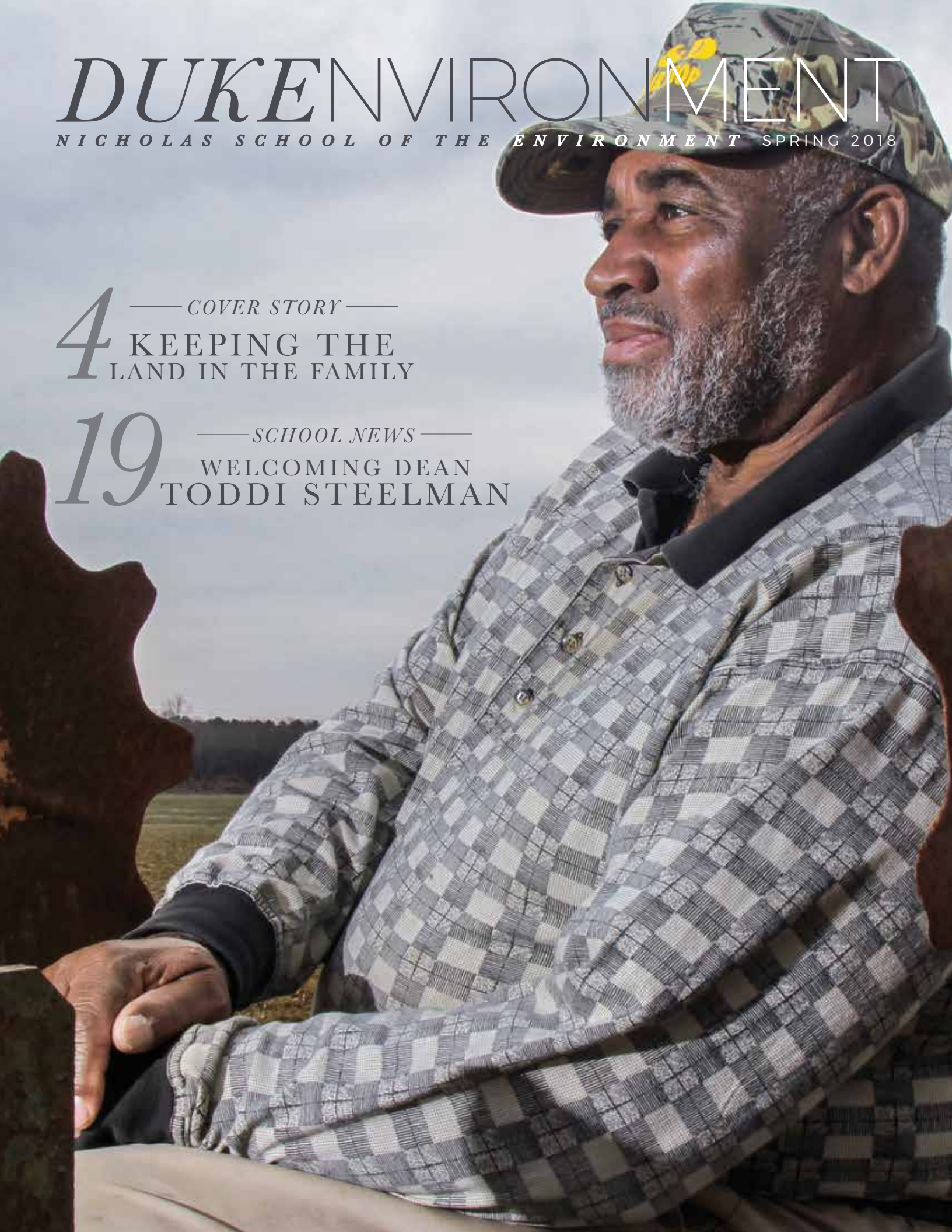


DUKE ENVIRONMENT

NICHOLAS SCHOOL OF THE ENVIRONMENT SPRING 2018

4 —COVER STORY—
KEEPING THE
LAND IN THE FAMILY

19 —SCHOOL NEWS—
WELCOMING DEAN
TODDI STEELMAN



4 —COVER STORY— KEEPING THE LAND IN THE FAMILY

22 —STUDENT STORY— NICHOLAS STUDENTS & COUNTER CULTURE COFFEE

26 —ALUMNI STORY— STORIES FROM THE MONTEREY BAY AQUARIUM

COVER IMAGE

JAMES PETERSON ON HIS LAND IN NORTHAMPTON COUNTY.

(Photo by Raul R. Rubiera) see pg.4

CONTENTS IMAGE

KYLE VAN HOUTAN IN MONTEREY BAY

(Photo courtesy of Monterey Bay Aquarium) see pg.26

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FEATURES

12

IN CLASSROOMS AND HER OWN RESEARCH, BETSY ALBRIGHT CHAMPIONS SMART DATA ANALYSIS TO SMOKE OUT HIDDEN BARRIERS TO ENVIRONMENTAL PROTECTION

18

SCHOOL NEWS
THREE NICHOLAS SCHOOL FACULTY MEMBERS NAMED TO LIST OF WORLD'S MOST INFLUENTIAL RESEARCHERS

20

Q + A WITH THE NEW DEAN
TODDI STEELMAN

32

NICHOLAS SCHOOL DEL ALUM SARA MROZ ASSISTS PUERTO RICO RECOVERY EFFORT



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KEEPING THE LAND IN THE FAMILY



NICHOLAS SCHOOL STUDENTS HELP NORTHAMPTON
COUNTY LANDOWNER MANAGE FOREST RESOURCES
TO KEEP HIS FARM ALIVE FOR FUTURE GENERATIONS

By LILY HUFFMAN MEM'19 *Photography by* RAUL R. RUBIERA



JAMES PETERSON HAS BEEN FARMING HIS LAND IN NORTHAMPTON COUNTY WITH THE HELP OF ONLY ONE HIRED HAND SINCE 1984

He's weathered recessions and rising costs, fluctuating land values, an ever-changing regulatory landscape, droughts, hurricanes, blizzards and blights.

Through it all, the quiet-spoken former Marine has strived to manage his 77 acres of corn, wheat and soy and 75 acres of forests as smartly as possible to ensure that the land remains healthy and productive—and in family hands—for years to come.

Peterson's farm, which sits on gently sloping sandy loam about five miles outside the town of Rich Square in northeastern North Carolina, has been in his family since he was a child. It passed from one hand to another until he purchased it at auction in 1984.

"I worked on this farm as a boy," he says. "My Granddaddy taught me how to work the land. And I want to pass it along to my children and grandchildren, too."

But like many African American landowners in rural communities, he knows the odds are against him.

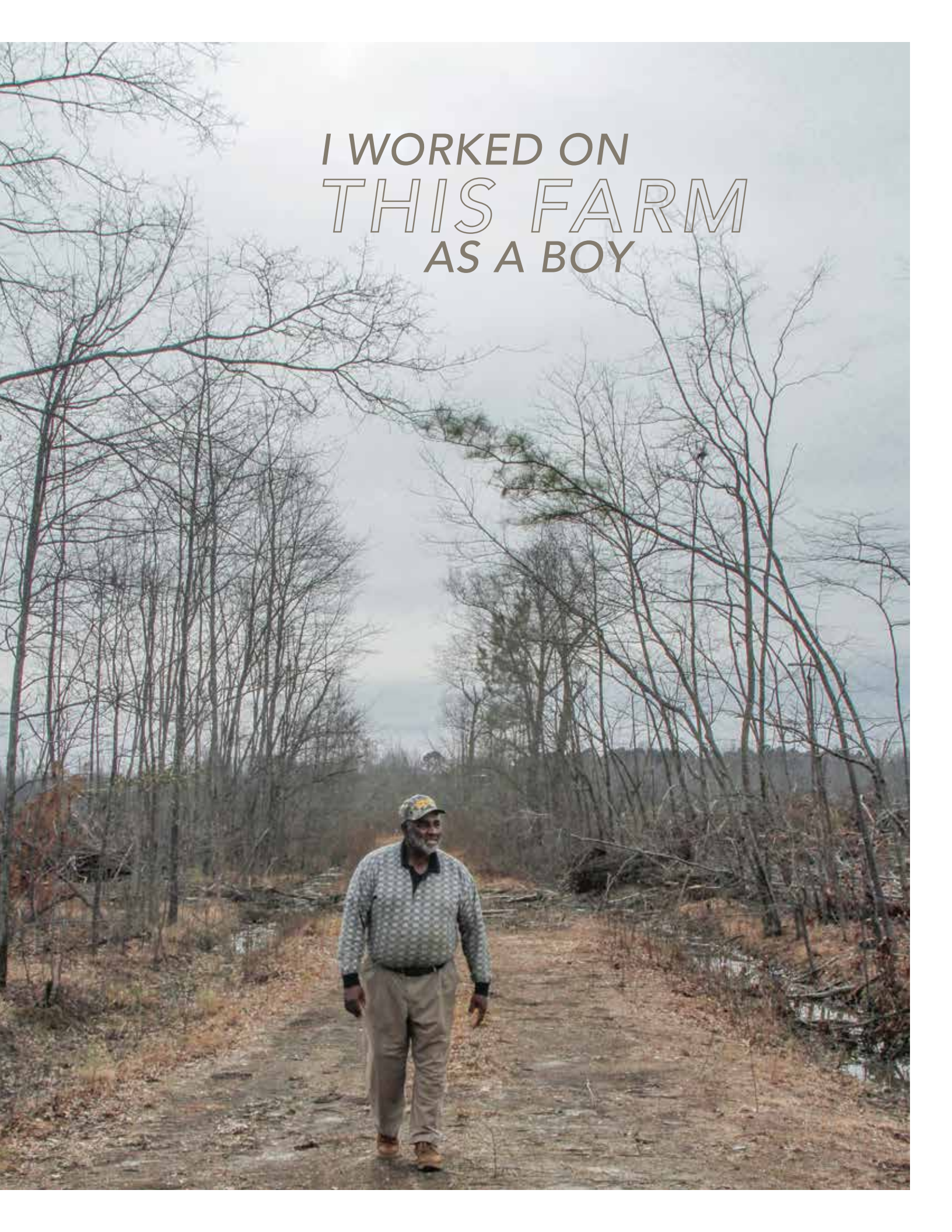
In 1920, African Americans owned between 16 and 19 million acres of rural land and accounted for roughly 14 percent of the nation's farmers. Today, they comprise less than 2 percent of farmers and less than 1 percent of rural landowners.

