

The North Carolina Collaboratory

ANNUAL REPORT

December 1, 2023 – collaboratory.unc.edu



MESSAGE FROM THE DIRECTOR

Just over seven years ago, the North Carolina General Assembly (NCGA) launched an ambitious initiative to more efficiently and effectively utilize the academic research capabilities of our State's best-in-class research universities to better inform policymakers on complex issues facing our residents. Initially focused solely on environmental and natural resource issues, which still dominate our portfolio, the SARS-CoV-2 pandemic marked an inflection point in our scope that now includes numerous public health challenges.

Examples of these initiatives include providing the first funded projects for the high-profile Rapidly Emerging Antiviral Drug Development Initiative (READDI) to the development of novel high-performance sorbent materials to remove per- and polyfluoroalkyl substances (PFAS) from our drinking water to launching new technology-based applications to address the opioid crisis.

To date, we have funded projects on every campus of the UNC System (including the School of the Arts and the School of Science and Math) as well as numerous private universities including Duke and Wake Forest.

North Carolina remains the only state in the nation with a legislatively funded research and development program directly tied to our academic campuses at the scope and magnitude of the Collaboratory. Here in North Carolina, we're used to being first – first in freedom, first in flight, and home to the nation's first public university.



Therefore, it's appropriate to close with a focus on the tagline incorporated into the Collaboratory's logo:

Science. Policy. Solutions.

Why? Because we're first in that, too.

A handwritten signature in black ink, appearing to read "Jeffrey Warren".

Jeffrey Warren, Ph.D.
Executive Director NC Collaboratory

OUR STORY

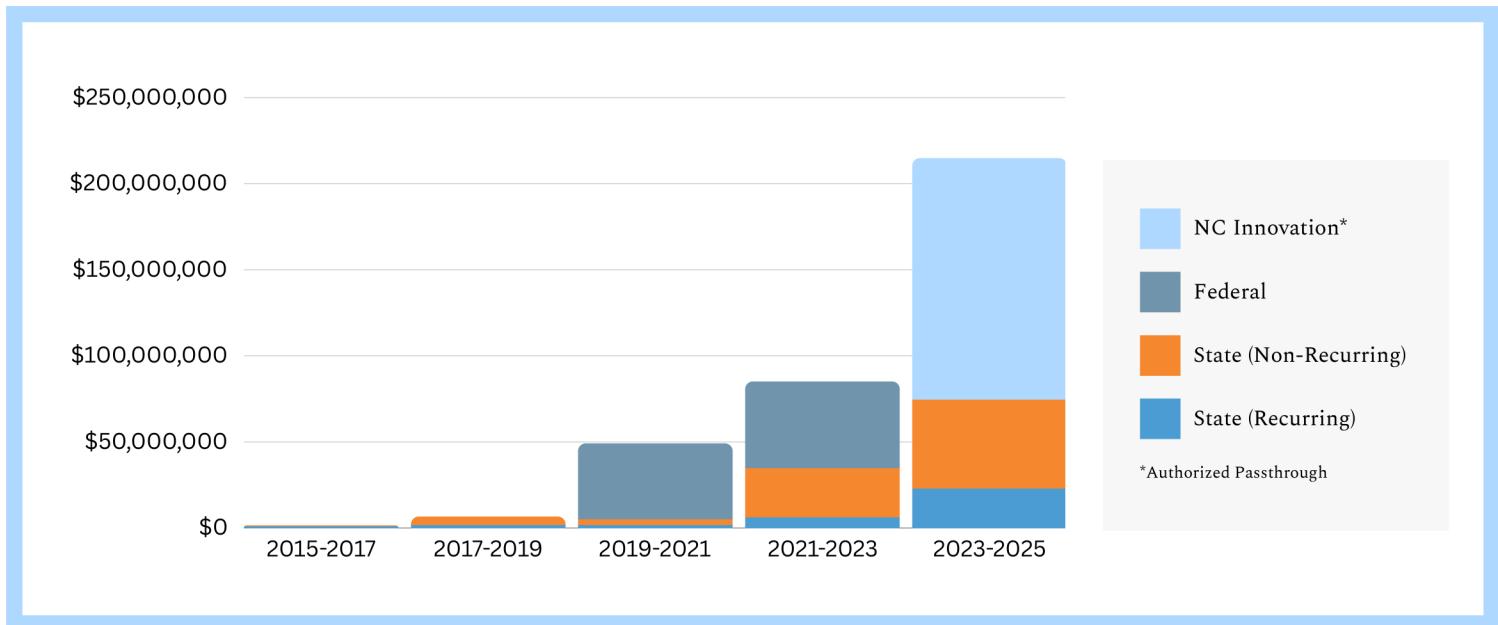
The North Carolina Collaboratory is a research funding agency that partners with academic institutions and government entities to transform research into practical information and technologies for use by State and local governments and the communities they serve.

