

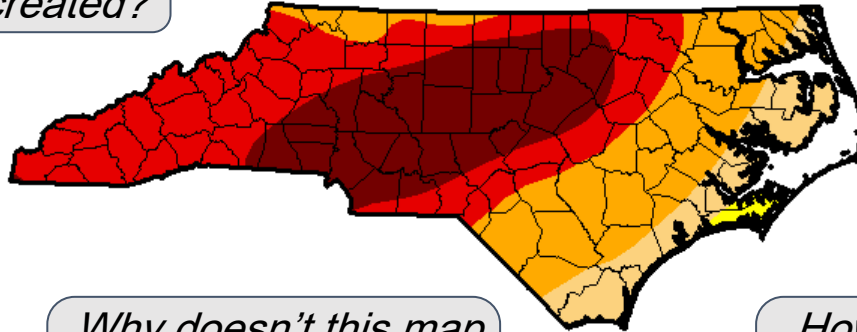
# Project Nighthawk

DMAC Annual Meeting  
September 29, 2020

# Project Background

*How was this map created?*

*Who is discussing drought in NC, and how often?*



*What does the forecast show?*

*How is this affecting my sector?*

*Why doesn't this map reflect conditions I'm seeing in my area?*

*How can I find out about local conditions?*

Official Project Title: *“Innovating Approaches to Drought Communications with North Carolina Decision Makers”*

Code Name: *Project Nighthawk*

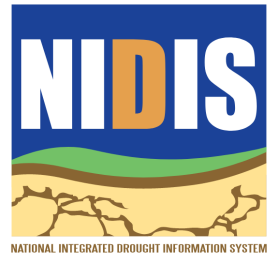
Funding:



**SARP**  
Sectoral Applications  
Research Program



**RISA**  
Regional Integrated  
Sciences and Assessments



## Phase 2: Develop

Develop tailored information and communication prototypes

## Phase 3: Evaluate and Refine

Assess prototypes with stakeholder assessment and engagement, refine and enhance information and communication deliverables

## Phase 1: Identify

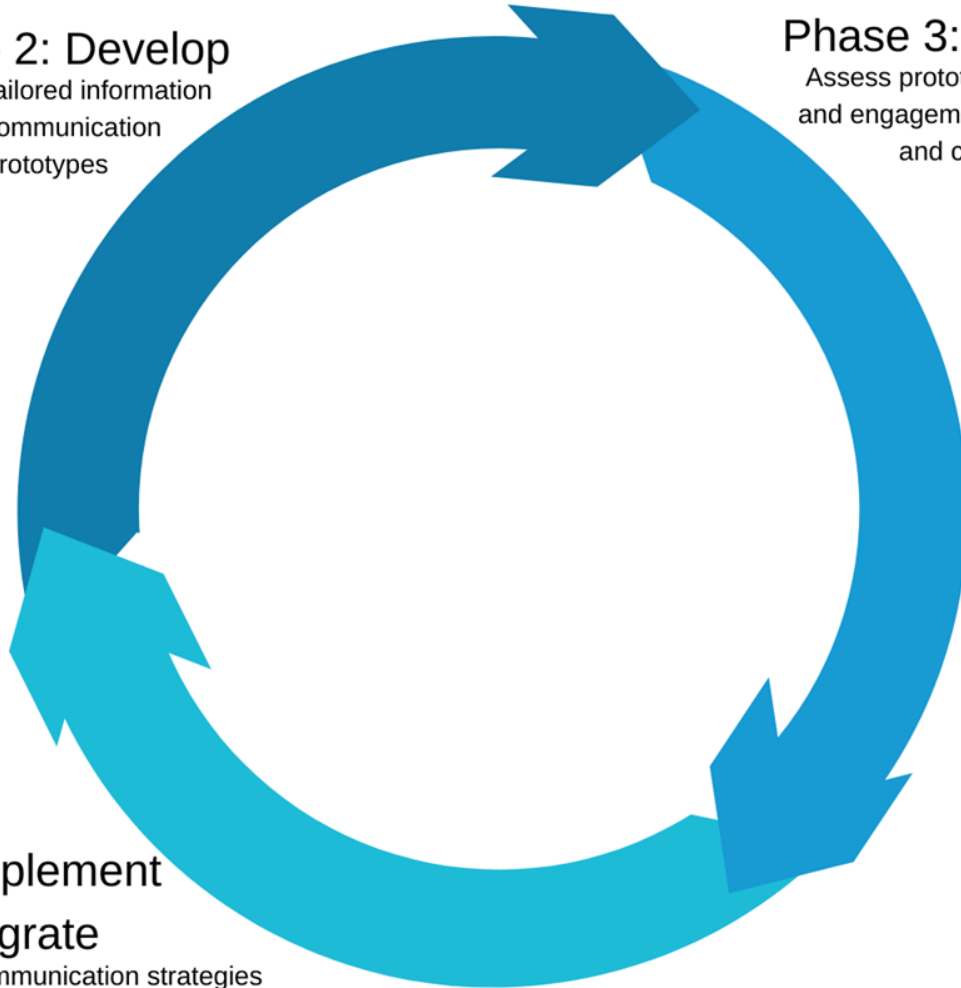
Refine priorities for new products with project partners and target audiences

