

**“And it never failed
that during the dry years
the people forgot about the rich years,
and during the wet years
they lost all memory of the dry years.
It was always that way.”**

—John Steinbeck
East of Eden

Tennessee's Water Resources

A Regional Concern

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**Tennessee Advisory Commission on
Intergovernmental Relations**

Tennessee's Water Resources

Having It All~

~Where you need it

~When you need it

~of the Quality you need

~in the Quantity you need

Stored Water vs. Natural Water Droughts

- **Stored water droughts** occur when large stores of water in man-made reservoirs, natural lakes, and groundwater aquifers depleted by very long, unusually low periods of precipitation.
- **Natural water droughts** quickly and fairly frequently follow just a few weeks or months of below-normal rainfall.

Source: National Drought Policy Commission Report (2000).

How Stored Water Droughts Happen

- People without enough stored water build reservoirs or tap into surface (natural lakes and streams) or groundwater (aquifers) storage.
- Reliable water supports population growth and more diverse water uses:
 - *Hydro-power dams create popular fishing and boating lakes and valuable lake view property.*
 - *Reservoir operating policies ensure minimum flows for fish and wastewater dilution when there would not otherwise be enough water in the stream.*
 - *Cities and farmers increase their withdrawals as they prosper and grow.*

Source: National Drought Policy Commission Report (2000).

How Stored Water Droughts Happen

- An unusually long dry period forces reservoir operators to draw down man-made lakes to
 - support withdrawals for cities and farms,
 - produce hydropower,
 - and keep enough water in navigation channels for barges to float.
- But
 - homes and businesses around the lake now have views of mud flats,
 - boat ramps no longer reach the water, and
 - lake fisheries suffer when releases are made for riverine species.

Source: National Drought Policy Commission Report (2000).

Where You Need It?

Franklin, Tennessee, August 27, 2007

With less than a tenth of an inch of rain so far this month, and more than 14 days with high temperatures at or above 100°F, water in retention ponds has been decreasing to record levels. This one is nearly dry. Water restrictions are currently in effect. Photo courtesy of Jordan Gerth.

Source: National Drought Mitigation Center



Where You Need It?



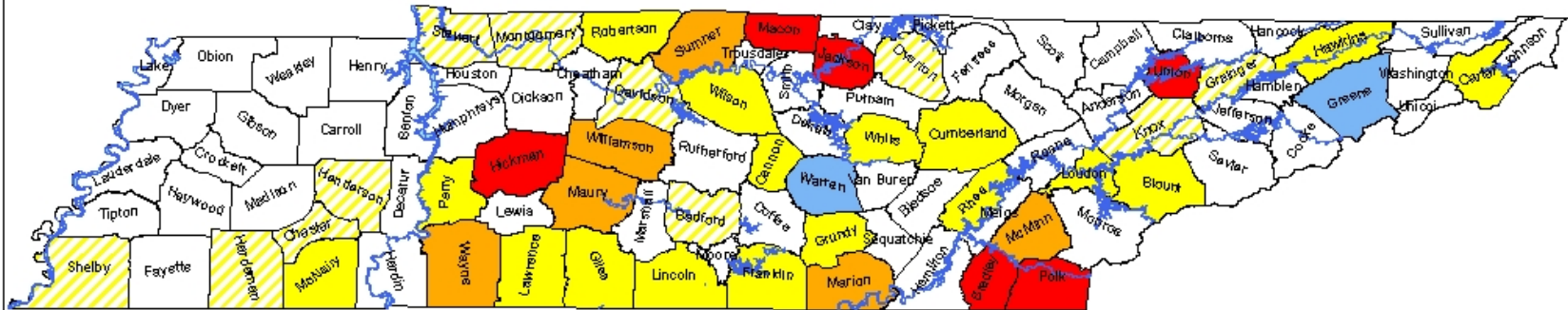
Laurel Lake

Source: WDEF, news12,
Chattanooga, Tennessee.



Monteagle, Tennessee, October 2007

Tennessee Counties in Which Water has Been Restricted or Required to have Additional Treatment as of September 21, 2007

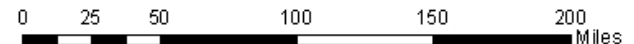


Legend

- No Restrictions or Additional Treatment
- Mandatory Restrictions
- Voluntary Restrictions
- Voluntary Restrictions (from News Article)
- Mandatory and Voluntary Restrictions
- Additional Treatment

Source: Tennessee Emergency Management Agency and News Articles from around Tennessee

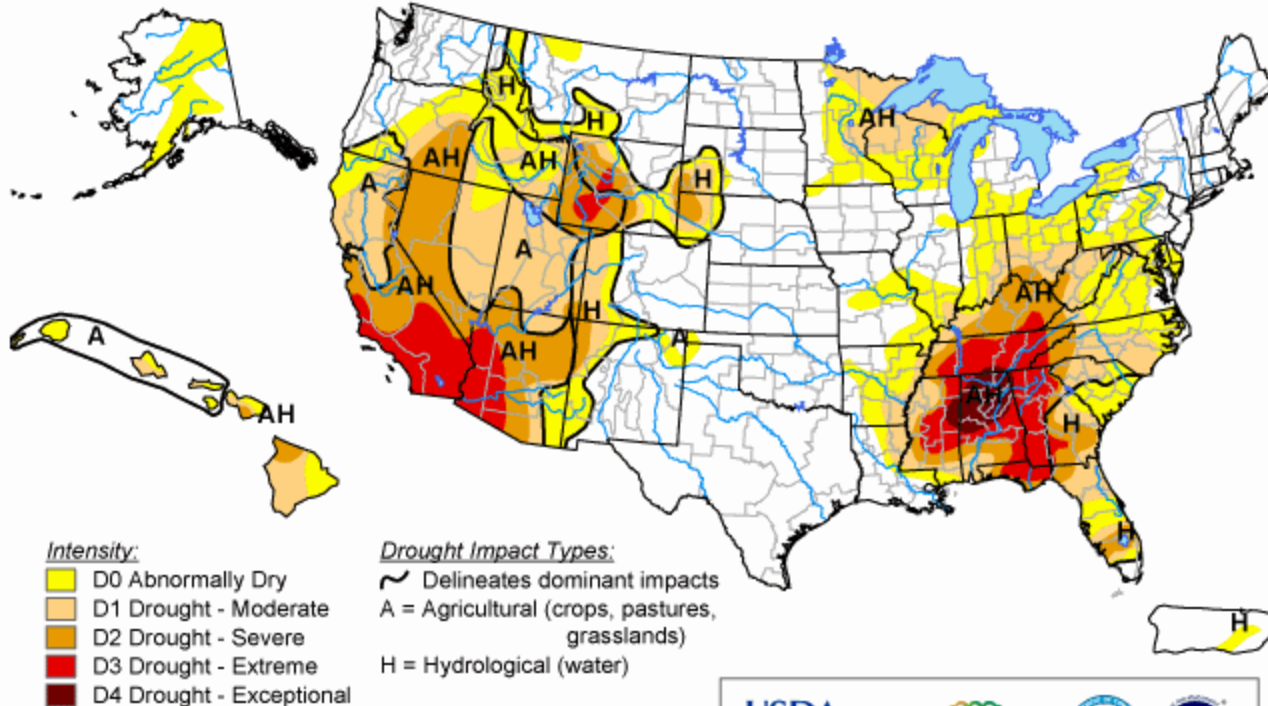
Note: Restrictions and treatment requirements are not county wide as depicted by county level shading.



Where & When You Want It?

