

Carolinas Collaborative on Climate, Health, and Equity

Annual Progress Report

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About C3HE

This RISA team is building upon years of regional work on climate science, tools and assessments to move into a new phase that centers Justice, Equity, Diversity, and Inclusion (JEDI) principles at the forefront of NOAA-funded climate research and to deliver climate futures to more communities than have been previously served. We will apply a bottom-up participatory action approach to develop a transferrable model for end-to-end co-production of actionable and equitable climate resilience solutions in at-risk communities in the Carolinas.

Our aims include

Aim 0. demonstrate our commitment to addressing the climate reality in a just and equitable way while ensuring that the inclusivity and diversity of all voices are represented in every aspect of our work in the Carolinas;

Aim 1. building and enhancing local partnerships in underserved communities across the Carolinas to identify, test, and refine equitable solutions for climate resilience;

Aim 2. understanding and predicting how co-occurring and consecutive hazards interact with exposure and vulnerability to shape climate risk;

Aim 3. identifying and connecting the complex linkages between structures of power, intersecting social positions, and climate-health inequities in vulnerable communities; and

Aim 4. designing and implementing community-sciences programs to track physical and social science metrics and build community-level climate resilience literacy.

Year 1 Highlights

Year 1 work was focused on building institutional capacity, especially with our historically Black colleges and universities (HBCU) partners, and establishing and strengthening connections with community partners. The major work and successes of our first year include

- (1) assembling the project team with PIs at seven universities and organizations across the Carolinas;
- (2) establishing C3HE processes for identifying, engaging, and funding work with frontline communities in the Carolinas;
- (3) convening an advisory board comprising a diverse group of regional voices that will provide guidance on integrating justice, equity, diversity, and inclusion principles into our work and establishing and maintaining community partnerships;
- (4) partnering with the NC Climate Justice Collective to train and support their work in assessing climate vulnerabilities; and
- (5) working in four diverse local communities, from tribal groups to health providers to majority minority towns who have recently experienced climate change impacts, with the groundwork laid for additional community engagement over the coming year.

Other work included preliminary scoping of climate concerns/priorities in partnering communities, recruiting graduate students and postdocs, and filling in gaps in technical expertise and regional focus on the team from the initial proposal. The full team met for a kickoff meeting in Beaufort County, SC, in October 2021 and meets monthly to advance center activities. A research retreat is planned for July 2022 to continue outlining an innovate research strategy for bringing the physical and social sciences together around priority climate and health concerns.

The C3HE hired a program manager, Shelly McComb, in January 2022. Dr. Caela O'Connell from UNC-Chapel Hill joined the team in January 2022 as our internal evaluator. Dr. Natasha Malmin from Clemson University joined the team in spring 2022 to help expand our footprint and capacity in South Carolina, especially around health equity and policy. Postdoctoral Scholar Dr. Jihoon Jung is working with PI Hino on migration and climate. Staff and students are all new to the project since the writing of the proposal and were brought on over the last year. The first round of graduate students specifically recruited for C3HE will start in fall 2022. The first advisory board meeting was held in March 2022.

Featured Accomplishments

Capacity-Building with the North Carolina Climate Justice Collective

The C3HE team worked with the North Carolina Climate Justice Collective (NCCJC) to enhance the NCCJC's capacity to better engage with their regional hubs to advance local understanding of how community members are experiencing the effects of climate change in combination with other social stressors (e.g., COVID-19 pandemic, environmental injustice, social inequality). The NCCJC is a multiracial intergenerational movement ecosystem rooted in the communities who are first and worst impacted by climate and environmental harms.

The partnership was established in fall 2021 to assist NCCJC with gathering the information they need to create climate education and climate response plans tailored to the needs of their five regional Eastern North Carolina Resiliency Organizing hubs. Resiliency Organizing hubs provide interactive, culturally relevant training in resilience-based organizing. They provide a space for respite and rejuvenation and can serve as a platform to galvanize a just transition.

