

So Why Does The Drought Map Look Like That? Unpacking The Linkages Between The Transparency Of Drought Monitoring Processes And Usability Of Drought Communication Products

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Abstract

During recent droughts in North Carolina, various audiences have articulated needs for information that explains current or anticipated impacts, droughts' geographic extent and timing, and how the State monitors drought. This is despite there being a regular process in place to evaluate statewide conditions and seemingly abundant information available through federal, state, and local agency websites; media outlets; and other channels. This presentation provides findings from a research project designed to improve the availability, understandability, and usability of drought communications products for North Carolina audiences, focusing on the US Drought Monitor map of North Carolina as an example. The North Carolina Drought Management Advisory Council (DMAC) technical committee has met weekly to assess drought conditions since the 1990s and has recommended the state's drought designations to the US Drought Monitor since 2000. The DMAC recommendations typically align with the weekly USDM map. Through surveys, focus groups, usability studies, and other engagement methods, we collected information from groups such as extension agents and water utility staff about 1) their communications preferences - resources that are concise, easily readable, and readily shareable through email, listservs, and social media - and 2) infographic prototypes created to address those preferences. User feedback on the prototypes informed iterative refinements to their content and design and provided information about their potential use for communications and management decisions. Ultimately, understanding the monitoring process and how drought designations are made was a key factor affecting the extent to which extension and other communication professionals apply, share, and value the information produced by monitoring groups and scientific agencies. This research suggests that addressing transparency questions can support efforts to communicate complex problems, such as drought.

1. INTRODUCTION

Motivation & Objectives

This collaborative project between the State Climate Office of North Carolina (SCONC) and NOAA's Carolinas Integrated Sciences and Assessments (CISA) program focused on improving the usability and communication of drought-relevant information for North Carolina decision makers working in the agriculture, forestry, and water resources sectors.

The project's motivation stemmed from needs articulated by the North Carolina Drought Management Advisory Council (DMAC) and constituents such as N.C. Cooperative Extension agents, fire managers, and public water supply system managers. These needs included a better understanding of how drought is monitored, the climatic and environmental conditions that can cause or worsen drought conditions, and drought impacts on various sectors and regions of the state.

The project objectives were to:

- Develop tailored, sector-specific information for drought-relevant decisions
- Deliver information in accessible and actionable formats
- Improve the transparency of the drought monitoring process through enhanced engagement and communications with decision makers

This poster explores how efforts to build transparency and better understanding of drought monitoring and designation processes can shape how decision makers apply, share, and value the information produced by monitoring groups and scientific agencies.

The North Carolina Drought Monitoring Process

The North Carolina Drought Management Advisory Council (NC DMAC) monitors drought and issues drought advisories for the state of North Carolina. Originally formed in 1992, subsequent state legislation in 2003 and 2008 formalized the DMAC's membership, functions, and responsibilities.

Technical experts from various agencies and organizations serve on a volunteer basis.

State agencies

Cooperative Extension Service	Forest Service
Department of Agriculture and Consumer Services	State Climate Office
Department of Commerce	Utilities Commission
Department of Environmental Quality	Wildlife Resources Commission
Department of Public Safety	

Federal agencies

Federal Emergency Management Agency	US Army Corps of Engineers
National Weather Service	US Department of Agriculture
Tennessee Valley Authority	US Geological Survey

Reservoir managers/energy producers

Cube Hydro	Duke Energy
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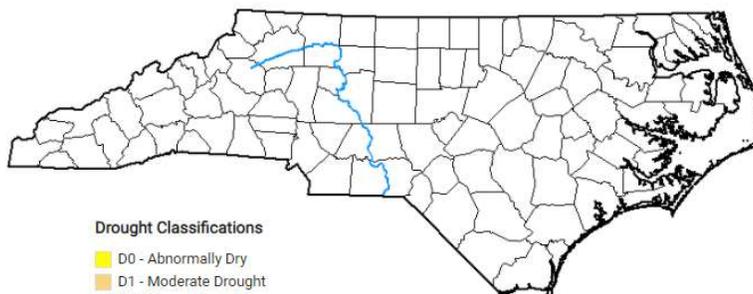
The DMAC meets regularly via teleconference and provide recommendations to the US Drought Monitor (USDM), following the "convergence of evidence" approach used by the USDM authors (Svoboda et al., 2002 (<https://journals.ametsoc.org/bams/article/83/8/1181/57818/THE-DROUGHT-MONITOR>)). The final product is the weekly US Drought Monitor of North Carolina Map.



Current Conditions

as of November 10, 2020 at 8am ET

US Drought Monitor of
North Carolina



- Drought Classifications
- D0 - Abnormally Dry
 - D1 - Moderate Drought
 - D2 - Severe Drought
 - D3 - Extreme Drought
 - D4 - Exceptional Drought



(<https://www.ncdrought.org/>)

Figure 1. The NC DMAC website. Click here (<https://www.ncdrought.org/> (<https://www.ncdrought.org/>)), or on the image (above), to visit the website.

2. APPROACH

An Iterative Process

The project was designed as an iterative process and involved decision makers throughout the various stages of product development, evaluation, and refinement.

