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# Climate Science, Impacts, and Action

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Western Region Climate Service Director

February 10, 2015



# Outline



- Impacts of a changing climate
- Resources
- Action



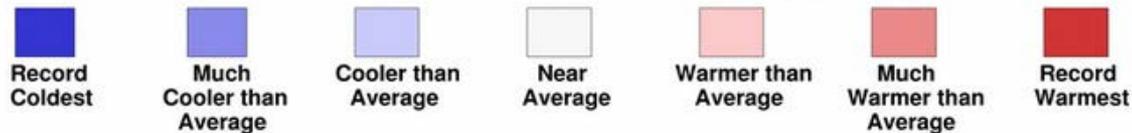
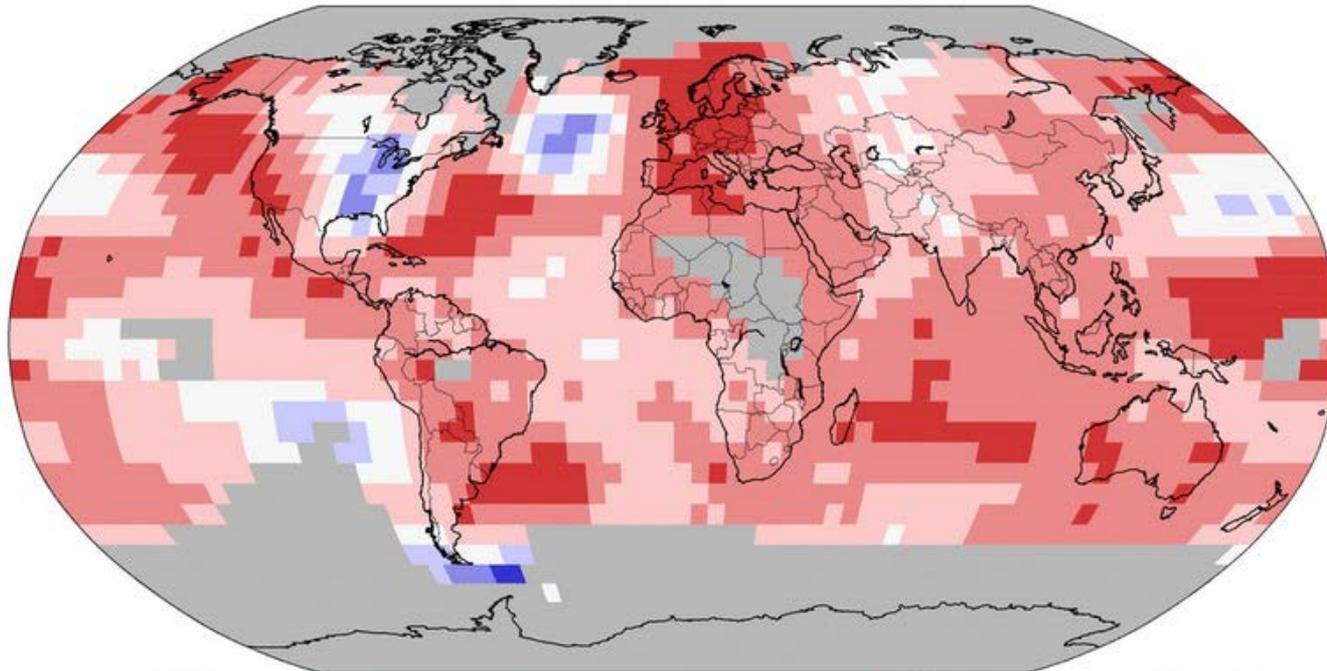
# 2014 Global Temperature



## Land & Ocean Temperature Percentiles Jan–Dec 2014

NOAA's National Climatic Data Center

Data Source: GHCN–M version 3.2.2 & ERSST version 3b





# Global Temperatures



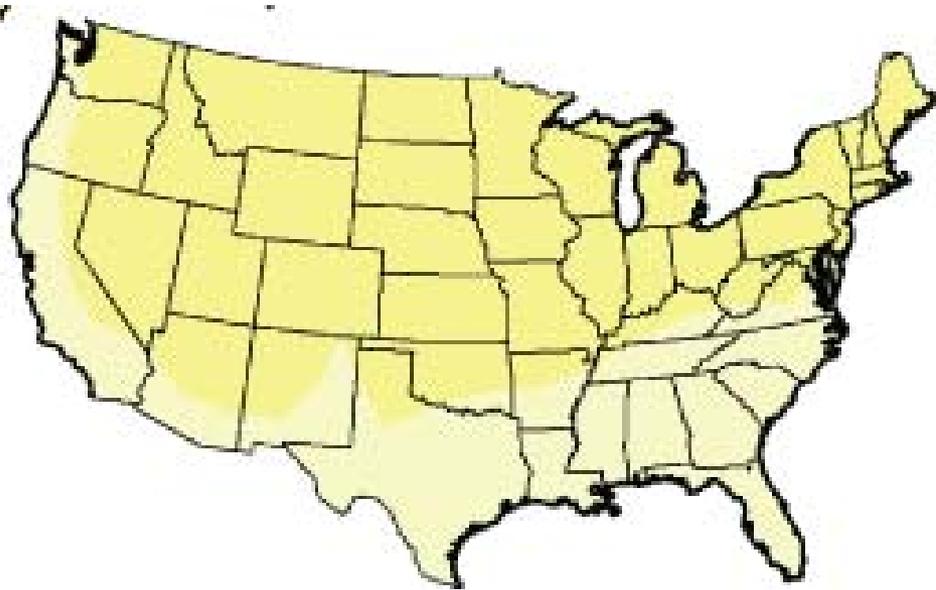
RANK 1 = WARMEST PERIOD OF RECORD: 1880–2014	YEAR	ANOMALY °C	ANOMALY °F
1	2014	0.69	1.24
2 (tie)	2010	0.65	1.17
2 (tie)	2005	0.65	1.17
4	1998	0.63	1.13
5 (tie)	2013	0.62	1.12
5 (tie)	2003	0.62	1.12
7	2002	0.61	1.10
8	2006	0.60	1.08
9 (tie)	2009	0.59	1.06
9 (tie)	2007	0.59	1.06



# Projected Temperature INCREASE by our Grandchildren's Time



Significant Emissions Reduction



Current Emissions Continue



2071-2099 relative to 1970-1999

Temperature Change (°F)

