

Planning in a Changing Climate: Projected Impacts and Adaptive Responses within the Water Resource Sector



water.usgs.gov/ogw/gwrp/photo_gallery/

Planning for North Carolina's Future: Ask the Climate Question—March 2010

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Presentation

What do we know about water use?

Why do we need to know about climate?

What impacts do we anticipate?

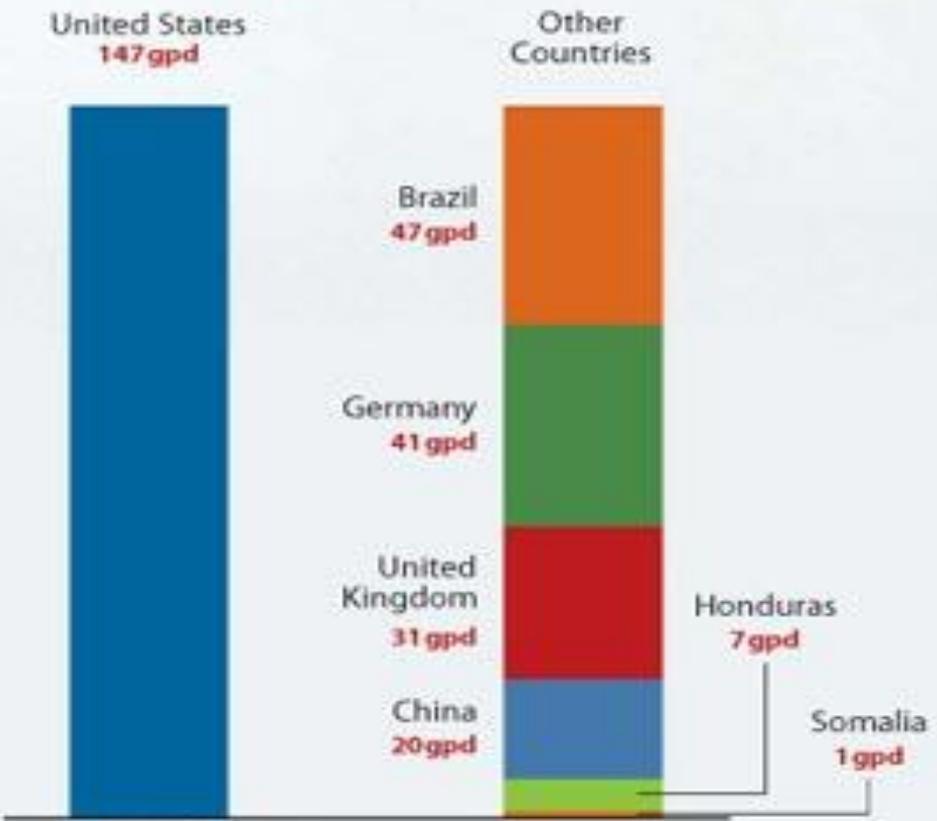
- In the US
- In North Carolina

How do we use/interpret this information?



