

Communicating Drought: What, When, How and Why?

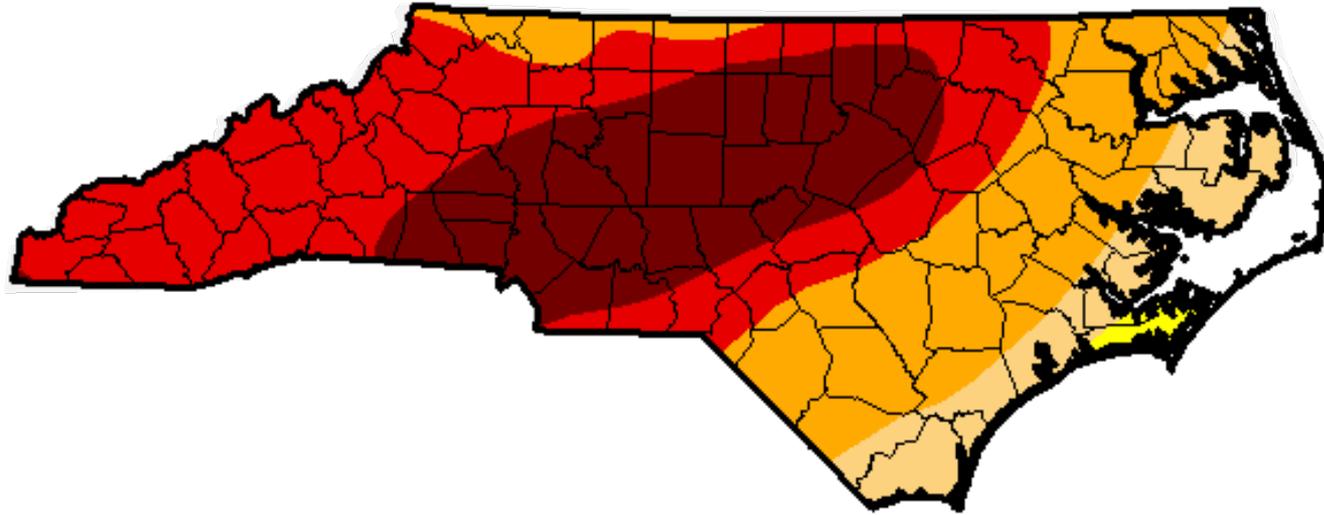
Rebecca Ward

State Climate Office of North Carolina
SE USDM Workshop, February 5, 2020

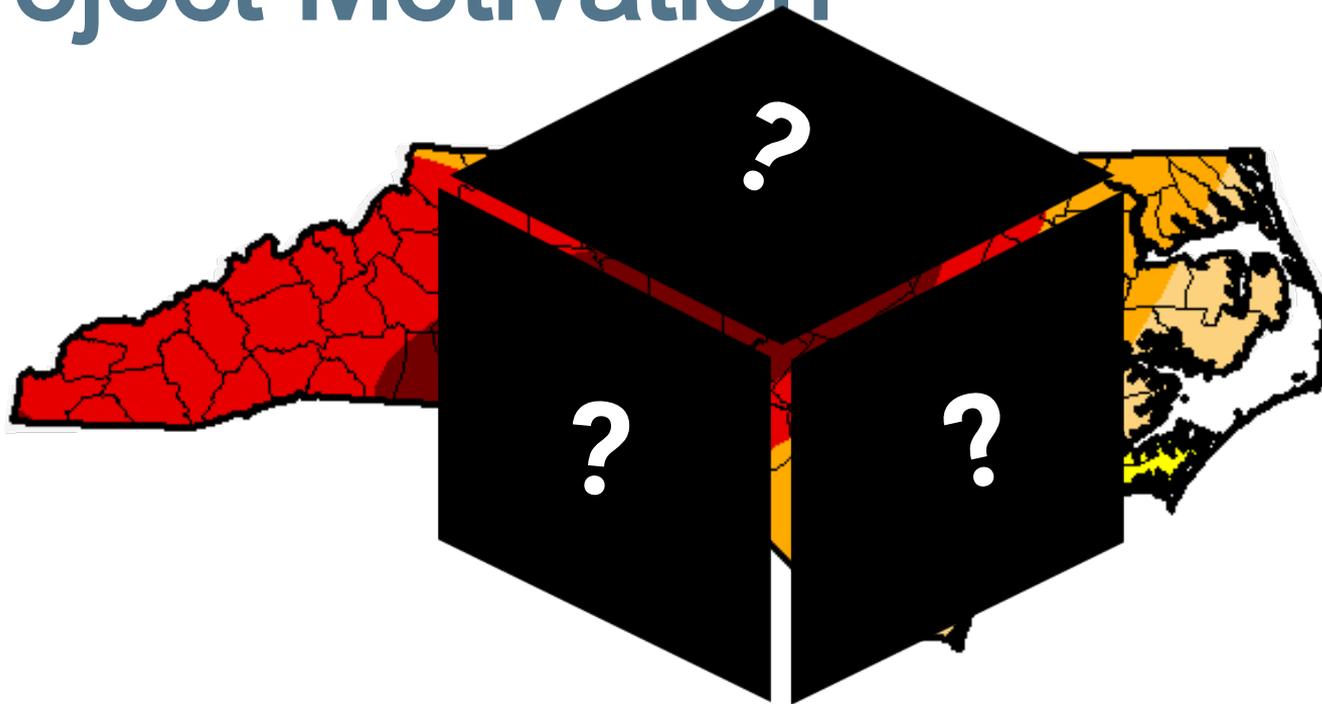
Project Background: Goals

- **Connect** decision makers in **agriculture** , **forestry** , and **water resources** sectors to information by making that information **more accessible** , rather than creating new information or data.

