

Emerging Risks: Climate Extremes in the U.S.



Credit: Sioux City Journal



AP Photo Seth Perlman

NAIC Center for Insurance and Policy Research
October 2014
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Kansas City, Mo



Credit: Argus Leader

Topics

- Extremes Overview
- What regional and national services, tools, and information exist?



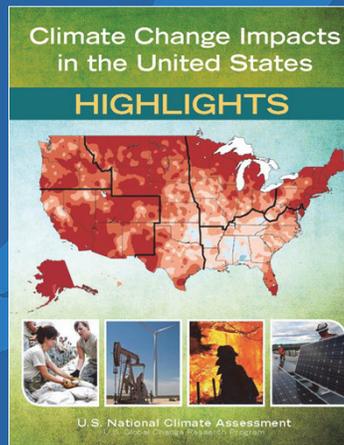
Blair, NE June 2014



July 2011 Gavins Point Dam

National Climate Assessment

- The **Assessment is the most comprehensive analysis to date** of the affects of climate change on our nation
- Climate change is not just a problem for the future – **it has moved firmly into the present**
- This **Assessment and the IPCC report agree** that climate change is already affecting many types of extreme weather and will continue to do so
- **Americans are already feeling the effects** of increases in certain types of extreme weather and sea level rise fueled by climate change
- America has **important opportunities** to reduce emissions and prepare for the effects of climate change



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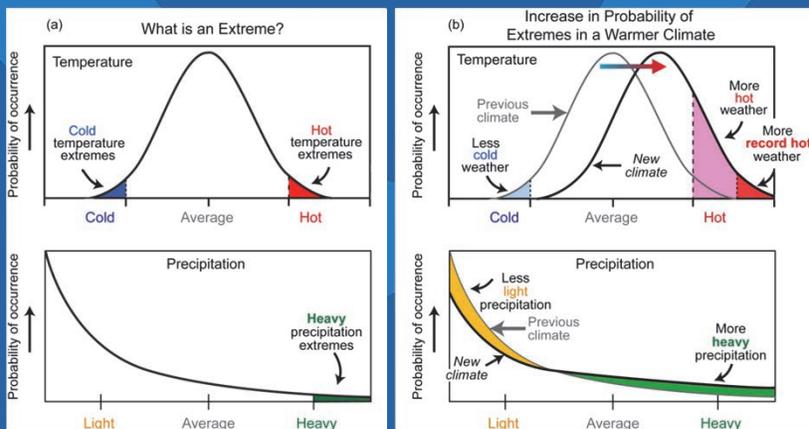
Extreme Weather & Climate

Some extreme weather and climate events have increased in recent decades, and new and stronger evidence confirms that some of these increases are related to human activities.



What is an Extreme Event?

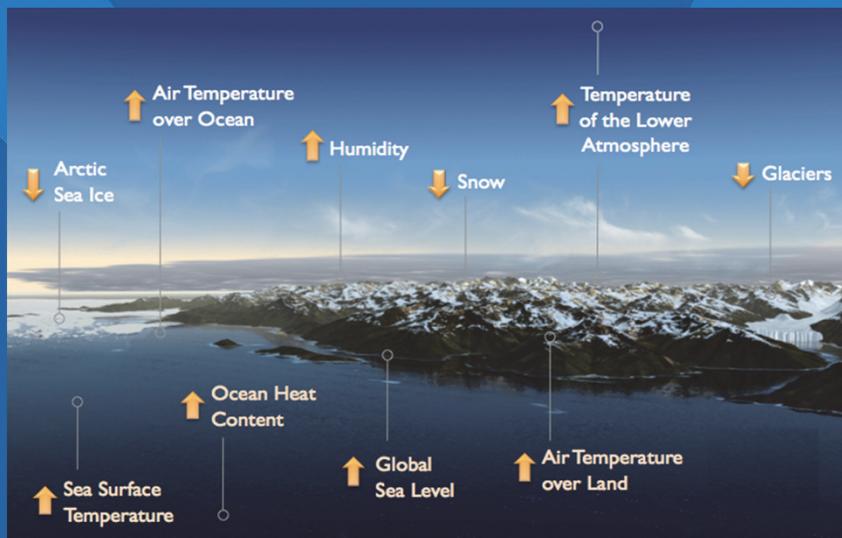
An 'extreme event' is a time and place in which weather, climate or environmental conditions — such as temperature, precipitation, prolonged drought, or coastal flooding — rank among the highest or lowest 10% of historical measurements.



Modified from: Climate Change 2007: The Physical Science Basis - Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change

5

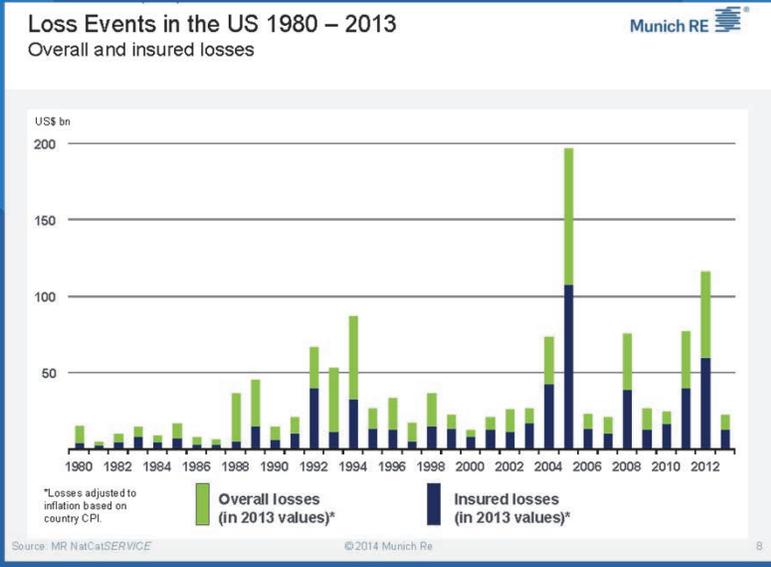
Changing Climate Conditions Contribute to Extremes



