



SCIPP DROUGHT INFORMATION DOCUMENT

INTRODUCTION TO DROUGHT :

If you were asked to contemplate the various natural disasters that are common to the United States, which disasters come to mind? Hurricanes? Tornadoes? Earthquakes? It is not uncommon for one to forget about drought, yet it is one of the most common (See Table 1) and costly hazards to impact the United States. In contrast to most hazards, drought can impact any state, or a majority of states, at any given time of the year. Moreover, drought is not a stranger to people in the SCIPP Region (See Figure 1).

The National Drought Mitigation Center (NDMC) defines drought as a normal and recurrent feature of our climate, which consists of a deficiency in precipitation over an extended period of time. They stress that drought is very difficult to define because the two main variables that define it (amount of precipitation deficiency and the time over which the deficiency persists) vary over space and time. For example, a five inch shortage in precipitation represents approximately half the amount that El Paso, Texas normally receives in any given year, but only approximately one month worth of precipitation at New Orleans, Louisiana. Drought can also vary at any given location over the course of a year. For instance, a dry spell during a naturally dry season, may not have as great an impact as a dry spell during a naturally wet season. Drought is also partially dependent upon the soil moisture conditions that precede dry spells, in that a dry spell when the soil is dry is more likely to result in a drought than a dry spell when the soil is saturated. Therefore, one definition of drought is not likely to satisfy every possible scenario.

The NDMC has established a national standard for drought monitoring, assessment and declaration with their product: The United States Drought Monitor (USDM). The USDM combines qualitative and quantitative information with scientific expertise from across the country. Each week, they release a national map that depicts drought conditions across the nation. Since the start of the USDM in 1999, the

Week	Nothing	D0-D4	D1-D4	D2-D4	D3-D4	D4
October 17, 2000	0.00	100	99.97	69.29	25.29	1.13