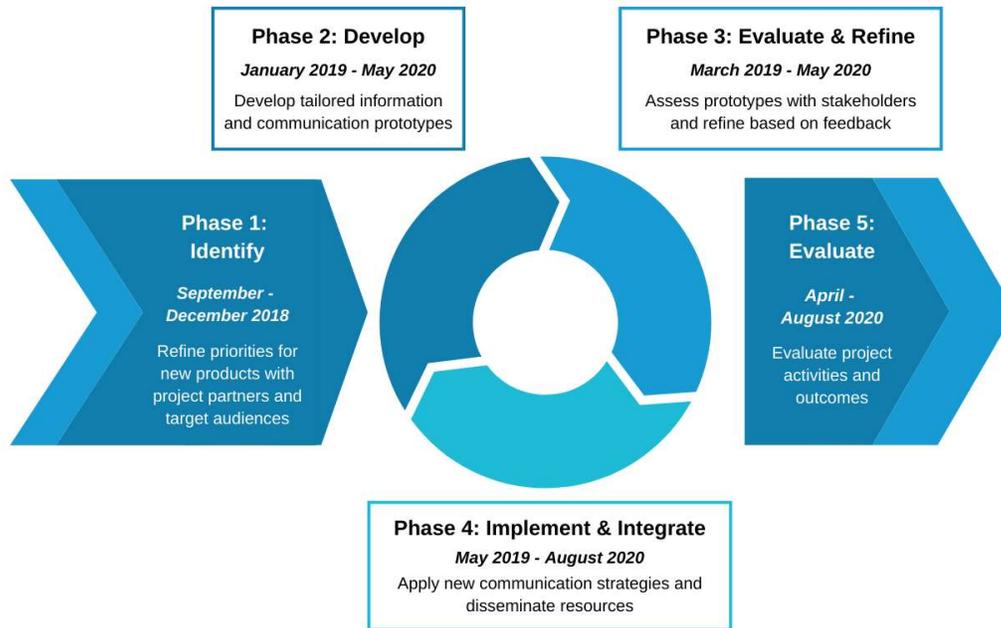


Figure 2. The project's five phases.

- **Phase 1.** We engaged with partners and our target sectors to conduct a needs assessment, identify priorities for new information resources, and explore strategies to disseminate new resources.
- **Phase 2.** We created prototypes to share drought information based on priorities identified in Phase 1.
- **Phase 3.** We systematically evaluated and refined the prototypes through a combination of surveys, in-person and virtual feedback sessions, and eye tracking studies with extension agents, water resource managers, and other stakeholders. Products were assessed in terms of their content, design, understandability, ease of access, and shareability.
- **Phase 4.** We began to disseminate new products through partner organization's communications processes, a listserv for project participants, and a project website.
- **Phase 5.** We evaluated project outcomes in terms of product use and the engagement process through a qualitative analysis of all feedback received during the project. Overall, we conducted and/or attended over 17 engagements with decision makers and other project stakeholders.

3. NEEDS ASSESSMENT RESULTS AND EXAMPLE PRODUCTS

Needs Assessment Methods

- In October 2018 we sent online surveys to 499 extension agents (agriculture, forestry), water resource managers, and NC DMAC members to collect information about decision makers' uses of and needs for drought information. We received 140 completed, or partially completed, surveys (28.1% response rate).
- In November and December 2018 we conducted two follow-up webinars to share survey results and refine ideas for new resources and tools to develop. Attendees (31 total) included NC DMAC members, information providers (e.g., National Weather Service offices), and key sector representatives (i.e., agriculture, forestry, water resources).

Needs Assessment Results

- We identified a need for a better understanding of the NC drought monitoring process and how drought designations are determined. Survey respondents were almost evenly split between those who were aware of the NC Drought Map and monitoring process and those who were unaware of the process. Over half of respondents indicated they consider the NC and USDM maps only moderately accurate or are unsure of their accuracy.
- The drought maps and indicators currently available are retrospective (i.e., show past conditions) and are not always presented at a meaningful scale for decision making.
- Participants indicated needs for products that are easily understandable and accessible to the various audiences with whom they interact and communicate. Preferred products were those written in clear and concise language, presented in user-friendly formats, and shareable through existing channels such as social media and websites.

