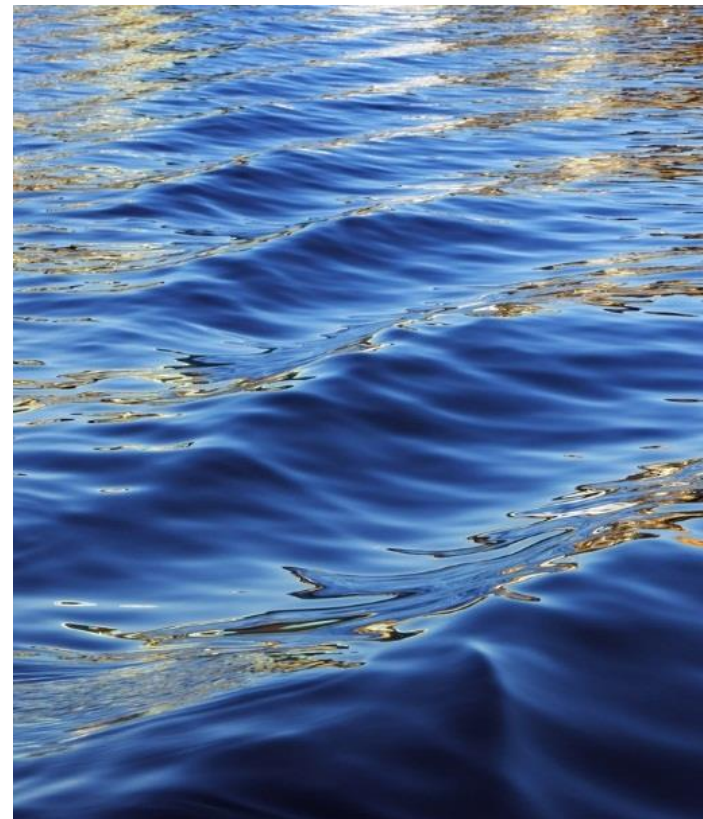




Summary of Research at Oregon State University

Russell B.B. Doughty



Questions:

- How does the world work?
- How does the Ouachita Highlands work?
- What is the role of the Ouachita Highlands in biogeochemical nutrient cycling?
 - Water
 - Nitrogen
 - Carbon

Findings:

- The Ouachita Highlands are unique
- Local climate is a factor of global and local processes – ENSO & Ouachitas
- A healthy, forested Ouachita landscape may mitigate affects predicted by climate science
- A healthy riparian forest is a necessity for watershed health
- The nature of freshwater is a cycle. The Sun and trees power that cycle.
- Trees = water.

“The heart of an ecologically healthy watershed is the riparian forest... This strongly suggests that maintenance of riparian forests... is of fundamental importance for long-term ecological and socioeconomic vitality of watersheds...”
- Robert J. Naiman et al. (1992, 173)

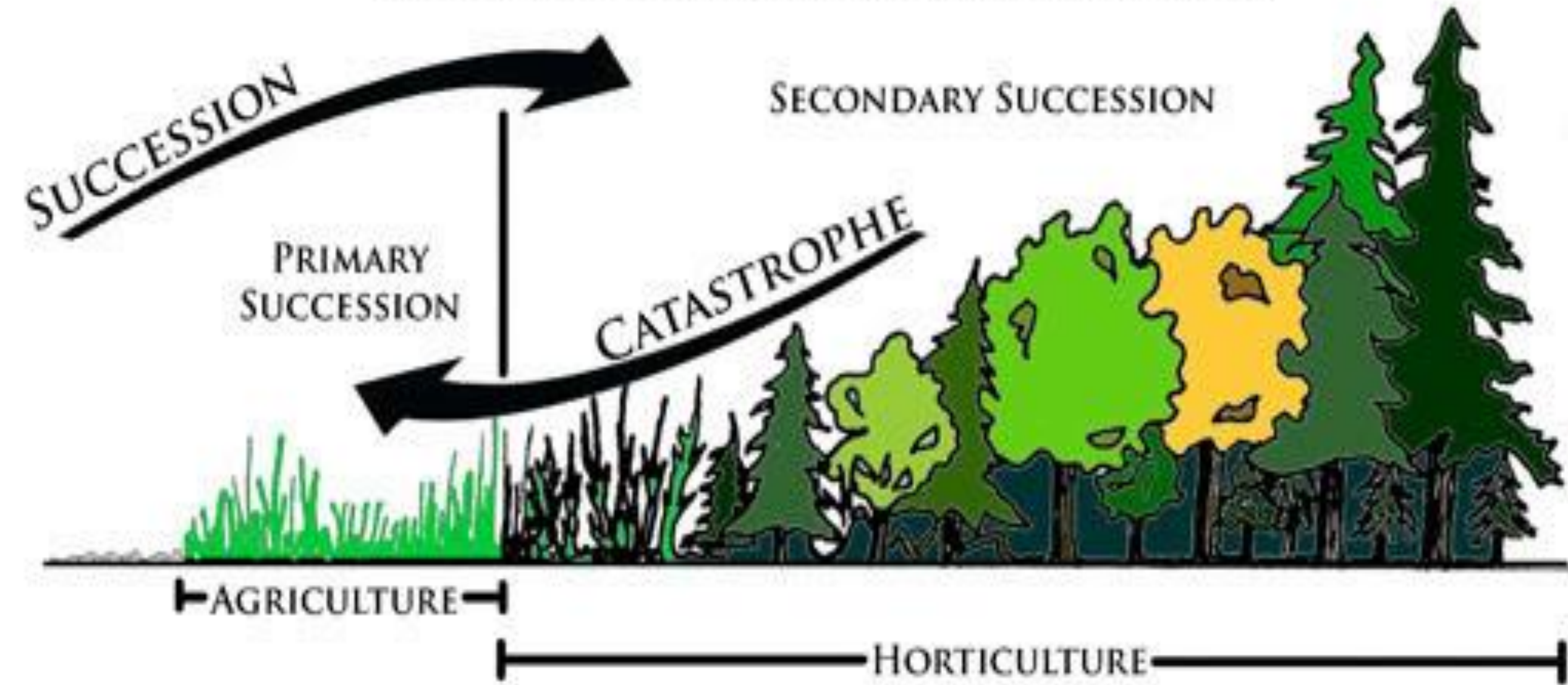
Hypotheses:

- A healthy, forested Ouachita landscape can mitigate affects predicted by climate science in regions outside of the Ouachitas
- The climate of western Oklahoma is directly influenced by the Ouachita landscape

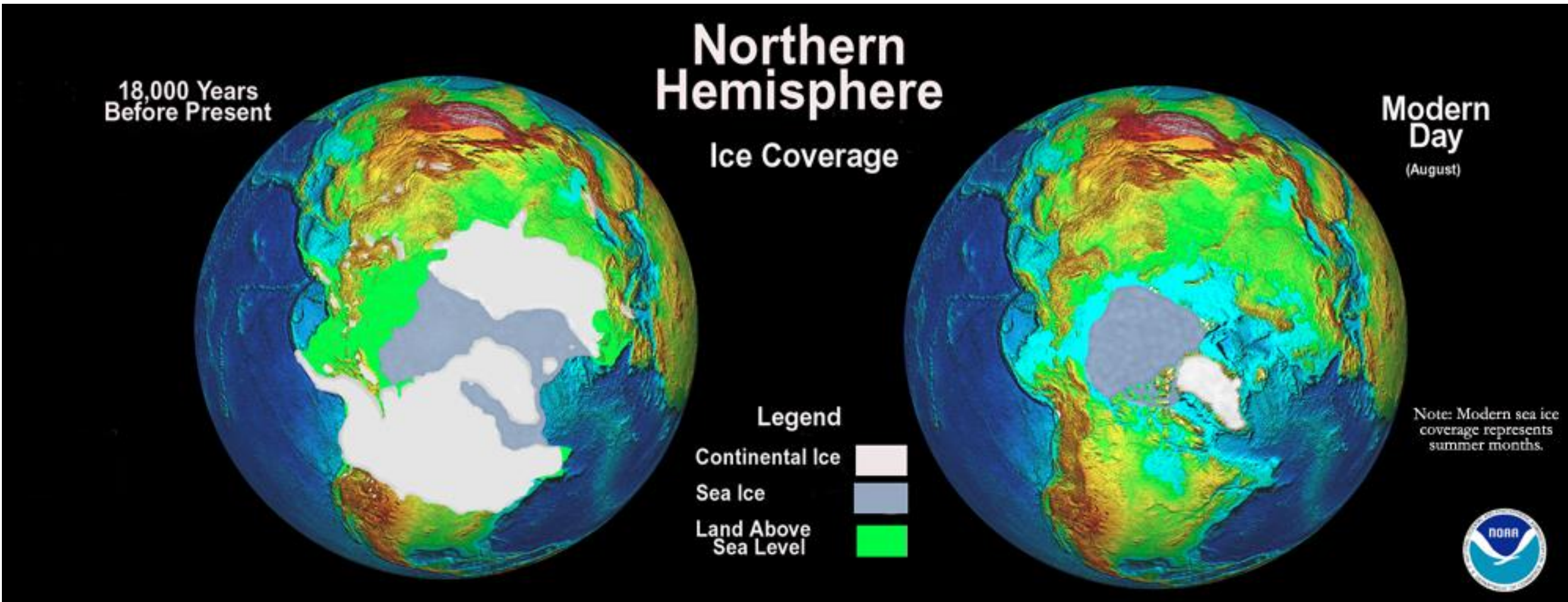
Succession

Ecological succession is the observed process of change in the species the structure of an ecological community over time.