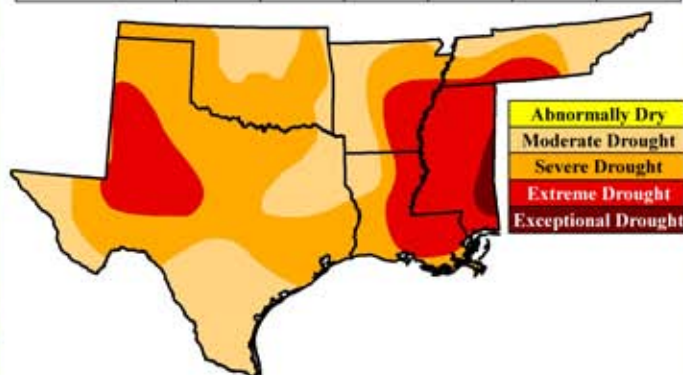


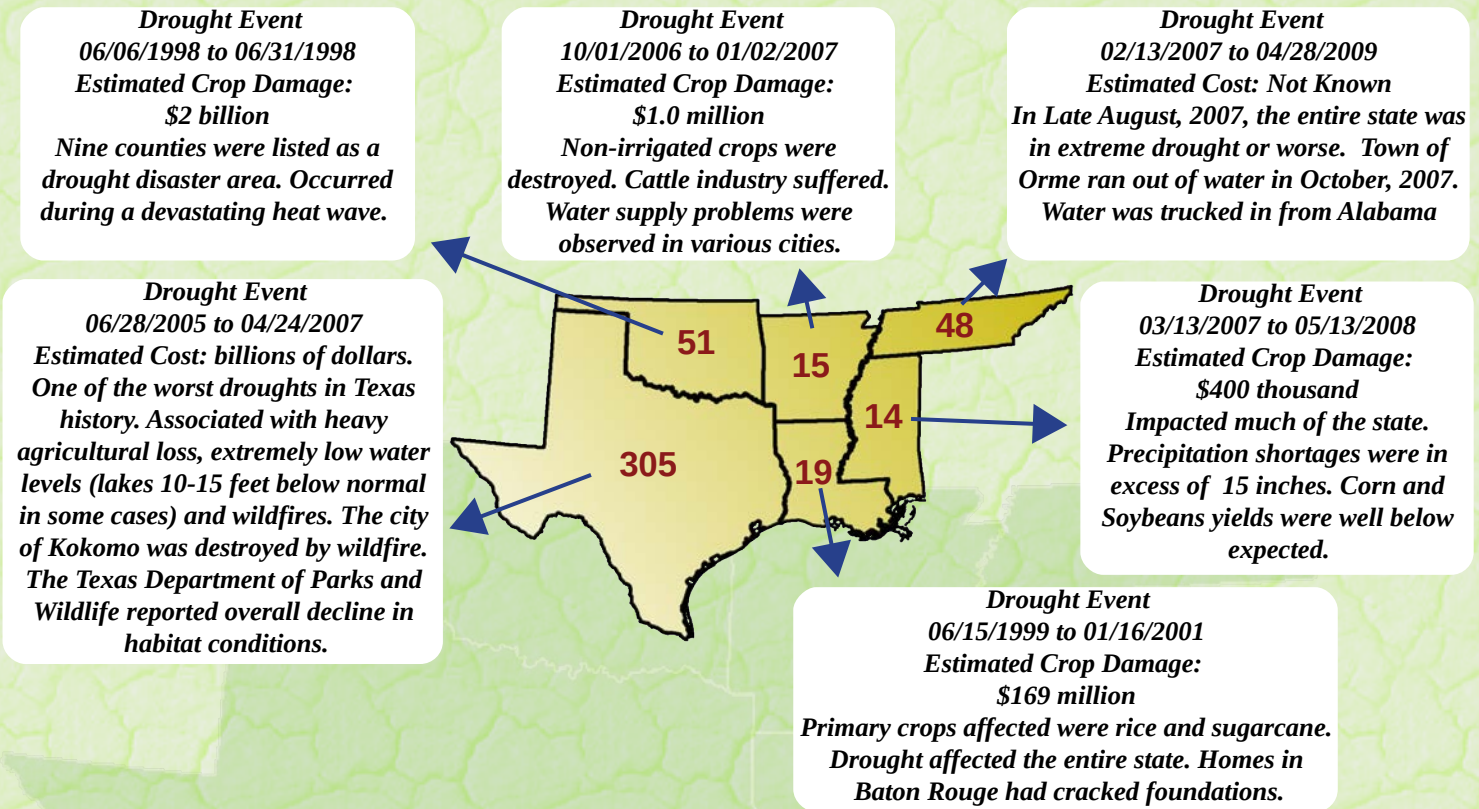
Figure 1: The October 17, 2000 United States Drought Monitor Map for the Southern Region. Table at the top indicates the percent areal coverage in a given drought category or worse. Image courtesy of the National Drought Mitigation Center.

United States has not been drought-free (Table1). The USDM have established four drought categories that range from D1 (Moderate Drought) to D4 (Exceptional Drought). A fifth non-drought category, D0, indicates abnormally dry conditions and it is often considered a strong bellwether for drought.

Table 1: Drought Occurrence in the USA and in the SCIPP Region. Data are based on archives from the United States Drought Monitor, which span from January 4, 2000 to March 30, 2010.

Percentage of weeks in a given drought class	D1 or worse	D2 or worse	D3 or worse	D4
SCIPP Region	94.77	87.10	69.16	39.07
Continental USA	100.00	100.00	96.82	74.58
Percentage of weeks with 25% or more areal coverage	D1 or worse	D2 or worse	D3 or worse	D4
SCIPP Region	41.31	17.01	3.74	0.00
Continental USA	48.79	15.70	0.00	0.00

DROUGHT IN THE SCIPP REGION



**Numbers indicate total drought occurrences from 1996-2009
Data based on the NCDC storm events database**

CURRENT & FUTURE TRENDS:

Figure 2 illustrates that much of the southeastern United States has showed increasing trends in drought over the fifty year period spanning from 1958 to 2007. Similar increasing trends are also evident in much of the northwestern states, and in southern California and southern Arizona. By contrast, drought occurrence has been decreasing through much of the northeast and in the mid-west.

Future trends in drought are much more difficult to predict. Computer models based on typical climate change scenarios are indicating that droughts may become more intense and more frequent. For the period spanning 2080-2099, models are currently projecting a decreasing trend in summer precipitation over much of the United States. This decrease is also expected in the southern states during spring and winter.

