A Primer on Drought History in Georgia

David Emory Stooksbury, Ph.D.
State Climatologist – Associate Professor
Engineering and Atmospheric Sciences
The University of Georgia

stooks@engr.uga.edu
706-583-0156

Drought in Georgia

- Is a normal component of the climate system
- Has occurred in the past and will in the future
- No evidence of change in drought frequency or intensity
- Societal Changes change our vulnerability to drought – both increasing and decreasing our vulnerability

Societal Changes in the Georgia

- Rapid population growth starting after World War II
  - Accelerated growth since 1980
    - 1960 – Metro Atlanta about 1 million
    - 1960 – State of Georgia about 4.5 million
    - 2008 – Metro Atlanta over 4.5 million
    - 2008 – State of Georgia over 9 million

Societal Changes in Georgia

- Rapid population growth starting after World War II
  - Accelerated growth since 1980
  - Growth has be unevenly distributed
    - Along the coast
    - Northern Piedmont – top of the water shed

Societal Changes in Georgia

- Rapid population growth starting after World War II
- Landscape changes
  - Urban sprawl – changes in the watershed flow patterns
  - Conversion of row crop fields to forest (started in 1920s)

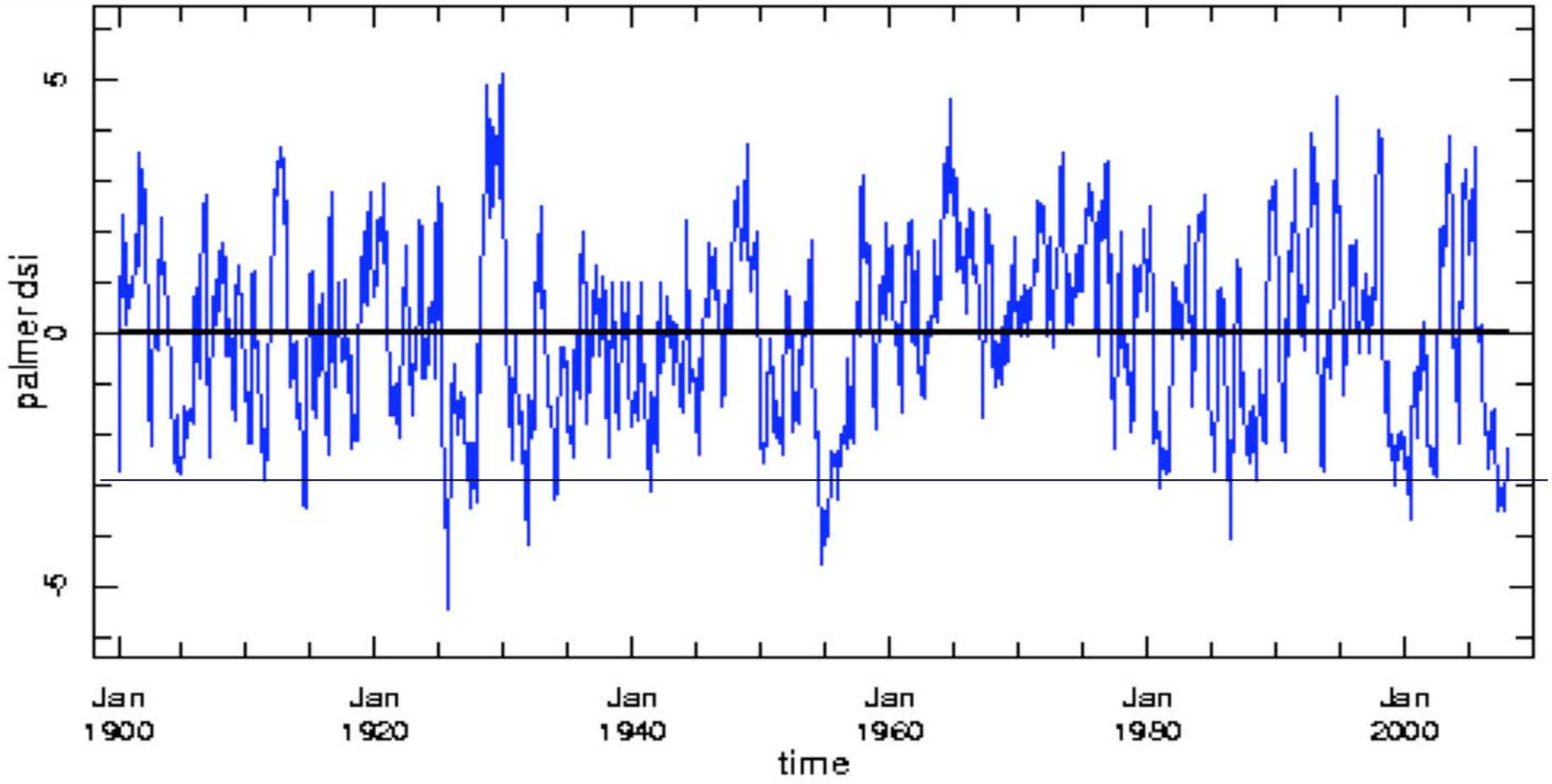
Societal Changes in Georgia

- Rapid population growth starting after World War II
- Landscape changes
- Agricultural Changes
  - Shift in amount in land in row crops and trees
  - Increase in irrigation
  - Increase in urban agriculture – the "green" industry

Climate Trends Across the Georgia

- Since 1900 – No trend in yearly precipitation
- Since 1900 – No trend to slight cooling in yearly average temperatures

Georgia Droughts



Tree Ring Georgia Droughts

- Long-term Droughts (3 or more years PDI < -0.99)
  - 1756-1760
  - 1762-1764
  - 1797-1802
  - 1855-1857
  - 1896-1899
  - 1925-1927
  - 1954-1956
  - 1998-2002
  - 2006- ?
- Long-term drought about once in 40 years

Tree Ring Georgia Droughts

- Long-term Droughts (2 or more years PDI < -0.99)

1756-1760	1762-1764	1797-1802
1855-1857	1896-1899	1925-1927
1954-1956	1998-2002	2006- ?

- Adds the following years
  - 1708-1709
  - 1714-1715
  - 1839-1840
  - 1844-1845
  - 1914-1915

Tree Ring Georgia Droughts

- Long-term Droughts (2 or more years)

1756-1760	1762-1764	1797-1802
1855-1857	1896-1899	1925-1927
1954-1956	1998-2002	2006- ?

