MANAGING DROUGHT IN THE SOUTHERN PLAINS

A Collection of Webinar Summaries from the Managing Drought in the Southern Plains webinar series

By

Southern Climate Impacts Planning Program

In Conjunction with:

National Integrated Drought Information System (NIDIS)
National Drought Mitigation Center (NDMC)
NOAA Regional Climate Services Director
Climate Assessment of the Southwest (CLIMAS)
American Association for State Climatologists (AASC)

SCIPP
Southern Climate Impacts Planning Program
A NOAA RISA Team

A drought of strong intensity and vast geographical extent gripped the South Central United States. As early as November 2010, the NOAA Climate Prediction Center predicted that eastern Pacific La Niña conditions would increase the potential for drought formation across the southern United States. In fact, the state of Texas set its driest water year (October 2010-September 2011) on record. To respond to these severe ongoing conditions, multiple efforts were launched to engage decision-makers from regional to state to local arenas in a conversation about drought.

Communication among agencies and affected sectors is a key to successful management. Towards this end, SCIPP, in collaboration with the National Integrated Drought Information System (NIDIS), NOAA Regional Climate Services Director, National Drought Mitigation Center (NDMC), Climate Assessment for the Southwest (CLIMAS), and the region's State Climatologists, launched a four-pronged approach to assure that all of these arenas were addressed: regional forums, state drought planning, a series of webinars and supporting local impact reporting. The net effect of these efforts is that interaction between these arenas and between the academic and practitioner communities increased substantially. Many decision-makers have participated in multiple activities, such as state drought planners attending the regional forums or local Farm Service Agency offices participating in the drought webinars and impact reporting.

While in many instances the response to the drought has remained reactive, these discussions have yielded a treasure trove of information that will form subsequent development of best practices guidelines, improve drought planning, and connect state and local monitoring more closely.

Webinars are held on the 2nd Thursday of each month at 11:00 a.m. Central Time. The content is geared toward a general audience – anyone who has responsibility to manage or assist others in managing drought and its related impacts. Each webinar includes an overview of the current drought assessment and outlook, summary of impacts across the region, and a topic or resource, such as La Niña or wildfire conditions. Webinar presenters include scientists, university extensions, professional associates, and state agencies. Topics range from explanation of causes and relationships to management practices and drought impacts.

This report contains a one-page summary for each drought webinar's topic material, presented in order by date.

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Historical Context and Evolution of the Drought (September 29, 2011)

Exceptional drought, or D4, remains entrenched across much of Texas, Oklahoma and New Mexico and parts of surrounding states. D4 is the most severe drought category on the U.S. Drought Monitor's scale and is defined as a drought the occurs, on average, once in every 50 years. The drought developed in the fall of 2010 in east Texas in part as a result of the atmospheric changes associated with La Niña and has gradually spread and intensified.

This drought is not the largest since the Drought Monitor was launched in 2000, but it is the most intense. Approximately 25 percent of the United States is included in a drought designation (D1 to D4), very near the average for any given year. However, nearly 10 percent of the U.S. is depicted as exceptional drought. Prior to the current event, no more than 7 percent of the U.S. had been in exceptional drought at the same time. Consequently, while the extent of the drought area is not unusual, where there is drought it is unusually intense.

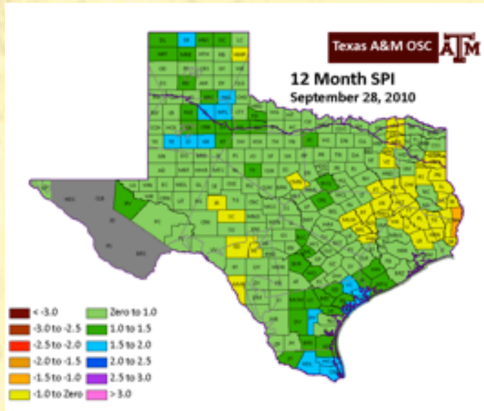
Outlooks over the next several weeks to 3 months indicate little chance for drought improvement. There will be chances for precipitation, but these will likely be interspersed with lengthy periods of dry weather and are not likely to be widespread. Above-normal temperatures and below-normal precipitation is expected across the region through at least December. Concerns are that this dry pattern will extend through at least next Spring, due largely to a developing La Nina pattern, similar to 2010. La Nina is typically associated with warm, dry winters across the Southern Plains.

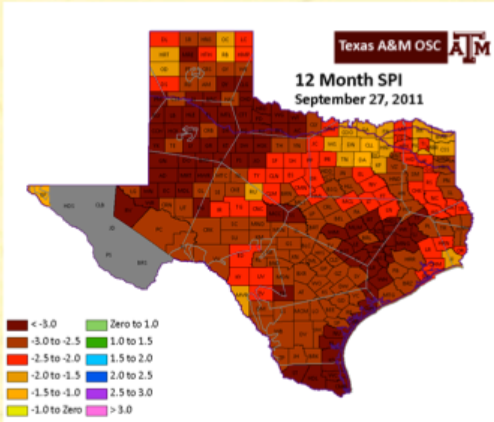
For temperature and precipitation outlooks, visit the Climate Prediction Center: http://www.cpc.ncep.noaa.gov/

Texas

The past 12 months (October-September) has been the driest 12-month precipitation total on record. Because of the drought, the sun's energy went into heating the air instead of evaporating water, leading to a hot, dry summer. The dryness and heat of 2011 exceeded anything previously experienced since 1895 with an average summer temperature more than 2 degrees higher than the previous record.

One year ago, the state looked pretty wet, with some dryness in East Texas. One year later the entire state shows record dryness, with a little less impact around the Dallas-Fort Worth area. The most severe precipitation deficits in the last two months are concentrated in an area from Austin to Houston, with enhanced wildfire danger.





New Mexico

All areas are below normal for the year-to-date with the most severely impacted area in the southeast, which has only 21% of normal precipitation for the calendar year-to-date

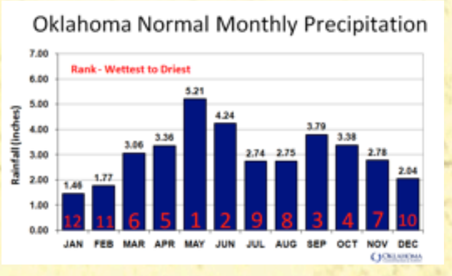
Like Texas, all areas of the state were at or above normal in summer 2010. Summer 2011 monsoon rainfall has been spotty, with all areas below normal and central mountains, eastern and southeastern regions driest.

Wildfires were the largest on record since 1990 with 1,050,153 acres burned (as of September 22), compared to only 120,055 burned all of last year.

Oklahoma

Oklahoma's second rainy season a dud for most of the state so far. Northeastern Oklahoma has gotten some relief in recent weeks, but with a few exceptions the monthly rainfall totals are still below normal. Without rainfall in September-October, Oklahoma will entire its driest months with little chance of relief

Year-to-date rainfall may set new record lows. Oklahoma Mesonet stations in western Oklahoma and the Panhandle have recorded less than 10 inches of precipitation in the last 365 days.



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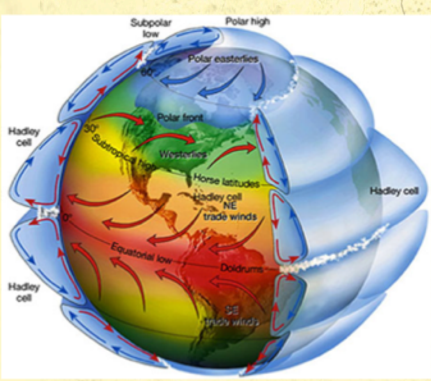
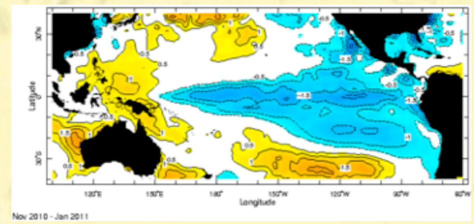
La Niña, PDO, AMO and Alphabet Soup (October 11, 2011)

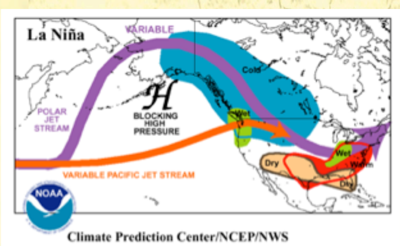


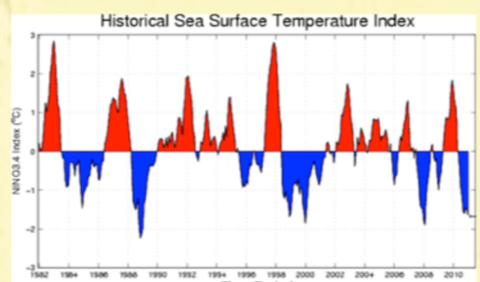
It is remarkable that the Pacific Ocean can influence weather and climate patterns in our region. The key connection is the location and strength of the jet stream. The jet stream, as we know it, is part of the prevailing westerlies, a band of air that generally travels from west to east about midway between the equator and the poles in both the northern and southern hemispheres. However, the westerlies are just one part of the global circulation. Near the equator and near the poles, air at the surface actually travels from east to west, although not usually as strongly. This motion may be apparent in the paths of hurricanes that travel westward across the ocean before turning northward and eastward as they get to higher latitudes.

