Adapting to North Carolina's Changing Climate

Part 2: Climate Change Program

Adaptation

Refers to actions taken at the individual, local, regional, and national levels to reduce risks from even today's changed climate conditions and to prepare for impacts from additional changes projected for the future.

Addresses two timescales:

1. adapting to current variability, which in any particular location may now be different than suggested by the historical record of climate observations, and
2. preparing for future change

4th National Climate Assessment, Chapter 28: https://nca2018.globalchange.gov/chapter/28/

Resilience

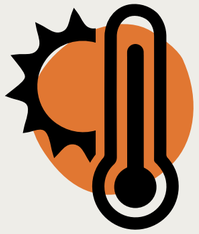
Resilience refers to the ability of a system to recover from or adjust to misfortune or change.

More formally, resilience is the capacity of a community, business, or natural environment to prevent, withstand, respond to, and recover from a disruption.

Climate resilience refers to situations where the disruptions are related to climate or extreme weather.

https://toolkit.climate.gov/#steps

Key Observed Climate Changes in North Carolina



Warming Temperatures
(esp.at night)

More Intense Precipitation

Sea Level Rise
(faster on northern NC coast)

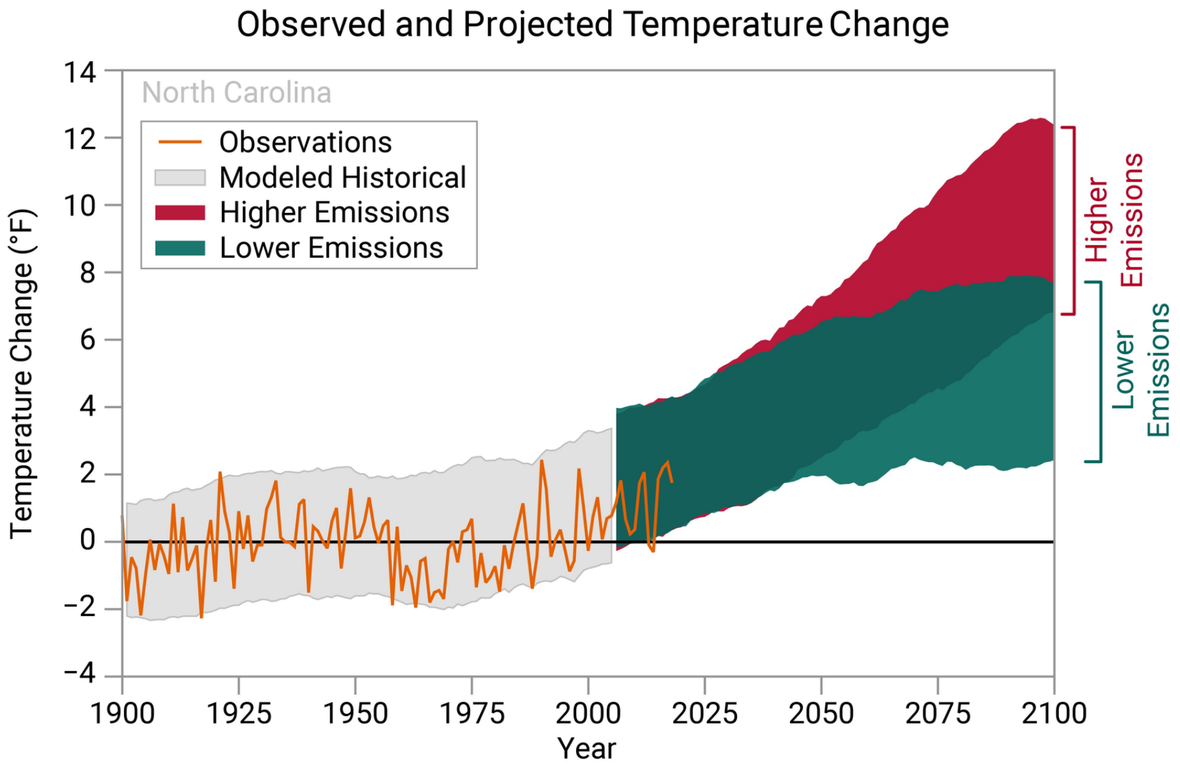
NC Climate Science Report Plain Language Summary. NC Climate Risk Assessment and Resilience Plan

Warming Temperatures

North Carolina has warmed by about 1°F over the past 120 years.
Scientists expect the warming to continue in North Carolina through this century, in all seasons.

