

Community Effects of Climate Change in North Carolina

By Caroline Norris and Jessica Olayvar

According to a 2021 report by the World Meteorological Organization, hurricanes, floods, heat waves, and droughts have increased in frequency and intensity around the world, accounting for 2 million deaths and \$3.64 trillion in losses globally between 1970 and 2019. In the mid-Atlantic region, these events typically result in river and coastal flooding; several recent examples have devastated communities.

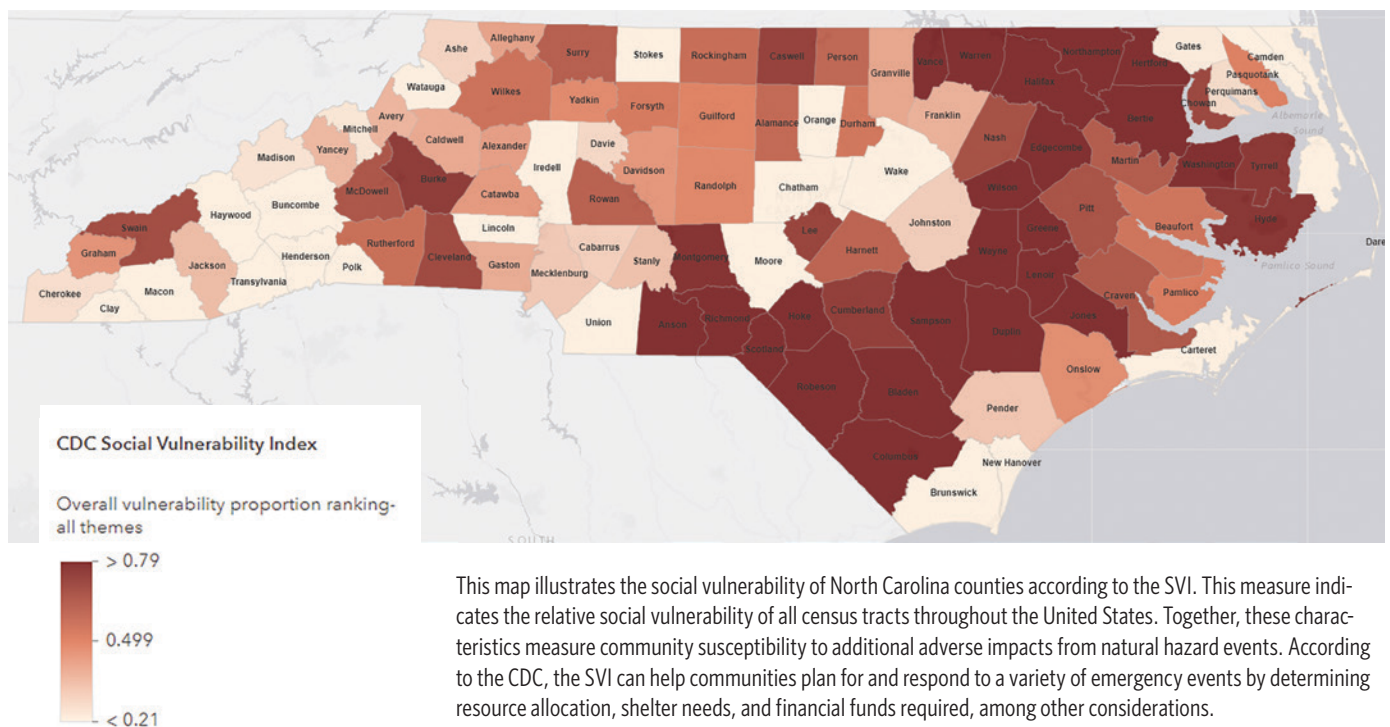
When considering a community's vulnerability to natural hazard events, one important factor is the community's social vulnerability. Social vulnerability has been defined by the Federal Emergency Management Agency (FEMA) as the susceptibility of social groups to the adverse effects of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood. In this chart gallery, the term refers to the Centers for Disease Control and Prevention's (CDC) Social Vulnerability Index, or SVI, a measure that is derived from 15 characteristics across four categories: socioeconomic status, household composition/disability, minority status/language, and household type/access to transportation. This index can provide additional insight into which communities may suffer disproportionately following a nat-

ural hazard event. For more detail on the makeup of the SVI, see the table.

