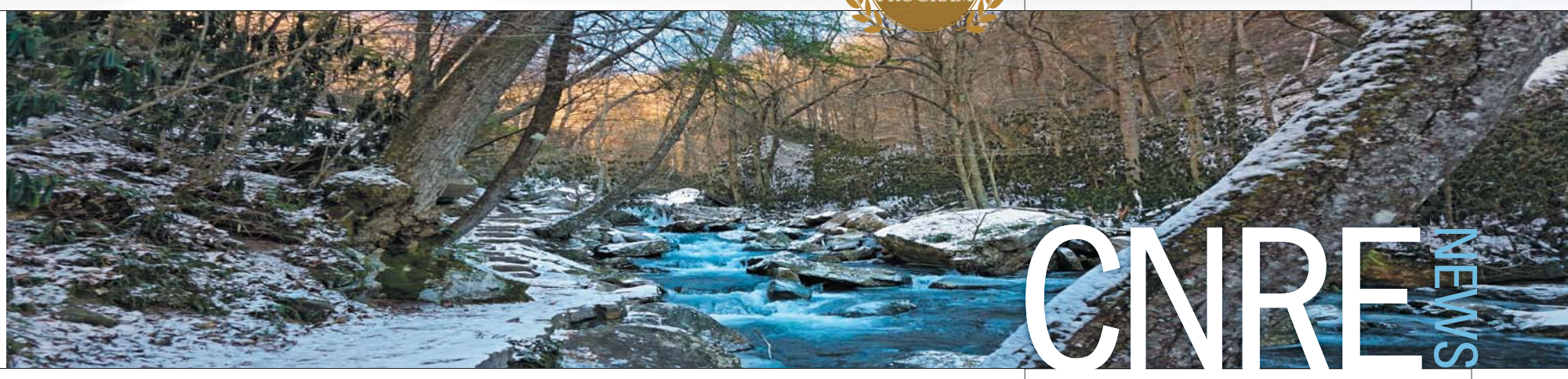
WINTER 2016
COLLEGE OF NATURAL RESOURCES AND ENVIRONMENT

No.1 RANKED PROGRAM

VirginiaTech
Invent the Future®



CNRE NEWS

ADVANCING THE SCIENCE OF SUSTAINABILITY

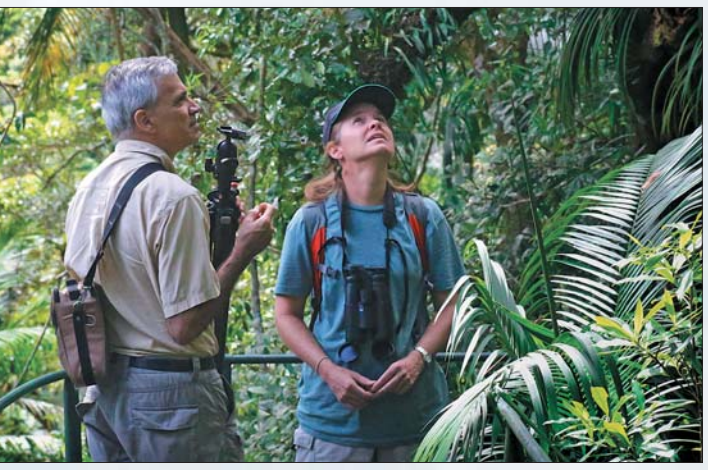
CNRE.VT.EDU

SAVING THE AMAZON

Scientists take a multi-faceted approach to sustaining the Amazon's biodiversity

The Amazon's vast rainforests, rivers, and soils are rich ecosystems vital to the basic functioning of the planet. They churn moisture into the atmosphere, sequester carbon, regulate climate patterns, and house much of the world's biodiversity. But those extensive, interconnected ecosystems are increasingly fragmented and degraded by unsustainable agriculture, exploitative commercial fishing practices, and other practices.

Scientists from several fields in the college are deeply engaged in the region, working in the Amazon's critical ecosystems to help reshape daily land-use and natural resource management decisions.



Senior Research Associate Kirsten Silvius (right) works with Brazilian government agencies to improve the livelihoods of forest-dependent peoples and ensure the boundaries of protected areas remain intact. Also pictured is her colleague, L. Flamarion de Oliveira of the Federal University of Rio de Janeiro. *Photo by José M. V. Fragoso, Stanford University*

For almost two decades, economists Frank Merry and Gregory Amacher have been at the forefront of land-use change modeling in the Brazilian Amazon. Using computers to generate models helps decision-makers see what short- and long-term impacts will result from different proposed land uses. Merry and Amacher's work on models that forecast land use in logging, ranching, and agriculture has led the way in the design of climate-related policies, including the UN-REDD Programme.

Furthermore, Merry, a research associate professor in the Department of Forest Resources and Environmental Conservation, and Amacher, the department's Julian N. Cheatham Professor of Natural Resource Economics, have long been seeking to address the problems faced by poor settlement families on the forest frontier.

"These households are the equivalent of the U.S. nonindustrial private forest landowner, yet they are largely excluded from the formal economy and struggle to survive under difficult, yet resource-rich, conditions," Merry said. "We try to inform Brazilian decision-makers about their plight and present viable development alternatives."

In conjunction with local partners like the Amazon Environmental Research Institute, Virginia Tech researchers have conducted more than 6,000 household interviews and brought these issues to the forefront of Brazilian policy design.

Merry serves as the administrative director of the nonprofit Aliança da Terra, which focuses on improving resource management on private lands in the Brazilian Amazon. This work includes a voluntary registry in which farmers commit to meeting select environmental, social, and production criteria on their properties. In return, their products are entered in the organization's Producing Right Platform, enabling manufacturers and consumers to trace a product's origin and evaluate how sustainably it was produced.

In a long-standing partnership with the U.S. Forest Service, Aliança da Terra established a firefighting brigade to help protect private and public forests. More than 630 local volunteer firefighters have been trained to date by the agency's world-renowned smokejumpers.

Senior Research Associate Kirsten Silvius, a wildlife ecologist, works with indigenous hunters in Amazonian Guyana to understand game population densities and hunting behavior. The information gained helps guide management decisions to ensure that wildlife populations remain healthy and thrive over the long term. That kind of participatory monitoring and management, involving data collectors, decision-makers, and community residents, is a "bottom-up approach" to effect change that can meet multiple objectives, she says.

Left: Indigenous technicians were recruited and trained in biological and social data collection for a three-year study in Guyana. *Photo by José M.V. Fragoso, Stanford University*

A volunteer firefighting brigade established by the nonprofit Aliança da Terra now helps protect public and private forests from wildfire. *Photo by Aliança da Terra*

In Silvius' three-year study, 335 locally recruited and trained indigenous technicians walked 2,000 kilometers a month recording data on animal observations and signs, forest structure, even fruit abundance. Silvius now works closely with Brazilian government agencies to improve the livelihoods of forest-dependent peoples and ensure the boundaries of protected areas remain intact.