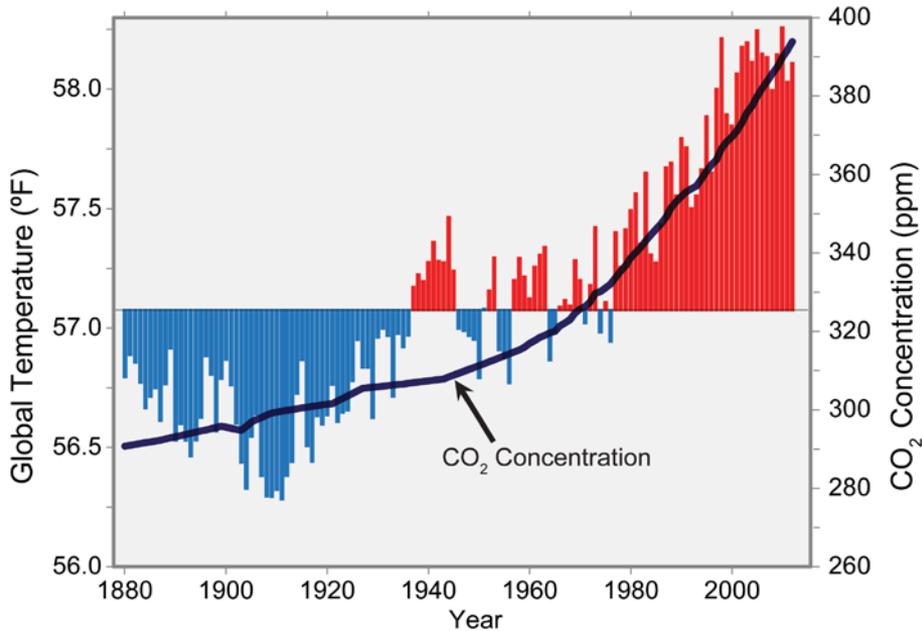




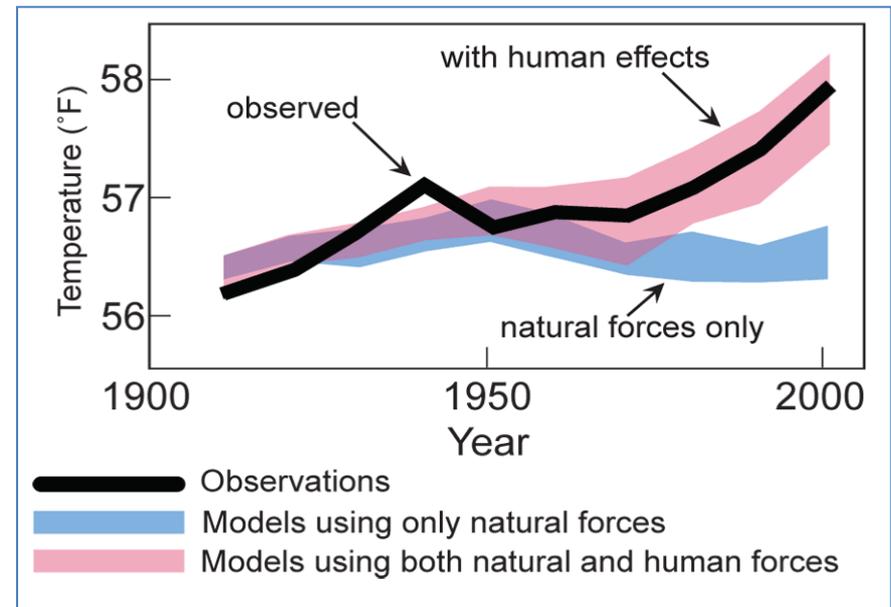
# Increasing Temperatures Correlate with Human Influences