Since its authorization in 2016 by the General Assembly (see 31a N.C.G.S. §116-255), the Collaboratory has stewarded approximately **\$225 million** in appropriations from the legislature, investing in over **450 research projects** that have the potential to develop innovative, evidence-based solutions that benefit our State and its residents.

Initially focused on environmental and natural resources, the scope of the Collaboratory's portfolio has expanded to also include projects focused on public health, education, technology, and infrastructure.

Given the Collaboratory's history, our mission has always been clear: to serve the State.

We believe in achieving a more sustainable, equitable, and prosperous future for North Carolinians, and we are confident in our ability to contribute to this vision through the efficient stewardship of taxpayer dollars for impactful research.



For more stories and content about Collaboratory-funded research, follow **@NCCollaboratory** on Instagram, Twitter, and LinkedIn, and subscribe to our newsletter at collaboratory.unc.edu/about/newsletter





From left to right: UNC Chancellor Kevin Guskiewicz, Sen. Gladys Robinson, Senate President Pro Tempore Phil Berger, Collaboratory Executive Director Jeff Warren, UNC Trustees John Preyer and David Boliek Jr. (Jon Gardiner/UNC-Chapel Hill)

“ The Collaboratory has given many of our researchers the resources they need to solve the great challenges of our time. This will be a place where researchers, students, faculty, and the people of our State come together to work and collaborate.

– **Kevin M. Guskiewicz**, Chancellor UNC-Chapel Hill

On March 22, 2023, the Collaboratory team, and University and State leaders celebrated the move to our new, permanent home in Kenan Labs on the University of North Carolina at Chapel Hill campus with a ribbon-cutting ceremony. ED Jeff Warren expressed his gratitude to UNC for aiding the Collaboratory’s rapid and unprecedented growth: “Operational support from Carolina enabled a critical scale-up of our abilities to plan, manage, measure, and assess our research portfolio and its outcomes.”

Now, in our seventh year, the Collaboratory is trained on continued growth and the efficient management of our increased funding and portfolio. With an operational budget supported by Carolina from non-State dollars, 100% of the funds appropriated to the Collaboratory are funneled directly to impactful research endeavors that are addressing some of the State’s most pressing challenges, from public health to technology and infrastructure to education to economic recovery.

2023-2025 BIENNIAL FUNDING

In October 2023, North Carolina approved its annual budget bill, appropriating over \$67 million in new dollars to the Collaboratory for the upcoming fiscal biennium, and tasking the organization with managing the distribution of up to \$140 million for NC Innovation. Funding amounts and brief project descriptions of these new legislative provisions and directives are below:



\$28 MILLION PFAS

This directive includes implementing an aqueous film-forming foam buyback program, evaluating PFAS destruction technologies, a human exposure study, water-related research on emerging compounds and more.



\$15 MILLION NEXT-GEN ENERGY

Next-generation energy research & development will focus on building business-academia partnerships within the State.



\$10.7 MILLION OPIOID ABATEMENT

This appropriation is designed to fund research to assist with opioid mitigation and recovery efforts across the State.



\$4 MILLION DIGITAL ENGINEERING

These funds will support grants across the UNC System focused on digital engineering, which leverages data and technology to produce improvements to applications—or even entirely new solutions.



\$3.5 MILLION ARTIFICIAL INTELLIGENCE

The budget provides funding to study the use of AI in improving non-confidential patient information.



\$3 MILLION HISTORICALLY MINORITY-SERVING INSTITUTIONS

The research grant program is specified for institutions in the UNC System identified as historically minority-serving, and includes ECSU, FSU, NCA&T, NCCU, UNC-Pembroke, and WSSU.



\$1.5 MILLION ENDOMETRIOSIS

The Collaboratory received funds for targeted research on endometriosis.



\$660,000 FERRYMON & MODMON

The ongoing FerryMon and ModMon programs collect and assess water quality data in the Albemarle-Pamlico and Neuse River Estuaries.



\$300,000 RECOVERY COURTS

This appropriation is for conducting a study of existing, judicially managed accountability and recovery courts (JMARCs), including drug treatment courts.



\$140 MILLION* NC INNOVATION

The Collaboratory is statutorily responsible for managing NC Innovation's academic grant portfolio across the UNC System, with up to \$140 million authorized for the current fiscal biennium.

