Anticipating Drought on Rainfed Farms in the Southeast

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Nobody wants drought, but it's been happening a lot in recent years in the Southeast U.S. For farmers without irrigation, it may seem that little can be done but to accept what rain does or does not come. However, by paying attention to forecasts and following general practices that help collect and retain moisture, risk can be reduced for all manner of future climate conditions. Here are some ideas on what you can do, centered around two practices:

First, know what's in store. *You'll find a current drought assessment and climate outlook below, with resources to help you keep up with future predictions.*

Second, be ready. *Use the outlook to plan for coming months, while building long-term resilience to moisture extremes. Some techniques that have worked follow the outlook.*

Drought Assessment for the Southeast United States

8 August 2011

Meteorological Conditions for May – July 2011

May through July 2011 were warmer than normal in the southeast, with Florida having its third warmest May through July and Georgia having its tenth warmest May through July on record (Fig. 1). Rainfall was below normal in the southeast, with Georgia having its sixth driest May – July on record (Fig. 2).

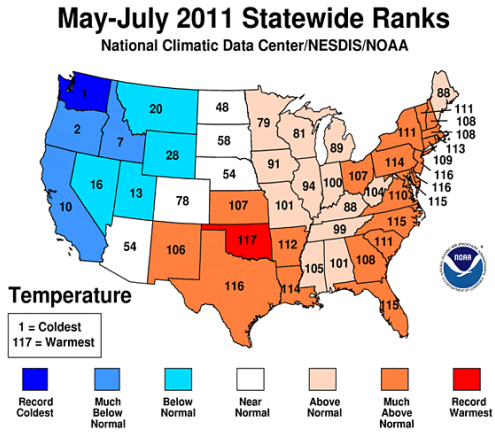


Figure 1: United States rankings for coldest to warmest temperatures for May through July 2011.

Rainfall was below normal in the southeast, with Georgia having its sixth driest May – July on record (Fig. 2).

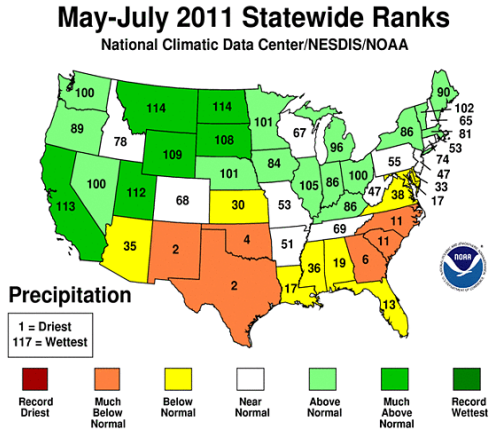


Figure 2: United States rankings for driest to wettest precipitation for May through July 2011.

Temperature and precipitation rank maps can be created for different geographic regions and time periods at: http://www.ncdc.noaa.gov/temp-and-precip/maps.php.

Effects of the warmer temperatures and low rainfall amounts

Warmer than normal temperatures and below average rainfall have led to much lower than average streamflows (yellow, red and orange dots in Fig. 3), very low groundwater levels (yellow, red and orange squares in Fig. 4) and abnormally dry soil (Fig. 5).

