2008 Winter - Spring Drought Outlook

January 2008 Assessment from NOAA's National Weather Service Office in Raleigh issued January 22, 2008

Despite above normal rainfall this past December, 2007 ranked as on of the driest years on record in North Carolina going back 113 years (Figure 1). The southwestern mountains experienced the driest year in the last 113 year while most of the Piedmont fell within the top 5 driest years on record (Figure 1). Other states in the US also experienced extreme dryness with most southeastern states ranking within the top 10 driest years of the last 113. The record warmth over the summer months helped 2007 rank as the 6th warmest year statewide in the last 113 years (Figure 2). The record dry weather combined with record heat across the southeast exacerbated drought conditions across much of the southeastern US. By August 2007, over 40% of the contiguous U.S. was in moderate to extreme drought, as reported by the US Drought Monitor. The complete 2007 Annual Climate Review can be found online by visiting the national Climatic Data Center websites at http://www.ncdc.noaa.gov/oa/climate/research/2007/ann/us-summary.html.

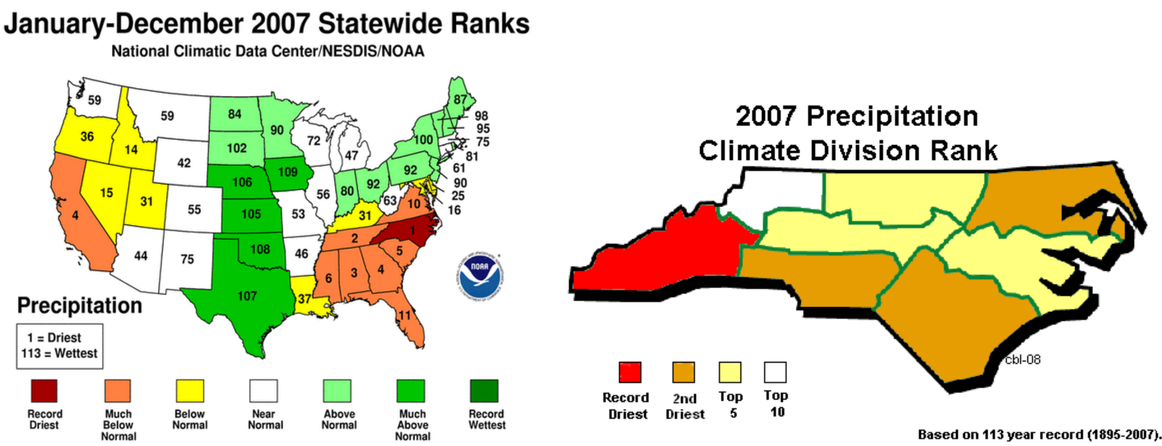


Figure 1: Rainfall rankings by state. Courtesy of the National Climatic Data Center.

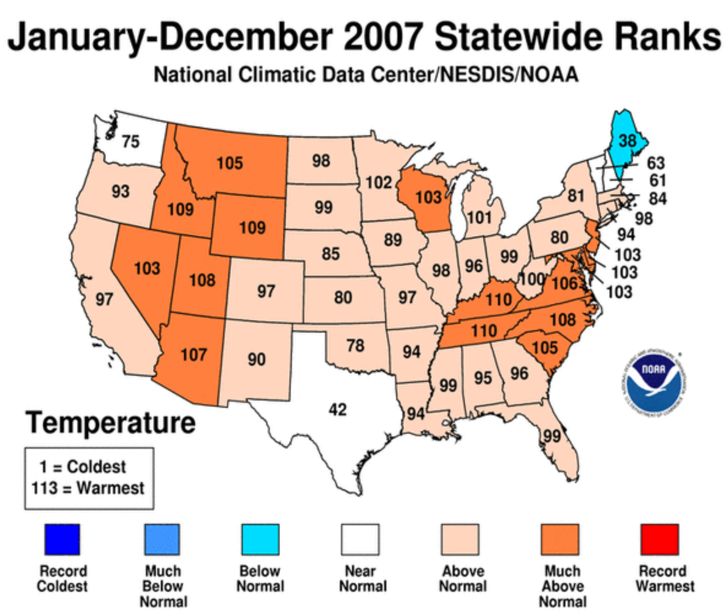


Figure 2: Temperature rankings by state. Courtesy of the National Climatic Data Center.

Rainfall deficits in 2007 ranged from 8 to 12 inches in the Piedmont inches to nearly 20 to 24 inches in the mountains and southeastern North Carolina (Figure 3). This meant most of North Carolina received only 50-75% of the normal rainfall expected in a year and extreme to exceptional drought was being experienced in 87 counties (Figure 4).

