WATER CRISIS IN GAZA
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can the environment BE A PEACEMAKING AND STATE-BUILDING TOOL?

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CAN THE ENVIRONMENT BE A PEACEMAKING AND STATE-BUILDING TOOL?

AVNER VENGOSH AND ERIKA WEINTHAL VIEW SOLVING THE WATER CRISIS IN GAZA AS A POTENTIAL STEP TOWARD COLLABORATION
by Tim Lucas

It was the eve of the 2006 Palestinian elections, and Avner Vengosh could barely hear himself think.

Vengosh, an associate professor of earth and ocean sciences at the Nicholas School, was conferring with a longtime friend and research colleague at Al Quds University in Abu Dis, a bustling East Jerusalem suburb in the West Bank.

Sequestered in his colleague's office in the heart of Al Quds' sprawling campus, the 47-year-old geochemist was trying to discuss the implications of recent findings about the chemical and isotopic compositions of water contaminants in the region.

Since 1998, Vengosh has spearheaded initiatives to bring Palestinian and Israeli scientists together to find solutions to the persistent water-quality problems and water allocation disputes that plague both nations. His studious, easy-going air belies his stubborn commitment to use "good, impartial science" as a tool to help provide access to safe water for all the region's inhabitants and to bridge cultural and political divides.

His interest in using his environmental expertise as a peacemaking tool began during the turbulent early 1980s.

"As a student at Hebrew University in Jerusalem during the war in Lebanon, I became active in the 'Peace Now' movement within Israel," he explains. After receiving his PhD in the geochemistry of water resources from Australian National University, he realized his scholarship on water issues was something he "could contribute to the peace process," a way to give voice to his belief in doing science for the public good.

But on this late January day on the Al Quds campus in Abu Dis, the politics of the volatile region were threatening to drown him out.

"From outside the campus, we could hear loudspeakers blaring Hamas election propaganda," he recalls. "It was a strange scene. The university was partly empty, as most of the students already had gone home to prepare for the election. And there we sat, my Palestinian colleague and I, trying to discuss water science over the sound of Hamas loudspeakers in the background."

Hamas is a fundamentalist Islamic political organization opposed to the existence of the state of Israel and to Middle East peace. It has claimed responsibility for many suicide bombings in Israel.

Disrupted but not derailed, Vengosh and his colleague pressed on with their meeting.

"Long ago, we made an agreement that though we were very aware of the politics, we wouldn't let them affect our science," Vengosh says. Besides, he adds, most of the pre-election polls predicted Hamas would fall short of winning a plurality of legislative seats in the next day's elections.

It wasn't until two days later, after his return flight from Tel Aviv touched down in New York that Vengosh learned Hamas had won 76 of the 132 contested seats.

He was surprised, and, at first, concerned. With Hamas in power, he knew continued cooperation between Palestinians and Israelis on environmental issues would be unlikely, at least in the short term.

But a perverse ray of hope also dawned on him. "In the long run, the two sides will have no choice" but to cooperate with each other, he knew. "The water crisis in the region will force them to."

Half a world away, Erika Weinthal was keeping a watchful eye on the Palestinian election returns from her home and book-strewn office in Durham, N.C.

An associate professor of environmental sciences and policy at the Nicholas School, Weinthal is a political scientist who specializes in the role environmental issues play in peacemaking and state building, especially in new and emerging governments in Central Asia.

Much of Weinthal’s research has focused on conflict and cooperation over transboundary water issues in the Central Asian republics of the former Soviet Union. But working with Vengosh, her husband since 2000, she has co-authored numerous papers on water issues and their policy implications across the Middle East and eastern Mediterranean, including in Israel and the Palestinian Authority.

Vengosh handles the science; Weinthal parses the policy.

Both share a conviction that the environment can play a crucial role in peacemaking and state building in the contentious region—if given the chance.

"People who are involved in peacemaking tend to focus on humanitarian efforts, political efforts and military solutions, but they leave environmental initiatives out of their toolbox," Weinthal
“That’s unfortunate, because the environment is another tool that could be used to build trust between governments, enhance public welfare and health, link societies and establish long-term communication and collaboration.”

Water issues in the Palestinian-controlled Gaza Strip are a textbook example of this, she says.

“The rapid population growth in Gaza and the sole dependence on ground water for both domestic and agricultural consumption there presents a serious state-building challenge for Hamas if it hopes to foster political stability and economic development,” Weinthal says.

A narrow swath of low-lying land about twice the size of Washington, D.C., the Gaza Strip is wedged between the modern borders of Israel and Egypt on the eastern shore of the Mediterranean Sea, near the northern edge of the Negev Desert. Covering only about 360 square kilometers, it has a population of about 1.4 million, making it one of the most densely populated spots in the world. The population is expected to double within the next decade.

The rapid growth has led to a severe overexploitation of the strip’s limited natural water resources and a sharp decrease in its ground water table in recent years, Vengosh has found. This has allowed seawater and saline groundwater from adjacent and underlying water basins to the east to seep into the aquifer from which Gaza and parts of southern Israel draw their water.

“High levels of salinity and boron in the intruding waters, coupled with nitrate pollution from sewage and farm runoff, have rendered most of Gaza’s ground water unsuitable for either human or agricultural consumption,” he says. “Nonetheless, this remains the sole source of water for the people of Gaza.”