The C3HE team held initial meetings to assess and understand the goals of the NCCJC and their work with the Resiliency Organizing hubs in September 2021. We worked with the NCCJC to develop a mobile-friendly Qualtrics survey to enable the NCCJC to conduct door-to-door community canvassing in the summer of 2022. The goals of the community canvassing work are to 1) help each of the five regional hubs better understand the strengths, vulnerabilities, and priority climate concerns of communities within their service area; 2) develop a communication strategy to reach and care for community residents before, during, and after a climate disaster; and 3) connect local residents with their neighbors to advocate for just solutions to the ongoing climate crises. The Qualtrics survey also provides the NCCJC and Resiliency Organizing hubs with a dashboard to showcase community survey responses for each hub service area.

The RISA team also worked closely with NCCJC volunteers to develop an in-depth focus group guide to collect insights from regional hub leaders to understand the ways in which marginalized residents within their community have been taking care of each other to collectively get through tough times. The interview guide also assesses the strengths of local communities within each hub at responding to emergencies and extreme weather events. Members of our team have been training the NCCJC team on how to conduct and analyze these focus groups.

The C3HE team provided the NCCJC with a transcription subscription to Otter.ai and the technical assistance in processing the interview data. We worked with them to design a codebook to analyze the interviews and provided them with access to the coding software NVivo. We plan to provide continued guidance on how to use the results of their interviews to shape future regional hub engagement. This work resulted in the creation of a visual representation of the knowledge gaps identified during this study.

The partnership with NCCJC will provide a working community-engaged model to the C3HE team to use internally to help focus our efforts in project Years 2–5. We are especially proud of this partnership, because our work with the NCCJC is helping to boost the adaptive capacity of the region to build community resilience in a changing climate. We look forward to continuing this partnership throughout the life of our project.

“As a result of our partnership with the [Carolinas Collaborative on Climate, Health, and Equity](#), the NC Climate Justice Collective (NCCJC) has been able to greatly expand our ability to do effective participatory action research. For the first time, we are now able to conduct our Community Disaster Survey using digital tools that enable us to collect and analyze data for over 20 eastern NC counties. We are also being trained in qualitative research techniques that are shaping our community-based resilience training and advocacy. Beyond their technical expertise, the CCCHE team's collaborative attitude has been deeply encouraging. We could not ask for better support from CCCHE and are grateful for the RISA funding that makes this joint work possible.” —Jodi Lasseter, Co-Founder & Co-Director, North Carolina Climate Justice Collective

New areas of focus and partnership

Eastern Band of Cherokee Indians (Western North Carolina)

A five-year collaboration with the Tribal Council of the Eastern Band of Cherokee Indians (EBCI) to integrate climate into all aspects of tribal governance

Through a partnership with the C3HE team, the EBCI aims to create adaptation strategies that will last the next seven generations as part of their “100 year vision for the future”. The goal of this collaboration is to enhance the capacity of tribal leaders to plan, adapt, and respond to changing climatic conditions. C3HE and the EBCI entered into a five-year formal agreement following the adoption of a Memorandum of Understanding between NC State University and the EBCI and the passage of a formal tribal resolution in May 2022. The team has co-developed a Scope of Work for Year 1 activities with key tribal leaders. Year 1 activities will involve listening to and learning from tribal government leaders and community members to answer: 1) What cultural, community, and environmental factors have helped the EBCI to remain resilient and thrive? 2) How does the EBCI envision resilience for the next seven generations? 3) What are potential threats and opportunities to ensure the health, economic, and environmental well-being of tribal members for many generations to come?

In summer 2022, the C3HE team will hold a series of community kickoff meetings with tribal leaders, council members, community club advisors, tribal elders, and other interested community members.

The team will scope regional-scale physical science analyses to explore current and future climate hazards (e.g., fire, flood, heat) and use that science to explore climate futures and move toward practical solutions. The ultimate outcome of the partnership is to identify and implement targeted action now to combat climate change and its economic, environmental, and health impacts. Results will directly inform the revamping of the 2012 EBCI’s legacy plan and the development of a 21st-century vision for climate action integrated as a cross-cutting theme across governmental sectors. While we’re only in the first year of a five-year long partnership, we aim to move beyond developing a report that sits on the shelf and instead work closely with the EBCI to co-develop an Indigenous model that elevates tribal knowledge, values, realities, and priorities to address climate, health, and equity in Western North Carolina. We will partner closely with the Department of Interior’s Southeast Climate Adaptation Science Center (SE CASC).

