

Governor's Drought Interagency Coordinating Group Meeting

November 13, 2014



WIFI: adwr-guest
Password: arizonah20!

Drought Monitoring Technical Committee Update

to the

Arizona Interagency Coordinating Group

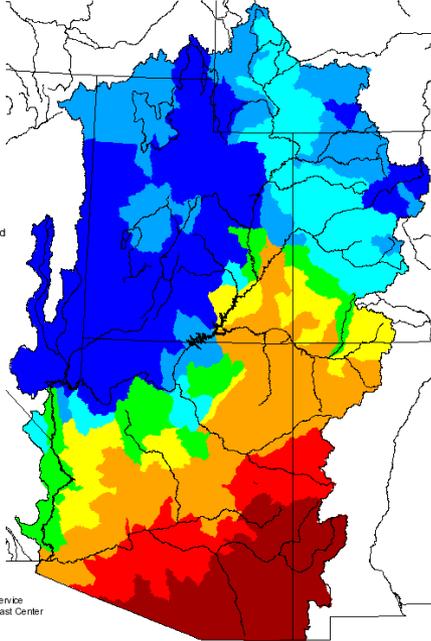
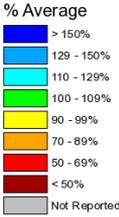
November 13, 2014

Nancy J. Selover
Arizona State Climate Office
Arizona State University
azclimate.asu.edu

Precipitation Comparison Colorado River Basin

WY 2011

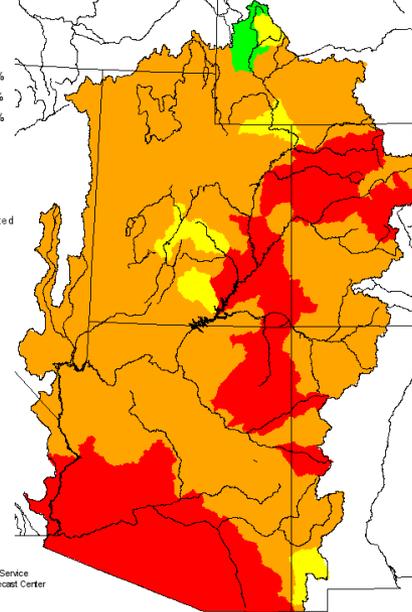
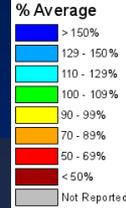
Seasonal Precipitation, October 2010 - April 2011
(Averaged by Hydrologic Unit)



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

WY 2012

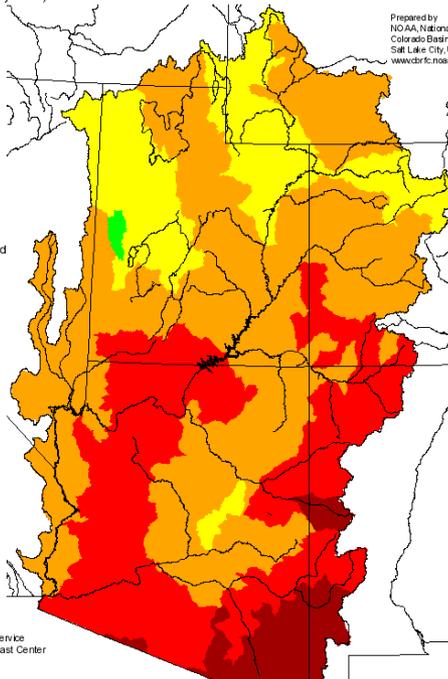
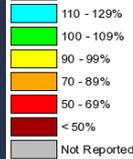
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WY 2013

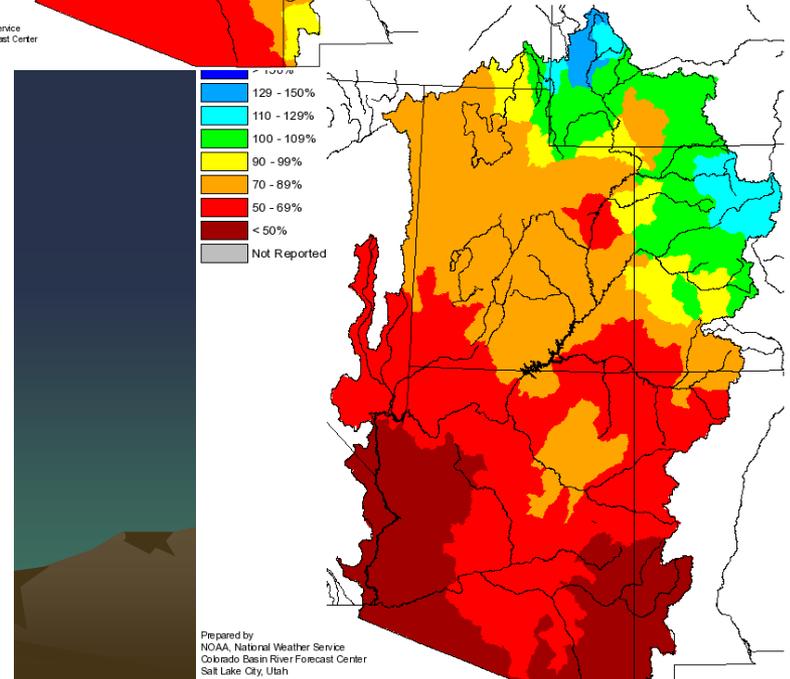
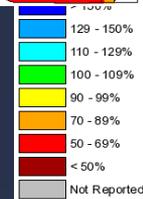
Seasonal Precipitation, October 2012 - April 2013
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WY 2014

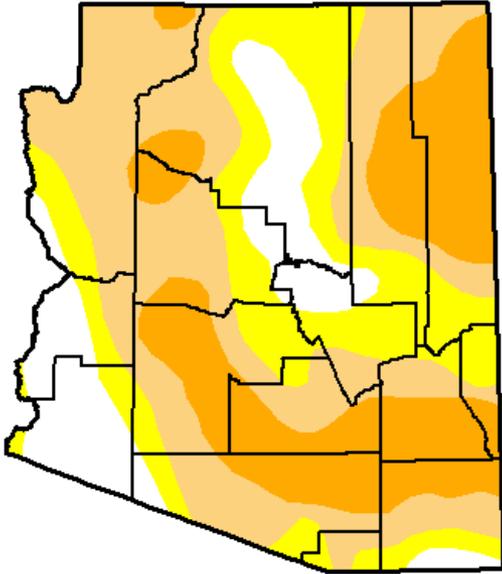
Seasonal Precipitation, October 2013 - April 2014
(Averaged by Hydrologic Unit)



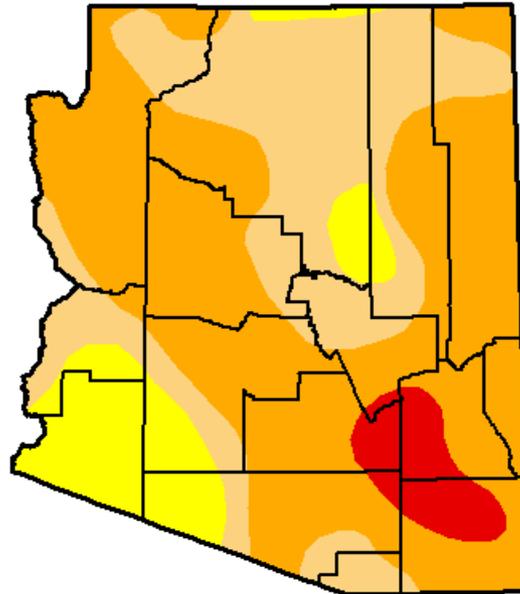
Prepared by
NOAA, National Weather Service
Colorado Basin River Forecast Center
Salt Lake City, Utah

National Drought Monitor Comparison (Short-Term)

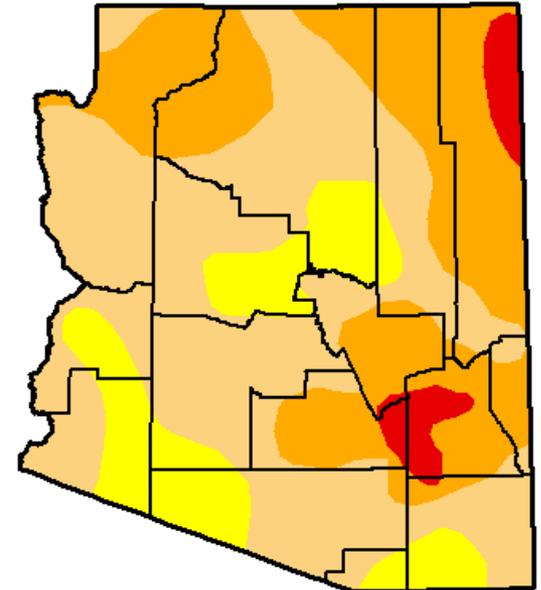
November 5, 2013



April 1, 2014

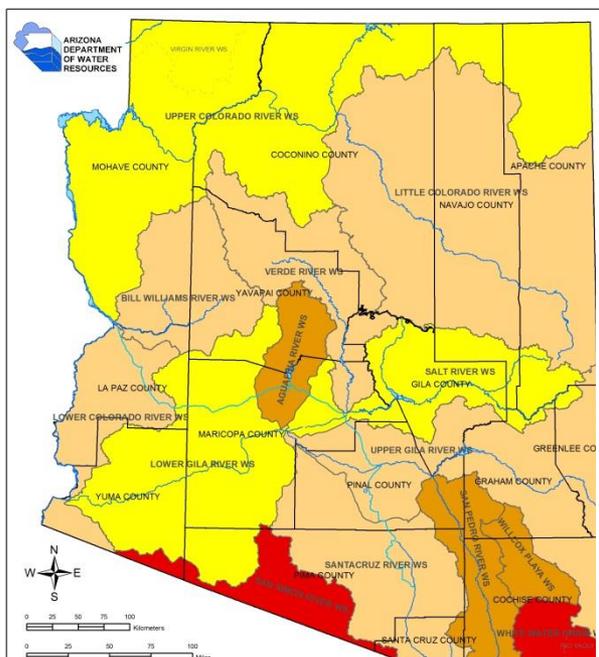


November 4, 2014



Long Term Drought Status Comparison

October 2013



Watershed Drought Level**

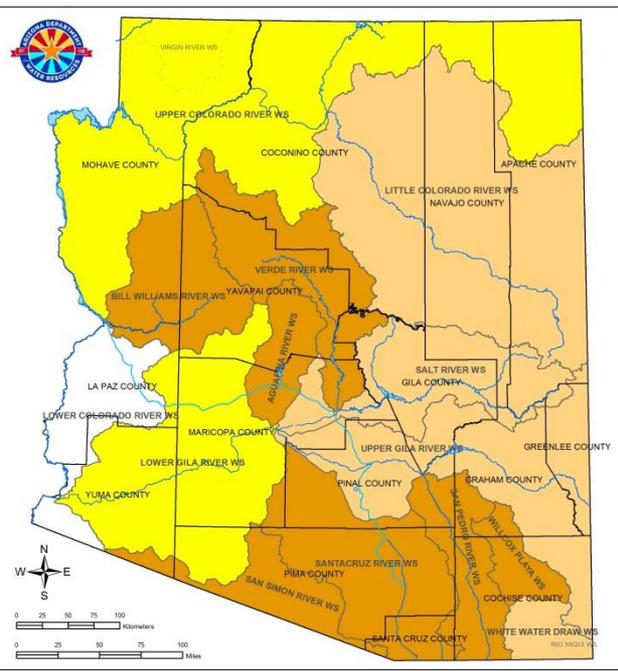
- No Drought
- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

October 2013 Long Term Drought Status
Data Through September 30th, 2013

Arizona Drought Preparedness Monitoring Technical Committee

** Watershed merged due to limited data.
** As of January 2011, drought categories have been adjusted to be consistent with the U.S. Drought Monitor.

April 2014



Watershed Drought Level**

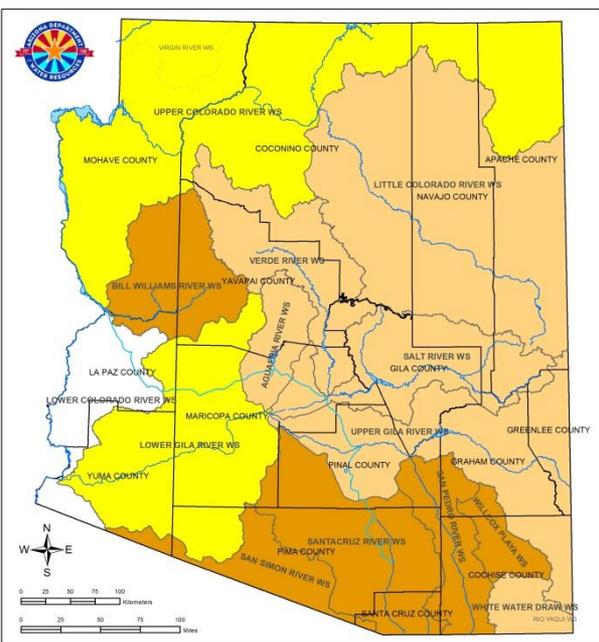
- No Drought
- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

April 2014 Long Term Drought Status
Data Through March 31st, 2014

Arizona Drought Preparedness Plan Monitoring Technical Committee

** Watershed merged due to limited data.
** As of January 2011, drought categories have been adjusted to be consistent with the U.S. Drought Monitor.

October 2014



Watershed Drought Level**

- No Drought
- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

October 2014 Long Term Drought Status
Data Through September 30th, 2014

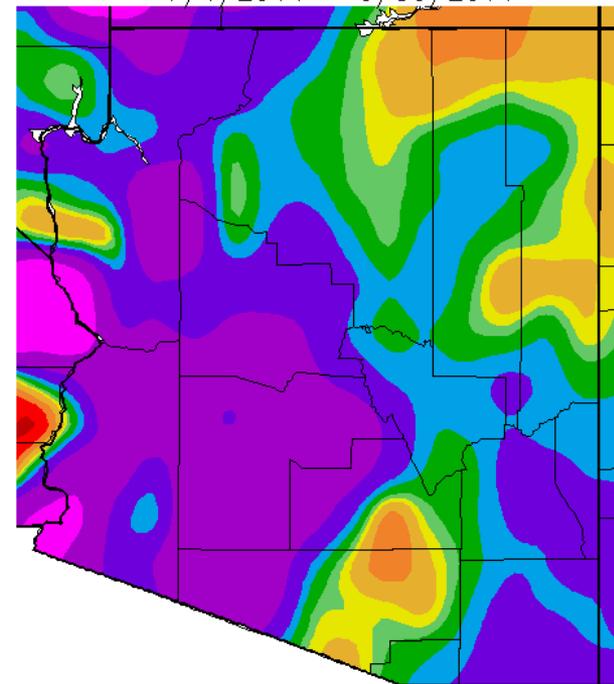
Arizona Drought Preparedness Plan Monitoring Technical Committee

** Watershed merged due to limited data.
** As of January 2011, drought categories have been adjusted to be consistent with the U.S. Drought Monitor.

Precipitation

Monsoon 2014

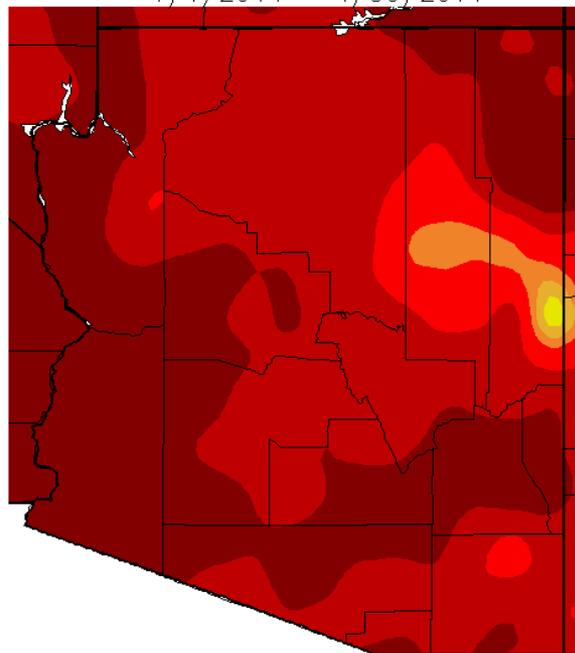
Percent of Average Precipitation (%)
7/1/2014 – 9/30/2014



5 25 50 70 90 100 110 130 150 200 300
Generated 10/01/2014 at WRCC using provisional data.
NOAA Regional Climate Centers

Jan-Apr 2014

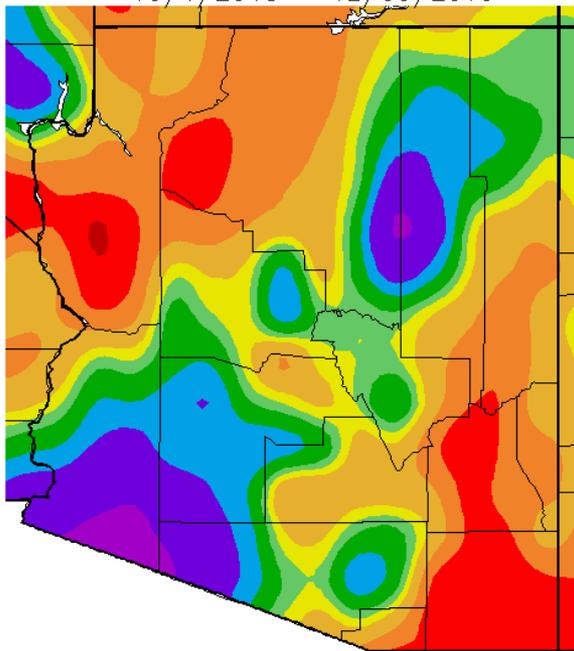
Percent of Average Precipitation (%)
1/1/2014 – 4/30/2014



25 50 70 80 90 100 110 120 130 150 175
Generated 5/01/2014 at WRCC using provisional data.
NOAA Regional Climate Centers

Oct 13-Jan 14

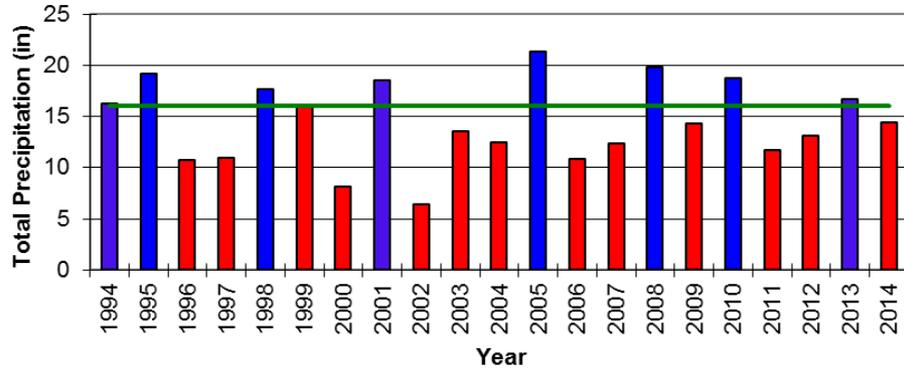
Percent of Average Precipitation (%)
10/1/2013 – 12/30/2013



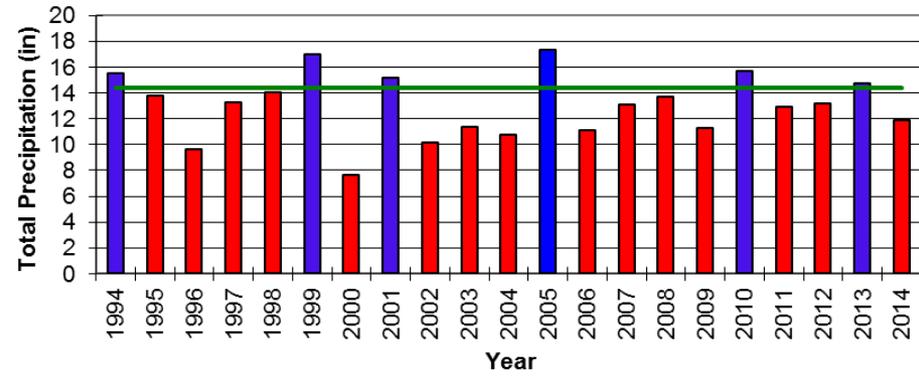
5 25 50 70 90 100 110 130 150 200 300
Generated 12/31/2013 at WRCC using provisional data.
NOAA Regional Climate Centers