Using isotopic and chemical tracers to identify the sources of the salinity, nitrates, boron and other harmful contaminants in water is a key focus of Vengosh’s research—one that makes it particularly useful for policymakers, international aid agencies and environmental managers looking to devise ways to remove or reduce pollutants from drinking water, not only in Gaza but throughout much of the Middle East.

“Because different sources of water pollution have unique isotopic fingerprints, we’re able to identify clearly the source of the contamination and delineate between natural and man-made sources,” he explains.

The results of his meticulously executed studies have, at times, confounded widely held but scientifically shaky assumptions about the causes of the region’s water woes.

“For instance, we have shown that Gaza’s boron pollution is associated primarily with the natural migration of saline groundwater from Israel into the Gaza Strip—not, as has long been presumed, from sewage contamination where boron is used as a bleaching agent,” Vengosh says.

In a similar study, funded by the U.S. Agency for International Development (US-AID), Vengosh and a team of Israeli, Palestinian and Jordanian scientists used isotopic and geochemical tracers to prove that natural groundwater discharge is the principal source of the severe salinity problem in the Jordan River, which provides water for Israel and Jordan.

Currently, most freshwater tributaries of the Jordan are dammed, and the major source of inflow is sewage effluent, Vengosh says. A peace treaty between Israel and Jordan calls for removing this sewage to improve the water quality.

But Vengosh’s research suggests that, counterintuitive as it may sound, “the removal of sewage would cause further deterioration of the river’s water quality, since saline ground water discharge would then become the predominant source of inflow.

“Our scientific findings may imply that the peace treaty between Israel and Jordan cannot be implemented, or, worse, can cause further harm to the environment,” he says.

To compound the region’s water woes further, additional research by Vengosh also has shown that some of the Negev’s fossil groundwater reserves are naturally radioactive.

“This area sits on Nubian sandstone, a type of sandstone found in many parts of the Middle East and North Africa,” he explains. His isotopic tracer studies show that the radioactivity is caused by water washing away a naturally occurring radioactive metal, radium, found in the sandstone.

The discovery of high radioactivity in ground water in the Negev may imply...
that many other ground waters in the Middle East suffer from the same problem, he says.

Vengosh’s findings support the need for increased international cooperation on water issues in the troubled region, Weinthal says, especially in places where the crisis is already dire, such as the Gaza Strip.

“If the Palestinian Authority continues to pump from the coastal aquifer, boron-laden saline ground water from the eastern side will continue to spread, further reducing the amount of available water,” she says. “The only plausible solution is to increase the supply of external water brought into Gaza.”

The most cost-effective way to do that, she believes, is for Palestinian and Israeli authorities to develop a joint water management plan. “The reality,” Weinthal says, “is that resolving this crisis will require cooperation with Israel, not further separation from it.”

Israel would benefit from the collaboration, too, she adds. By helping to solve Gaza’s water woes, it gains international goodwill and could, ultimately, help protect its own sizable investment in water treatment technologies. The nation’s largest and newest desalination plant is located just 10 kilometers up the coast from Gaza, she notes. When conditions are right, the prevailing coastal current could carry contaminated wastewater straight from Gaza to the plant.

Weintal’s interest in the environment and politics of Central Asia and the Middle East began in the early 1980s, during her high school years in Rochester, N.Y.

“I was a child of the Cold War,” she says. “I wanted to know what life on the other side, the Soviet Union, was like, so I started to learn Russian.”

As an undergraduate at Oberlin College in Ohio, her fascination with Soviet politics and her burgeoning interest in the environment led her to study the environmental movement within the Soviet Union, a topic that received relatively scant scholarly attention at that time in the West. During a study-abroad trip to Russia in the late 1980s, she wrote her first paper on the subject—an examination of Russian environmental activists’ limited role in the policymaking process.

It was during her undergraduate years that she also developed an interest in the Islamic cultures of the USSR’s Central Asian republics and allies. “I wanted to explore these republics when I was in Russia, but traveling to them was still much too difficult,” she remembers.

When the Soviet era ended in 1991 and the former republics began breaking away, Weinthal realized it was a golden opportunity to combine all her scholarly interests and study firsthand the role environmental policymaking would play in the newly emerging Islamic states.

She made her first visit to the region in 1992, when travel there by Western scholars was still extremely rare and restricted. Two years later, she moved to Uzbekistan, Kazakhstan and Kyrgyzstan on a graduate research grant and began her doctoral dissertation on the role environmental cooperation played in domestic and international politics in the region.

In 1998, after receiving her PhD in political science from Columbia University, Weinthal moved to Israel and joined the faculty at Tel Aviv University.

“Once I was there, I realized that much of what I had learned in Central Asia was applicable to understanding state formation processes and water issues in the Palestinian-controlled regions,” she says.

She and Vengosh, who was on the faculty of Ben Gurion University in the southern Israeli desert town of Beer...
Sheva, 65 miles south of Tel Aviv, had met the year before in California. Vengosh was on sabbatical at the University of California at Santa Cruz and Weinthal had a predoctoral fellowship at the Center for International Security and Arms Control—now called the Center for International Security and Cooperation—at Stanford University.

Scholarly discussions and collaborations eventually led to romance, and in 2000, the couple was married in a civil ceremony in Lincoln, Mass., the site of Walden Pond.

Their daughter, Emma, was born in 2002—the same year MIT Press published Weinthal’s award-winning book, *Stemaking and Environmental Cooperation: Linking Domestic and International Policies in Central Asia*. In 2004, the couple’s son, Adam, was born.

