

# Drought and Wildland Fire Risks

6 February 2014  
Jim Oberhofer KN6PE

Cupertino ARES/RACES



# Agenda

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## Drought

Definitions

Measures

History

Causes

## Water

## Fire

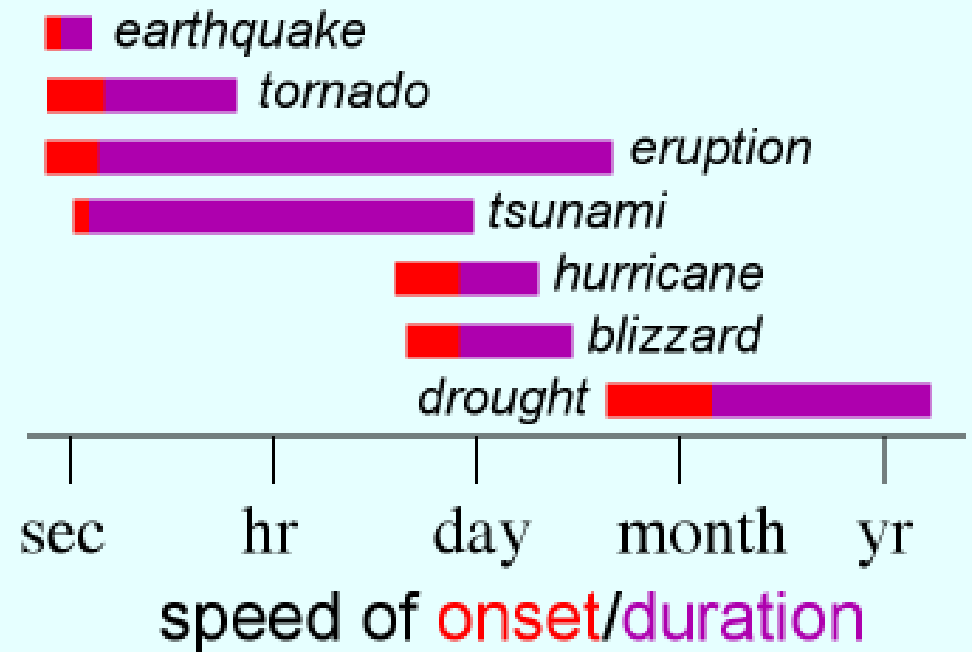
## What does this mean to us?



# Definitions

## Drought

- **A long period of abnormally low rainfall, especially one that adversely affects growing or living conditions.**
- Can be short term or long term.
- There can be short term moist spells in the midst of a long term drought.
- **Hazard profile**
  - slow onset
  - prolonged duration
  - widespread



# Measures

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## PDSI – Palmer Drought Sensitivity Index

- An index that states the severity of meteorological drought in a location.
- Ranges from  $-4$  (extreme drought) to  $+4$  (extremely moist)
- Most widely used drought index in the US.
- Takes a supply-and-demand approach to the surface water balance.
- PDSI is a good measure of long-term drought; over several months.
- In addition to drought, PDSI provides information about wet spells.



# Measures

## PDSI – Palmer Drought Sensitivity Index

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### Variables that go into the PDSI calculation

- climate data
- soil moisture
- stream flow
- ground water
- reservoir and lake levels
- snow pack
- short, medium, and long range forecasts
- vegetation health/stress and fire danger

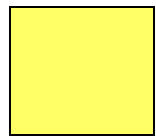


# Measures

PDSI – Palmer Drought Sensitivity Index

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## Intensity Categories



**D0** *Abnormally Dry* (30%tile)



**D1** **Drought – Moderate** (20%tile)



**D2** **Drought – Severe** (10%tile)



**D3** **Drought – Extreme** (5%tile)



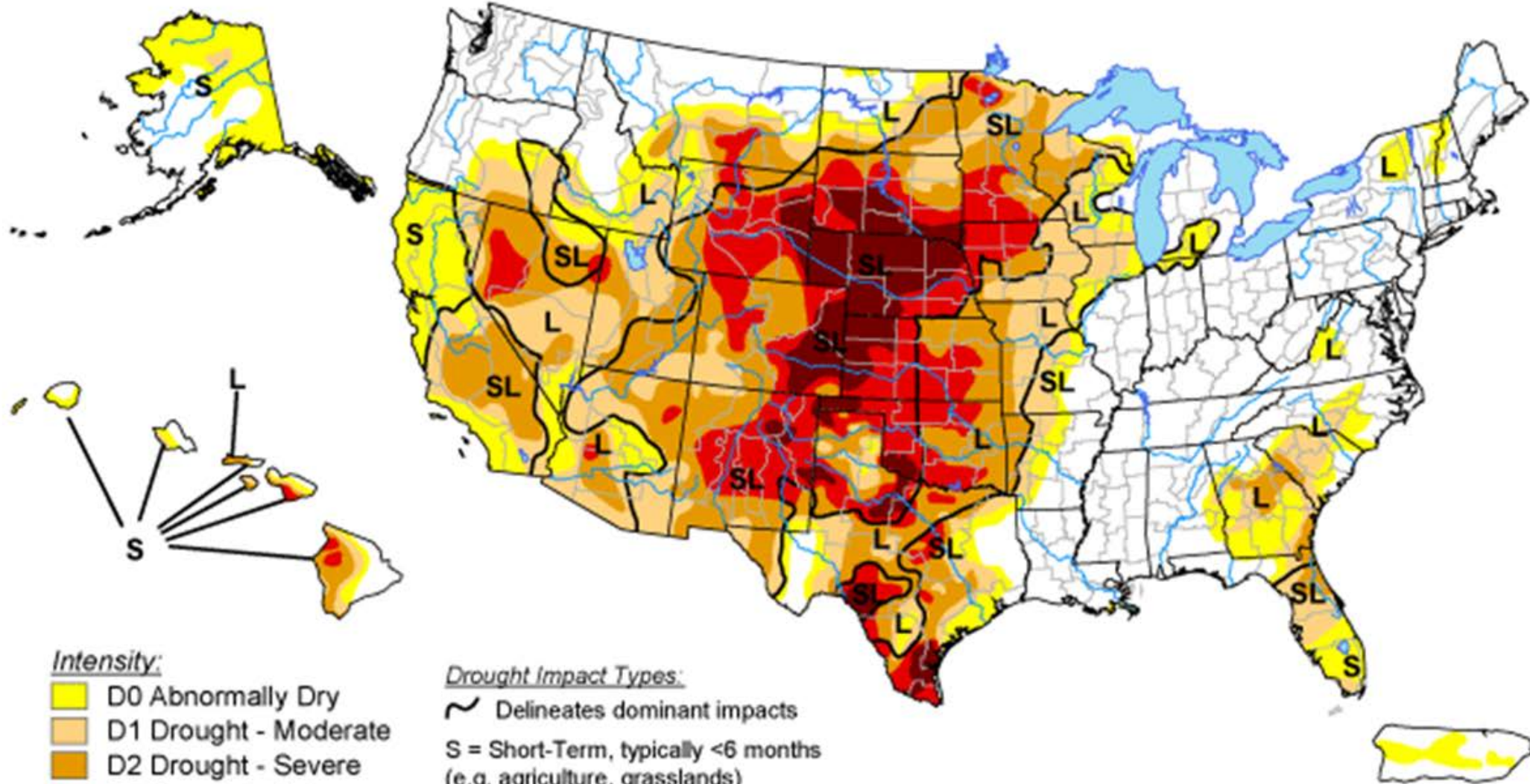
**D4** **Drought – Exceptional** (2%tile)




# U.S. Drought Monitor

March 5, 2013


Valid 7 a.m. EST



## 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.



Released Thursday, March 7, 2013  
Author: Matthew Rosencrans, NOAA/NWS/NCEP/CPC

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

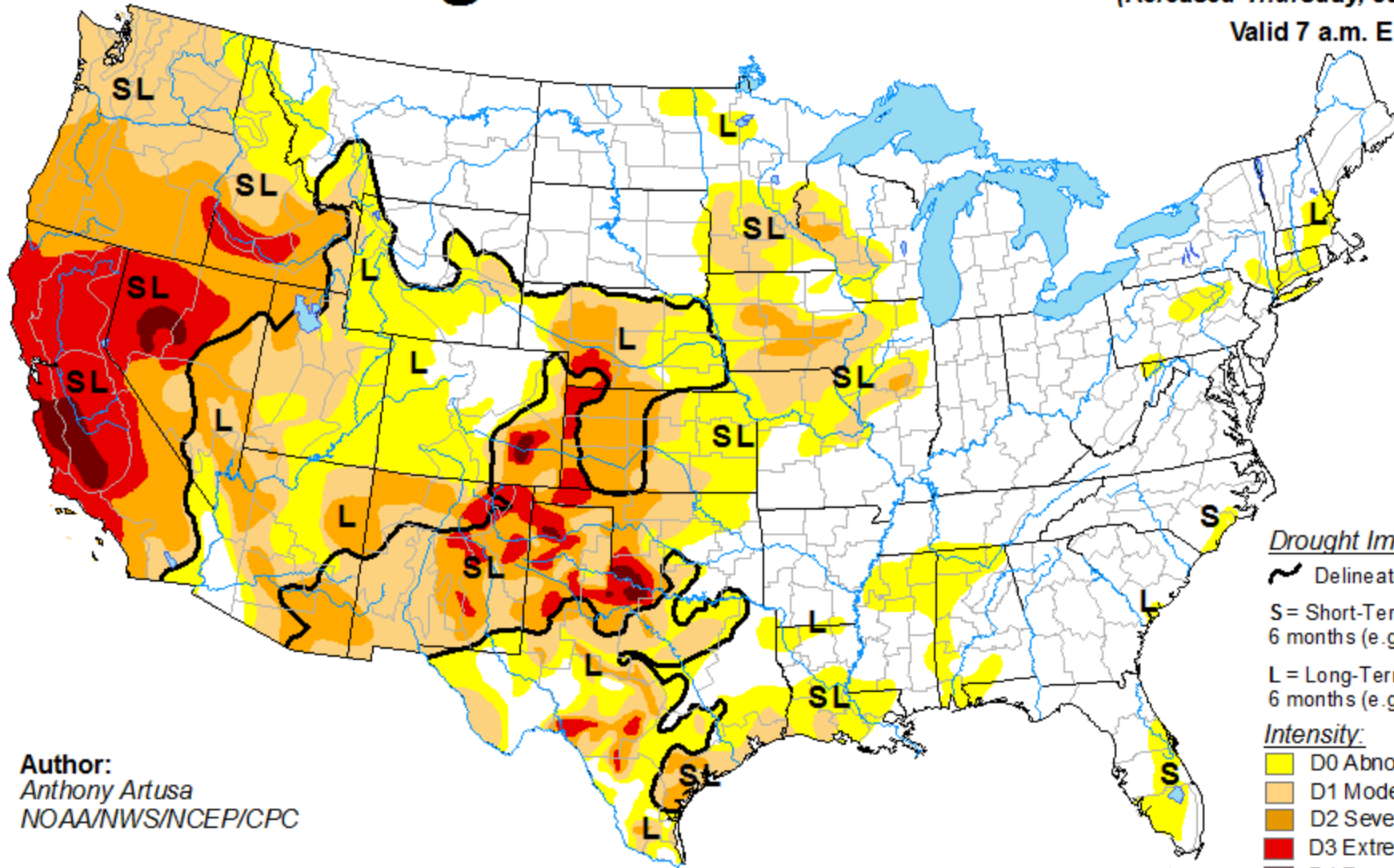


# U.S. Drought Monitor

January 28, 2014

(Released Thursday, Jan. 30, 2014)

Valid 7 a.m. EST



Author:  
Anthony Artusa  
NOAA/NWS/NCEP/CPC

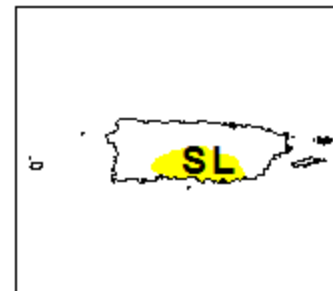
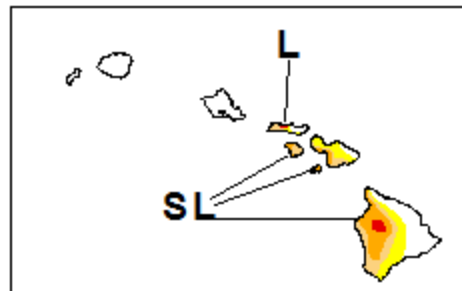
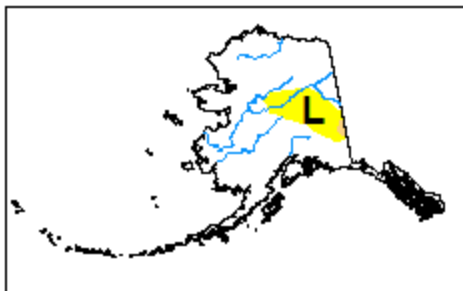
### Drought Impact Types:

- 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:

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

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

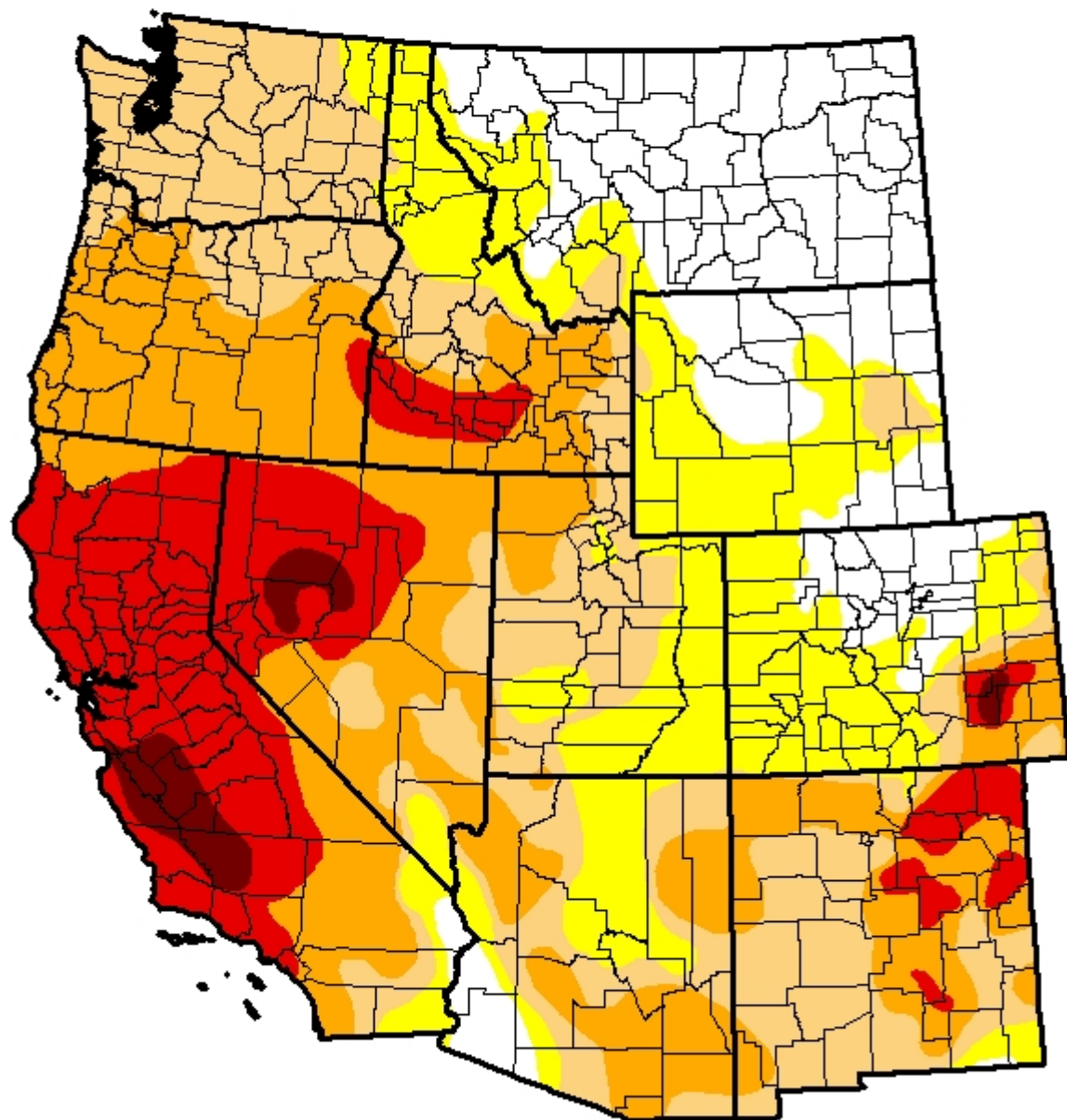


<http://droughtmonitor.unl.edu/>



# U.S. Drought Monitor West

**January 28, 2014**  
(Released Thursday, Jan. 30, 2014)  
Valid 7 a.m. EST



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
<b>Current</b>	17.38	82.62	63.50	39.67	15.29	1.80
<b>Last Week</b> <i>1/21/2014</i>	18.74	81.26	60.81	36.99	13.78	0.63
<b>3 Months Ago</b> <i>10/29/2013</i>	27.90	72.10	53.62	32.25	5.34	0.63
<b>Start of Calendar Year</b> <i>12/31/2013</i>	22.20	77.80	51.44	31.11	7.75	0.63
<b>Start of Water Year</b> <i>10/1/2013</i>	25.25	74.75	58.96	34.18	5.57	0.63
<b>One Year Ago</b> <i>1/29/2013</i>	23.58	76.42	66.52	44.01	16.39	2.15