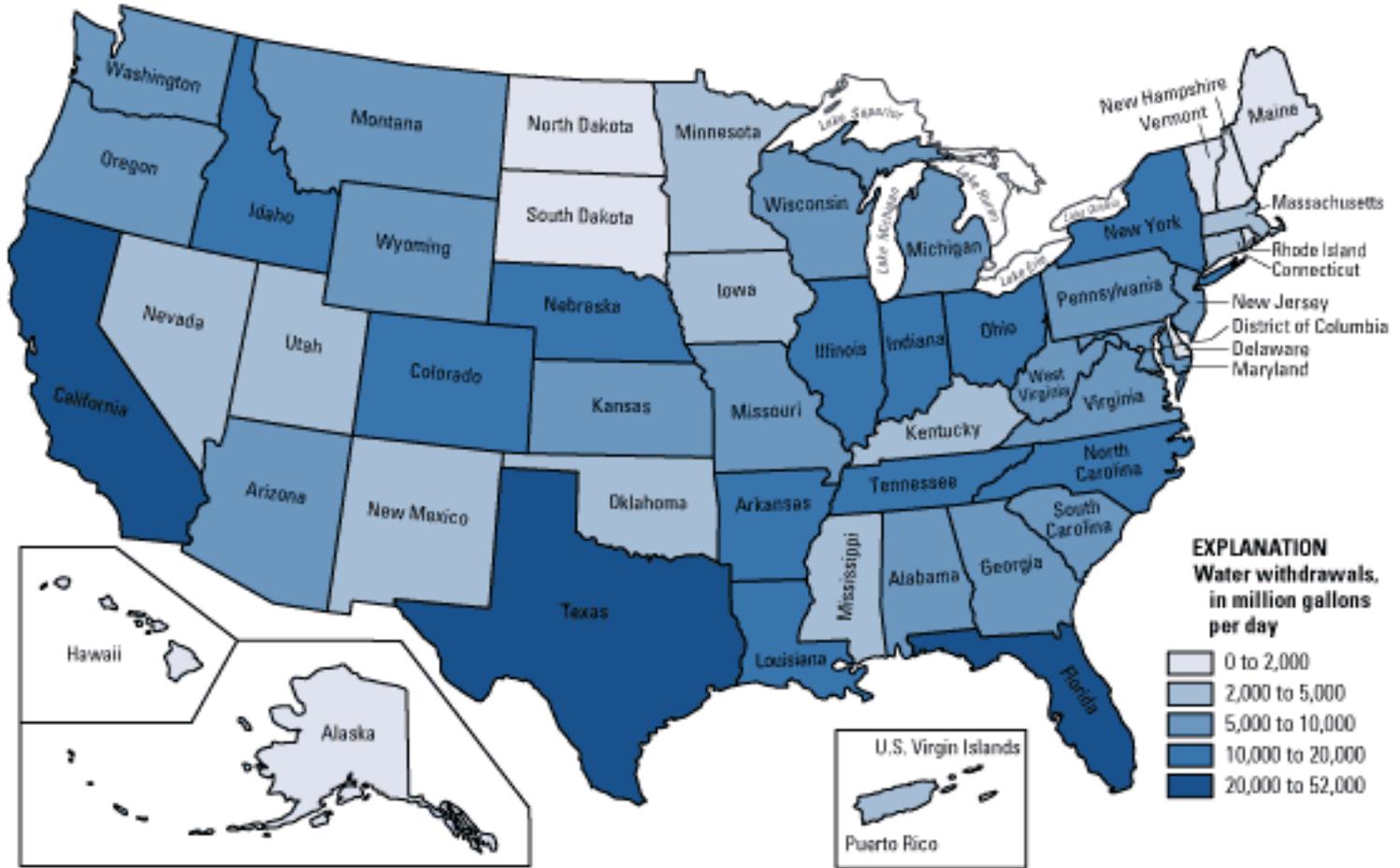


Per Capita Domestic Water* Use In gallons per day (gpd)



Source: Pacific Institute
www.worldwater.org





Total water withdrawals, 2000.



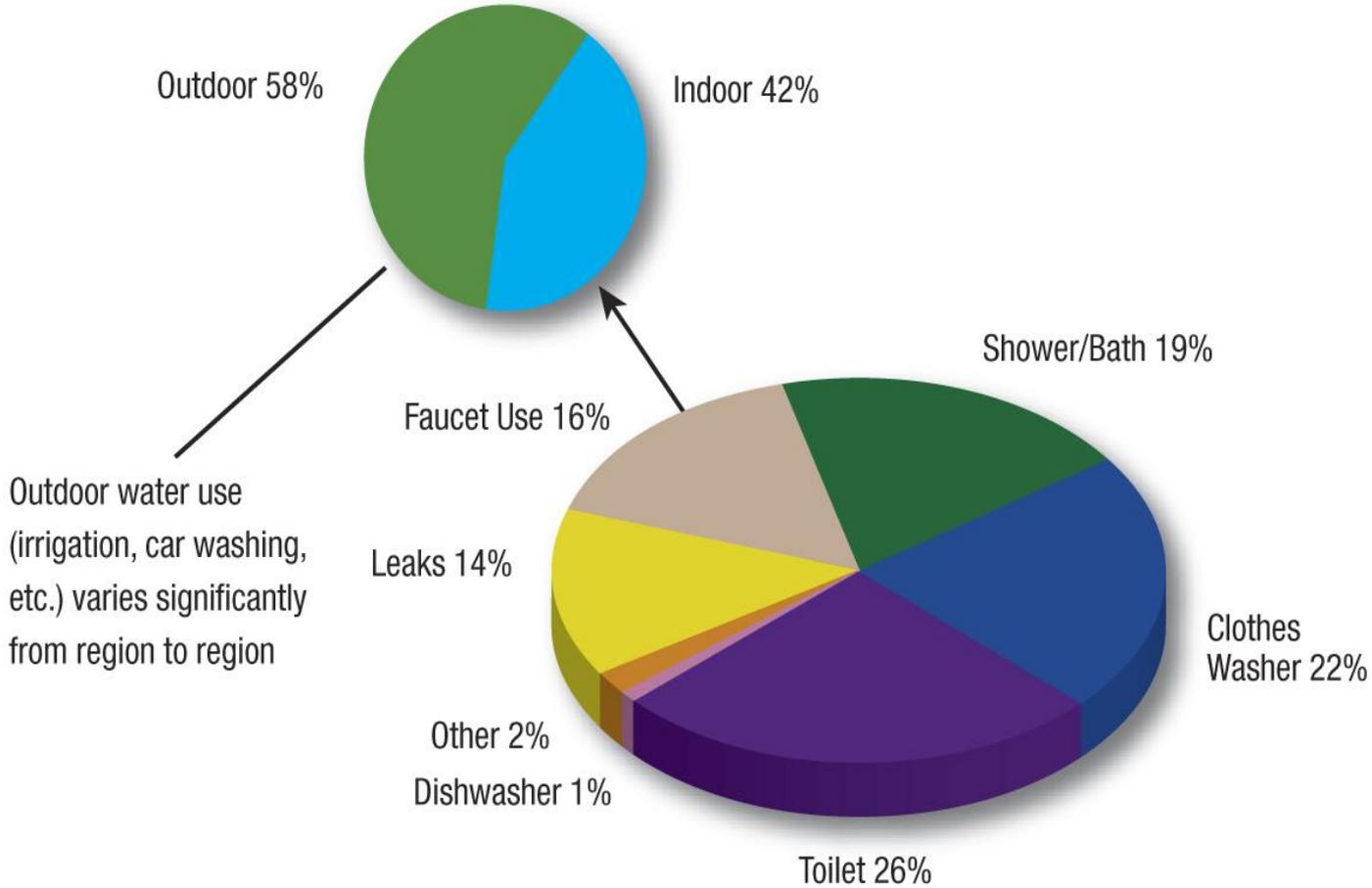
Half of the U.S. water use goes to power generation: One-third is used in irrigation



Water is essential for cooling power plants.