In 2005, Weinthal and Vengosh accepted offers to join the Nicholas School faculty, and the family moved to Durham.

“We wanted to be at the same university, but it had to make sense for both of us,” Weinthal says. “The strength in environmental chemistry and applied hydrology here is a good fit for Avner. And being a political scientist on the faculty of an environmental school is my dream job.”

Whether leaders on both sides of the Israeli-Palestinian border will be willing, or politically able, to put aside differences and cooperate on Gaza’s water crisis is still an unanswered question. It may be months before scientists know if continued collaborations are possible, Vengosh says.

What is clear, he adds, is that both sides stand to gain by cooperating.

One of the most cost-effective, scientifically sound solutions to the problem, he and Weinthal believe, would be for Israel and the new Hamas leadership to negotiate a joint pumping plan in which saline ground water could be pumped and desalinized at Israeli-operated treatment plants along the Gaza-Israel border, and then transported into Gaza.

“Israel has nothing to lose from this plan. Gaza has nothing to lose,” Vengosh says. “Rather than returning to armed conflict, cooperation over water would provide benefits for both sides. The Palestinian Authority gains another source of drinking water for its growing population, at a cost that is far less expensive than large-scale desalination of seawater.

“For Israel, the transfer of desalinated ground water could help to lessen the political tension between Israel and the new Palestinian leadership,” Weinthal adds. “It could serve as a source of environmental peace-building in a region shattered by decades of war.”
Nicholas School Associate Research Professor Marie Lynn Miranda describes her December motor trip to areas afflicted by Hurricane Katrina in almost apocalyptic terms.

Driving instead of flying from North Carolina to the Gulf region—in order to lug their equipment to the widest swath of territory—she and three research associates started seeing extensive damage around Biloxi and Gulfport, Miss., that continued all the way to New Orleans and beyond into Texas.

There to verify the data they have been collecting from local environmental investigators and uploading to a special central hurricane effects government Web site, they saw far more than they were prepared to see.

"We’d looked at all the satellite and aerial imagery data,” Miranda recalls during a post-trip interview. “We’d collected all the flood stage, and housing and demographic data. We’d read hundreds of articles that had come out over the Web or print media. We’d probably seen a thousand photos. But what was not captured in any of this is the incredibly huge geographic scale over which the hurricane-affected area extends. We just kept driving for hundred of miles and seeing more damage.

"Then when we went into those neighborhoods that had been flooded, it engaged all our senses. Some communities were full of houses but virtually silent, except maybe for a creak, creak, creak of a (powerless) attic fan blade. There were cats everywhere that had managed to make it by turning feral.

“We could sort of smell the deteriorating waste. When we walked into houses we could smell the mold and the mildew. We could feel the dampness and sense it on our skin. There was a heaviness to the inside air that was really striking. As much as we thought we knew what the situation was going to be like, I think the four of us felt completely overwhelmed by it.”

A principal investigator at Duke’s Superfund Basic Research Center, Miranda previously developed a series of Geographic Information System (GIS) projects. Immediately after Hurricane Katrina’s landfall she began working with the National Institute of Environmental Health Sciences in Research Triangle Park to expand that work into a special Hurricane Response Portal.
In doing that she was able to mobilize the GIS analysts that staff her Children’s Environmental Health Initiative (CEHI). CEHI is a research, education, and outreach program committed to fostering environments where all children can prosper. Given the enormous justice components inherent in the impacts of Katrina, CEHI staff were especially well-positioned to take on the work.

“Our purpose in going down to the Gulf was to ground truth some of the environmental data we have been collecting for the Web site,” she said, noting that her group visited about 25 houses. “We also wanted to get a better sense of what the key environmental health issues were down there. In addition to visiting houses we talked to people from Tulane and Louisiana State universities and the government agencies and the emergency operations center. We were kind of round-robinning information to get a better sense of what the key problems were.”

Out of all that, Miranda says she has identified four issues of special concern: respiratory health, mental health, how to deal with the solid and hazardous waste debris, and the fate of contaminants in the flood waters.

The respiratory health problem her group focused on in the Gulf was mold. The Children’s Environmental Health Initiative previously has received significant funding for mold investigations from both the Robert Wood Johnson Foundation and the Department of Housing and Urban Development.

“So walking into houses that have mold problems is not new to us,” she says. But the mold that accumulated on walls and ceilings in flooded houses in New Orleans was something else.

“It was a several orders of magnitude different kind of problem,” she adds. “In a substantial portion of the city, the water stood for three weeks. And when the water receded, they had 90-degree temperatures and no electricity to run water vacuums, dehumidifiers or air conditioners. That created absolutely perfect conditions for mold growth.”

New Orleans, mold species
Tape Samples, December, 2005

1. Acremonium
2. Aspergillus
3. Aspergillus niger
4. Chaetomium
5. Cladosporium
6. Curvularia
7. Gliocladium
8. Graphium
9. Mycelia sterilia
10. Penicillium
11. Scopulariopsis
12. Stachybotrys
13. Trichoderma
14. Yeasts

Potential Contaminant Sources

The coded trackable Web site now includes pinpoint information on the locations of about 30 potential categories of sources of contamination that could be spread by flood waters. Those range from Superfund sites to gasoline stations, and petroleum and gas-well sites to chemical plants. They also include poultry and hog farms, cattle feed lots and farm fields.