Assistant Professor Leandro Castello of the Department of Fish and Wildlife Conservation recruits community-based fishermen to guide fisheries management. He leverages local knowledge of habitat and ecology for the conservation of arapaima — a 400-pound, air-breathing, top-predator species fished to extinction in some communities. "Many fishing communities are developing their own management strategies, asking scientists and governments to better manage fisheries," he said.

Now is the time to reverse current trends, according to Castello. "In Brazil's Amazonas State there have been significant strides," he said. "The arapaima fishery there is coming back, a far cry from 10 years ago." Things are not looking as promising in other locations, but Castello says his research "has the primary goal of influencing policy, not just creating knowledge. I think there is evidence with the arapaima that it has helped."

"There is no doubt the Amazon rainforest and the peoples and animals that depend upon it continue to be under tremendous pressure," Merry concluded. "Fortunately, many Virginia Tech scientists are playing an important role in understanding the pressures facing this vital resource."

The arapaima, a 10-foot-long fish that can weigh more than 400 pounds, has been fished to extinction in some Amazon Basin communities. *Photo by Sergio Ricardo de Oliveira*

Livestock production is one of many practices that can degrade natural ecosystems in the Amazon.
Photo by Aliança da Terra

FROM THE DEAN'S PERSPECTIVE

Professor Jay Sullivan, who has been a member of our faculty for nearly three decades, has been selected as head of the Department of Forest Resources and Environmental Conservation (see story below). He was selected from among several top-notch candidates and has the knowledge, skill, and ability to lead the department forward. There has never been a more important time for forestry and the effective and sustainable management and utilization of forest resources on a global scale. We are also selecting a new department head for geography and will fill several additional faculty positions important to our teaching, research, and outreach.

We are nearing historic enrollment levels in the college; undergraduate enrollment will exceed 800 during the spring semester. Applications for fall 2016 were at record levels and will yield a larger, more diverse, and academically accomplished freshman class. Our enrollment goals for the next six years are aspirational and aggressive, and we are examining all aspects of our ability to support a growing enrollment without compromising the quality we are noted for. Growth is important, quality even more so. Our new degree programs in packaging systems and design, meteorology, and water: resources, policy, and management are all in high demand and growing rapidly, while all of the college's degree programs are experiencing demand.

We successfully completed our inaugural cohort of the Sustainability Institute in January (to be highlighted in the spring issue). This 10-day intensive training program gives us a platform to bring students from diverse

Dean Paul Winistorfer with Angie DeSoto, director of the college's new Sustainability Institute.

majors across campus into comprehensive study and conversation about all aspects of sustainability. We plan to convene a cohort during the summer; future planning will include a study abroad experience. Everything we do in the college contributes to a sustainable future, provision of sustainable natural resources, and health and quality of life.

In mid-January we held our first CNRE Briefing Day, a compilation of 20 faculty presentations in 10-minute format. It was an informative and fun day learning from each other as we examine ways to leverage our expertise and build collaborations. And we have begun planning for a conference this fall on the theme "Women in Natural Resources: Leading, Mentoring, and Connecting." Look for more information in the coming months.

Finally, in partnership with the School of Architecture, the Myers-Lawson School of Construction, and the Department of Apparel, Housing, and Resource Management, we are proud to announce the Mitchell O. Carr Symposium, titled "Creative Use of Wood in Design," to be held on campus March 19-21, 2016. It will feature a two-day student competition and a full-day symposium, which will offer continuing education credits for professionals. This event is made possible through the support of the Carr Family Foundation and family patriarch Mitch Carr, who founded Augusta Lumber and is a noted hardwood lumberman. We are excited about the symposium and hope it can become an annual event. Visit **www.cfpb.vt.edu/?p=728**.

The summer will bring renovations to several rooms, orientation for new students, and arrival of new faculty. While we execute today, we are always looking ahead. Let's get to it. Thank you for your support and interest in the college.

Warm regards on behalf of our faculty, staff, and students,

Paul M. Winistorfer
Dean
pstorfer@vt.edu

@vt_cnre

A new student council for the college

The fall 2015 semester brought a new academic year, and, for the college, a new student council. It was formed by a group in last year's Leadership Institute, where students "put leadership into action in an open-ended project," explained Student Council President Charles Aquilina. While brainstorming about a project, the group decided to meet with the dean to discuss ideas, and he suggested forming a college student council. During spring semester, the group developed the organization's structure, wrote its constitution, and recruited members.

The council "strives to provide a collective, unified, and representative voice for the values and interests of the students, departments, and the organizations within the college," said Vice President Kaylyn Duda. Its membership consists of a four-person executive board plus two representatives from each of the four departments.

So far the council, which meets twice a month, has met with the dean and department heads on multiple occasions to discuss issues of communication, engagement, and cooperation. The council's goals include informing students about opportunities, promoting professional development, and providing solutions to relevant issues within the college. "I am excited to have a formal structure for communication with our students and to provide additional leadership opportunities for them," said Dean Paul Winistorfer.

The Student Council's executive board includes (left to right) Ethan Reuse, Charles Aquilina, Kaylyn Duda, and Samantha Hannabass.

Sullivan named department head

Professor Jay Sullivan has been selected as head of the Department of Forest Resources and Environmental Conservation after an international search. "Dr. Sullivan emerged from an extremely strong applicant pool, and I'm especially pleased that we have identified new leadership from within the department," said Dean Paul Winistorfer. "He knows our strengths, our challenges, and our aspirations and had the strong support of the search committee as well as department faculty and staff. He has the best attributes of leadership to help continue a positive, productive, and collegial environment.

Sullivan, who had served as interim department head since May 2015, intends to continue to build on the department's strong foundation. "My vision is to continue to develop our culture of growth, seeking to grow our enrollment, our commitment to achieving diversity in our student and faculty ranks, and our global reputation as the thought leaders in the science and practice of our field," he said. "I hope to guide us in continuing to serve our students, the commonwealth, and clientele through our department's strong leadership role in matters of forestry and the environment."

Students take over Instagram

We've turned the college's Instagram page over to our students! See the college and campus life through an undergrad's eyes as students take over our Instagram page for a week at a time this semester; each is sure to provide a unique perspective. Follow us at **vtcnre**.

Correction

Laszlo Horvath and **Young Kim** were each promoted to assistant professor in the Department of Sustainable Biomaterials. The fall issue incorrectly reported that their promotions were to the position of assistant professor with tenure. We apologize for the error.

