NC STATE UNIVERSITY

Citizen Science Campus





Leadership in Public Science

Innaugural Year **2019 - 2020**

CITIZEN SCIENCE CAMPUS

NC State is the pioneer of Citizen Science Campus, an innovative program that aims to simultaneously increase the research capacity of the university and enhance the undergraduate experience. Citizen science can enrich student life while increasing research, discovery and innovation. The Citizen Science Campus program embeds citizen science opportunities in campus life and makes the campus an incubator for new projects.

The Citizen Science Campus vision includes offering every NC State undergraduate an authentic experience with scientific research, helping NC State researchers grow the scope and power of their projects, and creating knowledge for communities across North Carolina

We are managing campus life opportunities in the following categories:

FEATURED PROJECTS

We offer programming each month around the featured projects in collaboration with the Citizen Science Club and NC State University Libraries and their makerspace.

UNDERGRADUATE RESEARCH EXPERIENCES FOR CREDIT

We offer guidelines for faculty in any department to mentor students in earning independent research credits via participation in citizen science projects.

COURSES WITH CITIZEN SCIENCE EXPERIENCES

STEM and non-STEM courses are leveraging citizen science projects to fulfill course objectives.

COMMUNITY SERVICE-LEARNING CREDIT

We are supporting Residence Halls that want to offer citizen science options for their service learning experiences.

CITIZEN SCIENCE EQUIPMENT AND KITS

NC State University Libraries stock equipment (sensors, lenses, gauges, etc.) for students to borrow for citizen science projects.

FACULTY AND STAFF WORKSHOPS

We offer on-campus workshops to acquaint NC State faculty and staff with ways to offer citizen science opportunities to undergraduate students.



Cutting-edge research: Advancing microbiology, biochemistry, engineering, ecology, wildlife management, entomology, ornithology, urban ecology, conservation, environmental justice, and more.



Innovative STEM curriculum across campus.

Engaged campus life fostering habits of lifelong learning, with citizen science to take home. Students encounter citizen science opportunities in residence halls, clubs, libraries and more.

CITIZEN SCIENCE IS AN OLD PRACTICE, REVIVED WITH MODERN TECHNOLOGY, AND GIVEN A NEW NAME.

Citizen science refers to multiple ways that nonscientists and scientists collaborate to advance scientific research. A common form of citizen science is crowd-based, meaning hundreds to millions of people contribute observations to shared databases for varied purposes including biodiversity monitoring and answering hypothesis-driven questions in medicine, astronomy, biochemistry and more. Another form of citizen science is community-based in which neighborhood and community organizations collaborate with scientists to gain knowledge to address a local problem. An overlooked value of citizen science is that the researchers become public scientists with an expanded set of interdisciplinary skills, societal roles, and transformed approaches to the research process that lead to discoveries that are not possible by the conventional scientific mindset or methods. NC State's Leadership in Public Science is a Chancellor's cluster program with faculty in four colleges, and affiliates across campus, who teach and mentor to ensure NC State STEM graduates have the skills of public science.



As an undergraduate student at NC State, **Caren Cooper was** an intern studying black bears at the Pisgah Bear Sanctuary. Cooper helped supervise field assistants who were volunteers for the Earthwatch Institute, an international environmental charity. Today, these assistants are known as citizen scientists.

MEET THE DIRECTOR: CAREN COOPER

Decades later, Dr. Cooper returned to NC State as an associate professor and leader in the field of citizen science. Her mission is to make engaging in discovery a possibility for everyone.



THE COLLECTIVE EFFORT LEADS TO SHARED EXPERIENCES AND DISCOVERIES, WHICH BRINGS WHAT'S MOST NEEDED: A UNIFIED UNDERSTANDING OF THE WORLD.





Cooper has two books about citizen science. One book has a Spanish edition.

MEET OUR STUDENT STAFF



BRIANNA JOHNS, COORDINATOR

Brianna Johns is an undergraduate student at NC State pursuing a B.S. in Zoology and B.A. in International Studies. She is cofounder of the Citizen Science Club, the university's first undergraduate student organization focused on citizen science, and serves as program assistant to the Leadership in Public Science faculty cluster. In addition, Brianna was awarded a grant for the 2019-2020 academic year from NC State's Office of Undergraduate Research to study university student perspectives on citizen science.



CAMERON BOWEN, CONTENT SPECIALIST

Cameron Bowen joined the Citizen Science Campus team in October 2019. He received his B.A. in English from NC State and is currently pursuing his M.S. in Technical Communication. Cameron's hobbies include cheering on the Wolfpack and spending time with his dog, Olsen.



