


RECENT CLIMATE TRENDS IN THE SOUTHEASTERN US AND THEIR IMPACT ON TREES

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Today's talk:

- General climate conditions and current situation
- Long-term climate trends
- Impacts of changing climate

What controls climate?

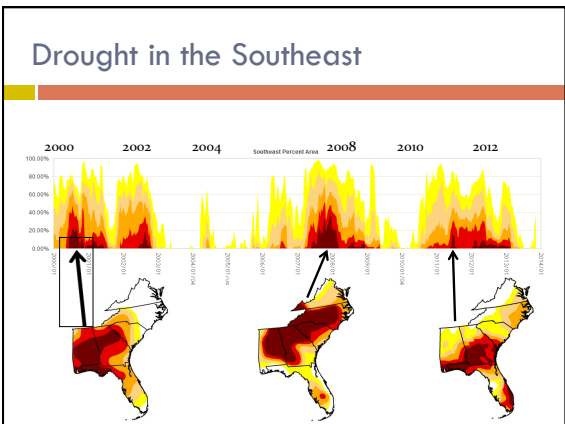
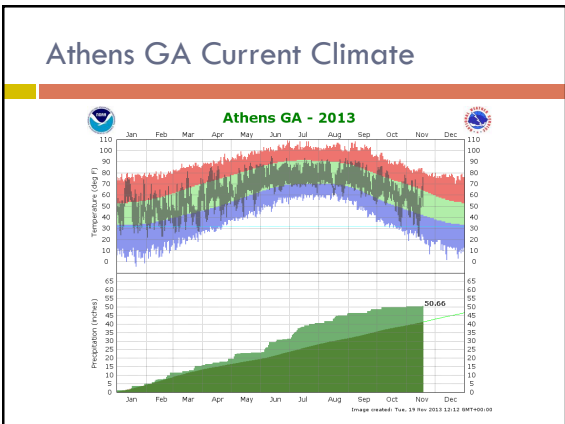


Physical geography:

Latitude, elevation, presence of water, land cover

Atmospheric composition:

Water vapor (humidity, cloudiness), aerosols (strength of sun, development of raindrops), CO2 and other gases (global warming, fertilization)



What drought impacts have you seen in your area?

- A. Increased problems with tree health, dropping limbs, etc.
- B. Reduced employment for landscapers and foresters
- C. Increased restrictions on watering and landscaping
- D. All of the above
- E. None of the above

If you have other impacts, you can write them in the chat box.

Impacts of last 15 years on trees and nursery owners

- Repeated episodes of stress on trees related to three multi-year severe droughts
- Tree deaths increased due to stress and insect pressure
- In wet periods, damage from trees falling increased when wet soil failed to support root systems
- Watering restrictions reduced market for young trees

Question

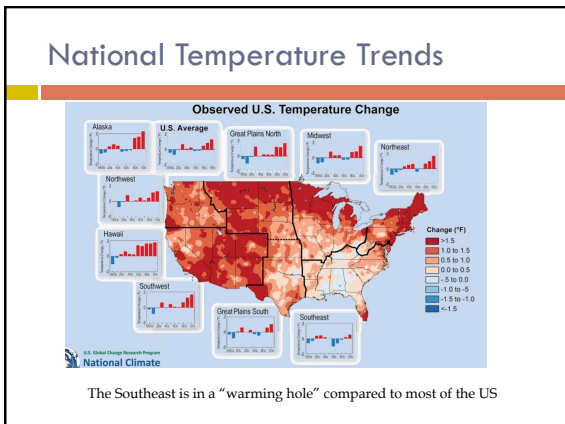
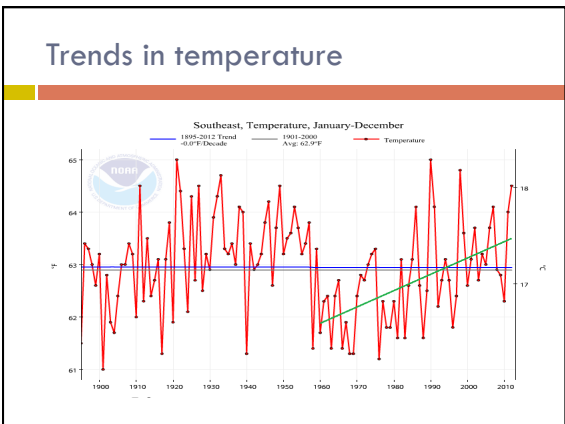
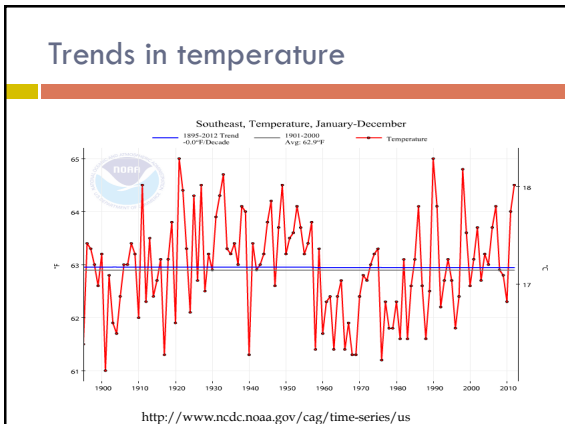
What trend in temperature do you think has been recorded in the Southeast over the last 100 years?