Intensity:

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

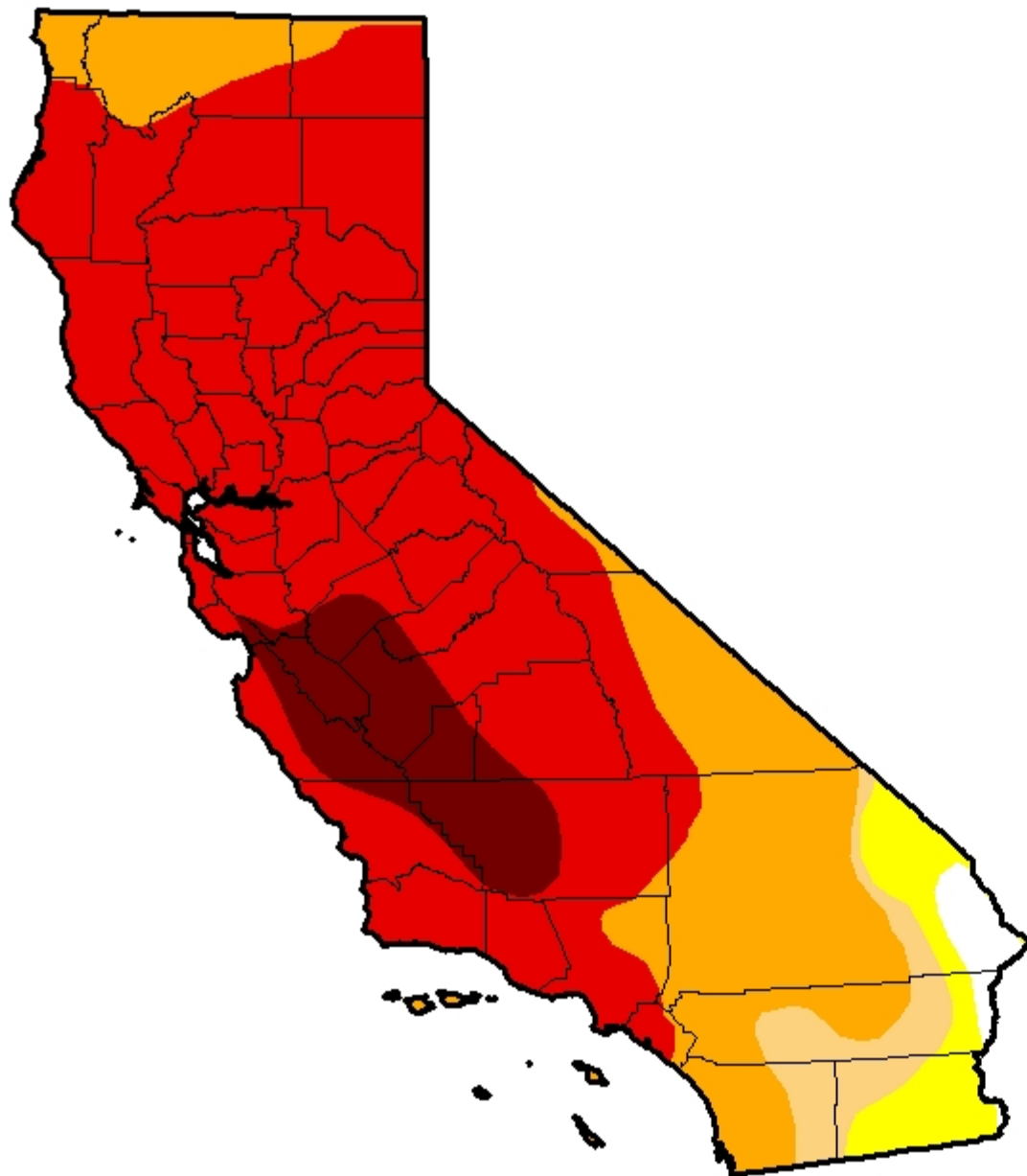
*The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.*

**Author:**  
Anthony Artusa  
NOAA/NWS/NCEP/CPC



# U.S. Drought Monitor California

**January 28, 2014**  
(Released Thursday, Jan. 30, 2014)  
Valid 7 a.m. EST



*Drought Conditions (Percent Area)*

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
<b>Current</b>	1.43	98.57	94.18	89.91	67.13	8.77
<b>Last Week</b> <i>1/21/2014</i>	1.43	98.57	94.18	89.91	62.71	0.00
<b>3 Months Ago</b> <i>10/29/2013</i>	2.66	97.34	95.98	84.12	11.36	0.00
<b>Start of Calendar Year</b> <i>12/31/2013</i>	2.61	97.39	94.25	87.53	27.59	0.00
<b>Start of Water Year</b> <i>10/1/2013</i>	2.63	97.37	95.95	84.12	11.36	0.00
<b>One Year Ago</b> <i>1/29/2013</i>	34.20	65.80	47.18	21.57	0.00	0.00

*Intensity:*

- D0 Abnormally Dry
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- D3 Extreme Drought
- D4 Exceptional Drought

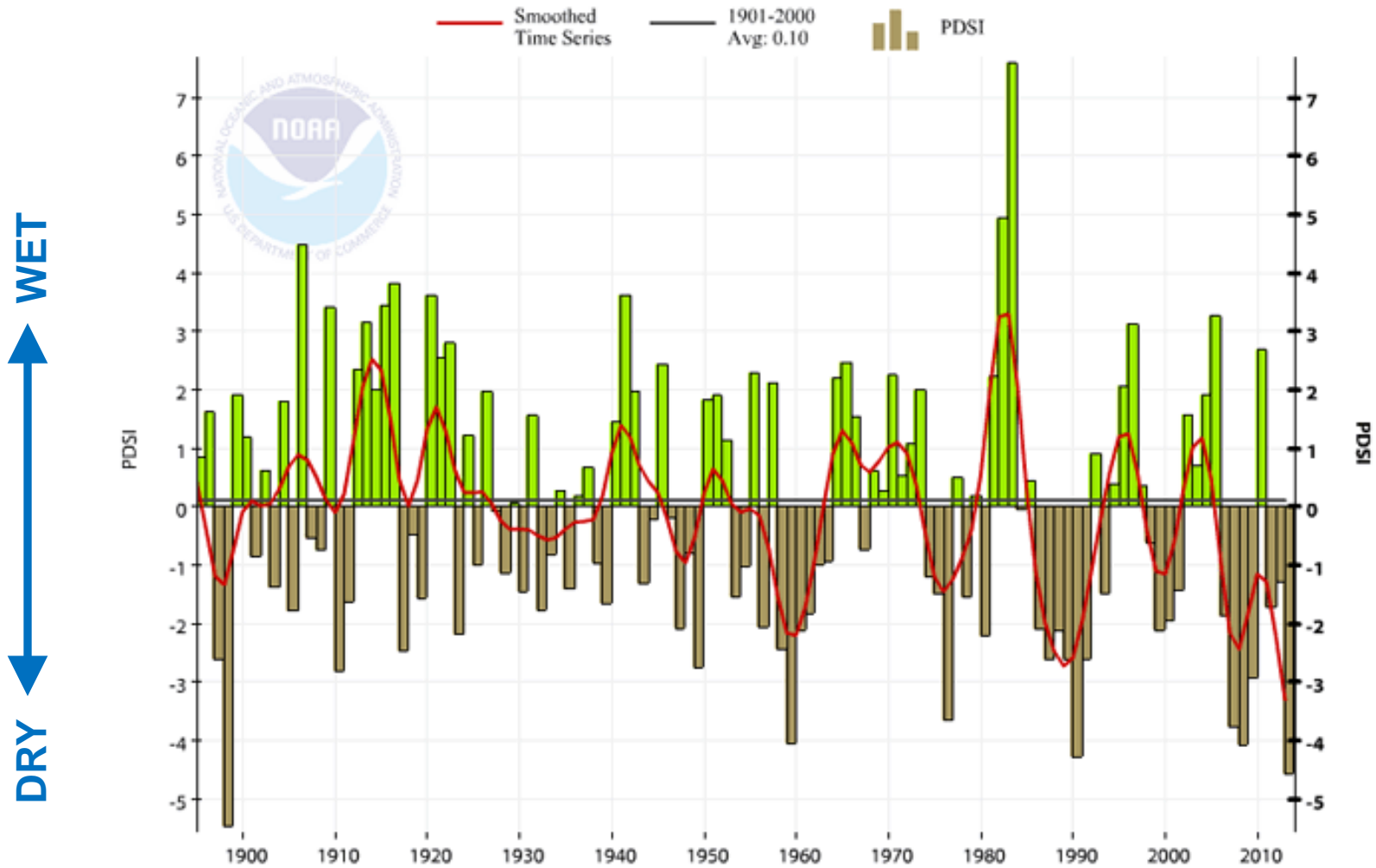
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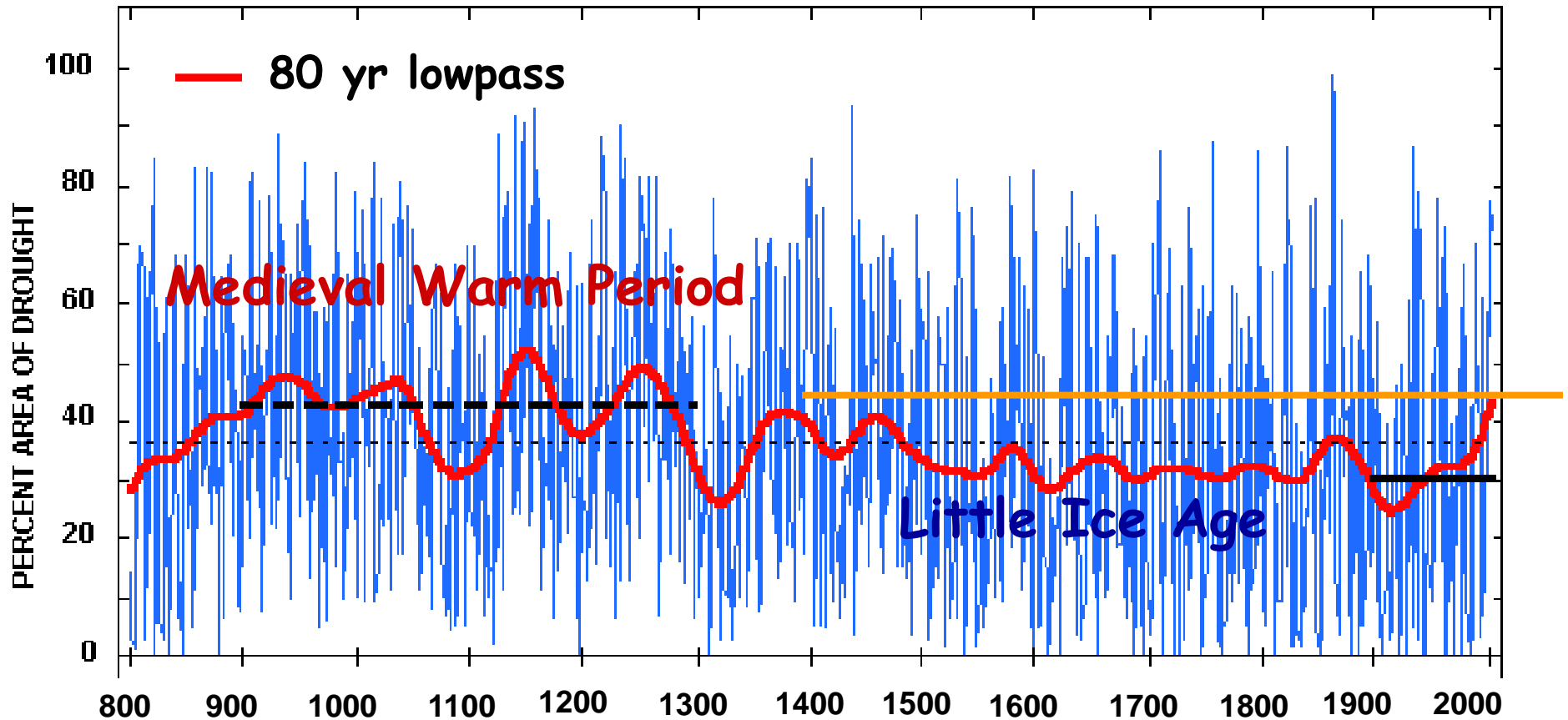
# History

December Palmer Drought Severity Index (PDSI), California, 1895 - 2013



# History

## Western US Drought Area Index (-1 PDSI)



Ref: Krusik & Cook (2004) North American Drought Atlas



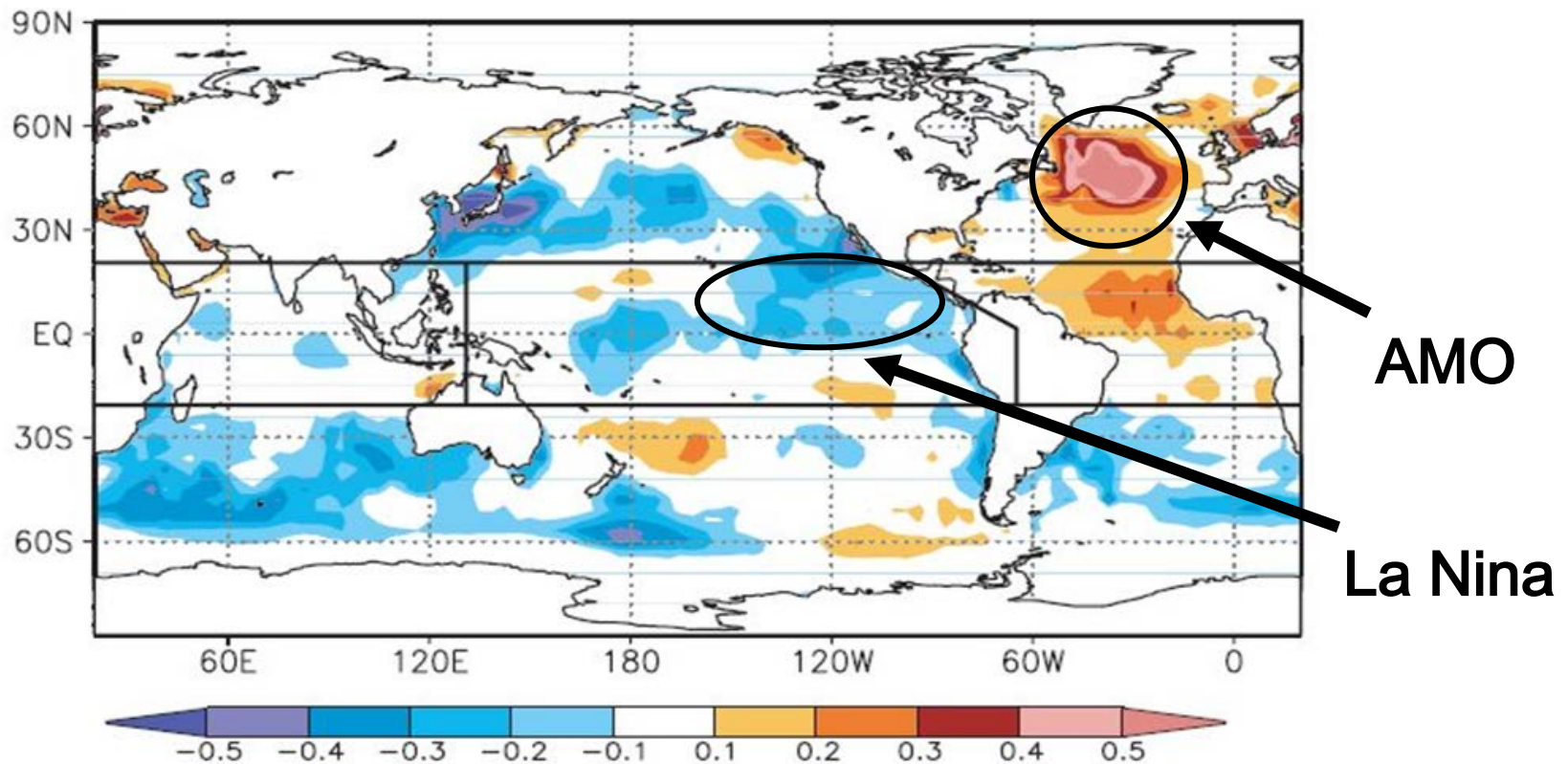


# Possible causes of drought

## La Nina's cool things down

There is evidence that La Nina is a significant cause of persistent drought in the U.S. ...but there also is a signal in the North Atlantic.

