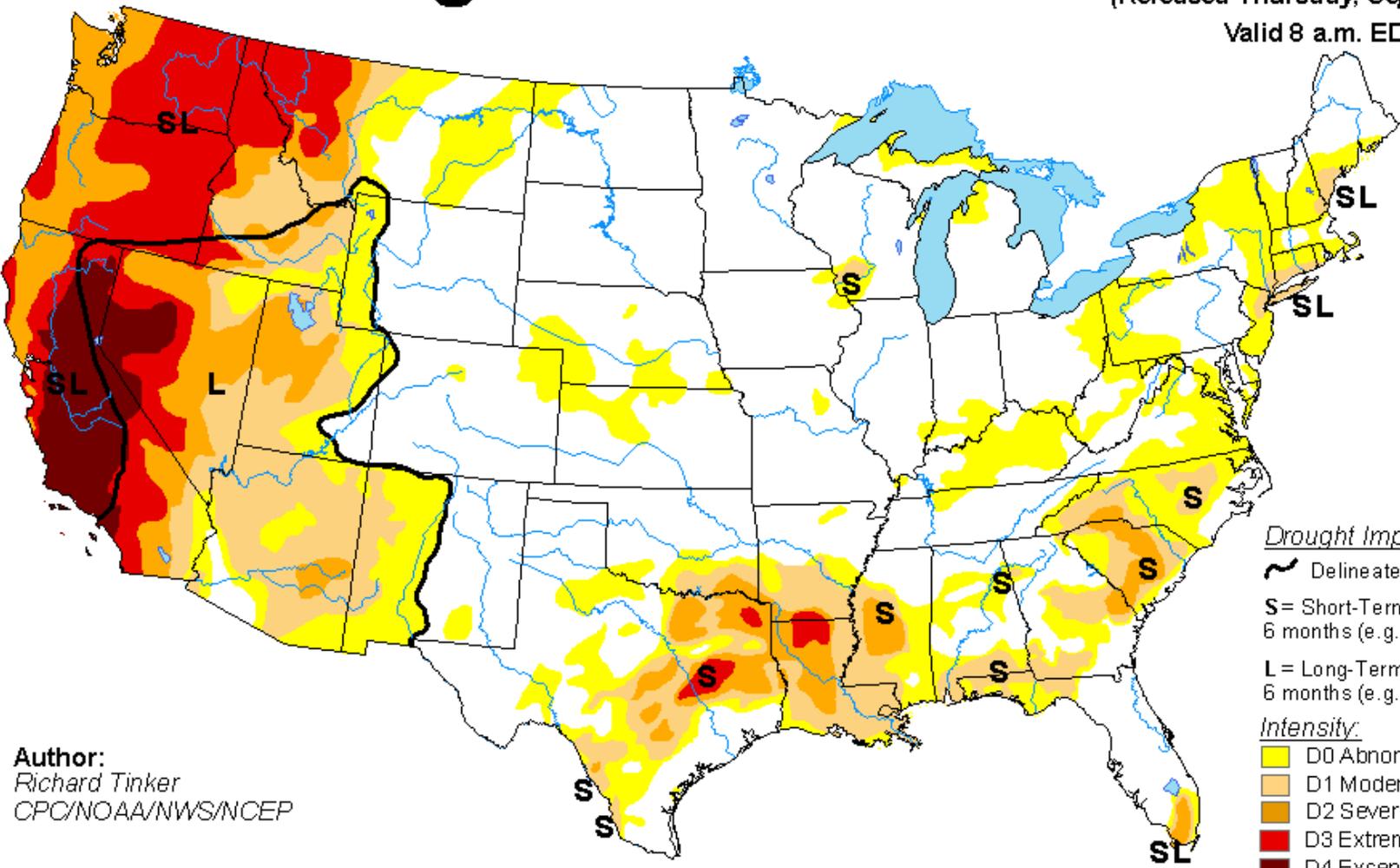
USDA Farm Service Agency
Production, Emergencies and Compliance Division
Washington, D. C.
August 14, 2013

1:23,721,366

U.S. Drought Monitor

September 8, 2015
(Released Thursday, Sep. 10, 2015)

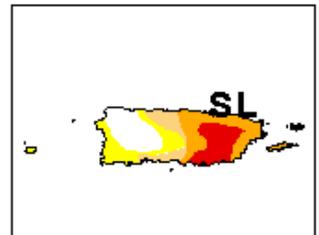
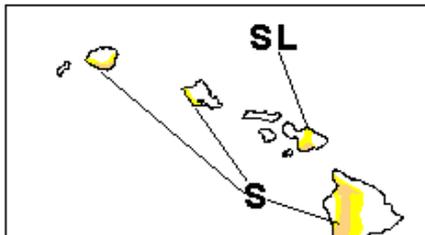
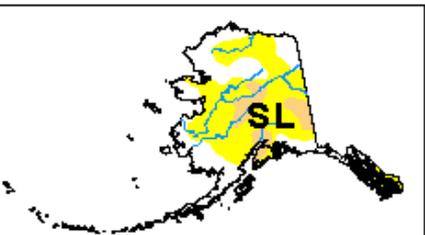
Valid 8 a.m. EDT



Author:
Richard Tinker
CPC/NOAA/NWS/NCEP

- Drought Impact Types:
- ~ Delineates dominant impacts
 - S= Short-Term, typically less than 6 months (e.g. agriculture, grasslands)
 - L= Long-Term, typically greater than 6 months (e.g. hydrology, ecology)
- Intensity:
- Yellow: D0 Abnormally Dry
 - Light Orange: D1 Moderate Drought
 - Orange: D2 Severe Drought
 - Red: D3 Extreme Drought
 - Dark Red: D4 Exceptional Drought

