DROUGHT BASICS

WHAT IS DROUGHT?

Most of us think of it as “no rainfall," but it's not that simple. Drought is when you have less rainfall than you expected for an extended period of time, usually several months or longer. Drought is a normal part of climate, and it can occur almost anywhere on earth. For example, Arizona and North Carolina have very different climates, but drought occurs in both states. Drought's features and effects vary from place to place because of different geographical features and cultures, which affect how people use water.

WHAT CAUSES DROUGHT?

Drought is caused by a lack of rainfall or snowfall.

Winds cause weather patterns to move around the world, including clouds that bring rain. Over the years, these patterns become routine, creating climate. Sometimes, these patterns change and when they do, some areas can receive less rainfall than normal.

CAN DROUGHT BE PREDICTED?

Generally, no. Predicting drought depends on our ability to forecast seasonal precipitation and temperature. Scientists don’t know how to predict a month or more in advance for most parts of the world with the precision needed to predict drought. But they are studying the global weather patterns and how those patterns’ repeated occurrence can help us determine if we could have an extended period with less than normal rainfall.

WHAT ARE THE IMPACTS OF DROUGHT?

A shortage of rainfall can result in major impacts on agriculture, city water supplies, tourism and recreation, energy (power) production, river navigation, and the environment.

If you are a farmer, drought means that you do not have enough water in the soil for crops to grow normally or for pastures to produce enough grass for livestock. For farmers who rely on irrigation to produce their crops, drought may be a shortage of water in reservoirs, streams, or groundwater, and irrigation may be restricted. If you live in a city, drought may result in a shortage of water for watering grass, trees and other plants. Often during drought, people in cities are asked to conserve water used inside the home and outside.

WHERE CAN I FIND THE MOST CURRENT INFORMATION ON THE DROUGHT AFFECTING NORTH CAROLINA?

State and federal officials maintain a map online that shows what parts of North Carolina are affected by drought or abnormally dry conditions. The map, called the U.S. Drought

Monitor of North Carolina, can be found at www.ncdrought.org. It is updated every Thursday.

The monitor illustrates the latest picture of drought in North Carolina and serves as the reference for drought classifications and response actions in the state. The monitor is a map that identifies general drought areas and labels droughts by intensity. For example, the D1, or moderate drought, is the least intense form of drought, and D4, or exceptional drought, is the most intense. D0 signifies areas that are either drying out, headed for drought or recovering from drought.

WHY ARE SOME AREAS OF NORTH CAROLINA EXPERIENCING DIFFERENT LEVELS OF DROUGHT?

Drought categories are based on stream flows, groundwater levels, the amount of water stored in reservoirs, the time of year and other relevant factors for assessing the location and severity of drought conditions. These factors often vary in different areas of North Carolina. This ranking system avoids the problems that some states have experienced in declaring drought warnings statewide, when conditions did not warrant it in all regions of the state. Instead, North Carolina experts tailor drought advisories to local conditions.

WHAT DO THE DIFFERENT DROUGHT CATEGORIES MEAN?

There are four categories of drought. From least detrimental to worst, the drought categories are moderate, severe, extreme and exceptional. State and federal officials use the different drought categories as a barometer to assist local governments and other water users in taking appropriate drought response actions. For instance, drought officials recommend to water users and local governments experiencing moderate drought to minimize non-essential water uses. Non-essential uses include those that do not have health or safety impacts such as car washing and cleaning streets or sidewalks. However, officials recommend that water users eliminate non-essential water use when areas are experiencing severe drought, a category that is one step worse than moderate drought.

WHO DETERMINES THE DROUGHT CATEGORIES FOR NORTH CAROLINA?

Each week, members of the N.C. Drought Management Advisory Council speak via conference call to discuss the most recent data available on the drought. The group includes meteorologists, climatologists and experts in forestry, agriculture and water resources. They discuss data measuring streamflows, groundwater and rainfall, the rain's affect on crops as well as wildfire activity and forecasts for each area of the state. The group makes a recommendation to the U.S. Drought Monitor about whether the drought is receding or spreading in all parts of North Carolina based on the data and its discussion. The U.S. Drought Monitor author for the week uses the state's recommendation and its own data to determine drought levels for North Carolina. The final drought map is released each Thursday by the U.S. Drought Monitor and posted on the state's drought Web site, www.ncdrought.org.