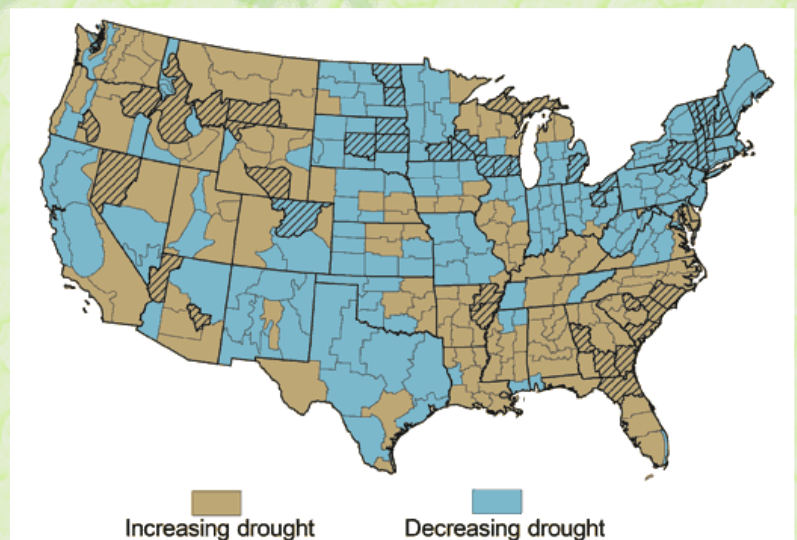


Figure 2: Observed trends in drought from 1958 to 2007. Hatching indicates significant trends. Source: Global Climate Change Impacts in the United States, Thomas R. Karl, Jerry M. Melillo, and Thomas C. Peterson, (eds.) Cambridge University Press, 2009.

DROUGHT TYPES:

Meteorological Drought:

This particular drought type encompasses all droughts in some way or another because all droughts are the result of meteorological conditions. It is usually defined by the magnitude of precipitation deficiency and the period over which that deficiency persists. Scientists typically use meteorological data to devise indices that are useful for drought identification. Because drought is defined differently in different regions, and over different times of the year, these indices may often be standardized to local meteorological conditions. Standardization allows scientists to compare drought conditions in one location to drought conditions in another location.

Agricultural Drought:

Simply put, agricultural drought is essentially meteorological drought that in turn imposes drought-related impacts on the agricultural sector. This includes crop production, but also pastures and the local ecology of the range. Drought-related impacts occur when the water demand for crops is not met. Agricultural drought is extremely destructive because it can attack at any period of the growth cycle from emergence to maturity. Scientists have made great strides to monitor agricultural drought by creating indices that interpret water demand, soil moisture content and vegetative stress.

Hydrological Drought:

Like agricultural drought, hydrological drought is essentially meteorological drought that imposes impacts on the hydrological cycle, particularly, streamflow and water reserves such as reservoirs, lakes and aquifers. It is linked to agricultural drought in that impacts to the local hydrology can reduce the potential to mitigate agricultural drought through the process of irrigation. Hydrological drought usually occurs slowly because it involves utilization of stored water. Unlike other forms of drought, it may impact other downstream locations that rely on streamflow for their own water needs. It can also have a strong impact on the local ecology. Low water levels can lead to changes in: riverine habitats, water temperature gradients, fish spawning and water species mortality rates.

Socioeconomic Drought:

Socioeconomic drought is drought that impacts either a sector of the economy or a given social activity. For example, low water levels may lead to reduced: tourism, river-based shipping practices and hydroelectric power generation. This type of drought is slightly different from the others because it is dependent upon the concept of supply and demand.

DROUGHT PLANNING:

An Ounce of prevention:

Droughts are very difficult to forecast. Onset of a drought can be slow and often undetectable and yet their impacts on society and the environment can be quite devastating. Droughts cost the American economy approximately six to eight billion dollars each year. It is therefore necessary to plan for drought. A sound, well thought out drought plan is beneficial because it allows us to reduce impacts and federal dollars spent on assistance. Drought planning, unfortunately is not an easy task because droughts can last just a couple of weeks, or they can linger around for years at a time. In the SCIPP region, three of the six states currently have a working state drought plan. They include: Oklahoma, Texas and Tennessee (Figure 3).

What to Consider:

When planning for drought, it is important to consider non-climatic factors such as: population growth, changes in technology, land use practices and water resource management, to name but a few. Perhaps one of the least considered factors is that drought is commonly linked to other hazards. For example, droughts increase the risk for wildfires because extended periods of dryness can lead to low soil moisture content and a build up of ground fuels. In addition, droughts can often be triggered by the very atmospheric conditions that typically lead to heat waves. This combination can be especially deadly because when combined, drought and heat waves can lead to unprecedented water shortages during periods of high water demand. Drought plans should therefore include measures to restrict water use, and impose burn bans, during extended periods of dryness. Moreover, planning for drought needs to be an ongoing process and it should include a robust drought monitoring program.