U.S. Drought Monitor

June 26, 2007
Valid 8 a.m. EDT



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

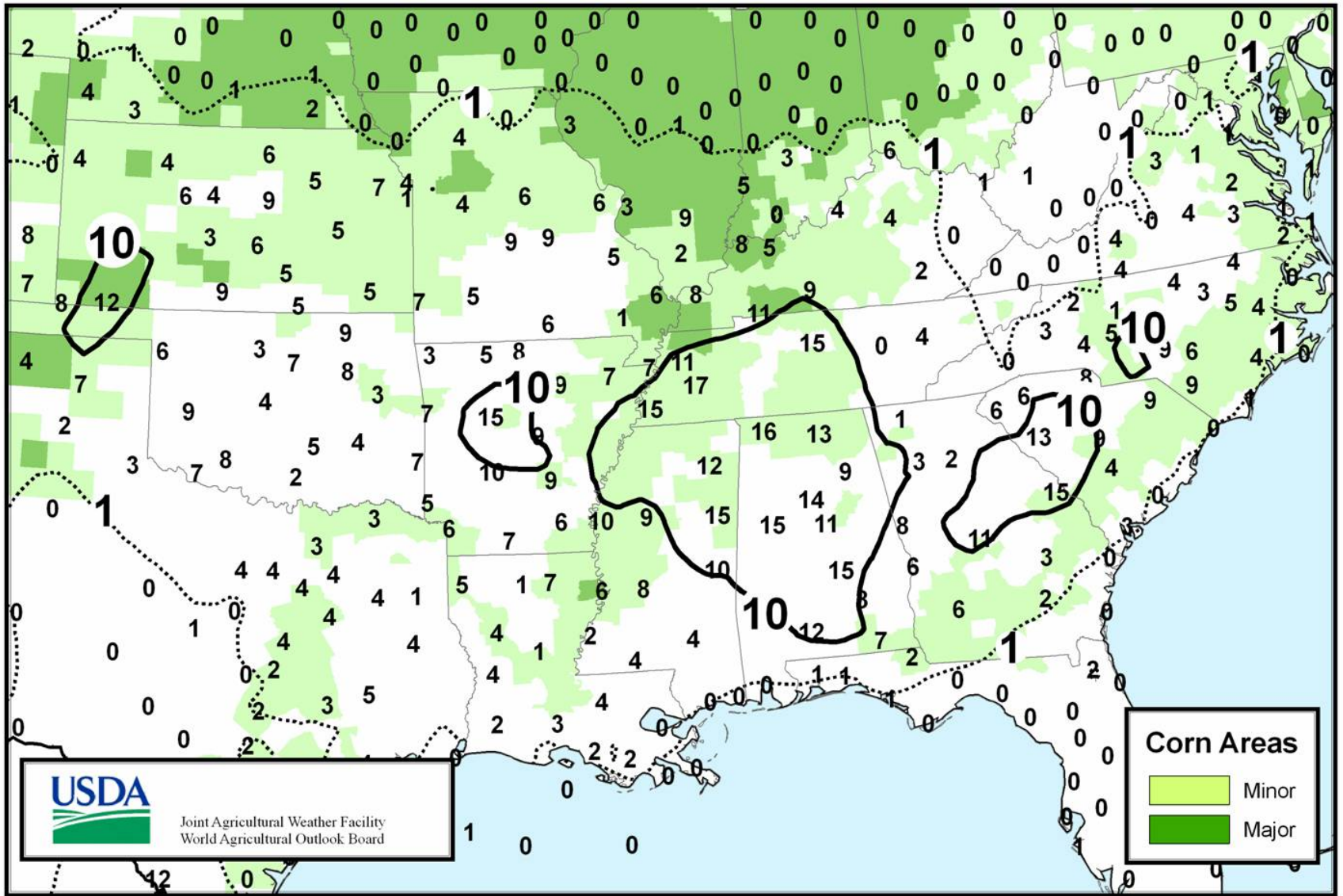
<http://drought.unl.edu/dm>



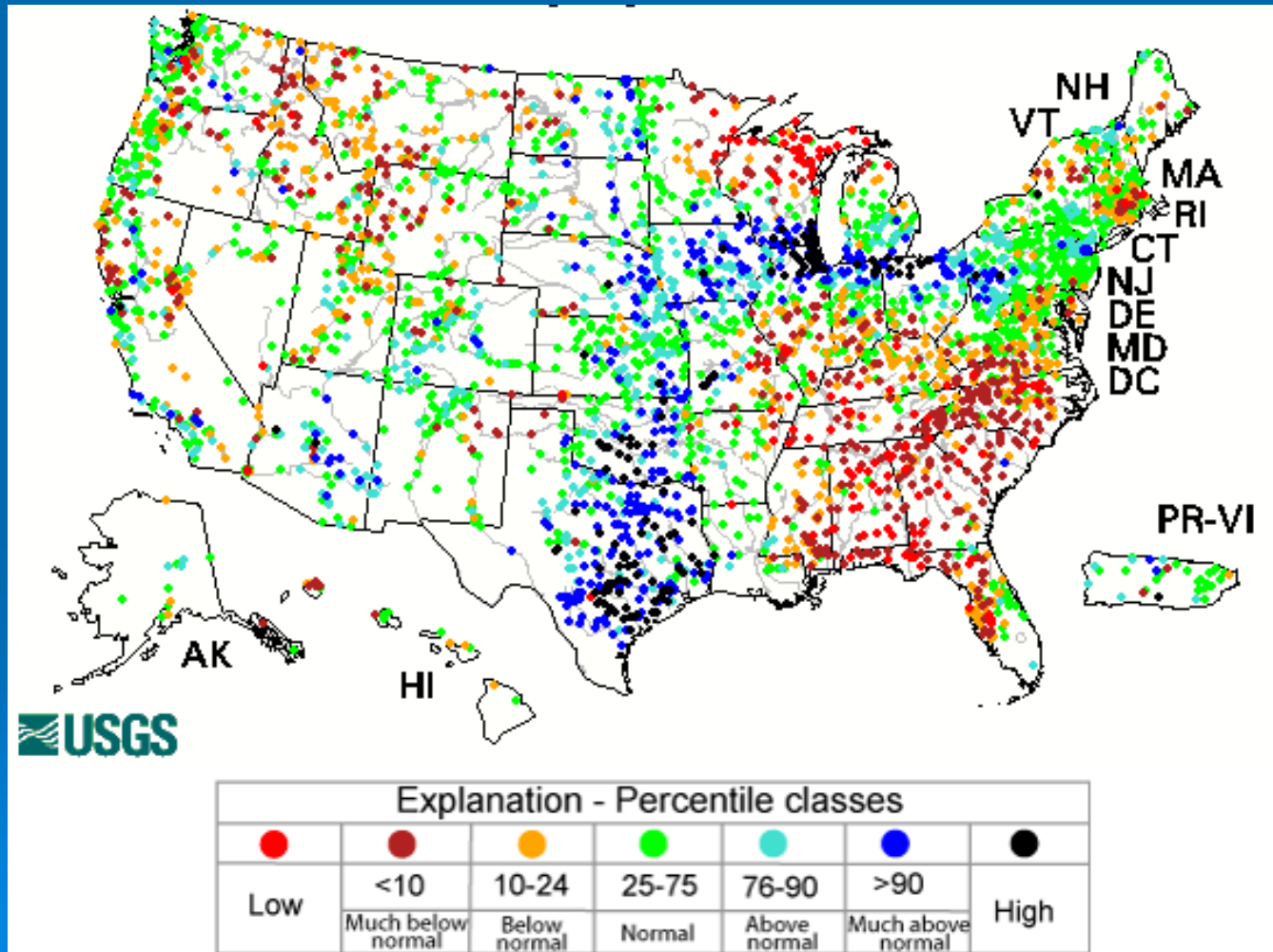
Released Thursday, June 28, 2007
Author: Douglas Le Comte, CPC/NOAA

