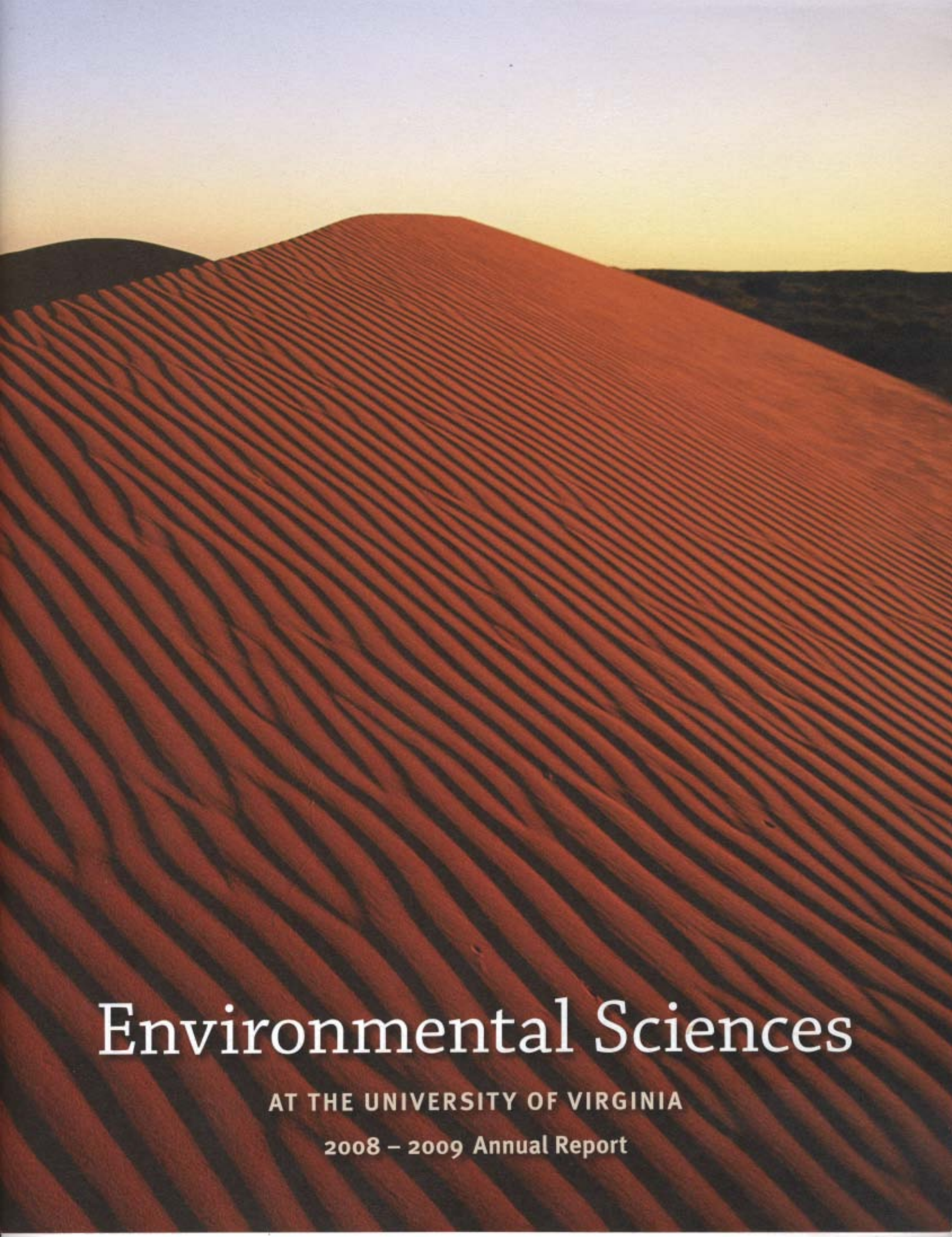


Environmental Sciences

AT THE UNIVERSITY OF VIRGINIA

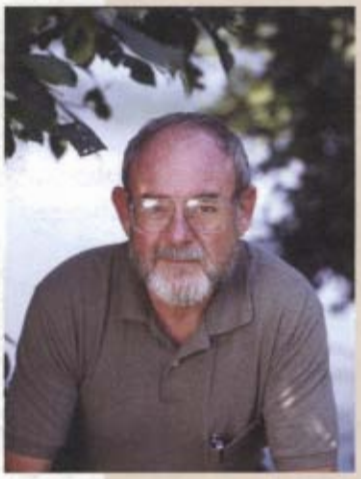
2008 – 2009 Annual Report

The Department of Environmental Sciences

Established in 1969, the Department of Environmental Sciences was one of the first to look at fundamental environmental process from a multidisciplinary perspective and the first in the nation to offer undergraduate, 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 National Science Foundation—sponsored Virginia Coast Reserve/Long-Term Ecological Research program on the Eastern Shore of Virginia, the Virginia Forest Research Facility in nearby Fluvanna County, and Blandy Experimental Farm near Front Royal, Virginia.

From the Chair



This is a natural moment for reassessment. The Department of Environmental Sciences, which welcomed its first student in 1969, has just completed its fortieth year. In every respect, the department has fulfilled the expectations of its founders, who were among the first to realize the power of combining a series of discrete fields into the fluid interdisciplinary project we call environmental sciences. We have continued their tradition of leadership.

Leadership starts with the quality of our faculty. Many like Paolo D'Odorico, an ecohydrologist, have been instrumental in opening new areas for interdisciplinary research. Others are singled out to receive high accolades. This year, Mike Pace was presented the G. Evelyn Hutchinson Award by the American Society of Limnology and Oceanography, while Deborah Lawrence was named a fellow in the Jefferson Science, Fulbright, and Guggenheim programs.

We also have independent verification that research conducted by our faculty has been extraordinarily influential. Jack Cosby, Jim Galloway, Mike Pace, Bill Ruddiman, and Hank Shugart have all been designated highly cited researchers by the Institute for Scientific Information. Highly cited researchers comprise less than one-half of 1 percent of all publishing scientists. The list of publications at the end of this report attests to the continued intellectual activity of our faculty.

Faculty members apply this leadership for the public good. Members of the department contribute their expertise to state boards and commissions. We have also taken a leading role in developing the U.Va. Bay Game, a University-wide project designed to draw attention to both to the urgency of protecting the Chesapeake Bay and the difficult decisions that must be made to do so.

At the same time, we are actively engaged in preparing the next generation of environmental leaders. We consistently attract large numbers of undergraduate majors and distinguished graduate students. They work side by side in the field and in the laboratory with faculty members, learning from firsthand experience the intellectual satisfaction and excitement of research.

It has been my privilege to lead the department for the last five years. As I hand my responsibilities as chair to Pat Wiberg, I do so with deep concern about what the future holds in store for the environment. It is clear that the leadership this department has displayed during the last forty years will be even more critical in coming decades.

JAY ZIEMAN, *Chair*

Professor Pat Wiberg, the new department chair, is an expert in sediment erosion, transport, and deposition in river, coastal, and wetland environments.

