# Emerging Risks: Climate Extremes in the U.S.

Credit: Sioux City Journal

AP Photo Seth Perlman

Credit: Argus Leader

*NAIC Center for Insurance and Policy Research*
*October 2014*
Doug Kluck, NOAA/NCDC
Doug.kluck@noaa.gov
Kansas City, Mo

# Topics

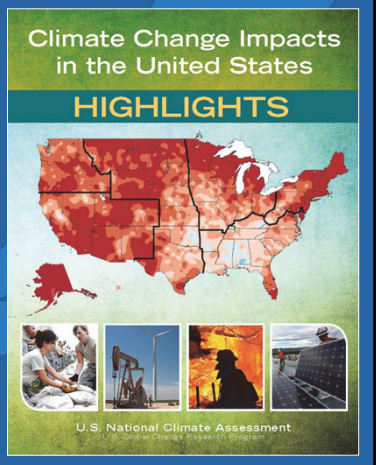
- Extremes Overview
- What regional and national services, tools, and information exist?

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



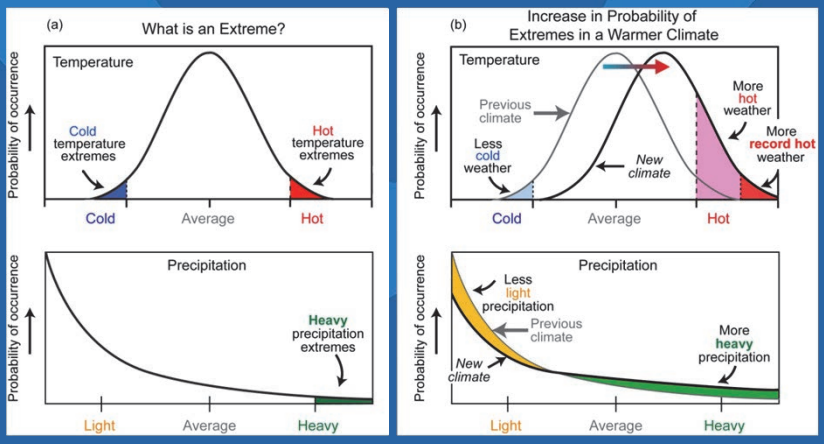

3

# 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

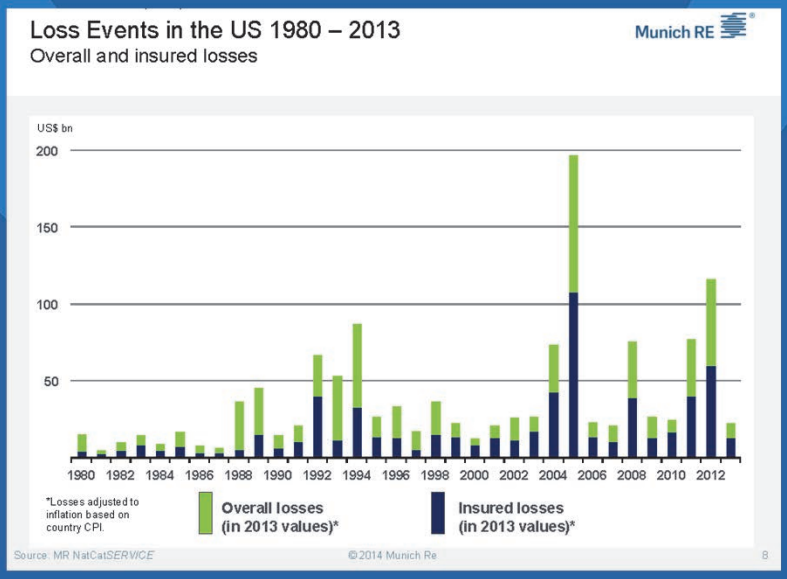
5

# Changing Climate Conditions Contribute to Extremes

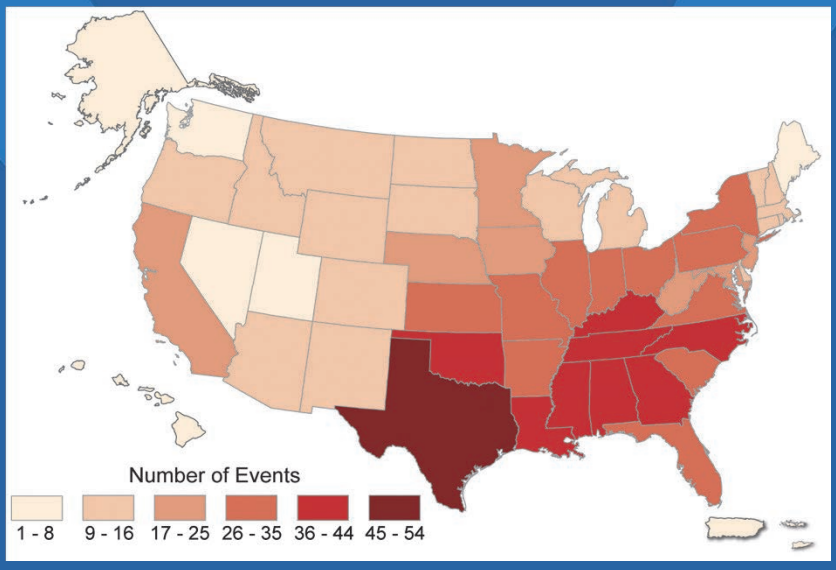

Source: http://www.climate.noaa.gov/warmingworld/

6

# U.S. Disasters Losses



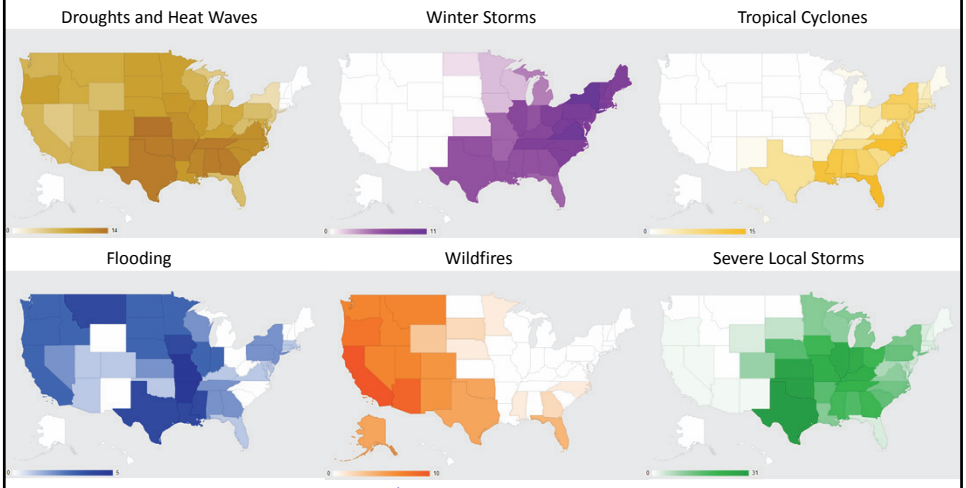

