

Climate change, flood hazards, and risk in North Carolina

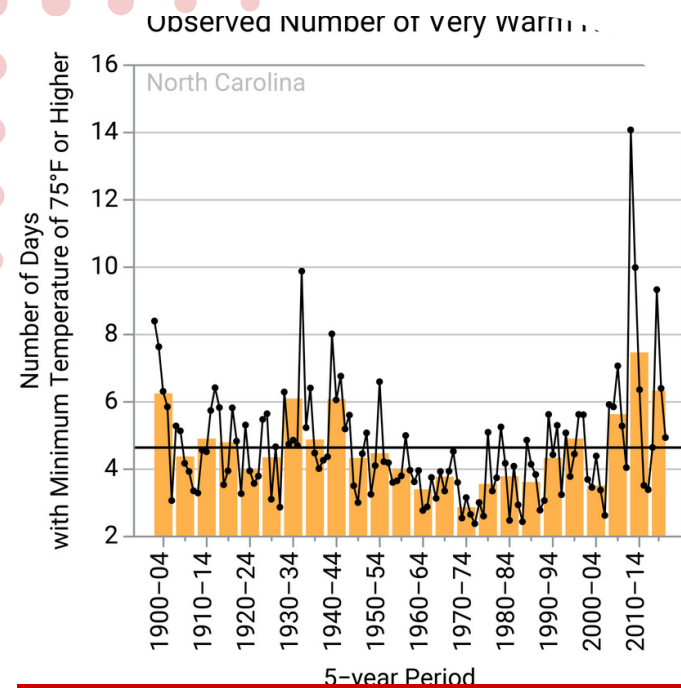
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Assistant Professor, UNC Chapel Hill

Carolinas Collaborative on Climate, Health, and Equity (C3HE), the Carolinas NOAA RISA team



OUR THREE MISSION AREAS

Get to know North Carolina's State Climate Office

Research

Original projects to address North Carolina's climate challenges

Extension and Education

Climate knowledge and support to all 100 counties

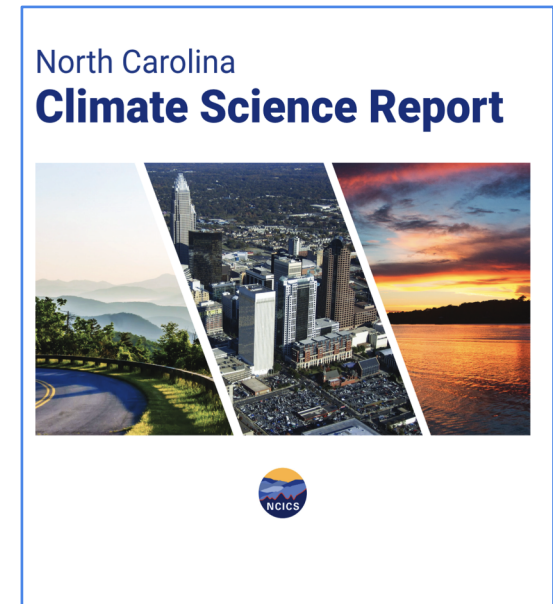
Monitoring

Understanding North Carolina's Environment

Take-home message

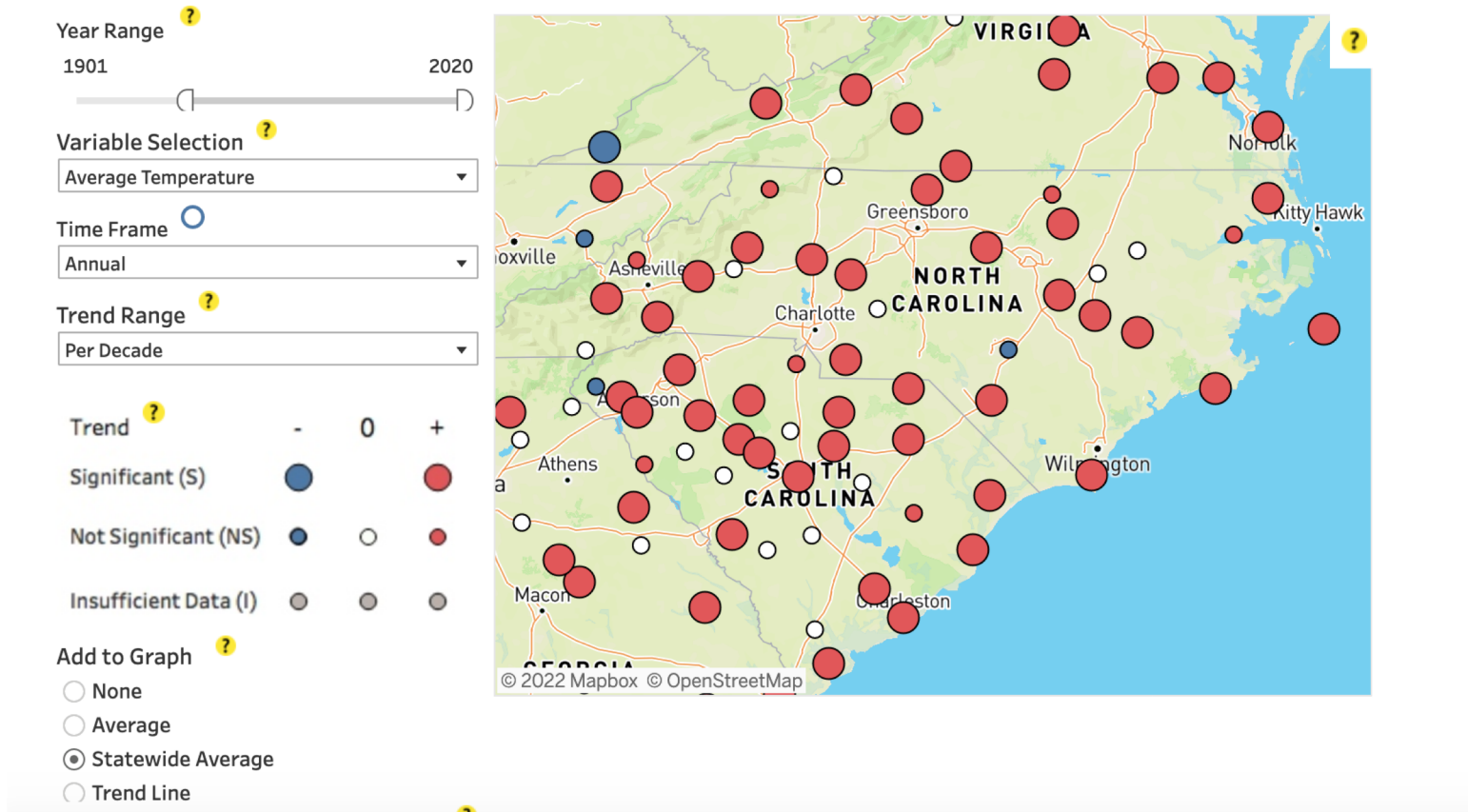
Large future climate changes for North Carolina if our current reliance on fossil fuels for energy continues

- Temperatures outside of historical envelope
- Disruptive sea level rise
- Increases in intensity and frequency of extreme rainfall
- More intense hurricanes
- Higher absolute humidity levels