Precipitation in Selected Watersheds for Past 20 Years

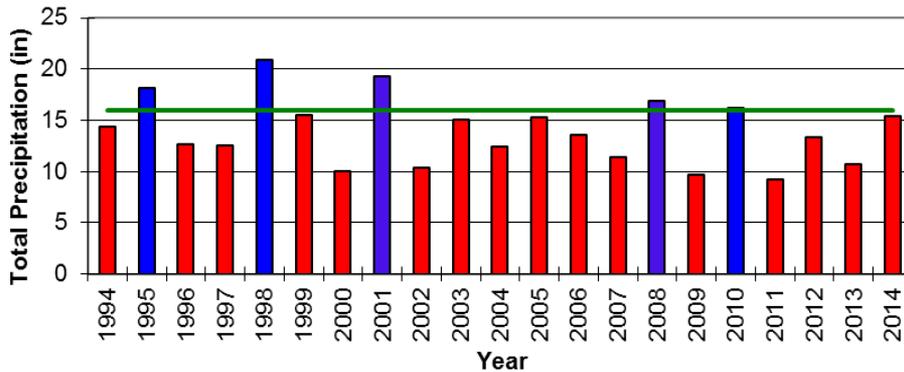
**Salt Watershed 12-month Precipitation
(Oct-Sep) Mean 16.08"
8 of last 21 years > mean**



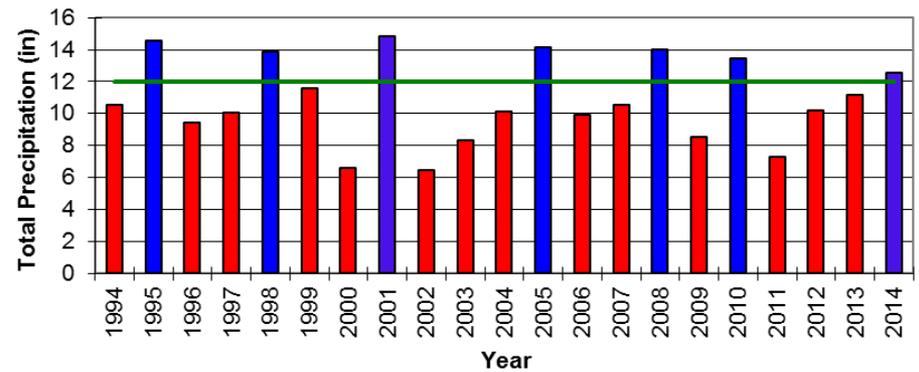
**Little Colorado Watershed 12-month Precipitation
(Oct-Sep) Mean 14.35"
6 of last 21 years > mean**



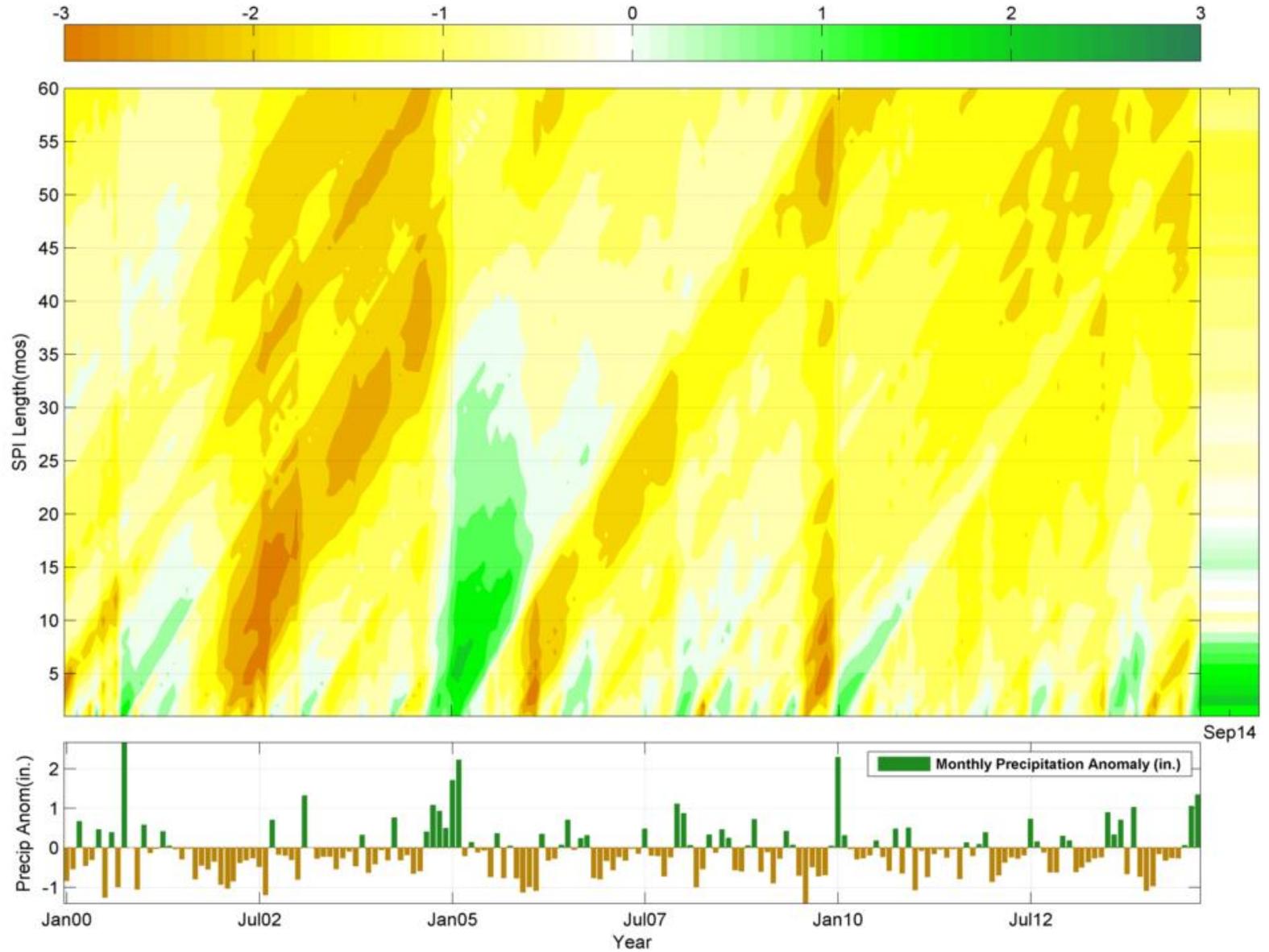
**Santa Cruz Watershed 12-month Precipitation
(Oct-Sep) Mean 15.96"
5 of last 21 years > mean**



**Upper Gila Watershed 12-month Precipitation
(Oct-Sep) Mean 12.00"
7 of last 21 years > mean**



Arizona - Standardized Precipitation Index - (1-60 mos, Jan2000 - Sep2014)



Questions ?

Nancy J. Selover
Arizona State Climate Office
Arizona State University

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<http://azclimate.asu.edu>

Winter 2014-15 Outlook Summer 2015 Preview

Mark O'Malley



National Weather Service

Phoenix, AZ

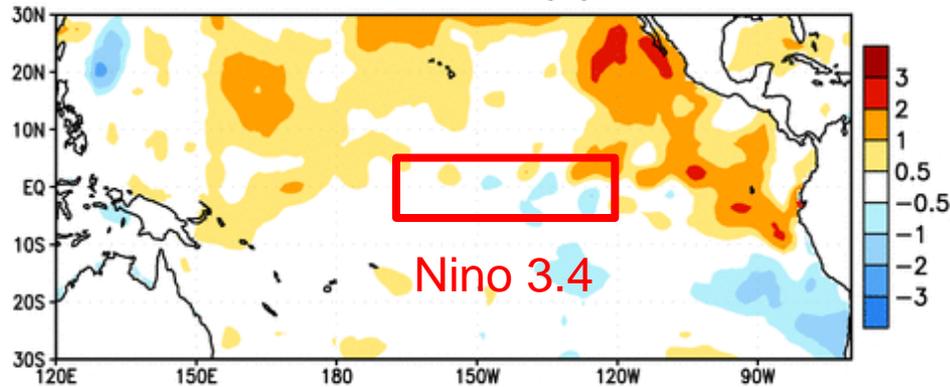
www.weather.gov/phoenix

Arizona Winter Influences

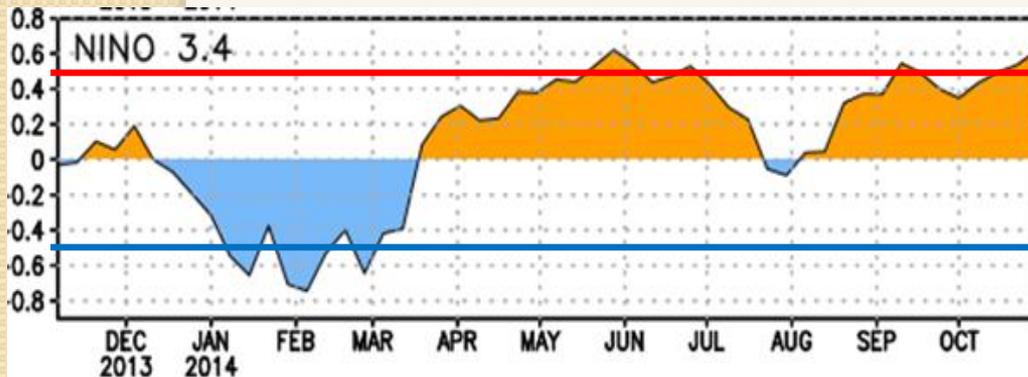
- El Nino Winters...
 - Mild/cool temperatures, wetter than normal during stronger El Ninos
- La Nina Winters...
 - Warm temperatures, almost always drier than normal
- Neutral Winters...
 - Near normal temperatures, varying amounts of precipitation (many other factors in play)
- Pacific Decadal Oscillation
 - “Warm phase” enhances precipitation chances
 - “Cold phase” decreases precipitation chances

Conditions in Tropical Pacific

Week centered on 13 AUG 2014
SST Anomalies (°C)



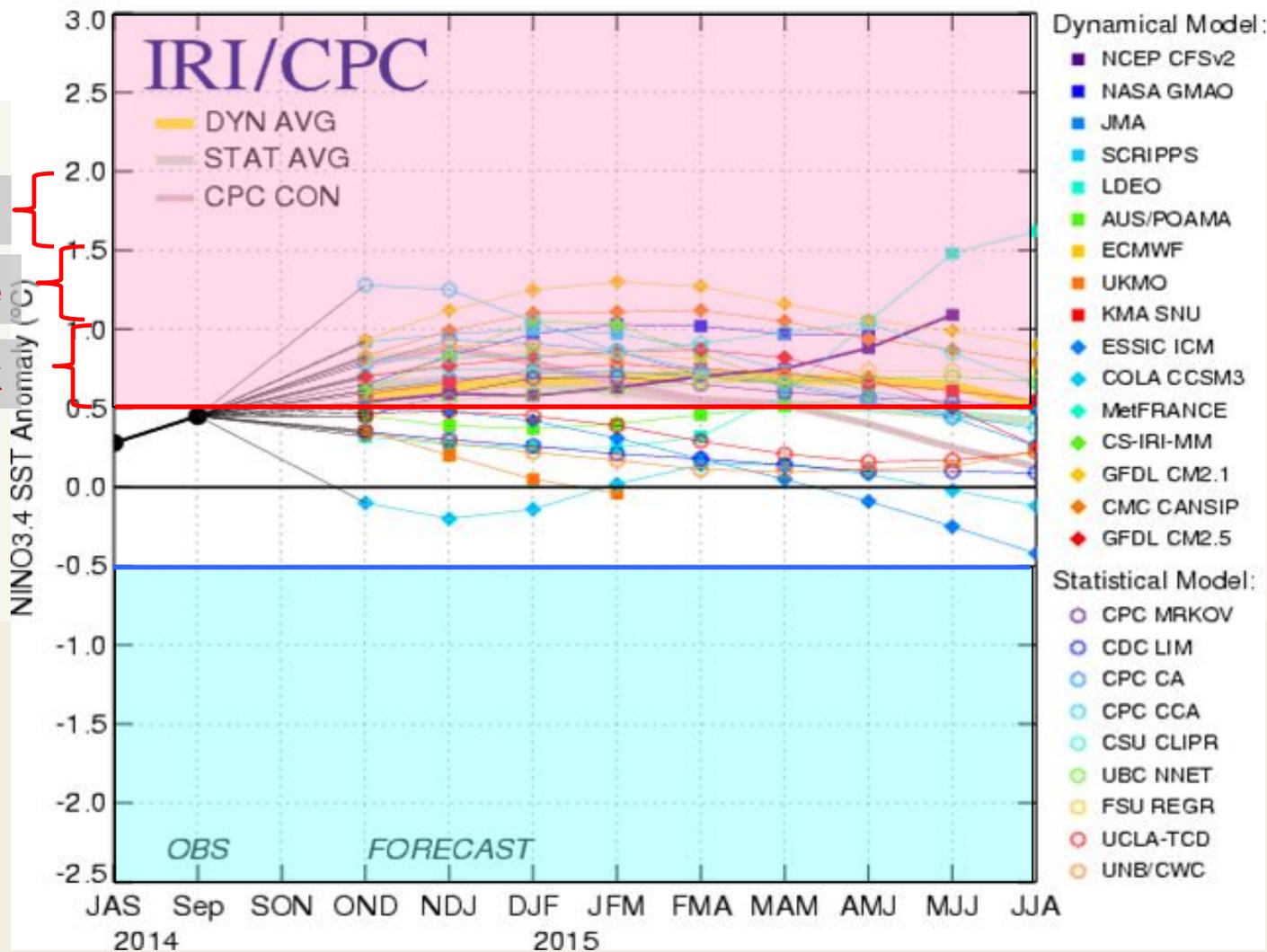
- Equatorial central Pacific waters have been warming since March
- Sea surface temperatures (SST) have been flirting with the El Nino threshold since May
- Large fluctuations in SST's over the summer and fall have kept a mature El Nino from developing



El Nino Outlook

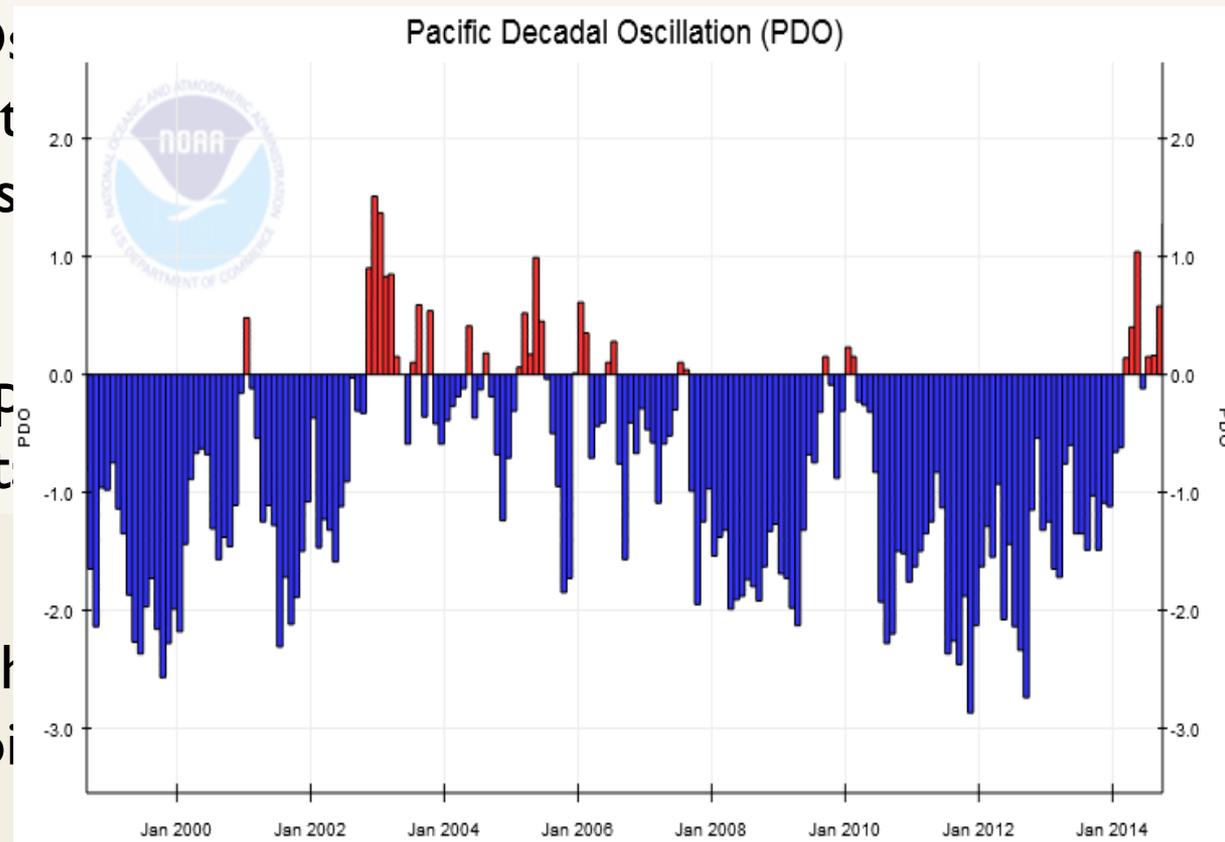
Mid-Oct 2014 Plume of Model ENSO Predictions

Strong
Moderate
Weak



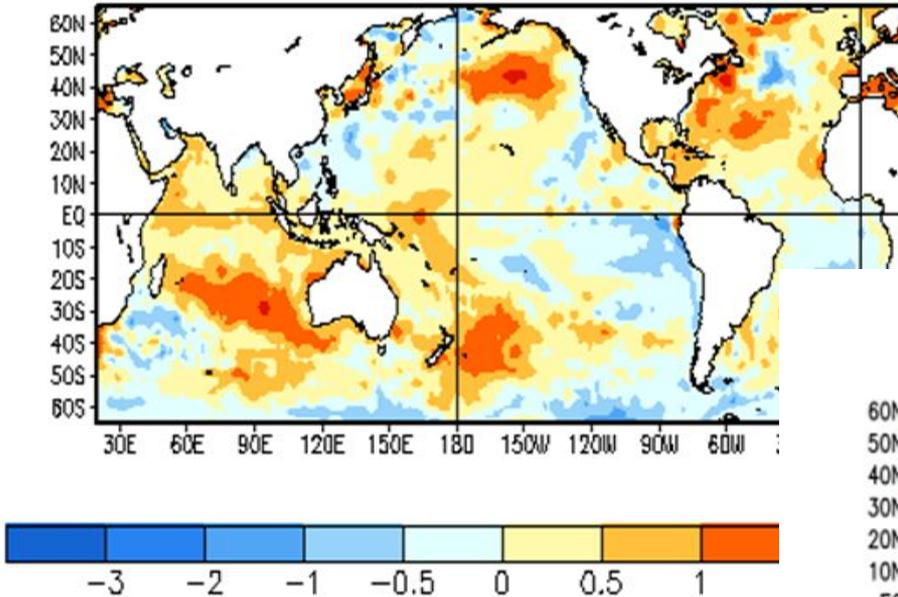
Weak El Nino's provide little predictable influence...what else

- Pacific Decadal Oscillation (PDO)
Long-term oscillation in the north Pacific sea surface temperatures
- Warm (positive) phase
enhanced precipitation in the
Arizona
- Cool (negative) phase
diminished precipitation in the
Arizona