These numbers could shrink further in coming years as younger generations continue to leave the farm to pursue brighter prospects elsewhere and as stagnating rural economies, reduced access to government resources, and decades of systemic discrimination in agricultural lending practices take their toll on the farms that remain.

That's where **Sari Palmroth** and five Master of Forestry (MF) and Master of Environmental Management (MEM) students at the Nicholas School of the Environment come in. The students are **Kendall DeLyser**, **Alison Petro** and **Michelle Kaiser**, all MEM/MF'18; **Dan Hickey** MF'18, and **Tal Jacobs** MEM'18.

Last year they began collaborating with a regional nonprofit, the Sustainable Forestry and African American Land Retention Project (SFAALRP) to help Peterson ensure that his farm survives by showing him how to tap into a source of revenue he previously left untapped: His forests.

I WORKED ON
THIS FARM
AS A BOY



"SMALL-LANDOWNERS
IN THE SEVEN-COUNTY
AREA EARNED ABOUT
\$37 MILLION IN
TIMBER SALES."



**PALMROTH + STUDENTS
ENVIRONMENT HALL**



**SARI PALMROTH
ASSOCIATE RESEARCH
PROFESSOR
ENVIRONMENTAL SCIENCES
+ POLICY DIVISION**

STUDENTS

1



2



3



4



5



Palmroth, associate research professor, proposed the idea of working with SFAALRP and Peterson to her students as a way of incorporating real-world experience into the Silviculture Prescription course she teaches.

Under her guidance and with support from **Tom Craven**, the Duke Forest supervisor, they surveyed Peterson's forest acreage, analyzed its economic and ecological value, and developed a management plan with multiple options for how he can generate sustainable revenues from it.

"I knew Kendall, Alison, Michelle, Dan and Tal would be up for the challenge, but the way they embraced it and ran with it—and the quality of the work they produced—far exceeded expectations," she says.

Peterson already has implemented, and is benefitting from, one of the management options the students proposed.

Palmroth and **Alton Perry**, director of SFAALRP, are now making plans to have a second group of her students work with another farmer next year.

"Northampton County is only a two-hour drive from Raleigh-Durham, but in a lot of ways it's a world apart. Landowners here don't have the same access to resources and information," says Perry, a forester by training who has led SFAALRP since its launch in 2013. "Being able to tap into the expertise of Nicholas School students has made a huge difference."

SEEDS OF CHANGE

SFAALRP currently works with about 170 farmers in seven economically distressed northeastern North Carolina counties served by the Roanoke Electric Cooperative. Its mission is to educate them about forest management practices; connect them to the resources, technical assistance and information they need to best utilize their land; and work with them to develop an individualized management plan they can follow.

"Landowners whose primary income comes from farming sometimes don't realize the benefits their forests could provide. They think of them as more of a liability. We're trying to change this way of thinking by showing them how productive these lands can be," Perry says.

When he talks to a local farmer who's not yet taking part in the program, he likes to point out that in 2012, small-landowners in the seven-county area earned about \$37 million in timber sales.

"A number like that really catches their attention," he says. "And then I point out that it represents only a small portion of the potential forest income local landowners could be bringing in through planned management."

Reaching out to absentee owners also is a priority, Perry says. As ownership of small family farms passes from generation to generation, it's becoming increasingly common that the children, grandchildren, nieces and nephews who inherit these lands no longer live on them. Many have moved far away and—if they think of the family land at all—view it as a burden they'd like to unload rather than as a sustainable source of long-term income from timber production, hunting rights, conservation credits or other revenue streams.

"Keeping these lands productive and in family hands benefits the families, the environment and the local economy," Perry says. "Our challenge is to show these owners how valuable their land can be and to provide them access to the local resources and expertise they need to manage it."

To participate in SFAALRP, landowners must own at least eight contiguous acres of land, although most own between 50 and 60 acres, on average. Despite the programs' name, it serves landowners of any racial background who meet the minimum-acreage requirement.

Providing individualized land management plans and ongoing assistance to each SFAALRP member sometimes stretches the organization's grass-roots resources to their limits, according to Perry. And demand is only going to rise in coming years as more landowners learn about the program and seek its help in generating forest revenues that will help them hold on to their family-owned lands.

Master of Environmental Management (MEM) students at the Nicholas School of the Environment

1. Kendall DeLyser 2. Alison Petro 3. Michelle Kaiser (all MEM/MF'18) 4. Dan Hickey MF'18 5. Tal Jacobs MEM'18.



THESE STUDENTS DID A MARVELOUS JOB ON MY FORESTRY PLAN

ONLINE

ONLINE VIDEO

Get a look at Peterson on the farm at
nicholas.duke.edu/petersonvide

James Peterson talks with Alton Perry

“Being able to rely on Sari and her Nicholas School students to do Mr. Peterson’s management plan was a big help,” he says. “They brought some great ideas to the table and gave Mr. Peterson a plan that meets his needs today but can also be a blueprint for managing his forests for years to come.”

A PLAN TAKES ROOT

The biggest challenges Palmroth and her students faced in developing their management plan for Peterson were the same things that drew them to him as a client in the first place: The size and complexity of his land.

Rather than being a contiguous stand of trees, Peterson’s forested lands are spread out in parts and parcels of various shapes and sizes across his property. Some are in wetland soils, others are in well-drained loam. The ages and sizes of the trees, and the proportion of hardwoods to pines, vary from tract to tract, as do their ecological and economic values.

Palmroth provided general guidance, but left it up to the students to decide how to tackle the project and present their final recommendations by the end of the month-and-a-half-long course.

They divided the work assignments based on personal skills and the time each student could commit for doing fieldwork in Northampton County. So Hickey and Kaiser took the lead on gathering field data, while DeLyser, Petro and Jacobs were charged with handling much of the analysis and modeling back in Durham.

“Although none of us had ever done such an extensive client-based land-management plan before, we had learned the skills and tools we needed in previous forest management and silviculture courses that led up to the project assignment, so we were pretty confident,” says Hickey.

To ensure that their recommendations would meet Peterson’s short-term and long-term financial objectives, they divided his forests into seven different tracts based on land composition. Each tract was then evaluated using three different management scenarios—no management at all; meeting landowner objectives; and achieving maximum timber values—to determine which approach made the most sense.

After reviewing all the options, the students developed a management plan they felt balanced economic and ecological considerations, while still being feasible for Peterson to carry out.

“When we first met Mr. Peterson, he told us he wanted to know what he could do to set his land up so he didn’t have to work it anymore but so that each of his kids, and then each of his grandkids, would eventually see some benefits from it,” says DeLyser. “With this in mind, we ended up suggesting a small-scale clear cut of some hardwoods on the property, which wasn’t our top choice from an ecological point of view but was better than many of the alternatives.”

“We really wanted to suggest doing a shelterwood cut, which involves leaving some trees standing instead of clear-cutting,” Petro explains. “But it’s a bit more difficult to do, and you really need to have a good contractor or logger out there to make sure you’re taking out the right trees. Even then, you might not get the same species coming back. Given Mr. Peterson’s objectives and the need to make our plan feasible under real-world

constraints, a small-scale clear cut was the best compromise.”

GROWTH AND BALANCE

Some of the sting of recommending the clear cut was eased by the knowledge that other stands on the property may never be logged.

“Part of Mr. Peterson’s land is a wetland forest with high conservation value. We informed him that although it could be logged, it would be a wreck afterward so it made more sense to look into conservation easement programs as a source of income instead,” says Kaiser.

Learning to make tough decisions and put the client’s objectives first is all part of the lesson plan, Palmroth says.

“Learning these skills and concepts in the academically rigorous environment of a classroom is challenging. Applying them outside the classroom, on a tight deadline, for a real person who is relying on you for the best guidance possible because his future depends on it, is another challenge entirely,” she says. “I have rarely seen students as motivated by this responsibility as this group was.”

Petro says that getting to know Peterson and understanding the positive impact their work could have for him and his family made all the late nights and hard compromises worthwhile.

“Working with a landowner like Mr. Peterson, who was so supportive and receptive to our recommendations, really inspired us,” she says.

The admiration is mutual.

“These students did a marvelous job on my forestry plan. They gave me a lot to work on and work with, and advised me on things I didn’t know about in the beginning,” Peterson says. “And they worked so hard—the first day they were here, they were out in the woods collecting samples for so long I worried they had gotten lost.”

Perry, too, is impressed—not only by the quality of the students’ work, but also by the potential for continued collaborations.

“For programs like the SFAALRP, increasing our operational capacity can be a challenge. Demand always outstrips supply. By having students work with some of the landowners we partner with, I think there’s an opportunity to expand the services we offer to countries beyond our current project area and help even more small-landowners,” he says. “I can’t say for sure this will happen, but it’s an idea I hope can be entertained in the very near future.”

Peterson—who has already made his first cut based on the students’ recommendations and is discussing plans with Perry to treat the cleared land and replant it in winter 2019—says he’ll be more than happy to serve as an enthusiastic reference if other landowners wonder what it’s like to work with Nicholas School students.

“I’d tell them: I trusted those students to make the right decisions for me and provide me with the knowledge I need to manage my land,” he says, “and they didn’t let me down.”

LILY HUFFMAN MEM’19 IS THE NICHOLAS SCHOOL’S STUDENT COMMUNICATIONS ASSISTANT.

BETSY ALBRIGHT

By CATHERINE CLABBY *Photography by* LES TODD + MEGAN MENDENHALL



IN CLASSROOMS AND HER OWN
RESEARCH, **BETSY ALBRIGHT**
CHAMPIONS **SMART DATA** ANALYSIS
TO SMOKE OUT HIDDEN BARRIERS
TO ENVIRONMENTAL PROTECTION

On a sunny late morning last fall, **Betsy Albright** handed her data analysis students plastic click counters while briefing them on what sounded like a simple assignment.

“Good morning everybody. Please find your name on the spreadsheet and sit in the groups one, two, three, four, five, six, seven, eight,” Albright instructed from the front of Field Auditorium.