# Billion Dollar Weather/Climate Disasters 1980-2012




Source: National Climatic Data Center http://www.ncdc.noaa.gov/extremes/cei/introduction

## The Nation Is Climate-Conscious…for Good Reason

U.S. Billion-Dollar Weather and Climate Disasters: 1980 – 2013*

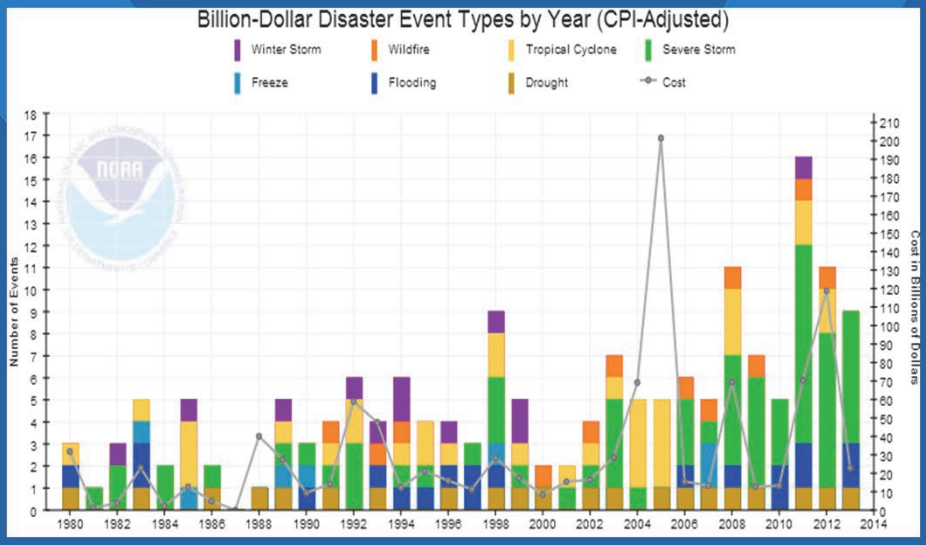



*170 weather and climate disasters reached or exceeded $1 billion during this period (CPI-adjusted)

*Please note that the map reflects a summation of billion-dollar events for each state affected (i.e., it does not mean that each state shown suffered at least $1 billion in losses for each event).*

9

## 1980 – 2013 Billion Disasters by Type



# Widespread Impacts

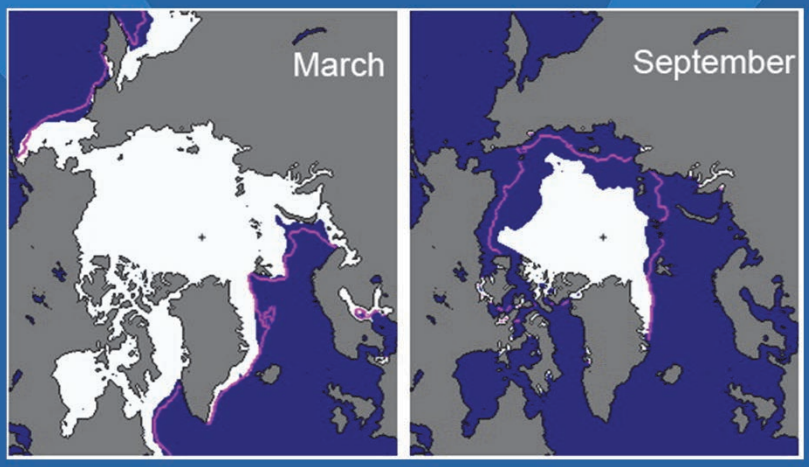
Impacts related to changes in climate are already evident in many sectors and are expected to become increasingly disruptive across the nation throughout this century and beyond.

