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 of what you can do, centered around two practices:

First, know what’s in store. You’ll find resources and examples in the first section below to help assess current conditions and learn about predictions for the future.

Second, be ready. The second section gives you ideas on how to use this information to plan for coming months, while building long-term resilience to moisture extremes.

I. Assessing Drought in the Southeast United States

NOTE: None of the maps in this publication are current! They are examples for illustration only. Go to the address provided to see the most recent version.

Current Conditions

The best way to be familiar with the situation on your farm is, of course, to visit your fields regularly and observe moisture levels below the surface and crop conditions. There is enormous local variation within regions, states, counties, farms, and even individual fields because of soil type, cropping history, localized...
storms, etc. Summaries of recent events in your area and short-term forecasts are available from media sources (TV, radio, newspapers) and the internet, for example:

- **AEMN, the Automated Environmental Monitoring Network** records air and soil temperature, humidity, precipitation, wind speed, and over 20 other variables every 15 minutes at 80 stations around Georgia, accessible 24/7 at [http://www.georgiaweather.net](http://www.georgiaweather.net).

- **National Weather Service** current information and forecasts for the next few days are available for select locations around the state at [http://www.weather.gov](http://www.weather.gov).

Because drought develops over long periods of time, and likewise takes more than a rain or two to alleviate, some of the day-to-day variation is less important. The best resource for accurate drought information is the **U.S. Drought Monitor**, produced at the University of Nebraska ([http://droughtmonitor.unl.edu/monitor.html](http://droughtmonitor.unl.edu/monitor.html)). At this site you will see an overall map of the U.S. showing categories of drought, and a written description of conditions by region. If you click on the Southeast, and again on Georgia, you will see a map that looks like this:

**U.S. Drought Monitor**  
**Georgia**  
**January 17, 2012**  
**Valdosta 7 a.m. EST**

Here you can determine where your county stands and, by looking at the table, see how things have changed in the state over the past year. The map uses colors to represent standard drought categories. For example, white shows those regions with sufficient moisture, and yellow (“D0, Abnormally Dry”) indicates an area which is on its way into or out of a drought situation. The
accompanying table shows the history of drought for the entire state. So we can see, for example, that the total area in exceptional drought (right-most column) increased from 0% to 4.48% in the past week, and that the area under severe drought (orange column) increased by almost 40% over the last year.

Here are some other resources for current drought-related information:

- **Drought Impact Reporter**, which compiles local and specific instances of impacts due to drought. On the U.S. map at [http://droughtreporter.unl.edu](http://droughtreporter.unl.edu), click on Georgia (or any state) to see the current reports.


- **Well measurements** compared to historical values are also available from the U.S. Geological Survey at [http://groundwaterwatch.usgs.gov/default.asp](http://groundwaterwatch.usgs.gov/default.asp).

- **Soil moisture** information, including deviations from normal, can be found at [http://www.cpc.ncep.gov/soilmst/w.shtml](http://www.cpc.ncep.gov/soilmst/w.shtml).


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**Outlook**

**The Coming Weeks**

The Climate Prediction Center at NOAA provides outlooks for precipitation and temperature for the coming 6-10 days, 8-14 days, one month, and three months. These are available at [http://www.cpc.ncep.noaa.gov](http://www.cpc.ncep.noaa.gov). An example of a three-month precipitation outlook map, from late January 2012, looks like this:
These maps give a rough idea of whether we expect to get a greater or lesser total volume of precipitation than the historical averages. The amount of precipitation anticipated is presented in three broad categories, above normal (A), normal (N), and below normal (B). The map is white and labelled “EC” if there’s an equal chance (33%) of these three situations occurring. Color bands are shown if there’s more than a 33% probability of above normal (green) or below normal (brown) rainfall. The colors become darker with increasing probability, with percentages given at the color boundaries. So we see that north Georgia (white with “EC”) has an equal chance of above normal, normal, or below normal precipitation; central Georgia (light brown) has a probability (33-40%) of below normal rain; and south Georgia (darker brown) has a higher likelihood 40-50% of below normal rain. South Florida has a >50% chance of below normal precipitation. If there is more than a 33% chance of normal rainfall, the map is white but labelled “N” instead of “EC,” as we see in Alaska. This can be confusing, so be aware that N means that normal conditions are likely, EC means that normal conditions are no more likely than below or above normal—essentially, we can’t predict what’s coming! Also note that this says nothing about how much more or less rain we might get!