Albright had the Nicholas School graduate students fan out in groups across West Campus to assess how hospitable specific spots were for bike riding. They carried their click counters to tally how many bicycles, cars and pedestrians they saw.

Within minutes, challenges to collecting just that little bit of data popped up

“Is this area safe for biking?” **Jeff Meltzer** asked fellow students stationed by a nearly empty traffic circle outside the Bryan Center.

“It depends on the time of day. This spot is usually crowded,” responded **Zainab Qazi**.

“This is kind of a bike path?” Meltzer said cautiously, as he and others puzzled over how to label a well-used sidewalk that cyclists sometimes use.

Observing challenges to collecting clean data was at the heart of Albright’s lesson.

“There are problems with subjectivity. You can say that in class a hundred times but it’s helpful to see it,” says Albright, an environmental policy researcher and a very popular teacher in Environment Hall.

FINDING KNOWLEDGE IN DATA

Good data exists, of course, and so does good analysis. But whether teaching Applied Data Analysis for Environmental Science or pursuing her own research, Albright makes one thing very clear: Both require gobs of work.



Albright got interested in the quality of information used to craft and implement environmental policy long before she joined Duke's faculty in 2011. After studying chemistry at The College of Wooster, Albright tried working in a research lab at Case Western Reserve University. But repetition on the job and so much time indoors left Albright, a painter as well as a researcher, uninspired.

Looking for adventure, Albright in 1994 followed a friend from her youth to a teaching job in rural Hungary with a program started by a former Peace Corps volunteer. She loved helping middle-school-aged pupils learn English. But she was startled by the environmental degradation in water and air that she encountered in a land only recently free from the Soviet bloc.

"There was a lot of particulate matter. It made for some really cool sunsets, but you noticed the poor air quality," Albright says.

Albright returned to the United States to acquire tools to try to address environmental problems. She enrolled in two master's degree programs to study environmental science and environmental policy at the School of Public and Environmental Affairs at Indiana University.

That training landed her a job at the EPA in Research Triangle Park and then another with the water quality division of what is now North Carolina's Department of Environmental Quality. The state job unintentionally taught Albright how not to help citizens protect their environment.

"I was a water quality modeler. We'd go out to towns in North Carolina and talk to farmers about what they should do based on the models. That didn't go well with the farmers," who knew a lot more about their land than computers did, Albright says.

"I thought there should be a better way," she adds.

So, she returned to the classroom, this time at Duke to earn a doctorate at the Nicholas School. In Durham she dove into topics such as collaborative decision making and, eventually, what it takes for communities to embrace environmentally minded changes after disasters.

Her dissertation research and a Fulbright scholarship brought her back to still newly democratizing Hungary, a lowland nation with a long history of damaging flooding. With interviews of flood and water policy experts, as well as surveys of 141 mayors of towns in river basins, she probed how extreme floods from 1998 to 2002 influenced governments.

Simply experiencing flooding wasn't enough to

produce policy shifts from engineering solutions to more ecological solutions, she found. Allowing citizens with ecological leanings and scientific evidence to be part of the conversation helped, she observed.

Eight years into her career as a social scientist, Albright is still exploring what conditions help communities promote ecological and social resilience after disasters.

"Resilience, in my mind means to learn from, adapt to and become stronger in the face of future risks. This could be at the community or household level, with the goal that communities and households are more prepared to face future risks," Albright says.

Albright is well equipped for the task, says **Deserai Anderson Crow** of the University of Colorado, one of Albright's collaborators.

"Betsy has this incredible combination: She's a great statistician and her comfort with quantitative methods is fantastic. And she has this totally creative very humanist side to her," Crow says.

LISTENING, DOCUMENTING + DECODING

Understanding how communities can learn from catastrophes to better meet all residents' needs is relevant after any environmental crisis, from toxic chemical spills to tsunamis. But given that global climate change is expected to produce more flooding, wildfires, and other natural disasters, the work may be more relevant today than ever.

Such concerns take Albright to where trouble strikes, including Columbia, S.C., in 2016 after severe flooding there. With funding from Bass Connections, she, a Social Science Research Institute staff member and Duke undergraduates parked a 37-foot RV converted to research vehicle in a downtown Piggly Wiggly parking lot. They surveyed more than 100 residents and recorded around 50 people answering this query about the floods: "Tell us about what happened and how it affected you."

Albright and Crow are collaborating on a more intensive study in Colorado, where they are comparing responses in seven communities to severe flooding in 2013. Some 18 inches of rain fell in the densely populated Front Range foothills that year, mostly in three days.

Resulting floods destroyed some homes and damaged others to the point where people had to abandon them until they were repaired. Water also ripped up roadways and harmed public buildings, businesses, and park land.

This National Science Foundation-funded project is analyzing how communities make decisions about

"BETSY HAS THIS INCREDIBLE COMBINATION: SHE'S A GREAT STATISTICIAN AND HER COMFORT WITH QUANTITATIVE METHODS IS FANTASTIC. AND SHE HAS THIS TOTALLY CREATIVE VERY HUMANIST SIDE TO HER,"

whether, where, and how to rebuild, as well as whether to adopt changes in zoning and floodplain uses.

Albright and Crow are deeply interested in whether the decisions are protective or maintain conditions that leave people and property vulnerable to future flood events. They are also probing how open community leaders are to public involvement in their decision making.

It's a big job, requiring social science tools such as text coding, specialized software, and case study approaches to dig in.

With help from research assistants, the research teams have interviewed and surveyed hundreds of government officials and residents about how well authorities involved residents in flood recovery planning, whether community resources were adequate, and if alternative plans for managing flood risks are needed.

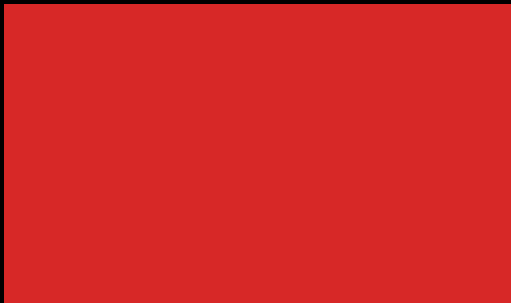
They also reviewed some 1,825 community documents that don't often get much attention, including municipal press releases, city council and task force minutes, government board memos, etc. They have and will continue to share their findings with the communities under study.

"I don't want our research to be extractive but to give back," Albright says.

LIGHTING THE SPARK

As she did all those years ago in Hungary, Albright still loves teaching. These days she instructs within and beyond traditional classrooms.

In 2014 she launched an iPad and iPhone application called *stats!* to tutor anyone



interested on statistical vocabulary and practices by spelling out the importance of probability, the power of sampling, simple and multiple regression, generalized linear models and more.

"I tried not to dumb things down but to write in a way that is not super jargony or full of symbology that people don't understand," Albright says of *stats!*, which she illustrated with her own abstract artwork.

The impact is palpable in online reviews for *stats!*, which averages 30 downloads a day. "This app single-handedly rescued my sanity," one user wrote. "Other texts give well-crafted and complete explanations, but it was here that I found the actual process of statistical analysis step by step."

Albright's impact was clear too after the Thanksgiving break in her data analysis class. This time small teams of students stood one after another to present progress on projects digging into publicly available data sets. After months under Albright's tutelage, the students were well equipped to weave together multiple data sets, including information from World Bank reports, U.S. county-level voting records, nonprofit group survey findings, and much more.

Using qualitative tools such as multilinear regression, heteroscedasticity, multicollinearity and p values, they sought answers to big questions. What factors explain carbon dioxide emissions in Latin America? Which features most strongly advance gender equity in a society? What increases risk of malnourishment globally? And what is the education and political profile of North Carolinians concerned about climate change?

After each group presented their work in progress, Albright applauded, asked questions, and offered suggestions.

"Do you have any information on the percent of the county's economies depending on natural resources, like fishing?" she queries the group exploring variation in sentiments about climate change.

Having direct contact with nature might influence a person's views about the reality of climate shifts, she explains.

In other words, she urged the students to keep thinking. And to keep asking.

"Try to get more granular," she counsels.

CATHERINE CLABBY IS A JOURNALIST WHO WRITES ABOUT SCIENCE AND THE ENVIRONMENT. SHE LIVES IN DURHAM, N.C.

**KEEP
THINKING
AND KEEP
ASKING.**



DELIVERING HIGH QUALITY TEACHING ACROSS ALL OF OUR PROGRAMS



dean's UPDATE

BY JEFFREY VINCENT
STANBACK DEAN

Students are at the center of what we do at the Nicholas School—and it's a big, complicated center.

Professional master's students in our Master of Environmental Management (MEM) and Master of Forestry (MF) programs comprise the largest share of our student body, but we also have robust undergraduate and PhD programs. We offer three undergraduate majors (AB in Environmental Science & Policy, BS in Environmental Science, BS or AB in Earth & Ocean Sciences), a concentration in Marine Science Conservation, and several minors and certificates. We offer six PhD programs, including three in collaboration with other schools at Duke.

And for working professionals, we offer a rich and expanding set of executive education courses in addition to the distance-learning-based Duke Environmental Leadership (DEL) MEM program.

This large number of educational programs makes coordination essential. We need to deliver high-quality teaching across all these programs while supporting our faculty members' important work as researchers and practitioners, which generates the knowledge and skills taught in our courses.

In response to this coordination need, this year we're preparing our first-ever school-wide teaching plan. I've asked the leaders of our various educational programs to determine if we are offering the right courses in our programs and assigning teaching responsibilities to the right faculty.

One intended outcome of this planning effort is to ensure that all of our faculty regularly teach core courses—required

courses or popular electives—at the undergraduate or master's level. Our PhD students work closely with our faculty given the research focus of doctoral programs, but our many undergraduate and master's students also need to learn directly from our world-class faculty researchers.

Guided by our new strategic plan, *Working Together to Advance Environmental Education and Research*, we are strengthening our educational programs in many other ways too. To foster a stronger sense of community among our PhD students, we held a schoolwide PhD symposium on Feb. 9—another first for the school. Duke University Provost **Sally Kornbluth** opened the symposium, which shined a spotlight on the vital contributions that PhD students make to our research mission.