Enhancing Climate Literacy and Health Equity with Albemarle Regional Health Services (Northeastern North Carolina)

The Albemarle Regional Health Services (ARHS) covers an eight-county region in the Albemarle-Pamlico Sound/Inner Banks of rural Northeastern North Carolina (Chowan, Bertie, Pasquotank, Perquimans, Gates, Hertford, Tyrrell, and Camden counties). This region is among the poorest and most vulnerable to weather/climate impacts in the Carolinas.

In Fall 2021, the C3HE team was approached to advise the ARHS team on a grant proposal to NOAA's Education and Literacy Program. Through this effort, the ARHS team started to explore a community partnership with the C3HE team. This region is experiencing sea level rise and saltwater intrusion, extreme heat, flooding, and other secondary hazards such as more frequent algal blooms. The C3HE team is working with ARHS leadership and others in this region to plan a climate workshop to assess the needs of the community, identify linkages between climate and health stressors, and develop a communication and response plan for the regional health providers. The C3HE team plans to kick off this work with ARHS in fall 2022.

Sustainability Activities in Greenville County, SC (Upstate South Carolina)

The C3HE team held an initial scoping meeting with Greenville community groups in fall 2021. Our team is working with the Shi Institute for Sustainable Communities at Furman University to explore climate resilience work in the Greenville-Spartanburg area in South Carolina. In June 2022, a meeting was held to form connections between the C3HE team, the Shi Institute, and local community partners. The team identified focus groups and gap analyses in a Greenville city-led long-term sustainability plan as initial partnership activities.

Building Climate Resilience and Adaptation Through Low-Impact Development, Home Elevation, and Cultural Preservation in Bucksport, South Carolina

Furman University SUS 473 Sustainability Science Practicum 2021-2022 (Habron)

Bucksport, SC, is a census-designated place in Horry County comprising a population of 750 people, of which 89% are African American, 22.6% are in poverty, and 50% live in mobile homes. Residents hold a strong Gullah Geechee cultural heritage. Located in the floodplain between the Pee Dee and Waccamaw Rivers, the Bucksport community has experienced since 2015 a sudden onset of catastrophic flooding events that exceeded the magnitude and frequency seen throughout their history, which has led to property damage and population outmigration.

Due to historical ramifications, many residents reside on heirs' property, so they lack the necessary property deeds to receive previous disaster funding from the Federal Emergency Management Agency. From August 2021 through April 2022, the eight members of the senior Sustainability Science Practicum course at Furman University partnered with the Association for the Betterment of Bucksport and a coalition of partners to develop three proposals to address equitable climate resilience and adaptation to protect assets subject to flooding.

The cultural preservation project collaborated with Coastal Carolina University and the Gullah Geechee Chamber of Commerce to receive \$61,000 from Horry County through the American Rescue Plan (ARP) Act in January 2022. While the low-impact development project that partnered with the Carolina Wetlands Association failed to receive ARP funding, American Rivers did receive \$19,000 from the Butler Conservation Fund to support the

development of rain gardens in collaboration with Clemson University, the Coastal Conservation League, and Winyah Rivers Alliance. Unfortunately, the home elevation and weatherization project did not receive funding.

Two Furman senior Sustainability Science students will build upon these efforts for their thesis research during summer 2022. These climate-induced issues affecting this vulnerable community and the strong partnership network provide groundwork to best mobilize the expertise and focus of the C3HE team, especially at South Carolina State University.

“Thank you Geoffrey to you and your students for an awesome year. I think that your work shows that learning and making a difference can be accomplished simultaneously and in such a meaningful way. We can use the summaries to communicate to others the great work that the Bucksport Community Partnership is doing. Thank you all again!” — Janae Davis, American Rivers and community partner

Developing a Process for Defining, Selecting, and Partnering with Frontline Communities

The C3HE team has devoted a significant amount of time and effort to developing a set of quantitative selection criteria and related processes to select which frontline communities we will partner with across the Carolinas after refining our process in our first four communities (EBCI, Northeastern North Carolina, Greenville County, and Bucksport, SC). Our RISA defines frontline communities as “A systematically excluded geographically, socially, temporally bound group of people exposed to disproportionate climate impacts, risk, and harm as a consequence of their exclusion. These communities experience repeat exposure to a hazard with minimal/degraded capacity to cope with the exposure and the resulting chronic cascading effects.”