The following images are from a data-mapping exercise completed by analysts at the Richmond Fed to highlight the impact of flooding on communities within North Carolina through the lens of social vulnerability. The exercise showed the connection between counties with high levels of social vulnerability and those projected to face high costs from natural hazard events in the future. Because these events in North Carolina tend to be flood related, the role of flood insurance and coverage was a significant consideration for the exercise. Finally, counties with high levels of credit insecurity — that is, limited access to credit and poor credit health — tend to have high social vulnerability scores and may face difficulties recovering from a disaster. The mapping exercise highlights these counties and explores the role financial institutions play as suppliers of capital in these communities.

The complete interactive exercise, which contains additional information about flood risk mitigation, the effects of rising temperatures, and the role of financial institutions, can be viewed online at bit.ly/nc-climate-maps.

SOCIAL VULNERABILITY



This map illustrates the social vulnerability of North Carolina counties according to the SVI. This measure indicates the relative social vulnerability of all census tracts throughout the United States. Together, these characteristics measure community susceptibility to additional adverse impacts from natural hazard events. According to the CDC, the SVI can help communities plan for and respond to a variety of emergency events by determining resource allocation, shelter needs, and financial funds required, among other considerations.

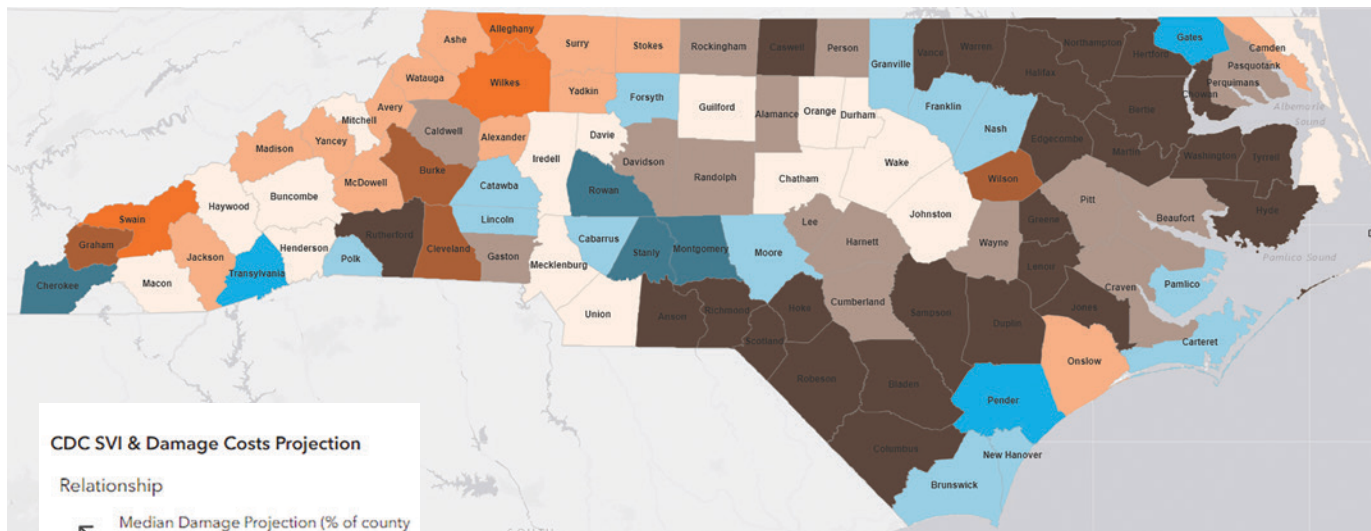
SOURCE: Centers for Disease Control and Prevention Social Vulnerability Index 2018



COMPONENTS OF SOCIAL VULNERABILITY INDEX

| Socioeconomic Status | Household Composition and Disability | Minority Status and Language | Housing Type and Transportation |
|--|--|---|---|
| <ul style="list-style-type: none"> Below Poverty Line Unemployed Income No High School Diploma | <ul style="list-style-type: none"> Aged 65 or Older Aged 17 or Younger Civilian with a Disability Single-Parent Households | <ul style="list-style-type: none"> Minority Speaks English "Less than Well" | <ul style="list-style-type: none"> Multi-Unit Structures Mobile Homes Crowding No Vehicle Group Quarters |