In yet another first, this year we are conducting a university-wide survey of Duke undergraduates to learn more about perceptions of our programs and courses. The number of students who select our majors has roughly doubled over the past decade. This growth is gratifying, but I'd like to see more Duke undergraduates from other majors, especially large ones such as economics, public policy, engineering and biology, enroll in our courses. Graduates of these majors frequently become leaders in the private and public sectors, and they need to understand environmental challenges and how to address them. We are designing the survey to help us understand how to reach more Duke undergrads.

In our master's programs, we are acting on suggestions from alumni and employers to enhance the development

of students' professional skills (e.g., project management, teamwork, communications). Also prompted by our alums, and funded to a large degree by them, we have launched a search for an executive-in-residence to lead a new natural resources finance program. This program responds to the rising need for natural resource and conservation professionals who combine skills in investment analysis with knowledge of resource science and policy.

Moving forward, we will continue to explore and implement new ways to ensure high-quality teaching in our myriad of educational programs, whether in the classroom, the lab, in the field or at sea. This issue of *Dukenvironment* profiles two examples:

In our cover story, we follow our students to Northampton County in northeastern North Carolina, where faculty member **Sari Palmroth** has created a partnership to help African-American forest landowners benefit more from their timber resources and keep the land in their families. See their story on page 4.

We also feature one of our most popular teachers (and leading researchers), **Betsy Albright**, who constantly brings new ideas into the classroom to engage our students and help them develop the skills, including rigorous statistical tools, that are the foundation of the work they do. You will find Betsy's story on page 12.

Be sure to check out these stories and more.

THREE NICHOLAS SCHOOL FACULTY MEMBERS NAMED TO LIST OF *WORLD'S MOST INFLUENTIAL RESEARCHERS*

Three Nicholas School faculty members were named to Clarivate Analytics' 2017 list of the world's most highly cited researchers.

Drew Shindell, Nicholas Professor of Earth Sciences, **John Terborgh**, James B. Duke Professor Emeritus of Environmental Sciences, and **Mark R. Wiesner**, James L. Meriam Professor of Civil and Environmental Engineering, each were recognized.

Inclusion on the Highly Cited list signifies that a researcher has published a high number of peer-reviewed papers that rank in the top 1 percent most-cited papers in his or her discipline over the last 11 years. Such consistent production of highly cited research indicates that the researcher's work is judged by his or her peers to be among the most influential and significant in their field.

Shindell is widely recognized for his work using climate models to investigate connections between climate change, air quality and chemical changes in the atmosphere, and for his studies quantifying the social costs of short-lived climate pollutants. He is a fellow of the American Geophysical Union and the American Association for the Advancement of Science. He is an author of more than 200 peer-reviewed publications, generating nearly 34,000 citations from his peers.

Terborgh is an internationally recognized expert on tropical ecology with nearly 300 peer-reviewed publications that have generated more than 36,000 citations from fellow scientists. In recognition of his pioneering research, he has been elected a member of the National Academy of Science and been awarded a prestigious MacArthur Fellowship, among other high honors.

Wiesner is widely cited for his work on membrane processes, nanostructured materials, and the transport and fate of nanomaterials in the environment. He is a member of the National Academy of Engineering and a fellow of the American Association for the Advancement of Science. According to Google Scholars, he has contributed to more than 400 peer-reviewed publications, which has generated more than 20,000 citations by fellow researchers.

TASTE, NOT APPEARANCE *DRIVES CORALS TO EAT PLASTICS*



Scientists have long known that marine animals mistakenly eat plastic debris because the tiny bits of floating plastic look like prey.

But a Duke University study of plastic ingestion by corals suggests there may be an additional reason for the potentially harmful behavior.

The plastic just plain tastes good.

"Corals in our experiments ate all types of plastics but preferred unfouled microplastics by a threefold difference over microplastics covered in bacteria. This suggests the plastic itself contains something that makes it tasty," says **Austin S. Allen**, a Nicholas School PhD student.

"When plastic come from the factory, it has hundreds of chemical additives on it. Any one of these chemicals or a combination of them could be acting as a stimulant that makes plastic appealing to corals," says **Alexander C. Seymour**, a geographic information systems analyst at Duke's Marine Robotics and Remote Sensing Center, who co-led the study with Allen.

Visual cues, such as a resemblance to prey, don't factor into the appeal, the researchers noted, because corals have no eyes.

Further research will be needed to identify the specific additives that make the plastic so tasty to corals and determine if the same chemicals act as feeding stimulants to other marine species.

Allen and Seymour's peer-reviewed study was published in the online edition of the journal *Marine Pollution Bulletin* (Oct. 23, 2017).

Microplastics, tiny pieces of weathered plastic less than 5 millimeters in diameter, began accumulating in the oceans four decades ago and are now ubiquitous in the marine environment. They pose a major threat to foraging sea animals, including many species of birds, turtles, fish, marine mammals and invertebrates.

Because plastic is largely indigestible, it can lead to intestinal blockages, false satiation or reduced energy reserves in animals that consume it. It also can leach hundreds of chemical compounds into their bodies and the surrounding environment. The biological effects of most of these compounds are still unknown, but some, such as phthalates, are confirmed environmental estrogens and androgens.

Daniel Rittschof, Norman L. Christensen Professor of Environmental Sciences, co-authored the new paper. Funding for the research came from the Oak Foundation. Allen and Seymour both earned Master of Environmental Management degrees from the Nicholas School in 2016.

NICHOLAS SCHOOL WELCOMES
ALUMNA TODDI STEELMAN
AS STANBACK DEAN

W

ildfire expert **Toddi Steelman**, the first permanent executive director at the University of Saskatchewan's School of Environment and Sustainability (SENS), has been selected as the next Stanback Dean of the Nicholas School of the Environment effective July 1.

Steelman, who earned her PhD in environmental and resource policy from the Nicholas School in 1996, will follow **Jeffrey Vincent**, Clarence F. Korstian Professor of Forest Economics and Management, who has been serving as the interim dean since the departure of former dean **Alan Townsend** last year.

"I am delighted to welcome Toddi Steelman back to Duke," says Duke President **Vincent Price**. "She has a rare combination of scholarly achievement and successful leadership in environmental education and research that will only accelerate the Nicholas School's great momentum in focusing on perhaps the defining issues of our time. And as a Duke graduate, she has a special understanding of our culture of collaboration, ambition and action."

Prior to serving from 2012 to 2017 as executive director at SENS, Steelman spent 11 years on the faculty in the Department of Forestry and Environmental Resources at North Carolina State University and four years in the Graduate School of Public Affairs at the University of Colorado at Denver.

Her policy research spans many environmental and resource management issues, including forest management and planning, water security, open space protection, and climate change, but she is best known for her work on community adaptation to wildfires and how communities and agencies can interact for more effective wildfire management.

In 2016, she was part of a faculty team that received a \$77,800,000 grant from the Canada First Research Excellence Fund to fund a multi-year interdisciplinary study, "Global Water Futures: Solutions to Water Threats in an Era of Global Change." The grant represents the largest investment in water research funding in Canadian history.

Steelman also is the recipient of research funding from the National Science Foundation, the U.S. Environmental Protection Agency, the U.S. Department of the Interior and the U.S. Forest Service.

A prolific researcher, she has published four well-known books and 59 peer-reviewed papers or book chapters—including widely cited studies in *Sustainability Science*, *Conservation Biology*, *Policy Sciences*, and the *Journal of Forestry*. She also has published 24 technical papers and contributed to scientific reports for the Royal Society, the U.S. National Academy of Sciences, and the National Socio-Economic Synthesis Center. She sits on the board of directors for the International Association of Wildland Fire, and was selected as a Fulbright Scholar in 2008.

In addition to holding a PhD from Duke, Steelman holds a Master in Public Affairs from Princeton University and a Bachelor of Arts in Political Science and International Studies from West Virginia University.



TODDI
STEELMAN

Q & A

WITH TODDI STEELMAN



Q: TELL US A LITTLE BIT ABOUT YOURSELF.

A: I was born and raised in West Virginia in a small coal mining and timber town. I spent a lot of time outside hiking, paddling whitewater and biking.

Coming from a rural, natural resource-dependent community has given me a powerful perspective on many issues. Mining caused enormous environmental damage in our community and state, but it also provided a social identity and livelihood for my family and many others. Our ability to find approaches that integrate or balance social, economic and environmental interests sustainably is very personal for me.

Q: WHAT DO YOU STUDY? WHERE HAVE YOU WORKED?

A: As a policy scholar, my research has always been very problem-oriented and I have worked on a variety of issues—forest management and planning, water security, open space protection, climate change, and most recently wildfire response and management.

I try to work where the problems are and with the people who experience them, and this has taken me all over the United States as well as South Africa, Brazil and Canada.

Like many people, I want to make a difference and serve a larger purpose. We are only put on this planet for a short time and by virtue of our education and wealth, we have an obligation to figure out how we can help others. We create science and other forms of knowledge in universities, and I firmly believe we need to put that knowledge in service of society.

Q: YOU'RE PERHAPS BEST KNOWN FOR YOUR WILDFIRE RESEARCH. HOW DID YOU GET STARTED IN THAT?

A: Over the years some of my best ideas have come from listening to students, and this an example of that.

In 2001, when I was on the faculty at NC State, a professional master's student walked into my office and asked if I did any wildfire research because that was what she wanted to work on. At that time, wildfire was not yet a major issue on the national or international environmental policy agenda. I told her I didn't have any interest and she should go find someone else on faculty who did, because that would be a better fit.

But she was persistent and came back a week later and asked if I would reconsider. So, we sat down and started a discussion about how we could approach the topic from a perspective that would be novel enough to suit her master's project needs and fit into my broad policy and scholarly interests—and here I am, all these years later, still working on wildfire.

Q: YOU WERE A DOCTORAL STUDENT HERE IN THE EARLY YEARS OF THE SCHOOL. HOW DID THAT EXPERIENCE SHAPE YOU AND YOUR CAREER?

A: At the time, the Nicholas School was one of the few programs that offered an interdisciplinary focus, and that was where my passion was. My advisor, **Bob Healy**, gave me a lot of leeway to pursue my interests and I thought that was fantastic. I was keen to have disciplinary depth that I could marry with interdisciplinary breadth to integrate knowledge from diverse fields.