## Global Temperature and CO<sub>2</sub>

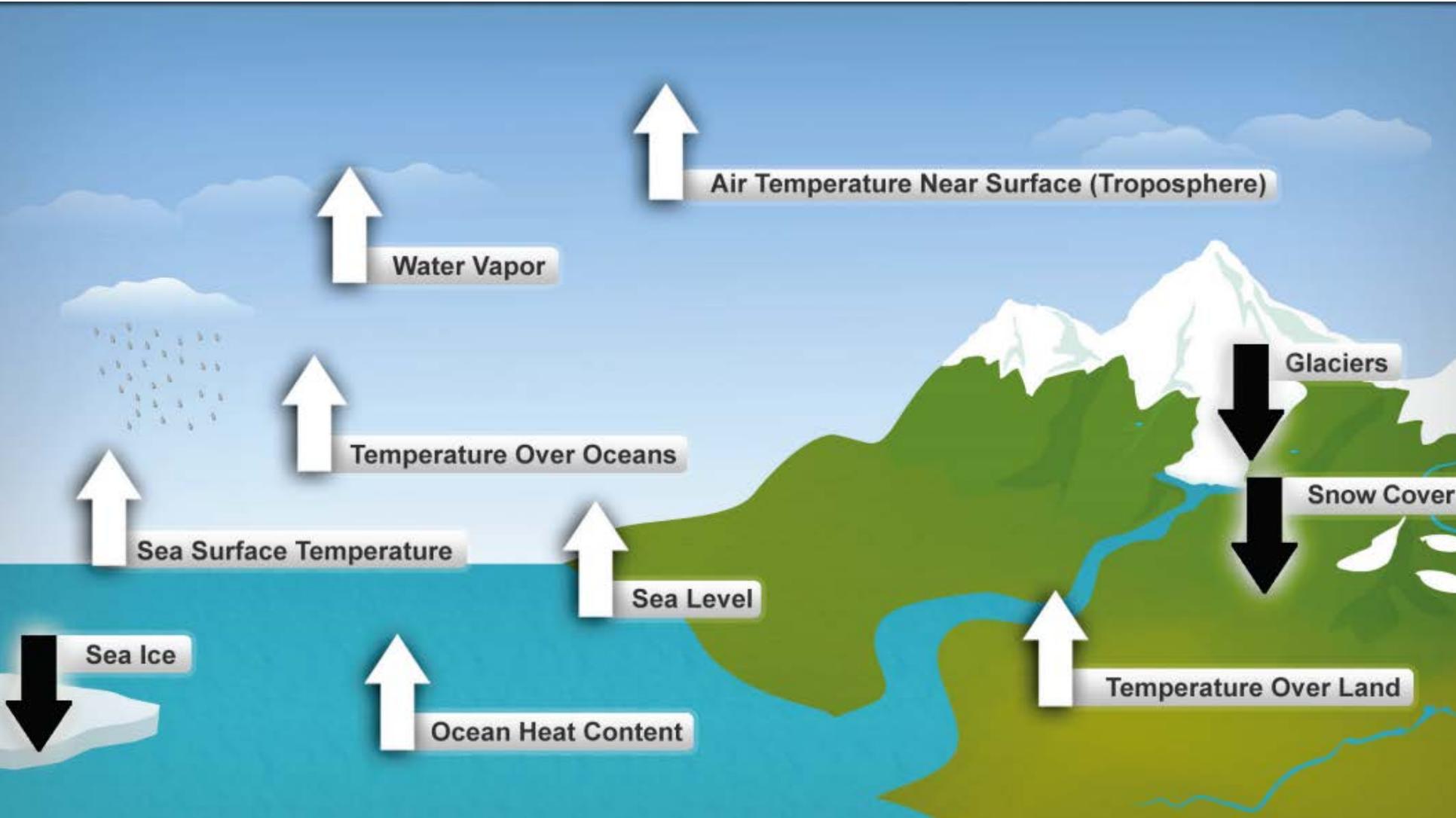


## Separating Human and Natural Influences on Climate



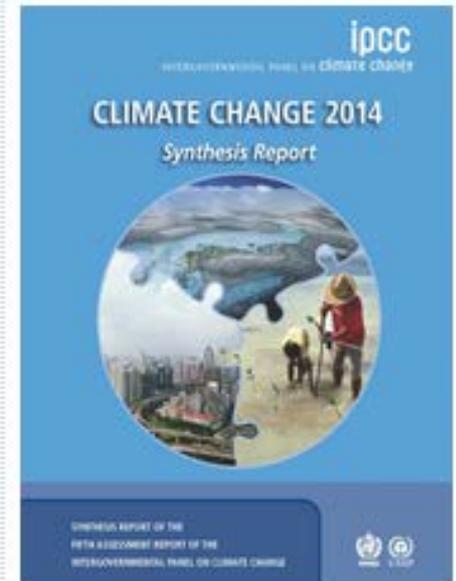
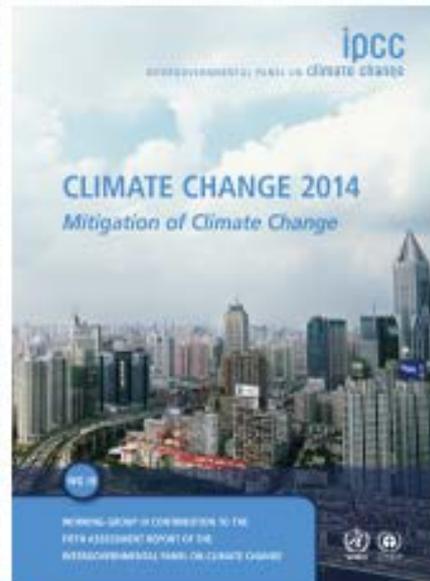


All indicators expected to **increase** in a warming world are **increasing** and those expected to **decrease** are **decreasing**





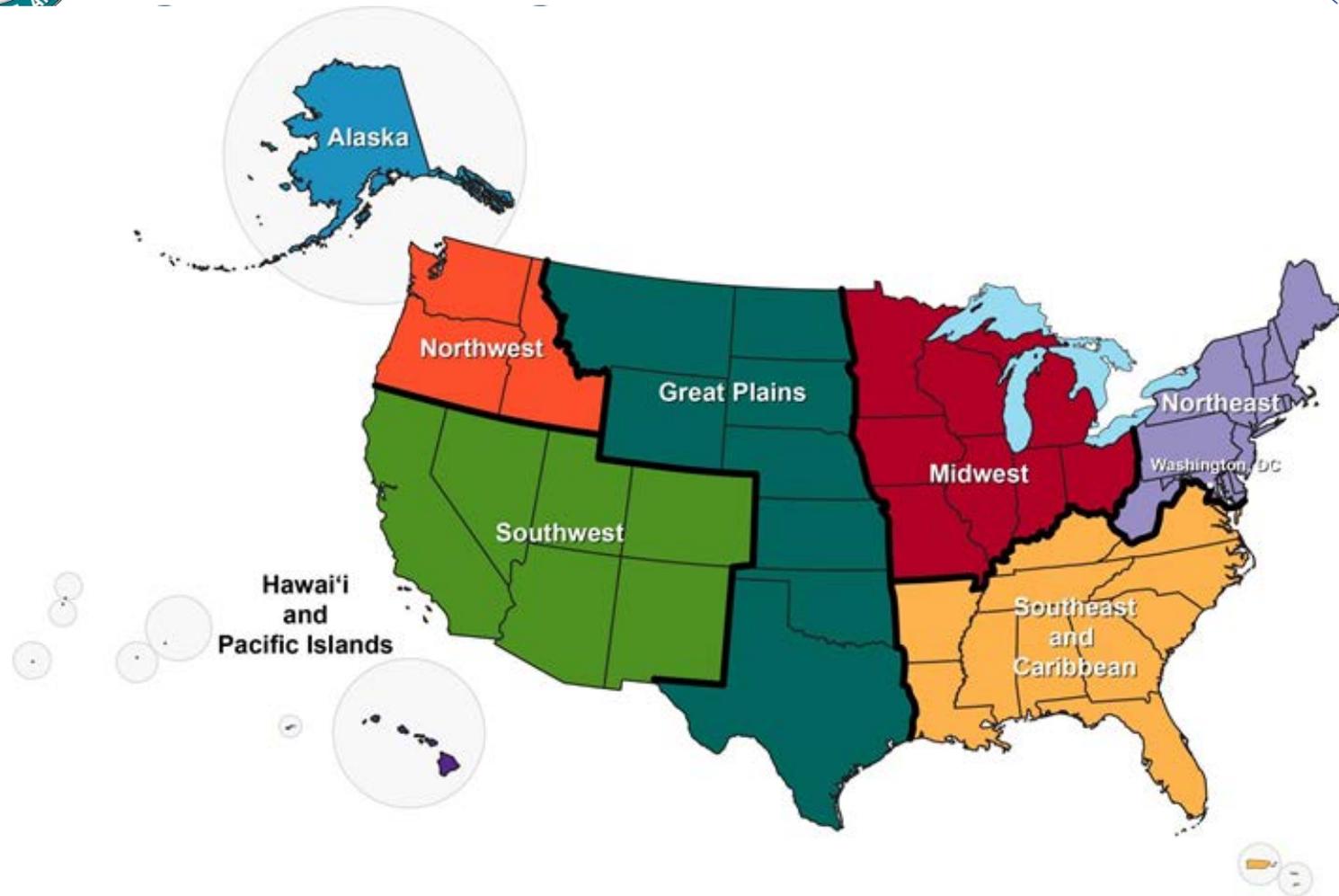
# Intergovernmental Panel On Climate Change (IPCC)



[www.ipcc.ch/report/ar5](http://www.ipcc.ch/report/ar5)

# Third National Climate Assessment

DEPARTMENT OF COMMERCE





# Main Messages



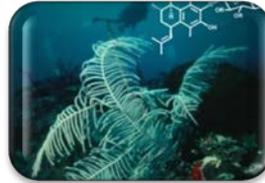
- Largest & most comprehensive **for the U.S.**
- Climate change is happening **now**
- America is **feeling the effects**
- Important **opportunities** to manage & prepare