Number of Days 100°F or Greater

August 1-27, 2007

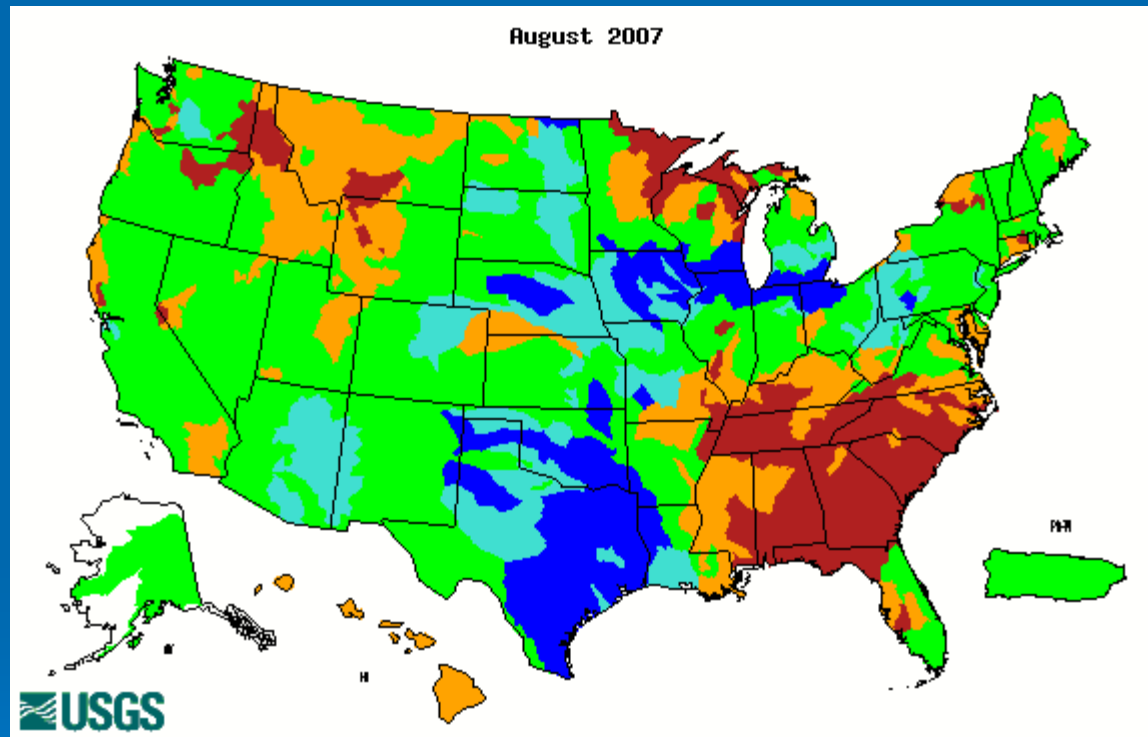


Average Stream Flow during August 1-27, 2007



Where & When You Want It?

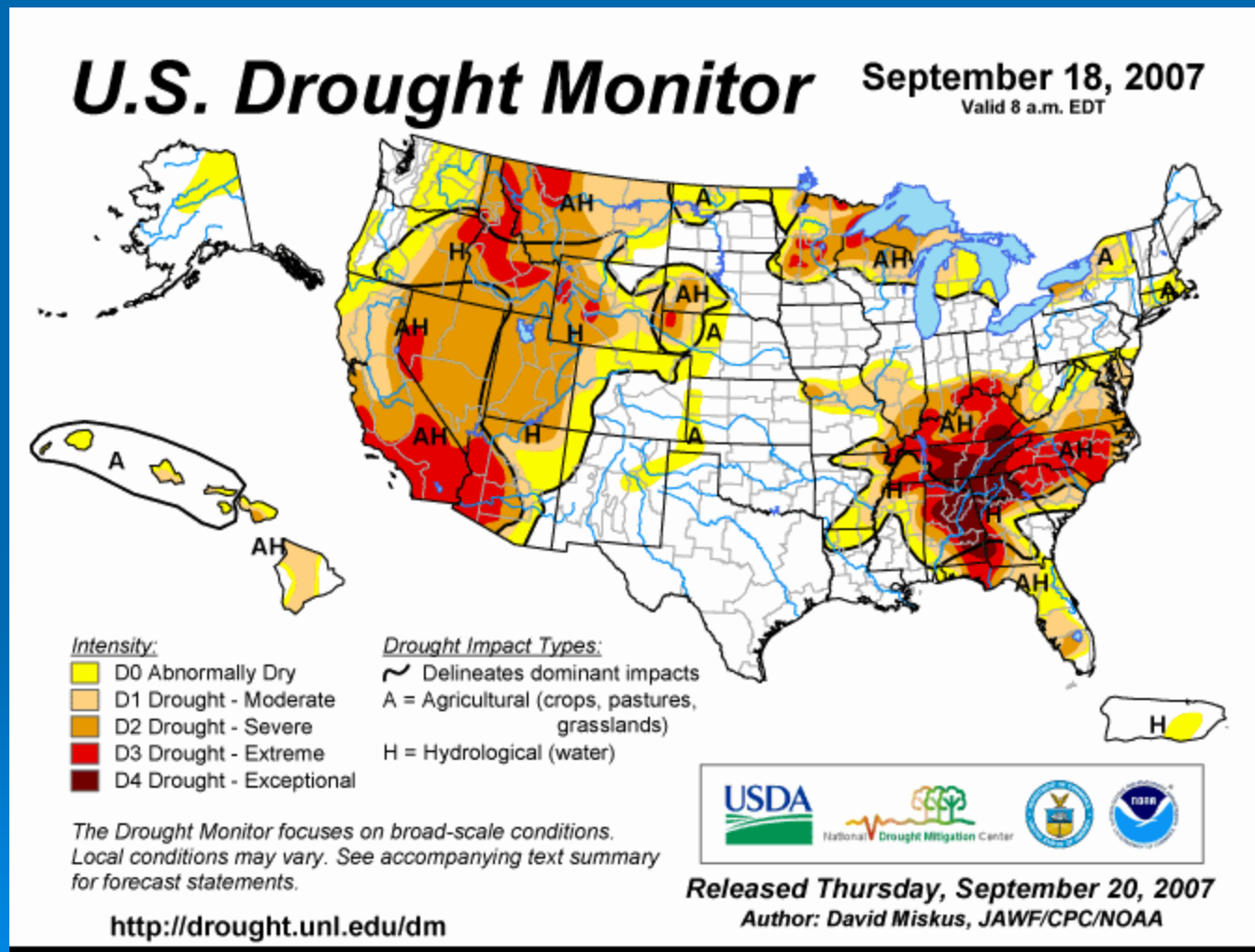
Monthly Average Stream Flow



Explanation - Percentile classes								
Low	<10	10-24	25-75	76-90	>90	High	No Data	
	Much below normal	Below normal	Normal	Above normal	Much above normal			

Where & When You Want It?

