ENVIRONMENTAL Sciences

at the University of Virginia

2015–16 ANNUAL REPORT

INSIGHTS THROUGH TECHNOLOGY

THE DEPARTMENT OF
ENVIRONMENTAL SCIENCES

Established in 1969, the University of Virginia's Department of Environmental Sciences was one of the first to look at fundamental environmental processes from a multidisciplinary perspective and the first in the nation to offer bachelor's, master's, and doctoral degrees in environmental sciences. Today, the faculty includes winners of the prestigious Tyler and Hutchinson awards as well as five professors who are among the most highly cited researchers in their fields.

Departmental field stations and facilities include the Anheuser-Busch Coastal Research Center in Oyster, Virginia, home of the National Science Foundation–sponsored Virginia Coast Reserve Long-Term Ecological Research program, the Virginia Forest Research Facility in nearby Fluvanna County, and the Blandy Experimental Farm near Front Royal, Virginia.

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COVER: LiDAR image by Atticus Stovall

FROM THE CHAIR

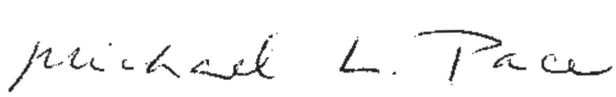
The technological advances that combined to put a smartphone in everyone's pocket are transforming the environmental sciences. We now have the miniaturized sensors to monitor natural systems with unprecedented accuracy, the communications networks to track these systems remotely, and the computational power to process immense amounts of data and drive complex simulations.

Technology is making it possible to complete what had been laborious, months-long field measurements in the space of a day and produce detailed records of change in the most inhospitable environments. Technology is not merely accelerating the pace of research and broadening its scope. It is allowing us to pose questions that would have been pointless to raise before.

Members of our department are at the forefront of exploiting these new possibilities. In some cases, faculty members and staff like Peter Berg (whose work we highlighted in last year's report) and Bill Keene have devised new technology. Others like Linda Blum and graduate student Atticus Stovall have found innovative ways to incorporate technologies associated with other fields—in this case computer-assisted tomography and LiDAR—to address pressing questions about environmental change.

To deploy today's technology, faculty members are securing grants, tapping university equipment funds, and collaborating with other departments and schools at the University. There are more and more shared University facilities that we can turn to—such as a genomics lab in the Biology department—and we are involved in developing new ones.

I remember dropping off my programs at the University's computer center when I was an undergraduate at UVA—and considering the resulting output a small miracle of sorts. The power of those mainframes, of course, pales in comparison to that of the computer I have on my desk, but the ability of technology to help us understand the structure of environmental systems, infer process, and predict change is no less miraculous—and certainly no less essential.



Michael L. Pace, Chair

PHOTOGRAPH COURTESY OF PATRICK DOLAN

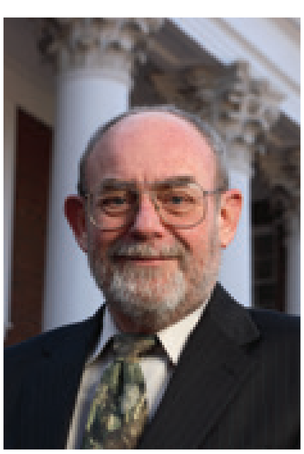
In Memoriam

Bob Dolan: Coastal Geomorphologist

This department exists because of Bob Dolan. As a young assistant professor in the late 1960s, he headed a committee that proposed folding the University's geology and geography departments into what it called an "environmental sciences" department, a dramatic reimagining of what had been called the "earth sciences." In 1969, the University adopted Bob's proposal, creating one of the first environmental sciences departments in the country, and appointed Bob its first chair.

Bob was also a pioneer in coastal geology and coastal geomorphology, with a special interest in the dynamics of North Carolina's Outer Banks. He debunked the theory that the islands were anchored to underground barrier reefs, describing them as a "ribbon of sand." His experiences at Nags Head during the Ash Wednesday storm of 1962 led him to develop the theory, now universally accepted, that over-wash is the dominant pattern in barrier island geology and that human attempts to build artificial dunes to block the ocean's advance were both futile and counterproductive.

Bob was that ideal UVA professor who valued teaching as well as research. He especially loved teaching undergraduates and was devoted to the Jefferson Scholars Program. For his dedication to teaching, Bob received the UVA Alumni Association's Distinguished Professor Award in 1991.



Jay Zieman: Seagrass Ecologist

More than any other researcher, Jay Zieman shaped the course of the Comprehensive Everglades Restoration Plan (CERP), a landmark effort to restore the water flow over what has been called "a sea of grass." In the 1990s, Jay accurately described the combination of events that caused the massive dieback of seagrass in Florida Bay, the body of water wedged between the southern tip of Florida and the Florida Keys. He argued that years of diversion projects had choked the flow of freshwater through the Everglades to the bay, a situation exacerbated by drought. The resulting hot, hypersaline water proved deadly to the grass.

Jay's research caught the attention of philanthropist Paul Tudor Jones, who relied on Jay for scientific insights as Jones and his fellow environmentalists worked with Congress to have CERP passed into law. In appreciation of Jay's work, Paul Jones made a $10 million challenge grant to the department that helped finance the research addition to Clark Hall.

As department chair between 2004 and 2009, Jay was instrumental in establishing the Anheuser-Busch Coastal Research Center in Oyster, Virginia. With its laboratory and dormitory facilities, it serves as headquarters and field station for the Virginia Coast Reserve Long-Term Ecological Research site, administered by the department for the National Science Foundation.

NEW FACULTY

THE DEPARTMENT'S CONTINUING ABILITY TO SERVE AS A REFERENCE POINT FOR ENVIRONMENTAL POLICY DEPENDS ON THE TALENT AND DETERMINATION OF ITS YOUNG FACULTY MEMBERS.

Xi Yang
Photosynthesis and Terrestrial Ecology

As a terrestrial ecologist, Assistant Professor Xi Yang knew that being able to measure photosynthesis directly over large scales would be the best way to assess the health of an ecosystem as well as determine the amount of carbon dioxide that ecosystem took from the atmosphere. "The problem," Yang says, "was that there was no good way to do this."

With colleagues at Brown University and the Marine Biology Laboratory in Woods Hole, Massachusetts, Yang has made dramatic progress in overcoming this obstacle. The impetus for their work was the realization several years ago that spectrometers aboard satellites, designed to track carbon dioxide or ozone concentrations, were also detecting faint fluorescence coming from croplands and forest canopies. The suspected source was photons emitted as a by-product of photosynthesis. Yang's challenge: to correlate the fluorescence readings with local measurements of photosynthesis on the ground.

Over the course of a summer, Yang and his colleagues took eddy covariance and spectrometry measurements at a tower in Harvard Forest and compared them to readings from a spectrometer aboard the European Space Agency's GOME-2 satellite. They discovered that the spectrometry readings from the tower and the satellite were tightly correlated with the eddy covariance measures of photosynthesis. "This discovery opens the way for using remote sensing to assess ecosystem health," Yang says.