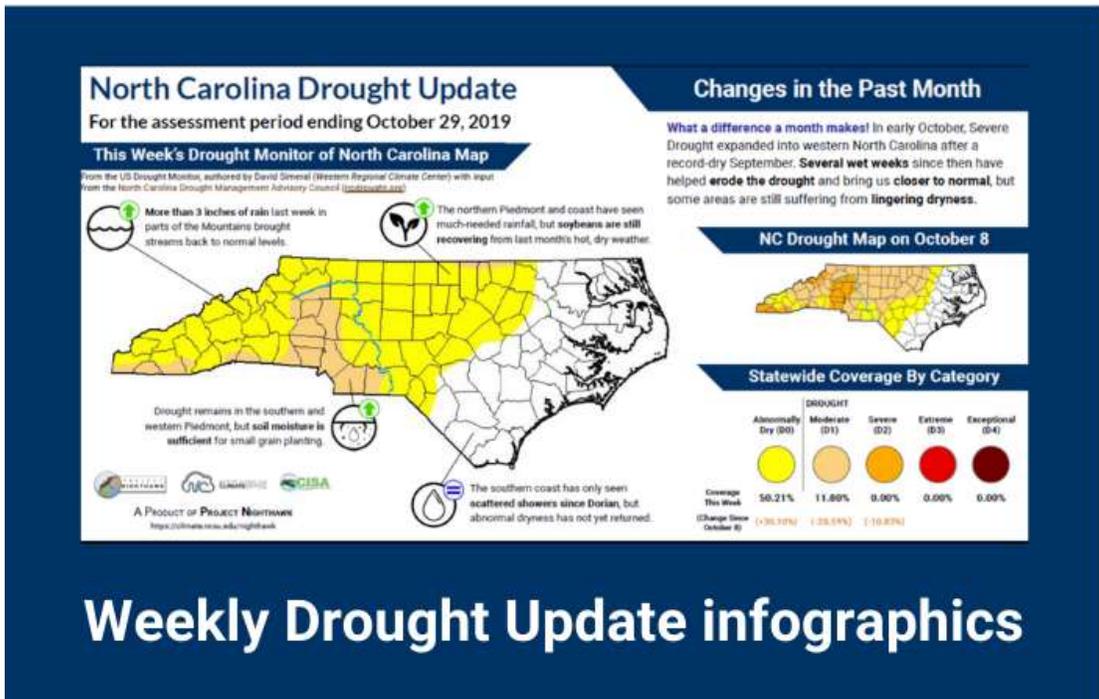
Priorities & Products

Through this process we identified the following project priorities to address the needs articulated by the survey and webinar participants. These priorities were the basis for new products and resources.

Click on each image to link to the example resource in a new window.

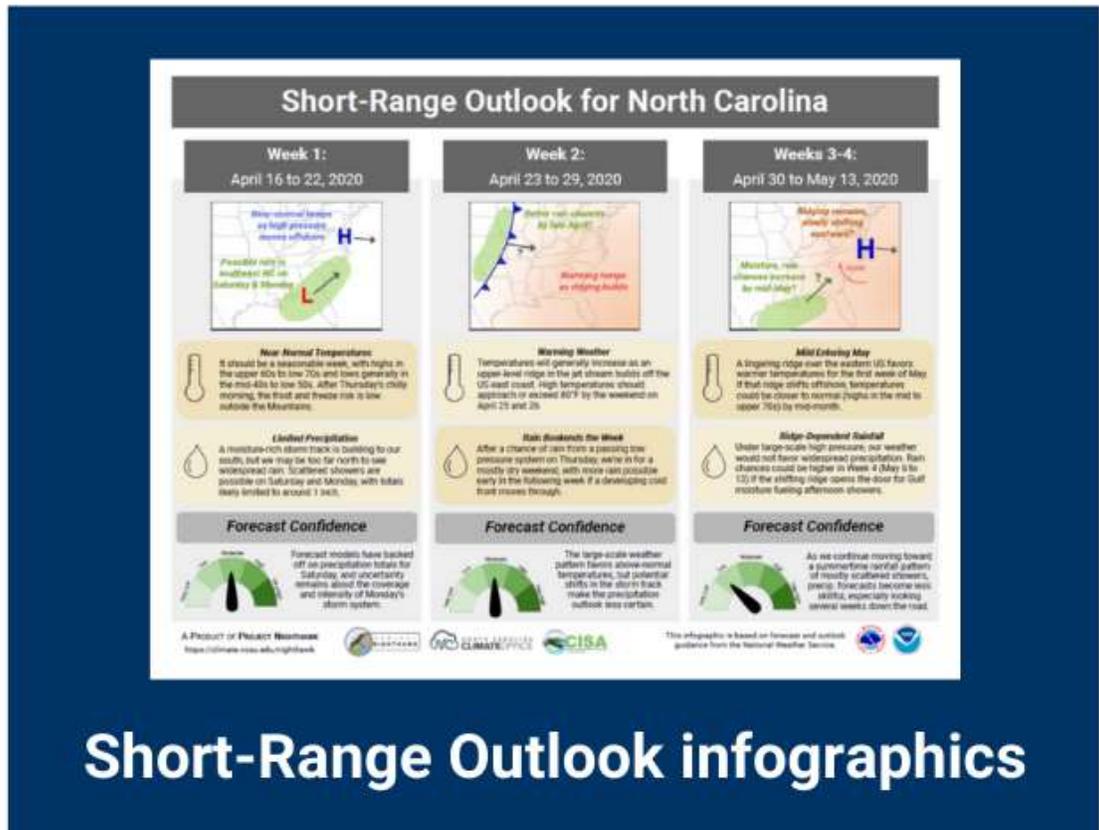
Visit the project website (https://climate.ncsu.edu/drought_comm) to see additional products and examples.

Priority 1. Narratives to accompany the NC Drought Map and synthesize the weekly drought status in North Carolina.



(https://climate.ncsu.edu/documents/nighthawk/DroughtUpdates/DroughtUpdate_2019-10-29.pdf)

Priority 2. Resources that relate anticipated short and long-range conditions to drought and local- and and sector-specific effects.