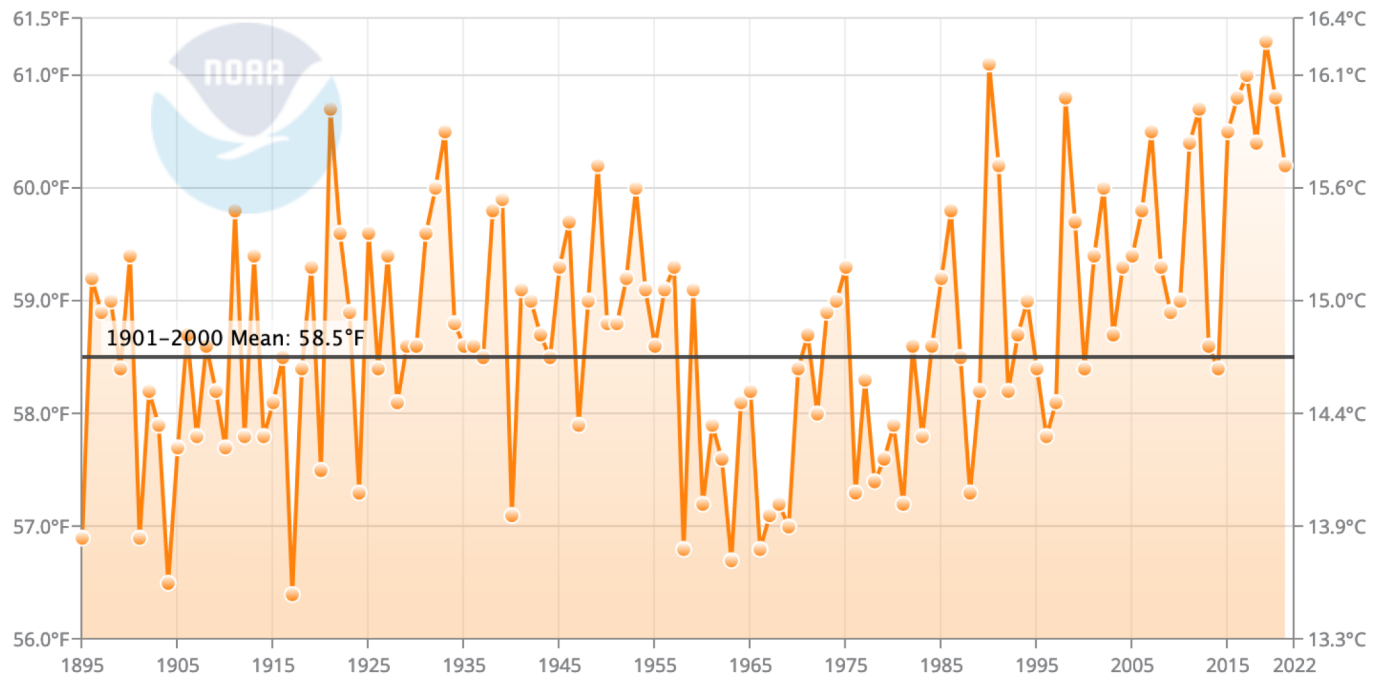
Kunkel et al. 2020

North Carolina has warmed about 1°F in the recent past



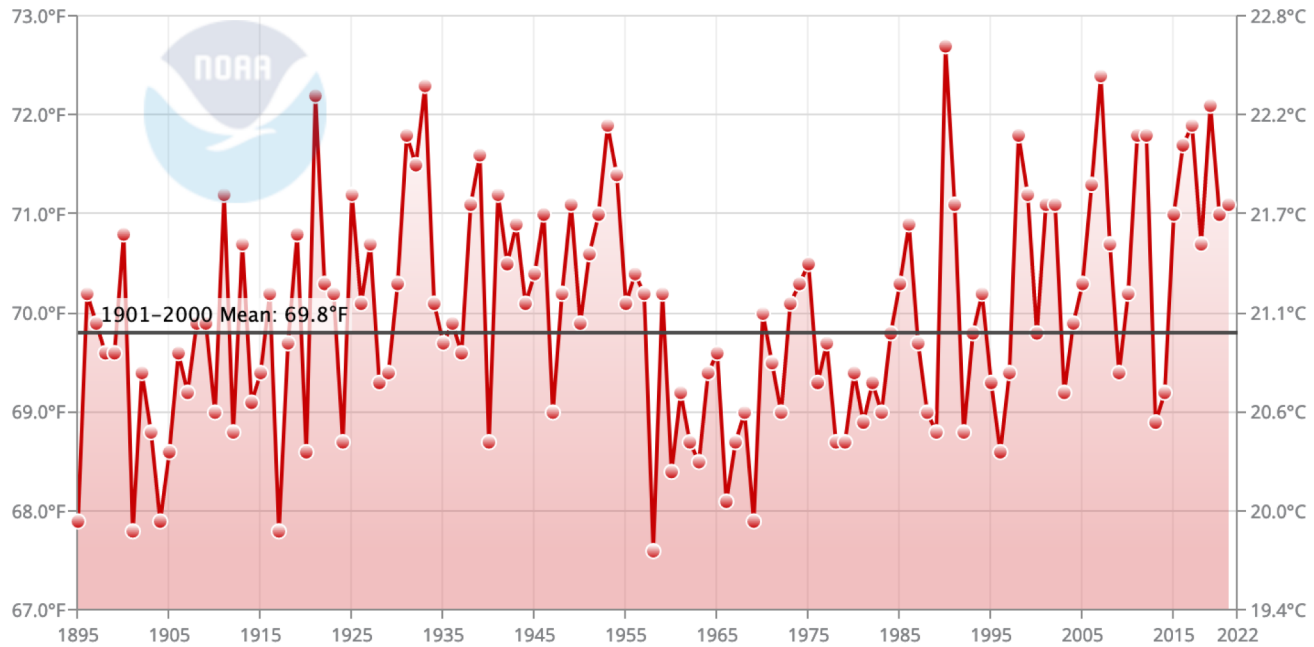
Only 1 year in past 20 has been below the 20th century average