Sally Pusede
The Atmospheric Chemistry of Oxidized Nitrogen

As Assistant Professor Sally Pusede points out, the processes that affect atmospheric chemistry and composition are complex enough that atmospheric chemists tend to focus on a particular set of molecules. Pusede's own area of specialty is reactive and unreactive oxidized nitrogen. She studies the role of nitrogen oxides as both a constituent and a driver of atmospheric chemical processes, including those that produce air pollution, act as greenhouse gases, and influence nitrogen cycling in ecosystems.

"I was attracted to this department because it has a strong interdisciplinary focus," she says. "Being here gives me the opportunity to extend my work from the atmosphere to the biosphere." At the department's field station in nearby Fluvanna County, Pusede is instrumenting a tower to measure nitrogen oxide fluxes at the top of the forest canopy to determine how nitrogen oxides are chemically processed within and above the forest canopy.

Pusede also researches nitrous oxide, a long-lasting greenhouse gas that is unreactive in the troposphere and that the EPA calculates to have between 265 and 310 times more impact than an equivalent amount of carbon dioxide. During summer 2016, she participated in NASA's South Korea-United States Air Quality Mission (KORUS-AQ). She was an instrument scientist measuring nitrous oxide, methane, and carbon monoxide concentrations onboard the NASA DC8 research aircraft. An important goal of the KORUS-AQ project was to disentangle local sources of these molecules from those transported to the Korean Peninsula from elsewhere in East Asia.

TECHNOLOGY IN FOREST

RESEARCHERS FROM THE DEPARTMENT ARE PRODUCING DATA — AT BOTH LARGE AND SMALL SCALES — NEEDED

REMOTE RADAR SENSING

Over the years, Professor Hank Shugart has served on more NASA satellite committees than he cares to recall—and none of these projects have come remotely close to leaving the ground. "You begin to feel you are the kiss of death," he says. "They put you on a committee, and the next thing you know the satellite doesn't get funded."

This year, Shugart's luck turned. In May, the European Space Agency (ESA) signed a contract with Airbus Defense and Space UK to build the €430 million Biomass satellite. Shugart was the NASA observer and resident forest structure expert on the team that bested 20 other groups to produce the winning proposal.

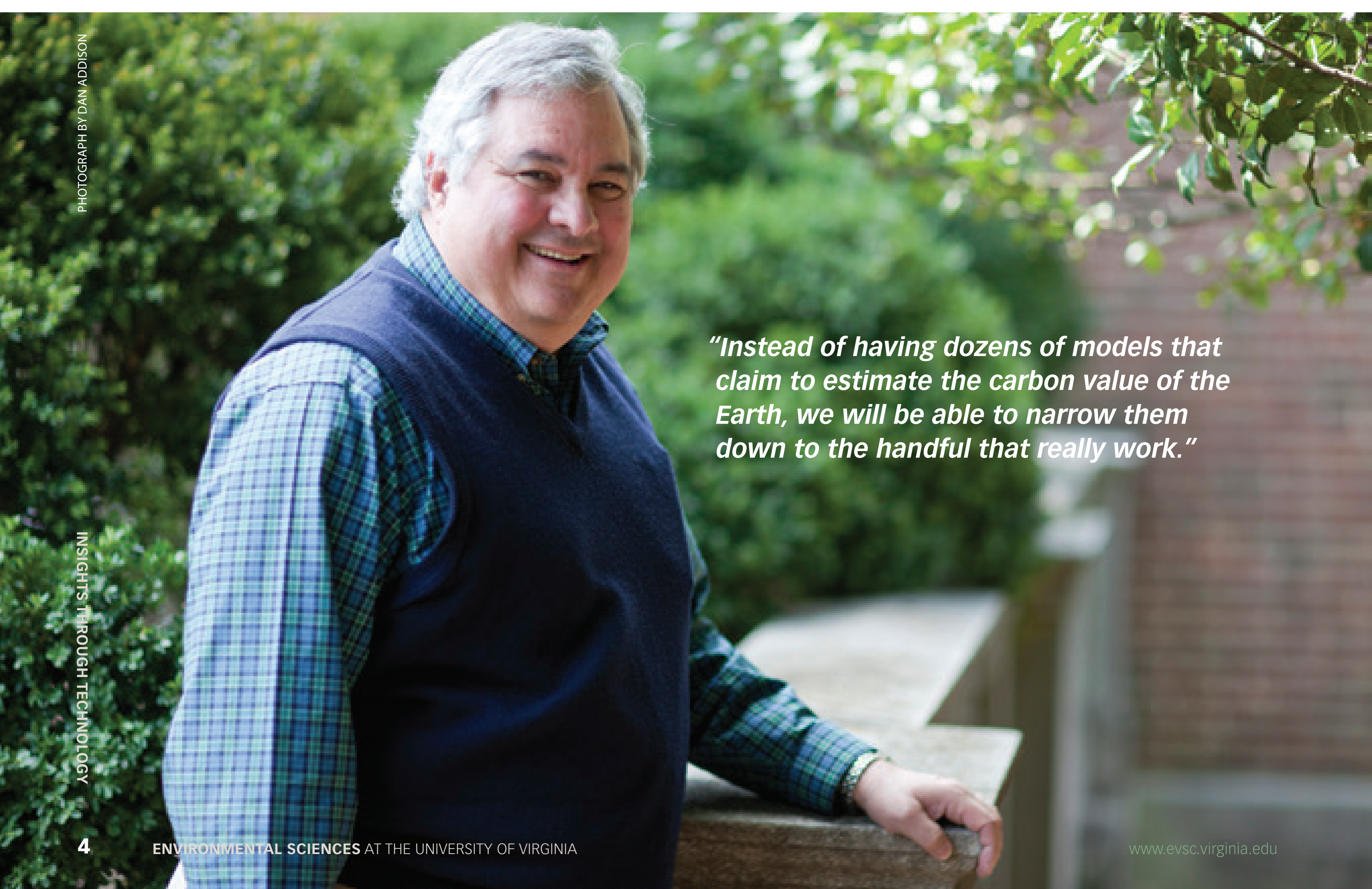
Due for launch in 2021, Biomass will be the first satellite to be equipped with P-band synthetic aperture radar. "The P-band wavelength is 68 centimeters long," Shugart notes. "This enables it to cut through the leaves in the canopy and detect the branches and trunk where the vast bulk of carbon is stored." One of the main purposes of the satellite is to ensure that parties to the United Nation's climate change treaties meet their obligations to increase their storage of carbon through reforestation.

Flying in a near-polar, Sun-synchronous orbit at an altitude of 660 kilometers, Biomass will measure biomass at a resolution of 200 meters and deforestation at 50 meters. In addition, the mission will have an experimental tomographic phase to provide 3D views of forests.