I roamed broadly across Duke and took courses in the Sanford Institute, the Department of Political Science and the Department of Economics, as well as the Nicholas School. That broad but focused approach has led to a career of amazing collaborations and the chance to explore some of the most pressing problems today with wonderful colleagues across multiple disciplines.

I think these qualities remain true today. Our school provides students the freedom, the academic resources, and the access to faculty and staff expertise they need to pursue their interests. That's critical for training future environmental leaders.

Q: DO YOU HAVE ANY SPECIAL MEMORIES FROM YOUR TIME HERE?

A: My friends and I would take weekend trips down to the Marine Lab. Beaufort is terrific and the folks at the Marine Lab have created a special community that was nice to experience. Duke Forest also holds a special place in my memory. I lived in a house in the forest for two years and walked along New Hope Creek every day with my dog, Coby.

Q: HOW DOES IT FEEL TO BE THE FIRST NICHOLAS SCHOOL ALUMNUS SELECTED TO SERVE AS DEAN?

A: It feels like a homecoming and makes me proud to be an ongoing part of the Nicholas School's tradition.

I was among the first generation to graduate from the school. My classmates, many of whom have remained close friends, have gone on to do amazing work shaping the environmental trajectory of our nation and planet. When I consider that we now have more than 5,000 alumni out in the world, all doing important work, the prospect of leading a school with such a huge potential for impact is thrilling.

Q: IF YOU WERE TO TELL PEOPLE ONE THING ABOUT YOUR LEADERSHIP STYLE, WHAT WOULD IT BE?

A: I am highly collaborative and a good listener, but am not afraid to make a decision. Also, I can be bribed with chocolate.

Q: IN YOUR OPINION, WHAT ARE SOME OF THE KEY CHALLENGES THE SCHOOL FACES TODAY?

A: When I was a student, we were one of only a few graduate environmental programs in the United States. Now there's much more competition, so we have to think harder about who we are, what we offer and what makes us special. The Marine Lab and Duke Forest are integral to our identity and we need to get students out in the forest and onto the water to experience these resources firsthand.

Embracing complexity in our research and teaching is also paramount. Complexity is the combination of uncertainty and conflicting value demands, and it's a defining feature of many environmental issues.

At a time when we're so deeply divided as a society and issues seem to grow more contentious daily, we can no longer treat environmental issues as solely scientific or technical problems. We have to wade into the complex values choices that are at the heart of policy decisions. Science will always be a central and essential input into the decision-making process, but policy decisions require choices. And choices reflect values.

We need to remain on the forefront of research and scholarship, while at the same time becoming much more skilled in engaging in the conversations that are at the heart of the values divide.

Q: GIVE US THREE GOOD REASONS WHY WE SHOULD BE OPTIMISTIC ABOUT THE FUTURE OF OUR PLANET.

A: We are at a curious place in modern history. There is a lot to worry about, but at the same time, we are seeing a reinvigoration of many institutions that are critical to democracy—journalism, activism, people running for office, and people educating themselves about what it means to be a citizen. I find this very heartening.

Also, while people may despair at the state of national or federal leadership, we are seeing an exciting new generation of leaders emerge at the local and state level. They are our future. Our school is poised to shape this next generation to be effective environmental leaders who contribute to a country and planet of which we can all be proud.

Last but not least, Generation Z and Millennials have a greater environmental ethic and literacy than the generations before them. My daughter and her friends, at age 15, know more about climate change than I did as an undergraduate. My sincerest hope is that we can attract the best, most capable and passionate students from across the globe to work with and learn from as we all strive for a more sustainable way of life.

NICHOLAS SCHOOL STUDENTS TEAM WITH

*COUNTER
CULTURE
COFFEE*

TO HELP SMALL FARMERS ADAPT TO

*CLIMATE
CHANGE*

A partnership between the Nicholas School of the Environment and Counter Culture Coffee looks to help small coffee farmers in Latin America adapt to the effects of climate change, a daunting challenge that has increasingly preoccupied the \$70 billion coffee industry for the past decade.

“They’re on the front lines of really experiencing climate change,” says Associate Professor of the Practice of Environmental Policy and Management **Elizabeth Shapiro-Garza**, who has led the project, pointing to outbreaks of a damaging fungus known as coffee leaf rust—roya in Spanish—as well as increasing inconsistencies in the rainy and dry seasons.

“At a really fundamental level, our supply of good-quality coffee—coffee in general—is directly being threatened by climate change right now.”

Counter Culture, a Durham-based specialty coffee roaster, has worked with Shapiro-Garza and nearly a dozen Master of Environmental Management students during the past five years to understand the viability of adaptation strategies that better support the company’s producers while ensuring long-term, sustainable coffee production.

The research has resulted in two group Master’s Projects, an internship and a research assistantship that will culminate in the creation of a tool kit based on recommendations from an earlier workshop to identify feasible adaptation solutions for smallholder farmers.

“There’s a sense of urgency, so we needed to figure out how to take that process and do something that we can repeat,” says **Meredith Taylor**, Counter Culture’s sustainability manager. “Not only is this something we want to repeat in our supply chain, but we also want everyone to be able to repeat it. This isn’t a proprietary process. We want to offer it to the coffee industry as a tool they can use.”

The joint venture began when six Duke University master’s students traveled in pairs to one of three cooperatives—located in Colombia, Guatemala and Peru—for eight weeks in the summer of 2014. There, they surveyed smallholder farmers about what climate-related challenges they were experiencing as well as what adaptation strategies they found most useful.

“It opened my eyes to the importance of talking to the communities that are directly experiencing climate change,” says **Martín Ramírez Mejía** MEM’15, who conducted research at the cooperative in Colombia.

“That bottom up approach, in which we can learn from the day-to-day operations, is extremely important to come up with what strategies can actually be successful.”

The participatory research also included interviews

with leaders in the local coffee industry and other non-governmental agencies to identify environmental, political and economic conditions that could impact what approaches could be implemented effectively.

As part of their 2015 Master’s Project, **Ramírez Mejía** and classmates **Claire Fox**, **Joanna Furguele**, **Saira Haider** and **Michael Younis** found that 89 percent of farmers across the three countries noticed the effects of climate change. Not only was it impacting the quality and quantity of coffee, but also the farmers’ ability to support themselves.

The students, including **Brenda Lara** from Duke’s liberal studies program, also discovered that farmers had come up with a large variety of adaptations—oftentimes implemented at small scales.

“Though individual farmers were innovating to adapt, there wasn’t a whole lot of collective action on these issues,” says Shapiro-Garza, who designed and analyzed the research.

In order to narrow down the 17 adaptation strategies that the first group reported to Counter Culture, a second group of students—2016 MEM alums **Jennifer Finley-Lezcano**, **Danielle King** and **Sapphire Wang**, Sanford School of Public Policy’s **Ariadne Rivera** and the Duke Global Health Institute’s **Jared Jinn**—returned to the cooperatives in Guatemala and Peru to find which ones were most feasible.

These students worked with cooperative leaders to

narrow their research to five strategies: income diversification, integrated pest management, solar coffee dryers, rainwater collection systems, and seed banks and nurseries. Analysis of data from extensive interviews and focus groups allowed them to rank the solutions based on how well they helped farmers achieve sustainable livelihood improvements and economic growth.

“We found that not only is climate change impacting people differently, but the solutions are very dependent on the conditions of each farm,” says Taylor.

She explained that minor changes in precipitation—too much or too little rain—can have a significant effect in

coffee farming, as the crop grows during the wet season and is harvested during the dry season.

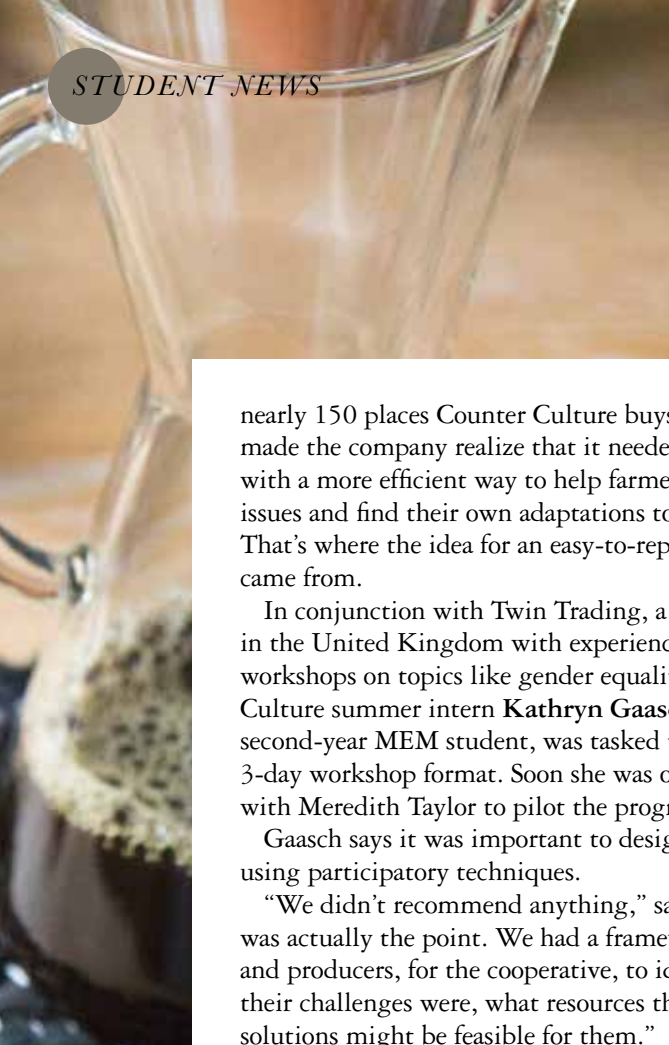
For example, if it’s raining when the coffee should be laid out to dry, the quality of the crop is negatively impacted and its price drops.

It would make sense that all farms seeing this problem would choose to install solar dryers, but the project found that this solution was only feasible if farmers had existing open, flat areas to build these structures and the access to the necessary resources.

“There’s no silver bullet to fix it all,” Taylor says.

Reaching only three cooperatives in two years—out of the

*“OUR SUPPLY OF
GOOD-QUALITY
COFFEE—COFFEE
IN GENERAL—IS
DIRECTLY BEING
THREATENED BY
CLIMATE CHANGE
RIGHT NOW.”*



nearly 150 places Counter Culture buys coffee from—made the company realize that it needed to come up with a more efficient way to help farmers identify their issues and find their own adaptations to climate change. That's where the idea for an easy-to-replicate workshop came from.