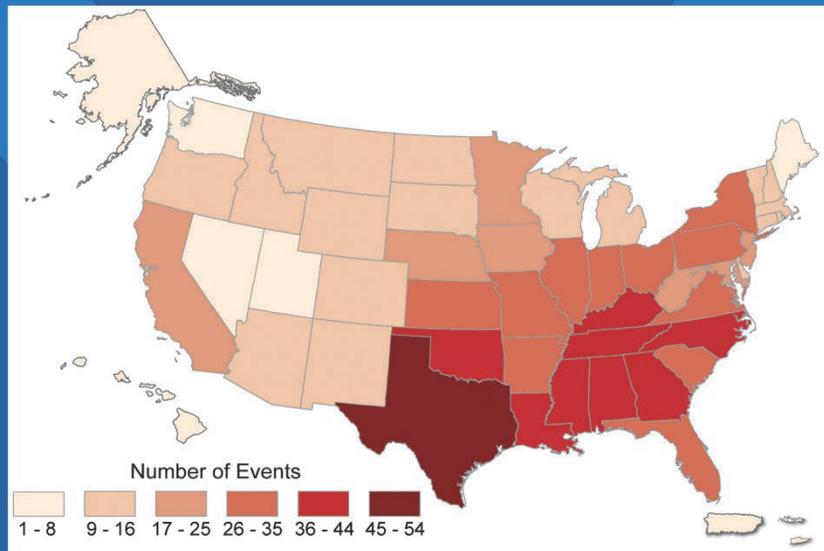
Source: <http://www.earth.nasa.gov/warmingworld/>

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U.S. Disasters Losses

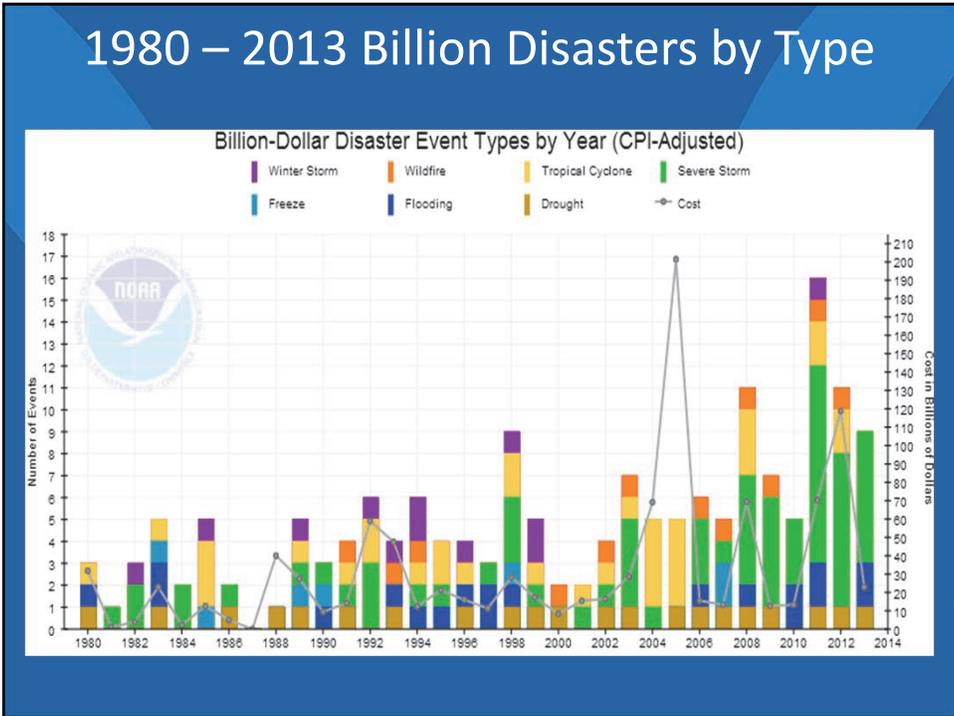
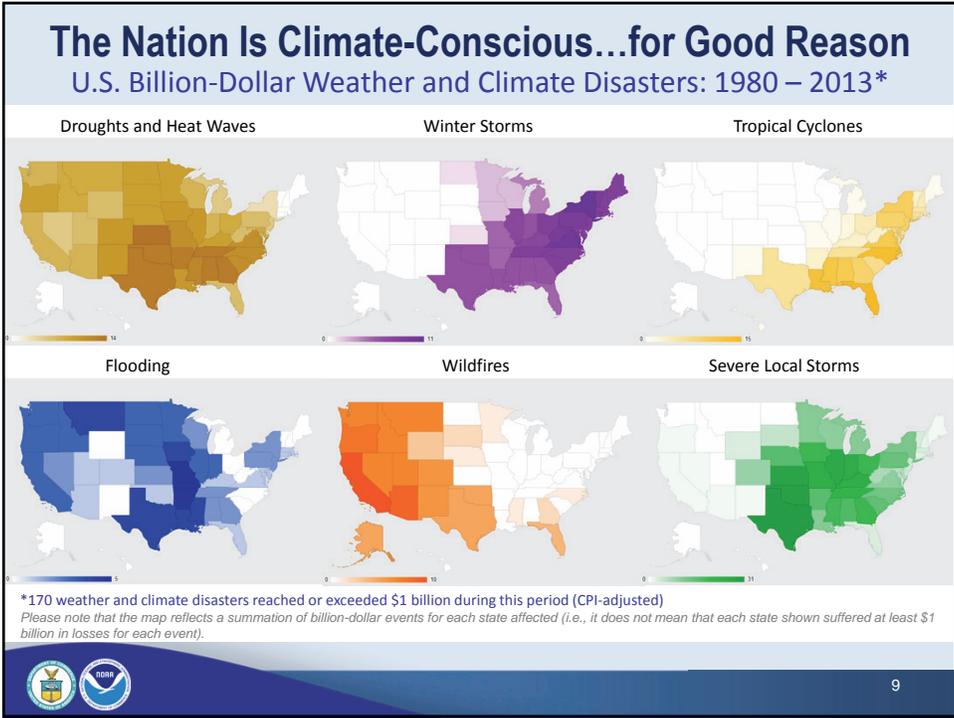