## Phase 5: Evaluate

Evaluate project activities and outcomes

## Phase 4: Implement and Integrate

Integrate and implement communication strategies



## Phase 2: Develop

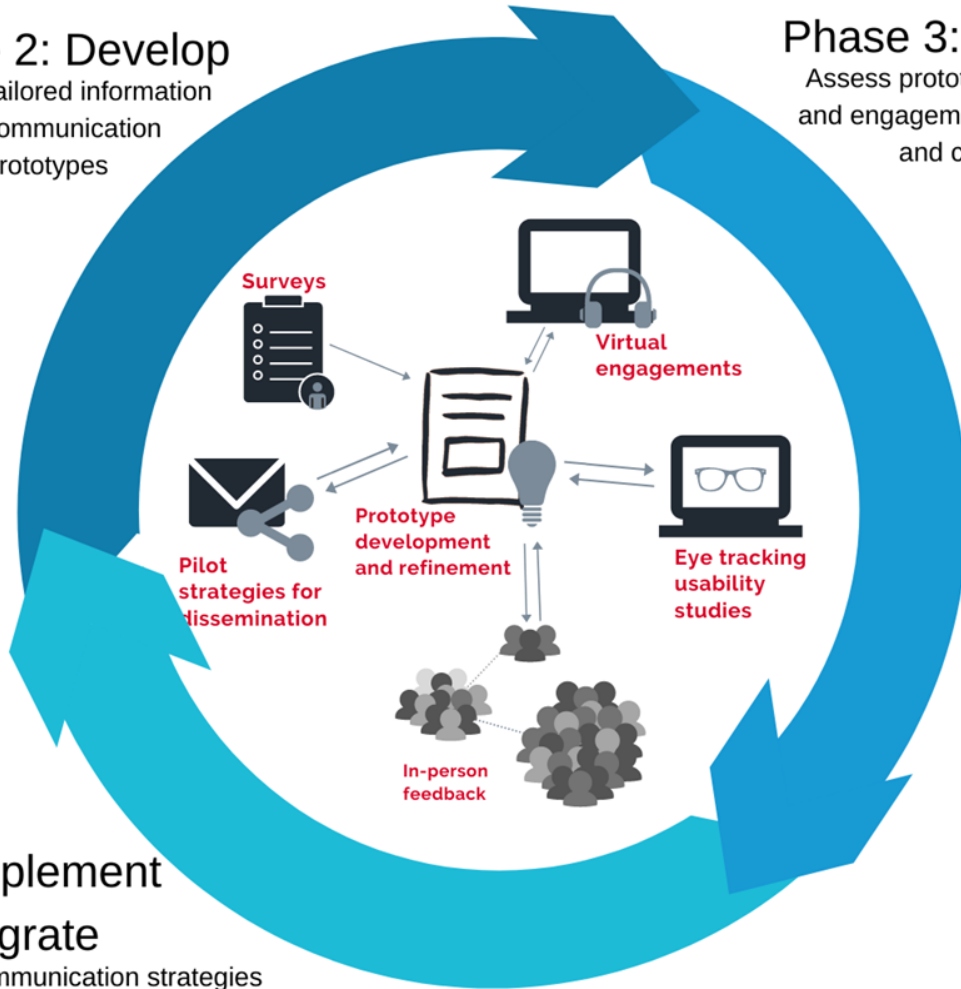
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Refine priorities for new products with project partners and target audiences



## Phase 5: Evaluate

Evaluate project activities and outcomes

## Phase 4: Implement and Integrate

Integrate and implement communication strategies

# Key Findings

- *Use and Usability.* balance of visuals and translated text
- *Access and Discoverability.* “Tune in” to existing information channels
- *Transparency.* proactive (*vs. reactive*) communications

# What to communicate?

1. What's the status? And *why*?
2. About the drought monitoring process
3. How does this affect me?
4. What can we expect in the future?