HOW COME SOME COMMUNITIES THAT ARE EXPERIENCING DROUGHT ARE NOT FACED WITH WATER SHORTAGES?

The severity of the drought and amount of water a public system has available for residents and businesses to use are two distinct things. Drought is based on a number of factors, including streamflows and expected rainfall as well as water availability for public consumption. A community may be experiencing a drought because of below average streamflows and a lack of rainfall but may have enough water stored in lakes and reservoirs to supply people with enough water for average daily usage for the foreseeable future.

As of early February, how much rain do we need to ameliorate the drought?
Between 14 and 18 inches during the next three months is needed to ameliorate the drought, or get back from exceptional to moderate drought.

How much rainfall do we typically receive during the winter months?

Our average precipitation for these three months is typically 11 to 12 inches.

Is the winter an important time for helping to relieve some of these drought conditions?

Winter is a critical time of year for rainfall. This is the time of year when we expect a recharge of our water supply because water use is way down, evaporation is low because the air is cooler and the plants and trees are not green and are not using as much water as they need when they begin to grow vegetation again in the spring. So, we need rainfall at this time of year because by the summer we'll all be using so much more water and the trees and plants will be sucking water from the ground as they "green over."

How dependent is our water supply on tropical weather such as hurricanes, tropical storms and depressions in North Carolina?

In North Carolina, tropical systems account for as much as 25 percent of our rainfall. Abnormally dry summers can sometimes lead to drought in the absence of moisture from tropical storms.

So we need tropical weather to recharge our water supply?

Yes. It's very important. We received very little in the way of tropical precipitation this past hurricane season. We were already abnormally dry to begin with. So, that hurt our conditions. We can typically expect to experience at least some influence of between one and two tropical storms in any given year.

Since we did not receive a significant tropical system in the 2007 hurricane season (June to November) the odds are favorable that we will receive one in the next hurricane season?

Not necessarily. The odds for a tropical storm to influence North Carolina is about the same every year given the general storm frequencies in the Atlantic Ocean. Since we aren't able to predict the tracks of tropical storms more than a few days in advance, we don't know if we're any more likely to experience the impacts of a storm on any specific year.

Why have we received below average rainfall?

During the winter, the answer has a lot do with a prevailing La Nina, a climatic episode characterized by lower-than-normal sea surface temperatures in the Tropical Pacific Ocean. A La Nina typically brings with it a ridge of high pressure over the Southeastern United States. This ridge of high pressure essentially blocks weather from reaching the Southeast. Therefore, all the major systems go west and north of the southeastern states such as North Carolina. It's for that reason that we're seeing many rain events miss the Southeast while the Midwest is experiencing a lot of flooding.

Is this drought an anomaly or are we expected to have more of these droughts in the future?

We have not seen a drought like this one in North Carolina in the 100 years of modern records, based on numerous drought indicators that have been recorded in the state since the 19th century. So, we don't expect to see droughts as bad as this one every time we have a drought.

One thing that many scientists point to is the study of tree rings to reconstruct seasonal and annual climatic variations such as droughts. Using this science known as dendroclimatology, scientists concluded that in trees that were 100 years or older, the tree rings indicated that droughts were actually more severe 1,000-to-1,500 years ago than they have been in the past century.

What we are able to conclude is that no matter what climate change may be happening, we know that droughts can and will occur. For that reason, we all need to make drought planning and water conservation part of our everyday lives because one thing we expect to see – more people in the future using a finite amount of water. Therefore, population growth may increase our vulnerability to drought.

Is the current drought an indication that we are experiencing climate change?

No single event can be attributed to climate change. Scientists believe that climate change occurs over many years or decades and has a many causes and effects, which include rising sea levels. We're too early into this drought to really say it's an indicator of climate change. It may be many years before we can say how much of the drought that started in

2007 is associated with global climate change. There probably is some relationship to climate change and this drought. But we're much more sensitive in North Carolina to the increasing demands on our water supply, mostly due to our population growth.

CURRENT DROUGHT INFORMATION

Where can I find out more about the drought?