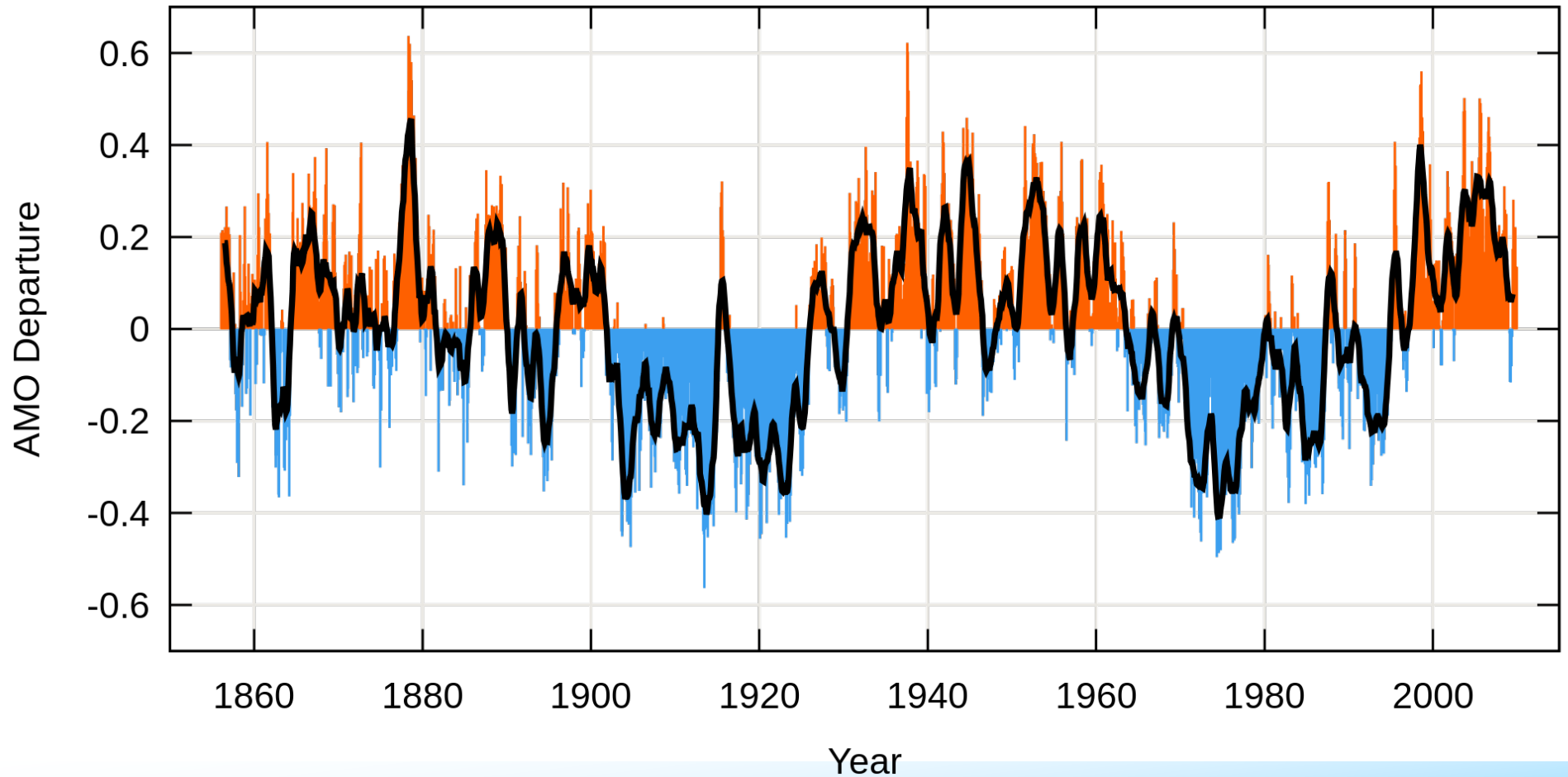
Composite Sea Surface Temperatures (SSTs), 1930s drought (1942 - 1938)



# Atlantic Multidecadal Oscillation

[\(BACK\)](#)

Monthly values for the AMO index, 1856 -2009



Cupertino ARES/RACES



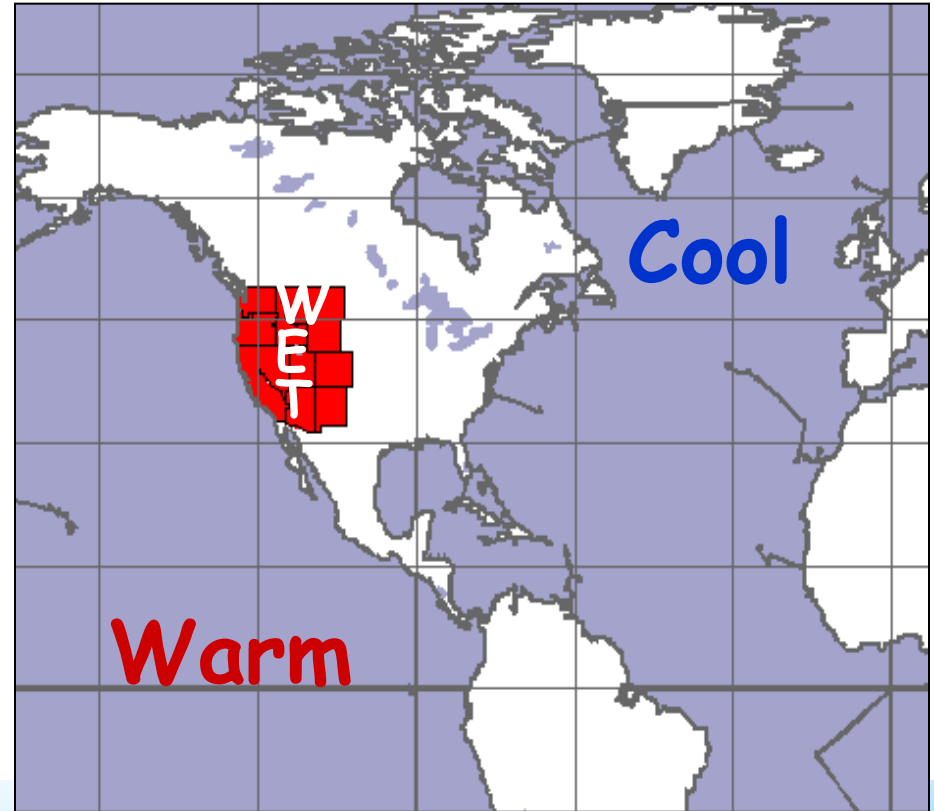
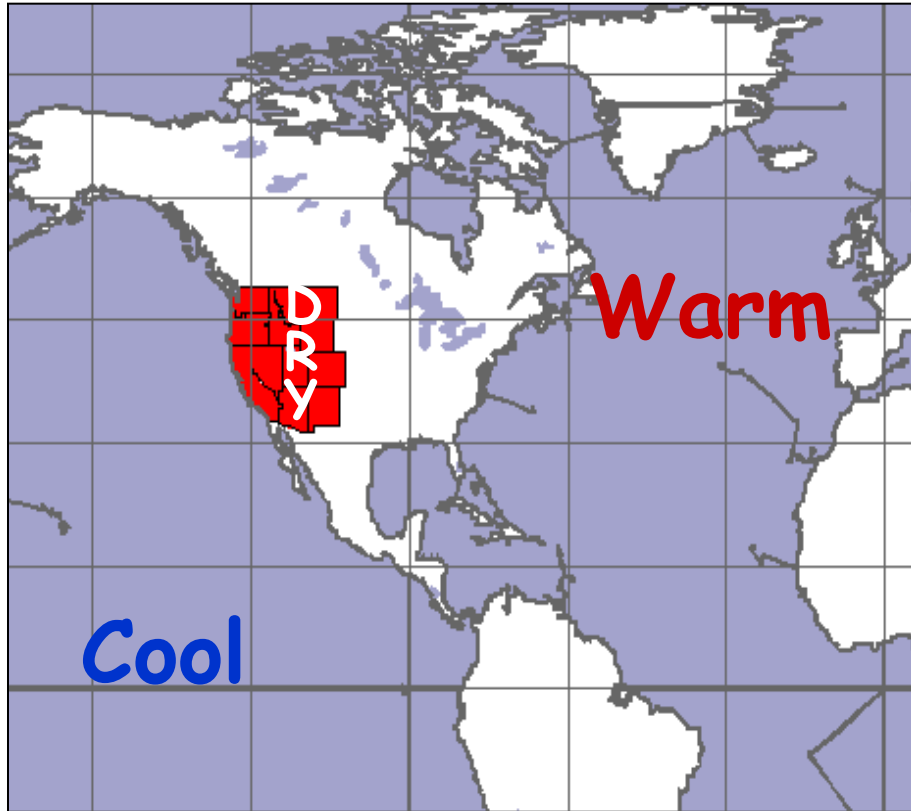
# Possible causes of drought

## Cycles of La Nina's and El Niño's

Interaction between Pacific and Atlantic Sea Surface Temperatures (SSTs) also may govern centennial-scale trends in western U.S. drought.

Medieval Warm Period  
AD 900-1300

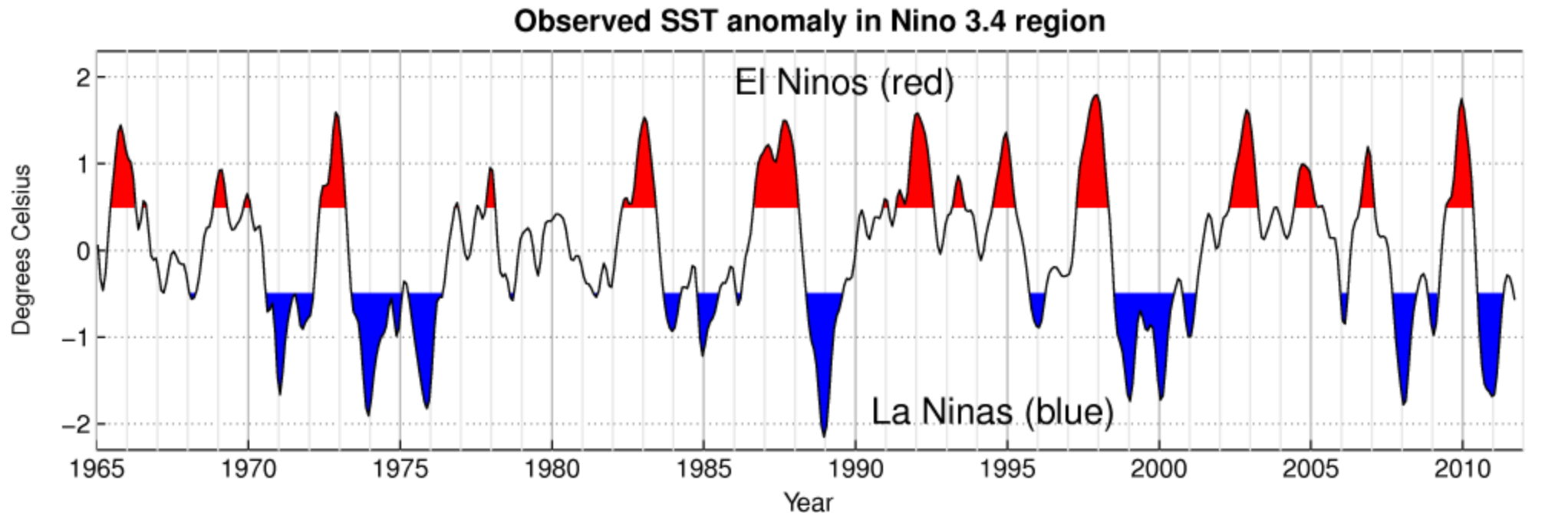
Little Ice Age  
AD 1400-1850





# Possible causes of drought

## Cycles of La Nina's and El Niño's



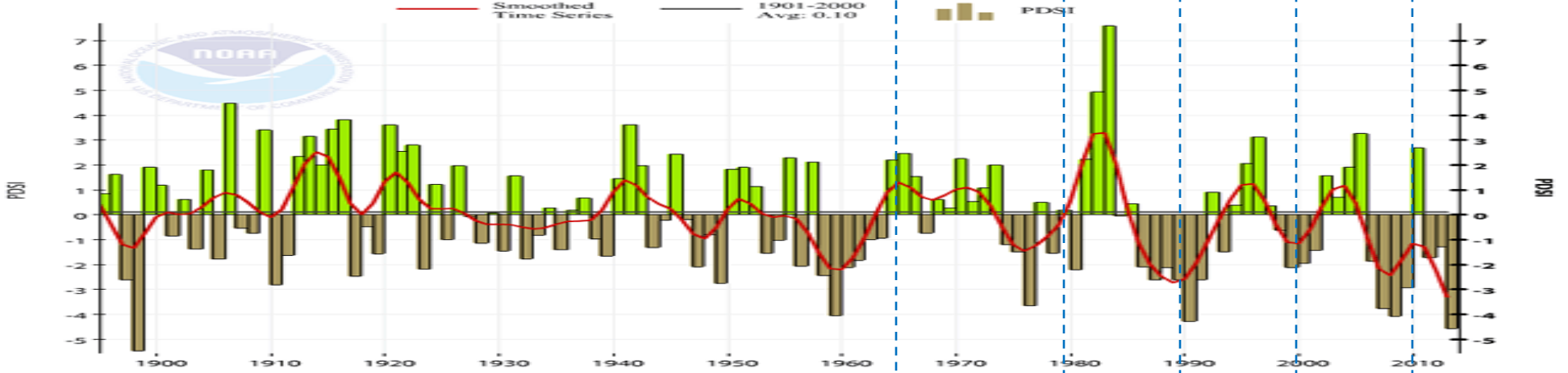
/data/obs/sst/NMC/make\_enso\_plot\_v2.R Thu Oct 13 10:01:21 2011

- When the difference from average conditions gets above 0.5 Celsius or so (red areas), you're in a warming period that is probably an El Niño.
- When the difference from average conditions gets below -0.5 Celsius (blue areas), it's in what's called the "cold phase", or "La Nina".