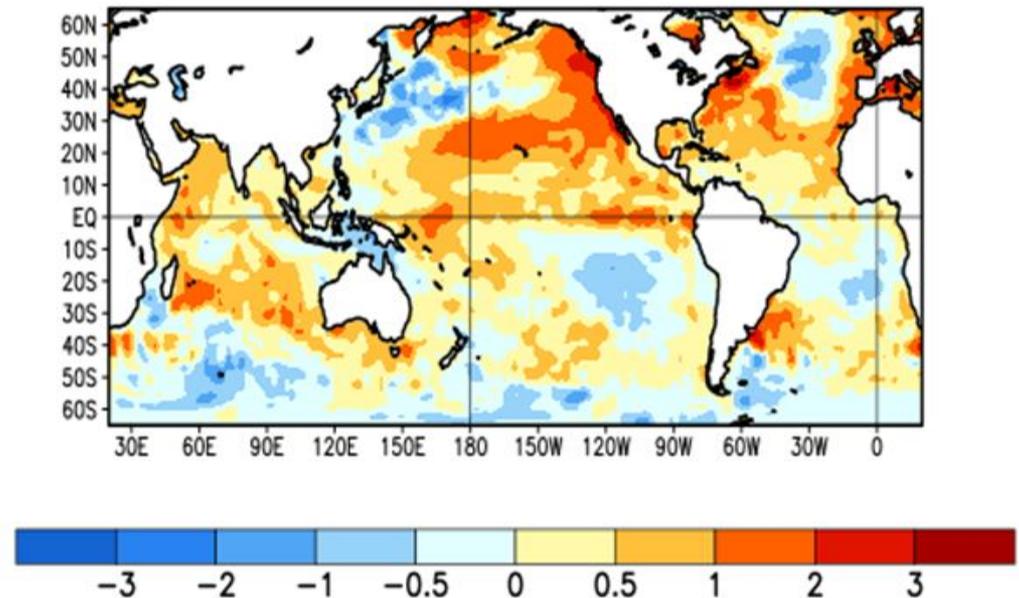
Latest Ocean Temperatures

Average SST Anomalies
27 OCT 2013 – 23 NOV 2013



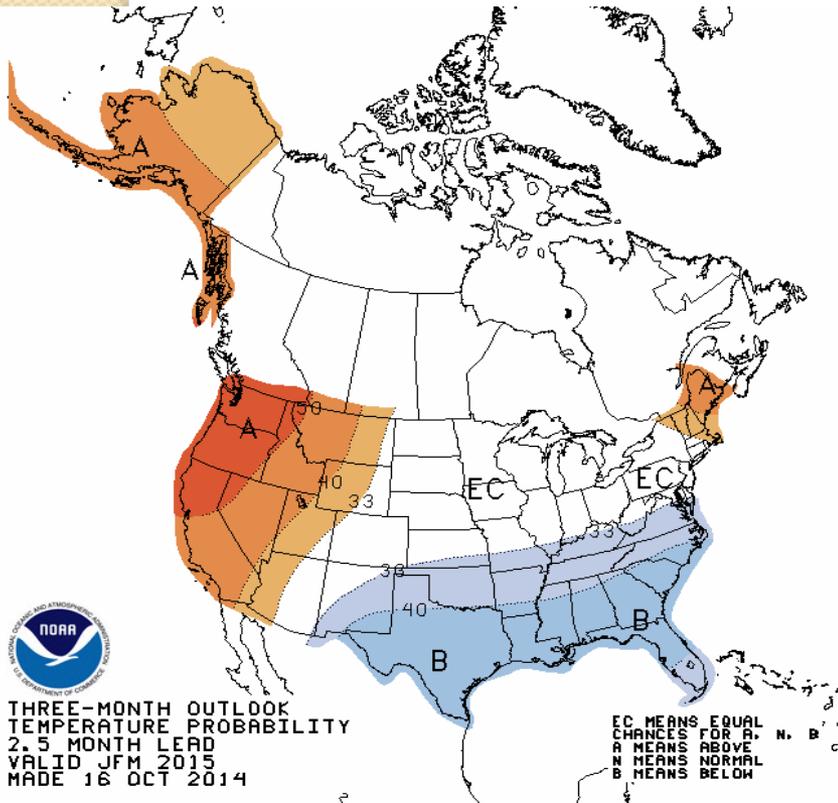
- November 2013: Negative PDO
 - Colder than normal water hugging U.S. West coast
 - Warmer than normal water over North Central Pacific

Average SST Anomalies
5 OCT 2014 – 1 NOV 2014



- November 2014: Positive PDO
 - Warmer than normal water hugging U.S. West coast
 - Colder than normal water over North Central Pacific

Outlook: Jan/Feb/Mar 2015

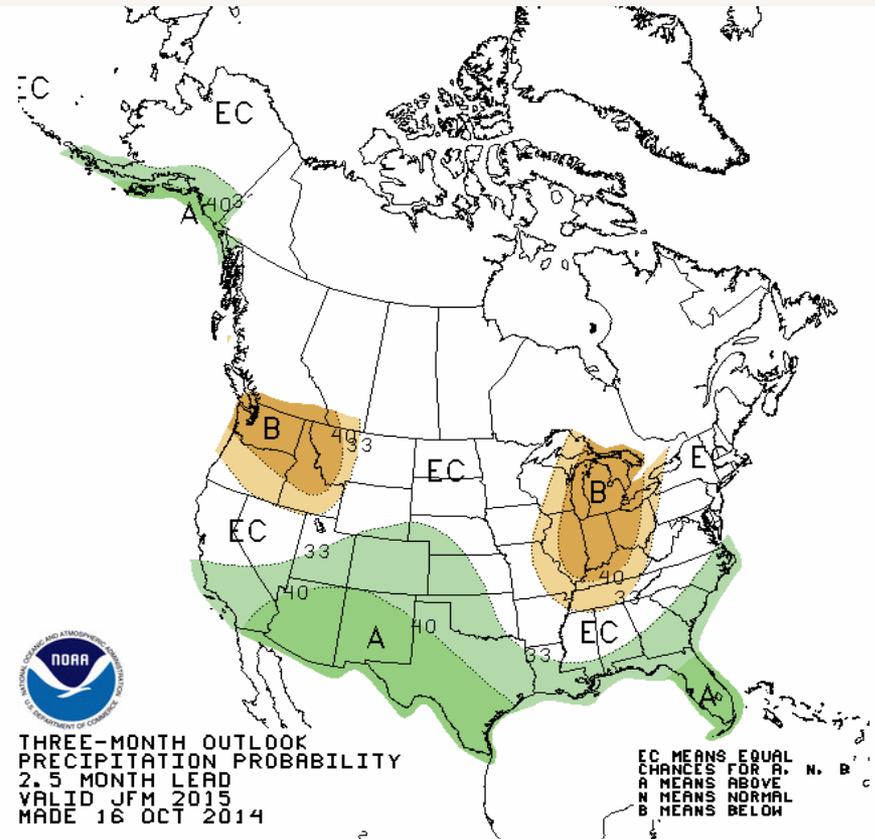


Near equal odds for
above, below, or near
normal temperatures

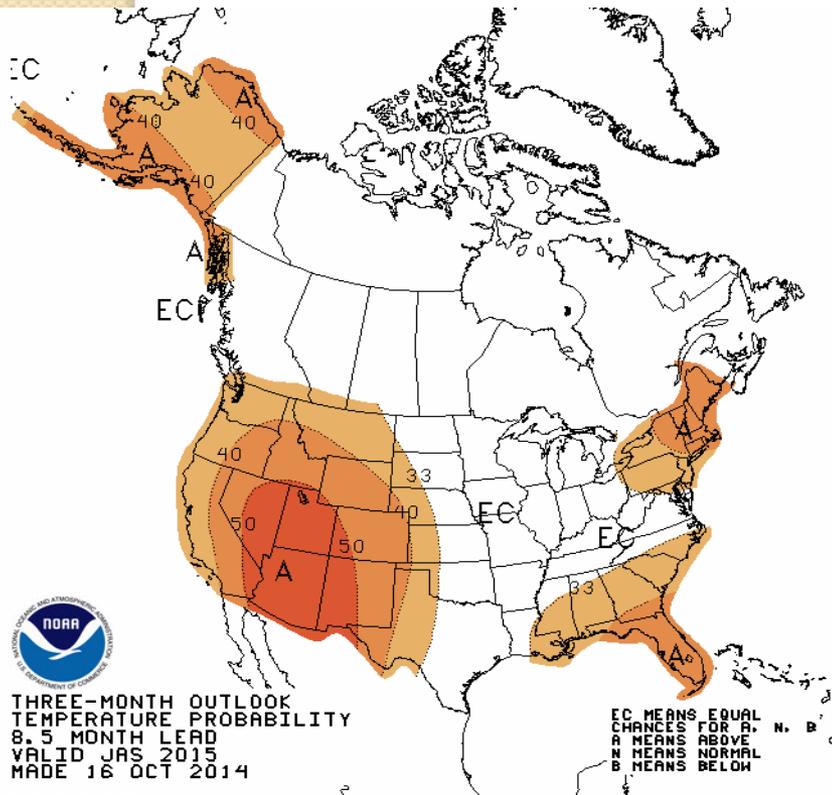
Better odds of above
average precipitation

Three-month averages

Shading indicates chances
of above/below normal



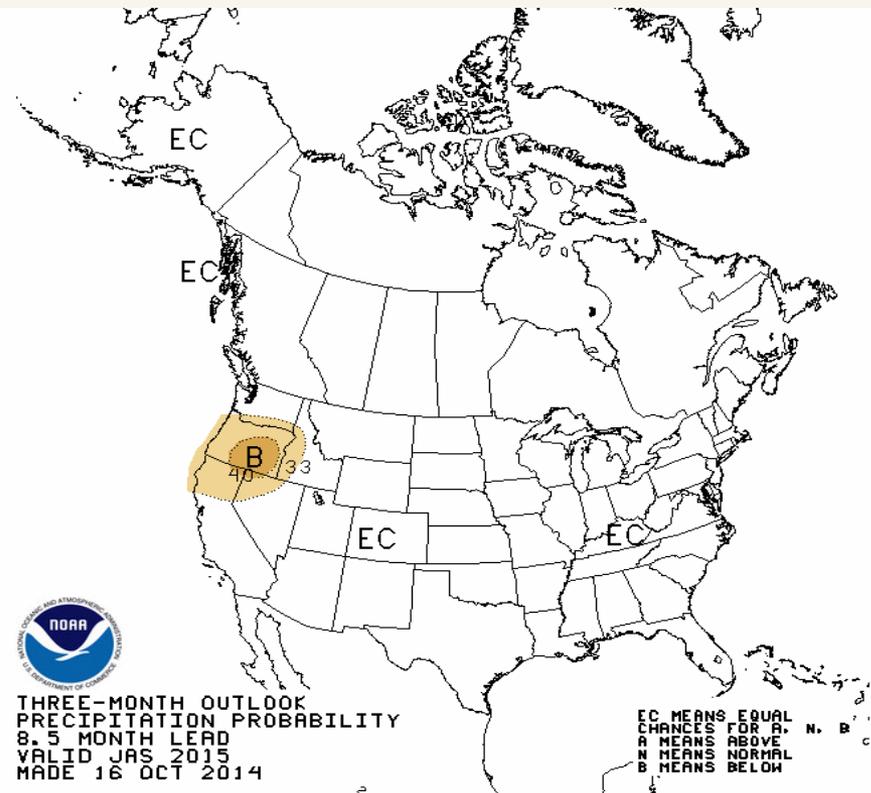
Outlook: Jul/Aug/Sep 2015



Three-month averages
Shading indicates
chances of above/below
normal

Temperatures most
likely warmer than
normal

No tilt in odds for
precipitation totals



Summary

- The outlook for winter 2014-15 indicates a 58% chance for El Nino development
- The most likely outcome is for a brief, weak El Nino event through the winter and early spring
- Weak El Nino events provide little predictable influence on weather across Arizona
- A shift in the PDO measure towards positive may be a more significant player in Arizona winter weather
- Odds are shifted towards wetter than normal winter, though no signal exists for temperatures
- The 2015 summer outlook favors better chances for above normal temperatures, but no precipitation signal

Questions? Contact us!

Telephone: 602-275-0073

Home page: www.weather.gov/phoenix

Facebook: www.facebook.com/NWSPhoenix

Twitter: www.twitter.com/NWSPhoenix

E-mail: mark.omalley@noaa.gov

Governor's Drought Interagency Coordinating Group

Local Drought Impacts on Municipal and Domestic Users

Michael J. Lacey

ICG Co-chair, & Director

Arizona Department of Water Resources



Governor's Drought Interagency Coordinating Group

Colorado River Hydrology Update

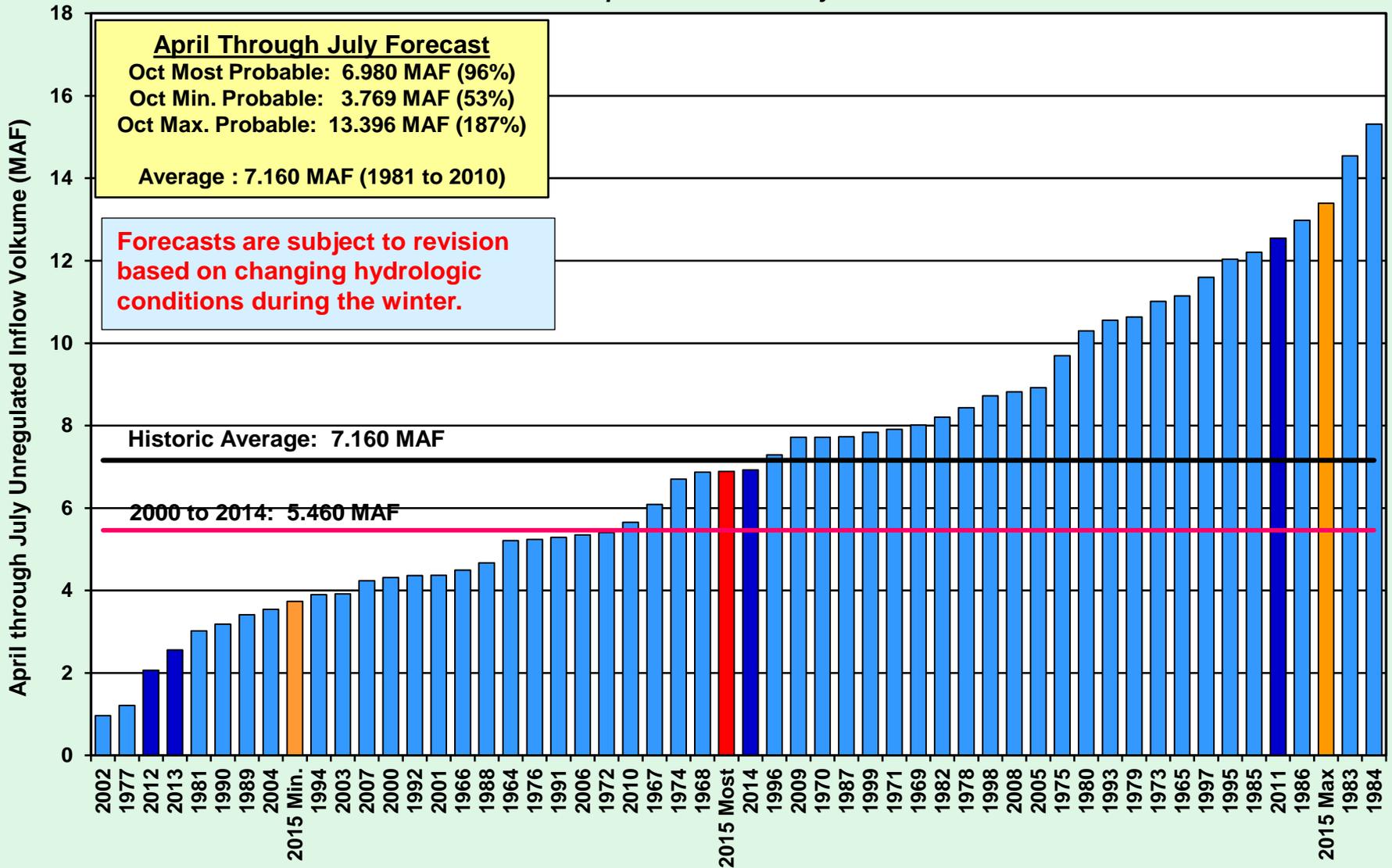
**Thomas Buschatzke, Assistant Director,
Water Planning Division**

Arizona Department Of Water Resources

November 13, 2014



Lake Powell Unregulated Inflow
April through July 2015 (issued October 2014)
Comparison With History



Data Source: United States Bureau of Reclamation:
 October 2014 24-Month Study

Water Year

Lake Powell and Lake Mead Operational Table

Operational Tiers for Water/Calendar Year 2015 Determined from Reclamation's August 2014 24-Month Study

Lake Powell			Lake Mead		
Elevation (feet)	Operation According to the Interim Guidelines	Live Storage (maf) ¹	Elevation (feet)	Operation According to the Interim Guidelines	Live Storage (maf) ¹
3,700	Equalization Tier Equalize, avoid spills or release 8.23 maf	24.3	1,220	Flood Control Surplus or Quantified Surplus Condition Deliver > 7.5 maf	25.9
3,636 - 3,666 (2008-2026)	Upper Elevation Balancing Tier³ Release 8.23 maf; if Lake Mead < 1,075 feet, <u>3,596.62 Ft. balance contents with 3,602.24 Ft.</u> Jan. 2015 Projection a min/max release of 7.0 and 9.0 maf October 2014 Jan. 2015 Projection	15.5 - 19.3 (2008-2026)	1,200 (approx.) ²	Domestic Surplus or ICS Surplus Condition Deliver > 7.5 maf	22.9 (approx.) ²
3,575		Mid-Elevation Release Tier Release 7.48 maf; if Lake Mead < 1,025 feet, release 8.23 maf	9.5	1,145	Normal or ICS Surplus Condition Deliver ≥ 7.5 maf <u>1,083.37 Ft. 1,084.87 Ft.</u> Jan. 2015 Projection October 2014 Jan. 2015 Projection
3,525	Lower Elevation Balancing Tier Balance contents with a min/max release of 7.0 and 9.5 maf	5.9	1,105	11.9	
3,490		4.0	1,075	9.4	
3,370		0	1,050	7.5	
			1,025	Shortage Condition Deliver 7.083 ⁵ maf	5.8
			1,000	Shortage Condition Deliver 7.0 ⁶ maf Further measures may be undertaken ⁷	4.3
			895		0

Diagram not to scale

¹ Acronym for million acre-feet

² This elevation is shown as approximate as it is determined each year by considering several factors including Lake Powell and Lake Mead storage, projected Upper Basin and Lower Basin demands, and an assumed inflow.

³ Subject to April adjustments which may result in a release according to the Equalization Tier

⁴ Of which 2.48 maf is apportioned to Arizona, 4.4 maf to California, and 0.287 maf to Nevada

⁵ Of which 2.40 maf is apportioned to Arizona, 4.4 maf to California, and 0.283 maf to Nevada

⁶ Of which 2.32 maf is apportioned to Arizona, 4.4 maf to California, and 0.280 maf to Nevada

⁷ Whenever Lake Mead is below elevation 1,025 feet, the Secretary shall consider whether hydrologic conditions together with anticipated deliveries to the Lower Division States and Mexico is likely to cause the elevation at Lake Mead to fall below 1,000 feet. Such consideration, in consultation with the Basin States, may result in the undertaking of further measures, consistent with applicable Federal law.

