

An aerial photograph of a dense forest with a dirt road winding through it. The trees are mostly green, but some show signs of autumn color change. The dirt road is a light brown color and curves through the lower right portion of the image. The overall scene is a lush, green forest landscape.

Drought Mortality Assessment

Chris Edgar

Texas Forest Service

February 8, 2012

“The date of the onset of the 2011 drought can be stated with remarkable precision: September 27, 2010. On that date a storm system bringing widespread rain to Texas left the state. Though it could not be known at the time, twelve of the next thirteen months would bring below-normal precipitation to Texas.”

John W. Nielsen-Gammon
Texas State Climatologist
The 2011 Texas Drought
A Briefing Packet for the Texas Legislature
October 31, 2011

		Ranges					
Category	Description	Possible Impacts	Palmer Drought Index	CPC Soil Moisture Model (Percentiles)	USGS Weekly Streamflow (Percentiles)	Standardized Precipitation Index (SPI)	Objective Short and Long-term Drought Indicator Blends (Percentiles)
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered	-1.0 to -1.9	21-30	21-30	-0.5 to -0.7	21-30
D1	Moderate Drought	Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent; voluntary water-use restrictions requested	-2.0 to -2.9	11-20	11-20	-0.8 to -1.2	11-20
D2	Severe Drought	Crop or pasture losses likely; water shortages common; water restrictions imposed	-3.0 to -3.9	6-10	6-10	-1.3 to -1.5	6-10
D3	Extreme Drought	Major crop/pasture losses; widespread water shortages or restrictions	-4.0 to -4.9	3-5	3-5	-1.6 to -1.9	3-5
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies	-5.0 or less	0-2	0-2	-2.0 or less	0-2

Drought Monitor

Drought Severity Classification

<http://droughtmonitor.unl.edu/classify.htm>

U.S. Drought Monitor

January 31, 2012

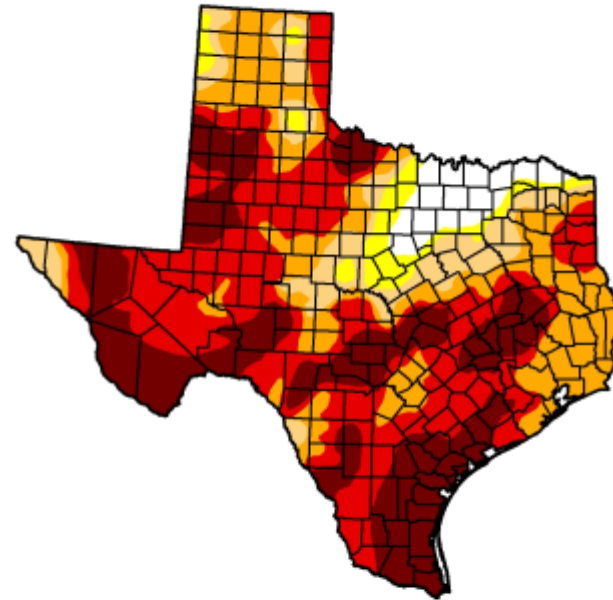
Valid 7 a.m. EST

Texas

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	4.93	95.07	90.66	80.78	59.79	27.36
Last Week (01/24/2012 map)	0.52	99.48	95.08	82.60	62.47	25.27
3 Months Ago (11/01/2011 map)	0.00	100.00	100.00	98.18	90.42	64.95
Start of Calendar Year (12/27/2011 map)	0.01	99.99	97.83	84.81	67.32	32.36
Start of Water Year (09/27/2011 map)	0.00	100.00	100.00	99.16	96.65	85.75
One Year Ago (01/25/2011 map)	19.47	80.53	53.00	31.56	8.66	0.00

Intensity:



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

<http://droughtmonitor.unl.edu>

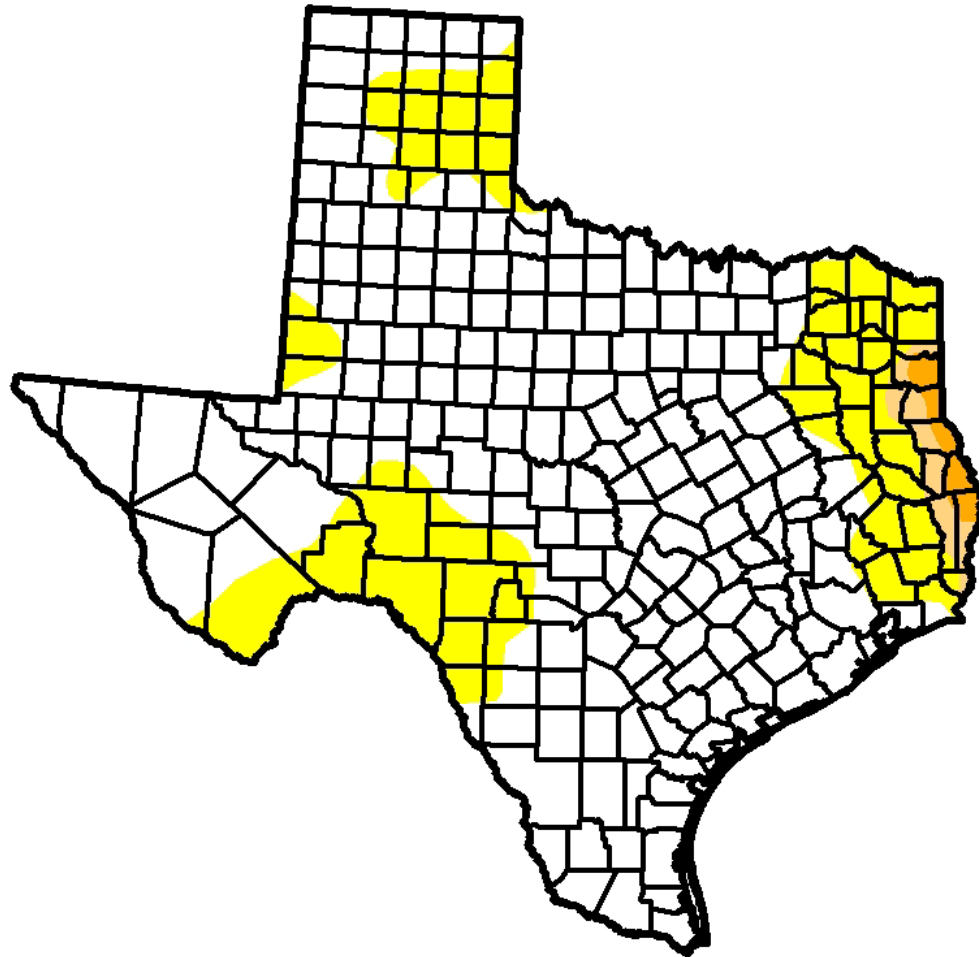


Released Thursday, February 2, 2012
Eric Luebehusen, USDA

Drought Monitor

A New map of latest conditions is released every Thursday

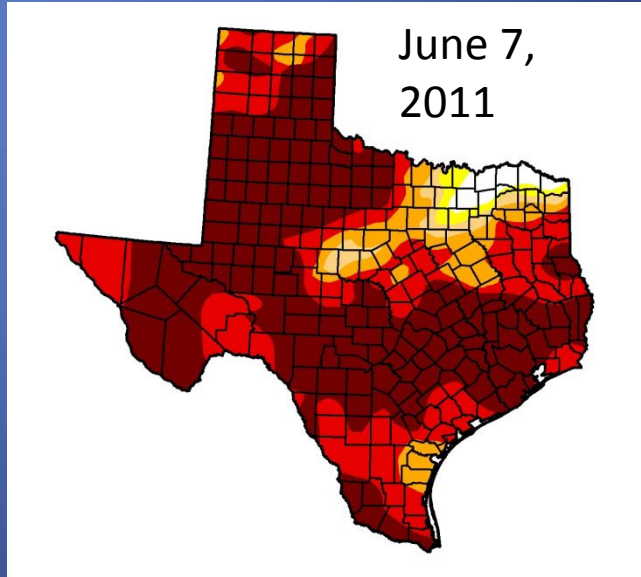
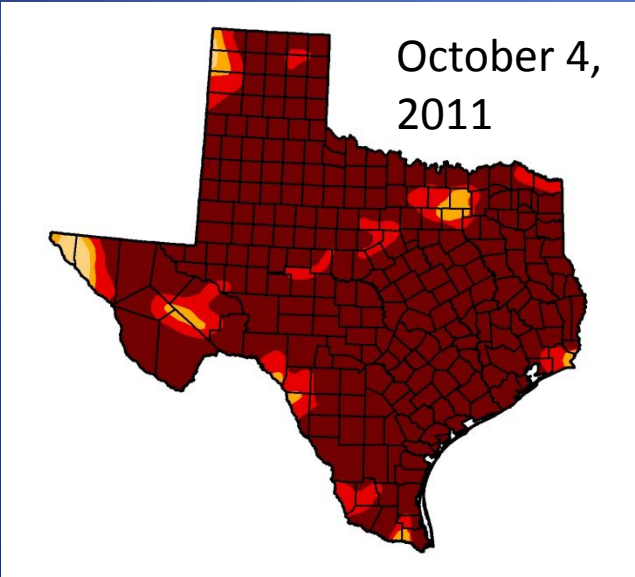
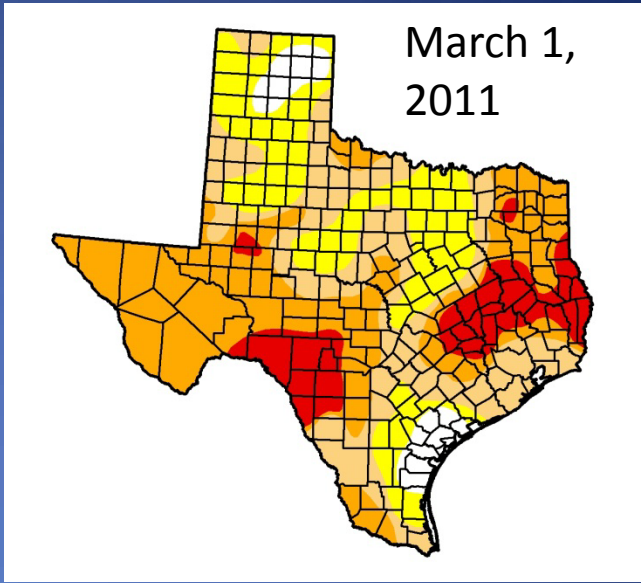
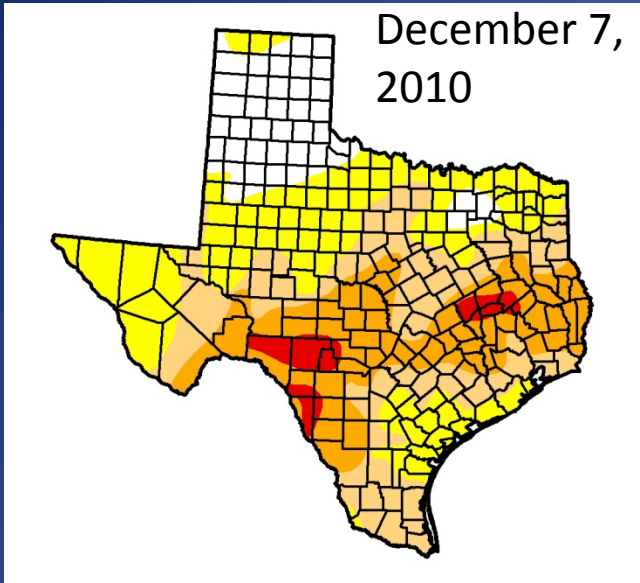
<http://droughtmonitor.unl.edu/monitor.html>