CNRE NEWS
COLLEGE OF NATURAL RESOURCES AND ENVIRONMENT
cnre.vt.edu
@vt_cnre
VirginiaTech Invent the Future®

Winter 2016 Quarterly Newsmagazine

MIX Paper from responsible sources FSC® C005991

Dean Paul M. Winistorfer
Editor Lynn M. Davis (davisl@vt.edu)
Associate Editor Helen Thompson
Assistant Editors Maya Chapman, Christine Gibson, Liz Kirchner, Lauren Mathews, Brooke Stephenson, Susan Trulove
Designer Joe Swope
Photography Contributors Dick Benson, Cayelan Carey, Lynn Davis, Jim Stroup, Helen Thompson, Logan Wallace
Printer Progress Printing of Lynchburg, Va.

Department of Fish and Wildlife Conservation fishwild.vt.edu
Department of Forest Resources and Environmental Conservation frec.vt.edu
Department of Geography geography.vt.edu
Department of Sustainable Biomaterials sbio.vt.edu
Center for Geospatial Information Technology cgit.vt.edu
Center for Leadership in Global Sustainability cligs.vt.edu
Center for Natural Resources Assessment and Decision Support cenrads.cnre.vt.edu
Conservation Management Institute cmi.vt.edu
Virginia Water Resources Research Center vwrrc.vt.edu

WEI turns the tables

This table design reflects the year Virginia Tech was established. The two lines engraved lengthwise indicate the tree's 1872 growth ring.

Each year, the Wood Enterprise Institute (WEI), a student-run entrepreneurial venture, uses a concept-to-market business approach to plan, design, manufacture, sell, and distribute a product, such as wooden coasters, cuttings boards, and bookends. This year's team has taken on an ambitious challenge. They acquired a 314-year-old white oak tree, which had succumbed to disease, from the Grove, the Virginia Tech president's residence. The team plans to design and craft three or four custom tables, each of which will highlight a date in the tree's history, identified by its growth rings, and correspond that date to a significant historical event, such as the founding of Virginia Tech in 1872.

The group plans to auction the tables for a minimum of $2,500 each. The profits generated will be donated to the Virginia Tech community to help support historical preservation and urban forest sustainability programs. Visit **www.vtwei.com** for more information on this unique effort and to track the team's progress throughout the spring semester.

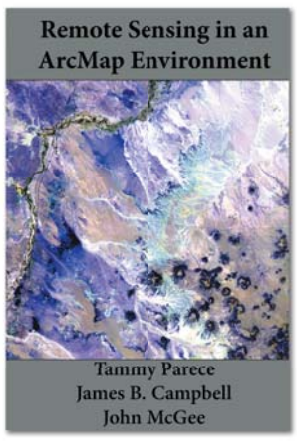
Day helps develop sustainable sites initiative

Susan Day played a pivotal role in the development of national guidelines for sustainable urban landscapes.

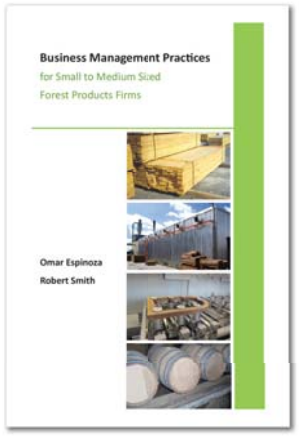
Associate Professor Susan Day initiated national discussions in 2007 that culminated with the recent rollout by Green Business Certification Inc. of its new Sustainable Sites Initiative (SITES) rating system, the most comprehensive program and toolkit for developing sustainable landscapes. Day not only helped create SITES but also served on the Soils Technical Committee that provided the standards for urban soil management. "Soil standards are a critical component of the rating system," Day explained. "We carefully deliberated what constitutes sustainable management and design. After working on this project for nearly 10 years, it is rewarding to see it all come together. Our nation's urban landscapes can only benefit as these guidelines are adopted."

The SITES rating system can be applied to development projects located on sites with or without buildings — ranging from national parks to corporate campuses, streetscapes, homes, and more. Modeled after the U.S. Green Building Council's LEED (Leadership in Energy and Environmental Design) rating system, SITES includes best practices in landscape architecture, ecological restoration, and related fields as well as knowledge gained through peer-reviewed literature, case-study precedents, and more than 100 projects registered in the SITES pilot program. Visit **sustainablesites.org**.

New geospatial, forest products publications



Authored by three geospatial experts — doctoral candidate Tammy Parece and professors James Campbell and John McGee — the e-book "**Remote Sensing Analysis in an ArcMap Environment**" was designed specifically to help make the tremendous volume of remotely sensed images more accessible to people who are learning, teaching, and working in geospatial sciences. Data derived from remote sensing imagery is often used as a "backdrop" to accurately develop GIS map layers. Written for students and professionals who have access to new remote sensing software through their employers or educational institutions, the e-book is presented as a set of tutorials, with screen-capture videos that walk readers through each step of the process and provide links that expand the training to supplemental information and support online. The book's nominal price — $2.99, or free to Kindle Unlimited subscribers — encourages wide distribution.



People often enter the forest products industry based on their passion for working with wood; they may not have an understanding of sound business practices. "**Business Management Practices for Small to Medium Sized Forest Products Firms**," by Professor Bob Smith and alumnus Omar Espinoza, presents the nuts and bolts of business management as it relates to the forest products industry, offering business owners and managers a framework for success. The book's chapters cover major topics in business management, such as strategic planning, human resources, finance, marketing, and operations management. The final chapter guides readers through writing a business plan. Appendixes include a sample business plan and contact information for dozens of agencies and organizations that can serve as resources. Funded by the U.S. Forest Service, the book is available free in electronic or hard copy format.

The Virginia Master Naturalist program's new affiliation with the Virginia Institute of Marine Science's Center for Coastal Resources Management will enhance the program's outreach and citizen science efforts in coastal and estuarine ecology and management. *Photo courtesy of Tidewater Chapter*

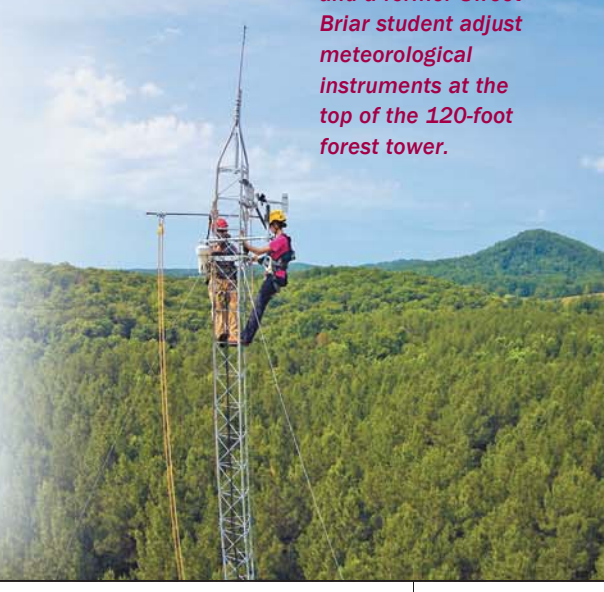
New sponsor for Virginia Master Naturalist program

The Virginia Master Naturalist program welcomes the Virginia Institute of Marine Science's Center for Coastal Resources Management as its newest sponsoring agency. "We are excited to have the Center for Coastal Resources Management join our growing network of sponsoring agencies and partnering organizations around the state," said Michelle Prysby, statewide coordinator for the program.