(https://climate.ncsu.edu/documents/nighthawk/SROutlooks/SROutlook_April2020.pdf)

Priority 3. Contextualized and sector-specific information to support use and understanding of drought information.

2016-17 DROUGHT FIRE SOUTHERN MOUNTAINS

Heatmap produced by: **NC CLIMATE OFFICE**
<https://climate.ncsu.edu>

Summary
 A broader drought across the Southeast US expanded into western North Carolina during summer 2016. Fueled by the ongoing hot, dry weather persisting unusually late into the year, the fall fire season was especially active and intense in the southern Appalachians.

Statistics

Year	Month	Temp Anomaly	Precip Anomaly	DM
2016	Aug	+3.2'	+0.2"	D0
	Sep	+4.2'	-2.4"	D1
	Oct	+3.8'	-3.3"	D2
	Nov	+4.1'	-2.1"	D3
2017	Dec	+3.2'	-0.5"	D2
	Jan	+6.0'	-0.4"	D2
	Feb	+7.2'	3.2"	D1
	Mar	+1.0'	-0.0"	D2
	Apr	+5.2'	-2.1"	D1
May	+0.3'	+3.2"	none	

Narrative

Driven by **extended high pressure over the Southeast US**, the severe drought centered on northern Georgia reached far western North Carolina by mid-summer 2016, but some seasonal rainfall in August slowed its eastward expansion.

After **three weeks of limited precipitation** to start September, Moderate Drought (D2) expanded across the southern Mountains.

White spots of **anemic BI** were felled by **Hickory Barkers**. Asheville recorded just **0.81 inches of rain** from Oct. 9 to Nov. 25.

Dead grasses and other vegetation **increased the fuel load** that could be easily ignited by a spark. Between lightning, campfires, and arson, the fire sparks began in mid-October.

At least **26 wildfires consumed more than 62,000 acres** in NC, with their spread aided by the ongoing dry weather and several windy days.

A series of **cold fronts** beginning in late November brought needed rainfall, and the ongoing fires were largely contained by mid-December.

Drought remained throughout the 2016-17 winter and briefly re-intensified after a dry February, leading to **spotty fires in March**.

A southward-sagging jet stream by late April meant **more storm systems** crossing the state, heavy rain, and the end of drought.

Timeline Legend

Monthly Temperature Rankings: (Scale: 1-12)

Monthly Precipitation Rankings: (Scale: 1-12)

US Drought Monitor Categories: (Scale: D0 to D5)

Historical drought factsheets

(https://climate.ncsu.edu/documents/nighthawk/Factsheets/Factsheet_Fire_2016-17_SMtns.pdf)

Priority 4. Resources that describe the NC DMAC, its weekly drought monitoring process, and how this relates to the US Drought Monitor.

The screenshot shows the website for the North Carolina Drought Management Advisory Council. The header includes the organization's name and a navigation menu with links for 'CURRENT CONDITIONS', 'MEETINGS & REPORTS', 'MAP ARCHIVES', 'EDUCATION', 'ABOUT', and 'CONTACTS'. The main content area is titled 'About' and features an 'esri' logo. A prominent section is titled 'DMAC Weekly Process', which includes a brief description of the council's role and a note that a new map is published each Thursday. To the right, there is a 'U.S. Drought Monitor North Carolina' section for the date 'November 11, 2020'. This section contains a map of North Carolina with color-coded regions and a data table. The table lists various counties and their corresponding drought severity levels. At the bottom of the story map, there are logos for the U.S. Drought Monitor and the Drought Monitor at A&A.

Story map about the NC DMAC's weekly drought monitoring process

(<https://www.ncdrought.org/about>)

4. KEY FINDINGS FROM PRODUCT EVALUATIONS

Creating Usable and Useful Products

User engagements conducted in Phase 3 focused on obtaining feedback on specific product design elements and content.

As an example, the slide deck (below) highlights different iterations of the Weekly Drought Update infographics.

As we worked through the product evaluation and refinement process, we refined our understanding of how users interacted with the information and how to adapt the prototypes so they would be most useful for the intended audiences.

- **Standardized formats**, a streamlined design, and balanced text and visual elements help users to consume the presented information on a week-to-week basis.
- **Avoiding jargon** and less technical language makes them useful for explaining drought status to the media, public audiences, and higher-level decision makers.
- **Presenting forecast confidence** in a clear and understandable manner is of utmost importance. The “forecast confidence scale” in the Short Range Outlook infographics went through several iterations.
- **Some users appreciated the amount of detail** included in the products, but others indicated they included too much text. Resources explaining “how the infographics are made” provide additional information for those seeking more details.
- **A “one-size-fits-all” approach may be ineffectual** for audiences requesting sector-specific information. We therefore created templates, such as those for the Historical Drought Factsheets, that could be adapted for different user groups.

Click here (https://climate.ncsu.edu/documents/nighthawk/SROOutlooks/SROOutlook_About.pdf) to access the "How It's Made" infographic for the Short Range Outlook product.

How It's Made: Short-Range Outlooks for North Carolina

Example Weekly Forecast

Week 1:
August 20 to 26, 2020

Lingering showers through Friday
Warmer, drier next week

Warming Up Early Next Week
Lingering cloud cover will keep highs in the low 80s today and Friday. The Bermuda high pressure system will slide closer to the coast this weekend, and temperatures should again reach the 90s in eastern NC by Monday.