ECOLOGICAL SUCCESSION



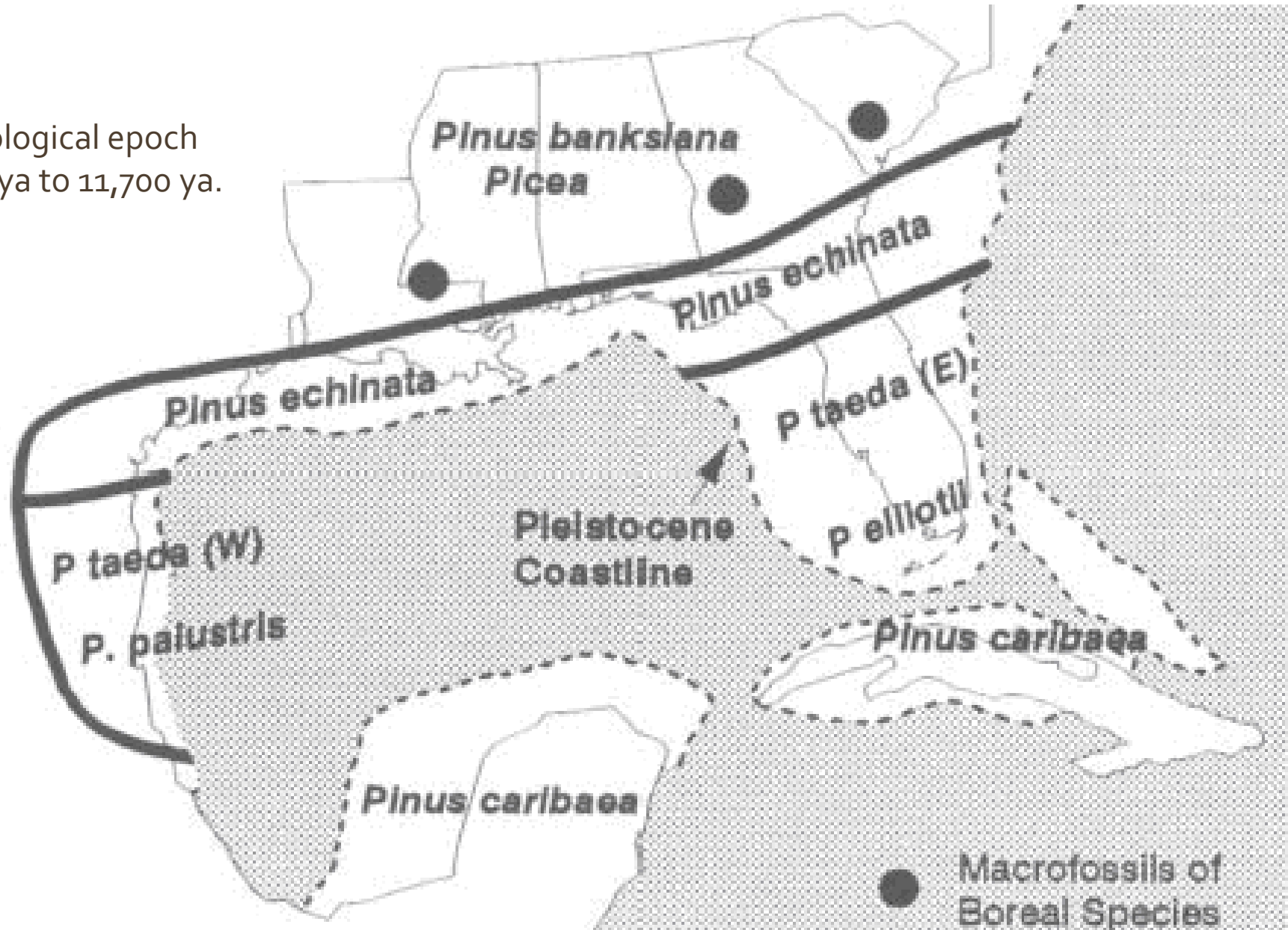
Succession also occurs over large spans of time and space



Source: Mark McCaffrey NGDC/NOAA - https://www.msu.edu/user/tuckeys1/education/PROMSE_o6/Supplemental%20Material/Glaciation%20notes.pdf

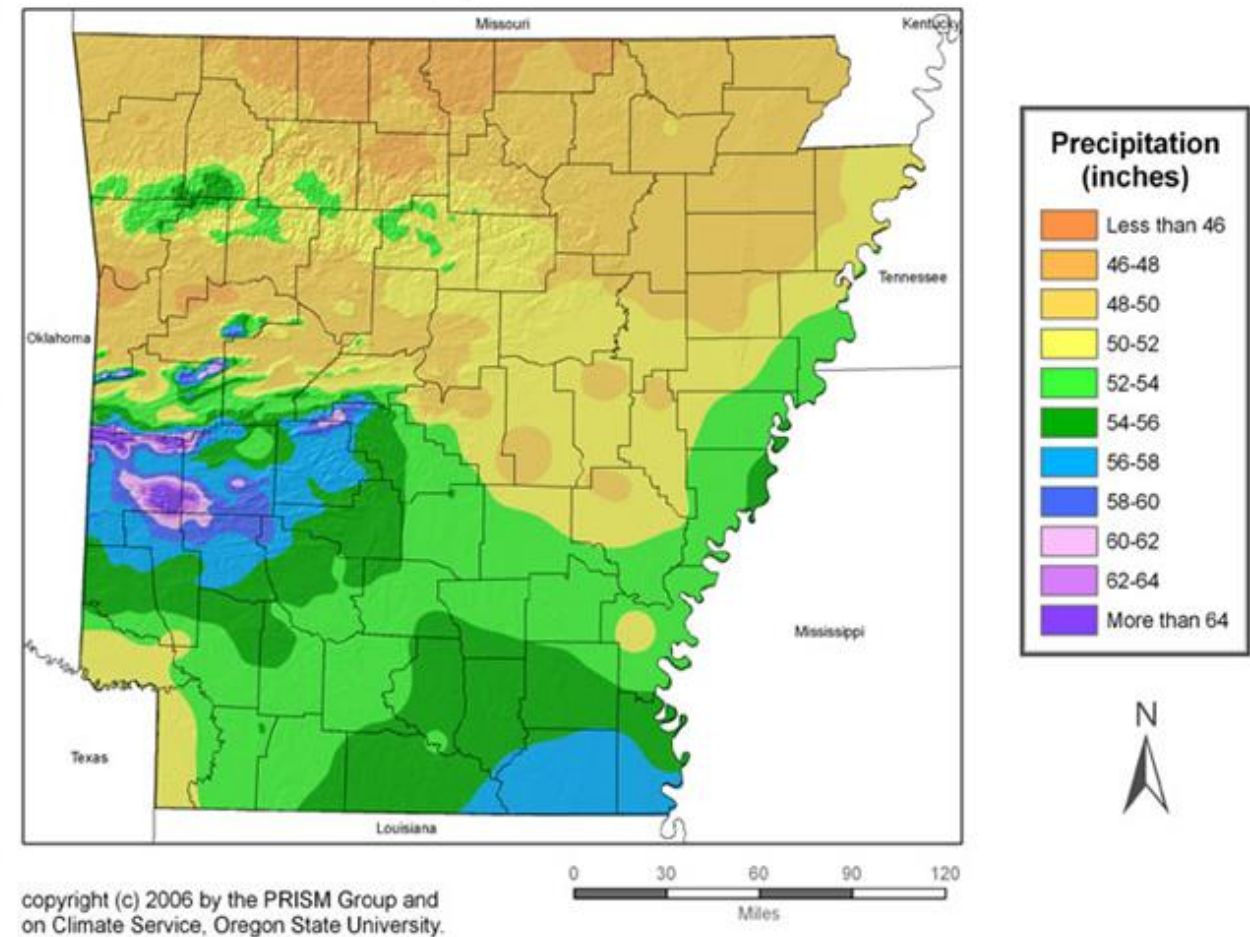
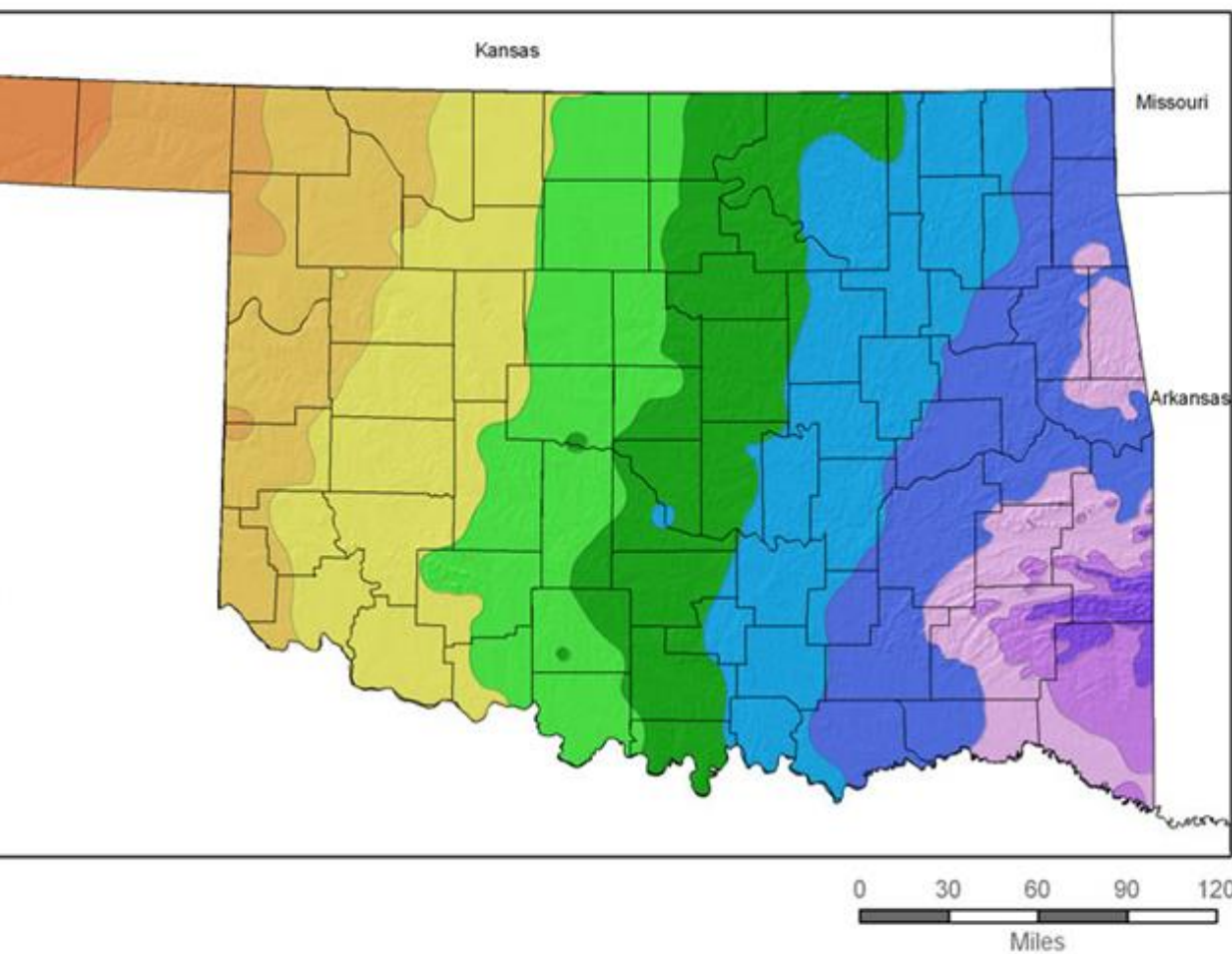
Pine forests of SE United States during last glacial maximum

