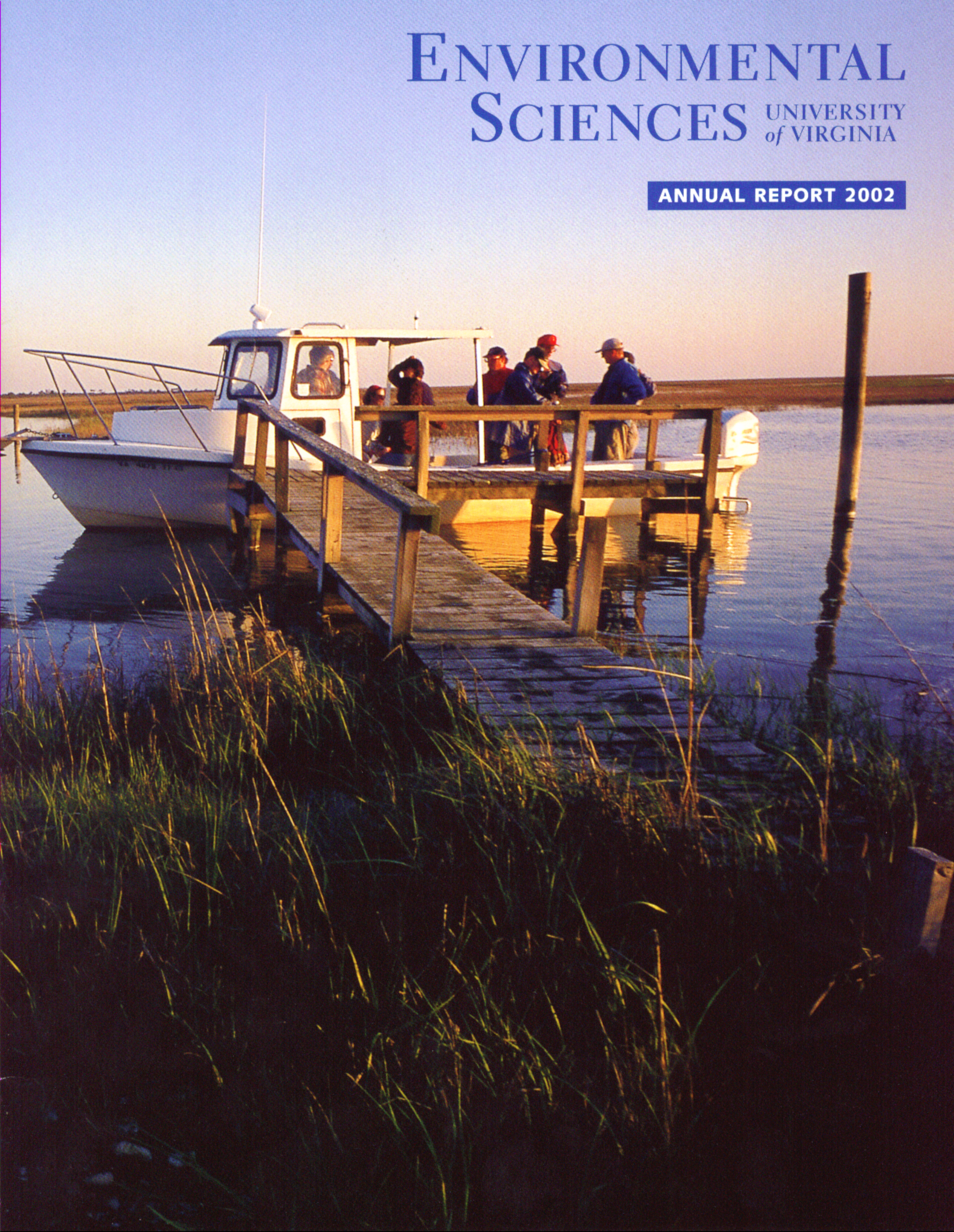
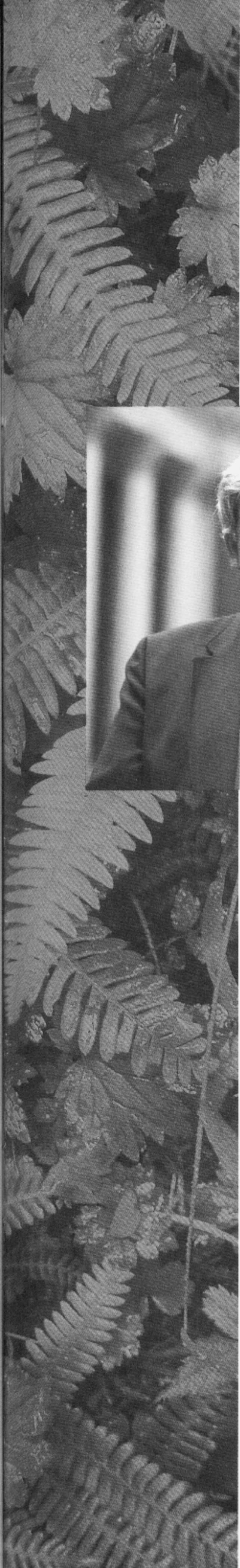
ENVIRONMENTAL SCIENCES

UNIVERSITY *of* VIRGINIA

ANNUAL REPORT 2002





Building Momentum

The Department of Environmental Sciences has crossed a very important threshold this year with the completion of the Clark Hall addition. For the first time ever, members of this department will work in laboratories constructed expressly with their research needs in mind and in office and conference areas designed to promote the exchange of ideas among faculty members and between faculty and students. We owe a great deal to the vision of Paul Tudor Jones, who funded this project with a $10 million gift.