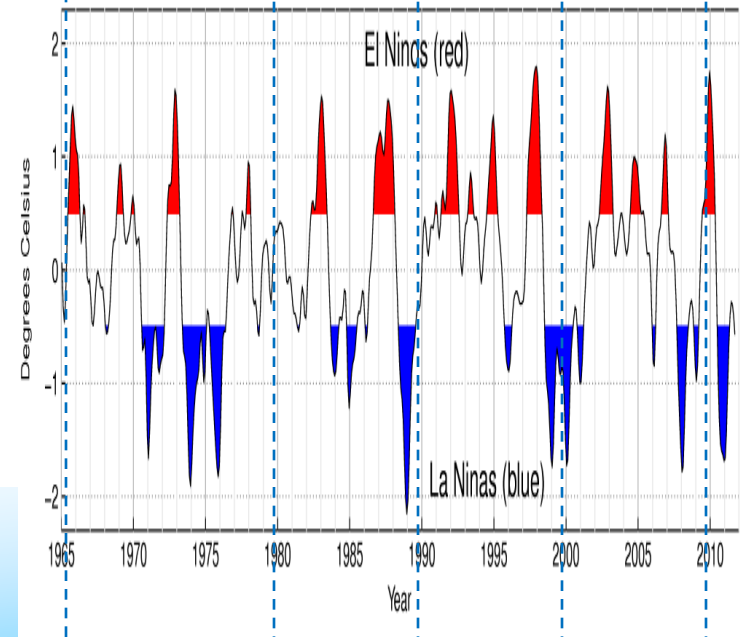


# Correlation between Drought & La Nina's?

December Palmer Drought Severity Index (PDSI), California, 1895 - 2013



Observed SST anomaly in Nino 3.4 region



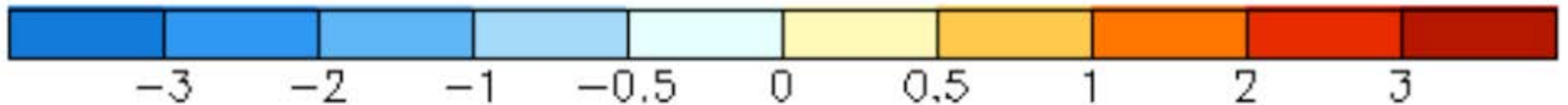
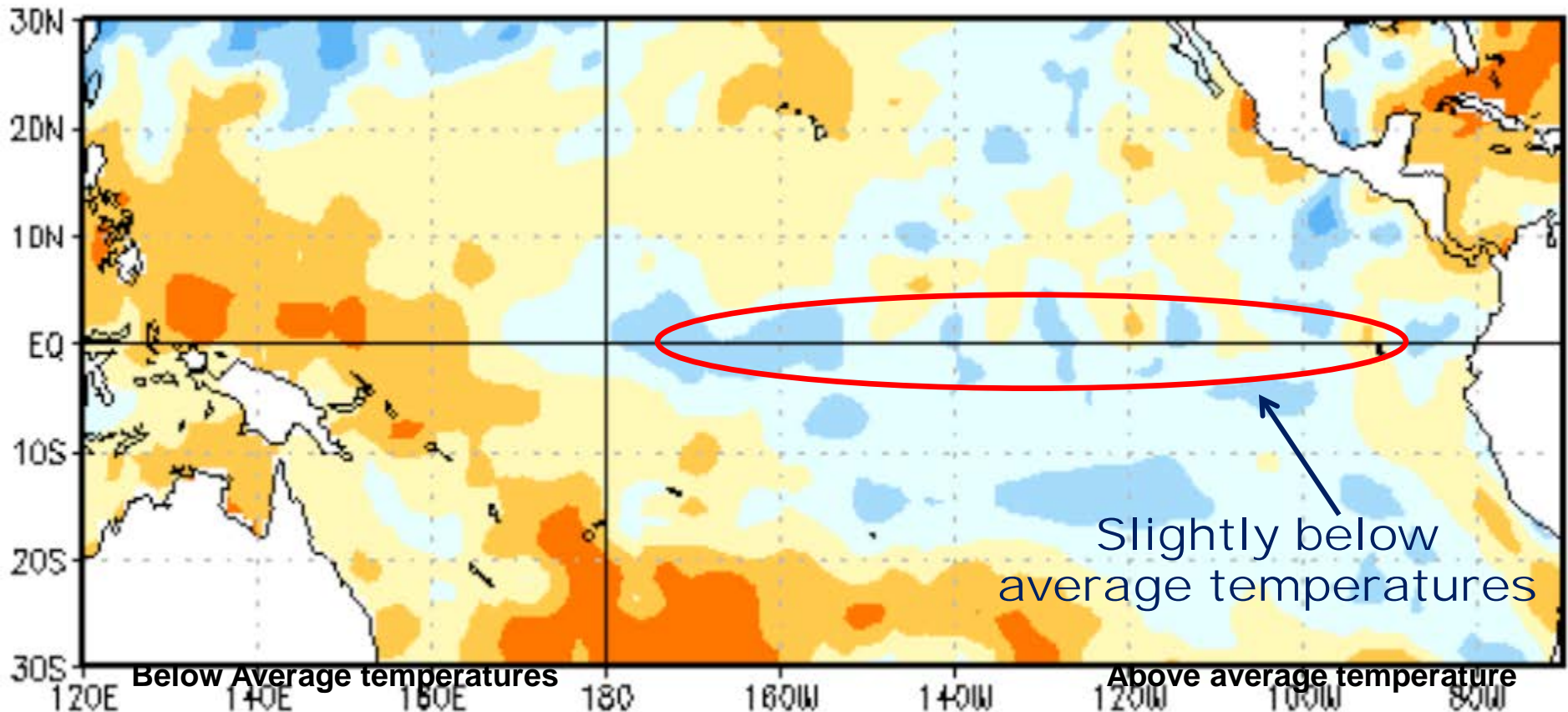
data:obs\_sst/NMCC/make\_enslo\_plot\_v2.R Thu Oct 13 10:01:21 2011

# Possible causes of drought

So, do we have a La Nina or El Niño?

Average Surface Sea Temperature Anomalies (°C)

01 JAN 2014



# To summarize

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- 1. Strong trade winds are blowing westward from South America toward Asia...**
- 2. Slightly below-normal surface height and temperatures (no El Nino)...**
- 3. Surface water cools the air above, forming high pressure systems...**
- 4. In a High, cool, dry air sinks back to the surface and there is no precipitation...**
- 5. No precipitation means we have a drought.**



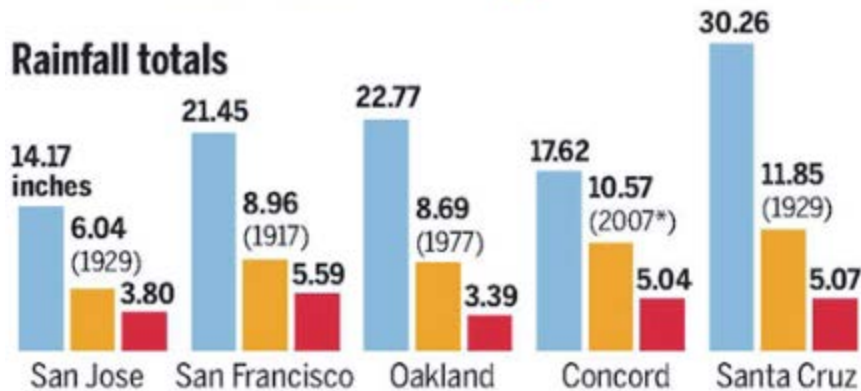
# Its all about the water

## Impacts of Drought

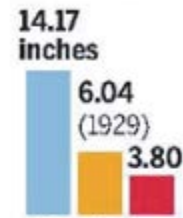
### Breaking records

Bay area cities are experiencing a record-breaking dry year.

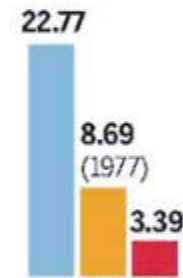
### Rainfall totals



### RECORDS FALL IN DRIEST YEAR



San Jose

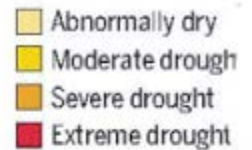


Oakland



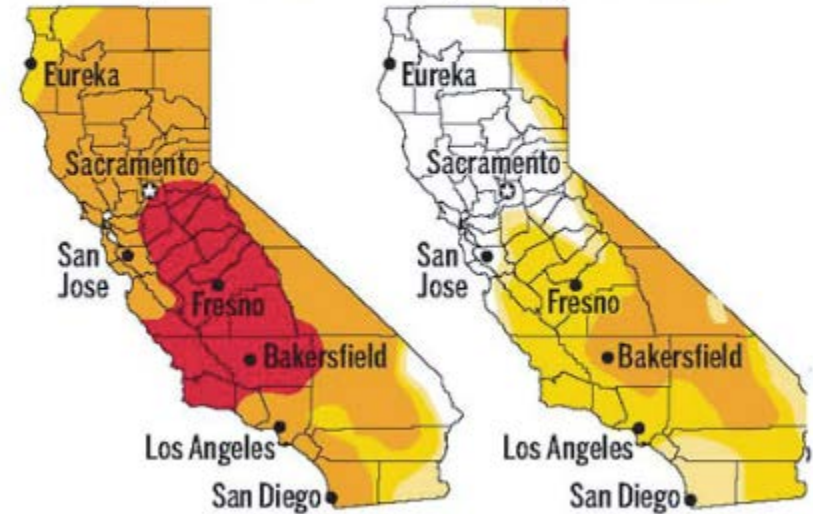
### A very dry year

The map of California drought conditions as of Dec. 24 shows nearly 85 percent of the state with severe to extreme drought. One year ago the red and orange categories covered just a quarter of the state.



Currently Dec. 24, 2013

One year ago Dec. 25, 2012



Source: U.S. Drought Monitor

BAY AREA NEWS GROUP



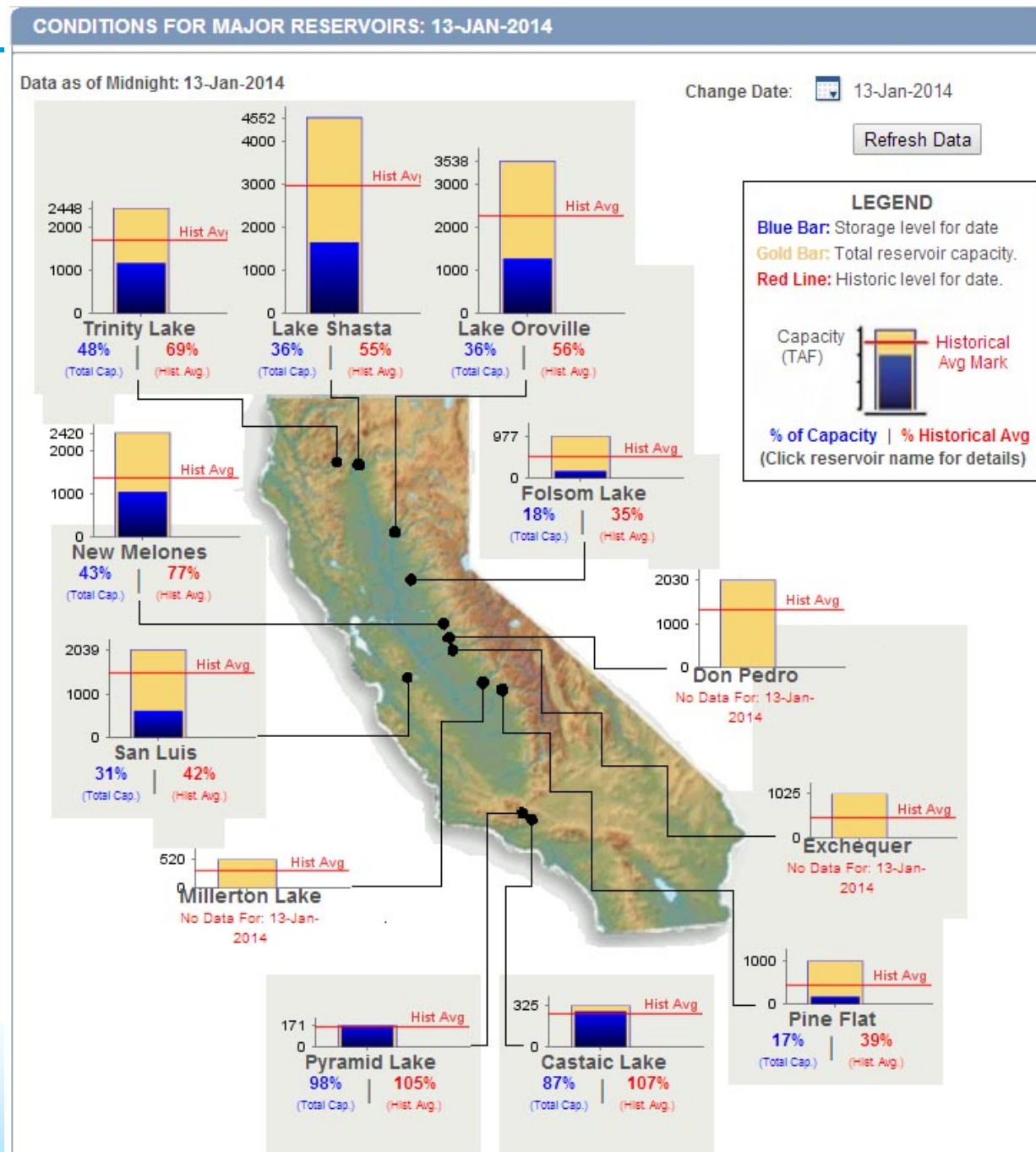


# Water drives our economy

## Impacts of Drought

### California is...

- the #1 state in cash farm receipts with 11.3% of the U.S. total.
- Accounts for 15% of national receipts for crops and 7.1% of the U.S. revenue for livestock and livestock products.
- the state produces nearly half of U.S.-grown fruits, nuts and vegetables.
- the nation's largest agricultural exporter.