Wet Through Friday, Then Drier
A slow-moving front will support widespread shower and thunderstorm activity today and Friday, especially at the coast. Behind that front, expect mostly drier weather through next week as high pressure builds in.

Forecast Confidence
Some showers could linger into Saturday but after that, most forecasts agree on a drier, hotter week ahead.

Main Elements

Each outlook covers 4 weeks across 3 separate panels: **Week 1, Week 2, and Weeks 3-4.**

Forecast maps show weather systems expected to affect North Carolina during this period, including high/low pressure systems, fronts, tropical storms, and potential sources of moisture or dry air.

Text summaries describe potential temperature and precipitation patterns in NC, including expected conditions (e.g., high temperatures and rainfall amounts/coverage) or areas of uncertainty in the forecast.

Forecast confidence is given on a scale from 1 (Very Low) to 5 (Very High), as assessed from NWS and CPC forecast discussions.

Data Sources Used

Week 1

- Forecasts from NWS offices covering NC, including their area forecast discussions (www.weather.gov)
- National forecast charts from the NWS Weather Prediction Center (www.wpc.ncep.noaa.gov)
- National Hurricane Center's areas of interest and discussions (www.nhc.noaa.gov)
- Computer model forecasts including from the American/GFS, Canadian, and European models to help assess forecast confidence and areas of uncertainty (more about modeling at www.weather.gov/jetstream/models)

Week 2

- Climate Prediction Center's 8-14 day outlook and discussion (www.cpc.ncep.noaa.gov)
- Medium-range model forecasts and ensembles to assess model agreement and timing of potential weather systems (more about ensembles at www.metoffice.gov.uk/research/weather/ensemble-forecasting/multimodel-ensemble-forecast)

Weeks 3-4

- Climate Prediction Center's week 3-4 outlook and discussion (www.cpc.ncep.noaa.gov)
- Climate Forecast System's weekly forecasts for temperature, precipitation, and jet stream patterns (www.cpc.ncep.noaa.gov/products/forecast/ensemble/ensemble-forecast/weekly/)

For more about our drought communication efforts including these infographics, visit: https://climate.ncsu.edu/drought_comm

"How It's Made"

(https://climate.ncsu.edu/documents/nighthawk/SROOutlooks/SROOutlook_About.pdf)

Click here (https://climate.ncsu.edu/documents/nighthawk/Factsheets/Factsheet_Flash_Drought.pdf) to access the Flash Drought factsheet developed for the agriculture sector.

FLASH DROUGHT AGRICULTURE

Factsheet produced by **CLIMATE**

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.

Statewide Statistics

2019	Temp	Precip	DM
Jan	+1.8°	+0.04"	0%
Feb	+6.2°	+1.16"	0.6%
Mar	+0.5°	-1.07"	2.0%
Apr	+3.3°	+1.64"	2.0%
May	+3.7°	-1.71"	19.7%
Jun	+0.5°	+1.23"	34.9%
Jul	+2.7°	-0.92"	30.0%
Aug	+1.4°	-0.74"	24.8%
Sep	+4.8°	-1.20"	34.8%
Oct	+3.0°	+1.63"	34.5%
Nov	-2.0°	+0.32"	29.6%
Dec	+3.0°	+0.89"	1.6%
Annual	+2.8°	+1.80"	

2019 Droughts: An Example
In Mar 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, **disturbing record moisture** along the coast led many growers to delay planting activities and **convinced them** plant perennials. 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.

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."

Timeline Legend
DM: Percentage of the state in DM. DM occurs when the soil moisture deficit is greater than the available water capacity. DM is a condition that can occur during the growing season, but it is not a drought. DM is a condition that can occur during the growing season, but it is not a drought.

Monthly Temperature Rankings
Wettest, Driest, Coldest, Near Normal, Warmest, Hottest, Warm

Monthly Precipitation Rankings
Wettest, Driest, Most, Near Normal, Moderate, Moderate, Driest

US Drought Monitor Categories
US D0 (Extreme Drought), US D1 (Extreme Drought), US D2 (Extreme Drought), US D3 (Extreme Drought), US D4 (Extreme Drought)

Flash drought factsheet

(https://climate.ncsu.edu/documents/nighthawk/Factsheets/Factsheet_Flash_Drought.pdf)

5. KEY FINDINGS FROM THE FINAL PROJECT EVALUATION

Creating Used and Trusted Products

At end of the project (Phase 5) we undertook a more holistic evaluation to assess the use of the new products, as well as the effectiveness of the engagement process. We used NVivo, a qualitative analysis software program, to analyze and code focus group discussions, meeting notes, and open-ended survey responses (Saldaña, 2013) and developed our coding categories from literature on climate information use and usability, knowledge, exchange, and co-production processes (McNie, 2007; Wall et al., 2017).