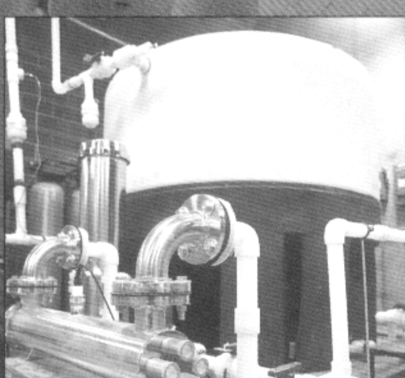
Although this new space—and the subsequent renovation of Clark Hall now under way—have been eagerly anticipated, we have not delayed our work until move-in day. In fact, the momentum behind our education and research programs has only increased. As detailed in this report, our faculty have pioneered real-time distance learning across continents, added to our knowledge in a score of areas, and led large-scale research programs of national and international importance. Moving forward, we hope to play a leading role in the creation of the National Ecological Observatory Network (NEON), a new regional initiative of the National Science Foundation.

This momentum is being reinforced by a new appreciation of the importance of the sciences to the future of this University. Attracting the very best students is the key to any initiative designed to strengthen the sciences, and the University is studying the feasibility of creating an honors college for science majors as a way of enhancing their experience here. George Hornberger, in his new position as associate dean for the sciences in the College, will play an important role in advancing the sciences, as will Bob Davis, who is chair-elect of the Faculty Senate.

At the same time, the University has endorsed our efforts to place our network of scientific and educational relationships in southern Africa on a new footing. This May, the University hosted a meeting that brought the leaders of four universities in the region to Charlottesville to create the basis for more intense and productive collaboration. We expect to formalize this agreement this fall, ushering in a new era of opportunity for faculty and students on both continents.

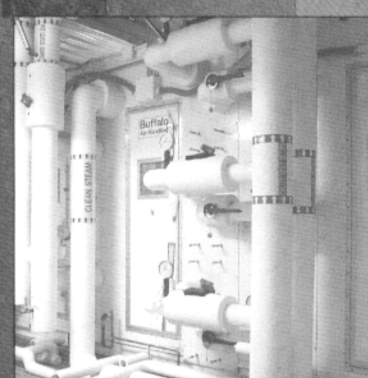
In essence, this department's potential and its ambitions have never been higher. We recognize that these are difficult times financially, but we believe that the enthusiasm, talent, and hard work of our faculty will enable us to realize our aspirations.

Bruce Hayden
Chair

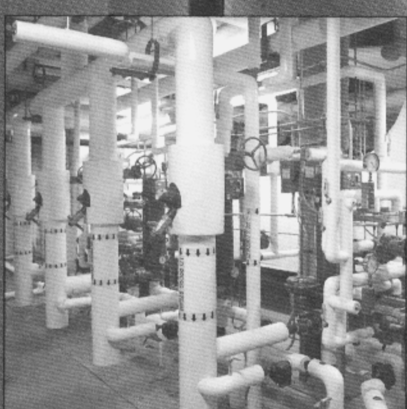


A reverse-osmosis, deionized water system serves our wet labs.

Primary and backup pump circulates chilled water throughout the building.



One of the building's six large air-handlers.



Semi-instantaneous, steam-heated hot water heater.

The Clark Hall Addition

Environmental sciences faculty and staff began moving into the new Clark Hall addition during the last week of July 2002. The four-story, 45,000-assignable-square-foot addition provides much-needed office, laboratory, and computational space and was funded by a $10 million gift from alumnus Paul Tudor Jones, who has long championed environmental causes. The department is raising an additional $10 million in matching funds for endowed professorships, scholarships, fellowships, field and laboratory equipment, and a general department endowment.

Their long experience of working in Clark Hall helped clarify the thinking of faculty members as the department formulated plans for the addition. Originally built to house the School of Law, Clark Hall had been modified many times, developing a mazelike floor plan along 14 different levels. It had become so complex that the second floor on one elevator was labeled the third floor on the other. For the new addition, the architects created a simple, straightforward design that brings people together, rather than separates them, in open, light-filled spaces.

A critical part of this effort was integrating graduate students more effectively into the department. The addition features shared graduate student offices on each of the first three floors, placing as many graduate students as possible within easy walking distance of their laboratories.

The electrical system and heating and air conditioning in Clark Hall were similarly Byzantine. Although adequate for an academic building, they did not provide the level of reliability or quality required for modern scientific laboratories housing state-of-the-art equipment. The addition features ample electrical circuitry—each laboratory has its own electrical box—and backup power to ensure the preservation of specimens during power outages. The new building also has a single-pass air circulation system for the first three laboratory floors and an advanced filtration system to remove trace gases and particulates.

GROUND FLOOR

The wet lab space on the ground floor benefits from a number of adaptations designed to ensure precise control of laboratory conditions.

A LAB OF ONE'S OWN

George Hornberger, the Ernest Ern Professor of Environmental Sciences, has spent his entire career at the University of Virginia. During this time he has gained an international reputation for research in catchment hydrology and hydrochemistry as well as the transport of colloids in geological media.

For his work, Hornberger has been elected a fellow of the American Geophysical Union and a member of the National Academy of Engineering. He is the current chair of the Advisory Committee on Nuclear Waste of the Nuclear Regulatory Commission.

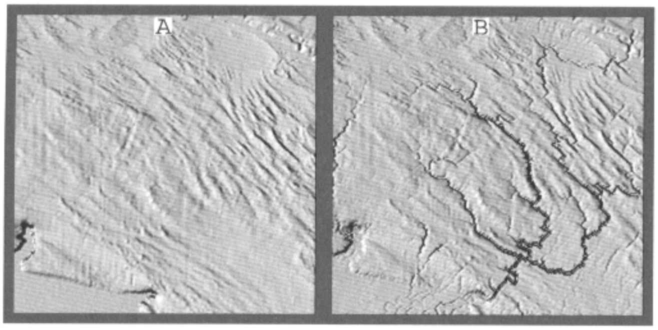
Remarkably, Hornberger has pursued his researches while sharing laboratory space in the basement of Clark Hall. With the construction of the Clark Hall addition, he finally has a laboratory of his own.