Front Range Flood 2013

SD Early Blizzard 2013

# Sea Ice Change

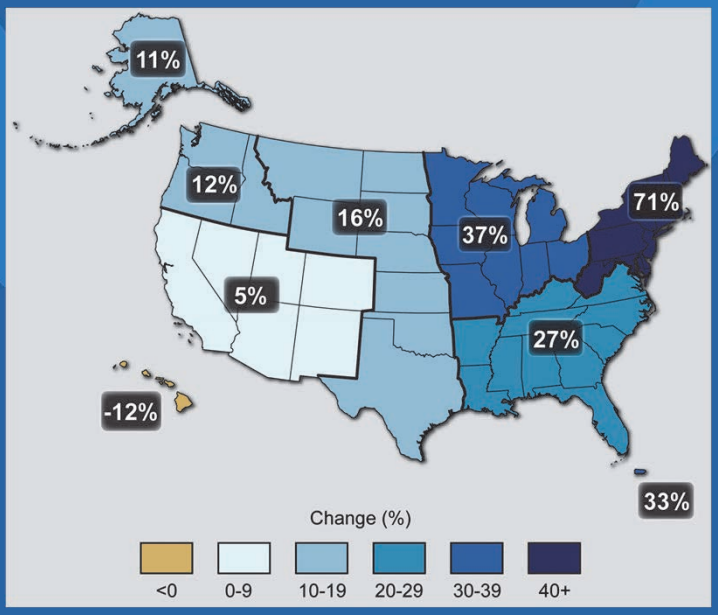
Sea ice extent in March 2011 (left) and September 2011 (right), illustrating the respective monthly winter maximum and summer minimum extents. The magenta line indicates the median maximum and minimum ice extents in the given month for the period 1979-2000.




12

Source: http://www.arctic.noaa.gov/reportcard/sea_ice.html

## Observed Change in Very Heavy Precipitation




Source: National Climate Assessment - http://nca2014.globalchange.gov/

## Trends in Flood Magnitude

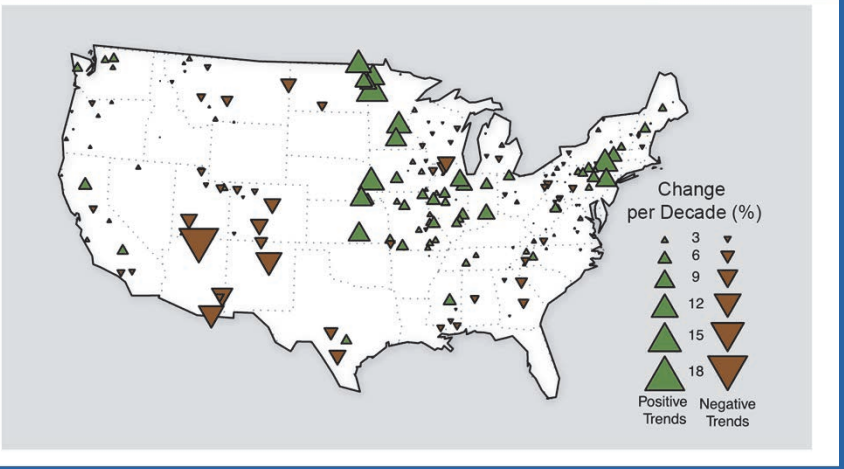
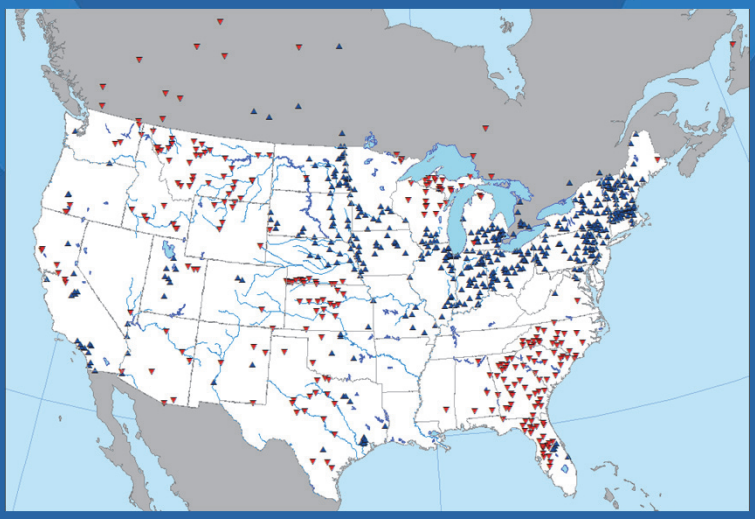