Because of the versatility of the radar, Biomass will have a number of spinoff applications. Known for his pioneering models of forest ecosystems, Shugart is especially interested in using Biomass data to validate computer simulations of forest carbon sequestration. "Instead of having dozens of models that claim to estimate the carbon value of the Earth, we will be able to narrow them down to the handful that really work," he says.

Even though the Biomass project is well underway, Shugart's team will continue to meet. ESA is flying airborne mock-ups of the satellite's instrumentation over tropical forests in Indonesia, French Guyana, and Gabon, and the proposal team is evaluating these flights. So far, the results have been reassuring.

Shugart is impressed by the audacity of the project. "Everything about this project is amazing," he says. "But for me, the most amazing thing about it is that it is actually going to happen."



PHOTOGRAPH BY DAN ADDISON

"Instead of having dozens of models that claim to estimate the carbon value of the Earth, we will be able to narrow them down to the handful that really work."

STUDIES

TO MAKE MODELS OF CARBON SEQUESTRATION IN FORESTS AND CLIMATE CHANGE MORE ACCURATE.

TERRESTRIAL LIDAR MEASUREMENTS

The simplest way to determine how much carbon is sequestered in a forest is to start small. Determine the carbon content of a set of sample trees or small plot, insert this information into a computer model, and hit return.

In practice, however, this approach is hardly foolproof. Even small defects in the sampling method can vastly alter the model's output—and as doctoral candidate Atticus Stovall can tell you, the current methods are riddled with assumptions. Working with Professor Hank Shugart, Stovall is perfecting a new approach that is not only more accurate, but also less time-consuming and destructive.

Today's carbon sampling techniques are resolutely analog. Researchers measure the diameter of the trees inside the sample plot, apply assumptions about relationship between their diameter and dry weight, and make further assumptions about the percentage of that weight attributable to carbon. “If anything is wrong with these relationships, you magnify the error when you extrapolate to a forest scale,” Stovall says.

It is, of course, more accurate to weigh individual trees, but the only way to do this is to cut them down, wait several months until the wood is dry, and then put them on a scale. This method is so labor intensive that it limits sample size, and, ultimately, it is counterproductive to be assessing the carbon storage capacity of a tree by killing it, thus releasing its stored carbon.

With a portable terrestrial LiDAR scanner, Stovall brings tree sampling into the digital age. LiDAR stands for light detection and ranging and calculates distance to an object by measuring the time it takes for reflected laser pulses to return. It emits thousands of pulses a second and is capable of generating data that can be converted into three-dimensional images of a forest plot that are accurate down to the millimeter.

Stovall has developed an innovative mathematical approach that provides a more fine-grained measurement of the volume of sample trees than previous approaches, which approximated tree trunks and branches as a series of cylinders. When combined with information about wood density, the volume can be converted to weight and then to carbon content. Stovall's method also includes carbon in branches, needles, and leaves.

Ultimately, Stovall's purpose is to locate carbon in forests so it can be managed effectively. “You want to know where the carbon is so that you can protect the areas where it is stored,” he says.

TECHNOLOGY AT THE VI

THE DATASETS PRODUCED BY SCIENTISTS AT THE VIRGINIA COAST RESERVE LONG-TERM ECOLOGICAL RESEARCH SITE

TAKING A CT SCAN OF THE ENVIRONMENT

In the face of rising sea level, salt marshes tend to pull themselves up by their own bootstraps. They elevate themselves in part by increasing their production of roots and rhizomes. An important theme of Associate Professor Linda Blum's research is to determine the capacity of marsh grasses to keep pace with rising water under different conditions. Accordingly, her career has been marked by efforts to develop improved ways to assess root production.

"I've been searching to develop a faster, better way to measure roots," Blum says. "CT scans are better than anything we've used before in terms of measuring their volume and examining factors controlling root dynamics."

The prevalent method for measuring root activity is to take root cores in the field, transport them back to the lab, and separate live roots from the dead, a painstaking and tedious process. "I can't tell you how many lab technicians I've gone through over the years," she says.

Five years ago, she met Earl Davey, an aquatic biologist with the Environmental Protection Agency's Atlantic Ecology Division. Davey was using CT scans to analyze the presence of worms in marine sediments. They decided that they could adapt this method to assess root cores.

With cooperation from the UVA School of Medicine, that is exactly what they have done. Blum can use the data produced by the scan to compile 3D images of the soil. She can also tune the scans to focus on specific components, highlighting sand and gas in the core as well as root material. This enables her to address issues like the impact of soil composition on root production.

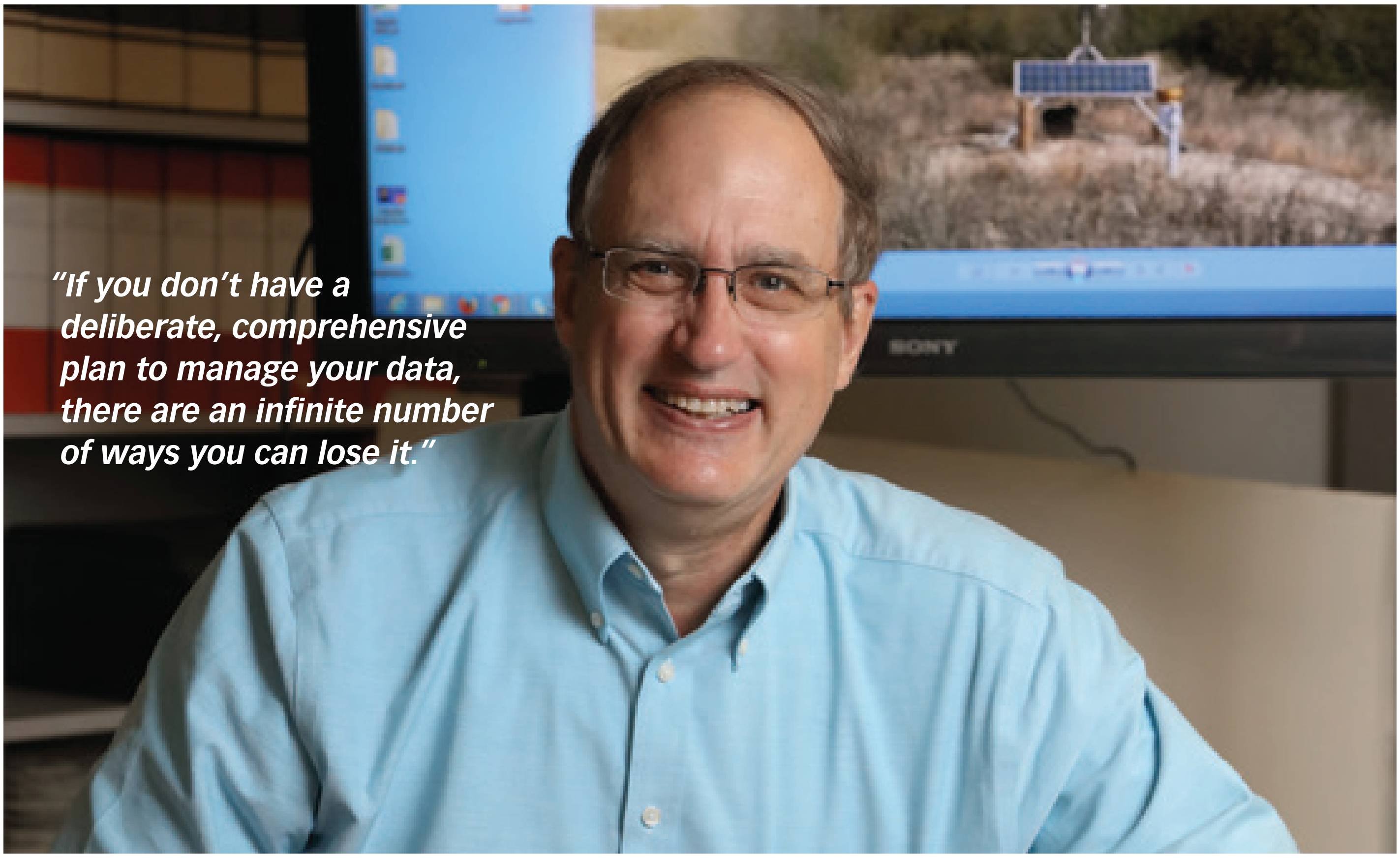
With CT scans, Blum can also directly determine the volume of each of these components. "Previous methods only allowed us to determine dry mass," she says. "We had to make assumptions about the relationship of mass to volume. With CT scans, we are much more confident about our results."