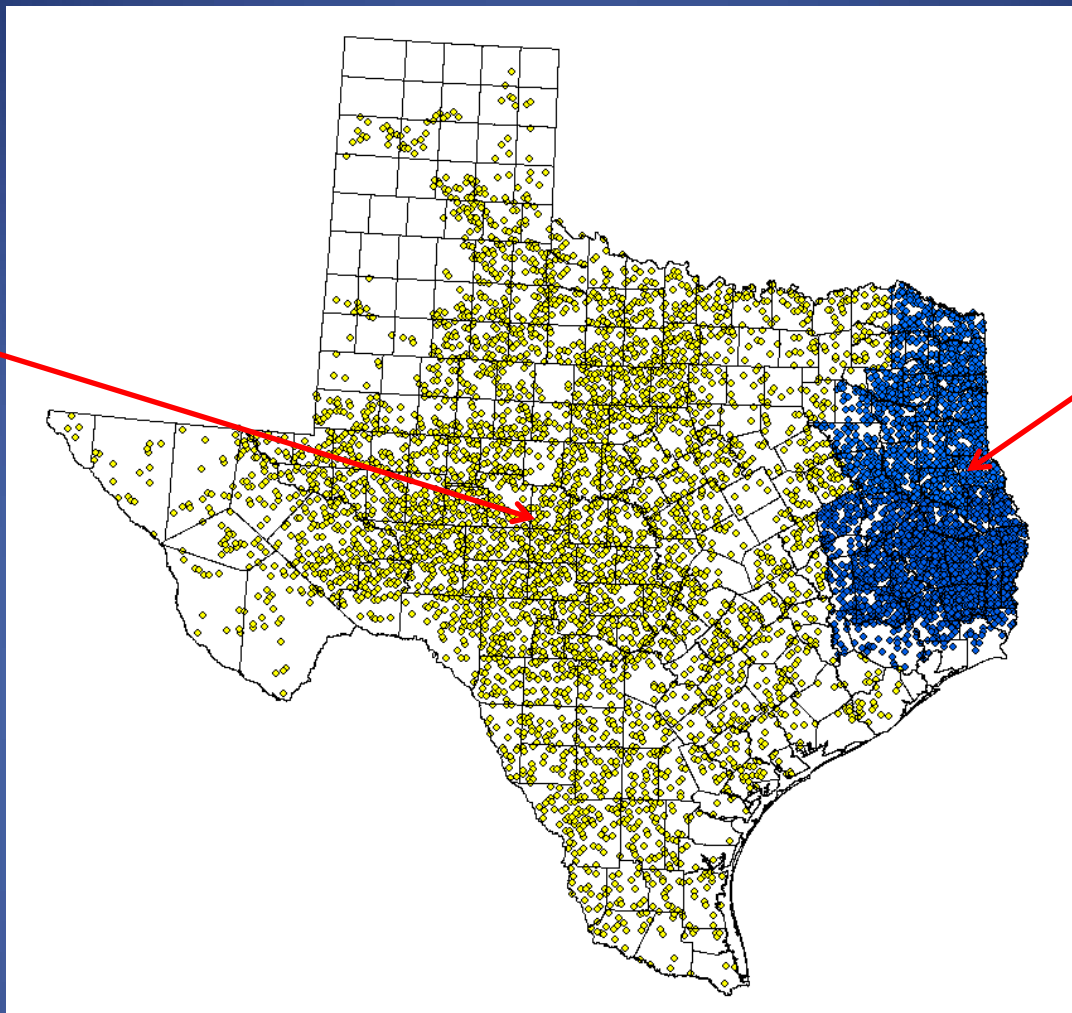


Drought Monitor for September 28, 2010

Conditions at the “onset” of the drought

<http://droughtmonitor.unl.edu/archive.html>





Central &
West Texas

4,305 forest
plots

East Texas

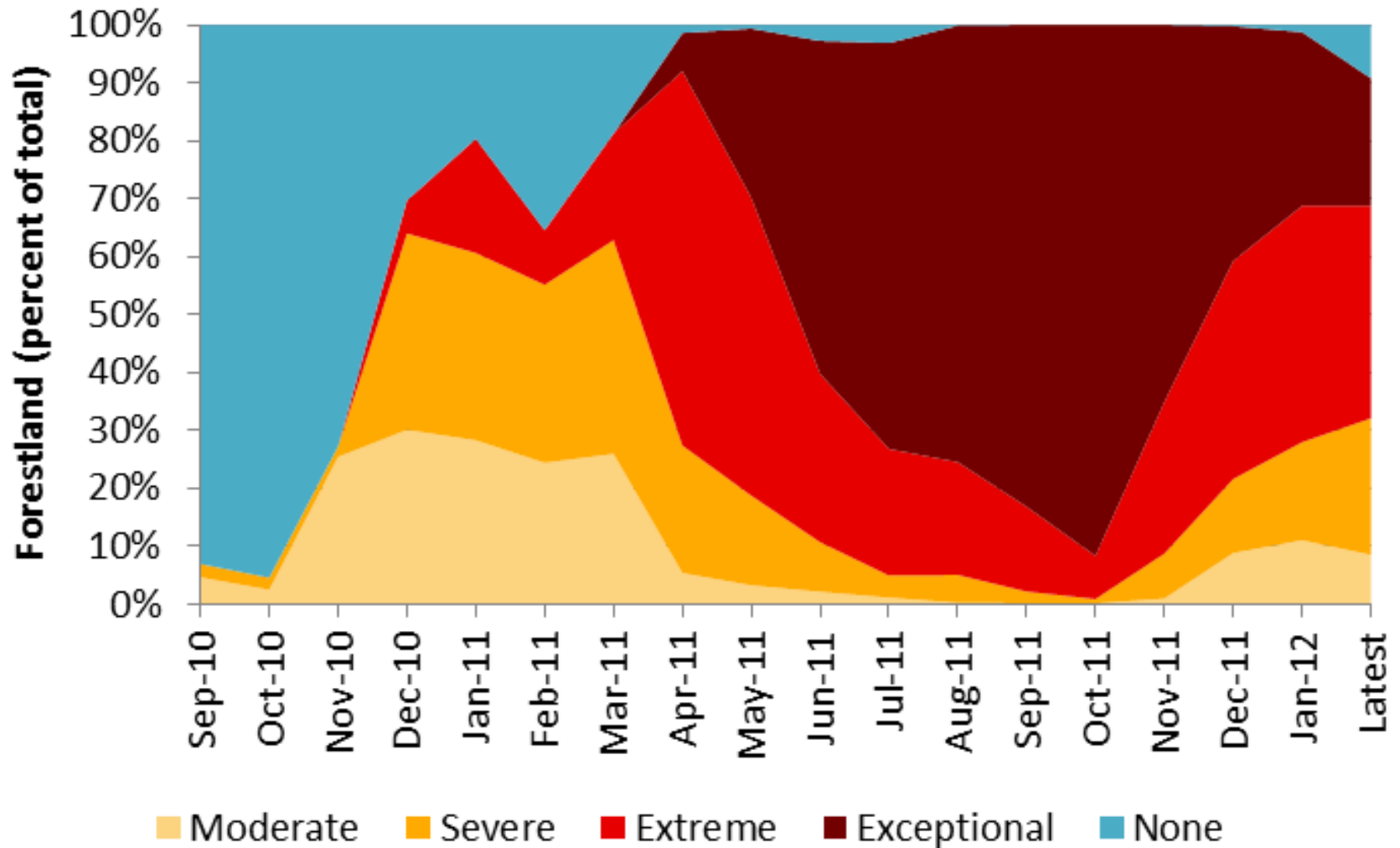
2,260 forest
plots

Forest Inventory and Analysis

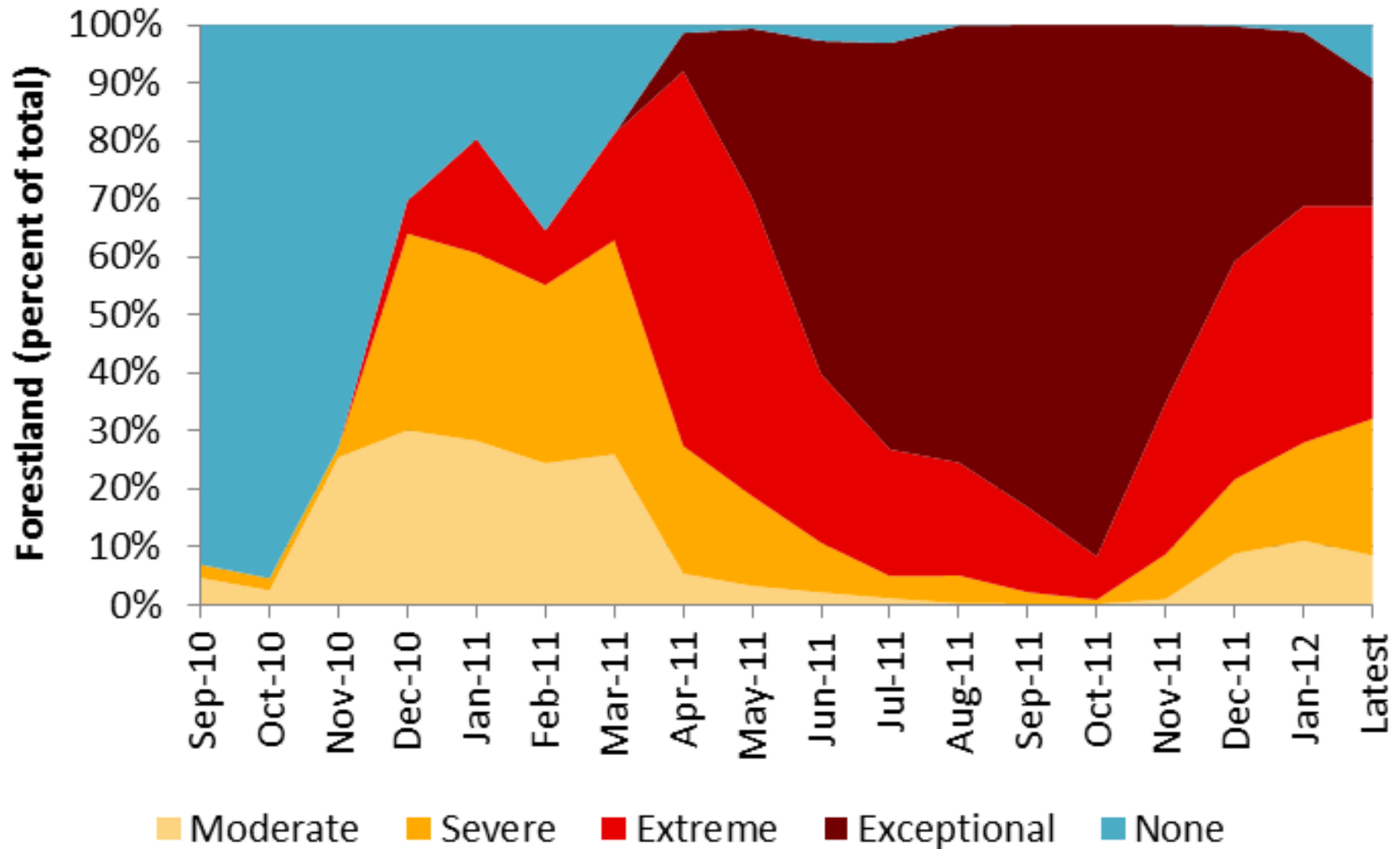
63 million acres of forestland in state

4.9 billion trees with at least 5" diameter on forestland

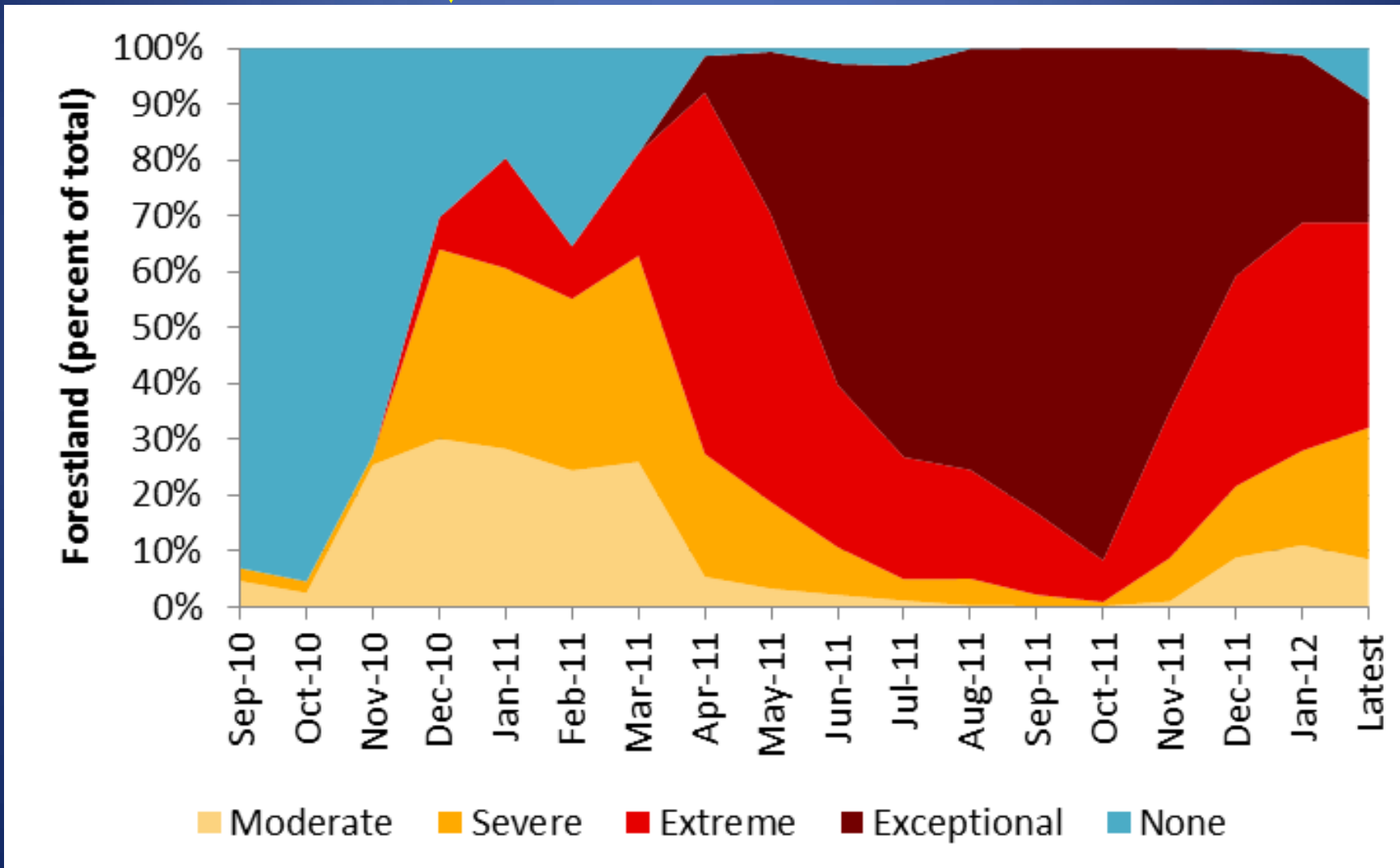
The onset of the drought in late September 2010



