

Perspectives on Drought in the Southeastern U.S.: Past, Present.... and Future?

**A presentation prepared for the 19th Annual Southeastern Lakes
Management Conference, Winston-Salem, NC, May 5-7, 2010.**

Jason Ortegren, Ph.D.

Department of Environmental Studies, The University of West Florida



THIS OLD PINE RECORDS CLIMATE



JOSEPH RODRIGUEZ/News & Record

Old longleaf pines don't carry large canopies; instead the age can be noted in the thick gnarly limbs and by taking a core sample of the wood. UNCG researchers found this tree at Weymouth Woods Sandhills Nature Preserve in Southern Pines.

UNCG researchers have found possibly the oldest living longleaf



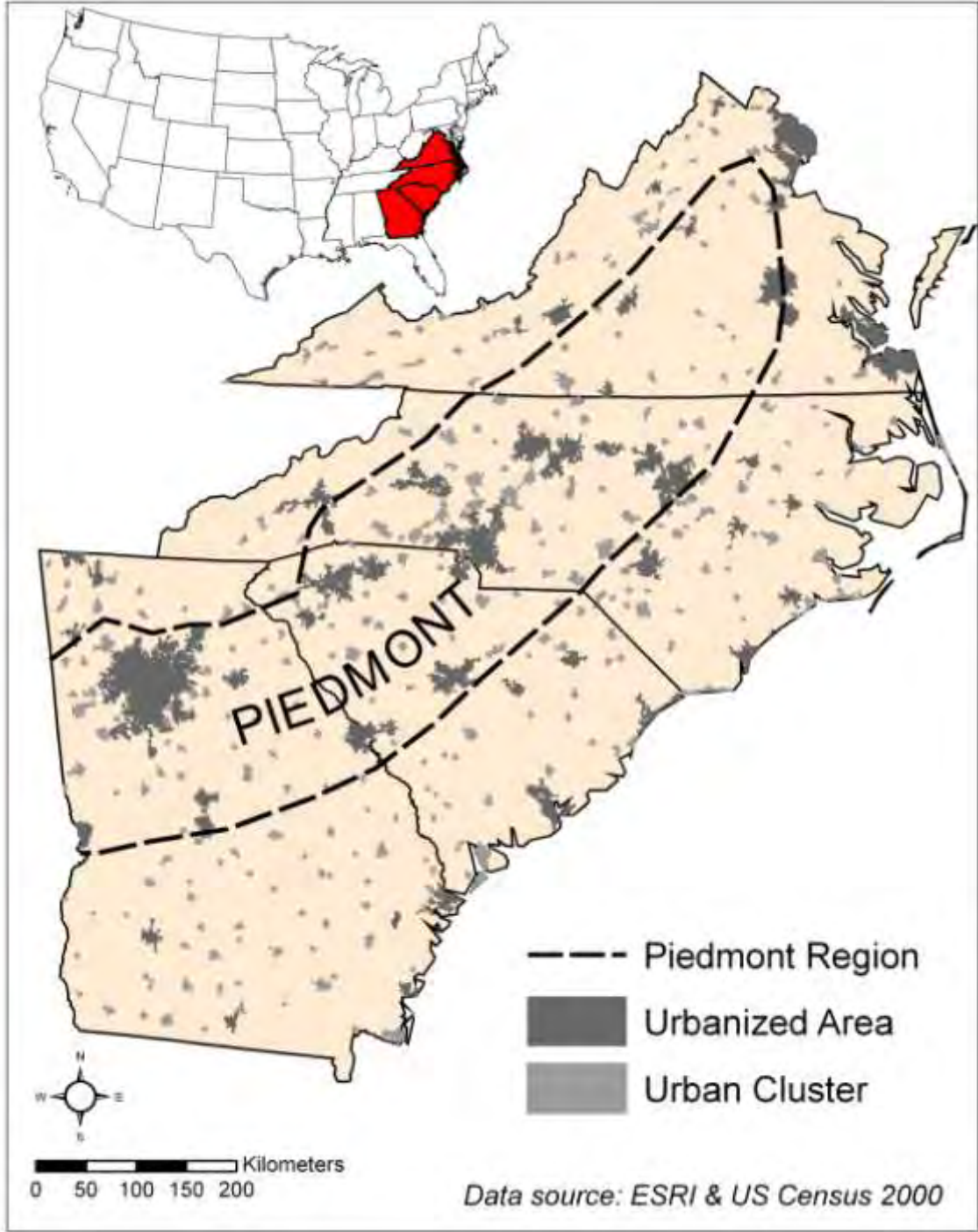






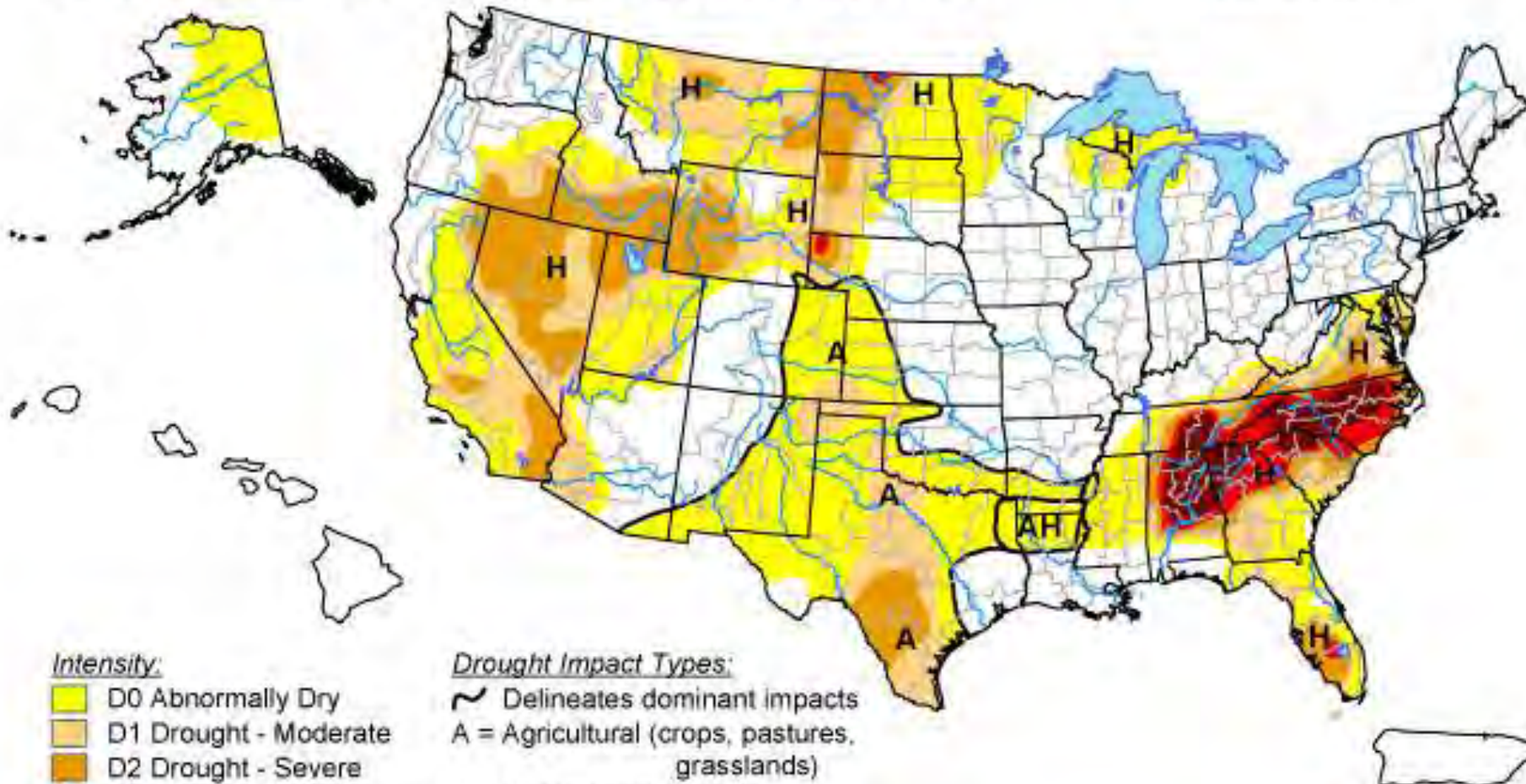


University of
West Florida








U.S. Drought Monitor


February 12, 2008
Valid 7 a.m. EST



Intensity:

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

Drought Impact Types:

-  Delineates dominant impacts
- A = Agricultural (crops, pastures, grasslands)
- H = Hydrological (water)

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



Released Thursday, February 14, 2008

Authors: Jay Lawrimore/Liz Love-Brotak, NOAA/NESDIS/NCDC

<http://drought.unl.edu/dm>

U.S. Drought Monitor

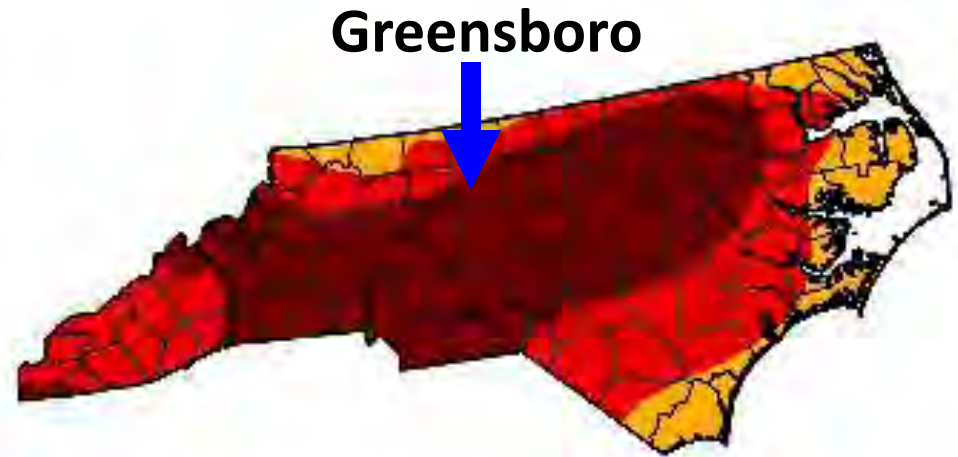
North Carolina

February 12, 2008

Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.0	100.0	100.0	100.0	85.2	49.2
Last Week (02/05/2008 map)	0.0	100.0	100.0	100.0	85.2	49.2
3 Months Ago (11/20/2007 map)	0.0	100.0	100.0	94.4	68.5	41.9
Start of Calendar Year (01/01/2008 map)	0.0	100.0	100.0	100.0	83.7	51.3
Start of Water Year (10/02/2007 map)	0.0	100.0	100.0	92.8	79.4	37.7
One Year Ago (02/13/2007 map)	84.9	15.1	3.2	0.0	0.0	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>

