



EDUCATION TO ACTION

BY DIANA HACKENBURG

This year, the dog days of summer seemed to drag on forever. The intense heat was no mirage: we sweated out the state's second-hottest summer on record, with unusually warm temperatures continuing into October.

But according to the National Climate Assessment, future summers could melt this one right off the charts.

What will the North Carolina coast feel — and look — like in fifteen years? Thirty years? A hundred years? As surely as the sand on our beaches shifts over time, so too will our communities, economies and environment. With change inevitable, North Carolina Sea Grant is working with communities to make plans and choices that will sustain our coastal and ocean resources.

Like climate change, many of the natural-resource management problems we face in North Carolina are complex, requiring not only sound research and policy but also community support. "Our mission is to help improve management decisions — and we can't do that without the public understanding the issues," explains Susan White, Sea Grant executive director.

"By actively working with communities, we can help them better understand the science underpinning policies," White adds.

From "pre-K to gray," Sea Grant strives to bring science where it can make a difference. "Sea Grant has very important resources for helping people solve real-world problems," Koch notes.

TEACH THE TEACHER

A common adage says: If you give someone a fish, they eat for a day; teach them to fish and they eat for a lifetime.

Teach them how to instruct others to fish — and you enable the world to eat.

Sea Grant teaches educators how to share science with their students. "I work with teachers and nonformal educators to make sure they feel comfortable teaching their students about the ocean and our coast," explains Terri Kirby Hathaway, marine education specialist for North Carolina Sea Grant.

Hathaway shares ways to help students understand how activities inland affect the coast and vice versa. She also ties these concepts to many parts of the K-12 curriculum. "If I can get teachers to use the ocean and estuaries to teach all their subjects, that's really going to make a difference," Hathaway concludes.

Another hallmark of many Sea Grant programs is place-based education, or connecting student learning to the local community, often through hands-on activities. Learning in this way has a longer-lasting impact according to Liz Baird, chief of school and lifelong education for the North Carolina Museum of Natural Sciences.

"The best learning opportunities engage people's minds in terms of learning knowledge, their hearts in terms of creating passion, and their hands in terms of giving them the skills and abilities to do things. Place-based and hands-on learning ties those three things together almost seamlessly," explains Baird, who also is a past chair of Sea Grant's advisory board.

Feeling the pressure to meet state standards, teachers may not pursue these types of learning, or even environmental literacy more generally. "Teachers report having very little time to do additional activities outside the classroom or the standard curriculum," reports Lisa Tolley of the N.C. Department of Environmental Quality's Office of Environmental Education and Public Affairs.

"Sea Grant helps teachers integrate environmental concepts in their classrooms by providing resources critical for increasing environmental awareness of coastal ecosystems and issues through its research, outreach and education."

ASKING QUESTIONS, FINDING ANSWERS

Climate literacy represents a new area where Sea Grant may be well positioned to deliver those resources, starting with basic research into the what — and who — of effective communication.

Rather than focusing on how communities can become more resilient as the climate changes, arguments over the terminology and science can cloud perceptions. Nils Peterson and Kathryn Stevenson of NC State University, along with an interdisciplinary team of fellow researchers, educators and partners, have found reason to hope

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"We also can better understand their needs and help them engage with the data-gathering process. Public education provides an avenue to change both policy and the personal ways we interact with our environment."

This emphasis on environmental literacy is not confined to North Carolina. The key to changing behavior, according to Louisa Koch, director of education for the National Oceanic and Atmospheric Administration, is education. "We work to understand Earth's systems so we can support better management of the planet to protect lives and property. Our information has little value if people don't use it to make better decisions."



• **LEFT:** A student from Cape Fear Middle School holds marine debris collected from a beach in Hawai'i. • **ABOVE:** Summer camps introduce North Carolina students to environmental and ocean-literacy topics such as plastic debris.

amid the climate change challenges: middle-school students.

"Middle school seems to be the sweet spot," explains Stevenson, a former educator. "These students combine the wonder and excitement of younger kids with the cognitive ability of older students — without being jaded."