North Carolina Average Temperature
January–December

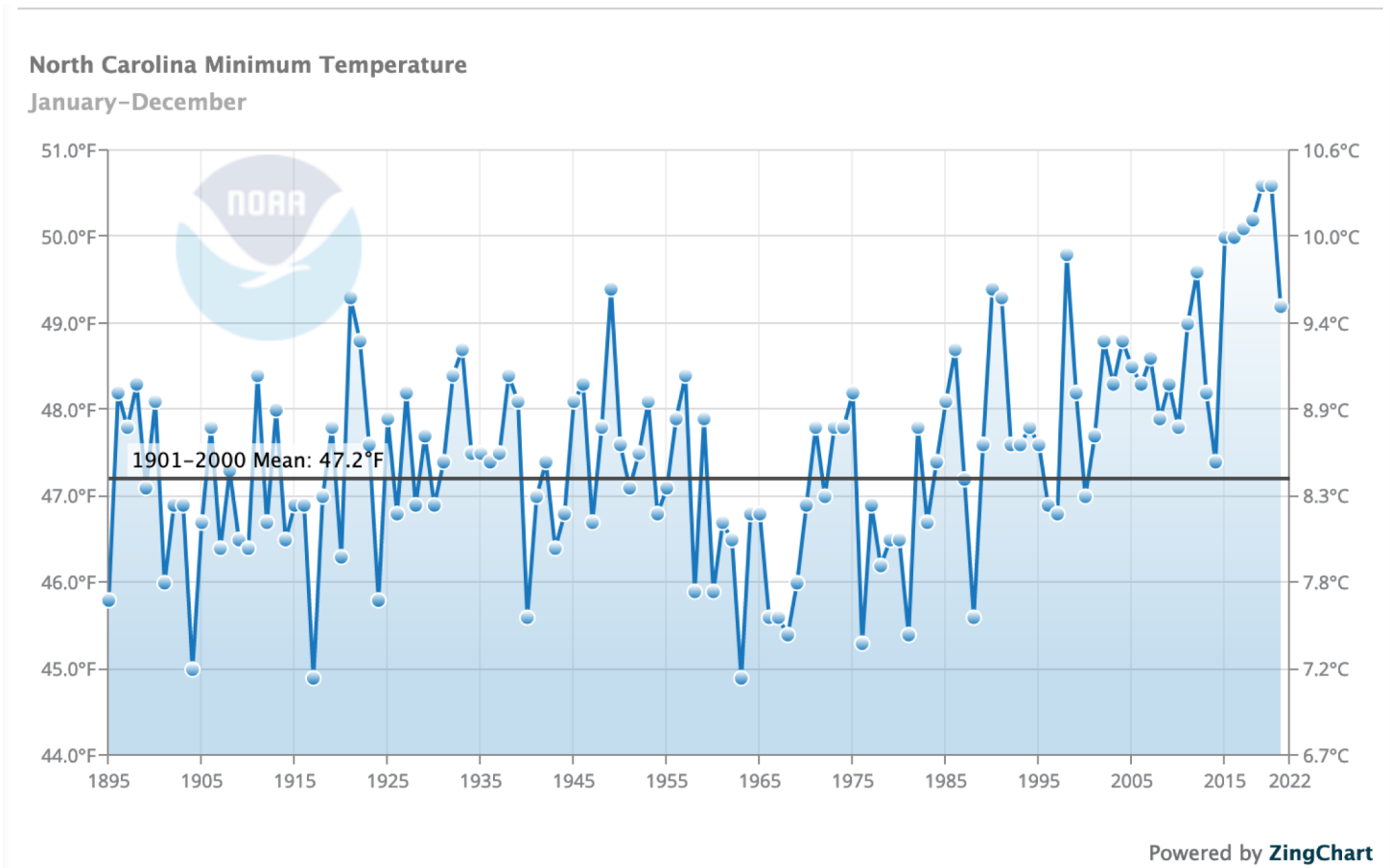


Small increase in daytime temps

North Carolina Maximum Temperature
January–December

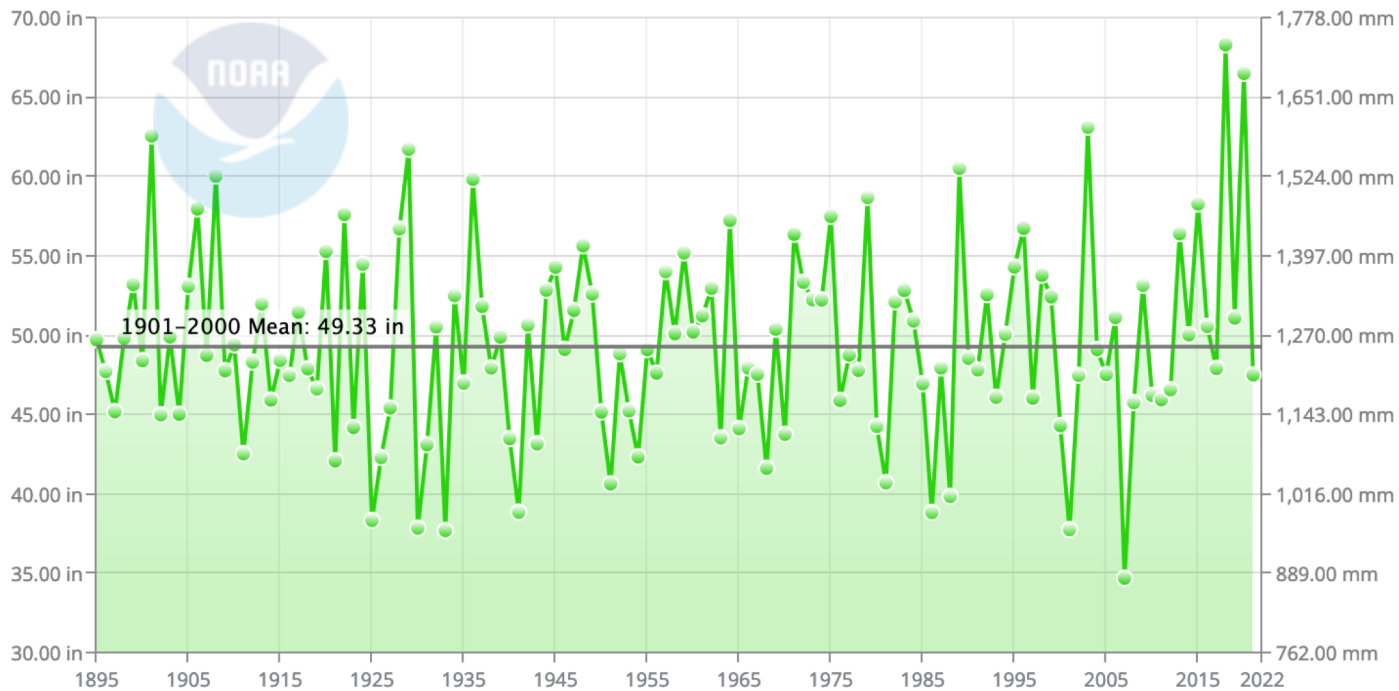


Warming trend dominated by nighttime temperatures



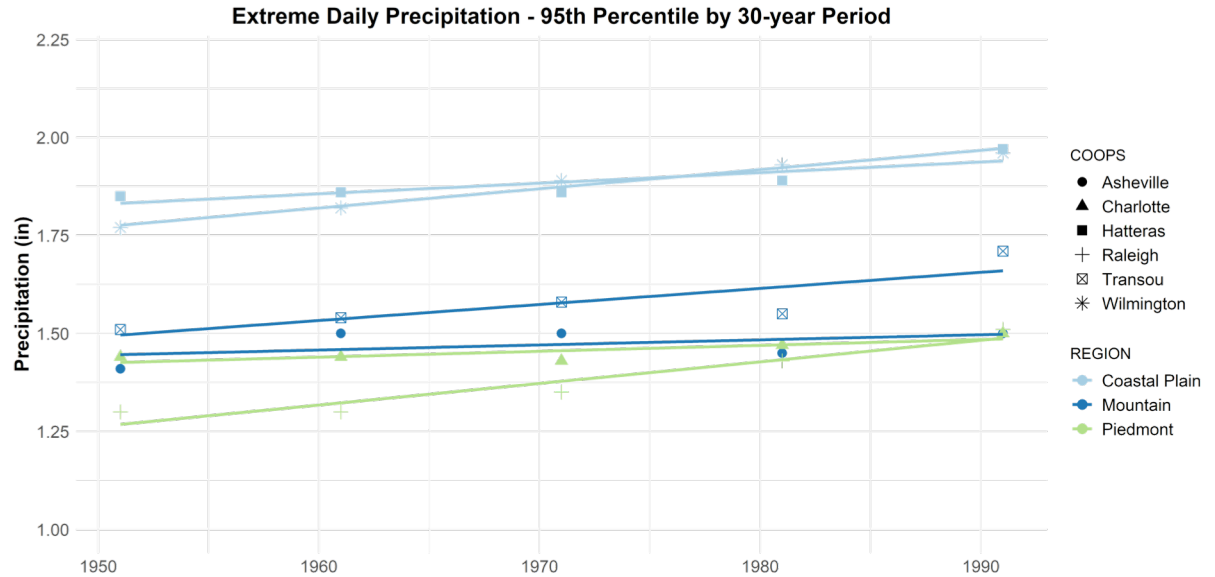
No overall trend; but 2018 & 2020 top-two wettest years on record