Uneven heating of the earth from the sun creates warm air – and water – near the equator and cold air near the poles. The heat near the equator causes air to rise and form thunderstorms and towering ran showers. But what goes up, must come down. The rising air in the tropics travels northward and sinks in the subtropics, roughly between 20 and 40 degrees latitude. Sinking air creates surface high pressure systems, while rising air near the equator creates low pressure at the surface. A similar circulation pattern happens northward, resulting in two jet streams – a sub-tropical jet to the south and a midlatitude or polar jet to the north, both forming in the band of westerlies.

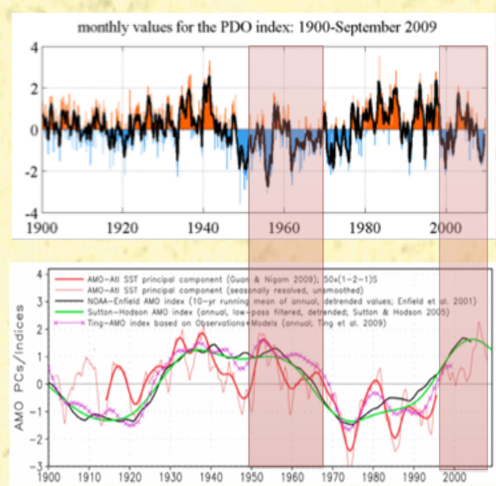


The easterly winds near the equator push warm water westward, allowing colder water from below to rise to the surface (to "upwell") along the coast of Peru. During La Niña, this pattern is intensified with the warmer water pushed farther westward, leaving the water in the central and eastern Pacific cooler than normal, what scientists often call a "cool anomaly". The warm water in the western Pacific enhances convection (storms), strengthening the low-pressure and the tropical easterlies and meanwhile strengthening the high pressure north and east of the area as the air sinks. The stronger-than-normal high pressure diverts the jet stream northward, which enhances storminess in the Pacific Northwest, along the position of the midlatitude jet stream, and weakens the subtropical jet stream. The storms eventually may turn southward again further east, bringing storms to the eastern U.S. but leaving the southwest and Gulf Coast region relatively dry. During the winter of 2010-2011, this persistent pattern kept storms from the area, although several events did make it into the region.





This past winter was a moderate-to-strong La Niña event which moderated in the spring and ended in May. It is not unusual to have a second La Niña event follow on its heels, as seems to be the case this year, with a new La Niña event developing since August. It is important to recognize that the weather over the past year has been extreme by any measure; a second La Niña does not necessarily mean that the rainfall again will be less than half of normal. However, drought consequences for water supplies tend to be cumulative, so even a moderately below-normal year would produce a worsening of water supply conditions in many areas.



La Niña, and its warm-anomaly counterpart El Niño, vary substantially from one year to the next. However, there are longer-term variations in the North Pacific Ocean, called the Pacific Decadal Oscillation (PDO) and the Atlantic Ocean, called the Atlantic Multi-Decadal Oscillation (AMO). Negative values of the PDO generally favor consistently dry patterns in the Southern U.S. Likewise, dry Plains are associated with a positive AMO, which implies unusually warm temperatures in the northern half of the Atlantic Ocean. The last time a negative PDO aligned with a positive AMO was the 1950s-1960s, which includes the drought-of-record in both Texas and Oklahoma. Since they became aligned again, around 2000, the region has suffered several short-term droughts, lasting up to 18 months. The general pattern favoring dryness could continue for 3-15 years, although individual wet years associated with El Niño conditions would lessen the impacts substantially.

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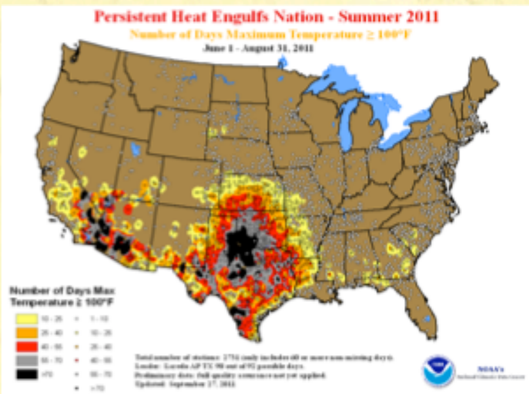
What is "Flash Drought"? (October 27, 2011)

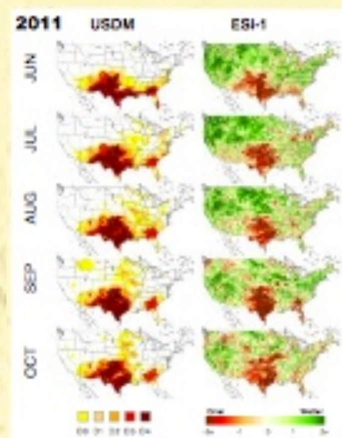
Drought is usually thought of as a slow-onset disaster, but much like flash floods, drought can develop very quickly. During summer, if evapotranspirtation (ET) – loss of water from the soil and plants to the atmosphere – is high, soil moisture can be depleted rapidly producing drought conditions even when precipitation departures are not all that extreme. In addition to soil moisture status, ET is affected by temperature, relative humidity, solar radiation (sunlight) and wind. Any one of these can contribute to higher-than-normal ET rates, but when several combine the results can be disastrous. This past spring and summer combined unprecedented heat with above-average wind speeds, low relative humidity, and abundant sunshine, resulting in ET rates as much as double their long-term average. Essentially, this means that an inch of rain which in some locations may provide sufficient soil moisture for 6 days may be depleted in only 3 days.

Drought is defined by its intensity and duration. A very intense drought coming on quickly can have a magnitude similar to a slower-developing but longer-lasting event. The term "flash drought" was first coined in 2000 when rapid-onset of extreme drought conditions developed in Oklahoma and Texas as severe short-term precipitation deficits and extreme heat overwhelmed soil moisture reserves. In 2011, these "flash drought" conditions were repeated, but this time in the absence of severe short-term precipitation deficits. April and May in Missouri and Arkansas were extremely wet, including the flood-of-record along the White River in Arkansas. During the subsequent summer months, precipitation was below-normal, but it was not at the extremes experienced in Oklahoma and Texas. Yet by mid-July it was apparent that things were not quite right. Reports started coming in from southwest Missouri that farmers were giving up on the corn crop, soybeans were stressed and pastures were burning up.

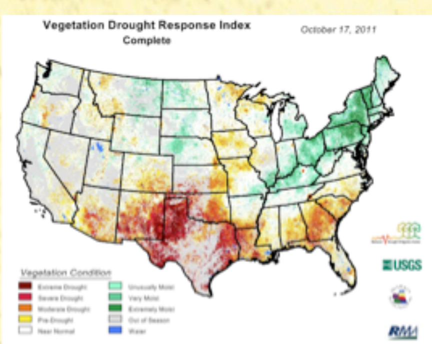


These reports ran counter to many of the precipitation-based indicators that continued to show near-normal conditions. The primary factors were heat and wind. The core of the southern plains heat, which had temperatures similar to those in the Arizona and California desert, spread outward from Texas and Oklahoma, where it combined with strong winds to produce the perfect conditions for flash drought. Based on field reports, D1 (moderate) drought was introduced on July 12 and D2 (severe) drought introduced on August 2. Had there been other ET-based or temperature-based drought indicators, they may have allowed earlier detection and consequently earlier action on depicting the more severe conditions. This underscores the importance of *systematic* reporting - whether from extension, USDA agencies, individuals, or media – and for people in the affected areas asking questions of the Drought Monitor authors and state climatologists.

Tools to Monitor Rapid-Onset of Drought Conditions



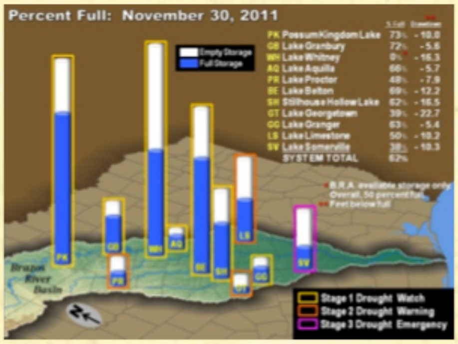
ET is a good indicator of what the plants are actually experiencing. It is difficult to measure directly over large areas, but it can be calculated using satellite-based remote-sensing. Surface temperature is related to the amount of water in the soil. Dry soils retain and give off more heat than moist soils. This "heat flux" can be measured by satellite and used to estimate actual ET. This is compared to how much ET would be possible given the weather conditions, if moisture were not limited, called potential ET. Anomalies in the ratio of the two gives an Evaporative Stress Index (ESI). As long as there is sufficient soil moisture, actual and potential ET are nearly in balance, giving a high ESI value. But as plants use up available water, ESI declines rapidly as there is no more water to extract from the soil, while the atmosphere continues to demand water. This is the situation at which point plants become stressed and drought impacts begin to emerge.