And, of course, CT scans are much less time and labor intensive. Blum estimates that a core that had taken a month to analyze now takes less than a day. But right now, while CT scans are still considered experimental, she is taking apart the cores by hand in order to validate the results from the scan.

Blum praises her colleagues at the School of Medicine for their willingness to try something new. "It's been a great collaboration," she says. "They welcomed the opportunity to help us out."

RGINIA COAST RESERVE

REFLECT THE INTERSECTION OF ECOLOGICAL PROCESSES AND CLIMATE CHANGE.



PRESERVING DATA BY PUBLISHING IT

As information manager for the department's Virginia Coast Reserve Long-Term Ecological Research (VCR-LTER) site on the Eastern Shore, Associate Professor John Porter knows the challenges of monitoring and managing the data flowing from an ever-proliferating number of sensors. To cite just a single instance, the project's salt marsh carbon flux tower generates a line of data every tenth of a second. Porter's job is to make sure the data collected by researchers, from sensors or through hands-on fieldwork, is accessible to other researchers. "If you don't have a deliberate, comprehensive plan to manage your data, there are an infinite number of ways you can lose it," he says.

Porter knows from first-hand experience how difficult it can be to salvage data. He operates an informal CSI unit for recovering datasets, but instead of futuristic equipment, he keeps closets full of obsolete computers and software programs. Accordingly, he was recently able to access data preserved on a 1980s–era 5.25-inch floppy disk in a compressed Lotus 1-2-3 spreadsheet file.

Although Porter is proud of his forensic data skills, he would like to avoid using them as much as possible. One way he ensures that VCR-LTER datasets are widely available is by writing programs that automate the workflows needed to make them accessible. The VCR-LTER collects data from 10 groundwater wells, three tide stations, and three meteorological stations once an hour. This data has to be checked for errors, integrated with previous data, and published on the VCR-LTER website. Porter's programs link these different processes.

"Having scientific workflows is especially important when the data is collected by different individuals," he says. "You need a way, for instance, to make sure that the units of measurements are the same, and, if not, convert them to the standard format."

At the VCR-LTER, Porter makes sure datasets collected by the researchers working at the site are published on the site's webpage as well as the national LTER data portal, but he notes that many scientists feel still feel uneasy about the process. "They view their datasets rightly as intellectual property that they have worked hard to accumulate," he says. "Publishing them can feel like giving this property away, but disseminating data allows new opportunities for co-authorship and citation." Porter has been active in efforts to encourage researchers to include the creators of datasets that they use as co-authors on their papers. "If you produce a database that others feel is important, you should get credit," he says. "Making data available is not just a scientific necessity, but also a cultural issue."

THAT "OH GOSH" MOMENT

For Professor Stephen Macko, a teacher's responsibility is to translate the words of the course textbook into experiences that convey the wonder of science and the thrill of discovery. It is a challenge that Macko takes on with relish.

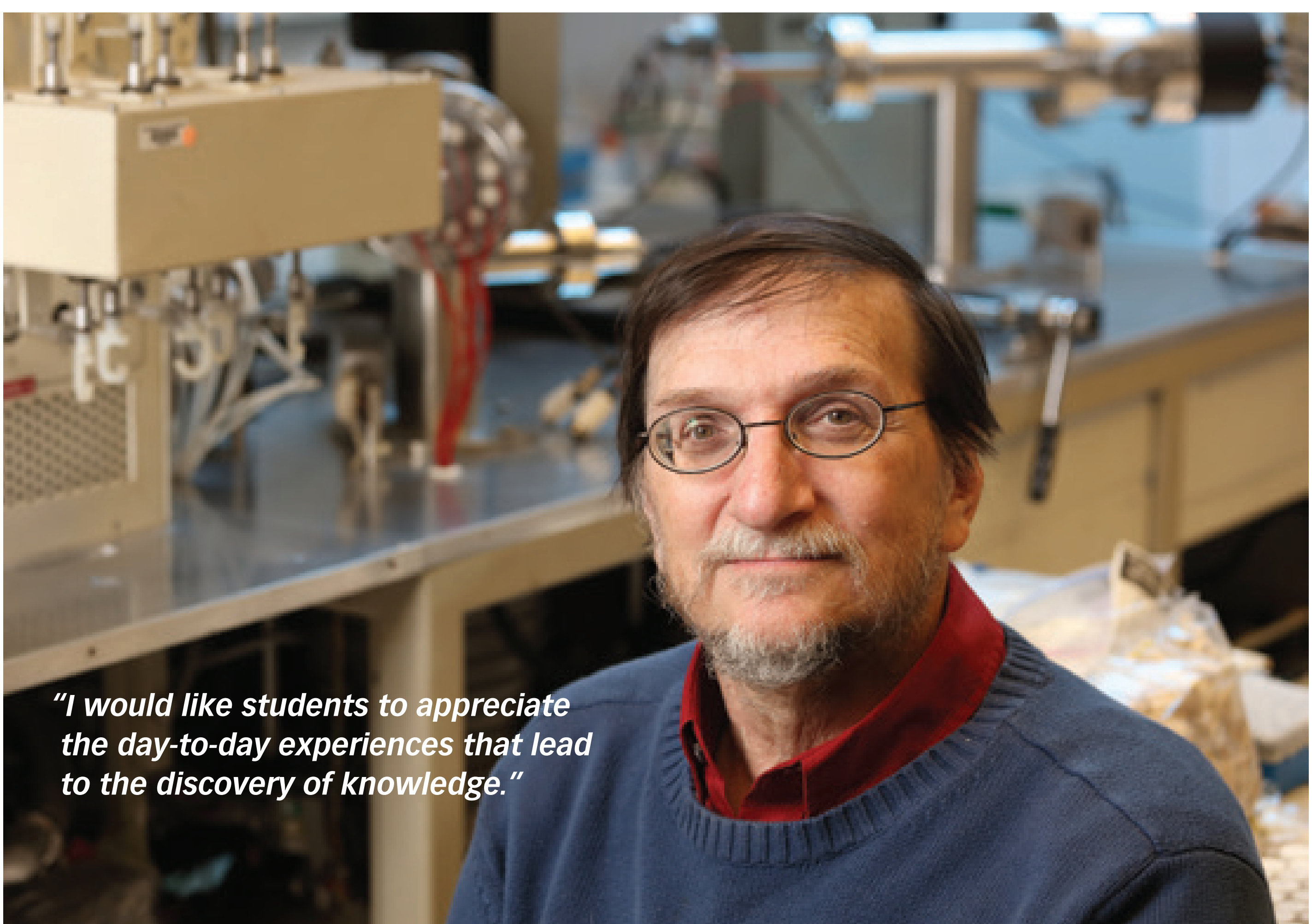
He does this in a number of ways. To convey the reality of the scientists who uncovered the processes his students read about in his oceanography classes, he uses his own experiences conducting geochemical experiments aboard research ships. "I would like students to appreciate the day-to-day experiences that lead to the discovery of knowledge," he says.