The Center for Coastal Resources Management develops and supports integrated and adaptive management of coastal zone resources. To fulfill this mission, the center undertakes research, provides advisory service, and conducts outreach education, including Master Naturalist training courses for coastal and estuarine ecology and management in collaboration with other Virginia Institute of Marine Science departments.

"Supporting the Virginia Master Naturalist program is a logical extension of our outreach efforts," said Center Director Carl Hershner Jr. "There is a growing need for educated citizens to support various local and state government initiatives aimed at restoring the Chesapeake Bay and adapting to climate change. These volunteers are well positioned to serve the commonwealth in these roles, and we look forward to helping make that happen."

Expanding forest study with access to new research station



Thomas O'Halloran and a former Sweet Briar student adjust meteorological instruments at the top of the 120-foot forest tower.

The college has increased its capacity to study forests and how such landscapes influence climate by adding Thomas O'Halloran to the forest resources faculty. O'Halloran, formerly of Sweet Briar College, brings access to the land-atmosphere research station he founded there. The move to Virginia Tech was facilitated by Assistant Professor Quinn Thomas, who began collaborating with O'Halloran at the site last year.

The research station features a 120-foot tower with an array of instruments to measure forest-atmosphere interactions across a 67-acre pine plantation. The two researchers are interested in similar questions and instrumentation but have different backgrounds — Thomas in ecosystem science and O'Halloran in meteorology — which they combine to study land-atmosphere interactions.

When it appeared that Sweet Briar would close, the project's future was uncertain, so Virginia Tech stepped in. Now that the school remains open, work at the site continues as a collaboration between the two schools. "The site is busier than ever. I am pleased to see undergraduate and graduate students from both schools working together," O'Halloran said.

The research station contributes to an international network of "flux towers" — sites that measure the exchanges of carbon dioxide, water vapor, and energy between the forest and the air above. "These sites are in many ecosystems across the globe, including large networks in the U.S., Europe, and China," Thomas said. "No site is exactly like ours but a lot are similar so that we can contribute to research at the global scale."

It will be another year before the first results are in. Meanwhile, in addition to gathering data, the research station continues to be a resource for graduate student projects and undergraduate classes at both schools from several disciplines, such as forest resources, environmental informatics, and meteorology.

RESEARCH SPOTLIGHT

Research is a critical component of the college's mission of Advancing the Science of Sustainability. The short summaries below provide a glimpse into the wealth of research for environmental sustainability being conducted by our world-class faculty members. Visit vtnews.vt.edu/feeds/natural-resources.html to read the full stories behind these summaries as well as other press releases pertaining to the college.

Land managers gain tools to mitigate greenhouse gas emissions

Being able to measure forestry and agricultural intake and emissions of carbon dioxide is critical to developing a strategy for addressing climate change by reducing greenhouse gases. A team of 38 scientists has developed science-based methods for measuring changes in greenhouse gases, published in a USDA report. Professor Stephen Prisley wrote the report section about management to increase carbon storage. "My contribution was how to measure dry weight, carbon uptake, and change," he said. "Measuring involves the use of data such as soil maps to tell us how productive a site would be and satellite imagery to determine land cover and assess the health of tree stands."

The report is geared to small landowners who want to increase carbon storage through agriculture or forestry. User-friendly tools are being developed that will assist land managers who are considering entry into the voluntary carbon storage market. The report explains how to map and inventory a forest based on acreage and tree size, age, and species, and also addresses what to do with the land after a timber harvest to continue or resume pulling carbon dioxide from the atmosphere. The USDA will also use the methods in the report to prioritize research and data collection to improve agriculture and forestry greenhouse gas inventory from local to national scales.

Stephen Prisley contributed to the team that developed science-based methods to quantify changes in greenhouse gas emissions and carbon storage.

Research aims to preserve the Great Plains by controlling woody shrubs

A team of scientists from four universities received a $1.3 million grant from the National Science Foundation to determine how to slow the encroachment of woodlands that is occurring on the Great Plains. "Once these grasslands convert to woodlands, restoration can be very difficult and can cause a lot of hardship for rural communities," said Assistant Professor Michael Sorice. The project includes looking at governmental policies and social attitudes on the use of fire to reduce the vulnerability of grasslands to the invasion of woody plants. The team will also determine the impact of the conversion of grassland to woodland on ecological services, such as forage production, groundwater recovery, stream flow, and the removal of carbon dioxide from the atmosphere.

In a healthy rangeland ecosystem, woody plants are interspersed within a grassland (left), but rangelands become unhealthy when woody plants dominate the land (right).

The researchers will compare three regions with contrasting degrees of woody encroachment and will analyze the factors that influence decision-making by land managers. "Overall, I want to understand how landowners in the Southern Great Plains perceive and interpret feedback from the rangeland system, judge risk, and make decisions about land management," Sorice said. The project will also provide Web-based educational materials, workshops, and tools for private landowners, extension agents, USDA staff, and K-12 science teachers.

Training key to improving citizen scientist-collected data

Using volunteer "citizen scientists" to collect data seems like an ideal way for budget-strapped agencies and nonprofits to augment their workforce. Unfortunately, data collected by citizen scientists have the potential for error, according to a study by scientists from four universities. "These people receive a little bit of training — a day at most, but often only 30 minutes — and then they collect data that are used by scientists. However, this movement is happening without really checking the accuracy of the data collected by these citizen scientists," said Associate Professor Carolyn Copenheaver, a co-author of the study, published in NACTA Journal.

The research team looked at how accurately high school students collected tree diameter data and identified trees within a fixed plot, and the degree to which accuracy was influenced by the scientific background of the adult instructor. The same data had been previously collected by professional scientific researchers as a baseline. The results were best when trained university faculty members instructed students and in study areas with lower biodiversity.

For this study, professionals first collected data as a baseline to compare with that collected by citizen scientists.

Harmful phytoplankton blooms such as this one in Lake Mendota, Wisconsin, severely degrade water quality.