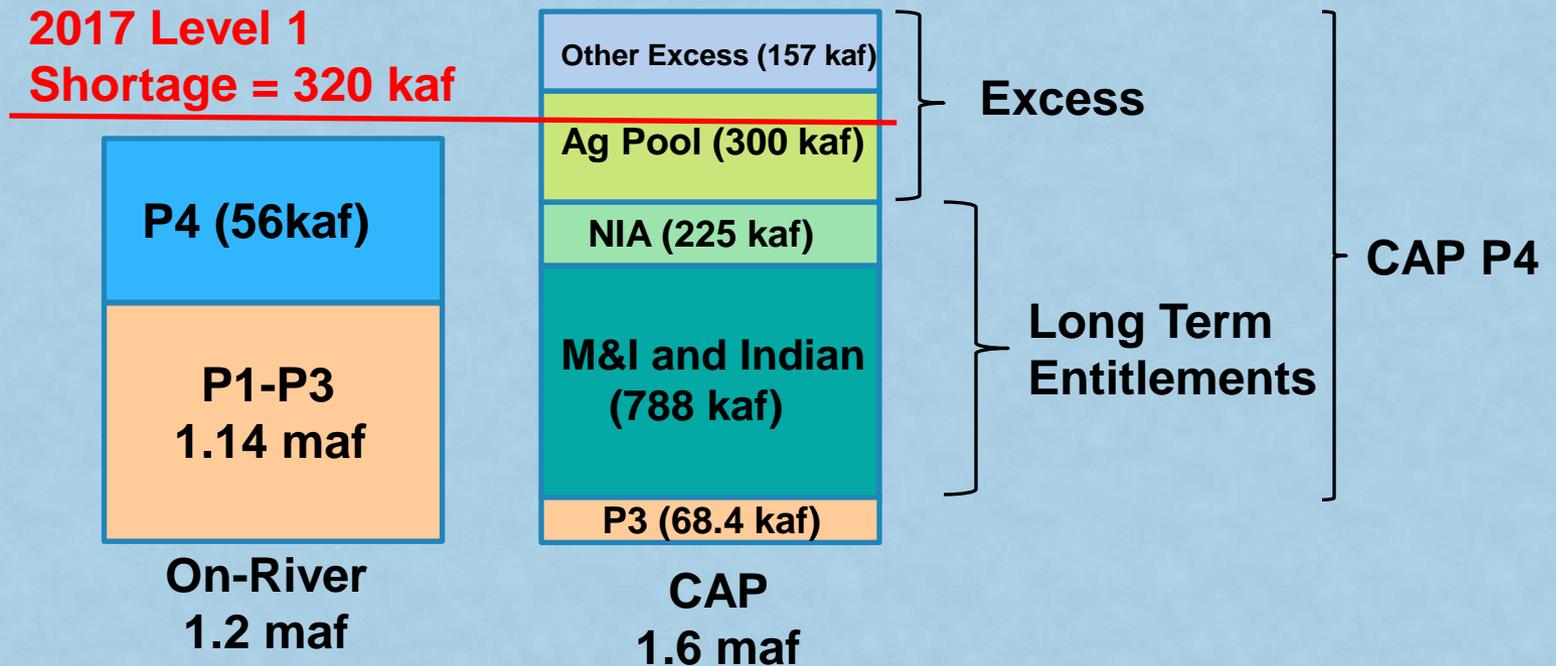
PROBABILITIES OF LOWER BASIN SHORTAGE

	2015	2016	2017	2018	2019
Probability of any level of shortage (Mead \leq 1,075 ft.)	0	25	53	62	61
1 st level shortage (Mead \leq 1,075 and \geq 1,050 ft)	0	25	40	44	37
2 nd level shortage (Mead $<$ 1,050 and \geq 1,025 ft)	0	0	13	14	14
3 rd level shortage (Mead $<$ 1,025)	0	0	0	4	10

From Bureau of Reclamation CRSS modeling based on most probable October 2014 24-Month Study projected reservoir elevations for December 31, 2014.

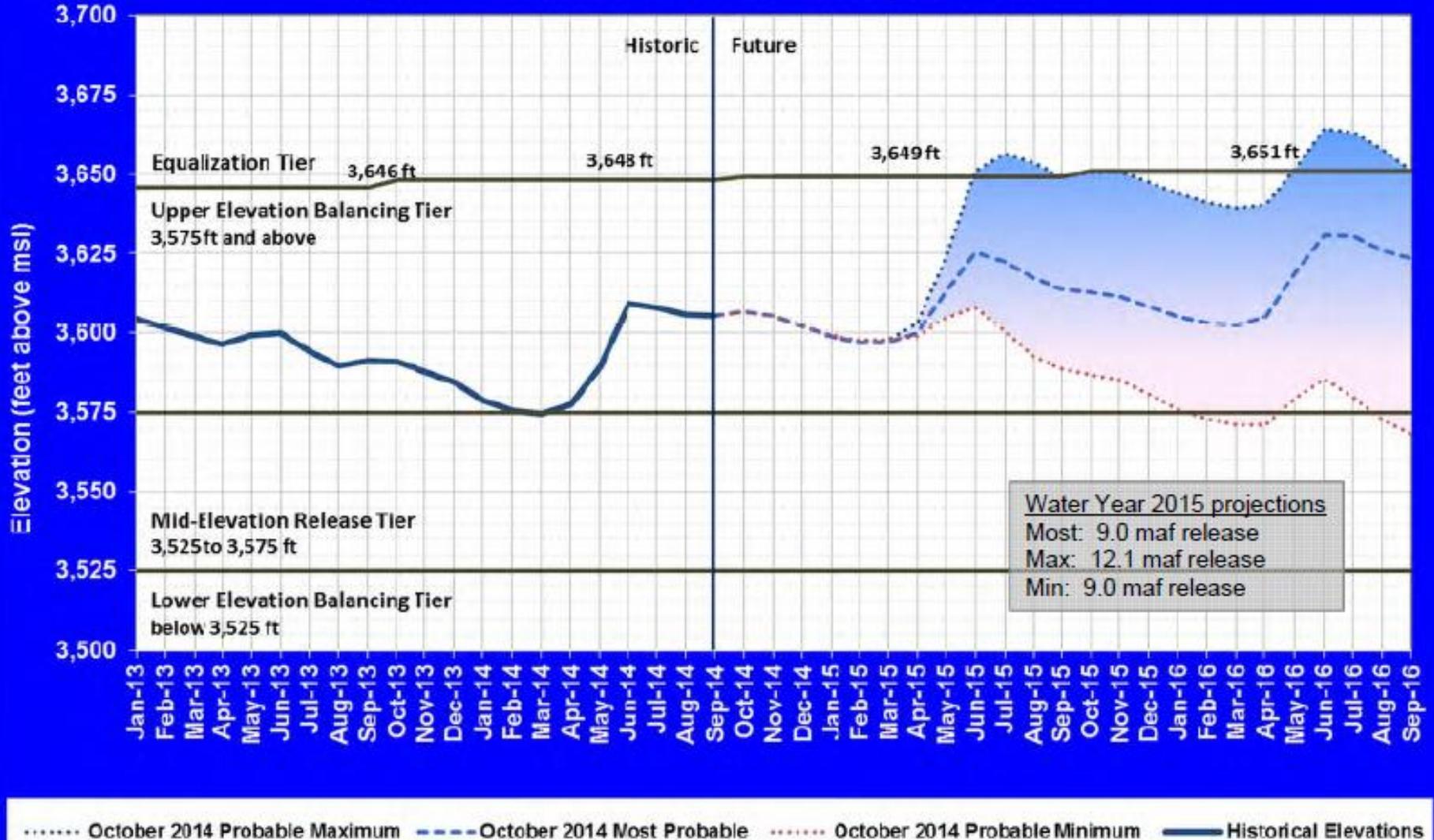


ARIZONA PRIORITIES – 2.8 MAF TOTAL



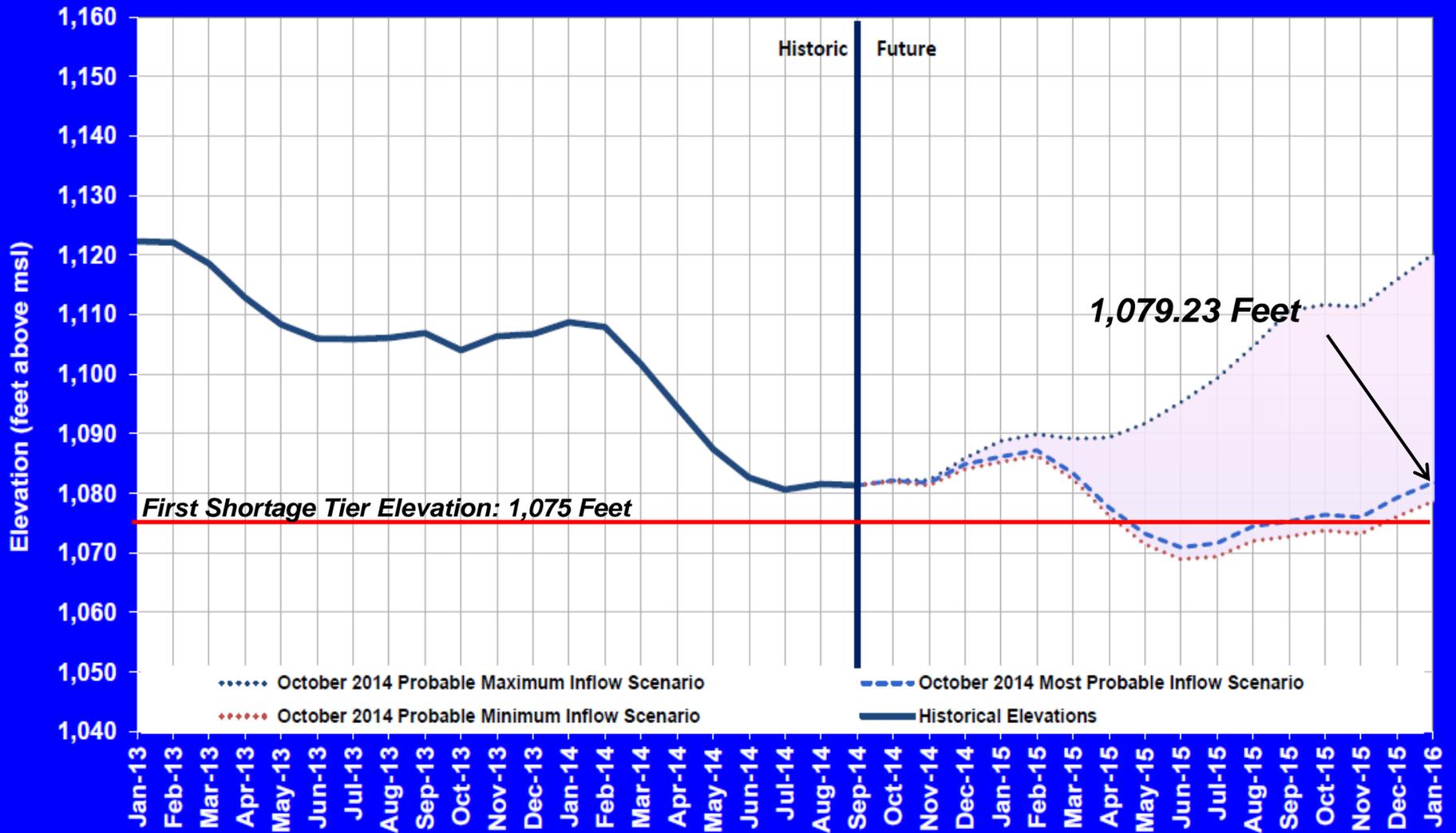
Lake Powell End of Month Elevations

Projections from October 2014 24-Month Study Inflow Scenarios



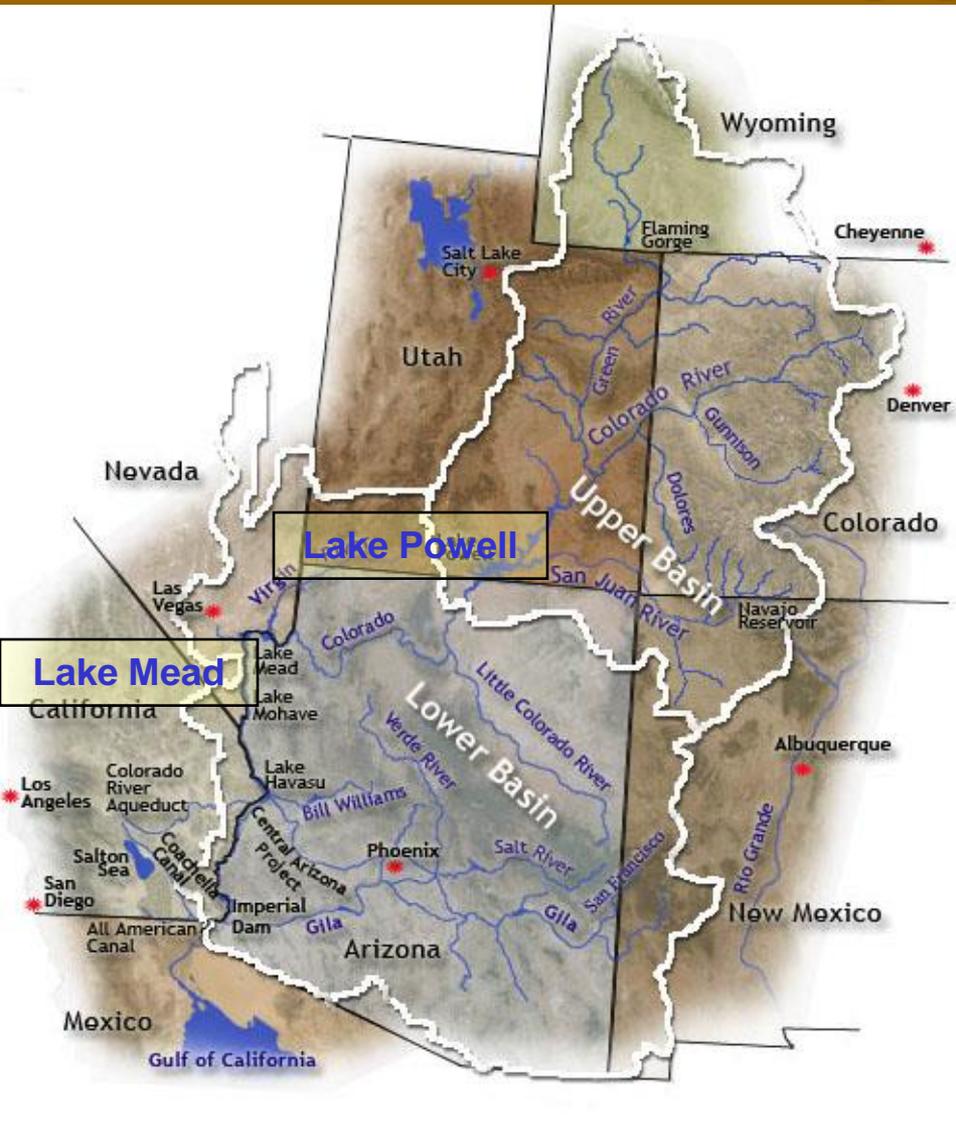
Lake Mead End of Month Elevations

Projections from the October 2014 24-Month Study Inflow Scenarios



* See attached page for an explanation of the three hydrologic scenarios displayed in this chart

Colorado River Basin Water Supply Outlook



**Total Reservoir System Contents:
29.89 MAF or 50%**

(As of November 10, 2014)

**Total Reservoir System Contents
Last Year:**

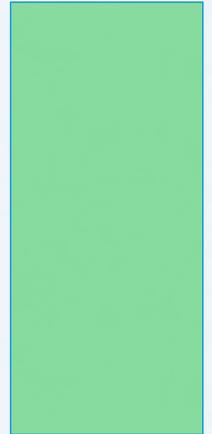
29.58 MAF or 50%

This is a change of + 0.310 MAF





Questions?



DroughtView: New Tools for Monitoring Drought across Arizona

Mike Crimmins

**Dept. of Soil, Water and Environmental Science
University of Arizona Cooperative Extension**



What is DroughtView?

- Web-based tool to access near-real time and historical remotely sensed vegetation 'greenness' data → useful for drought status monitoring
- Building on legacy of *RangeView* developed in early 2000's → new web-technology
- Decision support tool focused on the challenging drought monitoring landscape of western U.S.



What is it for?

- Assessing (especially rapid) changes in short-term drought conditions
- Interrogating potential drought impacts at fine spatial scales (zoom and supporting data layers)
- Providing data synthesis and reporting functions (image capture) for drought narratives and reports



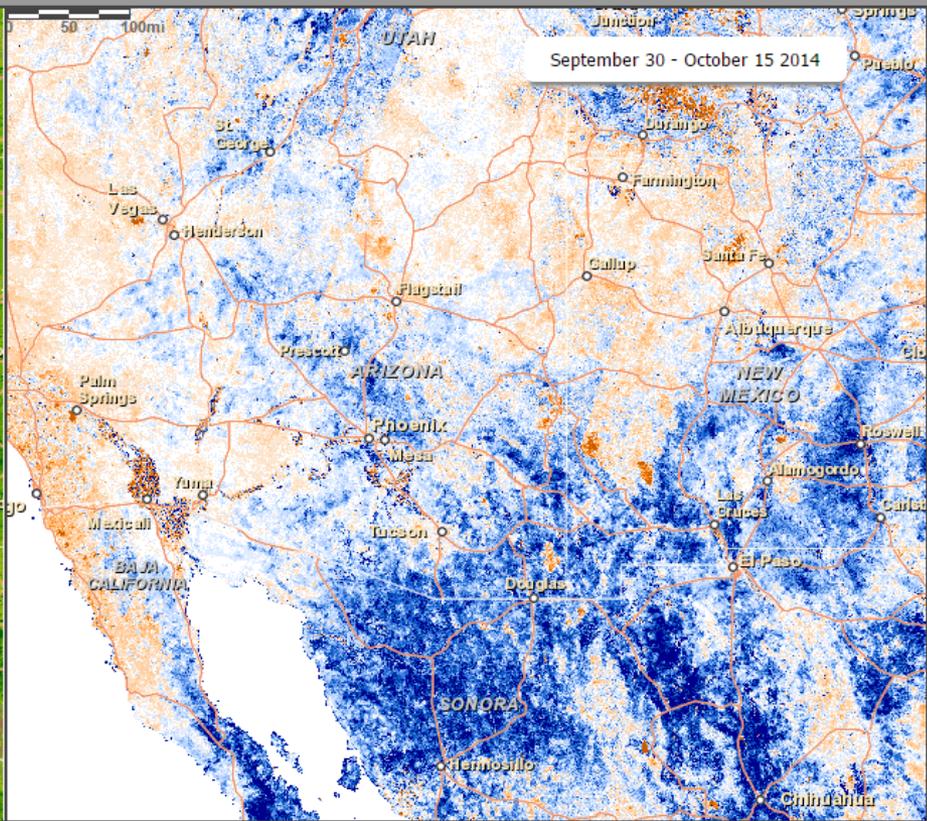
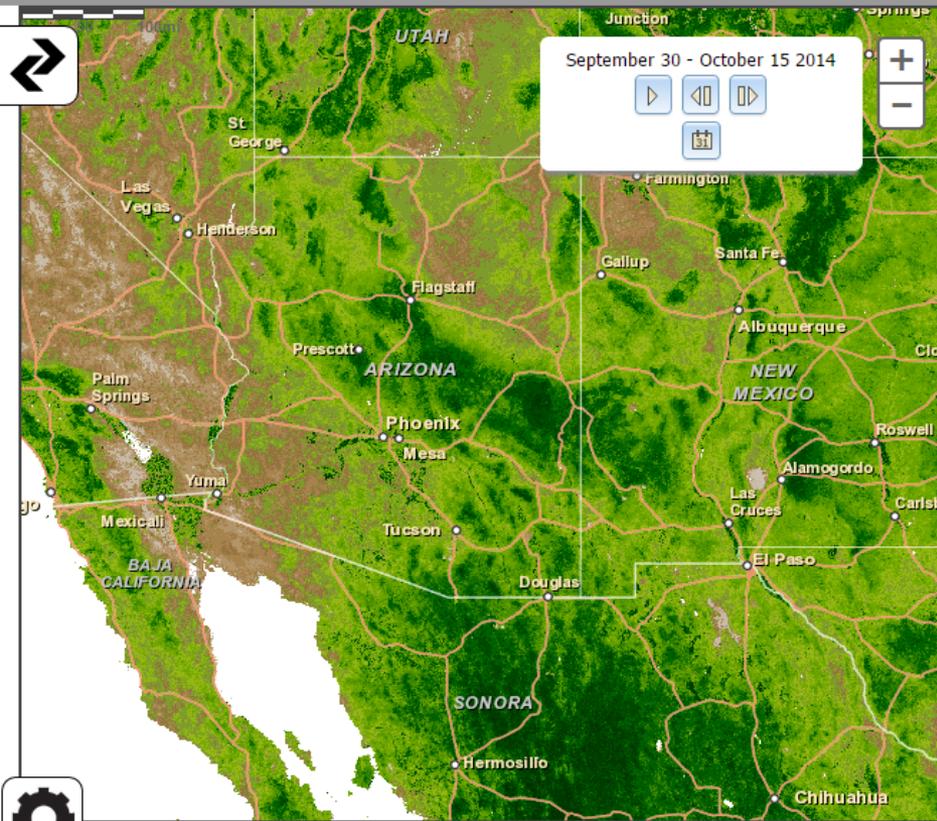
Available Data and Information

Available Now	Available Soon/under development
MODIS Normalized Difference Vegetation Index, biweekly composite, 2000-present	NOAA AHPS weekly to monthly precipitation composites, percent of average (2005-present)
MODIS Enhanced Vegetation Index, biweekly composite, 2000-present	PRISM precipitation and temperature composites (2000-2013)
MODIS Cloud/Snow Mask	Daily MODIS NDVI and EVI (to bring remote sensing data up to real-time)
Multiple supporting data layers (management units, watersheds, roads...)	Other gridded climate/drought indices(?)
Aerial photo and topographic image background layers	