Check out the state's drought Web site, www.ncdrought, for the latest information.

What else can I find at the www.ncdrought.org Web site?

The Web site includes information on:

- Drought map depicting the current situation, www.ncdrought.org
- water conservation tips, http://p2pays.org/water/
- weekly water use by North Carolina communities, http://www.ncwater.org/Drought_Monitoring/reduction/weeklyreport.php
- the status of streamflow conditions in North Carolina, http://nc.water.usgs.gov/drought/droughtsw.html
- the drought outlook, http://www.cpc.ncep.noaa.gov/products/expert_assessment/season_drought.gif
- the amount of rain North Carolina has received in recent months, http://cig.mesonet.org/~derek/public/droughtmonitoring/NC-30day.html
- the status of the public water systems facing the most severe water shortages, http://www.ncwater.org/Drought_Monitoring/reporting/weekstatust123.php
- the status of the state's reservoirs: http://epec.saw.usace.army.mil/ http://www.duke-energy.com/lakes/levels.asp http://www.progress-energy.com/aboutenergy/powerplants/hydro/lakelevels.asp http://www.dom.com/about/companies/ncpower/lakedata.jsp http://www.alcoa.com/yadkin/en/lakes/reservoir_data.asp http://www.nantahalapower.com/lakes/levels/ http://www.tva.com/river/lakeinfo/index.htm
- the latest news on drought, http://www.ncdrought.org/news.php

WHAT CAN I DO IF I WANT TO REPRODUCE THE DROUGHT MAP IN MY PUBLICATION OR WEB SITE?

You will find a high-resolution PDF of the drought map that you are welcome to reproduce. Go to www.ncdrought.org and click on "hi-resolution PDF," in blue lettering beneath the drought map.

WATER CONSERVATION

What's our best option for combating the effects of the drought?
In times of drought and other water emergencies, increasing water efficiency and managing demand through conservation is our best option. For this reason, Gov. Easley has called on public water system managers to set up interconnections to other water supplies, conduct water audits and adopt conservation based price structures to encourage citizens to conserve water. The governor believes that it is everyone's patriotic duty to conserve and has called on most people to increase their conservation efforts by at least 30 percent.

WHY ARE PEOPLE ASKED TO CONSERVE WATER?

The water we receive from rainfall is the supply we have available. We often store water in reservoirs and lakes. We also sometimes have water available in underground aquifers. During drought, the amount of available water is reduced. Therefore, it's essential that we reduce our use or demand for water so that there is enough available to meet our basic needs until rainfall amounts return to normal.

WHAT'S THE EASIEST WAY RESIDENTS CAN CONSERVE WATER SO THAT THEIR EFFORTS CAN EXTEND OUR AVAILABLE WATER SUPPLIES?

1. Reduce bathroom water use. About half of all indoor water is used in the bathroom, where we flush toilets and bathe. Turn off water while lathering, shampooing, shaving and brushing teeth. Reducing showering time to five minutes can save an average of 20 gallons to 40 gallons of water a day.

2. Reduce or eliminate outdoor irrigation. The typical single-family suburban household uses at least 30 percent of their water outdoors for irrigation. So, during times of severe drought reduce or eliminate outdoor irrigation.

3. Fix leaks. Leaks account for about 15 percent of all household indoor water use. Check tub and sink faucets for drips and replace washers and "O-rings" as necessary. Put food coloring in your toilet tank. If the coloring shows up in the toilet bowl before flushing, replace the leaking flap. Turn off all water to your home and look at the readout dial on your water meter. If the dial moves, you have a leak.

Need more conservation tips? Check out the state's conservation Web links, http://www.p2pays.org/water/ or http://www.ncwater.org/Water_Supply_Planning/Water_Conservation/.

Has my community instituted water restrictions?

For the answer, go to www.ncdrought.org and click on "Current Conditions" heading at the top. Then, click on "Water Use Restrictions" heading beneath the "Public Water Supply Systems" area at the top of the page. Scroll down the page to find if your community water system has reported to the state the latest on any water restrictions.

Where can I find a statewide overview of water use restrictions in North Carolina?

Go to www.ncdrought.org and click on "Current Conditions." Then, click on "Water Use Restrictions" beneath the "Public Water Supply Systems" heading. At the top of the page, you will find the number of people subject to voluntary and mandatory restrictions as well as those who are not subject to water use restrictions.