Researchers investigate human-natural feedbacks in freshwater systems

A multidisciplinary team of researchers led by Assistant Professor Kelly Cobourn will examine the linkages between humans and freshwater quality using a $1.8 million National Science Foundation grant. The goal is to investigate human-natural feedbacks in freshwater systems by examining the linkages between land-use decision-making, water quality, and collective action taken by the public to protect water quality.

"We know that humans affect the environment, but you can't really understand any complex system without also studying how the environment affects human behavior," Cobourn said. "This linkage from the environment back to humans is a key piece of the puzzle that allows us to better understand changes in many diverse types of human-natural systems." The framework found by the research will act as a guide for citizen-driven lake associations to advocate for laws and regulations that will allow for the environment surrounding lakes to be protected and ultimately the benefits gained by humans to be preserved.

Scientists tap trees' evolutionary databanks to discover environment adaptation strategies

Researchers have been using the gene function of a small, simple, model plant to learn about and sequence hundreds of tree genomes for decades. However, a research team recently developed a new strategy to learn about trees' genetics. Their study, published in Nature Genetics, identified gene sequences from Populus trichocarpa, commonly knows as black cottonwood.

To determine how the trees adapt to different climates, cuttings from trees in many wild populations were grown in research plots in four distinct environments from California to British Columbia. Associate Professor Amy Brunner explained that by watching the trees' traits and genetic code change simultaneously, scientists can easily deduce which genetic variations are important to adaptation. The real work is finding out why. "The challenge is that we have identified all these genes but don't yet have a good idea of their function," she said.

This study identified two related genes in trees that were altered based on environmental conditions — the FT1 gene is known to regulate the transition to flowering and the FT2 is important for controlling fall growth cessation and bud set. "Trees must time entry and exit from winter dormancy appropriately for their climate to maximize growth but avoid damage by fall and spring frosts, so these two genes may have a crucial role in the timing of both dormancy transitions," Brunner said, adding that her research can be a bridge between genome-wide studies of the ways trees in different environments adapt and the understanding of the role of specific genes in a process.

Amy Brunner is working to identify gene sequences from Populus trichocarpa, commonly known as black cottonwood.

Successful natural resource management built on trust

Trust is an important driver of collaboration, conflict resolution, and enhanced group performance in the business world as well as in the management of natural resources. “One thing we can be sure of in ecosystem management is that we don’t know all the answers,” said Associate Professor Marc Stern. “Therefore, collaborative learning and innovation is particularly important.” Stern explains that trust between government agencies, environmental groups, industry, and local citizens is “necessary to effectively govern natural resources.”

According to Marc Stern (left), trust between multiple stakeholders is essential to building the types of collaboration necessary to effectively govern natural resources.

Four forms of trust may play a role in building resilient collaborations for natural resource management. “The first we call dispositional trust — some people are predisposed to be generally trusting or generally distrusting,” Stern said. The other three forms are the results of actions. Rational trust is based on the expected benefits of an action, affinitive trust develops primarily through social relationships and is more personal than factual, and action-based trust involves faith in the system of procedures or rules. The best collaborations work with a combination of all three forms of actionable trust. While there are no magic trust-building tools, its growth can be encouraged through consistency, collaboration, and an open and informal relationship. Additionally, long-term relationships foster more trust than short-term ones.

Study on New River trotlines reveals changing traditions in fishing

Master’s student Ben Dickinson interviewed trotline fishers along the New River.

While the popularity of fishing for smallmouth bass is on the rise in Virginia’s New River, the decades-old practice of fishing for catfish using trotlines is fading, according to a recent study. A trotline is a heavy fishing line with baited hooks attached at regular intervals. Most trotline fishers in the New River use trotlines sunk to the bottom, minimizing exposure to other river users. Catfish fishing and trotline fishing have never been strictly regulated in Virginia, according to the research article, published in Fisheries magazine, by former master’s student Ben Dickinson, Professor Donald Orth, and Associate Professor Steve McMullin.

Dickinson interviewed 39 trotline fishers, and it was a challenge to find that many. Fifty years ago, harvest was the primary goal of fishing in the New River, with catfish the predominant fish harvested. Now recreation is the goal, with game fish such as bass, muskie, and walleye being the focus, many of which are caught and released. Several retired fishers said they no longer need to supplement their diets with wild-caught fish. “Our findings provide a peek into characteristics of trotline fishers that should prove useful for managing or studying this or other hidden fisheries,” the authors concluded.

Antibiotic resistance in Africa

Kathleen Alexander (left) confers with her research team member Cisco as they take sample animal droppings to analyze for studies on antibiotic resistance.

Associate Professor Kathleen Alexander and former postdoctoral associate Sarah Jobbins used the common intestinal bacteria Escherichia coli to evaluate the spread of antibiotic resistance among humans, domestic animals, and wildlife in the Chobe district of northern Botswana, as reported in the Journal of Wildlife Diseases. The researchers tested for resistance to 10 antibiotics among cattle and 18 species of wildlife to explore key attributes and behaviors that may increase exposure and allow resistance to move between humans, animals, and ecosystems. Results were compared to 193 human samples from healthy and clinically ill patients at the local hospital and 12 environmental sources of human fecal waste.

Multidrug resistance was found across land types, from areas of human habitation to protected areas such as Chobe National Park. It was significantly higher in carnivore species, water-associated species, and species inhabiting urban areas. The study is one of few to examine antimicrobial resistance in such a broad range of hosts, both in absolute numbers and breadth of species, in their natural environment. “We can harness life history diversity in wildlife communities to identify where contact with resistant microbes might occur in the environment. Right now, our data suggest that surface water may be a critical exposure medium. In an environment where there are no commercial agriculture or livestock production activities, our next step is to establish why we are seeing these patterns,” Alexander said.

Successful ecological restoration must meet more robust standards

Four principles are recommended for restoring degraded ecosystems. Photo by A.E.J. Valenzuela

In a succession of international agreements, governments worldwide have pledged to restore degraded ecosystems to address climate change. “In spite of this clear consensus, there have been no clear standards or protocols that managers can use,” said Adjunct Professor Chris Anderson, a socioecologist at the Austral Center for Scientific Research in Argentina.

To maximize such benefits as conserved biodiversity and sustained livelihoods, ecological restoration should increase ecological integrity, be sustainable in the long term, be informed by the past and future, and benefit and engage society. Adherence to these four principles will add clarity, accountability, and accomplishment in this new era of embracing ecological restoration as an environmental policy tool, Anderson and his co-authors write in a study published in Science. “Initiatives that emphasize one principle over the full suite are not true restoration — and therefore are insufficient to address restoration goals.”