- Adds the following years

1708-1709	1714-1715	1839-1840
1844-1845	1914-1915	

Return interval is now once in 25 years

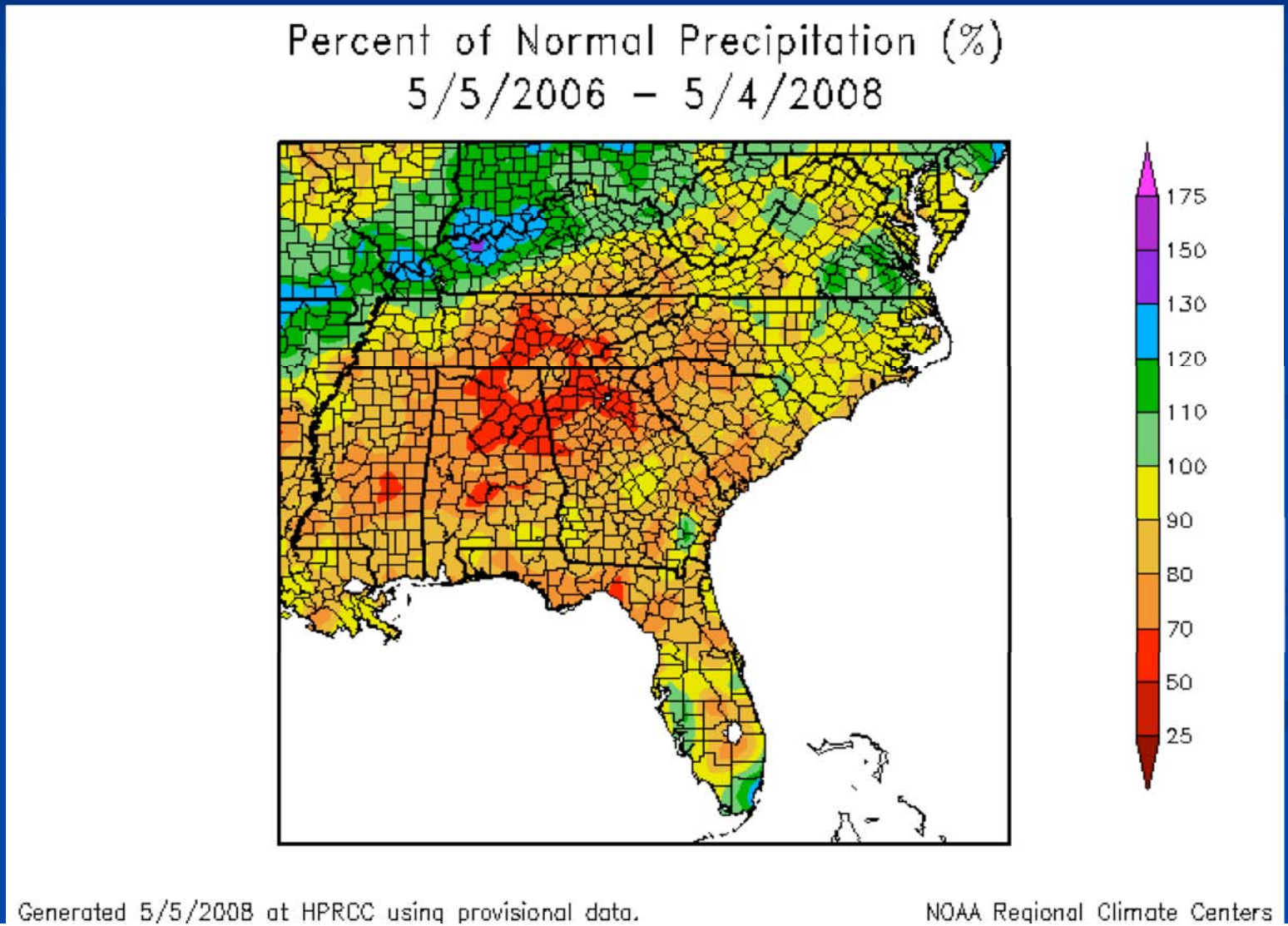
Summary of the Past

- Droughts are a normal component of the climate system
- We will have droughts in the future
- No trend in southeastern climate since 1900
- More people but the same amount of water