Released Thursday, February 14, 2008

Author: J. Lawrimore/L. Love-Brotak, NOAA/NESDIS/NCDC

U.S. Drought Monitor

South Carolina

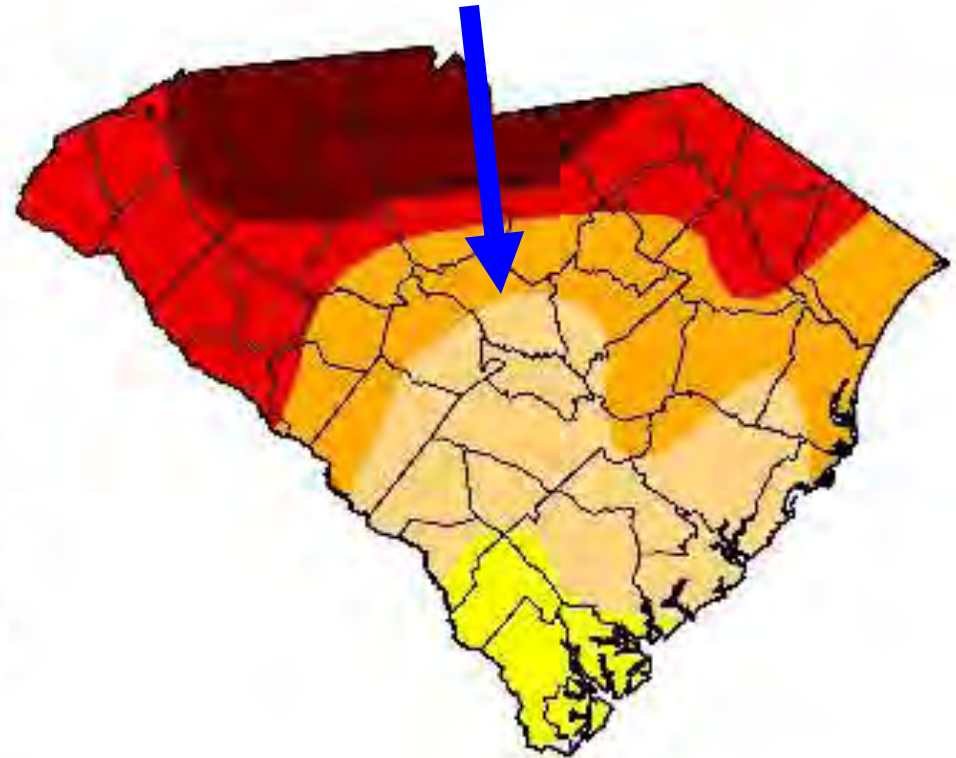
February 12, 2008

Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.2	99.8	92.8	67.4	41.9	15.7
Last Week (02/05/2008 map)	0.2	99.8	92.8	67.4	41.9	15.7
3 Months Ago (11/20/2007 map)	0.0	100.0	94.8	81.2	58.3	30.6
Start of Calendar Year (01/01/2008 map)	1.0	99.0	95.3	76.5	41.9	19.5
Start of Water Year (10/02/2007 map)	9.9	90.1	82.0	65.6	42.7	18.3
One Year Ago (02/13/2007 map)	93.7	6.3	0.0	0.0	0.0	0.0

Columbia



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>

Released Thursday, February 14, 2008

Author: J. Lawrimore/L. Love-Brotak, NOAA/NESDIS/NCDC

U.S. Drought Monitor

Georgia

February 12, 2008

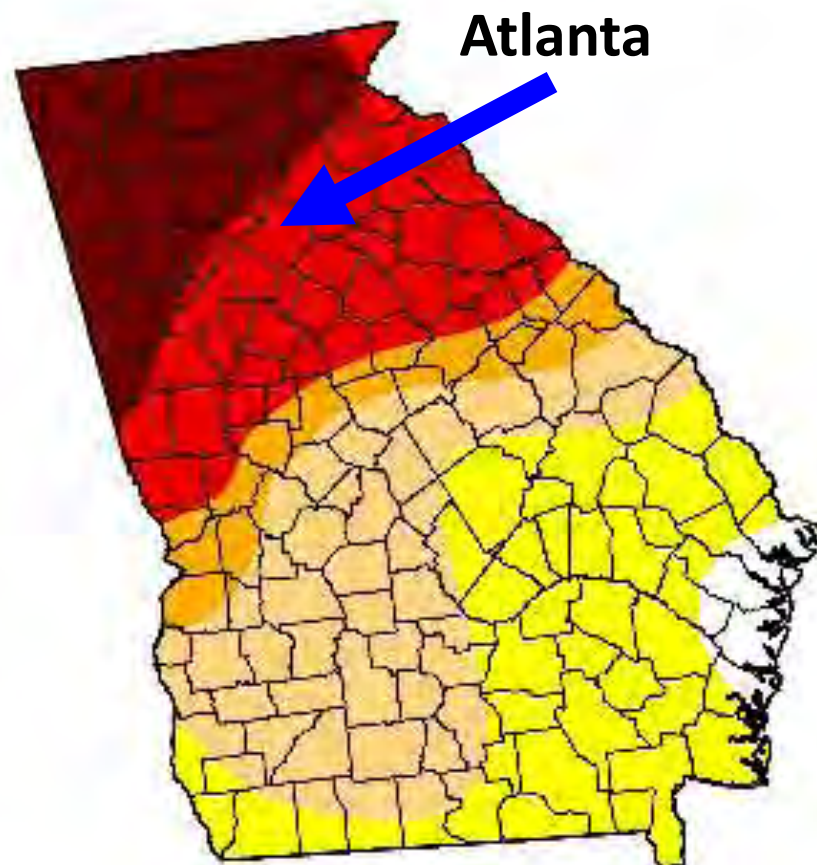
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	3.0	97.0	68.5	42.5	35.1	15.0
Last Week (02/05/2008 map)	3.0	97.0	68.5	42.5	35.1	15.0
3 Months Ago (11/20/2007 map)	7.9	92.1	77.1	63.5	53.3	36.9
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 (02/13/2007 map)	66.2	33.8	2.2	0.0	0.0	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