Part Deux



Statewide Precipitation Ranks for Tennessee , 2006-2007

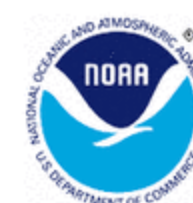
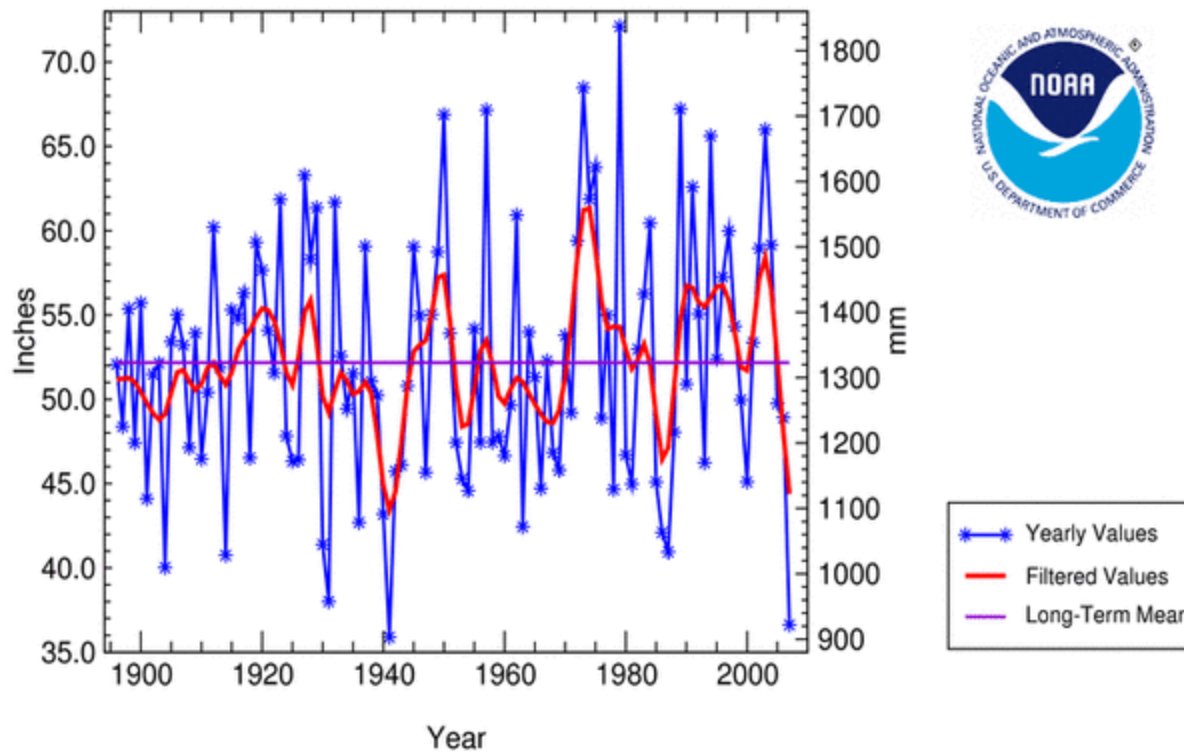
Period	Rank
Nov	<u>45th driest</u>
Oct-Nov	<u>32nd wettest, (82nd driest)</u>
Sep-Nov	<u>48th wettest, (66th driest)</u>
Aug-Nov	<u>37th driest</u>
Jul-Nov	<u>28th driest</u>
Jun-Nov	<u>24th driest</u>
May-Nov	<u>9th driest</u>
Apr-Nov	<u>8th driest</u>
Mar-Nov	<u>2nd driest</u>
Feb-Nov	<u>1st driest</u>
Jan-Nov	<u>2nd driest</u>
Dec-Nov	<u>2nd driest</u>

Source: National Climatic Data Center/NESDIS/NOAA.

<http://www.ncdc.noaa.gov/oa/climate/research/prelim/drought/st040dv00pcp.html>

When You Need It?

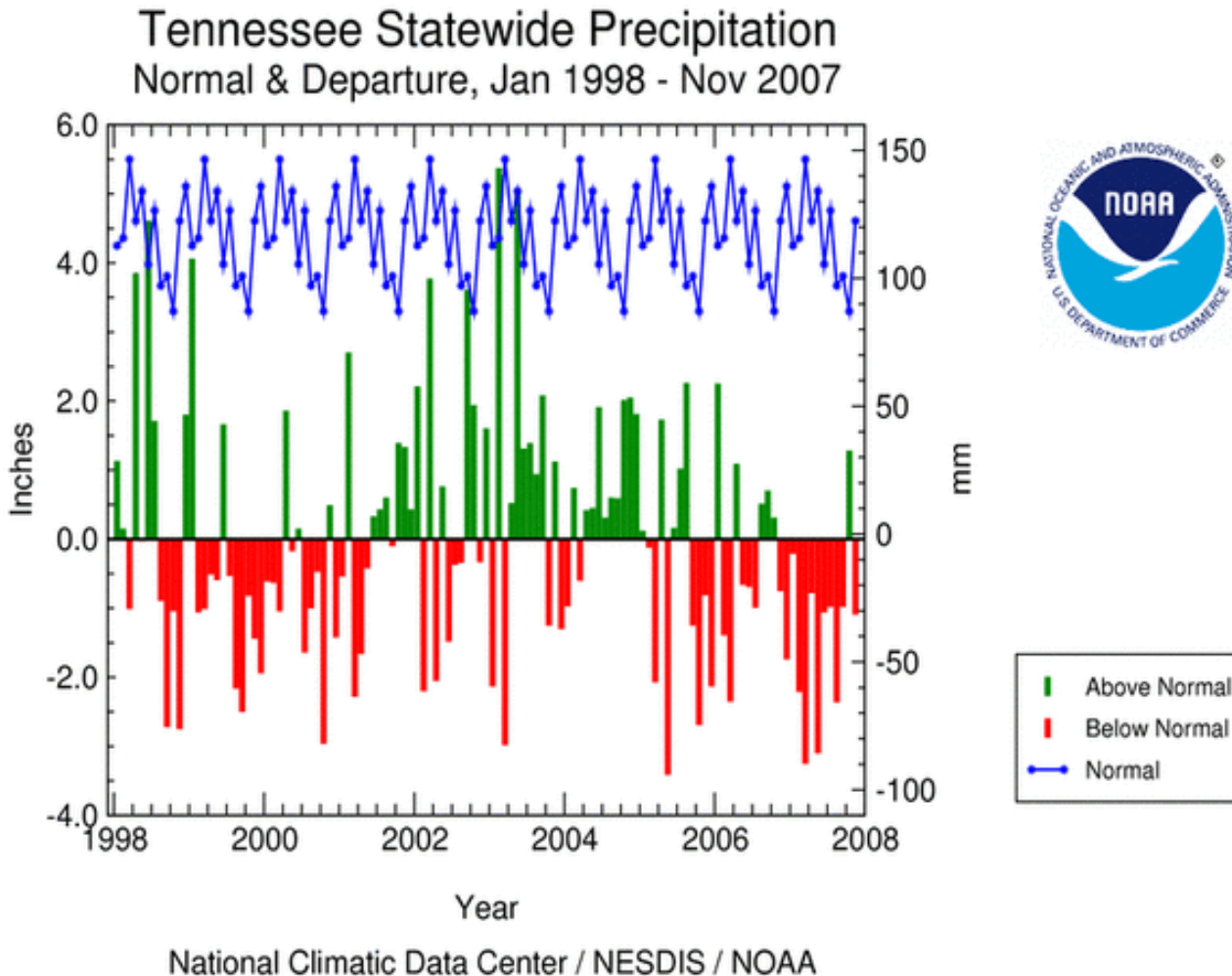
Tennessee Statewide Precipitation
December - November, 1895 - 2007



National Climatic Data Center / NESDIS / NOAA



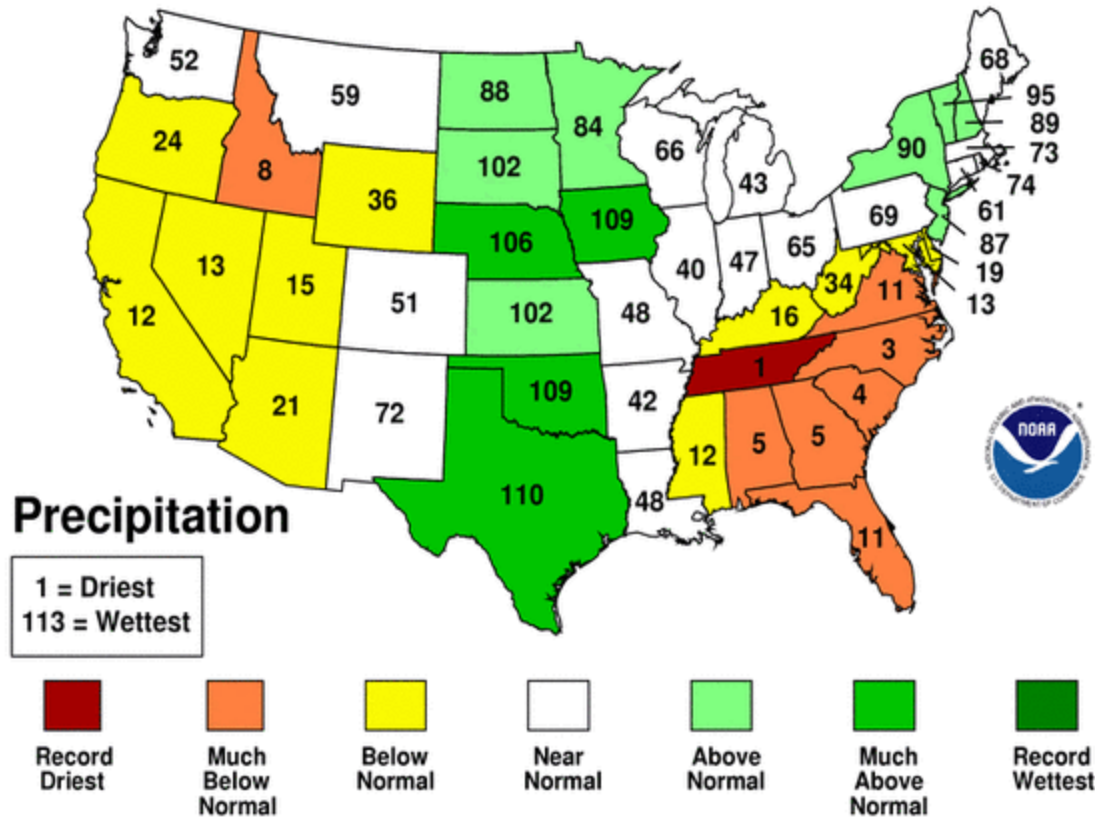
When You Need It?