# No “One Size Fits All”

## Water resources

- When there is a drought
- When the drought is affecting them

## Agriculture and Forestry

- When we’re in a drought or not
- What to expect in the future? (forecast)



# What did we create?

# Story map describing NC DMAC and weekly process

## Ideas for content and layout of ncdrought.org website

**A Story Map**  
DMAC Weekly Process

**Water**

The DMAC assesses hydrologic conditions using streamflow, groundwater, and surface reservoir levels from across the state. These data are explored in conjunction with historical information for the given month or day, as well as any water management actions that may influence them.

The NC DMAC examines streamflows over multiple periods to identify short- to long-term patterns in hydrologic conditions. For example, a 7-day averaging period would indicate how streamflow levels are responding to more-recent weather events, while 28-day average streamflows are used to gauge longer-term trends in hydrologic status.

The United States Geological Survey (USGS) provides information about streamflow and groundwater levels and percentiles. Percentiles place current values within a historical context, facilitating drought assessment. The map to the right shows 14-day averaged streamflow percentiles for USGS gauges. In general, values around 25-75 are considered "near normal," values below 25 are considered "below normal," and anything below 10 would be considered "much below normal." Notice how much of eastern North Carolina has streamflows that are less than the 25th percentile, with a few places below the 10th percentile, indicating below and much below normal conditions at this timescale.

The NC Department of Environmental Quality (DEQ), Division of Water Resources (DWR), alongside USGS, monitors groundwater levels across the state and shares this information with the DMAC. These data are combined with other hydrologic information, such as streamflow levels, to calculate estimates for baseflow.

Much of western and central North Carolina rely on surface reservoirs (man-made lakes) for water supply. Several groups provide reservoir operations information to the NC DMAC.

Chief among these is the US Army Corps of Engineers (USACE), a federal agency under the Department of Defense. Within North Carolina, the USACE manages five dams and four river basins.

**LEGEND**  
14 Day Avg Streamflow Percentile from June 4, 2019

- 70 - 75
- 50 - 70
- 30 - 50
- 25 - 30
- 20 - 25
- 10 - 20
- 5 - 10
- 2 - 5
- 1 - 2
- < 1

## North Carolina Drought Management Advisory Council

North Carolina droughts are complex, and they influence and are influenced by a variety of factors, both natural or human. Members of the NC Drought Management Advisory Council (DMAC) meet regularly to assess conditions across the state and determine drought designations. Drought advisories made by the NC DMAC are based on technical data obtained from sources throughout the state and are tailored to local conditions.

### Technical Information

- Temperature:** Temperatures give an indication of the atmosphere's demand for water through evapotranspiration (the combination of evaporation and transpiration).
- Surface Water & Groundwater:** The levels of surface water and groundwater supplies are used as indicators for hydrological drought and drought impacts.
- Precipitation:** Precipitation that enters the soil provides moisture for plant roots. One of the earliest indicators of drought is low soil moisture.
- Precipitation Demand:** Comparing how much precipitation fell over the past week, month, season, or even year to the average over that same time period provides an indication of the supply side of the water supply-demand balance.
- Forest Health:** Reports of forest fire incidence and acreage help the NC DMAC understand drought impacts to forested lands.
- Agriculture:** Reports of agricultural conditions and crop progress from across North Carolina provide information about drought impacts to agriculture.
- Water Conservation:** Water conservation measures implemented by public utilities are one indication of water supply impacts.
- Wildlife:** Reports from CoCoRaHS Condition Monitoring observers help capture the baseline of moisture conditions and often provide information about impacts to backyard and wildlife.

### The Context

The NC DMAC examines technical information as well as the context for that information when making drought designations. This context includes timing, location, and recent history.

This includes the timing and geographic location of a drought. The current season also influences the types of drought impacts that can be expected, such as poor germination in the spring or increased wildfire likelihood of intensity in the fall. Recent and continuing past influence the likelihood of drought in the future. For example, droughts may develop more easily after a short wet spell if it was preceded by a prolonged drought.