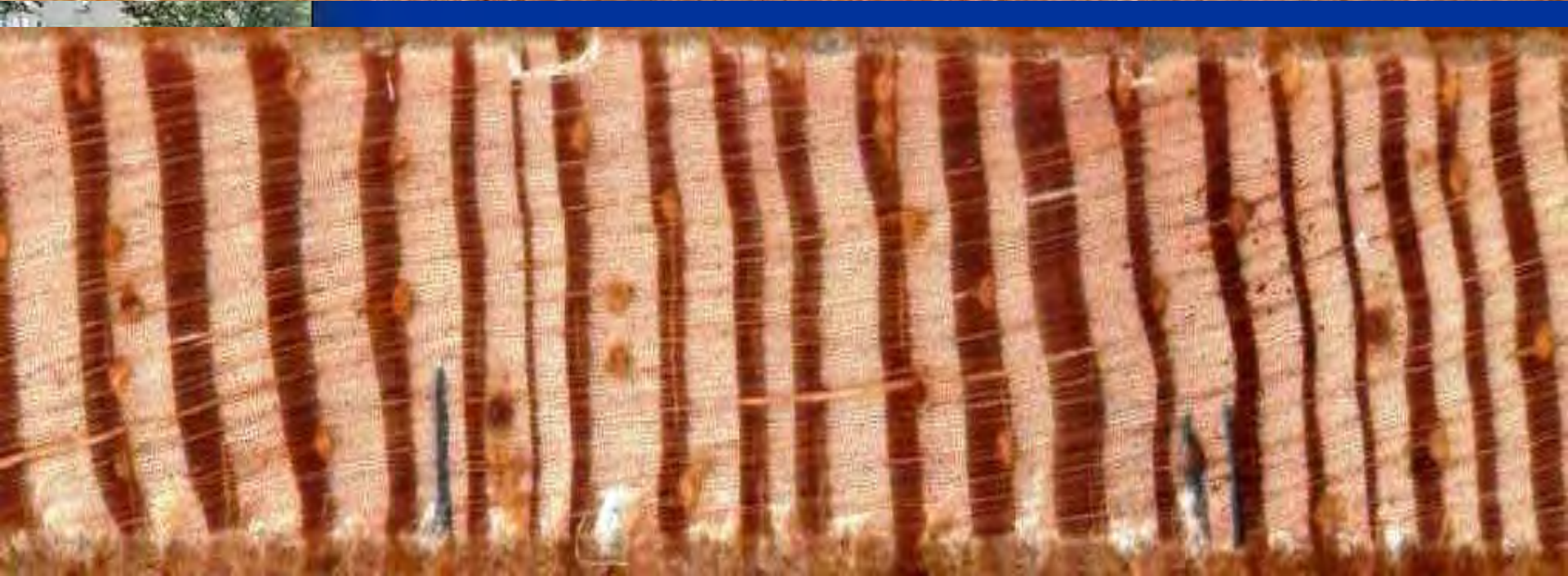


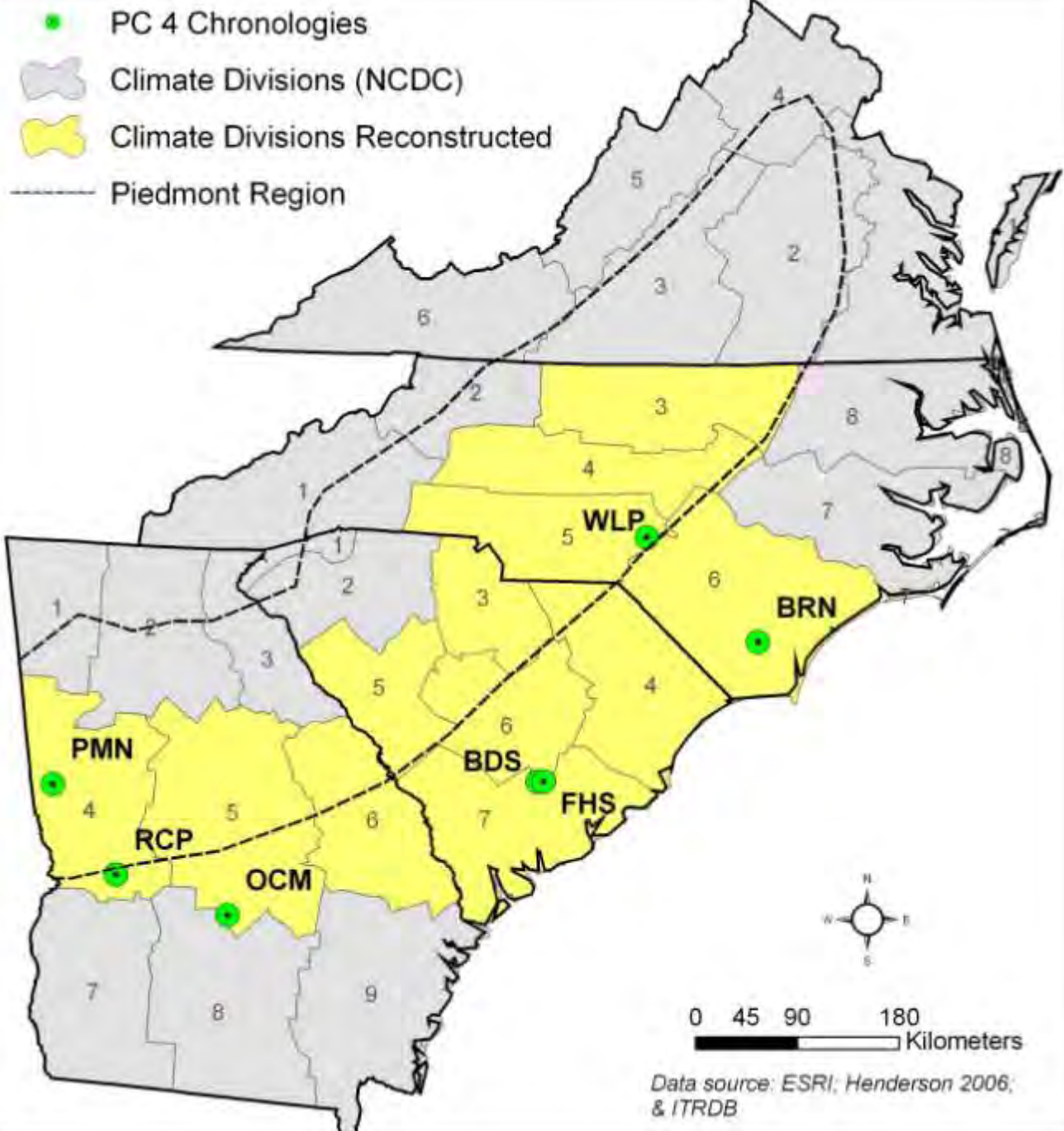
<http://drought.unl.edu/dm>

Released Thursday, February 14, 2008

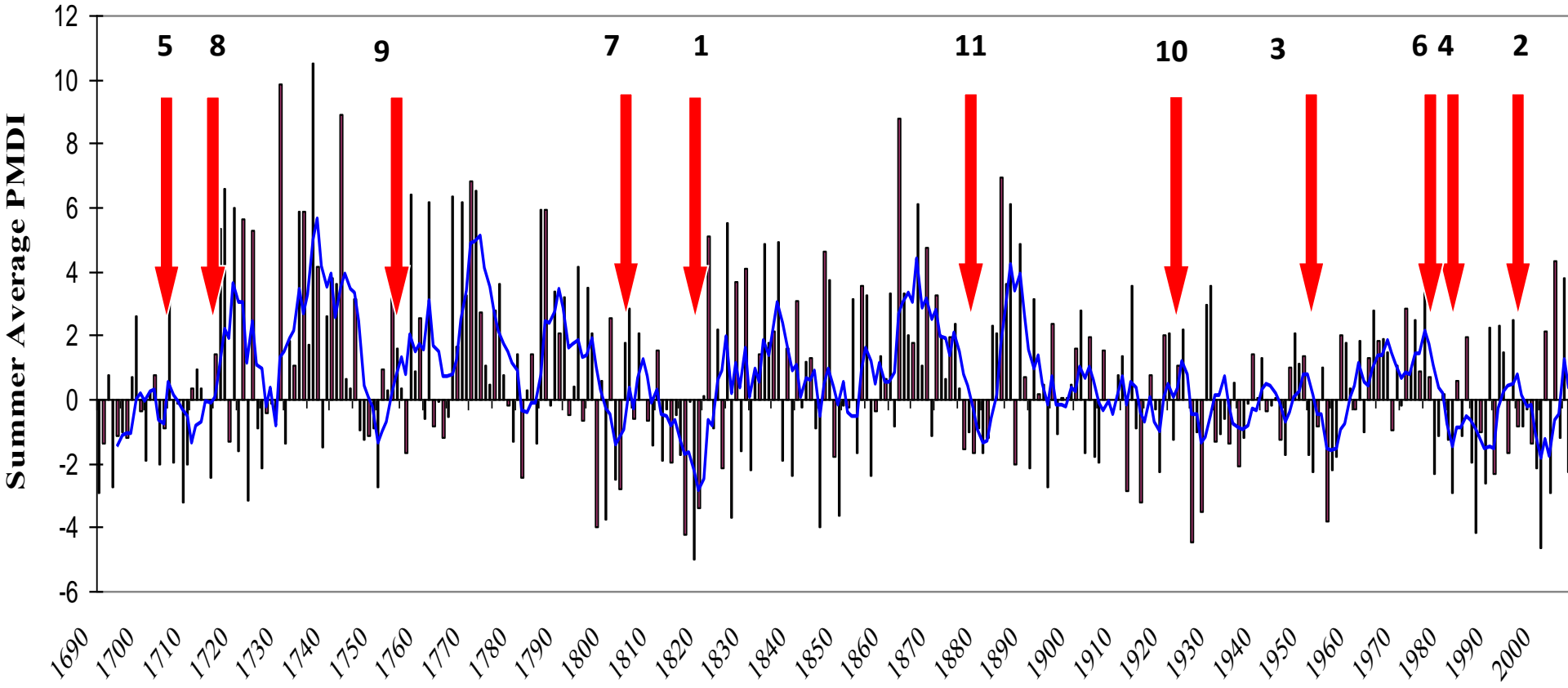
Author: J. Lawrimore/L. Love-Brotak, NOAA/NESDIS/NCDC