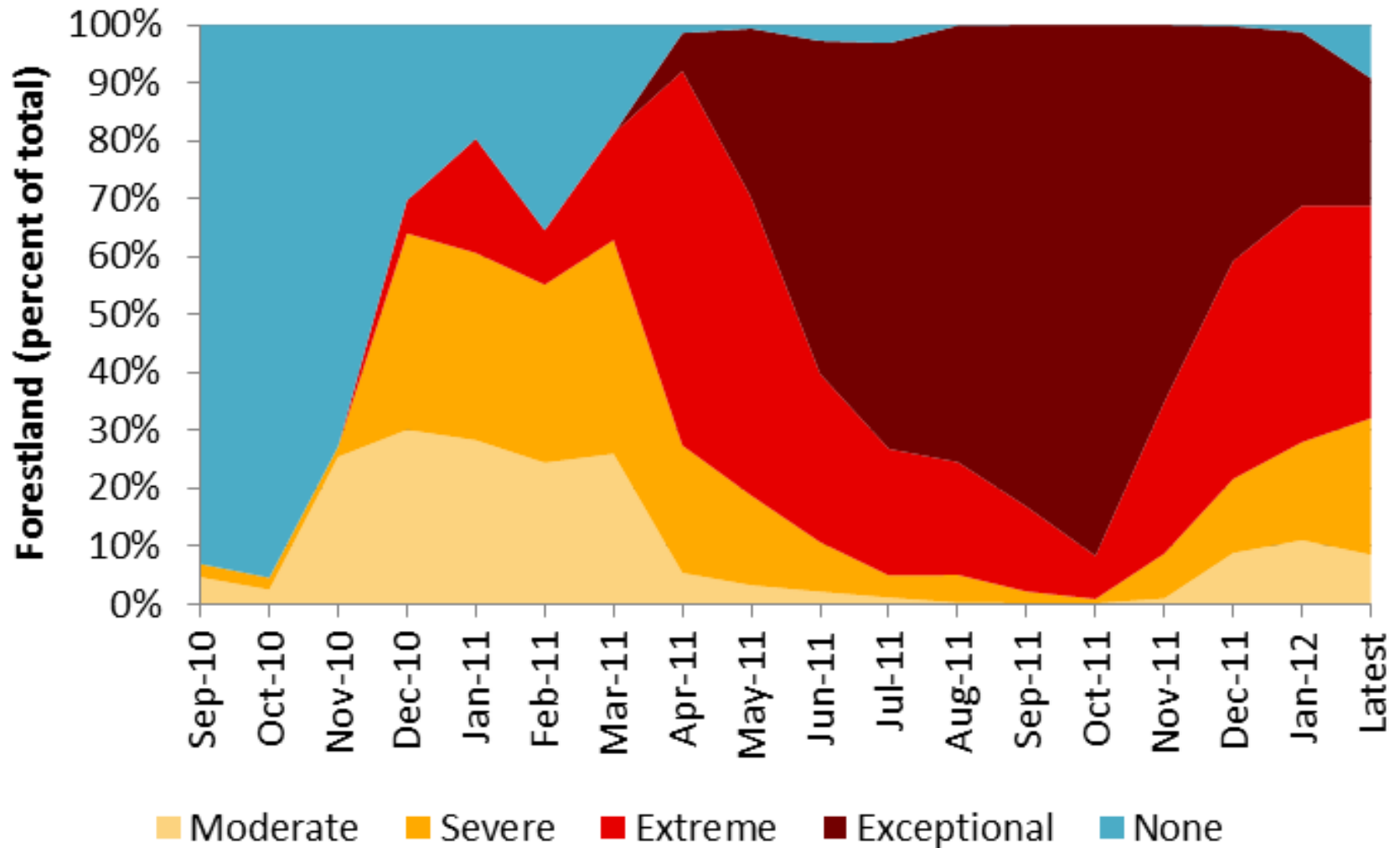
Moderate drought conditions spread to encompass more area of forest



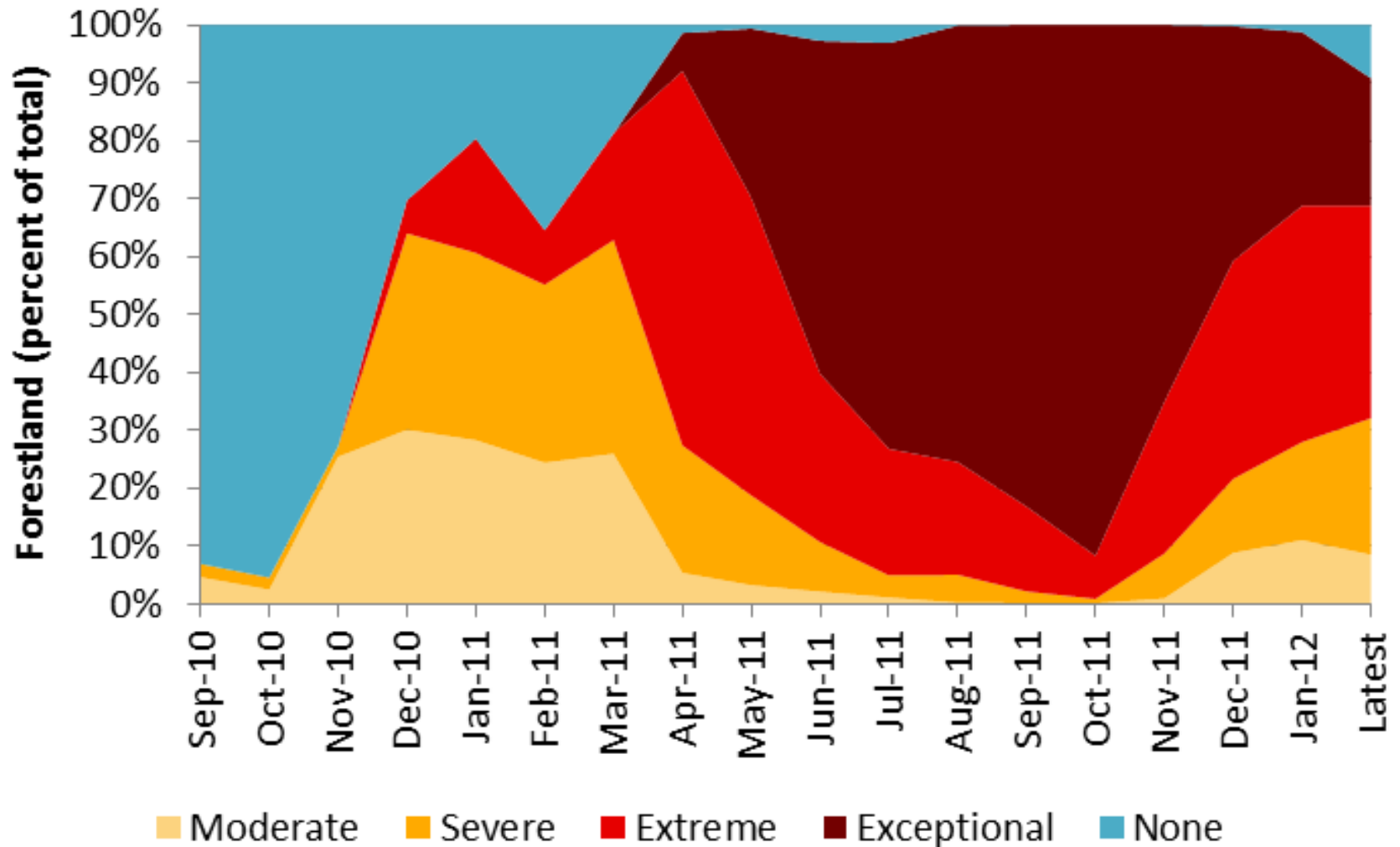
Extreme drought conditions begin to occur in forest areas