Another indicator, the Vegetation Drought Response Index, or VegDRI (http://vegdri.unl.edu), combines vegetation "greenness", as calculated by satellites, with climate-based drought indices and other biophysical data such as landcover, soil characteristics, elevation, irrigation, and ecological settings. VegDRI works by identifying anomalies, or variations from average conditions, where vegetation is stressed because of it being too dry or too wet. VegDRI is computed bi-weekly and includes a 20+ year historical record (available on the website). It also masks areas that are out of season to limit false positives, as dormant vegetation could be mistaken for drought. Current VegDRI values in west Texas are among the most extreme values observed during the last 20 years.

Water Resources (December 2, 2011)

The exceptional drought conditions prevalent across eastern New Mexico, Texas and western Oklahoma have taken their toll on river systems. Along the Rio Grande, fairly dismal conditions during the winter of 2010-2011 set the stage for record low flows this past summer. Poor snow conditions in New Mexico, and not much better conditions in the headwaters of southern Colorado, contributed little runoff during the spring. Mid-to-late season snowfall failed to materialize. The first 9 months of the year in New Mexico was their 2nd driest January-October of any period on record. Taken together, this has depleted soil moisture in southeastern New Mexico and west Texas and has been particularly harsh on the Pecos River Basin. November has been a bit more favorable, especially in southwestern and northwestern New Mexico, but most of the basin experienced yet another month of below-normal precipitation. With very little soil moisture in New Mexico, it is anticipated that much of the spring snowmelt will be absorbed by soils and shallow aquifers rather than feeding streams. There is hope for improvement in the mountain snowpack in coming days as another storm system traverses the region.



The Brazos River spans from the Texas Caprock near Lubbock to the Gulf of Mexico near Houston. The Brazos River Authority manages 11 reservoirs along the way. Municipal users, steam-electric power generation facilities and industrial users place the greatest demands on the reservoir system. Releases from the larger reservoirs provide much of the stream flow needed to meet downstream demands during droughts. Smaller reservoirs are primarily used for local supply.

Currently most reservoirs range from 40-75% full. Recent rains provided about 2 months of additional supply, although runoff remains minimal throughout the basin. Even with the basin receiving some rainfall this past year, the cumulative inflow since September 2010 is the lowest on record, more than 100,000 acre-feet below the previous record (set in 1917) and only 16% of the median inflow of about 2.5 million acre-feet. If exceptional drought conditions continue, projections for September 2012 are for reserves to drop from a current 62% of capacity to near 35% of capacity, with reservoirs 10-50 feet below normal. Mandatory restrictions and curtailment of contracts are possible if these projections materialize.

The Lower Colorado River is much the same story. Unlike its northern sibling, water use along the Lower Colorado goes primarily to agriculture, with about 1/3 of water releases going to industrial use and power generation. Six dams and lakes dot the 180,000 square mile watershed; of these only two are used for water storage. Rainfall across much of the basin during October 2010-September 2011 was 20 inches or more below normal. About ¾ of the basin remains in exceptional drought, with recent rains either missing the basin or yielding little runoff. Beginning in March, inflows along the four major tributaries fell below 2009, which was the driest recent period, and is on pace to record the lowest-ever annual inflow. Reservoirs are only averaging 37% full, the third lowest elevations on record. Evaporation rates during the summer were 13% higher than during the 2009 drought. Even if precipitation over the next six months followed the pace of the wettest such period on record, reservoirs would still remain less than 70% full and interruptible supplies would remain curtailed. If inflows continue on the current pace, reservoirs would hold only about 600,000 acre-feet with even firm supplies and environmental flows curtailed. The low flows also cause severe downstream salinity problems at Matagorda Bay where seawater is able to intrude upstream.

Further north, in the Arkansas-Red Rivers basin, the picture is not nearly as bleak. Heavy rainfall in October and November filled many reservoirs in eastern Oklahoma, although reservoirs across western and central Oklahoma remain near record lows. Lake Texoma, along the Red River, has had only 20% of normal inflow during 2011, impacting recreation, hydropower and water supply. Several reservoirs had reached Level 3 drought contingency, in which interagency coordination committees are assembled to navigate the complex relationships between competing water demands.

Impacts in the region included water curtailment, extreme evaporation rates, proliferation of blue-green algae, challenges with endangered species, and fisheries. One lake, in eastern Oklahoma, was projected to be completely depleted by Christmas before heavy rains caused rapid recovery. Had that occurred, a major industrial user would have had to furlough hundreds of people. Evaporation rates exceeded planning criteria by 18%, on top of a 40% increase projected during severe drought. These new values will go into future contingency plans. Lack of inflow, stagnant pools, and high temperatures caused high concentrations of blue-green algae, a toxin, forcing closure of several lakes during peak recreation periods. Other lessons learned included the need for calculating environmental flows needed to maintain endangered species and maintaining flow to keep fish hatcheries viable, especially for non-native species like trout that are stocked in many Oklahoma lakes.

The Cattle Industry (December 8, 2011)

Crop insurance has been around for years but there has been a big gap in insurance for ranchers. Congress directed USDA RMA to developed an insurance program for pasture, rangeland and forage. The insurance is based upon either a Rainfall Index (RI) or Vegetation Index (VI). New Mexico is testing the VI program. Texas, Oklahoma and Kansas use the RI program. Insurance can be purchased for either a 2-month (RI) or 3-month period (VI). Verification is based upon rainfall or vegetation conditions over a grid instead of the usual county-based methods. Losses are based upon the data so that producers need not maintain loss records, allowing more timely payments.. The VI uses satellite remote-sensing of vegetation health to calculate a departure from average conditions to determine where biomass production is below normal. In New Mexico, this captured a transition from near-record health early in the year to record poor health during summer. The Rl uses observed daily rainfall to determine departures from normal. Through September, payments for VI have totaled $4.1M, with $3.7M of that total in New Mexico. RI payments have totaled $151M, with $132M in Texas, $2M in Oklahoma and $714,000 in Kansas. More details are on www.rma.usda.gov.

Because of record high cattle prices, ranchers have been able to maintain revenue despite the unprecedented numbers of animals moving through markets. However, the drought has put a dent in long-term plans of increasing national inventory, which had been steadily declining since 1975. In 2011, Oklahoma experienced a decline of 12%, rates never before seen in the state. November proved to be remarkably good coditions for winter wheat pasture, greatly improving the dim prospects from October and allowing ranchers to bring in more stocker cattle than anticipated, although still well below normal levels. If drought returns with a pattern similar to 2011, expectations are for additional liquidiation to kick in early in April due to tighter feed and financial resources. If drought is delayed until summer, there will be more flexibility in maintaining herds, although financial resources will still be an issue. Long-term rebuilding of herds will face higher costs due to the market's high prices and reduced availability of proper genetic stock. More patient recovery strageties and consideration of new production mixes are encouraged as we come out of the drought.

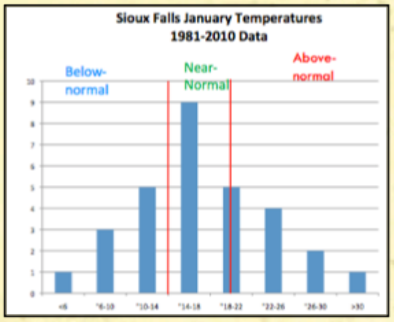
In New Mexico, the year began with the lowest inventory of the last 20 years, partly attributed to lingering drought since 2000. During 2010-2011, more than 100,000 head have been sent to other pastures, sold, or harvested, most from eastern New Mexico. Nearly 64,000 cows will be needed to replace these. Like elsewhere in the drought-stricken region, limited winter grazing options and water avaialbility are primary concerns. Coupled with imported forage comes introduction of new weeds as grasses come into the region, some from as far away as Manitoba, Canada. Buyers should also beware of differences by state in how producers define their quality of hay. Lower quality of feed also could cause cattle to become energy-deficient. In addition to feeding high-protein cake, there are many other commodity-based products on the market that can help decrease supplement costs. Water concerns are perhaps more dire as cattle deaths have increased related to high mineral concentrations in the dwindling water supplies. Major decisions revolve around how long producers feel they can stay in and how long they can continue to provide feed, knowing many calves have already left the state.

A decision-map used by cattle raisers begins in spring (April-May) as ranchers assess the prospects for spring rains and forage growth. Based on these perceptions, they forumulate plans for stocking rates, pasture rotation, and future hay needs. In Summer (June-August), the plan is implemented. During drought, options include weaning calves at lighter weight to save feed and reduce nutrition needs of cows, to extend available pasture through fed hay or "range cubes", more frequent pasture rotation, use of reserve pasture, or leased pasture out of state. If these options prove insufficient, ranchers will reduce herd size. During fall (September-November), plan adjustments are made. Water supplies become critical, the cost of feeding increases dramatically, and distance to available pasture increases, resulting in higher pasture lease costs or increased transportation costs. A critical decision point comes in mid-September based on prospects for fall wheat grass pasture availability and cost of hay for the winter. Decisions in this next cycle may be even more difficult as there is limited wheat grass pasture, a projected return of La Nina – and drought, and 2012 spring rains are uncertain.