Keeping the Desert at Bay

Land degradation and desertification are not simply an ecological disaster. They are a human tragedy. The fragile drylands that cover so much of the earth's surface support societies that themselves are fragile. Paolo D'Odorico is conducting research at the intersection of water, ecology, and human activity that illuminates the changes that threaten these ecosystems. In doing so, he has become a leader in the emerging discipline of ecohydrology.

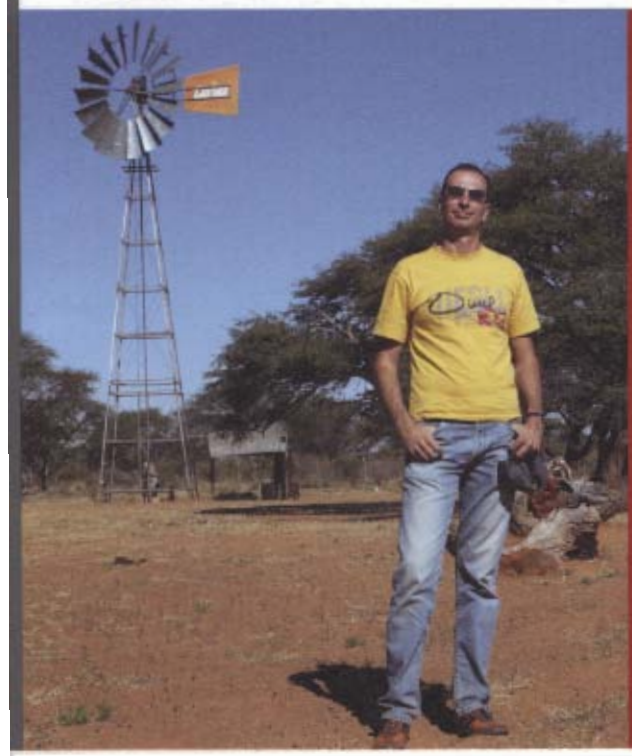
The dryland ecosystems that cover 40 percent of the earth's land area are under severe stress. According to the United Nations, about 12 million hectares are lost to land degradation each year, directly impacting the lives of hundreds of millions of people. The effects of desertification, however, are often felt far beyond the regions where it occurs. Airborne particles from deserts affect cloud formation and rainfall patterns hundreds and even thousands of miles away.

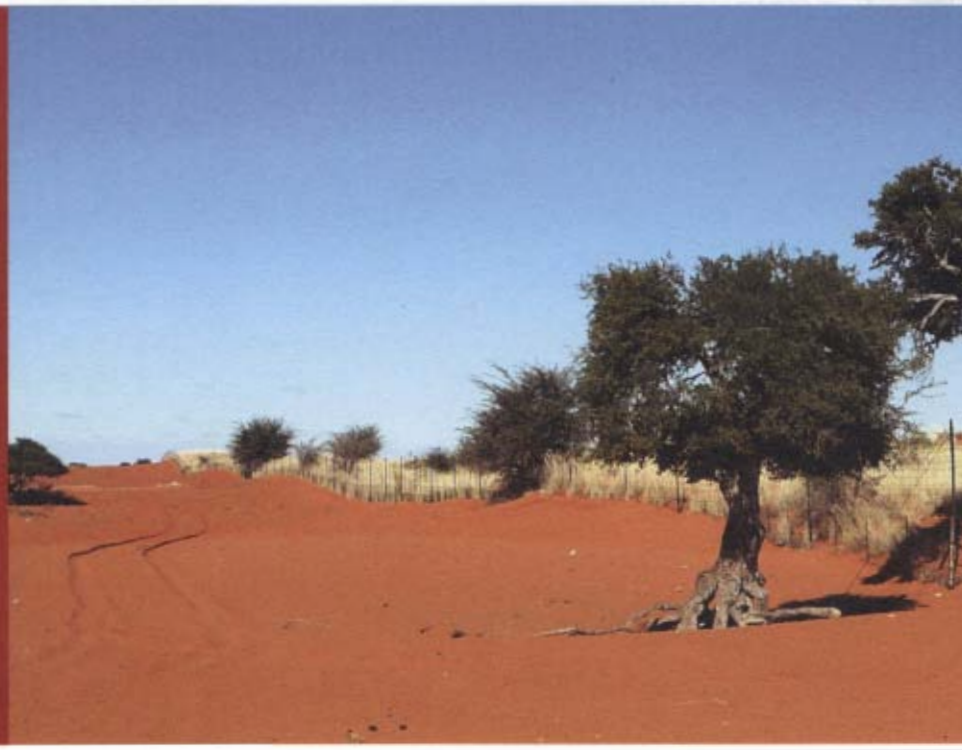
Associate Professor Paolo D'Odorico works at the junction of two critical factors that determine the health of these ecosystems—water and ecology. These factors are interrelated: changes in plant species, for instance, alter the distribution of water in the soil, while changes in the amount of water available can alter the composition of plant species.

As one of the nation's pioneering ecohydrologists, D'Odorico devotes himself to teasing out the connections between water and dryland ecosystems. Inevitably, his work leads to an investigation of a third factor that changes the balance between water and ecology: human activity, whether in the form of overgrazing, slash-and-burn agriculture, or drought caused by climate change. "If we can understand the relationship among water, ecosystems, and human beings, we can begin to develop strategies to prevent and even to reverse land degradation," D'Odorico says.

From the Chihuahuan Desert to the Kalahari

D'Odorico's research has taken him to the Chihuahuan and Sonoran deserts of the American Southwest and the Kalahari in southern Africa. Working with scientists at the University of Arizona, the University of California, Los Angeles, and the University of New Mexico, D'Odorico has posited a sequence of events that can transform a stable dryland ecosystem dominated by perennial grasses into a highly eroded, depleted wasteland.