Are all water systems and the state's entire population included in the data on water use restrictions?

No. The overview of water use restrictions found (in the previous question at www.ncdrought.org) includes only those systems the state is required to track. By law, the state Department of Environment and Natural Resources tracks all local government-owned systems, privately owned systems with 1,000 or more service connections or those systems that serve 3,000 or more people and privately-owned systems on voluntary or mandatory restrictions. In other words, the state tracks water systems that serve 6.78 million people, or about 75 percent of the state's population.

Much of the water conservation message seems focused on individual residents. But shouldn't the water conservation message be directed toward businesses and industries since they are the largest water consumers in North Carolina?

First, water conservation message is directed at every water user.

That said, the often-held assumption that businesses and industries use more water than residents is false. Based on the water systems the state tracks, residents in North Carolina use far more water than industries, according to the N.C. Division of Water Resources. In fact, 56 percent of North Carolina's water users are residential (includes single and multi-family homes) and 27 percent are commercial, industrial or institutional, based on the most recent data received from the 527 systems that filed water plans with the Division of Water Resources in 2002. **(NOTE: Commercial water users include small businesses such as car repair, hotels, dry cleaners and movie theaters. Industrial water users include manufacturing or processing facilities and utilities. Institutional users include hospitals, prisons, schools, churches and government buildings).**

However, water usage – whether residential or industrial – varies widely from one community to the next in North Carolina. For instance, industries use about 79 percent of the water in Eden, home to Miller Brewing Co. and several textile manufacturers. But in Johnston County, residents use 93 percent of the water.

Because the use of water varies so greatly from one community to the next, everyone needs to be doing their part to conserve water. Water is the most important shared resource we have. Industries, like residents, can reduce or eliminate irrigation and install low-flow aerators in faucets to reduce water usage when employees shower or wash their hands.

(NOTE: As of February 2008, the state Division of Water Resources tracked 628 public systems that provide water to 6.78 million people, or about 75 percentage of the state's population.)

Generally, what's the best way we can ensure we have enough water during the drought?

In times of drought and other water emergencies, increasing water efficiency and managing demand through conservation is presently our best option.

What authority does the state have to force communities to conserve water?
The governor does have the authority to declare a water-shortage emergency to order mandatory restrictions on water usage if he determines that the dwindling water supplies are a threat to life and property. But Gov. Easley has been calling on community leaders since last summer for help in spreading the water conservation message because individual communities have been affected by the drought differently and are best equipped to determine what conservation works best in their communities.

So, have individual communities responded to the governor's calls for water conservation?
Yes. More than half of the state's approximately 9 million people have been adhering to water use restrictions for several months. The governor's water conservation message has helped a great deal. Water usage has declined – in some places as much as 50 percent – in the most of the 615 public water systems the state tracks since Gov. Easley called on all systems to enact either voluntary or mandatory conservation measures last fall.

WATER SUPPLY

It would be nice to know how much water we have left in North Carolina. What efforts are there to measure the amount of water so we know when we might run out of water?

State, federal and local water resources' specialists each week measure the amount of water in streams, lakes, reservoirs and groundwater wells. We use those measurements

and a community's estimated daily usage to determine how many days of water a water system may have left.

These measurements play a significant role in the water shortage response plans that all municipalities in North Carolina are required to develop and use to extend available water supplies during droughts.

These measurements also are used by the N.C. Drought Management Advisory Council in its weekly recommendation to federal officials about the severity of the state's drought.

Are there any unknowns when it comes to measuring water supplies?

While there are unknowns when it comes to our water supplies, state, federal and local officials are working to provide a reasonable gauge of our state's available water supplies.

For instance, it is difficult and would be far too expensive and impractical to quantify how much groundwater we have in North Carolina. That's because the types of water storage vary greatly due to the state's significant geological differences. Groundwater is stored between deep, hard layers of bedrock in the Piedmont and mountains and in layered aquifers in the coastal plain.