The 2007-8 drought created critical water issues for NC's electric power industry

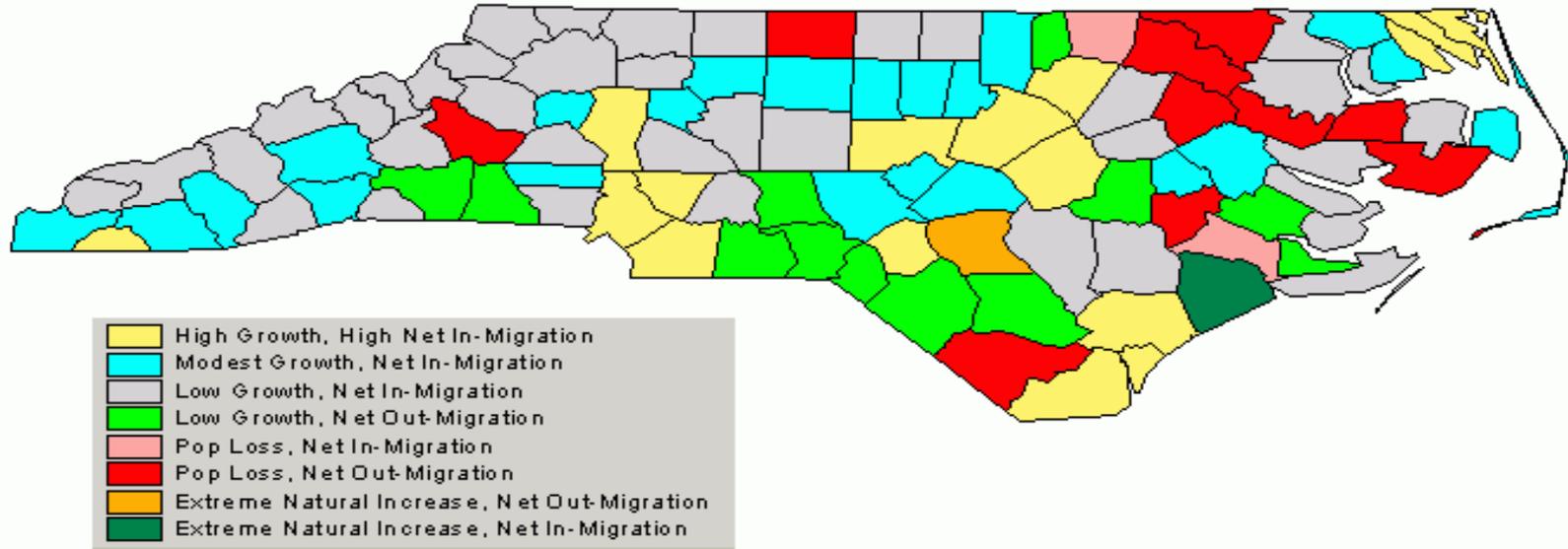




Residential uses of water in the United States (typically 200 gallons per day per household).

Data from Mayer, et al. Residential End Uses of Water, 1999.





Source: NC State Demographer's Office

Some counties are growing faster than others; they may experience water supply issues sooner than slower growing areas.

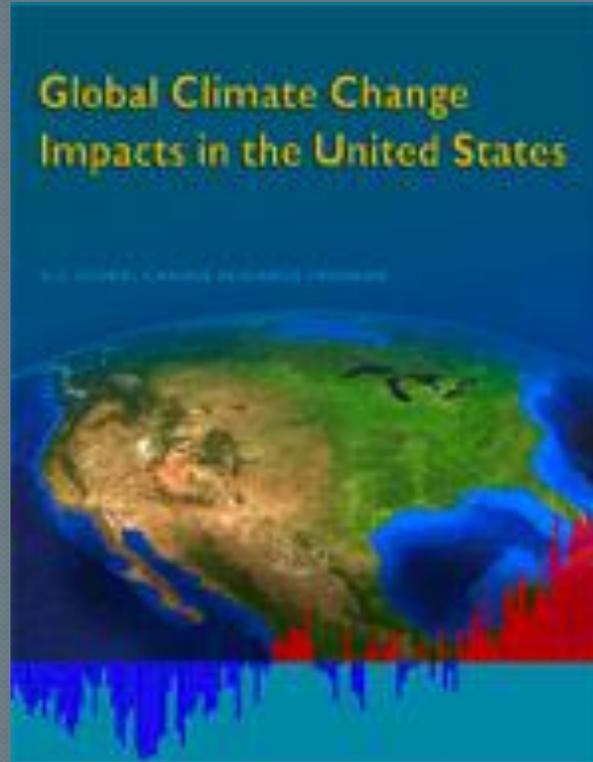


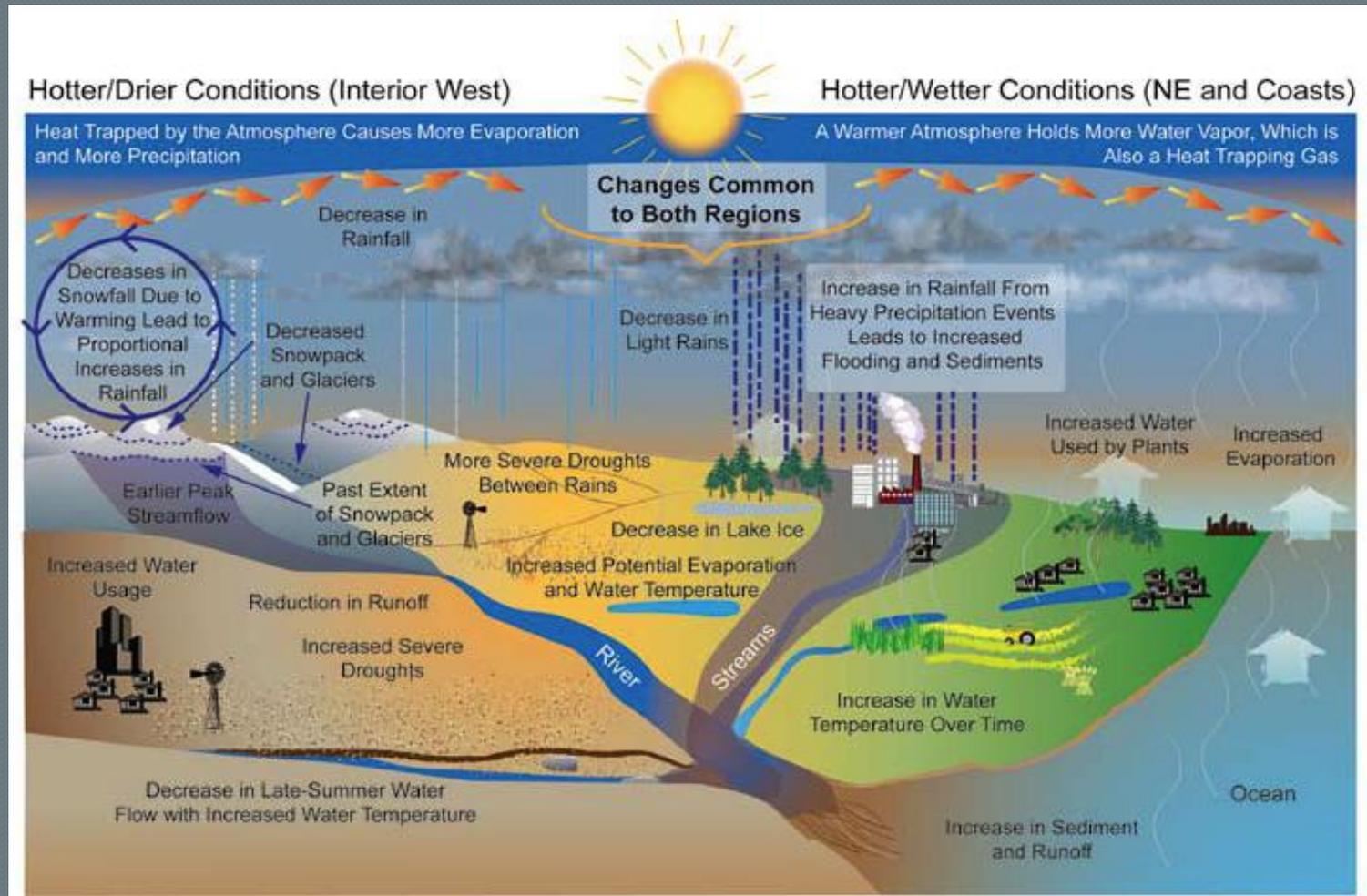
Examples of Water Resource Decisions Related to Climate Forecasts