Functions

- Current site functions...
 - Mobile-phone ready display
 - Access historical images, animate time series
 - Report generator based on current view
 - Share link for field recon; social media and blogs
- Functions under development
 - Spatially explicit drought impact reports (replacing AZ DroughtWatch)
 - Analog lookup tool (find past year most similar to present conditions)





Product:

Show:

Product:

Show:

<http://droughtview.arizona.edu/>



Select Layers:



- Boundaries and Places
- Roads
- Water Bodies
- Management Agency
- Native American Areas
- Watersheds

Synchronize:

- Time
- Extents

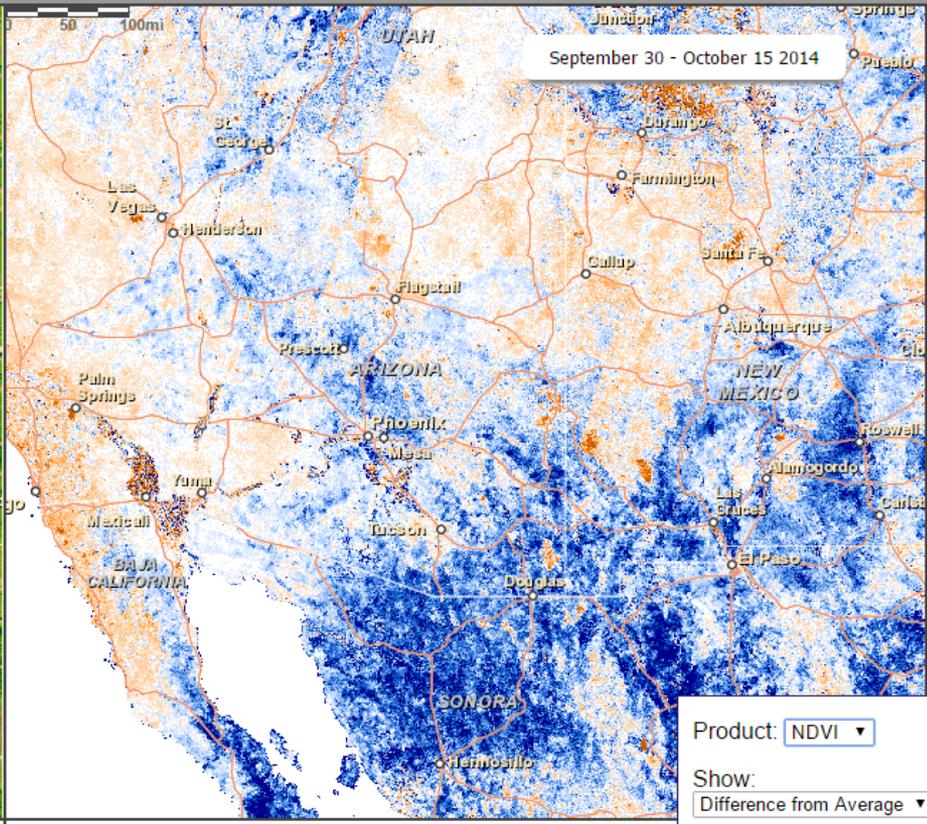
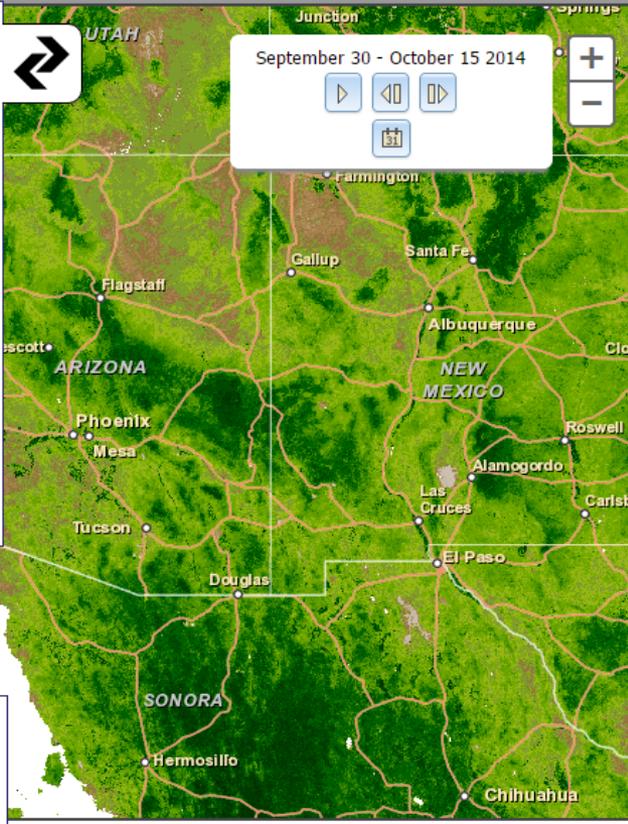
Share

Create Share Link



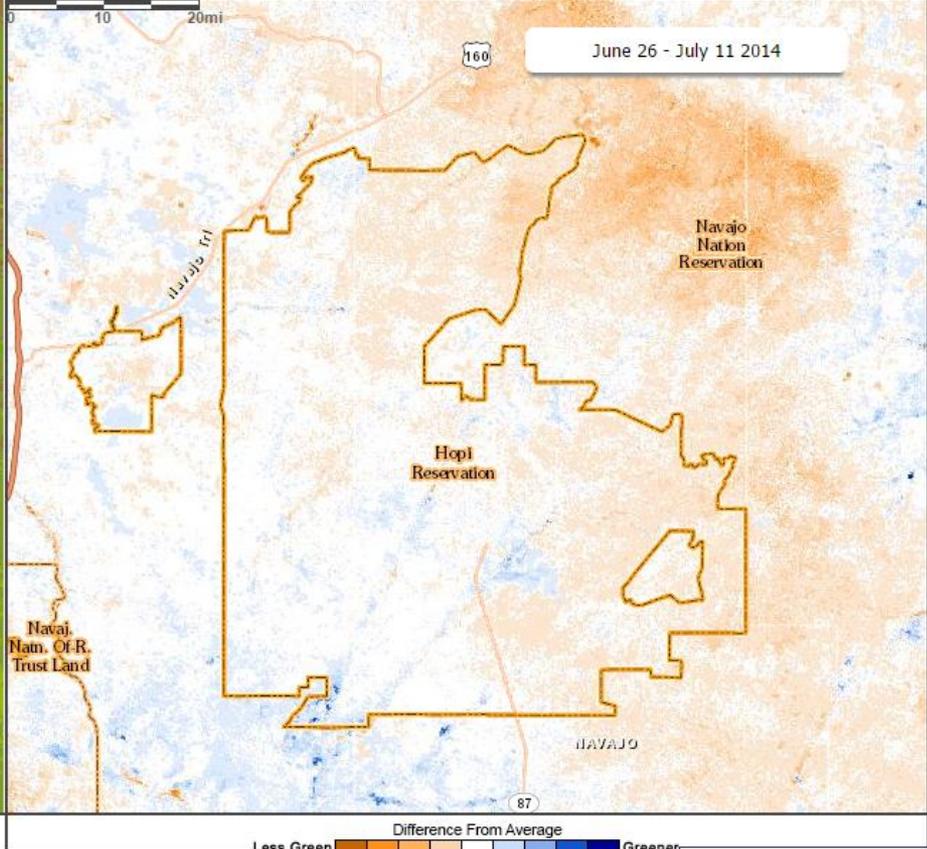
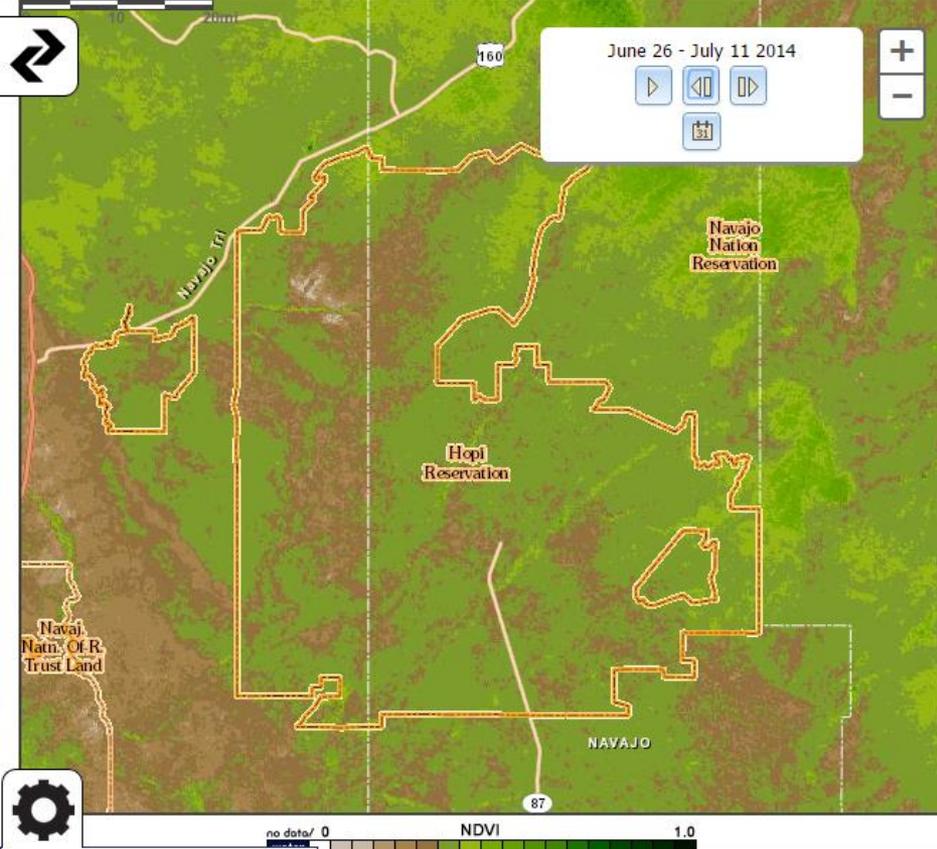
Product: NDVI ▾

Show: Vegetation Index ▾



Product: NDVI ▾

Show: Difference from Average ▾



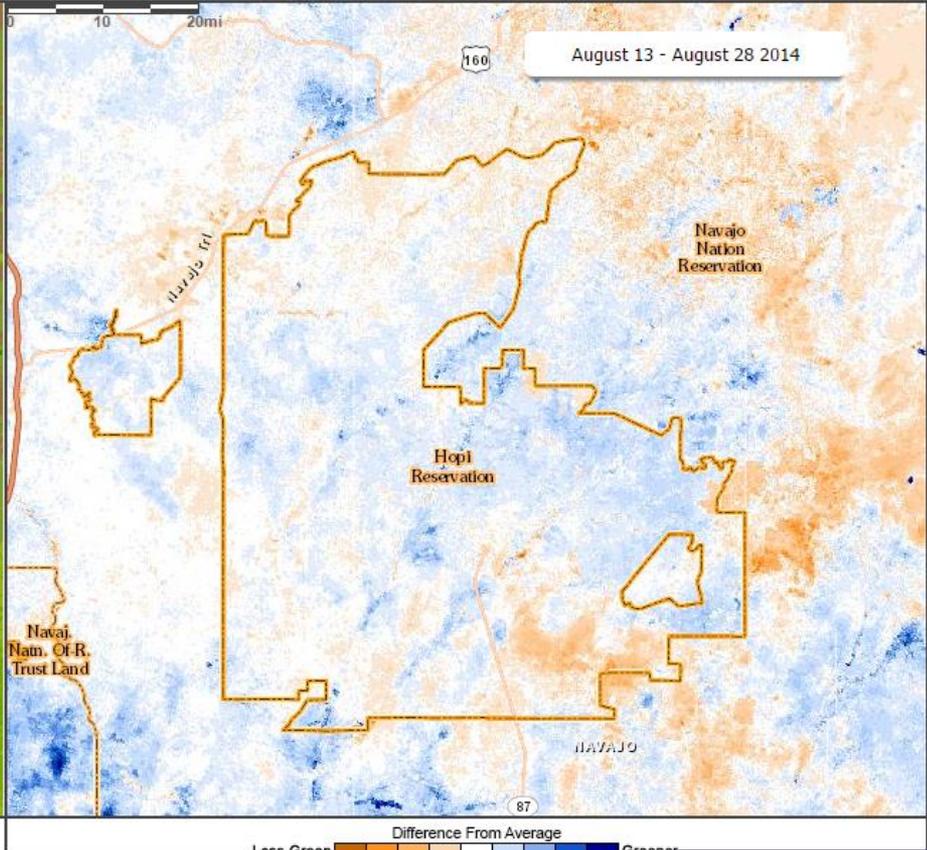


Product:

Show:

Product:

Show:

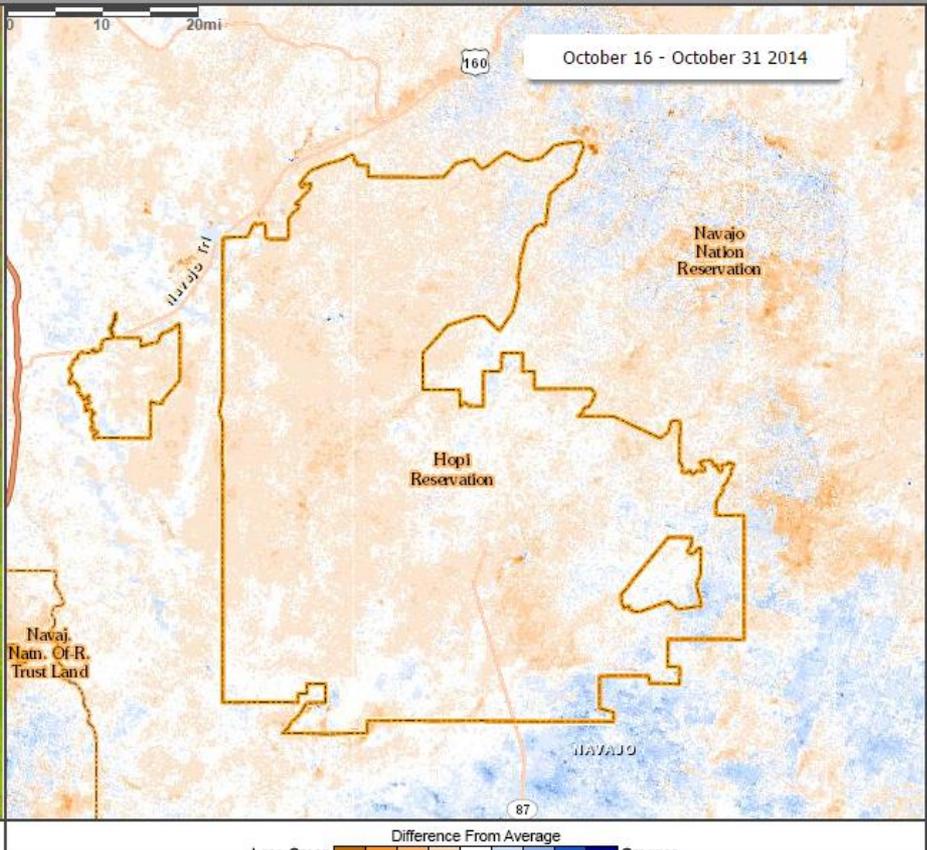
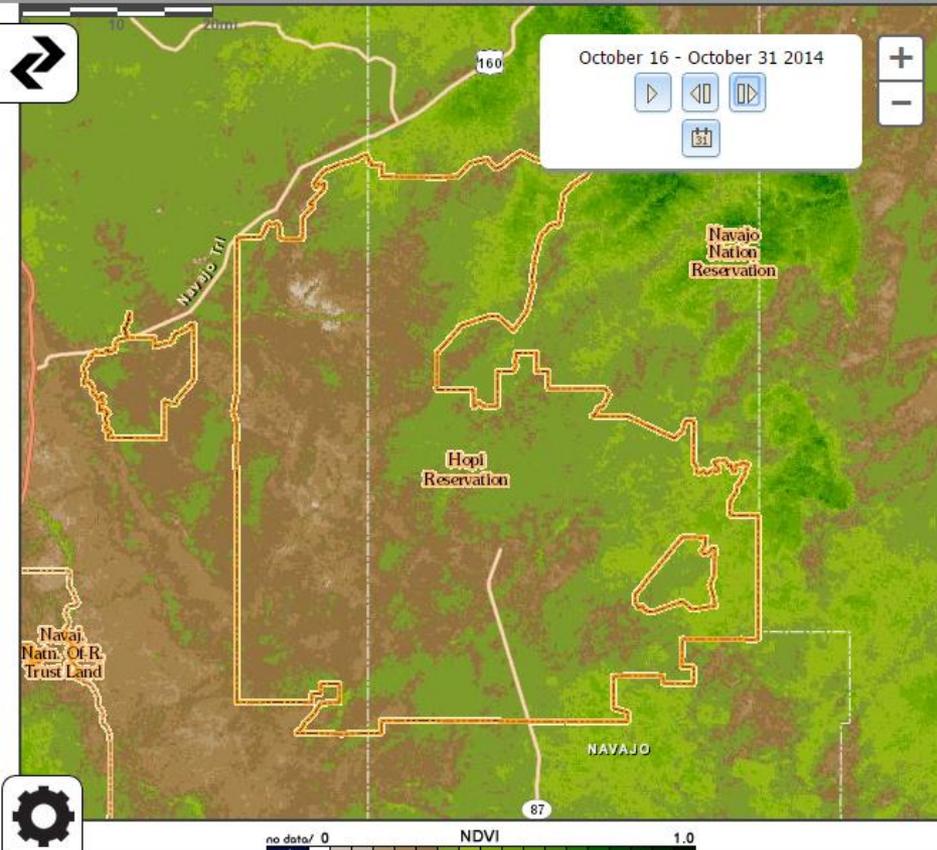


Product: NDVI

Show: Vegetation Index

Product: NDVI

Show: Difference from Average



Thanks!

crimmins@email.arizona.edu

<http://cals.arizona.edu/climate>



2014 WILDFIRE SEASON RECAP

GOVERNOR'S DROUGHT
INTERAGENCY COOR GROUP
NOVEMBER 13, 2014

Byron Kimball
Planning and Preparedness Officer
Arizona State Forestry



2014 Fire Season Stats

(to Date)

- ▶ 2014 Statewide Area Burned: 183,406 Acres
- ▶ 2014 Statewide # of Fires: 1,541 Fires

Across all jurisdictions

2013 Statewide Area Burned: 104,351 Acres

2013 Statewide #of Fires: 1,582 Fires

10 Yr. Avg. (2003-2012) 334,057 Acres

10 Yr. Avg. (2003-2012) 2,526 Fires

2014 Fire Season Stats

Large Fires – 100 acres +

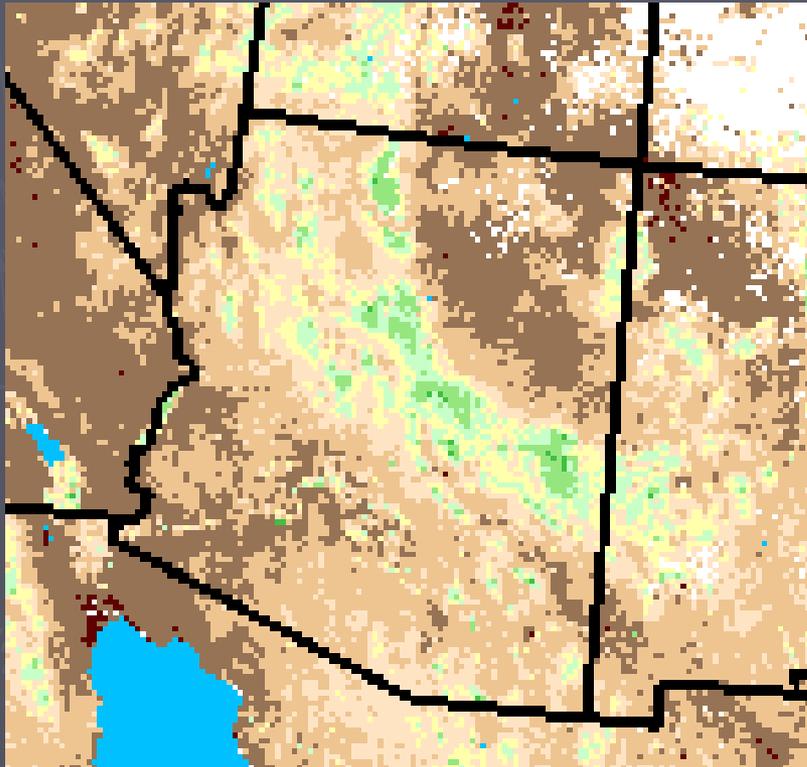
- ▶ From 4/4, the Lion Incident (300 acres burned)
- ▶ To 08/26, the Belknap Incident (2,256 acres burned)
- ▶ 38 fires of more than 100 acres
- ▶ 23 fires of greater than 1,000 acres
- ▶ 6 fires of greater than 10,000 acres