# Its all about the water

## Impacts of Drought



*Satellite images comparing California from a year ago to today. Not only is the snow cover drastically less, but also notice how brown the central valley ground cover is relative to the green of January 2013.*

Images from NOAA

Cupertino ARES/RACES





# SCVWD Reservoir Status Report

For the period 01/1/2014 TO 02/01/2014

## RESERVOIR DATA

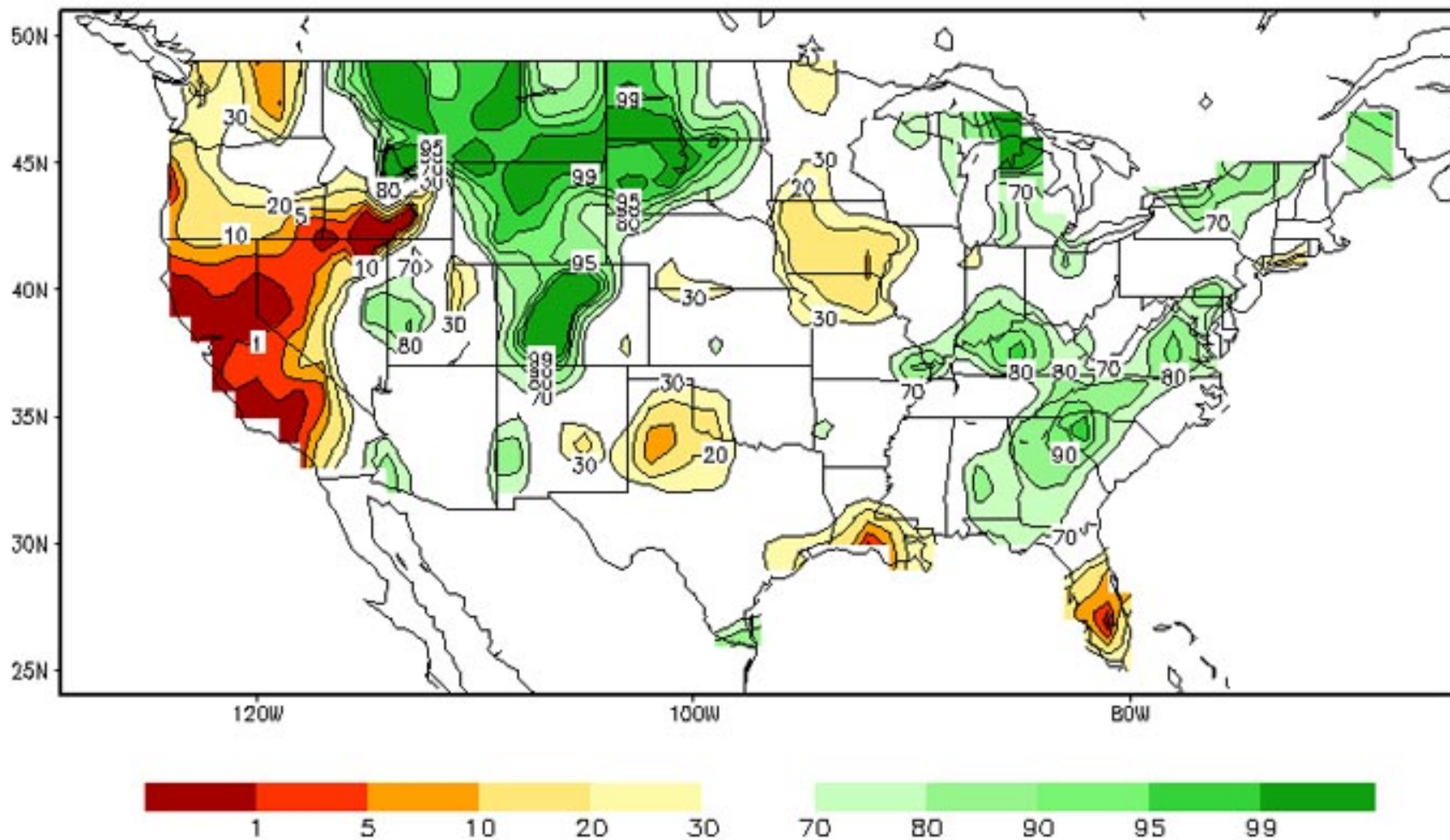
Reservoir	Capacity at Spillway	Storage 06:00 01/1/2014 (ac-ft)	Storage 06:00 02/01/2014 (ac-ft)	Storage Change (ac-ft)	Percent Capacity	Percent of Seasonal Average to Date
Almaden	1,586	50	49	(1)	3.1%	6%
Anderson	90,373	35,681	34,397	(1,284)	38.1%	59%
Calero	9,934	4,146	4,057	(89)	40.8%	67%
Chesbro	7,945	1,086	936	(150)	11.8%	20%
Coyote	23,244	7,849	7,556	(293)	32.5%	68%
Guadalupe	3,415	372	278	(94)	8.1%	15%
Lexington	19,044	6,110	5,745	(365)	30.2%	61%
Stevens Creek	3,138	168	96	(72)	3.1%	4%
Uvas	9,835	590	193	(397)	2.0%	3%
Vasona	495	317	308	(9)	62.2%	95%
<b>TOTAL</b>	<b>169,009</b>	<b>56,369</b>	<b>53,615</b>	<b>(2,754)</b>	<b>31.7%</b>	<b>53%</b>



# Its all about the water

## Impacts of Drought

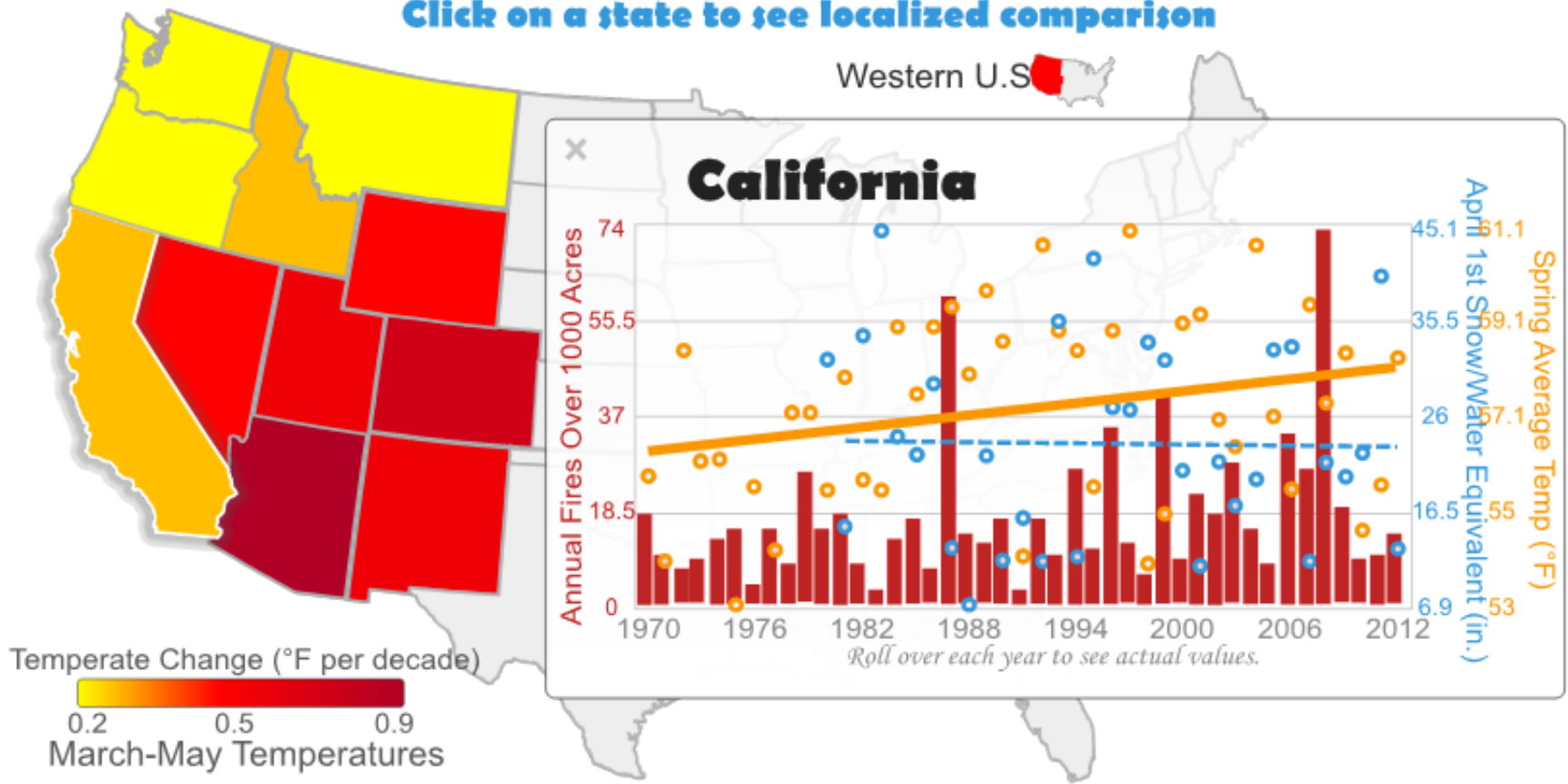
Calculated Soil Moisture Ranking Percentile  
JAN 13, 2014



# Western Wildfires On the Rise

## Warmer Temperatures and Less Spring Snowpack Increase Fire Risk

Click on a state to see localized comparison



Western U.S. wildfires have increased dramatically since 1970. Years with warmer spring and summer temperatures and reduced spring snowpack tend to have the most fires. In the coming decades, more war



# The fire risk

## Impacts of Drought

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# CAL FIRE NEWS RELEASE

California Department of Forestry and Fire Protection



**CONTACT:** Daniel Berlant  
Information Officer  
(916) 651-FIRE (3473)  
[@CALFIRE\\_PIO](https://twitter.com/CALFIRE_PIO)

**RELEASE**  
**DATE:** January 28, 2014

### **Drought Prompts CAL FIRE to Increase Statewide Staffing** *Expected Prolonged, Elevated Threat of Wildfire Due to Dry Conditions*

**Sacramento** – With unseasonably high temperatures, limited rainfall and moisture levels resembling the state’s peak fire season, the California Department of Forestry and Fire Protection (CAL FIRE) announced today that it has hired 125 supplemental firefighters in Northern California and extended seasonal firefighting forces in Southern California due to dry winter conditions.

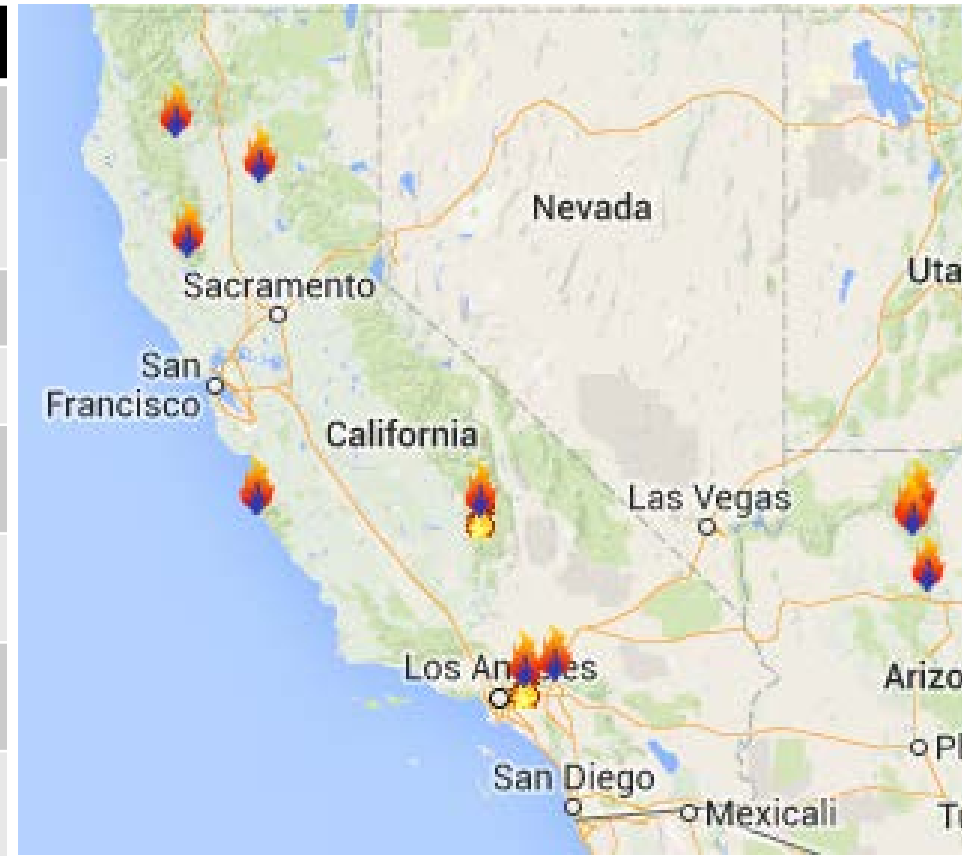
Today’s announcement follows Governor Edmund G. Brown Jr.’s drought State of Emergency earlier this month.

“In order to maintain a sufficient depth of resources to address the prolonged, elevated threat of wildfire due to drought, we have staffed 25 additional fire engines and have retained aerial firefighting assets at five air attack bases that would normally be closed this time of year,” said Chief Ken Pimlott, director of CAL FIRE. “We have a well exercised mechanism for addressing short term elevations in the threat of wildfire, but these prolonged conditions warrant an even more aggressive action in order for us to be prepared to protect the people, property and natural resources of California.”

# Fires in CA today

28 January 2014

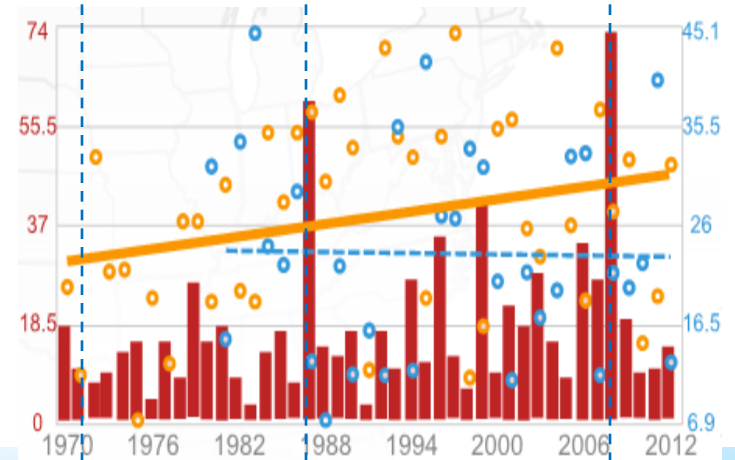
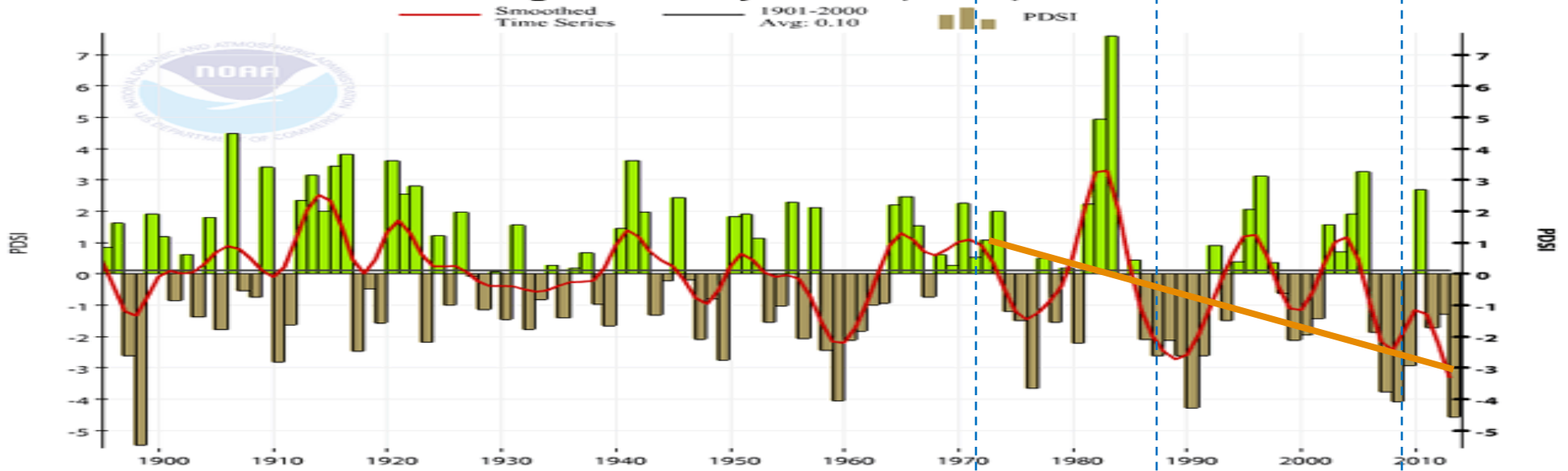
Incident	Type	Unit	Acres
Soda Fire	Wildfire	Sequoia Nat'l Forest	1,274
Shf Prescribed Fire	Prescribed Fire	Shasta-Trinity Nat'l Forest	0
Colby	Wildfire	Angeles Nat'l Forest	1,952
Campbell Fire	Wildfire	Lassen Nat'l Forest	865
Pfeiffer Fire	Wildfire	Los Padres Nat'l Forest	917
Kern River/ Sequoia	Prescribed Fire	Sequoia Nat'l Forest	140
High Glade Fire	Wildfire	Mendocino Nat'l Forest	305
Prescribed burn	Prescribed Fire	Stanislaus Nat'l Forest	0