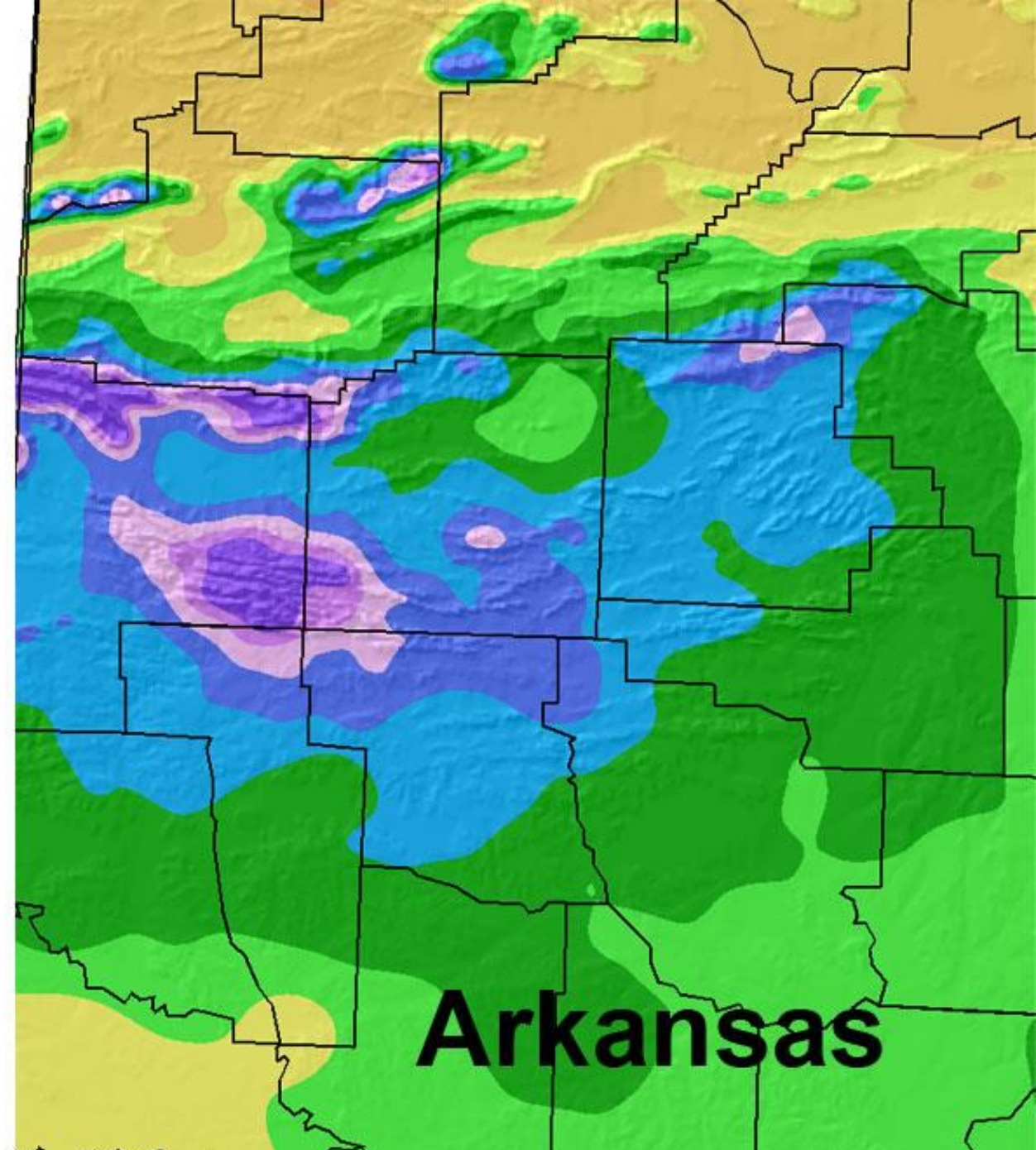
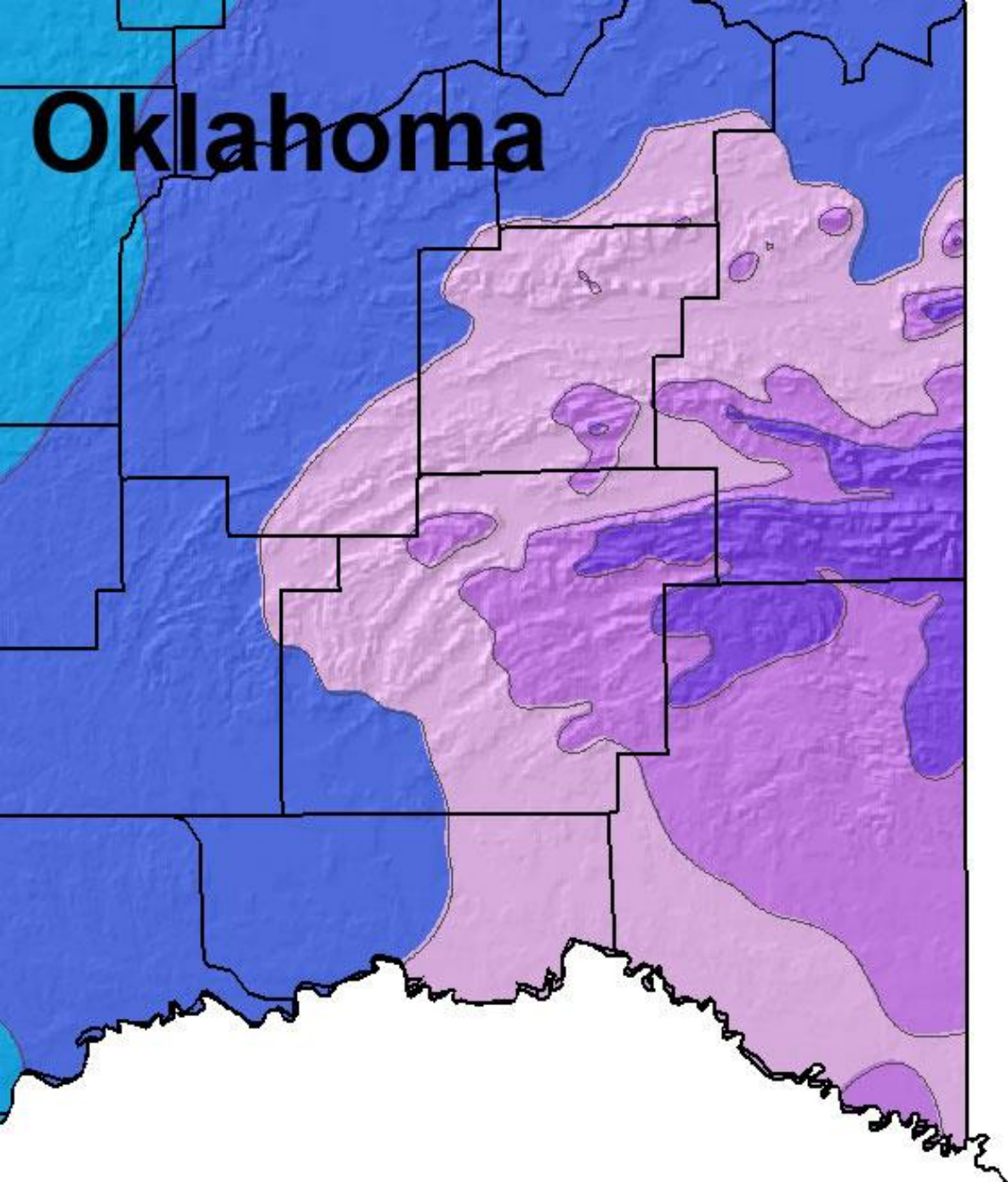
Pleistocene – Geological epoch
from about 2.5 mya to 11,700 ya.