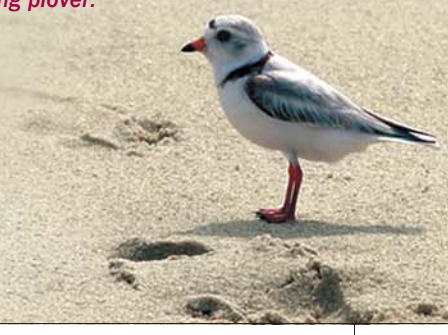
Habitat model to help protect piping plover

The piping plover, which nests in open areas along Atlantic Coast beaches, has been on the federal threatened species list since 1986. Doctoral student Katherina Gieder has created a model combining sea-level rise, shoreline change, geomorphology features such as beach width, and piping plover nesting habitat suitability to help managers protect the birds against habitat damage and predation. Her research was published in Ecological Modelling.

Gieder’s research to meet her first goal — to develop and implement a tool to predict future change to piping plover habitat — was unique in that it incorporated relative sea-level rise and the dynamic response of specific variables to that rise. Using her model, she simulated two rates of sea-level rise between 2050 and 2100: 3 and 4.1 millimeters per year. Such modest sea-level rise rates could increase suitable piping plover habitat 40 to 80 percent.

Her second goal was to address gaps in the understanding of predator population ecology, in particular red foxes and piping plover breeding populations. For example, the study found that red fox occupancy increases sharply with increased eastern cottontail presence, but having more rabbits to eat didn’t always keep birds off the fox’s diet. “Red foxes are territorial, so if one red fox has territory with few rabbits or small mammals, then it might turn to shorebird chicks and eggs,” Gieder said. The U.S. Geological Survey is using an iPhone app built for the model that records data on nesting behavior.

Doctoral student Katherina Gieder created a model to help managers protect the threatened piping plover.



Deveau interns at the White House

Alena Deveau of Fairfax, Virginia, received a rare opportunity last summer, joining about 130 students selected to experience public service at its finest in the White House Internship Program. Deveau, a meteorology and geography double major with a minor in communication, interned in the Office of the First Lady under Joining Forces, the First Lady and Dr. Jill Biden's initiative to support U.S. active duty military members, veterans, and families in areas of employment, education, and wellness. She also participated in events such as the Congressional Picnic, the Fourth of July celebration on the White House South Lawn, the 2015 Kid's "State Dinner," and the first-ever White House Girl Scout Campout.

"It truly was a privilege. The laughter, hard work, and insatiable desire to empower others all unleashed in the journey to learn what it truly means to become a public servant," Deveau said. "I was humbled to be surrounded on a daily basis by the most dedicated and talented individuals. Every moment and every opportunity is revered."

Deveau previously interned with the U.S. Coast Guard, NBC in New York City, and NBC's affiliate station WSLS, in Roanoke, Virginia. She is thankful for her past experiences and is eager for what's to come!

Students attend Pack Expo

A dozen packaging students traveled to Las Vegas for the 2015 Pack Expo, where they met with leading packaging companies, learned about the latest developments in the packaging industry, and networked with packaging students from other schools. Pack Expo hosts the largest packaging industry trades show in North America, attracting over 30,000 attendees from around the world, including students from several university programs.

Student attendees at Pack Expo with Assistant Professor Laszlo Horvath (far right).

In addition to visiting exhibitor booths and attending education sessions, students participated in some friendly competitions. In the Amazing Packaging Race, students from different schools teamed up to complete a series of tasks, requiring them to visit multiple industry booths and solve problems. Students also took part in the Pack Solution Challenge, in which they worked with an industry mentor prior to the expo to design a packaging line for a specific product and then presented their results to an industry board at the event. Pack Expo arranged for volunteers from industry to give tours of different parts of the expo to students and introduce them to a number of company representatives.

"I would suggest that any student serious about the packaging discipline attend the trade show," said student attendee Andrew Smith. "Pack Expo is a great way to learn about companies and the industry, network with potential employers, and represent the Virginia Tech packaging program."

"The expo is a great way for the students to gain connections and to learn about internship opportunities," said Assistant Professor Laszlo Horvath, who added that the Center for Packaging and Unit Load Design, which he directs, has an on-campus internship program available to freshman and sophomore students, enabling them to gain professional, hands-on experience early in their college experience.

Tech-savvy sophomore only student on interdisciplinary water study team in Africa

Paige Williams takes a break from field research to pose with children in the village of Batondo, Burkina Faso.

Paige Williams of Radford, Virginia, headed to her interview at the Center for Geospatial Information Technology last May hoping to land a part-time job. The next day she had a plane ticket to Burkina Faso. The rising sophomore majoring in environmental informatics had just earned a spot on a team conducting field research on multiple-use water services in the West African country.

Project leader Ralph Hall, assistant professor of urban affairs and planning, enlisted specialists from several programs at Virginia Tech for the project, combining expertise in water and sanitation systems, public health, gender issues, statistics, data visualization, and geospatial representation. "Paige was the only student; the rest of the team were faculty," he said. "That can be very intimidating, but she did really well."

Hall tapped Peter Sforza, director of the Center for Geospatial Information Technology, to help develop a data management and visualization platform to support water services planning. Since Sforza couldn't travel with the team, Hall asked him to find a substitute. "We needed somebody with GIS skills — hands-on, using the software and understanding the data sets," Sforza explained. "I knew this was the type of student the environmental informatics program would have."

Williams went to the interview expecting to help with small projects at the center. But when Sforza mentioned the opportunity to conduct fieldwork in Burkina Faso, she immediately volunteered. In the month before the team left for Africa, Hall and Sforza trained Williams for the task ahead. "On the plane, I was very nervous, like, 'what did I say yes to?'" Williams admitted. "But as soon as I got there, I thought, 'I was meant to be here.'"

The goal of the team, which spent 10 days in Burkina Faso, was to combine community knowledge about water sources with biophysical maps to explore ways to advance the multiple-use water services planning process. The research is the first step in the development of a decision support platform that they hope will someday enable decision-makers to leverage all available data to create water services that are sustainable and support rural livelihoods.

To learn more about the social dynamics surrounding water use, the team planned to run two 10-person focus groups in the community of Batondo. But when they arrived, they found more than 100 adults and some 40 children waiting. "It seemed like the whole village was there," Williams said. "They were so excited to talk to us."

Williams logged GPS readings at water sources and mapped the results so her colleagues could immediately begin analyzing and sharing the data. "She was clearly able to pull her weight, which is impressive since she was working alongside faculty while experiencing rural Africa for the first time," Hall said. He hopes Williams can help forge a long-term research initiative. "She's now our go-to person for processing data and getting information together."

Williams' travels have brought a new dimension to her work at Virginia Tech. "She's gained a perspective on the world now, and we certainly see an impact in her work," Sforza said. "Now she's connecting real people and places. Understanding the cultural context of what we're doing is really important." Hall also remarked that in the time he has known Paige, "she has transformed from a shy undergraduate student to a confident researcher and valued team member."