North Carolina Precipitation
January–December

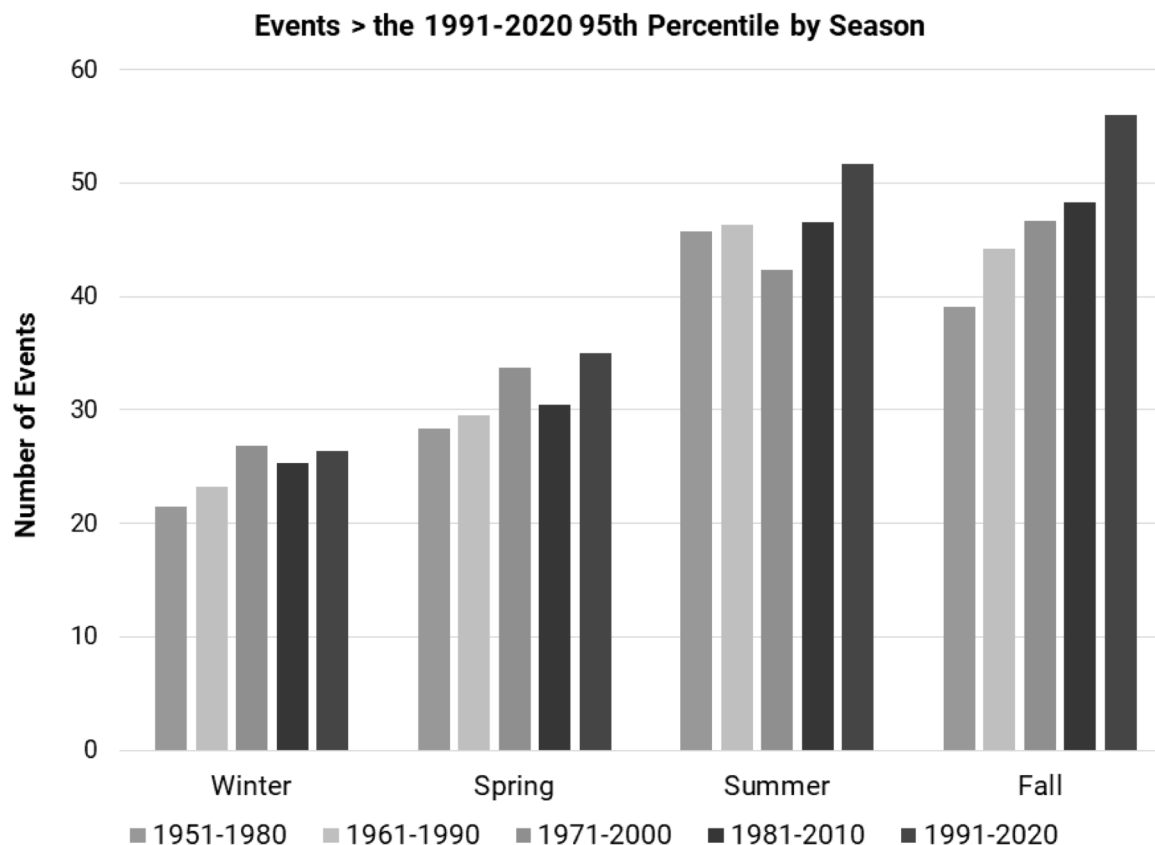


Extreme precip increasing in NC

Station	Trend (inches per decade)
Asheville	0.01
Transou	0.04
Charlotte	0.02
Greensboro	0.02
Raleigh	0.06
Fayetteville	-0.01
Wilmington	0.05
Hatteras	0.03