# Correlation between Drought & Fires?

December Palmer Drought Severity Index (PDSI), California, 1895 - 2013

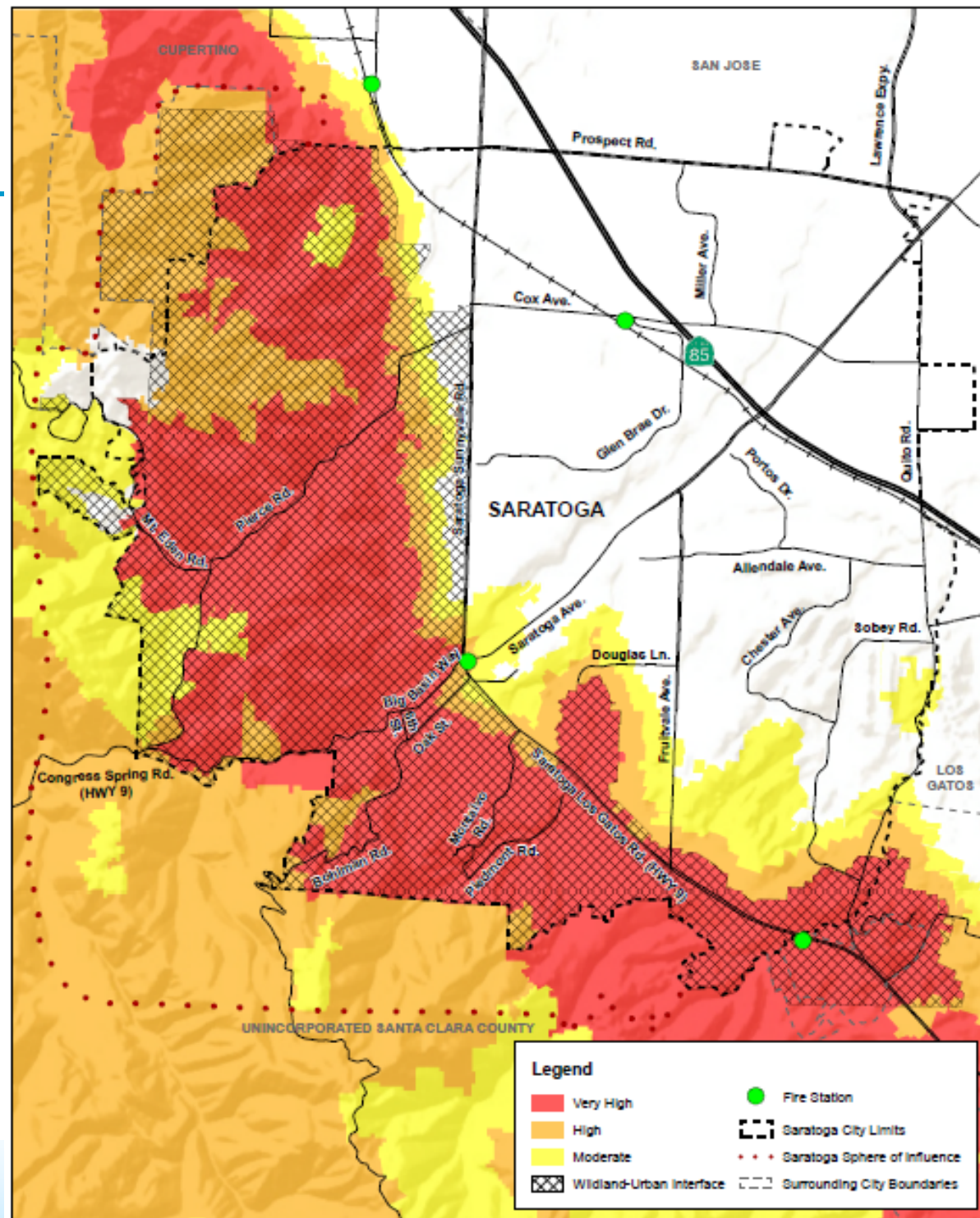


# Backyard risks

## Wildland Urban Interface

A wildland–urban interface refers to the zone of transition between unoccupied land and human development.

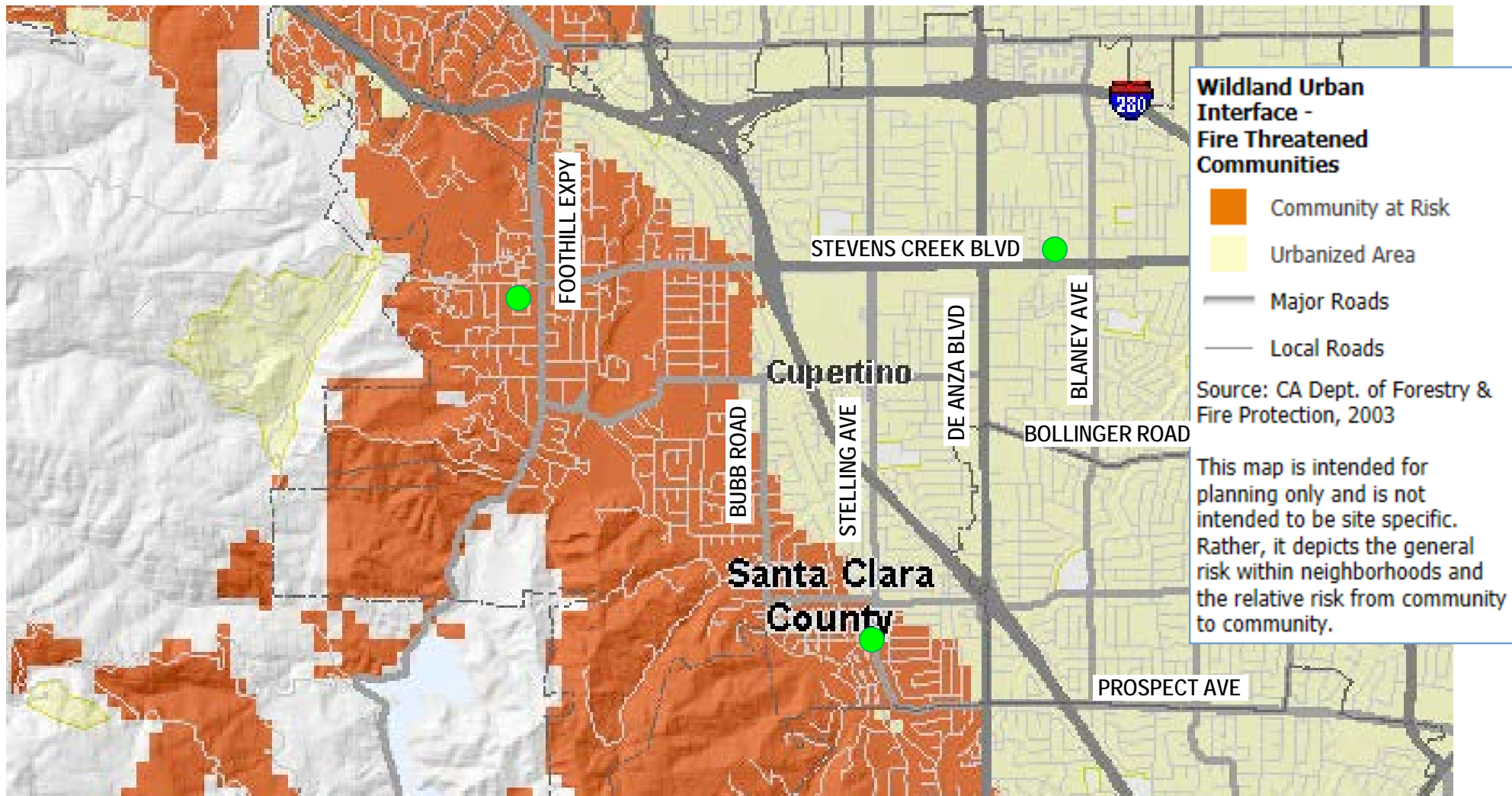
Communities that are within 0.5 miles of the zone may also be included. These lands and communities adjacent to and surrounded by wildlands are at risk of wildfires.





# Cupertino's Wildland Urban Interface

## Backyard risks



REF: [http://gis3.abag.ca.gov/Website/Fire\\_Threat\\_WUI/viewer.htm](http://gis3.abag.ca.gov/Website/Fire_Threat_WUI/viewer.htm)



# City Hazard – Wildland Fire

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## Field Battalion Three (Greater Los Gatos area) Fire History

The major wild land fire occurrence has been in the remote and sparsely populated South western portion of the Battalion Three.

### Big Events:

- 1987 Lexington Fire
- 2002 Croy Fire
- 2008 Summit Fire
- 2009 Loma Fire

**Local Events:** On August 30, 2007, fire broke out in the hills west of the Cupertino in an unincorporated area of Santa Clara Valley, burning 151 acres.



# City Hazard – Wildland Fire

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## Probability

The Cal Fire identifies *State Responsibility Area (SRA)* Fire Hazard Severity Zones as Moderate, High, and Very High based on land, fuel loading, slope, and fire weather.

Field Battalion Three is divided into 3 sections:

- South Section (Loma Prieta area) is assessed to be a VERY HIGH
- Center section (West Santa Clara Valley Foothills) is MODERATE, and
- North Section (Hwy 85 and I-280) is HIGH.



# City Hazard – Wildland Fire



Cupertino as seen from the air, October 2013

Steven Creek Blvd

Route 85

Steven Creek Reservoir

Photography by Gerd Goette KI6WEJ

Cupertino ARES/RACES



# Mapping Disasters to Capabilities

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## Disasters

- Earthquakes
- Flooding by dam failure
- Flooding by rain
- Wildland fire
- Large urban fire
- Manmade disasters (BNICE)

## Potential Problems

- People – Injuries
- People – Trapped
- People – Homeless
- People – Hungry
- People – Sick
- Structures Damaged
- Structures Burning
- Utilities – Power
- Utilities – Gas main
- Utilities – Sewage
- Utilities – Water
- Access problems

## Response Requirements

- Mass care shelters
- Evacuations
- Field First Aid stations
- Mass care, feeding
- DC/Fire Suppression
- DC/Prelim Safety
- Mass Prophylaxis
- Search and Rescue
- Information Outreach
- Information Gathering

## Response Capabilities

- Safety Assessments
- Shelter Staff
- Search & Rescue
- First Aid
- Fire Suppression
- Watches (creek, fire, traffic, incident, etc.)
- Communications (Field, Shadows, etc.)
- General resource





# Wild land, Urban Fire

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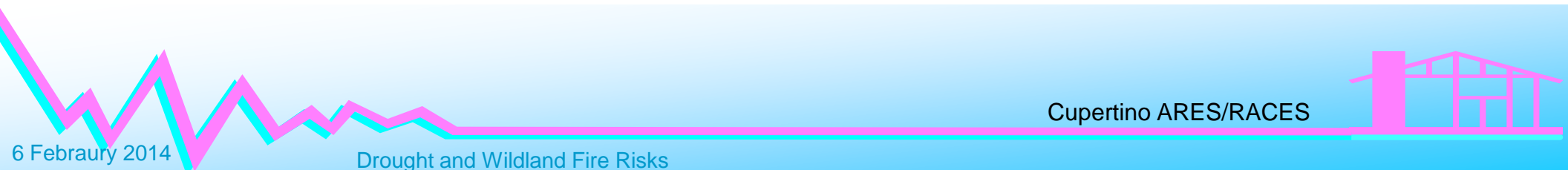
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## Response Capabilities – CARES

- **Safety Assessments**
- **Shelter Comms**
- Search & Rescue
- First Aid
- Fire Suppression
- **Watches (creek, fire, traffic, incident, etc.)**
- **Communications (Field, Shadows, etc.)**
- General resource





# What is our plan for this year?

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- Plan: May communications drill with a focus on supporting the city during a wild-fire event
- Goal: Message handling between the field assignments and the EOC
- Approach:
  1. work with County Fire on plausible CARES and Cupertino Citizen Corps response scenarios
  2. make it interesting



# References

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1. Drought onset vs duration, 2003; [http://www.sfu.ca/~ianh/geog312/lectures/Drought\\_files/Drought.ppt](http://www.sfu.ca/~ianh/geog312/lectures/Drought_files/Drought.ppt)
2. "Drought Monitoring: Challenges in the Western United States," Brian Fuchs, 2009; [http://cses.washington.edu/cig/outreach/workshopfiles/boise2009/Fuchs\\_Boise\\_102209.ppt](http://cses.washington.edu/cig/outreach/workshopfiles/boise2009/Fuchs_Boise_102209.ppt)
3. National Drought Summary -- January 28, 2014; <http://droughtmonitor.unl.edu/>
4. PDSI, California 1895 - 2013; <http://beta2011.wunderground.com/blog/JeffMasters/www.ssd.noaa.gov/goes/east/catl/archive.html?year=2014&month=01>
5. "North American Drought: Paleoclimatic and Historic Contexts," Greg McCabe, USGS, ~2010; <http://www.iwr.usace.army.mil/Portals/70/docs/projects/31May07/mccabe.drought.05312007.ppt>
6. "El Niños of the Past", Scripps Institution of Oceanography, 2011; <http://meteora.ucsd.edu/~pierce/elnino/history.html>
7. Atlantic Multidecadal Oscillation; [http://en.wikipedia.org/wiki/Atlantic\\_multidecadal\\_oscillation](http://en.wikipedia.org/wiki/Atlantic_multidecadal_oscillation)
8. "Rising Temps, Shrinking Snowpack Fuel Western Wildfires", 2013; <http://www.climatecentral.org/news/rising-temps-shrinking-snowpack-fuel-western-wildfires-16222>
9. "Central California Enters a Drought Period Unprecedented in its Weather History", Christopher C Bert, 2014; <http://www.wunderground.com/blog/weatherhistorian/comment.html?entrynum=233>
10. "A Very Dry Year", San Jose Mercury, 2014; [http://www.mercurynews.com/science/ci\\_24812749/california-drought-deepens-another-years-rains-stay-away](http://www.mercurynews.com/science/ci_24812749/california-drought-deepens-another-years-rains-stay-away)
11. "Forest Fires and Drought in the U.S. Southwest", 2013; [http://geochange.er.usgs.gov/sw/impacts/biology/fires\\_drought/](http://geochange.er.usgs.gov/sw/impacts/biology/fires_drought/)
12. "California drought brings 'unprecedented' fire danger", 2014; <http://www.latimes.com/local/lanow/la-me-ln-california-drought-brings-unprecedented-fire-danger-20140118,0,3445118.story#ixzz2sQ8oOypC>
13. "Saratoga Fire Hazards"; <http://www.saratoga.ca.us/cityhall/cmo/emprepinfo/wildfire.asp>
14. "Wildland Urban Interface, Fire-threatened Communities", ABAG GIS; [http://gis3.abag.ca.gov/Website/Fire\\_Threat\\_WUI/viewer.htm](http://gis3.abag.ca.gov/Website/Fire_Threat_WUI/viewer.htm)