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

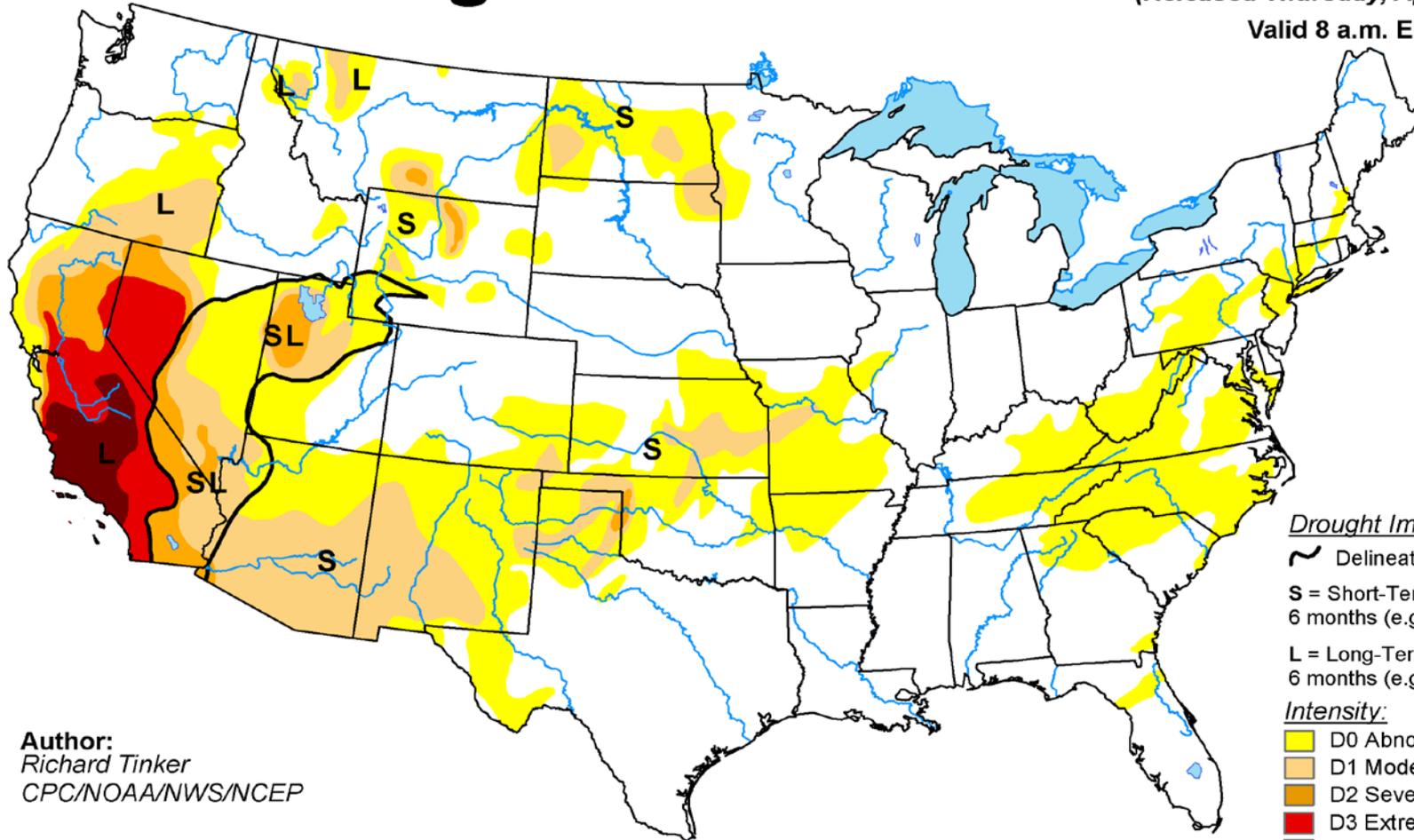


U.S. Drought Monitor

April 19, 2016

(Released Thursday, Apr. 21, 2016)

Valid 8 a.m. EDT



Author:
Richard Tinker
CPC/NOAA/NWS/NCEP

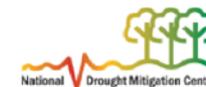
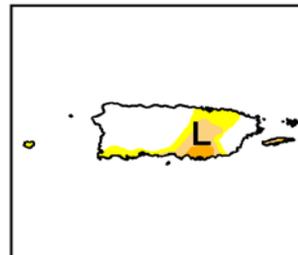
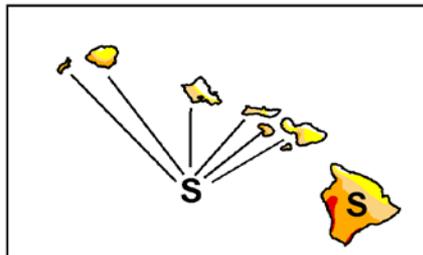
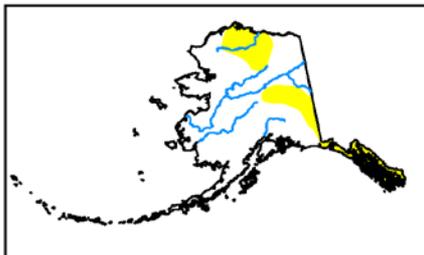
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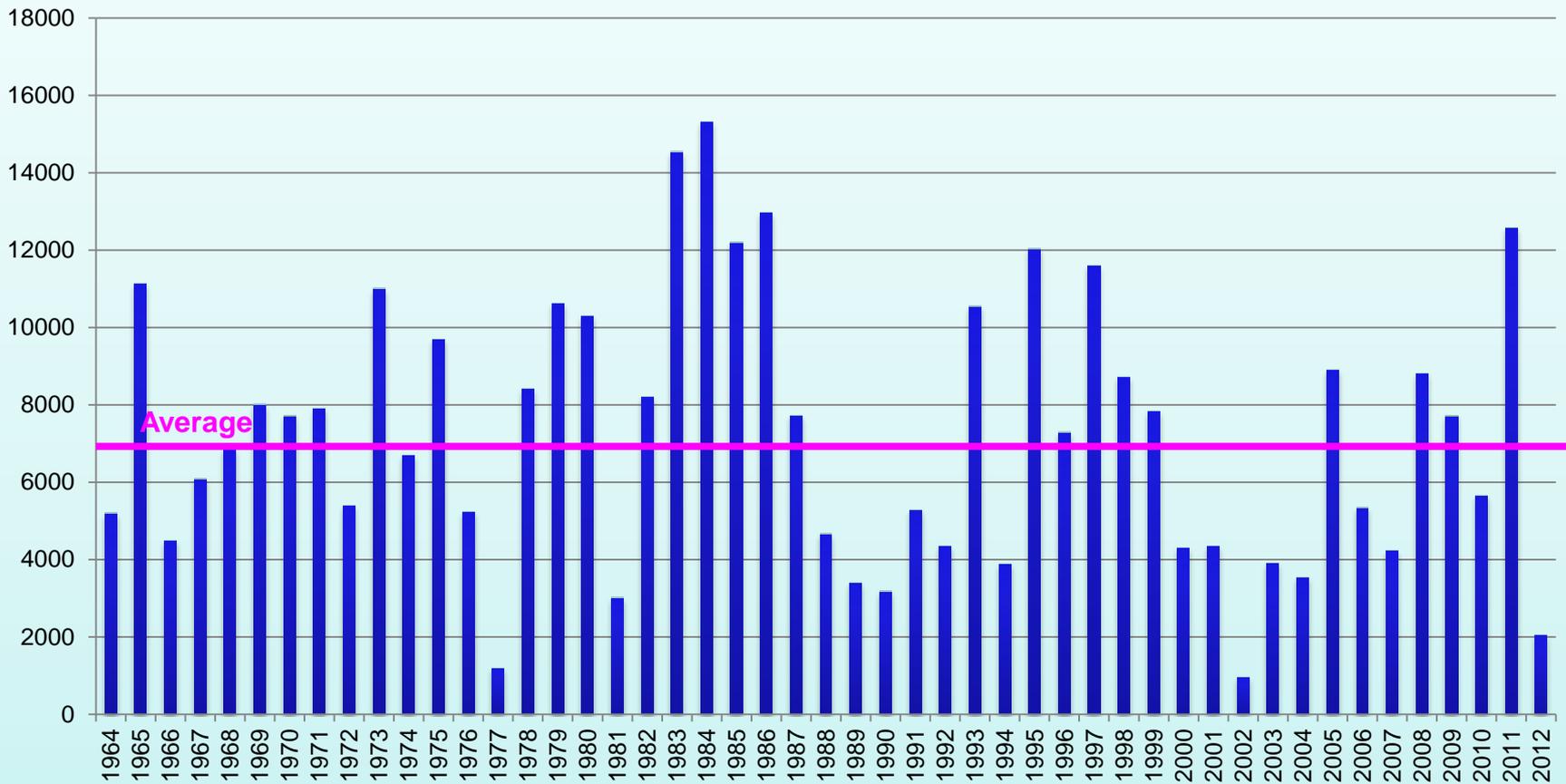
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.