Overview of our approach for identifying frontline communities:

- Step 1. Quantitative risk assessment
- Step 2. Internal team review/qualitative assessment
- Step 3. Scoping a project with potential community partners
- Step 4. Conducting community-engaged research

Our selection of which communities to work with will be driven by identifying communities/sub-populations that are vulnerable to hazards and risks that our team has the expertise to address. From a quantitative perspective, we will focus on the use of datasets across the social, epidemiological, and physical sciences that support the skill sets of our PI team to identify vulnerable populations across the Carolinas (*Step 1*).

We are also developing a set of qualitative guidelines to guide the quantitative selection process (*Step 2*). Specifically, we are integrating principles of justice, equity, inclusion, and fairness from the political ecology, environmental justice, and Black feminist literature to guide how we select and work with communities.

Once a community is selected, we have allocated funds to support one to two scoping meetings to determine if partnership is possible. If partnership is not possible, we will compensate the community for the time that they spend with us during the scoping process (*Step 3*). The team is currently working on a process for approaching and funding candidate communities. The team has set aside \$5,000 to fund scoping activities for both the candidate community and C3HE to reach a consensus on priority areas for a collaborative project and a potential plan of work. An additional \$30,000–\$50,000 is allocated toward Year 1 activities.

If partnership is possible, we will work closely with the community to co-develop projects to address identified climate risks and hazards (*Step 4*).

Table 1. List of key indicators to include in quantitative risk assessment.

Domains	List potential indicators
Physical/Climate	Heat (e.g., heat index, WBGT, heat wave days, exceedance events), drought (e.g., SPI, SPEI, KBDI), wildfire (e.g., areas burned— historical, prescribed burn, ignition probability), air quality (e.g., ozone, PM2.5), flood (e.g., cumulative 3-day precipitation, 24-hr/sub-daily precipitation intensity, historical flood extent, FEMA floodplains)
JEDI - Climate justice (disproportionate exposure, urban heat island)	
Health and Well-Being Indicators	Healthcare access (e.g., health professional shortage areas, medically underserved area, number of Intensive Care Units), disability, mental health (suicide, depression/anxiety), infant mortality rate, life expectancy, COVID-19 burden (annual cumulative cases, deaths), life expectancy, obesity
JEDI - COVID-19 burden, life expectancy, infant mortality (health equity)	
Socioeconomic and Cultural	Language barriers, employment, poverty/income, home ownership, residential segregation, family structure, living alone, insurance status, race/ethnicity composition, gender identity
JEDI - Residential segregation/poverty (equity)	
Built Environment	Housing type, condition, age; communications technology; AC prevalence; proximity to major roads, hospitals, greenspace, waterbodies, and public transportation; land use, and land cover; rural versus urban
JEDI - Energy justice, gentrification, environmental justice	

Table 2. Qualitative assessment draft of C3HE prerequisites when considering a community for a RISA partnership.

	1 (does not meet)	2	3 (adequate)	4	5 (exceeds)
Team expertise					
Has NOAA or another federal climate effort been heavily involved?					
Within our network, is there a contact for the identified community?					
Lack of funding					
Historical marginalization where NOAA hasn't been					
Relevant team expertise					
Proposed community need touches the expertise for 3-4 team members/grad students					
Have other federal agencies/nonprofits been involved?					
Summary score Communities scoring 21 or more will be advanced in community selection					

Research Highlights:

Runkle, J. D., J. L. Matthews, L. Sparks, L. McNicholas, and M. M. Sugg, 2022: Racial and ethnic disparities in pregnancy complications and the protective role of greenspace: A retrospective birth cohort study. *Science of The Total Environment*, 808. <https://doi.org/10.1016/j.scitotenv.2021.152145>

- Some of our recent work involves examining the health benefits of local access to and availability of greenspace for preventing leading pregnancy complications. Results showed that maternal residence characterized by low greenspace is linked to a higher risk of prenatal mental/depressive disorders, preeclampsia, and preterm birth. We observed that increased maternal access to and availability of greenspace is linked with a decrease in the risk of gestational diabetes. Most importantly, our findings suggest that low-income, majority-Black communities might benefit the most from access to and availability of greenspace.