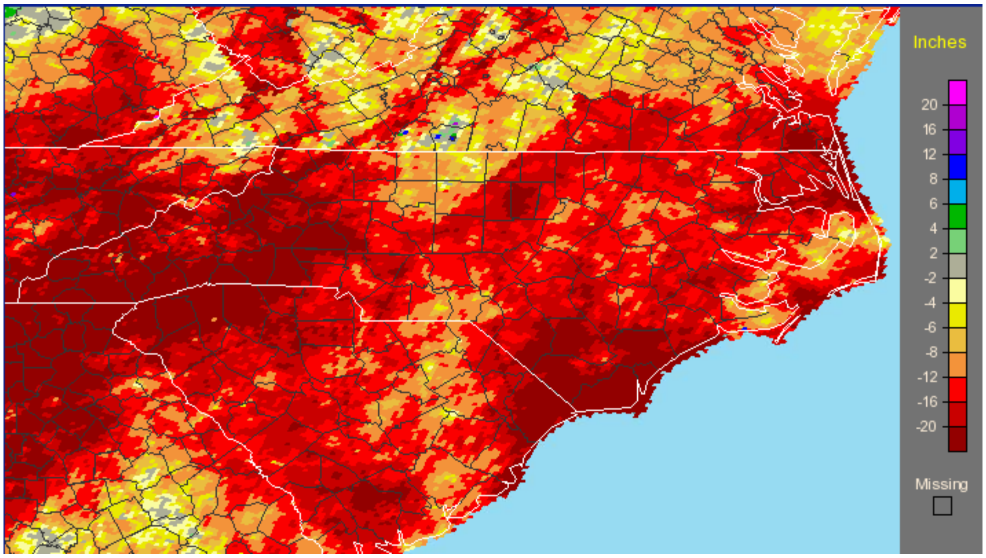


Figure 3: 2007 observed rainfall deficit. Courtesy of the National Weather Service.

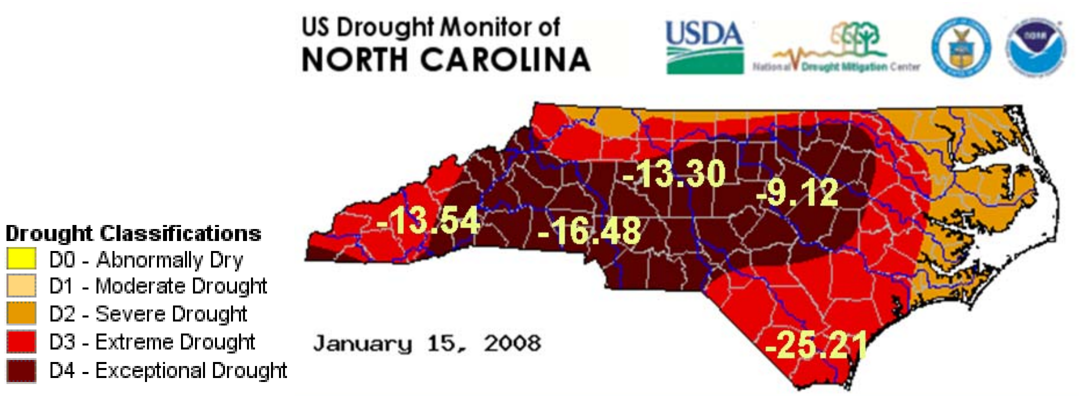


Figure 4: North Carolina Drought Monitor including rainfall deficits from January 1,2007 to January 16, 2008. Image courtesy of http://www.ncdrought.org

Following a rather dry November, December closed the year recording above normal precipitation for the month with many locations receiving between 3 to 6 inches of rain (Figure 5). The timely December rains significantly improved soil moisture levels statewide and by the end of the month agricultural drought conditions had improved while the hydrological drought continued (Figure 6). It is worth noting agricultural conditions are typically the first to respond to frequent rainfall as the soil soaks in the moisture. Due to the responsiveness of the soil and crops to periods of wet and dry weather it becomes easier to move in and out of agricultural droughts. The current extreme to exceptional hydrological drought is classified by the long term lack of surface and ground water. This water supply takes much longer to replenish therefore hydrological droughts last much longer typically ending slower. Due to the responsive nature of agricultural droughts if dry weather returns over the next few months portions of the state could return to agricultural drought conditions.