Project Motivation



Project Motivation



Project Background

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

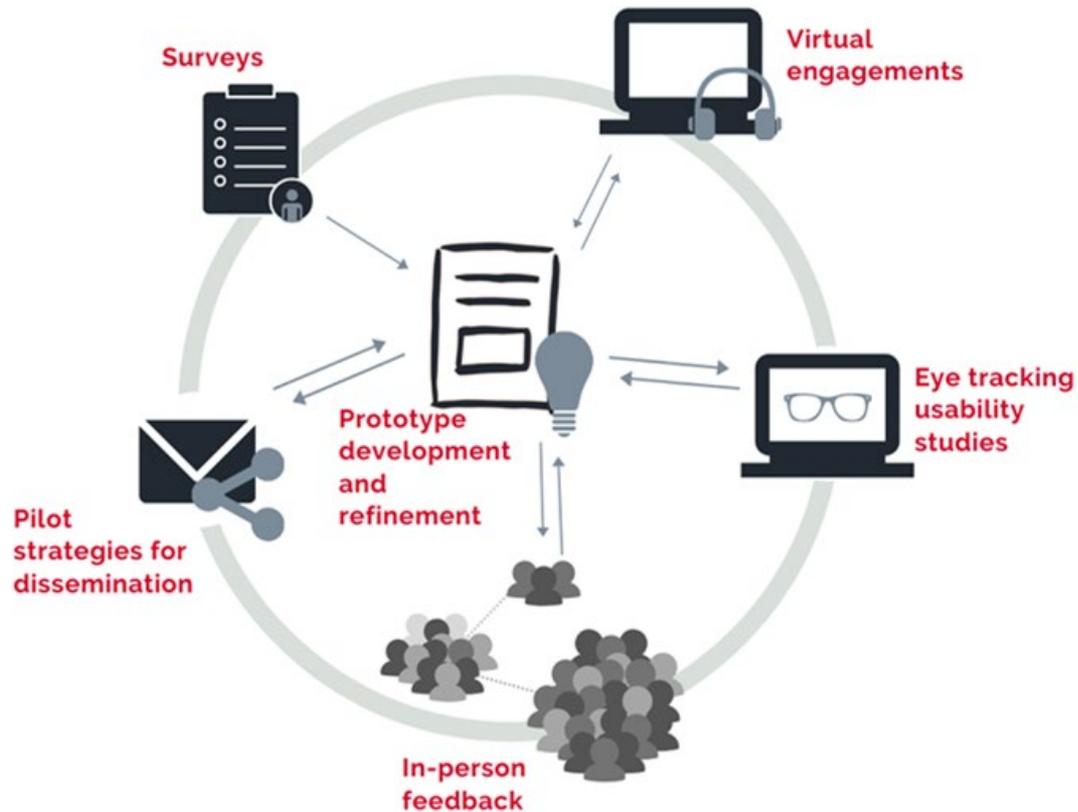
Code Name: *Project Nighthawk*

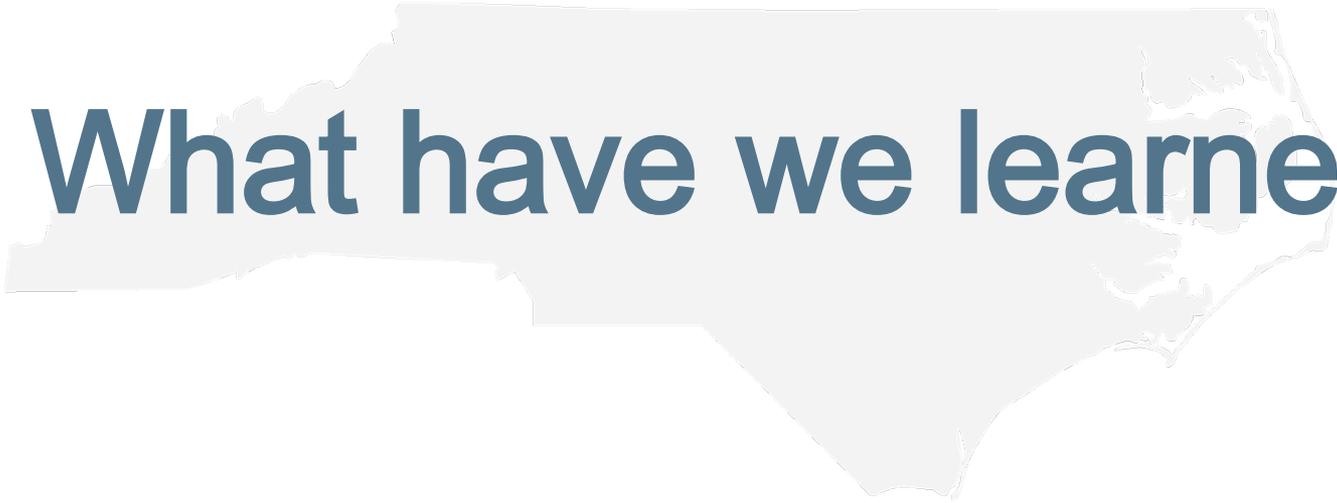
Project Team: Corey Davis
(SCONC), Kirsten Lackstrom (CISA)



The common nighthawk. Photo by Andy Reago and Chrissy McClarren, shared under CC BY 2.0.

Our Process





What have we learned?

What to communicate?

- What's the status? And *why*?
- How does this affect *me*?
- What can we expect in the future?
- About the drought monitoring process

Communications Formats (How)

Preferred:

- Email and/or text alerts (short text messages)
- Infographics, maps/graphs