Grant, E. and **J.D. Runkle**, 2021: Long-term health effects of wildfire exposure: A scoping review. *The Journal of Climate Change and Health*, 100110.
<https://doi.org/10.1016/j.joclim.2021.100110>

- Wildfires are increasing in size and frequency worldwide, due in part to the hotter and drier conditions caused by climate change. However, limited research to date has examined the longitudinal effects of wildfires on the health of impacted populations. Our review highlights that there are too few studies examining the long-term health effects of wildfires, particularly on vulnerable subgroups, and that future research on the sociodemographic characteristics of vulnerable subgroups who are disproportionately affected by long-term health effects of wildfire exposure is a leading research priority. Public health professionals will benefit from additional information, which can guide messaging and care for impacted populations suffering from the health consequences of wildfires and future preparedness and response efforts in geographic areas most impacted by wildfire events.

Mullenbach, L. E., Breyer, B., Cutts, B. B., **Rivers III, L.**, & Larson, L. R, 2022: An antiracist, anticolonial agenda for urban greening and conservation. *Conservation Letters*, e12889.
<https://doi.org/10.1111/conl.12889>

- In this article we seek to contribute to the growing body of literature examining the effects of past and ongoing racism and colonial practices in the conservation space. Specifically, to ground our critique, we focus on urban greening practices (i.e., tree-planting programs) in the United States. The paper is divided into two sections: 1) a review of social justice concerns in the US conservation space (White ideals of nature; power disparities; and displacement and exclusion); and 2) recommendations for an antiracist, anticolonial urban conservation agenda (building of environmental justice principles).

Wang, Y., & **Sebastian, A**, 2021: Community flood vulnerability and risk assessment: An empirical predictive modeling approach. *Journal of Flood Risk Management*, 14(3), e12739.
<https://doi.org/10.1111/jfr3.12739>

- This paper presents an empirical modeling methodology to predict flood vulnerability and risk, considering factors of hazard distribution, property exposure, built environment, and sociodemographic and economic characteristics of a community. Flood insurance is required only for structures located in the floodplain with a federally backed mortgage. Outside of the floodplain, or for homes without a federally backed mortgage, insurance purchase is entirely voluntary. There is evidence that wealthier, Whiter households are more likely to purchase flood insurance. There is also evidence that compliance inside the floodplain is low. As a result, we expect that certain communities (e.g., less wealthy, less white) may be more vulnerable to flood impacts, so we tried to identify areas with high expected

uninsured flood damage (absolute) as well as a function of property value. This approach allows for input variables beyond traditional approaches that do not consider social vulnerability.

Outreach and Engagement

American Meteorological Society Annual Meeting 1st Presidential Session on Environmental Justice (Houston, TX/virtual)—January 2022

- This presidential-level session was the first of its kind at the American Meteorological Society Annual Meeting. The session was convened and co-chaired by PI Dello and Dr. Gaige Kerr from George Washington University. PI Rivers was a panelist along with Dr. Bob Bullard, Dr. Bakeyah Nelson from Climate Imperative, and Dr. Matthew Tejada from EPA. It was moderated by Dr. Raj Pandya from the American Geophysical Union's Thriving Earth Exchange.

North Carolina State University's Center for Human Health and the Environment (CHHE) Annual Symposium (Raleigh, NC)—February 2022

- Lead PIs Dello, Runkle, and Rivers participated on a 90-minute panel during the CHHE's Annual Symposium to introduce the North Carolina climate and health community to the C3HE team and project.

Catawba-Wateree Water for All Summit (Richburg, SC)—March 2022

- PIs Dello and Sebastian presented research on future climate and flooding in the Catawba-Wateree Basin at the annual Water for All summit.

PBS NC State of Change Screening and Panel on Climate Change in North Carolina (Raleigh, NC/North Carolina Museum of Natural Sciences)—April 2022

- PIs Dello, Hino, and Advisory Board member Dr. Amanda Martin participated on a panel following the premiere screening of PBS NC State of Change series, which also featured Dr. Hino's research on sunny-day flooding. This was PBS NC's most-attended event in the history of their programming.

NC Breathe Conference on *Health, Equity, and the Climate Crisis* (Catawba College, NC)—April 2022

- PI Cawley participated in a panel discussion around innovative mapping tools and applications that can be used to advance health and equity solutions. PI Runkle participated in a panel discussion moderated by Senator DeAndrea Salvador, NC Senate District 39, Charlotte, to introduce the new NOAA RISA Carolinas Collaborative on Climate, Health, and Equity (C3HE) to advance climate resilience and health equity in the region.