MEET OUR PARTNERS

MEET OUR TECH PARTNER

The Citizen Science Campus program benefits from a partnership with **SCISTARTER**, **LLC**. Through the NC State SciStarter Portal, individuals with a Unity ID can access their customized account and dashboard. Faculty can assign citizen science projects to students in their courses, while students can track their contributions as part of a class, residence hall, or research project, or simply participate in a project of their choosing. The portal also allows instructors and institutions to keep track of their students' efforts.

MEET OUR CAMPUS PARTNERS FOR COMMUNITY ENGAGEMENT

WAKE COMMUNITY-UNIVERSITY PARTNERSHIP (WAKECUP), directed by Dr. Kwesi Brookins, generates intentional and reciprocal partnerships by connecting faculty and students to community-identified needs.



THE SCIENCE HOUSE provides programs, materials, and equipment loans for teachers and students across North Carolina to empower scientific literacy and hands-on discovery. The Science House provides teacher professional development that introduces current and relevant Citizen Science projects that are great to incorporate in K-12 classrooms. Dr. Jason Painter serves as director of the Science House.





CITIZEN SCIENCE CLUB AT NC STATE

The first student organization of its kind, **Citizen Science Club** serves undergraduates at NC State. Citizen Science Club is based on the idea that "Science is for Everyone," and stresses that science can be an interdisciplinary endeavor. The club organizes events, programs, trainings and field trips focused on citizen science. Students who join the club are ambassadors for the **Citizen Science Campus** program, bringing citizen science outside of the university to schools and organizations in Raleigh.





"I love the potential the club has and the great initiatives we have undertaken so far. The club truly lives by the motto 'SCIENCE IS FOR EVERYONE!', and that shows in the diversity of people and majors. I am excited to see what the club will accomplish in the future!"

> Mike Lewis, Founding Member, Graduate Class of 2021







"My time in Citizen Science Club has been really cool! As a firstyear student I have been to a lot of different clubs and I feel like this was the first club I joined where everybody felt like a family. I started Citizen Science Club without knowing anybody but as I started attending more and more meetings and events, I feel like I have gotten closer to everyone. It just has such a great group dynamic!"

> Madeline Kohls, First-Year Club Member, Undergraduate Class of 2023

RESEARCH PROJECTS

Citizen science enables research that would otherwise be impossible. A single scientist, or even a small team of scientists, cannot be the eyes, ears, noses and sensors over large spatial and temporal scales. They cannot be in every backyard, drainpipe or bellybutton. When people volunteer to help scientific research, they do not need to become science experts. They only need to be experts of their local environment. At NC State, scientists in three colleges and several institutes and centers have expanded to new research frontiers through the power of citizen science. In the following pages, we spotlight some of the university's faculty and the impact of their citizen science research projects across campus, North Carolina and beyond.



The following NC State institutions are engaged in citizen science research:

- COLLEGE OF NATURAL RESOURCES
- COLLEGE OF AGRICULTURE
- COLLEGE OF SCIENCES
- INSTITUTE FOR CLIMATE STUDIES
- CENTER FOR GEOSPATIAL ANALYTICS
- > NC CLIMATE OFFICE
- **EXTENSION**

Science is our most reliable system for discovery, and because it has brought us to a pinnacle of health and comfort, it might seem like all research frontiers have been explored. But that's not the case. There will always be more unknown than known. Scientists are most challenged when addressing mysteries at large geographic scales, long time periods, uncommon phenomena, overloaded with volumes of digital data, or facing puzzles too challenging for all but a network of minds to conquer. In these ways, citizen science extends exploration deeper into the unknown. Citizen science is not redundant with traditional science. It is about leveraging all sorts of people in making discoveries that would otherwise not be possible. There are too many unanswered questions and too many urgent answers needed for us to rely on scientists alone. Citizen science is a call for all hands-on deck.

THE GLOBAL SOURDOUGH PROJECT



ROB DUNN College of Agriculture and Life Sciences



ERIN MCKENNEY College of Agriculture and Life Sciences

560

samples

4 continents





survey respondents

Humans have baked bread for over 10,000 years. All over the world, different cultures bake their own unique breads – and have for centuries – and yet we know almost nothing about the microbes that truly make a traditional sourdough bread. In this project, participants will grow their own sourdough starter from scratch just by mixing flour and water. For two weeks, participants will measure the height and pH of the starter to track the growth of their "microbial zoo" over time and share data with scientists. Scientists have identified organisms in each of the hundreds of starters from around the world.





CANDID CRITTERS



ROLAND KAYS Research Associate Professor College of Natural Resources





1.9 million



.....