Visual Greenness

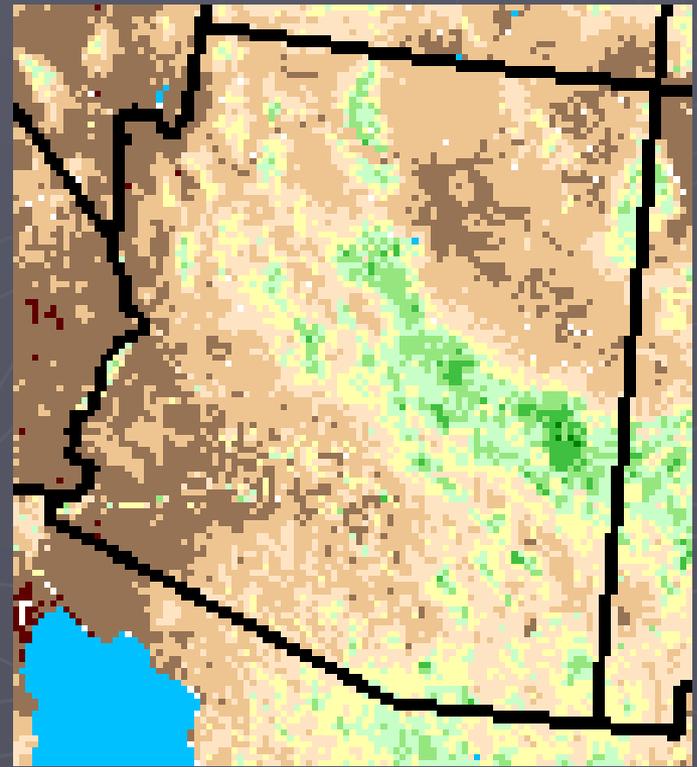
Compares to
Irrigated Green Field

Majority of state is
10 to 20% of
possible green

2013



2014



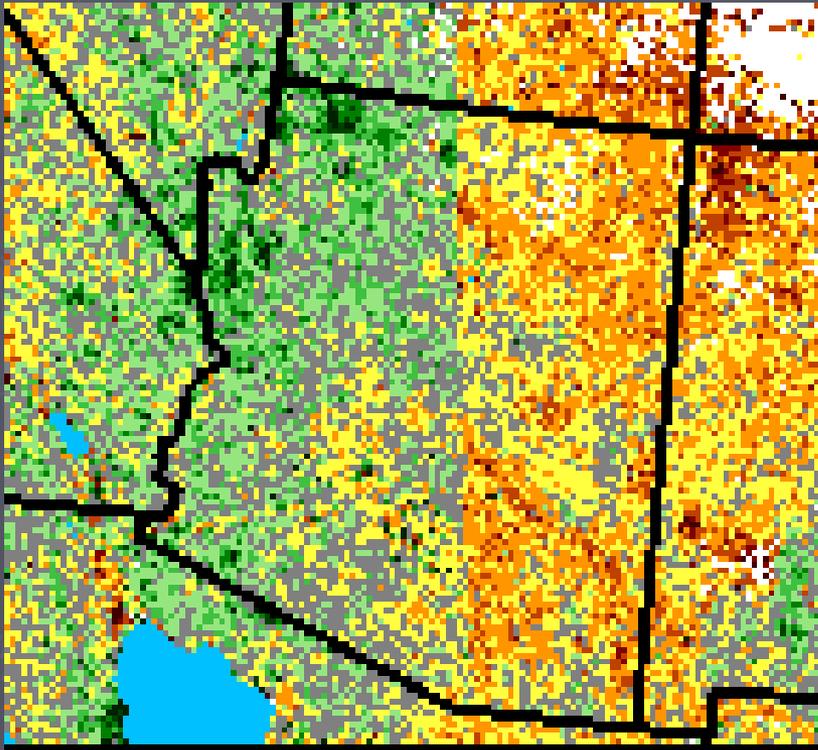
Departure from Average

Percentage of greenness
as compared to the
historical average for this
time of year

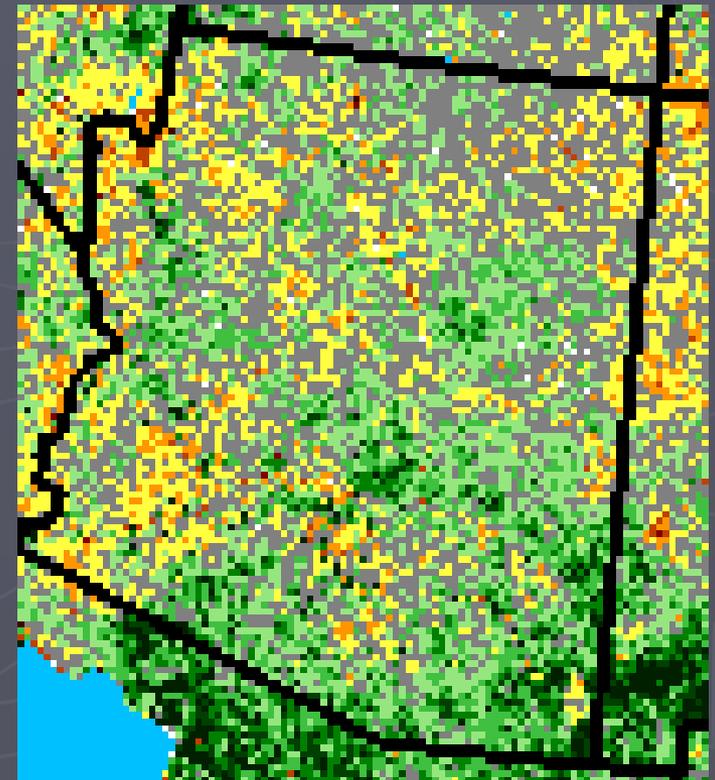
Grades East to West
65% to 150%

Historical Baseline
1989 to 2003

2013



2014



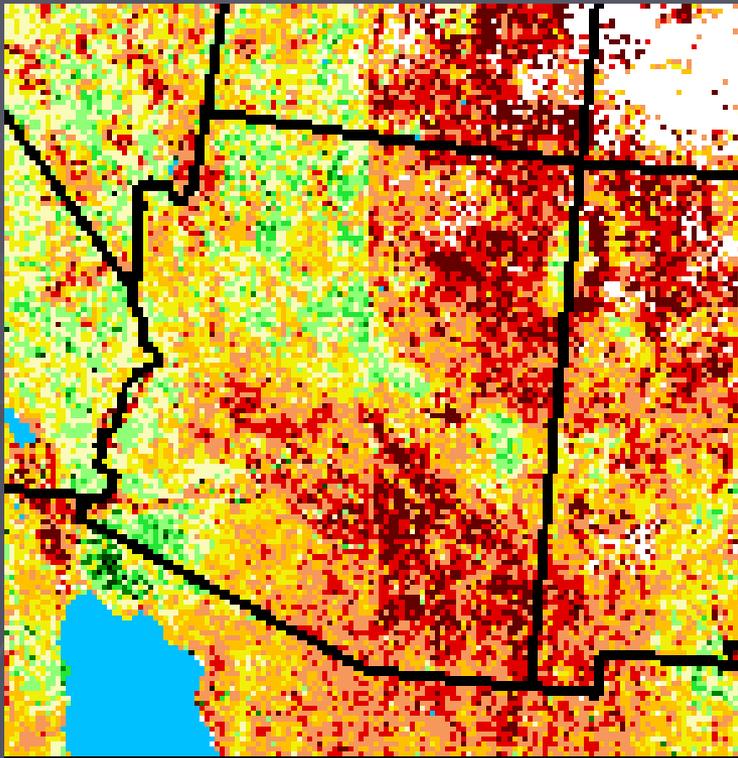
Relative Greenness

Percentage of the historical high for the pixel

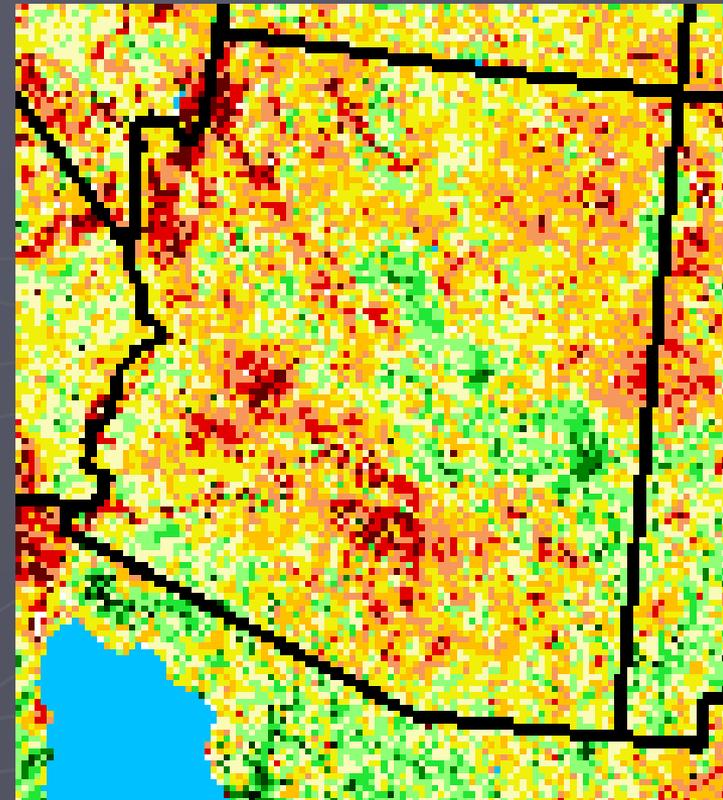
At best we are 80% of historical greenness for this time of year. Most of state is well below 50%.

Historical Baseline
1989 to 2003

2013



2014



QUESTIONS?



Governor's Drought Interagency Coordinating Group

November 13, 2014

Forest Health Update



Bob Celaya, Forest Health Specialist

Arizona State Forestry Division

Forest and Woodland Health and Drought in 2014

- ◆ Bark beetle activity in 2014 was mainly confined to southeast Arizona.
- ◆ Localized drought may have affected the health of forests and woodlands in this part of the state.
- ◆ Most surprising was the detection of native bark beetles infesting non-native pines in the desert.

Bark Beetle Mortality of Aleppo Pines in the Tucson Area-2014



**Tanque Verde & Grant Rd
Area**



I-19 & West Ajo Way

Bark Beetles on Aleppo Pine-2014



Inner Bark Galleries

Bark Beetles



Localized drought response by oak-woodland vegetation in Molino Basin-August 2014

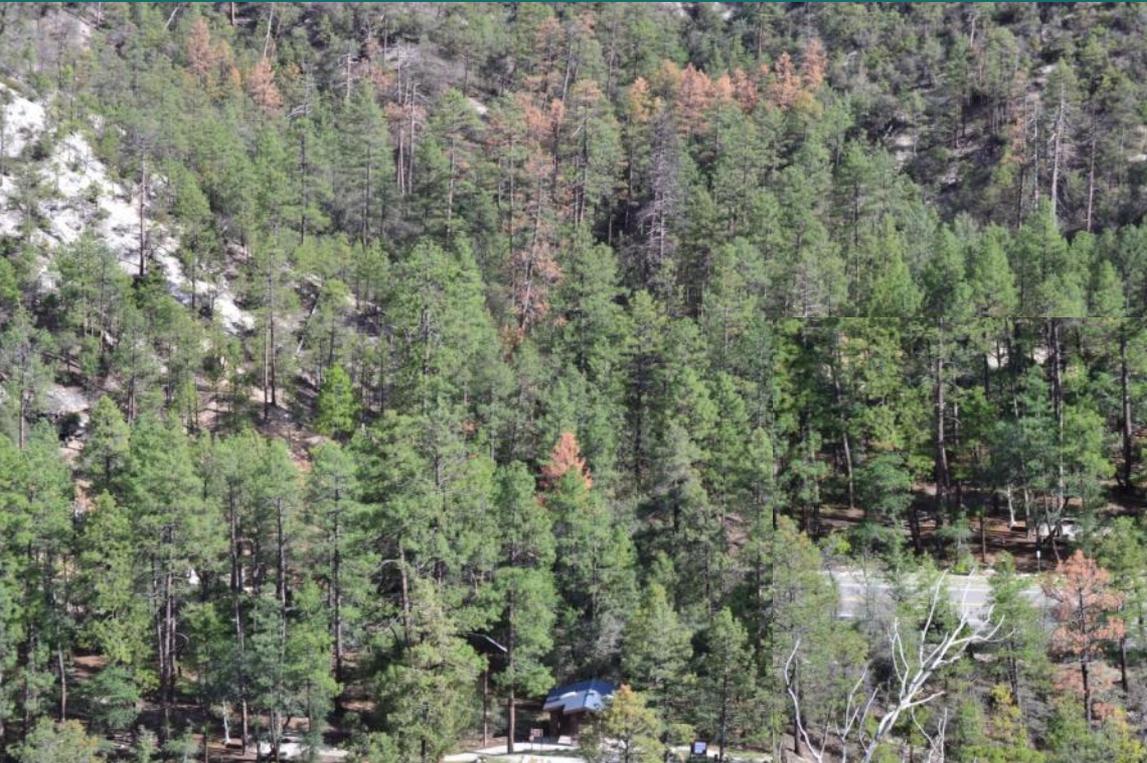


Catalina Mountains

Oak Refoliated by September 2014



Bark Beetles in Bear Canyon-August 2014



Questions?



Bob Celaya, Forest Health Specialist
bobcelaya@azsf.gov
602-771-1415

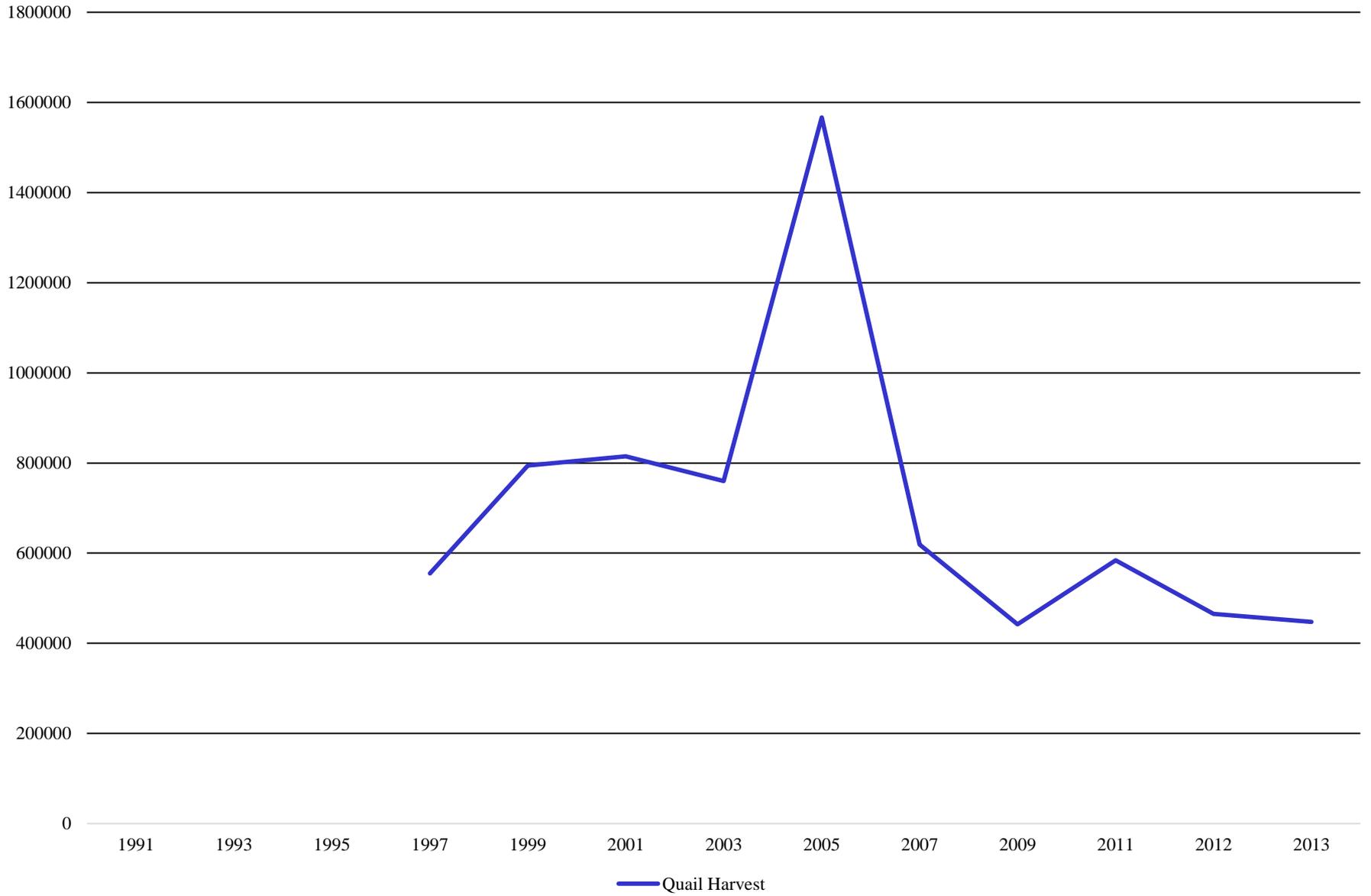
IMPACTS OF DROUGHT ON WILDLIFE 2014

Ed Jahrke

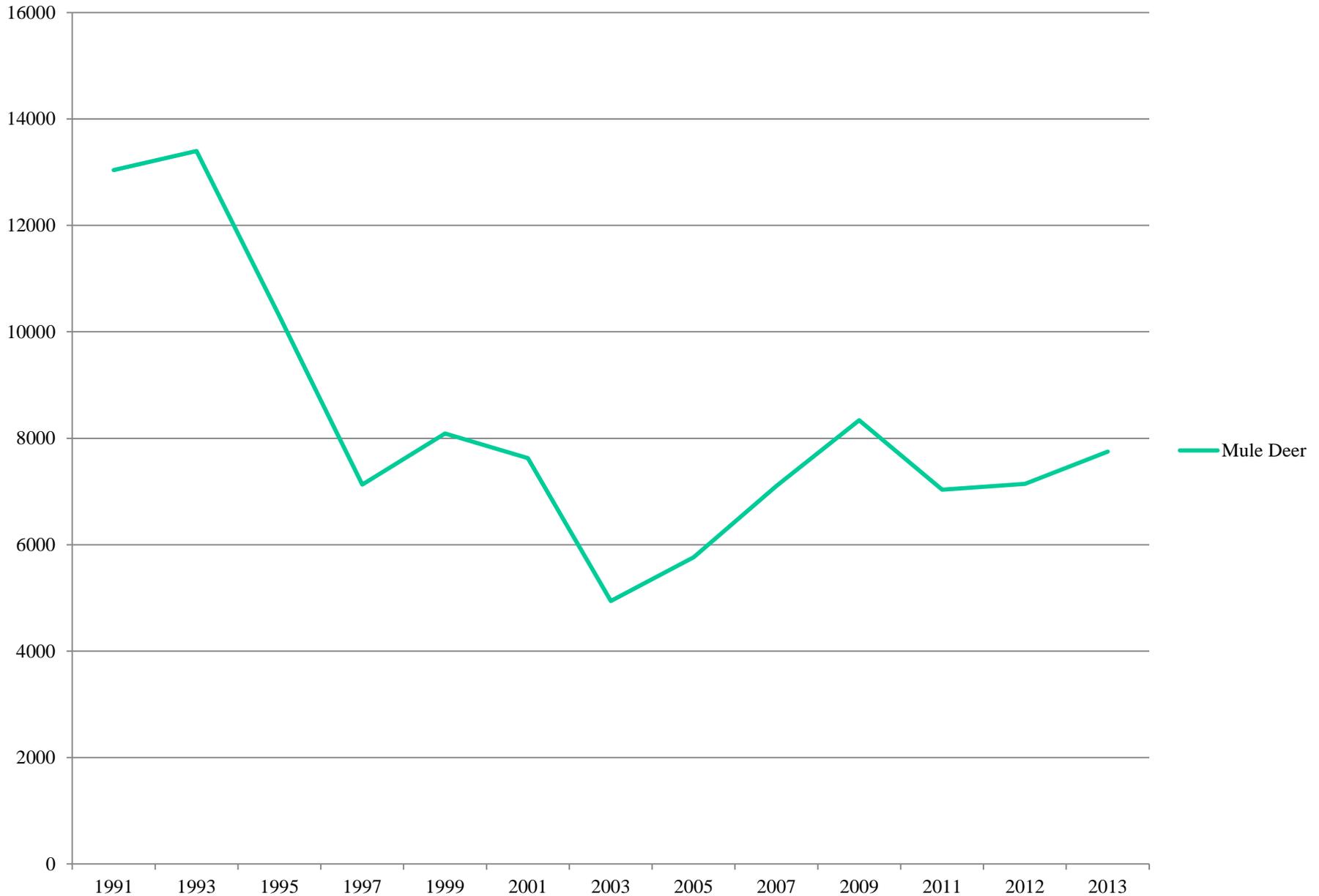
Wildlife Specialist Statewide Supervisor