U.S. Global Change Research Program  
**National Climate  
Assessment**



# What is at Risk? What Can We Do?





# Key Messages for the West



## Northwest:

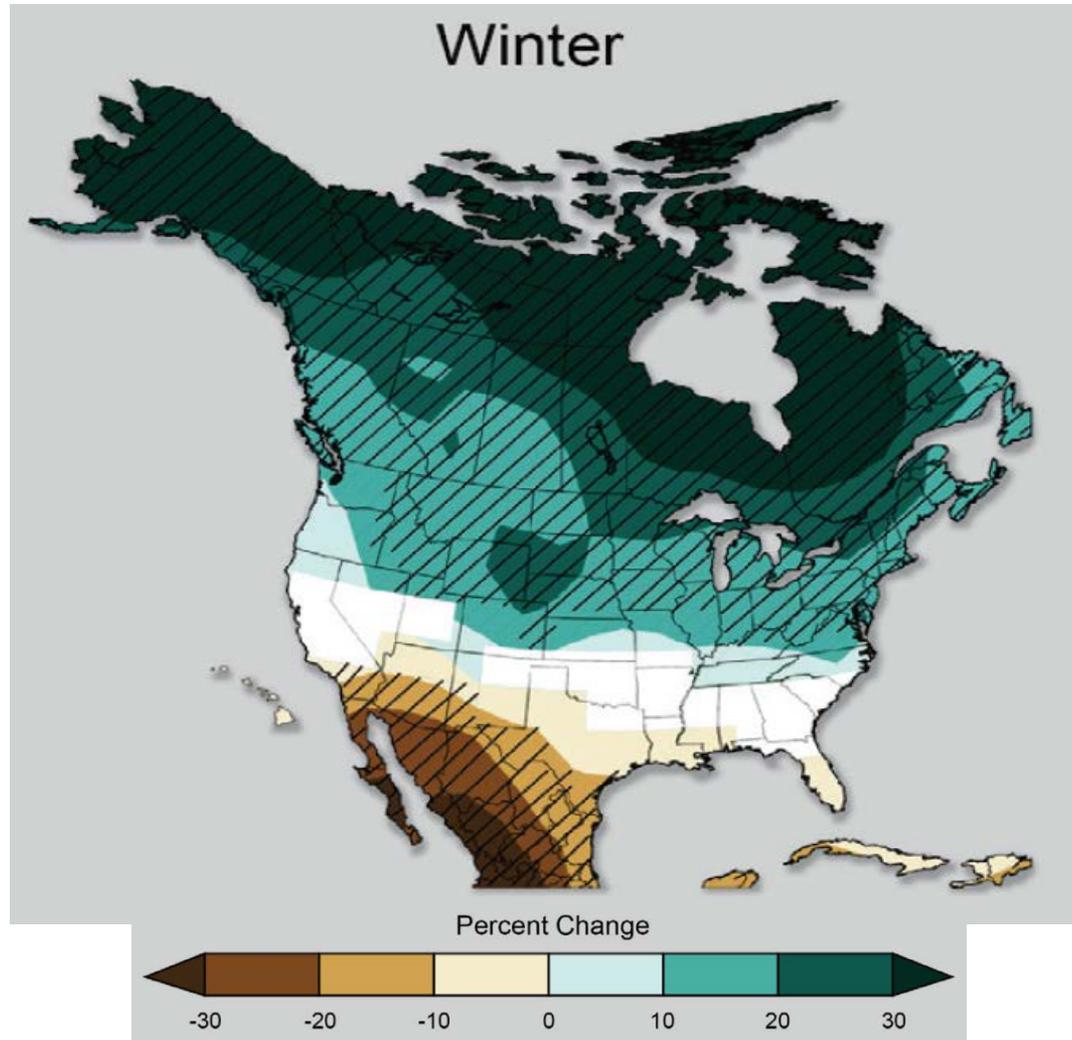
1. Water Related Challenges
2. Coastal Vulnerabilities
3. Impacts on Forests
4. Adapting Agriculture

## Southwest:

1. Reduced Snowpack and Streamflows
2. Threats to Agriculture
3. Increased Wildfire
4. Sea Level Rise and Coastal Damage
5. Heat Threats to Health