In Texas, the story is the same, only worse. Of the 15,500 members of the Teexas and Southwest Cattle Raisers Association, 84% have reported reducing herd size by an average of 38%. This translates to a net reduction fo 600,000 to 800,000 head, or about 12%-16% of supply. Total impacts on the Texas economy are estimated at $2.2 billion from livestock losses alone. But with the unquenchable optimism common to those in the agricultural industry, there are bright spots for the future. As the cattle herd is rebuilt, it will be higher genetic quality as many of the older, less productive, lower genetic stock were the ones sold. Long-term planning, moving to a 10-year planning cycle for managing grass, appears more viable to soften the impacts of future droughts. Lastly, even though the effects of a single-year drought will be felt for another two to three years – and longer if the drought continues – it is important to remember that cattle raisers are survivors.

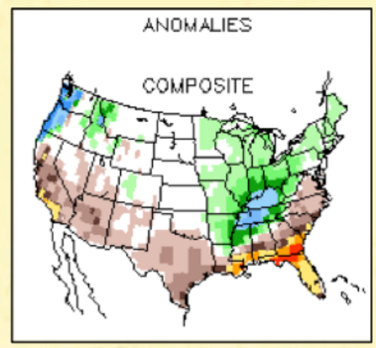
Seasonal Forecasting (January 12, 2012)

To begin to understand seasonal forecasts, we have to start with normals. Normals are usually an average of weather conditions over a 30-year period. These normals may represent a particular day, month, season or year. However, weather is very rarely normal. Rather, it is usually within some range about that average. This range may be wide, like in spring when weather changes rapidly, or it may be narrow like mid-Summer. Seasonal forecasting projects to which side of this range the temperature or rainfall will lie.



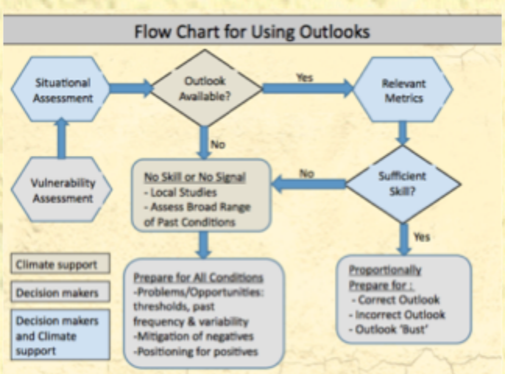
To do this, the 30-year period is broken into thirds, with the highest 10 values being considered above normal, the middle 10 values being near normal, and the lowest 10 values being below normal. The Climate Prediction Center, which issues seasonal outlooks, then tries to predict which of these three categories is most likely. The more confident they are that the total will like in either above or below normal, the higher the value that is depicted on a map. If there are no clear signals to forecast which way it will lie, the CPC shows “EC”, or Equal Chances, meaning temperature or rainfall could end up in any one of the categories – there is not enough *skill* to make a forecast. This means an equal 33% chance for each category (the “left over” fraction is usually added to the middle, near normal, category).

A forecast of below or above normal has a number attached to it. For example, a contour (line) showing 40 would mean that there is a 40% chance that the value will be below normal. Because probailities need to add up to 100, 7% is taken away from the above normal category, to make a 40-34-26 percent chance distribution. The higher the confidence of one way or the other, the higher the percentage shown, and consequently, the greater the “odds” of the temperature or precipitation landing in that category. Two things to keep in mind: 1) this is like “loading the dice”, it makes an outcome more likely but there is no guarantee, and 2) the cutoff values are dependent upon local climatology, so below-normal may be not far from the average in one location or season compared to another.



The CPC makes forecasts for overlapping 3-month periods out to about a year. You may see a legend on the map saying “valid JFM”, for example, which would mean that the outlook is for the months of January, February and March. Each outlook is accompanied by a discussion describing the forecaster’s reasoning, such as what influences may be important. The main variables forecasters use are 1) natural climate variability that organizes weather on seasonal time scales, such as El-Nino Southern Oscillation (ENSO), 2) statistical forecasting tools using various methods and data, 3) long-term trends, 4) dynamical weather and climate forecast models, and 5) “boundary conditions” such as soil moisture, ocean temperatures and snow cover. Forecasters look for instances where 3-4 of these techniques may agree to have confidence to make a forecast other than equal chances.

A major challenge for forecasters is that even though there may be relationships in the data, rarely are they near-certain. For example, La Nina may favor warm, dry conditions in the Southern Plains, but it doesn’t always behave the same way. In many locations, a clear, consistent relationship may not exist, thus the product cannot shed light. Other confounding factors are atmospheric patterns that shift on less than a seasonal basis, such as the Arctic Oscillation (AO). For example, the northern plains may be warm or cold depending upon the AO phase, even with the same background conditions.

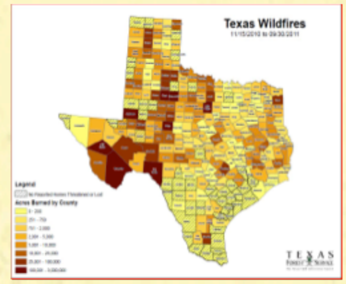


Even wth the difficulties in forecasting, there are times when the forecasts can add important information to help shade decisions and capitalize on likely outcomes or reduce potential losses. To identify these conditions, CLIMAS developed a Forecast Evaluation Tool: (FET) : http://fet.hwr.arizona.edu/ForecastEvaluationTool/. The tool lets you look back at seasonal forecasts according to where you are, what season(s) are important to you, and how much lead time you need. For example, if decisions have to be made in September for the upcoming spring, you would want to look at the performance of the 6-month lead time forecasts. The FET takes into account the percentage of time in which a forecast other than equal chances is made and how those forecasts compared to observations when they were issued. If the outlook has a history of showing skill, it allows hedging toward the forecast conditions while still preparing for adverse outcomes, depending upon your wilingness to accept risk. If no skill is indicated, then it may not be wise to use the outlooks; keeping in mind that the outlooks are prepared nationally while there may be some local studies that show skill but are not embedded in the national record.

Preparing for Wildfire (February 9, 2012)

Fire is a natural part of our ecosystem with an average of 5.5 million acres burned per year. However, under some conditions, these fires can get out of control, posing threats from smoke due to poor visibility and health impacts in addition to the fires themselves. Improvements in forecasting have helped us anticipate where large fires may occur, giving us time to pre-position resources to fight the fires before they can become large.

The National Weather Service undertook an intensive effort to improve fire weather forecasts following large blazes in Oakland, California in 1991 and Long Island, New York in 1995. Since then, forecasts have grown to 8-days to allow better deployment of equipment and staffing. Forecasters look for dry, windy conditions and dry thunderstorms – those that produce lightning but little rainfall. Sixty-one percent of total acres burned were started by lightning, including 99% of the fires in the Northern Rockies during the extreme fire season of 2000. Forecasts project fire potential as critical, extremely critical, or dry thunderstorms with associated updates and additional details in text discussions. To make these products, forecasters combine information from weather observations, lightning detection, climatological studies, radars, satellites (which can detect hot spots and burn areas), computer models and fuel dryness forecasts .



The dry winter of 2010-2011 set the stage for the worst fire season in Texas history. More than 3,000 fires burned 3 million acres and destroyed 2,246 homes, an area the size of Connecticut. Most of the fires occurred during two periods, April 6th – 30th, mostly in west Texas, and August 30-September 5th, with the worst in Bastrop County in Central Texas. In 2011, the Keetch-Byrum Drought Index (KBDI) averaged a record 550 (on a scale of 0 to 800), compared to a long-term average of 300. As fire weather forecasts have improved, officials have been able to be more proactive in staffing decisions. Texas Forestry Service uses 30 and 60-day dryness, shorter-term forecasts and fuel dryness to anticipate areas at risk. Current concerns are greatest from the Big Bend area to near Lubbock, although much lower threat than last spring. Two wildcards are in the mix this year. Juniper mortality, greatest in southwest and west Texas, could make fires more severe. This is balanced by a lack of fine fuels (grasss) that requires higher wind speeds to move fire along the landscape.