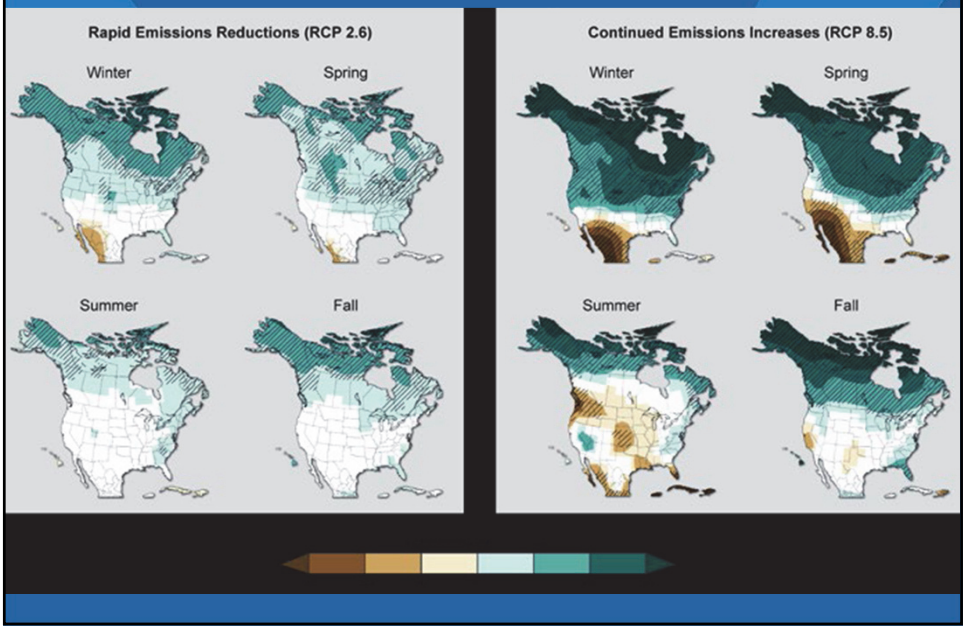

Figure source: Peterson et al. 2013

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

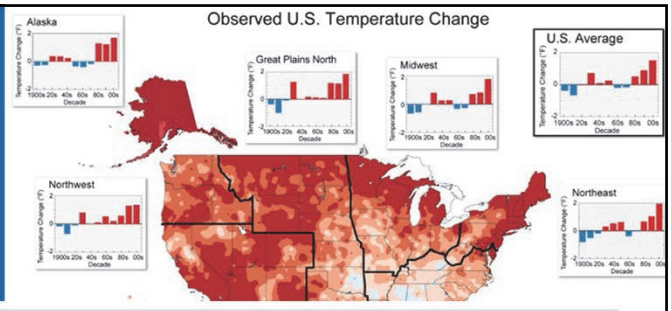


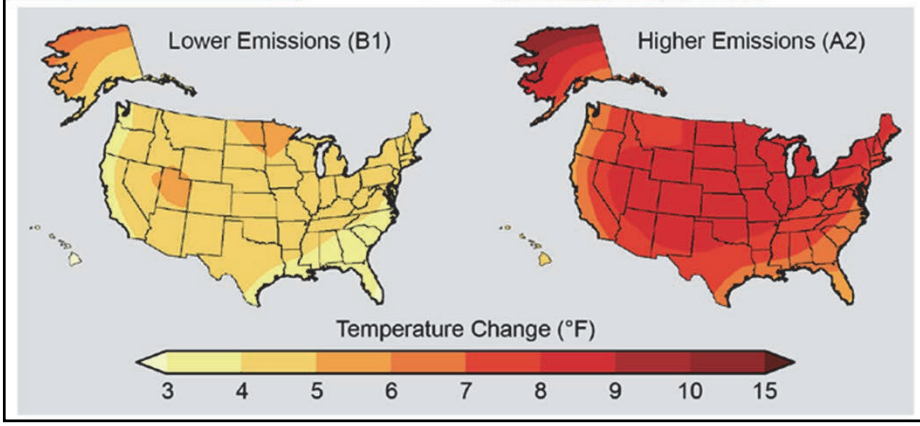
Preliminary Information – subject to revision. Not for citation