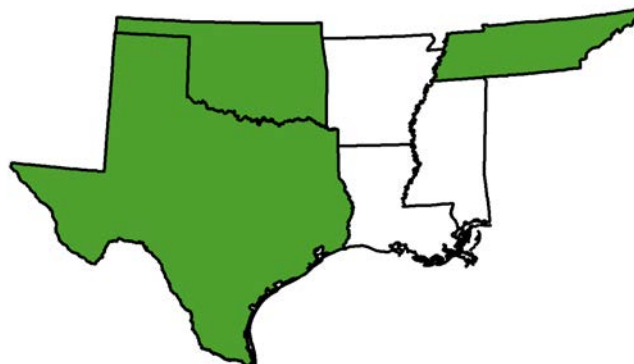
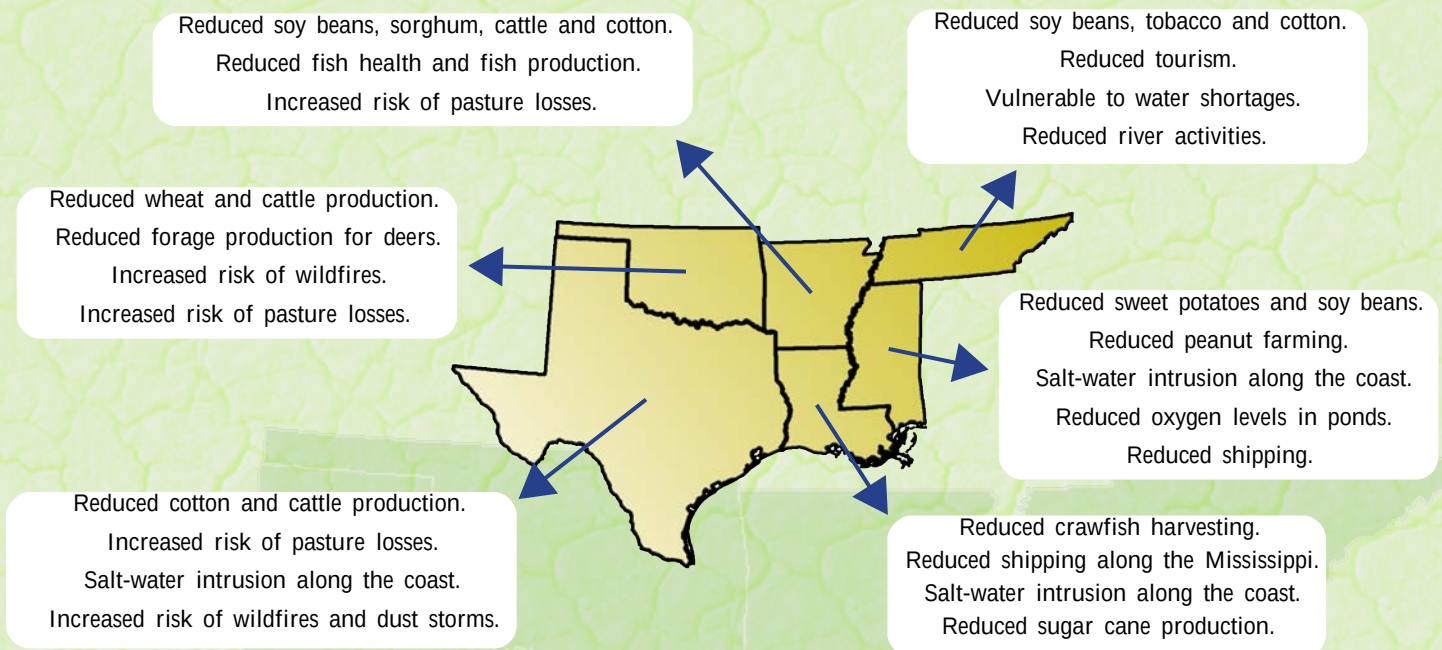


Figure 3: States in the SCIPP Region that currently have a drought plan in place are shaded.

DROUGHT IMPACTS IN THE SCIPP REGION



DROUGHT MITIGATION

Plan: The severity and tenacious, repetitive behavior of drought points to a need for a proactive approach to drought planning. Plans should allow for action orders to be taken prior to, during and after a given drought. This may include orders to reduce water use, or the implementation of a burn ban.