| Decision/Topic | Examples of Activities Affected | Climate Forecast Info |
|---|--|--|
| Public water supply/waste water management | <ul style="list-style-type: none"> • New wastewater treatment facilities, reservoirs, dams, etc. • Long-term water supply and demand management plans • Drought Planning | <ul style="list-style-type: none"> * Changes in temp., precipitation * Reductions in base-flows * Greater evaporation rates |
| Irrigation/water allocation for agriculture / aquaculture | <ul style="list-style-type: none"> • How much water • When to allocate it • Where to allocate it | <ul style="list-style-type: none"> • Long/short term precipitation • Long/short term temp |
| Coastal Zones | <ul style="list-style-type: none"> • Erosion: marsh deterioration • Flood control, water supply, sewage treatment • Fish production, coastal food systems, salt water intrusion | <ul style="list-style-type: none"> • Tropical storms • Changes in precipitation patterns • Wind changes • Storm surges |



Projected Impacts in the United States

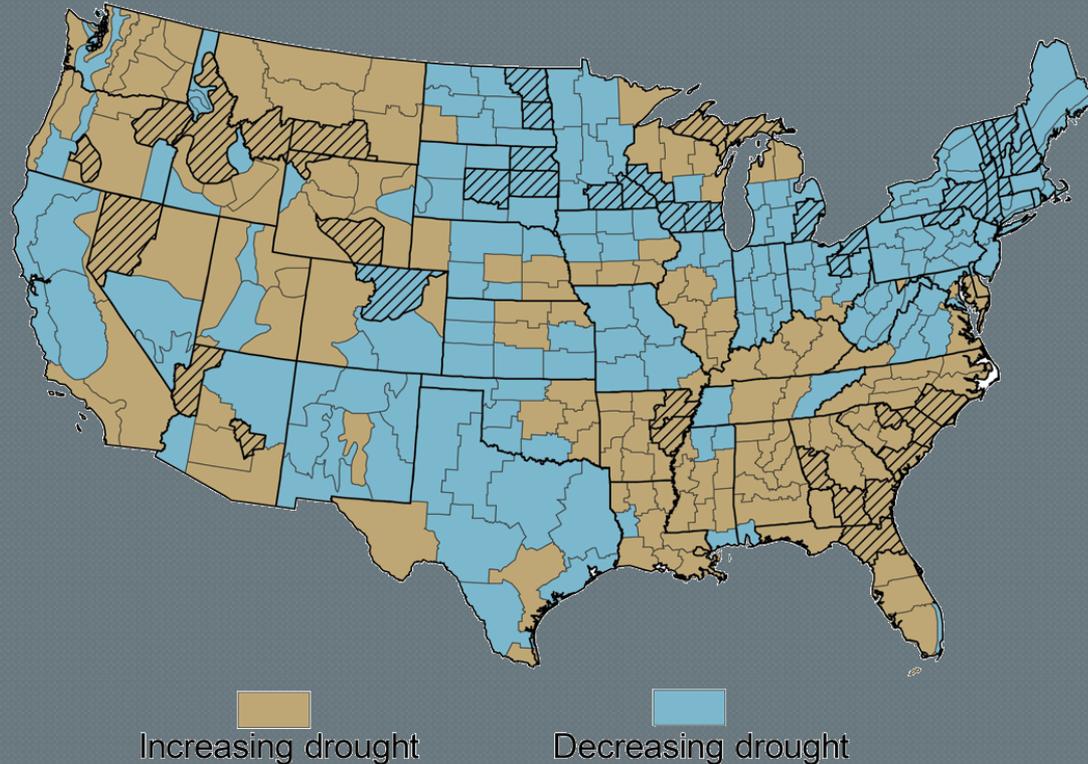




Climate change has already altered, and will continue to alter, the water cycle, affecting where, when and how much water is available for all uses.