- Story maps
- Factsheets

Less preferred:

- Blog posts/news letters
- Webinars
- Audio/podcasts
- Written reports
- Twitter*

North Carolina Drought Update

For the week ending October 15, 2019

This Week's Drought Monitor of North Carolina Map

From the US Drought Monitor, authored by Richard Heim (National Centers for Environmental Information) with input from the North Carolina Drought Management Advisory Council (ncdrought.org)

Rain along the Tennessee border helped remove Severe Drought, but streams are still running low.



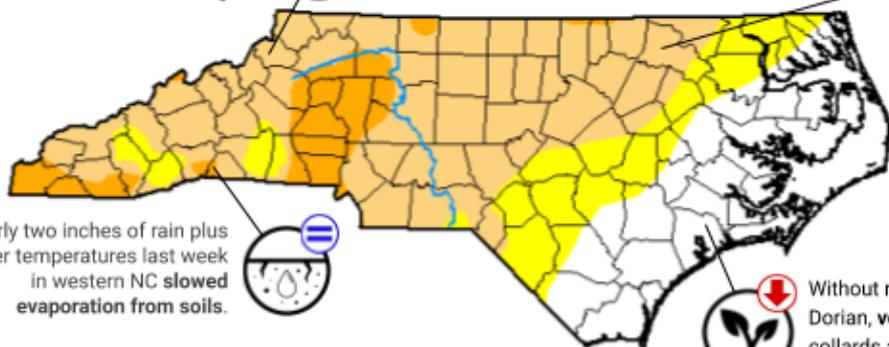
With less than an inch of rain the past month, streamflows across the northern coast have fallen much below normal.