- Annual average temperature increases relative to the recent climate (1996–2015) for North Carolina are projected to be on the order of 2°–5°F under the current emissions scenario and 2°–4°F under a lower emissions scenario by the middle of this century.

The amount of warming will depend on future emissions of heat-trapping gases.



National Climate Assessment State Climate Summaries

NC Climate Science Report Plain Language Summary
NC Climate Risk Assessment and Resilience Plan

In the future, both days and nights are likely to get hotter

Hotter Days

There is no historical trend in **very hot days**

It is **likely** that the number of hot and very hot days will increase in the future, consistent with the overall trend in warming.

- This increased heat, together with increases in humidity, will present a public health risk.
- The heat index is a measure that combines air temperature and relative humidity to get at how the human body experiences these conditions. It is very likely that there will be more days with dangerously high heat index values due to increases in temperature and humidity.

Warmer Nights

Nights have been getting warmer.

- The last five years (2015–2019) have had the warmest overnight low temperatures on record in North Carolina, with 2019 setting the record for the warmest lows in the recorded past.

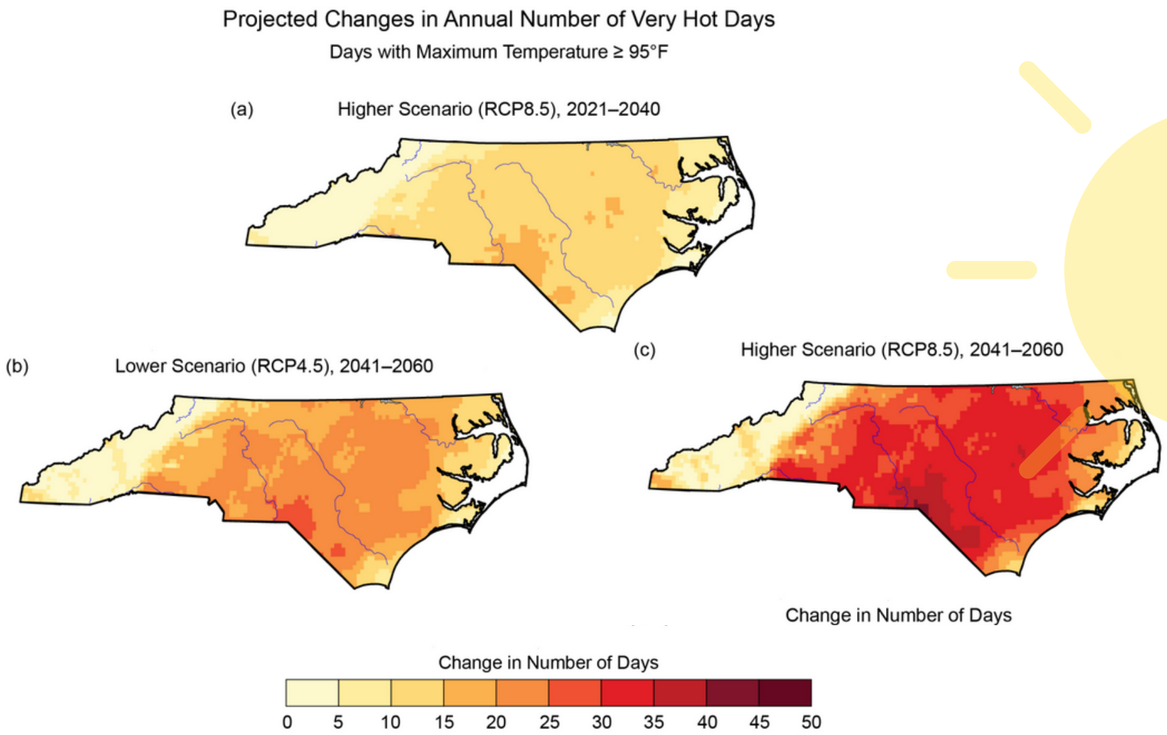
The number of **very warm nights** will **very likely** increase, reducing relief from the heat of the day and increasing heat-related stress on public health; households and people who lack access to sufficient cooling will be most vulnerable.

These warm nights affect public health and agriculture.