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

Lake Powell Inflows

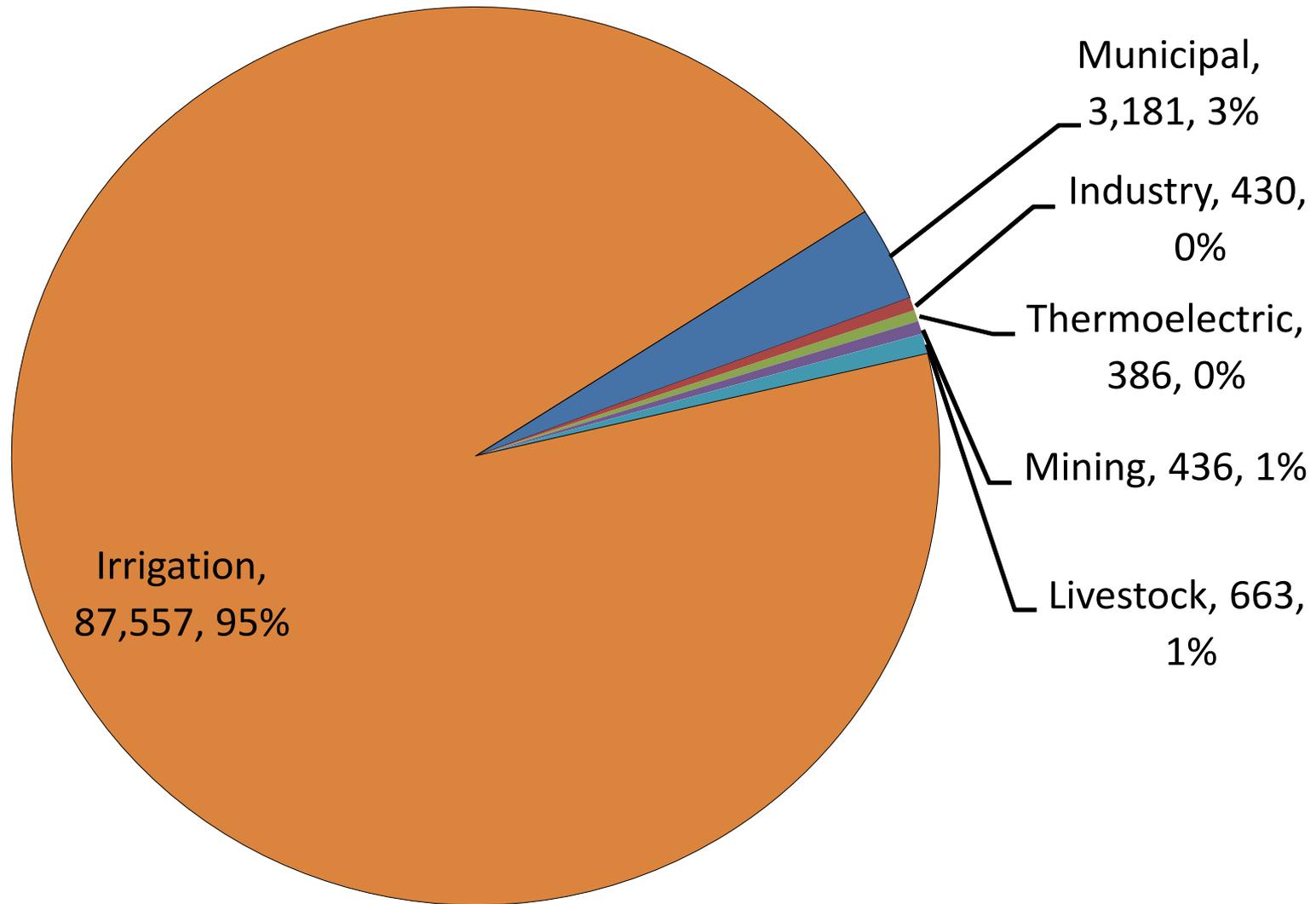
Lake Powell April-July Inflow (kaf)







2010 Water Consumption (MGD)





Water Transfers in the West



PROJECTS, TRENDS,
and LEADING PRACTICES in
VOLUNTARY WATER TRADING

DECEMBER 2012



Water Law 101

- Law of Prior Appropriation (surface/groundwater)
- Water is a complex public/private good
- Establish a private right to use a public resource
- Origin in western mining/agricultural practices
- Developed to promote orderly development of the arid West by allowing the movement of water
- Abandoned common law and riparian law
- Intended to provide certainty given significant uncertainty regarding annual water supplies
- Provides for economic development and markets while also considering the public interest
- Accepted institution for over 150 years

Priority Dates and Water Duties

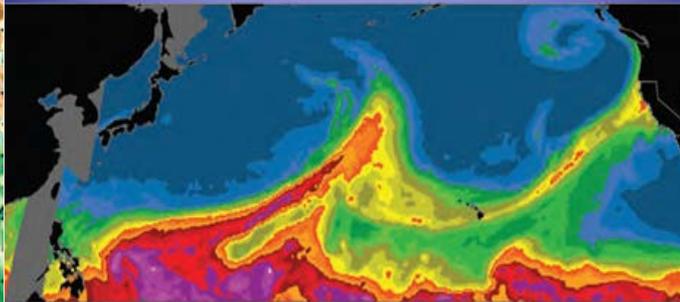
- Priority based on date water is first put to use
- Generally requires diversion out of stream
- Permit applications and vested rights
- Period of time allowed to perfect rights
- Once vested becomes private right to use
- Water duties for irrigation generally 2-4 acre feet per acre annually
- Based on consumptive use, not diversions or withdrawals

Priority State & Federal Actions

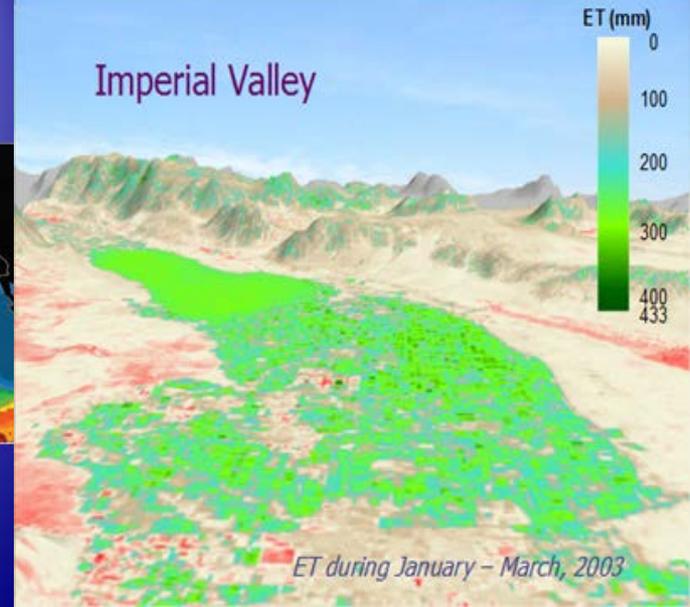
- Increase support/funding for data
- Identify and close data gaps
- Gather/disseminate real-time data
- Foster remote sensing capabilities
- Reduce costs through innovation