White adds that, "middle school is a key period of science learning — not just from a curriculum standpoint but also from a sociological perspective." They may not be old enough to vote, or even drive, but these early adolescents listen, learn and decide for themselves how to view the world.

A Sea-Grant funded survey of environmental literacy in middle-school students initially launched Stevenson's interest and career in this research. She has since worked on two other Sea Grant-funded projects, while also transitioning from doctoral student to post-doctoral researcher to faculty member — all at NC State.

Those projects resulted in multiple surveys, new lessons for bringing climate into the classroom and now, an effort to engage students in service-learning as a way to literally bring the message home to the students — and their families. Read more about this research on page 9.

"Not only has this sequence of research built and enhanced strong partnerships within North Carolina, it also has generated results that stand the test of peer-reviewed publications. Requests for training and presentations are coming in from educators' organizations, such as the Environmental Educators of North Carolina and the Southeastern Environmental Education Alliance," adds John Fear, deputy director for Sea Grant.

"Ultimately, we want our work to make a difference on the ground," Stevenson says. "We're seeking to develop best practices for teaching climate change by understanding what teachers need and what is practically going to work to create change in communities."

EDUCATION TO ACTION

Creating change in the classroom — and in a community — all comes down to understanding people's interests. "People want to partner with organizations to find solutions to whatever challenges they face," White says. "If you can see it in your backyard, you feel compelled to do something about it."

This cooperative approach relates to the larger philosophy behind environmental education, Tolley explains. "It's about providing people with the knowledge and skills to look at issues from all viewpoints and come to their own conclusions. It starts with building awareness, followed by knowledge, attitudes, skills and eventually participation."

White sees education as a critical piece of the Sea Grant portfolio. "We need to educate students of all ages so that they not only find successful careers but also so they can work together to sustain our state's future. Our program has had great success. We look to build on that success through new, and strengthened, partnerships."

Several stories contained within this issue of *Coastwatch* illustrate this expansion. From grants that require community



- **THIS PAGE, top:** Exploring beach erosion at Fort Fisher connects student learning with community issues.
- **THIS PAGE, bottom:** Junior Rangers explore how mushrooms form at New River State Park with Darius Pollard.
- **FACING PAGE:** Environmental literacy is important for all ages, from "pre-K to gray."

collaboration to joint fellowships with partner organizations and the rise of a network known as SciREN, Sea Grant works to frame the science so it brings people together and empowers them with information and tools they need to address real issues.

Some issues, like climate change, reach beyond our state's borders. "What we choose to do with our environment in North Carolina can influence not only our neighboring states and the entire country, but also the rest of the world," Baird surmises.

Tolley confirms that others are taking notice. "We really do hear from a lot of states that say: Wow, you guys have so much going on in North Carolina," she recounts. "When you look around, we do have a lot of opportunities that are not found in other places."

Opportunities for all ages to learn, teach and work together are valued and abundant in our state, White notes.

"How we work to sustain our coast with those resources will be the next big push," she gathers.



CLIMATE CHANGE COMMUNICATION CHALLENGES: Including Kids in Solutions

BY KATHRYN STEVENSON
AND DANIELLE LAWSON

- **Kathryn Stevenson** is a faculty member in parks, recreation and tourism management at North Carolina State University. She focuses on environmental and climate literacy, having worked as a marine-science educator in California, and as a high-school biology teacher. Her doctorate in fisheries, wildlife and conservation biology from NC State included a North Carolina Sea Grant-funded statewide survey on environmental literacy among the state's middle-school students.

- **Danielle Lawson** is a doctoral student whose Sea Grant-funded research focuses on climate literacy. She has previous experience as an informal educator. As an AmeriCorps volunteer, Lawson worked with middle-school minority students enrolled in MarineQuest camps at the University of North Carolina Wilmington.

Kids think differently than adults. New parents may notice their child delights in the seemingly mundane, squealing in unbridled joy at bouncing a ball down a set of stairs. Teenagers may be keenly aware of how their parents disparately value keeping a tidy room or making curfew. Teachers, students and parents may have varying perceptions of homework's importance.