Hornberger believes having adequate laboratory space will have a beneficial effect on his own productivity and, equally important, will improve the ability of his graduate students to pursue high-quality research projects. "In the past, my students have had to rely on the generosity of my colleagues," he observes. "The new laboratory space will allow us to think more expansively and to house additional postdoctoral and graduate students as the opportunity arises."

One of the first uses for the new laboratory will be to investigate the fate of agricultural nitrates as they move through drainages with dynamic hydrological properties. Along with Janet Herman and Aaron Mills, Hornberger has secured a multiyear grant from the National Science Foundation to investigate the effects of surges of oxygenated water from storms on soil microbes that process nitrogen near streams.

Hornberger will also be balancing his research with service to the University. He has accepted the newly created post of associate dean for the sciences. "I saw this as an opportunity to improve the standing of the sciences at U.Va.," he says. "My goal is to raise the visibility of the sciences and to excite and motivate faculty."

George Hornberger (left) joined the leadership of the College of Arts & Sciences as associate dean for the sciences.



Pat Wiberg and colleague Alan Howard are modeling the continental shelf off the coast of the Virginia Eastern Shore.

READING THE ADRIATIC

Pat Wiberg is another longtime environmental sciences faculty member who will have a lab of her own for the first time in the Clark Hall addition. Wiberg works primarily with sediment deposition and sediment transport and looks forward to having more adequate space to test and set up her instruments. The timing couldn't have been better. Wiberg is involved in a new project just getting under way to measure sediment transport and the formation of stratigraphy on the Italian coast of the Adriatic.

"The task is to link modern processes that we can observe with marine stratigraphy," she says. "This knowledge will help us learn more about climate change and changes in ocean circulation in the past." The team involved in the project will be using a number of different technologies. Some of Wiberg's colleagues use acoustic imaging of sedimentary features, which provides resolutions in thousands of years, while others drill cores, which have much higher resolution. Another group is making measurements of erosion and deposition during storms and floods. Wiberg herself will be focusing on along-coast and across-shelf variations in the erodibility of the seabed and how this affects sedimentation in the Adriatic.

Modeling plays an important role in Wiberg's Adriatic project. In addition to her Adriatic project, she is working on a modeling project with department colleague Alan Howard and postdoctoral associate Sergio Fagherazzi. They have adapted a model that Howard has developed for landscape evolution and applied it to the continental shelf off the East Coast of the United States. "There have been times when the water levels dropped and the entire continental shelf was a coastal plain," she observes. "We want to look at the exposed and submerged landscape as a single system and see what we learn by adding sea-level values to the model."

Wiberg's work is part of a growing trend to combine the work of terrestrial and marine geologists and to examine the ways signals are propagated from one end of the system to the other. "Our goal," Wiberg says, "is to sort out these signals."

CARBON DIOXIDE ON THE MARGINS

The acidification of streams in the Blue Ridge and other areas of the country is of major concern to environmentalists. Unfortunately, policymakers are hesitant to address this issue without a firm understanding of the factors that produce acidification. Graduate student Danny Welsch, working with George Hornberger, is hoping to put in place a piece of this puzzle.

Welsch is developing a model of carbon processing in the soil and its effect on stream water chemistry. Organic carbon in the soil on the margins of streams is translated into carbon dioxide, which, as it enters streams can increase the alkalinity of the water. Carbon dioxide is generated at elevated levels in places where the soil is warm and wet. "Constructing the model is a complicated process," Welsch observes. "Among other things, you need to understand chemical processes, soil physics, and microbiology."

Welsch is basing his model on data collected during extensive fieldwork that began last summer. Along the stream he was studying, he measured soil carbon dioxide concentrations and soil temperature and moisture every 15 minutes. He placed instrumentation at ten other spots around the watershed to make weekly measurements, though some of his instrumentation was destroyed by thirsty bears.

"The variations I'm studying are short-term," Welsch explains. "They set the stage for understanding the way such long-term factors such as climate change and higher levels of atmospheric carbon dioxide affect soil chemistry and stream acidification."

Danny Welsch checking results at one of his test sites.

1st FLOOR

Like the ground floor, the second floor provides the department with additional wet lab space.

THE DISAPPEARING NITROGEN

Over Thanksgiving, Janet Herman, Aaron Mills, and George Hornberger wrote a proposal to the National Science Foundation to study the fate of nitrogen in groundwater as it enters tidal creeks. This summer, the foundation gave them a $440,000, three-year grant to do just that.

The ideas behind the proposal grew out of routine observations of tidal creeks in the Eastern Shore of Virginia by the late graduate student Meeten Chauhan. Chauhan found that high nitrate levels in groundwater caused by heavy fertilizer use in nearby farms failed to translate into high nitrate levels in the small tidal creeks that drained the area. "We had initially thought that organic matter in the creek might account for this nitrogen reduction," Herman says, "but this hypothesis did not hold up."

They then looked to the soil in the riparian zone on the margins of the creeks—and here their complementary expertise in aqueous geochemistry, microbial biology, and hydrology proved useful. They believed that microbes in the stream bank could be responsible for nitrogen reduction, using nitrates to metabolize carbon in the absence of oxygen. This is not, however, a steady-state process. High storm tides could force oxygenated creek water into the subsurface, changing the environment for the microbial population to one favoring oxygen-reducing bacteria.

Understanding this process is critical. Although each stream is small, collectively they account for much of the water entering the bay. The information Herman, Mills, and Hornberger produce will provide material for policymakers hoping to reverse the eutrophication of Chesapeake Bay.

The methods that they propose to use are both simple and high-tech. They will construct a subsurface flume in the hillside along their study site, Cobb Mill Creek, which will enable them to deliver controlled pulses of oxygenated water to the surrounding ground. In order to create a more detailed picture of microbial processes in the subsoil, they will be using a technique from microbiology—the polymerase chain reaction—to identify the different microbial populations.