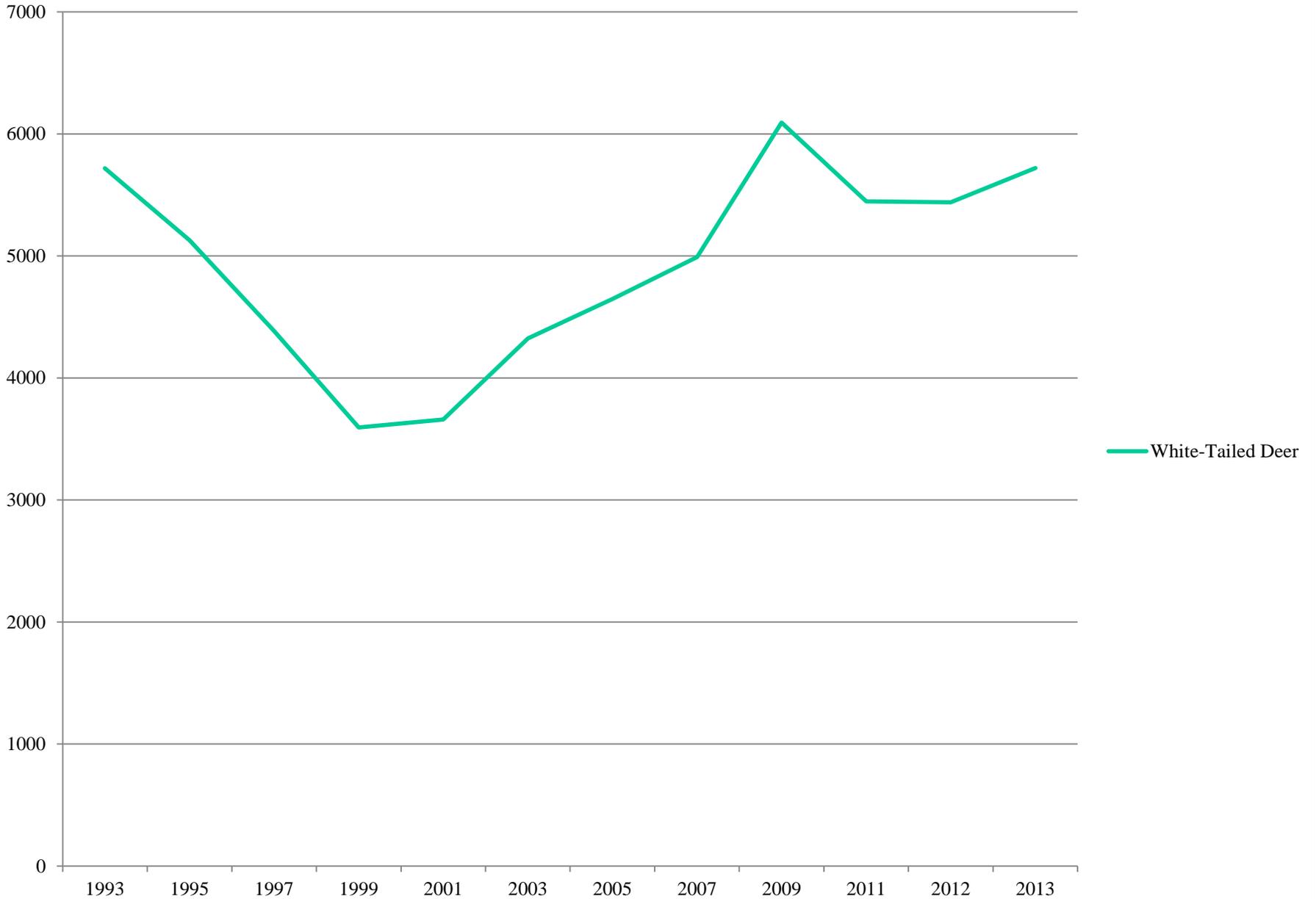
Quail Harvest



Mule Deer Harvest



White-Tailed Deer Harvest



#1169 - Little Springs Point, GMU 12A west
April 2014































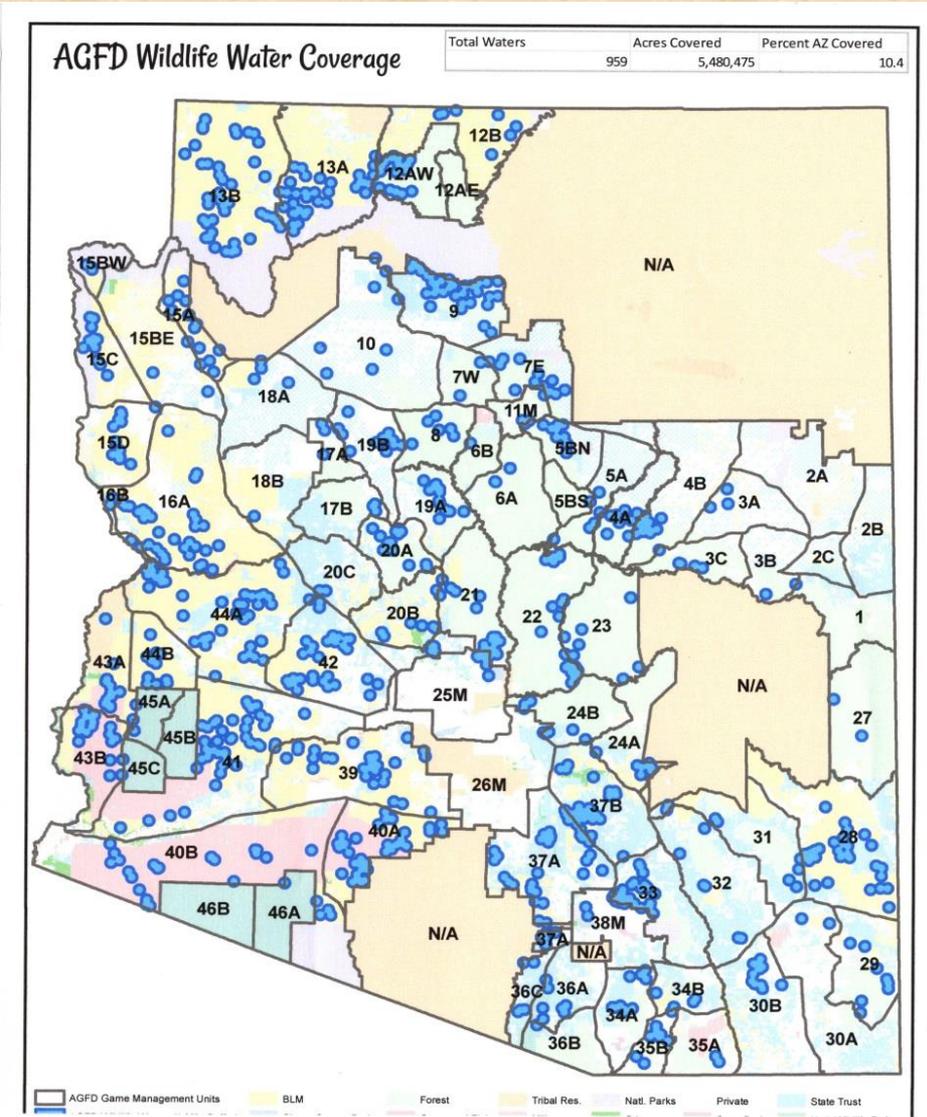






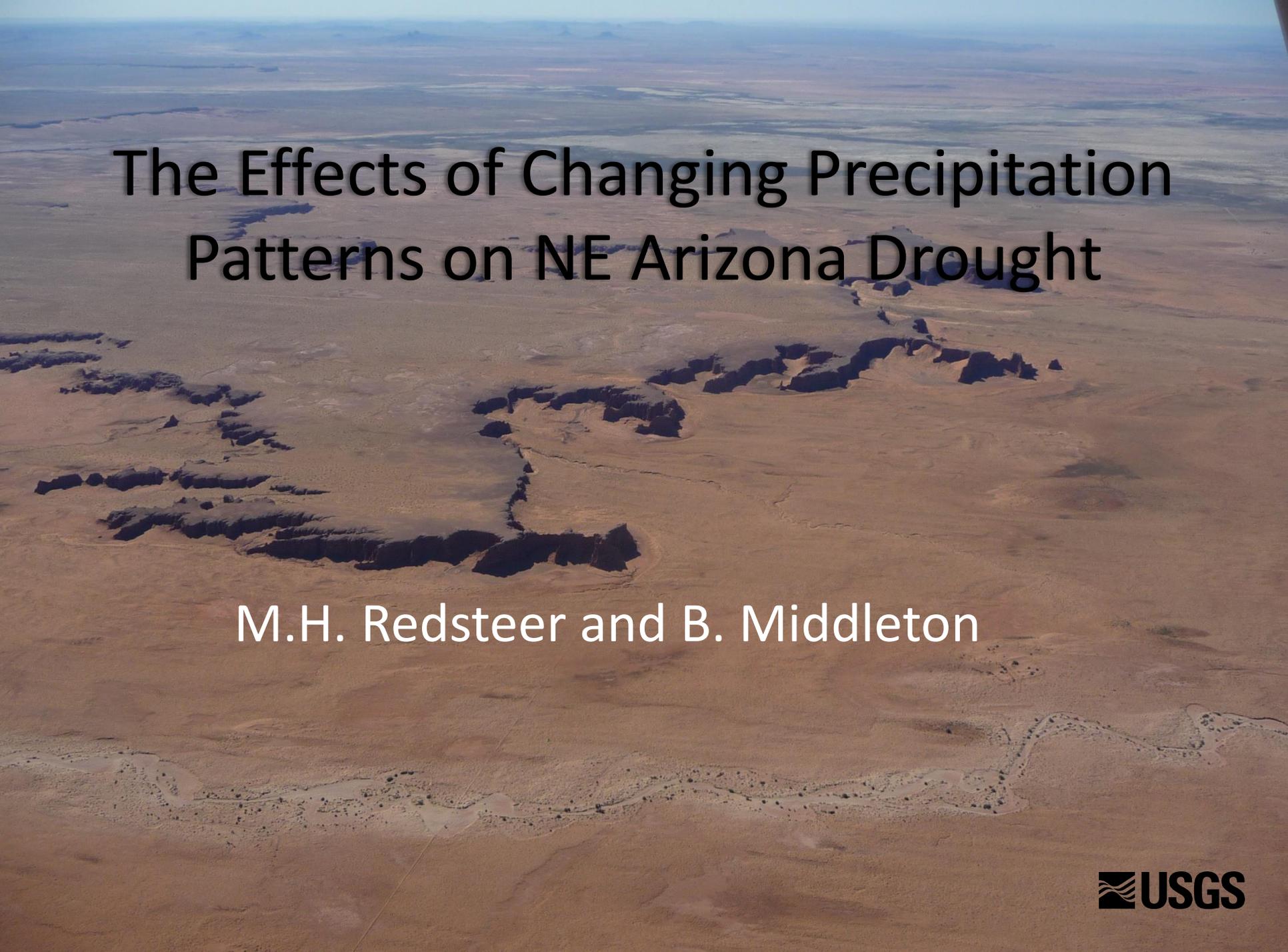
959 AZGF Water Developments

2 mile radius = 8,000 acres



Questions?



An aerial photograph of a desert landscape in NE Arizona. The terrain is arid and brown, with a prominent winding river or streambed cutting through the center. Several mesas and buttes are scattered across the landscape, some with distinct shadows. The background shows a vast, flat expanse extending to the horizon under a clear blue sky.

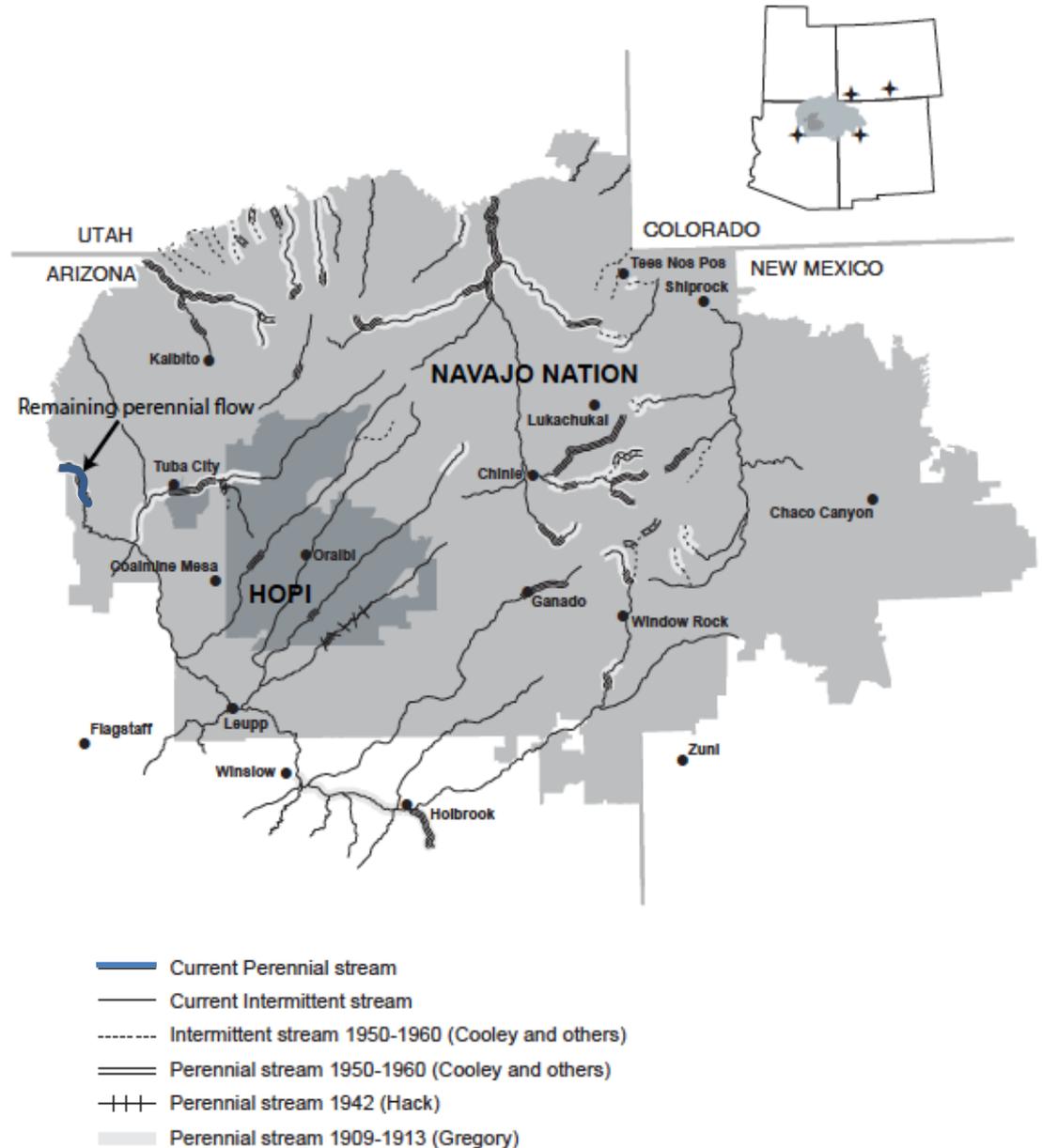
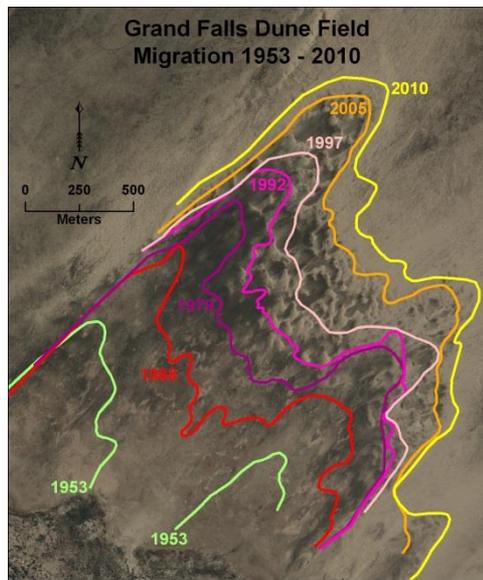
The Effects of Changing Precipitation Patterns on NE Arizona Drought

M.H. Redsteer and B. Middleton

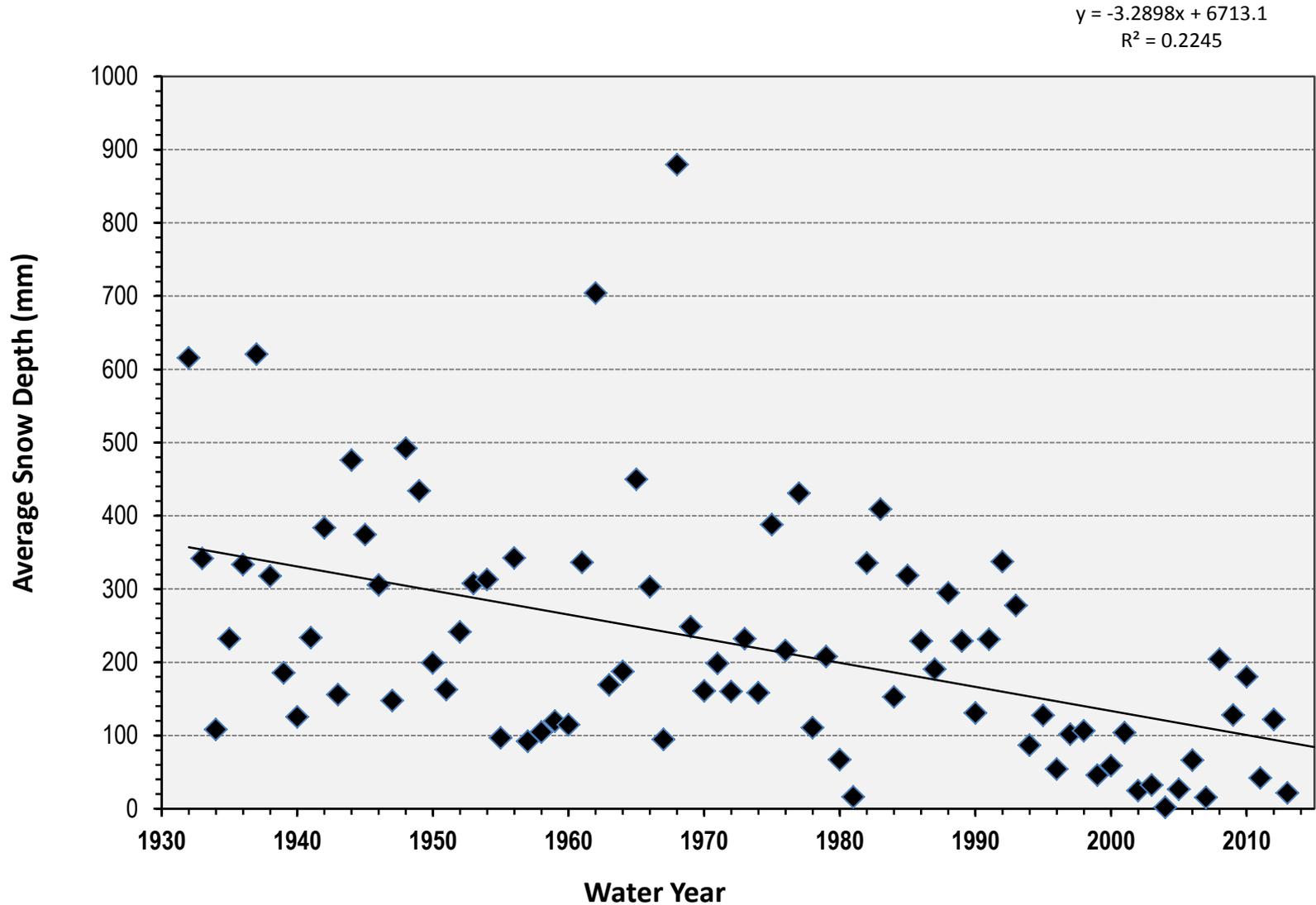
Current Underlying Changes to Aridity Occurring in NE Arizona