Southeast Oklahoma Climate

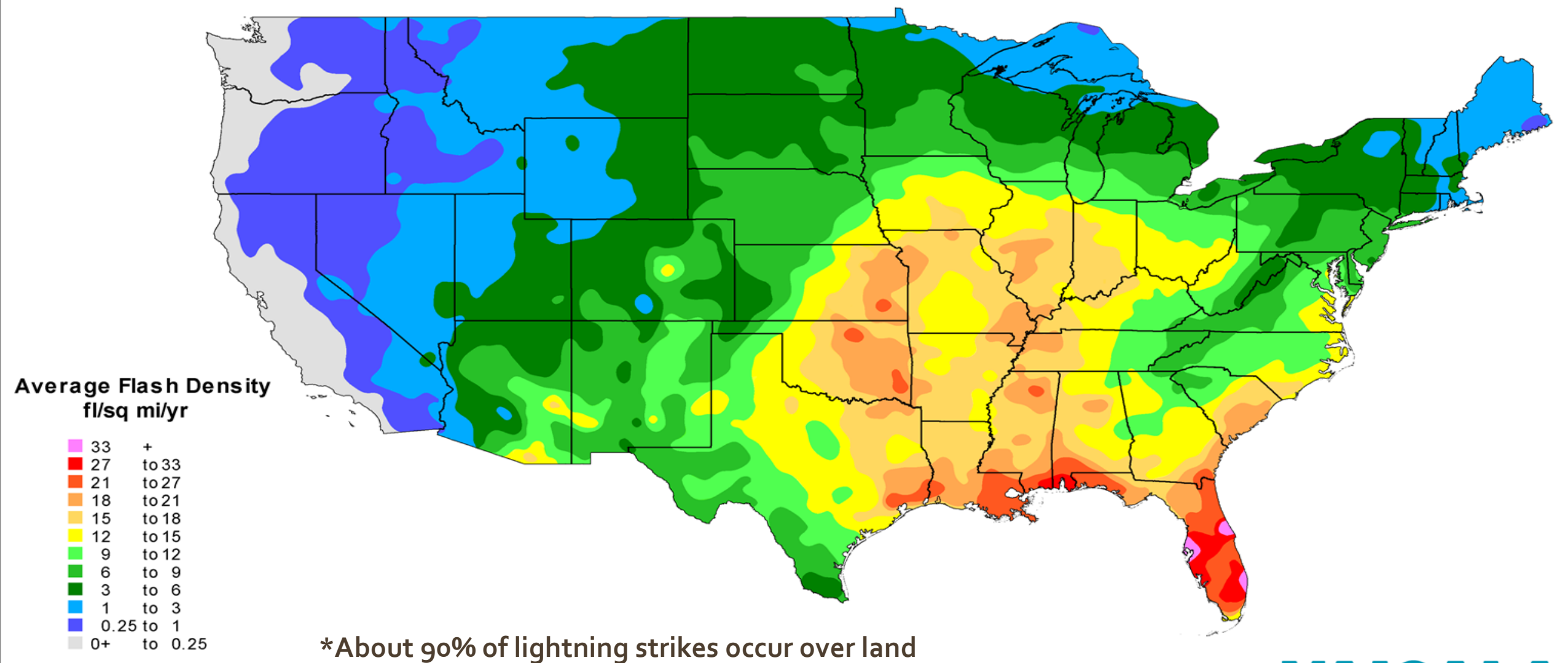
Average Annual Precipitation for Oklahoma and Arkansas, 1971-2000