## Convergence of Evidence

Like the US Drought Monitor, the NC DMAC uses a convergence of evidence approach: each piece of information is examined by the members of the NC DMAC and drought designations are based on what the majority of the data indicates. By having multiple technical experts examining the same information, no undue weight is given to any single piece, ensuring that the drought designations correctly reflect on-the-ground conditions.

### Drought Designations

The designations used by the NC DMAC match the US Drought Monitor. The lowest classification is Abnormally Dry (D0) which indicates conditions are drier than normal, but not quite a drought. The remaining categories indicate increasingly intense drought severity. Moderate Drought (D1), Severe Drought (D2), Extreme Drought (D3) and Exceptional Drought (D4).

The NC DMAC examines technical information as well as the context for that information when making drought designations. This context includes timing, location, and recent history.

### Who is the NC DMAC?

The NC Drought Management Advisory Council (DMAC) has statutory authority to monitor drought and issue drought advisories for the state of North Carolina. The Chair of the Council is a member of the Department of Environmental Quality designated by the Department and various groups have been invited to serve on the DMAC based on their technical expertise. These include N.C. Cooperative Extension, US Geological Survey, US Army Corps of Engineers, the NC State Climate Office, NC Forest Service, NC Wildlife Resources Commission, National Weather Service, and others who may be able to provide technical expertise related to drought.

This factsheet was developed under Project Nighthawk, a collaboration between the State Climate Office of North Carolina and the Carolina Integrated Sciences and Assessments to improve drought information resources and communication strategies in North Carolina. For more information, please visit the project website. (climate.ncsc.edu/nighthawk)

This project is supported by the NOAA Sectoral Applications Research Program, award number NA18OAR0310250, and by the National Integrated Drought Information System.

Let's say that the pie chart above is the breakdown, by percentage, of each of the drought levels for your county. Even though a larger percentage of the county is in Moderate Drought (D1, 4%), the county's drought designation would be Severe Drought (D2, 30%). This is because D2 is the highest drought designation that applies to at least 25% of the county.

# Factsheets describing the DMAC and drought monitoring process

Priority: NC DMAC descriptive resources



# Factsheets Describing Past NC Droughts

Available online: [https://climate.ncsu.edu/drought\\_comm](https://climate.ncsu.edu/drought_comm)

## 2007-08 DROUGHT

### FIRE

Factsheet produced by:  
NORTH CAROLINA CLIMATE OFFICE  
CISA

Evans Road fire, from US Flickr, Wildlife Services

#### Summary

Drought gripped North Carolina after a warm, dry end to 2007, and much of 2008. As a result, the state had its worst spring and summer than 20 years, including the long-lived Evans Road wildfire at the P

#### Statistics

For all of North Carolina

Year	DM	DM		
2007	-0.4'	-2.2'	D1	
Jun	+0.5'	-0.8'	D1	
Jul	-1.1'	-2.0'	D1	
Aug	+5.0'	-3.2'	D1	
Sep	+2.2'	-2.2'	D3	
Oct	+5.8'	+1.1'	D4	
Nov	+0.2'	-2.1'	D4	
Dec	+6.0'	+0.5'	D4	
2008	Jan	+0.1'	-2.0'	D4
Feb	+4.3'	+0.2'	D4	
Mar	-1.7'	-0.4'	D2	
Apr	+0.9'	-1.4'	D2	
May	-1.6'	-1.1'	D0	
Jun	-3.5'	-2.3'	D1	
Jul	-0.3'	-0.5'	D1	
Aug	-0.1'	+0.7'	D1	
Sep	+0.6'	+1.2'	D1	

#### Narrative

After a dry spring with sustained high Southeast US, most of NC was in Moderate. It's a fairly common warm-season weather onset and sustained duration helped drive our warmest August on record was also to rapidly drying vegetation and soils.

A hot, mostly dry fall with only one minor tropical storm (Gabrielle) saw Exceptional Drought (D4) take hold.

The dry 2007-08 winter brought limited moisture recharge, especially in organic soils.

The spring fire season started early in passage on February 10 brought dry air whipped up 300+ fires. March saw more Spring storms improved the state's overall but lightning strikes ignited several wild Road fire at the coast on June 1.

Even with near-normal precipitation in July and August, drought lingered at the coast and in the Mountains, and fires continued smoldering.

Late-summer rainfall aided response efforts, but the final hot spots on the Evans Road fire were not fully extinguished until January 2009.

#### Timeline Legend

Statewide temperature and precipitation departures from 1961-2000 normal, from the National Centers for Environmental Information.