LEARNING RECOVERY NETWORK



DPI Research Analyst Erin Manuel, Ph.D., participates in a roundtable discussion at NCLRN's workshop, "Creating Effective and Equitable Research-Practice Partnerships."

Launched in 2022, the North Carolina Learning Recovery Network (NCLRN) was created by the North Carolina Collaboratory and Department of Public Instruction (NCDPI) in response to widespread challenges across the State's education system during the pandemic. Working together, the Collaboratory and NCDPI distributed \$7.2 million to 20 faculty at multiple institutions of higher education to study a broad range of topics, from changes in postsecondary trajectories to the impact of the State's supplemental salary fund on educator turnover.

Project Spotlights

At Duke University, Lorrie Schmid was funded for a project focused on better understanding teacher attrition, health, and wellbeing. The project, which examines how school districts across the State are intervening to retain teachers and evaluates efficacy of these efforts, has the potential to address the shortage of teachers across the State. Project findings will be used to inform decisions around teacher recruitment and retention programs, as well as improve teacher preparation programs.

At North Carolina Agricultural & Technical University, Yudan Wang is assessing the impact of COVID-19 on the applications to and enrollment in UNC System schools. The project uses secondary data analyses of administrative data from NCDPI and the UNC System, along with county-level socioeconomic characteristics from the CDC, COVID-19-related statistics from the NCDHHS, and student responses. The project will report out to participating institutions and at the State Board of Education meeting to inform future policy and practice.

At North Carolina State University, Isaac Woods received funding for a research project exploring the enrollment of nontraditional undergraduates to increase diversity and equity at historically minority-serving institutions (HMSI) in mental health professions. The project has the potential to address the shortage of school psychologists in North Carolina. By providing mentorship and support to undergrads from HMSIs, the project can help bolster the number of culturally responsive school psychologists in the workforce.

CATALYZING ACTION: NEXT-GEN ENERGY

The 2023 State budget appropriated \$15 million to the Collaboratory for “Next-Generation Energy and Research Development.” The Collaboratory is tasked with leveraging its academic research partnerships with North Carolina businesses to research technologies, including lithium batteries; computer chip manufacturing; small modular- or micro-nuclear reactors; hydrogen production, storage, and transportation; and grid modeling for power generation, storage, and distribution.

This recent funding from the State builds on ongoing energy research the Collaboratory has been supporting, such as a study on the economic impacts of mineral mining for batteries in NC and various research studies on lithium extraction technologies.

Project Spotlights

- In March 2023, Michael Walden of **North Carolina State University** published a study on the impact of mineral mining for electric vehicle (EV) batteries in Eastern NC, estimating a potential annual impact of over \$3 billion.
- A project, led by Drew Coleman at **UNC-Chapel Hill** and Adam Curry at **North Carolina State University**, focused on improved lithium exploration methods, with promising preliminary results achieved in May 2023.
- Hemali Rathnayake at **UNC Greensboro**, developed Nano Mosaic solid-phase extraction technology, achieving highly efficient lithium extraction (up to 87%) and significantly reducing extraction time to less than 48 hours. These advancements are critical to meeting the growing demand for lithium in the EV battery market.

FOREVER CHEMICALS, FOREVER FUNDED

After the discovery of per- and polyfluoroalkyl substances (PFAS) in the Cape Fear River in 2016, the North Carolina General Assembly took action to address rising concerns about PFAS compounds and concentrations in the State. The 2018 Water Safety Act provision provided the Collaboratory with funds used to establish the NC PFAS Testing Network, which investigates the prevalence and toxicity of PFAS from the environmental to the biological level.



Since its inception, the PFAS Testing Network has been granted nearly \$50 million - representing the nation's largest legislative funding commitment for academic PFAS research - to carry out this imperative work.

These dollars do not revert to the State's General Fund at the end of each fiscal year and will remain

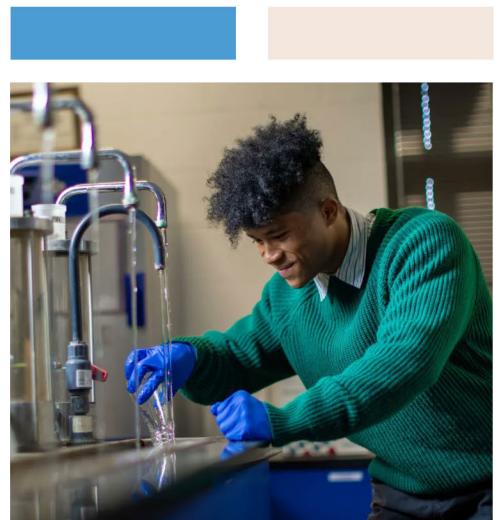
available for PFAS research until expended. Additionally, the \$4 million for PFAS funding in the 2023-2025 budget is a recurring appropriation (i.e., the Collaboratory will receive \$4 million in PFAS research funding every year moving forward).