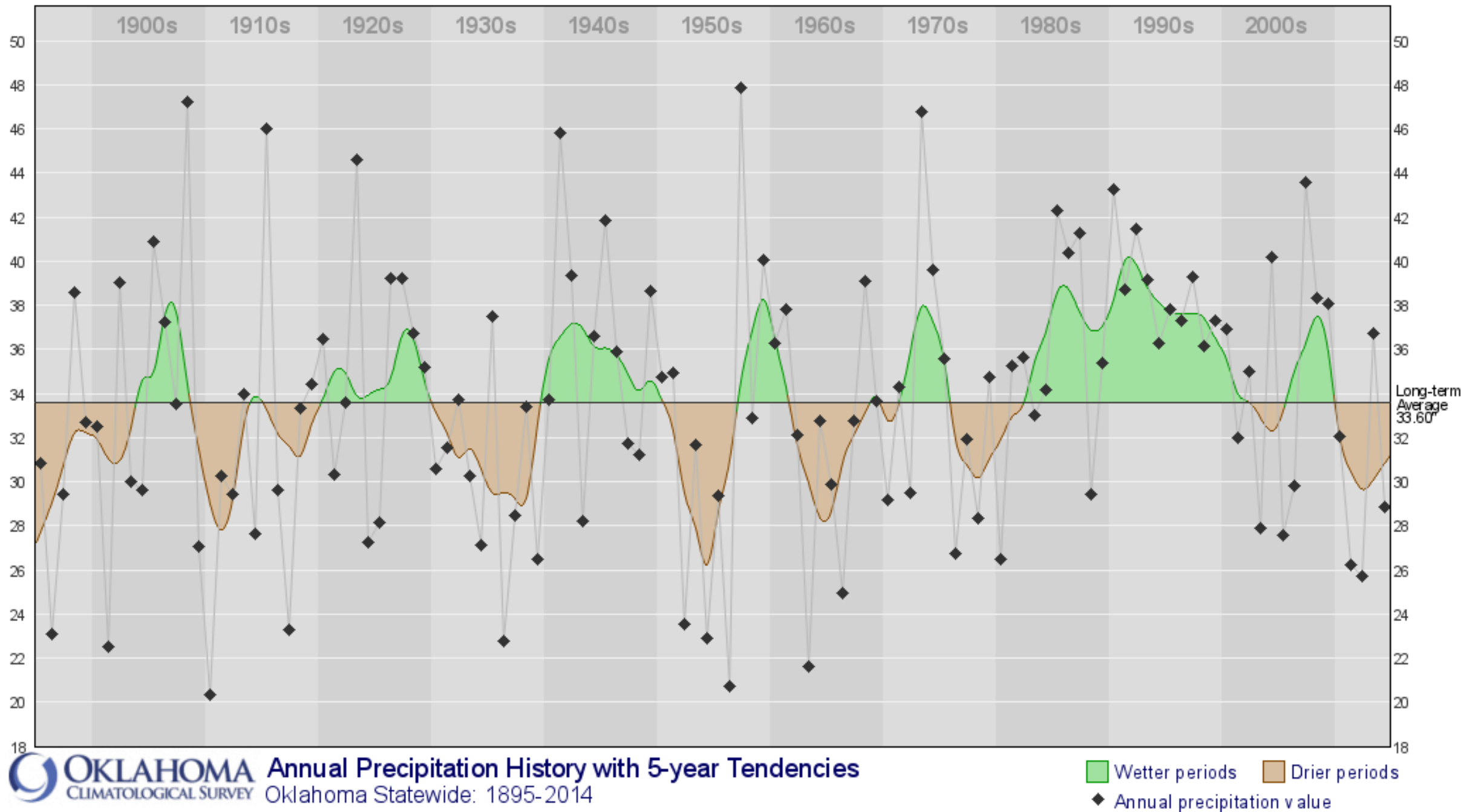


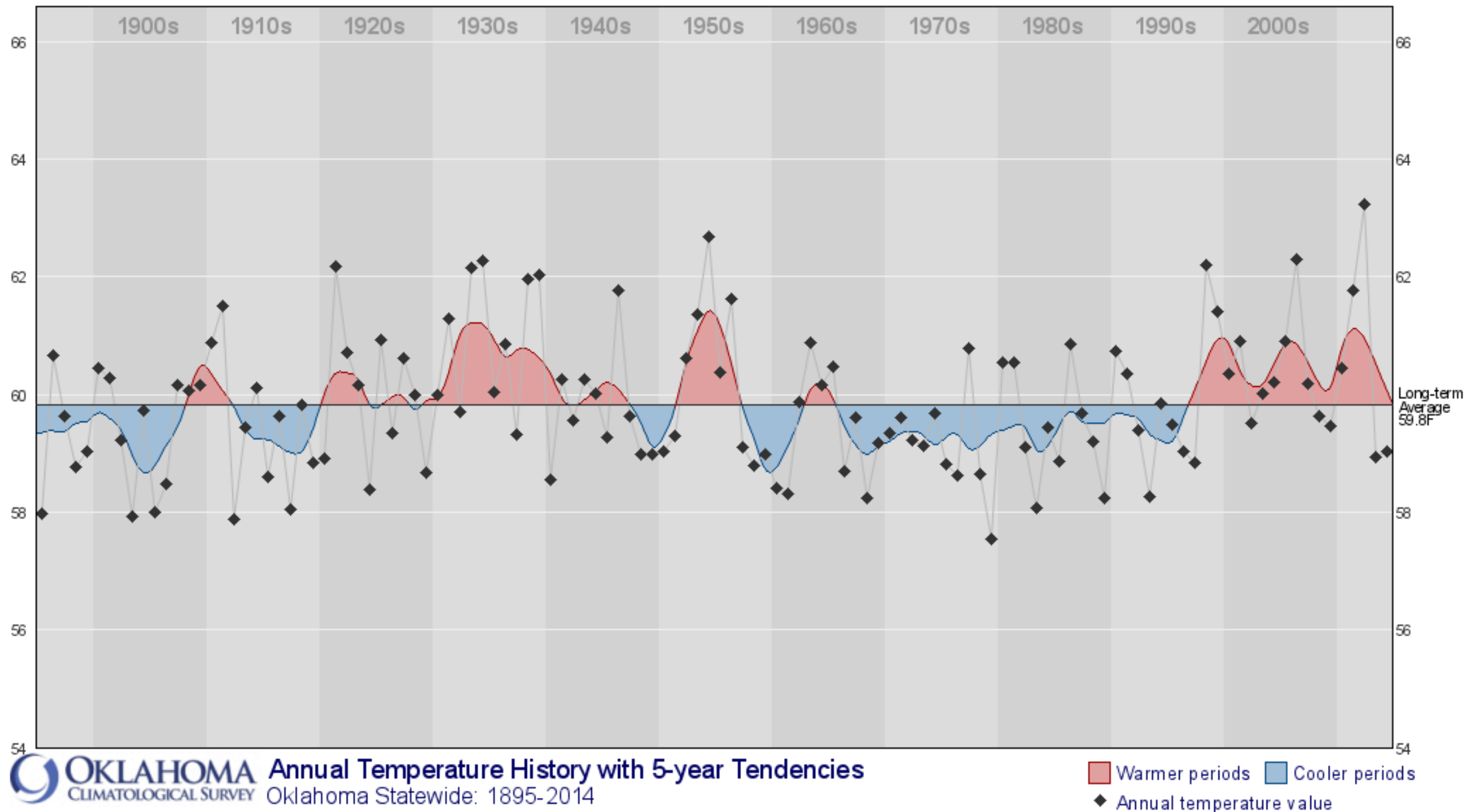
Vaisala's National Lightning Detection Network® (NLDN®)

Cloud-to-Ground Lightning Incidence in the Continental U.S. (1997 - 2012)