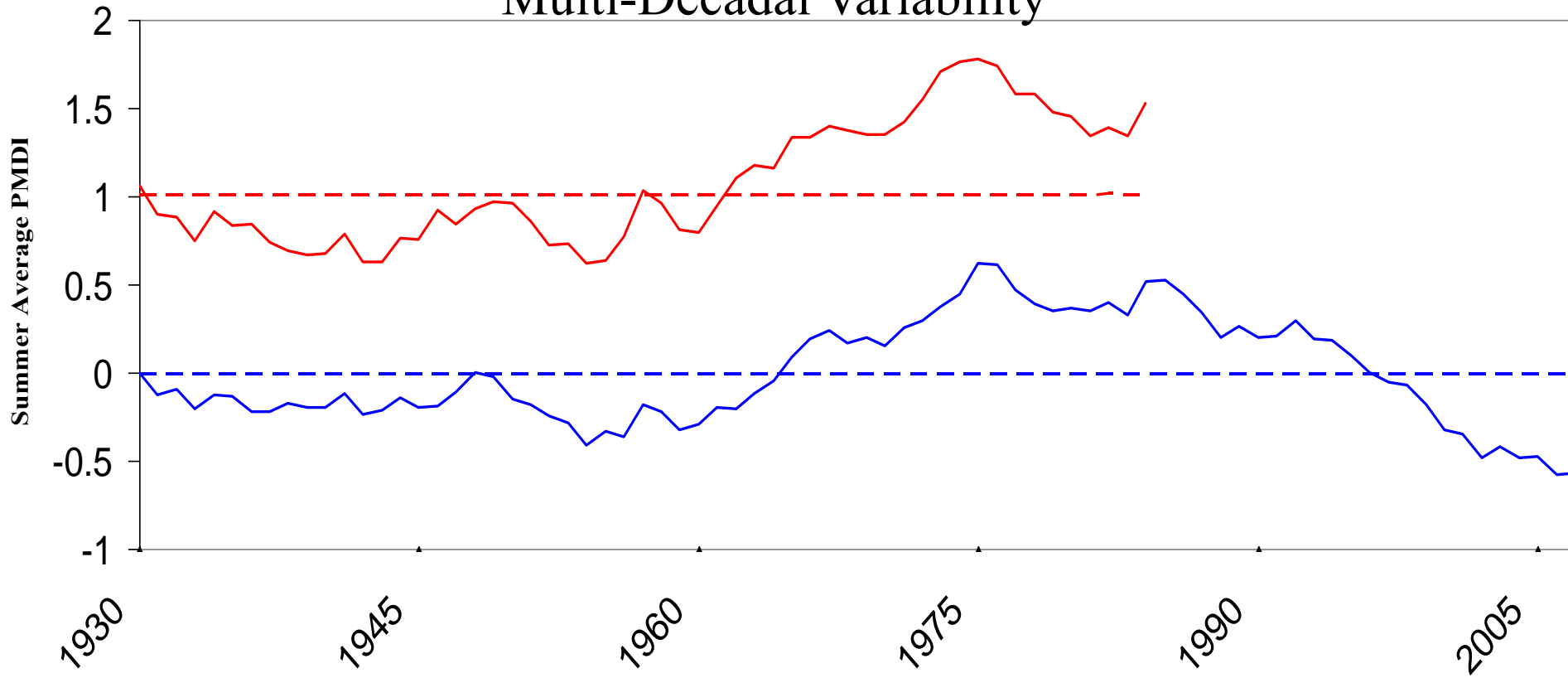




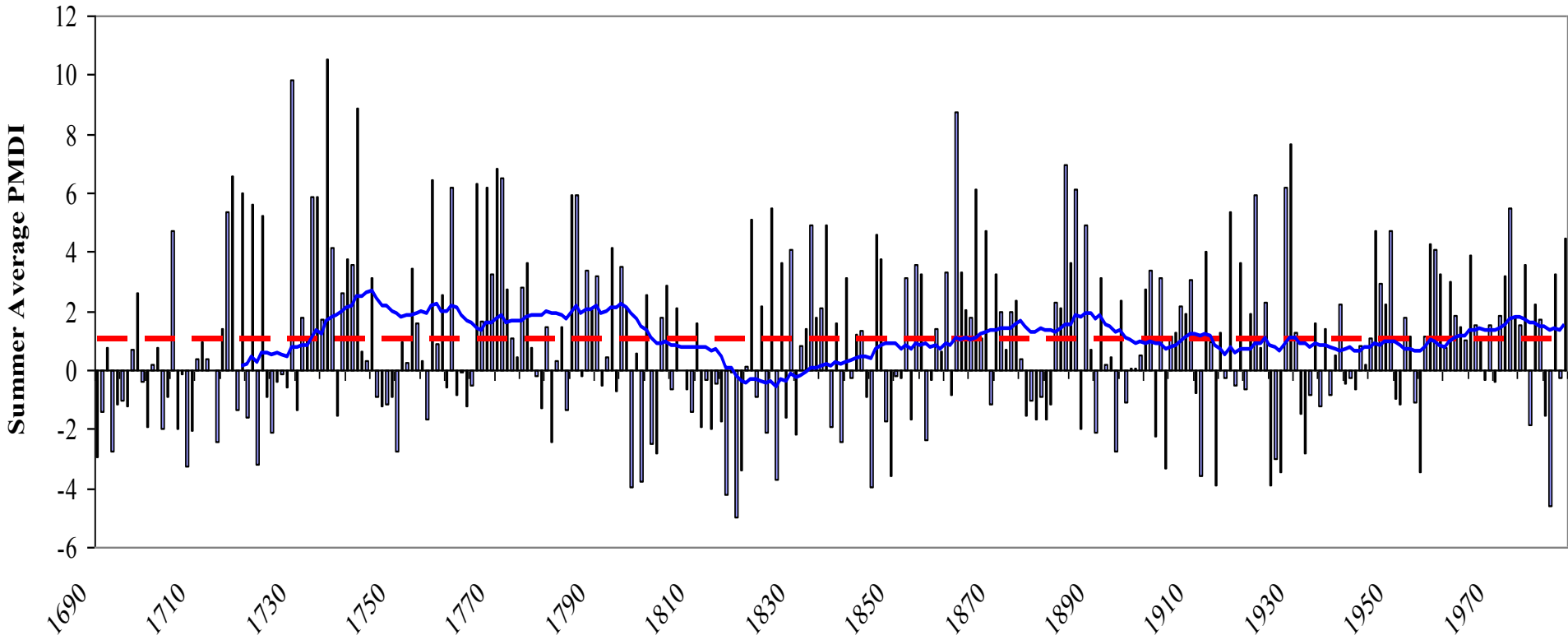
Sustained Summer Droughts, 1690-2007



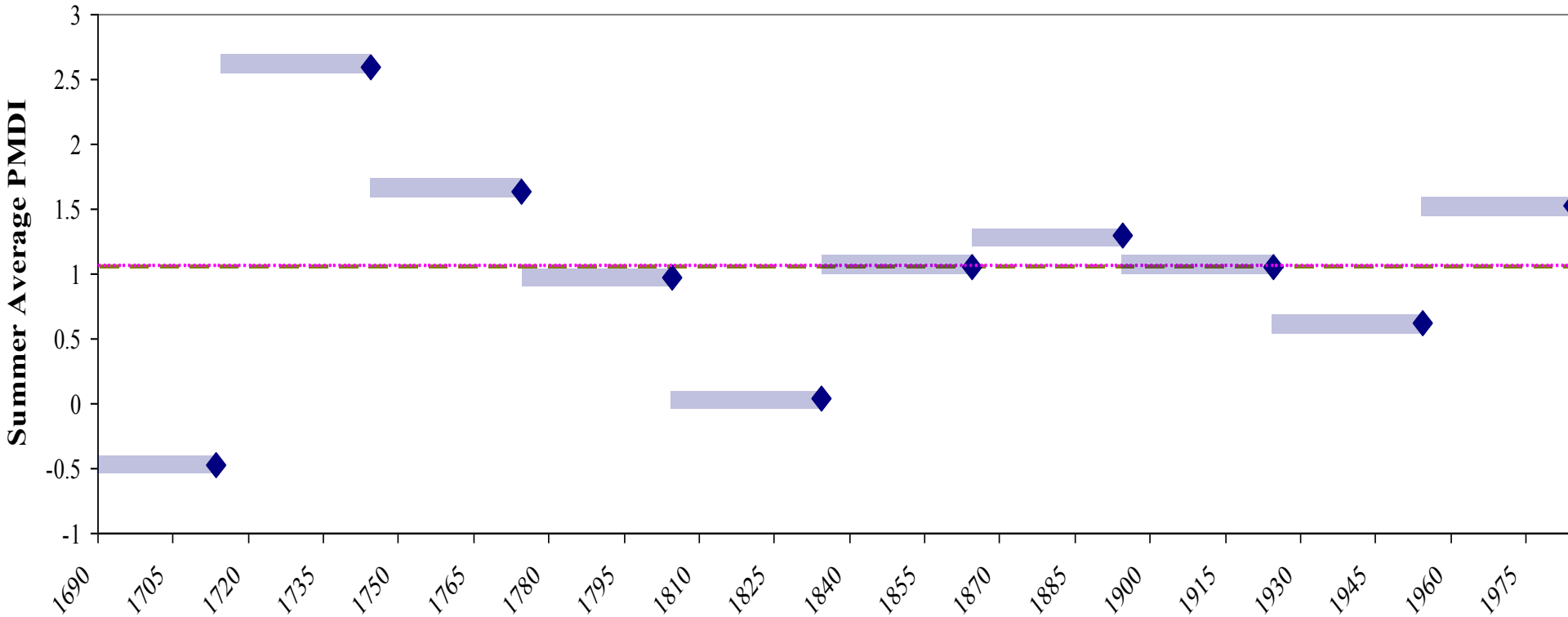
Multi-Decadal Variability



Piedmont Summer PMDI, 1690-1984



Non-overlapping 30-year Means in the Reconstruction (1690-1984)





Probability of sustained (> 3 yr) summer drought in a given decade:

-- 1690-2006: 34.8%

-- 1900-2006: 47.2%

-- 1950-2006: 71.4%

Perspectives



Perspectives

- 1690-2006: 34.8%
- 1900-2006: 47.2%
- 1950-2006: 71.4%

“Droughtbusters”