DM Most common US Drought Monitor category in North Carolina, by area covered.

#### Monthly Temperature Rankings

Month	Wettest	Driest	Wettest 10%	Driest 10%	Wettest 33%	Driest 33%	Near Normal	Wettest	Driest
Jan	0.0%	0.0%							
Feb	0.6%	0.6%							
Mar	2.0%	2.0%							
Apr	2.0%	2.0%							
May	17.7%	17.7%							
Jun	34.9%	34.9%							
Jul	30.0%	30.0%							
Aug	24.8%	24.8%							
Sep	34.8%	34.8%							
Oct	66.5%	66.5%							
Nov	25.6%	25.6%							
Dec	3.8%	3.8%							
Annual	1.80"	1.80"							

#### Monthly Precipitation Rankings

Month	Wettest	Driest	Wettest 10%	Driest 10%	Wettest 33%	Driest 33%	Near Normal	Wettest	Driest
Jan									
Feb									
Mar									
Apr									
May									
Jun									
Jul									
Aug									
Sep									
Oct									
Nov									
Dec									
Annual									

#### US Drought Monitor Categories

DM D0 Abnormally Dry, D1 Moderate Drought, D2 Severe Drought, D3 Extreme Drought, D4 Exceptional Drought

## 2007-09 DROUGHT

### WATER

### TRIANGLE

Factsheet produced by:  
NORTH CAROLINA CLIMATE OFFICE  
CISA

Falls Lake in October 2007. From the Associated Press.

#### Summary

A multi-year, multi-state drought enveloped the Triangle of North Carolina in mid-September 2008.

## FLASH DROUGHT

### AGRICULTURE

Factsheet produced by:  
NORTH CAROLINA CLIMATE OFFICE  
CISA

#### Summary

Speed of onset distinguishes flash droughts from more "typical" droughts: flash droughts develop rapidly, often with little advance warning. Conditions can go from near-normal to extreme dryness in a matter of days to weeks and can even occur in otherwise wet years. Like all droughts, impacts depend on the season and how dry or wet conditions are before the flash drought develops. In North Carolina, sustained above-normal temperatures or heatwaves frequently accompany flash droughts. Rain-fed crops are impacted first as increased evaporation depletes soil moisture.

#### 2019 Droughts: An Example

Spring. In May 2019 drought developed over the span of a few weeks in eastern North Carolina due to hot temperatures and lack of rainfall. While places in western NC saw ample precipitation, diminishing topsoil moisture along the coast led many growers to delay planting soybeans over concerns about poor germination. Already established plants initially held up, but reports indicated corn and wheat both experienced stress and concerns over yield potential. To manage the dry conditions, farmers employed supplemental irrigation or reduced field work. The drought persisted in southeastern NC throughout the summer, finally ending in early September following Hurricane Dorian.

July. Following Hurricane Dorian's brush along the coast, the axis of dryness shifted west as a period of warm dry weather accompanying a high pressure ridge developed. The Mountains and Piedmont, which missed out on rains from Dorian, saw drought emerge. Initially, the dry weather aided harvesting of crops such as corn and soybeans. As the drought continued, however, inadequate soil moisture led to delays in planting of forage crops and winter crops. The dryness combined with warm temperatures in September and October to curtail growth of forage crops and pastures. In mid-October the weather pattern shifted again, bringing more regular rainfall in passages and precipitation, and ending the drought by early December. Even though the state experienced two droughts, 2019 as a whole was slightly wetter than the long-term average.

#### Future Flash Droughts?

The trend of warming temperatures in NC is projected to continue. Warmer temperatures lead to higher amounts of evaporation and transpiration, making it likely that future droughts will be more severe and "flashy."

Drought (D1) first impacts were in the River basin in May.

Drought (D2) and wet summer on 20 added Stage 1 actions on August 10m implemented mandatory water measures on 11.

Drought December had just 39 days of rainfall - 1st on record in 36-month period.

38 days worth Lake reached a Piedmont from La Nua winter.

Monitor, Feb. 26, 2009

Wettest 10% Wettest 33% Near Normal Driest 10% Driest 33%

# North Carolina Drought Update

For the assessment period ending May 19, 2020

Note: updates will be issued monthly when the state is **not** experiencing dry or drought conditions.