In conjunction with Twin Trading, a nonprofit based in the United Kingdom with experience in developing workshops on topics like gender equality, Counter Culture summer intern **Kathryn Gaasch**, a current second-year MEM student, was tasked to develop a 2- to 3-day workshop format. Soon she was on her way to Peru with Meredith Taylor to pilot the program.

Gaasch says it was important to design the program using participatory techniques.


"We didn't recommend anything," says Gaasch. "That was actually the point. We had a framework for farmers and producers, for the cooperative, to identify what their challenges were, what resources they had and what solutions might be feasible for them."

By fostering the farmers' knowledge and letting them find their own adaptations, the farmers had more buy-in on the solutions and were better motivated about the project.

"People came in ready to take notes at the workshop, when it was the other way around," says Taylor.

"By the end, everyone expressed that they felt really valued, heard."

In October, Counter Culture conducted a second workshop in Guatemala, where they adjusted the language of the instructions and activities to make sure participants understood that non-agricultural solutions also were on the table. This was important because farmers could then have options for a steady source of income even when climate events prevent them from working at the farm.



"When you think about climate change resilience and communities like these being able to absorb climate shocks, the solutions don't necessarily have to be agricultural-based," Taylor says. "There's a whole social, economic side of things that builds community resilience."

The farmers in Guatemala came up with income diversification solutions, including raising chickens and building a seed nursery, that are less weather-dependent than day-to-day farm work.

Current MEM student **Shannon Thoits**, who wrote a case study on the beta workshops in the fall as part of her assistantship with Shapiro-Garza, is responsible for turning the workshops' protocol into a digital toolkit. This will allow others to replicate the program without needing to be long-time facilitators or climate change experts.

Kim Elena Ionescu, the Specialty Coffee Association's chief sustainability officer and Counter Culture's sustainability manager when the project launched, is hopeful about the project's overall implications for the coffee industry.

"As I've seen it evolve, it seems to me that the project is a great example of what a company can do to be innovative and responsive in the context of an issue like climate change," she says.

Counter Culture hopes to launch the toolkit at a coffee association expo this spring. Meanwhile, Shapiro-Garza and some of her former students are collaborating on peer-reviewed articles about their findings, which they've already presented at different workshops and conferences.

"The students have been really involved throughout the whole process, which is so impactful," Shapiro-Garza says.

Working for a client, the students have been able to garner hands-on research experience while traveling abroad and getting to understand how people's lives,





environment and other factors provide and constrain their options.

“Experiencing that on the ground is incredibly important, especially for students interested in working in an international context,” says Shapiro-Garza.

King, who was a research assistant for Shapiro-Garza before being part of the second Master’s Project, says having that real-world training was a great learning experience.

“I got to learn a lot more about coffee, more than you can even learn in a book,” she says. “But more than that, I think I learned how to work across fields—with research institutions, nonprofits and the corporate sector—which was probably the biggest thing I got out of this project.”

Taylor says the benefit is mutual, as being able to tap Nicholas School students’ specialized expertise is a big plus.

“We don’t often get infusions of people who are looking at problems from a different angle,” Taylor says. “The students provide some of that lens.”

Gaasch agrees.

“Students bring innovative ideas and perspectives in a way that a lot of professionals are kind of removed from,” she says. “I think that’s something that every business should be taking advantage of.”

Shapiro-Garza credits the students’ hard work, and their ability to navigate difficult living conditions as well as cultural and language barriers, for the partnership’s success.

“It’s their willingness to really jump in feet first, but also their dedication to producing something of use and value that’s going to have a real impact on the world,” she says. “And our students are like that. That’s who they are. They’re ready to go change the world.”

Sergio Tovar is the Nicholas School’s social media specialist.



stories from the MONTE

sea OTTERS

For 30 years the Monterey Bay Aquarium has rescued stranded pups and reintroduced them to the wild.



REY BAY

aquarium

DUKE ALUM **KYLE VAN HOUTAN** AND
HIS COLLEAGUES STUDY MARINE
CREATURES THAT CARRY TRACES OF
OCEAN HISTORY IN THEIR BODIES

By SANDRA J. ACKERMAN *Photography by* MONTEREY BAY AQUARIUM + ISTOCK



kyle
VAN HOUTAN
PhD'06

*The Aquarium's
director of science,
oversees 30 employees
+ about 100 volunteers.*

On a map of California,

Monterey Bay looks like a small bite taken out of the coastline just south of Silicon Valley. With a deep underwater canyon a short distance offshore, where the cool California Current mingles with nutrient-rich waters upwelling from the canyons, the area is unique for the vibrant ecosystems it contains. This is home to a great variety of marine mammals, fish, seabirds and innumerable species of plankton. It's also an ideal setting for the Monterey Bay Aquarium, whose purpose, in the words of one of its officers, is to "cause people to fall in love with the ocean."

Certainly, the Monterey Bay Aquarium draws many admirers to the ocean—roughly two million people visit each year—but this facility also has another aim, to convert that wonder and awe into a desire for conservation.

In this effort, the scientific staff plays a crucial role. **Kyle Van Houtan**, the Aquarium's director of science, oversees 30 employees and about 100 volunteers. It's a wide-ranging responsibility, he says: "There's not a single message or placard on

the aquarium floor that doesn't come across my desk."

Van Houtan was hired two years ago as part of "a reimagining of our strategic plan," says **Margaret Spring**, the aquarium's vice president and chief conservation officer. The new plan called for focusing on a few iconic species to convey their ecosystem roles and the vital importance of ocean conservation. With his PhD in ecology and environmental ethics from the Nicholas School, Van Houtan had a scientific perspective well-suited to the shift under way at the aquarium. Spring says, "The way he presents information is something along the lines of, 'How can we tell the story of climate change through an animal?'"

mascots of conservation

The aquarium's research on Pacific Ocean wildlife and ecosystems focuses on three ocean species to explore long-standing issues of conservation: great white sharks, southern sea otters, and Pacific bluefin tuna. In all three cases, a closer look at the animal has yielded insights that are useful for conservation efforts.

Sharks suffer from a fearsome reputation that they don't deserve. "You're far more likely to be harmed by your automobile than by a great white shark," says Van Houtan. By contrast, humans represent a real threat to shark populations worldwide: both because of accidental capture ("bycatch") by commercial fishing operations and because of strong demand for shark fins and other parts of the animal, it's estimated that up to 100 million sharks are killed each year. Scientists at Monterey Bay are working with other researchers and policymakers internationally, as well as in the United States, to promote sustainable fishing practices, reduce bycatch, monitor shark populations and conserve habitats critical to their populations.

Sea otters play an underappreciated role in

maintaining coastal ecosystems such as the kelp forests and estuaries in Monterey Bay. Kelp forests support vital communities of fish, but the fronds of the kelp are a tempting food for sea urchins; otters, by preying voraciously on sea urchins, help to keep that population in check and thereby spare some of the kelp.

Sea otters play a similar role in coastal wetlands, keeping crab populations in check so eelgrass can thrive and provide vital nursery habitats for a host of species like Dungeness crab. Through its one-of-a-kind program for sea otters, now in its 30th year, the aquarium rescues stranded pups and reintroduces them to the wild, while also conducting scientific research on sea otters' interactions with their environment.

Even the bluefin tuna has a public-image problem, according to Van Houtan. "This is really a fascinating creature," he says. "It's a top predator; it's warm-blooded, which is unusual for fish; and it's a gold-medal athlete, migrating thousands of miles across the ocean each year."



Because the market for tuna is consistently strong in many parts of the world, Pacific bluefin tuna have been fished so intensively that the entire population is down to just 3 percent of its historical biomass. Scientists from the aquarium began working with fishery managers in the mid-1990s to rebuild the Pacific bluefin population and put



1. Kyle Van Houtan PhD'06, the aquarium's director of science, oversees 30 employees + about 100 volunteers.
2. The aquarium's sea otter program rescues stranded pups and reintroduces them to the wild. The aquarium revitalized its mission in 1998.
3. The Tuna Research and Conservation Center was established in 1994.
4. Kyle Van Houtan in his laboratory at the aquarium.
5. Map of the Monterey Bay area, this area is unique for its vibrant ecosystem.
6. Callorhynchus red algae from the aquarium's herbarium.

great white SHARK

*It's estimated that
up to 100 million
sharks are killed
each year.*

it onto a path toward sustainability. Fortunately, in recent years, a growing number of research groups and policy agencies have joined in these efforts, which in 2017 led to a major victory—an international agreement to recover Pacific bluefin tuna populations.

information everywhere

“Kyle’s work is very innovative,” says Spring. “He takes an ecosystem-wide approach, but he’s also—and this is rare—a very talented storyteller.” Perhaps one of Van Houtan’s greatest talents is to find potential stories in the most mundane-seeming observations. He likes to use information that others have overlooked, saying, “I call a lot of things data that don’t look like conventional data.”

For example, many body parts of animals can be seen almost as sensors, keeping a faithful record of their environment

throughout the animal’s lifespan. “Equipped with our modern ability to analyze the chemical composition, museum collections of shells, feathers, bones or even whale earwax, open up the opportunity to go back a century or more and find out what the ocean was like,” he says.

This kind of approach was the inspiration for the aquarium’s new “Ocean Memory Laboratory,” where, in Van Houtan’s words, “The animals are helping us to tell the stories of the ocean where they lived.”

In a recent study, he examined samples of shell from Hawaiian hawksbill sea turtles, using traces of radioactive carbon in the Pacific from 1960 to 2015, in the wake of thermonuclear-bomb testing, to age the turtles and estimate when they reach maturity. Before that, he had pored over old menus from long-forgotten Hawaiian restaurants to illustrate a loss of diversity in local seafood species due to over-harvesting.

Van Houtan's knack for gleaning data from outwardly uninteresting sources is "like opening a treasure box of information," says Spring, "and this fits very well with our mission, because, before anything else, we want the science to excite people."

from birds to ethics to oceans

At a critical juncture in Van Houtan's academic career, he says, "I turned down what I thought was my dream job to take what turned out, in fact, to be my dream job." He had focused on biogeochemistry as an undergraduate, then studied bird behavior in Peru. At Duke, while tracking birds in the Amazon for his doctoral degree, he took some ethics classes at the Divinity School, to learn about better ways to explore the questions and assumptions that can sometimes arise in science and conservation.