Keynote Speaker at the 18th Annual SC Upstate Research Symposium on *The Future of Public Health in the Climate Crisis* (Spartanburg, SC)—April 2022

- At the annual symposium, PI Runkle presented on the 21st-century vision for public health that involves addressing the root causes of health inequality and climate injustice. She concluded that the climate crisis has the potential to dramatically improve public health and transform our most vulnerable communities into thriving and resilient ecosystems.

Research Presentation at the European Geophysical Union Annual Conference (Vienna, AT)—May 2022

- PI Sebastian attended the European Geophysical Union 2022 Annual Meeting in Vienna, Austria, where she presented our preliminary framework for mapping community exposure to compound extreme heat and flood hazards in the Carolinas. At the conference, she attended networking sessions within the multi-risk community of scientists studying multi-hazards and compound and correlated climate extremes, as well as their community impacts.

Plenary Speaker at the Universities Conference on Water Resources (Greenville, SC)—June 2022

- At the annual conference of the Universities Council on Water Resources, PI Dello presented the team's approach to integrating climate, health, and equity to advance climate resilience.

Workshops and Other Events

Creating Solutions for the Global Blue Economy (Morehead City, NC)

Members of the C3HE team collaborated with partners from the Department of Marine, Earth, and Atmospheric Science, the NC State Coastal Resilience Initiative, First Flight, North Carolina Sea Grant, and others on the Creating Solutions for the Global Blue Economy workshop. This event was held in Morehead City, NC, on March 25–26, 2022. The purpose of this workshop was to engage students in the development of solutions for innovating the blue economy. Throughout the two days, students collaborated with experts in marine technology and coastal science to brainstorm issues our coastal economy is currently facing. The two-day event resulted in research projects that the student teams are encouraged to continue to develop in the academic year, with support from the project partners.

Raleigh/Durham Urban Heat Island NOAA/National Integrated Heat Health Information System (NIHHIS) Campaign Follow-Up

Partners hosted a public webinar to disseminate results from the 2021 HeatWatch Campaign, featuring short talks, reflections, and initial analysis of data by partners from the Museum of Life and Science (MLS), Activate Good, Climate Adaptation Planning + Analytics

(CAPA) Strategies, North Carolina State Climate Office (NCSCO), Durham County, and the City of Raleigh. Using heat sensors mounted on their own cars or bikes, volunteer citizen scientists, led by a team of local partners in each city, citizen scientists traversed their neighborhoods in the morning, afternoon, and evening on one of the hottest days of the year. The sensors recorded temperature, humidity, time, and the volunteers' location every second.

New data and maps created by the campaign were disseminated and are available on the NCSCO [webpage](#) and both cities' webpages for public use. Partners proactively worked with local neighborhoods to organize smaller-scale community-engaged meetings, listening sessions, and interactive data analysis with collaborators across the study area. This included more localized dissemination of results at neighborhood association and commission meetings. Reporting the results to residents and community leaders was intended to provide a deeper dive into and enhanced access to data about the places where they live, as well as building understanding, capacity and trust for collaboration and future partnership, and increasing efficacy and confidence in using tools and understanding localized hotspots revealed by the data.

The Raleigh/Durham Urban Heat Island team also worked with DataWorks NC to reanalyze and interpolate data into the Durham Neighborhood Compass for further public access. Durham partners also reanalyzed data for Durham County's website, presented data to the county commissioners and to City Council, and began incorporating data into the 2023 Community Health Assessment. Presentations were given to Raleigh neighborhood organizations. A public data hackathon using the heat data collected was conducted in April at Morehead Planetarium at the University of North Carolina.

Durham's Neighborhood Improvement Services (NIS) has begun using maps and data to continue to engage neighborhoods, advocates, and residents in education and in bi-directional approaches to understanding priorities for heat mitigation in the future into their neighborhood forums. In Raleigh, the data were reanalyzed into new publicly available interactive GIS maps and placed onto the city's new webpage about urban heat. Both cities involved in the campaign continue to coordinate with urban forestry, parks, data and GIS departments, and local health departments to continue to develop effective public messaging, outreach, and mitigation strategies. Decision-makers and planning departments in both cities have been briefed and are considering these data in future planning decisions.