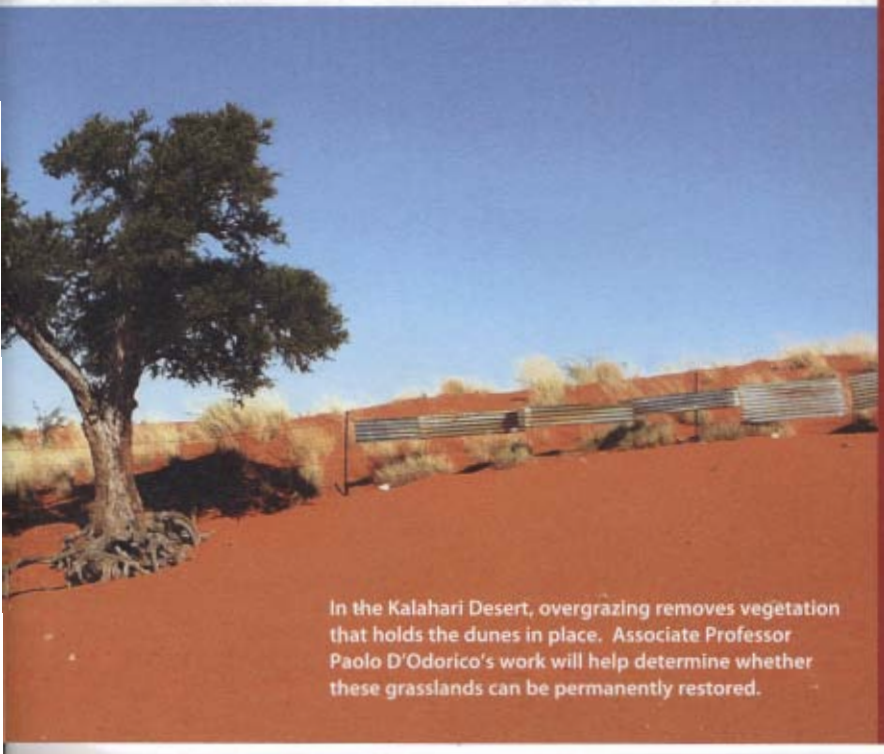




As they see it, overgrazing can transform an ecosystem dominated by perennial grasses, where nutrients and water are widely distributed, to one dominated by woody shrubs, which concentrate water and nutrients in the soil around them. D'Odorico and his colleagues have found that these resource islands are perfect incubators for invasive annual grasses. In wet years, the grasses spread between the islands, creating dry annual grasslands that can catch fire when lightning strikes. These fires, which tend to redistribute ground resources evenly once again, encourage these grasses to grow even more thickly. The problem is that invasive annual grasses, unlike the perennial grasses they replaced, are not drought resistant. In a dry year, they will die off, exposing the entire soil surface to intense erosion.

D'Odorico also studies the reactivation of enormous sand dunes in the Kalahari Desert, which covers much of Botswana and parts of Namibia and South Africa. These dunes had been stabilized by grass species that had adapted to being occasionally covered by sand. Since the 1970s, a combination of drought and overgrazing has denuded the landscape, mobilizing the dunes, which then cover productive soil. At the same time, this growing desert is a source of atmospheric dust, which can exacerbate climate change.

This process can in some instances be reversed. In Botswana, D'Odorico has found that grasses return to areas on which grazing has been excluded. Whether these grasslands are sustainable over the long term is a question that only further study by ecohydrologists can answer.



In the Kalahari Desert, overgrazing removes vegetation that holds the dunes in place. Associate Professor Paolo D'Odorico's work will help determine whether these grasslands can be permanently restored.

The Transformation of an Old World Civil Engineer into a New World Ecohydrologist

Q. You originally trained as a civil engineer. How has that background helped you in your work?

A. Quantitative methods are very useful when you try to understand the intersection of hydrology and ecology. They help you create a theoretical framework that enables you to integrate a variety of processes and feedback loops to see how the system as a whole behaves.

Q. Why did you switch fields?

A. Civil engineering introduced me to hydrologic processes, but I found I was drawn to the natural world rather than to man-made structures. The great thing about being interested in hydrology is that you have a lot of options.

Q. Did you intend to become a faculty member at an American university?

A. It was not something I planned. I came to the United States to work on the last chapter of my dissertation—and one thing led to another. I was offered a post-doc, then a faculty position, and then a job at U.Va. I stayed in the United States because the academic environment is more dynamic than in Italy. There an assistant professor is really an assistant to a senior professor. Here, you can take intellectual ownership of your research at a formative time in your career.

Q. In 2006, you published *Dryland Ecohydrology* with Amilcare Porporato. Why did you take time out to put together this collection of essays?

A. Our goal was to call attention to the emerging discipline of ecohydrology and to encourage additional research on dryland degradation. One way to do this was to pull together the best thinking in the field.

Q. What are some of the benefits of being based at U.Va.?

A. This department has a great tradition of collaboration. Since I came here, I've worked with Howie Epstein, Todd Scanlon, Deborah Lawrence, Steve Macko, Greg Okin, Karen McGlathery, Pat Wiberg, Manuel Lerdau, and Stephan De Wekker. If I'm looking for something new and exciting to investigate, all I have to do is walk down the hall.

Recognized for Excellence

Awards for scientific research do more than simply recognize past achievement. They often give faculty members the impetus to expand the scope of their work, to pursue new projects, and to reach fresh audiences. Award winners Mike Pace and Deborah Lawrence are currently engaged in projects that are among the most ambitious of their careers.

Mike Pace receives the 2009 Hutchinson Award

Throughout his career, Professor Mike Pace has been interested in seeing specific observations within a larger context. He began his career investigating the role of protozoa, rotifers, and crustacean zooplankton in the aquatic food web at the same time he was helping to develop a model of coastal marine food webs.

This interest in synthesis, in tracing the underlying patterns that connect unique events, has come to define his work and is one of the reasons that Pace was awarded the G. Evelyn Hutchinson Award from the American Society of Limnology and Oceanography, the most prestigious award in his field. It also accounts for the enduring influence he has had on his colleagues. He is included in the list of highly cited researchers by the Institute for Scientific Information.

Pace's interest in understanding the larger significance of discrete phenomena is clearly evident in his current project. He is looking to identify the telltale warning signs that an ecosystem is about to undergo regime shift, a rapid and sometimes catastrophic state change. With global warming exerting ever-greater influence on the environment, such regime changes are expected to become more prevalent. "Knowing the warning signs may help us avoid moving to regimes that are unsatisfactory," he says.

Pace is focusing on the increasing amplitude of variability within a system as it approaches a regime shift. He and his colleagues at the University of Wisconsin and the Cary Institute of Ecosystem Studies have created a theoretical model for regime change in lake food webs. "Theoretically, we know what moves a lake from one state to another," he says. "We are now conducting an experiment to determine if we see the warning signs in nature that we find in the model."

He is pushing Peter Lake at the University of Notre Dame Ecological Research Center in Wisconsin to regime shift by introducing bass. As these predatory bass eliminate other fish species and feed on their own young, older, larger fish will come to dominate the lake, a change that will alter the food web. As this happens, Pace is monitoring a number of phenomena, for instance fluctuations in the population of algae, to see if they foreshadow a state change.

Pace's work at Peter Lake is part of a larger recognition that changes in the amplitude of variability prefigures state changes of all sorts. Economists are studying variability as an indication of shifts in financial markets while physicians are studying the use of variability as a warning sign for asthma attacks, epileptic seizures, and sepsis infections in newborns.

Professor Mike Pace has introduced bass at Peter Lake, an event that will ultimately cause a state change in its food web. By tracking changes in variability in the ecology of the lake, he hopes to learn how to predict when that change might occur.

Deborah Lawrence wins Jefferson Science, Fulbright, and Guggenheim Awards

As Jefferson Science Fellow at the Department of State, Associate Professor Deborah Lawrence is helping to prepare the U.S. delegation to the Copenhagen climate conference.

By any standard, 2008–2009 was a banner year for Associate Professor Deborah Lawrence. She was named a Jefferson Science Fellow by the U.S. Department of State, a Guggenheim Fellow, and a Fulbright Scholar. In addition, a proposal that she and Paolo D'Odorico submitted to the National Science Foundation was funded. "These awards will enable me to see my research on land use and tropical forests in a much wider context," she says.

They will energize Lawrence's research in two distinct ways. With her Guggenheim and Fulbright awards, Lawrence will add Thailand to the list of sites where she has studied the interplay between vegetation dynamics and nutrient dynamics in secondary forests. These are forests that appear after land cleared for agriculture has been left fallow. She has already conducted research in Mexico and Indonesia, and adding Thailand will provide greater comparative depth.