Observed Drought Trends 1958-2007



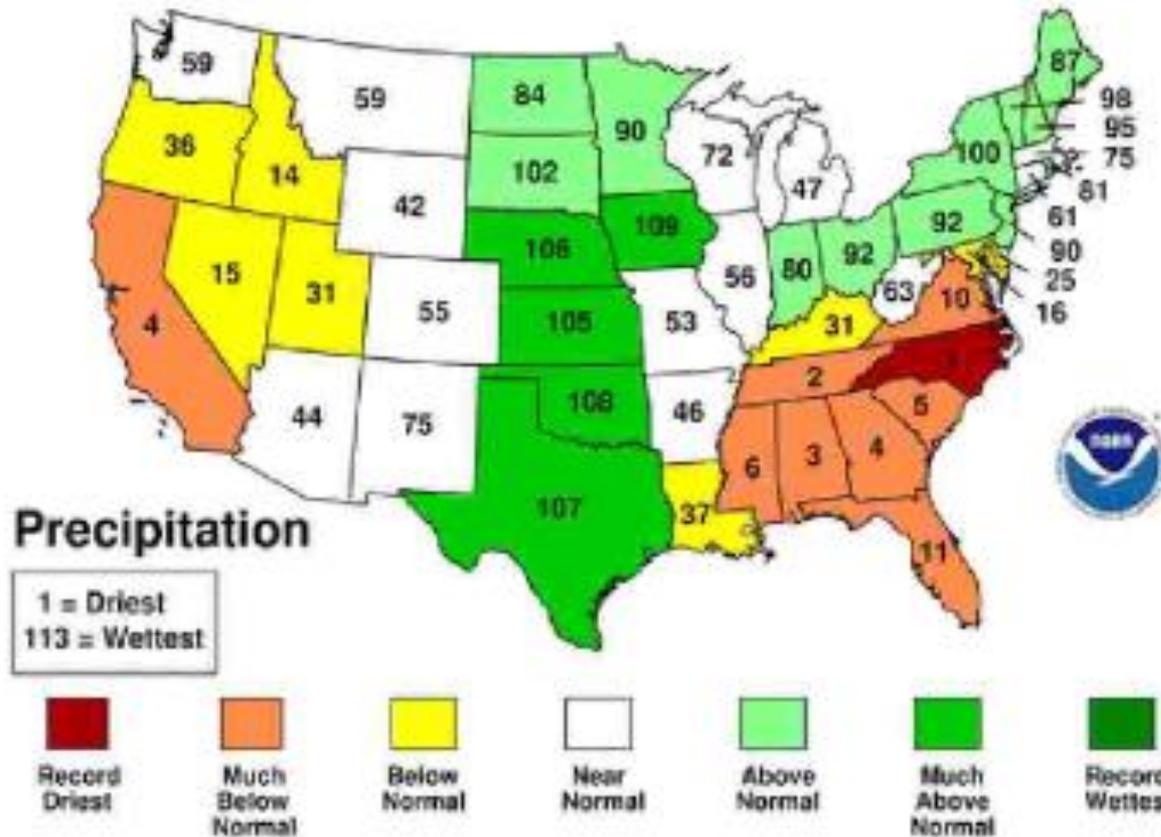
Floods and droughts are likely to become more common and more intense as regional and seasonal precipitation patterns change and rainfall becomes more concentrated into events (with longer, hotter dry periods in between).



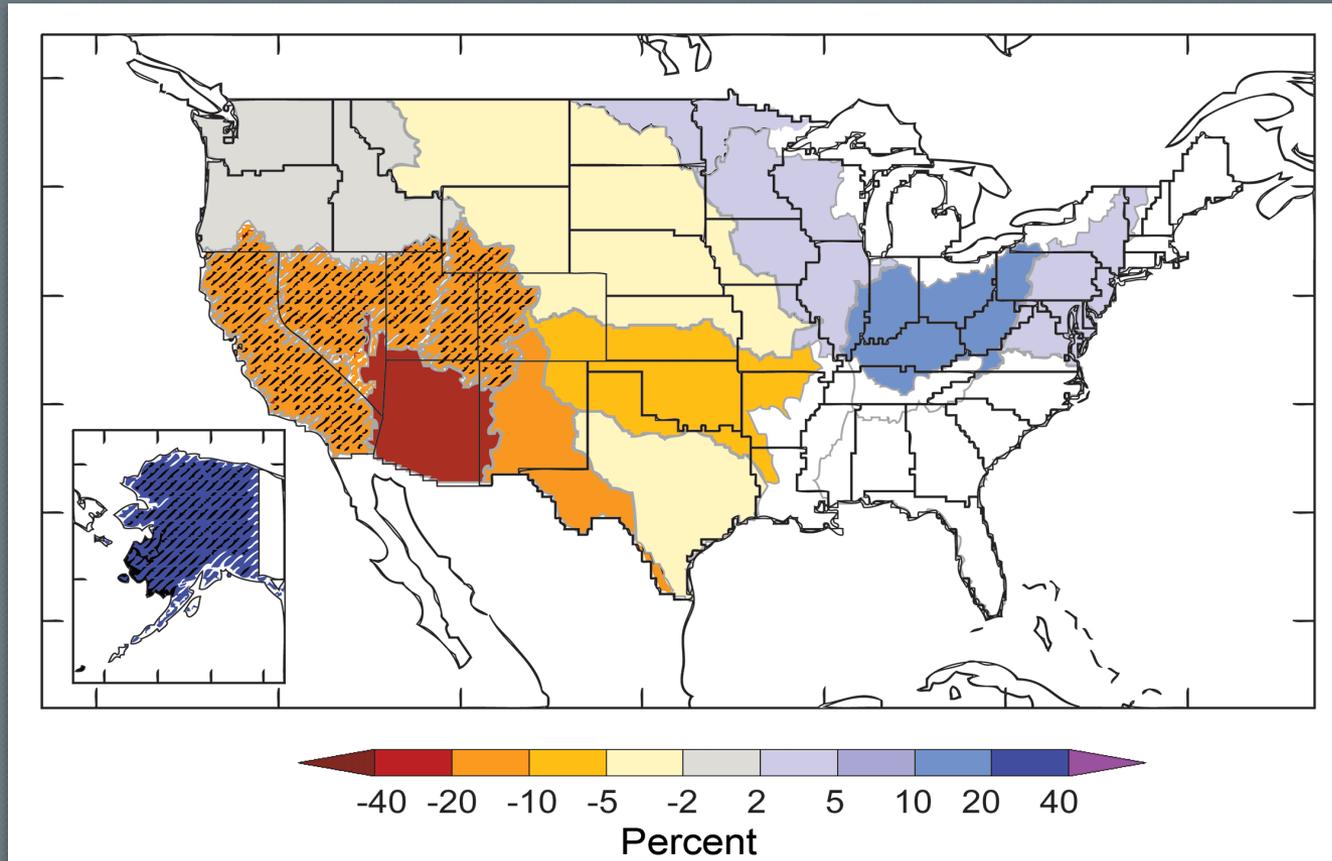
What are we seeing in North Carolina?