This commitment provides, for the first time in State history, forever funding to address forever chemicals.

8 universities

\$50 million

Leveraging expertise, analytical instrumentation and technology to study PFAS toxicology, occurrence in drinking water, atmospheric transformations and occurrence, and removal technologies.



OPIOD ABATEMENT & RECOVERY

The Collaboratory's opioid abatement and research recovery program was initiated in 2022 with an appropriation from the NCGA to address the opioid crisis through treatment, recovery, harm reduction, and other strategies. The program has funded five projects to date at WCU, NCCU, UNCG, UNC-CH, and ECU.

Eleven million dollars of funding for the 2023-2025 fiscal biennium will allow for the continued expansion of the program.



(Photo credit: Heather Craig)

NABARUN DASGUPTA

The Collaboratory-funded senior scientist was recognized by TIME100 Next for his work responding to the national opioid crisis. Dasgupta's Street Drug Analysis Lab tests samples submitted by public

health programs to improve community education and develop harm reduction approaches to reduce overdose risk. Dasgupta shared with UNC Gillings, "While this may appear to be a singular honor, I am humbled to highlight the compassionate heroes who care for our loved ones and offer practical scientific solutions."

Read more about Nab's work:
go.unc.edu/opioid-abatement-research

Reducing the Burden of Opioid Use Disorder in North Carolina

At **Western Carolina University**, a statewide assessment of epidemiological trends associated with opioid use will identify harm reduction measures to reduce overdose and substance misuse. Specifically, the study analyzes usage trends for harm reduction measures implemented in rural and historically underserved areas in the seven Western NC counties.

Community Opioid Resources Engine

This center at **UNC-Chapel Hill** will support an online resource library, develop educational training material, and maintain dashboards for population-level indicators of opioid use. The center is also a resource to report on upcoming financial plans, expenditures, and settlement funding. Leveraging peer-to-peer networks, this project ensures data integrity and harmonization while disseminating best practices and success stories.

Toolkit for Opioid Abuse Abatement

Researchers at **North Carolina Central University** will develop and test a comprehensive, interactive toolkit called "Resilient Community Recovery" to help address opioid use and overdose, with tailored interventions for the African American community. Created in partnership with community organizations and health workers, the project empowers community members and local governments to understand the risk factors for opioid use and learn how opioid overdose can be prevented.

JORDAN & FALLS LAKE STUDIES

The North Carolina General Assembly mandated a multi-year study of Jordan and Falls Lakes in the 2016 State budget bill, allocating the Collaboratory \$500,000 annually for six years to support this work. An additional single appropriation of \$750,000 in year seven, and an authorization to use up to \$1 million of challenge grant funds, have brought the total investment in this work up to \$4.75 million.

Over the last several years researchers from UNC-Chapel Hill, East Carolina, and NC State University have been conducting research at Jordan and Falls Lakes. Their research has

comprehensively assessed factors affecting water quality, both external and internal, to provide actionable information for policymakers and stakeholders.

A public forum in April 2023 gathered over 100 participants including local government officials, State agency staff, agricultural leaders, environmental advocacy organizations, and many others, to share findings and gather feedback. The Falls Lake study's culmination will be a final legislative report due in December 2023, intended to guide future regulatory and management actions in the coming years.

Examples of Falls Lake Research Projects:

- Evaluating transport of water in the lake and flows in and out of the lake;
- Analyzing the potential for toxic algae growth;
- Developing mitigation strategies intended to improve water quality;
- Identifying policy options that could result in achievable solutions; and,
- Conducting an analysis of new revenue generation to assist in paying for water quality improvements.



Researchers from the Luettich Lab at UNC-Chapel Hill deploy instruments in Jordan Lake to evaluate nutrient concerns. The study aims to find solutions to protect the water quality of the lake. (Marley Parker/UNC-Chapel Hill)

HISTORICALLY MINORITY-SERVING INSTITUTION PROGRAM

In 2021, the NCGA codified the Collaboratory, significantly broadening its reach and incorporating additional statutes. This included provisions for sustained funding and research support for the UNC System's six historically minority-serving institutions: ECSU, FSU, NC A&T, NCCU, UNCP, and WSSU. A recurring allocation of \$1.5 million per year (\$3 million total over the 2023-2025 fiscal biennium), ensures ongoing support to strengthen these institutions. Below are three research projects currently funded by the Collaboratory through this initiative.