Our research out of North Carolina State University suggests that we may be able to use these differences to build a brighter future. Since 2010, North Carolina Sea Grant has funded three projects to investigate the potential for younger generations to be part of a solution to influence acceptance of — and action on — climate change.

SHAPING PERCEPTIONS

Climate scientists agree: Climate change is happening, humans are responsible and the potential impacts will be widespread. In the Southeast, sea-level rise, extreme heat events and decreased water availability pose threats to our communities, economies and ecosystems, according to the third National Climate Assessment.

Though the science is clear, public opinion regarding climate change remains divided. Sometimes attributed to a lack of scientific knowledge, this gap actually appears to widen with increasing science literacy, according to the research. Data may be shaped to support a person's perception of climate change, but it's not why they have their opinions. Cultural worldviews and political beliefs seem to drive climate change concern more than scientific understanding.

How do these powerful worldviews and beliefs form? Our upbringing and life experiences shape the framework we use to understand and interpret the world around us. Adolescence represents the formative window during which we establish our cultural and political beliefs. During this time, kids might base their opinions on an issue less on what they inherently believe and more on what they learn.

As part of our first Sea Grant-funded study, we surveyed around 400 middle-school students in coastal North Carolina to examine this idea of how learning may influence their views on climate change. We found that as student knowledge increased, the gap in opinions about climate change associated with personal beliefs disappeared instead of widened as it does with adults. Kids with more knowledge were more likely to respond that climate change is happening and human-caused.

"This study demonstrates why I like this line of research," says Nils Peterson, the study's co-author. "Working with kids represents an opportunity to make a lasting difference."

IN THE CLASSROOM

If kids rely less on their personal beliefs than adults do when forming opinions about climate change, learning more about the science could make a real difference in driving their concern and behavior.

Project WILD, an environmental education program, fosters behaviors that respect wildlife and natural resources by developing students' environmental literacy. In a second Sea Grant-funded project, new members added to the research team — climatologists from the State Climate Office, N.C. Wildlife Resources Commission biologists and Project WILD educators — helped create a Project WILD unit for middle-school students on how climate change affects wildlife in the state.

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We then conducted professional development workshops for middle-school science teachers statewide to introduce the new curriculum. Participating teachers agreed to deliver the lessons and survey their students. Surveys measured not only how much students understood of climate change, but also their feelings about the topic and motivation to take action.

"I believe climate education is crucial to all individuals that call planet Earth home," notes April Cheuvront, an eighth-grade science teacher at Avery County Middle School in the mountains and a workshop participant. "Therefore, it needs to be integrated into the curriculum for all ages of students."

Students exposed to the new curriculum did show gains in climate-change knowledge. That new understanding seemed to increase two things: their concern for climate change and also, their hope.

"I found the lessons extremely beneficial for students to see how climate change affects North Carolina species. Too often, students believe that climate change is just a 'polar bear/penguin' issue. However, these lessons stress that many organisms will face consequences of climate change. The lessons also show how students, as individuals, can make a difference," Cheuvront explains.

This hopefulness is important because greater concern and hope seem to drive action. After the lessons, students reported they were more likely to conserve energy or choose to bike or walk instead of riding in a car. In short, the curriculum worked.

OUTSIDE INFLUENCES

But, as any parent with school-age kids knows, knowledge is not the only influence on students. Teachers can profoundly impact their students' learning.

Recent research published in *Science* shows that science teachers remain divided on climate change like the general public, with their personal beliefs influencing how they present climate change in the classroom. This raises questions about whether teachers pass on this difference in opinion to their students.

So far, our data show that students whose teachers thought climate change is happening were more likely to agree. However, teachers' beliefs in the causes of climate change had no relationship with the kids' thoughts. If teachers think climate change is happening, their students are likely to determine it is caused by human actions rather than occurring naturally, regardless of their teacher's views.

"If you just teach kids the science, they get it," says Amy Bradshaw, an NC State zoology undergraduate who co-authored a manuscript associated with this study.