Then came a couple of years at Emory University in a postdoctoral program in science and religion. At the intersection of these two seemingly disparate vantages, Van Houtan deepened his appreciation for the value of communicating with and relating to different groups of people—to identify important issues and find productive ways to look at those issues.

It was in his next post, at the National Oceanic and Atmospheric Administration (NOAA) in Hawaii, that Van Houtan came under the spell of the ocean. As he puts it, "After the first couple of years in Hawaii, seeing the incredible role of the ocean in buffering climate change, I was hooked.

"I used to think of the Amazon rainforest as the lungs of the planet, but what I've learned since then is that 50-85 percent of the oxygen we breathe comes from phytoplankton in the ocean. It's an understatement to say, as many people do, 'The ocean drives the climate system.' A more poetic way of putting it might be that the ocean is the beating heart of our climate system."

Here at the aquarium, he says, "We don't have the scale of research of a university and we can't affect policy like NOAA, so we've had to find our own niche. An example is our Seafood Watch program, which we started to provide information to consumers and have now shifted to working with producers all over the world to reform fishing and aquaculture practices for more sustainable seafood."

For other big projects such as reducing plastic pollution in the ocean, Monterey Bay has joined with 21 other major American aquariums to form the Aquarium Conservation Partnership, which is launching a public-awareness campaign and pursuing business commitments to reduce reliance on single-use plastics significantly over the next few years. But being driven by science, the aquarium's science team has joined with its partner institution the Monterey Bay Aquarium Research Institute (MBARI) to explore the fate of microplastic in the ocean's deep.

the monterey-duke connection

Van Houtan still keeps up his ties with academia, teaching a couple of classes at the Nicholas School every year as an adjunct associate professor in environmental sciences and policy. In addition, he continues to work with master's degree students on their projects and usually brings two or three graduate students

to work at the Monterey Bay Aquarium as interns.

The aquarium has hired another two people from the Nicholas School: **Andre Boustany**, as principal investigator of fisheries, and **Jerry Moxley**, as postdoctoral scientist. But the Duke connection extends even further than that, because Van Houtan's boss, Margaret Spring, also is an alum. Spring received her law degree from Duke Law School; and while at Duke Law helped to found the Duke Environmental Law and Policy Forum.

Boustany, whose time at Duke overlapped only briefly with that of Van Houtan, now works closely with him in looking at the historical ecology of the Atlantic bluefin tuna as gleaned from stock assessments and other old records.

"Until recently, tuna wasn't much valued or closely monitored—in fact, sadly, it was considered fit only for pet food," Boustany explains. This attitude began to shift in the 1970s with the advent of air travel, as fish buyers from Japan began purchasing more and more bluefin abroad for their clientele back home.

Boustany also is studying the age at which Pacific bluefin tuna can reproduce; if it turns out to be significantly older than had been thought, this finding might cause regulators to set a higher minimum age for harvesting, to allow the stock to replenish. Another study focuses on diseases that occur often among bluefin tuna in captivity but only rarely in the wild. Insights gained from this study may be helpful not just in aquariums but also hold promise for aquaculture where fish live in dense populations.

Thanks to generous support from donors and sponsors, the Monterey Bay Aquarium, a 501(c)(3) nonprofit, continues to find new and creative ways to inspire conservation of the ocean. The aquarium has added a new lab and a shop for designing sophisticated electronic tags that are almost imperceptible to the animals wearing them.

Researchers now have the means to track ocean wildlife and collect all kinds of data about their environment in the open ocean—temperature, acidity, salinity, and so on—all while minimizing the impact on animals' movements. Like tiny Fitbits for conservation.

"Science may seem like a kind of blood sport at times, but here we're lucky," Van Houtan muses. "The aquarium is a place that people have a lot of respect for. What's great about my role is that when we find a cool piece of science, it goes through peer review, gets published, and we can push that out to inform the public right away.

"Just as special is that you see people here from all walks of life, from all beliefs and political persuasions and from every country," he says. "Day by day, many thousands of people come here to fall in love with the ocean, then return home eager to take care of it."

Sandra J. Ackerman is a science writer based in Durham, N.C., and is a member of the National Association of Science Writers.



The Monterey Bay Aquarium has more than 35,000 creatures representing over 550 species and fill 34 major galleries, with nearly 200 exhibits in all.

Hurricane Maria is regarded as the worst natural disaster on record in Dominica and Puerto Rico.



NICHOLAS SCHOOL DEL ALUM **SARA MROZ** ASSISTS **PUERTO RICO** RECOVERY EFFORT

Sara Mroz DEL-MEM '09, a technical assistant with the U.S. Nuclear Regulatory Commission, was deployed to Puerto Rico in the fall to assist the Federal Emergency Management Agency (FEMA) with hurricane response efforts in the wake of Hurricanes Irma and Maria.

Mroz worked with FEMA's Surge Capacity Force (SCF) on the Congressional Affairs team. In that role, she traveled around Puerto Rico to see and learn about communities that were severely impacted by the storms. Mroz then planned and executed Congressional visits to affected areas.

Dukenvironment corresponded with Mroz to talk more about her experience in Puerto Rico, and how her Duke Environmental Leadership (DEL) MEM degree helped prepare her. DEL is the Nicholas School's online MEM program.



WHAT WAS THE NATURE OF YOUR WORK IN PUERTO RICO, AND WHAT WAS YOUR BIGGEST TAKEAWAY FROM YOUR TIME SPENT DOWN THERE?

"After arriving in Puerto Rico, I quickly realized that as so often happens, the news story and the real story didn't necessarily align. It was my job to tell the real story, to ensure that when the members of Congress came to visit Puerto Rico, that they saw and experienced the devastation across the island and that they also saw opportunities for action.

"So, I made sure that they saw food and water deliveries being made to municipalities. That they saw survivors registering for assistance at a Disaster Recovery Center. That they talked to the young pregnant woman in Barranquitas who lost access to her home when the road collapsed at the base of her driveway. That they saw the collapsed bridge in Utuado that connected 60 families to the town and also carried dirty water to and clean water from the water sanitation facility. That they realized that although Puerto Rico looks small on a map, getting to the interior of the island is difficult, fixing issues of power transmission will be extremely challenging, and the logistics of recovery are tremendously difficult.

"Rebuilding Puerto Rico will be a long journey. The policy conversation is starting to shift from one of rebuilding what was to building what can be, and this has broader impacts on recovery policies in our country. It was interesting to witness the beginnings of that policy conversation with our members of Congress."



WHAT ELSE STRUCK YOU ABOUT HOW THINGS CHANGED DURING YOUR TIME IN PUERTO RICO?

"When I first arrived in Puerto Rico, it was night time, and the drive from the airport to the JFO was eerie. There were very few cars on the road, streetlights were out, and many buildings did not have electricity, so there was little ambient light.

"The next morning, when I looked outside, it was a strange view. Looking out from the convention center, where the JFO was located, there were buildings everywhere. And I had had no idea of that the night before!

"The trees were bare except for a few palm fronds. Driving out of the city a few days later, the trees looked like broken match sticks with occasional random tufts of leaves. My coworkers remarked at how green things had become in the past two weeks. I laughed because the view was anything but green. As the days went on, the trees looked more and more like drawings from Dr. Seuss books with bunches of leaves here and there. After three weeks, the foliage cover had made it such that it was hard to see damage in the mountains during helicopter overflights.

"By the time I left Puerto Rico, four weeks to the day after I had arrived, things looked and felt very, very different. Cruise ships were returning to port and there were long lines of taxis to take tourists around. Electricity was sporadic, but at least in San Juan, most buildings had some form of power. And the trees were so green.

"Recovery will take a long time and things might not be just like they were before the storm, but people and nature are resilient."



WHERE WERE YOU WORKING IN PUERTO RICO?

"I was working in the Joint Field Office (JFO) in San Juan. I was deployed to FEMA as part of the Surge Capacity Force (SCF). The JFO was staffed by employees of many federal agencies, some in their agency roles and some like me 'on loan' to FEMA. The SCF was created after Hurricane Katrina to create a workforce that is capable of deploying rapidly and efficiently after activation to prepare for, respond to, and recover from natural disasters, acts of terrorism, and other man-made disasters, including catastrophic incidents."



→ WHAT ARE YOU MOST PASSIONATE ABOUT, AND HOW DO YOU CULTIVATE THAT PASSION IN YOUR PROFESSIONAL LIFE?

"Professionally, I am passionate about good policy. I find partisanship and politics maddening because so often they get in the way of making sound policy decisions.

"As a career federal employee, I have made a point of taking politics out of what I do. Policy is ineffective if people don't or won't follow it, so in my mind, the best policy is that which is well informed and is built with consensus. I listen. I build relationships. I get people to talk to each other who normally wouldn't. I find common ground. I plant seeds. I ask hard questions.

"As the global environment changes, I think that environmental and emergency management policies will necessarily become more intertwined. Some of the questions I think about are: What makes a community resilient? How can communities be more prepared to weather natural and technological hazards? How can I contribute to making positive changes and contribute good ideas to improve resiliency?"



WHAT COMMUNITY/ COMMUNITIES WERE YOU HELPING WITH?

"In San Juan, I was assigned to the External Affairs cadre, specifically the Congressional Affairs team. My career has been spent in external affairs roles, including time as Congressional staff and in Congressional Affairs positions, so this was a natural fit for me.

"The Congressional Affairs team in San Juan augmented the work of FEMA's Congressional Affairs team in Washington, D.C., answering questions specific to the Puerto Rico response efforts and responding to inquiries about individual cases.

"My role was to plan and execute Congressional visits to Puerto Rico, so I travelled around the island to see and learn about communities that were severely impacted by the hurricanes. I met with local governments and our federal partners to understand the needs of various communities and to plan site visits for the visiting delegations. During the visits, I traveled with the delegations, doing everything from managing logistics to answering questions about the generation capacities of various power plants."



HOW DID YOUR DUKE DEL-MEM EXPERIENCE HELP PREPARE YOU TO HELP IN PUERTO RICO?