More importantly, Lawrence is using her Guggenheim and Fulbright awards to help her pinpoint the way socioeconomic and political forces impact environmental processes. "At the sites I looked at, slash-and-burn agriculture proved more sustainable in Indonesia than in Mexico. It's a difference that simply cannot be explained by variations in soil, vegetation, or climate," she says. "Human dimensions—whether in the form of government programs that support monoculture, economic forces that lead skilled farmers to migrate, or even the construction of roads that connect outlying area to markets—affect sustainability."

Developing a comprehensive understanding of the forces that impact the capacity of tropical forests to regenerate is crucial to formulating sound environmental policy. Tropical forests hold vast stores of the earth's biodiversity. They also play a major role in regulating the global carbon cycle and thus global climate.

As a Jefferson Science Fellow in Washington, Lawrence finds herself at the epicenter of efforts to formulate global environmental policy. Assigned to the Bureau of Oceans, Environment, and Science, she supports the special envoy for climate change, Todd Stern. In the run-up to the United Nations Framework Convention on Climate Change in Copenhagen, she is providing insight on REDD, the United Nations Collaborative Program on Reduced Emissions from Deforestation and Degradation. "REDD will dovetail with efforts in developed countries to reduce emissions, but for it to be effective we need to understand constraints such as the limitations of using satellite systems for monitoring," she notes. "I can make a contribution because I'm familiar with many of these issues through my research."

Highly Cited Researchers

Each year, the Thomson Scientific publishing company compiles a list of the 250 researchers in each of twenty-one fields whose collected publications have been cited most often during the previous two decades. Citation by other researchers is considered the ultimate measure of an individual's scientific contribution, because it reflects the appraisal of experts who view the individual's contribution as essential to their own.

Being included in this list is an extraordinary accomplishment. Fewer than one-half of 1 percent of all publishing researchers make the grade. Five of the twenty-two highly cited researchers at the University of Virginia are from the Department of Environmental Sciences. Three of them, Hank Shugart, Jim Galloway, and Jack Cosby, are covered on these pages, while Mike Pace, highly cited in plant and animal sciences, is featured in an article that celebrates his being named the Hutchinson Award winner for 2009. Bill Ruddiman, a professor emeritus who is highly cited in the geosciences, was profiled in our 2006–2007 report.

Jack Cosby Ecology/Environment, Engineering

Since Thomas Jefferson's time, the study of the environment has been motivated by intellectual curiosity, by a desire to understand the world around us. In recent decades, however, that curiosity has taken on a sense of urgency, as scientists recognized that the world they are observing is changing at rates unprecedented in human history. Determining the causes and consequences of this change has become the preeminent scientific project of our age.

Research Professor Jack Cosby's work has been cited extensively because it addresses fundamental issues that must be answered if we are to resolve this question. In order to understand how and why the environment is changing, we must be able to trace the interaction among the various forces that shape our environment. This requires the synthesis of vast quantities of data and their translation into large-scale models.

Cosby has done pioneering work in this area, developing quantitative techniques and applying them to large-scale aquatic and terrestrial systems. Along with George Hornberger, Jim Galloway, and Dick Wright, he developed the MAGIC model, which, thanks to regular updates, continues to be the leading model for the assessment of acid deposition effects on ecosystem function.

Because of the nature of his work, Cosby's research appeals to a large audience. MAGIC, for instance, has been used internationally for more than twenty years for both scientific and policy assessments of acid rain. Cosby himself has been involved in a wide range of international initiatives. He is a member of the United Nations Economic Commission for Europe Joint Expert Group on Dynamic Modelling and the Critical Loads Ad Hoc Committee of the National Atmospheric Deposition Program, a federal-state-nonprofit collaboration that tracks the chemistry of precipitation. "By participating in these efforts, I'm helping to move scientific understanding around the world and make scientific knowledge available for policy decision making" he says.

Professor Jack Cosby is codirector with Professor Jim Galloway of the Shenandoah Watershed Study, the longest continuously conducted watershed research and monitoring program in the National Park System. This spring, they will be collaborating with other state and nonprofit groups in the third decadal regional water quality survey of trout streams in Virginia. It is being conducted as part of the Virginia Trout Stream Sensitivity Study.

In Professor Hank Shugart's view, his work as a teacher and mentor is the ultimate measure of his influence. During his career, he has mentored forty-two doctoral students and seventeen postdoctoral fellows. His student Jackie Shuman is testing the use of a model to detect the effects of climate change on forest succession in Siberia.

Hank Shugart

Ecology/Environment

With typical modesty, Hank Shugart says his inclusion in the list of highly cited researchers is a matter of good fortune. "I was lucky enough to be there at the beginning of three or four lines of research, all of which took off," he says.

But Shugart, who is the W. W. Corcoran Professor of Environmental Sciences, clearly made his own luck. "I've always been drawn to big-picture ecology and the challenge of understanding large processes," he says. Trained as a field ornithologist, he was among the first to use statistical methods to predict where you might find a particular species of animal. In addition, Shugart was a pioneer in the field of systems ecology. He developed a computer model that has been widely used for forest succession, and he has been a leader in the effort to understand global change.

Shugart is quick to note that some of the articles that he felt are among his best are rarely cited. Nonetheless he considers the award significant. "It's a merit-based award," he points out. "Either people think enough of your work to cite it or they don't." He also considers the number of faculty members included on the list shorthand for the quality of a department or university. "It says good things about our department that we have five highly cited researchers on our faculty," he says.

Jim Galloway

Ecology/Environment, Geosciences, and Engineering

Very few scientists make the list of highly cited researchers, and even fewer are cited in three separate fields. Professor Jim Galloway, the 2008 Tyler Prize winner and Sidman P. Poole Professor of Environmental Sciences, is a member of this select group. He attributes his wide influence to the broad constituency for his area of study, biogeochemistry.

Galloway believes that all good scientists, whether they make the list or not, are driven by their intellectual curiosity. "There has to be a question that they really want to answer," he says.

Galloway discovered his question after his original dissertation topic was scooped by another researcher, and he was left without an adviser. Walking on the beach, he saw an old rusty anchor chain embedded in the sand and wondered how the iron in it was extracted, how the chain was created, and what effect the rusting chain had on the environment. These questions, all related to the impact of human activity on biogeochemical cycles, form the underlying theme of his work.

"This is a question you can ask focusing on different materials and at different scales, " he observes. Over the last decade, Galloway has devoted much of his energy to studying reactive nitrogen, but he insists that given enough time, he would work his way through the entire periodic table.

When Meredith Woo, dean of the College of Arts & Sciences, asked Professor Jim Galloway to join her administration as associate dean for the sciences, he rose to the challenge. "These are difficult times," he says, "but I think I can make a contribution to advance the sciences at the University."

Environmental Leadership for the Public Good

There is no longer any doubt: human activity has set in motion a series of environmental changes that will have profound consequences for people and ecosystems across our globe. Through our educational and outreach efforts, the department is preparing citizens to take part in the debate on these issues, following in the steps of faculty members who have volunteered their time and expertise to help governments manage these changes.