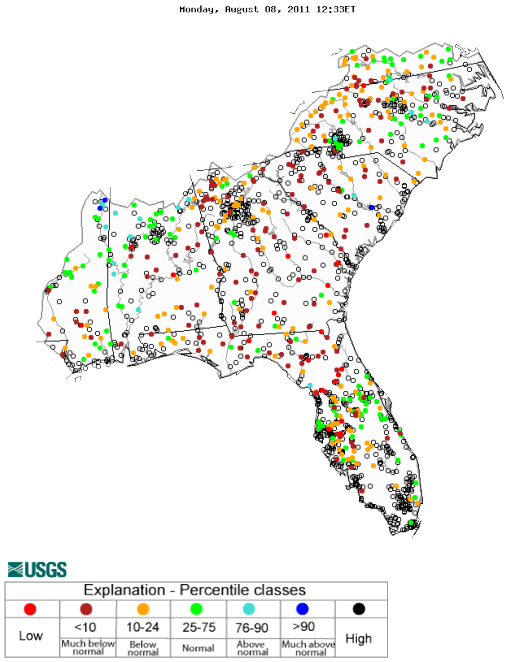


Figure 3: Current streamflow compared to historical stream flow for day of year. Many streamgages are showing below normal flow in the southeast. Current stream flow information can be found at: http://waterwatch.usgs.gov/new/index.php?id=ww_current.

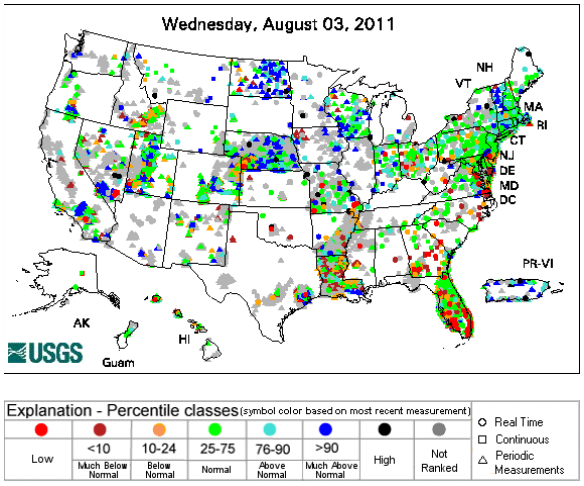


Figure 4: Most recent well measurements compared to historical measurements. Many wells in Georgia have below normal levels. Current groundwater information can be found at: http://groundwaterwatch.usgs.gov/default.asp.

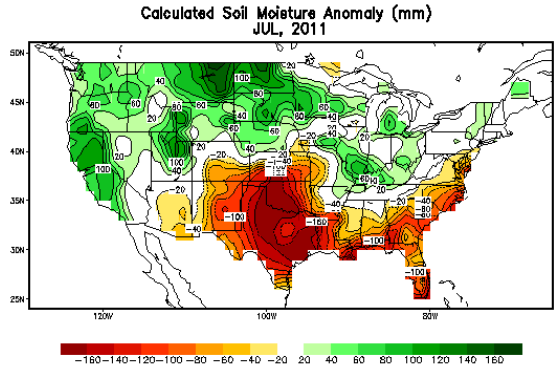


Figure 5: Soil moisture deviations from normal (in mm). Most of the southeast U.S. had drier than normal (yellow to red shading) soil moisture during July 2011. Calculated soil moisture products can be found at: http://www.cpc.ncep.noaa.gov/soilmst/w.shtml.

These warmer and drier conditions led to the development of drought in the southeast U.S. Since the start of the calendar year, 77% of the southeast has received a designation of D0 (abnormally dry) to D4 (exceptional drought) on the U.S. Drought Monitor.

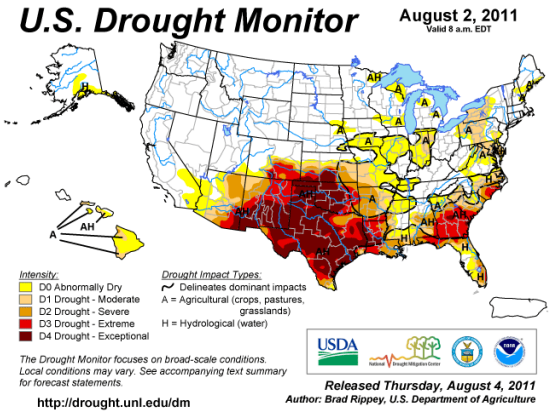


Figure 6: U.S. Drought Monitor. More than half of Georgia is currently in extreme drought, while surrounding areas vary from abnormally dry to extreme drought. The drought monitor can be found at (http://droughtmonitor.unl.edu/monitor.html), where drought maps for regions and states can also be created.