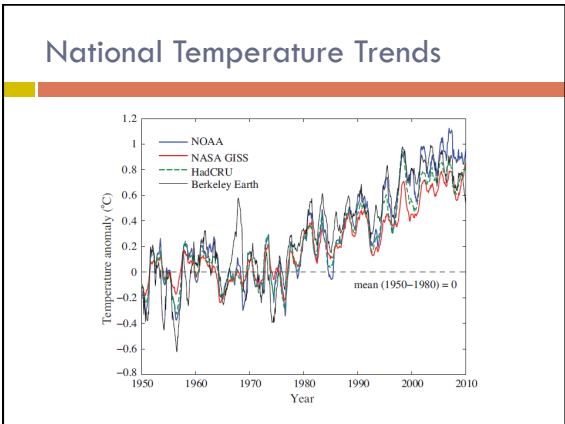
A. Increasing temperature
 B. Decreasing temperature
 C. No trend in temperature

Question

What trend in temperature do you think has been recorded in the Southeast over the last 30 years?

A. Increasing temperature
 B. Decreasing temperature
 C. No trend in temperature

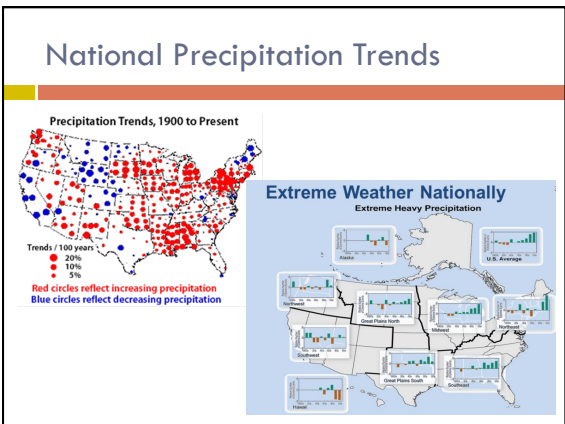
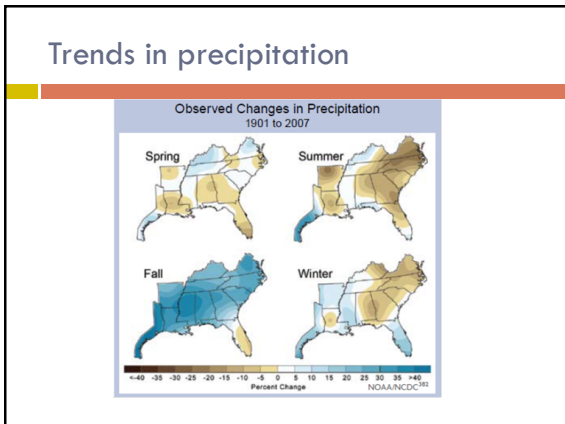
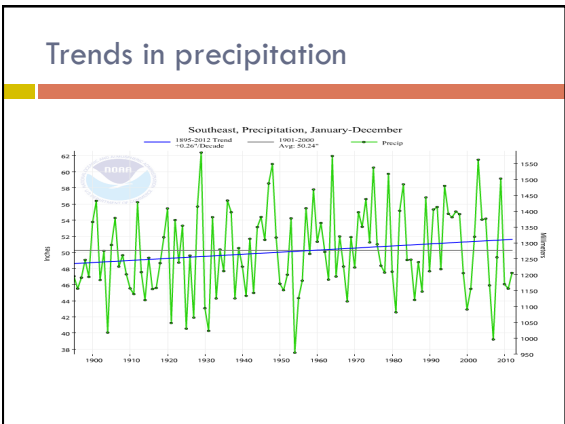




Question

What trend in precipitation do you think has occurred in the Southeast over the last 100 years?