January-December 2007 Statewide Ranks

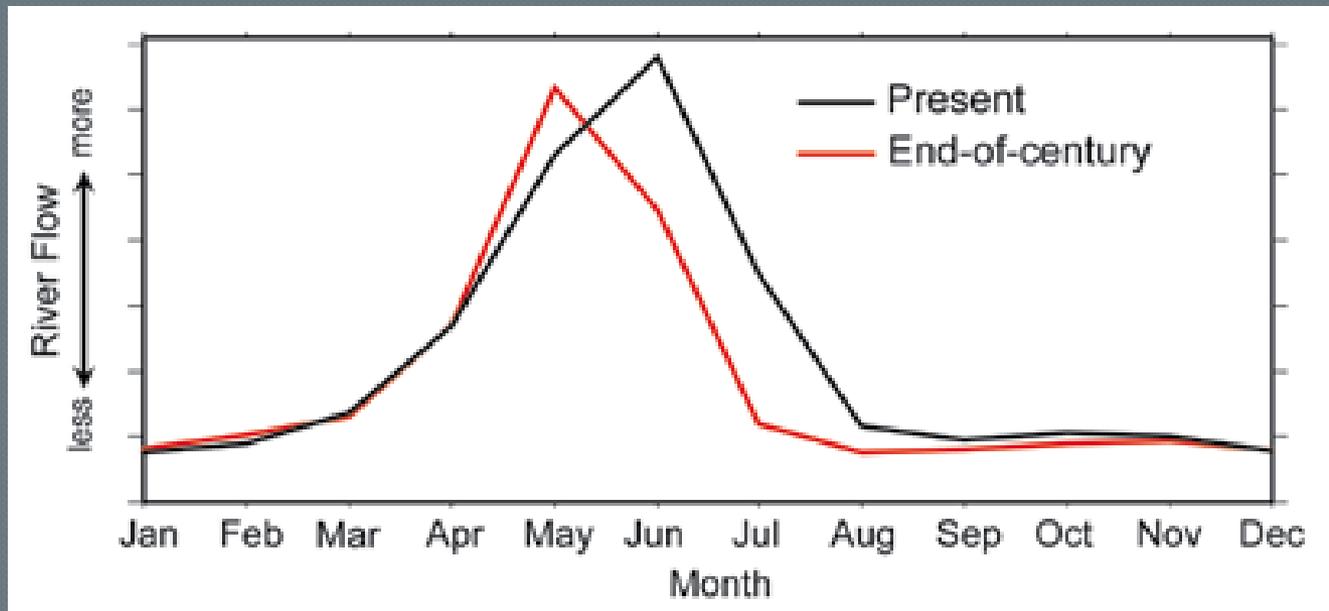
National Climatic Data Center/NESDIS/NOAA



Projected Changes in Annual Runoff



Precipitation and runoff are likely to increase in the Northeast and Midwest in winter and spring, and decrease in the West, especially in the southwest in spring and summer.



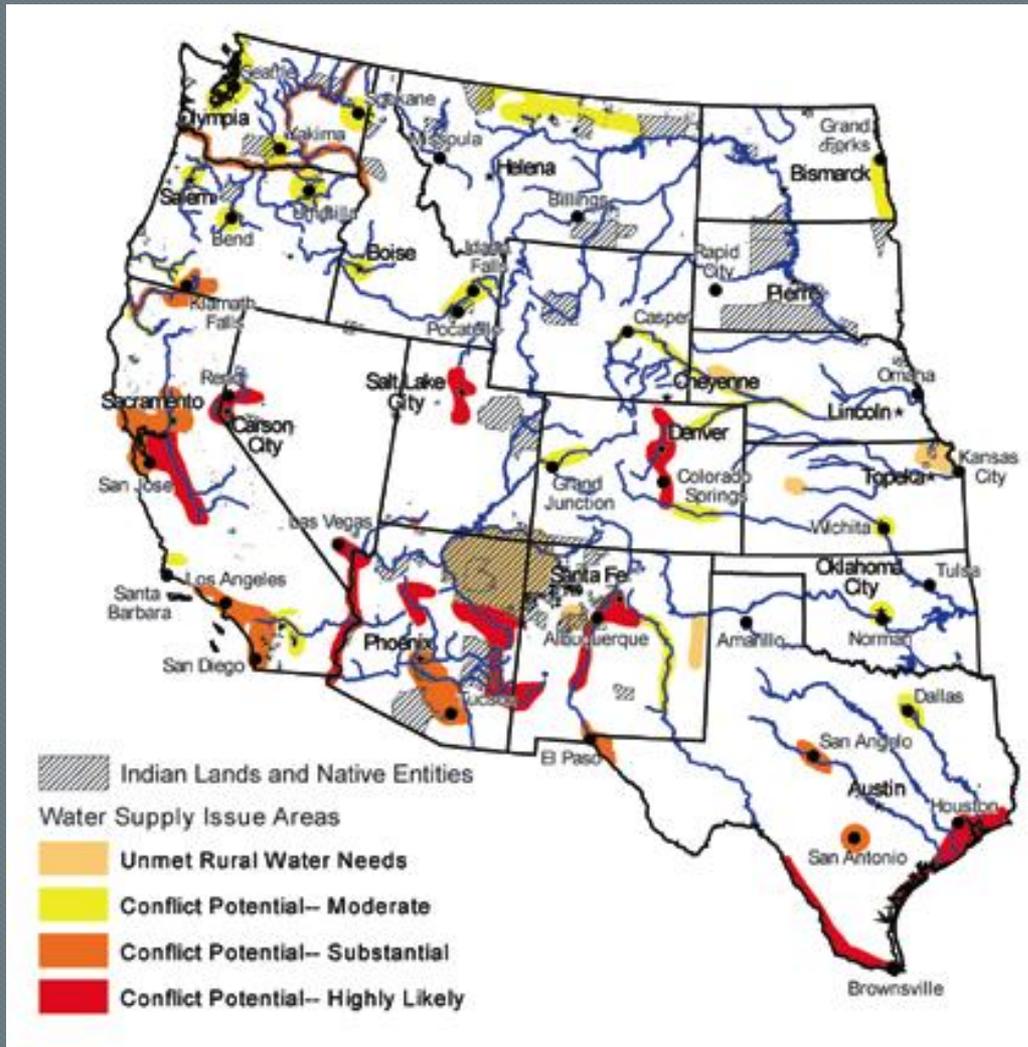
In areas where snowpack dominates, the timing of runoff will continue to shift to earlier in the spring and flows will be lower in late summer.