Assess: Any assessment should outline the sectors or activities that have been impacted by preceding events. Assessments need to account for changes in population, land use and social activities.

Monitor: Keeping an eye out for drought is an excellent way to reduce the response time in implementing mitigative strategies.

Respond: This involves implementing any or all action orders in an attempt to reduce the impacts of drought to a given location. Responses should account for the potential need for action adjustments to items that could not be anticipated for in advance of the drought.

In the SCIPP Region:

Some activities include:

In Texas, Holistic Management International Texas (HMI Texas), a non-profit organization, routinely hold drought mitigation workshops.

In Texas, the senate passed bills in 1997 and 2001 that require water suppliers to have a drought plan and that they be updated every 5 years.

In Oklahoma, the Oklahoma Climate Survey monitors drought conditions at a variety of time scales.

The NOAA Southern Regional Climate Center, State Climate Offices, and NOAA Weather Forecast Offices work closely with the NDMC's USDM to ensure accurate and timely depictions of drought conditions.

In Arkansas, the National Water Management Center is actively involved in studying groundwater as it pertains to long-range drought planning.

DROUGHT MONITORING

Monitoring Drought:

Drought monitoring is important because it allows scientists to track and evaluate changes to moisture conditions as they occur. It involves any activity that examines the variables that define drought. Because of the complexities associated with defining drought, several key drought indicators have been developed. When combined, these indicators can paint a much clearer picture of drought conditions at a given location. Many drought-related tools and data products have been created, all of which assist scientists in the identification and evaluation of drought. One of the most common tools available is the USDM's weekly drought monitor map (Figure 4). The map is produced using a variety of drought indicators and input from scientists across the country. Both sources prove to be equally important in developing an accurate depiction of drought conditions from week to week. Popular drought indicators include: the Standardized Precipitation Index (SPI), the Palmer Drought Severity Index (PDSI), the Crop Moisture Index (CMI), and the seven day Mean Streamflow Percentiles.

The SPI is used to identify precipitation deficits at certain locations. The values are standardized so they may be compared to values in different climate regions. In December, 2009, drought scientists from across the world met in Lincoln, Nebraska and they agreed that the SPI should be the international standard indicator for drought monitoring.

The PDSI uses both precipitation and temperature to indicate differing degrees of dryness. The index is intended to be used as a measure of long term agricultural drought. The CMI is a derivative of the PDSI, and it is calculated in a similar fashion. Unlike the Palmer Index, however; the CMI reflects short-term moisture deficits and therefore it is quite useful in the identification of potential agricultural drought.

The 7-day streamflow Percentiles is also useful because it indicates standardized streamflow values at hydrological gauge stations throughout the country. Values below a 20 percentile correspond to hydrological drought. It can also help identify areas that may be impacted by upstream drought conditions.

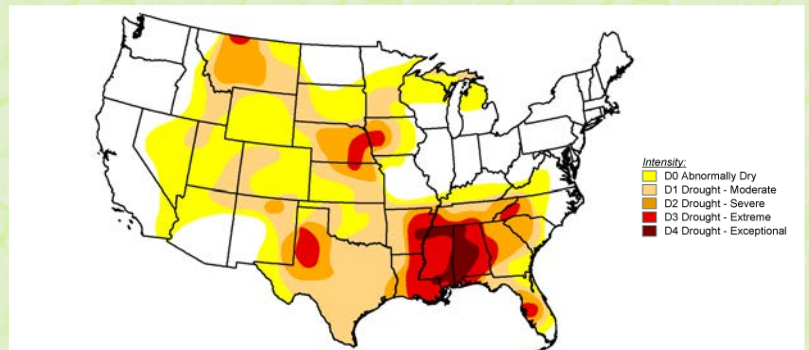


Figure 4: A sample map from the United States Drought Monitor, valid for April, 13, 2000. Map is Courtesy of the National Drought Mitigation Center.