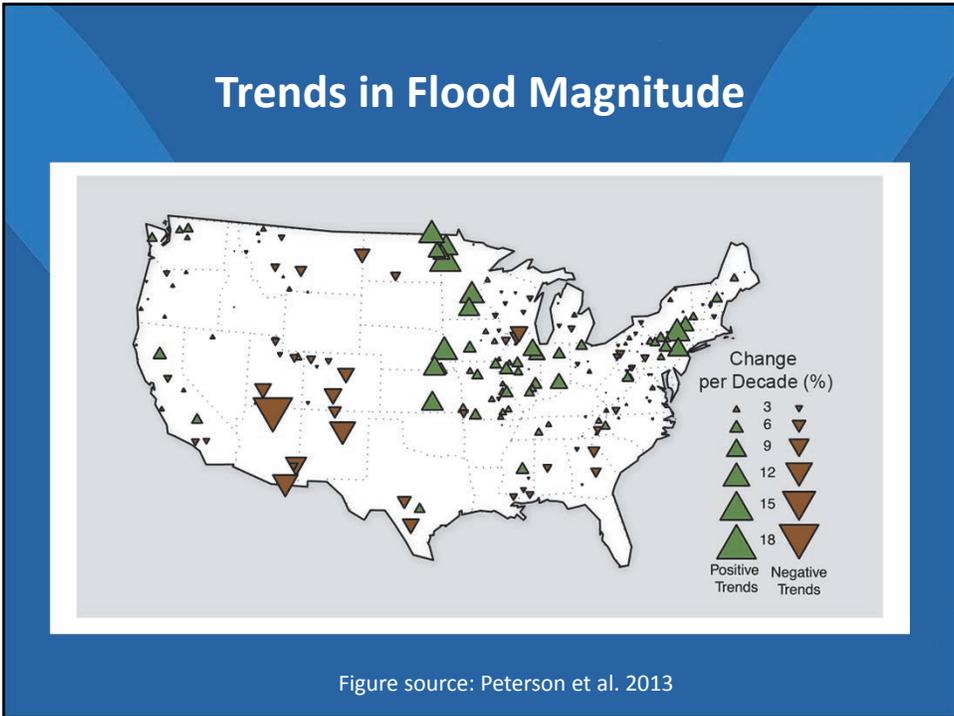
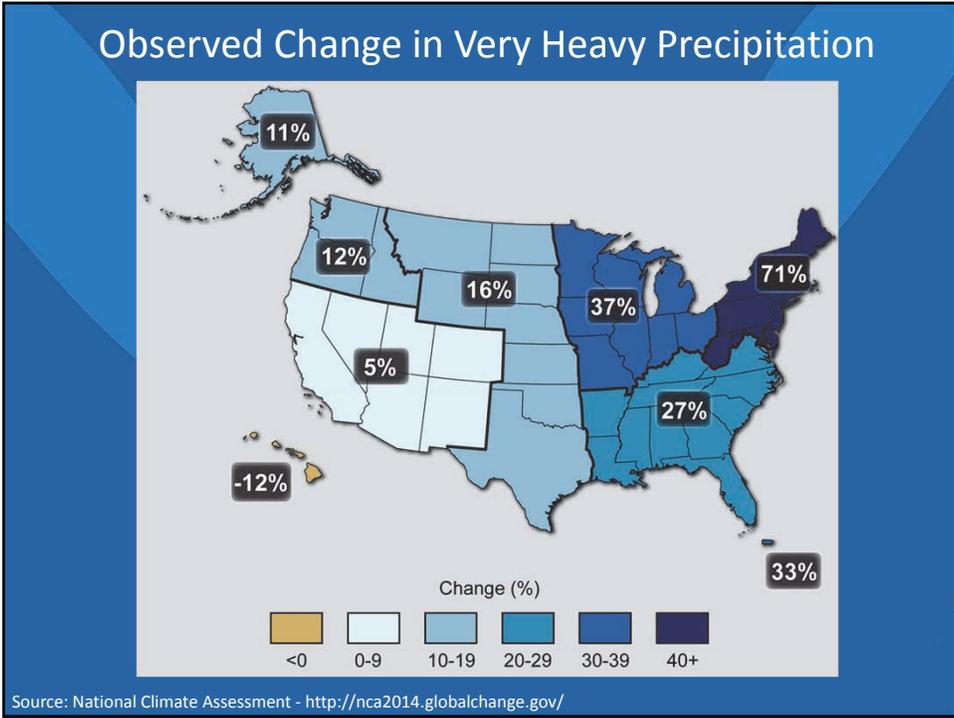
Billion Dollar Weather/Climate Disasters 1980-2012