- A. Increase in precipitation
- B. Decrease in precipitation
- C. No change in precipitation



How to predict future climate

- Assume that there will be no change
- Assume that current trends will continue
- Assume that we will swing back to a former pattern
- Do simulations of what climate might look like using models of physical systems

Question

Do you know what El Niño is and how it affects weather in your area?

- A. Yes
- B. No
- C. Not sure

El Niño and La Niña

In an El Niño, the trade winds are weaker, allowing warm surface water to move towards the east. This causes a deepening in the pool of warm surface water near the coast and increased clouds and thunderstorms above the warmest water.

Effects of El Niño

Composite Precipitation Anomalies (Inches) Versus 1950-2007 Longterm Average

Composite Precipitation Anomalies (Inches) Versus 1950-2007 Longterm Average

Indian Water precipitation

Impacts of El Niño/La Niña on Forestry

- La Niña caused high death and disease rates in new plantings due to dry conditions in 1999-2000 and stands planted during that time still show poor quality today.
- El Niño plantings from 1998 were well established except in very low-lying areas where excessive rainfall drowned newly planted seedlings.
- In El Niño seasons, wet ground can make it hard to harvest trees, especially in low-lying areas.
- In La Niña seasons, dry conditions can increase pest pressure but also improve ability to get heavy machinery into low-lying areas for harvesting.

Current status of El Niño

- Currently there is no El Niño or La Niña – we call that “neutral conditions”
- About 50 percent of all years are neutral
- Neutral years do not have strong statistical signals to help us make seasonal forecasts
- Neutral years are associated with active tropical seasons

ENSO forecast from IRI

All models predict no El Niño or La Niña is likely to develop for the next few months. That makes seasonal trends harder to forecast. However, neutral conditions are associated with increased tropical storm activity in the Atlantic Ocean.

Climate Models

Models try to predict the conditions of the atmosphere using basic physics but have to simplify to account for small-scale processes that cannot be simulated at the scale that computers can handle due to dataset size constraints. Types of models:

- Box model
- Atmosphere-only model
- Static ocean
- Full atmospheric-oceanic global circulation model

Increasing Model Complexity

Models can separate out CO2 Effects

Models can be used to separate out the effects of individual factors to see what effect each factor has on the temperature trend.

Predictions of future temperature

- Temperatures will increase, day and night
- Amount of warming is not certain (5-10 F in next 100 years)
- Longer growing season
- Increased evaporation

Predictions of future precipitation

- Predictions of future rainfall are not well modeled
- Trends indicate increased rainfall intensity (more thunderstorms) with longer dry spells in between
- Precipitation changes by season cannot be predicted
- Effects on El Niño and hurricane frequency not known

What changes can we expect and when?

- Average temperatures will likely increase in all seasons by 5-10 °F over the next 100 years
- Day vs. nighttime temperatures will both increase but not necessarily at the same rate
- Extremes in maximum temperature and warmer nights will cause added heat stress
- Growing seasons will lengthen

Impacts of Changing Climate on Trees

- Warmer temperatures would increase growing degree days for trees but also weeds and insect pests and diseases as the growing season gets longer and hotter.
- Increases in extremes of temperature may lead to more fires due to extended hot and dry spells.
- Winter storms may change from snow to ice storms, increasing damage to trees.



Impacts of Changing Climate on Trees

- Warmer temperatures will increase evaporation from soil, lakes and reservoirs as well as evapotranspiration from trees, which could affect water availability.
- Hurricanes could increase in number and/or intensity, causing increased damage in Southeastern forests.



Impacts of Changing Climate on Trees

- Uncertainty of rainfall predictions makes it hard to determine what to expect in the future, especially since there is already a lot of natural variability in rainfall patterns by location and season.
- Higher intensity rainfall will increase erosion and runoff from fields and open areas and could increase localized flash flooding in storms.



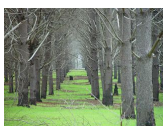
Impacts of Changing Climate on Trees

- Longer dry spells, coupled with warmer temperatures, will increase the likelihood of drought and will reduce average stream flows.
- More info can be found at <http://ncadac.globalchange.gov>



Strategies for adaptation to changes in climate

- Increase resistance to climate change to maintain current practices
- Increase resilience to variations in climate by protecting against effects of disasters and increasing recovery from them
- Transform operations by altering species or management practices



Thank you!

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