## Precipitation Trends and Scenarios



## Temperature Trends and Scenarios



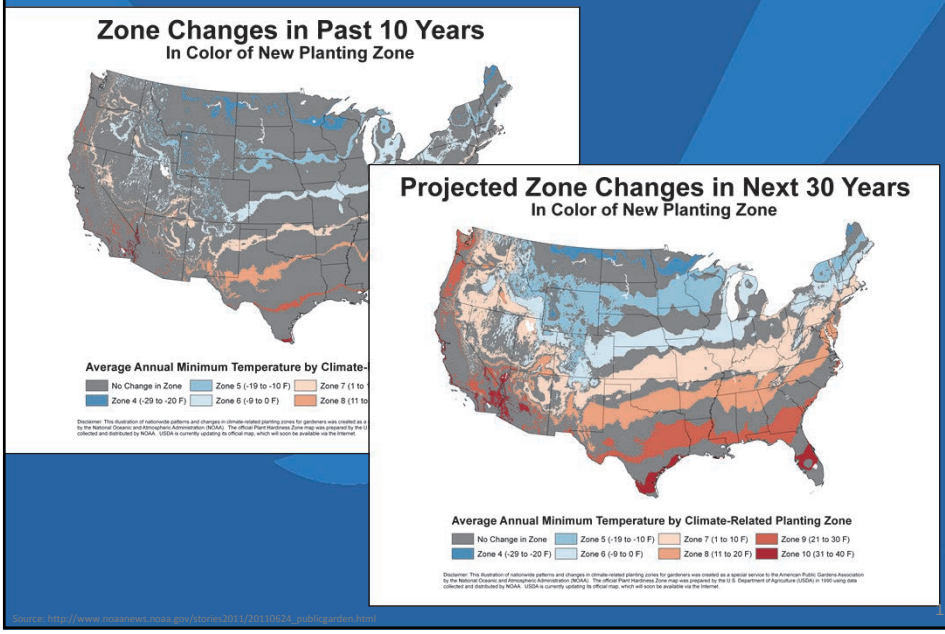




## Heat and Heat Waves

- 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


18

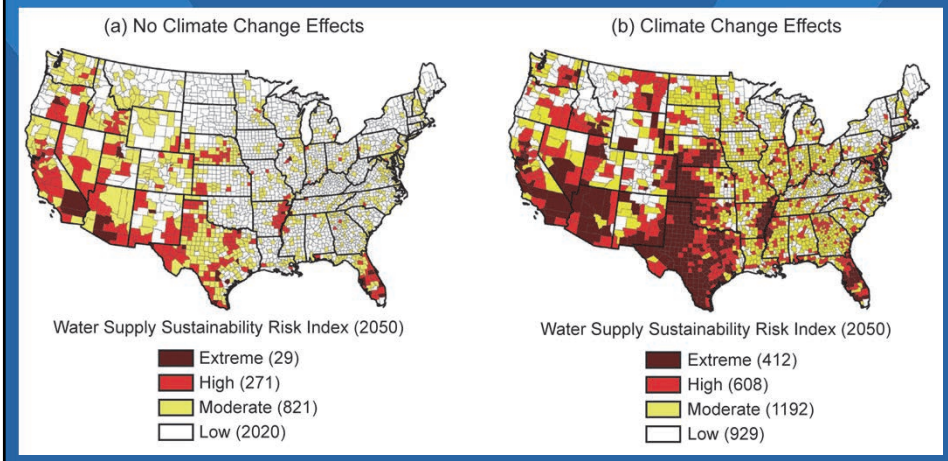
## Changes in Planting Zones




Source: http://www.noaanews.noaa.gov/stories2011/20110624_publicgarden.html

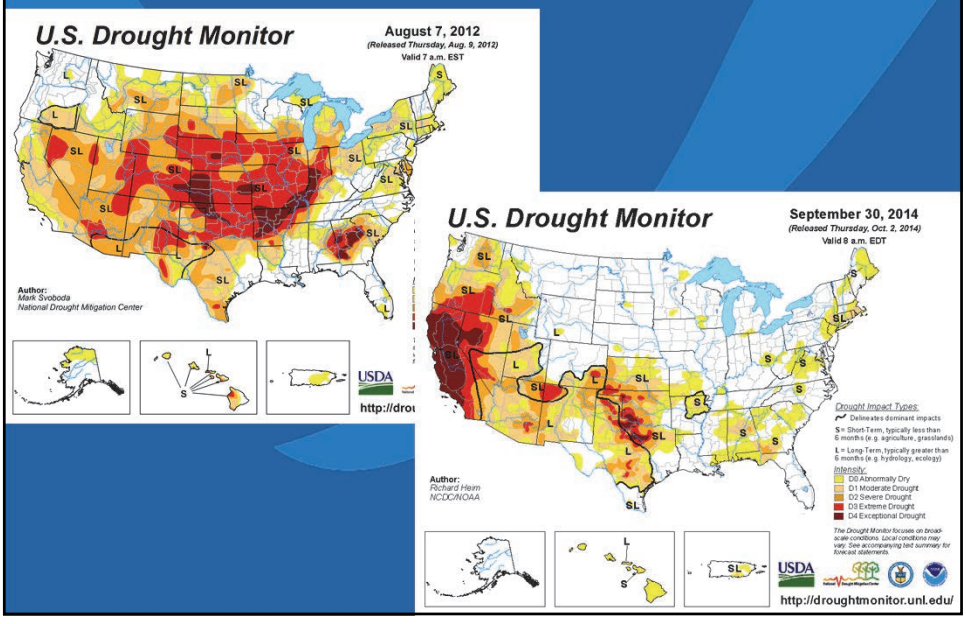
19

## Water Supplies Projected to Decline

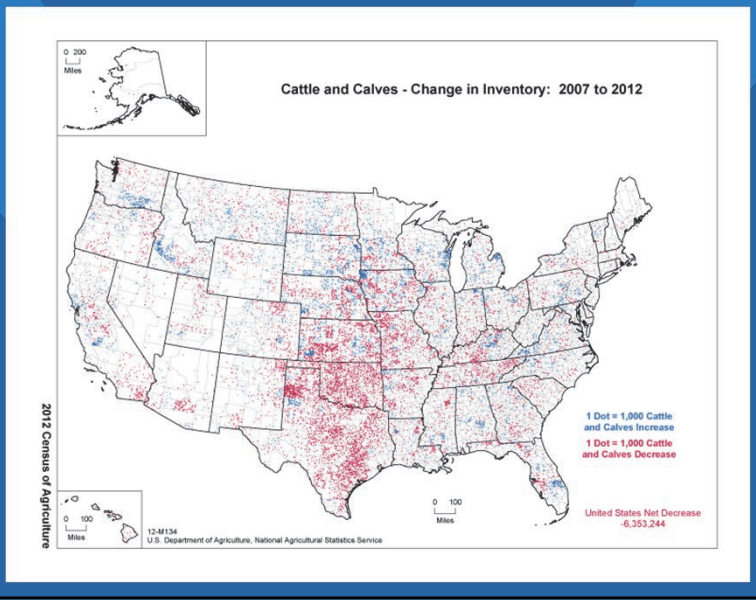


