



**North Carolina
Conservation
Network**

APRIL 14, 2025

**NORTH CAROLINA STATE OF
THE ENVIRONMENT
2025 / SUMMARY DOCUMENT**

We are grateful to all those who contributed to the development and review of this report, including our incredible colleagues at NCCN. Outside our organization, we offer special thanks to Kerri Allen, Jacob Boyd, Ryan Carter, Blakely Hildebrand, Emma Hughes, Gray Jernigan, Megan Kimball, Michelle Lovejoy, Ramona McGee, Hannah Nelson, Will Scott, Emily Sutton, Daisha Williams, Kendall Wimberley, Julie Youngman, and Jean Zhuang for sharing their wisdom and advice.

FRONT MATTER

About the State of the Environment

This report assesses trends in North Carolina’s human and natural environments. It is organized around 46 goal statements that we think can draw broad support across the political spectrum – “Drinking water is (should be) safe”; “Residents (should) have long lives and good health”; “Electric power (should) be reliable.” Our trajectories towards or away from these goals are measured by 114 indicators. We’ve tried to select indicators that measure real-world outcomes: not how many dollars government has spent, or how many grants or permits it has issued, but how often drinking water violates health standards; how long North Carolinians live; how often the power goes out. Some indicators are important but lack reliable data series. We label these as data gaps.

North Carolina is blessed with a strong university system, built through committed investment of public funds over decades. In our discussions of goals and indicators, we’ve made an effort to cite relevant research, especially from the last five years, and especially published by researchers based in or studying North Carolina. No doubt our literature searches have missed relevant studies and findings; we hope researchers reading this will share their results with us to cite in future iterations of the State of the Environment.

The discussion of each goal follows a consistent format: we name the indicators tied to the goal and state their directional trends, and list policy solutions that could help the state achieve the goal. The policy solutions are collected in an appendix at the end of the report. But the solutions are nearly an afterthought; the focus of this report is the condition of the state we share.

The discussion of each indicator also follows a standard format. A ‘top line’ briefly explains the indicator and its trend. An ‘about’ section discusses the indicator in greater depth, explaining what it shows, and usually including a chart or graph that lays out the data for the last ten years, or less if the data series is shorter. We discuss relevant history, official reports, and academic research in this section as well. Many indicators finish with a ‘recent developments’ section that notes key changes in policies or new scientific findings from the last five years.

We offer two notes about data limitations. In the interest of protecting their employees from exposure to COVID-19, many institutions stopped collecting data for part or all of 2020. Generally, most data series resumed by mid-2021. But some data series – for example, freshwater fish sampling, which follows a fish-year rotation across dozens of streams – still suffer from the lost year. Substantively, several data series show odd dips that track economic contraction during and recovery from the pandemic. For ten-year series, we think the availability of data before 2002 and after 2021 has allowed us to largely iron out temporary effects, although the pandemic placed a few indicators on a distinctly new trajectory.

For most indicators, annual data ends in late 2023. That means that the trends do not account for changes in direction in 2024. For example, after a few good years, 2024 was a truly terrible year for North Carolina agriculture. More broadly, none of the impacts of Hurricane Helene in western NC show up in the data. With long data series, one anomalous year would likely not change an overall trend. But some changes wrought by Helene are more fundamental and will cast a longer shadow. We've tried to address those key changes narratively as 'recent developments.'

How to use the State of the Environment

We have designed this report to be used in five ways:

- First and foremost, it is an assessment of where North Carolina is and where we're headed. To get a top-line perspective, you can study the mandala, discussed below under 'overarching trends', which boils all 46 goals and 114 indicators down into a circle. Or you can consider the top five challenges we identify for North Carolina's environmental future, discussed below under 'five drivers'.
- Second, it is a reference. For any particular topic – energy efficiency; exposure to microplastics – you can keyword search the document to find the indicators where that topic is discussed. Or, you can skim the goals and indicators for topics that look interesting or relevant and jump to those.
- Third, we hope you will use this document as a jumping off point to find and follow current and evolving research. We've looked for the best and most down-to-earth scientific studies we could find tied to our goals and indicators, especially studies with a North Carolina focus. We've linked to reports, studies, and journal articles in the footnotes.¹
- Fourth, for readers looking for solutions, the policy appendix is a springboard. No doubt each policy proposal has pros and cons; this report does not attempt to weigh those. Rather, the policies listed following each goal and gathered in the appendix reflect the collective aspirations of North Carolina's environmental and conservation organizations, as well as a few ideas that no one has actively proposed in North Carolina but seem to us worth exploring.