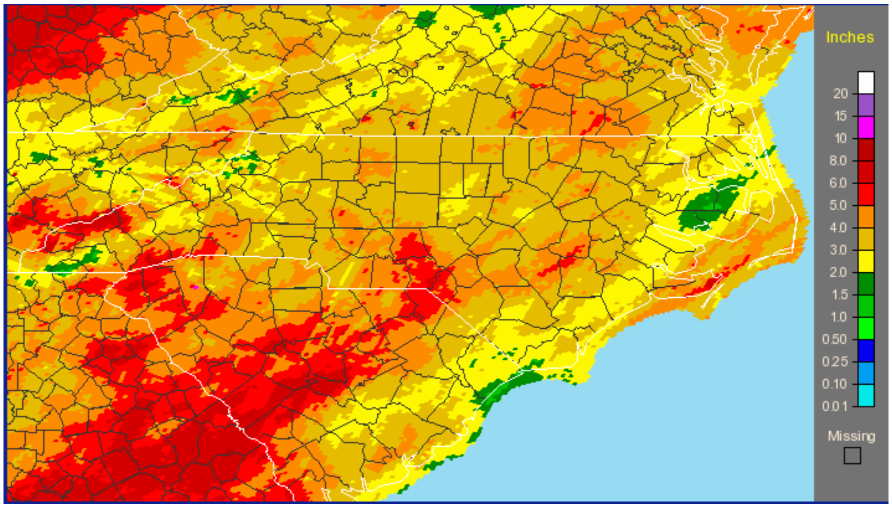


Figure 5. December observed rainfall. Courtesy of the National Weather Service

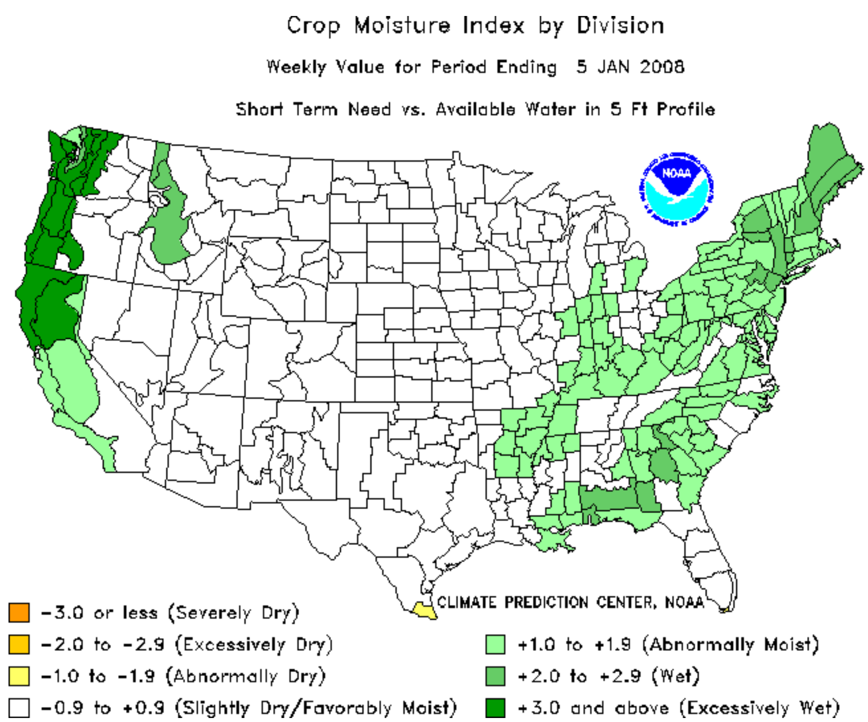


Figure 6. US Crop Moisture Index. Provided by NOAA's Climate Prediction Center.

Following the December rains many stream gages quickly responded statewide recording some significant rises. This slightly eased the drought conditions and by the end of December the state was experiencing the 3rd worst drought on record based on short term drought indicators (Figure 7). Despite the December rainfall by early to mid-January the exceptional nature of the drought allowed many streams to fall back to much below normal flows (less than the 25th percentile) especially across the Piedmont and foothills (Figure 8). As of January 21, 2008, 89 percent of river gage sites across North Carolina reported percentiles for 7-day average flows falling below the 25th percentile for the calendar date. About 61 percent of sites across North Carolina reported having 7-day average flows below the 10th percentile or reaching new minimum for calendar date. These low flows mean the recharge in the larger reservoirs remains limited and much below normal for the time of year.