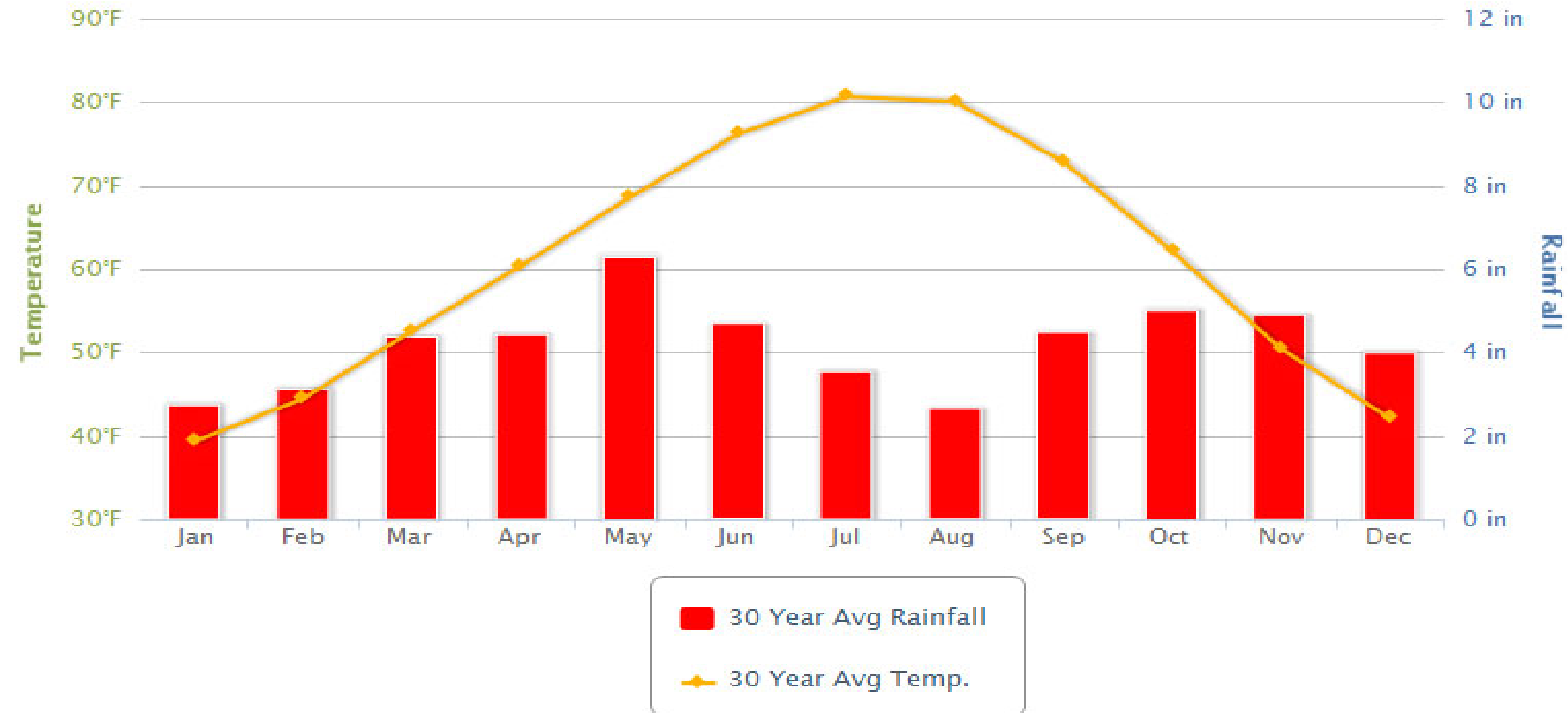
VAISALA



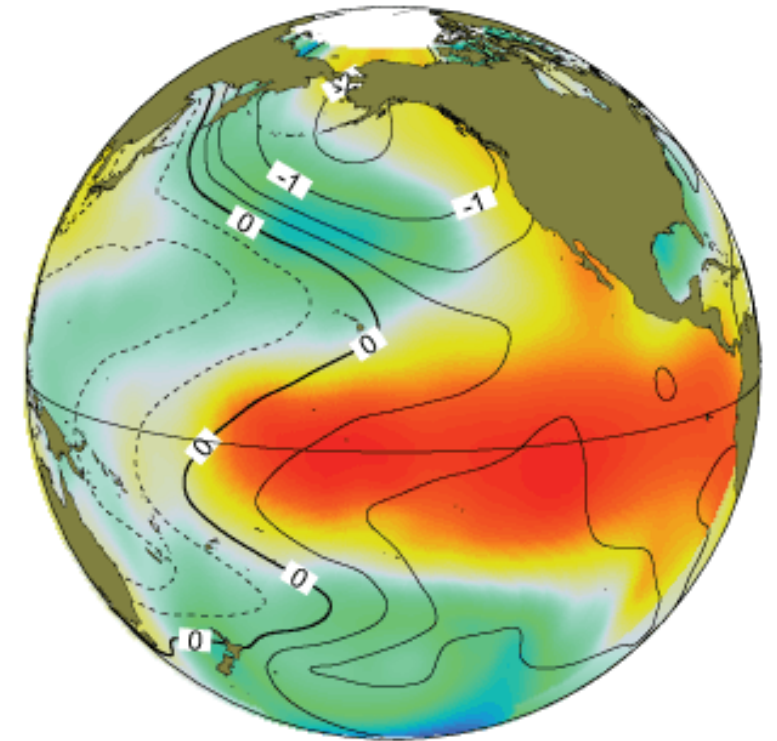
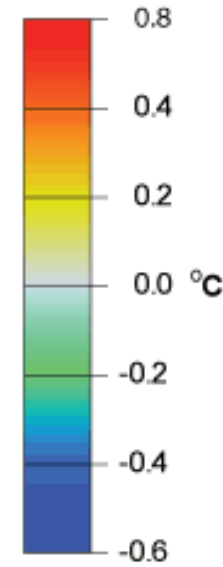
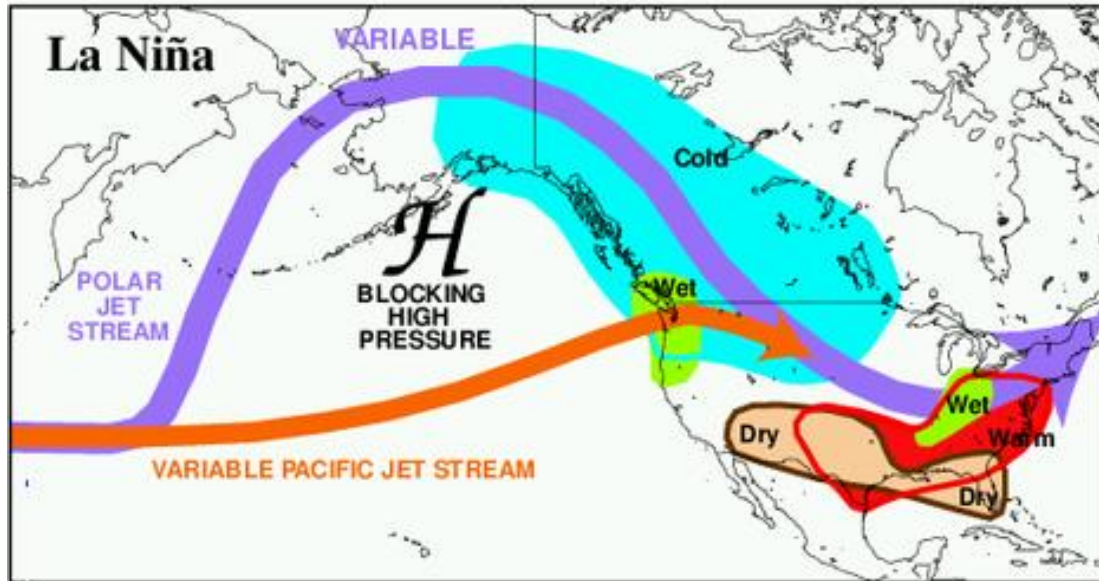
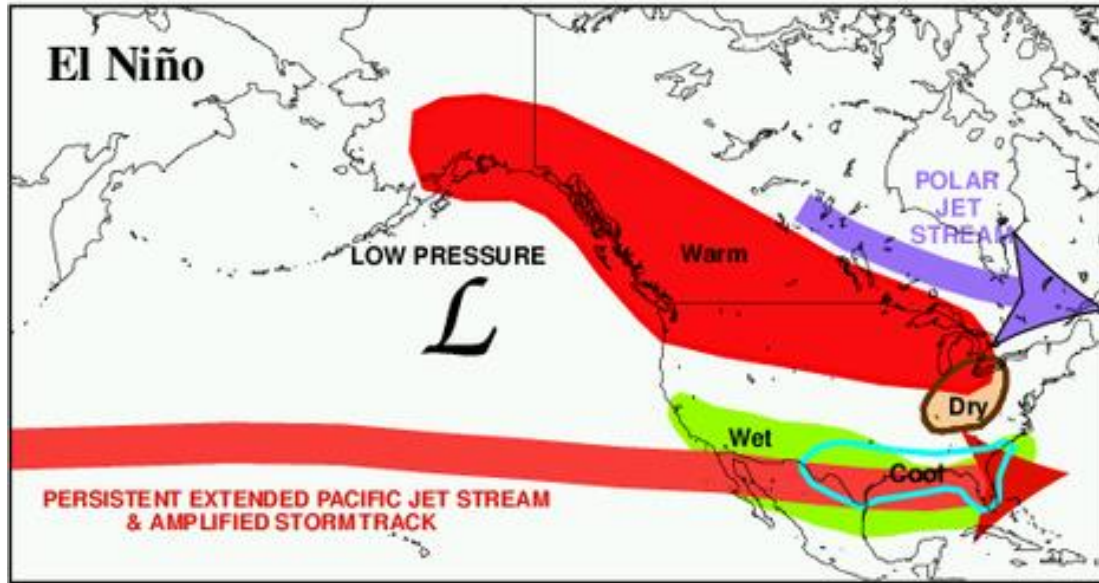


Average Monthly Temperature and Rainfall for SE Oklahoma

30 Year Average (1982-2011)



TYPICAL JANUARY-MARCH WEATHER ANOMALIES AND ATMOSPHERIC CIRCULATION DURING MODERATE TO STRONG EL NIÑO & LA NIÑA



Source: Climate Impacts Group, University of Washington

1990-1992 El Niño.

<http://cses.washington.edu/cig/pnwc/aboutenso.shtml>

El Nino/Southern Oscillation (ENSO)