The amount of rain needed to bring the southeast out of drought is shown in Fig. 7. For most of the southeast, 6 to 15 inches of rain are needed to bring the area out of drought

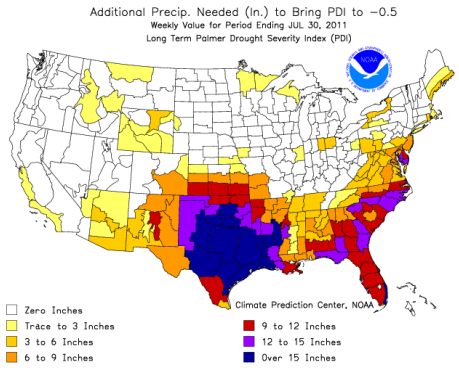


Figure 7: Amount of rain needed (in inches) to ease drought conditions in the U.S. (http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/regional_monitoring/addpcp.gif).

Outlook

The NOAA Climate Prediction Center (CPC) products indicate that August will be warmer than normal in the southeast U.S., and precipitation for the month has equal chances of being below normal, normal or above normal (designated as EC on the map in Fig. 8). The three-month temperature outlook for August, September and October also indicates warmer than normal temperatures in the southeast. The three-month precipitation outlook shows the possibility of wetter than normal conditions in most of Florida and much of Georgia and South Carolina, with equal chances of below normal, normal or above normal precipitation elsewhere in the southeast.

Given all of these conditions, recovery from the current drought could take some time (barring any land-falling tropical storms that may bring heavy rain to parts of the southeast). However, NOAA/CPC's most recent drought outlook does call for a modest improvement in the southeast over the next three months (Fig. 9).