National Priority List Sites • TRI Reporting Facilities 2003 (All) • TRI Hazardous Air Pollutants • TRI Metals and Metal Compounds • TRI OSHA Carcinogens • TRI Persistent, Bioaccumulative, and Toxic Chemicals • Gas Stations • Gulf Platforms • Lube Oil and Grease Plants • Refineries • Crude Petroleum and Gas Operations • Oil and Gas Well Locations • Petroleum Product Storage Stations and Terminals • Petroleum Refineries • Chemicals Industry Facilities • Meat Packing and Processing Plants • Agricultural Minerals Operations • Construction Minerals Operations • Crushed Stone Operations • Ferrous Metal Processing Plants • Misc. Industrial Minerals Operations • Nonferrous Metal Mines • Nonferrous Metal Processing Plants • Refractory, Abrasive, and Other Industrial Mineral Operations • Sand and Gravel Operations • Crop Businesses • Dairy Farms • Farm Ranch Businesses • Cattle Feed Lots • Poultry and Hog Farms
Miranda and research associate Matthew Stiegel applied tape to collect samples from about 10 dwellings, then used a portable microscope to begin identifying different mold species. "We found an incredible variety," she marveled, "including some that are known to be very significant respiratory pathogens." The tape sample list included 13 different kinds, among those "abundant penicillium, aspergillus and stachybotrys.

The federal government says that if you walk into a house with more than 10 square feet of mold you should retreat and hire a professional," she says. "I’m trying to remember if we went into any house that had less than 100 square feet.

“You can tell people they shouldn’t go into those houses but they’re going to. That point was brought home very poignantly to us by a man who was going in and out of a house that had incredible amounts of mold. He was on kidney dialysis and was immunocompromised. He really should not have been in there.”

The man was wearing the kind of face mask that can be bought in a building supply store, but that provided far less protection than the respirators that she and Stiegel wore. And while the alternative approach of hiring a professional sounds logical "it’s not clear what ‘professional’ means when it comes to mold remediation, because there are no federal or state certification programs," she says.

“There were signs up everywhere in New Orleans for ‘professional mold remediators.’ But when we talked to these guys we realized they didn’t have any specialized training, had very low educational attainments, and didn’t have a good sense of the risks.”

Mental health can be harder to document. But living day to day in such an unsettled environment "is really going to take a toll on people," says Andy Hull, one of the GIS analysts in Miranda’s group. “One person we talked to in New Orleans said people down there are living three different lives. You’re still working, so you go to work every day. You’re probably living with three or four other people and not in your own house. And then, before you go to work and on the weekends, you go to your own house that was flooded, just spending an hour or two there every day throwing things out on the street.

“Other people told us that they just got another flat tire while driving to work. They had had three flat tires in two weeks because of all the stuff on the road. Little things like that can really affect people.”

Photos Miranda’s group snapped provide additional stark
records of the aftermath of disaster. A man dumps yet another wheelbarrow of debris onto his neighborhood street. “His house was full of *stachybotrys* mold, which is very pathogenic,” Miranda says. In another image, taken in the Lower Ninth Ward, a small bouquet of flowers rests incongruously on concrete steps to nowhere surrounded by yet more debris. She says colleagues teased her that she had ‘planted’ the flowers for graphic effect.

Especially memorable to Miranda was the picture of a woman with her arms full of freshly picked fruit. “That was in New Orleans East, the final house we went to,” she recalls. “I was shaking hands and thanking her for allowing us to sample in her home. Then she went to the back of her house—just completely destroyed—and picked a bunch of grapefruit, oranges and lemons off her trees. ‘You guys might need a snack later,’ she told us. I was really struck by the incredible generosity of spirit by people who had lost everything.”

Other striking aerial images, plucked off a government Web site, showed New Orleans’ densely occupied Ninth Ward area before the flood and some of the same blocks deeply submerged in water afterwards. In the “after” view, water from the Industrial Canal spews in cruel waves through the levee breach. A barge that flood waters floated over the levee sits atop a crushed school bus—the ultimate challenge to solid waste removal.

“All of this outside debris and all of this inside debris is going to end up being landfilled,” Miranda said. “Then there are all of these cars that have also been ruined. You just see piles of debris sitting in front of these houses up and down streets, house after house after house,” says Hull. Miranda’s field team—herself, Stiegel, Hull and data manager Alicia Overstreet—spent a good deal of their time just navigating around such obstacles after the flood waters were pumped out.

“It was really slow down there,” she recalls. “It was ‘Go this way; oh that road is closed so we’ll try this house.’” Hull describes it as “just days and days of driving, driving through neighborhoods,” he says. “It was like if you drove around Raleigh for an entire day, and every house you saw was completely destroyed or uninhabitable.”

The group’s big challenge is to continue digitizing the growing amount of information they are collecting from local and federal agencies, including the Environmental Protection Agency field teams for the Web portal. They also recorded the GIS coordinates of their mold sampling sites so those can be added to the database.

The coded trackable Web site now includes pinpoint information on the locations of about 30 potential categories of sources of contamination that could be spread by flood waters. Those range from Superfund sites to gasoline stations, and petroleum and gas-well sites to chemical plants. They also include poultry and hog farms, cattle feed lots and farm fields.

“We’re trying to gather as much public data as we can before something like this happens again,” Hull says. “Then, if something like this happens again in a different area, we’ll already have that data ready to go.

“The other side of this is opening up new channels of information. That way we’ll have contacts at the EPA or the U.S. Geological Survey and know where to go to get new aerial photographs and be able to integrate those into the Web site relatively quickly.”