"One of the things that makes this project so satisfying is that the hydrologic and microbial time-scales overlap," Herman notes. "A change in the hydrology produces an almost instantaneous change in microbial activity."

With a grant from the National Science Foundation, researchers at U.Va. hope to learn more about nitrogen reduction in tidal creeks.

Deborah Lawrence and graduate student Tara Wood survey a forest-floor litter removal experiment in the Costa Rican rain forest.

THE NEW FARMERS

In West Borneo, Deborah Lawrence studied the effects of subsistence agriculture and shifting cultivation on soil nutrients. Compiling two centuries of land-use history at a remote, well-established village, she found that species diversity declined in sites that went through many cultivation cycles and that certain species became more dominant over time. This result was not unexpected. What was surprising was evidence that phosphorous in surface soils actually increased the more a site was disturbed, a result that helps explain the long-term success of the village.

Lawrence's experience in Indonesia provides a context for work under way in the Yucatán peninsula of Mexico, where recent settlers are converting large tracts of forest to agriculture. She is part of a NASA-funded Land Cover Land Use Change project that includes economists, political scientists, and historians, as well as ecologists. The project is designed to study the drivers of change in the region—which include areas of fertile land, the availability of roads and transportation, the development of cash crops such as chili—and their effects on forest structure and function, the Calakmul Biosphere Reserve, and the regional carbon cycle. "Our goal is to produce an integrative model that includes the social as well as the biophysical implications of deforestation," she says.

One of the major differences she sees between West Borneo and the Yucatán is that people in the village had access to knowledge about land-use practices, perfected over hundreds of years, that limited the degradation of soil nutrients. The new inhabitants of the Yucatán have no such body of knowledge. "Anything that we can learn, we will turn around into useful information as quickly as we can," Lawrence says.

ADJUSTING TO SEA LEVEL

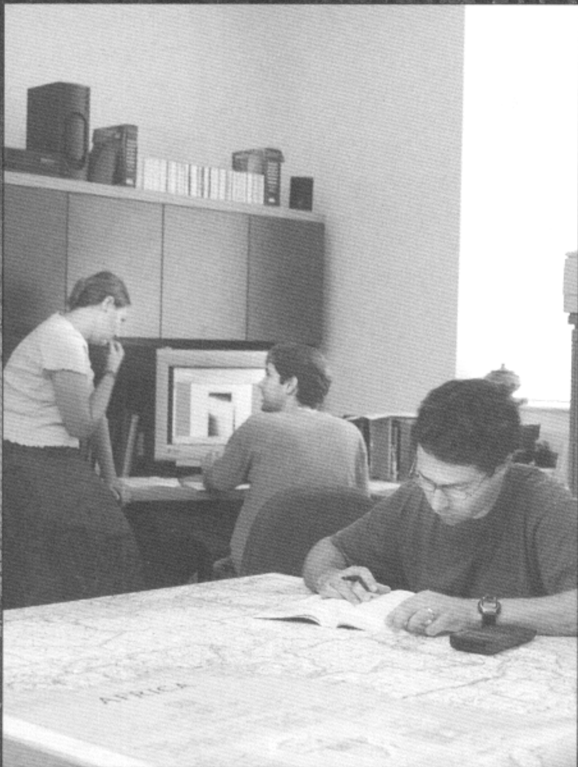
Healthy salt marshes are among the most biologically productive ecosystems in the world. Found in protected bays and estuaries, and along the shores of tidal rivers, salt marshes serve as the transition zone between the land and the sea. They help control floods, improve water quality, contribute significantly to coastal food webs, and provide valuable habitat for fish, birds, and other wildlife.

Rising sea levels can endanger salt marshes. Graduate student Cassondra Thomas studies mechanisms that enable salt marshes to adapt by changing their elevation. "I want to understand the factors that increase their ability to survive," she says.

Some marshes receive very little sediment input; in these cases, changes in elevation are almost entirely driven by biological processes that affect root production and decomposition. As the water rises, the soil in the root zone becomes more anaerobic, leading to increased sulfate reduction. A by-product of this process is sulfide, which is toxic. Marsh plants respond to this stress by producing more roots. This process can be tempered by the presence of iron in the soil, which combines with the sulfide to form pyrite, as well as the activity of such organisms as crabs, which introduce oxygen as they burrow in the soil.

Thomas has been tracking these variables at two sample sites on the Eastern Shore. Among other activities, she has measured water chemistry, taken cores for sulfate-reduction analysis, and filled litter bags to track root growth and decomposition. She is quite naturally looking forward to analyzing her results in the new wet labs at Clark Hall. "I expect to spend most of the fall in the lab preserving samples," she says. "Thanks to the new facility, my labmates who study molecular microbial biology won't have to worry about contamination from my samples."

Graduate student Cassondra Thomas studies mechanisms that enable salt marshes to adapt to changes in sea level.



2nd Floor

The emphasis in the atmospheric, hydrology, and dry lab space on the second floor is on modeling, simulation, and equipment calibration.

THE LESSONS OF HISTORY

Mike Mann looks back in time so we can look forward. This year, working with colleagues from the NASA/Goddard Institute for Space Studies, he helped analyze simulations from a new NASA computer model that reinforces the long-standing theory that low solar activity could have changed the atmospheric circulation in the Northern Hemisphere from the 1400s to the 1700s and triggered a Little Ice Age in North America and Europe.

Aert van der Neer (1603-77), "Frozen River with Skaters." Printed with permission from Bridgeman Art Library.