Fire is often portrayed as a destructive, uncontrolled element, but effective use of fire on the landscape has many benefits. Native Americans used fire to restore grasslands and today it is used similarly to control invasive vegetation and provide natural fertilizers to pastures. Controlled burning is also used to reduce dangerous fuels like dead wood and brush. Excessive fire supression leads to build-up of these fuels which can make uncontrolled fire reach much higher intensity. Prescribed fire is commonly used in Oklahoma, Kansas and Florida on up to 1.5 million acres every year. Prescribed burns are more challenging to conduct during drought but are still possible. Some things a producer should keep in mind:

- Should I burn? Producers can consider patch burning so that parts of the field are maintained.
- Do I have enough fuel to burn? If fires cannot get hot enough to control cedars and junipers, it may be better to postpone a burn and instead adjust stocking rates.
- Will fire kill my native plants during drought? Native plants are adapted to fire and will recover.
- Should I wait to see if it rains before burning? Timing can be adjusted to see if there is sufficient rainfall for regrowth.
- Is there risk of fire escaping? There can be good burn days during drought and high fire danger days in wet years. The big difference is less leaf moisture in evergreens and cedars making them more volatile.

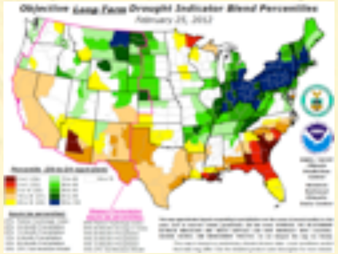
Texas offers two programs to assist homeoners and communities in preparing for wildfire: Firewise (www.firewise.org) and Ready-Set-Go (www.wildlandfireRSG.org). Firewise is a community-driven program that gives national recognition to homeowners and communities that have taken steps to address risks under guidance from a wildland-urban interface specialist. Steps include conducting a hazard risk assessment; forming a "Firewise Board"; creating a wildfire protection plan; invest at least $2 per capita in Firewise projects; completing at least one major project a year; and observe a Firewise Day pulic awareness event. The funding requirement need not be cash; it could be met through the value of volunteer time.

Ready-Set-Go builds upon many of the principles in Firewise. Getting Ready involves creating at least 30 feet of defensible space around the home. Thinning and removing dead vegetation, pruning vegetation near windows and choosing plants with a high moisture content inhibit the spread of flames as well as creating a more attractive environment around the house. Using non-combustible materials, boxing eaves and screening vents to prevent embers from getting inside the house, clearning and fencing underneath decks, using double-pane and tempered glass, and replacing wood supports and fencing immediately adjacent to the house with non-combustible materials make the home more defensible. When conditions are favorable for wildfire, Get Set. Remove lawn furniture and doormats near the house, remove flamable window shades and curtains, and back the car into the driveway so you can evacuate quickly. Have a stock of food, water, medication and important documents ready. Turn on the lights so firefighters can see your house clearly and turn off the air conditioner. When you receive an evacuation order – Go. Delaying departure can create traffic problems when fire vehicles are attempting to enter the area.

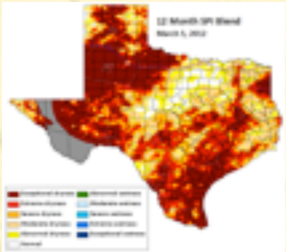
The U.S. Drought Monitor (March 8, 2012)

Since its inception in 1999, The U.S. Drought Monitor (http://droughtmonitor.unl.edu) has produced a weekly assessment of drought conditions across the United States.. What's more, you won't find the Drought Monitor in any agency budget. It is produced by a group of scientists who began the effort out of a curiosity more than a decade ago. Today, more or less those same agencies, and in many instances those same people, are at the heart of producing this important assessment tool. Production of the Drought Monitor rotates among a team of 10-11 authors from several organizations.

The Drought Monitor is not a forecast (the Seasonal Drought Outlook fulfills that role). It is not a declaration, although several states use it as a trigger. Rather it is a snapshot of current drought status based on the best available information. When the Drought Monitor was started, it incorporated data from 5-7 key indicators available on a climate division (multi-county) scale. Today it includes dozens of indicators, many available on a sub-county scale. Each of these indicators are ranked using their historical performance. Values representing the driest 30%, 20%, 10%, 5% and 2% of observations are determined as thresholds for the various drought categories. These correspond to the familiar D0 to D4 levels appearing on the weekly maps. For example, an indicator in the top 20% of its driest observations, or an expectation of similar conditions occuring about once every five years, would match to a D1 level. D0 is not considerd to be a region in drought; rather it is a "heads up" that drought could be developing or impacts from a drought may be lingering.



The next generation of tools avaialble to the Drought Monitor authors include satellite-based assessments of vegetation health, radar-raingage comparisons, soil moisture monitoring and assimilation modeling along with high-altitude snow measurements. The author uses these, in addition to objective blends that mix many of these ingredients to account for short-term or long-term impacts and seasonal and regional differences, to make an initial assessent. Some of the factors an author considers are where it rained in the preceding week and whether that rain was enough to show improvements or if a lack of rainfall warrants intensification or indication of a developing drought. Typically, a core suite of indicators on a 60-90 day time scale works well. Another useful check is whether stream flows quickly dropped back to low values following a rain, indicating sub-surface dryness remaining and cautioning against rapid improvement. Soil moisture models are also a good sanity check; if the indicators don't show dryness matching the soil moisture then further investigation is needed.



These data sources are supplemented with input from about 325 local experts who contribute via a listserv e-mail system each week. These local experts are excellent sources of knowledge on how well indicators match up to what they see on the ground especially when varous indicators conflict with each other. Local experts, such as state climatologists, regional climate centers, and National Weather Service offices, are often well-connected with state coordinators, local sources, media, and 'rumors and impacts'. These provide some ground-truth to the depiction.

Local experts often have their own products and resources as well, such as the Texas Office of the State Climatologist's Standardized Precipitation Index (SPI) assessments using radar-based rainfall estimates. Local experts may also be aware of what observation sites are the best indicators, such as stream flow measurements along managed versus unmanaged streams, or which areas are sensitive to drought at which times due to different agricultural uses.

While drought assessment is important, it is just one step in the process. The National Integrated Drought Information System (NIDIS) was established by Congress in 2006 to move the nation from reactive to proactive management of drought through improved coordination, creating an interactive clearinghouse (the drought portal), and creating a Drought Early Warning system that emphasizes preparedness and planning. To do this, NIDIS has set up several pilots. Each is established to work with different local and state entities in regions with very different water sources and needs. This includes identifying key indicators and triggers, gaps in observations, and needs for tools, products and research. Engagement techniques include weekly drought assessments, webinars, outlook forums, newsletters and fact sheets. NIDIS responded to the evoloving drought in the Southern Plains through conversations with regional partners, leading to establishment of a regional drought planning workshop, several drought outlook forums, and this weinar series.

Uses of the Drought Monitor
- USDA livestock assistance
- Extensive media dissemination
- Featured on the NIDIS Drought Portal
- National Weather Service Drought Information Statements
- IRS deferral of cattle replacement costs

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Wildlife Management During Drought (April 12, 2012)

To improve management of natural lands, the Department of Interior created a set of Landscape Conservation Cooperatives. (LCCs). The LCCs are designed along ecoregion boundaries, requiring partners to work across traditional state and federal administrative boundaries. They base their collective efforts on sound science, become more strategic in our conservation delivery efforts to meet some of the greater challenges we face today, whether climate change, weather, or other stressors like population growth. By working together they are able to share their time, treasure and talent to stretch precious resources farther. Each of the 21 LCCs sets their own regional priorities but use a similar approach, working with an adaptive management strategy that focuses on biological planning and conservation design with our partners and then monitoring that design over time.

The Gulf Coast Prairie LCC is a collaboration among several federal agencies, including NOAA, U.S. Fish and Wildlife Service, 5 states and Mexico. It also includes a number of private partners and non-governmental organizations, including 2 Fish Habitat Partnerships, 3 migratory bird Joint Ventures, USGS and NOAA shared positions, and strong relationships to the National Wetland Research Center, Cooperative Environmental Studies Unit at Texas A&M and Wildlife Management Institute. It encompasses 3 ecological region that are quite dverse and includes one of the most rapidly-growing populations in any region of the U.S. The Gulf Coast Prairie LCC was established in 2010 and is overseen by a steering committee to set priorities. Although they take a long-term look at management challenges, events like the drought, fires, and water shortages pose more immedate challenges with which the partners contend.

The South Texas wildlife management refuges has more wildlife diversity than any other state except Texas and Arizona as a whole. The refuges are located in a transition zne from subtropical to arid. On the west side, habitat clearing was in full-force by the 1930s and relatively few native brushland habitats are left. With transition from brushland to buffalo grass, fire, which is not very natural to the region, has increased. The area is home to many species of birds, federally-endangered ocelots, white-tailed deer and coyotes. Antelope and feral hogs are invasive species, moving into the area and crowding out resources needed to sustain native populations. Other challenges are population growth and border control issues. More ocelots are killed by vehicle strikes than from any other cause.