Largest increases in extreme precip are in the fall





Haywood floods of 2021 worse than '04

Haywood flooding described as the worst ever witnessed

By Vicki Hyatt vhyatt@themountaineer.com Aug 20, 2021 0



REV



1 of 15



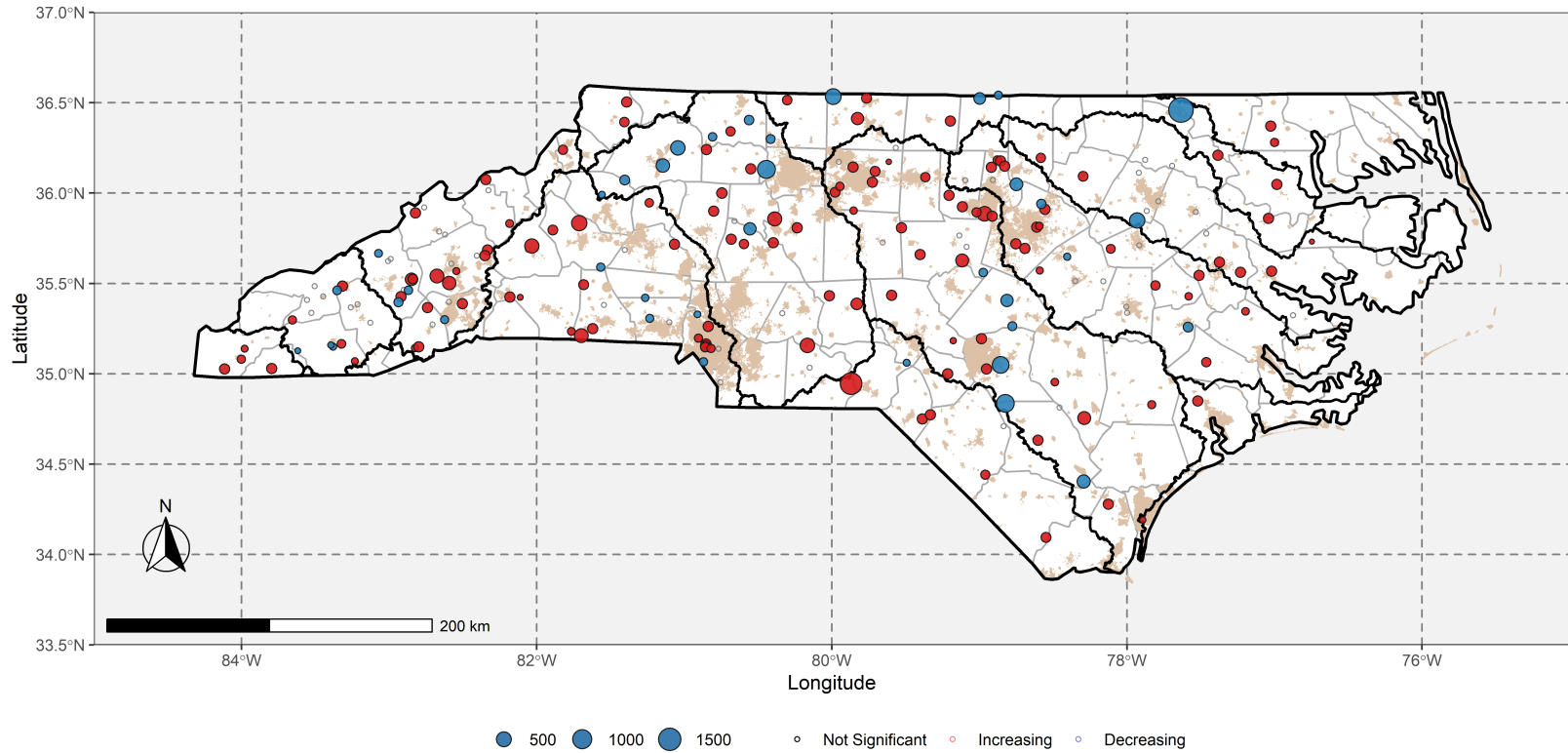
GET IN THE DRIVERS SEAT

AREA'S
LOWEST PRICES
ON NEW FORDS

CLICK TO TESTDRIVE

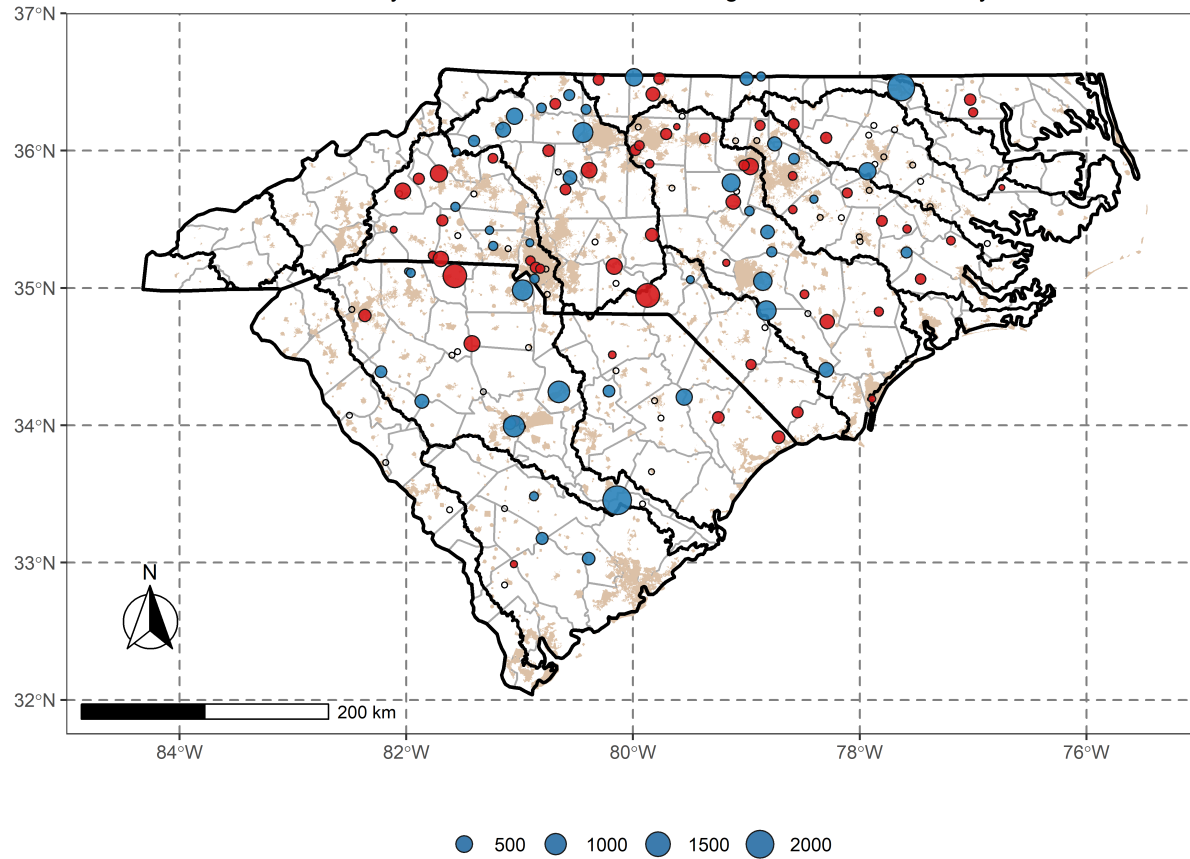
Taylor Ford

The magnitude of the 100-year flood is also increasing statewide



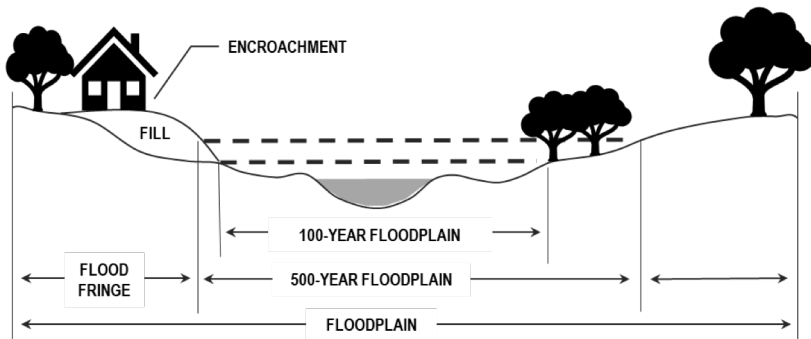
Brannum & Sebastian,
in prep.

Trends in 100-year Streamflow at USGS Gages with Records >30 years



The 100-year floodplain is the primary marker of risk and an important planning tool, but it is poorly understood by the public.

The area with >1% chance of being inundated by a **river** or **coastal flood** in any given year.



It is *not* the area that will only flood once in 100 years. In fact, a home in a floodplain has a **26% chance of flooding** during a 30-year mortgage.

The floodplain also doesn't represent flooding from other hazards.

Pluvial Flooding:

Extreme
Precipitation



Storm Sewer or
Groundwater
Surcharge

David Pfeiffer CC BY 2.0

Compound Flooding:

Storm Surge

Extreme
Precipitation



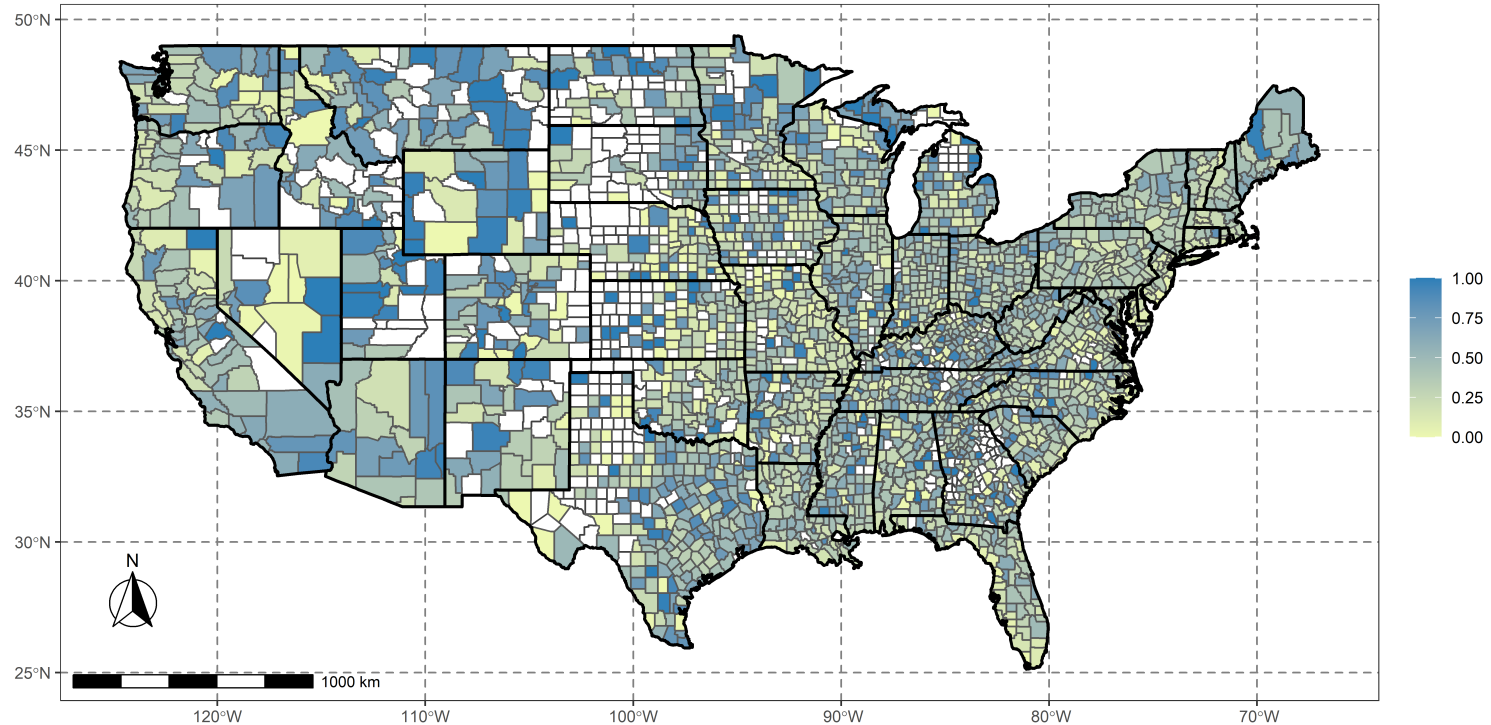
Storm Sewer or
Groundwater
Surcharge

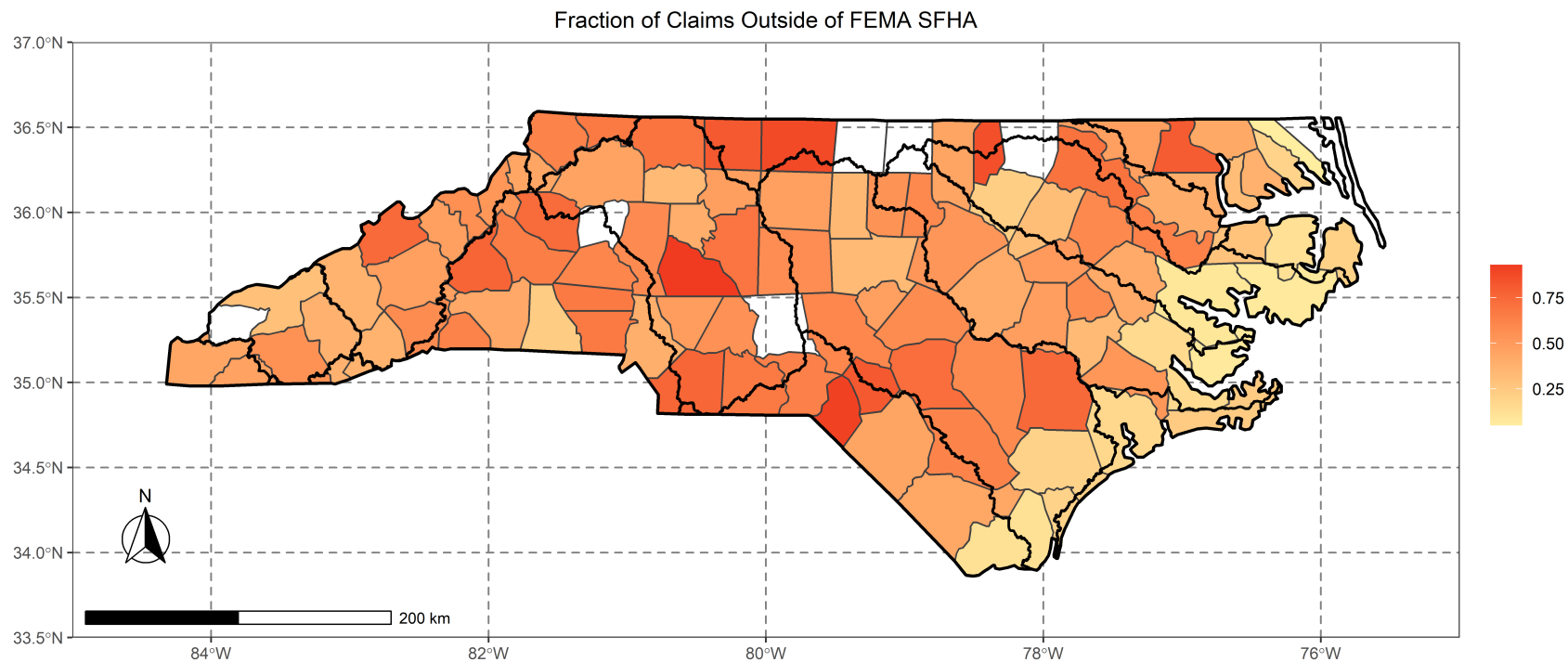
Image credit: AP Photo/Steve H.