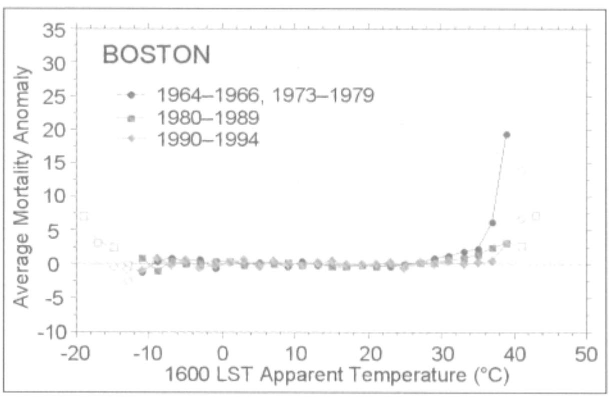
During periods of low solar activity, levels of the Sun's ultraviolet radiation decrease, significantly impacting ozone formation in the stratosphere, which affects the atmospheric system known as the Arctic Oscillation and leads to changes in the surface climate.

This model simulation is one of the first to track regional variations in climate over time. Global models show relatively small overall temperature changes.

Until it was superceded by greenhouse gases produced during the Industrial Revolution, change in the Sun's energy was one of the biggest factors influencing climate change. By understanding its influence in the past, we set the stage for assessing the interplay of solar energy and greenhouse gases, a critical element in forecasting future climate change.

BEATING THE HEAT

From Bob Davis's point of view, your ability to survive a heat wave has a lot to do with where you live. Working with a vast set of daily mortality data from the National Center for Health Statistics that extends back to 1964 as well as demographic and weather information from as many as 28 of the largest metropolitan statistical areas (MSAs) in the United States, Davis and his colleagues are



Bob Davis's work shows that our ability to adjust to temperature spikes has improved in recent decades.

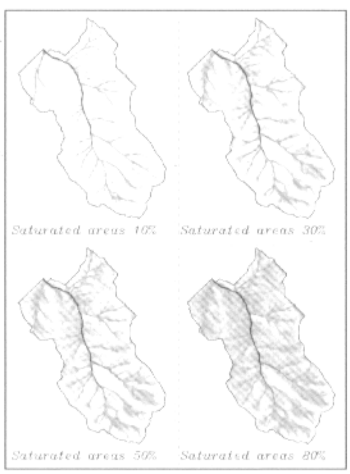
assembling a remarkable image of human adaptability.

Davis's findings confound conventional wisdom. When the apparent temperature—a combination of temperature and humidity—exceeds 100 degrees, people who live in northeastern and north central cities die at a greater rate than those who live in places like Phoenix or Miami where it is routinely hot. Davis believes that people in hot climates adjust. They use air conditioning more, drink more water, and plant more shade trees. In fact, mortality does not rise in these already torrid cities no matter how high the apparent temperature climbs.

Davis has also pursued the question of how heat-mortality relationships have changed over time. Some scientists have suggested that human-induced greenhouse warming will produce significant increases in heat-related mortality. Using data from the 1960s and 1970s, Davis computed for a number of cities the threshold apparent temperature at which mortality is significantly elevated and then compared age-adjusted mortality rates over subsequent decades. He found that these rates declined over time, a phenomenon he attributed to such factors as better access to medical care and medical facilities and the spread of air conditioning. He concludes that estimates of summer, heat-related deaths due to greenhouse warming that don't factor in adaptability should be lowered.

MODELING CHANGE

Paolo D'Odorico models the hydrologic processes that determine soil moisture as well as the interplay of these processes with the soil nutrient budget, vegetation, and near-surface atmosphere. This year, he has been involved in a number of projects. He is modeling the way precipitation affects the soil moisture content in different soils, which in turn affects the availability of nitrogen to vegetation. He is applying similar methods to a study of landslides that result when precipitation produces high levels of soil moisture. In this case, his key variable is the thickness of the colluvial deposit.



Paulo D'Odorico's analysis reveals that water saturation in an Alpine basin is not evenly distributed.

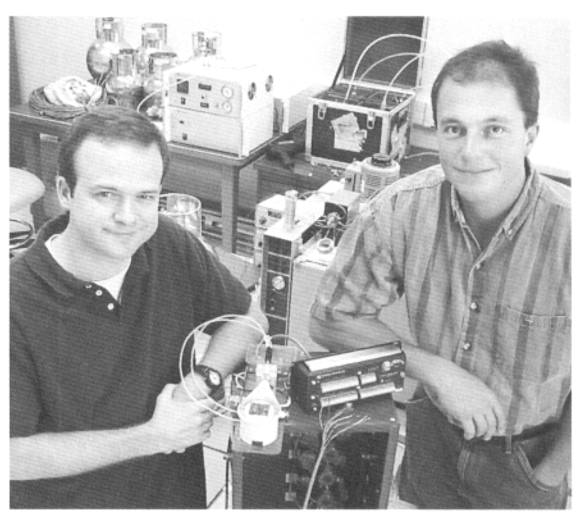
D'Odorico is also developing a multivariate stochastic process to simulate wind speed and other weather variables and to apply it to existing models of wind erosion. "Current models measure wind speed at hourly intervals, which misses the peaks that can be responsible for heavy erosion," he explains. D'Odorico's goal is to downscale from an hourly timescale to intervals of just a few minutes.