Use of New Products

Although North Carolina experienced little drought during the project period, participants indicated using the products to:

- communicate drought status to their colleagues and constituents
- educate others about drought and drought monitoring processes
- maintain situational awareness about changing or static conditions
- justify decisions such as those related to prescribed burning

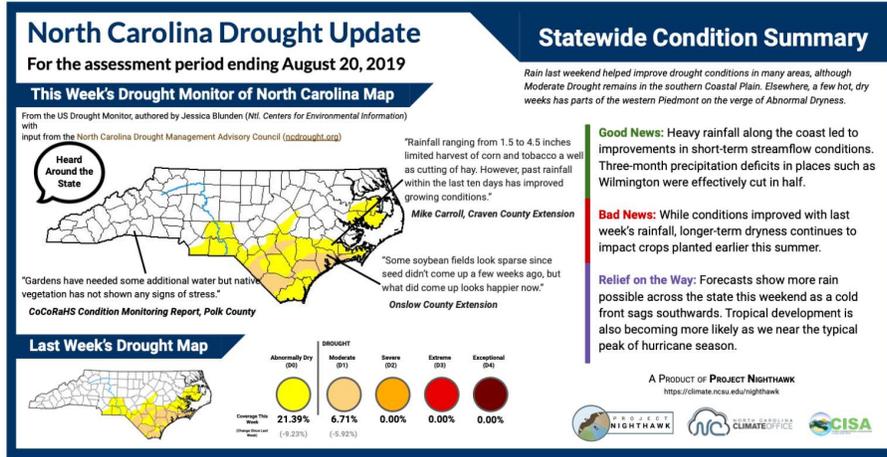
Supporting the Use of Drought Information through Enhanced Transparency – What Worked?

- **Communicating the process** and reasoning behind the drought status designations shown on the USDM and North Carolina Drought Maps
- **Drawing from reputable and trusted sources** (such as the SCONC, National Weather Service) and explaining the connections between the new products and the original data sources
- **Contextualizing climate and drought information** in meaningful ways for the end users, for example, focusing on impacts rather than difficult-to-understand indices
- **Explaining drought status at multiple scales** (state, regional, and local) and how conditions at one level may affect another
- **Designing products that can be disseminated** through sector's preferred and existing mechanisms such as Facebook (extension agents) or Twitter (water utilities)
- **Providing information and status reports**, even when there is "no drought"
- **Leveraging existing networks, partnerships, and activities** to refine and provide information, such as through workshops and training with extension agents

Featured Product: Weekly Drought Update

Slide 1 of 8

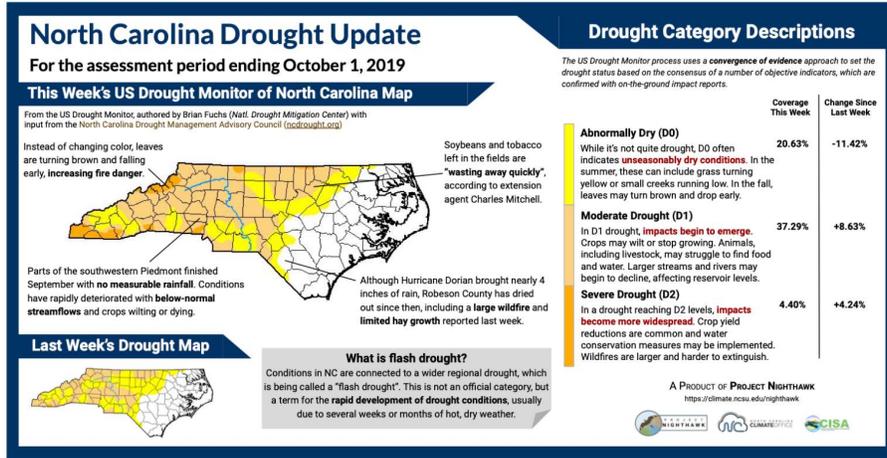
The infographic format was designed to meet users' requests for concise and easy-to-understand content that explained the reasoning behind drought designations.



Featured Product: Weekly Drought Update

Slide 2 of 8

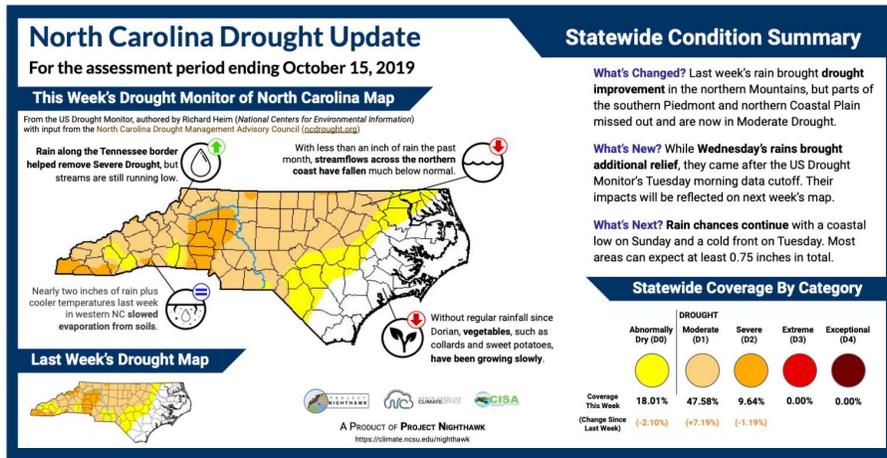
During the emergence of flash drought in fall 2019, we used the infographic to educate users about what to expect and look for during different drought severity levels.