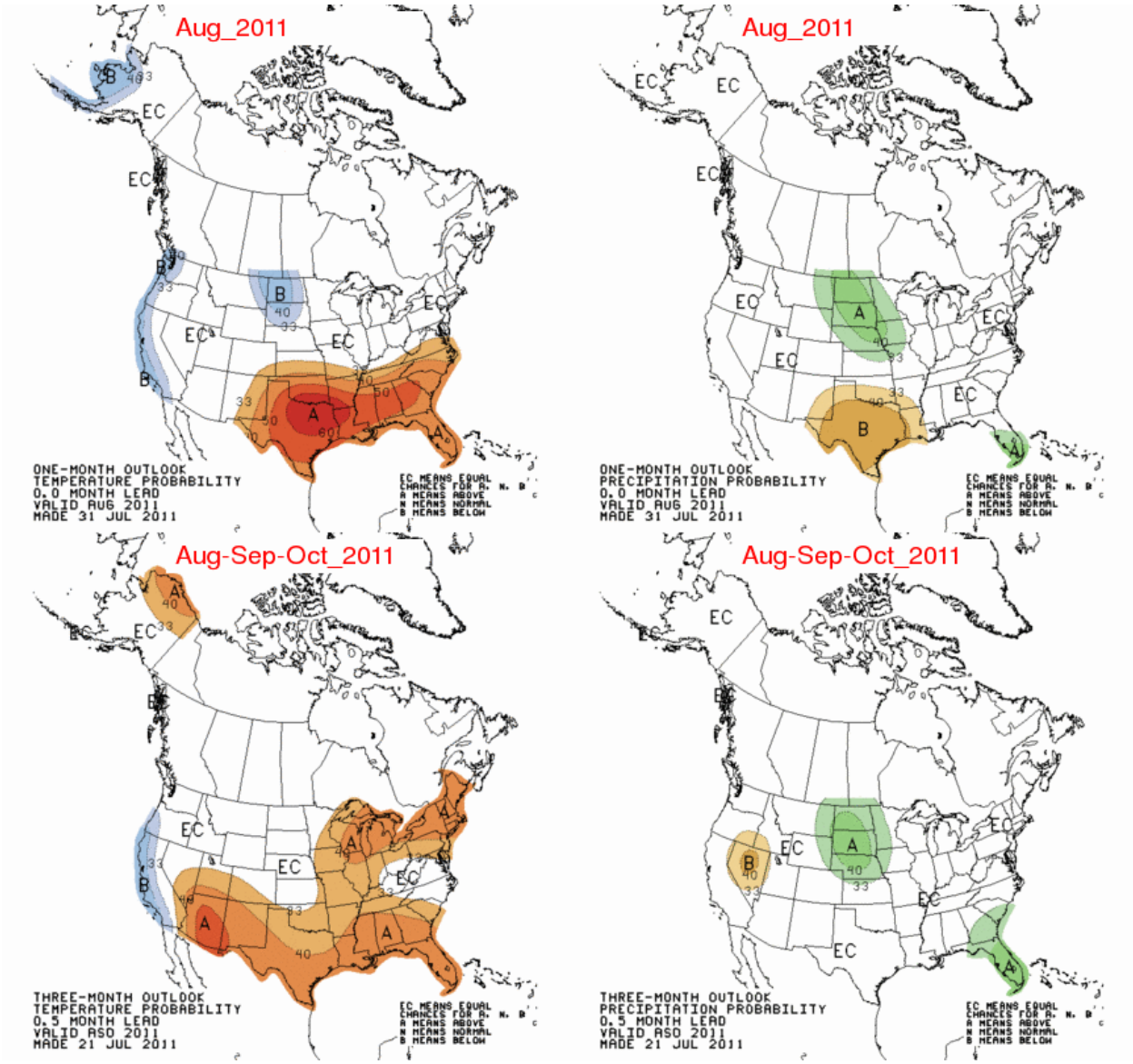


Figure 8. ***NOAA Climate Prediction Center one-month and three-month outlooks for temperature and precipitation for North America. The temperature outlooks are on the left-hand side (brown areas indicate above normal temperatures) and the precipitation outlooks are on the right-hand side (wetter than normal conditions are indicated in green)***

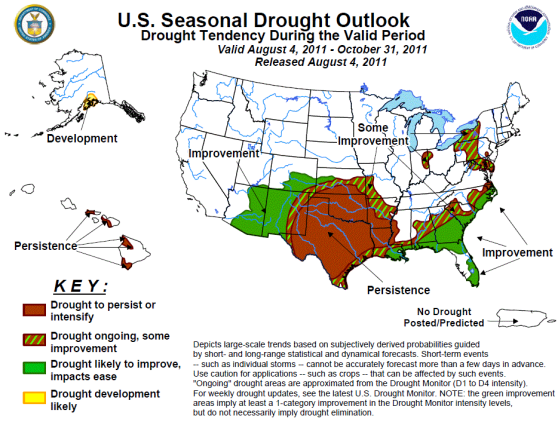
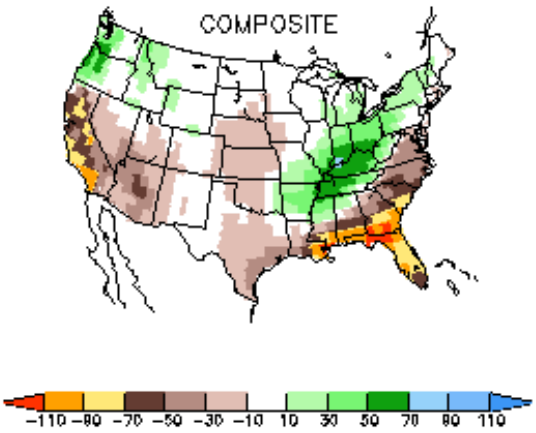


Figure 9: U.S. Seasonal Drought Outlook from NOAA/CPC (http://www.cpc.ncep.noaa.gov/products/expert_assessment/season_drought.gif).