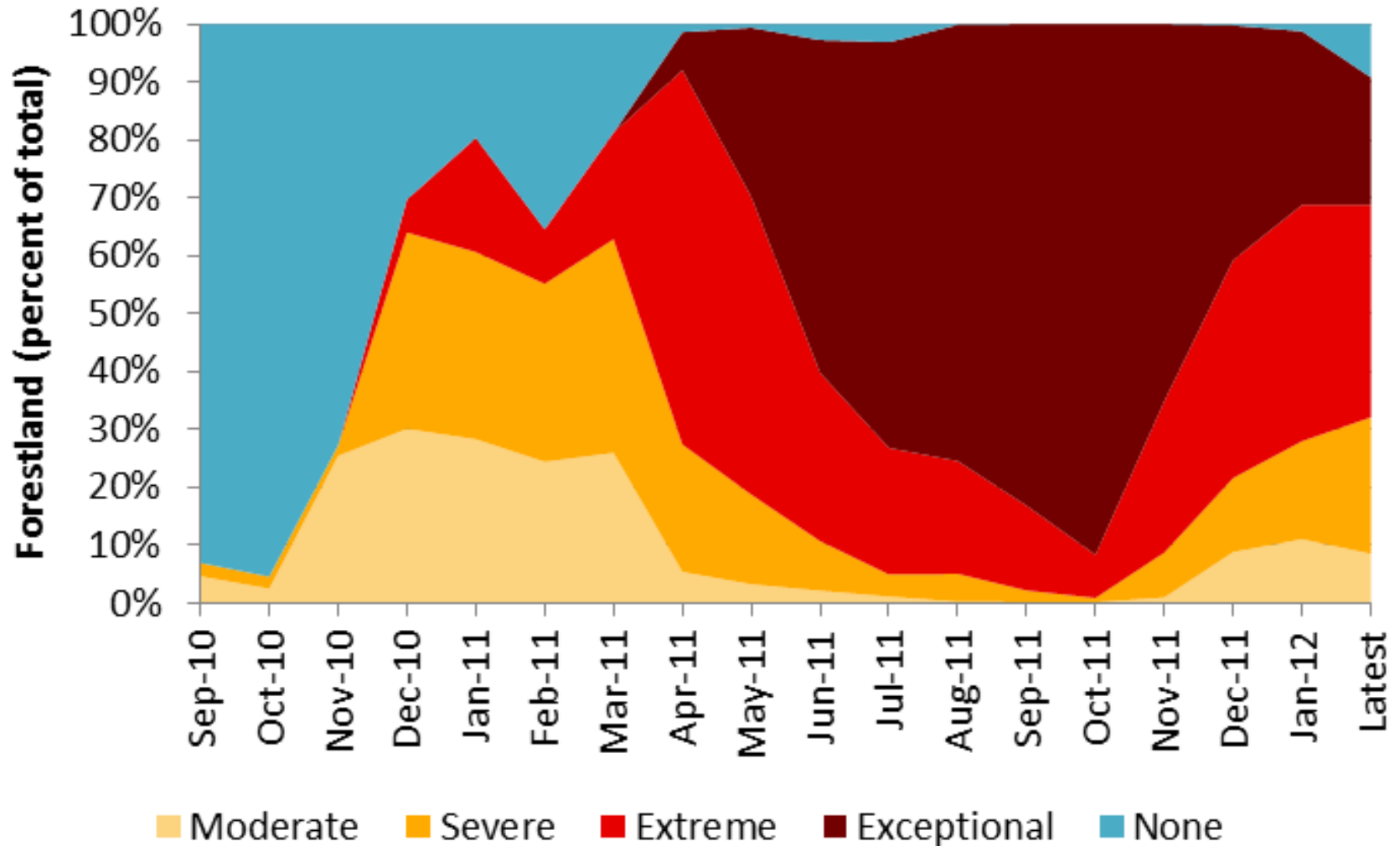
January precipitation slightly above normal



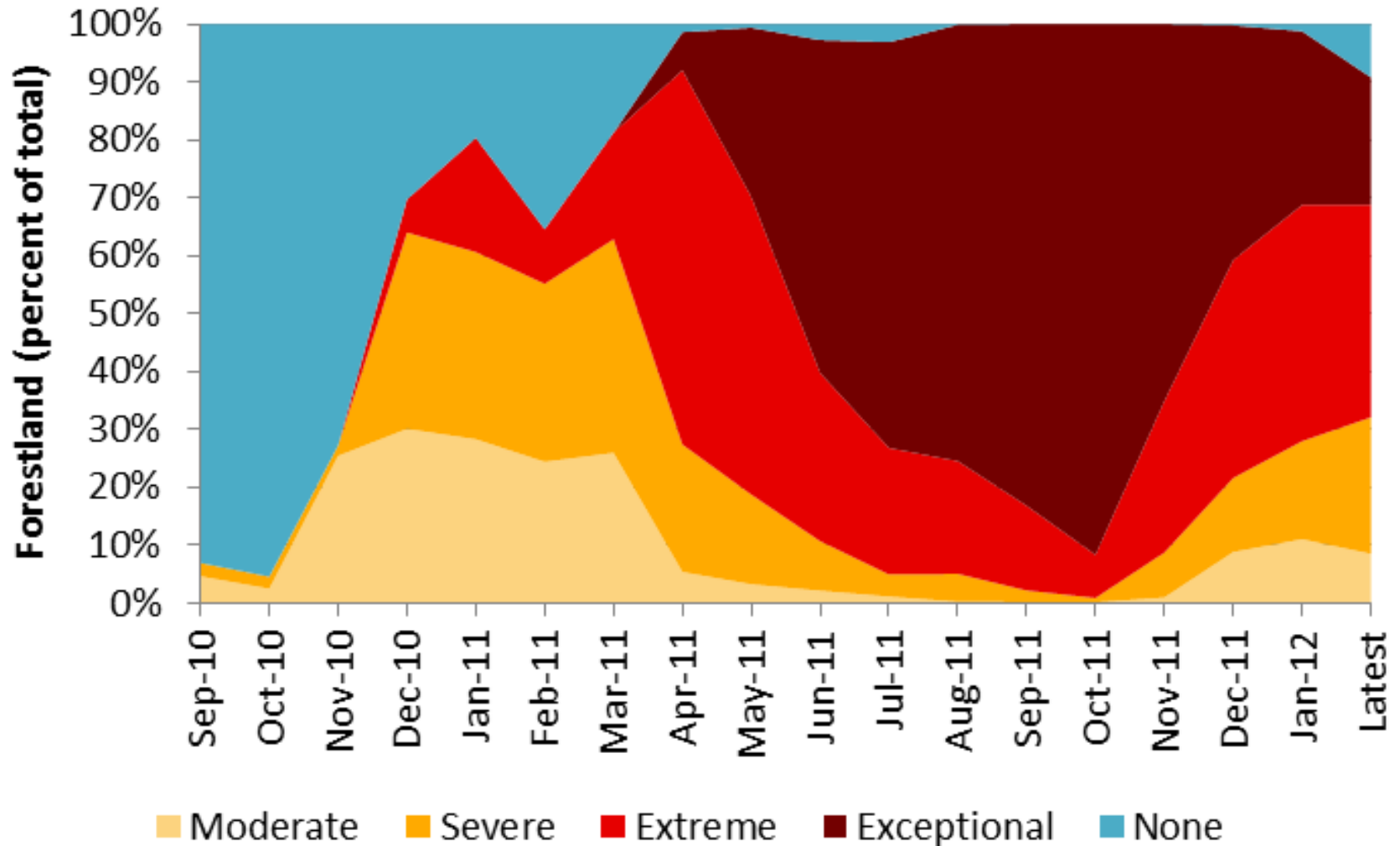
Drought conditions spread to cover most area where forests occur



Exceptional drought conditions extend over many areas where forests occur

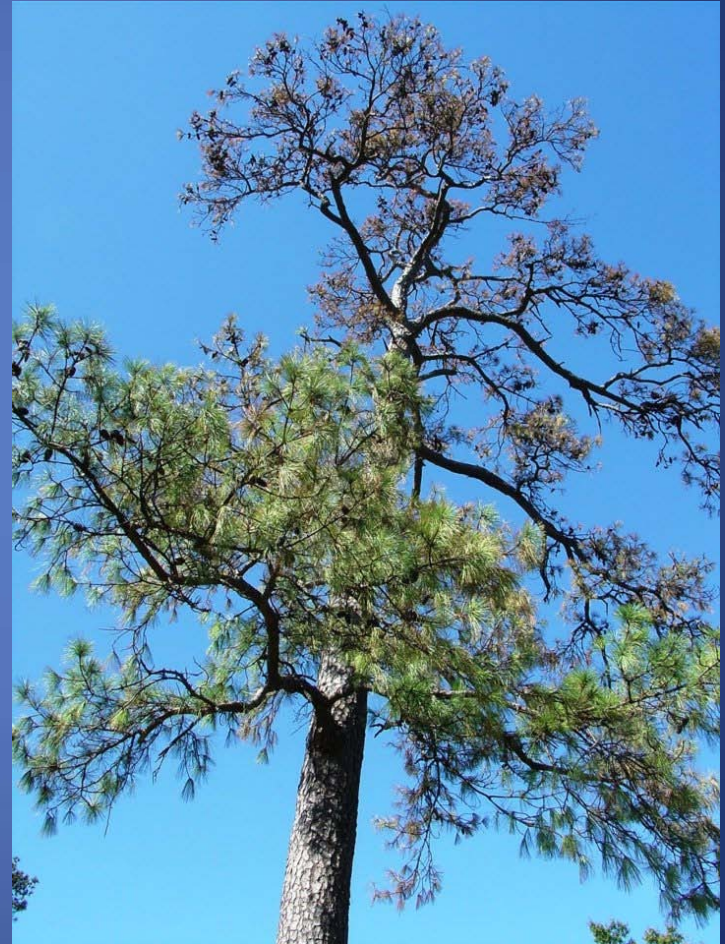


Normal conditions begin to appear in some forest areas



Drought Impacts to Trees

- Fewer needles or leaves
- Early dormancy
- Reduced growth and loss of vigor
- Increased susceptibility to insects and disease
- Death



Tree Death

- Carbon starvation
 - Negative carbon balance resulting in depletion of carbohydrates reserves
- Hydraulic failure
 - Water stress increases leading to interruption of the water column and tissue dehydration