NC Climate Science Report Plain Language Summary
NC Climate Risk Assessment and Resilience Plan

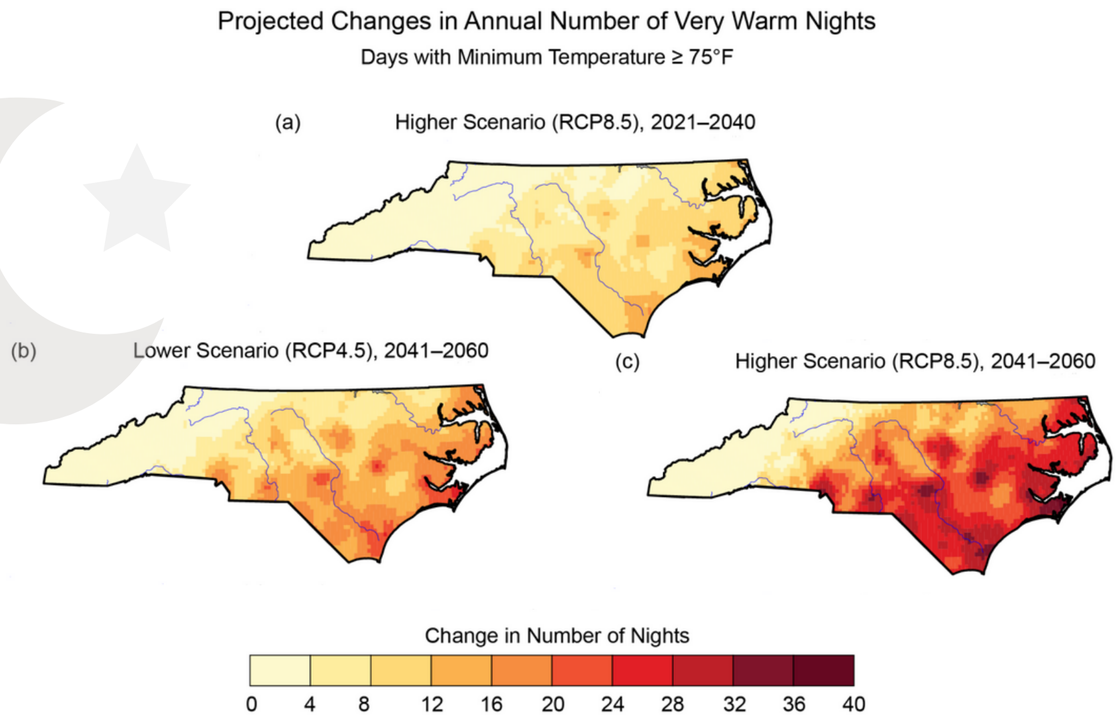
In the future, both days and nights are likely to get hotter

Hotter Days



*The long-term (1900-2018) average is 9.9 very hot days per year

Warmer Nights



*The long-term (1900-2018) average is 4.6 very warm nights per year

NC Climate Science Report Plain Language Summary

NC Climate Risk Assessment and Resilience Plan

Adapting to Changing Temperatures

The Home Garden

As now, the climate, the season, and potential pests all affect the selection of what and when to plant.

Are you planting something that will live <1 to a few years? Consider current and recent climate information

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Are you planting something that will live for 10-50+ years? Consider future climate projections as well as how the landscape may change (e.g., is the area urbanizing or likely to become more urban?)

Annual and Extreme Rainfall

There is no historic trend in annual precipitation, but annual precipitation is projected to increase in the future.

Extreme rainfall has increased in the recent past, and in the future, heavy rains from hurricanes and other weather systems will become more frequent and more intense.

These changes are driven primarily by increases in atmospheric water vapor as the climate warms.