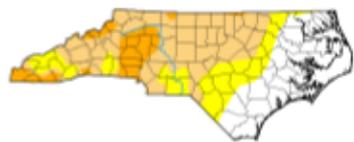
Nearly two inches of rain plus cooler temperatures last week in western NC slowed evaporation from soils.



Without regular rainfall since Dorian, vegetables, such as collards and sweet potatoes, have been growing slowly.



Last Week's Drought Map



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

Statewide Condition Summary

What's Changed? Last week's rain brought **drought improvement** in the northern Mountains, but parts of the southern Piedmont and northern Coastal Plain missed out and are now in Moderate Drought.

What's New? While **Wednesday's rains brought additional relief**, they came after the US Drought Monitor's Tuesday morning data cutoff. Their impacts will be reflected on next week's map.

What's Next? Rain chances continue with a coastal low on Sunday and a cold front on Tuesday. Most areas can expect at least 0.75 inches in total.

Statewide Coverage By Category

	DROUGHT				
	Abnormally Dry (D0)	Moderate (D1)	Severe (D2)	Extreme (D3)	Exceptional (D4)
Coverage This Week	18.01%	47.58%	9.64%	0.00%	0.00%
(Change Since Last Week)	(-2.10%)	(+7.19%)	(-1.19%)		

Short-Range Outlooks for North Carolina

Week 1: December 5 to 11

Forecast Confidence



Cloud cover on Sunday could limit our high temperatures, and uncertainty remains about how much precipitation we see on Monday and Tuesday.



Rain Early Next Week: Moisture moving in from the south on Monday and a cold frontal passage on Tuesday will bring rainfall across the state. The Mountains could see 2 to 3 inches while the coast may see half a



Warming Up This Week: Temperatures shifting from near-normal to steadily increasing in the 50s on Saturday. Temperatures after the cold front

Week 2: December 12 to 18

Forecast Confidence



Some forecast models show Arctic air moving into the US Midwest. If that air mass reaches farther south, temperatures could be colder than expected.



More Weekend Rain: Gulf moisture and a cold front, with rain possible beginning on Saturday, December 14, and lasting through



Seasonable, Then Cooler: Temperatures begin the week in the 50s before the cold front brings a shot of colder air, with overnight lows in the 20s by Tuesday

Week 2: December 12 to 18

Forecast Confidence



Some forecast models show Arctic air moving into the US Midwest. If that air mass reaches farther south, temperatures could be colder than expected.



More Weekend Rain: Another batch of Gulf moisture may move in ahead of a cold front, with rain possible beginning on Saturday, Dec. 14 and potentially lasting through the weekend.



Seasonable, Then Cooler: We should begin the week with near-normal highs in the 50s before the weekend cold front brings a shot of colder air, with overnight lows possibly dropping into the 20s by Tuesday and Wednesday.



Forecast guidance from the NWS Climate Prediction Center and the GFS and CMC computer models

Weeks 3 and 4: Dec. 19 to Jan. 1

Forecast Confidence



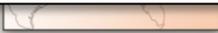
This variable pattern is difficult to predict weeks in advance. Cold air outbreaks are unlikely, but otherwise a wide range of conditions are possible.



Warmer Weather: A subtropical jet shifting farther north could keep our temperatures normal overall.



A Drier Pattern: A drier pattern is possible, that would mean less rain as well, keeping us from seeing as many storm systems. However, cold fronts could still clip the state and bring some rainfall.



Forecast guidance from the NWS Climate Prediction Center and the Climate Forecast System model



<http://climate.ncsu.edu/nighthawk>



Story map describing NC DMAC and weekly process.

Ideas for content and layout of ncdrought.org website

A Story Map esri

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 Percentiles from June 4, 2019

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

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North Carolina Drought Management Advisory Council

North Carolina droughts are complex, and they influence and are influenced by human activities. Members of the NC Drought Management Advisory Council (DMAC) examine the state and determine drought designations. Drought advisories made by the DMAC are obtained from sources throughout the state and are tailored to local conditions.

Technical Information

Temperatures give an indication of the atmosphere's demand for water through evapotranspiration (the combination of evaporation and transpiration).

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.

Reports of forest fire incidence and acreage help the NC DMAC understand drought impacts to forested lands.

Water conservation measures implemented by public utilities are one indication of water supply impacts.