Associate Professor Vivian Thomson serves as vice chair of Virginia's Air Pollution Control Board.

Protecting Virginia's Air Quality

Serving on Virginia's Air Pollution Control Board is not for the faint of heart. Each time a utility company proposes a new power plant or the Virginia Department of Environmental Quality (DEQ) proposes major regulations, members of the board can count on spending long months at the center of the heated battle that almost inevitably ensues.

Associate Professor Vivian Thomson endures controversy as the board's vice chair because she believes in its mission and feels that she can contribute constructively to its deliberations, given her background in environmental and political sciences and her experience as a policy analyst at the U.S. Environmental Protection Agency. "This can be contentious and time-consuming work, but it is also exciting and extremely satisfying," she says. "Serving on the board is my way of protecting air quality in Virginia."

The Air Pollution Control Board consists of seven experts appointed by the governor and approved by the General Assembly. Its primary statutory focus is stationary sources of pollution, which include small individual polluters like dry cleaners as well as factories, incinerators, and power plants. It enacts regulations that apply to sources in a particular category, often by incorporating federal Environmental Protection Agency regulations into the Virginia code. "We have the option of adopting these standards or imposing stricter ones based on the scientific evidence," Thomson says.

The board also reviews DEQ decisions to permit individual facilities if citizens petition the board to step in. In these instances, board members evaluate hundreds of pages of documents provided by DEQ staff, examine pertinent EPA standards, and review the actions that other states have taken in comparable circumstances. In some cases, the board has been sued by industry and environmental groups, but even in these cases the board usually prevails. "We are not a rubber stamp organization," Thomson says. "We do our best to balance all the interests, but our bottom line is preserving air quality in the Commonwealth."

Thomson is proud that the board's permit for a new power plant in Wise County is considered one of the tightest in the nation, and she is pleased when citizens express their gratitude for the board's hard work. She also feels that her work on the board benefits students. Thomson constantly draws on her experience as a board member in the classroom, and she feels that the presence of a woman in a leadership position on a powerful expert public body sets an important example for female students.

Students in Professor Dave Smith's classes tested the U.Va. Bay Game during its development. The Bay Game is designed to increase understanding and awareness of the factors that determine the environmental health of the Chesapeake Bay watershed.

Creating a Common Context for Saving the Chesapeake Bay Watershed

As long as there is no consensus about the meaning of sustainability, progress cleaning up the Chesapeake Bay is going to be slow. An important goal of the U.Va. Bay Game, a large-scale simulation sponsored by the University's Office of the Vice President for Research, is to create a starting point by helping players understand how the different groups whose activities affect the six-state Chesapeake Bay watershed define the term.

This innovative agent-based simulation allows players to assume the roles of farmers, watermen, developers, and local policy makers. They make decisions about their activities at two-year intervals over the twenty-year run time of the simulation. At each interval, they consult a computer dashboard that displays such key indicators of the health of the bay as the oxygen content of the water and the size of the crab harvest. There is also a chat room where players representing the different stakeholders exchange views.

"Players assess the impact of their behavior on each other and on watershed health," notes Professor Dave Smith, who provided insight on environmental issues for the developers of the game. "Ultimately, they take away an understanding of the trade-offs made in building a consensus for sustainability."

The number of different schools represented in the development team is one measure of the complexity and richness of the game. Smith was joined by colleagues from the Schools of Architecture, Commerce, Law, Medicine, and Engineering, as well as the Darden School. Another indication is the 43,023 equations incorporated in the program, embodying factors that impact the health of the bay such as the amount of acreage converted from agriculture to residential development and changes in the length of the crab harvest season. "This type of intense collaboration with other schools at the University is a natural extension of the department's own interdisciplinary focus," Smith observes.

Departmental students have been active participants in this partnership. A number of students in Smith's J-Term course, Chesapeake Bay Ecology and Conservation, served on an advisory group for the game's developers. Students in his oceanography course were part of the group that tested the game before a beta version was unveiled during Earth Day in April.

"The game is a work in progress," notes Smith. "We make changes each time we run it, fine-tuning the simulation and broadening its scope." News of the game has already attracted attention. Arizona State University and Melbourne University in Australia have already voiced their interest in using the Bay Game's technology to raise understanding of problems in local watersheds.

Nurturing the Next Generation of Environmental Leaders

Traditionally, scientists conduct research, while students study their conclusions. Environmental scientists at U.Va. are hoping to lessen this distinction by mentoring students and inviting them into their laboratories. In the process, they hope to give them a taste of the intellectual excitement and satisfaction of scientific discovery, setting the stage for the next generation of environmental leaders.

Mercury Transport in Todd Scanlon's Lab

In the United States alone, coal-fired power plants, waste incinerators, and other polluters pour 150 tons of mercury into the air each year. Much of this mercury eventually returns to earth, where anaerobic organisms convert it into methylmercury, a powerful neurotoxin linked to neurological damage and birth defects. Methylmercury builds up in lakes and streams, where it works its way up the food chain, increasing in concentration as it goes. As a result, the U.S. Food and Drug Administration has issued an advisory for women who are pregnant, nursing mothers, and mothers of young children, urging them to eliminate or curtail their consumption of large, carnivorous fish.

With funding from the National Science Foundation, Assistant Professor Todd Scanlon has established a program to track the movement of mercury from the atmosphere into the land and water in the Shenandoah National Park. Both graduate student Ami Riscassi and undergraduate Thushara Gunda are part of the effort.

Riscassi is studying how storms flush mercury from the soils into stream water at three different sites in the park, each with its own characteristic biogeochemistry. She has developed a system that collects water samples automatically. "You have to be very meticulous to do this kind of work because mercury is a trace element," Scanlon observes. "Ami has done a fantastic job retrofitting equipment with Teflon® liners and testing her modifications thoroughly." Riscassi has been awarded an EPA Science to Achieve Results (STAR) Fellowship and presented a poster on her work at the American Geophysical Union Fall Meeting in 2008. "Todd has been great," she says. "He knows the literature and he's superb at translating what you see in a stream into a well-thought-out scientific paper. He's making me a well-rounded scientist."

Thushara Gunda found environmental sciences during her first semester at U.Va., attracted by its blend of hard science and human impact. With Scanlon's guidance she is analyzing the way mercury moves through forests, sampling leaf litter and soil. "Working with Professor Scanlon is extremely rewarding," she says. "He gives me the leeway to think through problems as they arise and come up with a solution on my own. You really learn a lot when you take more responsibility for your work." Gunda has clearly taken this precept to heart. Rather than depend on Scanlon for financial support, she sought out and won a fellowship from the Morris K. Udall Foundation as well as a Harrison Award from the University to fund her research.

Thushara Gunda and Ami Riscassi are helping Assistant Professor Todd Scanlon track the movement of mercury in the environment.

David Hondula and Jacob Bales are working with Professor Bob Dolan to validate and update shoreline erosion and storm damage projections.