## This Week's Drought Monitor of North Carolina Map

From the US Drought Monitor, authored by Brian Fuchs (National Drought Mitigation Center) with input from the North Carolina Drought Management Advisory Council ([ncdrought.org](http://ncdrought.org))



Reservoirs in the state are close to their guide curves. Operators are preparing for flood control as heavy rain continues this week.



Vegetation across the state is completing green-up this week. Combined with the recent rain, this effectively ends the spring fire season.

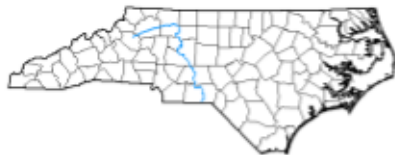


Streamflow levels in the western part of the state had risen to above- and much-above normal levels in response to the rainfall so far this week.



Parts of the Piedmont to northern Coastal Plain were experiencing slight dryness over the past week, including lawn growth slowing and newly planted plants needing watering. Ongoing rains this week are likely to lead to improvements.

## Last Week's Drought Map



A PRODUCT OF **PROJECT NIGHAWK**  
<https://climate.ncsu.edu/nighthawk>



## Statewide Condition Summary

**What's Changed?** Though the past couple of weeks were drier for some parts of NC, slightly **below-normal temperatures** and **antecedent wet conditions** managed to keep the state drought map blank.

**What's New?** **Tropical Storm Arthur** brought 2 to 4 inches of rain at the immediate coast, and a **slow-moving low pressure system** continues to soak the state. Overall, most places are expecting at least 2.5 inches, with some areas in the Foothills and Mountains seeing as much as 7 inches.

**What's Next?** Localized flash flooding is possible through the weekend. **Scattered showers and storms** will linger for much of next week, with our temperatures and precipitation similar to the **typical summertime pattern**.

## Statewide Coverage By Category

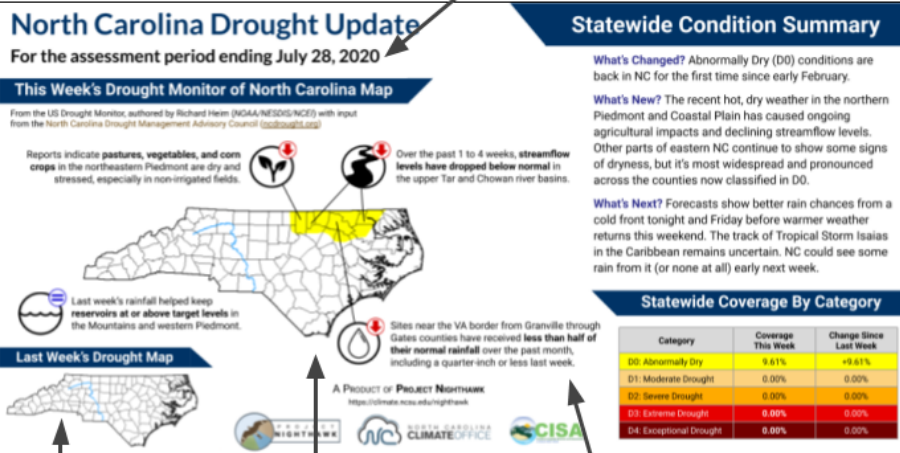
Category	Coverage This Week	Change Since Last Week
D0: Abnormally Dry	0.00%	0.00%
D1: Moderate Drought	0.00%	0.00%
D2: Severe Drought	0.00%	0.00%
D3: Extreme Drought	0.00%	0.00%
D4: Exceptional Drought	0.00%	0.00%

# How It's Made: Drought Update Infographics

## Example Infographic

The US Drought Monitor's weekly assessment period includes data through Tuesday morning.

## Key Elements



A summary of changes to the drought map over the past week and the current status across the state.

Forecasts are **not** factored into the weekly drought status, but are included as a reference on these graphics based on user requests.

The coverage of each US Drought Monitor classification, and percent changes from the previous week's map.

For more about our drought communication efforts including these infographics, visit: [https://climate.ncsu.edu/drought\\_comm](https://climate.ncsu.edu/drought_comm)

Available online:

[https://climate.ncsu.edu/drought\\_comm](https://climate.ncsu.edu/drought_comm)

Last week's US Drought Monitor map for North Carolina.

This week's US Drought Monitor map for North Carolina.

Indicators and impacts that explain the current drought status.

## The Drought Map Explained

North Carolina's drought monitoring process considers conditions across multiple sectors and timescales, from short-term (over the past week) to long-term (over the past 6 to 12 months). Key impacts are highlighted on each infographic with descriptions, icons, and tendency indicators.