# Projected Precipitation Change Higher Emissions (A2)

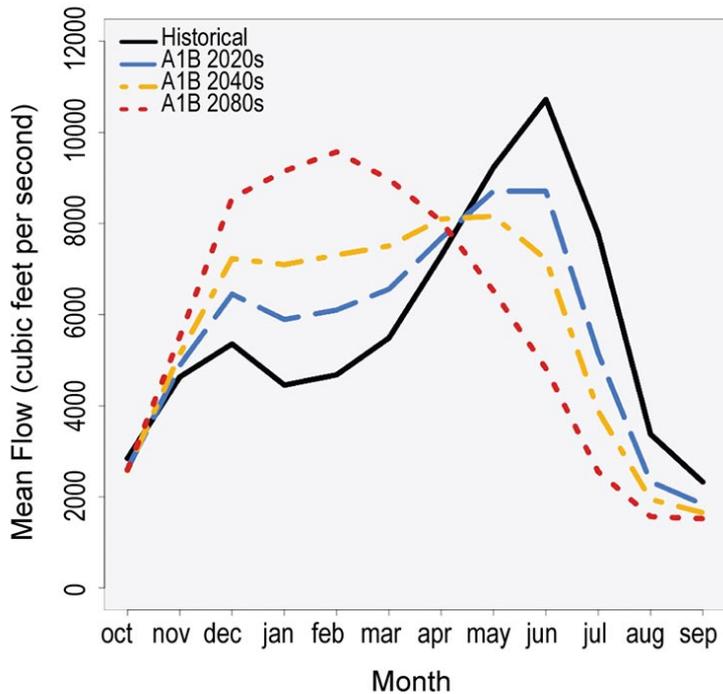




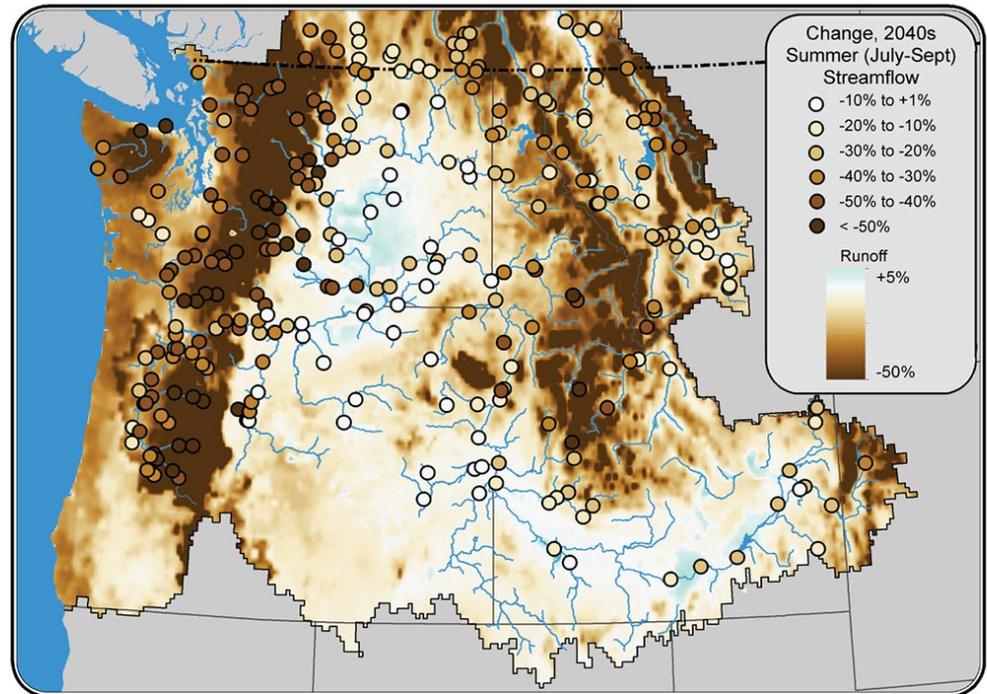
# Water-related Challenges



### Future Shift in Timing of Stream Flows



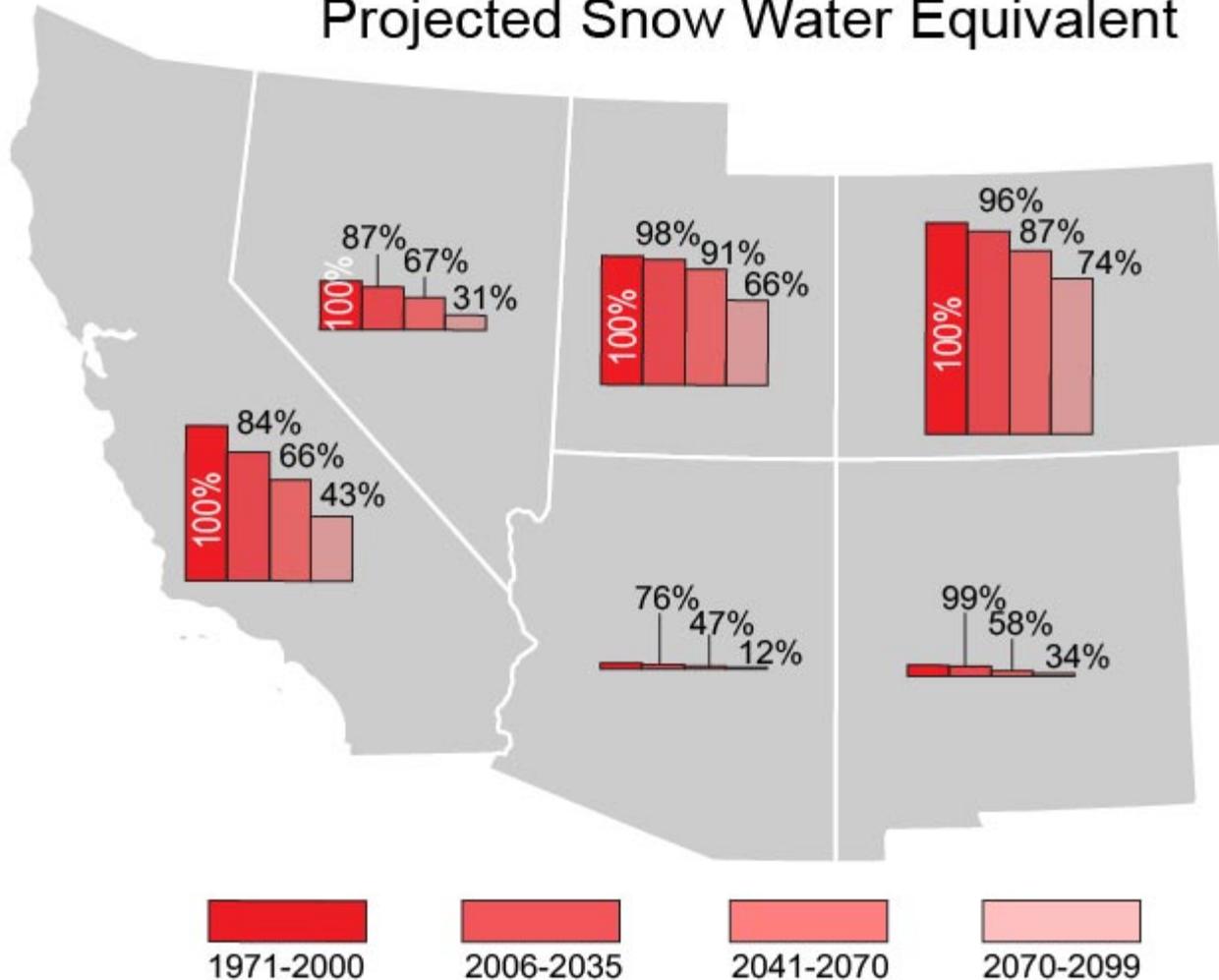
### Reduced Summer Flows





# Water-related Challenges

## Projected Snow Water Equivalent





# Big Cottonwood Creek climate sensitivity

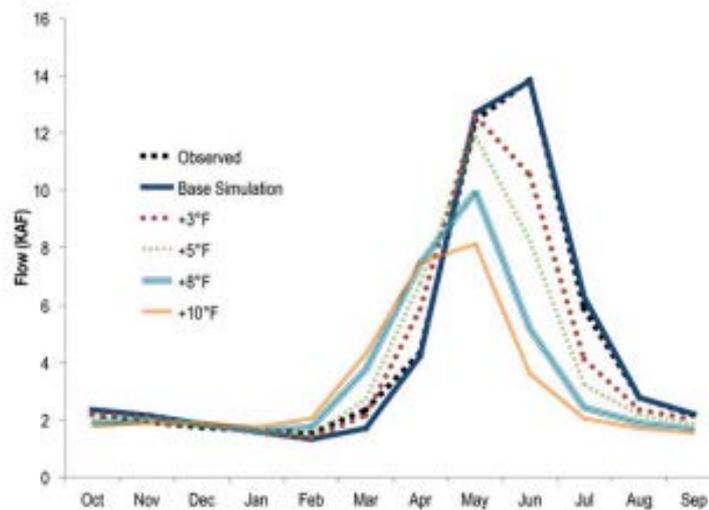


Figure 6. Big Cottonwood Creek runoff sensitivity to temperature as indicated by 30-yr mean (water years 1981–2010) monthly runoff volumes forced by various temperature changes. Temperature changes (°F) are indicated in the legend, where “base” signifies base climate historical simulation with no temperature adjustment. Also shown is the observed mean monthly streamflow.

Credit: Bardsley et al, 2013

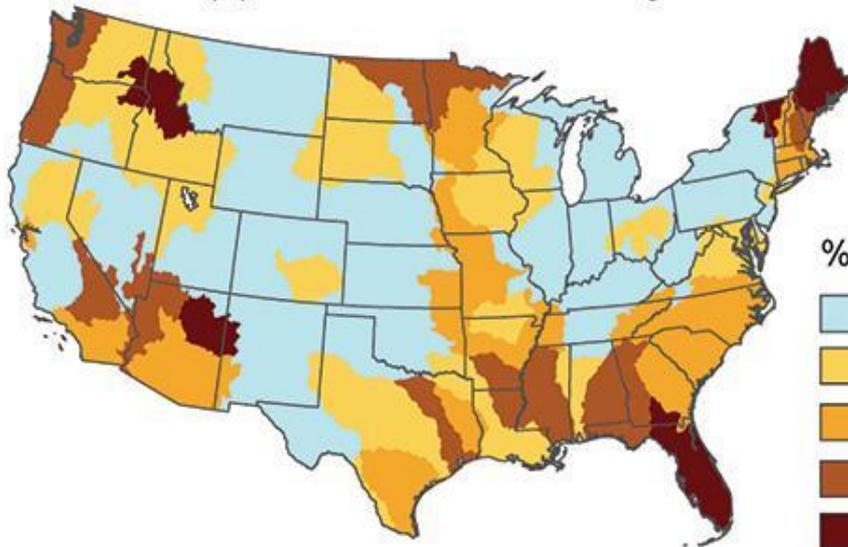


Water quality and water supply are jeopardized by climate change in a variety of ways that affect ecosystems and livelihoods.