Tracking Coastal Erosion with **Bob Dolan**

Professor Bob Dolan has had a long and influential career. He is a leading expert on coastal processes, particularly shoreline erosion and the consequences of storms. He was the first chairman of the department and a driving force in its creation. And he is a dedicated teacher, conveying his fascination with the structure and dynamics of barrier islands to generations of students. "Working with the bright, motivated students we have at Virginia is really a pleasure," he says. "I like to whet their appetites for the kind of research I do."

This year, Jacob Bales and David Hondula joined the roster of students who have worked closely with Dolan over the years. Bales, an undergraduate, is working with Dolan to assess the accuracy of a twenty-five-year prediction Dolan made in 1977 about the behavior of the shoreline and the erosion patterns at the Assateague National Seashore. His forecast was based on a statistical model that he prepared for the U.S. Department of Interior and was included in its *Atlas of Environmental Dynamics*.

Bales is stitching together a series of high-resolution satellite images, identifying the high water line, adjusting the scale of the images to correspond to Dolan's original work, and superimposing the aerial view on Dolan's prediction. Bales hopes to complete the project by the end of the semester. "Working with Professor Dolan has been great," Bales say. "He doesn't look over my shoulder all the time, but when I get stuck, he's always available."

Dolan has also enlisted assistance from graduate student David Hondula on another project. Although Hondula's principal interest is climatology, he has served as the teaching assistant for Dolan's introductory Beaches, Coasts, and Rivers class for a number of years. Dolan has Hondula studying the effects of the Ash Wednesday Storm, a massive winter storm that killed 40 people in the mid-Atlantic states, injured more than 1,000, and caused hundreds of million of dollars in property damage when it struck in 1962. Hondula's assignment is to look at the zones of damage and destruction in 1962 and assess the consequences if a similar storm struck today. "We've found that the risk zones now extend far inland," Hondula says. He and Dolan are preparing to publish a paper on their findings.

"Bob Dolan has been a great mentor," says Hondula, who has known Dolan since he was an undergraduate in the department. "He's opened my eyes to other opportunities and given me a sense of who is doing important research in academia and in the private sector."

Awards, Appointments, and Publications

Undergraduate Students

The department recognizes fourth-year students who have done outstanding work in each of the environmental sciences. This year, the Mahlon G. Kelly Prize in ecology went to **Kelly L. Hondula**, the Michael Garstang Atmospheric Sciences Award went to **Mallie E. Toth**, the hydrology award went to **Joshua R. Richards**, and the Wilbur A. Nelson Award in geology went to **Allison M. Leach**.

Selected as distinguished majors were **Brittany L. Craven**, **Sarah A. Drummond**, **Kelly L. Hondula**, **Allison M. Leach**, **Karl S. Philippoff**, **Leslie R. Piper**, **Dana S. Richards**, and **Amanda M. Schwantes**.

The Bloomer Award provides a $1,500 award to a rising second-, third-, or fourth-year undergraduate majoring in the department with a focus on geology. This year's winner was **Kelly J. Hokanson**.

This year's Wallace-Poole Prize, for the fourth-year student majoring in environmental sciences with the highest grade point average and who was judged to be the most outstanding student in the class, went to **Leslie R. Piper**.

Savanna C. Barry was honored for her outstanding presentation at this year's Environmental Sciences Research Symposium.

Thushara Gunda was this year's recipient of the Richard Scott Mitchell Scholarship, which provides $1,500 to a rising fourth-year student who is focusing on geology and who has taken petrology and mineralogy. In addition, she received a 2009 Morris K. Udall Scholarship to support her research in hydrogeological sciences. The scholarship, given by the Morris K. Udall Foundation in honor of the late Arizona congressman, provides up to $5000 for one year. Gunda was one of 80 winners chosen on the basis of their commitment to careers in the environment, in health care, or in tribal public policy, their leadership potential, and their academic achievement. In addition, Gunda also won a Harrison Undergraduate Research Award from the University, as did **Nathaniel C. Farrar**.

Double 'Hoo Research Grants pair an undergraduate student with a graduate student mentor to pursue an independent research project. Of the ten Double 'Hoo awards in 2009, two sets went to students in the department. **Kelly J. Hokanson** is collaborating with **Ami L. Riscassi** and **Savanna C. Barry** is working with **Luke W. Cole**.

Graduate Students

Marcia S. DeLonge won the Maury Environmental Sciences Prize. Established by Dr. F. Gordon Tice in 1992, it is the department's premier award.

Ami L. Riscassi received the Trout Unlimited Award, which was established by the Thomas Jefferson Chapter of Trout Unlimited for "significant contributions to research concerning cold-water fisheries or related ecosystems."

Kier S. Soderberg was awarded a Buckner W. Clay Dissertation Year Fellowship by the Graduate School of Arts & Sciences for 2009–2010. The fellowship provides a stipend, tuition, and health insurance.

Two graduate students won awards at the 9th Annual Robert J. Huskey Graduate Research Exhibition, open to all students in the Graduate School of Arts & Sciences. **David M. Hondula** placed first and **David Morris** placed second in the physical sciences and mathematics oral paper competition.

Luke W. Cole received the Thomas Jefferson Conservation Award, which supports basic research related to the conservation of the earth's resources.

Thomas J. Mozdzer, **Luke W. Cole**, **Michael S. Long**, and **Matthew H. Long** were honored for making outstanding graduate student presentations at this year's Environmental Sciences Research Symposium.

Virginia A. Seamster won the department's Fred Holmsley Moore Teaching Award. This award is funded by an endowment set up by Fred H. Moore along with matching donations from Mobil Oil Company.

The department offers a series of awards honoring outstanding graduate students in each specialty of environmental sciences. This year, **Gerald V. Frost** earned the Graduate Award in Ecology, **Jennifer C. Romanowich** won the Graduate Award in Hydrology, and **Guan Song** won the Graduate Award in Atmospheric Sciences. **Amber D. Converse** received the Robert Ellison Award for Interdisciplinary Studies.

David M. Hondula won the Joseph K. Roberts Award. It is given to a student who presents the most meritorious paper on geology at a state, national, or international conference.

Karen L. Vandecar received the Graduate Student Research Publication Award.

This year, **Marcia S. DeLonge** and **Kier S. Soderberg** won Moore Research Awards. The awards are based on merit and were initiated to help sponsor the dissertation and thesis work of environmental sciences graduate students.

Abinash Bhattachan, **Yufei He**, **Charles E. Clarkson**, **Sean M. McLoughlin**, **Kirby Webster**, and **Elizabeth R. Whitman** received Exploratory Awards. These awards were initiated to support preliminary research leading to a thesis or dissertation proposal.

The Michael Garstang Award supports graduate student research in interdisciplinary atmospheric sciences. This year, the award went to **Temple R. Lee**.

Staff

William B. Tomanek won the Graduate Student Association Award.

Chair's Awards were presented to **Pamela M. Hoover**, **Grace J. Lipscomb**, **William B. Tomanek** and **Gerald W. Williamson**.

Faculty

We are proud to have twelve faculty members serving in an editorial capacity on twenty-two journals.

Thomas H. Biggs received the Environmental Sciences Organization Award. He taught the geosciences portion of the Virginia Master Naturalist Program and worked with the Virginia Department of Natural Resources to curate the department's rock and mineral collection and make it available for display.