*Justin Maxwell, Paul Knapp, Jason Ortegren,
and Peter Soulé



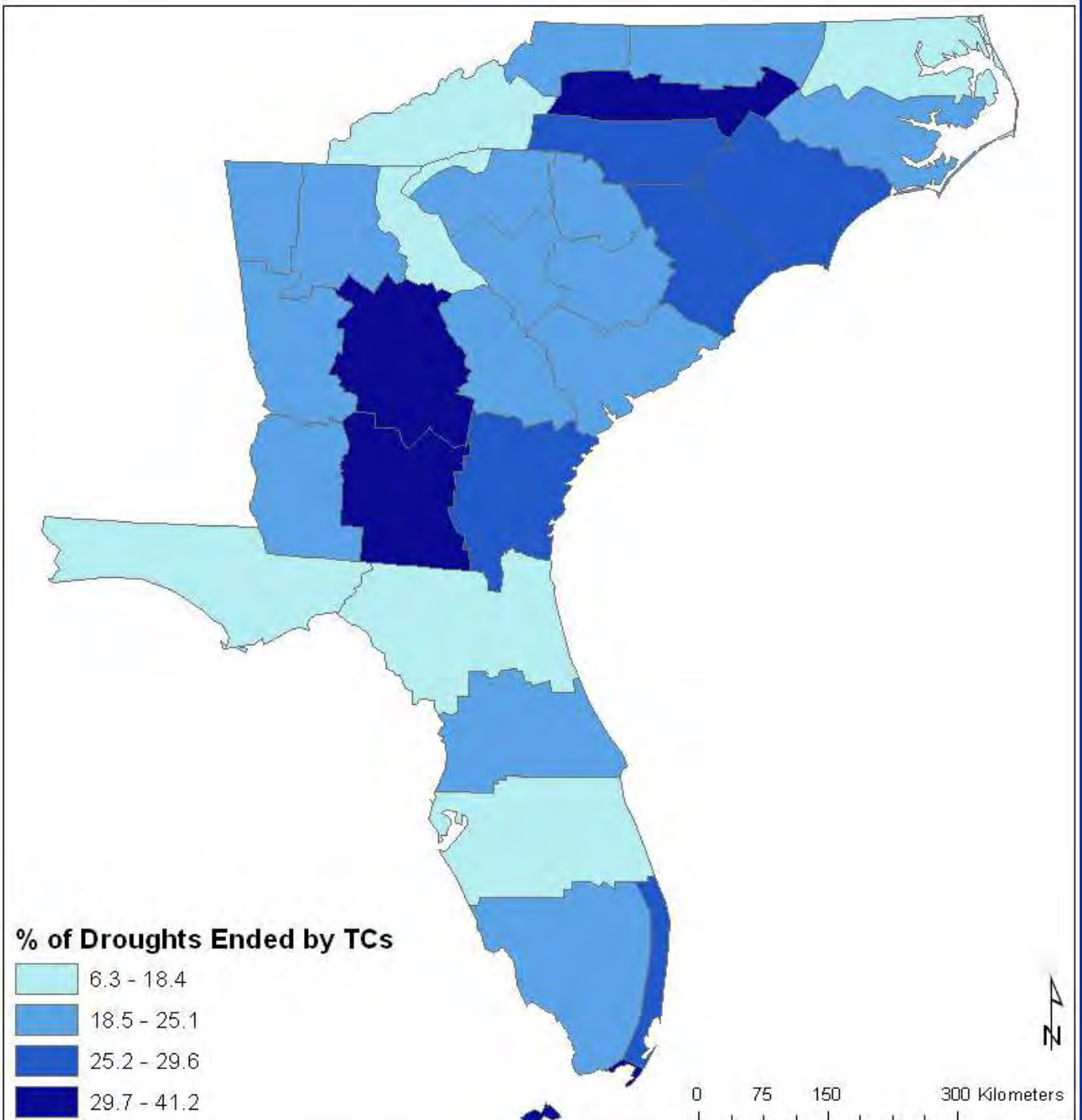


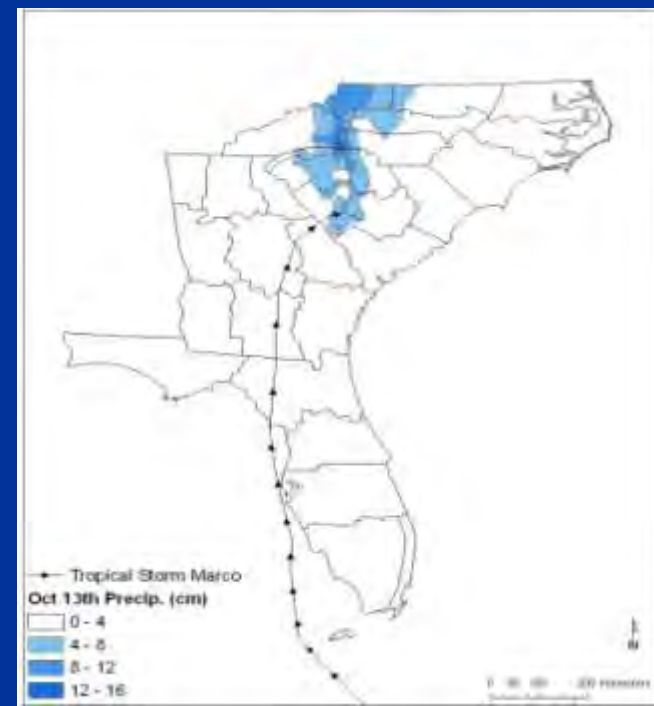
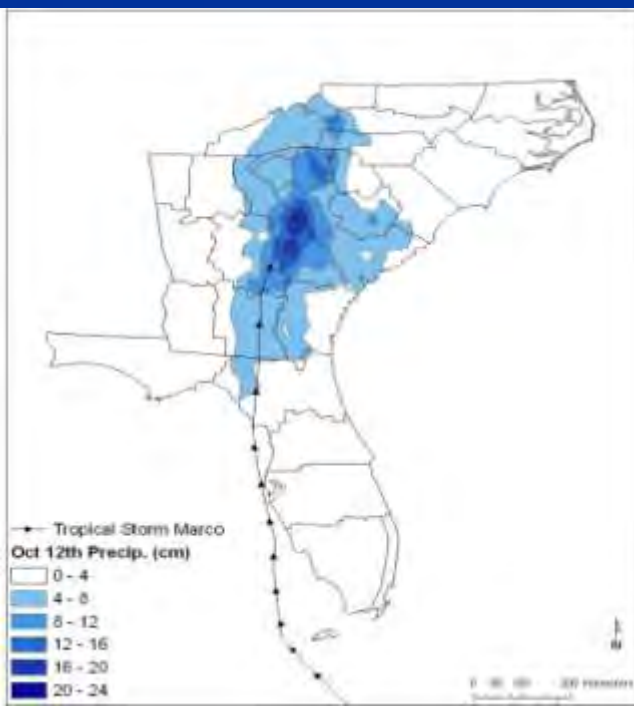
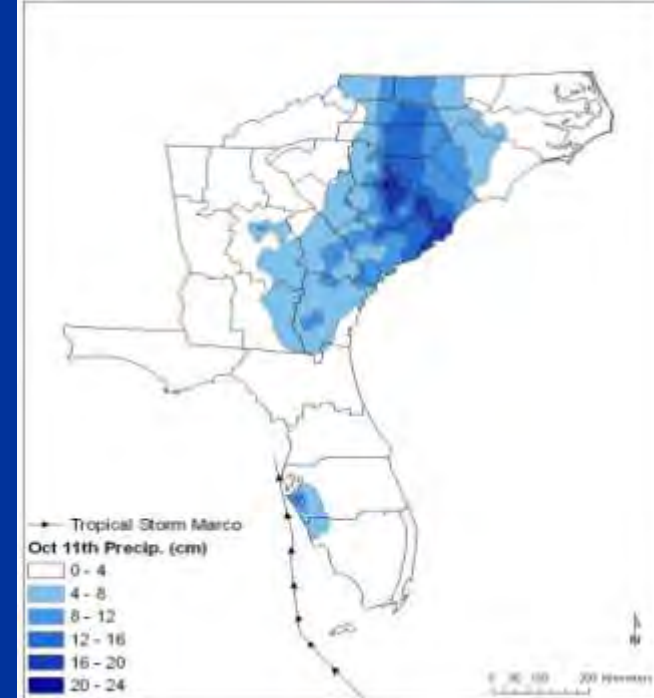
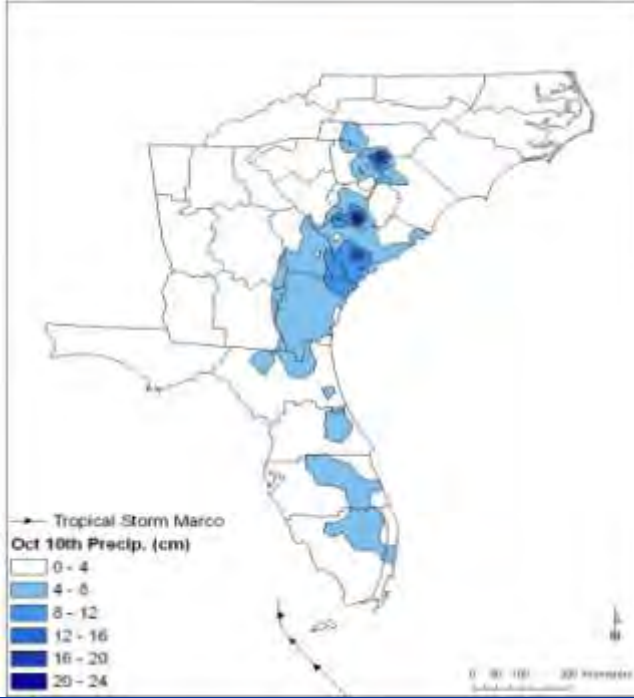




OLD WORLD POTTERY
ORNAMENTAL IRON

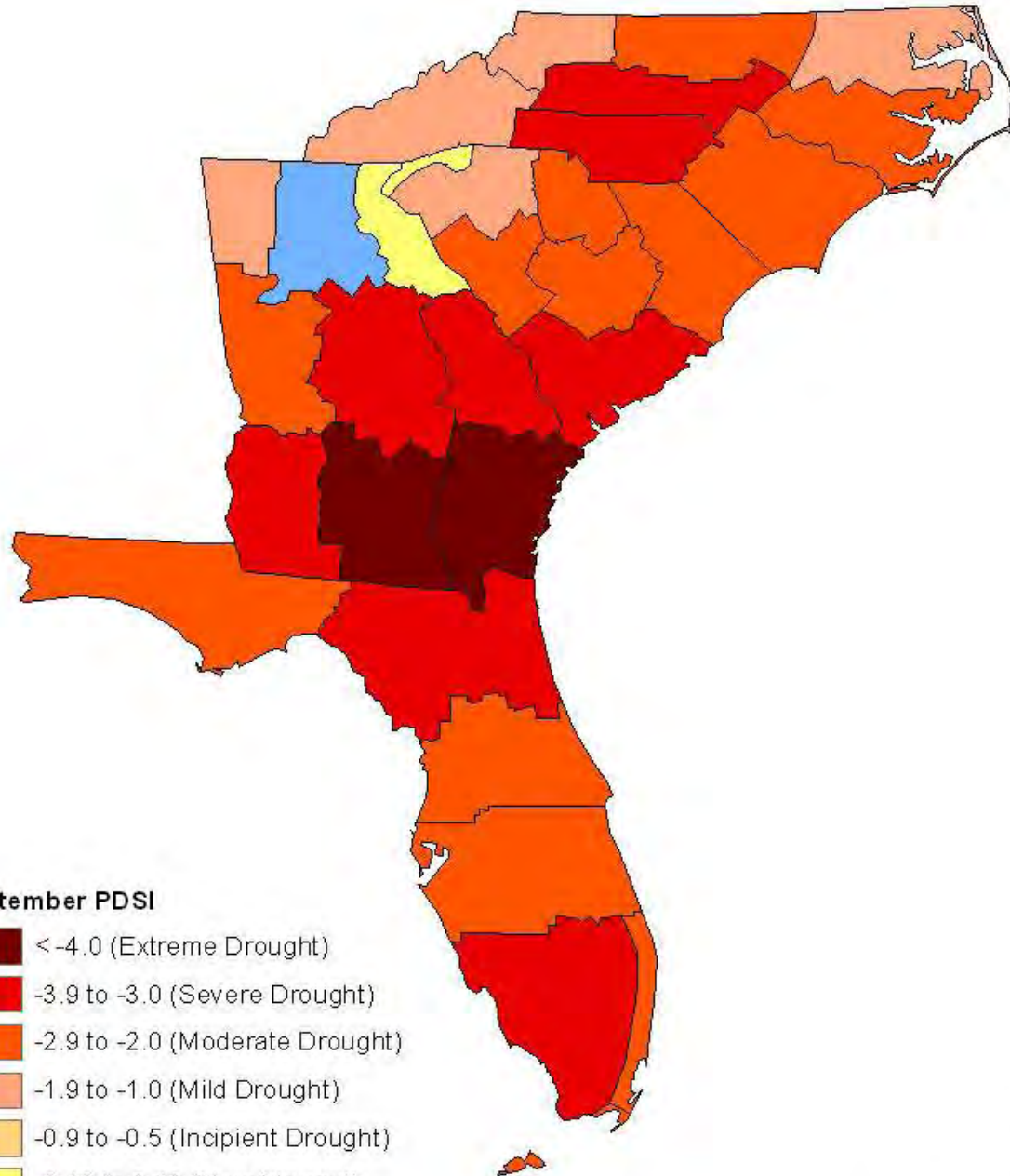
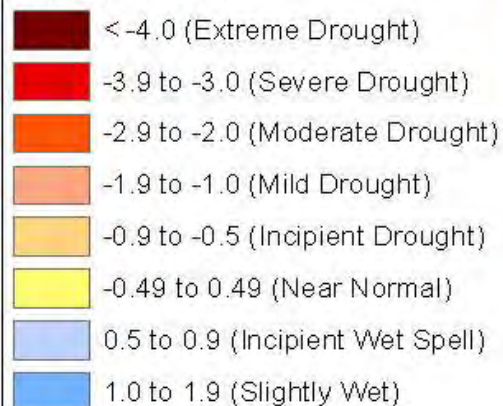
Kirkwood Way
100 E.