Autonomous Multi-Drone System for Search Operations



Fayetteville State University's Sambit Bhattacharya received funding for

research focused on developing AI software for multi-drone search operations in challenging environments. The project has wide-ranging applications, from search and rescue to disaster relief to infrastructure inspections. It also offers educational opportunities in AI and machine learning for students.

Improving Financial Literacy among Native American Communities



UNC-Pembroke's Xinyan Shi received funding for a project to improve financial literacy among Native American communities through an economic education program. The study's findings will inform the development of a community-level program with long-term impacts on constituents' lives and North Carolina's economy.

Novel Carbocyclic Nucleosides as Antibacterial Agents



Elizabeth City State University's Tesfaye Serbessa received funding for a

nuclear magnetic resonance spectrometer and research on new antibacterial drugs. The instrument enhances understanding of chemical compound properties, crucial for addressing antibiotic resistance. The project also trains students in high-demand pharmaceutical skills.



BUSINESS-ACADEMIA PROGRAM

6 universities
11 industry partners
\$15 million

Fostering and strengthening partnerships between businesses and academic research groups to transform applied research and innovation into technological solutions for the benefit of public health and the economy in North Carolina.



On-Mask Covalent Capture and Detection of SARS-CoV-2

Partnering with NanoDiagnostic Technology, LLC, Terry Xu's project aims to develop a more effective and accessible way to detect COVID-19. The platform will combine a high-efficiency mask containing a newly engineered nanomaterial, a nanoparticle-amplified detection device, and a mobile app. The technology could assist with mass screening in communities, which would help identify and isolate infected individuals earlier, preventing the further spread of the virus.

Multi-omic Solution for Determination of COVID-19 Infections and Severity

Alongside Codetta Bio Inc., Deepak Kumar's project addresses health disparities by working to improve the accessibility, accuracy, and efficiency of COVID-19 detection. Researchers aim to develop and assess SARS-CoV-2 detection technologies. These technologies could evaluate the severity of a patient's response or differentiate SARS-CoV-2 from other respiratory illnesses. The project is designed to ensure that COVID-19 research, testing, and treatment options are accessible.

Addressing Disparities in Homeownership Exacerbated by the COVID-19 Pandemic

With the National Institute of Minority Economic Development, Bruce Rich's project partners with Community Development Corporations and Community-Based Organizations to revitalize communities with vacant housing and increase homeownership rates for African-American families. Implementation of homebuyer education programs and down payment assistance aims to create a diverse pool of low-middle-income buyers, fostering equity in NC communities.



THE COST OF FLOODING

In 2018, following Hurricane Florence, the NCGA provided a \$2 million appropriation to the Collaboratory to conduct a comprehensive study of flood impacts and mitigation strategies. The final study report was submitted to the legislature in June of 2021 and focused on floodplain buyouts, improved mapping, protecting infrastructure, public health, and financial impacts. The Collaboratory continues to actively support flood resiliency research and has committed additional funds in support of this topic.

Project Spotlight

In March 2023, Greg Characklis of UNC-Chapel Hill and his research team published findings in *Earth's Future*. Their study showed that while traditionally, the financial impacts of flooding have focused on estimating damages that directly impact insurers and property owners, lenders and local governments can also be affected.