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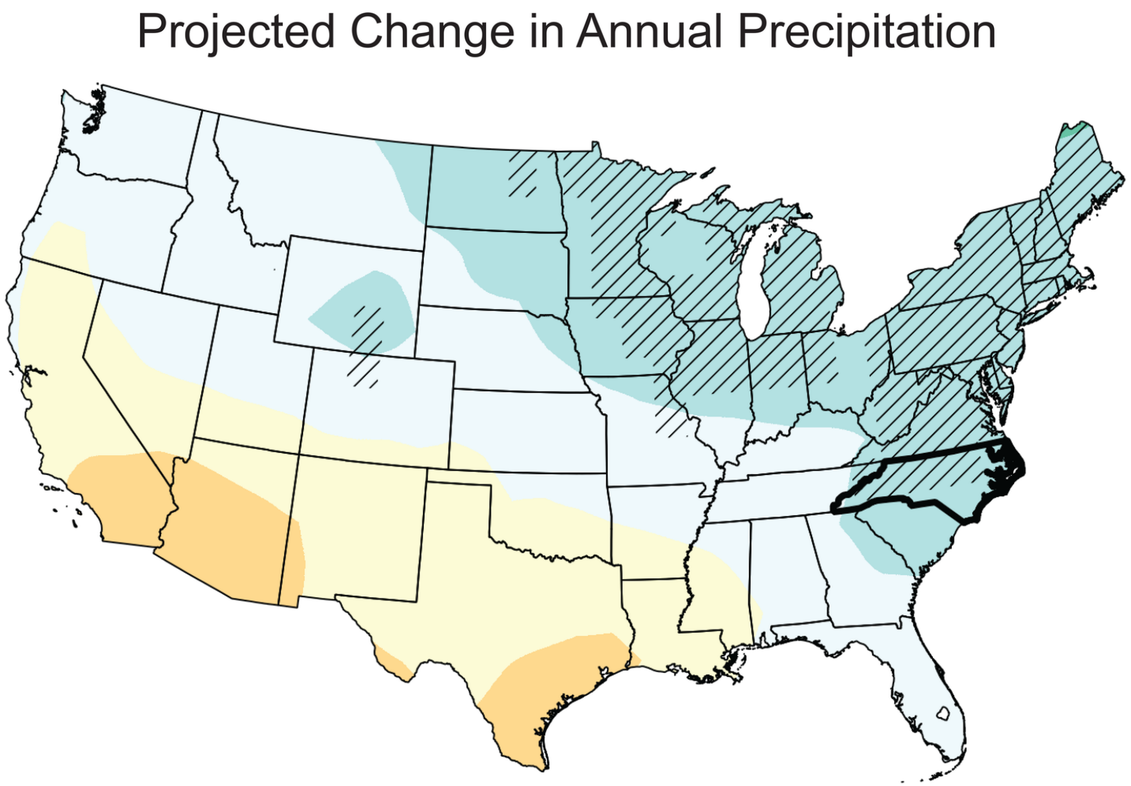
NC Climate Risk Assessment and Resilience Plan



National Climate Assessment State Climate Summaries

Heavy Precipitation

A warmer atmosphere contains more water vapor. A 1°F rise in temperature equals as much as a 4% increase in atmospheric water vapor

An atmosphere with more water vapor can make more precipitation

The biggest rainfall events are getting bigger, and extreme rain is comprising more of our annual precipitation

Aerial views of flooded farms in Duplin County, North Carolina following Hurricane Florence in 2018. Image Credit: Jo-Anne McArthur / We Animals Media

https://www.globalchange.gov/browse/indicator-details/3962
https://www.ncei.noaa.gov/news/warming-earth-also-wetter-earth

Hurricanes

Strongest storms are projected to become stronger

Likely that hurricanes in a warmer environment will produce heavier precipitation

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Less consensus on how the frequency of hurricanes will change or what this means for US or NC landfalls

NC Climate Science Report Plain Language Summary
4th National Climate Assessment, Chapter 2: Our Changing Climate

Ken Gray, Savannah District Construction Division Chief, prepares to enter a boat to inspect the washout of Boiling Springs Dam, N.C. Sept. 19 after Hurricane Florence. The object stretching across the divide is the guard rail of the road that once passed over the dam.

Source: US Army Corps of Engineers (CC by 2.0) https://flic.kr/p/2bcFnmm

Droughts and Wildfires

Severe droughts will become more intense, and this will increase the risk of wildfires

It is **likely** that future severe droughts in North Carolina will be more intense.

- Rising temperatures and the resulting increase in evaporation will accelerate the rate at which soils dry out. Thus, naturally occurring droughts in North Carolina will be more severe.

It is **likely** that future severe droughts in their multiple forms in North Carolina will be more frequent and intense due to higher temperatures leading to increased evaporation.

- As a result, it is **likely** that the frequency of climate conditions conducive to wildfires in North Carolina will increase.