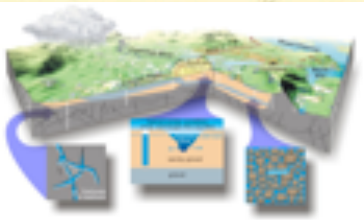
Drought concerns emerged in the 1990s and peaked in 2003, when the Rio Grande did not even reach to the Gulf of Mexico and Laguna Madre went dry after 18 months with no rain. Learning from this experience, 14 rain catchments, called guzzlers, were installed to provide fresh water for all wildlife. Guzzlers use a pitched roof to catch water in a 600 gallon tank, which is fed down to the drinker bya pipe. Cameras were installed to monitor wildlife coming to the guzzlers. Each time an animal comes to drink, a picture is taken. Typically about 3,500 photos were captured per month; it is now up to 5-6,000 per month. It was discovered that hogs were setting up camp around these drinkers and preventing other wildlife from using them. Fences were set up around the perimeter with smaller cutouts, allowing smaller animals like ocelots to get through while keeping out the larger hogs and antelopes. Visit http://www.friendsofsouthtexasrefuges.org to learn more.

The drought is taking its toll on waterfowl as well. The drought has accelerated already gradual decline of snow geese in Texas. At the mid-December count last year, 200,000 snow geese were counted compared to an average of 400,000-600,000 in other years. Duck populations are down 9% for the state overall, but with large regional differences. The Panhandle and south Texas were down more than 90% while in east Texas counts were 173% of normal. The rainfall since mid-December has been extremely beneficial, especially in east Texas with grass and flowers blooming. Reservoirs are 80-85% full in the east, about half-full in central and even lower in the West. Drought over the years has dried Lake Meridith in the Panhandle and caused the loss of ½-billion trees in east Texas with associated impacts on wildlife.

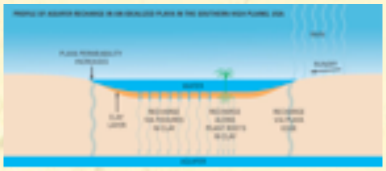
By 2025, projections show a potential water supply crisis along the Texas Gulf Coast, but with the drought we may already be there. A projected doubling of Texas' population in the next 40 years, from 25 to 50 million people, will stretch surface water demands that are already at capacity. As an example, the Lower Colorado River Authority will not release irrigation water from the depleted highland lakes that feed lower parts of the basin; with the lakes sitting about 35% of capacity there just is not enough water. As a consequence, there will be 400,000 fewer acres of rice planted. Last year ducks did fairly well, but without the rice fields they are sure to feel the delayed effects of the drought this coming year.

Groundwater and Surface Water (May 10, 2012)

Increasing demands for sources of water combined with changing land use, population growth, aging infrastructure and climate change pose significant threats to our water supply. One result is enhanced development of groundwater. Although groundwater seems a plentifical and replenishable source, we often do not realize the connections between groundwater and surface water.



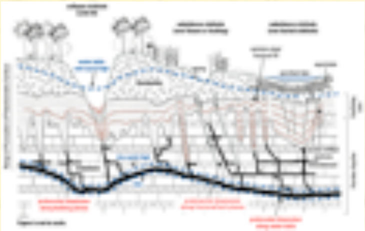
Water in streams can recharge aquifers below the streambeds (losing streams) or be fed by groundwater (gaining streams). Gravel aquifers have high yields while fractured bedrock may contain a great deal of water but are more difficult to pump. The process of water infiltrating into the aquifers can take from days to thousands of years. Pumping from these aquifers can draw down water trables resulting in gaining streams becoming losing streams as the water tables fall. As an example, the groundwater well field for the community of Spiecwood Beach, near Austin, Texas, went dry in 2011 as the levels of nearby Lake Travis declined, dropping the water table even though the community did not increase pumping.



Recharge is water that infiltrates to the water table of an aquifer. Recharge can be either diffuse (gradual infiltration over a wide area) or focused (concentrated water source, such as from a playa lake). It is nearly impossible to measure recharge so the best that can be done is various forms of estimation. Many approaches can be used, depending upon the type of aquifer and what variables are important to assess, and all may yield different results.

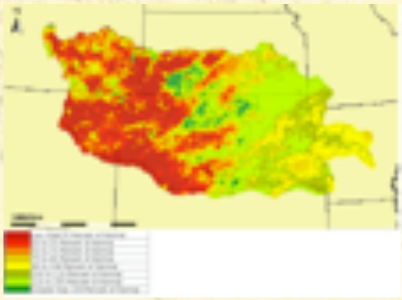
There are several zones below the surface. The top zone is surface water – the lakes and streams we can see and measure. Below this is the unsaturated zone, the layer through which water moves downward. Below this is a saturated zone. There may be a layer of bedrock or clay beneath the saturated zone, confining water above it except through cracks that may be created through fractures or roots. Playa Lakes – shallow lakes that fill with rains – are good sources of concentrated infiltration.

Sand, gravel or silt aquifers have many pores through which water filters slowly. These are often found below stream beds, such as alluvial aquifers. Karst aquifers – fractured bedrock – allows water to cascade through fissures and can travel tens of miles a day, but do not store as much as allivial aquifers. The Edwards Aquifer near San Antonio and the Arbuckle-Simpson Aquifer in south central Oklahoma are examples of karst aquifers.



The Arbuckle-Simpson Aquifer is designated as a sole source aquifer by the EPA, which requires additional review to assess the impacts on water of projects. Water is used primarily for minicipal applications with some agriculture, industrial and mining uses. Water is also important for tourism and recreation of the region, along with important cultural aspects with the region's Native American tribes. The aquifer provides baseflow to area springs and streams, so depleting groundwater could threaten the flow of these streams. Groundwater is treated as a private property right in Oklahoma and is managed separately from surface water. Consequently, it may be over-pumped compared to sustainable yield levels while remaining within state law on allowable extraction rates. Because of drought and pumping, flow on the Blue River in 2011 was comparable to the 1956 drought of record, following a period of 25-30 years of abundant preipitation that supported much greater yields and flows.

All of these complex factors, including soil type and land use, are combined with hourly rainfall estimated from radar and measured by rain gauges in complex computer models to estimate soil moisture in these different zones. The models are developed primarily for estimating flash flood guidance and making streamflow forecasts, but can also be used during drought to assess water sources that cannot be measured directly. The model used by the Arkansas-Red River Basin Forecast Center computes the amount of water in several layers, which are combined into an upper zone (useful for agriculture applications) and a lowe zone (good for hydrologic assessment and ground water use). The upper zone is sensitive to short-term rainfall and can change rapdily day-to-day, while the lower zone changes more slowly over time and is not extremely sensitive to a single event. The amount of water is expressed relative to historical measures as a maximum amount of water that could be held, departures from average (anomalies) or percent full. The anomalies are more sensitive over climatologically dry areas like western Oklahoma.



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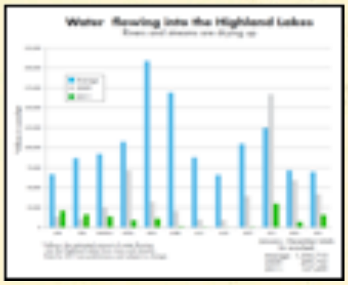
Then and Now (June 14, 2012)

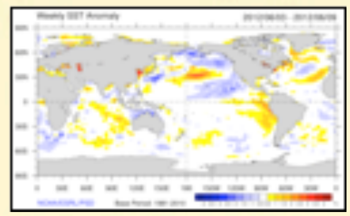
The Hill Country of south central Texas, which includes the Lower Colorado watershed, has recorded near to above normal rainfall since January but gains in reservoir storage have been limited. October 2010-September 2011 was the driest *water year* on record in Texas, with some areas more than 20 inches below normal. Consequently, inflow into Lakes Buchannan and Travis, the primary storage reservoirs for the Lower Colorado River Authority (LCRA) were only 10% of average, dropping total system storage as low as 37% of capacity, the 3rd lowest since the system was constructed.



Fortunately, since September, much of the area is near to slightly above normal. However, the heaviest rainfall either missed the basin or was absorbed by the very dry soils. Consequently, runoff and inflow into the lakes has still been limited. Aside from March, which was the first above-normal month in more than a year, April and May have returned back to well below normal numbers. Reservoir capacity now stands ad 51%.

For the first time in its history, the LCRA was forced to curtail water to downstream agricultural users. Not enough water could have been released to germinate and sustain a rice crop, which accounts for 55-60% of total rice production in Texas and 5-10% of the national rice crop. Consequently, the decision was made to conserve the water in hopes of recovery for next year. The possibilities of an El Niño pattern, which typically results in wet conditions for Texas, would aid recovery, but absent a very wet pattern, projections are to maintain current storage if precipitation is near average or return to levels recorded in 2011 if the weather turns dry again.

Since last fall, a renewed La Niña has faded into neutral conditions and appears to be on a track toward El Niño. La Niña typically relates to dry winter and spring for the Southern Plains, although this past event was drastically different from the one preceding it in 2010-2011. Only about 1 in 5 La Niña events result in a wet pattern for the region; fortunately the event that just ended was one of those. Dry conditions were shifted further to the west and east, giving the Southern Plains a much-needed break.



So why was it so different? Part of the answer may lie in other influences of the Atlantic Ocean and North Pacific. Last year, warm temperatures in the tropical Atlantic helped shift precipitation away from the area, as thunderstorms tended to develop over the warm water rather than over land. This year, the Atlantic is cooler, which may assist summer rainfall patterns near the coast. However, even with rainfall we are not out of the woods; a lingering warm pattern means higher evaporation during the summer, which will still stress vegetation regardless of rainfall.