# Cascading Effects

# Drought Monitor: 2012 and Now



# Cascading Effects




# Potential Services & Information


Little Big Horn College - 2011


Near Salina, KS July, 2013

## 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

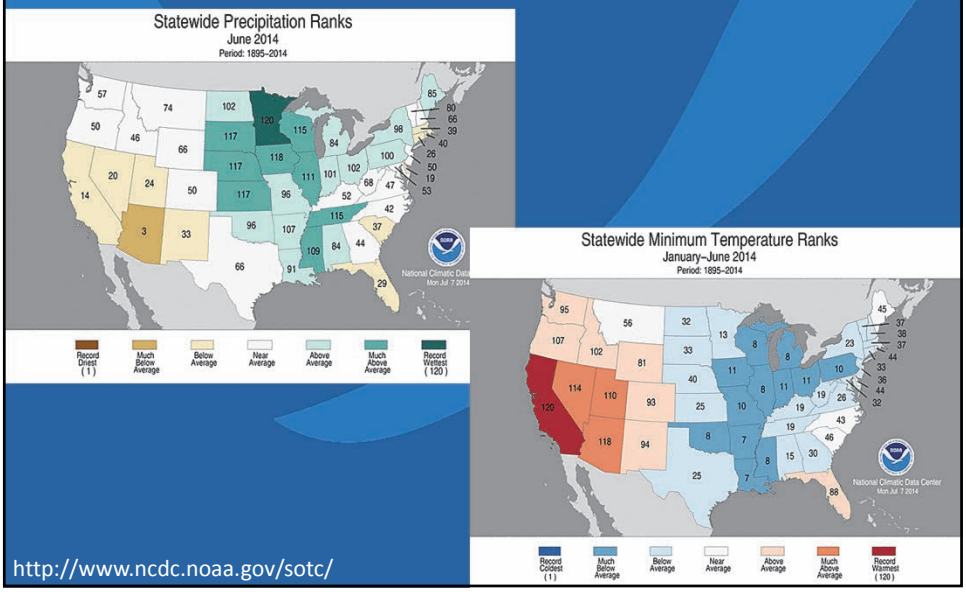
| | WEEKLY | MONTHLY | SEASONAL-ANNUAL | DECADAL |
|---|---|---|---|---|
| LOCAL | Regional Snowfall Index | Heating & Cooling Degree Days | Temperature & Precipitation Outlooks | Climate Normals |
| REGIONAL | Hurricane Tracks | Heat Wave Prediction | Drought Outlook | Extreme Detection & Attribution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