7 publications



North Carolina's Candid Critters is a camera trap survey of wildlife in North Carolina. The project works with citizen science volunteers of all ages and backgrounds to set camera traps (motion and heat sensitive trail cameras) around the state. Citizen scientists get to explore the outdoors and learn about the critters living in their community, while helping researchers gain information that can be used for conservation and management purposes. Cameras are set out for three-week periods, and all images are reviewed and uploaded by citizen science volunteers in a custom software program called eMammal.



CAT TRACKER

Cat Tracker is a citizen science project that seeks to understand the processes behind domestic cat behavior and movement. Scientists rely on volunteer cat owners to place small backpacks on their cats. Each backpack allows the collection of movement data through GPS and accelerometer tags. This project has been featured by numerous media outlets over the years, including National Geographic.







2 publications

CARDINAL CAPTURE



CAREN COOPER Associate Professor College of Natural Resources



CROWD THE TAP

The mission of Crowd the Tap is to ensure safe drinking water in the United States. Volunteers can make their home part of the national inventory of water pipe materials. The inventory will help prioritize areas for tap water testing and infrastructure replacement. Volunteers can also report on tap water chemistry with off-the-shelf kits and become eligible for discounted testing of lead in tap water.

Cardinal Capture volunteers help examine the potential effects of light and noise pollution on avian health in the Triangle area. Researchers capture, assess health, and release Northern Cardinals in yards during the day. Volunteers use a light meter to measure outdoor light pollution at night.







SPARROW SWAP

Sparrow Swap aims to engage bluebird nest box monitors across the United States in finding ways to improve control of an avian pest, the House Sparrow. Volunteers monitor birdhouses, remove House Sparrow eggs (and sometimes swap in fake eggs in their place) and send those eggs to NC State for analyses of heavy metal pollution.









SOUND AROUND TOWN

Sound Around Town seeks to improve the National Park Service's understanding of how people perceive natural and anthropogenic sounds. Scientists rely on volunteers to host recording devices in their yards and to carry out periodic listening sessions during which they identify and rate sounds. This project is coordinated by Dr. Caren Cooper.





SUDDEN OAK DEATH (SOD) BLITZ



ROSS MEENTEMEYER Goodnight Distinguished Professor of Geospatial Analytics Center for Geospatial Analytics, College of Natural Resources

Citizen scientists help forecast the spread of the emerging infectious disease, Sudden Oak Death. These volunteers learn to detect an important pathogen and collect symptomatic vegetation in the annual "Sudden Oak Death (SOD) Blitz." Scientists use the data to develop and update predictive maps of disease risk that prioritize management efforts.













COMMUNITY COLLABORATIVE RAIN, HAIL AND SNOW NETWORK

The Community Collaborative Rain, Hail and Snow Network (CoCoRaHS) is a unique, nonprofit, community-based network of volunteers of all ages and backgrounds working together to measure and map precipitation — rain, hail and snow. By utilizing low-cost measurement tools, an interactive website, and training and educating the public, the organization aims to provide the highest quality data for natural resource, education and research applications. CoCoRaHS is now operating in all 50 states.





DARRIAN BERTRAND Applied Climatologist and NC CoCoRaHS Co-coordinator State Climate Office of NC, College of Sciences









THE DELFTIA PROJECT: THE MICROBE THAT POOPS GOLD



CARLOS GOLLER Assistant Teaching Professor College of Sciences





It almost certainly sounds made up, but it isn't. A bacterial species of the genus Delftia can precipitate gold out of solution. Let them grow in water with gold, and they accumulate gold. All of this we know. We also know the genes that Delftia uses to accomplish this incredible feat. But here is the rub: We don't really have a clue where *Delftia* lives, how many species of *Delftia* there might be, or how important this gold-pooping power is for *Delftia*. Volunteers go on guests to find *Delftia* by carefully swabbing samples from across the NC State campus, identifying the microbe in places scientists did not think to look.





e nsus

THE CYCLONE CENTER PROJECT



CARL SCHRECK Research Assistant Professor North Carolina Institute for Climate Studies, College of Sciences

The Cyclone Center project was launched in September 2012 with the goal of studying global tropical cyclones in order to better understand and predict their behavior. The project ran for seven successful years on the Zooniverse platform, during which 18,000 users contributed 1 million image classifications.











TRIANGLE BIRD COUNT



MADHU KATTI Associate Professor of Leadership in Public Science College of Natural Resources



MOSQUITO BYTE

The Triangle Bird Count is a citizen science project to help monitor the abundance and diversity of bird species in urban habitats modeled after several other Urban Bird Counts already being conducted in North America. This is a new project from NC State University's Reconciliation Ecology Lab, dedicated to mapping the distribution and abundance of bird species in and around the cities of North Carolina's "Research Triangle": Raleigh, Durham, Chapel Hill and surrounding municipalities.