Heavy rain can cause sediments to become suspended in water, reducing its quality, as seen in the brown swath above in New York City's Ashokan reservoir following Hurricane Floyd in September 1999.

Surface water quality and groundwater quantity will be affected by a changing climate.

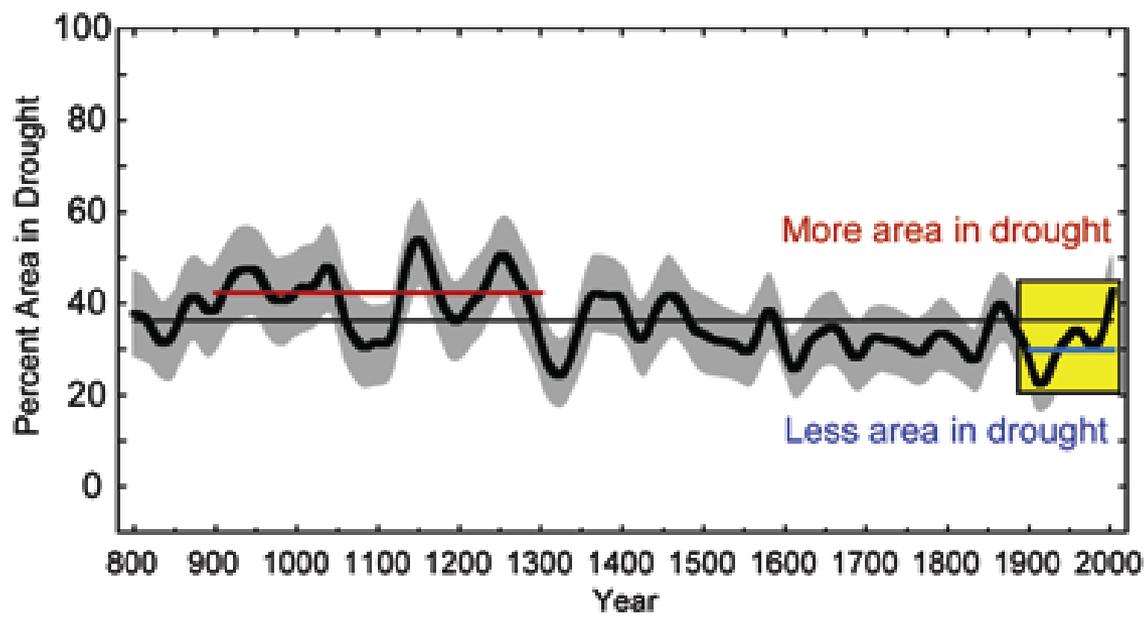




Potential Water Supply Conflicts by 2025

Climate change will place additional burdens on already stressed water systems.