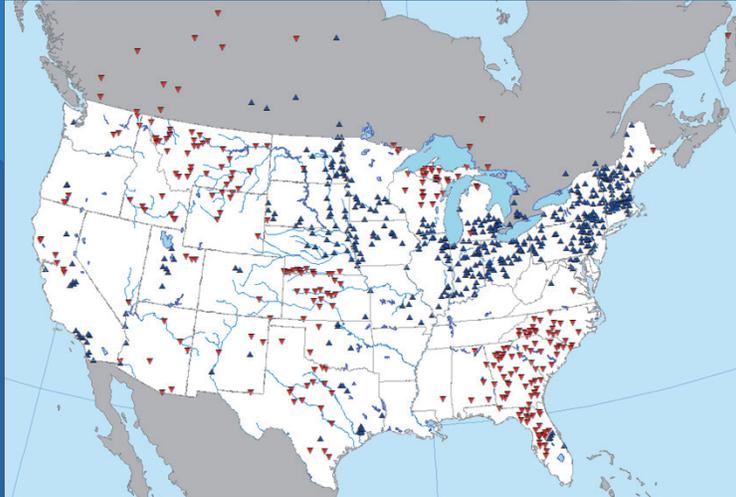
Source: National Climatic Data Center

<http://www.ncdc.noaa.gov/extremes/cei/introduction>



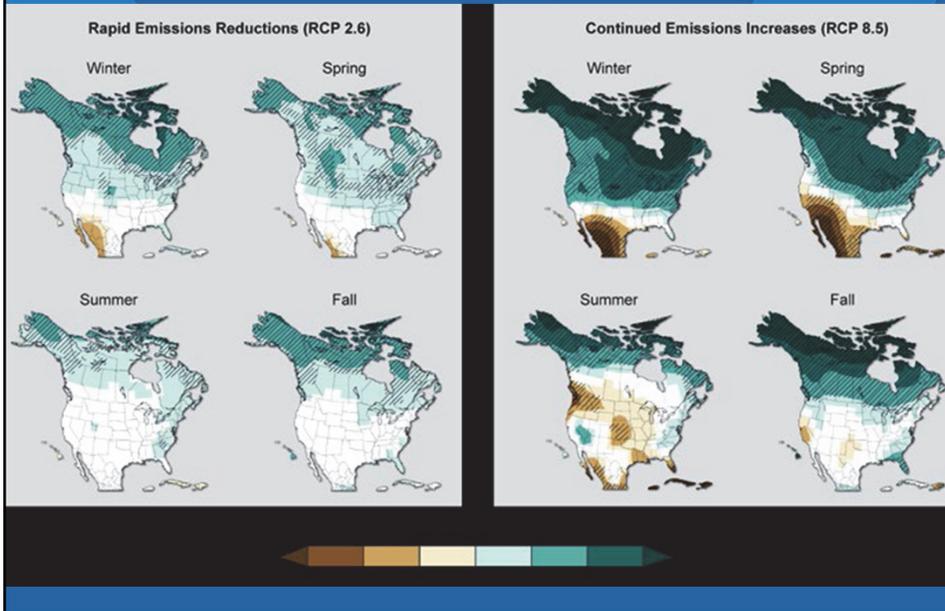


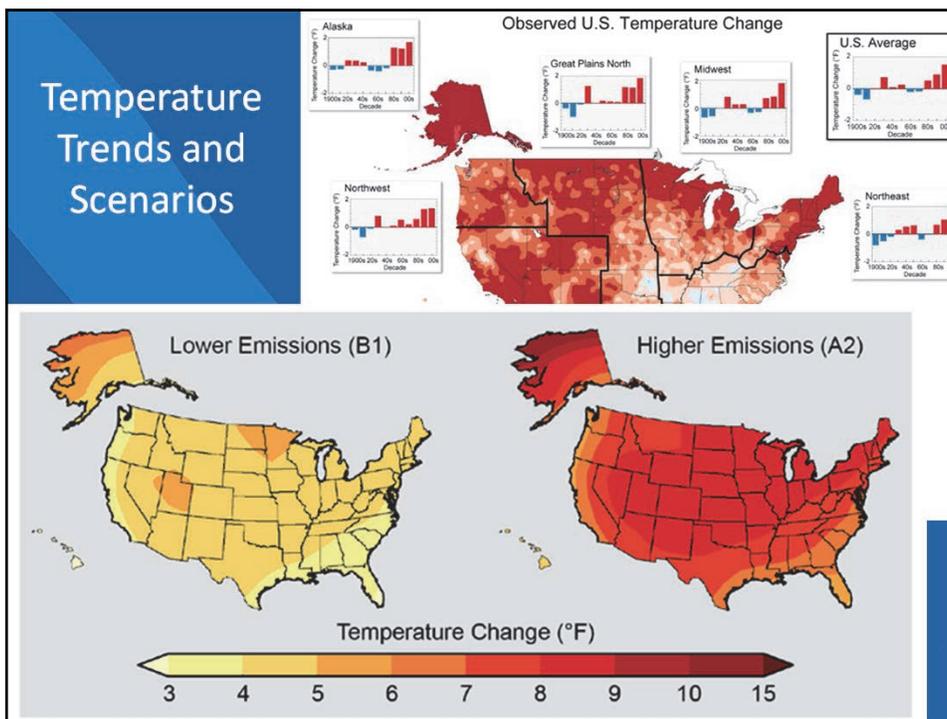
Streamflow trends ($p=0.10$) for stations with continuous records 1960-2012