Linda Blum continues to serve on the National Research Council Committee on Earth Surface Processes. She is a panel member of the Hudson River Foundation Proposal Panel.

David Carr was appointed director of the Blandy Experimental Farm and the Orland E. White State Arboretum.

Stephan De Wekker was a University Teaching Fellow and served on the American Meteorological Society Committee on Mountain Meteorology.

Paolo D'Odorico continued to serve as associate editor for *Water Resources Research* and edits *Geophysical Research Letters*. He is chair of the Ecohydrology Committee of the American Geophysical Union and is a member of the Rivanna Watershed Commission.

Robert Dolan served the University as a member of the Jefferson Scholars National Selection Committee.

Howard Epstein was associate editor of *Plant Ecology*.

Michael Erwin chaired the Natural Heritage Committee of Albemarle County as well as the Strategic Planning Committee of the Waterbird Society.

James N. Galloway, the Sidman P. Poole Professor of Environmental Sciences, was named the associate dean for U.Va.'s College of Arts & Sciences. He continued to serve as a member of the International Nitrogen Initiative Steering Committee, the EPA Science Advisory Board, and the board of trustees of the Bermuda Biological Station for Research.

Bruce Hayden was associate editor of the *Journal of Climate Research* and chair of the Long Term Ecological Research Climate Committee.

Janet S. Herman was named 2008 Educator of the Year by the Association for Women Geoscientists and Outstanding Karst Scientist by the Karst Waters Institute. She also chaired the External Review Committee for the Department of Geosciences at the University of Nebraska. She served as associate editor of *Water Resources Research*, which is published by the American Geophysical Union.

Alan D. Howard was a member of the National Science Foundation's Review Panel on Geomorphology and Land Use Dynamics. He also served as vice chair of the Executive Committee of the Earth and Planetary Surface Processes Group of the American Geophysical Union.

William Keene served on the advisory group for the U.S. Surface Ocean–Lower Atmosphere Study, which is sponsored by the International Geosphere-Biosphere Programme.

Deborah Lawrence received numerous honors this year. She won a Mead Honored Faculty Award from the University to foster faculty-student interaction. She was the first U.Va. faculty member chosen a Jefferson Science Fellow at the Department of State. This program, administered by the National Academies, places tenured science faculty into advisory positions in bureaus within the department. In addition, she won a Guggenheim Fellowship as well as a Fulbright Scholarship. She chaired the Environmental and Biological Conservation Program for the Environmental Sciences, served as a science adviser to the TROPI-DRY International Research Network

and as an expert assessor of international standing for the Australian Research Council. In addition, she was associate editor of *Ecology*.

Manuel Lerdau was a National Academy of Sciences Kavil Fellow. He served as associate editor of the *Journal of Geophysical Research—Biogeosciences* and of *Oecologia*. He was a member of the Domain 2 Executive Committee of the National Ecological Observatory Network (NEON) and leader of its Global Change Experiment Terrestrial Committee. He was also on the External Review Committee for the University of Arizona/Biosphere 2.

Stephen A. Macko was a member of the Committee on Education and Human Resources of the American Geophysical Union and program director for the National Science Foundation Geobiology and Low-Temperature Geochemistry initiative. Macko served as associate editor of a number of publications: *Amino Acids, The Scientific World: Isotopes in the Environment*, and *Science of the Total Environment*. He was also education editor of *EOS*.

Karen J. McGlathery served as the lead principal investigator on the Virginia Coast Reserve Long Term Ecological Research (LTER) site, which was re-funded for years 21–26. She sat on the LTER Science Council and was associate editor of *Ecosystems*.

Aaron L. Mills was a member of the U.S. Department of Energy Environmental Remediation Science Program Review Panel. In addition, he sat on the Advisory Committee of the Appalachian College Association.

Jennie Moody was the University of Virginia's representative to the University Corporation for Atmospheric Research.

Laura Moore was a member of the Coastal Working Group, Community Surface Dynamics Modeling System. She was also a contributing author to the Synthesis and Assessment Product 4.1 report issued by the U.S. Climate Change Science Program. She was an invited convener at Teaching Geomorphology in the 21st Century, a four-day workshop.

Michael Pace received the G. Evelyn Hutchinson Award from the American Society of Limnology and Oceanography. The G. Evelyn Hutchinson Award has been presented annually since 1982 to recognize excellence in any aspect of limnology or oceanography. The award is intended to symbolize the quality and innovations toward which the society strives and to remind its members of these goals. Recipients are scientists who have made considerable contributions to knowledge, and whose future work promises a continuing legacy of scientific excellence. He was associate editor of *Ecosystems, Frontiers in Ecology and Evolution* and section editor of the *Encyclopedia of Inland Waters*.

John Porter was a member of the User Working Group for the Oak Ridge National Laboratory Distributed Active-Archive Center and Long term Ecological Research Network Information System Advisory Committee.

G. Carleton Ray was a member of the Scientific Advisory Committee of the Bahamas National Trust for Places of Historic Interest and Natural Beauty. He has been a longtime member of the editorial board of *Aquatic Conservation*.

Matthew Reidenbach was one of six faculty members chosen to be a University Teaching Fellow for 2009–2010. The fellowship provides support to impressive junior faculty as they refine their teaching expertise while pursuing strong research agendas. He also served on the Jefferson Scholars Program Selection Committee.

Todd Scanlon received a National Science Foundation Faculty Early Career Development (CAREER) Award, the foundation's most prestigious award for young faculty. He was also a member of the Large-Scale Field Experimentation Technical Committee of the American Geophysical Union and the Rivanna River Basin Commission Technical Advisory Committee.

Herman H. Shugart was elected the distinguished landscape ecologist for 2009 by the U.S. chapter of the International Association of Landscape Ecologists. He was also one of two faculty to receive the 2009 Excellence in Faculty Mentoring Award from the University. Shugart was the chief scientist for the Northern Eurasia Earth Science Partnership Initiative and served on the editorial board of the *Eurasian Journal of Forest Research*. He was also on the mission steering committee coordinating the development of a new NASA environmental satellite surveying forests, ice, and geological deformation. In addition, he was associate editor of *Global Change Biology* and represented the University of Virginia on the Ecology Section of the Board on Natural Resources at the National Association of State Universities and Land-Grant Colleges. He was also a member of the Board of Directors of the University of Virginia Press and a member of the Provost Office's Committee for Historically Black Colleges and Universities.

David E. Smith was a member of the Network Education Committee and the Executive Committee of the Long Term Ecological Research Network and represented the University on the Virginia Sea Grant Policy and Oversight Board as well as its Academic Advisory Committee. He was a member of the Board of Directors of the Association of Ecological Research Centers and the U.Va. Executive Leadership Network.

Thomas Smith released the eighth edition of his highly successful ecology text, which has been translated into several more languages.

Robert J. Swap, who served as the University's special assistant for international research, received the 2008 Z Society Distinguished Faculty Award. He represented the efforts of the University and its environmental sciences programs in South Africa at a number of meetings with the Department of State, the U.S. Agency for International Development, the World Bank, the World Wildlife Fund, the National Academy of Sciences, and Conservation International.