And you don't have to be a teacher to get kids learning and thinking about climate change. Just talking with kids seems to help, even if you don't know all the answers.

Our research also looked at how kids' own perceptions, the perceived views among their friends and family, and frequency of discussing climate change related to their concern about the issue.

Personal perceptions most closely predict climate change concern, according to our data. If they think climate change



- **THIS PAGE, top:** Sea Grant research reveals how outdoor education can advance environmental literacy and student well-being.
- **THIS PAGE, bottom:** Marine Quest summer campers learn about climate change through service-learning projects.
- **FACING PAGE, top:** Researchers are exploring how outdoor education benefits kids and also potentially their parents.
- **FACING PAGE, bottom:** Climate literacy can influence how students perceive the risks and causes of climate change.

is happening and human-caused, kids are more likely to show concern. As shown by our earlier work, these personal perceptions of climate change can be bolstered through education.

The second most important factor related to climate change concern was how often the students talk about the topic with their friends and family. Interestingly, the actual views of their discussion partner did not matter — just having the conversations was important. Even among those who didn't think their friends and family believed in human-caused climate change, talking more about the issue helped build students' concern.

Kids' perceptions about their friends' and families' acceptance



Claire Aubel/NC Aquarium at Pine Knoll Shores



Bill Brinkmeier

of climate change also matters somewhat. Personal perceptions were most important, but knowing friends and family believe in human-caused climate change made kids more concerned.

"You don't have to be a scientist to talk to kids about climate change," Peterson explains. "Adults should share what they know, listen to any concerns, and talk about what actions can be taken to be part of the solution."

THE HERE AND NOW

Parents certainly have influence over their children, but children also influence their parents. Advertising companies have known this for years. They market foods, amusement parks and clothing to children, even though parents actually make the purchases.

Research also shows that kids can influence their parents' behaviors like recycling and leading more active, healthful lifestyles. The same principle may apply to climate change.

Our latest Sea Grant-funded study looks to evaluate how students may transfer climate knowledge and concern to their parents. We held additional professional development workshops in summer 2016 to train teachers in using our Project WILD curriculum. The research team also is working with local partner organizations to organize service-learning projects for students.

During the school year, students are conducting fieldwork, such as monitoring sea turtles or restoring wetland habitat, as a way to learn more about the effects of climate change and ways to contribute to solutions. Students will blog about their experiences in the field at go.ncsu.edu/wwcc.

"This project allows students to work with scientists, and become scientists themselves," says Amy Lawson an eighth-grade science teacher in Pender County, and co-author Danielle Lawson's sister-in-law. "My students will get hands-on experience with how wildlife and climate are impacted by nature and the actions of humans, as well as have the opportunity to build relationships within local and statewide community members."

These experiences will help students think about climate change in a local context and understand how to make a difference. Teachers also will encourage students to talk about the issue with their parents. We researchers will conduct surveys throughout the program to evaluate its effectiveness.

"Experiences such as these allow my students in the small town of Burgaw to truly feel as if their voices matter," Lawson affirms.

Climate change represents a big problem with big challenges. But there remains much hope in our children — and in our future. ■

PUBLISHED PAPERS

The North Carolina Sea Grant-funded research on climate change and middle-school children has yielded multiple peer-reviewed publications, including:

- "How climate change beliefs among U.S. teachers do and do not translate to students," *PLOS ONE*, Sept. 7, 2016.
- "Are we working to save the species our children want to protect? Evaluating species attribute preferences among children," *Oryx*, May 4, 2016.
- "The influence of personal beliefs, friends, and family in building climate change concern among adolescents," *Environmental Education Research*, April 29, 2016.
- "Motivating action through fostering climate change hope and concern and avoiding despair among adolescents," *Sustainability*, Dec. 23, 2015.
- "Overcoming skepticism with education: The interacting impacts of climate literacy on perceived risk of climate change among adolescents," *Climatic Change*, Aug. 11, 2014.

Kathryn Stevenson lists additional papers at kathrynstevenson.wordpress.ncsu.edu under Research. Select News and Updates to read media coverage, including from NPR and the *Washington Post*.