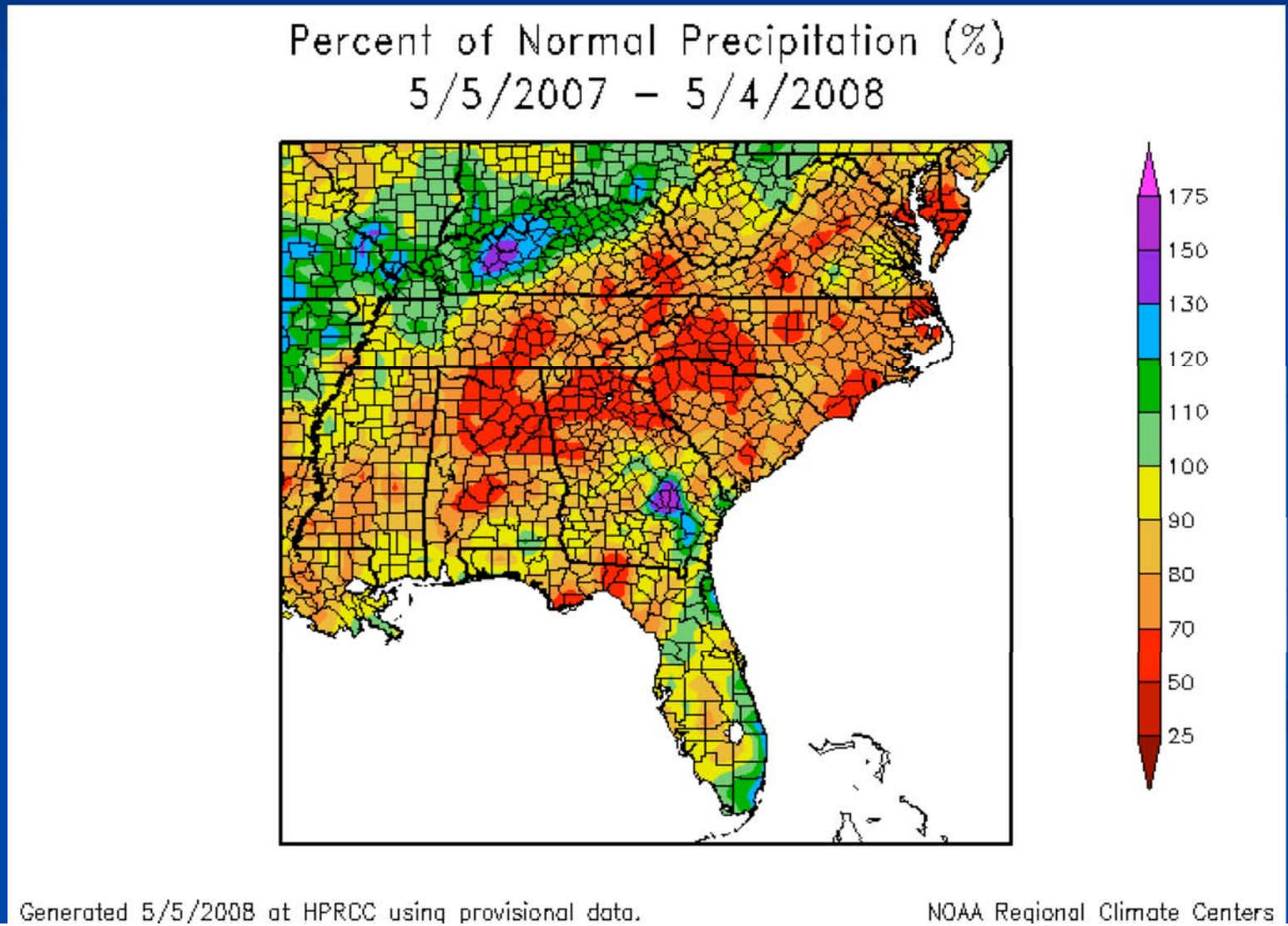
The Present Drought

- Started in March 2006
- Intensified in early spring 2007
- Cause Unknown
  - Winter 2006/07 El Nino Winter/Spring
  - Winter 2007/08 La Nina Winter Spring
  - Not evidence for or against climate change