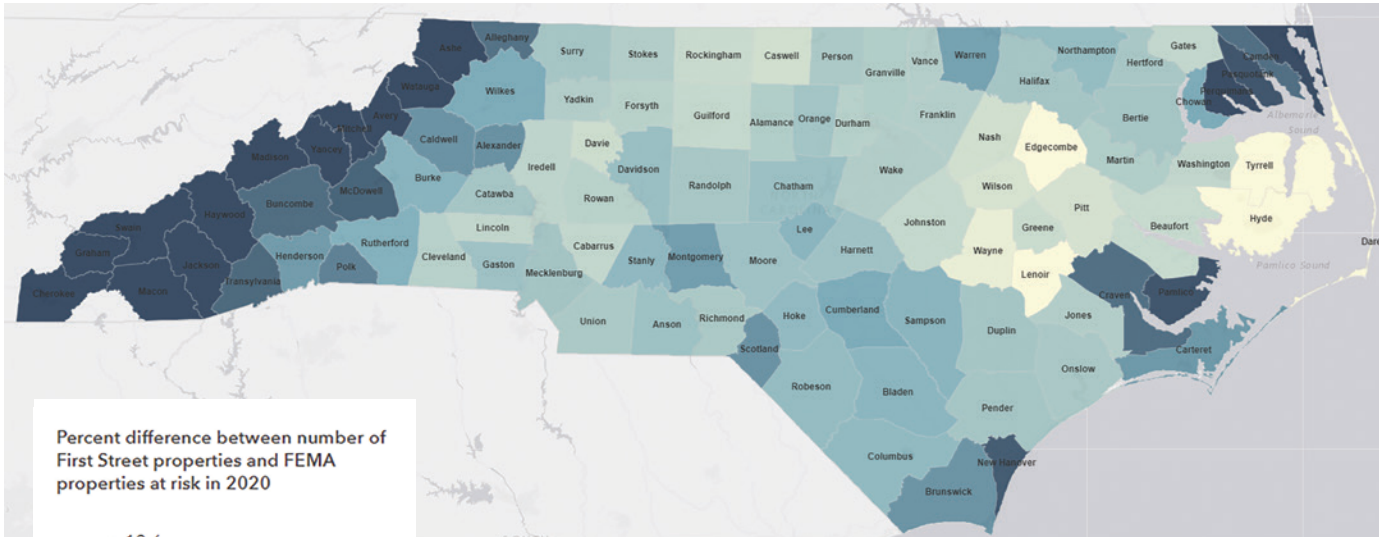
COMBINING SOCIOECONOMIC STATUS AND PROJECTED DAMAGE COSTS



This map combines two indicators that together shed light on the susceptibility of a community to strong economic harm from natural hazard events. (Socioeconomic status is one of the four major components of social vulnerability in the CDC's index.) Primarily, this map shows county-level estimates of future economic damages from climate change as a percent of county income, overlaid with the socioeconomic vulnerability of each county. Counties in dark brown are those that are both ranked high for socioeconomic vulnerability today and predicted to have high future damage costs from climate-related events. Considering these components together highlights the current and future unequal distribution of climate impacts among geographic areas.

SOURCES: Centers for Disease Control and Prevention Social Vulnerability Index 2018; Hsiang, S., et al. "Estimating economic damage from climate change in the United States." *Science*, 2017, vol. 356, no. 6345, pp. 1362-1369.