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 the drought, as well as the timing and geographic location of the drought. For example, drought may develop in a region that has recently experienced a prolonged drought.



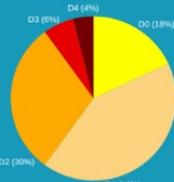
Convergence of Evidence

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 indicate. 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).

Droughts don't follow political boundaries, so it's possible (and even common) for a county to have several levels of drought within its bounds. In these instances, the drought designation of the county will be the highest drought designation that applies to at least twenty-five percent (25%) of the land area of the county.



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, 42%), 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.



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's Integrated Sciences and Assessments to improve drought information resources and communication strategies in North Carolina. For more information, please visit the project website (climate.ncsu.edu/nighthawk).

This project is supported by the NOAA Sectoral Applications Research Program, award number NA15OAR010258, and by the National Integrated Drought Information System.



Also:

- Collaboration with NC State University graduate-level design course
- Drought information on a basin-wide or statewide scale

When to communicate?

- 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)

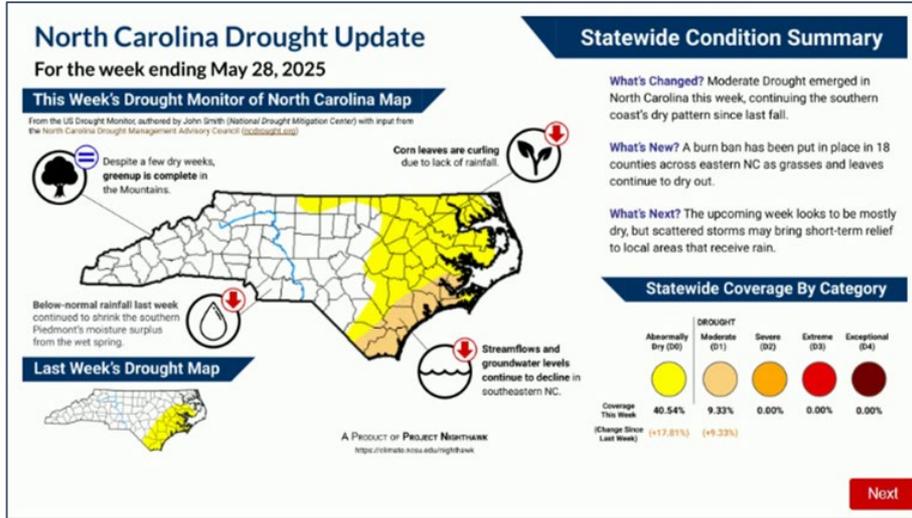
Where to communicate?

- Tune into existing channels:
- Emails via listservs
 - Testing with a group of ~40 participants
- Social media (Facebook, Twitter)
- Websites (ncdrought.org)

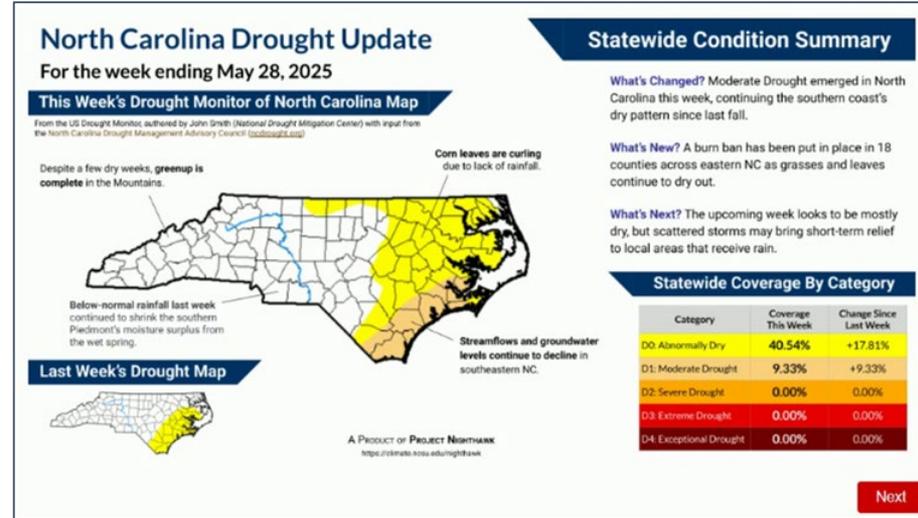
Is it working?