Long-term Outlook

The upcoming winter months of December, January and February could see the return of La Niña, which is a large-scale phenomenon driven by cooler than normal ocean temperatures in the tropical Pacific. La Niña affects the weather in North America by shifting storm tracks northward. The result for the southeast U.S. in a La Niña winter is for warmer temperatures and less precipitation (Fig.10). If this occurs, farmers may have to adjust for the drier conditions.

Rainfall changes in La Niña winters



Temperature changes in La Niña winters

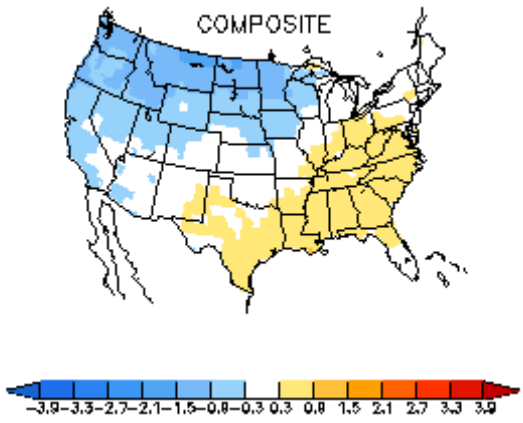


Figure 10: Historical patterns of deviation from normal in La Niña winters. The Southeast has below-normal rainfall (warm colors on left map) and above-normal temperatures (yellow color on right map) (http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ENSO/composites/EC_LNT_index.shtml).

Using the outlook for decision-making

Near-term choices

You will use current weather forecasts from sources like the radio, TV, newspaper, the National Weather Service (www.weather.gov), or Weather Underground (www.weatherunderground.org) to help make day-to-day decisions about planting, cultivating, spraying, cutting hay, etc. But when the climate outlook for the coming months predicts little rainfall, or a La Niña winter means you are likely to start next season with a moisture deficit, you can make choices that reduce your vulnerability to loss.

- *Crop and cultivar.* Instead of planting a demanding crop like corn, you might opt for a low-moisture alternative such as grain sorghum or pearl millet (see Publication B1216, Univ. of Georgia). Within a crop species, there may be cultivars that are less sensitive to moisture stress. Among vegetables, for example, short-season varieties generally require less water. Note that nitrogen-fixing bacteria, which occur in legumes and make them a great source of fertility, are particularly susceptible to low moisture. Check with your extension agent about choices for your locality.

Pearl millet in flowering stage.

- *Cropping system.* Generally avoiding bare, exposed soil will help conserve moisture. This can be accomplished between seasons with cover crops, and the choice of crop makes a difference. Grasses like rye, triticale, and wheat work better for water conservation than legume covers. Be sure to terminate the cover crop 3-4 weeks before planting to reduce water depletion. During the growing season, mulch will reduce evaporation and erosion, and help absorb precipitation. Plastic mulch with a white surface will improve water conservation and avoid heat accumulation relative to black or clear mulch, but organic mulches such as straw are less expensive and will add organic matter to the soil, improving water-holding capacity. Conservation tillage also aids in preserving precious water. Using transplants rather than direct seeding reduces the risk of a poor stand. Also adjust fertilization—a crop that is water-limited will not respond well to added nutrients.

- *Livestock and forage practices.* Drought creates unique problems like nitrate and salt toxicity for livestock producers, but they also have some flexibility in altering stocking rates, buying in feed, reducing nutritional needs of animals, and culling if necessary. Farmers may benefit from consulting publications such as *Forage Use and Grazing Herd*

Management during a Drought (Publication C 914, Univ. of Georgia) or *Mississippi Beef Cattle Producer Guide to Coping with Drought Conditions* (Publication p2426, Mississippi State Univ.). When the dry, warm conditions of a La Niña winter and spring are predicted, a producer can minimize risk by reducing herd size or arranging to have winter feed ahead of time. He may avoid seeding pastures or applying fertilizer, because response is likely to be poor without rain. A number of practices are recommended for La Niña conditions at agroclimate.org; click on the "Forage & Livestock" link.