26

# NIDIS: Creating a drought early warning information system


# Climate Trends and Monitoring

## State of the Climate

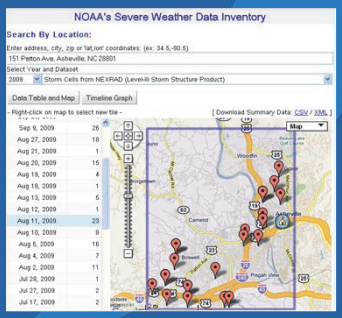


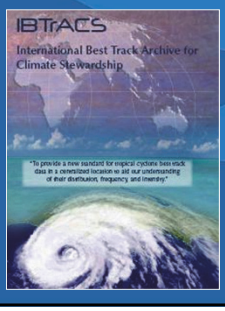

http://www.ncdc.noaa.gov/sotc/

## 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

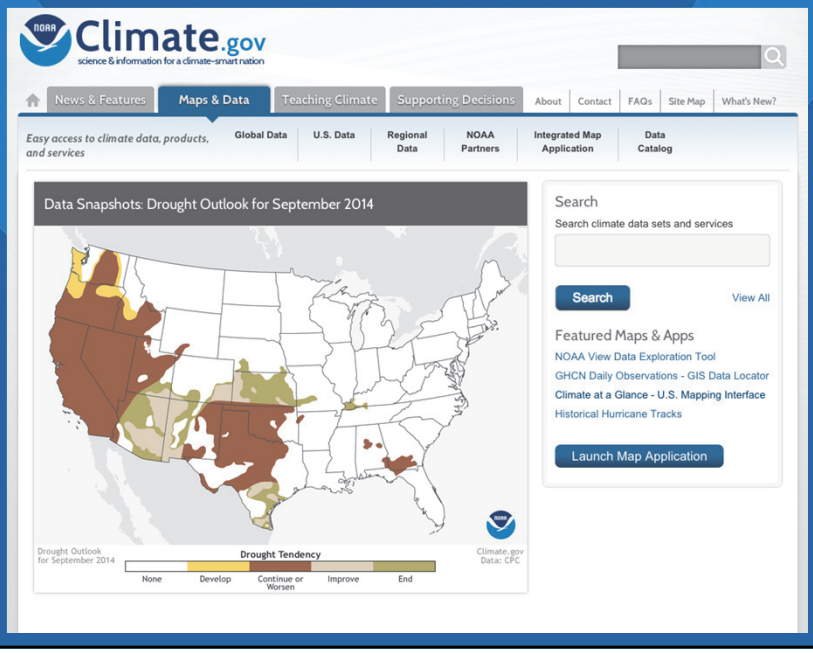



- **International Best Track Archive for Climate Stewardship (IBTrACS)** merges tropical cyclone best track data sets globally into a single-database with open QA/QC procedures

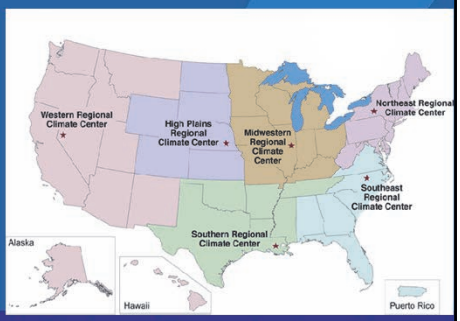
https://www.ncdc.noaa.gov/ibtracs/

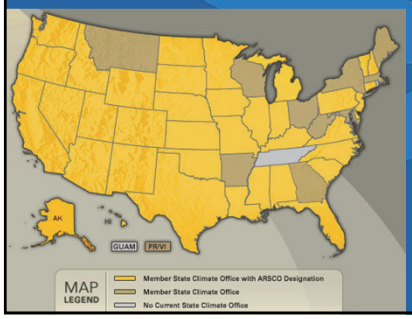
## Climate.gov

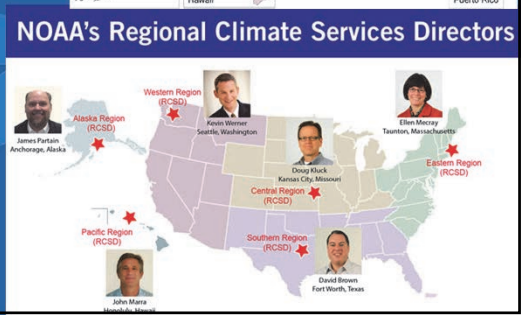


# Regional Climate Services

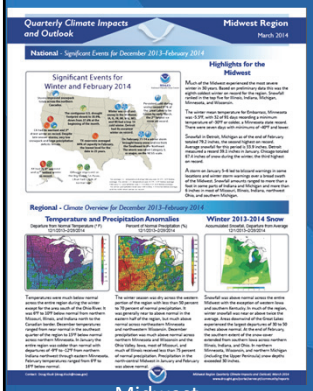
- Regional Climate Centers
- State Climatologists
- Other NOAA
- Federal
- State
- Academia
- NGOs
- Tribes