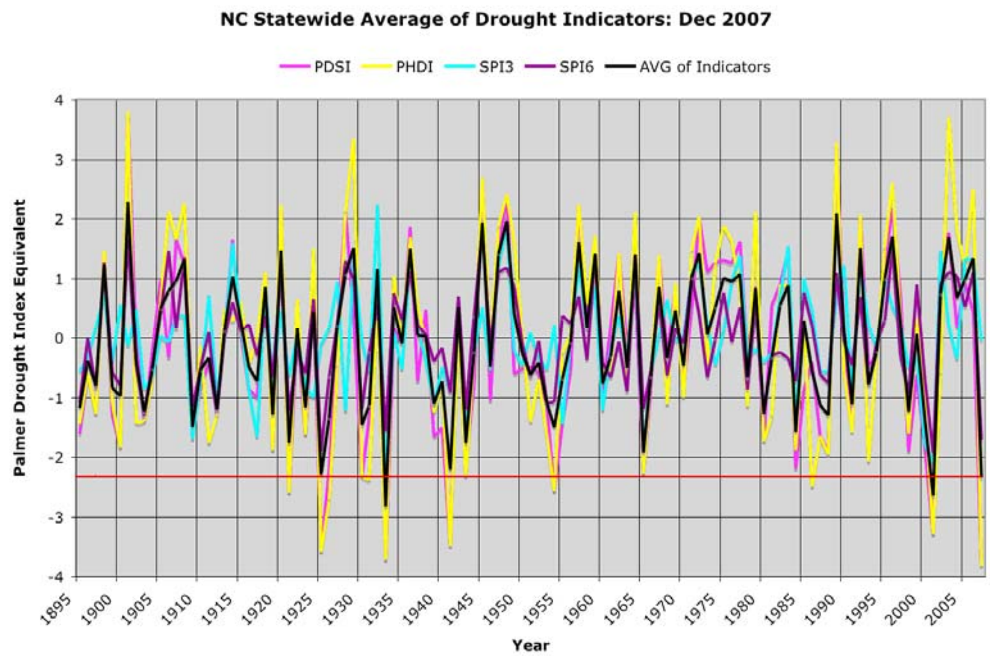


Figure 7. Average of drought indicators for North Carolina. Data and image provided by the North Carolina State Climate Office.

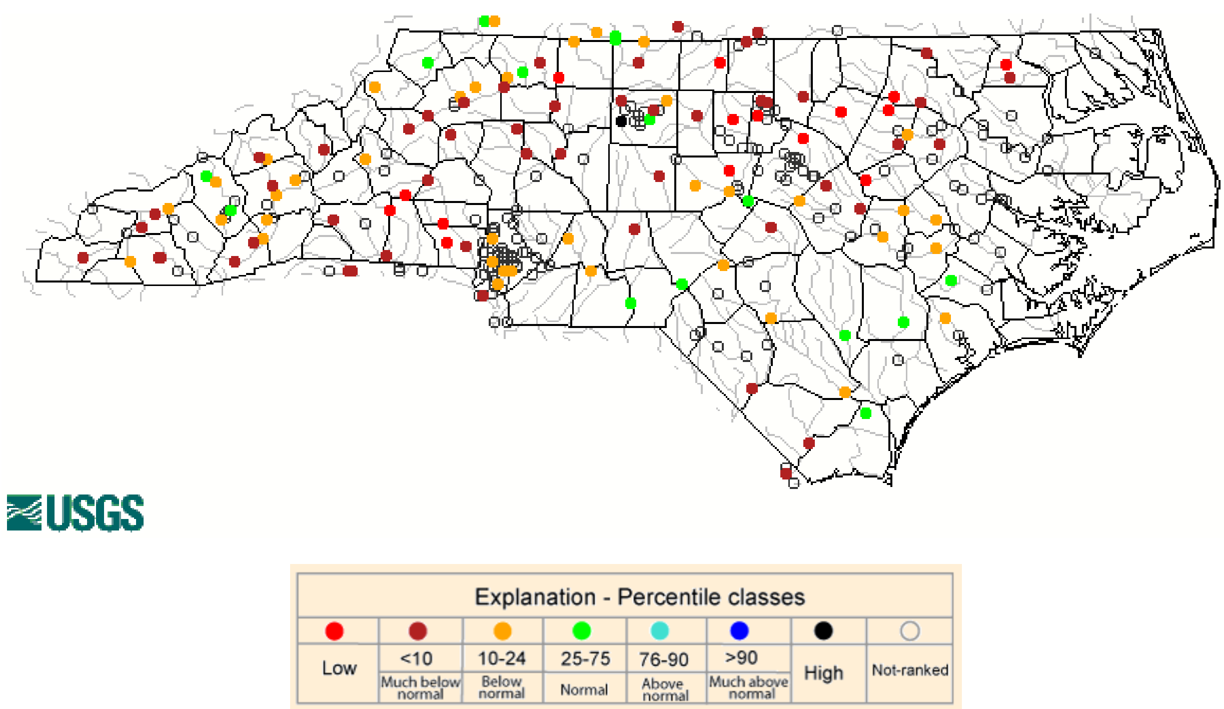
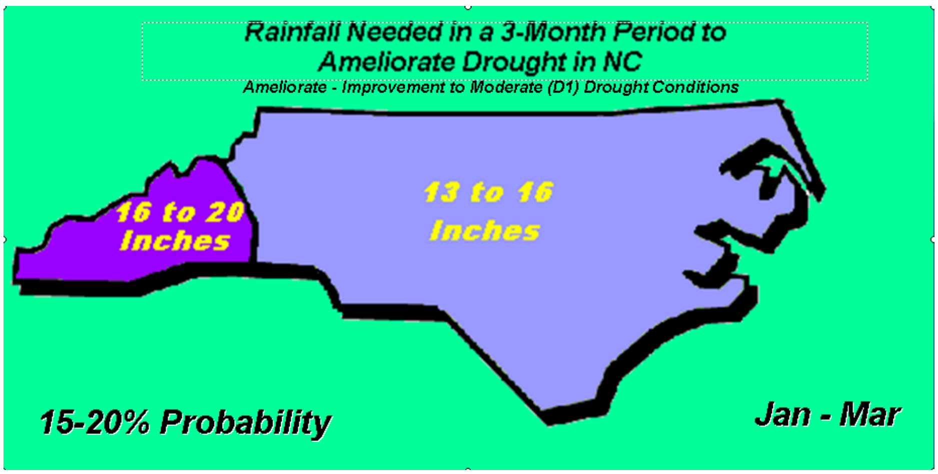