Looking ahead, the NOAA Climate Prediction Center has issued an El Niño watch, meaning probabilities of development are greater than 50%. Historically, El Niño favors wet, cool winters in the Southern Plains. Cool, though, is relative as winters have been warming, so as of now forecasts show equal chances of near-normal compared to warm or cool temperatures. In the longer-term, the Pacific and Atlantic ocean cycles remain unfavorable for drought relief. Hopes are for El Niño to help us recover before diving into the next drought.

As extreme drought conditions have eased in the Southern Plains, it appears that drought may be coming on strongly and quickly in the Midwest. Like last year, temperature has a big effect. This year, those temperature and precipitation patterns appear to be starting earlier. Rainfall deficits over the last 5 weeks are well below-normal over Missouri and Arkansas, combined with a top-5 warmest May on record (2nd-warmest for the U.S. as a whole). This hot, dry pattern comes at a critical time for crop development and is beginnng to impact a large portion of the corn belt.

The combination of warm temperatures and low dew point increases the *vapor pressure deficit*, a variable used to monitor plan transpiration. The greater the difference, the more water a plant needs to keep up. In May 2012, this plant water use has been running much higher than the historical daily averages. Solar radiation also is running well above-average, which is the biggest factor driving moisture loss from the soil profile and vegetation (i.e., evapotranspiration). Total water lost from soil and plants in May was 5.90 inches, a value more typical of the height of summer.

Missouri may be more vulnerable to flash drought than Iowa or Illinois because of high clay content and shallow topsoils in parts of the state. The lessened ability of soil to hold on to that moisture leaves crops more vulnerable, particularly in early development stages in Spring as the root system is developing. Soybean emergence has been uneven and corn is short with poor root development and curling of the leaves.

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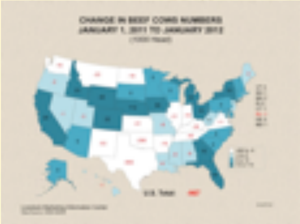
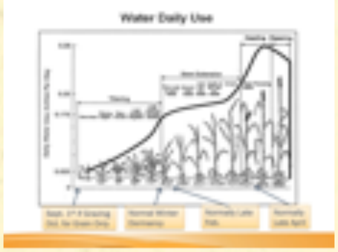
Livestock and Agriculture (August 9, 2012)

The U.S. inventory of beef cattle dropped just under 1 million head last year, almost all of it from Oklahoma and Texas. Because so much had been liquidated last year, slaughter rates in this region are still running below normal, although higher than what would be expected because of continuing drought conditions. Auction receipts in Oklahoma are down 77% this year compared to last year. Unlike last year, though, this year is more challenging in that remaining stocks cannot be relocated to alternate pastures. Nationally, 65% of the country has poor or very poor forage conditions and a decline in corn production from a projected 14.5 billion bushels in May to a current estimate of 10 billion bushes has limited alternate feed sources.



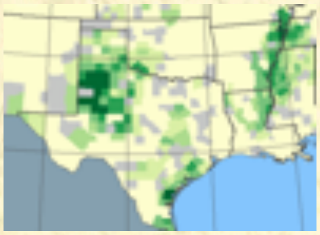
Markets have probably bottomed out, given a tight supply of calves. If prospects for fall pasture improve, a dramatic turn-around in the market is possible. We did not see markets drop as much a year ago because there were other alternatives, but widespread drought this year has resulted in more typical and rapid impacts on the market. There will not likely be a big fall run in cattle sales because so many have already been marketed, so price pressures should remain minimal through Fall.

Livestock is the first value-added componet of wheat production, but it depends on getting moisture early. Wheat planted for cattle grazing needs to be sowed around September 1 while wheat grown only for grain can wait until mid-October to plant. Mositure is essential for establishing a good stand before a dormancy period from December until late February. Water demands are greatest in late April when wheat is heading and ripening, In addition to sufficient moisture, extremes in either heat or cold will affect the final yield.



In 2011, most wheat was dusted in to dry ground with little expectation of getting a crop; it is worth taking a chance on a crop because insurance payments for prevented planting are much lower. Unexpected mositure in October combined with warm temperatures helped wheat get a very good start and allow sufficient development that even wheat that did not germinate until October was able to be used for cattle grazing. Despite the great start, however, the hot, dry spring took a toll in kernal prouction. Temperatures above 85 degrees are detrimental to kernal development; temperatures in April and May were routinely climbing above 90 degrees across much of the wheat belt. Soil moisture columns depleted from the 2011 drought left little reserves for plants. High temperatures, little rainfall, low humidity and high winds stressed plants at a critical time, producing shrunken kernals and highly variable protien.

Warm nighttime temperatures were more important than the daytime temperatures, accelerating wheat development and resulting in a harvest 2-3 weeks ahead of normal. This year's pattern seems nearly identical to last year. Dry soils make tilling impossible and stressed weeds make herbicide applications ineffective.



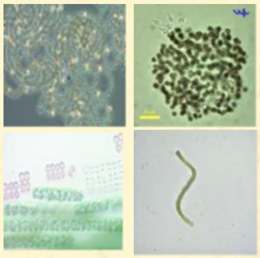
The drought has been particularly hard on cotton. Sixty percent of the nation's cotton crop is grown within 150 miles of Lubbock, Texas. About two-thirds of this is dryland cotton with the rest irrigated. Even though cotton plants in the Texas High Plains only grow to about 8-10 inches high, they produce as much cotton bolls as plants that grow 3-4 feet high in Georgia. In 2011, 60% of the regional crop was lost compared to an average of 18-20%; this year will likely exceed the losses of last year.

After a good start in 2012, ratings have dropped quickly with the quality of the palnts at the lowest of the season. The crop started off similar to 2010, a record year for production in the Texas High plains. More cotton was planted than last year and in early July squaring was ahead of each of the last two years. But the recent heat has made it difficult for plants to set bolls. Some dryland production has already cutoff where additional rain would not matter.

Another challenge has been to soil microbiology. *Arbuscular Mycorrhizal Fungi*, a soil microbe that attaches to the roots of the plant helps the plant to uptake phosphorus, aids in resistance to root disease, and increases drought tolerance, especially within the first 8 weeks of plant development. Without the microbes, more moisture and fertilizer is needed. High soil temperatures killed off a large number of these microbes last year leaving plants more vulnerable. Typically about 40% of roots have these fungi; this year they are found on only about 2% of roots. Re-establishing the fungus is difficult as cotton has few roots so that little organic material goes back into the soil. Dryland or irrigated cotton rotated with sorghum or soybeans helps maintain these communities while continuously irrigated cotton actually depletes the microbes. It can take decades to re-establish these colonies, even with good growing conditions.

Drought Impacts on Public Health (September 13, 2012)

Blue-Green Algae (BGA) has become a common occurrence related to drought. Warm, stagnant water becomes a breeding ground for algae, causing enormous algae blooms. These algae produce toxins which cause health problems, posing a threat to drinking water supplies, recreational activities, pets and livestock.



BGA gets energy through photosynthesis, just like plants, absorbing the sun's energy and using it to grow. It is present in almost all surface waters in small numbers but can reproduce rapidly in certain conditions. Blooms look either like spilled paint along the surface or like pea soup where it is distributed through a deeper water column. Not all blooms produce toxins and some produce several types of toxins. Most common are dermal toxins causing skin irritation like poison ivy rashes or gastrointestinal and respiratory problems if ingested. More severe are neurotoxins which affect the central nervous system and hepatotoxins which affect liver function. Toxins can produce rashes, flu-like symptoms, neurological disorders and abnormal liver function.

BGA has become more common in Oklahoma during the last two summers. Blooms occur when there is excessive nitrogen and phosphorus from fertilizer and urban runoff – a food source for the algae – coupled with hot, dry, sunny, and windless weather condtions and low lake levels with stagnant water. Prolonged dry periods allow suspended clay to settle which increases light penetration and warms the water, allowing blooms to continue into late Fall and early Spring.

2011 was the first time which widespread blooms were found in Oklahoma lakes. Eleven lakes were affected; in 2012 that number rose to 24. The first and most prominent bloom in 2011 occurred at Grand Lake, a popular summertime tourist destination, near the 4th of July holidays. Flooding rains in the spring washed nutrients into the lake, followed by hot, dry conditions as the drought settled in. Wind pushed the BGA into leeward coves where it then expanded into deper waters, up to 90 feet deep. The most serious case in 2012 occurred at Clear Creek Lake near Duncan, in southwestern Oklahoma. The lake was 9 feet below normal due to the extended drought. There was no visual sign of a bloom, but 2-3 feet below the surface there was an incredible concentraton of algae with no chlorophyl. Even larger concentrations were found in the Cimarron River, where blooms of such magnitude have never been found in free-flowing steams in Oklahoma before.