Preliminary Information – subject to revision. Not for citation

Precipitation Trends and Scenarios

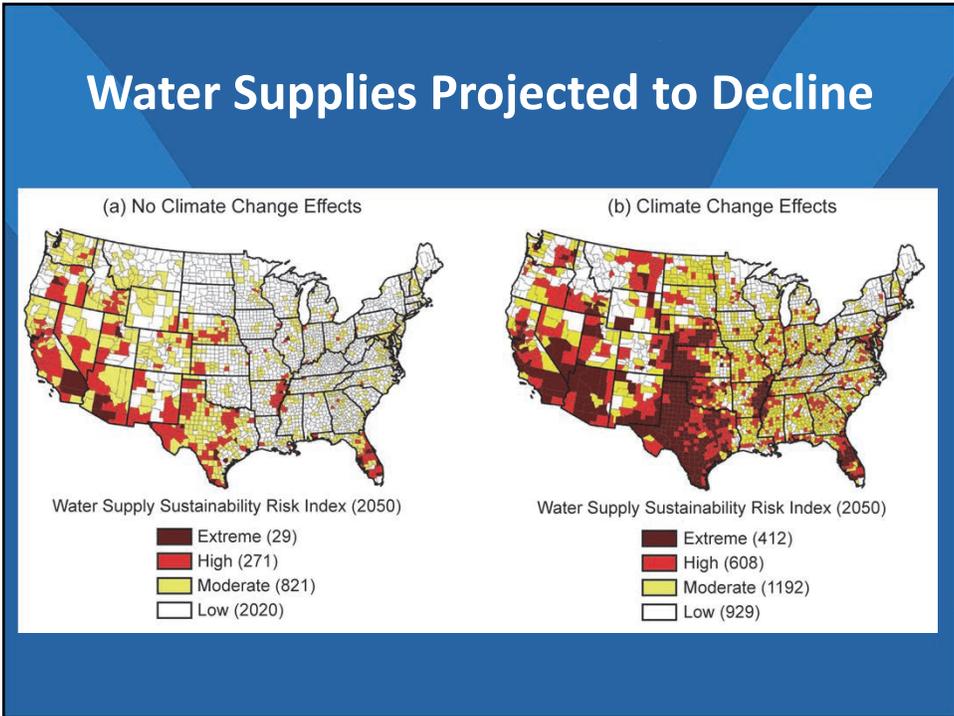
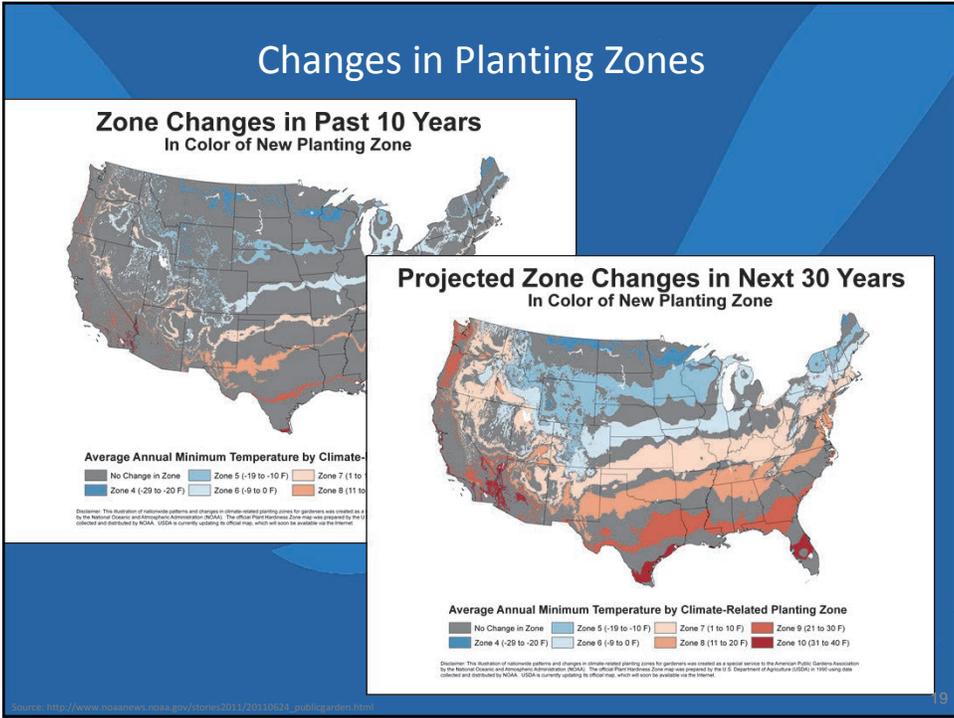




Heat and Heat Waves

- Changes in trends of maximum and minimum temperatures
- Changes in “normal” distribution of temperatures
- Heat waves – stress on people, plants and animals
- Shifts in plant and animal species