Vivian Thomson was vice chair of the Virginia's Air Pollution Control Board and director of the University's initiative in Panama.

Patricia Wiberg was elected department chair. She chaired the American Geophysical Union's Information Technology Committee as well as the Marine Working Group of the National Science Foundation's Community Surface Dynamics Modeling System (CSDMS). She was also a member of the CSDMS Executive Committee. Wiberg was selected one of four distinguished lecturers for the National Science Foundation's MARGINS program and was lead guest editor for a special issue of *Continental Shelf Research*.

2008–2009 Publications

Annual report of published peer-reviewed papers, book chapters, and books by faculty and graduate students for the 2008–2009 academic year (Summer 2008, Fall 2008, Spring 2009)

Aranibar, J. N., I. C. Anderson, **H. E. Epstein**, **C. J. W. Feral**, **R. J. Swap**, J. Ramontsho, and **S. A. Macko**. 2008. Nitrogen isotope composition of soils, C_3 and C_4 plants along land use gradients in southern Africa. *Journal of Arid Environments* 72 (4): 326–37, doi:10.1016/j.jaridenv.2007.06.007.

Austin, M. P., **T. M. Smith**, K. P. Van Niel, and A. B. Wellington. 2009. Physiological responses and statistical models of the environmental niche: A comparative study of two co-occurring *Eucalyptus* species. *Journal of Ecology* 97 (3): 496–507.

Barnhart, C. J., **A. D. Howard**, and J. M. Moore. 2009. Long-term precipitation and late-stage valley network formation: Landform simulations of Parana Basin, Mars. *Journal of Geophysical Research—Planets* 114, E01003, doi:10.1029/2008JE003122.

Barr, J. G., **J. D. Fuentes**, V. Engel, and **J. C. Zieman**. 2009. Physiological responses of red mangroves to the climate in the Florida Everglades. *Journal of Geophysical Research—Biogeosciences* 114, G02008, doi:10.1029/2008JG000843.

Bartolini, E., P. Claps, and **P. D'Odorico**. 2009. Interannual variability of winter precipitation in the European Alps: Relations with the North Atlantic Oscillation. *Hydrology and Earth System Sciences* 13, 17–25.

Bastviken, D., J. J. Cole, **M. L. Pace**, and M. C. Van de Bogert. 2008. Fates of methane from different lake habitats: Connecting whole-lake budgets and CH_4 emissions. *Journal of Geophysical Research—Biogeosciences* 113, G02024, doi:10.1029/2007JG000608.

Berg, P., and M. Huettel. 2008. Monitoring the seafloor using the noninvasive eddy correlation technique: Integrated benthic exchange dynamics. *Oceanography* 21 (4): 164–67.

Borgogno, F., **P. D'Odorico**, F. Laio, and L. Ridolfi. 2009. Mathematical models of vegetation pattern formation in ecohydrology. *Reviews of Geophysics* 47, RG1005, doi:10.1029/2007RG000256.

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Canham, C. D., and **M. L. Pace**. 2009. A spatially explicit, mass-balance analysis of watershed-scale controls on lake chemistry. Chapter 8 in *Real World Ecology: Large-Scale and Long-Term Case Studies and Methods*, ed. M. ShiLi, S. Carstenn, and M. Nungesser. New York: Springer, doi:10.1007/978-0-387-77942-3_8.

Carpenter, S. R., J. J. Cole, J. F. Kitchell, and **M. L. Pace**. 2009. Trophic cascades in lakes: Lessons and prospects. Chapter 4 in *Trophic Cascades*, ed. J. Terborgh and J. A. Estes. Washington, D.C.: Island Press.

Cook, B. I., G. B. Bonan, S. Levis, and **H. E. Epstein**. 2008. The thermoinsulation effect of snow cover

within a climate model. *Climate Dynamics* 31:107–24, doi:10.1007/s00382-007-0341-y.

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Crusius, J., **P. Berg**, **D. J. Koopmans**, L. Erban. 2008. Eddy correlation measurements of submarine groundwater discharge. *Marine Chemistry* 109 (1–2): 77–85, doi:10.1016/j.marchem.2007.12.004.

Daanen, R. P., D. Misra, **H. E. Epstein**, D. Walker, and V. Romanovsky. 2008. Simulating nonsorted circle development in arctic tundra ecosystems, *Journal of Geophysical Research—Biogeosciences* 133, G03S06, doi:10.1029/2008JG000682.

Davis, R. E. 2008. Perspectives on global warming science. In *What Should I Read Next? 70 University of Virginia Professors Recommend Readings in History, Politics, Literature, Math, Science, Technology, the Arts, and More*, ed. J. Feldman and R. Stilling, 100–04. Charlottesville, Virginia: University of Virginia Press.

D'Odorico, P., F. Laio, L. Ridolfi, and **M. T. Lerdau**. 2008. Biodiversity enhancement induced by environmental noise. *Journal of Theoretical Biology* 255 (3): 332–37, doi:10.1016/j.jtbi.2008.09.007.

Duce, R. A., J. LaRoche, K. Altieri, K. R. Arrigo, A. R. Baker, D. G. Capone, S. Cornell, F. Dentener, **J. N. Galloway**, R. S. Ganeshram, R. J. Geider, T. Jickells, M. M. Kuypers, R. Langlois, P. S. Liss, S. M. Liu, J. J. Middelburg, C. M. Moore, S. Nickovic, A. Oschlies, T. Pedersen, J. Prospero, R. Schlitzer, S. Seitzinger, L. L. Sorensen, M. Uematsu, O. Ulloa, M. Voss, B. Ward, and L. Zamora. 2008. Impacts of atmospheric anthropogenic nitrogen on the open ocean. *Science* 320 (5878): 893–97, doi:10.1126/science.1150369.

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Epstein, H. E., D. A. Walker, M. K. Raynolds, G. J. Jia, and **A. M. Kelley**. 2008. Phytomass patterns across a temperature gradient of the North American arctic tundra. *Journal of Geophysical Research—Biogeosciences* 113, G03S02, doi:10.1029/2007JG000555.

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Estes, L. D., G. S. Okin, A. G. Mwangi, and **H. H. Shugart**. 2008. Habitat selection by a rare forest antelope: A multi-scale approach combining field data and imagery from three sensors. *Remote Sensing of Environment* 112 (5): 2033–50, doi:10.1016/j.rse.2008.01.004.

Fatoyinbo, T. E., M. Simard, **R. A. Washington-Allen**, and **H. H. Shugart**. 2008. Landscape-scale extent, height, biomass, and carbon estimation of Mozambique's mangrove forests with Landsat ETM+ and Shuttle Radar Topography Mission elevation data. *Journal of Geophysical Research—Biogeosciences* 113, G02S06, doi:10.1029/2007JG000551.

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Hondula, D. M., **L. J. Sitka**, **R. E. Davis**, **D. B. Knight**, **S. D. Gawtry**, M. Deaton, **T. R. Lee**, **C. P. Normile**, and **P. J. Stenger**. 2009. A back-trajectory and air mass climatology for the Northern Shenandoah Valley, USA. *International Journal of Climatology*, doi:10.1002/joc.1896.

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