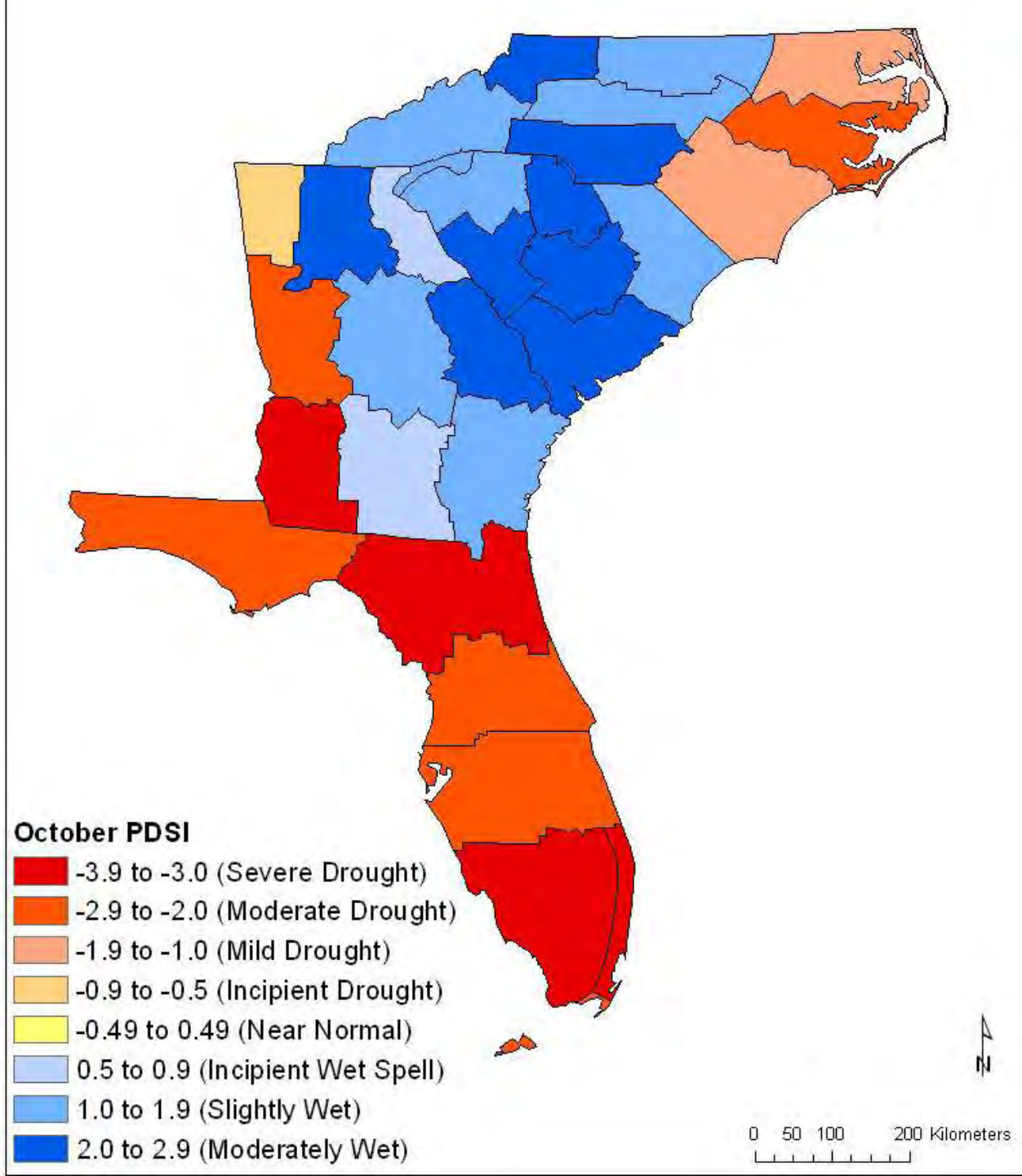


September PDSI



0 50 100 200 Kilometers





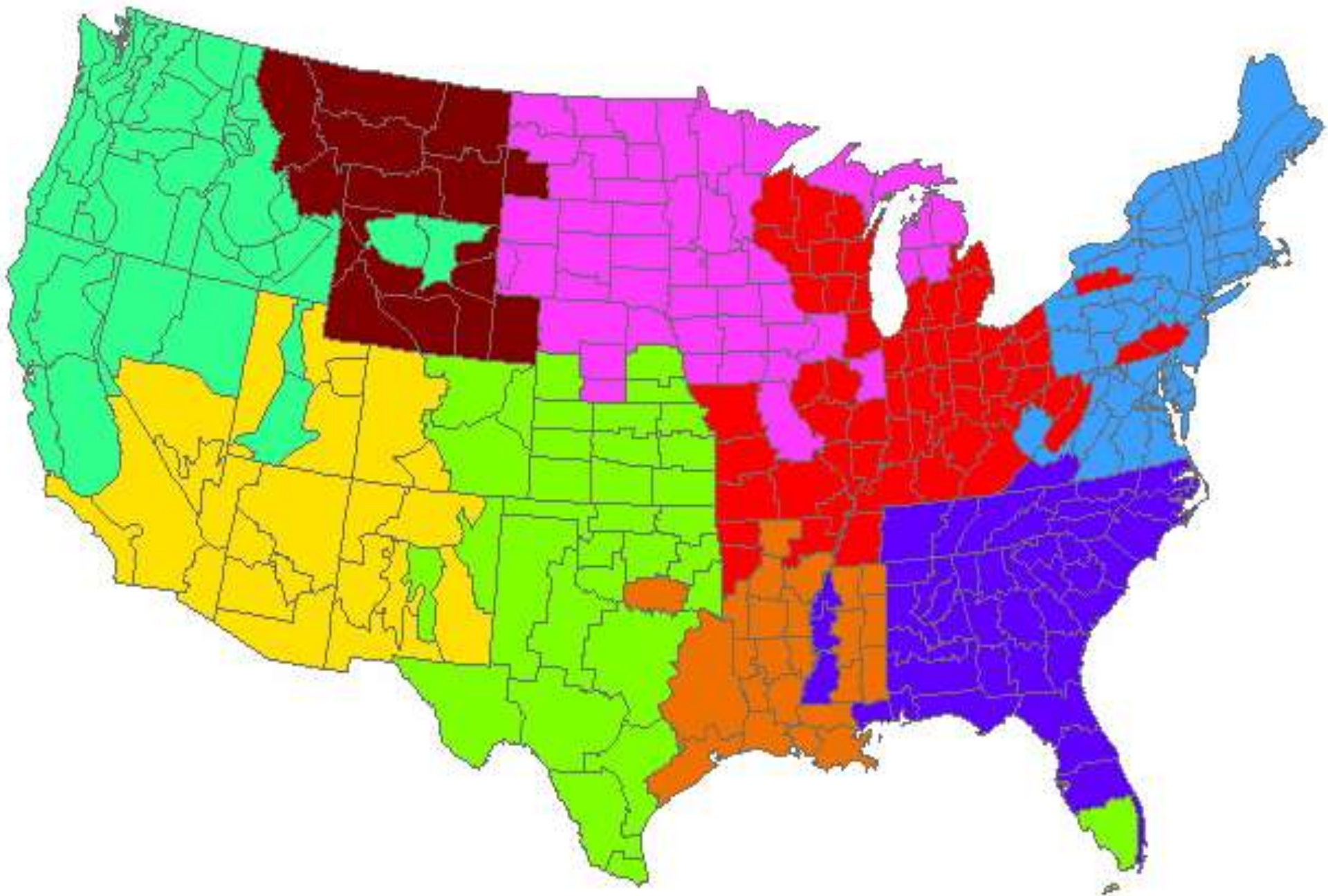
Perspectives



Synoptic ‘Safety Net?’

Jason Ortegren, Justin Maxwell, Paul Knapp, Peter Soulé, and William Tyminski





Regional Susceptibility

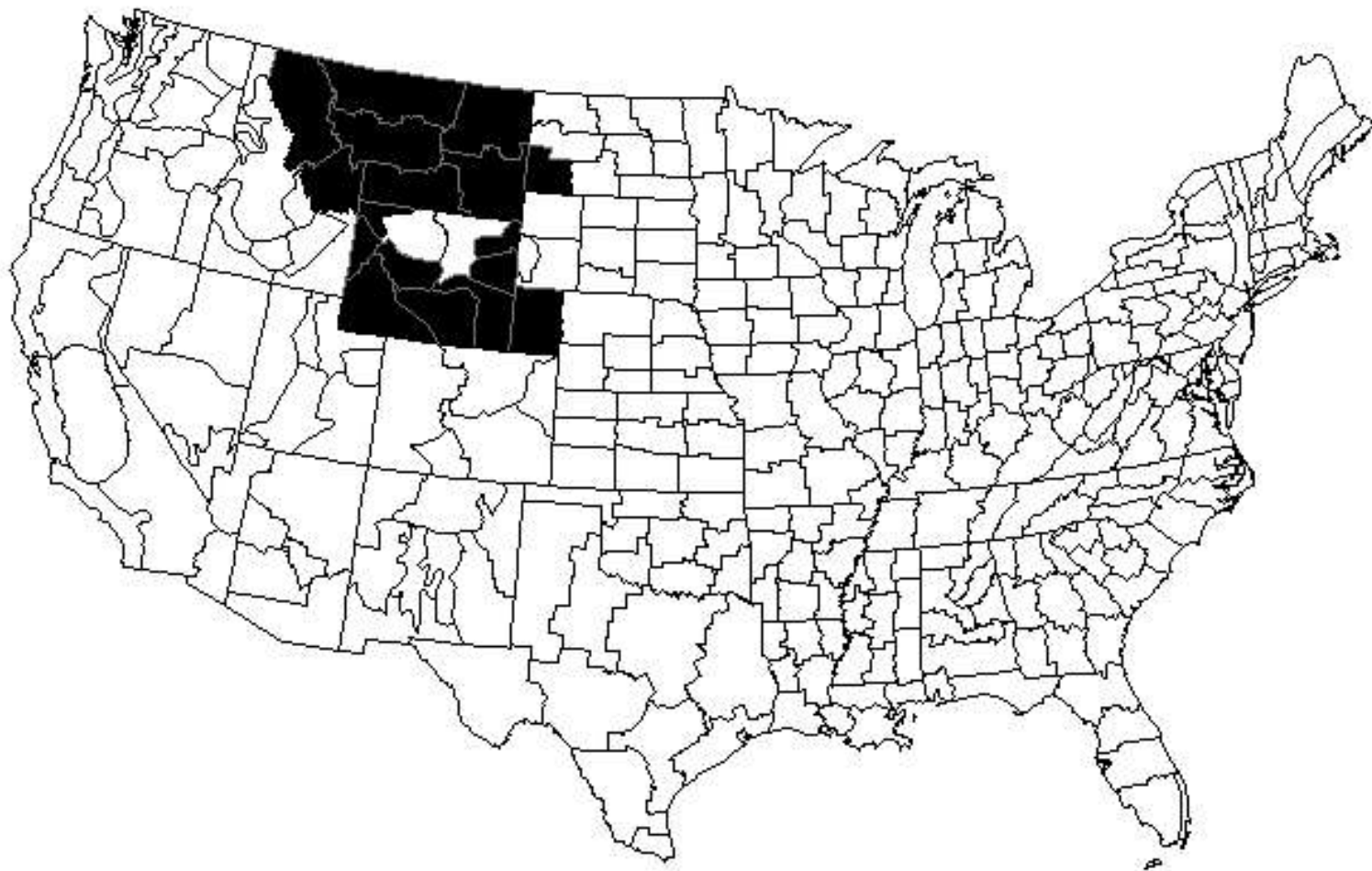
Climate Divisions grouped according to maximum factor loading scores

For each of the 344 Divisions, we computed:

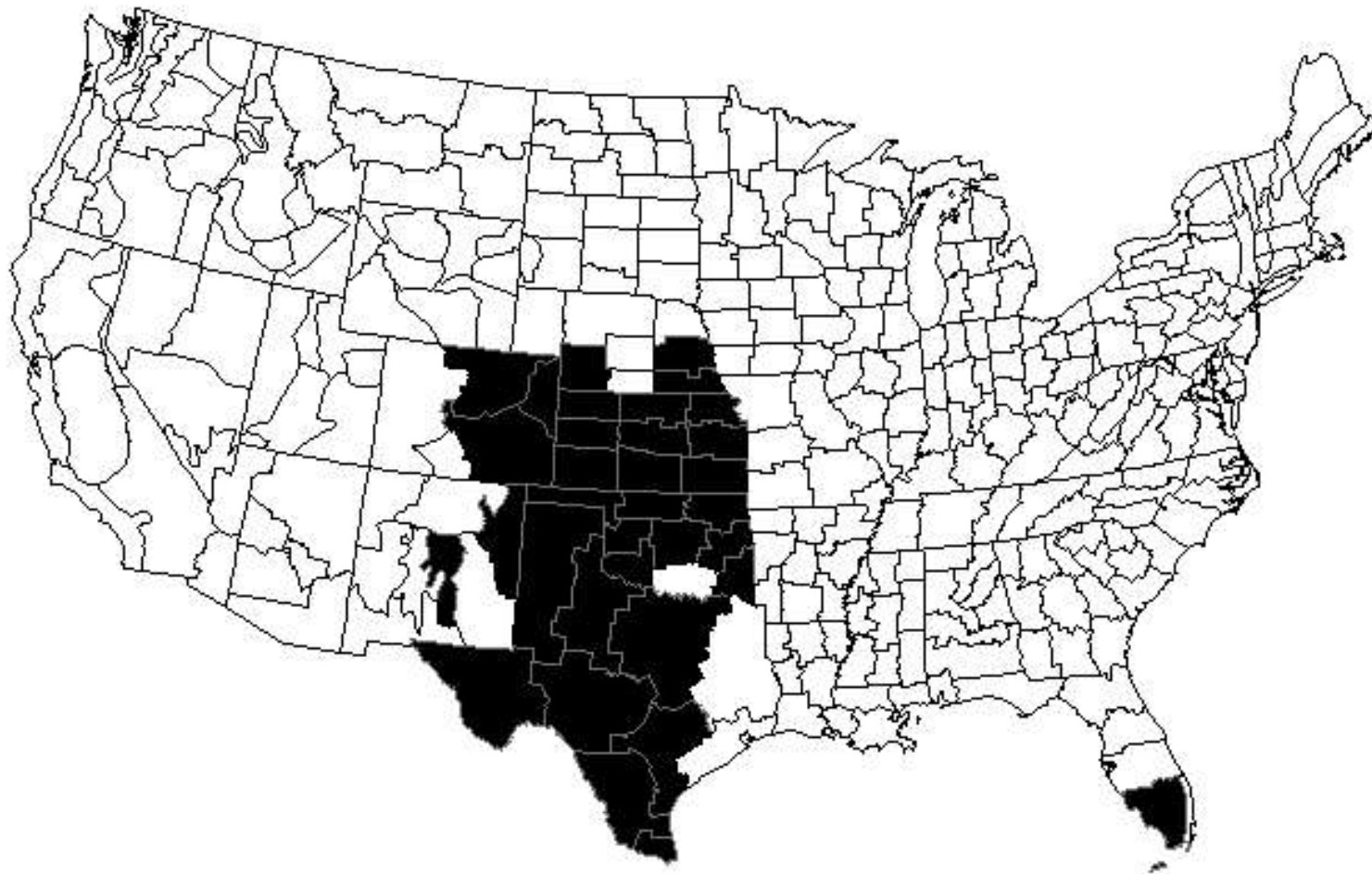
Measure	Upper MW	N. Plains	Southeast	Northeast	PNW	S. Plains	SW	Gulf South	N. Rockies
# events	4.293	4.271	5	4.170	6.125	3.857	5.750	5.167	5.176
avg length	4.213	4.692	3.817	4.483	4.438	4.758	4.603	3.726	4.890
total length	17	20	21	19	27	17	26	19	25
max length	5.328	7.255	5	7.000	7.400	6.771	7.583	4.583	8.118
avg. severity	-2.525	-3.017	-2.396	-2.345	-2.794	-3.151	-3.173	-2.225	-3.179
av lgth * av sev.	-10.078	-14.376	-9.175	-10.674	-12.508	-15.298	-14.771	-8.256	-15.756
Suscept. Index	0.818	1.167	0.745	0.866	1.015	1.242	1.199	0.670	1.279



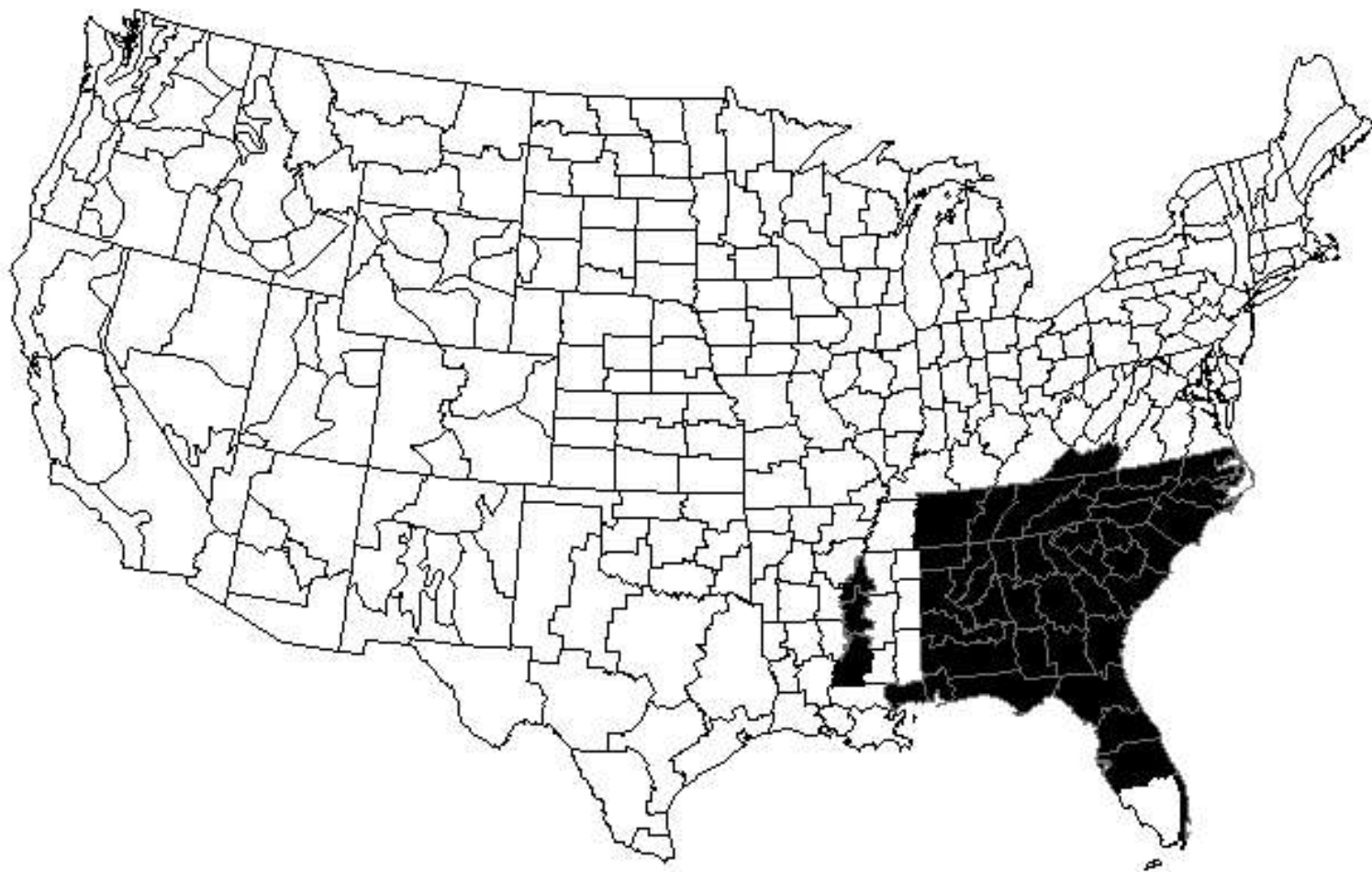
Northern Rockies



Southern Plains



Southeast U.S. (SEUS)



Eastern Gulf South (EGS)



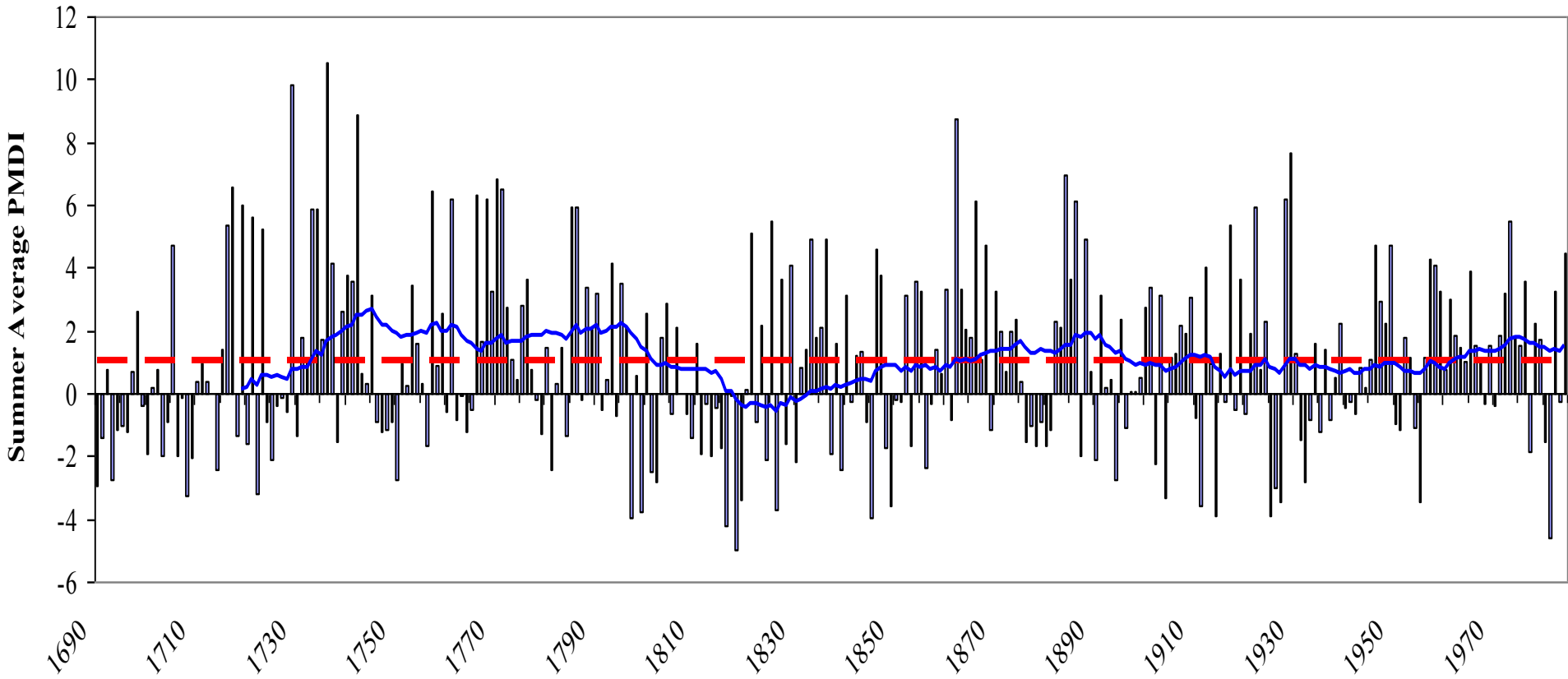
Synoptic influences on summer drought in the Southeast and Gulf Coast:

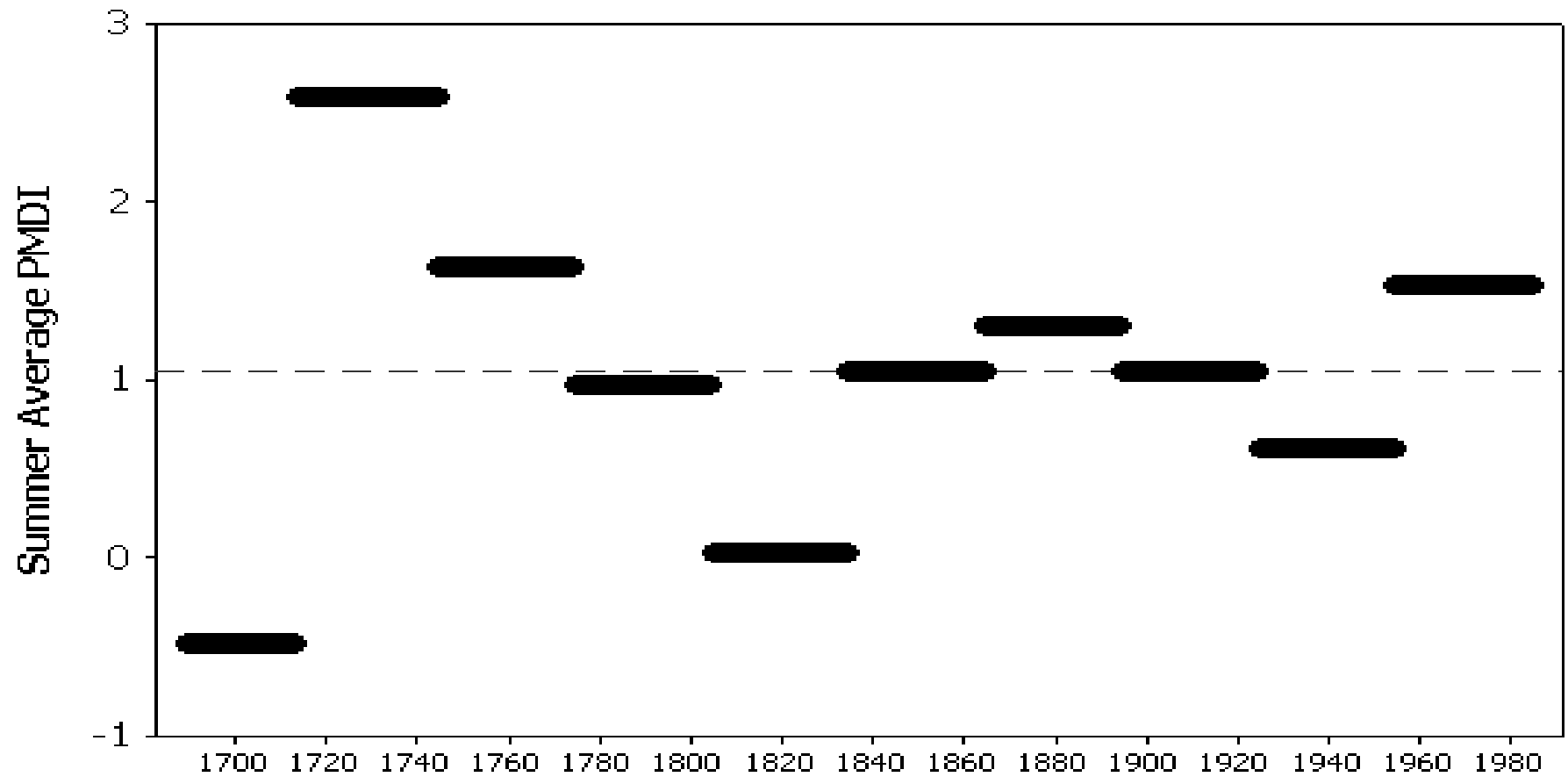
--Subtropical Atlantic Ocean (AMO)

Warm phase → increased likelihood of summer drought AND long-term (30 yr) regimes of drier summers

Cool phase → opposite

Piedmont Summer PMDI, 1690-1984





Synoptic influences on drought in the Southeast and Gulf Coast

North Atlantic Subtropical (Bermuda)
High Pressure





**Hot humid air from
the Gulf of Mexico**

**Clockwise circulation
around high pressure**



Source: www.usatoday.com/weather/whothumd.htm



Synoptic influences on drought in the Southeast and Gulf Coast

North Atlantic Subtropical (Bermuda)

High Pressure

Eastward location → wetter summers

Westward location → drier summers



**Hot humid air from
the Gulf of Mexico**

**Clockwise circulation
around high pressure**



Source: www.usatoday.com/weather/whothumd.htm

Synoptics cont'd


Westerly „epochs’ of the Bermuda High have been concurrent with warm phases of the AMO and vice versa



Synoptic influences on drought in the Southeast and Gulf Coast

“Droughtbusters”

More common in warm AMO phases
(and during La Niña events)



Positive AMO is also linked to strengthened winter El Niño impacts--“wetter wetter winters”

Thus:

Development of decadal-scale (or longer) continuous droughts would apparently require:



-Prolonged suppression of winter precip.
(i.e., La Niña); especially under cool
AMO conditions





- Prolonged suppression of winter MLCs (i.e., La Niña); especially under cool AMO conditions
- Prolonged suppression of tropical cyclone activity in the region (i.e., cool AMO)



- Prolonged suppression of winter MLCs (i.e., La Niña); especially under cool AMO conditions
- Prolonged suppression of tropical cyclone activity in the region (i.e., cool AMO)
- Dry summer regime (i.e., warm AMO)



Forcing mechanisms that cause summer drought in the Southeast encourage winter wetness and/or tropical precipitation

...AND VICE VERSA

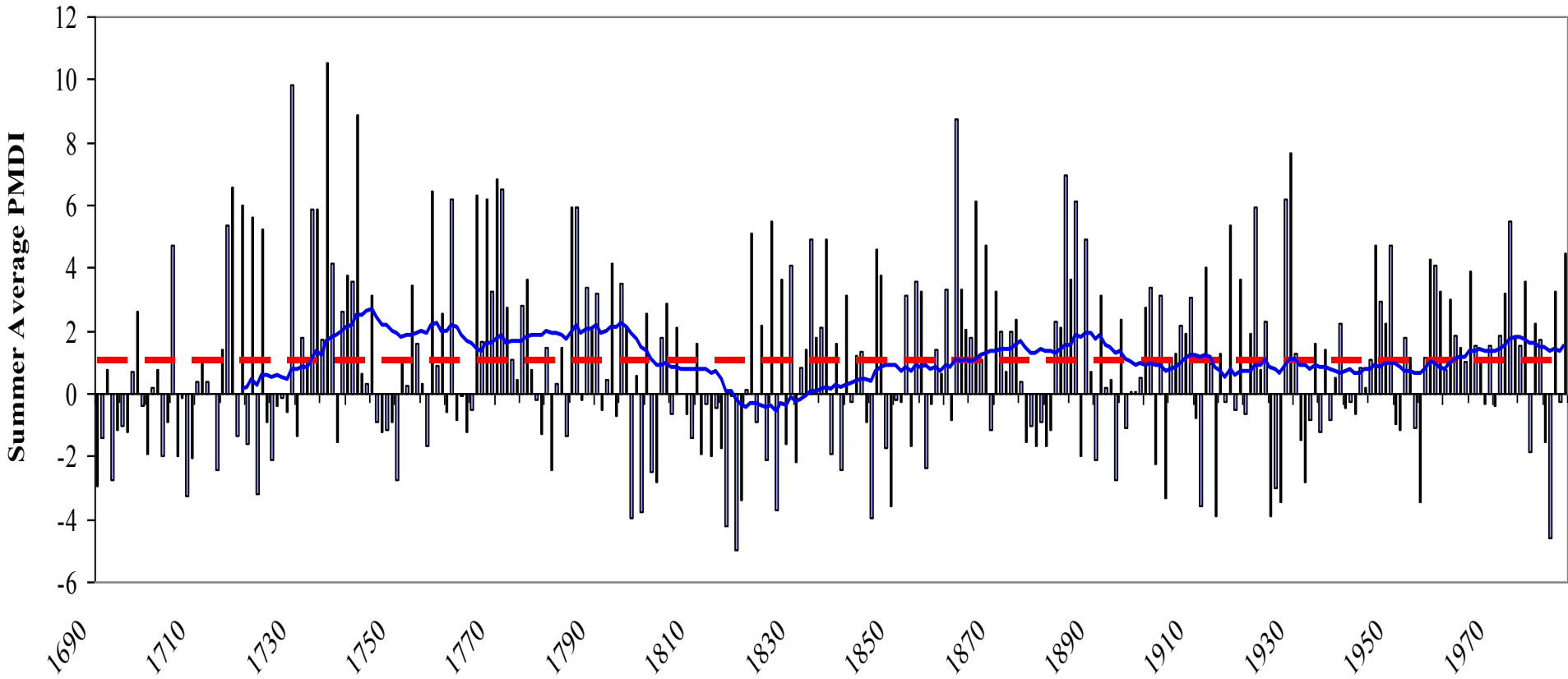
Towards predictability:

**Multivariate linear regression models;
Atlantic Ocean / atmosphere variability
to predict multi-decadal drought
variability in the SEUS and EGS**

Towards predictability:

**Atlantic SSTs and location of the
Bermuda High explain ~80% of long-
term (~ 30 yr) summer drought
variability**

Piedmont Summer PMDI, 1690-1984



Perspectives

Doesn't imply true "safety."

Southeast and Gulf Coast regions less susceptible to prolonged drought

Perspectives

Doesn't imply true "safety."

Southeast and Gulf Coast regions less susceptible to prolonged drought

Multi-year droughts (<10 yr) do occur, and:

Pop. growth and urbanization exacerbate impacts, BUT:

Perspectives

Doesn't imply true "safety."

Southeast and Gulf Coast regions less susceptible to prolonged drought

Multi-year droughts (<10 yr) do occur, and:

Pop. growth and urbanization exacerbate impacts, BUT:

Decadal-scale continuous droughts unlikely*

Conclusions

Increased drought frequency in 20th century;

Wetter and drier summer “regimes” on the order of ~ 30 yrs

Relative protection from Dust Bowl-style droughts

Conclusions

- Uncertainty still dominates, BUT:
- Regardless of perspective, drought preparedness and watershed management likely to become only more important
- pop. growth, impervious surfaces, water quality, etc...

Thanks!