In the busy 2005 hurricane season, “again” has actually already occurred.

“We started with Katrina, which involved Mississippi, Alabama, Louisiana and the Florida panhandle,” Hull says. “Then Hurricane Rita came by, so we had to expand out to Texas, then Wilma came, and we had to cover all the rest of Florida.

“So we’ve got all the Gulf Coast covered now. Hopefully this spring we can also follow up in North and South Carolina, Georgia and maybe Virginia.”

Monte Basgall is a senior writer with Duke’s Office of News and Communications and specializes in science coverage.
Duke Researchers Receive $1.88 Million Grant for Wireless Environmental Sensor Network

Duke University environmental scientists have received a five-year, $1.88 million grant from the National Science Foundation (NSF) to develop an advanced wireless sensor network that can measure, model and predict biophysical changes in the forest environment.

The network will help researchers better understand how the growth, survival and reproduction of forest trees are influenced by changes in climate, atmospheric carbon dioxide and other environmental variables that can fluctuate rapidly. Such changes are expected with the ongoing alteration in global climate as increasing carbon dioxide levels from burning fossil fuels and other sources contribute to global warming.

James S. Clark, who is H. L. Blomquist Professor of Biology at the Nicholas School, is principal investigator on the grant.

“This network will allow us to go into remote locations, install the sensors, and, for years to come, collect a depth and breadth of data that would be virtually impossible to obtain through any other means,” he said. “It has the potential to let us study environmental change on a whole new scale.”

Clark’s co-investigators are Alan Gelfand, James B. Duke Professor of Statistics and Decision Sciences; Pankaj Agarwal, Earl McLean Jr. Professor of Computer Science and Mathematics; Carla Ellis, professor of computer science; Kameshwar Munagala, assistant professor of computer science; and Jun Yang, assistant professor of computer science.

They will collaborate with Paul Flikkema, professor of electrical engineering at Northern Arizona University. Flikkema received an additional five-year NSF grant for $760,000 to work with the Duke team on the network.

Judson Edeburn, resource manager for DukeForest, also is assisting the team.

Share your stories

Share your memories and comments about Duke Forest with the Nicholas School community. E-mail them to judeburn@duke.edu, or mail them to the Duke Forest Office at Box 90332, Durham, N.C. 27708-0332.

Many of the comments we receive will be posted online or printed in future issues of Dukeenvironment magazine and Duke Forest LOG newsletter.

Who uses Duke Forest?

The beauty, solitude and tranquility found in many parts of Duke Forest belie its role as a bustling research, teaching and recreational hub. Among its many uses:

• The U.S. Department of Energy, NASA, the National Science Foundation and the U.S. Forest Service are among the many agencies that sponsor research, currently exceeding $4 million, in the Forest.

• More than 50 research projects currently are being conducted in the Forest by students, faculty and researchers from Duke and other universities.

• The Forest hosts an average of 13,000 visits each year from students, ranging in age from grade school to graduate programs, for field exercises or class projects.

• Each year, the Forest accommodates more than 170,000 recreational visits by members of the Duke and local communities.

> for more
To get the complete story by the Nicholas School’s Tim Lucas, go to www.dukenews.duke.edu/2005/11/wirelessnetwork.html
The Nicholas School and Duke University will mark the 75th anniversary of the founding of Duke Forest with a commemorative book about the Forest’s storied history and a series of tours and events designed to illustrate its pivotal role in research, teaching and recreation over the years.

“Duke Forest is a unique resource, not only for students and faculty at the Nicholas School, but for the entire Duke and Durham communities,” said forest manager Judson Edeburn. “This anniversary gives us a golden opportunity to look back on the first 75 years, and ahead to the next 75.”

Edeburn said the commemorative book, *Duke Forest: A Tribute*, will be published this fall. It will feature historic and current photos and maps of the 7,000-plus-acre property; an overview of how the land was acquired and how it’s been developed; little-known facts about the Forest; recaps of some of the most significant research findings made there; and stories about the people who have managed and used the Forest during its history.

Duke Forest originated in the mid-1920s when Duke University administration purchased many small farms and interspersed forest land as a buffer for the new campus and as future investment. Clarence F. Korstian was hired as the Forest’s director and later became the first dean of Duke’s School of Forestry, formally established in 1938.

“We want to show what makes the Forest a unique holding for a private university, and how its impact has stretched far beyond its borders, influencing not only research and teaching in the Research Triangle, but also the development of forest ecosystem-based teaching and research across the United States,” Edeburn said.

Details about the book, including its price, publication date and how to order it, will be posted on the Forest’s Web site, www.dukeforest.duke.edu, as they become available.

Another focus of the yearlong celebration will be collecting memories and comments from people whose lives and careers have been enriched by access to the Forest, Edeburn said.

“We want to hear from alumni, students, current and former faculty members, recreational users—everyone who has a story to share,” he said.

Many of the comments and stories submitted will posted on the Forest’s Web site, highlighted in future Duke Forest LOG newsletters, and included in articles about the Forest in the Fall 2006 issue of *Duke Environment* magazine.

For those who can make it to campus to share their memories, four events celebrating the Forest’s anniversary are planned. They begin this month.

Members of the Environmental Explorers, an educational enrichment program offered for Nicholas School friends and donors through the school’s Office of External Affairs, will be given a private tour of the Forest on April 8.