However, state and federal agencies do measure groundwater in some parts of the state in order to gather a rough idea of how much groundwater we have. The N.C. Division of Water Resources and federal partners measure groundwater levels by monitoring more than 500 wells, many of which measure water availability in the deep coastal plain aquifers. The agencies measure the impact of rainfall (or the lack of rainfall). These wells are chosen as so-called drought indicator wells because they respond to rainfall quickly and their levels are a measure of the amount of water stored in the subsurface that is available to discharge to surface water features.

Likewise, state, federal and local officials take regular measurements of streamflows statewide. The U.S. Geological Survey has a network of monitoring stations with real-time water-stage data at 270 sites, with streamflow computed at 219 locations, and rainfall recorded at 135 stations. These sites continuously record data at 15-minute intervals (or less) and transmit the data via satellite or UHF radio to be incorporated into the USGS National Water Information System for public dissemination. The N.C. Department of Environment and the U.S. Geological Survey share the costs of maintaining the basic stream gauge network.

What is the state doing to help towns and cities from running out of water during the drought?

The N.C. Department of Environment and Natural Resources continues to ensure that communities do not run out of water. The department's main strategies are helping communities strictly conserve the water they have to make it last longer and helping them bring new supplemental water sources on line. The department is in weekly contact with

the most vulnerable water systems to identify their needs and resources, particularly in regard to connection to alternative or backup water sources.

Staff members with DENR and the Division of Emergency Management are also working to identify any additional statewide or regional measures needed to put the state in the strongest possible position to manage water supplies in 2008. This planning may include possible recommendations for legislative action or rule changes needed to strengthen water conservation and water management, along with targeting resources to the most drought-vulnerable communities.

In addition, DENR and Emergency Management staff members are meeting with representatives of different funding agencies in state and federal government to ascertain possible funding strategies to assist in developing alternative water supplies. Thanks to the state's efforts, some cities and towns are now working together to build water lines and supply those vulnerable towns with water from communities with ample water supplies. Staff members in DENR have now identified projects that department water supply experts believe portray the best option for meeting each system's drought response needs.

What does it mean when a community says they have a certain number of days of water left?

Communities figure out the number of days of water left by dividing the volume of water they have available by the average amount of water the community uses each day.

A lot of people have mentioned that if you use well water to irrigate, wash your car or drink you will not affect the amount of water other users have available to them. Is this true?

A groundwater well that is 1,000 feet deep does not respond on drought time scales.

However, shallow groundwater is certainly linked to streams and reservoirs and, therefore, does impact surface water supplies. So, if the shallow wells are not being recharged by rain, then the groundwater supply will dwindle.

We are already seeing evidence of the groundwater affecting surface water in some parts of North Carolina. For example, hydrology students at N.C. State University recently worked on a project to test water quality in Black Creek near Raleigh. But due to the drought, the creek – which is fed primarily by groundwater – was dry in many places and students were unable to do water quality sampling.

The bottom line: all of our water sources in North Carolina are connected. When groundwater supplies begin to dwindle, many of these supplies pull on the supply of surface water that many people depend upon for consumption, bathing and emergencies such as firefighting.

Has anyone suggested taking the treated sewer water, piping it back to the filtration plant, cleaning it up, and putting it back into the water system to use again?

Yes, it has been suggested and even done. In Cary, for instance, the town has been using partially treated sewer water for irrigation purposes. Residents can irrigate using this water and it costs less than regularly treated or potable water and it's safe to use for irrigation purposes.

Has North Carolina government ever thought of the possibility of transferring excess snow from other states to help with the drought situation?

Due to costs and logistics, this is simply not a feasible operation. The N.C. Department of Environment and Natural Resources and the state Division of Emergency Management are working to identify statewide and regional measures to put the state in the strongest possible position to manage water supplies in 2008. Some of this planning may include possible recommendations for legislation action or rule changes needed to strengthen water conservation and water management.

Would it be possible to extend water supplies and provide more potable water to North Carolinians by desalinization, or removing the salt from ocean or brackish water?

Desalinization is a simple idea in theory for producing an alternative freshwater source, and is increasingly used in arid areas of the world such as the Middle East. Unfortunately, in practice, desalinization presents several problems, the most significant of which is cost. Infrastructure costs for implementing a large scale desalinization project and distribution system would be extremely costly, in addition to water and wastewater treatment processes.