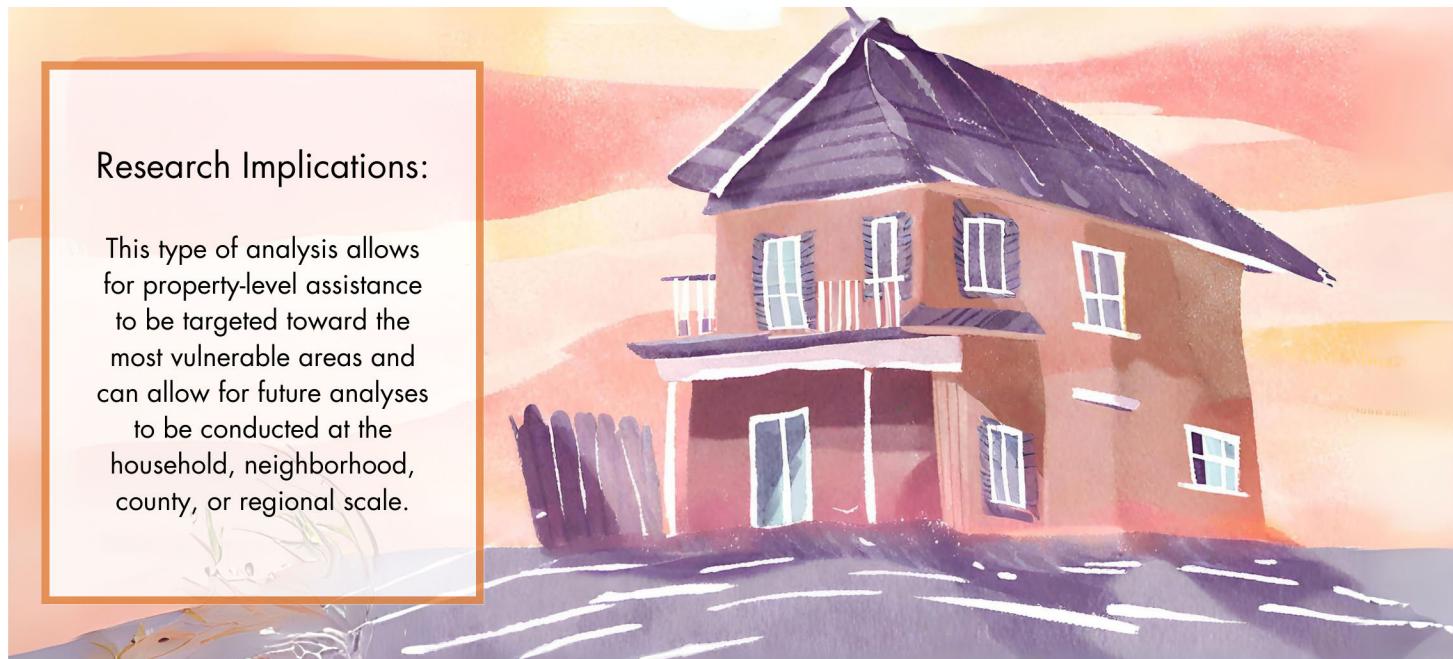
Following a flood, uninsured damage and reductions in property value can combine to reduce a property owner's equity, hampering their ability to borrow money and recover from the flood. This can lead to mortgage default or even property abandonment, resulting in further financial consequences.

Their research estimates uninsured damage and property value changes post-Hurricane Florence via a novel machine learning approach, using highly resolved, property-level data on the physical characteristics of residential properties, insurance claims, property sales, and mortgages.

The results indicate that uninsured damage and property value decreases combined to be substantial (over \$562 million) and significantly increased the risk of mortgage default and/or abandonment. Lower-valued properties experienced higher rates of default and abandonment than high-valued properties, with risk varying widely across communities.

Research Implications:

This type of analysis allows for property-level assistance to be targeted toward the most vulnerable areas and can allow for future analyses to be conducted at the household, neighborhood, county, or regional scale.