- Feedback from listserv “beta users”
 - Using in outreach to homeowners, community, media
- Eye tracking evaluation

Eye tracking - Fall 2019

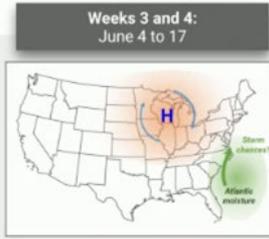


“Icons”



“No Icons”

Insights from eye tracking



Limited Rain Chances
Our pattern will favor **mostly dry** weather, with a few localized showers possible at coast if an afternoon sea breeze develops.

Summer Heat Builds
High pressure over the Southeast US will put **high temperatures** into the mid-90s. Along with elevated humidity, this will increase heat stress.

Fuel for Fires
The ongoing heat will dry out vegetation and soils, and with lower humidity, **fire danger will ramp up** especially across already-dry parts of the southern Coastal Plain.

Warm Weather Continues
We will remain in a warmer pattern, with temperatures likely 2 to 5 degrees **above normal**. Normal highs for this time of year are in the low to mid 80s.

Relief from the Heat?
The high-pressure system controlling our weather in May could finally shift to our northwest in the first half of June. This would likely bring our temperatures **closer to normal**.

Rain May Return
If that stubborn high finally moves, it could open the door to a feed of Atlantic moisture from the southeast, fueling **showers and thunderstorms** mainly in eastern North Carolina.

Forecast Confidence

High pressure will be slow to move out, so all signs point to a hot, dry week.

Forecast guidance from the National Weather Service (NWS) Climate Prediction Center

Forecast Confidence

A potential eastward shift in jet stream later in the week could increase our rain chances.

Forecast guidance from the National Weather Service (NWS) Climate Prediction Center

Forecast Confidence

Exactly if and when a pattern change takes place is still uncertain.

Forecast guidance from the National Weather Service (NWS) Climate Prediction Center

Week 1: May 21 to 27

Forecast Confidence

High pressure will be slow to move out, so all signs point to a hot, dry week.

Summer Heat Builds: High pressure over the Southeast US will put **high temperatures** into the mid-90s. Along with elevated humidity, this will increase heat stress.

Limited Rain Chances: Our pattern will favor **mostly dry** weather, with a few localized showers possible at coast if an afternoon sea breeze develops.

Forecast guidance from the National Weather Service (NWS) Climate Prediction Center

Week 2: May 28 to June 3

Forecast Confidence

A potential eastward shift in jet stream later in the week could increase our rain chances.

Warm Weather Continues: We will remain in a warmer pattern, with temperatures likely 2 to 5 degrees **above normal**. Normal highs for this time of year are in the low to mid 80s.

Fuel For Fires: The ongoing heat will dry out vegetation and soils, and with lower humidity, **fire danger will ramp up** especially across already-dry parts of the southern Coastal Plain.

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Weeks 3 and 4: June 4 to 17

Forecast Confidence

Exactly if and when a pattern change takes place is still uncertain.

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Rain May Return: If that stubborn high finally moves, it could open the door to a feed of Atlantic moisture, fueling **showers and thunderstorms** mainly in eastern North Carolina.

Forecast guidance from the National Weather Service (NWS) Climate Prediction Center

“Vertical”

“Horizontal”

Preliminary

Insights from eye tracking

- No significant differences in responses (accuracy, perceptions of ease)
- Participants who viewed infographics with icons took longer to answer questions

Takeaways - Eye Tracking

- Verdict still out on icons
- Text *is* read
 - Not all text is equal
- Usability \neq to [anticipated] use

Communicating Drought Takeaways

- Don't just create; **evaluate!**
- Translate technical information, but know where to **stop**
- Know your audience
 - **When** will they use your products, and **for what purpose?**
 - Consider a **variety of formats** to meet their needs
 - May not please everyone 100%

Acknowledgements:

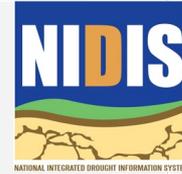
- Project Support:



SARP
Sectoral Applications
Research Program



RISA
Regional Integrated
Sciences and Assessments



- Participants and Stakeholders:

- NC DMAC
- Water Utilities, N.C. Cooperative Extension, NC Forest Service
- Many more!

<https://climate.ncsu.edu/nighthawk>