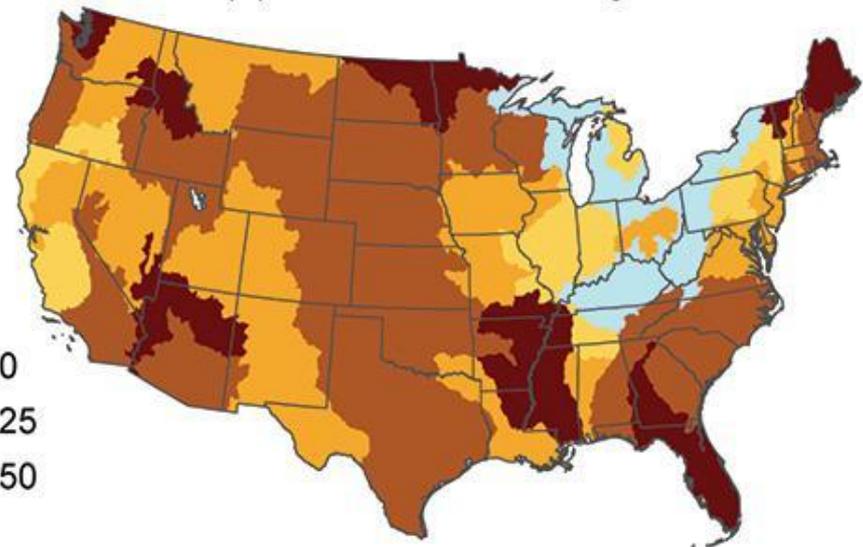


## Projected Changes in Water Withdrawal

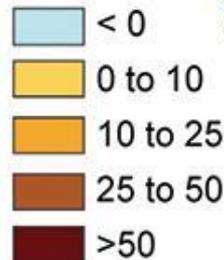
(a) Without Climate Change



(b) With Climate Change



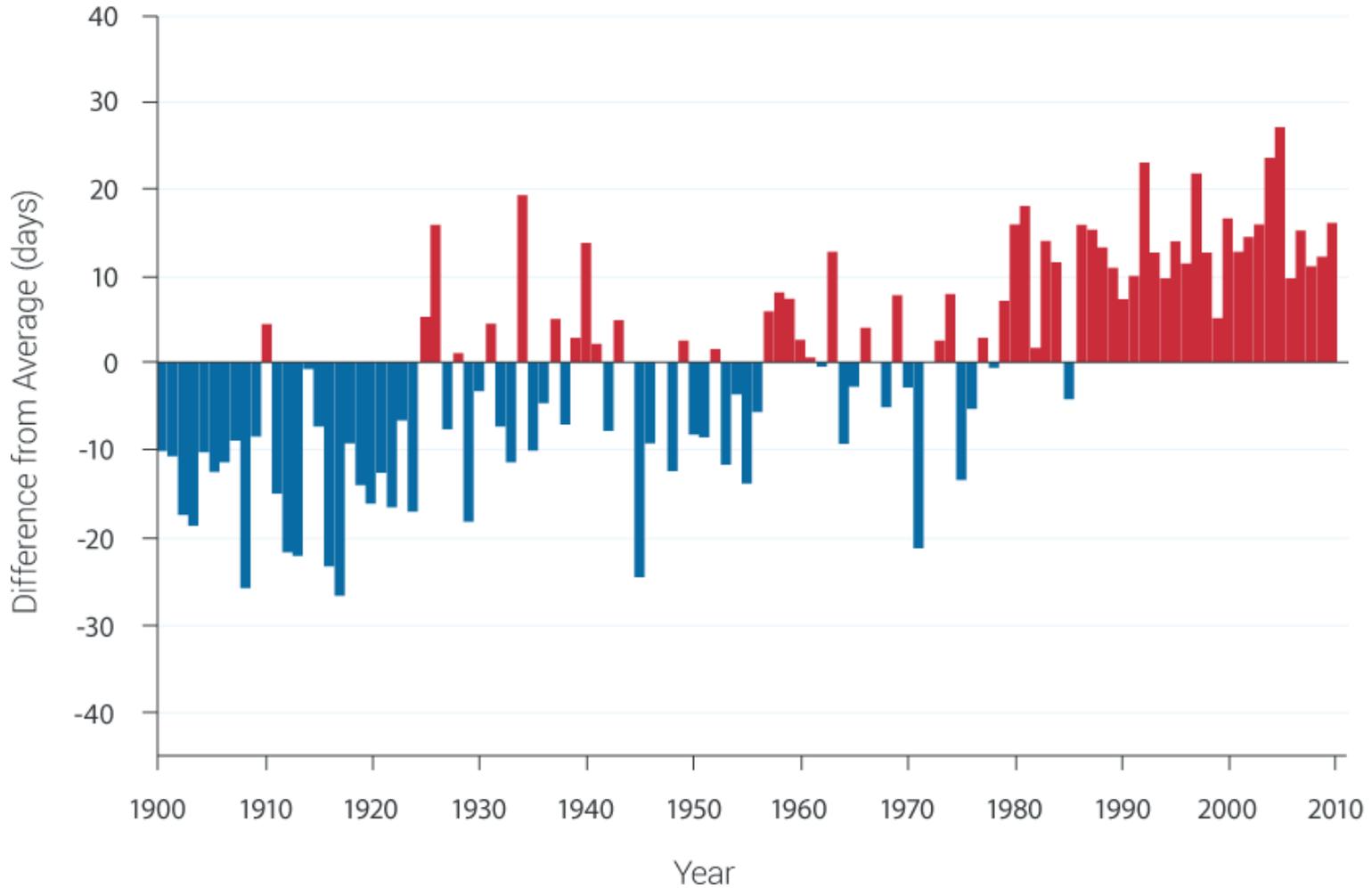
% change





# Threats to Agriculture

## Longer Frost-free Season Increases Stress on Crops





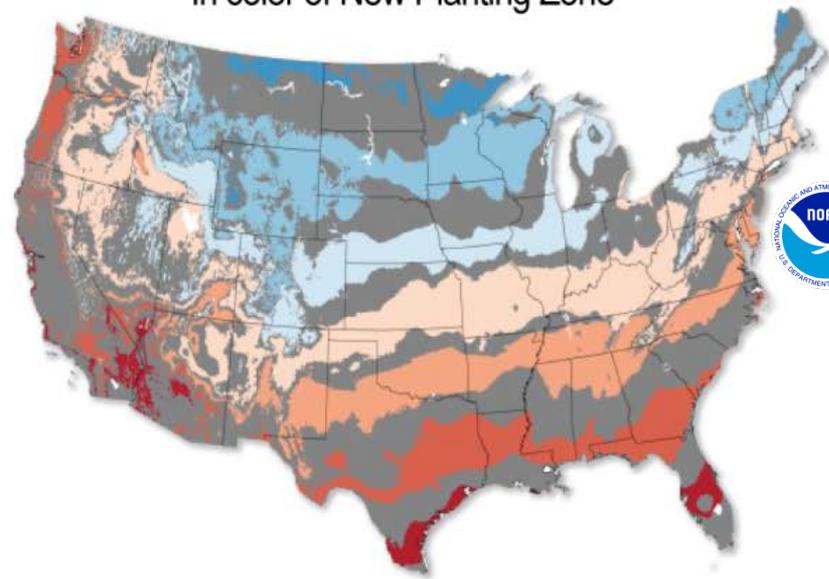
# Shift in Plant Hardiness Zones



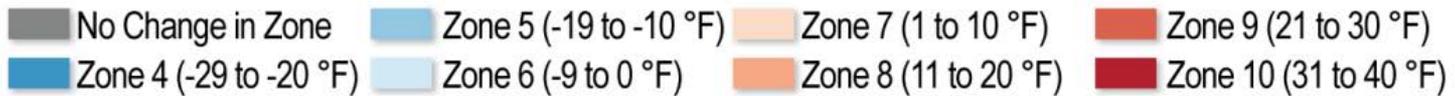
Zone Changes in Past 10 Years  
In color of New Planting Zone



Zone Changes in Next 30 Years  
In color of New Planting Zone



Average Annual Extreme Minimum Temperature by Climate-Related Planting Zone





## Rising Sea Levels and Changing Flood Risks in Seattle





# Regional Reports



Southwest:

[nca2014.globalchange.gov/report/regions/southwest](http://nca2014.globalchange.gov/report/regions/southwest)

Northwest:

[nca2014.globalchange.gov/report/regions/northwest](http://nca2014.globalchange.gov/report/regions/northwest)



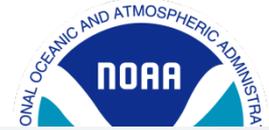
# Regional Resources



- NOAA
  - Regional Climate Service Director (me!)
  - NOAA [River Forecast Centers](#): Colorado Basin River Forecast Center
  - NOAA [Regional Integrated Climate Assessments](#): Western Water Assessment
  - [Regional Climate Centers](#): Western Regional Climate Center
  - [State Climatologists](#): Utah State Climate Office, USU
- DOI
  - Landscape Conservation Cooperatives
  - DOI Climate Science Centers
- USDA Agriculture Hubs
- And more



[nca2014.globalchange.gov](http://nca2014.globalchange.gov)