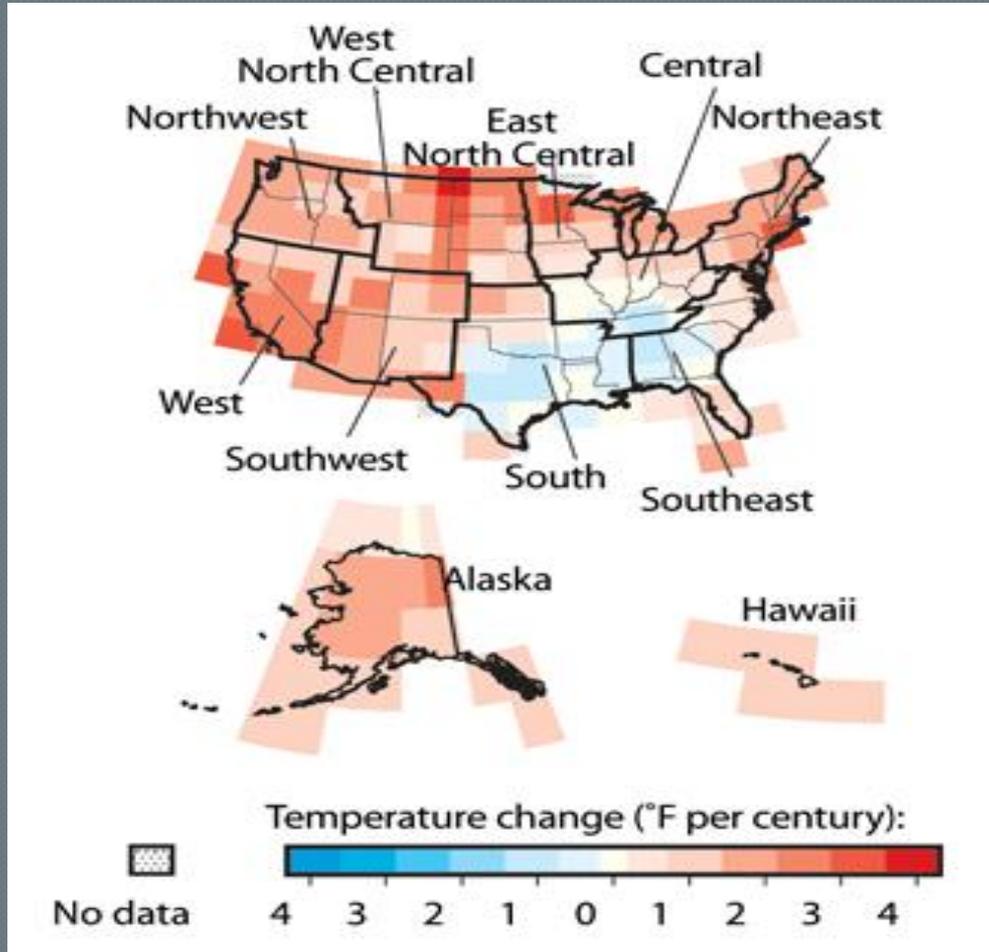


Long-Term Aridity Changes in the West

The past century is no longer a reasonable guide to the future for water management.



Other Potential Impacts



**Annual Mean Temperature Anomalies
1901-2005**

**Air and
Water
Temperature
Increases**



Potential Impacts of Changes in Air/Water Temp. on Water

Water Availability

Reduced ground & surface water supply



Water Quality

Increased runoff resulting in erosion and sedimentation



Increased water demand due to higher temperatures



telegraph.co.uk

Overwhelmed water infrastructure due to flooding



wakeupwakecounty.com



Rainfall and Snowfall Levels Distribution: Effects on Water Programs

(areas in white are most affected by rainfall and snowfall levels)

| Drinking Water Standards | Surface Water Standards | Technology Based Standards | Emergency Planning |
|---------------------------------------|----------------------------|----------------------------|-------------------------------|
| Drinking Water Planning | Clean Water Planning | Water Monitoring | Water Restoration/TM DLs |
| Underground Injection Control Permits | Discharge Permits | Stormwater Permits | Wetlands Permits |
| Source Water Protection | Nonpoint Pollution Control | Coastal Zone | National Estuary Program |
| Drinking Water SRF | Clean Water SRF | Ocean Protection | Combined Sewer Overflow Plans |



Air and Water Temperature Increases

Increases
in tropical
storm
intensity



Rising sea
levels



Changes in
coastal
regions—
chemical &
physical
aspects



Increases in
water
temperature



Increases in Storm Intensity

Damage from high wind



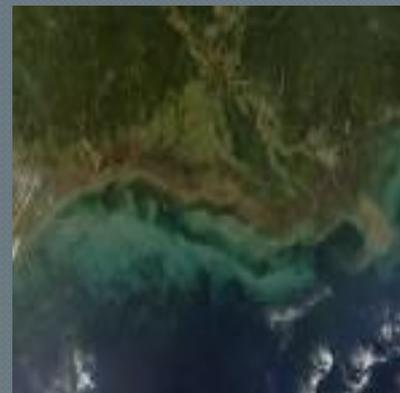
Contaminated waters



Flooded wastewater treatment plants



Damaged wetlands



Storm Intensity: Effects on Water Programs

(areas in white are most affected by rainfall and snowfall levels)

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EPA. 2008cc. National Water Program Strategy: Response to Climate Change. EPA 800-R-08-001, accessed August 31, 2009.



Sea Level Rise



Effects on water resources:

- Displacement of coastal wetlands and habitat
- Increased coastal erosion
- Inundation of wastewater treatment infrastructure
- Salt water intrusion threat to drinking water supplies

Sea Level Rise : Effects on Water Programs

(areas in white are most affected by rainfall and snowfall levels)

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Changes in Coastal Regions

Estuarine waters will become more saline as sea levels rise – impacting:



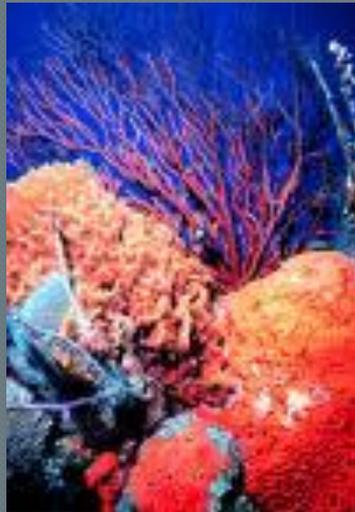
water
systems

+

biological
systems.



Ocean
temperature
s increase -
threatening
ocean and
estuarine life



Oceans
become
more acidic



How do we use/interpret this information?

- Most managers make decisions with imperfect information all the time; making decisions regarding climate change is the same.
- Many of the climate change actions have more than one benefit (and address other vulnerabilities)
- “Climate Change” is an excuse to do integrated planning (look at NYC)



- “Climate change” offers the potential for partnerships and economic opportunity
- Preparation for a changing climate allows us to develop new technologies and re-vamp old practices



Programs within our Office – With a Water Focus



keepbanderabeautiful.org

Sectoral Application Research Program (SARP)

Regional Integrated Sciences and Assessments
(RISA)

Transition of Research Applications to Climate
Science (TRACS)

National Integrated Drought Information System
(NIDIS)



For more information:

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301-734-1205

http://www.climate.noaa.gov/cpo_pa/sarp/