IMPORTANCE OF ENERGY TRANSFER

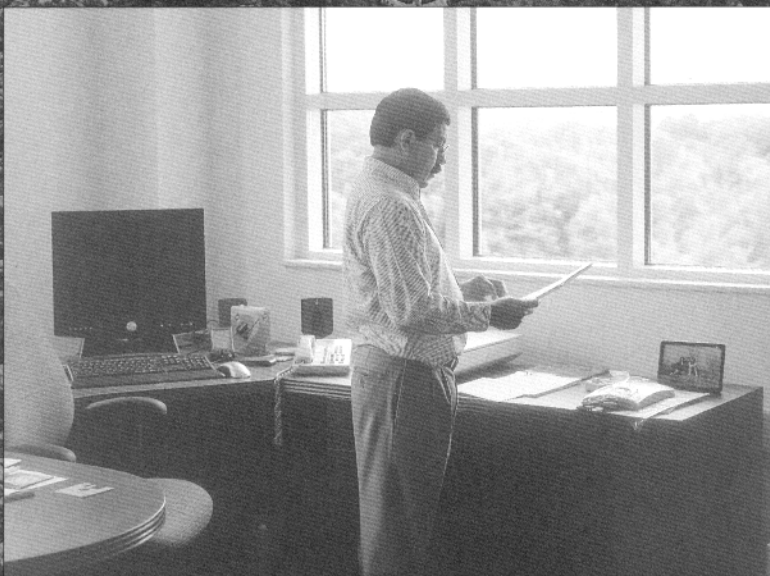
Energy transfer in the atmosphere not only makes our planet a hospitable place but also drives a myriad of ecological and atmospheric processes. Two young scientists already receiving national acclaim for this type of research are environmental sciences graduate students Jordan G. Barr and Court Strong. Under the guidance of adviser José D. Fuentes, Strong recently obtained a National Science Foundation Fellowship, tackled research projects in a variety of ecosystems, and published papers on thermodynamic attributes of boundary-layer ozone depletion in the Arctic and the relation of clouds to water-vapor flux in Brazil. Strong has spoken at two national conferences, earning an American Meteorological Society Award for the Best Student Oral Presentation at the 25th Conference on Forest Meteorology.

Strong, who was a television meteorologist for seven years, says he is grateful for the resources and excited by the opportunities made available through the department to pursue his interest in clouds. "By learning more about how water vapor moves in a vertical column of the atmosphere, we gain insight into the energy balance of Earth, as well as everyday issues such as when and where it rains," he says.

Barr is a PhD student who received a NASA fellowship to investigate the hypothesis that biogenic aerosols in the atmospheric boundary layer can lead to enhanced forest carbon dioxide uptake. Barr just published a feature article on this topic in the *Bulletin of the AMS*. He discovered that these aerosols backscatter irradiance in sufficient quantities to alter the surface energy balance. For his dissertation, Barr is also investigating interactions between mangroves and physical climate in the Florida Everglades. The department provided an award to study the physiology of mangroves during summer 2001, and the new laboratory space is a motivating force for a return visit. He notes, "The new laboratory will enable us to fully test our instruments before deploying them in the field. This is critical, especially in a harsh environment such as the Everglades."



Graduate students Court Strong and Jordan Barr in their lab.



3rd FLOOR

Offices on the third floor enjoy sweeping views from Monticello to Scott Stadium and ample opportunity for collaboration and the exchange of ideas.

GROWING CONNECTION TO SOUTHERN AFRICA

Things look good from Hank Shugart's perspective, beginning with the view of Monticello from his third-floor office. This has been a remarkable year for the Global Environmental Change Program that he directs and for the faculty associated with it. The primary focus of the program is southern Africa, and 2001-2 saw a number of research, educational, and institutional initiatives coming to fruition.

In fall 2001, the department, at the impetus of Steve Macko, launched a real-time, distance learning course in African ecology for students at U.Va., the University of Witswatersrand in Johannesburg, South Africa, and Universidade Eduardo Mondane in Maputo, Mozambique. The course was team-taught by professors at all three institutions. The first of its kind, this course reached over 200 students across six time zones and at a distance of 13,000 kilometers.

In May 2002, representatives from Witswatersrand, Eduardo Mondane, the University of Botswana, and South Africa's University of Venda met in Charlottesville to form a consortium to address environmental, health, and education concerns throughout southern Africa. This is an unprecedented effort, which attracted representatives of the Department of State, the World Wildlife Fund, the National Academy of Sciences, the National Science Foundation, the United Nations, and other federal agencies and international conservation organizations. Gene Block, the University's provost, is expected to join Shugart, Macko, Bob Swap, Jay Zieman and Paul Desanker in Maputo this fall for the program's formal launch.

This summer, in an initiative led by Swap, the department inaugurated a three-week, multidisciplinary course that sent 14 University students to South Africa to study the interaction between human beings and the environment.

This year, the department inaugurated a summer program in South Africa for U.Va. students.

Students spent the first week in the city of Johannesburg, the second at the University of Venda in the Northern Province of the Republic of South Africa, and a third on a wildlife refuge in Witts Rural Facility near Kruger National Park, where they took part in a community service project.

Finally, Shugart and his colleagues are readying scores of articles on their research in southern Africa for publication. Shugart and Macko are in the midst of organizing a special issue of *Global Change Biology* featuring work done by researchers at the Kalahari Desert in 2000, while Swap is publishing a special edition of *Geophysical Research* on the SAFARI 2000 project. In both cases, department graduate students co-authored numerous papers.

"All of these initiatives are the end result of contacts and collaborations developed by individual faculty members in the department over a decade," Shugart says. "As we move forward, we are seeing this network of collaboration, in Africa as well as within the University, include more and more people from different institutions and disciplines."

Bob Dolan's work on expert systems is designed to produce additional information from existing coastal research.

AN EXPERT APPROACH TO OCEANOGRAPHIC RESEARCH

Bob Dolan, the department's first chair, has spent more than 25 years in Clark Hall and retains a fondness for its classic decor and solid construction. At the same time, he cannot help but be impressed by the view from his third-floor office. When the leaves begin to fall, he may just have the best seat at Scott Stadium.

But Dolan is more excited by the prospect of being in close proximity to his colleagues. "Most of us with office space on the third floor are synthesizing information about large-scale processes," he notes. "A number of us have worked together before, but this arrangement should encourage further collaboration."