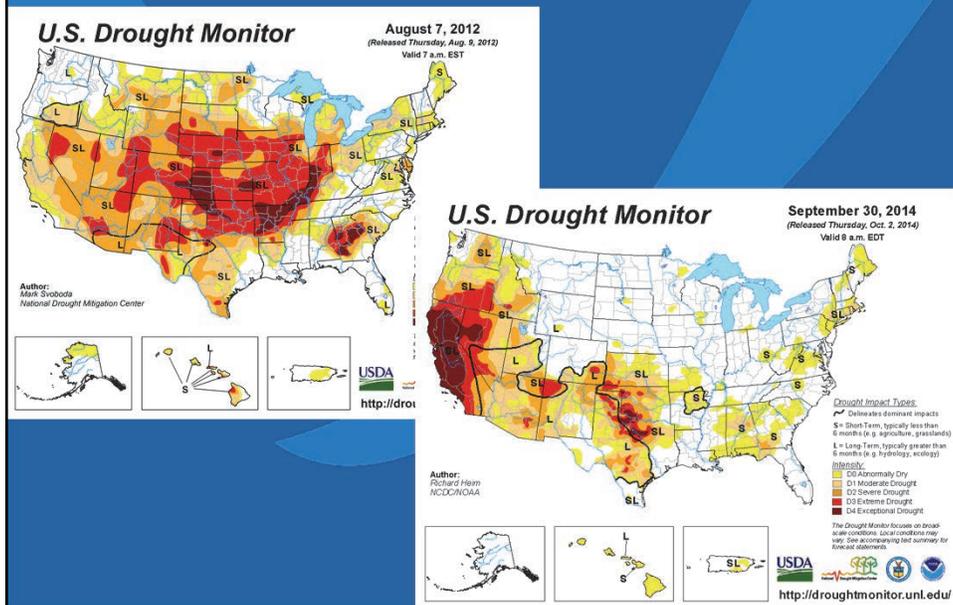
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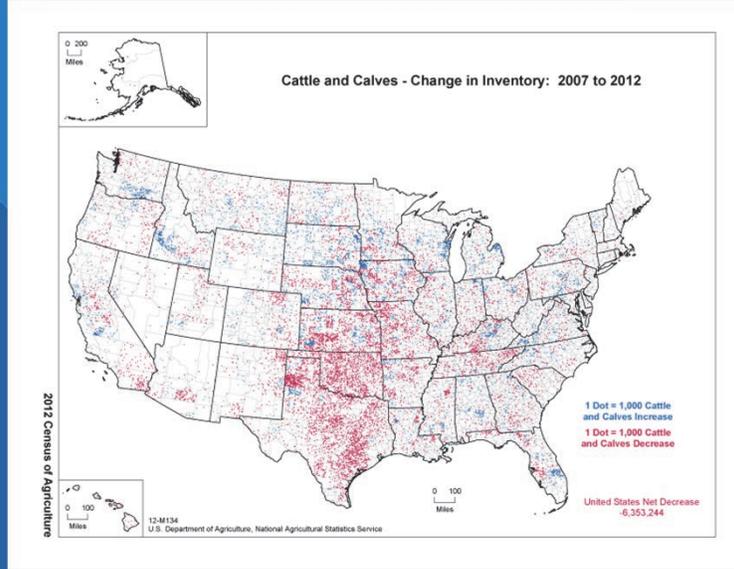
Cascading Effects



Drought Monitor: 2012 and Now



Cascading Effects



Potential Services & Information



Risk-based approach

- Integrated understanding of hazards/exposure with capacity to respond (adapt &/or mitigate)
- Extreme events and long-term change
- Direct impacts and global competitiveness
- Near-term problems and long-term planning
- Risk management and risk sharing
- Improve “effectiveness” of information
- Understanding, communicating, responding

Samples of NOAA’s Products and Services

	WEEKLY	MONTHLY	SEASONAL-ANNUAL	DECADAL
LOCAL	Regional Snowfall Index	Heating & Cooling Degree Days	Temperature & Precipitation Outlooks	Climate Normals
REGIONAL	Hurricane Tracks	Heat Wave Prediction	Drought Outlook	Extreme Detection & Attribution
NATIONAL AND GLOBAL	Drought Monitor	Monthly State of the Climate Reports	Annual State of the Climate Reports	National Climate Assessment

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NIDIS: Creating a drought early warning information system

WESTERN GOVERNORS' ASSOCIATION
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Home | Blog | News 2014 | Western Governors salute House, Senate reauthorization of NIDIS to battle drought

Western Governors salute House, Senate reauthorization of NIDIS to battle drought

Published on February 10, 2014.

UPDATE, March 6: President Obama has signed the National Integrated Drought Information System Reauthorization Act of 2013 into law. [Read the final legislation](#) and [read a story](#) in the influential water blog *Circle of Blue* that notes WGA's support.

Feb. 10, 2014: The reauthorization of the National Integrated Drought Information System (NIDIS) passed the House on a 365-21 vote on Monday, Feb. 10. The bill previously passed the Senate by unanimous consent on Feb. 3. The chambers now will reconcile the final budget, which the House approved at \$13.5 million and the Senate at \$12 million.

The votes are an important victory for Western Governors, who are well-acquainted with drought's impact on the West. It contributes to forest and rangeland fires, degrades growing conditions for farmers, and poses threats to municipal and industrial water supplies.

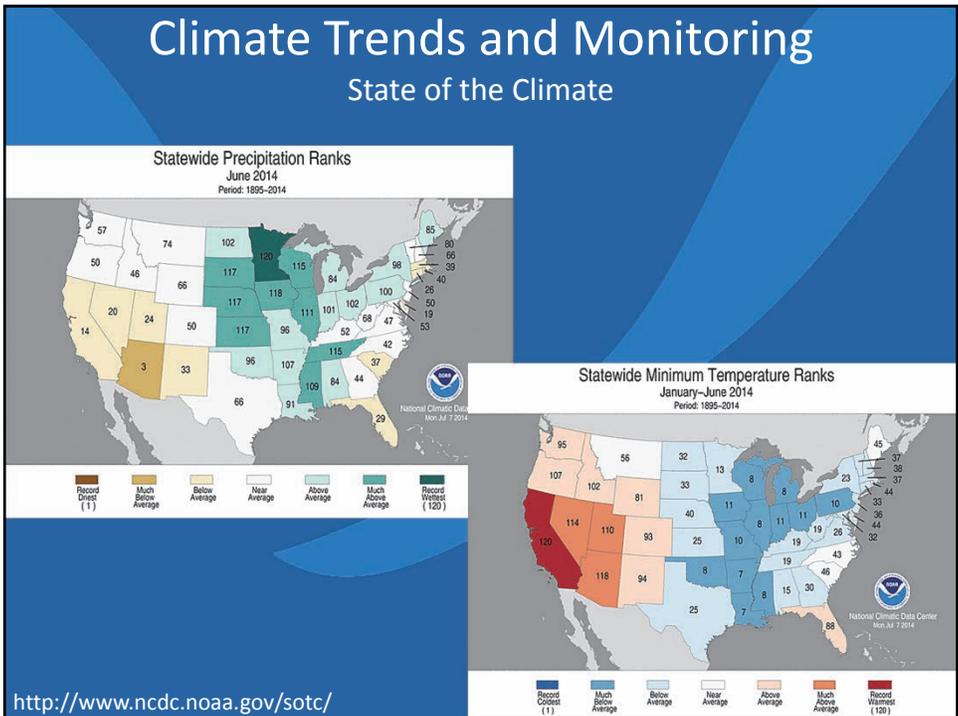
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Climate Trends and Monitoring