Where & When You Want It?

January-October 2007 Statewide Ranks

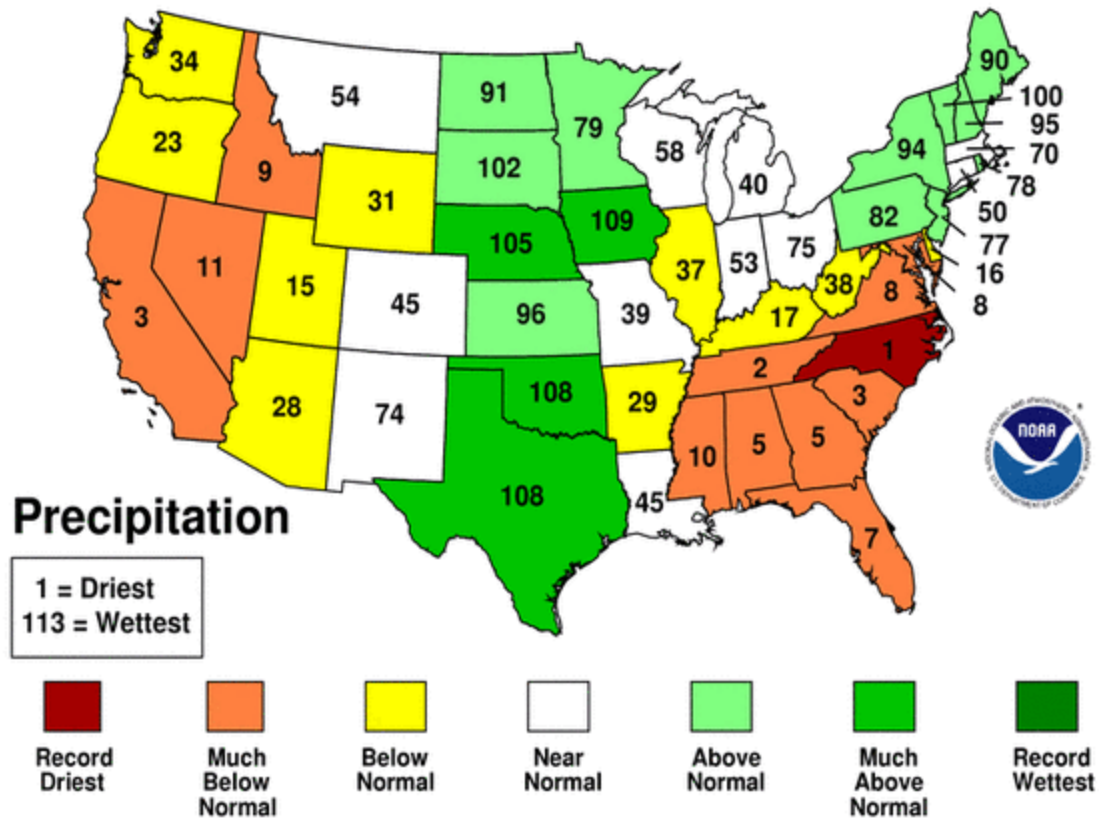
National Climatic Data Center/NESDIS/NOAA



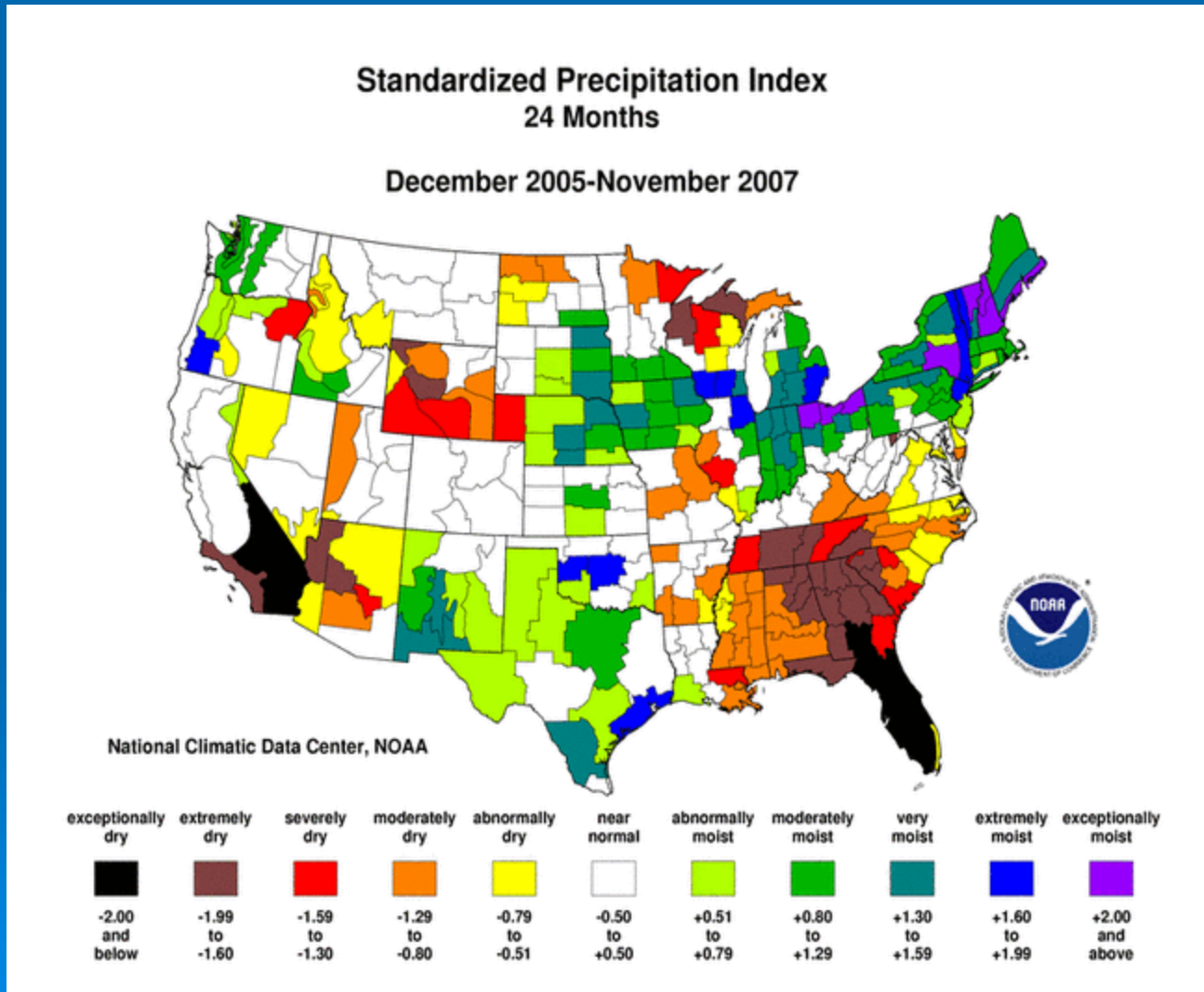
Where & When You Want It?