# Thank you

*Any Questions?*

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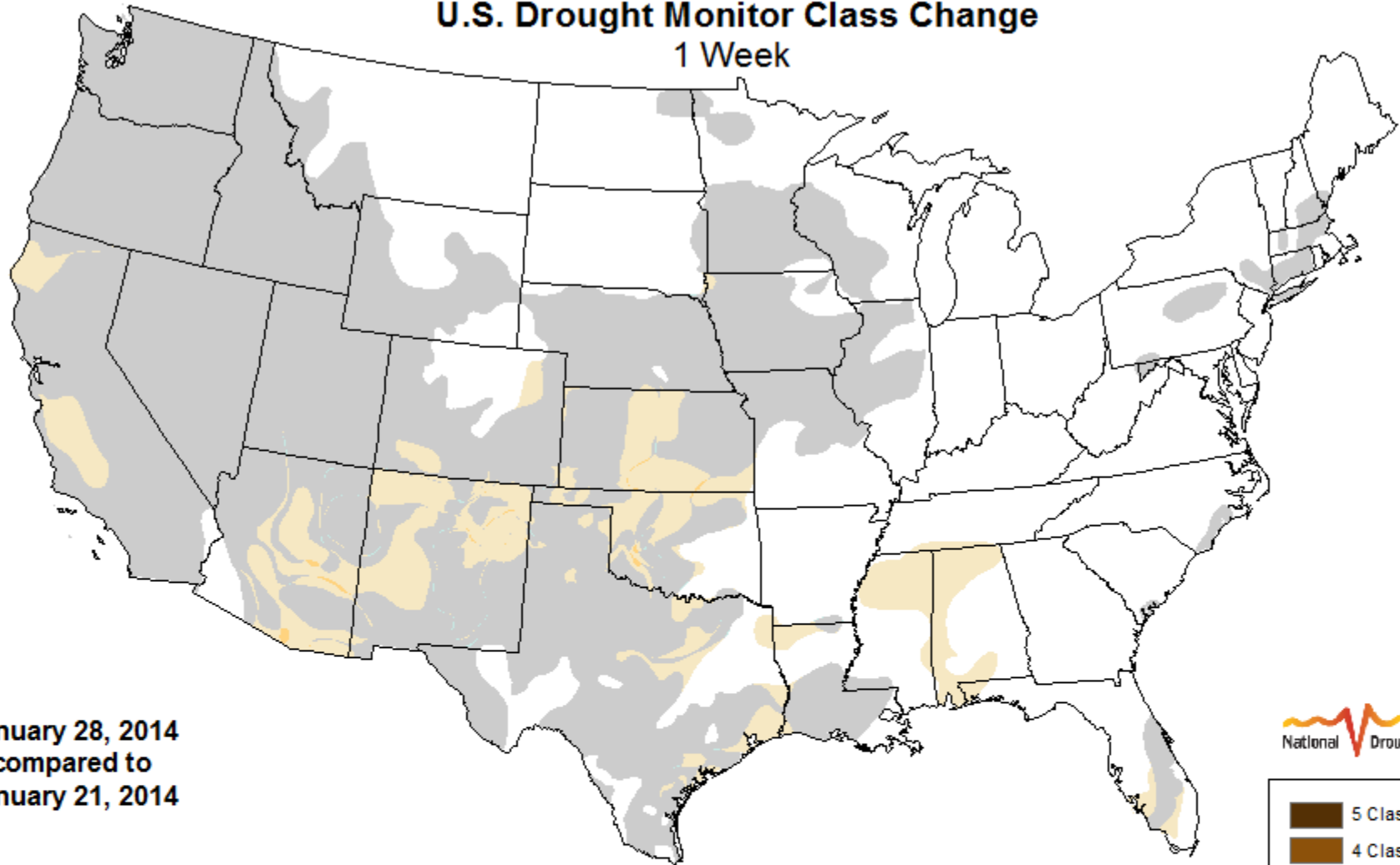


Cupertino ARES/RACES

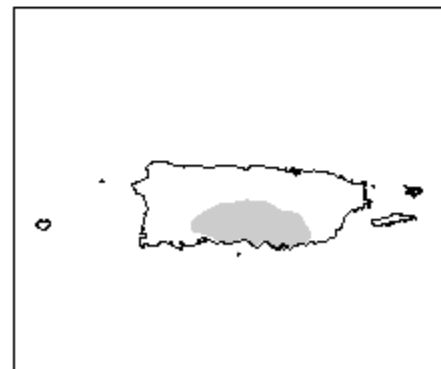
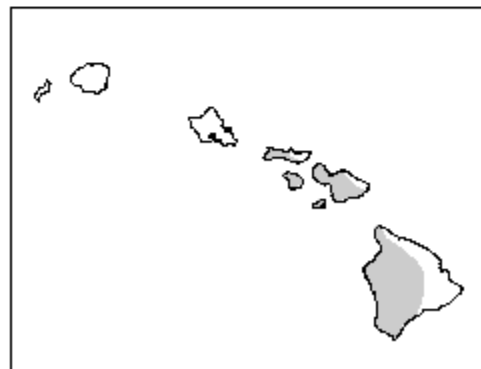
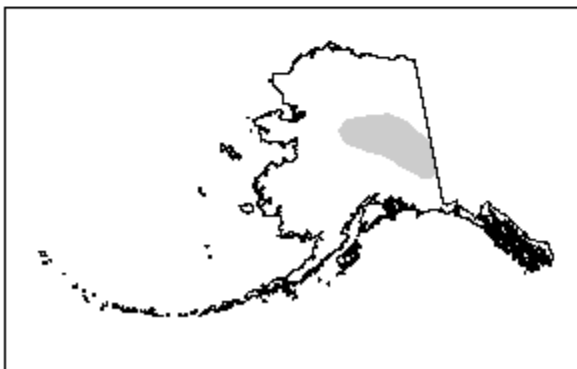
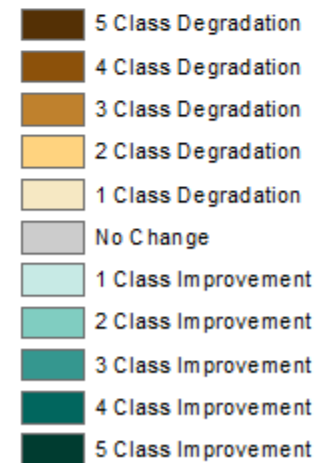
6 Febraury 2014

Drought and Wildland Fire Risks

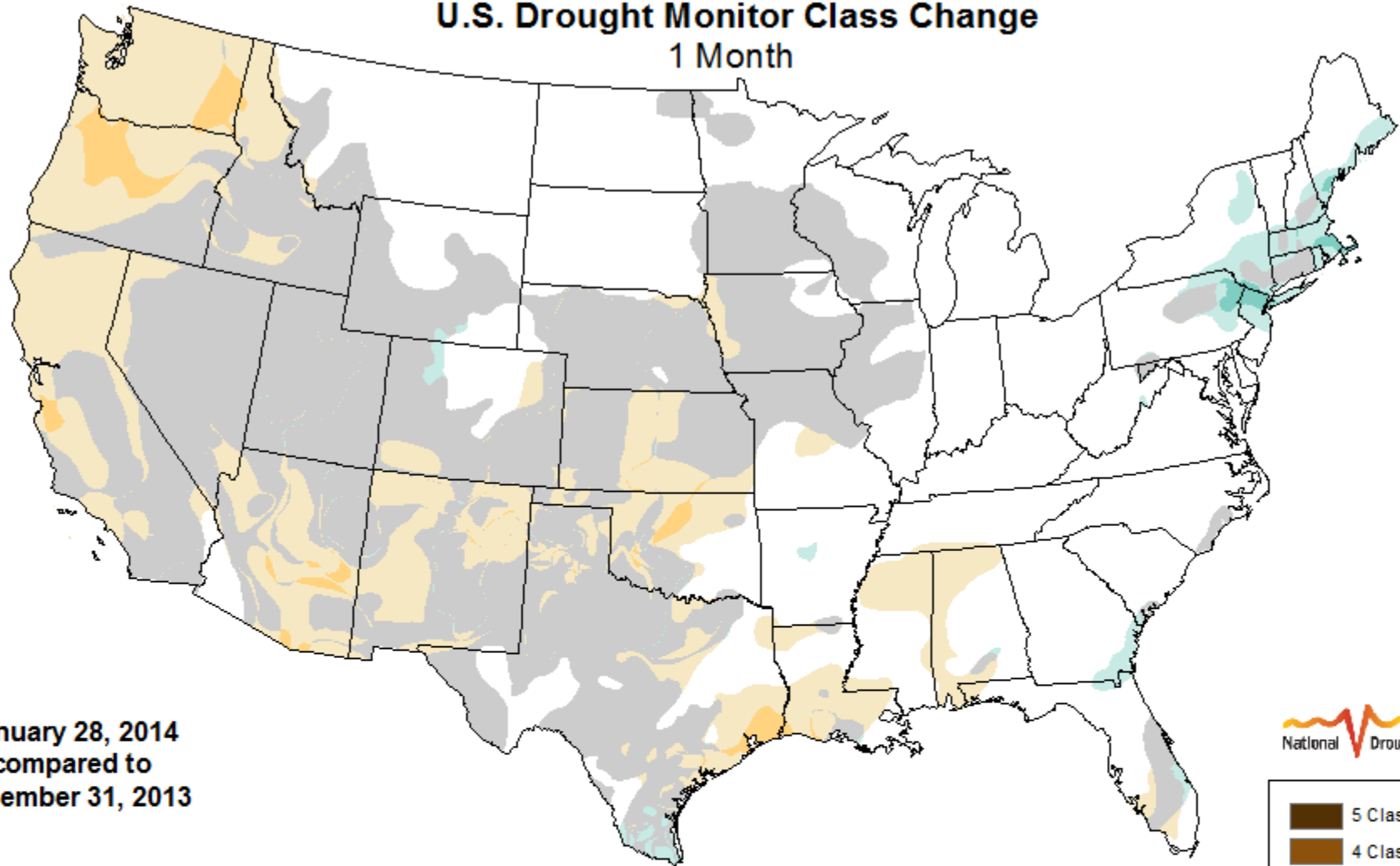
# U.S. Drought Monitor Class Change 1 Week



January 28, 2014  
compared to  
January 21, 2014



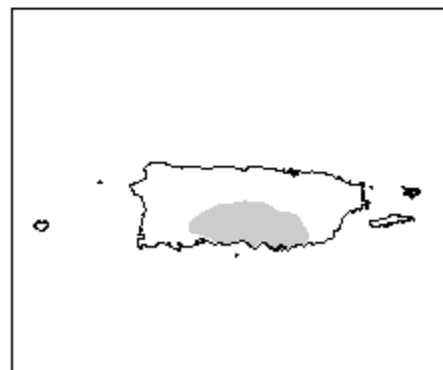
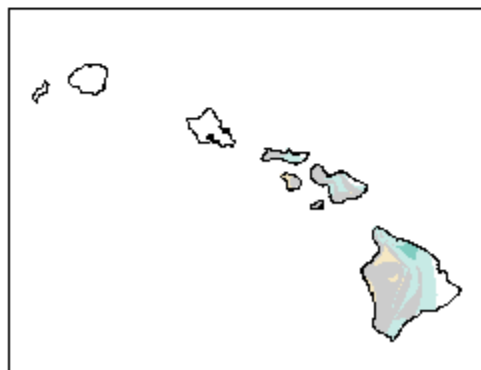
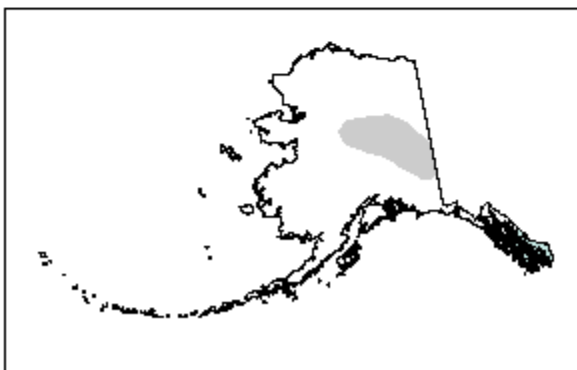
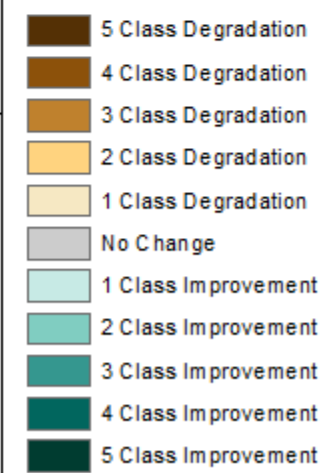
# U.S. Drought Monitor Class Change 1 Month



January 28, 2014  
compared to  
December 31, 2013



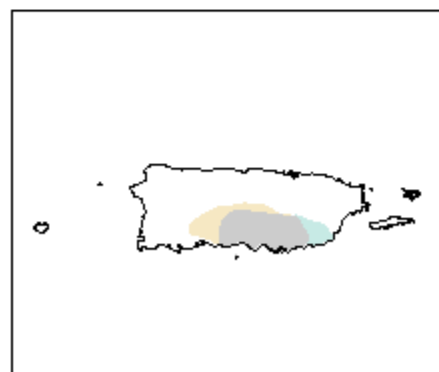
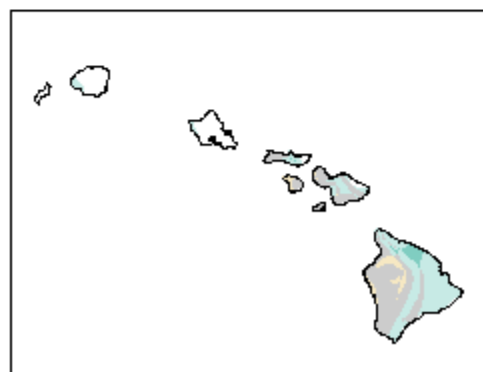
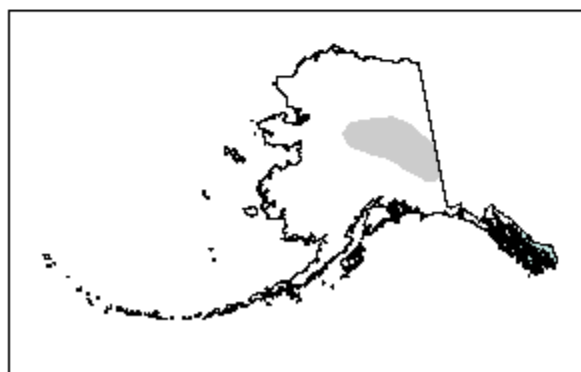
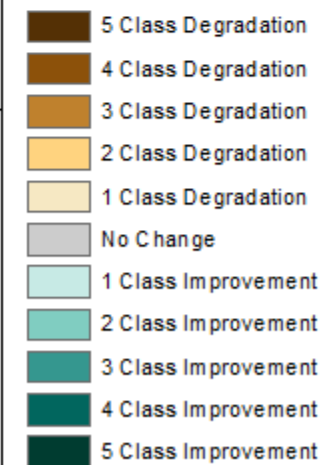
National Drought Mitigation Center





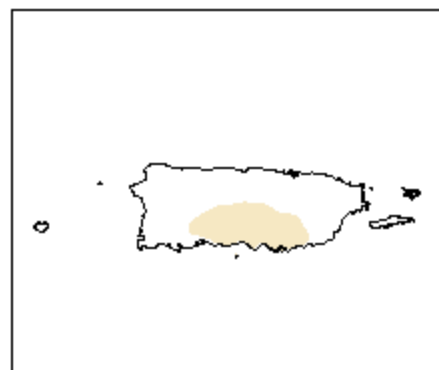
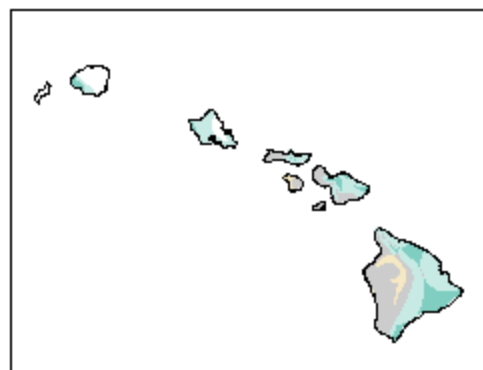
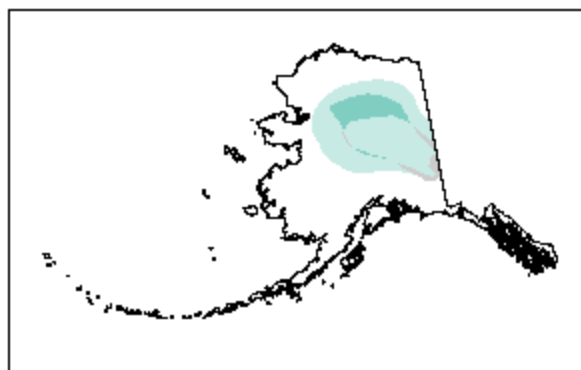
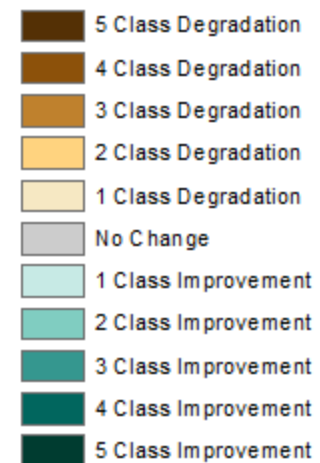
## U.S. Drought Monitor Class Change 2 Months