Treating water for BGA requires removing the cells prior to applying disinfectant, because as the cells die, they release toxins. Tests on water supply systems found that the removal process was highly effective, so the problem appears to be confined to the source lakes. Longer-term climate projections favoring more frequent and more severe droughts in this region suggest that this will become a perrenial problem.

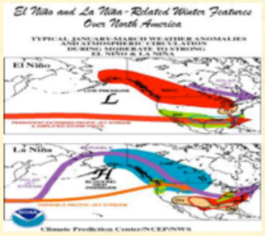
Another public health threat that seems to be thriving in drought-related conditions this year is West Nile Virus (WNV). WNV resides in nature in birds and is transmitted by mosquitos. It occurs naturally in Africa, the Middle East and India but became established in North Ameerica beginning in 1999. It was first detected in New England but spread quickly to warmer climates in the South as birds made their annual migrations. While many bird species are not significantly affected and can be carriers of the virus, blue jays and crows succumb to its effects. Most of the blue jay and crow population in Tennessee was wiped out and is only now coming back. Although there seems to be some relationship to weather patterns, that relationship is complex and evolving. Each season is somewhat different.

In the vast majority of cases, humans bitten by an infected mosquito show no symptoms. For some however, they develop a fever with flu-like illness that in a few cases can require hospitalization. It is difficult to discern WNV cases from regular influenza; one distinct difference is that WNV often does not produce a cough. In the most serious cases, WNV can get into the central nevous system, causing inflamation similar to meningitis and encephalitis. This happens primarily among those already immuno-compromised, primarily among those over 50 years of age.

As of September 12, there were 1,405 neuro-invasive cases causing 118 deaths. Texas, Michigan, Louisiana, Oklahoma and Mississippi accounted for nearly half of these cases. Three factors contributing to these numbers are climate, drought and society. Warm weather permits infected mosquitos to survive and start breeding earlier. Also the hot summer weather allows the virus to replicate more rapidly, infecting more mosquitos. Drought, although reducing the amount of standing water, concentrates water in fewer places causing more interaction between mosquitos, birds and other wildlife. Social aspects come into play through things like neglected pools at foreclosed homes and overflow from irrigation on lawns leaving puddles to become breeding sites. However, it is not clear why some drought areas are affected more than others; possible explanations revolve around migratory patterns of birds or micro-effects that are unknown.

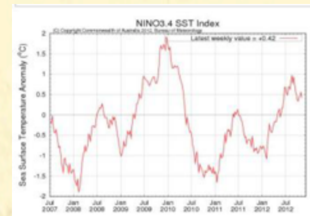
The Chameleon El Niño of 2012/2013 (November 8, 2012)

There exists a strong relationship between sea-surface temperatures (SSTs) in the Central Pacific Ocean and precipitation in the Southern Plains. Therefore, we watch the development of El Niño very attentatively. El Niño is a periodic warming of about 1-3 degrees Celsius that typically occurs every few years. Its counterpart, La Niña is a periodic cooling of about 1-2 degrees Celsius. Together these are called ENSO – the El Niño Southern Oscillation. There is a strong relationship between fall ENSO status and October-June precipitation in the Southern Plains.



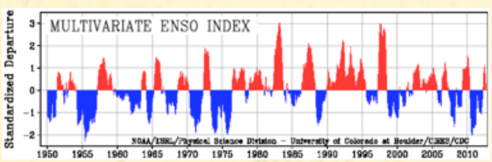
During El Niño, a strong jet stream typically develops across the Southern U.S., bringing rich tropical moisture into the area. During La Niña the jet stream typically takes a more northwest-to-southeast track across the states, bringing drier air into the region. Because of these differences, it makes a big difference on the prospects for recharging our soils before next summer rolls around. El Niño tends to bring above-normal rainfall to the region, La Niña tends to bring drought.

Sea-surface temperatures during July through September actually ran above normal, signaling a developing El Niño event. However since then, it appears to have stalled with temperatures unchanged in the central Pacific Ocean and cooling in the eastern portion near the South American coast. The good news is this warming makes it unlikely that there will be a third consecutive year of La Niña. The middle ground – neutral conditions – makes the whole system less predictable and increases uncertainty for decision-makers.



About 3 months ago, oceanic temperatures and associated atmospheric patterns were lining up indicating a developing El Niño. However, the tropical Pacific wind anomalies are underwhelming and sea-surface temperatures have almost reversed themselves since then. The remaining warm anomalies near the dateline could help to reignite an El Niño event if the right wind pattern comes along, like it did in 2004/2005. The last time we eperienced an El Niño that peaked early and dissipated was in 1953.

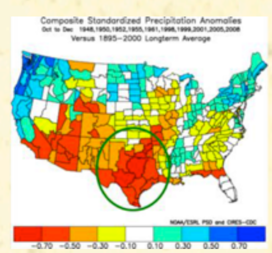
The Multivariate ENSO Index (MEI; http://www.esrl.noaa.gov/psd/enso/mei) shows a wide range of possibilities with a lot of uncertainty. This is coming off a period where the MEI indicated the recent 2010-2011 La Niña event was the strongest since 1975, playing a major role in development of the regional drought. Neutral conditions have been pretty rare, especially following a double-dip La Niña event like the winters of 2010-2011 and 2011-2012. This winter is the first neutral winter since 2003-04 so we need to look at other factors to improve our abilities to predict the outcome.

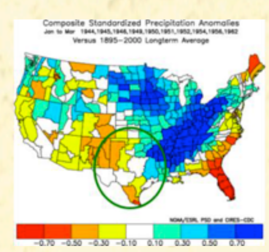


A key factor in our prospects for drought in the Southern Plains is the Pacific Decadal Osciallation (PDO). During this ongoing drought event, the PDO reached an extreme value cold anomaly not seen since 1933. Given this and the long time it takes for these patterns to change it is a pretty safe bet that it will remain in its current cold phase through the winter. When a cold PDO phase matches up with a neutral ENSO phase, it tends to be dry in the Southern Plains, but not as strong of a relationship as a cold PDO with La Niña.

The North Atlantic Osciallation (NAO) changes phase much more quickly than either PDO or ENSO and is not predictable beyond 1-2 weeks. Combined with a neutral ENSO, when the NAO is in a warm phase it tends toward slightly wetter in the Southern Plains, while in the cold phase it tends toward slightly drier. The increase in snow cover in Europe and Asia in October 2012 tilts the odds toward a cold phase, however this can change quickly and several times over the course of a season.

Most troubling is an alignment of a cold PDO with a warm North Atlantic Multidecadal Oscillation (AMO) that produces pervasive drought conditions in the Continental United States. During these scenarios, as was common in the 1950s, late fall precipitation is suppressed. In late winter, it is less tilted toward dry, especially in eastern Oklahoma and Texas, but in the springtime it tends to go back to dry again. Now entering the third year of drought in much of the region, that is not good news.





And if you are looking for hope that the forecasts may be wrong, well, when the MEI has forecasted dry conditions, it has verified every time. The neutral ENSO phase opens the door for these other circulation features to exert their influences. With PDO likely to stay cold and AMO warm, a lot will hinge on the status of the NAO, which is the least predictable part of this whole process!

How can drought planning be proactive?

Water Resources:
* Improved assessment of evaporation rates
* Maintaining environmental flow requirements
* Anticipating tradeoffs in present versus future use of water resources

Cattle and Livestock:
* Long-Term Planning for managing grass (10-yr cycle)
* How long do producers think they can stay in and provide feed? Must consider.
* Long-time production strategy

Agriculture:
* Understand the inter-related temperature and precipitation impacts on wheat protein development
* For cotton, if the microbes have been depleted, farmers will have to add more "fuel" to the crops
* FUEL = Water and Fertilizer
* Farmers can help the cotton crop microbes by crop rotation.

Wildfire Management:
* Fire Weather Watches issued by SPC
* Firewise: Community-Driven Program
* Ready-Set-Go
  * Ready=Creating at least 30 feet of defensible space around home
  * Get Set=When conditions are favorable for wildfires, remove flammable items from the perimeter of the home, and be ready to evacuate
  * Go=Follow an evacuation order

Public Health:
* 'If It Is Green on Top, Stop!' Oklahoma Dept. of Tourism Campaign

Blue-Green Algae Checklist IF IT IS GREEN ON TOP STOP

* Don't get bit by Mosquitoes! 1) Stay away from standing water sources, or 2) Protect against bites using Mosquito Repellant

West Nile virus is now in most of the United States.
The most important way people become infected is through the bite of an infected mosquito. You can reduce your chance of getting infected by avoiding mosquito bites.

SCIPP
Southern Climate Impacts Planning Program
A NOAA RISA Team

Summary

Every major sector has been affected in some way by the ongoing drought

Many participants are learning (and adopting) how others effectively mitigate some aspects of the drought via these webinar discussions

SCIPP, in conjunction with NDMC, NIDIS, and NOAA are working together to produce this webinar series in order to understand the impacts of the drought, and to provide relevant information towards planning for and mitigating the effects of, drought conditions

We intend to continue this series as long as the drought remains mired across the region

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