Atmospheric Rivers



Imperial Valley





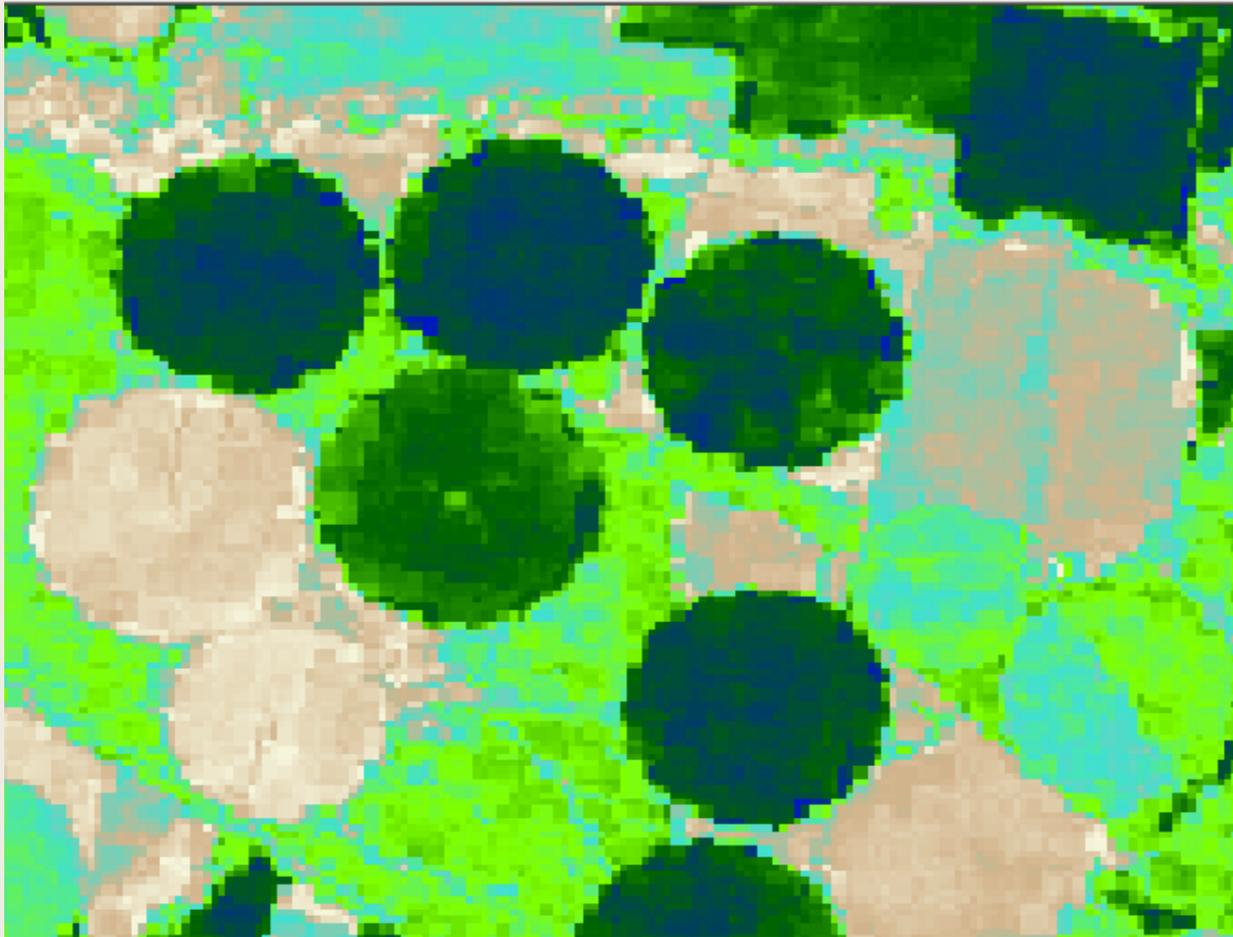
EROS • GSFC • KSC



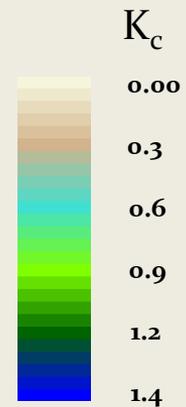
LDCM

LANDSAT
Data Continuity Mission
NASA • USGS

Why use High Resolution Imagery?



ET from
Landsat 5
with thermal
sharpened to
30 m



$$(K_c = ET_{act} / ET_{ref})$$

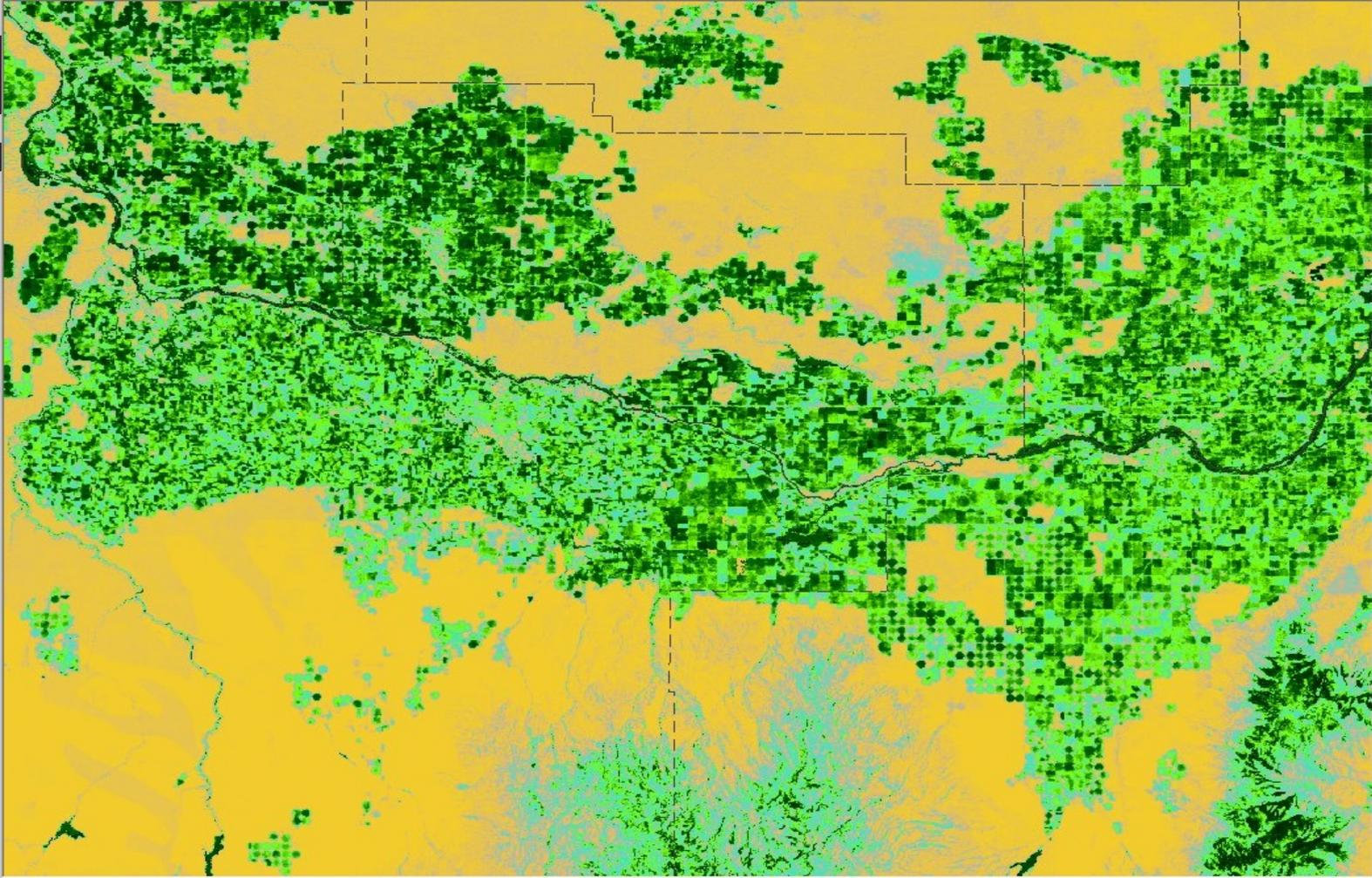
*ET from individual fields is essential for: Water Rights,
Water Transfers, Farm Water Management*



Idaho Department of Water Resources Evapotranspiration



- Zoom/Pan
- Identify
- Locate Address
- Capture Screen
- Print
- Download
- Help
- Map Server Menu