"There are many lessons that I carry with me and that were influential during my time in Puerto Rico, particularly given the DEL-MEM focus on leadership. As I was packing for my deployment, I read a quote from St. Francis of Assisi that I carried with me as inspiration: 'Start by doing what's necessary, then do what's possible, and suddenly you are doing the impossible.'

"To me, this sentiment is also at the heart of the DEL-MEM program—leaders become leaders because they see a problem and they do something about it. When the problems facing the world seem too big or too many to tackle, we can all do something small to affect positive change; we are all leaders."

CAREER MATTERS

HONING THE MOST CRITICAL JOB SKILL - ADAPTABILITY

Personal adaptability is an important skill in today's competitive job market. **Deb Wojcik**, who served for two years as director of career and professional programming and counseling at the Nicholas School, shares her insights on this key skill, including how it is cultivated at the school.

1. WHAT DOES IT MEAN TO HAVE PERSONAL ADAPTABILITY?

Personal adaptability involves both a mindset that prepares you to face change and ambiguity as well as a skillset that allows you to deal with it effectively. Adaptable people are able to identify and embrace change as well as keep an open mind when the landscape shifts. They are willing to experiment and take risks. They see change as an opportunity to grow and develop rather than as an obstacle to overcome.

2. HOW CAN HAVING THIS SKILL HELP ADVANCE ONE'S CAREER?

I've heard several workforce experts and futurists describe adaptability as one of—if not the—most critical job skills. If you're on the job market or looking for your next promotion, be ready to share examples where you have demonstrated abilities to adapt, be flexible and flourish under uncertainty. Show that you can be their go-to person when things don't go as planned.

3. HOW IS PERSONAL ADAPTABILITY DEVELOPED AT THE NICHOLAS SCHOOL?

Students can stretch themselves by taking courses in different schools across Duke's campus, which the Nicholas School does a great job of supporting, and by adapting to the variety of content, teaching styles, student interactions, and expectations that come with those opportunities.

The interdisciplinary nature of the Nicholas School is great training for adaptability. Students learn a breadth of tools that can be applied in different contexts along with decision-making frameworks that help them ascertain what the best approach to a particular problem might be under conditions of uncertainty.

We've also worked to integrate adaptability into the master's curriculum. I worked with **Deb Gallagher** and her Business and Environment Master of Environmental Management students this year to present a three-part workshop addressing adaptive management from an organizational perspective and personal adaptability as a professional skill. This gave students the opportunity to reflect on how they currently react to change and how they can proactively work to improve their skills to achieve greater career success.

4. WHAT IS YOUR BEST ADVICE TO THOSE SEEKING TO BECOME MORE PERSONALLY ADAPTABLE?

First, make yourself uncomfortable. Stretch yourself, then stretch some more. Put yourself in situations where you can't possibly know what's coming.

Second, be mindful when you face change. We have natural self-protective instincts that can lead us to avoid uncertainty and shy away from change. Instead, actively reflect on how you react and how you feel when you face change. Think about how you could do it better next time and figure out what skills you might need to make that possible.

Adaptability can only come through practice. The more we put ourselves in situations where we have to deal with uncertainty and change, and the harder we work to improve our mindset and skillset to handle what comes, the more successful we will be.

GIVING 'EM THE BUSINESS... EXPERIENCE

When companies provide opportunities for Nicholas students to help with business challenges, everyone wins

BY LAURA ERTEL

These, days, one in four students in the Nicholas School's Master of Environmental Management (MEM) program are planning to make their environmental impact through a career in business or industry—a huge increase from even a decade ago.

That means it is more important than ever for our students to learn sound business practices and application of environmental concepts to business before they graduate, so they'll be able to hit the ground running in their post-graduation careers.

The Nicholas School is stepping up our emphasis on business skills, knowledge and application to sustainability. In addition to expanding opportunities for students to intern or do master's projects at companies, this fall, the school launched a Business & Environment (BE) concentration within the MEM degree program. Led by Associate Professor of the Practice **Deb Gallagher**, BE is designed to prepare students to become effective managers and analysts who can support organizations in implementing environmentally sustainable business practices.

One of the Business & Environment concentration's core courses is Business Strategy for Sustainability. Each spring, Nicholas alumni and others who manage sustainability practices in companies and organizations serve as clients for small teams of students

to apply classroom learning to a sustainability-related strategic challenge the business is facing. Students share their findings and recommendations with their clients, who gain actionable data to drive future business decisions.

"These projects are win-win for students and clients," says Gallagher. "Managers get a bright, motivated workforce to attack a specific area of need, so our students provide real value. And for our students, it's really important to be able to talk about this real-world experience when they apply for internships or jobs after graduation."

NICHOLAS STUDENTS: THEY GET THE JOB DONE

For **Kevin Fritze** MEM'09 MS'13, working with Nicholas students offered an opportunity to complete a project for which his company hadn't had the internal bandwidth.

Fritze, a corporate services and sustainability coordinator at global paper manufacturing company Domtar, enlisted a team from Gallagher's class to develop a total cost of ownership model for factory lighting. The customizable tool developed by students helps Domtar facility managers make more informed choices about what type of lighting to use.

"I knew this model would be a valuable tool for our organization, and one that we can build on going forward," Fritze says. "Thanks to the student group, the model was actually developed."

In addition to benefitting his company and the students, Fritze

himself relished reconnecting with the Nicholas School. “I very much enjoyed working with students going through the program now, hearing what was going on in the program that I was part of, and picking up a bit of the energy and enthusiasm of the current students.

“I also enjoyed passing on some of my perspective and advice as an alum, though you’ll have to ask the students if that was of any value,” he says, laughing.

Clients for the Business Strategy for Sustainability course range from large national corporations to small local businesses; an entirely new slate of business challenges is attacked each year. Other student teams have developed strategies for a regional hospital network to implement sustainability practices at its many sites; designed a dashboard to show employees at a large construction company the impact of its sustainability practices; and helped a nonprofit aquarium identify partners to apply its marine biology research to sustainable seafood. Clients gain a unique perspective on challenges they face, and most go on to implement the students’ recommendations.

OPEN SECRET: BUSINESSES BENEFIT FROM STUDENT ENGAGEMENT, TOO

While the Business & Environment concentration is new, corporate clients have played an important role in providing experiential learning experiences for Nicholas students for decades—and have seen how student involvement can benefit the bottom line by solving business challenges and recruiting top talent once these future leaders graduate.

Many Master’s Projects (MPs) and

internships are hosted by corporate clients, says **Charlotte Clark**, assistant professor of the practice of sustainability. Current and past clients include Fair Trade USA, Cree and a real estate development firm looking to “green” its large apartment complexes.

“With the new BE concentration, and the large and increasing number of our students who combine our MEM degree with an MBA at Fuqua or UNC’s Kenan-Flagler, providing MP and internship opportunities that allow students to gain practical experience outside of the classroom, while also making tangible progress toward a professional network, is highly beneficial, Clark says.

“Our corporate partners tell us they appreciate the ability to hire students from a program that attracts the best and brightest students who come to Duke for an MEM. Students who are trained not only in important content in environmental science, policy and economics, but also in teamwork and the ‘tools of the trade’ such as geospatial analysis, statistics, program evaluation, and research design and implementation,” she adds.

In addition, the student-run Business and Environment Club (BEC) organizes speakers and networking events, a “Business Bootcamp” series, and club trips to prepare students for careers in corporate sustainability. In October 2017, a group of BEC students traveled to the West Coast to meet with managers and executives at a variety of corporations, foundations and consulting firms to learn what they need to be industry-ready.

“It was a valuable experience to be able to meet with sustainability professionals from a variety of fields and to learn about

the different opportunities in diverse industries,” says **Bobbi Lesser MEM’18**, who will be one of the first to graduate from the Business & Environment concentration. “It was helpful to talk with Nicholas alumni and to be able to ask them how I can best tailor my degree for a career in corporate sustainability.”

To help guide the BE curriculum and identify opportunities to enhance students’ preparedness for the corporate sector, the Nicholas School has convened an Advisory Council comprised of Nicholas alumni and volunteer leaders who work in the corporate sector.

Interested in learning how your business or department could benefit from connecting with Nicholas School students as a client or MP or internship host? Contact **Ann Thurston**, Nicholas School associate director for development services & corporate engagement, at 919-613-8018 or ann.thurston@duke.edu.

Laura Ertel is a freelance writer living in Durham, NC, and is a longtime contributor to Dukenvironment magazine.



Interested in how you can benefit from connecting with our students?

Contact:

ann.thurston@duke.edu or 919.613.8018

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EVENTS+ HAPPENINGS

Mark your calendar for the following dates
and monitor our website at
nicholas.duke.edu for additional events.

APRIL 20, 11 A.M.-5 P.M.

EARTH DAY CELEBRATION

LSRC Courtyard

Contact: Nancy Kelly, 919-613-8090 or nkelly@duke.edu

SPRING-SUMMER 2018

Nic School Executive Education Courses

TIMBERLAND INVESTMENTS FOR PROFESSIONALS

May 3-4, The Cornell Club, New York, NY

PODCASTING FOR ENVIRONMENTAL PROFESSIONALS

Online - April 30-June 8

MAY 10-11

DEL-MEM PLACE-BASED SESSION

Environment Hall, Field Auditorium

Contact: The DEL Program, 919-613-8070 or

del@nicholas.duke.edu

MAY 12, 9 A.M.

NICHOLAS SCHOOL RECOGNITION CEREMONY AND
PROFESSIONAL DEGREE CANDIDATES

Graduation Keynote Speaker: Dr. Mamie A. Parker,
Renowned Conservationist

Location: Gross Chemistry Lot

Contact: Nancy Kelly, 919-613-8090 or nkelly@duke.edu

MAY 13, 9 A.M.

UNIVERSITY COMMENCEMENT EXERCISES

Location: Brooks Field at Wallace Wade Stadium

Contact: Student Services 919-613-8070 or

admissions@nicholas.duke.edu

AUG. 5-10

ESA 103rd ANNUAL MEETING

"Extreme Events, Ecosystem Resilience and Human
Well-Being"

Ernest N. Morial Convention Center, New Orleans, La.

Contact: faye@esa.org

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