Pine plantation that
is mostly green

Mixed natural forest with
shades of brown and grey
showing impacts of drought

Aerial photograph by Ron Billings
near Nacogdoches, TX, August 26,
2011



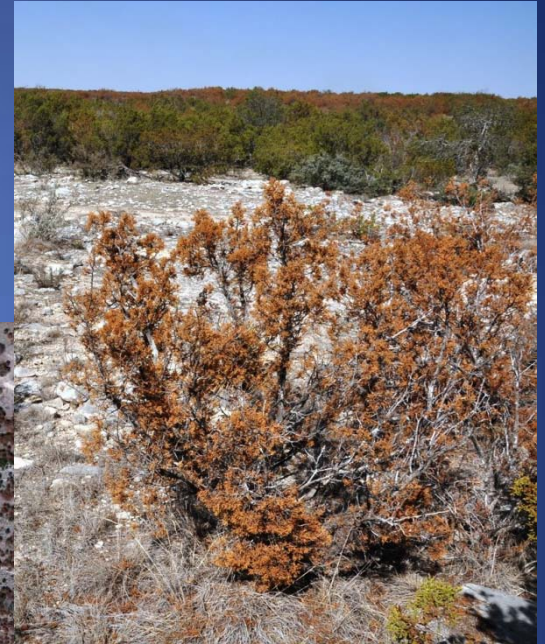
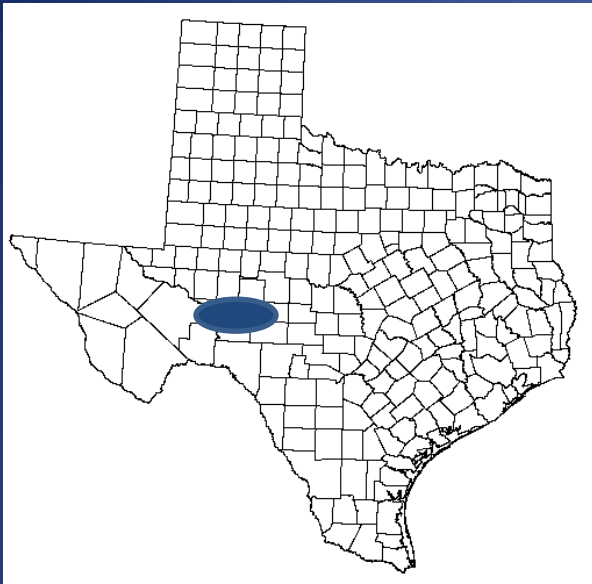
Preliminary Estimate of Mortality

- We surveyed foresters and asked them the likely range of mortality in their area
- This information was combined with Forest Inventory and Analysis data on the number of trees
 - Trees at least 5 inches in diameter
 - Trees on forestland
 - Does not include urban areas

Preliminary Estimate of Mortality

- 100 million to 500 million trees have died as a result of the drought
- 2 to 10 percent of all trees on forestland in the state
- Localized pockets of heavy mortality were reported for many areas
- Several multi-county areas appear to be especially hard hit

Sutton, Crockett,
western Kimble
and eastern
Pecos Counties



Juniper
mortality
just east of
Sonora off
of
Interstate 5



Google Earth



Pine mortality in Harris, Montgomery, Grimes, Madison and Leon Counties



About 200,000 acres were reforested the last two years in East Texas

An estimated 116,000 acres will need some level of reforestation

Costs to restore these lands is estimated to be \$57,000,000

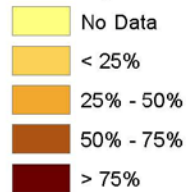
Results of 2011 Seedling Survival Inspections

Data based upon 2011 Texas Forest Service seedling survival inspections conducted on tracts planted during the 2010/2011 planting season

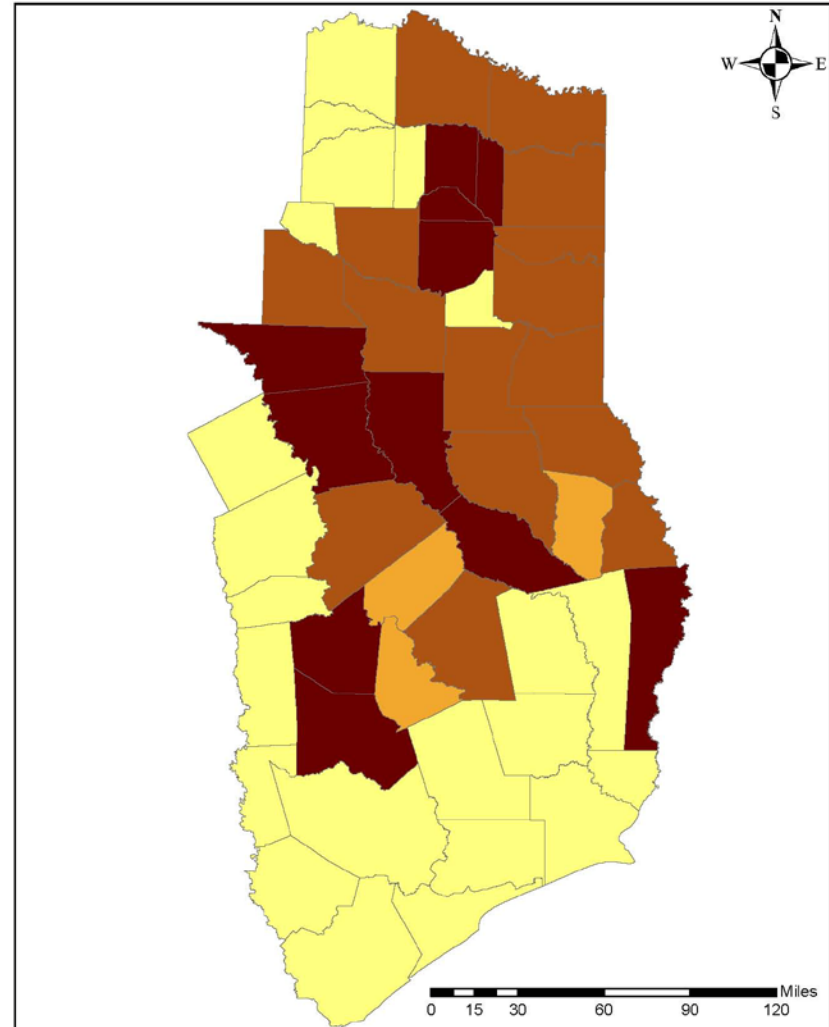
A total of 165 tracts were inspected on 9,966 acres

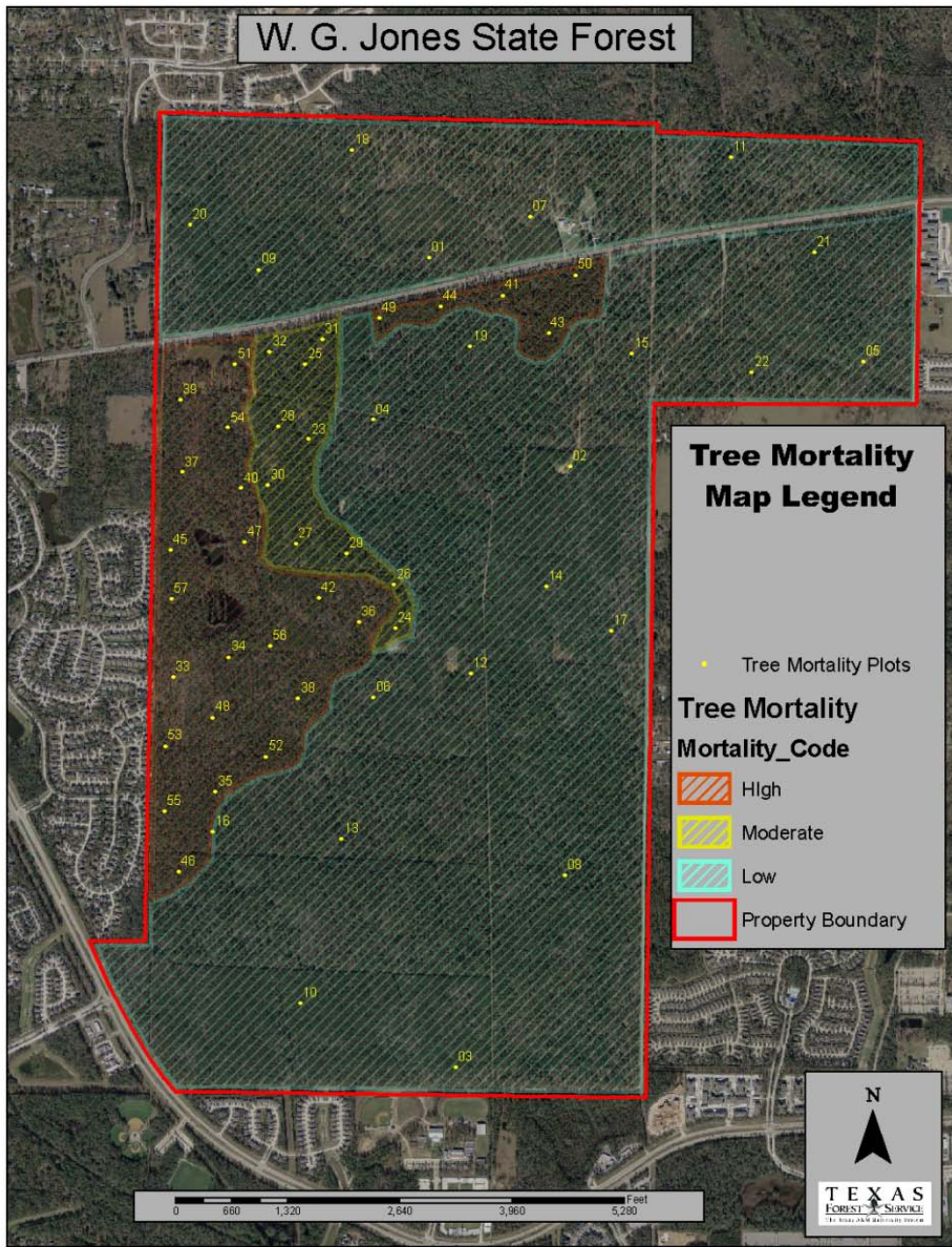
*Average Survival % = 33.73%
Average Mortality % = 66.27%*