Dolan recently returned from two months in London working with the U.S. Navy's Office of Naval Research. The goal is to better predict relatively short-term changes in coastal ocean systems. Expert systems modeling is used widely in such fields as medicine, business, and engineering. "You begin by building a model that incorporates the current state of knowledge about a field," Dolan explains. "You distill this knowledge down to a very focused information base, and then you fill or bridge the gaps by use of unpublished data as well as qualitative knowledge, or best estimates, from experts." Specialists in expert systems use well-established methodology to assess the uncertainty associated with unpublished and qualitative data.

This summer Dolan helped a team of British ocean scientists in the development of a prototype expert systems model for the inshore and beach areas along sandy coasts. He served as the first phase "expert" in the model development, and he assisted in identifying other experts and persuading them to participate in this new modeling effort.

HOPING FOR A GREEN LIGHT FOR NEON

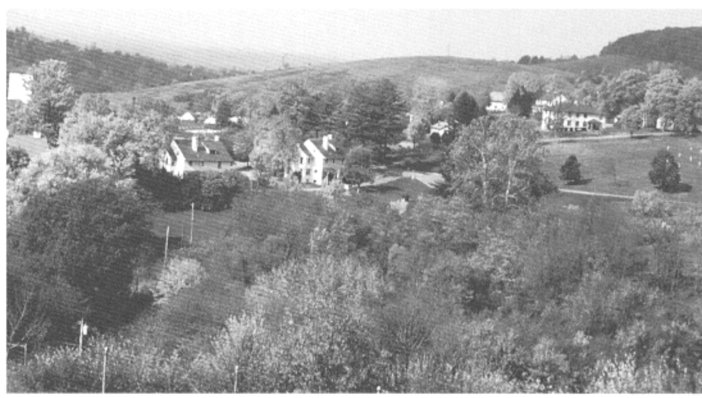
One of the initiatives that Bruce Hayden will focus on this year is securing for U.Va. a leading role in NEON, the National Ecological Observatory Network being launched by the National Science Foundation. With congressional approval, the formal competition for the first two NEON sites is expected to be announced this fall.

NEON is breathtaking in scope. NEON will be a national platform for integrated studies and monitoring of natural processes at all spatial scales, timescales, and levels of biological organization. Once in place, NEON would be a collection of field observatories linked via high-capacity communication systems. Each NEON observatory would comprise a core facility and several satellites, such as field stations, government research sites, museums, and universities. High-quality field-based and laboratory instruments would be deployed across the observatory region to collect comprehensive data.

"This program will give us access to equipment and information at field sites that, to date, has been only available in university laboratories," Hayden says.

As part of the proposal process, members of the department are in discussion with the Smithsonian Institution's Conservation and Research Center in Front Royal, the proposed site for a core NEON facility, and assembling a consortium of institutions, many of which have not had the resources to mount their own initiatives. Together, they are developing a vision for their NEON proposal that encompasses a variety of ecosystems, from the mountains to the coast and from the Potomac drainage to the Neuse River in North Carolina, with a special focus on the smallest of watersheds, streams that are not perennially running. "These are closed systems," Hayden notes. "We can budget the whole area and scale our findings upward to a regional perspective with an accounting system that makes sense."

"This network of observatories will be at the forefront of ecological sciences," Hayden says. "It's a great opportunity for us to extend our own network of cooperation with scientists and organizations throughout the region. There are few departments that have the range of expertise to put together a persuasive proposal. We are quite hopeful."



The department hopes to collaborate on NEON with the Smithsonian's Conservation and Research Center in Front Royal, Virginia.

Making Sense of Clark Hall

The completion of the Clark Hall addition does not mark the end of construction for the department. The renovation of Clark Hall, already under way, is accelerating and is expected to be completed by summer 2003.

One of the goals of the combined renovation and expansion is to provide more coherent and more efficient use of space. Inside the McCormick Road entrance, visitors will find classrooms, teaching laboratories, and department offices. Walking farther into the building, they will encounter faculty offices, and, behind these, department laboratories in the Clark Hall addition. At the same time, the building's decades-old electrical, plumbing, and heating systems will be completely replaced.

In addition, the Science and Engineering Library in the heart of Clark Hall is being modernized and expanded. Virtually unchanged since it was opened in the 1930s, the library will benefit from easier access to the stacks, fully wired study rooms, and an addition to the main reading room complete with a gas fireplace.

Taken together, these changes will give the department a solid base for teaching and research for decades to come. But even in the midst of these comprehensive changes, one familiar element of Clark Hall will remain. The mural room will continue to serve as a meeting place for students and faculty, as it has since the department first moved into the building.

Awards, Appointments, & Achievements

UNDERGRADUATE STUDENTS

Each year, the Morris K. Udall Foundation awards undergraduate scholarships of up to $5,000 to American juniors and seniors in fields related to the environment. **Drew B. Gower** was selected for this prestigious scholarship in April 2002.

Lisa N. Florkowski was awarded a fellowship from the College of Arts and Sciences to help support her research in Arizona during summer 2002.

Selected for the Distinguished Majors Program in 2002 were **MaryAnn T. Bogucki, Jessica L. Burton, Laura A. Cacho, Kirsten L. Doub, Adam J. Kalkstein, Melissa A. Kenney, Rachel A. LeRoy, Michelle L. L'Heureux, Sarah E. Parnes, Catherine A. Shaw**, and **William M. Yeatman**.

The department recognizes outstanding fourth-year students in each of the environmental sciences. This year, the Mahlon G. Kelly Prize in ecology went to **Jessica L. Burton**, the Wilbur A. Nelson Award in geology was given to **Sean B. McGinty**, the Michael Garstang Atmospheric Sciences Award went to **Michelle L. L'Heureux**, and the Hydrology Award was presented to **Robert L. Wyckoff**.

This year's Wallace-Poole Prize for the fourth-year student majoring in environmental sciences with the highest grade point average went to **Catherine A. Shaw**.

The honors for producing the best undergraduate poster at this year's Environmental Sciences Research Forum were shared by **Kennedy F. Rubert IV** and **Jessica L. Burton**. **Melissa A. Kenney** gave the best presentation by an undergraduate.