- *Diseases and pests.* An up side of dry conditions is that diseases tend to develop poorly or not at all, which may allow you to reduce or eliminate sprays and save money, or consider planting cultivars you might avoid when disease is likely. But don't be complacent! A few diseases do indeed fare better when things are hot and dry, such as white mold of peanuts and soybeans (caused by *Sclerotium rolfsii*), bot rot of apples, and many powdery mildews. So it is important to be familiar with your crop and its likely diseases. Insect and other arthropod pests, on the other hand, often do well in dry conditions, sometimes because natural enemies are less effective at controlling them. Fall armyworms, spider mites, aphids, and thrips (which carry the tomato spotted wilt virus) are among the many pests favored when rain is low and temperature is high. Be aware of indirect problems in drought conditions as well: the fungus *Aspergillus* does well and produces the toxic aflatoxin chemicals in corn and peanuts, seriously degrading quality. Clearly there is no single prescription for pests and diseases under drought, so each grower must become familiar with his likely problems, consult with extension agents and publications, and plan accordingly.

Pumpkin and winter squash vines may wither in drought before the fruit is completely mature, so if you harvest rot is more likely in storage.

- *Matters of Scale.* Not only might livestock producers reduce herd size or stocking rates, but produce or crop farmers might opt to scale back operations by leasing less land or minimizing the acreage of risky or high-water-use crops. New enterprises such as agrotourism or adding value through processing, as well as new markets, might be considered.

Building long-term resilience to drought

- *Diverse and adaptable cropping strategies.* As the adage goes, "Don't put all your eggs in one basket." By growing a diversity of crops you hedge your bets so that poor performance or even failure of one drought-intolerant species does not ruin your year.

The same can be said for diversifying cultivars if you do tend to specialize in one or a few crops. Flexible rotations and adaptable equipment allow you to alter plans when the rainfall outlook is poor or a dry La Niña winter occurs. Cooperation with neighbors or borrowing/leasing of equipment and land can maximize flexibility at the lowest cost.

- *Soil quality improvement*. Increasing the water-collecting and water-holding capacity of soil, coupled with good drainage, provide enormous benefits in time of drought, and when rains do finally come. There are three important ways to do this:

    1) Adding organic matter. A 1% increase in soil organic matter can increase available water capacity 1.5 times.

    2) Keeping the soil covered. Bare soil allows rain to run off, while vegetation traps it long enough to enter the soil. In one study in north Georgia, 16% of annual rainfall was lost from a conventional field, compared to only 2% in an adjacent no-till field.

    Soil under conservation tillage, on the right, had lots of organic matter and trapped rain instead of allowing the excessive runoff seen on the inset

    3) Avoiding soil compaction. Many southeastern soils have a hardpan at a depth of 6-9" that effectively prevents penetration of rain or roots below this level. Eliminating this layer and avoiding further compaction therefore retain water and encourage deep root growth, a great benefit in times of drought.

    Planting cover crops (especially deep-rooted ones), and taking care to work the soil only when conditions are good, will build soil organic matter, break up the hardpan, avoid compaction, and allow your soil to retain more moisture each year. Using the sod-based rotation described below, conservation tillage, or your own system which includes these elements all build soil quality, which has benefits beyond just drought relief: better nutrient retention, reduced disease and weeds, and greater yields overall.

- *Sod-based rotation.* The University of Florida has developed a four-year rotation with cotton, peanuts, and two years of grass which can be harvested as hay or by grazing. This sod-based rotation (SBR) greatly improves water retention and is ideal for rainfed conditions. Reduced water use, fertilizer, pesticide, and fuel use, has resulted in as much as a doubling of cotton and peanut yields in trials in three states. Learn more at their website: http://nfrec.ifas.ufl.edu/programs/sod_rotation.shtml.