Figure 8. Stream flow at long-term stream flow gaging stations as of January 22, 2008. Graphics courtesy of the USGS.

The Haw River, Flat River and Eno River all fell below the 10th percentile within a week following the heavy rain on December 26th. This allowed water levels on Lake Jordan and Falls Lake to only rise about 2 feet.

Local research conducted by the National Weather Service and North Carolina State Climate office suggests much of the region needs as much as 13 – 16 inches of rain through March and 22 – 26 inches of rain through June in order to significantly lessen the drought on the state. These rainfall amounts which are anywhere from 1-5 inches above the normal would allow for some improvement in water the supply across the state setting the stage for summer. Rainfall amounts significantly less than those needed to at least ease the current drought conditions could have serious consequences during the summer especially if rainfall deficits continue through August.



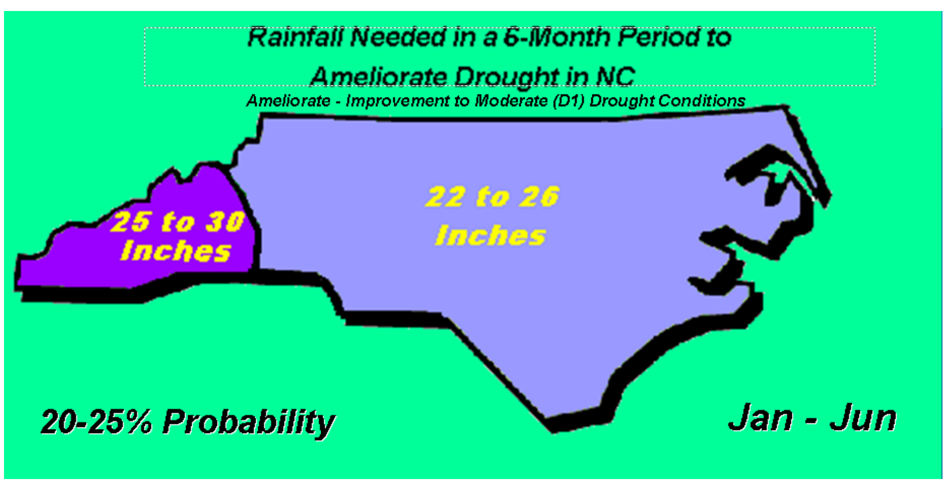


Figure 9. Rainfall needed to ameliorate drought conditions through March and June.