Drought Monitoring Activities at SCIPP:

SCIPP developed a monitoring tool that examines drought conditions in the eleven southeastern states that span from Oklahoma and Texas, to Florida and the Carolinas (Figure 5). The tool is very useful because it aggregates precipitation by climate division. It also provides users the ability to evaluate wet or dry conditions in a historical perspective. The tool has several components that allow users to select various map layers over different time periods and start dates. The selectable time periods coincide with those that are used by drought scientists across the country, which in turn allows for robust comparisons of drought conditions. In addition, the tool makes use of the internationally recognized SPI. Since its release, the drought tool has become popular among drought monitoring scientists in the southeastern United States. The SCIPP drought tool is available at:

<http://www.southernclimate.org/products/precip.php>

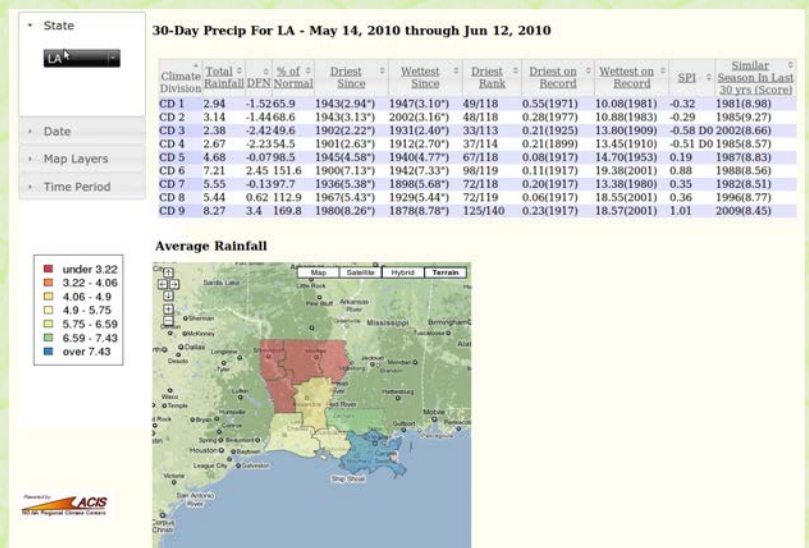


Figure 5: A screen shot of the SCIPP Southern U.S. drought monitoring tool.

WHAT YOU CAN DO TO PREPARE:

Conserve Water:

First and foremost, citizens should obey any government enforced water restrictions. Even if no restrictions are in place, you can conserve water by doing the following:

- reduce or eliminate lawn watering practices
- cut off water to pools, ponds and water fountains
- install low flow shower heads, toilets and faucets
- turn off running water while brushing teeth or shaving
- fix all leaky faucets and toilets
- keep cold water in your refrigerator
- recycle water when possible
- take shorter showers or take baths instead
- run your dishwasher only when it is full

Become a weather observer and track drought:

The Community Collaborative Rain, Hail, & Snow Network (CoCoRaHS) is a non-profit organization that involves volunteers in the measuring and mapping of precipitation across the country. For the small fee of a low-cost rain gauge you can become a weather observer. For more information on how to join the CoCoRaHS Network, visit <http://www.cocorahs.org>.



Be mindful of other drought-related hazards:

Observe all burn ban laws to reduce the risk of wildfires during droughts.



Figure 6: A sample burn ban map for Oklahoma.

CONTACT US:

Please contact either one of our two program managers for more information about SCIPP or to get involved:

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FOR MORE INFORMATION:

1) **The National Drought Mitigation Center:** a national leader in the monitoring, assessment and declaration of drought.

<http://drought.unl.edu>

2) **The United States Drought Monitor:** A product of the National Drought Mitigation Center, the monitor is the United States standard for assessing drought conditions throughout the nation.

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

3) **The National Integrated Drought Information System:** The national drought portal. This site combines drought information from around the country.

<http://www.drought.gov>

4) **The NOAA Drought Information Center:** a portal for NOAA drought and climate conditions.

<http://www.drought.noaa.gov>

5) **The NOAA Regional Climate Centers:** The Regional Climate Centers are a national leader in climate service, climate data management and applied climate research and development.

<http://www.srcc.lsu.edu/regional>

6) **State Climate Offices:** This website contains links to all state climatologist offices.

<http://www.stateclimate.org>

7) **The North American Drought Monitor:** An extension of the United States Drought Monitor that includes Canada and Mexico.

<http://www.ncdc.noaa.gov/oa/climate/monitoring/drought/nadm>

8) **Regional Integrated Sciences & Assessments:** The RISA programs research and address climate issues that are of concern to policy planners, and decision makers.

http://www.climate.noaa.gov/cpo_pa/risa/

SCIPP is a NOAA-supported Regional Integrated Sciences and Assessment (RISA) program.

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