Featured Product: Weekly Drought Update

Slide 3 of 8

Based on user feedback, we settled on a standardized set of icons with accompanying text to depict worsening, stable, or improving conditions.



Featured Product: Weekly Drought Update

Slide 4 of 8

Water utility representatives recommended that we use the infographic format to explain how reservoir levels and operations respond to drought during different times of the year.

North Carolina Drought Update

For the assessment period ending November 5, 2019

This Week's Drought Monitor of North Carolina Map

From the US Drought Monitor, authored by David Simeral (Western Regional Climate Center) with input from the North Carolina Drought Management Advisory Council (ncdrought.org)

The seasonal drawdown of TVA's reservoirs paused last week, as 3 to 5 inches of rain caused lake levels to briefly bump up again.

Fire danger has decreased after last week's rainfall, which saturated ground fuels such as grasses and fallen leaves.

With only about half an inch of rain last week, Durham's reservoirs are still recovering from the drought.

Last Week's Drought Map

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

Statewide Condition Summary

Last week's rain brought more drought improvements, especially where 2 or more inches fell in western North Carolina. The Coastal Plain hasn't seen as much rain recently, but cooler weather has slowed degradation.

Reservoir levels are one of our best indicators of drought impacts this time of year, but even healthy lakes might not be full. Why not?
Leaving lake levels a few feet below full pond offers some extra room in case of heavy rain events such as hurricanes.

Each fall, some reservoir operators steadily decrease target levels to wintertime elevations, which meet the water supply demand but don't need to be as high for uses like recreation.

Some reservoirs rely on releases from other lakes farther up the river basin to determine their levels, and dry conditions upstream can have a literal trickle-down effect.

Statewide Coverage By Category

Category	Coverage This Week	Change Since Last Week
Abnormally Dry (D0)	27.37%	(-22.84%)
Moderate (D1)	4.69%	(-7.11%)
Severe (D2)	0.00%	
Extreme (D3)	0.00%	
Exceptional (D4)	0.00%	

Featured Product: Weekly Drought Update

Slide 5 of 8

Agriculture stakeholders monitor conditions closely, even when there is no drought. Although the winter was drought-free, weekly explanations helped to show how a lack of precipitation and warming temperatures might affect the spring growing season.

North Carolina Drought Update

For the assessment period ending March 17, 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 Deborah Bathke (National Drought Mitigation Center) with input from the North Carolina Drought Management Advisory Council (ncdrought.org)

Many reservoirs continue to be at or above target levels, though releases have been lowered to account for decreasing inflows.

Reports from CoCoRaHS Condition Monitoring observers suggest that while rain would be welcomed, no on-the-ground dry weather impacts are occurring at this time.

A well located in Grantham (Wayne County) is below normal for this time of year. All other wells in the state indicate groundwater conditions are near or above normal, although levels are declining.

In parts of the Piedmont and Coastal Plain, 7- and 28-day average streamflows have declined over a very short time. Nearly 40% of 7-day average flows are below normal, compared to 6% at the beginning of March.

Last Week's Drought Map

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

Statewide Condition Summary

What's Changed? The state continues to be free of drought or Abnormally Dry (D0) conditions, according to the US Drought Monitor.

What's New? As spring has started to emerge across the state, so too has a shift in our weather pattern. Precipitation amounts have lagged for the past few weeks, and temperatures are warming. Though conditions are holding steady for now, there is the potential for things to dry out quickly in the coming weeks.

What's Next? Little precipitation (<0.5") is expected across the state over the next week, combined with a forecast for above-normal temperatures.

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%

Featured Product: Weekly Drought Update

Slide 6 of 8

Confusion about the difference between North Carolina's normal summer variability and "abnormal dryness" motivated this mid-summer infographic.

North Carolina Drought Update

For the assessment period ending July 21, 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 Richard Heim (NOAA/NESDIS/NCEI) with input from the North Carolina Drought Management Advisory Council (ncdrought.org)

Reservoirs in the Piedmont are maintaining target levels, although inflows have declined and some downstream releases are being reduced.

Our wet spring put streamflows and groundwater into a surplus. Despite losses from evaporation, this buffer has kept recent levels at or above normal.

Recent rains have been spotty, especially in eastern NC. Roanoke Rapids is having its driest July on record, while New Bern is on pace for its 18th-wettest.

Topsail moisture remains mostly adequate, but in parts of the northern and central Coastal Plain, soybean planting is delayed while corn and tobacco crops are wilting or fringing.

Last Week's Drought Map

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

Statewide Condition Summary

After another hot week with only scattered precipitation, conditions are drying out, but the state drought map remains blank. So when does a summer weather pattern become abnormal dryness, or even drought? Here are some signs:

Summer Weather

- Warrants routine irrigation of crops, lawns, and gardens
- Brown grass and low creek levels after a few hot, dry days
- A mix of wet and dry conditions from ag, fire, & hydro indicators

Abnormal Dryness

- Needing to irrigate more often, or plants showing extra stress
- Impacts lasting for a week or more, even after receiving rain
- Multiple indicators converging on similar levels of dryness

Want to share impact reports to help monitor emerging dryness? Consider contributing them to the CoCoRaHS Condition Monitoring program at www.cocorahs.org.