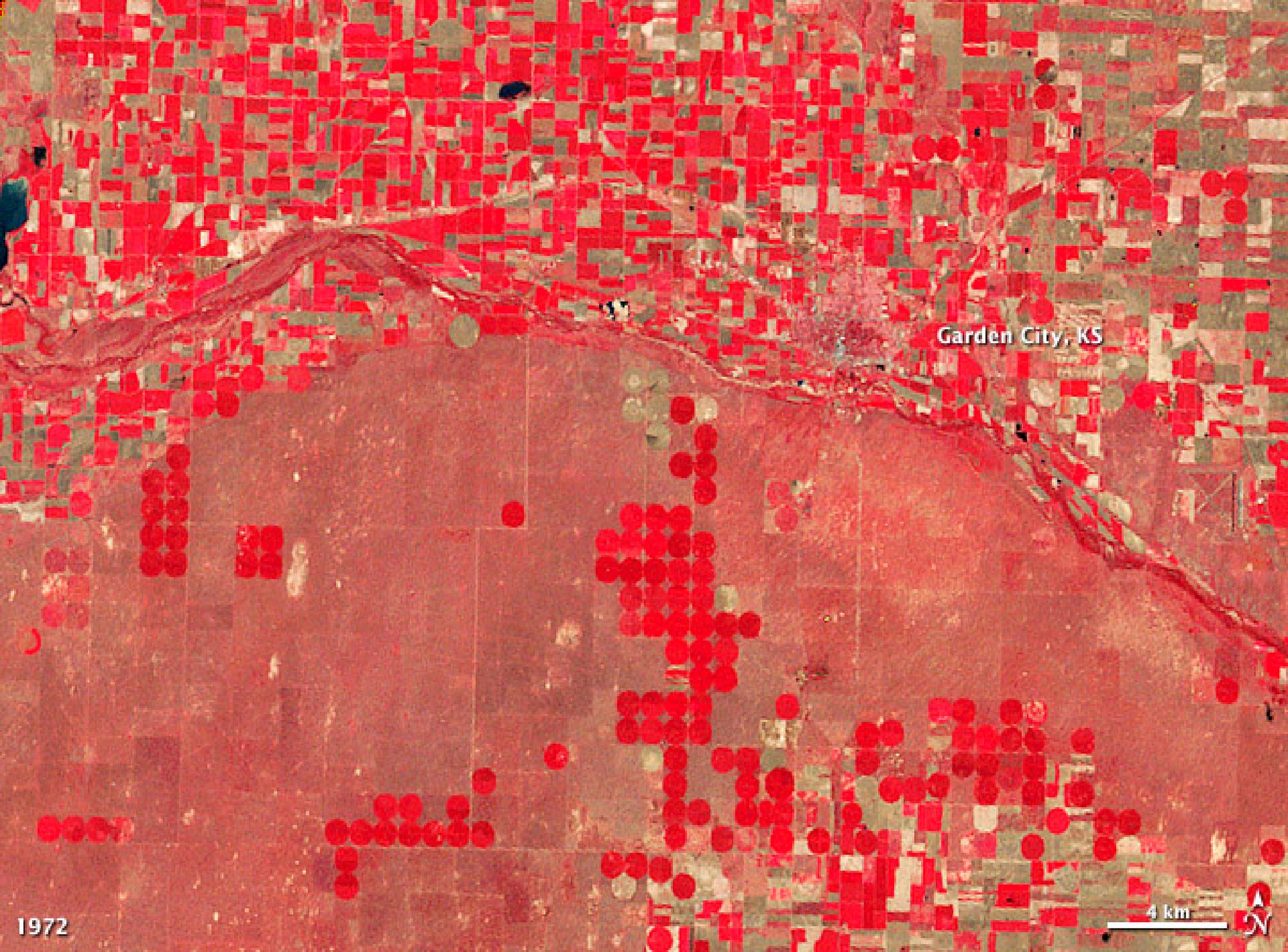


Layers | Legend | Metadata

- Base Map
- Evapotranspiration
 - 2003 -- P39R30
 - 2003 P39R30 6/5, 2
 - 2003 P39R30 7/7, 2
 - 2003 P39R30 8/24,
 - 2003 P39R30 6/1-9,
 - 2003 P39R30 LAND
 - 2000 -- Southern Idaho
 - 2000 Snake Plain 3/:
 - 2000 P3940 LANDS
 - 2000 -- P42R2930
 - 2000 -- P41R30
 - 2000 -- Lemhi
 - 1997 -- P42R30
 - 1985 -- P39R3031
- Background Images