**Inland Flood
Wave**

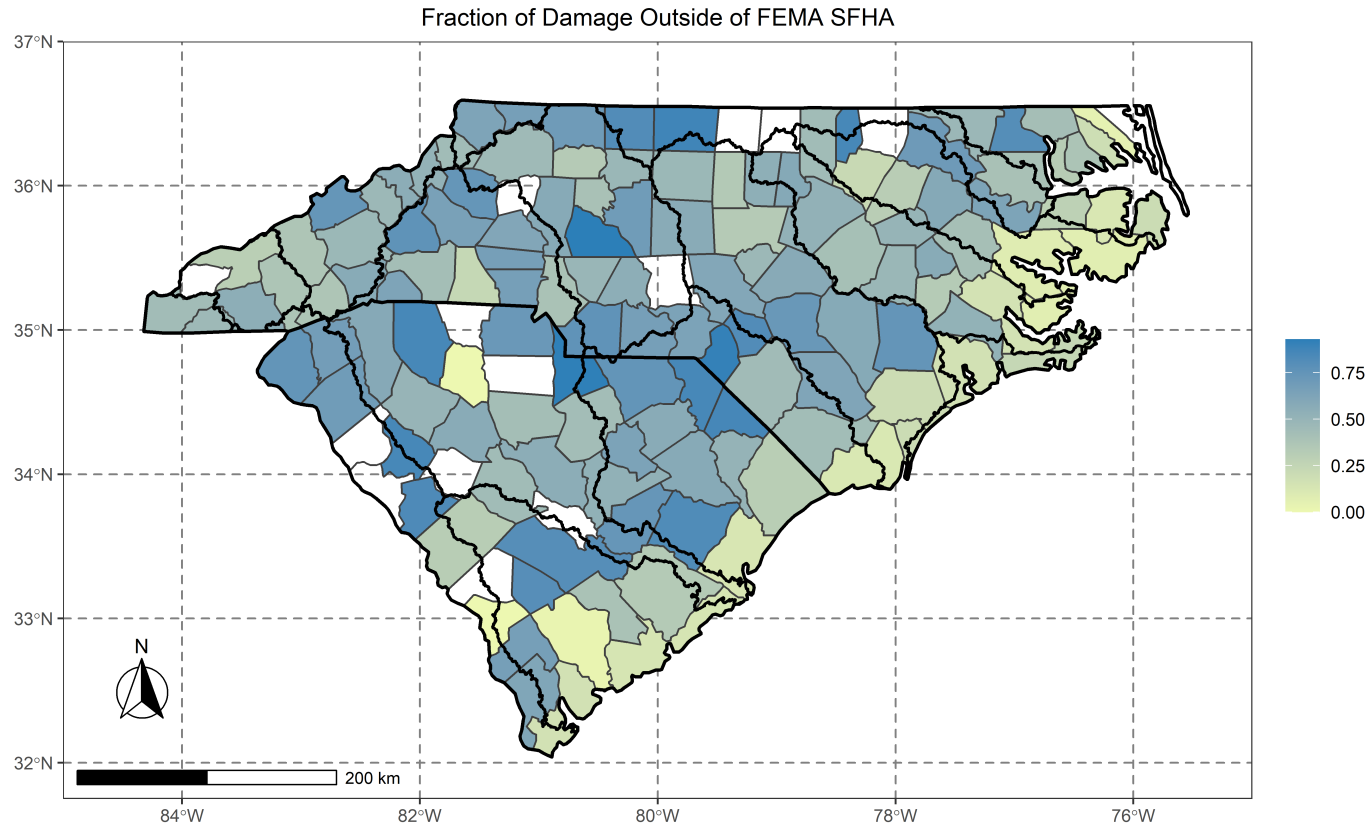
Flooding during Hurricane Florence in Englehard, NC looking towards Pamlico Sound

In fact, nationwide, 28% of historical flood damage has occurred outside of mapped floodplains.



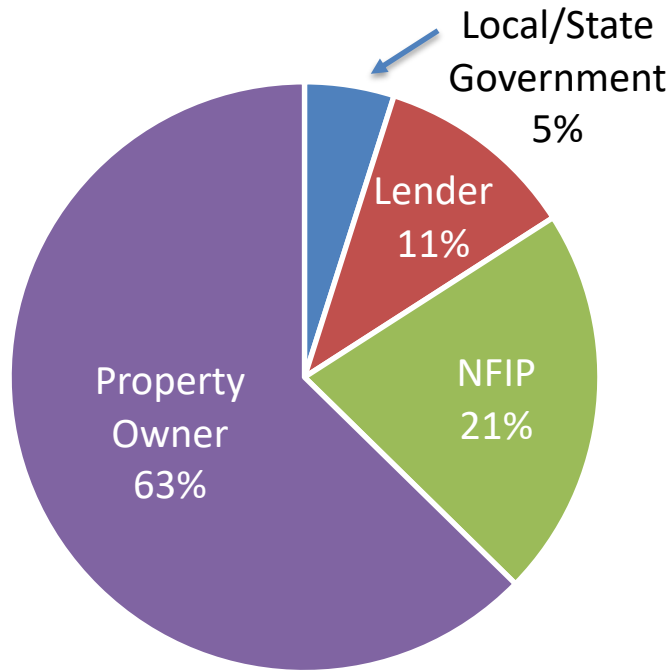


Brannum & Sebastian,
in prep.



Brannum & Sebastian,
in prep.

But insured flood damage is a small fraction of the total loss.

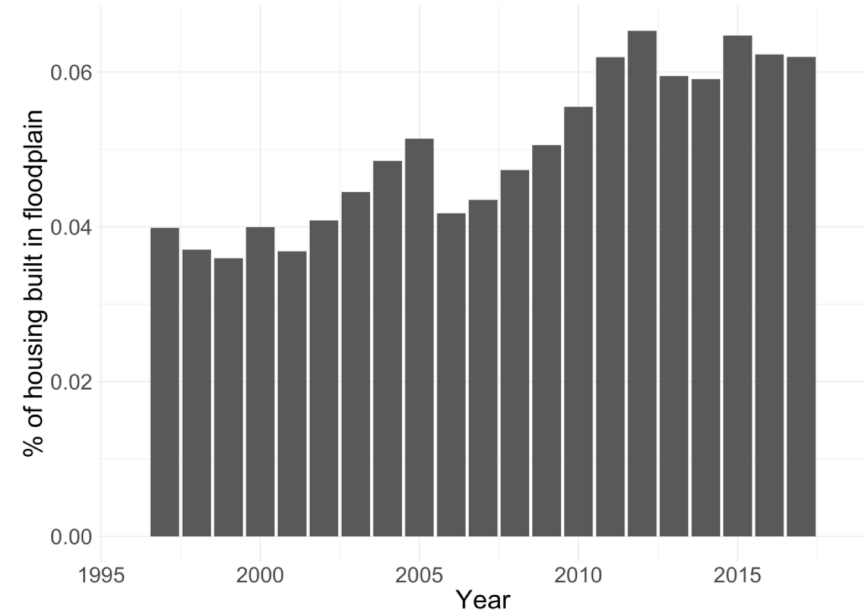
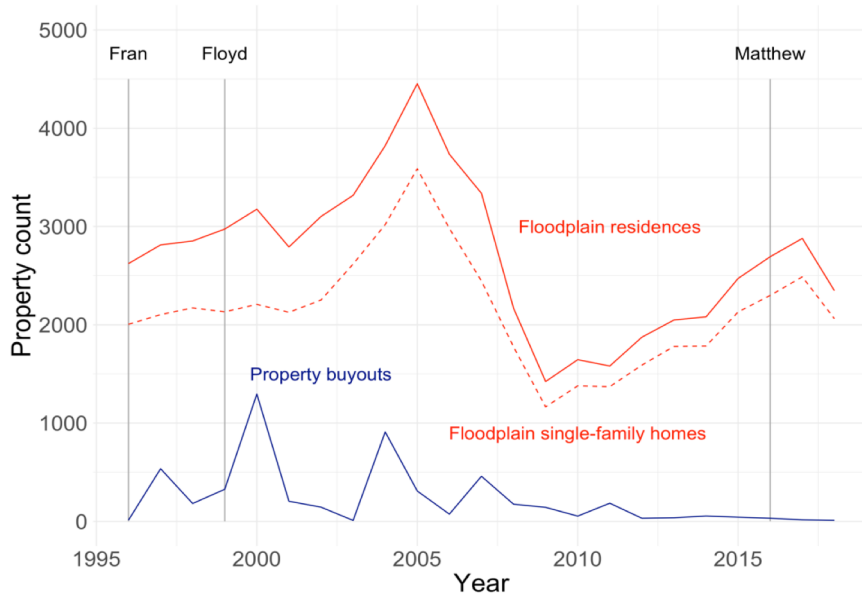