Impact: Raleigh City Council voted to authorize \$70,000 to treat streets that were identified as hotspots during the urban heat mapping campaign, championed by the city's

sustainability director, Megan Anderson. Ms. Anderson was also a key partner on the heat mapping project, which helped ensure that the data would inform future city policy.

Supporting the Southeast Climate Adaptation Science Center's Global Change Fellowship

NC State University is home to both C3HE and the Department of the Interior's Southeast Climate Adaptation Science Center (SE CASC). Each year, SE CASC hosts an incredibly successful and competitive Global Change Fellows program, which targets a diverse pool of 10 to 12 interdisciplinary climate and global change graduate students at NC State University. The selected fellows start their academic year in a weeklong intensive fellows experience in the field. During the school year, they participate as a cohort in training events, immersive experiences, and research intensives. In partnership with SE CASC leadership, the C3HE was invited to add one NC State graduate student to the 2022–2023 fellows cohort. PI Dello's PhD student, Lily Raye, will join the cohort for this academic year. In return, the C3HE will help support the weeklong field intensive in Beaufort, NC, and will invite the fellows cohort to relevant events throughout the academic year. We plan on leveraging the respective capacity and expertise of each of our centers throughout the life of our grant through collaborative events and check-ins to reduce duplication.

Next Steps

- We will continue with planned community engaged activities in our scoped communities of the Eastern Band of Cherokee Indians; Greenville County, SC; Northeastern North Carolina; and Bucksport, SC.
- The C3HE team is planning a three-day summer experience for students, especially representing Historically Black Colleges and Universities (HBCUs) and primarily undergraduate institutions (PUI). The intent is to build a pipeline from HBCU and PUIs to some of the regional R1 institutions for mentorship and career experience and to reduce barriers in considering and applying to graduate school. The main theme of this three-day summer student experience is environmental justice. All activities planned will correspond to this learning area.

The first full day will start off with a tour of North Carolina Central University's campus and a meeting with local advocates for environmental justice in the community. After that, students will head to the Museum of Life and Science for an interactive afternoon in the exhibits, with a focus on learning how their actions affect the environment. Day 2 will be about climate, starting off with a tour of the National Weather Service's and North Carolina State Climate Office's facilities and ending with presentations about careers in climate science at the Hunt Library. On the morning of the final day, students will meet city leaders who have careers in diversity, equity, and inclusion.

This experience will equip students with the resources and connections they need to pursue a career in the climate resilience space. They will also learn about environmental justice issues on a local level and hear from academic researchers and government leaders on how these issues are being addressed by advancing science and policymaking.

Our intention for this experience is to create an annual event that brings together students from underrepresented institutions to build their capacity for knowledge and understanding of climate science and research, as it relates to justice, equity, diversity, and inclusion.

Evaluation

PI O’Connell is leading project evaluation efforts. We will be borrowing from an existing framework to evaluate the scientific impact of community-informed climate resilience projects by capturing evaluation data on the following domains: 1) Disseminating Science, 2) Creating Awareness, 3) Catalyzing Action, 4) Effecting Change, and 5) Shaping the Future. A description of evaluation metrics and aims for each year of the project is included in Tables 3 and 4.

Table 3. Description of planned evaluation methods distributed by group and timeframe for C3HE programming.

Evaluation Metrics and Aims for C3HE Programming			
Group	Initial First Year	Process (Ongoing, Annual, or Intervals Across the Project)	Outcomes (Fifth Year)
Select Community Partners and Projects	<ul style="list-style-type: none"> Participant observation Community life histories Community’s choice of initial evaluation (select semi-structured interviews, focus groups, or surveys) 	<ul style="list-style-type: none"> Participant observation Focus groups Semi-structured interviews with leaders/ organizers Surveys 	<ul style="list-style-type: none"> Participant observation Community life histories Repeat of community’s choice of initial evaluation (select semi-structured interviews, focus groups, or surveys)
C3HE Team	<ul style="list-style-type: none"> Career life histories Surveys 	<ul style="list-style-type: none"> Participant observation Semi- structured interviews Surveys 	<ul style="list-style-type: none"> Career life histories Surveys
Community Advisory Board	<ul style="list-style-type: none"> Surveys 	<ul style="list-style-type: none"> Survey Participant observation 	<ul style="list-style-type: none"> Survey Semi-structured interviews
C3HE Students	<ul style="list-style-type: none"> Surveys 	<ul style="list-style-type: none"> Surveys Focus groups 	<ul style="list-style-type: none"> Surveys Focus groups

Table 4. Descriptions of factors and metrics that evaluation methods will collect and assess for by group and timeframe for C3HE programming.