January-November 2007 Statewide Ranks

National Climatic Data Center/NESDIS/NOAA



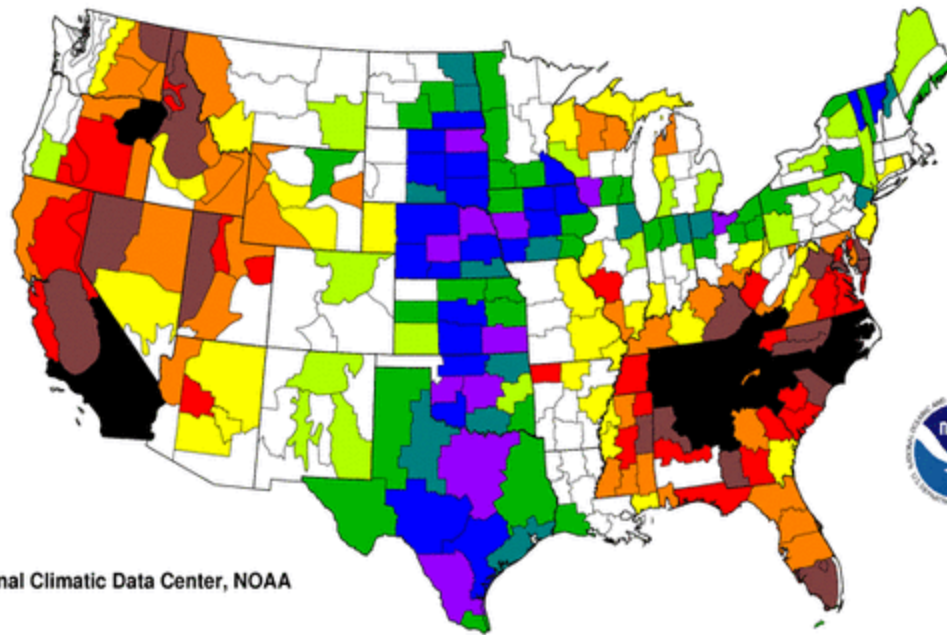
Where & When You Want It?



Where & When You Want It?

Standardized Precipitation Index Twelve Months

December 2006-November 2007



National Climatic Data Center, NOAA

exceptionally dry	extremely dry	severely dry	moderately dry	abnormally dry	near normal	abnormally moist	moderately moist	very moist	extremely moist	exceptionally moist
black	dark brown	red	orange	yellow	white	light green	green	teal	blue	purple
-2.00 to below	-1.99 to -1.60	-1.59 to -1.30	-1.29 to -0.80	-0.79 to -0.51	-0.50 to +0.50	+0.51 to +0.79	+0.80 to +1.29	+1.30 to +1.59	+1.60 to +1.99	+2.00 to above

Where You Need It?

Orme, Tennessee, November 08, 2007

Orme Mayor Tony Reames makes one of his regular trips to check the filtration, pump and tank system in Orme, Tennessee, November 8, 2007. A small town tucked away in the mountains of southern Tennessee is getting by on just a few hours of water a day because its spring has run dry in the drought sweeping the U.S. Southeast.

Source: Montreal Gazette



“There is only so much water on this mountain.”

Crossville city attorney Lanny Colvard

- Crossville, the county seat of Cumberland County, the 5th fastest-growing county in Tennessee, faces conflict with its neighbors as it seeks to provide for its own future water needs. Its city council recently approved a plan to restrict further expansions by other utility districts that purchase city water. Worried that its own sources of supply are barely adequate for anticipated needs, Crossville officials are seeking to limit the ability of neighbors to tap into local reservoirs. Meanwhile, Cumberland County has sought help in the form of a \$5 million federal grant to develop a regional pilot program and feasibility study of various water supply options and implement a long-term solution.
- Crossville has been pinning hopes for additional water on a dam to be constructed on the Caney Fork River. As of this writing, there appears little chance that a permit will be issued for such a project due, in part, to environmental opposition. Enlargement of the city’s current Meadow park Lake Dam is another option being explored in lieu of the Caney Fork proposal. While the ultimate choice of water supply alternative remains uncertain, it appears likely that some combination of pumping water uphill from TVA’s Watts Bar Reservoir on the Tennessee River, storing rainwater in new lakes and ponds, or building new dams on nearby creeks and streams may be adopted.

Source: Research Needs for Protecting Tennessee’s Water Supply: A Baseline for Continued Policy Development (Feldman & Albertson 2003).

Dealing with Stored Water Droughts

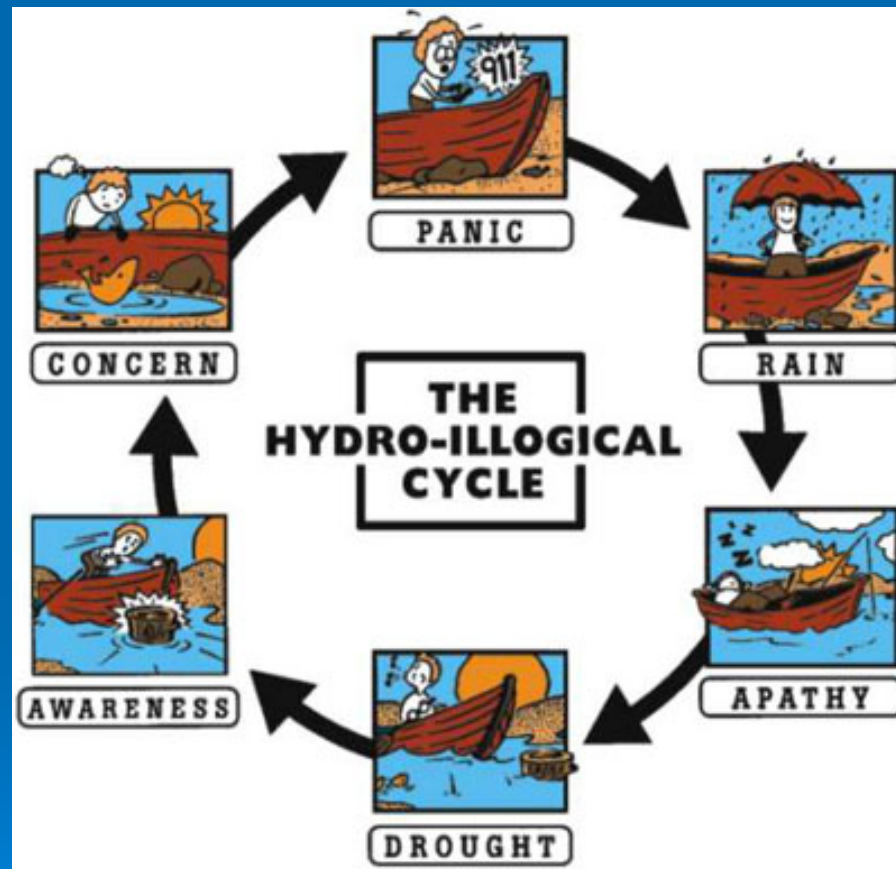
No one can tell when it will rain enough to reverse this trend, so water deliveries have to be reduced, *but to whom first and by how much?*

- There may be a conflict between fairness and good economic policy in making water allocations.
- The newest water uses may generate more income and tax revenue than the oldest established uses.

Such conflicts are normally resolved on a case-by-case basis.

Source: National Drought Policy Commission Report (2000).

The Hydro-illogical Cycle



Source: National Drought Mitigation Center, University of Nebraska, Lincoln, Nebraska, USA.