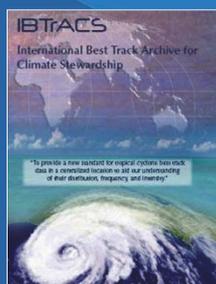
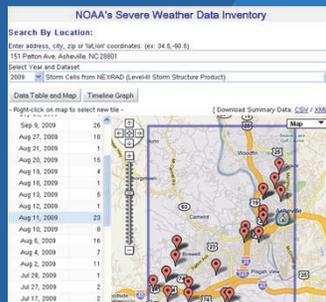
State of the Climate



More data products...

- Severe Weather Data Inventory (SWDI)** includes > 1 billion searchable data points on severe weather derived from NEXRAD related to general storm structure, hail, and tornadoes, preliminary and verified reports of storm damage, and National Weather Service warning areas.

<http://www.ncdc.noaa.gov/swdi/#Intro>



- International Best Track Archive for Climate Stewardship (IBTrACS)** merges tropical cyclone best track data sets globally into a single-database with open QA/QC procedures

<https://www.ncdc.noaa.gov/ibtracs/>

Climate.gov

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Data Snapshots: Drought Outlook for September 2014

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NOAA View Data Exploration Tool
GHCN Daily Observations - GIS Data Locator
Climate at a Glance - U.S. Mapping Interface
Historical Hurricane Tracks

Launch Map Application

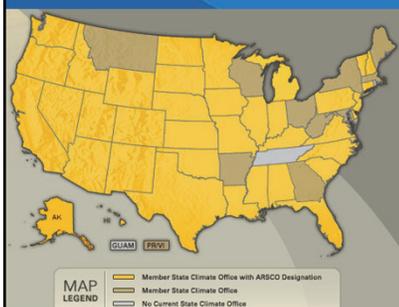
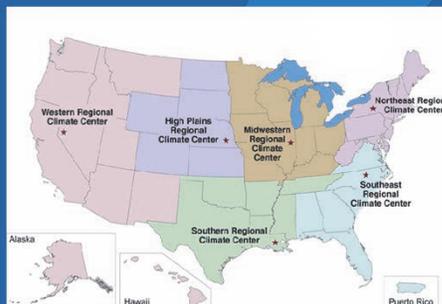
Drought Outlook for September 2014

Drought Tendency
None | Develop | Continue or Worsen | Improve | End

Climate.gov Data: CFC

Regional Climate Services

- Regional Climate Centers
- State Climatologists
- Other NOAA
- Federal
- State
- Academia
- NGOs
- Tribes



NOAA's Regional Climate Services Directors



Quarterly Regional Climate Summary & Outlook

Quarterly Climate Impacts and Outlook - Midwest Region - March 2014

National - Significant Events for December 2013 - February 2014

Highlights for the Midwest

Significant Events for Winter and February 2014

Regional - Climate Overview for December 2013 - February 2014

Temperature and Precipitation Anomalies

Winter 2013-2014 Snow

Quarterly Climate Impacts and Outlook - Missouri River Basin - March 2014

National - Significant Events for December 2013 - February 2014

Highlights for the Basin

Significant Events for Winter and February 2014

Regional - Climate Overview for December 2013 - February 2014

Temperature and Precipitation Anomalies

Mountain Snowpack

Quarterly Climate Impacts and Outlook - Great Lakes Region - March 2014

Great Lakes Significant Events - for December 2013 - February 2014

Regional Climate Overview - for December 2013 - February 2014

Great Lakes Ice Cover

Great Lakes Water Levels

Snowfall

Temperature

- Midwest
- Pacific Region
- Eastern Region
- Western Region
- Alaska Region
- Rio Grande/Bravo Basin
- Gulf of Maine Region
- Midwest Region
- Caribbean Climate

Missouri Basin

Great Lakes

<http://drought.gov/drought/content/resources/reports>

El Niño Impacts and Outlook

Missouri Basin Region
September 2014

Typical El Niño Winter Pattern

Typical Climate Patterns for the U.S. during El Niño

El Niño is a particular pattern in the Pacific Ocean that affects weather downstream to the United States. It has its most notable impacts in the winter, when wind patterns in the atmosphere are strongest. When El Niño is present, it provides some predictable effects to weather patterns. While no two El Niño events are alike, the typical winter weather patterns (left) brings the polar jet stream farther north than usual, across Canada, while the Pacific jet stream remains in the southern U.S. As a result, the upper Missouri River basin can be warmer than normal, with the potential for less frequent, heavy snow than usual. Confidence in these patterns is higher with stronger El Niño events.

El Niño Outlook and Climate Connections

Winter Temperature and Precipitation

Departure from Average Temperature (°F) in Winter During Past El Niños

Departures from average temperature (left) and percent of average precipitation (right) in December through February during past El Niño years. Image courtesy of the Midwest Regional Climate Center.

El Niño Likely

Highest Potential for Weak to Moderate El Niño

Chance for El Niño Development and Potential Intensity, Winter 2014-15

Legend:
 ■ La Niña
 ■ Neutral
 ■ El Niño Weak
 ■ El Niño Moderate
 ■ El Niño Strong

Chart based on summaries and forecast model data from the NOAA/NWS Climate Prediction Center and the International Research Institute for Climate and Society.

Qeds still favor an El Niño forming by mid to late fall, with a 60-70% chance of development. There is a 30-40% chance for neutral conditions to continue through this winter, with a near-zero chance for La Niña to develop.