Evaluation Metrics and Aims for C3HE Programming			
Group	Initial (First Year)	Process (Ongoing, Annual, or Intervals Across the Project)	Outcomes (Fifth Year)
Select Community Partners and Projects	<ul style="list-style-type: none"> • Determine past and ongoing equity issues • Document needs, past experiences, fears, and hopes • Identify potential strengths and barriers (including capacity, cohesion, or dissent) • Measure knowledge, buy-in, connection, concern, and flexibility (form will be dependent on community's choice for initial evaluation methods) to establish baseline 	<ul style="list-style-type: none"> • Track progress on project goals (identified by the RISA scientists and the community partners) • Detect changes in needs, fears, and hopes • Continue to collect measures of knowledge, buy-in, connection, concern, and flexibility (form will be dependent on community's choice for initial evaluation methods) to determine points/process of change over time 	<ul style="list-style-type: none"> • Record community's experience of project, community and team roles, and outcomes • Evaluate the role of needs, past experiences, fears, and hopes on outcomes • Assess whether initially identified past and ongoing equity issues were validated and whether or not they played a role in outcomes • Assess whether initially identified strengths and barriers were validated and whether or not they played a role in outcomes • Analyze final measures of knowledge, buy-in, connection, concern, and flexibility (form will be dependent on community's choice for initial evaluation methods) to determine overall change over time • Count impacts in traditional and social media
C3HE Team	<ul style="list-style-type: none"> • Document past experiences, training, hopes, and concerns • Measure baseline on adaptation and equity beliefs, community participatory collaborations, decision-making and knowledge-generation styles, and interdisciplinary thinking 	<ul style="list-style-type: none"> • Capture experiences, reflections, hopes, concerns, and successes through research and engagement in program projects and work with community partners • Continue to collect measures of adaptation and equity beliefs, community participatory collaborations, decision-making and knowledge-generation styles, and interdisciplinary thinking 	<ul style="list-style-type: none"> • Assess outcomes for team members • Evaluate whether past and program experiences, reflections, hopes, concerns, and successes played a role in outcomes • Analyze final measures of adaptation and equity beliefs, community participatory collaborations, decision-making and knowledge-generation styles, and interdisciplinary thinking to determine overall change over time

Community Advisory Board	<ul style="list-style-type: none"> • Measure baseline on adaptation and equity beliefs, community participatory collaborations, decision-making and knowledge-generation styles, and interdisciplinary thinking 	<ul style="list-style-type: none"> • Continue to collect measures of adaptation and equity beliefs, community participatory collaborations, decision-making and knowledge-generation styles, and interdisciplinary thinking 	<ul style="list-style-type: none"> • Analyze final measures of adaptation and equity beliefs, community participatory collaborations, decision-making and knowledge-generation styles, and interdisciplinary thinking to determine overall change over time • Collect and assess experiences and reflections of individual Advisory Board members and projected outcomes on their future engagements and commitments
C3HE Students	<ul style="list-style-type: none"> • Measure baseline on adaptation and equity beliefs, community participatory collaborations, decision-making and knowledge-generation styles, and interdisciplinary thinking 	<ul style="list-style-type: none"> • Continue to collect measures of adaptation and equity beliefs, community participatory collaborations, decision-making and knowledge-generation styles, and interdisciplinary thinking • Capture experiences, reflections, hopes, concerns, and successes through study and engagement in program projects and work with communities 	<ul style="list-style-type: none"> • Analyze final measures of adaptation and equity beliefs, community participatory collaborations, decision-making and knowledge-generation styles, and interdisciplinary thinking to determine overall change over time • Evaluate the role of students' experiences, reflections, hopes, concerns, and successes through study and engagement in program projects and work with communities in their future plans, commitments, and employment plans