\$1.7B Residential Flood Loss after Hurricane Florence

- The NFIP provides a first line of defense for property owners, mortgage lenders and local government
- While property owners carry the brunt of the risk, uninsured losses (incl. property value losses) can **cascade** through the financial system, threatening local/state government and mortgage lenders
- The distribution of risk varies greatly by community:

Thomson et al. *in prep.*

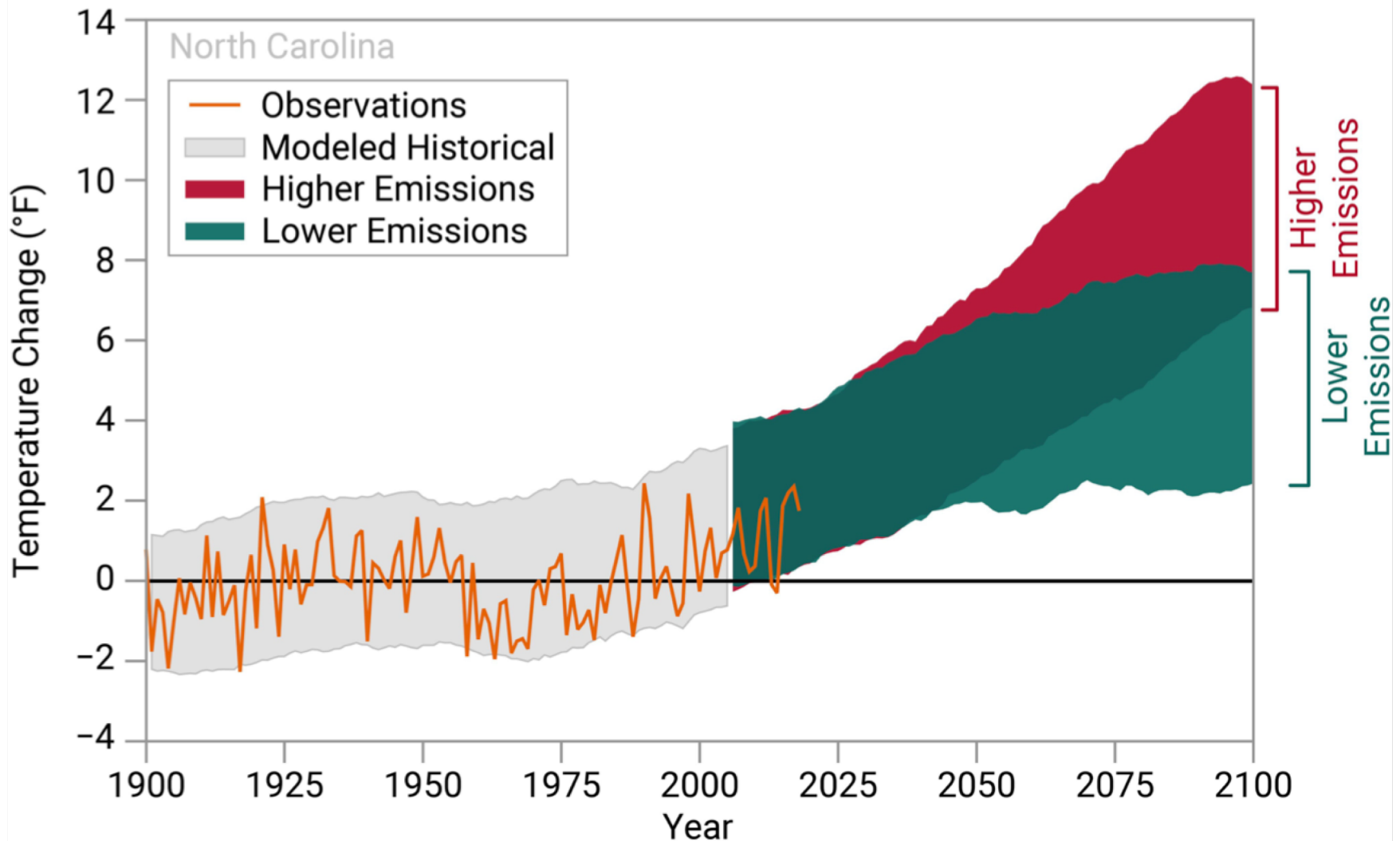
Despite what we know, development inside of floodplain areas far exceeds the rate of mitigation across the State of North Carolina



Hino et al. *in prep.*

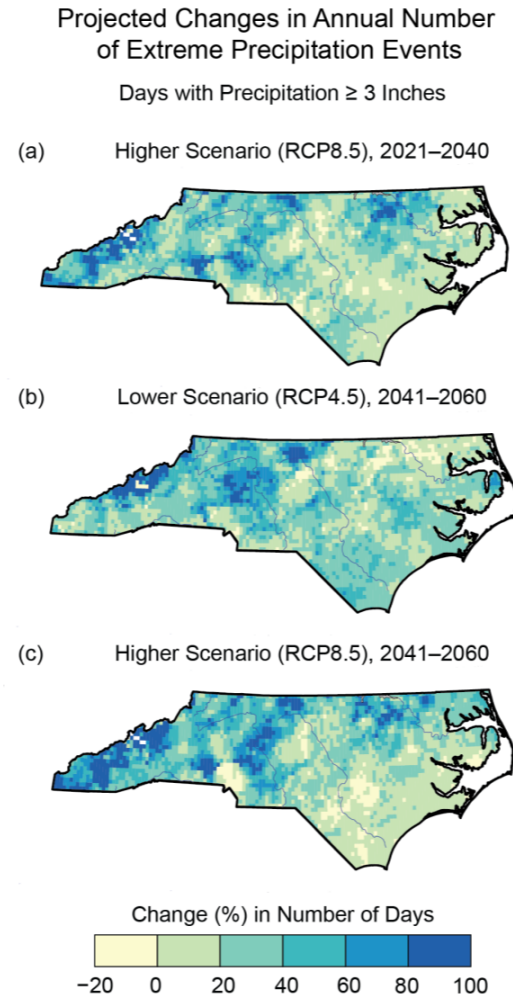
North Carolina will continue to warm

Observed and Projected Temperature Change



What does the future hold?

- Increases in **extreme precipitation** and **sea level rise**, coupled with **urban development** will increase the **hazard magnitude**
- **Poor development decisions** and **aging infrastructure** will increase **exposure** and **vulnerability** leading to higher flood risk...



Take homes

- Large future changes for NC's climate
- Flood risk in the Carolinas is significant, and a warming climate with more extreme events exacerbates our risk
- The magnitude of the 100-year flood is increasing
- Flood damage often occurs outside the mapped FEMA floodplain
- Uninsured flood damages can cascade through a community

Thank you!

- Special thanks to Corey Davis and Evan Fisher (NCSCO); Sarah Brannum, Miyuki Hino, and Hope Thomsen (UNC-CH)
- climate.ncsu.edu
- carolinasc3he.org (under construction)



NOAA-OAR-CPO-2021-2006677 Regional Integrated Sciences and Assessments (RISA) Program. Innovating a Community-based Resilience Model on Climatic and Healthy Equity in the Carolinas (2021-2026).