2014 – El Niño?

What does it mean for the Missouri Basin?

THREE-MONTH OUTLOOK TEMPERATURE PROBABILITY 1.5 MONTH LEAD VALID NDJ 2014 MADE 18 SEP 2014

THREE-MONTH OUTLOOK PRECIPITATION PROBABILITY 1.5 MONTH LEAD VALID NDJ 2014 MADE 18 SEP 2014

EC MEANS EQUAL CHANCES FOR D
 A MEANS ABOVE
 B MEANS BELOW

Building Awareness: Regional Monthly Climate & Drought Webinars

- Since November 2011
- Response to climate extremes
- Popular w/states, feds, tribes, private interests
- Presenters: AASC, NDMC, RCCs, USDA, LCC and others

Midwest and Great Plains Drought and Climate Webinar
September 10, 2013

"Central Region Agricultural Update"

Brad Rippey
USDA Meteorologist
Washington, D.C.

Photo by B. Rippey
Saline Co., Nebraska
April 18, 2013

Missouri River Basin Climate Outlook
1 May 2014

Dr. Dennis Today
State Climatologist
South Dakota State Univ.
dennis.today@sdsstate.edu
605-688-5141

Logos: NOAA, AASC, US Army Corps of Engineers

Attribution and Assessments

Devil's Lake Attribution
 2011 Flood Attribution Study
 2012 Drought Assessment (Coming Soon)
 2012 Drought Attribution Study

2007 April Freeze
http://www1.ncdc.noaa.gov/pub/data/tech_rpts/tr200801/tech-report-200801.pdf

An Interpretation of the Origins of the 2012 Central Great Plains Drought



Assessment Report

NOAA Drought Task Force
 Narrative Team
 Lead: Martin Hoerling
 Co-Leads: Siegfried Schubert & Kingste Mo

20 March 2013

Explaining Climate Extremes

An Assessment of the 2011 Missouri River Basin Flood

In early 2011, the Missouri River Basin experienced devastating flooding which caused significant property loss and threatened thousands of lives. January-May was the wettest recorded in the region since 1951, and the annual runoff above Sioux City has equaled the previous record. Researchers from the National Oceanic and Atmospheric Administration (NOAA) conducted a scientific study on the meteorological causes for the flood event with hopes to better understand its cause and assess its predictability. An assessment report has been completed following peer review and below are highlighted the major scientific findings.

Major Findings

- The factors immediately responsible for flooding were found to be a sequence of events that included:
 - Pre-winter wet conditions - a particularly cold and wet 2010-2011 winter that led to unusually high snow pack and
 - Rapid melting rains in late spring

The late spring rains were almost certainly the most critical to the meteorological sequence for understanding the historic proportion of Missouri Basin flooding. The wintertime cold and wet conditions were shown to be consistent with those occurring in the upper Missouri Basin during La Niña events, and in this case NOAA La Niña Advisory issued on 5 August 2010 provided early warning for these types of winter conditions. However, La Niña in general, and the particular ocean conditions in 2011 specifically, were found not to be suitable alone for explaining the upper Missouri Basin.

The report suggests that neither the NOAA La Niña Advisory Series nor subsequent ocean weather events, a flood of this magnitude

61 million acres (and) of runoff above Sioux City, (and) beat the prior record by 12 in

knowledge of the details of the ocean conditions could have forecasted of extreme heavy spring rains.

The analyses in the report indicate that the record setting amount of water from the Upper Missouri Basin could not have been anticipated by the heavy spring rains as is, and it could almost certainly not have been anticipated at long seasonal (3-6 month) lead times.

Conclusions

The report found that the record flooding was consistent with the physical response chains specific to a sequence of naturally occurring climate conditions, the majority of which result from random atmospheric variations, which could not have been predicted with current scientific knowledge. Due to the unusual sequence of extreme weather events, a flood of this magnitude

<http://www.esrl.noaa.gov/psd/csi/factsheets/>

2012 Drought Assessment

From Too Much to Too Little:

How the Midwest drought of 2012 evolved out of one of the most devastating floods on record in 2011



Collaboration between the climate sciences and insurance community is essential in helping to transform climate data into information that is *relevant, credible, and trusted*.

NOAA will continue to work closely with this community to better, understand, address, and anticipate data needs.

We look forward to working together.

doug.kluck@noaa.gov

Thank You!

Climate.gov
Drought.gov
Weather.gov



Climate Data and Insurance

- Many segments of the insurance industry vulnerable to the impacts of a changing climate
- Increasing risks to insurers and their customers are driven by many factors including reduced periods of time between loss events, increasing variability, shifting types and location of events, and widespread simultaneous losses.
- Insurance industry representatives have cited NOAA as a "trusted information broker" in providing a wide variety of weather & climate data often used in validating industry catastrophe (CAT) models

Continued...

- NOAA's data also represents the United States' official environmental records and can be used as admissible evidence in legal cases.
- Based on several decades of responding to requests for information and continued engagement with the insurance community
- We are seeking to provide new and more robust datasets, which may improve the ability of insurers to predict the probability of risk from a variety of extreme events
- For example: development of US Disaster Risk Climatology
 - for several extreme event categories using these data sources: hurricanes (NHC), winter storms (NESIS/RESIS), tornadoes (SPC; SWDI), hail (SPC; SWDI), high winds (SPC), and drought (USDM/NIDIS)
 - including county & polygon-level NWS warning data, insurance loss data (USDA, FEMA, PCS), socioeconomic data from the Bureau of Economic Analysis (BEA) and U.S. Census (e.g., gridded population/density, mean housing value, per capita income, production wealth) for normalizing increases in population, inflation, and wealth to establish risk climatologies.