“This is an exceptional group of individuals who have demonstrated a lifelong interest in the environment and support for environmental educational activities,” Edeburn said. “It’s an honor for us to have them as our guests.”

On April 22, the Nicholas School will host the public kickoff of anniversary celebrations as part of the annual Field Day activities at the Forest. Alumni, prospective and current students, faculty and staff members, friends of the school, and others are invited to join in for a day of fun and games, giveaways, and the cutting of the official Duke Forest anniversary cake.

Anniversary events will culminate in October with the Duke Forest Annual Gathering on Oct. 19 and a research symposium on Oct. 20, at which Nicholas School faculty members and scientists from other institutions will offer a scholarly perspective on the Forest’s history.

For more information about these events, visit the Duke Forest Web site or call the Forest office at (919) 613-8013.
Urban sprawl, increased road density and waterway fragmentation are among many changes to the landscape that affect the health of ecosystems across the United States.

Norman L. Christensen Jr., professor of ecology and founding dean of the Nicholas School, reported on what’s being done to provide decision makers with timely information about these changes—good and bad—at the 2006 annual meeting of the American Association for the Advancement of Science on Feb. 18 in St. Louis, Mo.


The second edition of the Heinz Center report is slated for publication in 2007, in time to be distributed to Congress before it begins drafting revisions to the U.S. Farm Bill.

“The goal is not to shape legislation, but to provide decision makers with accurate benchmarks so they know where things stand,” Christensen said.

Data for the report are still being collected and analyzed, he added, but some trends are emerging.

“In the East, the indicators are reflecting changes in how the land is used, particularly in terms of farm land and forest land being converted into suburban development,” he said. “In the West, we’re also seeing big changes tied to the diffusion of urban areas into very rural landscapes.”

Other changes likely to be reflected in the report, he said, are the increasing fragmentation of waterways by dams, diversion devices and other structures, and the growing density of roads—measured by miles of pavement per unit area—crisscrossing the nation.

The value of having updated benchmarks every five years, Christensen noted, is “so we can look at them through time and understand in a quantitative way how our world is changing. That’s more meaningful than seeing isolated snapshots.”

Christensen serves on the 15-person executive committee that is overseeing the 2007 report.

Joining him on the AAAS panel were Ann Bartuska of the USDA Forest Service and a member of the Nicholas School’s Board of Visitors, Craig Cox of the Soil and Water Conservation Society and Ted Heintz of the Council on Environmental Quality.

Christensen’s AAAS presentation was co-authored by Kent K. Cavender-Bares of the Heinz Center.
Norman Christensen Elected President of Ecological Society of America

Norman L. Christensen Jr., professor of ecology and founding dean of the Nicholas School, has been elected president of the 9,000-member Ecological Society of America (ESA), beginning August 2006.

ESA is a nonpartisan, nonprofit organization of scientists founded in 1915 to promote ecological sciences and raise policymakers’ and the public’s awareness of the importance of ecology in everyday life.

“I look forward to serving ESA at a time when ecological issues such as global climate change and the sustainable management of our public lands and waters need to be placed at the forefront of national and international policy,” said Christensen.

“As a society of scientists, we have an opportunity, and a responsibility, to work with governments, industry, landowners and others to safeguard the health and productivity of our planet’s natural resources for future generations,” he said.

Election as ESA’s president represents a three-year commitment as president-elect, president and past president, during which time he will oversee committees, serve on the governing board, and preside over the society and its board. Christensen, who completed a three-year term as ESA’s vice president for finance in 2005, is widely cited for his work on sustainable forest management, wildfire management, and the impact of disturbance and succession in forest ecosystems.

Other faculty members have served ESA as elected officers during recent years, including William H. Schlesinger, current dean of the Nicholas School, who served as ESA’s president in 2003-04, and James S. Clark, H.L. Blomquist Professor of Biology, who served as ESA’s vice president for science from 1999-2004.

William Schlesinger Elected as Fellow of American Geophysical Union

William H. Schlesinger, dean of the Nicholas School, has been elected a Fellow of the American Geophysical Union (AGU).

The AGU confers Fellowships to scientists who have attained acknowledged eminence in one or more branches of geophysics. The number of Fellows elected each year is limited to no more than 0.1 percent of the union’s membership.

Schlesinger, who holds the James B. Duke Chair in Biogeochemistry at Duke, was cited for his seminal work on the biogeochemistry of global climate change, particularly the role of soils in the global carbon cycle and on desert ecosystems.

He will receive his award during the AGU’s annual meeting, May 23-26 in Baltimore, Md.

The AGU is a nonprofit scientific organization established in 1919 by the National Research Council to promote interdisciplinary global research in four fundamental areas: atmospheric and ocean sciences; solid-Earth sciences; hydrologic sciences; and space sciences. It has more than 41,000 members in 130 countries.

Pimm Recipient of Prestigious Conservation Biology Award

The Society of Conservation Biology (SCB) has named Stuart Pimm, Doris Duke Professor of Conservation Ecology at the Nicholas School, as the recipient of the 2006 Edward T. LaRoe III Memorial Award.

The LaRoe Award is given annually to an individual who has made major research contributions to conservation biology and also has been highly effective in working with policymakers on controversial issues.

In selecting Pimm for the honor, the award committee cited his “exceptional” work as a researcher, educator and conservationist, particularly his work on endangered species in Florida and the restoration of the Everglades.