Precipitation Outlook and La Niña

Looking ahead to remainder of this winter and spring, there are better chances of the state receiving below normal rainfall through the spring as moderate La Nina conditions persist over the equatorial Pacific Ocean through February and March (Figure 9). Although the La Nina conditions are no longer intensifying, a continued moderate La Nina is expected to persist through the spring before possibly weakening later this summer. Past La Nina events occurring during the winter and spring months have resulted in an average rainfall deficit of 1 to 3 inches below normal rainfall for the months of February through March. Below normal rainfall over

North Carolina this spring would impact water availability this summer in locations currently experiencing below normal water supply levels. La Niña, the cold phase of the ENSO cycle, occurs when cooler than normal sea surface temperatures over the central Pacific Ocean persist for several months. The El Niño/ La Niña phenomena are one of the main sources of year-to-year variability in weather and climate for many areas of the United States and even the world. La Niña conditions during the later winter and spring tend to influence the atmospheric flow across the eastern North Pacific and North America. During La Niña the southern stream of the upper level jet, which typically brings moisture and enhanced storm systems into the mid is weakened. This can result in fewer storms and less moisture in the Carolinas (Figure 10).

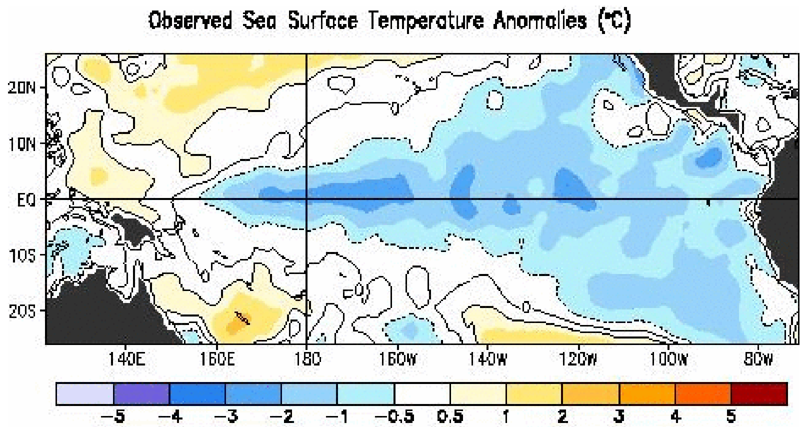


Figure 9. January 9, 2008 Sea surface temperature anomalies showing colder then normal temperatures across most of the equatorial Pacific Ocean. Graphic provided by NOAA's Climate Prediction Center.

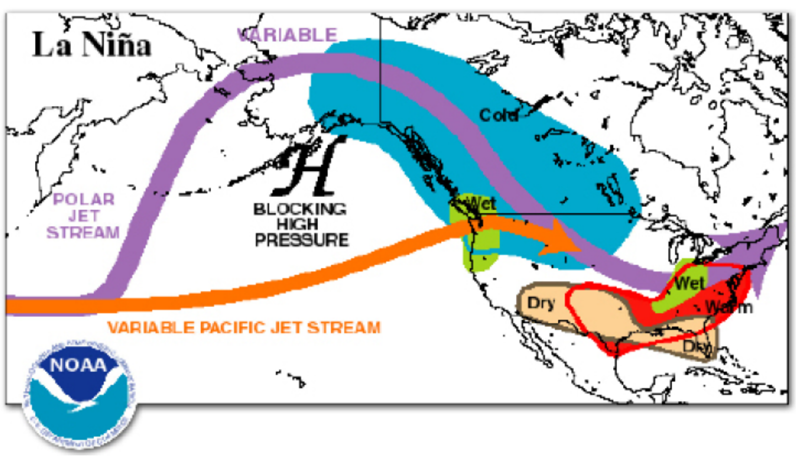


Figure 10. La Niña's influence on jet stream provided by NOAA's Climate Prediction Center.

The precipitation outlook from NOAA's Climate Prediction Center for the remainder of this winter and through most of the spring continues to call for increased probabilities of below normal precipitation. (Figure 11). The period from January through March is the most likely time frame for the state to experience below normal rainfall purely based on La Nina's influence on the weather pattern. La Nina's influence on the weather pattern during the late spring and early summer months is less significant. As La Nina looses its grip on the weather pattern later this spring and summer there will be an increasing chance of returning to near normal rainfall by late spring and summer. However, summer rainfall is highly dependent upon sporadic thunderstorm activity as well as occasional tropical systems such as hurricanes.