Macko also looks for ways to take students beyond their intellectual understanding of natural phenomena and give them a visceral appreciation of how the environment works. For instance, he built a device, using recycled soda bottles, plastic tubing, and five-minute epoxy that, with the addition of hot and cold water and a bit of food coloring, illustrates the density-driven stratification that explains the Gulf Stream.

For his geochemistry class, he worked with former UVA glassblower Willy Shoup to construct a cloud chamber, a particularly dramatic method—involving dry ice, alcohol vapor, and a glass box, all illuminated by a spotlight in a dark room—for observing the tracks left by cosmic particles streaking in from space. "You can see from the eyes of the students that they are really getting it," he says. "They are having an 'oh gosh' moment."

Another way Macko increases the impact of his classes is to take students on field trips or to have experts visit his classes. For his January term course, "Visions for Your Future Ocean," he gives students a sense of the scientific, policy, and commercial issues related to the oceans by taking them to the National Aquarium in Baltimore, to the National Oceanic and Atmospheric Administration offices in Silver Spring, and to J. J. McDonnell's seafood market in Jessup, Maryland. He has also brought in specialists to discuss fisheries law and Reedville native Dudley Biddlecomb to talk about his life as an oysterman on the Chesapeake Bay.

"My goal is to take abstractions, lift them off the page, and make them a reality to students," Macko says. "I want them to see and feel science, not just understand it."



O G Y

EFFECTIVE.

MARINE AEROSOL PRODUCED BY ARTIFICIAL WHITECAPS

PHOTOGRAPH BY LUCY XI

Wind on the water. For most people, it's a poetic phrase that evokes ocean voyages or lazy afternoons at the beach, but for Professor Bill Keene, this phrase also has immense scientific resonance. When bubbles generated by wind-waves burst at the ocean surface, they propel marine aerosols into the air, where most persist for many days to a week or more. This process is the single largest source of aerosol mass in Earth's atmosphere. Freshly produced particles, which include both organic and inorganic substances, undergo rapid chemical reactions in air that significantly impact tropospheric composition. Marine aerosols also scatter sunlight and influence cloud albedo, thereby modulating Earth's radiation balance and climate. Keene points out that "the environmental implications of these aerosols are quite important but in many respects still poorly understood."

Because freshly produced aerosols are rapidly modified through interaction with light and reactive trace gases and are also mixed with particles transported from non-marine sources, it is impossible to reliably tease out the original composition and subsequent evolution of marine aerosol based on measurements of ambient aerosol composition over the ocean. In response, Keene, in collaboration with Senior Laboratory Specialist John Maben, developed a high-capacity marine aerosol generator deployed in a portable laboratory van that allows marine aerosol production to be studied over relevant ranges of controlled conditions at sea.

Essentially a physical model of a white cap, the generator mimics the production of marine aerosols by bubbling clean air through fresh, flowing seawater on a research vessel. The generator is a closed system constructed of inert material that excludes ambient air and solar radiation thereby preventing chemical reactions. Keene can regulate variables that influence the chemical and physical properties of freshly produced aerosol including bubble size distributions and plume depths, which vary over the open oceans as a function of sea state.

Because the generator is portable, Keene can also characterize aerosol production from distinct seawater types. For example, organic surfactants, which vary as a function of biological productivity in the surface ocean, modulate bubble surface tension and the corresponding aerosol production when bubbles burst. Results from this work are leading to improved parameterizations of aerosol production as functions of major physical and chemical drivers in global chemical transport and climate models.

Keene recently returned from a month-long research cruise that explored relationships between the processing of marine aerosol in air and recalcitrant dissolved organic carbon (RDOC) in seawater. The massive pool of marine RDOC exceeds that of the entire terrestrial biosphere but its cycling is poorly understood. "Preliminary results support the hypothesis that that emission in association with marine aerosol coupled with subsequent atmospheric oxidation is a significant sink for RDOC in the ocean," he says. "It is a major, previously unrecognized source for reactive organic compounds in marine air, with important implications for Earth systems."

SURVEILLANCE TECHNOL

WHETHER CREATING A NATIONWIDE OBSERVATIONAL PLATFORM OR USING COLD WAR SPY IMAGES, OUR FACULTY IS

A TRANSCONTINENTAL SCIENTIFIC INSTRUMENT

In the 1990s, Professor Emeritus Bruce Haydn was a driving force behind the creation of NEON, the National Ecological Observatory Network. He and his colleagues conceived of NEON as a single massive instrument, consisting of numerous towers in 20 ecoclimatic domains across the continental United States, Hawaii, and Puerto Rico. Together, they would gather a uniform, high-quality dataset on interactions among land, life, water, and climate. The National Science Foundation approved funding for NEON in 2011.

"The idea is to collect identical datasets at main and subsidiary sites in each domain so that hypotheses about ecological processes at large geographic scales and over long time-scales can be tested," says Professor David Carr, the director of the department's Blandy Experimental Farm. Blandy now hosts one of the first towers erected as part of the NEON roll-out, which is expected to be completed in 2018. Instrumentation of the tower was installed last summer.

The Blandy site is part of domain 2, which is characterized by the Eastern deciduous forest. Domain 2 is headquartered at the Smithsonian Conservation Biology Institute (SCBI) in Front Royal. Professor Manuel Lerdau was one of the co-principal investigators that brought NEON to SCBI as well as to Blandy.

In addition to the tower, Blandy has a soil array with sensors. Researchers at each site will also sample life forms as diverse as birds, beetles, and mosquitos and conduct diversity and biomass surveys.