Mortality Percentage



Map Preparer: Shane Harrington
Map Prepared: 11/3/2011





Inventory to assess mortality on 1,700+ acre W. G. Jones State Forest near Conroe, TX

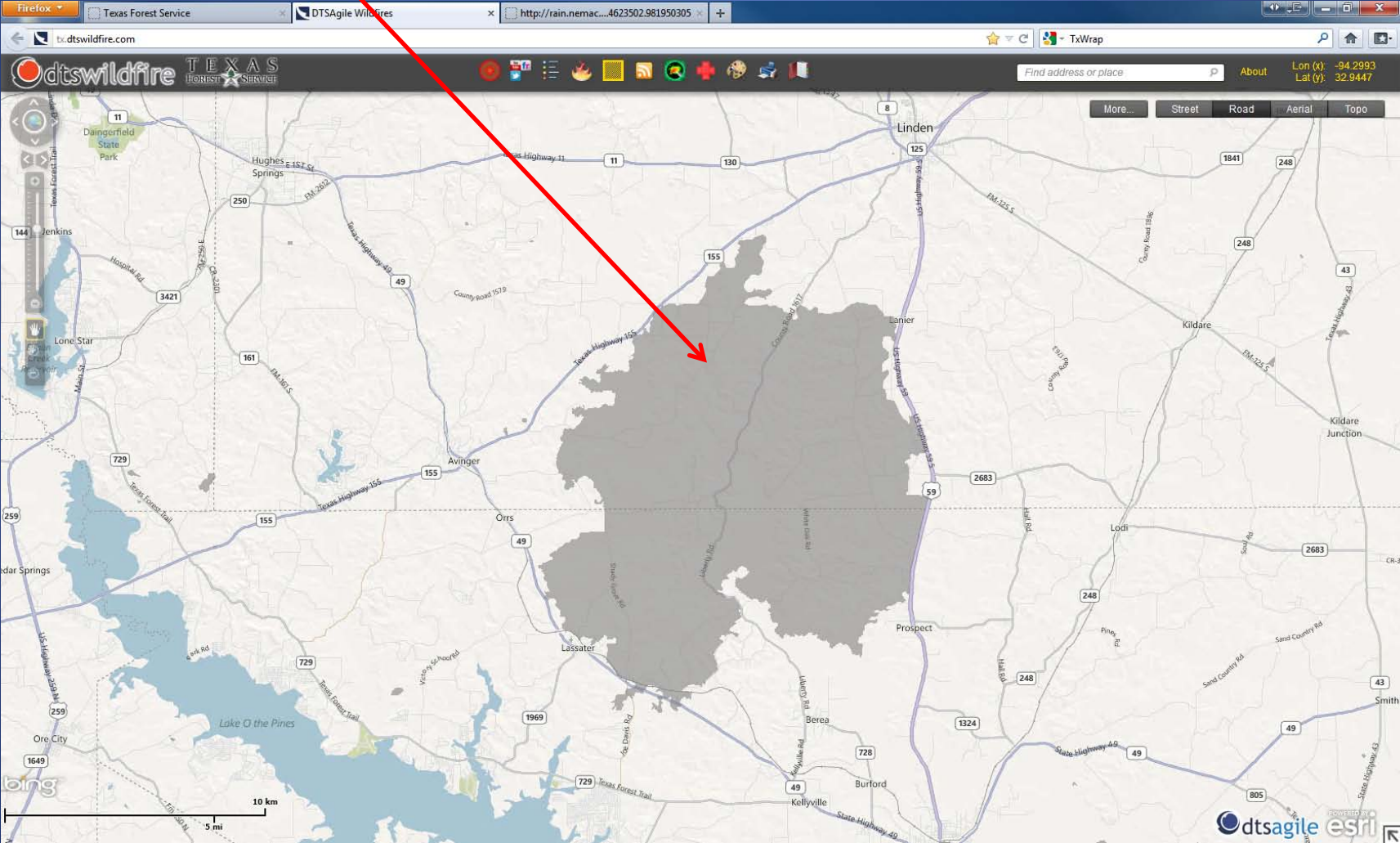
6.1 percent of trees have died as a result of the drought

2.2 percent more are not expected to survive

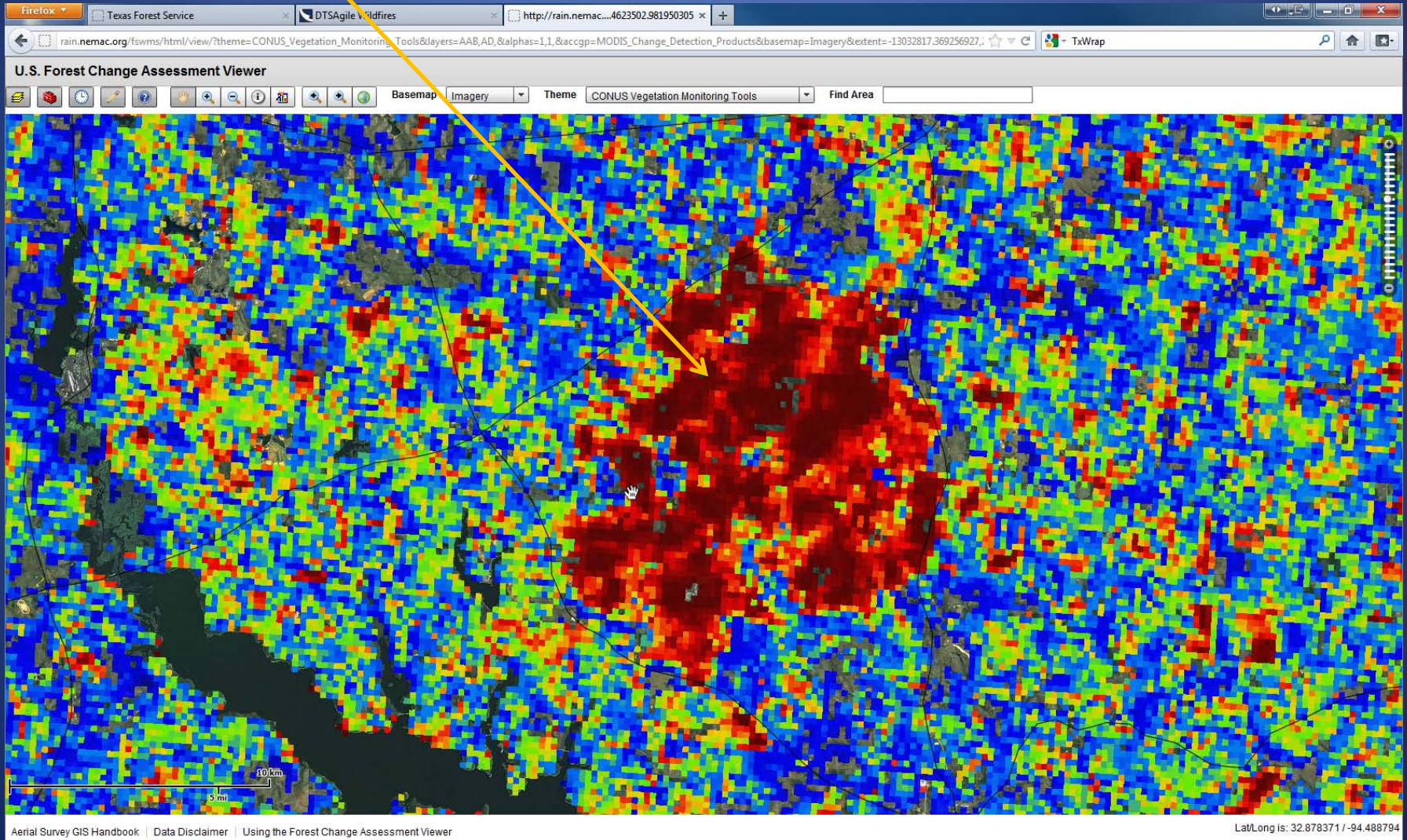
Next Steps

- Use remote sensing to identify areas where “greenness” has changed
- Send foresters in the field to measure sample plots and trees to more thoroughly assess mortality
- Produce an updated estimate of tree mortality this summer