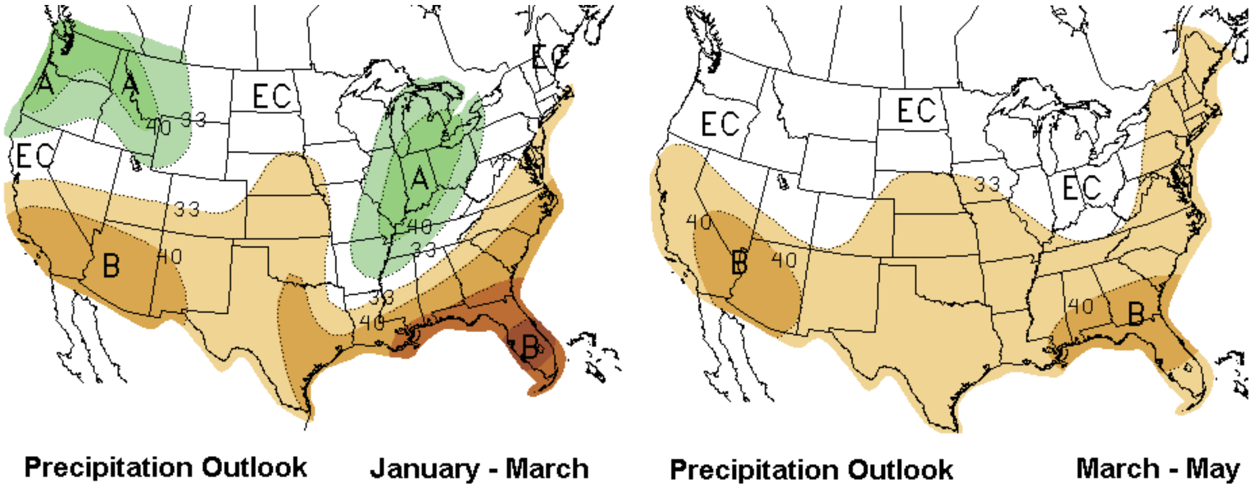


Figure 10. Precipitation outlooks provided by NOAA's Climate Prediction Center.

A local study examining precipitation at Asheville, Charlotte, Greensboro, Raleigh and Wilmington indicates below normal precipitation occurred anywhere from 42% to 58% of the time during past moderate to strong La Nina episodes. More importantly above normal precipitation during the spring has been very uncommon during La Nina. Above normal precipitation occurred no more than 2 out of 12 winters (17% and less) when moderate to strong La Nina conditions persisted (Figure 11). It is worth noting the rain any which does fall through March will be beneficial since evaporation and water usage is lower in the winter and early spring.

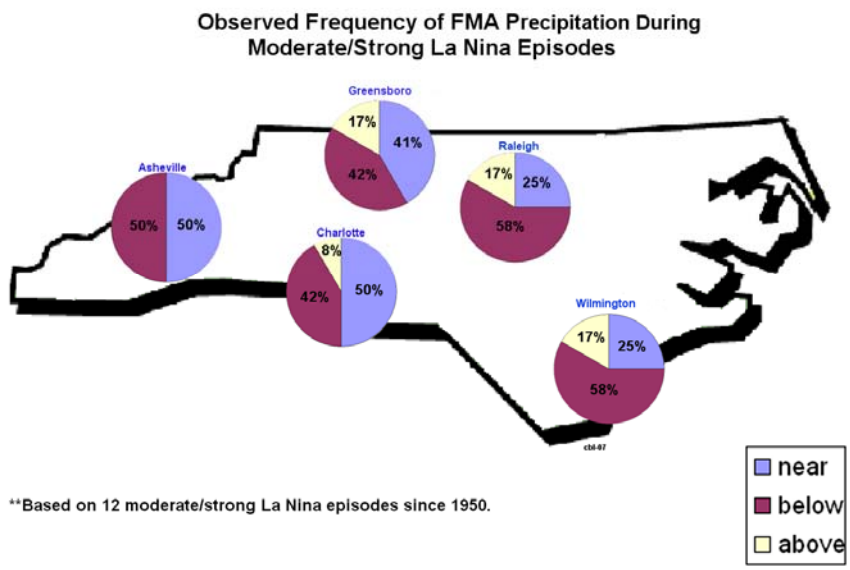


Figure 11. Observed frequency of precipitation during moderate and strong la Nina episodes. Data provided by the National Climatic Data Center. Graphic created by the Raleigh National Weather Service Office.