You can view NOAA’s prediction of future drought conditions by clicking on the U.S. Drought Assessment—Drought Outlook link at the same site, or go directly to http://www.cpc.ncep.noaa.gov/products/expert_assessment/season_drought.gif for a map like the one shown below.
This example, also from January 2012, indicates that most of Georgia should expect the drought to continue and perhaps get worse (solid brown color), with “some improvement” probably occurring in the narrow strip (hatched brown) adjacent to the northwest corner of the state (white). This white region has not been affected by drought so far, and no development of drought is foreseen.

The Coming Months

In Georgia we can sometimes predict winter and early spring conditions many months in advance, because we are quite responsive to the El Niño Southern Oscillation (ENSO) phenomenon. ENSO primarily describes sea surface temperatures in the equatorial Pacific Ocean, which can affect weather globally. When the central and eastern Pacific becomes unusually warm, we have an El Niño situation and that means cool, wet conditions in the southeast U.S. in winter and spring. When the Pacific is abnormally cool, we get what’s known as La Niña, which brings warm and dry weather to the Southeast during this period. The maps below show this trend for precipitation. In Map A, which illustrates rainfall trends in El Niño winters, we see green shades in south Georgia that correspond with rainfall 30-50 mm above normal (indicated in the bar below the maps). In contrast is the La Niña winter pattern shown in Map B. Here we see violet and orange colors which correspond with various levels of reduced rainfall.
El Niño conditions have occurred in about 25% of the years for which we have records. The same is true for La Niña. When neither occurs we call it a “neutral” condition, and this has been the case in the remaining half of observed years. There is no clear pattern to their occurrence from year to year. However, an El Niño, La Niña, or neutral condition that develops in the summer in the Pacific Ocean typically persists through the winter and has predictable effects on our weather well into spring. This makes it possible to plan for likely drought-related developments, such as soil moisture recharge in the winter.

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**The Coming Years**

There is a consensus among climatologists that temperatures have been rising globally since the industrial revolution, and will continue to rise substantially over the next century, in the range of 3.5-5° F. Predictions indicate there will be changes in precipitation, with some regions becoming drier while others become wetter, in addition to a general increased likelihood of extreme weather events such as floods, hurricanes, and drought. A summary of current predictions can be found in the synthesis report of the last Intergovernmental Panel on Climate Change (IPPC) assessment, at [http://www.ipcc.ch/publications_and_data/ar4/syr/en/spm.html](http://www.ipcc.ch/publications_and_data/ar4/syr/en/spm.html).
These are general expectations and will vary greatly by region. In Georgia, warming has been minimal over the last 30 years, perhaps due to other factors like land use change. Nonetheless temperatures are expected to climb over the next several decades, including more summer days with extreme heat. Changes in precipitation, the most important factor in drought, are not predicted well for the state by current models. The ability of climatologists to predict outcomes at more regional and local levels improves every year, as well as understanding the way in which these interact with land use and other phenomena like ENSO.

In the meantime, the best bet for farmers is to do what works in the short term as well: *Build resilience.* Whatever practices can be undertaken to maintain and improve productivity through a wide range of climate variation, including drought, will always be of benefit. The next section provides some suggestions on how to do just that.

## II. Using the outlook for decision-making

### Near-term choices

You can use current weather forecasts from sources like the radio, TV, newspaper, the National Weather Service ([www.weather.gov](http://www.weather.gov)), or Weather Underground ([www.weatherunderground.org](http://www.weatherunderground.org)) to help make day-to-day decisions about planting, cultivating, spraying, cutting hay, etc. But what if the climate outlook for the coming months predicts little rainfall? Or a La Niña winter is predicted, which means you are likely to start next season with a moisture deficit? There are choices you can make 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.

- **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

[Pearl millet in flowering stage.](#)
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](http://agroclimate.org); click on the “Forage & Livestock” link.

- **Diseases and pests.** An upside 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.
• **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.

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**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.

  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. 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](http://nfrec.ifas.ufl.edu/programs/sod_rotation.shtml).