NC Climate Science Report Plain Language Summary
NC Climate Risk Assessment and Resilience Plan

The Chestnut Knob Fire started on Sunday November 6, 2016 at 8:00 am in South Mountain State park 10 miles south of Morganton, NC, during an intense drought. Image credit: NC Forest Service

Adapting to Changing Precipitation

The Home Garden

Consider the water needs of landscape and garden plants. How will these handle more frequent drying (droughts) associated with warming temperatures?

The combination of urbanization and more intense precipitation from climate change are exacerbating stream bank erosion.

Examine low-lying areas and areas prone to (flash) flooding. Can existing vegetation handle frequent inundation?

What inputs do you currently need to grow _____?

- fertilizer?
- water?
- frost/freeze protection?
- pesticide application?

How might these inputs grow or shrink under future climate change?

Resources on gardening for stream repair and water quality:
https://content.ces.ncsu.edu/a-gardeners-guide-to-protecting-water-quality
https://content.ces.ncsu.edu/options-for-backyard-stream-repair

Sea Level Rise

Over recent decades, global average sea level risen ~2x as much from increasing ocean water as from thermal expansion

It is **virtually certain** that sea level along the North Carolina coast will continue to rise due to expansion of ocean water from warming and melting of ice on land.

It is also **virtually certain** that rising sea level and increasing intensity of coastal storms will lead to an increase in storm surge flooding in coastal North Carolina.

Many areas along NC's coast projected to be impacted by high tide flooding on a near daily basis by 2100

Location	*Relative Sea Level Trend (inches/year, 95% confidence interval)*	*Record Dates*
Duck	0.182 ± 0.0268	1978–2018
Oregon Inlet	0.1846 ± 0.0457	1977–2018
Beaufort	0.122 ± 0.0138	1953–2018
Wilmington	0.094 ± 0.0138	1935–2018
Southport	0.079 ± 0.0161	1933–2008

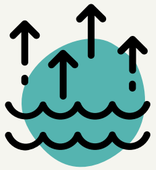
Trend in relative sea level determined from long-term water level records in North Carolina.

North Carolina Climate Science Report, Chapter 4
NC Climate Risk Assessment and Resilience Plan

Sea Level Rise

Canals may serve as conduits for saltwater intrusion. Photo: NC State University news

Recap: Projected Climate Changes and Impacts in NC



Sea Level will continue to rise

Virtually Certain

Summer heat index values will increase

Very Likely

Annual total precipitation will increase

Likely

Hurricane intensity will increase

Likely

Severe droughts will become more intense

Likely

Increase in precipitation will lead to increase in inland flooding

Likely

Probability of Outcome Key				
	Virtually Certain = 99-100% ***Very Likely*** = 90-100%	***Likely = 66-100%*** ***About as Likely as Not*** = 33-66%	***Unlikely = 0-33%*** ***Very Unlikely*** = 0-10%	***Exceptionally Unlikely*** = 0-1%

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Group Brainstorming Activity

Name, where you're from, area of expertise or interest, and what brought you here today.

GET TO KNOW YOUR GROUP

Introductions

As a group, decide on a location (e.g., a garden, park, community center) and brainstorm the climate-related impacts it may face over the next few decades.

CATALOG IMPACTS

Define the Problem

For each of the impacts your group identified, brainstorm how that impact could be reduced or eliminated through adaptation. What resources (e.g., time, money, people) will be needed?

THINK ABOUT CLIMATE RESILIENT ADAPTATIONS

Brainstorm Solutions

Explore More:

Resilience Toolkits*

US Climate Resilience Toolkit

Learn about potential climate hazards, learn about building resilience, view resilience case studies, and explore climate data.

https://toolkit.climate.gov/

Georgetown Adaptation Clearninghouse

An online database and networking site that serves policymakers and others who are working to help communities adapt to climate change

https://www.adaptationclearinghouse.org/

Climate Adaptation Knowledge Exchange

Climate adaptation case studies and resources.

https://www.cakex.org/

*Most online toolkits and similar resources are aimed at local governments and city planners, rather than individuals

Reflection Activity

Explore the US Climate Resilience Toolkit case studies: https://toolkit.climate.gov/case-studies

Find one that is relevant or interesting to you and read it.

Afterwards, write down (or mentally reflect):

- How did the five steps to resilience appear in this case study?
- What is one thing you learned?
- Can you apply anything from this case study to your area (e.g., your town/city? community?) What is it, and how would you apply it?

Thank you

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