Leadership Institute

The sixth student cohort of the college's Leadership Institute visited the Virginia Department of Forestry headquarters in Charlottesville in January. The cohort's annual winter break trip also included stops in Richmond and Washington, D.C., to meet with decision-makers in government, industry, and the nonprofit sector.

Front row (left to right): Deputy State Forester Rob Farrell, Maria Elisa Vollmer, Cassidy Williams, Paige Crane, Rachel White, Catherine Steentofte, Olivia Jancse, and State Forester Bettina Ring.

Back row: Regional Forester Ed Zimmer, Michaela Wenger, David Tilson, Hunter Hatcher, Allison Moser, Alex Pelletier, Davis Gilbert, and Associate Professor Steve McMullin, director of the Leadership Institute.

ALUMNI CORNER

ADAM LAYMAN

Protector of the night sky

In his 14-year career at Staunton River State Park in Halifax County, Virginia, **Adam Layman** ('07 B.S. forestry and forest resource management) has devoted himself to preserving its natural riches — 2,400 acres of forests and meadows at the intersection of the Staunton and Dan rivers. But several years ago some visiting astronomers called his attention to an endangered resource he'd overlooked: the night sky.

Adam Layman oversees activity on the observing field at a star party, which the park hosts twice a year. Photo courtesy of Staunton River State Park

Layman is now leading the park's battle against light pollution, caused by outdoor lamps that wash out starlight. "We always think about protecting our trees, water, and soil," he said, "but the night sky is a resource we need to protect as well."

In July, Staunton River was named an International Dark Sky Park, the 25th in the world and Virginia's first. The nonprofit International Dark-Sky Association designates sites that comply with strict lighting standards and commit to public outreach.

Staunton River is one of only six Dark Sky Parks east of the Mississippi, where a dense web of cities and suburbs casts a nearly unbroken haze over a third of the country. Light pollution can disrupt animals' migration, mating, and feeding patterns, and it erases the panorama of stars that countless generations have enjoyed.

"A hundred years ago, everybody could see the Milky Way on a clear night. Now very few people have that opportunity," Layman said. "We want people to see what the sky is supposed to look like."

Layman has spent his entire career at Staunton River. During high school, he looked for a job "doing anything outdoors" and signed on to help with park maintenance during weekends and summers.

His dedication to the environment spurred him to enroll at Virginia Tech. "I wanted a career in natural resources," Layman explained. "Virginia Tech was the obvious choice." He credits the Forestry Club and Xi Sigma Pi, the forestry honors society, with training him to serve as part of a team. "A lot of people can work solo," he explained, "but when the park staff works together, it's very similar to how we pulled off projects in both clubs." He continued to work summers and holidays at Staunton River. In August 2007, three months after graduation, he landed a full-time position as a ranger. By November 2013, he was park manager.

He had taken the park's starry nights for granted until astronomers from the Chapel Hill Astronomical Observational Society (CHAOS) drove up from North Carolina in 2010 in search of a patch of dark sky. Light pollution blots out their view at home, so the club scouted for better conditions on a map that plots regions of nighttime darkness. Noticing a shadow over Staunton River, CHAOS's members headed north to investigate.

Soon, as many as 400 people were lining up at CHAOS's telescopes during public observing sessions at the park. In 2011, CHAOS and Staunton River threw their first star party. For several days each March and October, astronomers colonize a 10-acre clearing in the park with telescopes and RVs. The most recent gathering drew 173 stargazers from New York to Alabama. "They stay up all night observing," Layman said. "We have wonderful facilities to accommodate them, with food service for 22 hours a day. They want a sandwich and a cup of coffee at three in the morning."

CHAOS leaders suggested that Staunton River apply to be a Dark Sky Park. The most labor-intensive hurdle was replacing the facility's lighting with special bulbs and shielded fixtures that direct light down rather than out or up.

Two months after Staunton River earned its Dark Sky designation, Layman won the "Our Hero" award, given annually by the nonprofit Virginia Association for Parks. "Adam was selected because of the outstanding leadership and managerial skills he displayed in working with his staff to have Staunton River State Park designated as an International Dark Sky Park," said Johnny Finch, association president.

Layman vowed to share the honor with his staff. His achievements, he said, come from his "drive to do a little better, always wanting to be better at everything. That's how I tackled my coursework at Virginia Tech, and that's how I strive to do things here every day."

A time-lapse photograph of the night sky during a star party at Staunton River State Park. Photo courtesy of Staunton River State Park

ENGAGEMENT AND OUTREACH

Bird boxes at Blacksburg High School engage students

In a partnership with Virginia Tech, approximately 50 wooden bird boxes were placed on a natural stretch of Blacksburg High School's property so that students can learn about bird biology, the scientific method, and environmental problems like climate change.

"The project has been a perfect hands-on, real-life experience for my students," said Steve Hulburt, a biology teacher who incorporated the boxes in his curriculum. "They have been able to be outside interacting with nature, with the understanding that the work they are doing is contributing data to long-term monitoring at the school. This experience is likely the one thing about high school science that they will remember for the rest of their lives."

Students monitor bird boxes placed along a nature trail at Blacksburg High School.

The students have developed data sets based on observations about the year-to-year breeding patterns of several bird species with the guidance of several Virginia Tech researchers, including Professor Bill Hopkins. The project was initiated two years ago with the help of Hopkins' former research associate Michelle Beck. The high school's shop teacher and his students made the boxes.

Beck said that while it may take at least five years for the students to compile significant data, the team is off to a good start and has already made several observations about differences in bird breeding patterns. "This project allows the students to act as citizen scientists and hopefully they will carry that with them in the future," Beck said. "It also provides a nice avenue to show students how changes in climate are associated with observable changes in animals that are in their backyard."

Delmarva Peninsula by kayak *(Continued from back page)*

After the storms cleared, the team paddled hard to complete their circuit, on schedule, back at Sandy Point. The expedition had been Baugh's chance to "pass the baton to the next generation of environmental leaders," and, back home, Eren and Crooks mulled over what to do with the responsibility. Eren planned to follow Baugh into the nonprofit sector. Crooks vowed to connect more children with nature. "I want to show them the world is bigger than their cellphone," she explained. "Once you have lived on the Chesapeake Bay, once you have eaten a fresh crab or swum in the water, it's more than just a place. It becomes something you care about. To see erosion directly affecting your swimming hole, it changes your perspective."

On Cedar Island, Virginia: The boulder to Alex Crooks' right had towered over her only hours earlier. By the next morning, it had washed completely away.