MARTHA AND MICHAEL REISKIND College of Agriculture and Life Sciences

This is a smartphone application for Apple or Android phones that allows the user to record a mosquito bite in time and space by simply pressing a button. This record is sent to a map that allows scientists to examine the pattern of mosquito bites. No personal information is collected. This tool can benefit mosquito control agencies in protecting people from mosquitoes and the pathogens they transmit.



SENTINELS OF THE SOUNDS



MARCELO ARDON SAYAO Associate Professor College of Natural Resources

Sentinels of the Sounds is a citizen science project that launched in October 2016 with the goal of collecting as many photos of cypress trees as possible. Participants have submitted more than 70 observations since then via the iNaturalist app. These observations have been collected by some 350 students enrolled in Ardon's "Introduction to Environmental Sciences" course and will help ground truth a remotely sensed classification system that maps ghost forests and to examine changes in cypress stands over time.



A TREE'S LIFE: CITIZEN SCIENCE FOR HEALTHIER TREES

STEVE FRANK Professor and Extension Specialist College of Agriculture and Life Sciences

More than 200 citizen scientists are monitoring the growth of red maples with dendrometers to help NC State researchers understand how climate and urbanization affect tree growth and health as well as the services that trees provide, like carbon sequestration. This project has appeared in two publications.





A Tree's

LIFE

SHARK TOOTH FORENSICS



TERRY "BUCKY"GATES Assistant Teaching Professor North Carolina Institute for Climate Studies, College of Sciences

Shark Tooth Forensics is a K-12 citizen science outreach program that allows students to collect simple measurements from thousands of shark teeth from a single site in North Carolina and enter them into a database. This program is supported by the University and the National Science Foundation's Diversity mini-grant titled, "Fostering Recruitment of Underrepresented students with Fossils."



HOFMANN OPEN WATER LABORATORY PROJECT



MEREDITH HOVIS Lecturer College of Agriculture and Life Sciences

The Hof mann Open Water Laboratory (HOWL) Project was created by a group of local researchers, students, conservation groups and community members who are interested in Hofmann Forest's importance in the North Carolina coastal community, as well as the impacts of land-use change on water quality of the White Oak, New, and Trent Rivers in eastern North Carolina.



LIBRARIES

NC State University Libraries are an integral part of the Citizen Science Campus by loaning tools, sharing kits and hosting training for students and instructors.

STAFF:



DANICA LEWIS

AVAILABLE EQUIPMENT:



KAREN CICCONE



TISHA MENTNECH



RTL SDR Software Defined Radio Scanner



Checkmate Sound Pressure Level Meter







Celestron Handheld Microscope



TEACHING

Citizen science in classrooms can improve learning outcomes. Students learn more through experiences that are relevant to the real world. We envision the Citizen Science Campus program to result in:

- More students encountering citizen science in STEM and non-STEM classes
- Curricular citizen science becoming an effective gateway to lifelong science learning
- Increased recruitment and representation of underrepresented students in STEM majors

At NC State, educators in STEM and non-STEM classrooms are designing innovative and impactful learning experiences by including citizen science projects in their courses.

NC STATE UNIVERSITY

College of Natural Resources

NC STATE UNIVERSITY

College of Sciences

NC STATE UNIVERSITY

Humanities and Social Sciences

MEET THE INSTRUCTORS

<u>PRT 240: GEOSPATIAL</u> <u>APPLICATIONS FOR PARKS,</u> <u>RECREATION AND TOURISM</u> 25 students, Fall Course



JELENA VUKOMANOVIC

<u>COM 289: SCIENCE</u> <u>COMMUNICATION AND</u> <u>PUBLIC ENGAGEMENT</u> 70 students, Spring Course



JEAN GOODWIN

ENG 101: ACADEMIC WRITING AND RESEARCH

38-57 students, Fall and Spring Course



CHELSEA KRIEG

<u>FW221: CONSERVATION OF NATURAL RESOURCES</u> 270 students, Spring Course





LARA PACIFICI



CAREN COOPER

ES 100: INTRODUCTION TO ENVIRONMENTAL SCIENCES 195-275 students, Fall and Spring Course



MEGAN LUPEK

BIO 105: BIOLOGY IN THE MODERN WORLD

~250 students, Fall and Spring Course



TERRY "BUCKY" GATES



ZAKIYA LEGGETT

ENG 333: COMMUNICATION FOR SCIENCE AND RESEARCH 23 students, Fall and Spring Course



CAITLIN STUCKEY



STEPH JEFFRIES

BIO 181: INTRODUCTORY BIOLOGY: ECOLOGY, EVOLUTION AND BIODIVERSITY 240 students, Fall 2019



MILES ENGELL

citizenscience.ncsu.edu citizensciencecampus@ncsu.edu