January 28, 2014  
compared to  
December 3, 2013

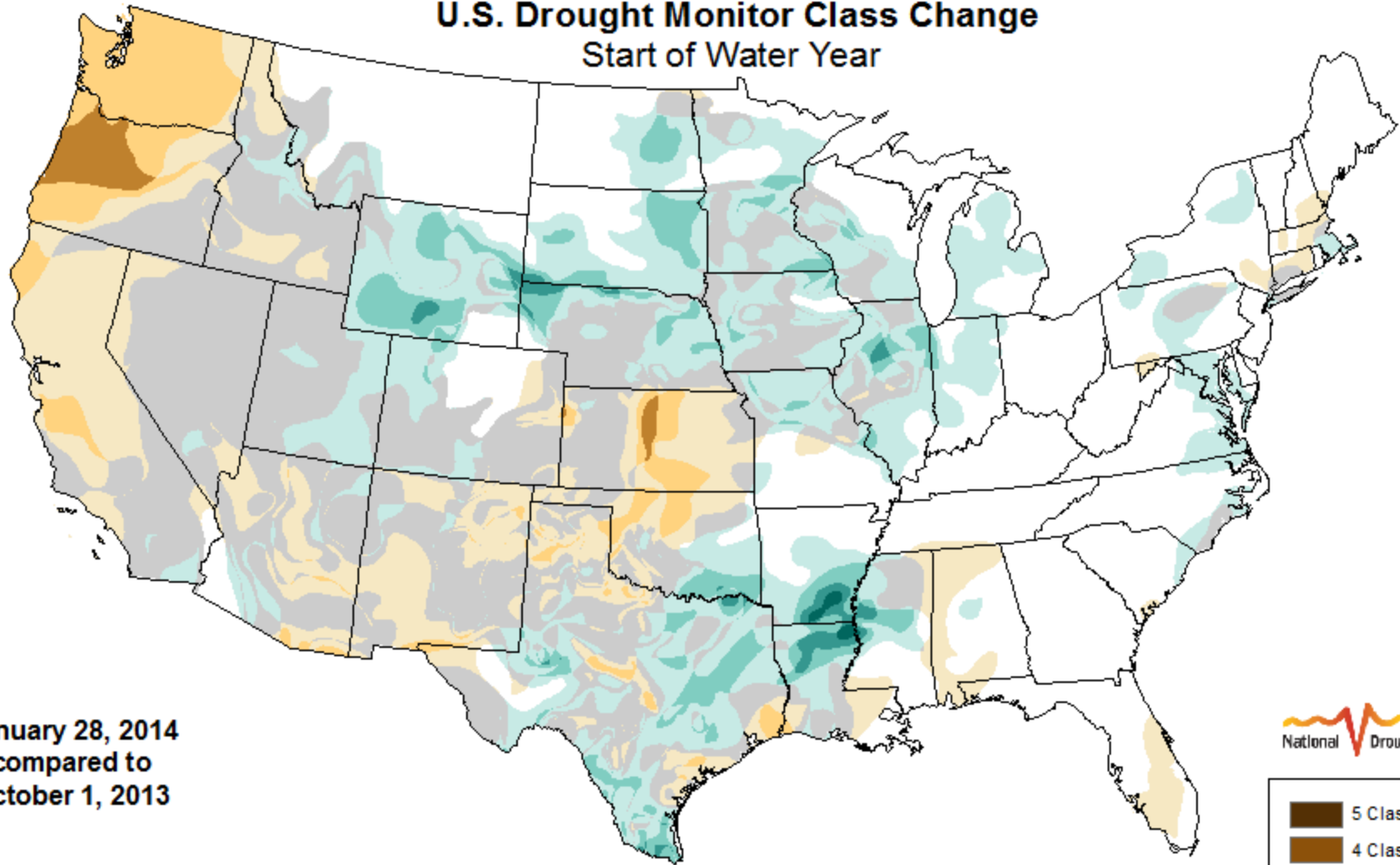


# U.S. Drought Monitor Class Change 3 Months

January 28, 2014  
compared to  
November 5, 2013



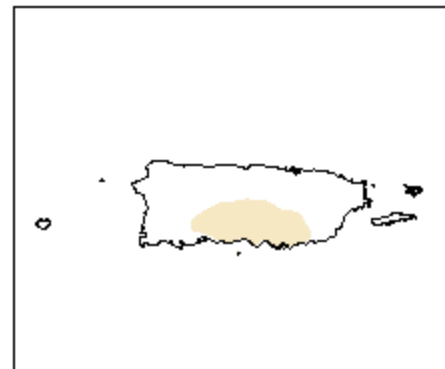
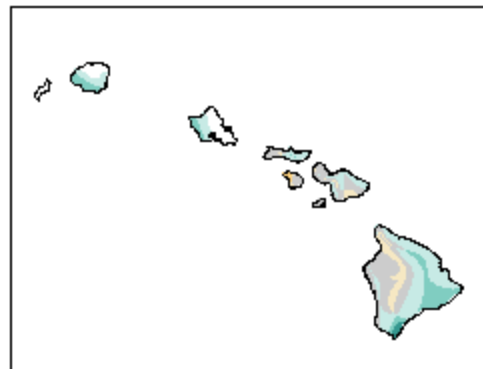
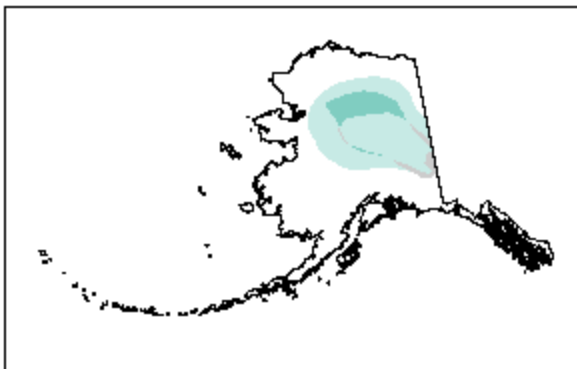
# U.S. Drought Monitor Class Change Start of Water Year



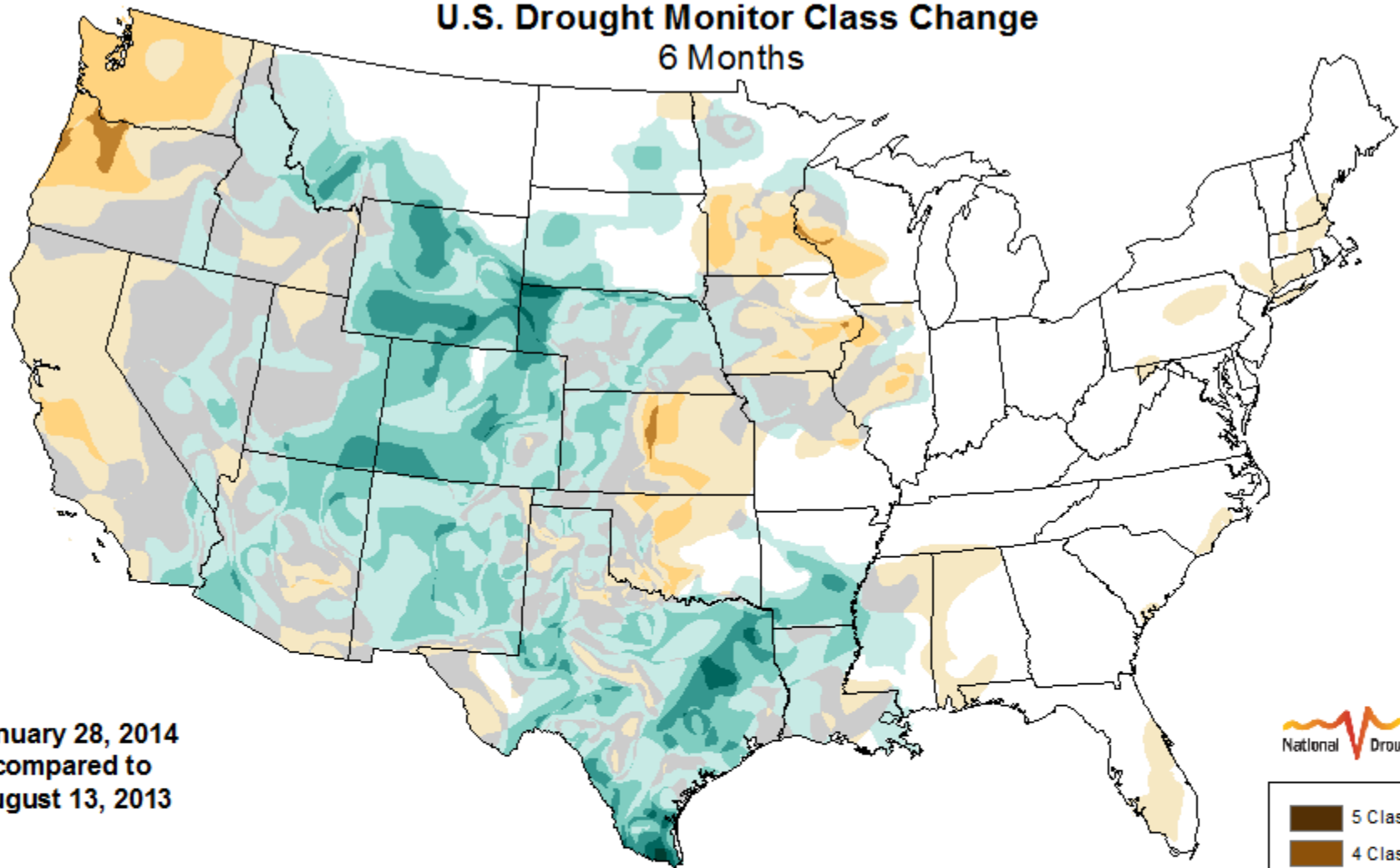
January 28, 2014  
compared to  
October 1, 2013



- 5 Class Degradation
- 4 Class Degradation
- 3 Class Degradation
- 2 Class Degradation
- 1 Class Degradation
- No Change
- 1 Class Improvement
- 2 Class Improvement
- 3 Class Improvement
- 4 Class Improvement
- 5 Class Improvement



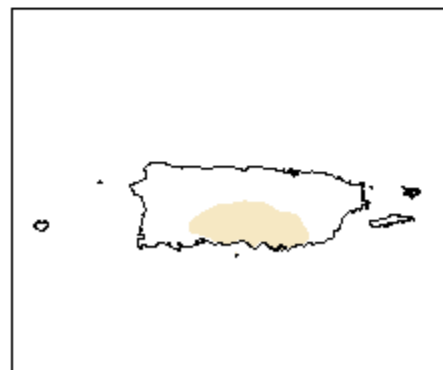
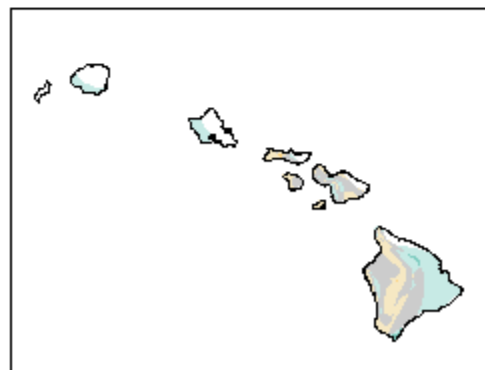
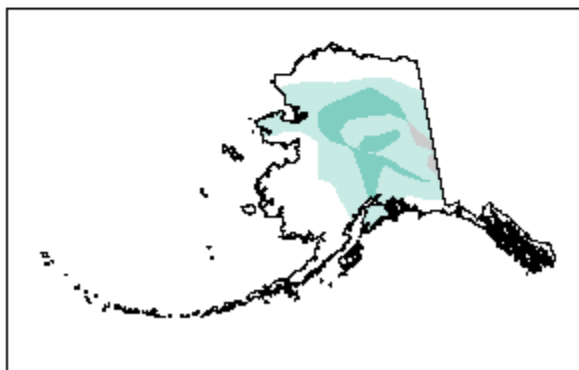
# U.S. Drought Monitor Class Change 6 Months



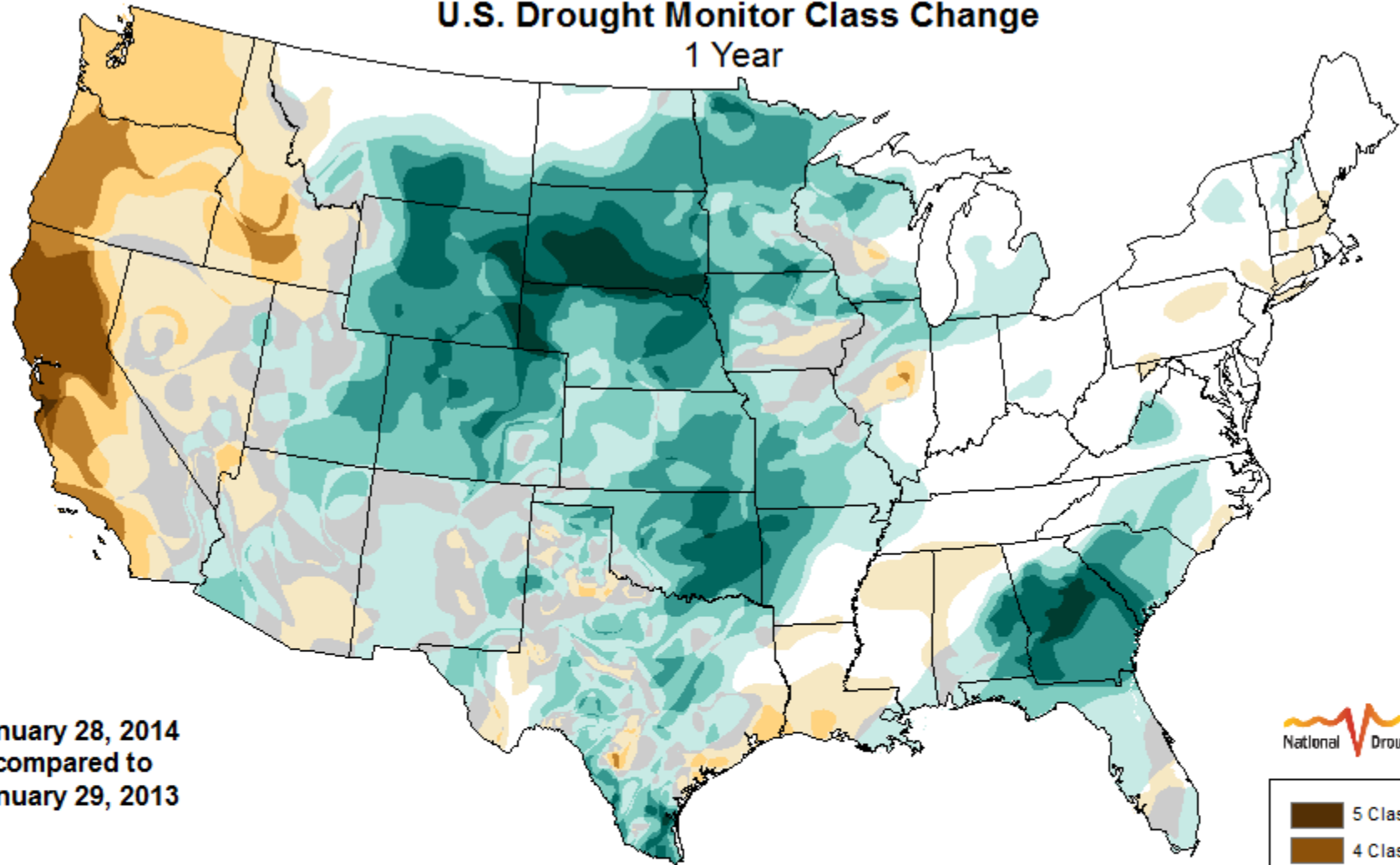
January 28, 2014  
compared to  
August 13, 2013



- 5 Class Degradation
- 4 Class Degradation
- 3 Class Degradation
- 2 Class Degradation
- 1 Class Degradation
- No Change
- 1 Class Improvement
- 2 Class Improvement
- 3 Class Improvement
- 4 Class Improvement
- 5 Class Improvement



# U.S. Drought Monitor Class Change 1 Year



January 28, 2014  
compared to  
January 29, 2013