Water Resource Policy

Challenges

➤ Needs of Tennessee residents

- Domestic consumption
- Recreation
- Power generation

➤ Needs of Business and Industry

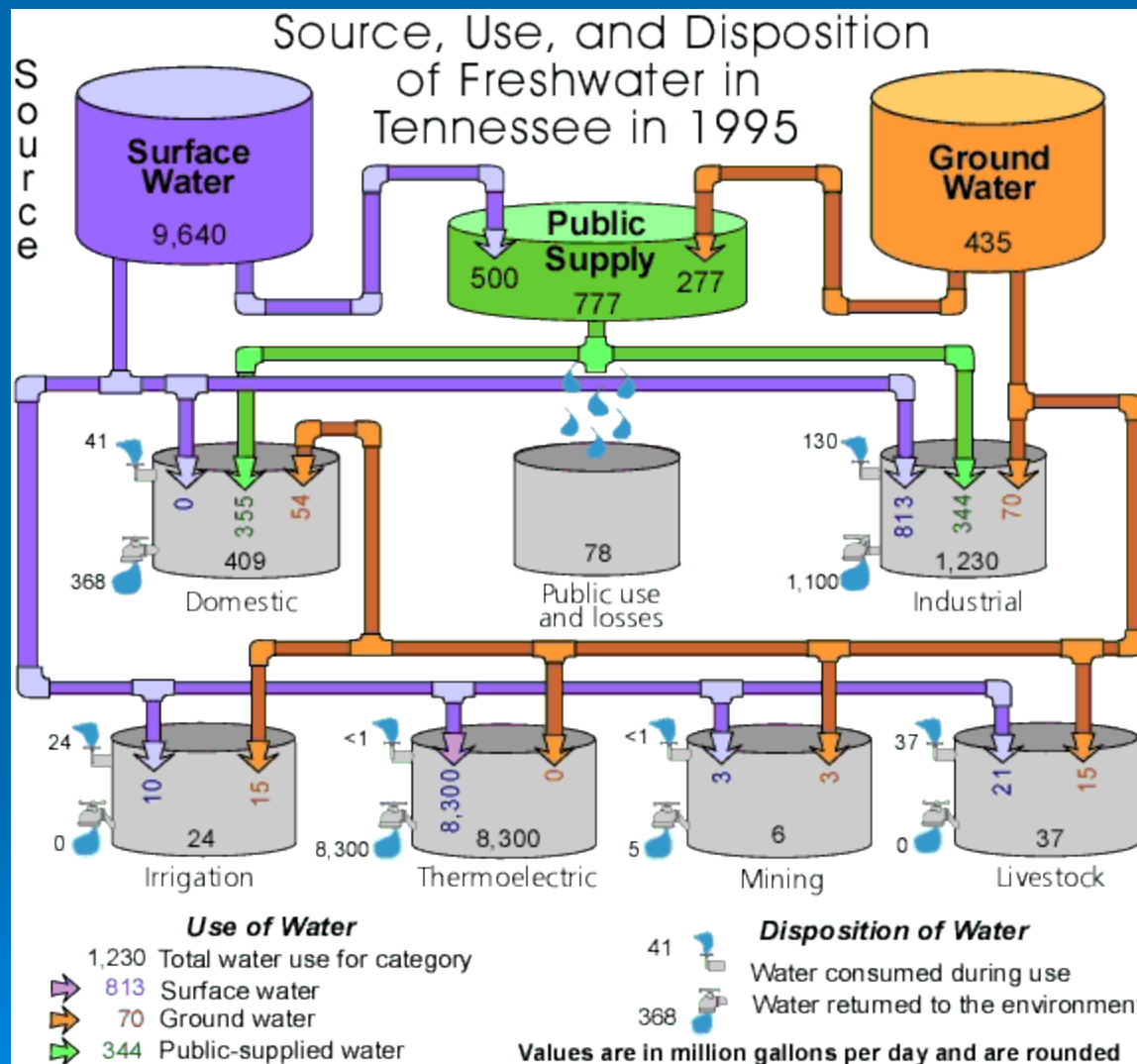
- Consumption
- Navigation
- Power generation

➤ Demands in other states that share watersheds

Managing competing interests!

Source, Use, and Disposition of Water in Tennessee in 1995

Total of 10.1 billion gallons per day.



Source: U.S. Geological Survey and the Tennessee Department of Environment and Conservation. <http://tn.water.usgs.gov/wustates/tn/summarypipes.html>

Normandy Dam

TVA's Duck River "Balancing Act"



Normandy Reservoir is located on the Duck River in south central Tennessee. The 17-mile-long reservoir was completed in the 1970s to aid in the economic development of the upper Duck River region.

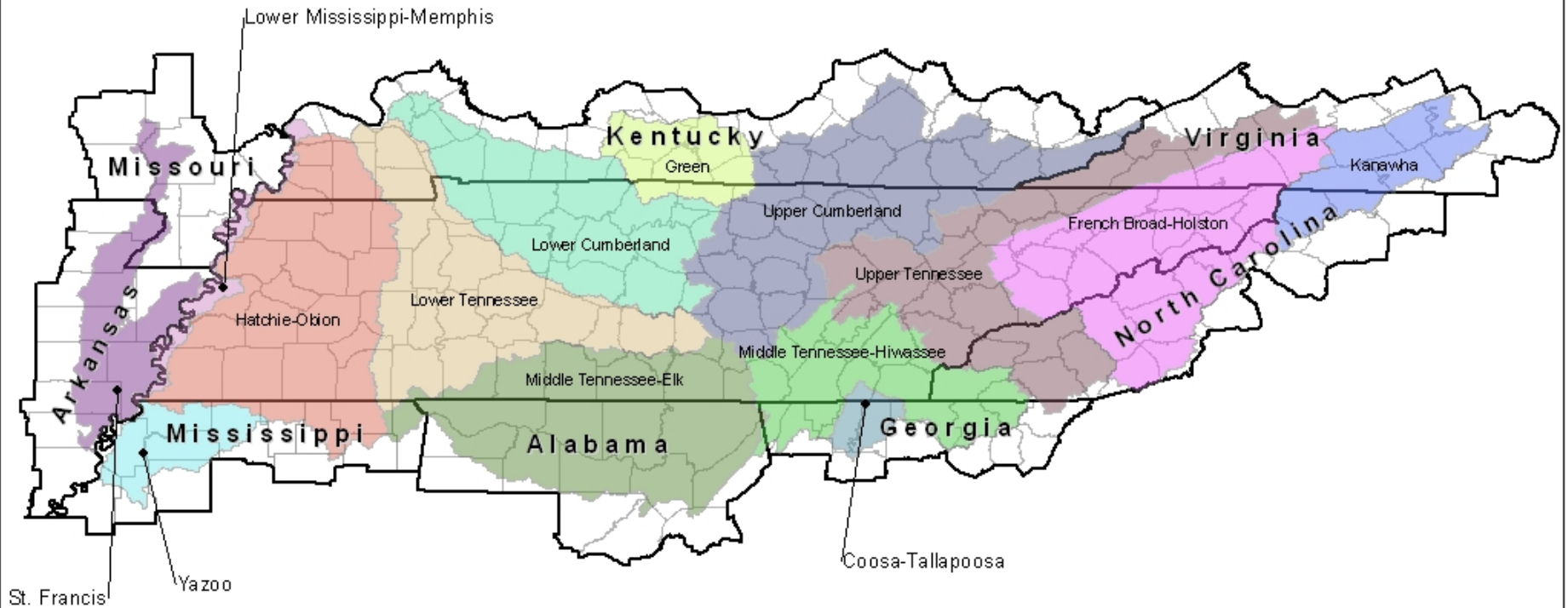
Source: TVA, <http://www.tva.gov/sites/normandy.htm>.