¹ If you're a person who reads footnotes, this is for you. For the sake of brevity and ease of use, we've invented our own citation format. News articles and reports are hyperlinked by their titles; we've relied on digital object identifiers (DOI) for peer-reviewed journal articles that provide them. For web resources, we've included a one- or two-word description before the title – 'blog post', 'interactive map' – so you know what you're getting before you click through, and the link is attached to the descriptive word. Links break – DOIs last longer than most – but if a link breaks for a web resource, we recommend that you use the [Wayback Machine](#) to find it. State legislation and statutes can be found at the [NC General Assembly website](#); the texts of state rules are in the [NC Administrative Code online](#). Sources cited more than once are given the full cite the first time, with an italicized [*Short Name*] provided in brackets. If you're looking at a footnote and see an italicized name, the full cite is somewhere earlier in the report. Do a keyword search of the italicized name to find the full citation, which will include the DOI or other link. By convention, *ibid* means the information comes from the same page in the same source cited in the previous footnote; *idem* means it came from the same source but not the same page.

- Finally, NC Conservation Network keeps a list of advocates across North Carolina’s environment and conservation organizations working on the problems identified in this report. Given staff turnover, the list changes rapidly enough that it doesn’t make sense to include it in the published text – but we have it. If you need to connect with advocates working on a particular topic or problem, please contact us; we’ll point you to the right people.

What we found: overarching trends

Reality is complex, but too much information is overwhelming. To make sense of our data, we’ve boiled the 46 goals and 114 indicators down to 19 categories and 7 supercategories. They are all shown here, in what we’ve come to call ‘the mandala’.



What we found: five drivers of North Carolina's future

We identified five areas that will shape North Carolinians' ability to live healthy and safe lives in our state. These areas are broad and interact with indicators from all through the report.

The human exposome. The exposome consists of everything a person is exposed to, from the air they breathe, to the water they drink or swim in, to the dust on their skin from the furniture and clothes they buy, to the social and built environments that surround them. A suite of indicators reflect air, water, and toxic pollution (indicators 12.1 – 19.3); others capture the built environment (indicators 21.1 – 24.3). Together, these drive common health outcomes (indicators 20.1 – 20.5).

What the trends in the exposome add up to: we've made much progress over the last 30 years in reducing exposures to conventional pollutants. Smog and particulates are rarer; rivers don't run red or green depending on the daily industrial releases upstream. In that sense, the major federal pollution control programs delegated to North Carolina – the Clean Air Act, the Clean Water Act – have worked. But as science improves, evidence of toxicity at low doses has piled up for a long list of chemicals whose release into air and water is unregulated, or that are used freely in consumer products. Moreover, the practice of only regulating toxics once health impacts can't be ignored has established a treadmill of regrettable substitutes: regulators work for years to address a known threat, but by the time standards are in place, polluters have shifted to release a different product or byproduct that is equally dangerous but not yet regulated. Finally, we've learned that several kinds of pollutants don't go away: PFAS, and plastics, which break into smaller and small pieces, now found around the world and in every human organ system. Exposures to these unregulated and emerging contaminants are headed in the wrong direction, with dire implications for human health.

Growth patterns. North Carolina is loved for its rural and natural landscapes, from the mountains to the sea. We're fortunate to have new North Carolinians flocking here from across the nation and around the world, bringing skills and vision with them. But the particular form our growth takes on the land today – sprawling outwards from metropolitan areas – threatens our rural landscape and our agricultural sector. It also drives higher greenhouse gas emissions from the transportation sector, longer commute times that damage residents' health, and increases in stormwater runoff that degrades rivers and estuaries.

We choose future development patterns through the land use and transportation policies we adopt. A different set of choices could promote compact development, lower total housing and transportation costs for residents, lower infrastructure costs for governments to serve their residents, lower carbon emissions, and protect North Carolina's rural landscapes for the future. Innovative policies and programs rooted in equity would result in better economic opportunities and higher quality of life for all North Carolinians, including lower income residents and members of communities that haven't enjoyed the benefits of growth to date.

Adaptation and the impacts of ongoing disasters. In September 2024, the remnants of Hurricane Helene devastated western NC, washing away or burying houses, roads, railroads, factories, workshops,

water and sewer plants, and farm fields. Beyond loss of life, the worst impact, the storm destroyed an enormous amount of wealth in a 24-hour period. Such a loss – in kind if not in scale – occurs every time a major storm brings flooding, storm surge, or landslides to one or another part of the state. And those disasters are happening more frequently now, as a warmer atmosphere carries more water and dumps it in more intense storms over our communities and landscapes.

Predicting climate doom has become a cottage industry; we're not interested in that. But economic historians with a very long field of view have studied the challenges that shifts in the climate have presented our civilization in the past.² One of the impacts of more frequent disasters is that – other choices aside – we have to spend more resources repairing and replacing lost buildings, infrastructure, businesses, and human resources, just to maintain our current quality of life. Fortunately, we can make choices – building back more resiliently, investing in hazard mitigation before disaster strikes – to reduce the recurring drain on our resources. History also shows that when societies fail to make those investments, the recurring losses are felt by everyone, but most keenly by those living on the economic margins. Smart adaptation policies are an investment in our common good.