BUILDING CAPACITY



NCDHHS



NORTH CAROLINA
Environmental Quality



GO OUTDOORS
NORTH CAROLINA



NORTH CAROLINA
ADMINISTRATIVE OFFICE
of the COURTS



North Carolina Department of
PUBLIC INSTRUCTION



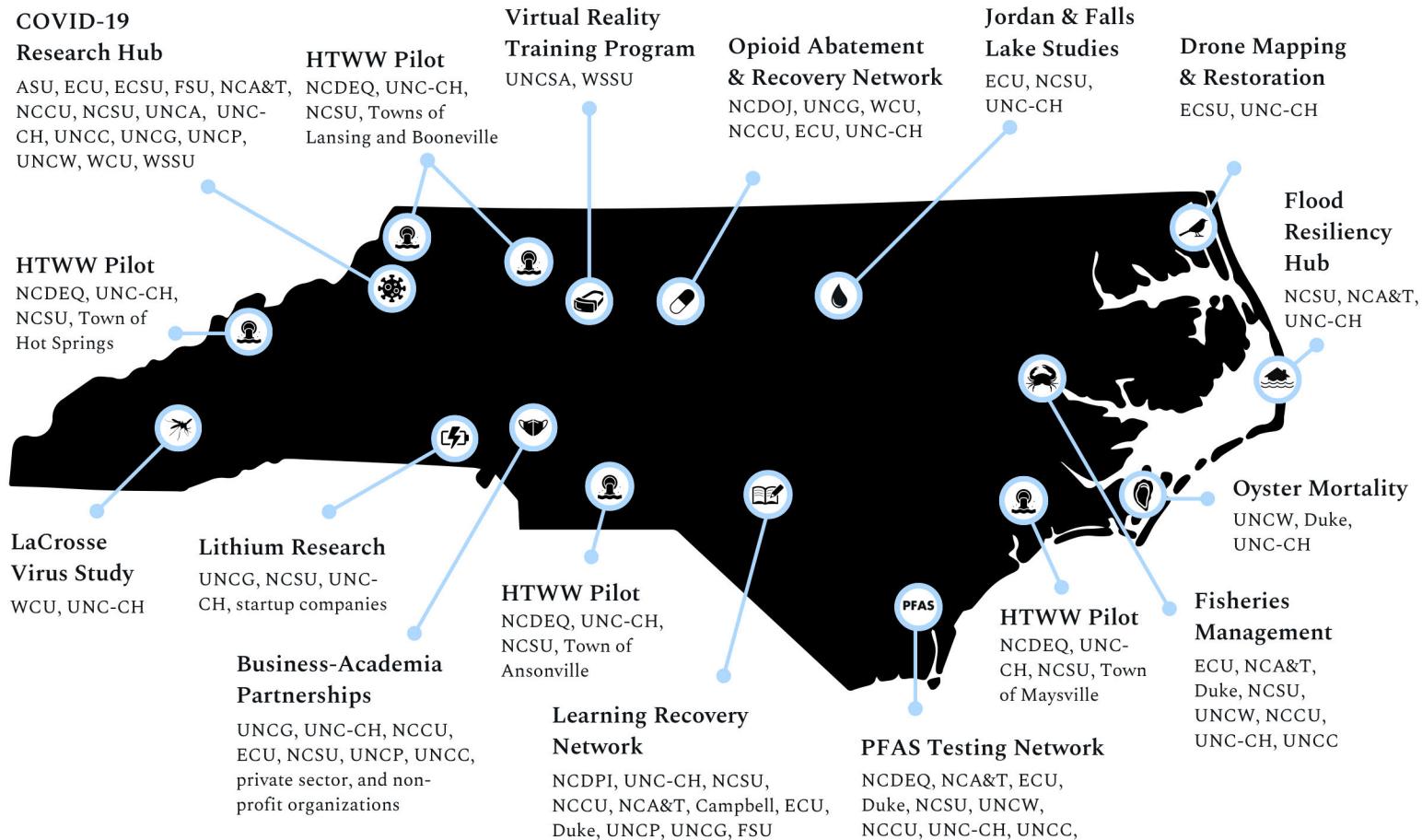
The Collaboratory is dedicated to providing vital insights for North Carolina's policymaking process at the State and local levels, leveraging the latest research findings, pertinent data, and expert guidance.

A significant component of this work is sharing research results with policymakers, stakeholders, and the general public. As such, over the last year, the Collaboratory and its partners have hosted symposiums, webinars, and public forums on topics ranging from water quality concerns to education policy to public health research.

Central to our approach is the rigorous academic research conducted by university experts tackling pressing issues within North Carolina. This endeavor is further enriched through collaborations with private sector entities, non-profit organizations, and government agencies. While our extensive list of partners is too great to enumerate, our noteworthy ongoing and past affiliations with key North Carolina state agencies include:

- Dept. of Agriculture and Consumer Services,
- Dept. of Environmental Quality,
- Dept. of Health and Human Services,
- Dept. of Justice,
- Dept. of Public Instruction,
- Dept. of Public Safety,
- NC Administrative Office of the Courts,
- Wildlife Resources Commission,
- and, NC Zoo.

LEVERAGING PARTNERSHIPS



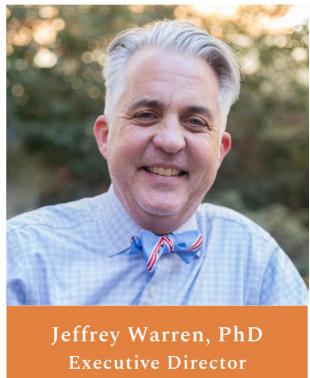
The projects displayed on this map all feature collaborations across multiple academic institutions, and in many cases, involve additional partnerships.

By fostering collaboration among various academic institutions, state agencies, nonprofits, and community organizations, the Collaboratory taps into a diverse pool of expertise and perspectives. These partnerships amplify the impact of research projects, enabling a more comprehensive and nuanced understanding of the complex issues facing North Carolinians.

The collective knowledge and interdisciplinary approaches that arise from these programs strengthen the Collaboratory's ability to address a wide range of challenges, from environmental issues to public health crises.

By connecting stakeholders, the Collaboratory builds a robust foundation for informed policymaking, ensuring that the funded research is tailored to the unique needs and circumstances of the State. In essence, partnerships catalyze academic insights into actionable policies that positively impact the broader community.