Active Layer
Counties

Refresh Map

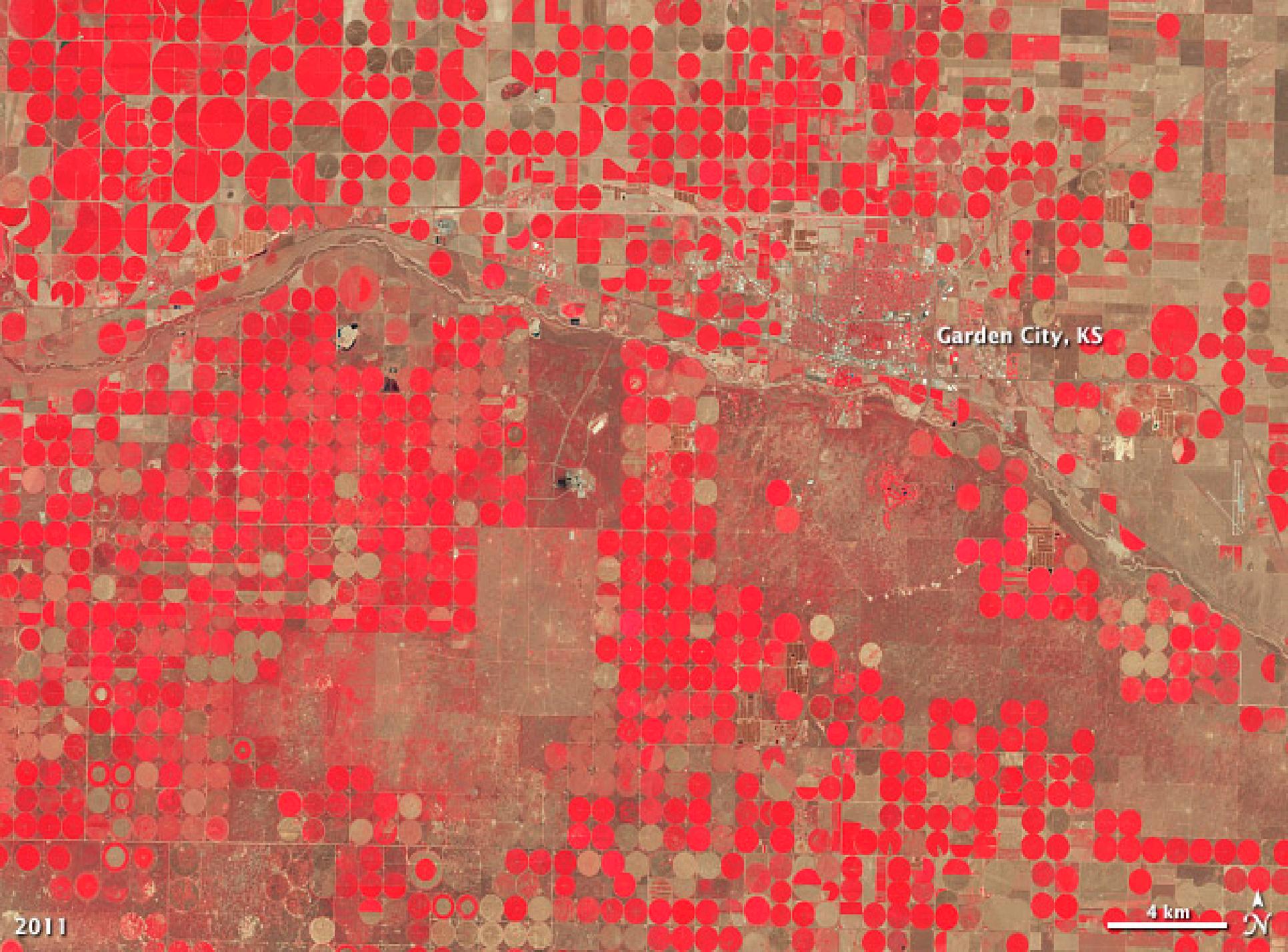


Garden City, KS

1972

4 km





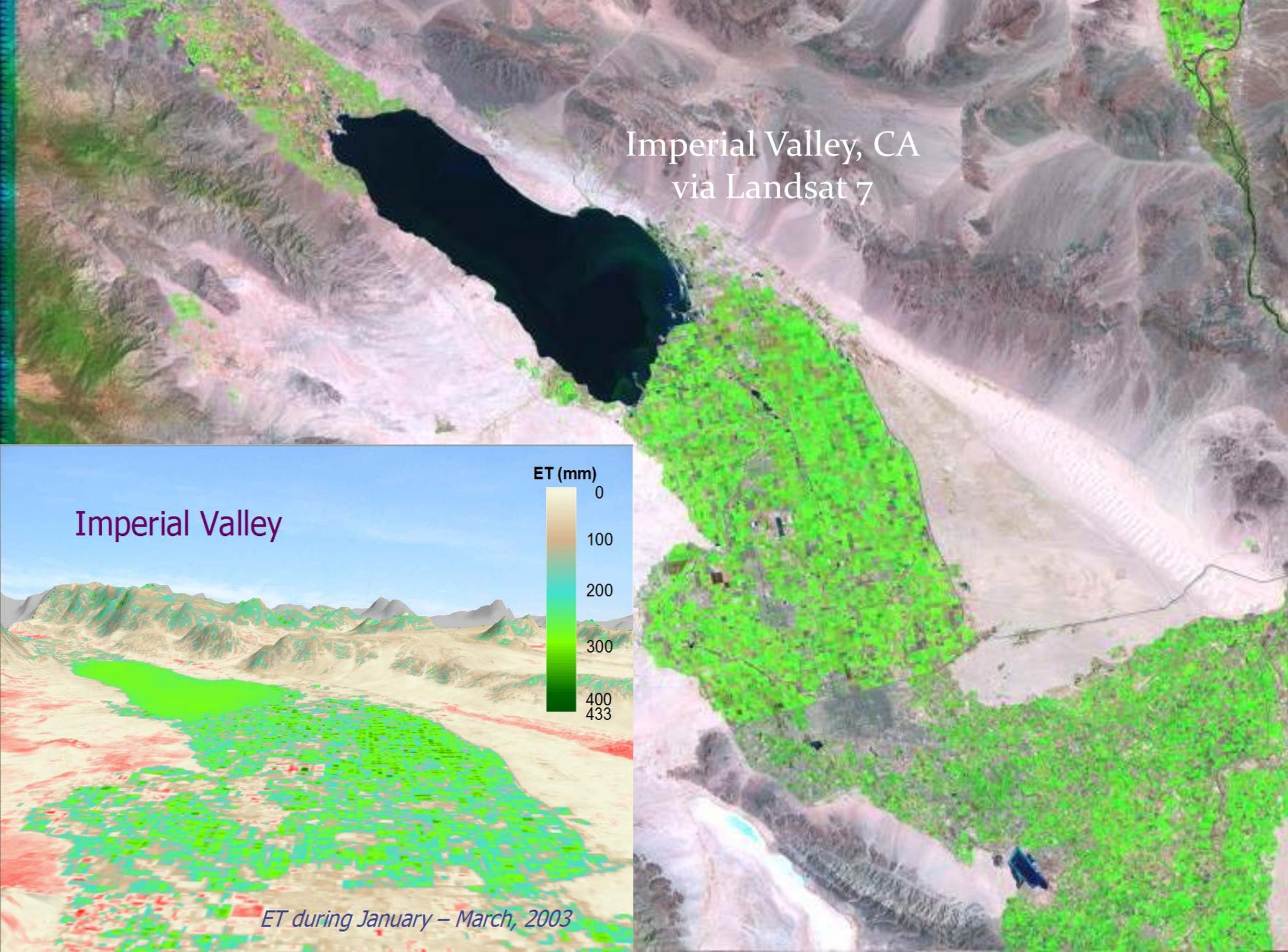
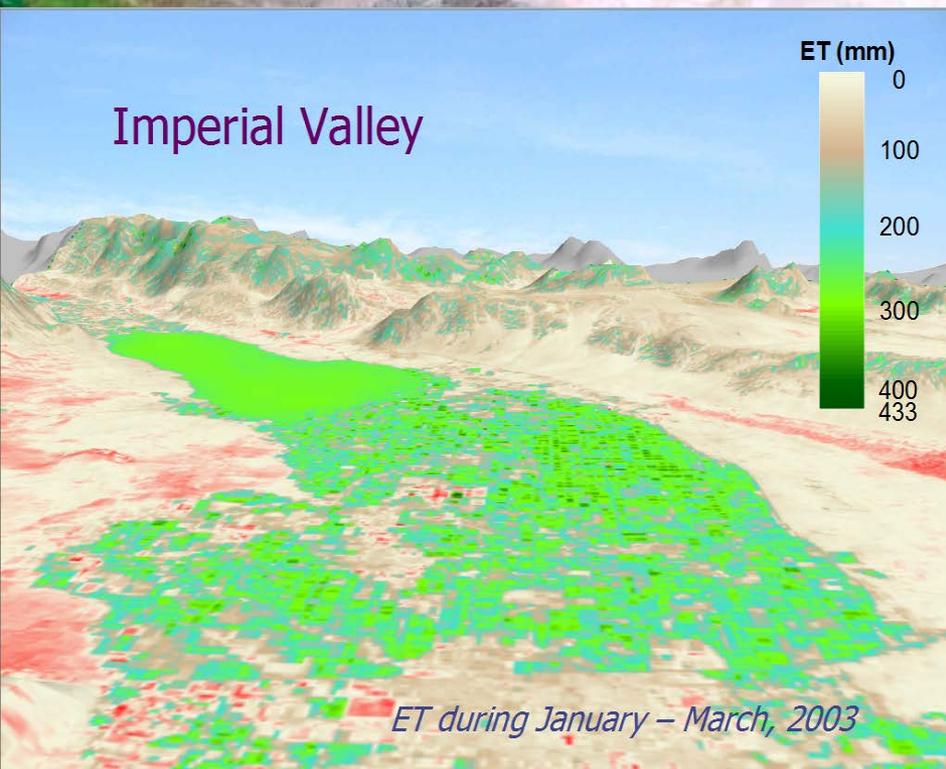
Garden City, KS

4 km



2011

Imperial Valley, CA
via Landsat 7



NASA/NOAA
Landsat Satellite



NWS
Co-Co Program
Air Group



NRCS
Snow Plot



NOAA
Greenland
Radar



NOAA
Atmospheric
Bioscience
Observatory



USGS
Monitoring Well



USGS
Streamgauge

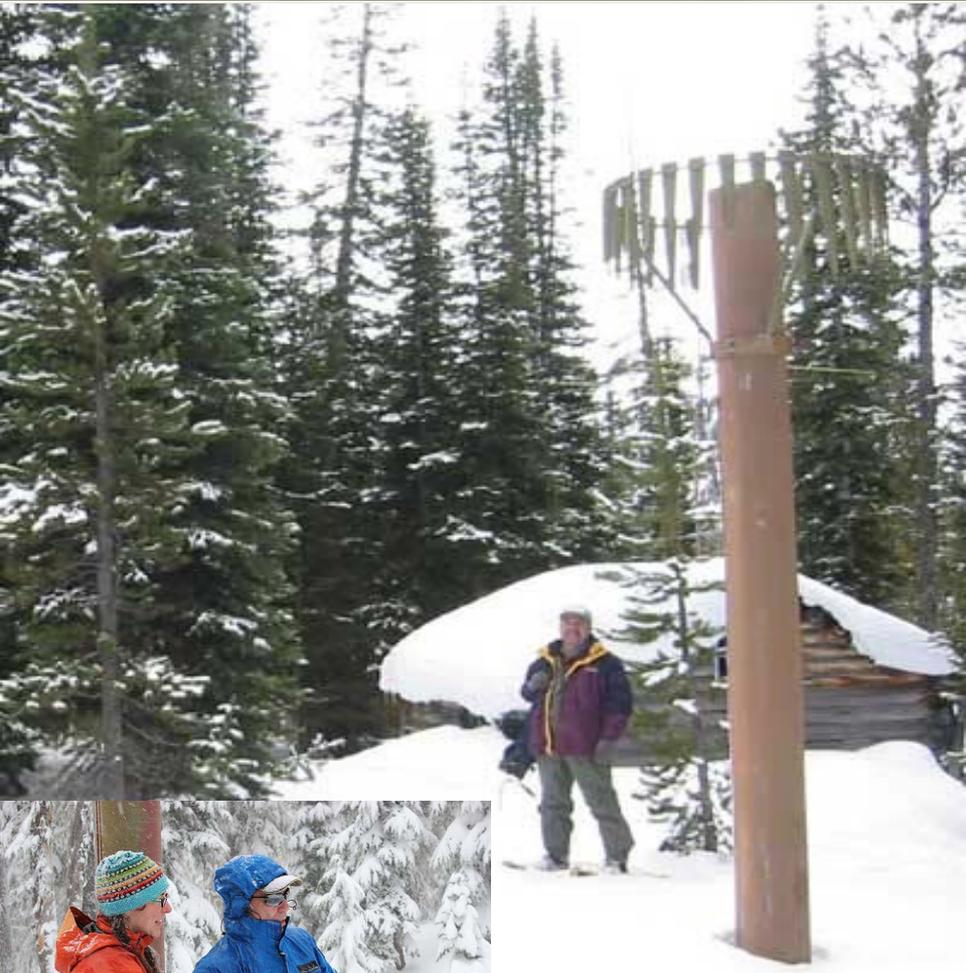


NWS
Respiration Pa



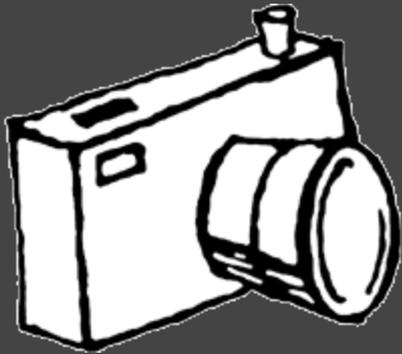
NOAA
TAO Array Buoy
(Tropical Atmosphere Ocean)





Water Data Exchange (WaDE)

What are the Big Picture Goals?