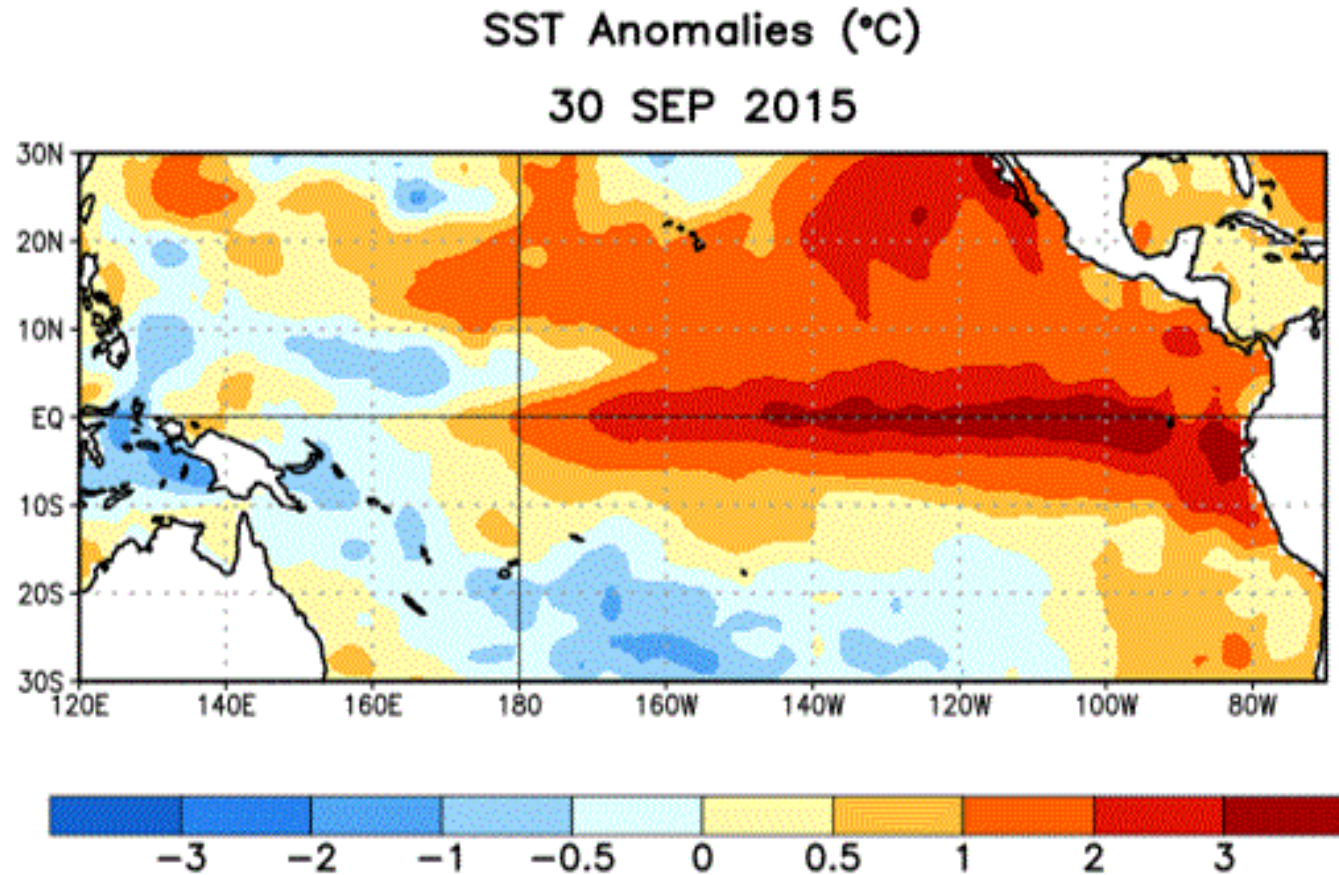


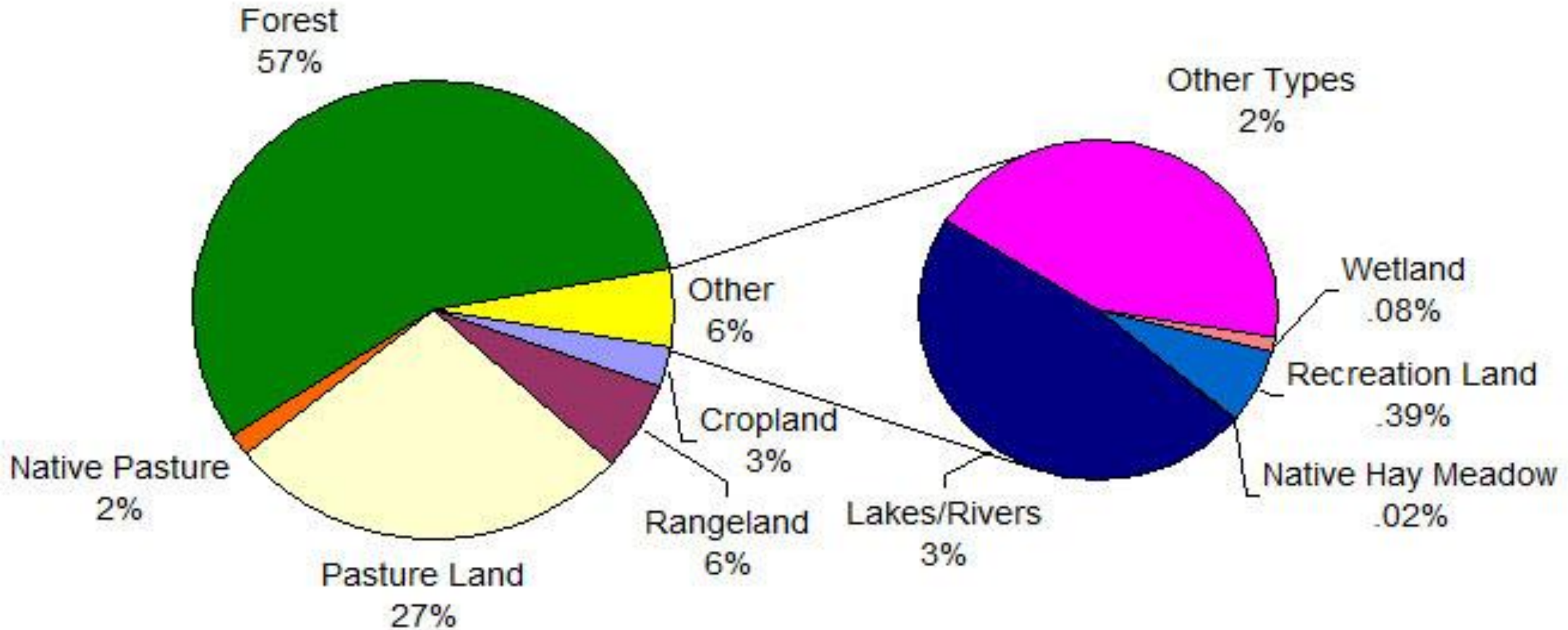
Figure 1. Average sea surface temperature (SST) anomalies (°C) for the week centered on 30 September 2015. Anomalies are computed with respect to the 1981-2010 base period weekly means.

Source: NOAA. Retrieved 11-10-2015.

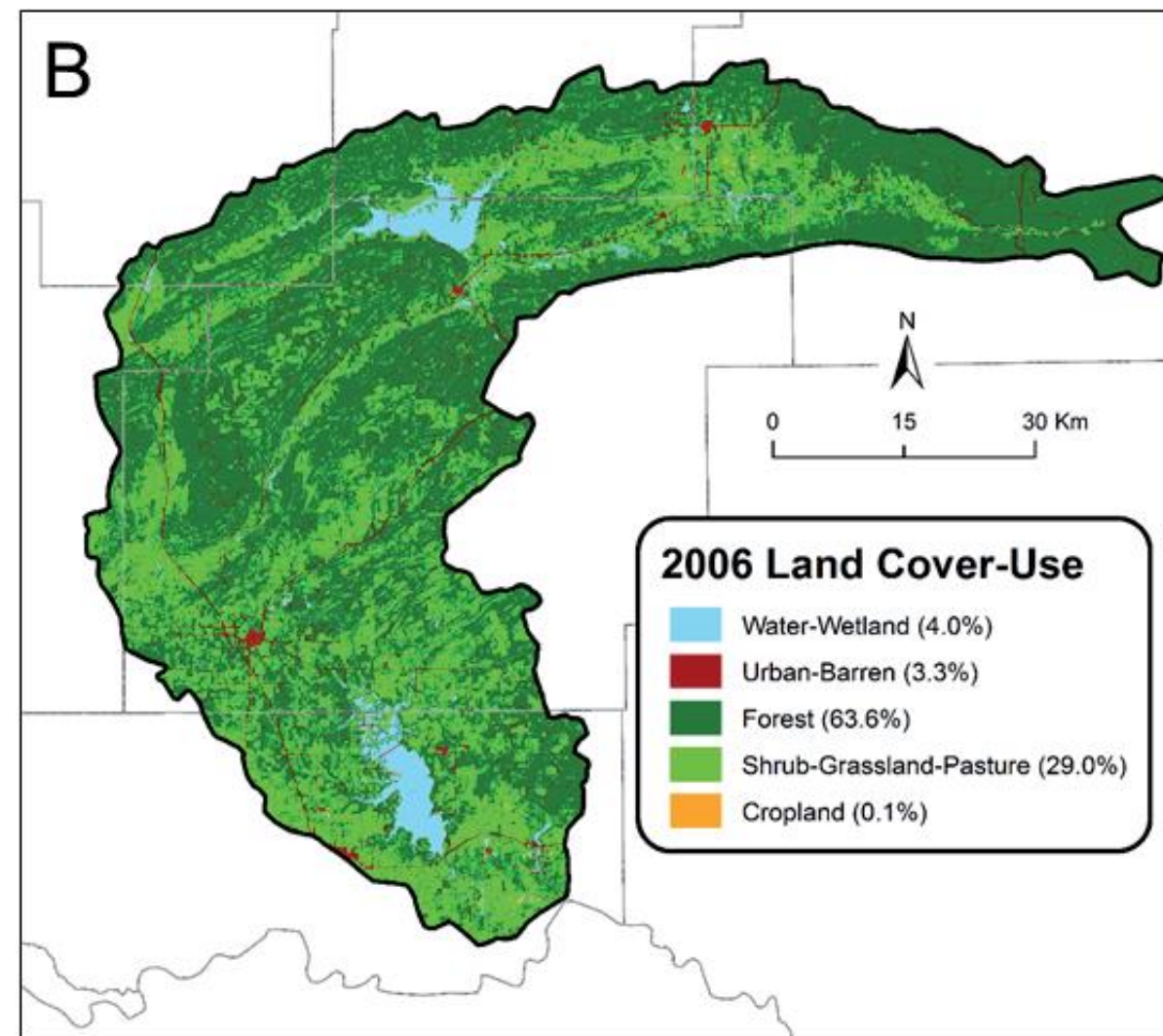
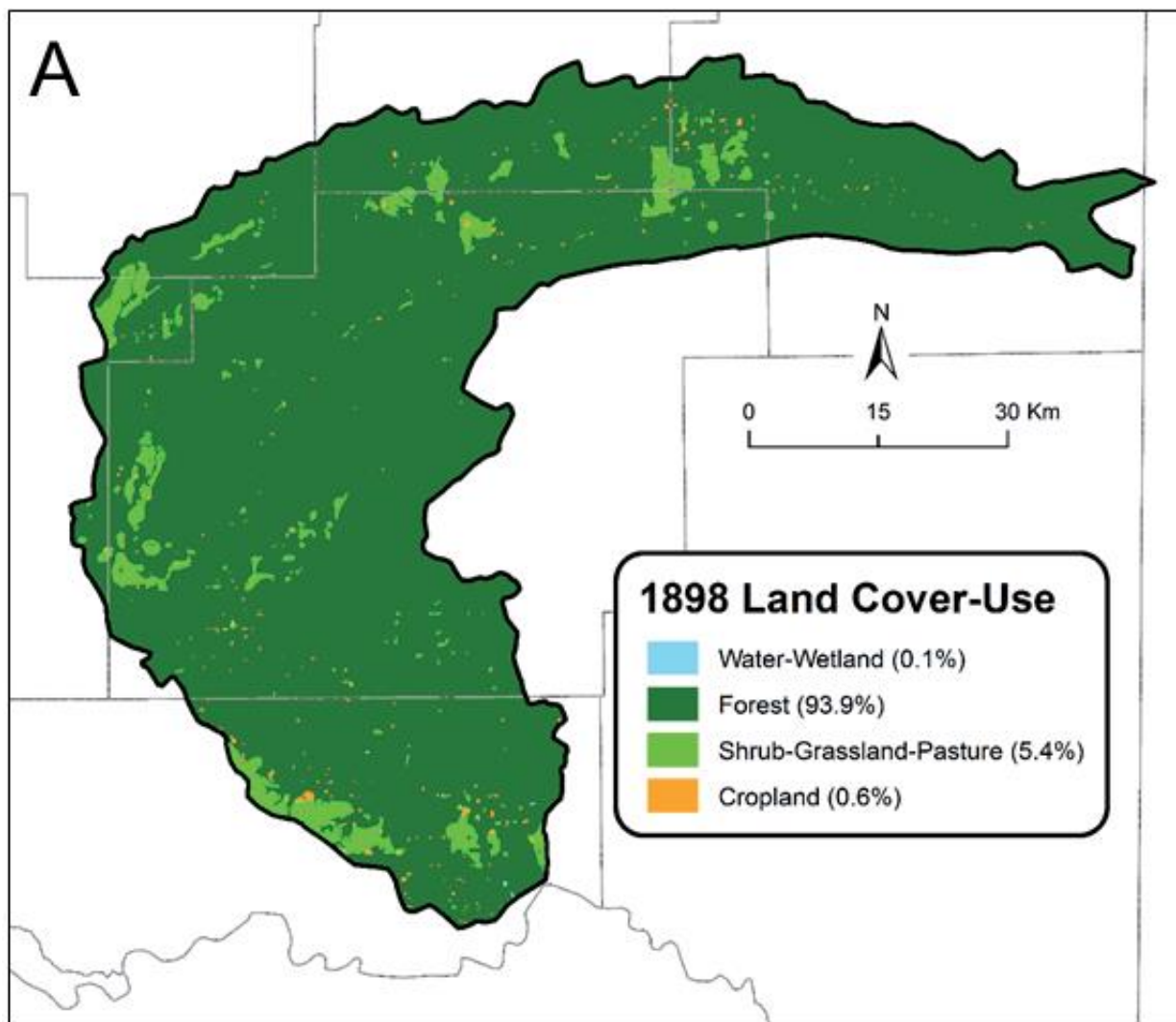
http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/ensodisc.html