FLOOD INSURANCE AND OUTDATED FLOOD MAPS

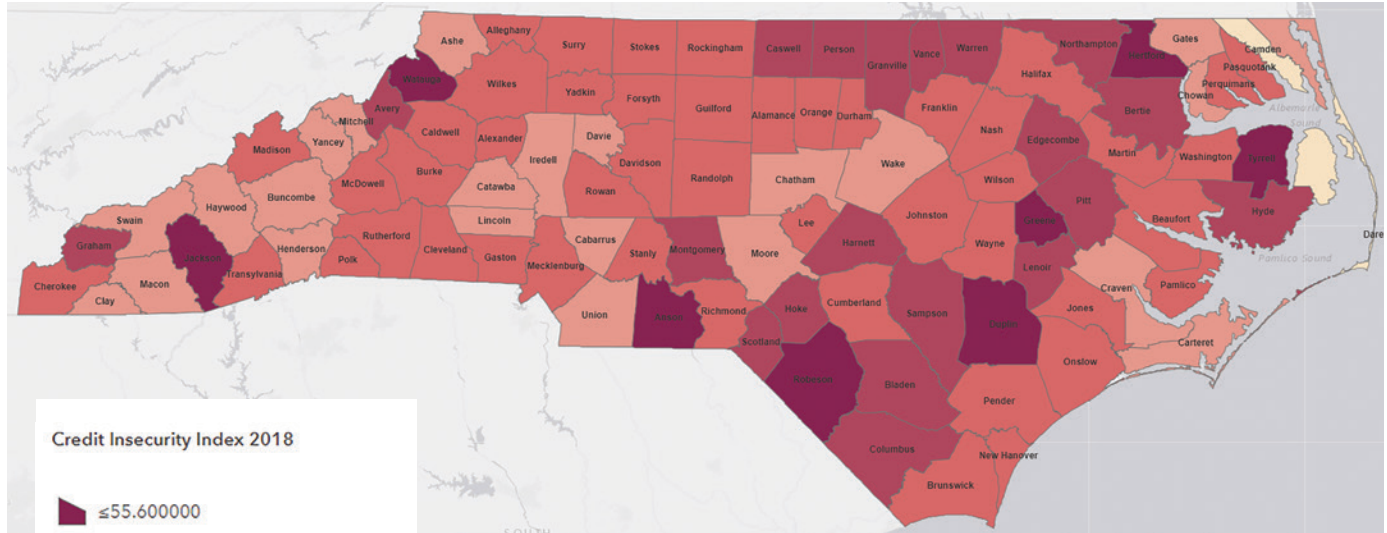


Mortgage lenders require the purchase of flood insurance at origination for any loan secured by a residence in a FEMA-designated flood zone, or special flood hazard area (SFHA). While this insurance mitigates risks for homeowners and lenders, gaps remain for several reasons. First, because flood insurance is required only for homeowners with mortgages, renters or those who outright own their homes (including homes passed down over generations) may be vulnerable, though voluntary flood insurance is available for purchase. Residents may forgo flood insurance as they mistakenly believe it is included with their home insurance policy or let it lapse due to cost. Finally, FEMA leadership has noted, and outside studies have found, that FEMA floodplain maps are outdated. As these maps determine insurance requirements for mortgagors, residents may live in flood-prone regions that are undesignated by FEMA. This map shows the percentage difference in the number of properties at risk using more recent First Street Foundation data in comparison to FEMA data. The First Street Foundation is a nonprofit research organization that shares climate risk data and models with individuals, companies, and governments.

SOURCE: First Street Foundation Flood Model and FEMA, via Federal Reserve Bank of Philadelphia RADAR



FINANCIAL INSTITUTIONS AND CREDIT INSECURITY



In a 2018 Maastricht University working paper, economists Jaap Bos, Runliang Li, and Mark Sanders noted that in the aftermath of natural disasters, banks tend to meet the credit needs of their community by adjusting their asset structure — selling their government bonds to finance the disaster-driven increase in real estate lending. The study used Call Report data for all U.S. commercial banks between the years 2002 and 2013. Financial institutions can take an active role in supporting their communities following climate events by ensuring access to credit, especially in regions considered “credit insecure.”

This map shows the credit insecurity index scores of North Carolina counties. (Higher values — darker colors — indicate greater credit insecurity.) The New York Fed developed this index to provide a comprehensive view of credit access and community credit health. The index is the sum of two community credit indicators: (1) those not included in the formal credit economy, and (2) those included, plus this inclusion quality-adjusted to capture the share of residents who may be credit constrained or unable to obtain credit at choice. The New York Fed’s full report, published in 2019, highlights the broad applications in which this index can be used, including measuring the potential resilience of a community following a natural disaster and its ability to adapt or recover without assistance.

SOURCE: Federal Reserve Bank of New York Credit Insecurity Index, “Unequal Access to Credit: The Hidden Impact of Credit Constraints,” September 2019.

READINGS

Bos, Jaap, Runliang Li, and Mark Sanders. “Hazardous Lending: The Impact of Natural Disasters on Banks’ Asset Portfolio.” Maastricht University Graduate School of Business and Economics GSBE Research Memoranda No. 021, Aug. 27, 2018.

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Helmore, Edward. “US flood maps outdated thanks to climate change, FEMA director says.” *The Guardian*, Sept. 4, 2022.

Hsiang, Solomon, et al. “Estimating economic damage from climate change in the United States.” *Science*, June 2017, vol. 356, no. 6345, pp. 1362-1369.