Summer Outlook

Warm summer days mean an increase in surface water loss to evaporation along with increased water use. Daily evaporation increases significantly in May and June and remains high through June, July, August and September. Climatologically between 3 to 4 inches of surface water is lost each month from June through October nearly equaling the amount of rainfall across the Piedmont during the summer. This suggests the balance of water received from rainfall versus the water lost to evaporation is in delicate balance especially in the Piedmont. Based on pan evaporation rates the amount of surface water lost to evaporation in a given year in the Piedmont (40 to 42 inches) is only slightly less than the normal rainfall of the region (43 to 44 inches) (Figure 12). While the process of evapotransiration, taking into account the effects of vegetation, lowers the water loss to around 70 percent of the actual direct evaporation it is still worth noting the balance between expected yearly rainfall and water loss to evaporation in the Piedmont is less than that for other portions of the state. On average a rainfall deficit of 20% to 30% in a given year will likely result in a drought of some variety. As population increases in the Piedmont further stresses on local water supplies will potentially increase the frequency of water shortages especially during periods of prolonged dryness.

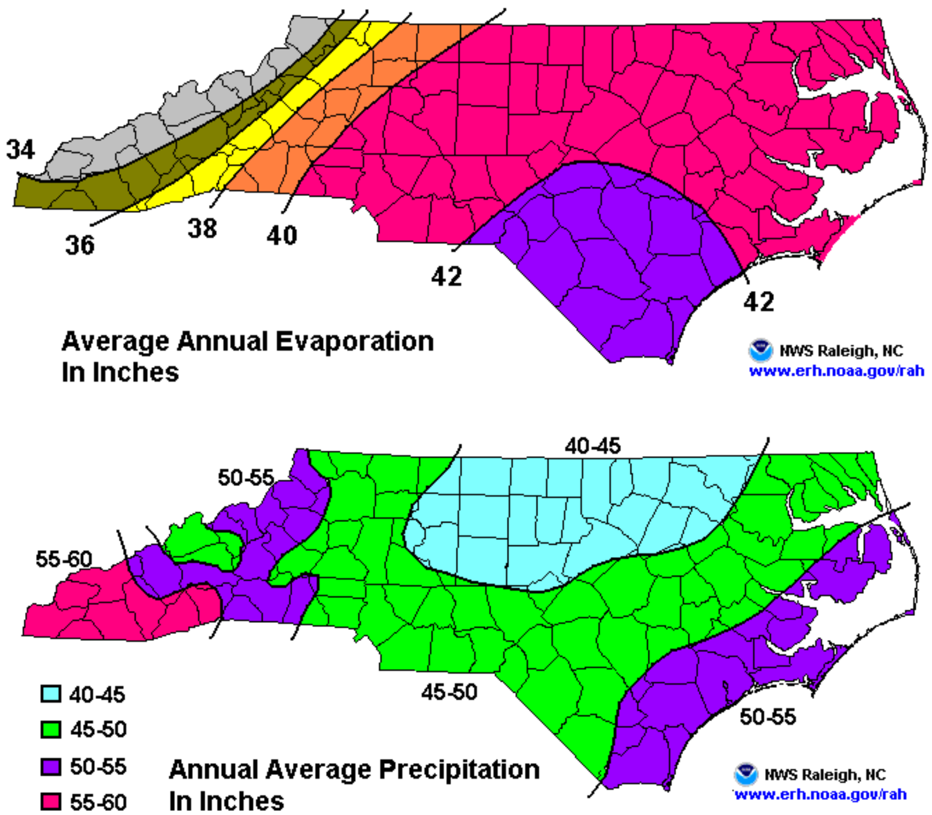


Figure 12. Annual average pan evaporation (top) and annual average rainfall (bottom). Graphic created by the Raleigh National Weather Service Office.

It is important to understand that due to low lake levels in some areas even near normal rainfall over the next three to six months will not bring an end to the current drought. If climate predictions come to fruition and the rains of the winter and spring remain below normal, farms, cities and residences will be facing ongoing water shortages as we move into the summer months. Water shortages of some degree will likely persist in those areas currently experiencing below normal water levels. With the prospects of possible slightly below normal rainfall this spring drought conditions will likely not end before summer.

Websites

National Integrated Drought Information System (NIDIS)
http://www.drought.gov

NC Drought Monitor
http://www.ncdrought.org

State Climate Office of North Carolina
http://www.nc-climate.ncsu.edu/

National Weather Service Raleigh, NC
http://www.erh.noaa.gov/rah/

Climate Prediction Center
http://www.cpc.ncep.noaa.gov

Acknowledgments & Contacts

National Weather Service, Raleigh
Contact: Jeff Orrock
Warning Coordination Meteorologist
Jeff.orrock@noaa.gov
(919) 515-8209 ext. 223

North Carolina State Climate Office (NC SCO)
Contact: Dr. Ryan Boyles
North Carolina State Climatologist
ryan_boyles@ncsu.edu
919-515-3056

Climate Prediction Center (CPC)
National Climatic Data Center (NCDC)