National Climate Assessment

[GlobalChange.gov](http://GlobalChange.gov)



SEARCH



DOWNLOAD

## Highlights

Explore highlights of the National Climate Assessment including an Overview, the report's 12 overarching findings, and a summary of impacts by region.

[→ EXPLORE HIGHLIGHTS](#)



## Full Report

Explore the entire report covering our changing climate, regions, cross sector topics, and response strategies in full detail.

[→ EXPLORE THE REPORT](#)



# Meet the Challenges of a Changing Climate

The Climate Resilience Toolkit provides resources and a framework for understanding and addressing the climate issues that impact people and their communities.

- 1 Identify the Problem
- 2 Determine Vulnerabilities
- 3 Investigate Options
- 4 Evaluate Risks & Costs
- 5 Take Action



## Find Out How People Are Building Resilience



Forests to Faucets  
[Watch video >](#)



Building a Bridge to Reduce Risk  
[Watch video >](#)



Dune Migration and Shoreline Protection  
[Watch video >](#)



Louisiana's Front Line Defense from Storm and Surge  
[Watch video >](#)

<http://toolkit.climate.gov/>



# Action

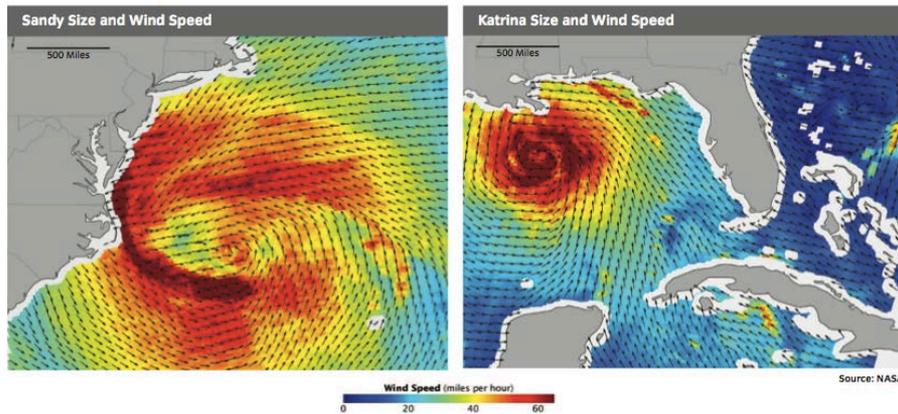


- Two recent examples



# Sandy

43 deaths... 6,500 patients evacuated from hospitals and nursing homes... Nearly 90,000 buildings in the inundation zone... 1.1 million New York City children unable to attend school for a week... close to 2 million people without power... 11 million travelers affected daily... \$19 billion in damage...