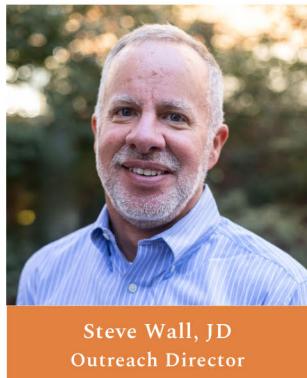
OUR TEAM: STAFF



Jeffrey Warren, PhD
Executive Director



Greer Arthur, PhD
Research Director



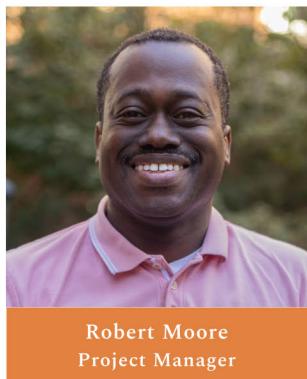
Steve Wall, JD
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Laurie Farrar
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Claire Revere
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Rick Luetrich, Professor and Director, UNC Institute of Marine Sciences

Mike Piehler, Chief Sustainability Officer, UNC-Chapel Hill and Director, UNC Institute for the Environment

Acknowledgments

The Collaboratory is grateful to the North Carolina General Assembly for providing the funding that makes our work possible and UNC-Chapel Hill for supporting our operational costs through non-State funds.

OUR TEAM: STUDENTS



Alexia



Anna



Auburn



Caroline



Chloe



Christian



Emery



Fatima



Hallie



Harris



Jenna



Jenna



Jude



Leah



Monica



Natalie



Perrin



Sarah



Stephanie



Tiana



Xiomara



Avianna



Rebecca



Sarah



Taylor

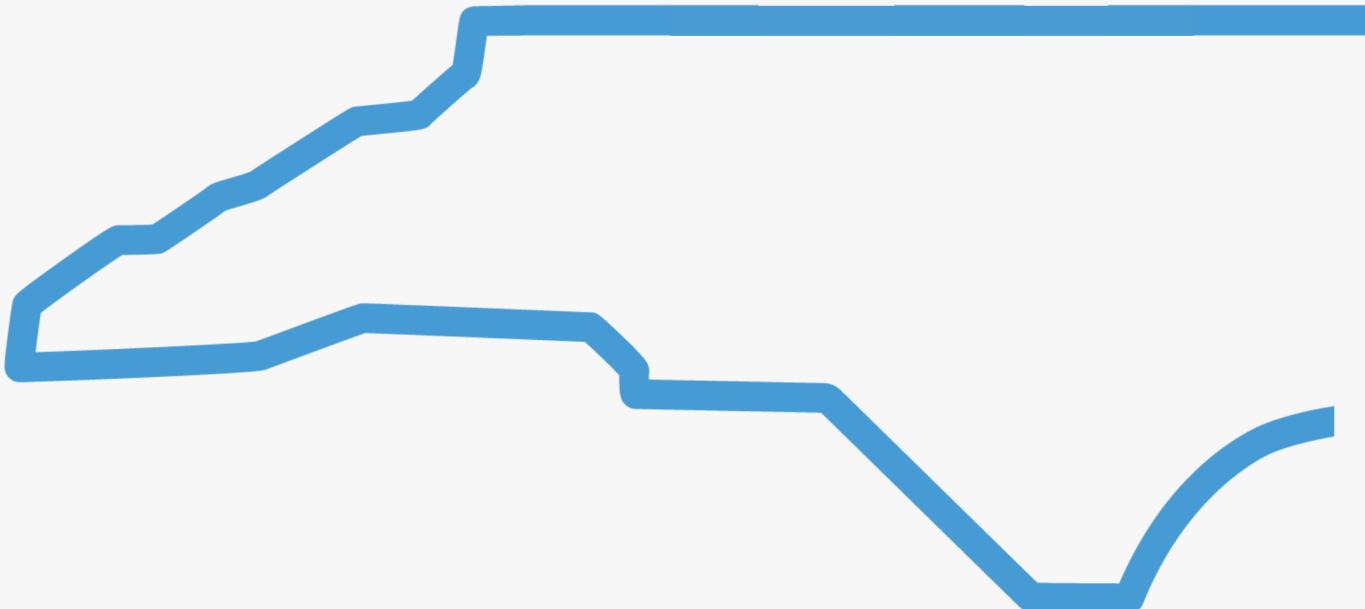
Undergraduate Interns

Graduate Research Assistants

Graduate Interns

COLLABORATORY

SCIENCE. POLICY. SOLUTIONS.



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THE UNIVERSITY
of NORTH CAROLINA
at CHAPEL HILL