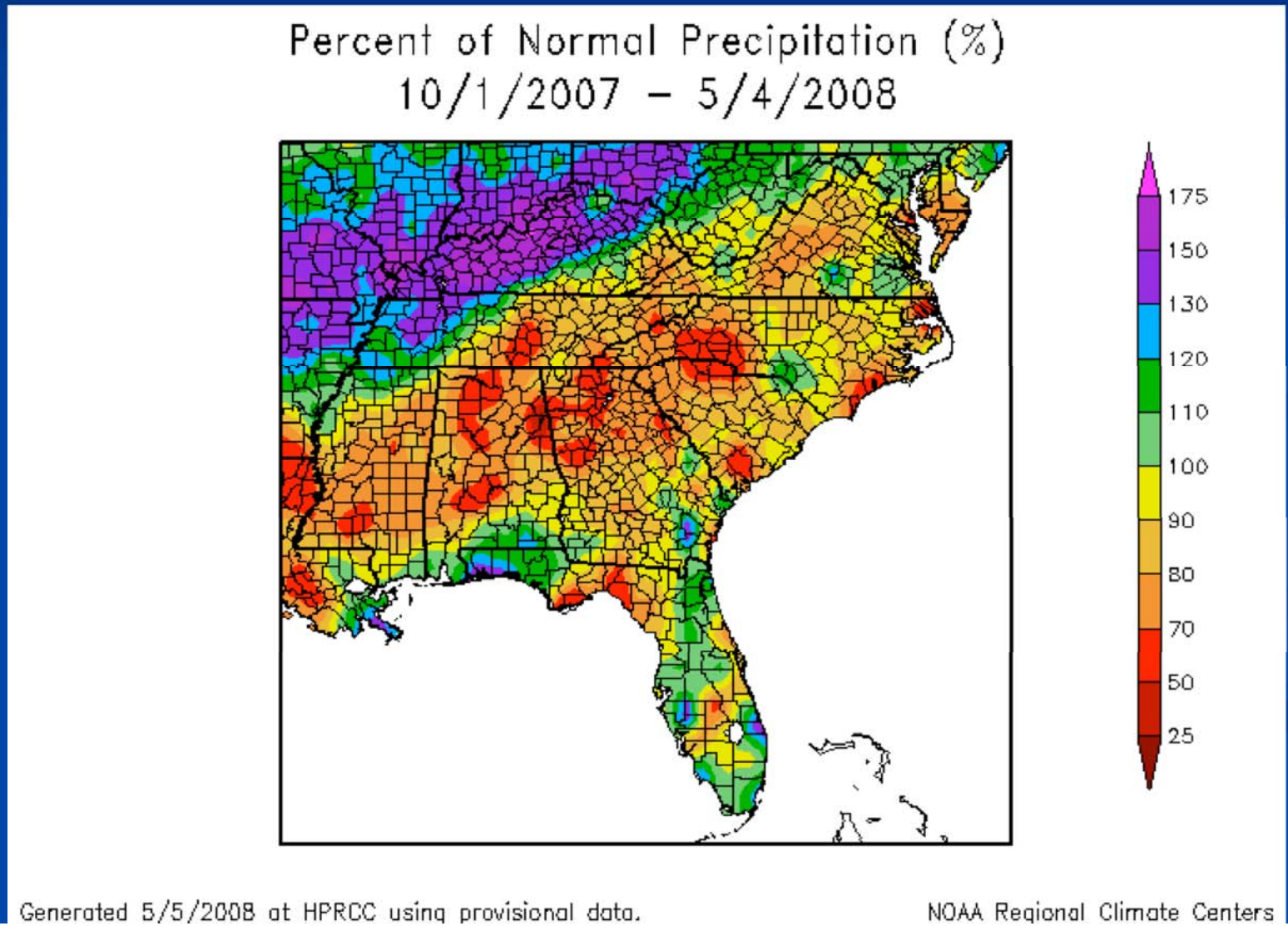
Rainfall – 24 Months



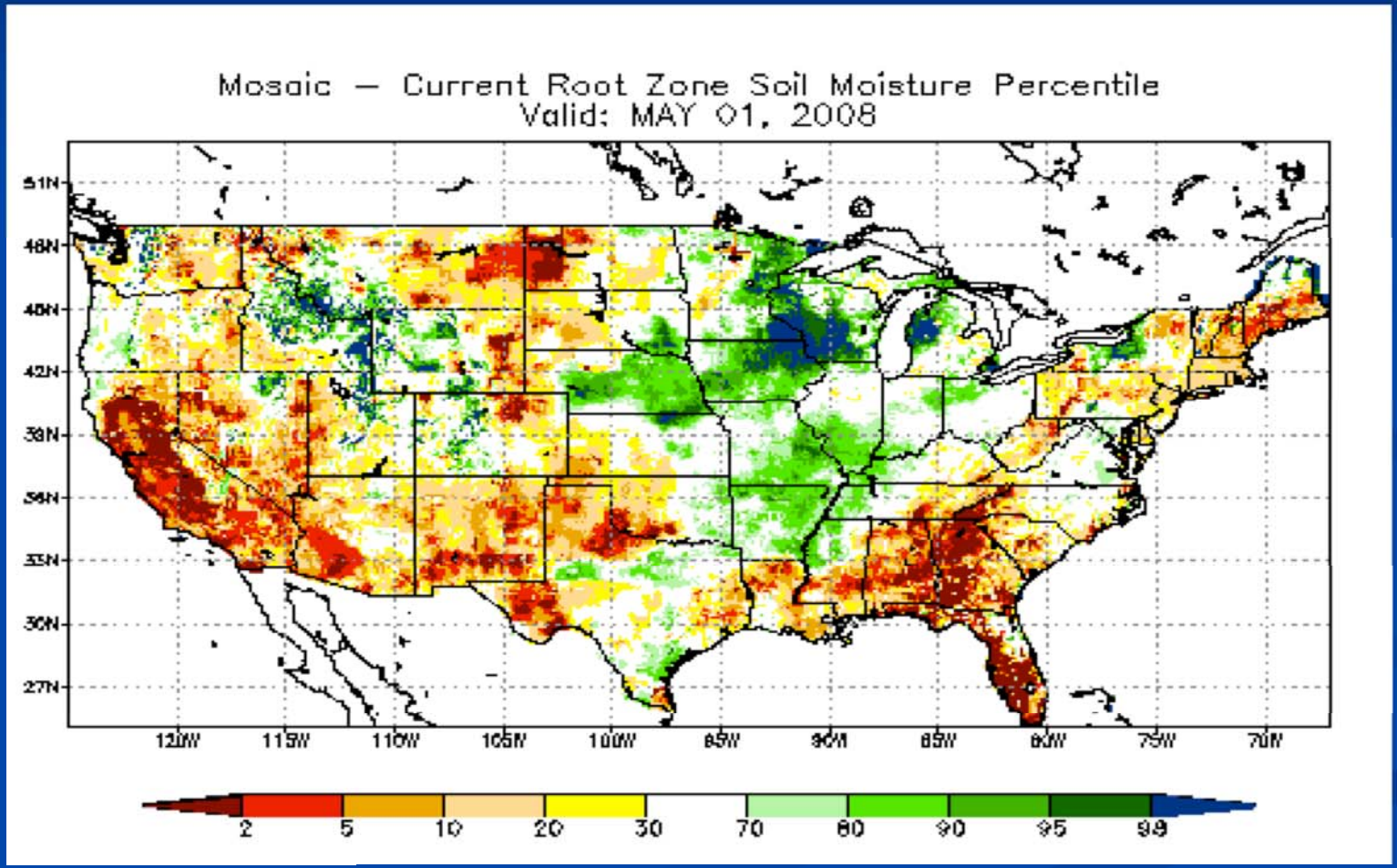
Rainfall – 12 Months



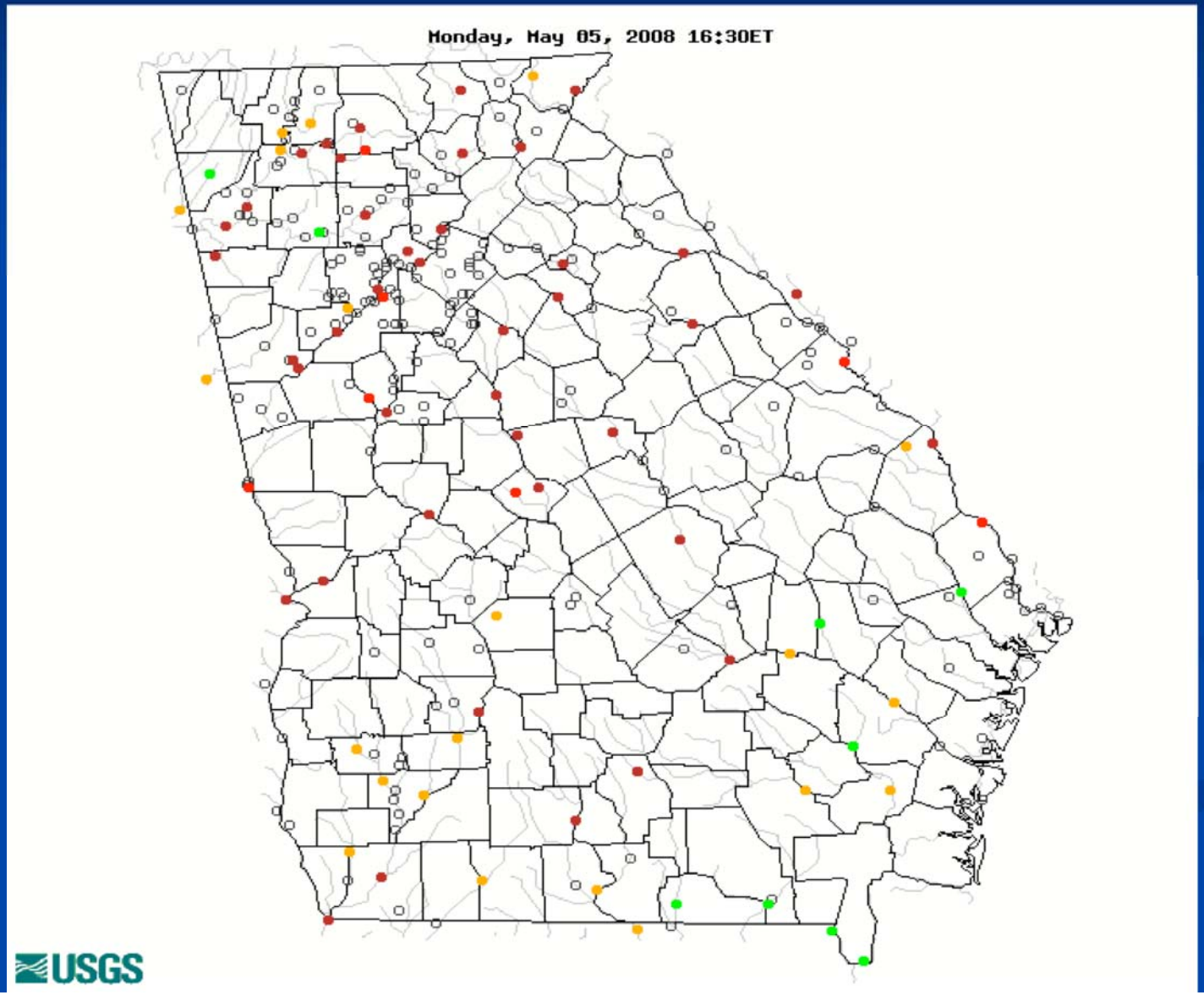
Rainfall – Water Year



Soil Moisture



Stream Flows



US Drought Monitor

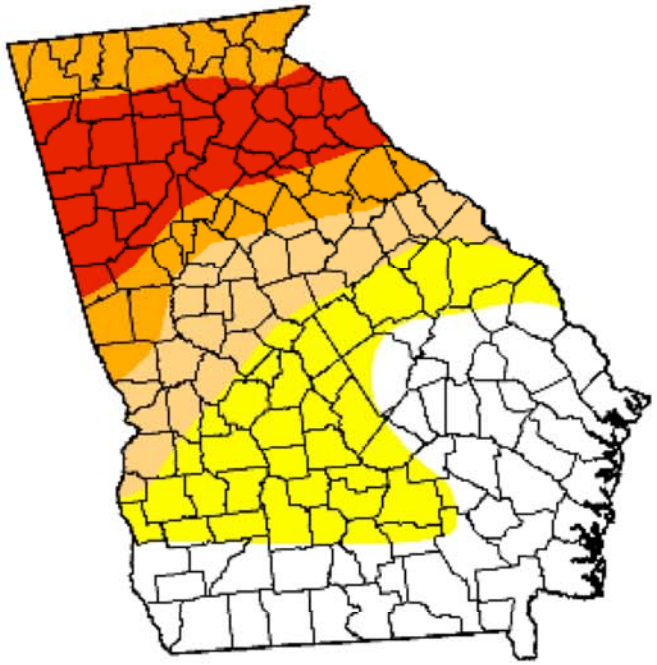
U.S. Drought Monitor

Georgia

April 29, 2008
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	33.7	66.3	43.2	29.9	15.4	0.0
Last Week (04/22/2008 map)	33.7	66.3	43.2	29.9	15.4	0.0
3 Months Ago (02/05/2008 map)	3.0	97.0	68.5	42.5	35.1	15.0
Start of Calendar Year (01/01/2008 map)	2.0	98.0	75.0	65.2	49.4	15.7
Start of Water Year (10/02/2007 map)	24.2	75.8	64.2	52.6	39.4	27.0
One Year Ago (05/01/2007 map)	0.0	100.0	99.3	52.6	22.7	0.0



Intensity:

- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements

http://drought.unl.edu/dm

USDA National Drought Mitigation Center

Released Thursday, May 1, 2008

Author: R. Heim/L. Love-Brotak, NOAA/NESDIS/NCDC

The Short-term Future

- No Forecast Skill for Warm Season
- We do know some things
  - The temperature of the air will increase over the next several months.
  - Moisture demand of plants will increase over the next several months.
  - Gradual darkening trend toward evening

The Short-term Future

- This increase in evapotranspiration will
  - Cause soil moisture to decrease through October
  - Leading to decrease stream flows and groundwater levels
  - Leading to lower pond and lake levels!

The Longer-term Future

- We do not know
  - Local climate has not in the past and may not in the future respond the same as the global climate
  - Climate models have not been shown to properly predict local or regional scale climate – a very difficult problem

The Longer-term Future

- What we do (or at least think) we know
  - Most of the warming will occur during the cool season
    - Could decrease recharge during the winter because of increased evapotranspiration
    - Could increase recharge because of increased moisture in the air (Clausius-Clapeyron Equation)

The Longer-term Future

- What we do (or at least think) we know
  - The hydrologic cycle will speed up
    - Increased evapotranspiration and increased run-off
    - More rain which will offset the increased evapotranspiration

What to Do in a Uncertain World?

- I am now leaving science and entering ethics
  - Plenty of good reasons to conserve energy and go off a carbon based economy
    - Economics – The Ultimate GREEN
      - Passive Solar in the Southeast
      - Wind energy along I-95 corridor for peaking demand
      - Bio-fuels from agricultural and forestry "waste"
      - Conserve
        - Personal savings
        - Southern Company wants us to pay to build for the future
    - National Security
      - Producing our own energy (and keeping money in US)
    - Public Health
      - Air Pollution
      - Particulates
      - Heavy Metals

The Challenge

- The Challenge is big
- Changing our ways is in our own self-interest
- We have the resources and the brain power to do it