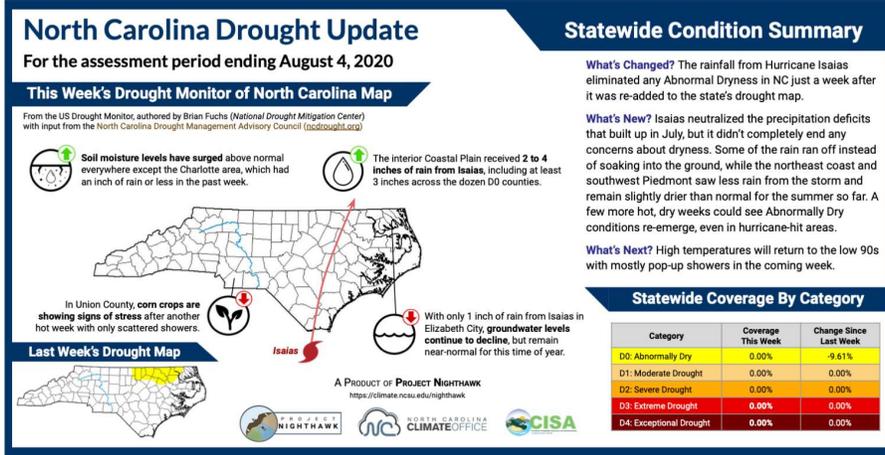
January through June Statistics

Location	Precip. Departure from Normal	Mean Temp. Dep. from Normal
All of NC	+7.99 inches	+2.4°F
Mountains	+11.68 inches	+1.9°F
Piedmont	+8.06 inches	+2.3°F
Coastal Plain	+6.10 inches	+2.8°F

Featured Product: Weekly Drought Update

Slide 7 of 8

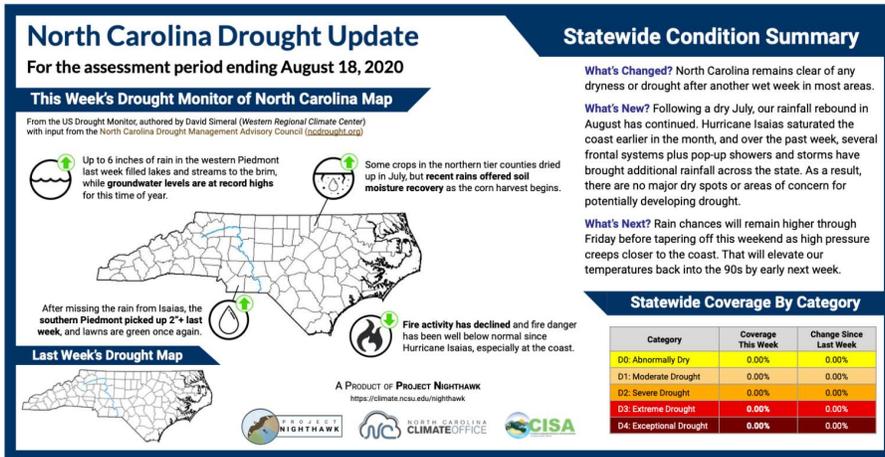
This infographic shows the effects of Hurricane Isaias. North Carolina relies on "drought-busting" tropical storms, such as Isaias, to alleviate precipitation deficits and dry conditions.



Featured Product: Weekly Drought Update

Slide 8 of 8

Pop-up storms keep conditions wet. User feedback indicates that monitoring recovery, and understanding why "no drought" conditions exist, informs agriculture and fire decisions.



AUTHOR INFORMATION

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ABSTRACT

During recent droughts in North Carolina, various audiences have articulated needs for information that explains current or anticipated impacts, droughts' geographic extent and timing, and how the State monitors drought. This is despite there being a regular process in place to evaluate statewide conditions and seemingly abundant information available through federal, state, and local agency websites; media outlets; and other channels. This presentation provides findings from a research project designed to improve the availability, understandability, and usability of drought communications products for North Carolina audiences, focusing on the US Drought Monitor map of North Carolina as an example. The North Carolina Drought Management Advisory Council (DMAC) technical committee has met weekly to assess drought conditions since the 1990s and has recommended the state's drought designations to the US Drought Monitor since 2000. The DMAC recommendations typically align with the weekly USDM map. Through surveys, focus groups, usability studies, and other engagement methods, we collected information from groups such as extension agents and water utility staff about 1) their communications preferences - resources that are concise, easily readable, and readily shareable through email, listservs, and social media - and 2) infographic prototypes created to address those preferences. User feedback on the prototypes informed iterative refinements to their content and design and provided information about their potential use for communications and management decisions. Ultimately, understanding the monitoring process and how drought designations are made was a key factor affecting the extent to which extension and other communication professionals apply, share, and value the information produced by monitoring groups and scientific agencies. This research suggests that addressing transparency questions can support efforts to communicate complex problems, such as drought.

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Project Website

Additional information and project materials are available on the project website (https://climate.ncsu.edu/drought_comm). (https://climate.ncsu.edu/drought_comm)

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