The Bloomer Scholarship provides a $1,500 award to a rising fourth-year undergraduate majoring in the department with a focus on geology. This year's winner was **Drew B. Gower**.

Daniel J. Van Orman was this year's recipient of the Richard Scott Mitchell Scholarship, which provides $1,500 to a rising fourth-year student focusing on geology.

Laura A. Cacho received the Joseph K. Roberts Award for presenting an exceptional undergraduate research paper at a national meeting.

The highly competitive Harrison Undergraduate Research Awards, administered by the U.Va. Faculty Senate, fund outstanding research projects conducted by rising third- and fourth-year undergraduate students working in collaboration with a faculty sponsor. Among this year's recipients were **Drew B. Gower** and **Amber K. Kozak**.

GRADUATE STUDENTS

Suzanne C. Walther received a Geological Society of America Graduate Student Research Grant in spring 2002.

To pursue research on the geomorphology of ancient lakes and seas on Mars, **Rossman P. Irwin III** was awarded a Virginia Space Grant Consortium fellowship for three years.

Katharina M. Ross and **Kaycie A. Billmark** were awarded Graduate School of Arts & Sciences Dissertation Year Fellowships for the 2002–3 academic year. **Ross** also won first place in the U.Va. Graduate School of Arts & Sciences Robert J. Huskey Graduate Research Exhibition in Physical Sciences and Mathematics in March 2002.

The department offers a series of awards honoring outstanding graduate students in each specialty in environmental sciences. This year **Keya Chatterjee** earned the Graduate Award in Ecology, **Jeffrey G. Chanat** won the Graduate Award in Hydrology, **Courtenay Strong** won the Graduate Award in Atmospheric Sciences, and **Janna M. Levin** won the Arthur A. Pagau Award in Geology. **Christopher A. Williams** received the Robert Ellison Award for Interdisciplinary Studies.

Daniel L. Welsch won the Fred Holmsley Moore Teaching Award presented by the department as well as the Teaching Resource Center Graduate Teaching Award presented by the University.

Daniel L. Druckenbrod and **Sarah M. Walker** were singled out for producing the best graduate posters at this year's Environmental Sciences Research Forum. **Ryan Emanuel** and **Anna Christina Tyler** gave the best presentations.

Daniel L. Druckenbrod was awarded a U.Va. Faculty Senate Dissertation Year Fellowship for the 2002–3 academic year. A maximum of eleven fellowships are awarded each year.

Sarah M. Walker received a three-year award from NASA to estimate the carbon budget response to land-use change for the Miombo ecosystem of southern Africa. **Walker** also received a travel award for the same project from the Women's International Science Cooperation (WISC) program of the American Association for the Advancement of Science. The award is funded by the National Science Foundation.

Established by Dr. F. Gordon Tice in 1992, the Maury Environmental Sciences Prize is the premier department award. This year's winner was **Todd M. Scanlon**. **Scanlon** also won an Outstanding Student Paper Award from the Biogeosciences Section of the American Geophysical Union spring 2002 meeting.

This year, **Mads S. Thomsen** and **Christie J. Feral** won the Moore Research Award. The award is based on merit and was initiated to help sponsor the dissertation and thesis work of environmental sciences graduate students. **Tana Wood** won a smaller Departmental Research Award, while **Bill P. Gilhooly, Janna M. Levin, Jody Marshall, Deborah S. Stein, Thomas A. Szuba, Cassondra R. Thomas, Suzanne C. Walther**, and **Elizabeth S. Watkins** received Exploratory Research Awards.

Courtenay Strong was awarded a three-year National Science Foundation Graduate Research Fellowship. He also received an American Meteorological Society Award for the best student presentation at the 25th Conference on Forest Meteorology.

Joseph A. Krawczel won the Trout Unlimited Award.

Jordan Barr was awarded a NASA fellowship and published an invited research article in the *Bulletin of the American Meteorological Society*.

FACULTY & STAFF

Robert Davis won one of the All-University Teaching Awards conferred by the University during the 2001–2 academic year. **Davis** is chair-elect of the University of Virginia Faculty Senate and is currently chair of the American Meteorological Society Committee on Biometeorology and Aerobiology.

Jim Galloway was on sesquicentennial associateship during 2001–2, serving as a visiting scientist at the Marine Biological Laboratory and at the Woods Hole Oceanographic Institution. **Galloway** was also guest editor of the March 2002 issue of the journal *AMBIO*.

Bruce Hayden is one of two candidates nominated to serve as president of the Ecological Society of America.

Janet Herman took on the duties of associate editor of the *Geological Society of America Bulletin* and of associate editor of *Applied Geochemistry* for the 2001–2 academic year.

George Hornberger was recruited to the post of associate dean for the sciences in the College of Arts & Sciences and began service during the summer of 2002. **Hornberger** also was selected as a National Associate of the National Academies in recognition of extraordinary service.

Steven Macko played a key role in the National Geographic Television film *The Mummies of Peru*.

Mike Mann has taken on the editorship duties of the *Journal of Climate Research*.

Neal Grandy won the Graduate Student Association Award and the Chair's Award.

Hank Shugart was inducted as a foreign member of the Russian Academy of Sciences.

George Gardner won the ESO Award.

Governor Mark R. Warner appointed **Vivian Thomson** to the Virginia Air Pollution Control Board. **Thomson** also held the Fulbright Chair in American Studies at the University of Southern Denmark during the 2001–2 academic year.

Four of our faculty—**George Hornberger, Jim Galloway, Hank Shugart**, and **Tom Smith**—were recognized this year by the Institute for Scientific Information for papers written during their careers that were cited an extraordinary number of times by their peers. These influential articles were identified as having "formed or changed the course of research in a subject." In addition, one of **Mike Mann**'s contemporary papers was recognized by the same organization for being heavily cited.

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This report was printed with private funds.