NEON themes that drive tower instrumentation and survey and sampling campaigns include biodiversity, biogeochemical cycles, invasive species, and land use. "Blandy's long history as a working farm makes it especially ideal for research on land use and invasive species," Carr says, noting that part of the NEON's sampling footprint at Blandy includes a row crop field that rotates between corn, soybeans, and winter grains.

"NEON doesn't view itself as a hypothesis-driven organization," Carr emphasizes. "Rather, it focuses on collecting datasets to make them publicly available." As the 81 sites envisaged for NEON become operational, provisional-grade data products will be added to the Data Portal, where they will be free to download and use. A substantial number of specimens and samples collected by NEON will be placed into one or more museums or similar institutions. These are collectively called the NEON Bioarchive and will be made available to investigators for further study.

PHOTOGRAPH BY TIMOTHY FARMER

OGY

DEVOTED TO CAPTURING THE PROGRESSION OF ENVIRONMENTAL CHANGE.

SPYING ON THE ENVIRONMENT

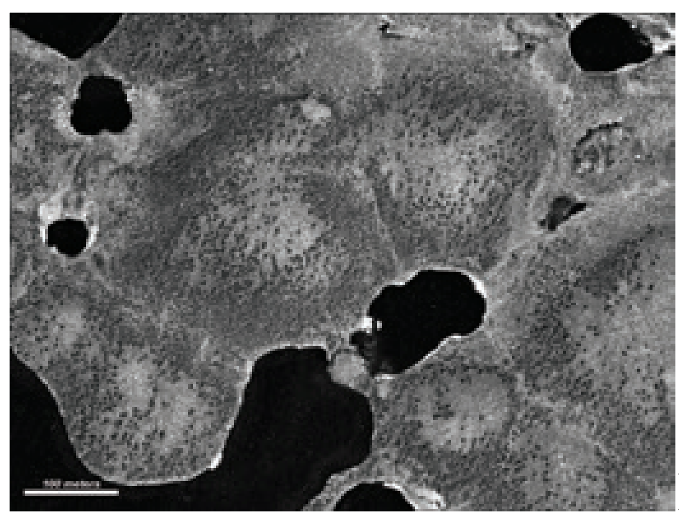
In 1960, at the height of the Cold War, the Soviet Union shot down a U-2 spy plane and captured its pilot, Gary Powers. This international incident only confirmed for American intelligence agencies how vulnerable their high-altitude but slow-moving aircraft were to missile attack. Fortunately, they had been working on another approach to photographing Soviet military assets—the spy satellite.

Between 1960 and 1972, the United States conducted 145 Corona satellite missions that generated over 800,000 images from space with resolutions as fine as 1.8 meters. It supplemented these efforts with the Gambit satellite program, which used a more sensitive camera over 38 missions to produce 19,000 images with resolutions down to 0.6 meters. The Corona photographs were declassified in 1995, with the Gambit photographs following seven years later.

"From the point of view of environmental science, these images are a gold mine," Professor Howie Epstein says. Epstein is interested in determining the effect of global warming on vegetation in arctic tundra and the potential of these changes, in turn, to accelerate global warming. A review paper published in 2011 revealed that these changes had been well documented across the Arctic except in Siberia. Working with graduate student Gerald "J.J." Frost, Epstein compared the Corona and Gambit images with more recent high-resolution photos from commercial satellites to track a half-century of vegetation change at 11 sites in Siberia.

Using these images, the team was able to distinguish tall shrubs like alder, willow, birch, and dwarf pine from sedges and mosses. "The changes we observed are consistent with what has been reported elsewhere," Epstein says. "We found that tall shrubs and trees had expanded by up to 26 percent over these landscapes since the 1960s."

The ecological consequences of this shrub expansion—the replacement of several-inch high plants with shrubs that can reach several meters in height—is significant. In addition to changing the surface energy balance, it alters plant-herbivore interactions and the distribution of snow on the landscape.



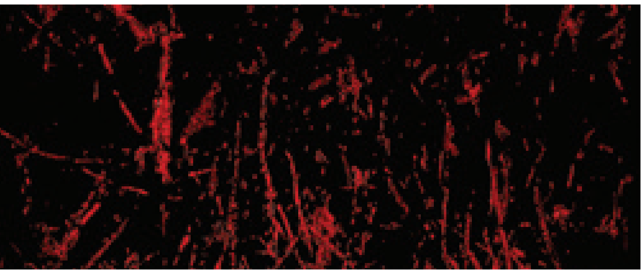
(1966) KH-7 GAMBIT IMAGE FROM U.S. GEOLOGICAL SURVEY

(2009) GEOEYE-1 IMAGE COPYRIGHT DIGITAL GLOBE, INC.

"From the point of view of environmental science, these images are a gold mine."

PHOTOGRAPH BY GERALD V. (JJ) FROST

AWARDS, APPOINTMENTS, AND PUBLICATIONS



LINDA BLUM

UNDERGRADUATE STUDENTS

Christopher Porter was a recipient of a College of Arts & Sciences Deans' Scholarship, one of the highest forms of recognition bestowed by the College. He received a scholarship from the Murphy Fund for International Study, which supports students traveling abroad to conduct research or present papers at scholarly conferences.

The department recognizes fourth-year students who have done outstanding work in each of the environmental sciences. This year, the Michael Garstang Atmospheric Sciences Award went to **Seth H. Garland**, and the Mahlon G. Kelly Prize in ecology went to **Adrianna L. Gorsky**. **Allison E. Rhea** won the Hydrology Award, and **Jessica L. Hawkins** received the Wilbur A. Nelson Award in geosciences.

The Departmental Interdisciplinary Award, for the undergraduate major who has excelled in interdisciplinary environmental sciences research, was presented to **Taylor D. Camper**.

Eryn Campbell was selected to receive the inaugural Hart Family Award for Undergraduate Research in Environmental Sciences. It provides funds to assist a full-time environmental sciences major conducing a supervised research project.

Laura D. Szczyrba received the Wallace-Poole Prize, awarded each year to the graduating student majoring in environmental sciences who has at least a 3.8 GPA and who is judged the most outstanding student in the class.

The Bloomer Scholarship awards $1,800 to an outstanding undergraduate environmental sciences major with a focus on geology. This year's winner was **Taylor D Camper**.

To be chosen for the College's distinguished majors program, students must achieve an overall GPA of 3.4 or above. This year, the department selected **Laurel A. Abowd**, **A. Nicholas Braun**, **Adrianna L. Gorsky**, **Shoshanna E. H. Jiang**, **Marnie R. Kremer**, **Rachel R. Meulman**, **Allison E. Rhea**, and **Laura D. Szczyrba** as distinguished majors.

Matthew C. Koenig was this year's recipient of the Richard Scott Mitchell Scholarship, which provides $1,800 to a rising fourth-year student who is focusing on geoscience and has completed Fundamentals of Geology and two other advanced courses in geoscience, preferably including mineralogy or petrology.