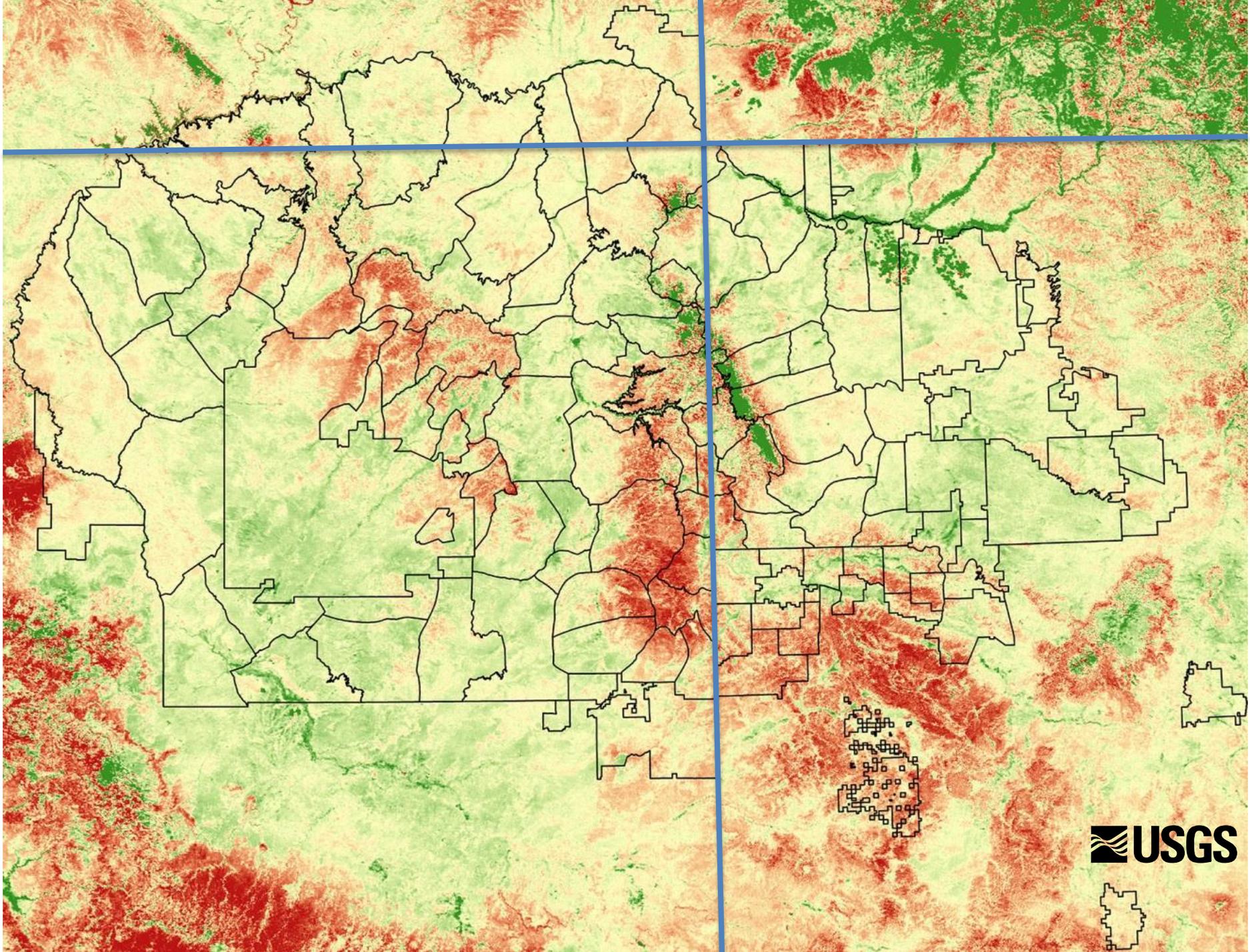
Changes in perennial stream flow in areas where water resource development has not occurred

Changes in the extent and movement of sand dunes

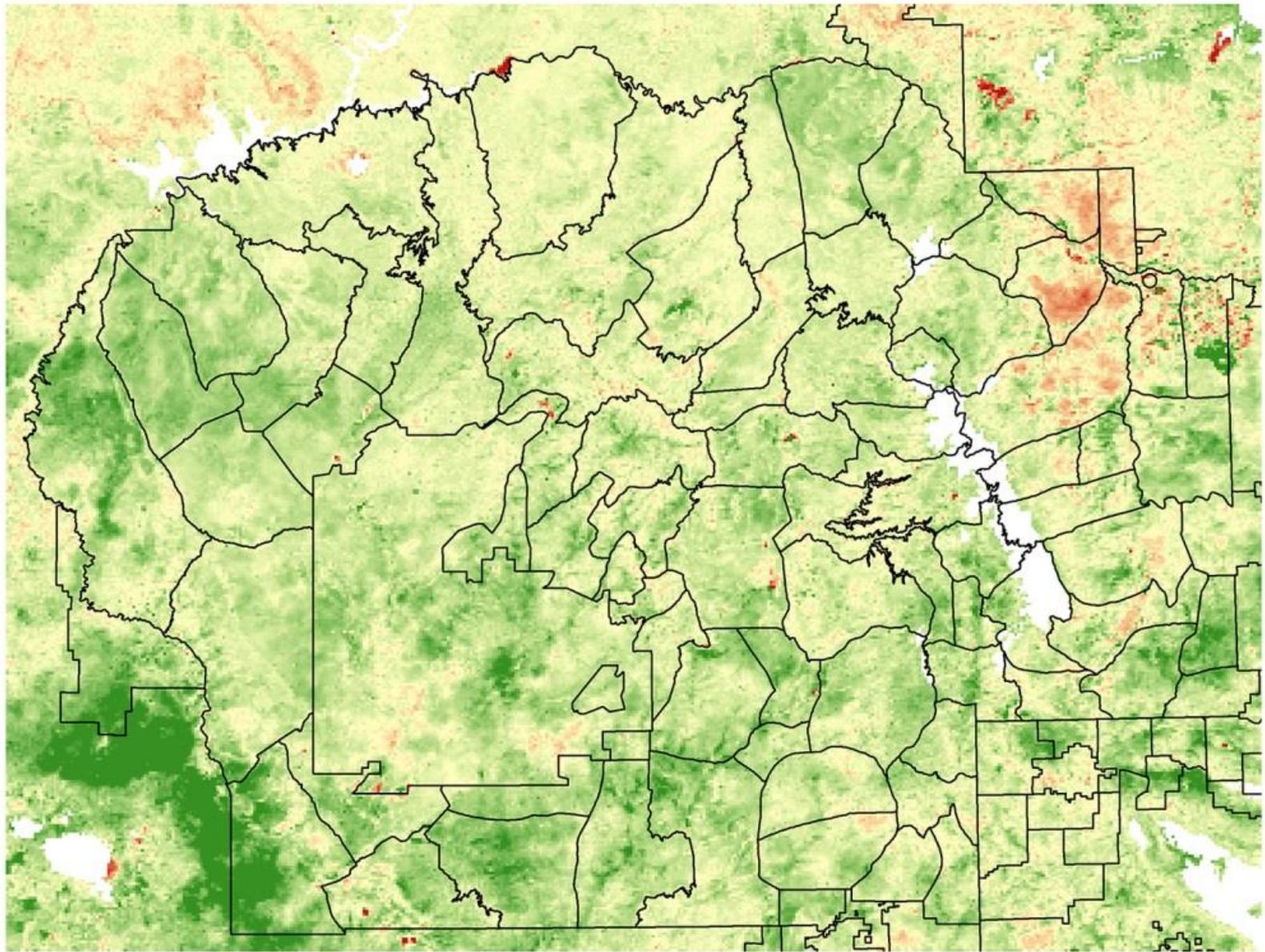


Long-term declining snowfall in NE Arizona on the Navajo Nation

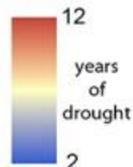
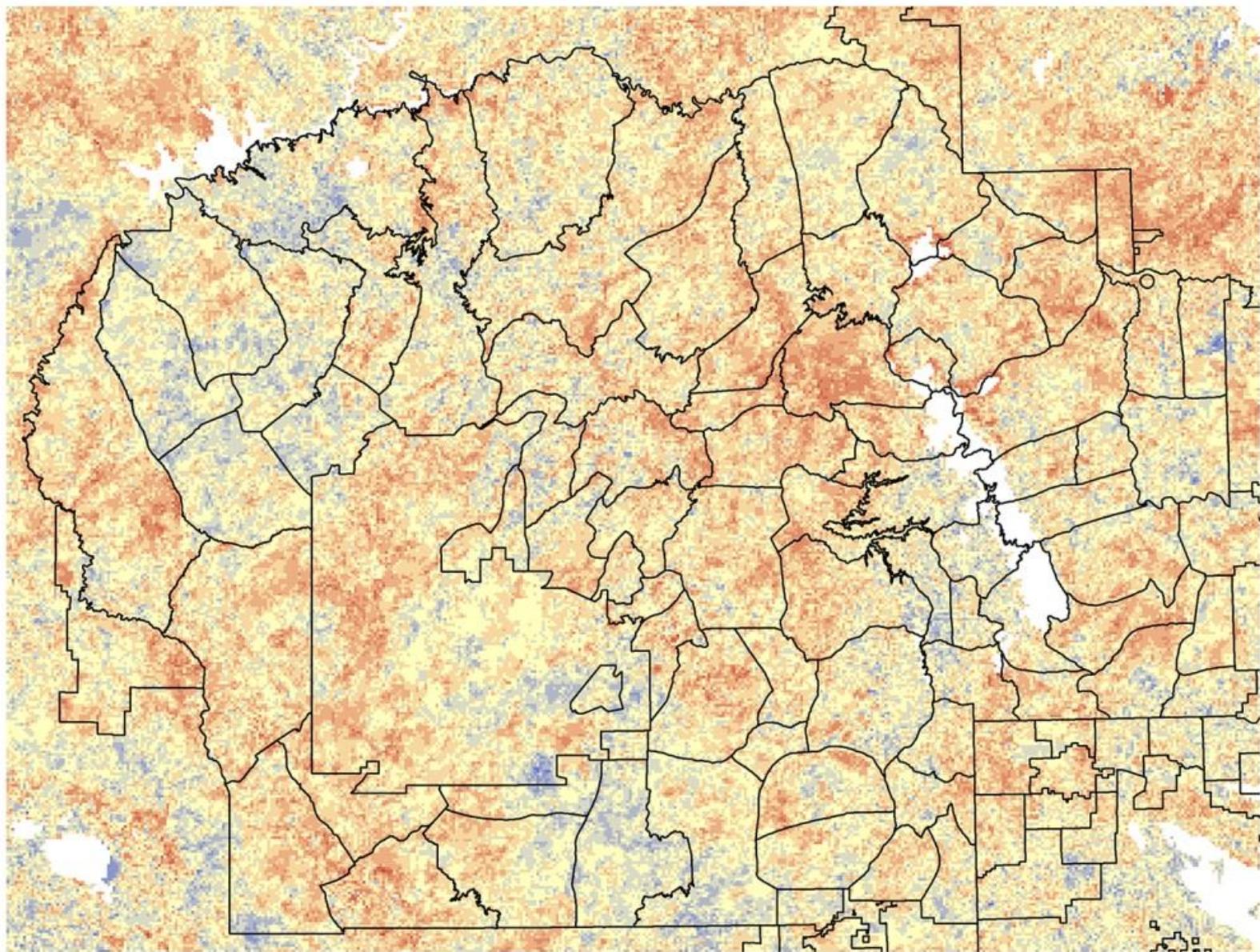




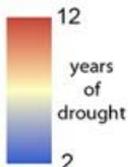
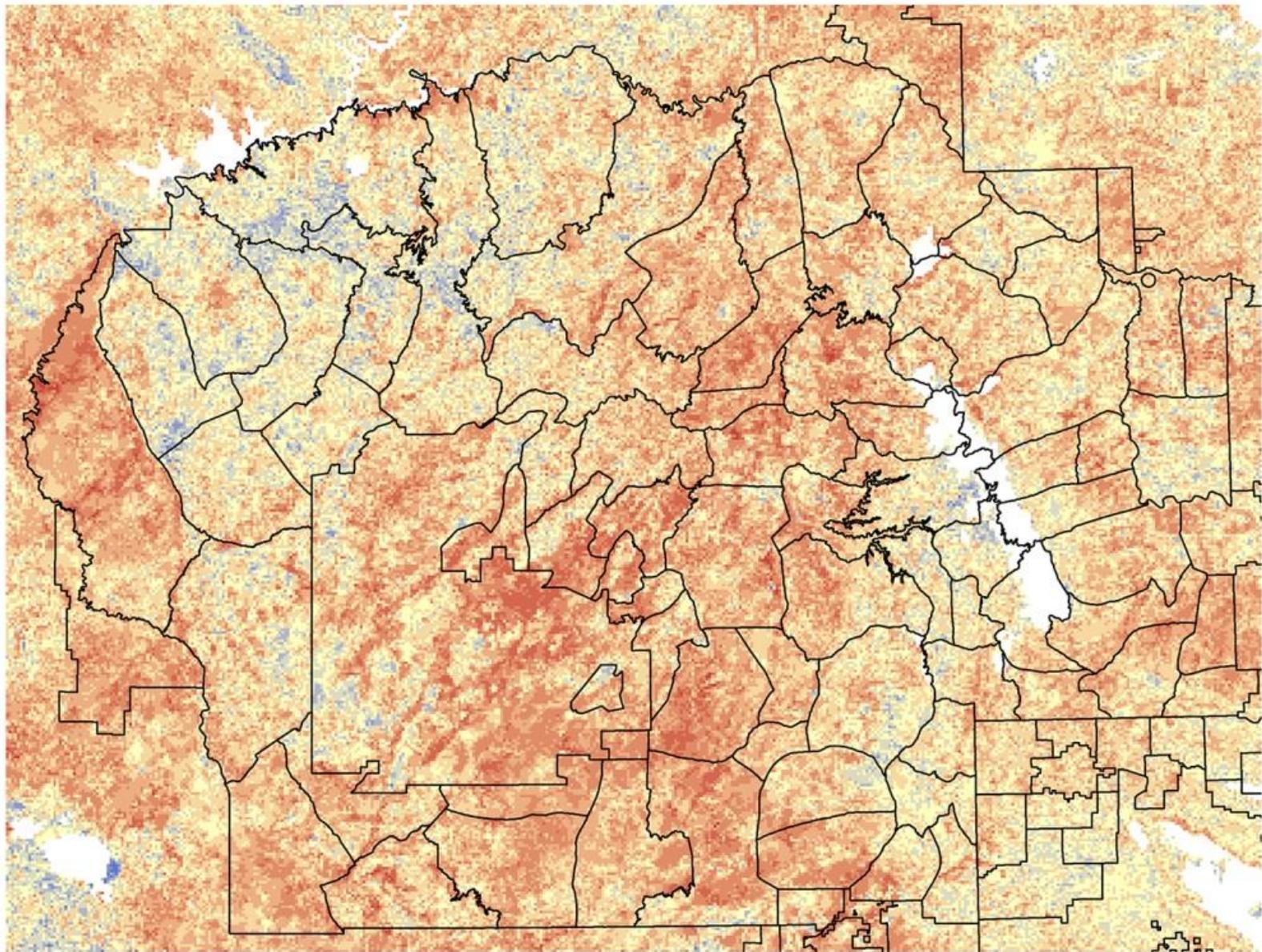
2013 Vegetation Anomaly Image of Navajo Nation (Summer)



Cumulative Drought Map of Navajo Nation During Last 14 Years (Annual)

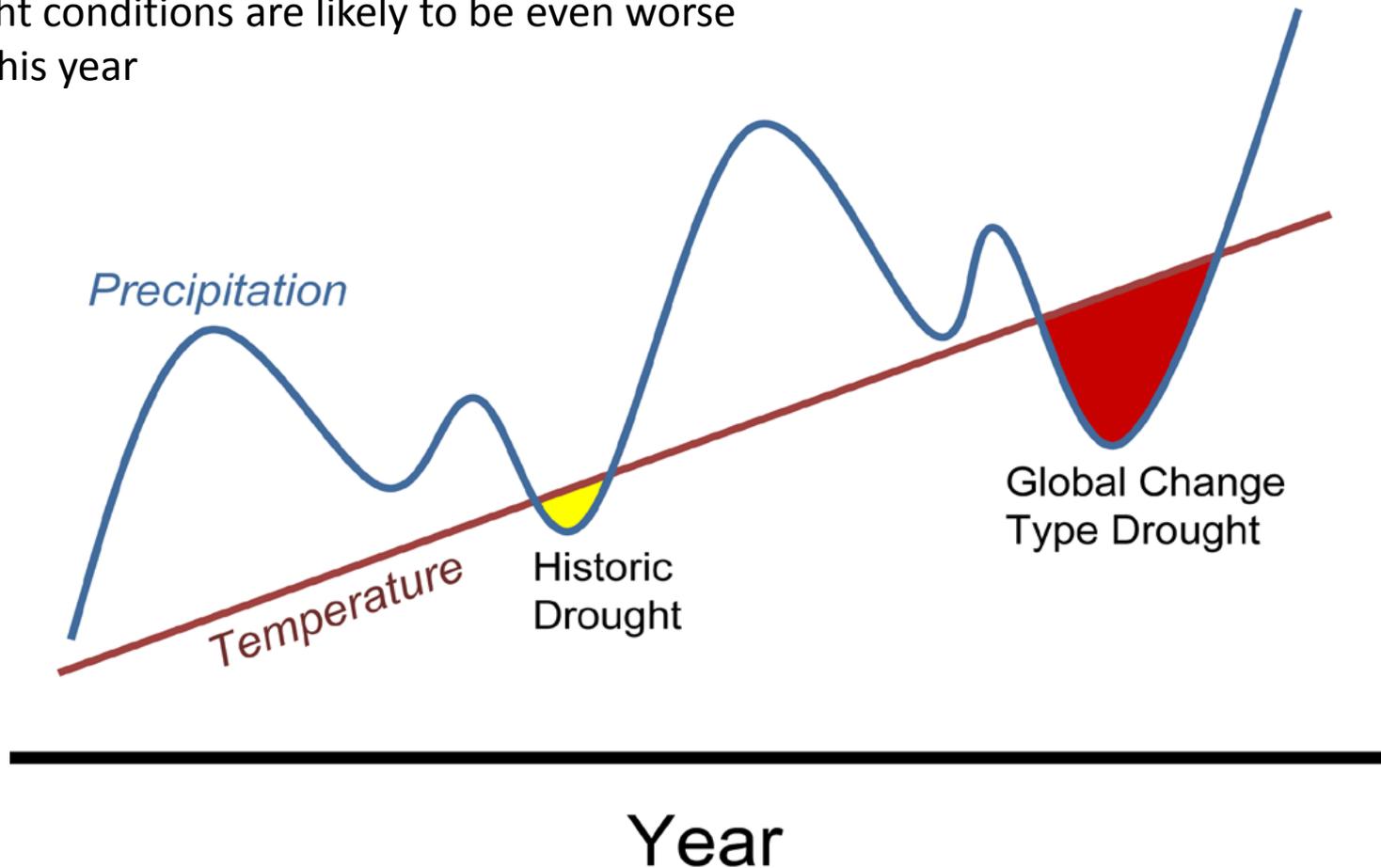


Cumulative Drought Map of Navajo Nation During Last 14 Years (Spring)



Currently temperatures much warmer than normal with very windy conditions

If we see little snowfall this winter, next spring drought conditions are likely to be even worse than this year



QUESTIONS?