Credit: PlanNYC, NYC SIRR

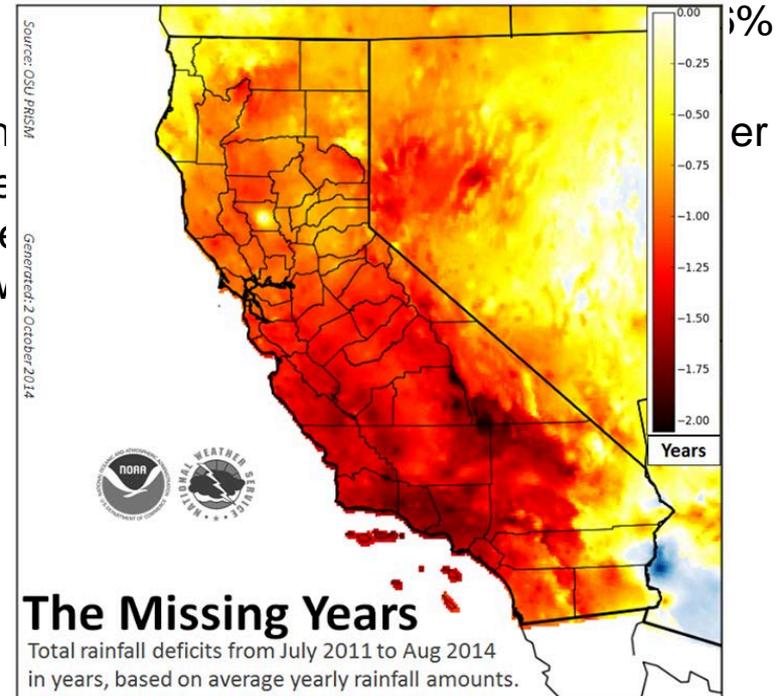


# CA Drought

2012-2014 driest 3 year period on record for much of state

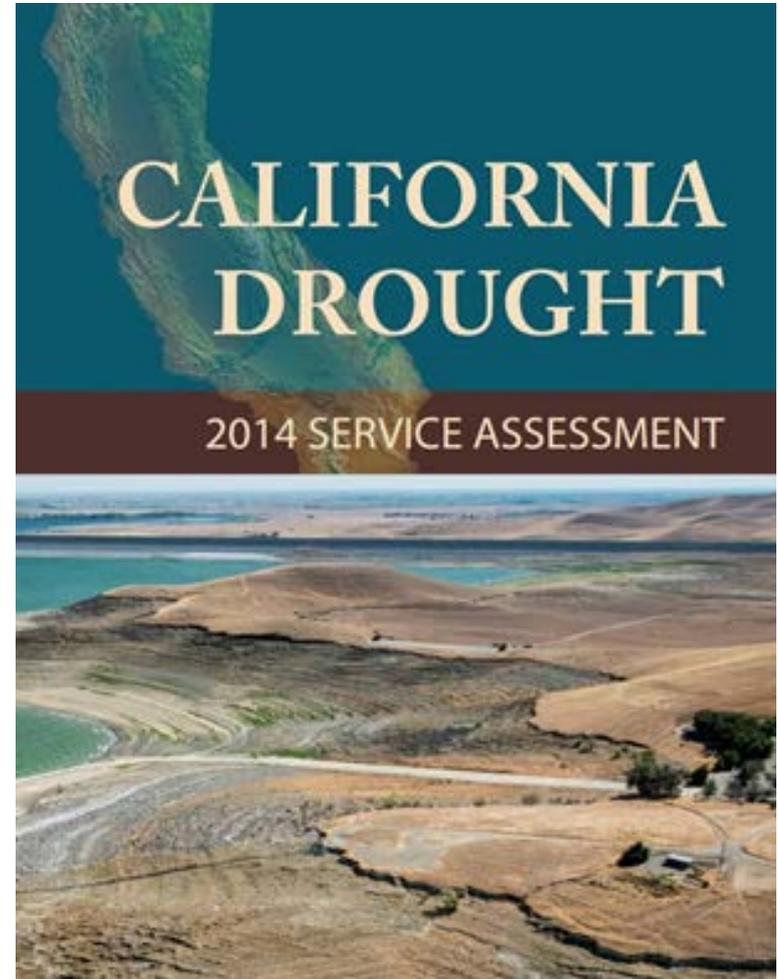
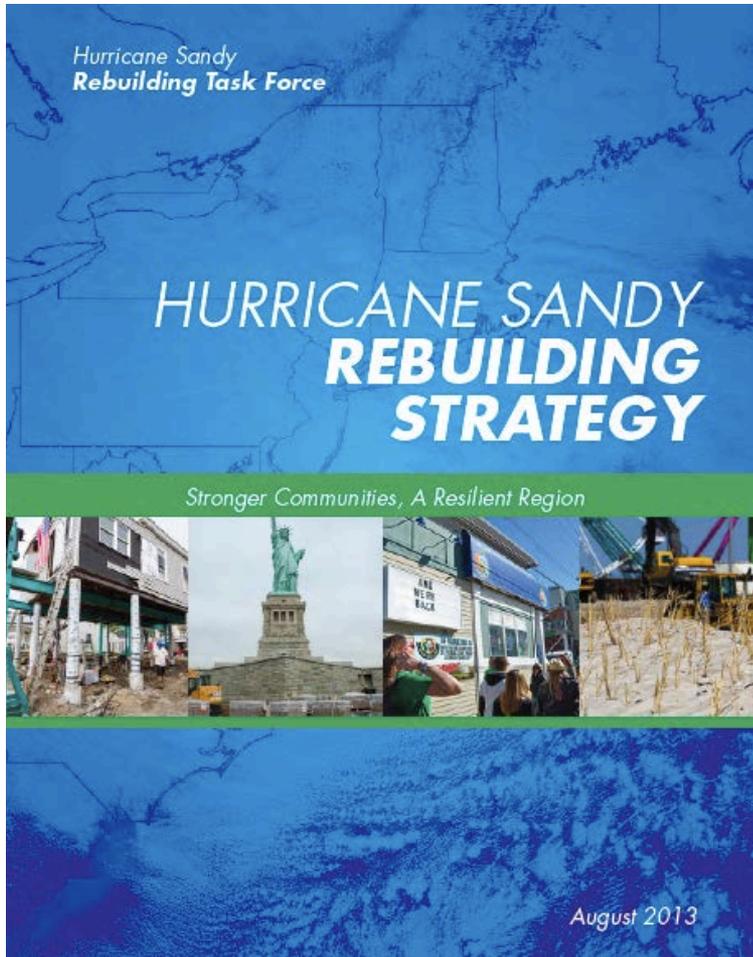
- Key 2014 statistics:
  - Precipitation: Less than 2 years worth of average precipitation over last 3 years
  - Reservoirs: Aug 2014 statewide

• Californian shortage snow/precipitation groundw...





# My Roles





# Lessons Learned



## Sandy

1. Decision making is highly complex but human centric
2. Politics and money matter
3. Relationships matter
4. People are tribal - especially in DC
5. Government is silo-ed; Many veto points exist; Many fewer willing to approve
6. You can lead a horse to water...

## CA Drought

1. Strong and widespread interest in drought and water resources analytical and prediction capabilities
2. Relationships matter
3. Decision making is highly complex but human centric
4. You can lead a horse to water...



# Common Themes



- Science agencies generally:
  - Disconnected from management/decision making agencies
  - More reactive than proactive
  - Not inherently coordinated/focused around problem
- Ideas for success:
  - Work to understand how others operate and build relationships
  - Be persistent and adaptive; decision makers ignore much more often than they say no.
  - Substance matters; Application does too



# Discussion



- Climate is changing
- Science is one tool among many for addressing it
- Answers lie in this room



# CLIMATE SUMMIT

WHAT IF IT'S A BIG HOAX AND WE CREATE A BETTER WORLD FOR NOTHING?

- ENERGY INDEPENDENCE
- PRESERVE RAINFORESTS
- SUSTAINABILITY
- GREEN JOBS
- LIVABLE CITIES
- RENEWABLES
- CLEAN WATER, AIR
- HEALTHY CHILDREN
- ETC. ETC.



YEL  
PITT  
LIFE US/DAWAY



# Questions?



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