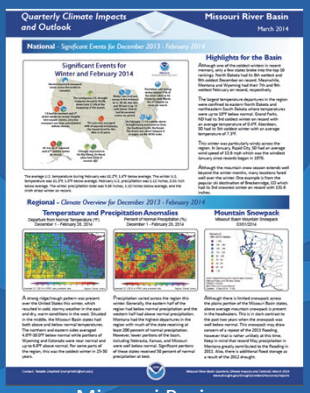




# Quarterly Regional Climate Summary & Outlook

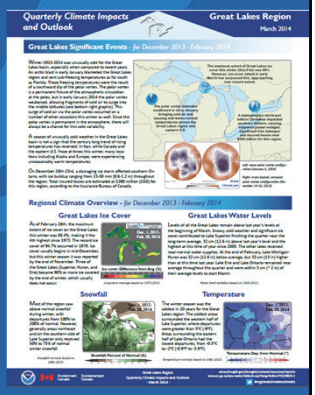



Midwest

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

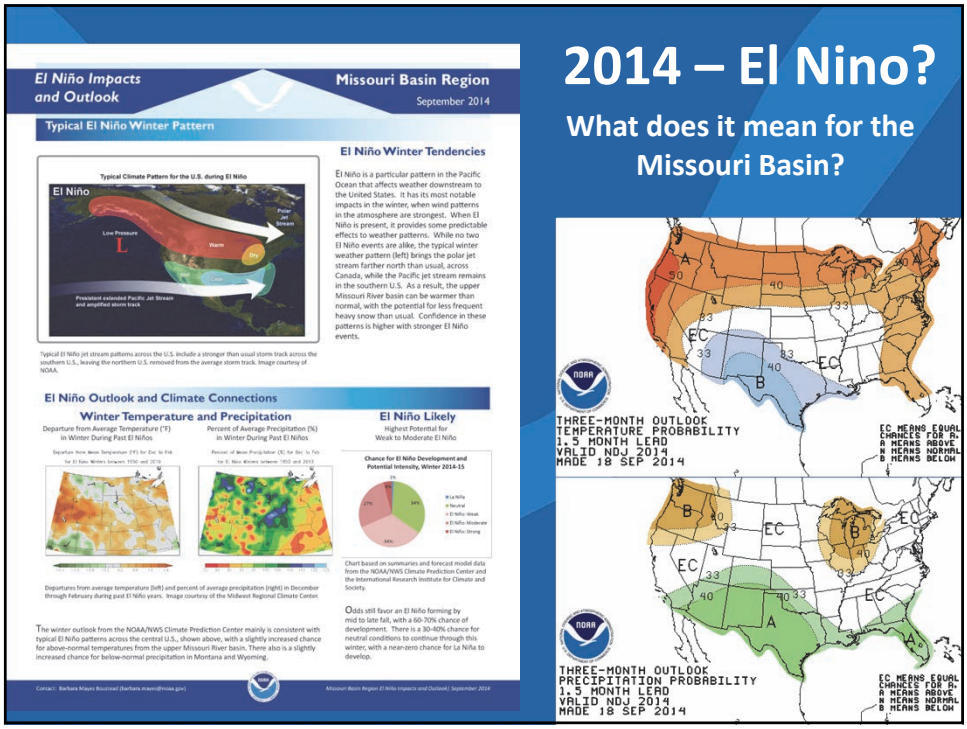



Missouri Basin



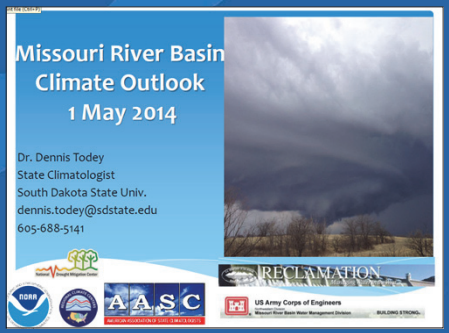

Great Lakes

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




# Building Awareness: Regional Monthly Climate & Drought Webinars

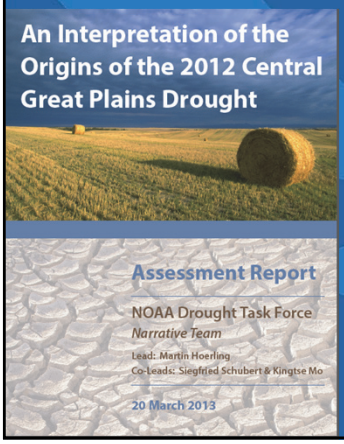
- Since November 2011
- Response to climate extremes
- Popular w/states, feds, tribes, private interests
- Presenters: AASC, NDMC, RCCs, USDA, LCC and others

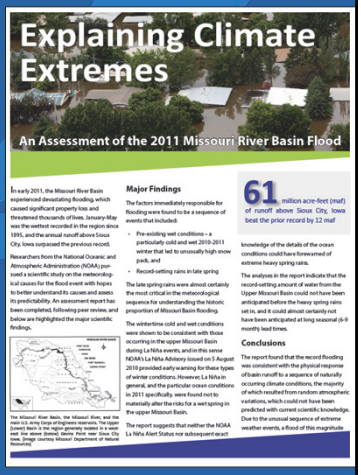



# Attribution and Assessments

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

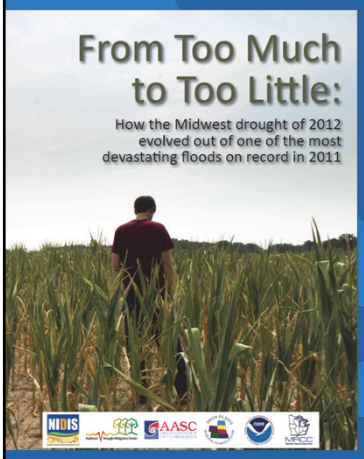
**2007 April Freeze**
http://www1.ncdc.noaa.gov/pub/data/techrpts/tr200801/tech-report-200801.pdf




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

# 2012 Drought Assessment




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.