To better enable the states to share important water data with each other, the public and federal agencies.

To improve the sharing of federal data with the states, to assist their planning efforts

Western Water Data Exchange (WaDE) Central Portal

A mapping application for discovering water data web services hosted by the states, federal agencies and Sandia National Lab

An state agency sponsored initiative to better share water data was begun in 2008 and has taken on a greater importance in more recent years. Faced with the need to collaborate on regional watershed management issues and the growing requests for access to water data, state agencies have initiated the Water Data Exchange (WaDE) project.

This Central Portal for WaDE provides access to state water data (pictured on the left), such as water planning, availability, use and allocation data, as well as summary water availability results from Sandia National Laboratory's Water/Energy Nexus Study (pictured on the right).

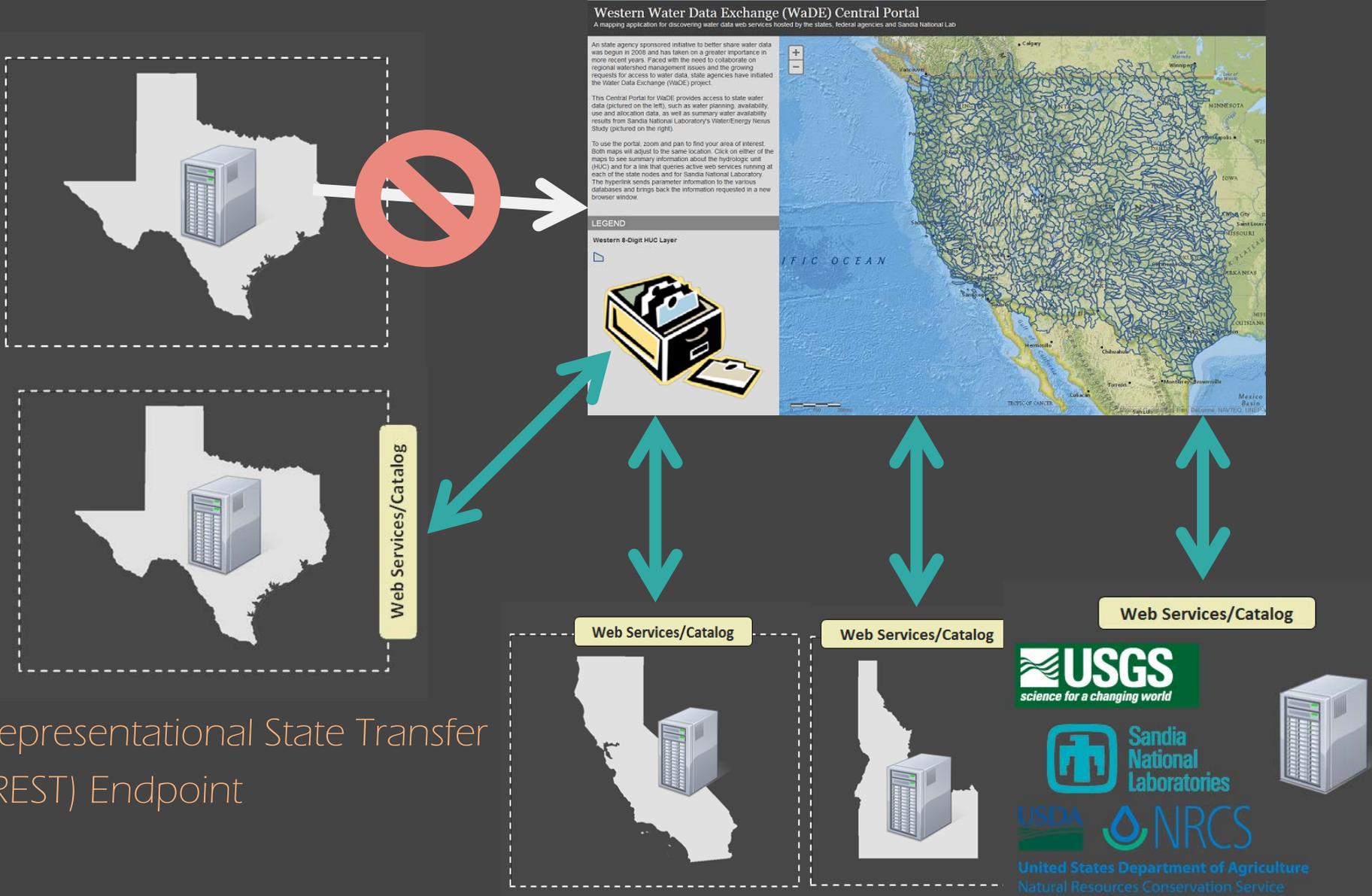
To use the portal, zoom and pan to find your area of interest. Both maps will adjust to the same location. Click on either of the maps to see summary information about the hydrologic unit (HUC) and for a link that queries active web services running at each of the state nodes and for Sandia National Laboratory. The hyperlink sends parameter information to the various databases and brings back the information requested in a new browser window.

LEGEND

Western 8-Digit HUC Layer



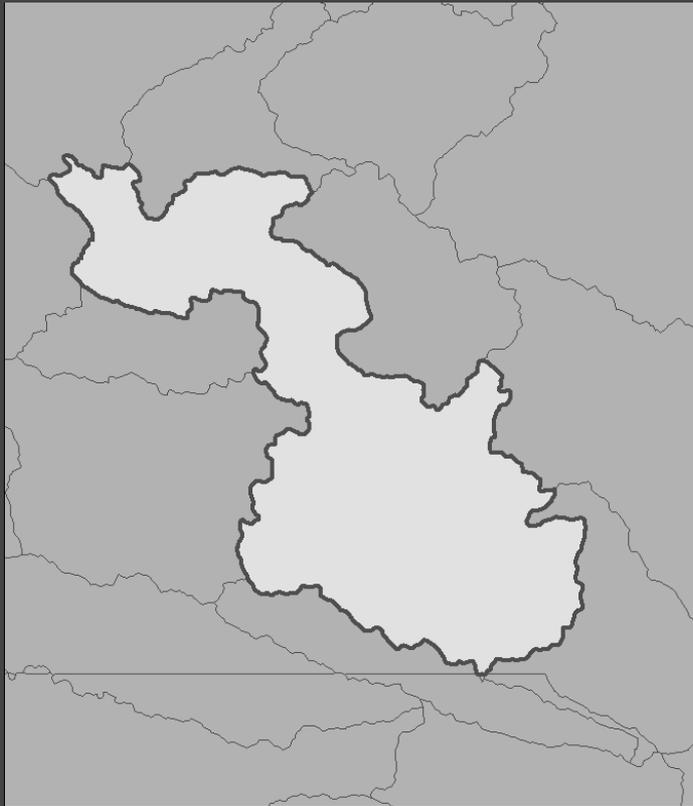
HOW DOES IT WORK?



Representational State Transfer (REST) Endpoint

<http://www.state.us/webservices/GetSummary>

WHAT WILL IT PROVIDE?