Bear Creek Fire in Cass and Marion Counties



Bear Creek Fire in Cass and Marion Counties

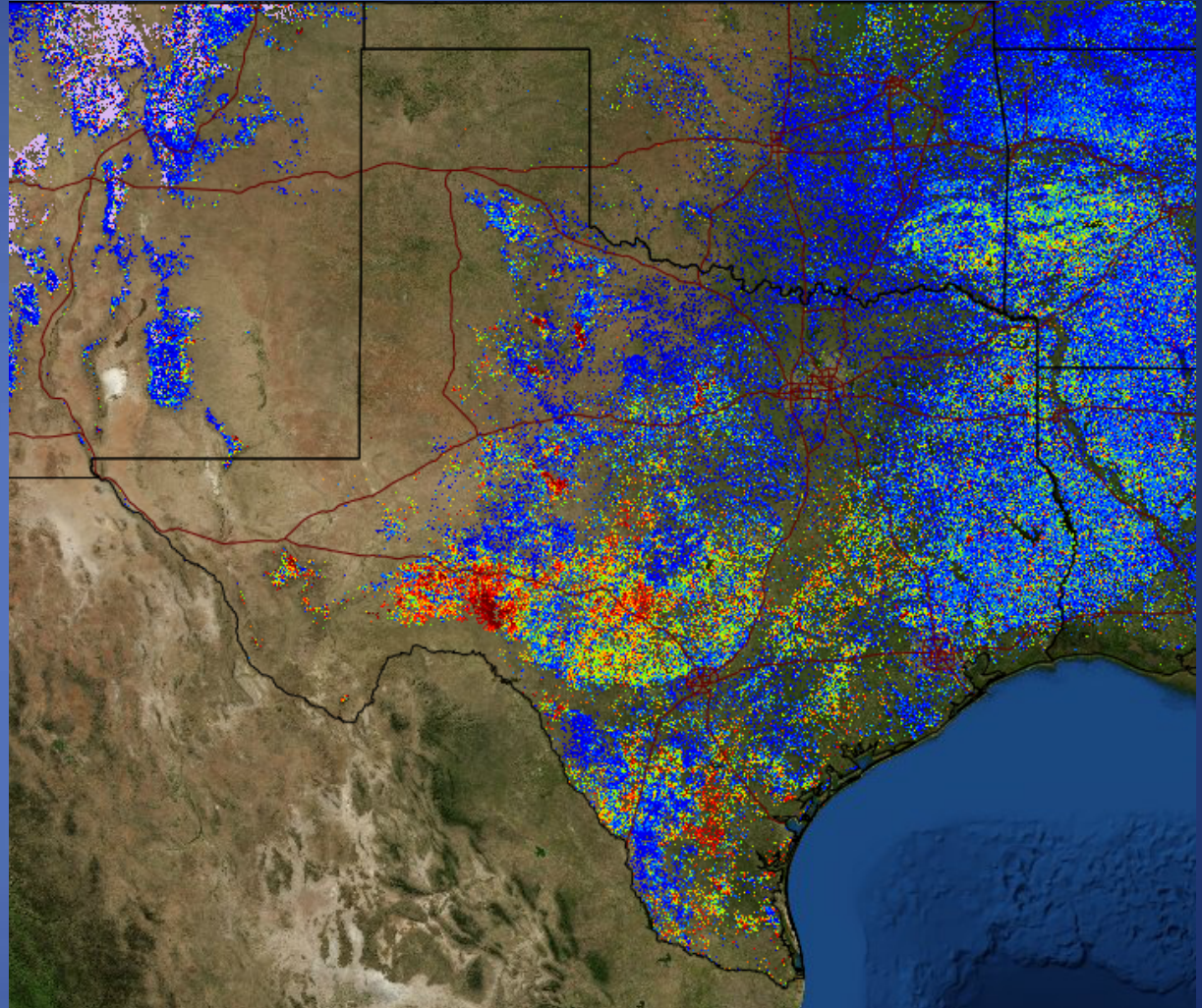


Forest Threat Assessment
Center

Forest NDVI Change (USFS
TACs-NASA)

Disturbance Since 2010 – 1-
Year Baseline

<http://ews.forestthreats.org/>



Historical Droughts

- According to the state climatologist 13 droughts have surpassed -4 (extreme drought) on the Palmer Drought Severity Index (PDSI) in 3 or more of the state's 10 climatic divisions since 1895

5 of the 13 droughts resulted
in PDSI below -4 in **East Texas**

1915-1918

1924-1925

1950-1957

2005-2006

2010-2012

- 2010-2012 has the lowest PDSI (-6.47)
- 1915-1918 has the highest number of months (10) at or below PDSI -4
- 1950-1957 has highest number of months (40) at or below PDSI -2

Loblolly Pine



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11 of the 13 droughts resulted in PDSI below -4 in the **Edwards Plateau**

1908-1911	1966-1967
1915-1918	1995-1996
1924-1925	1999-2002
1933-1935	2005-2006
1950-1957	2010-2012
1961-1966	

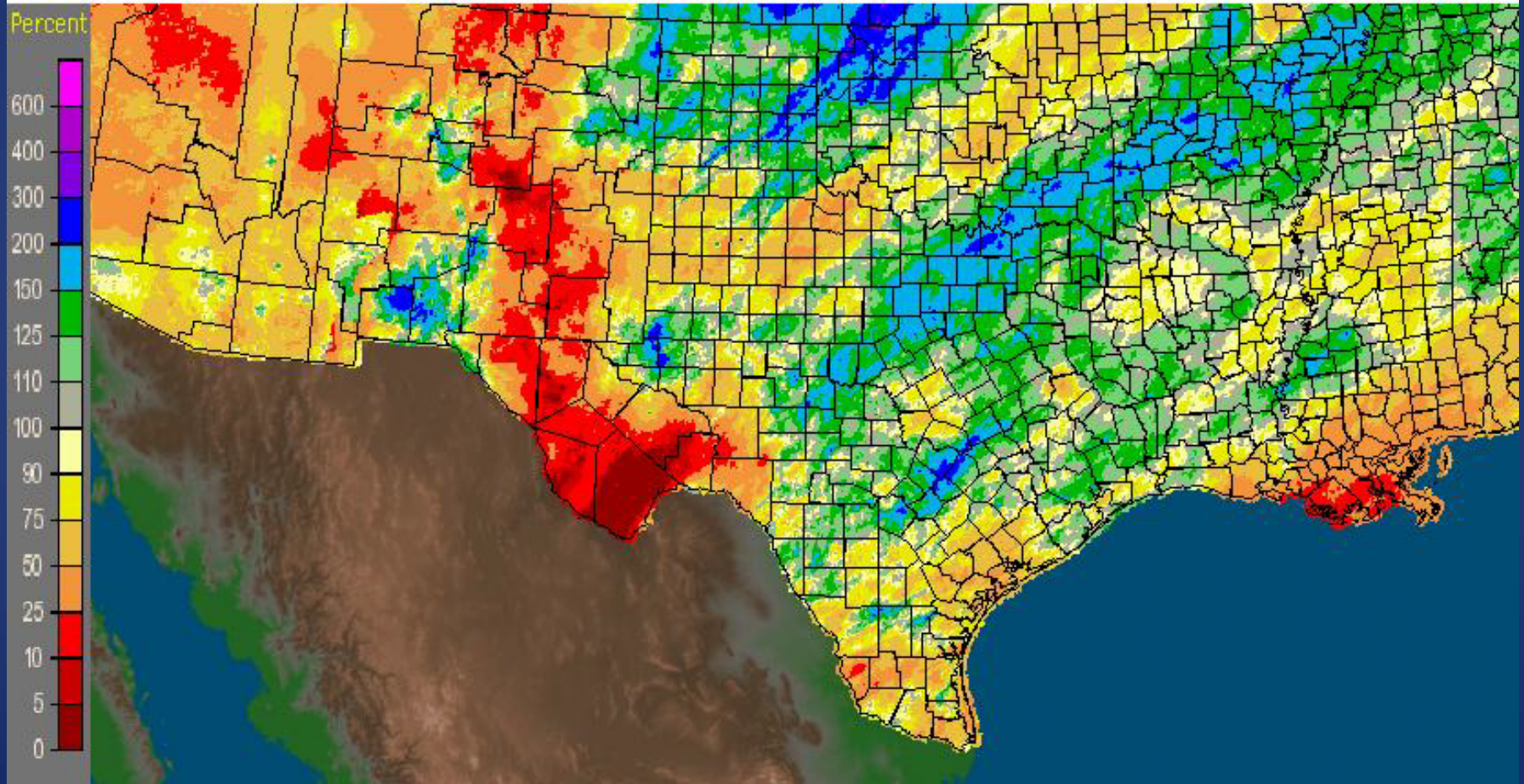
- 1950-1957 had the lowest PDSI (-6.08), the highest number of months (29) at or below PDSI -4, and the highest number of months (66) at or below PDSI -2

Live Oak



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Texas: Current 90-Day Percent of Normal Precipitation
Valid at 2/7/2012 1200 UTC- Created 2/8/12 0:17 UTC



An aerial photograph of a large forest area. The trees are in various stages of autumn, with many showing vibrant orange, yellow, and red leaves, interspersed with some green trees. The forest is dense and covers a rolling landscape. In the upper right, there is a small clearing or field with fewer trees. The overall scene is a lush, colorful woodland.

QUESTIONS?

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