North Carolina's energy transition. The cause of increased storms, flooding, and higher storm surge is climate change, driven by human emissions of carbon dioxide and other planet warming gases. This is now beyond serious scientific debate. There are multiple paths to reducing carbon emissions; all require a transition to 'clean' sources of energy and away from coal and gas. The chief obstacle to that transition is not the cost of energy efficiency or renewables, or the availability of technologies; it is a set of legal and institutional structures that suppress competition in energy generation and reward our energy-generating monopolies for the money they spend, not the efficiency and quality of the electric service they provide. Because this report focuses on outcomes, it is neutral with respect to the institutions. But the impacts of past and current energy policy choices show up in several indicators: rising atmospheric concentrations of CO₂, rising temperatures, rising sea levels (indicators 1.1 – 1.3); efficiency of new housing stock (indicator 28.1); energy affordability, reliability, and spillover effects (indicators 39.1 – 42.2). To date, implications of other sources of energy aren't showing up in our data, but we discuss them where appropriate: wood pellet harvesting under timber volume (indicator 6.2), animal waste biogas (indicator 11.2), and land used for solar farms (indicator 42.1).

Annual greenhouse gas emissions dropped with coal plant closures in the state in the 2010s (indicator 2.1), proof that progress is possible as long as we hold fast to commitments made towards a carbon neutral future and phase out expensive, polluting energy generation. The crucial forum for decisions about energy policy in North Carolina is the NC Utilities Commission. There, stakeholders of all kinds engage with and make cases for an energy landscape that is affordable for ratepayers today, and resilient, robust, and cost effective for ratepayers in the future.

Household economic outlook. One core measure of well-being is household economic health. That's a function of household income and job opportunities (indicators 26.1 – 26.4), and also housing costs

² Bruce Campbell, *The Great Transition: Climate, Disease, and Society in the Late-Medieval World*, 2016; Geoffrey Parker, *Global Crisis: Warm Climate Change and Catastrophe in the Seventeenth Century*, 2013.

(indicators 27.1 – 27.2), access to medical care (indicator 21.1), transportation options (indicators 30.1, 30.2, 33.1, 33.2), energy affordability (indicator 39.1), and water rates (38.1). In general, North Carolina’s households have done well over the last four years, despite the pandemic, and despite tight housing markets in several metro areas. We think that is in part a marker of robust metropolitan economies drawing new residents from across the country and around the world. It is also a reflection of federal and state policies: tax credits during the pandemic, and expansion of Medicare to afford health coverage to 600,000 more North Carolinians.

While the general trajectory has been strong, opportunities are not equally distributed. In the early 2000s, local and state elected officials spoke often about ‘two North Carolinas’, urban and rural. Our data suggests three: urban centers, exurban, and rural, with blurry boundaries, but different patterns of expense and opportunity in each. To capture this, we include a number of maps that don’t show trends but do show important geographic disparities. Where the data allows, we share breakouts for several indicators by race and ethnicity as well. Racial and ethnic disparities usually reflect the deep-rooted legacy of historic racism, embedded in land uses and property values, and in the capacity of local governments to fund public goods based on property taxes. When evaluating trends, we’ve tried to take a consistent approach: if an indicator is getting better for the ‘average’ North Carolinian, but racial or ethnic disparities are getting worse, it isn’t getting better for the state. In a just, healthy North Carolina, we want to see averages improving *and* racial disparities narrowing over time.

Hurricane Helene Recovery

In September 2024 – six months ago – Hurricane Helene brought historic rainfall, strong winds, and tornadoes to western NC, and left deadly flooding and landslides in its wake. More than 100 people died in North Carolina alone, making it the most lethal tropical system on record in North Carolina.³ The NC Office of State Budget and Management has estimated the overall damage and needs at more than \$59.6 billion across the state.⁴ Recovery will require building back better and preparing for future extreme weather.

The quantitative data in the report does not include Hurricane Helene’s impact on the natural or built environments. However, discussions of Helene damage and recovery are included in the “recent developments” sections of the indicator discussions. It’s also worth noting that the path to recovery and resilience is in effective policy design and implementation. The State of the Environment’s policy appendix does not have a Helene specific section, because recommendations for Helene recovery are already reflected in the broader resilience recommendations (M1 through M8).

³ Corey Davis and Katie Dello, [blog](#): The Weather Year in Review: Heat, Helene, and Weather Whiplash in 2024, North Carolina State Climate Office, January 2025.

⁴ NC Office of State Budget and Management, [Hurricane Helene Recovery: Revised Damage and Needs Assessment \[Helene DNA 2.0\]](#), December 13, 2024.