Phi Beta Kappa, the oldest and most distinguished honor society in the country, offers membership to less than 1 percent of all undergraduates. The Beta Chapter of Virginia of Phi Beta Kappa inducted seven environmental sciences majors this year: **Kaitlyn A. Carter**, **Adrianna L. Gorsky**, **Amber N. Kozacek**, **Meigan D. McManus**, **Leah M. Reichle**, **Renee E. Saur**, and **Laura D. Szczyrba**.

GRADUATE STUDENTS

Kyle F. Davis was the winner of the Maury Environmental Sciences Prize, the department's premier award, established by Dr. F. Gordon Tice in 1992. It recognizes and honors outstanding undergraduate or graduate students for their contributions to environmental sciences, their ability to communicate their findings, and their efforts to promote a better understanding of the environment.

The department offers a series of awards honoring outstanding graduate students in environmental sciences specialties. **Alice F. Besterman** earned the Graduate Award in Ecology; **Elizabeth A. K. Murphy** won the Graduate Award in Hydrology; and **Nevio Babic** won the Graduate Award in Atmospheric Sciences. **Melissa Hey** received the Ellison-Edmundson Award for Interdisciplinary Studies.

Gina B. Digiantonio received the Thomas Jefferson Conservation Award, which supports basic research related to the conservation of the earth's resources.

Kailiang Yu was this year's winner of the Joseph K. Roberts Award, given to a student who presents the most meritorious research paper at a national meeting.

Established by the Thomas Jefferson Chapter of Trout Unlimited, the Trout Unlimited Award is for "significant contributions to research concerning cold-water fisheries or related ecosystems." This year's recipient was **Olivia M. Stoken**.

Jessica A. Gephart received the Jay Zieman Research Publication Award. The donor requested that the award be renamed after former department chair Jay Zieman, who died this year.

Ksenia Brazhnik was honored for making the best graduate student poster presentation at the 32nd annual Environmental Sciences Student Research Symposium. **Jessica A. Gephart** was honored for making the best oral presentation.

This year, **Elizabeth A. K. Murphy** and **Kailiang Yang** won Moore Research Awards. Based on merit, these awards were initiated to help sponsor the dissertation and thesis work of environmental sciences graduate students. **Christina Fantasia** and **Amber Slatosky** received Exploratory Research Awards, meant to support preliminary research leading to a thesis or dissertation proposal.

Laura C. Cattell Noll received the department's Fred Holmsley Moore Teaching Award, bestowed on a graduate teaching assistant distinguished by the ability to instill excitement, wonder, and confidence in students. An endowment set up by Fred H. Moore funds this award, along with matching donations from Mobil Oil Company.

STAFF

Rachel B. Short won the Department Chair's Award, which recognizes an individual who has performed extraordinary service to the department.

In a special award this year, **Nancy Wickliffe**, a member of the UVA housekeeping staff, won the Graduate Student Association Award, which typically recognizes members of the department who have been particularly helpful to the graduate student body.

FACULTY

Linda Blum is associate editor of *Estuaries and Coasts* and a board member of the Chesapeake Bay Sentinel Site Cooperative, sponsored by the National Oceanographic and Atmospheric Administration. At the University, Professor Blum served on the Committee on Faculty Rules and participated in the Faculty Panel at Days on the Lawn.

David Carr is an associate editor of the *American Journal of Botany*. He serves on the Domain Science and Education Coordination Committee of the National Ecological Observatory Network.

Robert Davis served on the Program Committee for the American Geophysical Union's July 2015 Chapman Conference. At the University, Professor Davis is a member of the Commencement and Convocations Committee.

Stephan De Wekker is an associate editor of the *Journal of Applied Meteorology and Applied Climatology* as well as an associate editor of *Atmosphere*. He was a co-organizer of the 17th Conference on Mountain Meteorology sponsored by the American Meteorological Society.

Paolo D'Odorico, the Ernest H. Ern Professor of Environmental Sciences, serves as editor-in-chief of *Advances in Water Resources* and associate editor of the *Oxford Research Encyclopedia of Environmental Science*. Along with colleagues **Michael Pace** and **Deborah Lawrence**, and faculty members from the Darden School and the School of Architecture, he was awarded seed money from the Arts & Sciences Research Initiative to start a Water Research Center. He also organized the University of Virginia's 2015 Water Week Forum.

Howard E. Epstein is an associate editor of *Ecosphere* and *Frontiers in Interdisciplinary Climate Studies*. He is also a member of the board of directors of the Arctic Research Consortium and a graduate student award judge for the American Geophysical Union. At the University, he codirects the College Science Scholars program and served as member of the Chair Selection Committee for the Department of Biology. He also is an advisor to the Jefferson Scholars Foundation Graduate Selection Committee and a codirector of the Committee on Graduate Educational Policy and Curriculum.

James N. Galloway, the Sidman P. Poole Professor of Environmental Sciences, received the Thomas Jefferson Award for Conservation from the Virginia Museum of Natural History in recognition of his significant conservation efforts. He is a trustee of the Marine Biological Laboratory at Woods Hole, Massachusetts, and continues to serve as a member of the Board of Trustees of the Bermuda Biological Station. For the U.S. Environmental Protection Agency, he serves as a member of the Executive Committee of the Board of Scientific Counselors and as a member of the Secondary NAAQS Review Panel for Oxides of Nitrogen and Sulfur, a panel of the Clean Air Scientific Advisory Committee. He is also an associate editor of *Environmental Development*. At the University, Professor Galloway served as chair of the Environmental Resilience Coordinating Committee and is a member of the University Committee on Sustainability.

Kevin Grise was selected as an Ignite Teaching Fellow by the University of Virginia's Center for Teaching Excellence. He was also a judge at the annual Robert J. Huskey Graduate Research Exhibition.

Kyle Haynes is an associate editor of *Ecosphere*.

Janet S. Herman is president of the Karst Water Institute and a councilor and member of the Executive Committee of the Geological Society of America. At the University, she served as the chair of the Committee on Educational Policy and Curriculum.

Alan D. Howard served on the Fellows Selection and Awards Committees of the American Geophysical Union. This year, the department awarded Professor Howard its Maury-Tice Prize for research excellence.

Deborah Lawrence will be spending the next academic year as a Stanford University Fellow at the Center for Advanced Studies in Behavioral Sciences. She served on a National Science Foundation proposal review panel and as a trustee of the Virginia Chapter of The Nature Conservancy. At the University, Professor Lawrence served as a member of the Dean's Promotion and Tenure Committee, the Dean's Committee on Targets of Opportunity, and the Dean's Committee on Diversity and Inclusion, all for the College and Graduate School of Arts & Sciences. Along with colleagues **Paolo D'Odorico** and **Michael Pace**, and faculty members from the Darden School and the School of Architecture, she was awarded seed money from the Arts & Sciences Research Initiative to start a Water Research Center.

Manuel Lerdau is a member of the academic board of the University's Morven Summer Institute and a member of the Sexual Assault Board.