Southeast Oklahoma Land Use

Land Use of Southeast Oklahoma

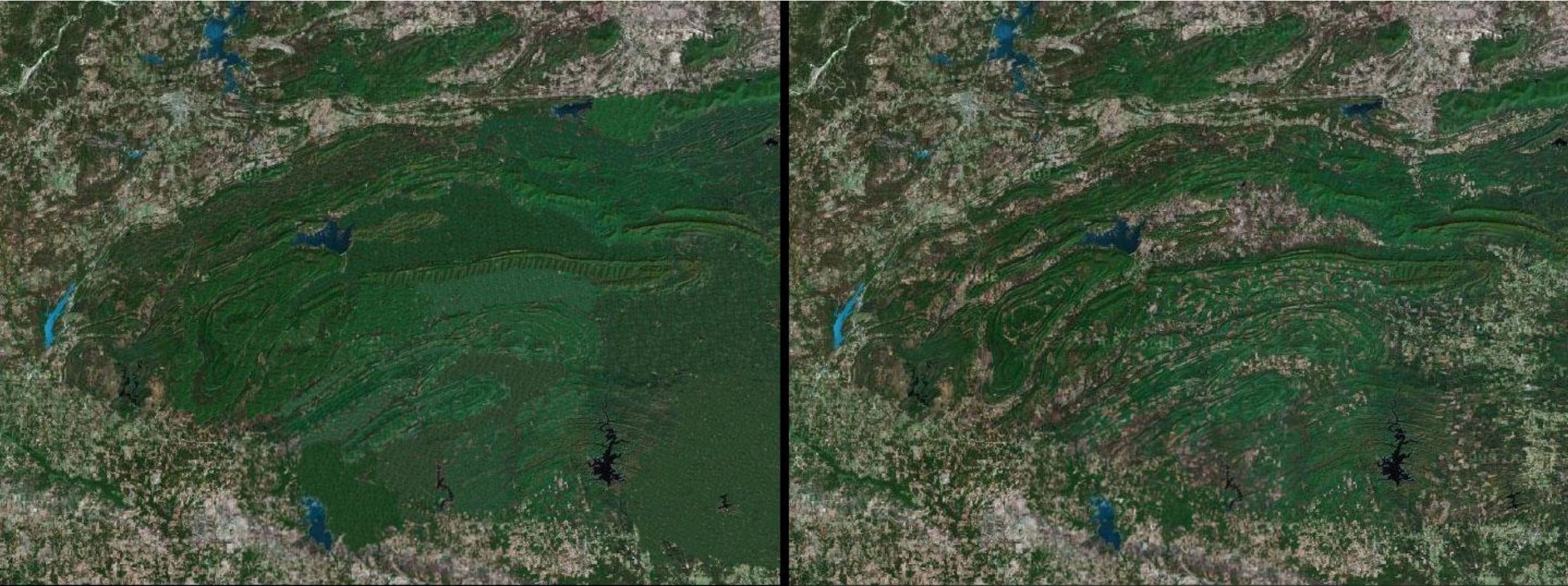


NRCS. 2009. Natural Resources Conservation Service. 10 Acre MIADS Landuse Data by County.
<<http://www.ok.nrcs.usda.gov/technical/GIS/MiadsCoIndex.html>>. Accessed November 2012.



Source: Casto, Vaughn, et al. 2015. Social Perception and Supply of Ecosystem Services — A Watershed Approach for Carbon Related Ecosystem Services

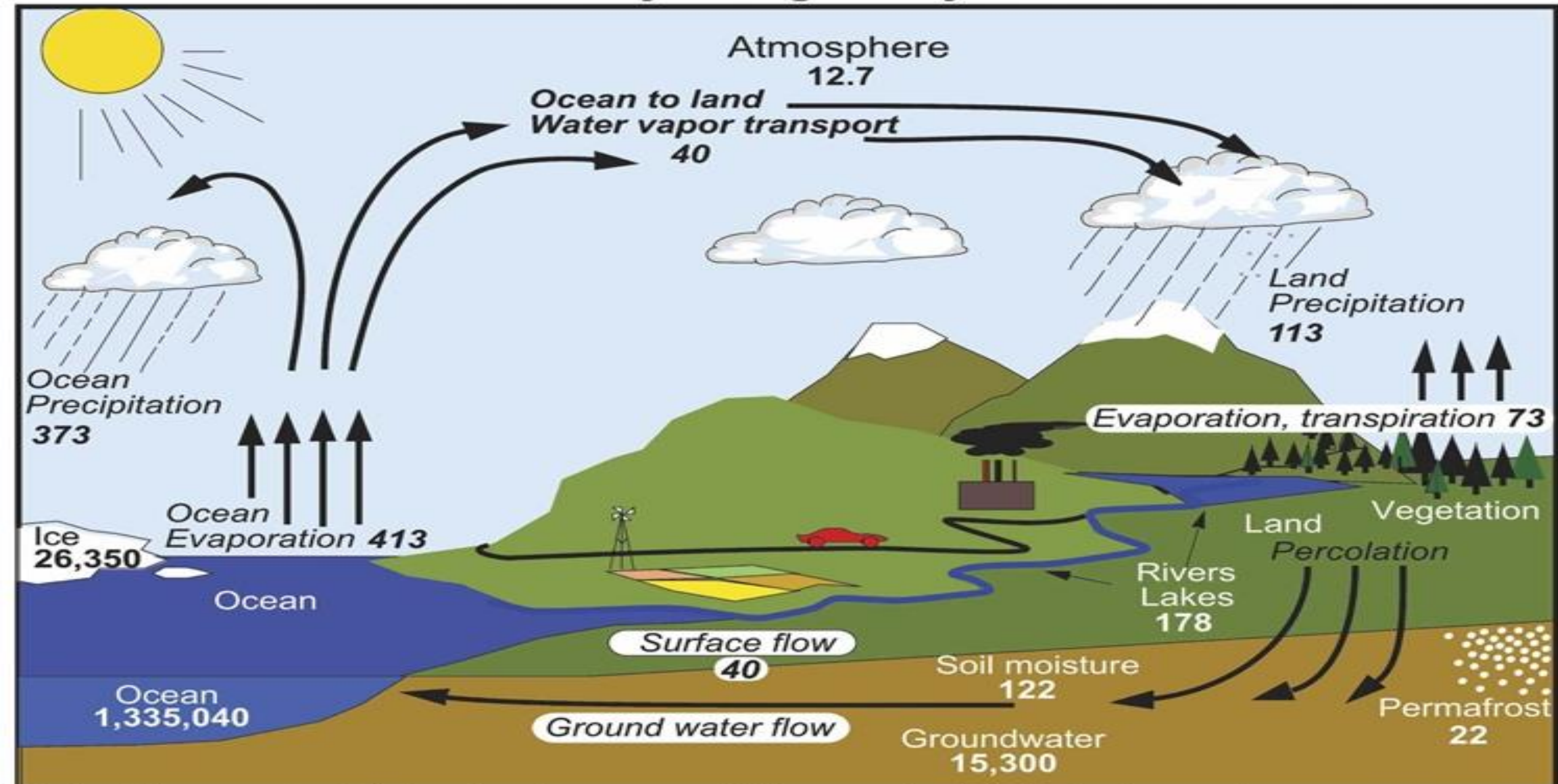
OK's Ouachitas Before and After Manifest Destiny



Artists Rendition vs. 2012 Satellite photo. Doughty, Russell BB (2013)

Relationship between Climate and the Ouachita Forest?

Hydrological Cycle



Units: Thousand cubic km for storage, and *thousand cubic km/yr* for exchanges

Hypothesis: The climate and water cycles of western and eastern Oklahoma are linked

A Climatology of Nocturnal Warming Events Associated with Cold-Frontal Passages in Oklahoma

By

ANITA NALLAPAREDDY

School of Meteorology, University of Oklahoma, Norman, Oklahoma

ALAN SHAPIRO

School of Meteorology, and Center for Analysis and Prediction of Storms, University of Oklahoma, Norman, Oklahoma

JONATHAN J. GOURLEY

NOAA/National Severe Storms Laboratory, Norman, Oklahoma

Here is some evidence

“In general, Oklahoma’s terrain is gently sloping with height increasing to the west, but the eastern part of the state has much more complex topography. Much of the eastern part of the state is forested whereas the west is characterized by prairie vegetation and farmland.

It is plausible that the combination of a forested land surface along with complex topography created shielding conditions that promoted enhanced surface cooling in advance of the mixing. An explanation for the site-specific maxima in warming frequencies and magnitudes, including the possible role of the surrounding terrain and vegetation, is a topic for future research.”

- Nallapareddy, Shapiro, and Gourley (2011)

ECOSYSTEM SERVICES

Humankind benefits in a multitude of ways from ecosystems. Collectively, these benefits are known as ecosystem services.

Supporting Services:

- Nutrient dispersal & cycling
- Seed dispersal
- Primary production

Regulating Services:

- Carbon Sequestration
- Pest and disease control
- Purification of water & air

Provisioning Services:

- Food
- Water
- Energy

Cultural Services:

- Spiritual & historical
- Cultural
- Recreation
- Science & Education

Water is Life!