Water Disputes in the Southeast and Their Impact on Tennessee

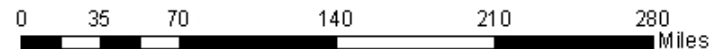
- *Growing competition by different users over the same surface and groundwater supplies is increasingly taking the form of “up” versus “downstream” use and dependence on water supply sources that extend over several jurisdictions and even states.*
- *Land use changes, population growth, rapid urbanization, and regional climate variation are imposing new, largely unanticipated pressures on the region’s water and reveal the impossibility of separating, and discretely managing, water supply and water quality.*
- *Protecting local water supplies and keeping them safe, clean, and available—while promoting economic growth—are proving to be difficult-to-reconcile goals in rapidly growing metropolitan areas and smaller communities that seek to broaden their tax base and economically diversify.*

Source: Research Needs for Protecting Tennessee’s Water Supply: A Baseline for Continued Policy Development (Feldman & Albertson 2003).

Tennessee's Water Basins and Sharing States



TACIR

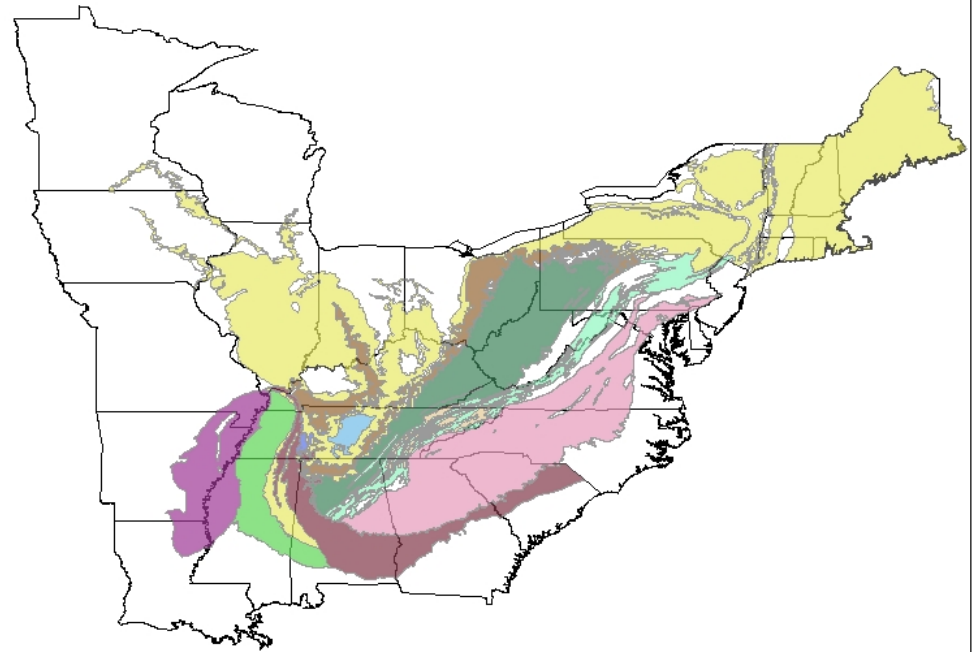


Memphis and its Light, Gas & Water Division have been sued by the state of Mississippi. The lawsuit was filed in the U.S. Federal District in Oxford in February 2005. (The trial has been rescheduled for early next year according to the Commercial Appeal.)












Mississippi claims that one-third of the water Memphis pumps—about 60 million gallons a day—comes from south of the state line. This water is "unreasonably and unlawfully diverted," causing harm to the aquifer, it says.

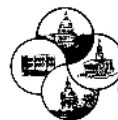
Source: *U.S. Water News Online.*

Shared Aquifers of Tennessee and Other States 2007



Legend

- | | |
|---|--|
|  Mississippi River Valley alluvial aquifer |  Piedmont and Blue Ridge crystalline-rock aquifers |
|  Mississippi embayment aquifer system |  Silurian-Devonian aquifers |
|  Mississippian aquifers |  Southeastern Coastal Plain aquifer system |
|  Ordovician aquifers |  Valley and Ridge aquifers |
|  Other rocks |  Valley and Ridge carbonate-rock aquifers |
|  Pennsylvanian aquifers | |



TACIR



0 115 230 460 690 920 Miles

Managing Water Resources

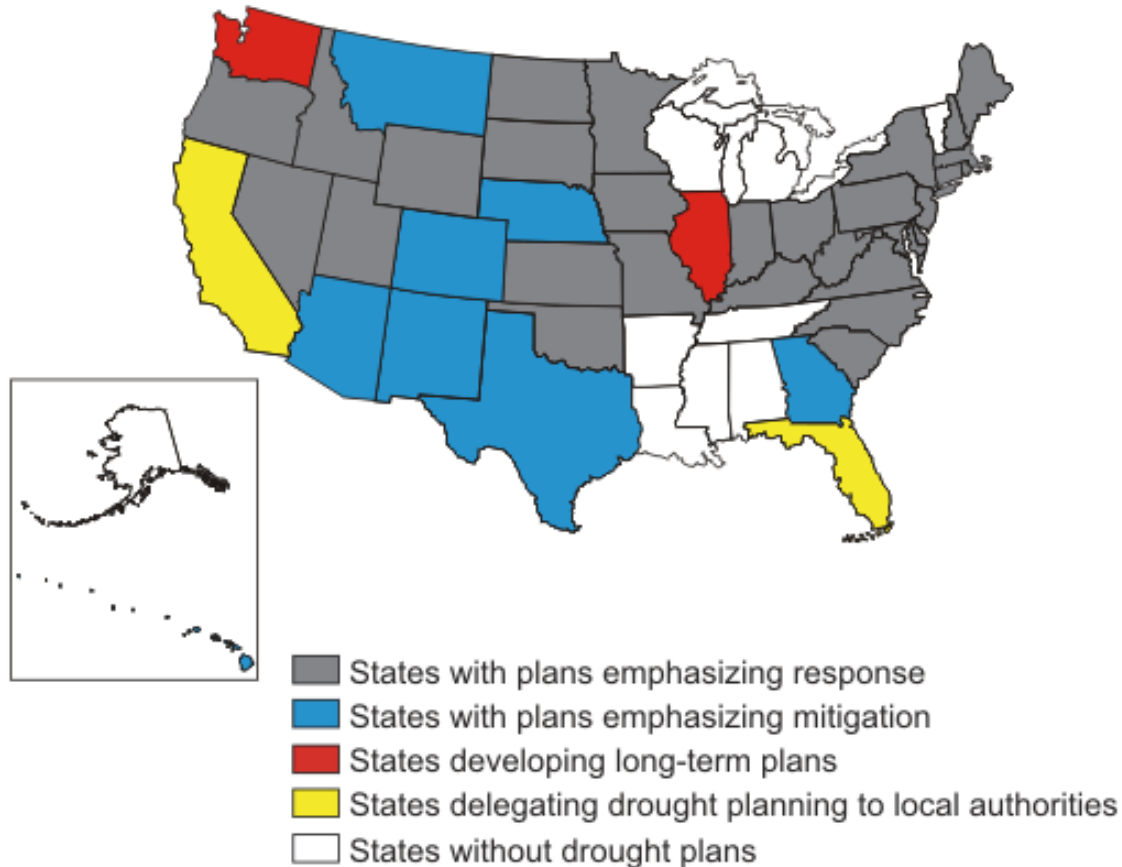
Complicating Factors

- Interests within and between states compete more and more for the same resource as we grow and develop
- State boundaries don't recognize watersheds
- Watersheds don't recognize state boundaries
- The weather doesn't always cooperate

“Development, management, and protection of water resources should be controlled by that level of government nearest the problem and most capable of effectively representing the vital interest involved.”

National Water Commission, 1973.

Status of Drought Planning October 2006



Source: National Drought Mitigation Center, University of Nebraska, Lincoln, Nebraska, USA.

“Conflict, unlike any
we’ve seen before,
may soon be
facing our nation.”

Colonel Byron Jorns

Water Wars: The Need for a National Water Policy

30 March 2007