Stephen A. Macko serves as an associate editor of *Amino Acids*. Professor Macko is a member of the Program Committee of the American Geophysical Union as well as the Committee on Education of the European Geophysical Union. He served on a National Science Foundation proposal review panel. At the University, he is the Environmental Sciences representative to the Faculty Senate, a member of the Faculty Advisory Committee to the Honor Committee, and a member of the University Library Committee.

Karen J. McGlathery is the University's associate vice president for research, sustainability, and the environment. She serves as the lead principal investigator of the Virginia Coast Reserve Long Term Ecological Research (LTER) program and sits on the national LTER Science Council. She is an advisor to the Florida Coastal Everglades LTER and the Moorea Coral Reef LTER. Professor McGlathery is also a member of the steering committee of the Mid-Atlantic Coastal Resilience Institute, served on National Science Foundation review panels, and is an associate editor of *Ecosystems*. At the University, she serves on the Environmental Resilience Coordinating Committee and the Dean's Committee on Academic Priorities for the College and Graduate School of Arts & Sciences.

Aaron L. Mills serves on NASA's Microbial Observatory Science Advisory Team. He was secretary of the Faculty of Arts and Sciences and a member of the University Assessment Advisory Committee and the Jefferson Scholars Graduate Selection Committee.

Michael Pace serves as chair of the department. He is an associate editor of *Ecosystems* and a member of the Publications Committee of the Association for the Sciences of Limnology and Oceanography. He served on a National Science Foundation proposal review panel. Along with colleagues **Paolo D'Odorico** and **Deborah Lawrence**, and faculty members from the Darden School and the School of Architecture, he was awarded seed money from the Arts & Sciences Research Initiative to start a Water Research Center.

John Porter is a member of the national LTER Network Information System Advisory Committee and advisor to the Luquillo LTER.

Sally Pusede is an associate editor at *Atmospheric Chemistry and Physics*. She won the department's Environmental Sciences Organization Award, which is given to a member of the department who has been particularly helpful to undergraduate majors. She was selected as an Ignite Teaching Fellow for the upcoming academic year by the University of Virginia's Center for Teaching Excellence.

G. Carleton Ray is a member of the Board of Trustees of the Bahamas National Trust.

Matthew Reidenbach is a member of the Jefferson Scholars Foundation Undergraduate Selection Committee. He is an associate editor of *Advances in Water Research* and served as a site reviewer for the Santa Barbara Channel LTER. He received the Pritchard Award from the Coastal and Estuarine Research Federation for having written the best geophysics paper in the last two years.

T'ai Roulston is an associate editor of *Ecosphere*. He served on a National Science Foundation proposal review panel.

Todd Scanlon served as a reviewer for the Harrison Undergraduate Research Award and as a member of the Committee on Personnel Policy in the College and Graduate School of Arts & Sciences.

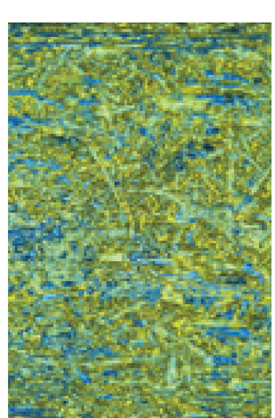
Herman H. Shugart, the W. W. Corcoran Professor of Environmental Sciences, was named the inaugural editor-in-chief of the *Oxford Research Encyclopedia of Environmental Science*. He is an associate editor of *Research Letters in Ecology* and *Ecological Processes* and a member of the editorial boards of *Ecosystems*, the *Eurasian Journal of Forest Research*, *PeerJ*, and *Forest Ecosystems*. In addition, he is on the Subcommittee on Earth Science of the NASA Advisory Council (NAC) Science Committee. At the University, Professor Shugart serves as a member of the Curriculum Planning Committee, the Forum Implementation Committee, and the selection committee for the UVA Distinguished Scientist Award. He is also a member of the board of the University of Virginia Press.

David E. Smith serves the University as a member of the Executive Leadership Network, the Facilities Management Advisory Board, the Process Simplification Advisory Committee, the Committee on Undergraduate Admission, and the Human Resources Advisory Council.

Robert Swap was an Intergovernmental Personnel Act assignee at NASA.

Vivian Thomson is director of the Environmental Thought and Practice interdisciplinary major.

Patricia Wiberg is an associate editor of *E-Surf*. She serves as the steering committee chair of the National Science Foundation's Community Surface Dynamics Modeling System (CSDMS), a National Science Foundation-funded modeling community of approximately 1,100 members.



LINDA BLUM

PEER-REVIEWED PAPERS, BOOK CHAPTERS, AND BOOKS

(Summer 2015 through Spring 2016)

Abbott, B.W., J.B. Jones, E.A.G. Schuur, F.S. Chapin III, W.B. Bowden, M.S. Bret-Harte, **H.E. Epstein**, M.D. Flannigan, T.K. Harms, T.N. Hollingsworth, M.C. Mack, A.D. McGuire, S.M. Natali, A.V. Rocha, S.E. Tank, M.R. Turetsky, J.E. Vonk, K.P. Wickland, G.R. Aiken, H.D. Alexander, R.M.W. Amon, B.W. Benscoter, Y. Bergeron, K. Bishop, O. Blarquez, B. Bond-Lamberty, A.L. Breen, I. Buffam, Y. Cai, C. Carcaillet, S.K. Carey, J.M. Chen, H.Y.H. Chen, T.R. Christensen, L.W. Cooper, J.H.C. Cornelissen, W.J. de Groot, T.H. DeLuca, E. Dorrepaal, N. Fetcher, J.C. Finlay, B.C. Forbes, N.H.F. French, S. Gauthier, M.P. Girardin, S.J. Goetz, J.G. Goldammer, L. Gough, P. Grogan, L. Guo, P.E. Higeura, L. Hinzman, F.S. Hu, G. Hugelius, E.E. Jafarov, R. Jandt, J.F. Johnstone, J. Karlsson, E.S. Kasischke, G. Kattner, R. Kelly, F. Keuper, G.W. Kling, P. Kortelainen, J. Kouki, P. Kuhry, H. Laudon, I. Laurion, R.W. Macdonald, P.J. Mann, P.J. Martikainen, J.W. McClelland, U. Molau, S.F. Oberbauer, D. Olefeldt, D. Paré, M-A. Parisien, S. Payette, C. Peng, O.S. Pokrovsky, E.B. Rastetter, P.A. Raymond, M.K. Raynolds, G. Rein, J.F. Reynolds, M. Robards, B.M. Rogers, C. Schädel, K. Schaefer, I.K. Schmidt, A. Shvidenko, J. Sky, R.G.M. Spencer, G. Starr, R.G. Striegl, R. Teisserenc, L.J. Tranvik, T. Virtanen, J.M. Welker, and S. Zimov. 2016. Biomass offsets little or none of permafrost carbon release from soils, streams, and wildfire: an expert assessment. *Environmental Research Letters* 11: 34014.

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