Precipitation, including recent amounts and departures from normal



Reservoir levels and inflows compared to seasonal targets



River and streamflow levels, real-time and over the past 7 to 28 days



Soil moisture and groundwater conditions



Crop & vegetation reports from sources such as ag extension agents



Forest conditions such as seasonal green-up and leaf drop



Observed fire activity and estimated fire danger

## Tendency Indicators



Improving dryness



Worsening dryness



Conditions holding steady



Mixed wet and dry conditions

# Priority: Relate forecasted conditions to drought, local- and sector-specific effects



## A Warmer Weekend, then Seasonable

High temperatures on Saturday will reach the mid-80s as a jet stream ridge builds over the Southeast coast. By Memorial Day, highs should relax into the upper 70s – about average for late May – and hover near 80°F for most of the week.



## Gradually Drying Out

The upper-level low that has brought heavy rain across the state this week will slowly move out

## Forecast Confidence

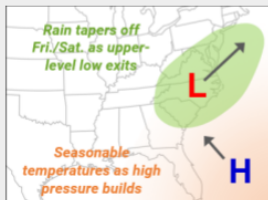


We're moving into a calmer pattern than the storm-soaked past week. The chances for afternoon showers are the main area of uncertainty.

# Short-Range Outlook for North Carolina

## Week 1:

May 21 to 27, 2020



## A Warmer Weekend, then Seasonable

High temperatures on Saturday will reach the mid-80s as a jet stream ridge builds over the Southeast coast. By Memorial Day, highs should relax into the upper 70s – about average for late May – and hover near 80°F for most of the week.



## Gradually Drying Out

The upper-level low that has brought heavy rain across the state this week will slowly move out on Friday. Some showers and storms will linger during the day on Saturday, with lower rain chances as we head through next week.

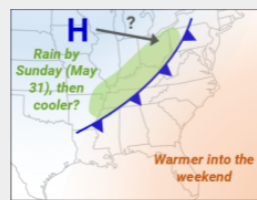
## Forecast Confidence



We're moving into a calmer pattern than the storm-soaked past week. The chances for afternoon showers are the main area of uncertainty.

## Week 2:

May 28 to June 3, 2020



## Late May Warmth, Early June Uncertainty

Weak ridging should remain over the east coast through next weekend, putting highs into the 80s. A brief cooldown is possible around June 1 if Canadian high pressure moves in. Temperatures could drop into the 60s with northeasterly winds.



## A Weekend Rain Event?

A possible cold frontal passage on May 30-31 could bring rain across the state. Beyond that, expect chances of afternoon showers almost daily as we continue moving into a summer-like precipitation pattern.

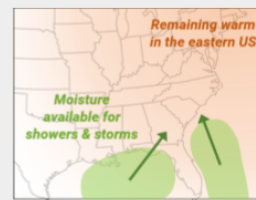
## Forecast Confidence



The large-scale jet stream pattern favors ridging over the eastern US, but the potential for cooler high pressure moving in makes our local temperature forecast less certain.

## Weeks 3-4:

June 4 to 17, 2020



## Jumping Into June-Like Weather

Most models favor temperatures generally a few degrees above normal in North Carolina with jet stream ridging continuing over the eastern US. The best chances for warmer weather look to be in Week 4 approaching mid-June.



## Tropical Moisture Fuels Rain Chances

Moist air moving in from the Atlantic and Gulf of Mexico should continue to support afternoon showers. Some models hint at tropical activity offshore similar to Arthur, but it's too early to tell if and when such systems might take shape.

## Forecast Confidence



Some models show more Gulf moisture moving across the Southern Plains than the Southeast, which might lower our rain chances. Otherwise, the low confidence is typical of this time of year.

A PRODUCT OF PROJECT NIGHTHAWK  
<https://climate.ncsu.edu/nighthawk>



This infographic is based on forecast and outlook guidance from the National Weather Service.



# Sustainability and Access

Resources available on:

- <https://ncdrought.org>

Project archive:

- [https://climate.ncsu.edu/drought\\_comm](https://climate.ncsu.edu/drought_comm)

# What's next?

- Internet of Water - Water Supply Dashboard
- Weekly Drought Update and Short Range Outlook Infographics
- Future funding opportunities





# Thank you!

[https://climate.ncsu.edu/drought\\_com](https://climate.ncsu.edu/drought_com)  
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