The SCB will present Pimm with his award at a June 24 ceremony in San Jose, Calif., during the society’s annual meeting. SCB is one of the world’s largest and most respected professional societies for conservation biology and ecology.

for more

www.nicholas.duke.edu/people/faculty/pimm.html
The 17 students in the Nicholas School’s Duke Environmental Leadership Master of Environmental Management (DEL-MEM) program described their first environmental leadership module in Washington, D.C., as “unequaled,” “rich and valuable,” and “unprecedented.”

The trip, one of several modules offered the students in the two-year online/on-campus master’s program, was held from Jan. 4–9, and involved meetings with prominent leaders from the private, public and not-for-profit sectors.

“Leadership is a driving theme of the DEL-MEM Program. Throughout the program, we provide opportunities for students to assess their leadership capabilities, leverage their strengths and develop an action plan for ongoing development,” says Sara Ashenburg, director of the Duke Environmental Leadership Program. “The module in D.C. offers students a one-of-a-kind immersion experience in which they can explore leadership on a personal level, an organizational level, and within the environmental field as a whole.”

Students had one-on-one talks with Steven McCormick, president and CEO of The Nature Conservancy; Thomas Lovejoy, president of the H. John Heinz III Center for Science, Economics and the Environment; Linda Fisher, vice president and chief sustainability officer for DuPont; James Connaughton, chairman of the White House Council on Environmental Quality; and Fran Mainella, director of the National Park Service.

They also had an opportunity to meet with staff from the offices of Sen. Joseph Lieberman (D-Conn.) and Sen. Ron Wyden (D-Ore.).

Student Kathleen Kutschenreuter, an environmental protection specialist at the Environmental Protection Agency (Washington, D.C.), says, “The opportunity to meet and work so intimately with such a diverse and distinguished group of leaders in the field must be unprecedented. I don’t know of any other program or...
Jackson Mixes Art, Poetry and Science to Create Animal Mischief

What do you get when you mix art, poetry and science? In the hands of the Nicholas School’s Rob Jackson and freelance illustrator Laura Jacobsen, you get Animal Mischief, a book of lighthearted, fact-laced poems and pictures that introduce children to some of the Earth’s most fascinating but misunderstood creatures.

Published this year by Boyds Mills Press of Honesdale, Penn., the collection features 18 light verses that use wordplay, puns and rhymes to teach young readers some subtly serious lessons about having respect for all members of the animal kingdom, even ordinary or seemingly unlovable ones such as ants, porcupines and sidewinders. In “Follow the Leader,” for instance, Jackson writes of everyone’s least favorite picnic pest: “When an ant finds food around/ It drags its stinger on the ground/ To lay a trail of chemicals/…Directions that the next ant Smells.”

At the end of the book, Jackson, a professor of biology and father of three young sons, includes more detailed information about each of the animals profiled, so that children (and their parents) can learn more about its special attributes and behaviors. Animal Mischief sells for $15.95.
Recent studies document previously unknown or under-reported methane and water trade-offs that could reduce the benefits from terrestrial carbon-sink practices such as reforestation and plantations. On Feb. 9, the Nicholas Institute convened a roundtable of 12 top experts from the EPA Climate Change Division, USDA Forest Service and other leading research and policy institutions to discuss the implications of these findings and issue a consensus document to guide policymakers and other stakeholders. For more about the roundtable, go to www.nicholas.duke.edu/institute/methanewater.html.

In a recent report for California policymakers, the Nicholas Institute identified the basic design principles of an effective cap-and-trade system for regulating greenhouse gas emissions at the state level, with emphasis on principles that promote greater environmental certainty, business certainty, flexibility and administrative ease. Read the report online at www.nicholas.duke.edu/institute/califcapandtrade.pdf.

The Nicholas Institute has hired five new full-time staff members.

Brian Murray is director of economic analysis. He focuses on developing economic models to analyze environmental and natural resource policies and regulations, with special expertise in the integration of economic and biophysical models to assess greenhouse gas mitigation strategies in agriculture, land use and forestry. Prior to joining the Institute, he was senior economist and director at the Center for Regulatory Economics and Policy Research at the Research Triangle Institute (RTI).

Eric Williams is project director for economic and policy research in The Climate Change Policy Partnership (CCPP). He brings with him more than eight years of experience in environmental and energy economics, climate change policy design and analysis, and energy modeling at the state, federal and international levels. Prior to launching an independent consulting career, he was a senior policy analyst at the Center for Clean Air Policy and an economist with the U.S. Energy Information Administration.

Research analyst Hallie Katarski is coordinating the efforts of the three Duke University Participants in CCPP—the Nicholas Institute, the Nicholas School and the Center for Global Change—and managing graduate student research for the partnership. Her climate change experience includes three years at Environmental Defense’s Climate and Air Program in Washington, D.C.

Laura Schloss is the institute’s new administrative manager. She previously was at the Duke Clinical Research Institute.

Administrative assistant Susanna Harris enhances the staff’s ability to respond quickly to client needs and queries.

For contact information or to learn more about the Institute’s staff, go to www.nicholas.duke.edu/institute/staff.html.

To read the text of the AP story, which appeared in the Washington Post, Los Angeles Times, San Francisco Chronicle and other major newspapers, go to www.nicholas.duke.edu/institute/news-bushoil.html.

To read the Duke University news tip about Profeta’s commentary, go to www.dukenews.duke.edu/2006/01/profeta_tip.html.
Stay Informed

To receive regular roundups of news and information about events at the Nicholas Institute, subscribe to our new e-mail notification service, NI Update, by going to www.nicholas.duke.edu/niupdate.