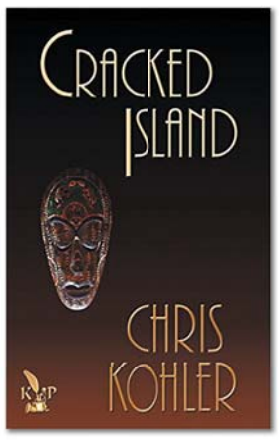
Alumni news online

We love hearing about the great things going on with our alumni, but we don't have enough space in the newsmagazine to print them all. Catch up with former classmates and fellow Hokies online; scan the QR code or visit **cnre.vt.edu/tags/alumni.html**.

Recent posts
John Copeland ('84 B.S.)
Ed Green ('81 Ph.D.)
Todd Holbrook ('84 M.S.)
Wayne Hubert ('79 Ph.D.)
Jim Kuykendall ('86 B.S.)
Mallory Martin ('83 M.S.)

In memoriam:
SamiDail Brown Gilley ('00 B.S.)
Kelly Meyer ('90 M.S.)

Alum debuts novel



Chris Kohler ('80 Ph.D. fisheries and wildlife sciences), professor emeritus of zoology at Southern Illinois University-Carbondale, turned from scientific writing to fiction for his first novel, "Cracked Island." The international focus of much of his research and development work often placed him in the midst of exotic locales throughout much of the Caribbean, Central America, and South America. One of his more memorable endeavors occurred in the colorful and mystical island nation of Haiti. "Cracked Island" draws upon his personal experiences, stories conveyed by friends and colleagues, and fragments of story lines gleaned from the many fine books and articles written about Haiti, its people, and its rich culture.

CNRE NEWS

Alumni circumnavigate the Delmarva Peninsula by kayak

A decade ago, Don Baugh planned a formidable 60th birthday gift for his friend Tom Horton. Baugh, an environmental educator, and Horton, a nature writer for the Baltimore Sun, had helped popularize kayaking in the Chesapeake Bay in the 1990s. Baugh proposed what Horton called a "victory lap": a month-long, 500-mile paddle around the Delmarva Peninsula. Blistered hands and soaking rains aside, they enjoyed the adventure enough to try it again. Last summer they retraced their route and brought along two Virginia Tech alumni: natural resources conservation graduates **Alexandra Crooks** ('12 B.S.) and **Stephen Eren** ('11 B.S.).

"Even though I've spent my life around the Delmarva and the Chesapeake," Horton wrote in 2006, "there's something about seeing the place entire, examining it at four miles an hour, about living outside for a month, that lends fresh perspective." Baugh has spent decades introducing students to the Chesapeake's beauty and bounty. In 2014, he retired after 38 years at the Chesapeake Bay Foundation to start, Upstream Alliance, a nonprofit dedicated to training environmental leaders.

With the Delmarva expedition — Upstream Alliance's maiden voyage — Baugh and Horton hoped to bequeath their panoramic expertise of the bay to two emerging naturalists. "I wanted excellent communicators, role models, and leaders with great outdoor skills. Alex and Stephen exemplify those qualities. Graduates of the College of Natural Resources and Environment are head and shoulders above their colleagues, particularly in their grasp of real-life issues."

The kayak expedition team (left to right): Stephen Eren, Alex Crooks, Upstream Alliance board member Walter Brown, Tom Horton, Don Baugh, and Upstream Alliance board member Mike Tannen.

Each day Alex Crooks and Stephen Eren collected water and biodiversity data, which was uploaded to the Upstream Alliance website. These fish were caught with a seine net.

Crooks was teaching science in an at-risk middle school in Tulsa, Oklahoma, when Baugh offered her a spot. Cooped up in a classroom, she yearned for hills, trees, and open water. "Don said, 'if you get another job, you can take it,'" she remembered. "I said, 'no, I'm telling you "yes" right now.'" Having grown up in Annapolis, Maryland, Crooks treasured the chance to return to the seascape of her childhood.

Eren, a Durham, North Carolina, native whose career had led him through America's mountain backcountry — including two stints as a dog-sled guide — looked forward to his first extended sabbatical on the water. Then the manager of a composting company, he built up his endurance by biking through downtown Durham hitched to a trailer piled with 400 pounds of food scraps.

The team, which also included two Upstream Alliance board members, launched from Sandy Point State Park on the bay's western shore under a nearly cloudless September sky, heading northeast. Their longest paddle came just five days out, when, pummeled by steep waves, they plowed 27 miles through the Chesapeake and Delaware canal and down the peninsula's east coast. They kayaked up to seven hours each day, usually within 100 yards of the shore, where they could observe wildlife but avoid breakers. Trailed by a motorboat carrying their heaviest gear, they camped on beaches, private lawns, and, as Crooks put it, "a lot of questionable shoreline."

Every day, Crooks and Eren tested the water's salinity, temperature, pH, turbidity, conductivity, and levels of dissolved oxygen. "The classes I spent outside, taking data in good and bad weather, prepared me for the job," Eren said, "especially the outdoor sessions in Blacksburg in January." Their measurements were posted online by Upstream Alliance and two public data-sharing platforms: NASA's Globe program and Natural Geographic's Fieldscope.

From high ground, climate change can seem like a distant prophesy, its creeping damage visible only in time lapse. But out among the coastal islands, the team watched in real time as rising sea levels and intensifying storms thrashed a disintegrating landscape. They saw the last sand dune on Cedar Island, Virginia, wash out with the tide. They battled two weeks of gale-force winds and slept on flooded ground for half of the trip. "Ten years ago, scientists were predicting significant climate challenges for the next generation, but the future is now," Baugh said. "No longer are we talking about our children and our grandchildren and their children. We're talking about us."

Less than a week after the team rounded the peninsula's southern tip, Hurricane Joaquin stranded them for four days on Smith Island, Maryland. The storm, chased by a nor'easter, submerged a third of the island. The team waded through knee-deep high tide in the streets, and Crooks and Eren conducted water tests from a porch. Smith Island loses about two feet of shoreline to rising seas every year, and scientists predict it will be almost completely underwater by 2100. The island's 240 permanent residents — down from 1,000 a century ago — make up what Eren called a "living museum" of the bay's once-thriving communities of crabbers and fishermen.

(Continued on page 7)

For more information on the team's voyage and data collection, visit **upstreamalliance.org/events**.

Above: Stephen Eren and Alex Crooks take a break on Smith Island during Hurricane Joaquin.

The team discusses the day's route.

All photos courtesy of Upstream Alliance

Above: The team asks a waterman how the bay's catch has changed.

Left: Stephen Eren prepares to test the biodiversity of four days' worth of floodwater on Smith Island.

NON-PROFIT ORG
U.S. POSTAGE PAID
LYNCHBURG, VA
PERMIT #714

VirginiaTech
College of Natural Resources and Environment
Cheatham Hall, Rm 324 (MC 0324)
310 West Campus Drive
Blacksburg, Virginia 24061