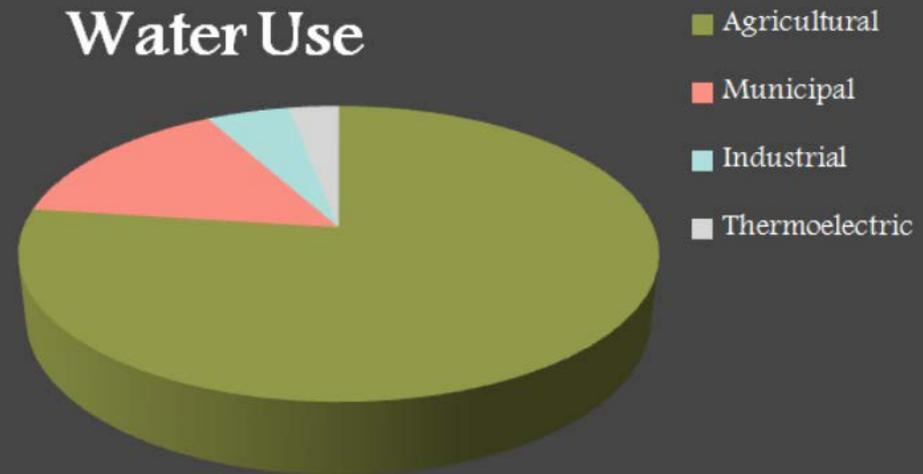
Summaries of Data

7,550 acre-feet

Water Availability



Water Use



Water Supply Summary: 24,000 acre-feet

Regulatory & Allocation Summaries:

- Groundwater Management Areas
- % of Allocations by Beneficial Use Category

2,850 acre-feet

More Detailed Data

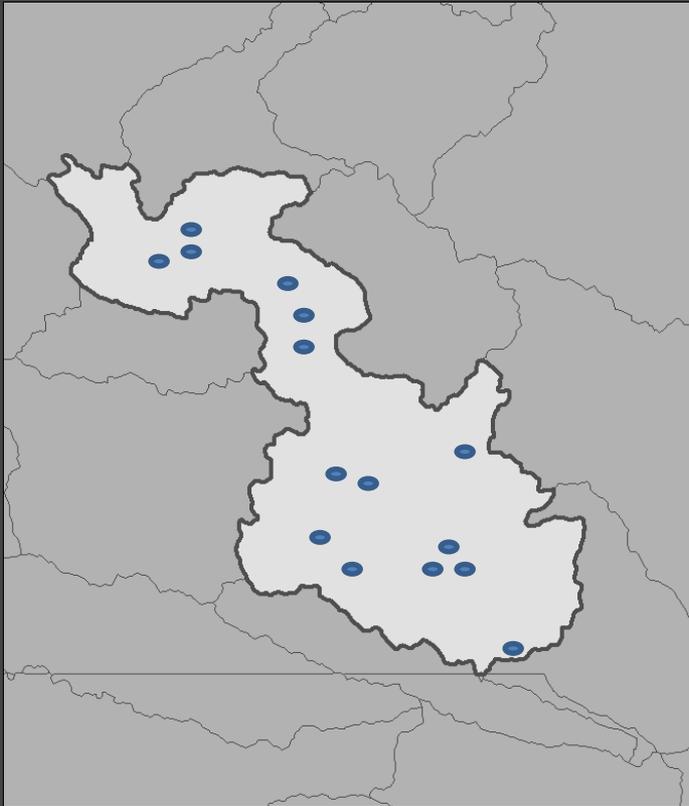
Allocation Data

- Owner
- Beneficial Use
- Status
- Priority Data

Diversions

Uses (withdrew)

Return Flows

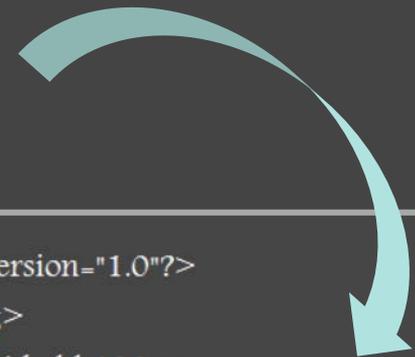


FUTURE STEPS:

States plugged in,
grants, accessing
federal data too



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Improving
Sub-Seasonal to Seasonal
Precipitation Forecasting for
Water Management



WESTERN
STATES
WATER
COUNCIL

Examples of Sub-Seasonal Water Management Decisions

- Will the rest of this winter be wet or dry?
- How much water will we be able to supply our customers?
- If it looks like a dry winter, can we store more water?
- Will we have to begin curtailing surface water diversions on intensively-used or fully-appropriated rivers?
- Will we hit shortage triggers that require extraordinary conservation measures, dry year contracts or special regs?
- Can we use some reservoir flood control storage space?
- Could an unusually wet late spring elevate flood risks?
- When should special flood emergency preparedness operations begin?

Seasonal Water Management Decisions

- Do we need additional response authorities and/or funding?
- Do we reprogram funds or raise water rates?
- Should we establish and operate a drought water bank?
- Do we need to secure/purchase supplemental water supplies?
- Do we negotiate temporary or permanent contracts?
- Do we accelerate groundwater pumping or can we recharge?
- Do we begin emergency preparedness exercises/training?
- Should we begin outreach in vulnerable areas?
- Do we announce/begin water use curtailment actions?

Comparative variability of Western precipitation

Coefficient of Variation, Water Year 1951-2008

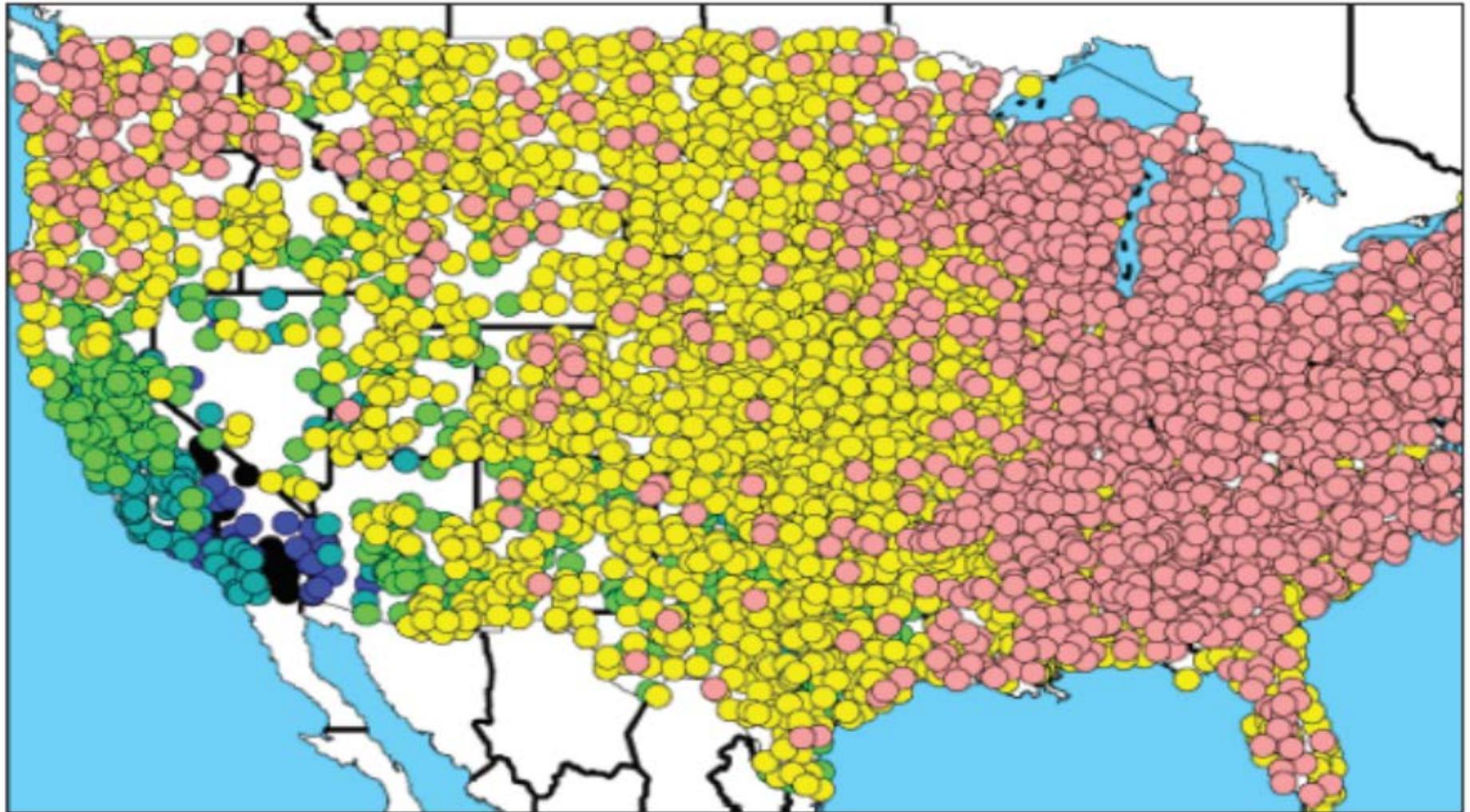


Figure provided courtesy of Mike Dettinger, USGS

Tony Willardson
Executive Director
Western States Water Council

twillardson@wswc.utah.gov

801-685-2555