Each month, we’ll give you capsule descriptions of a few of our most important recent meetings, projects and news announcements, with links to Web pages where you’ll find more information. Updated news and information about events at the Institute are regularly posted online at our Web site, www.nicholas.duke.edu/institute. Check back regularly; new Web site to be launched soon.
DOES DANGER LURK in Your Carpet and Cell Phone?

New Faculty Member Heather Stapleton Studies the Risks Posed by Flame-Retardant
They’re in your carpet. And your mattress. And the cushions of that sofa you love to lounge on.

You come into contact with them each time you use your cell phone. Or send an e-mail. Or take a drive in your car.

For more than 30 years, polybrominated diphenyl ethers—or PBDEs, for short—have been among the most common flame-retardant chemicals used in North America and Europe. When exposed to high heat or flame, they release bromines that rob the air of the oxygen needed to start or feed a fire.

Manufacturers add the quick-acting coatings to toys, electronics, mattresses, seat cushions, carpet padding and a long list of other plastic, foam or fabric products found in our homes, cars and offices.

The beauty of PBDEs is that they’re designed to last the lifetime of these products.

The problem is, they persist in the environment much longer.

“People throw away computers, cell phones or electronic games, the PBDEs they contain end up in the dump,” says Heather Stapleton, assistant professor of environmental chemistry at the Nicholas School. The bromines, which are similar in structure to PCBs and dioxins, aren’t chemically bound to the products, but merely dissolved onto them. They evaporate or leach out into surrounding ecosystems and can be carried hundreds, or even thousands, of miles away by tides, currents and winds, she says. They are also released, through normal wear and tear, from products still in use in our homes and cars.

Studies show PBDEs are rapidly accumulating in aquatic food webs and human environments across much of the northern hemisphere.

The question is: What dangers do they pose? Is the risk the same for people who inhale PBDEs primarily through dust as it is for species in the wild that ingest them chiefly through diet?

Stapleton is working to find answers.

A soft-spoken, quietly competitive native of upstate New York whose interest in environmental chemistry was sparked by a childhood fascination with marine science, she’s in the vanguard of international research efforts to learn more about PBDEs’ toxicity and long-term fate in the environment.

Her research focuses on identifying the underlying factors that influence exposure and accumulation of PBDEs in aquatic organisms, and, increasingly, on human exposures as well.

“Do bromines pose risks for people? It’s hard to say, because the toxicology is still being investigated,” Stapleton says, choosing her words with obvious care. “But close scrutiny is warranted, because from studies on fish and other model organisms, we know these are very persistent and bioaccumulative chemicals that can be converted into more toxic compounds as they move up the food web.”

Despite her youth—she received her doctoral degree from the University of Maryland in 2003—her words carry weight.

In papers published in 2004 and 2005 while she was a post-doctoral researcher at the National Institute of Standards and Technology, Stapleton became the first scientist to document that fish possess enzymes capable of metabolizing the most commonly used flame-retardant, known as deca-BDE, into compounds found in two of its more toxic and persistent cousins, penta- and octa-BDE.

“That was novel,” she recalls with pride. “Now, we’re working on the next questions: Which enzymes, specifically, are causing the change? And can it also occur in humans?”

To answer these, Stapleton, who joined the Nicholas School faculty in September 2005, is conducting studies on human cell fractions as well as fish.

Preliminary results are promising. "It may be thyroid hormone enzymes,” she says. "If so, that has implications for endocrine activity and other important functions. But there’s still a lot of work to do before we know for sure.”

Stapleton’s natural curiosity, coupled with a lifelong fascination with aquatic animals, has taken her far from her childhood home in Candor, N.Y., a rural, landlocked community of about 5,000 in the bucolic Finger Lakes region.

“I was one of those kids who loved animals, especially sharks,” she remembers. As an undergraduate at Southampton College, however, her classes involved research cruises and water-quality sampling in bays and estuaries, and she became increasingly aware of the impact pollution was having on the organisms that lived there.

Realizing where her true interest lay, she switched her major to chemistry, and, after graduation, enrolled in the graduate program in environmental chemistry at the University of Maryland.
It was there, while studying the accumulation of PCBs—polychlorinated biphenyls—in the Great Lakes’ food web that Stapleton took the plunge into the murky world of PBDEs.

Given their widespread use and chemical similarities to PCBs, and the scant attention that had been paid to them in American scientific journals, “it just made sense to start studying them,” she says. “There was clearly a need.” Her doctoral dissertation spawned three peer-reviewed papers and led to a two-year National Research Council Postdoctoral Fellowship at the National Institute of Standards and Technology.

Stapleton’s speedy ascendance up the scientific ranks has earned her a reputation as a tireless and meticulous researcher. But visitors to her office, or to her old Web site at the Chesapeake Biological Laboratory, are presented with a different, more fun-loving image: A photo of her posing, mock-seductively, on the seat of a Harley-Davidson with her long blonde hair cascading over one shoulder and a pair of high heels dangling over the handlebars.

She smiles when asked about it. “I was at a friend’s wedding,” she explains. “We were all dressed up and everyone in our lab took turns posing on this guy’s bike. It was a joke. Chemists are allowed to joke.”

All joking aside, Stapleton’s emergence as one of America’s top experts on PBDEs comes at a time when there is increasing evidence of the chemicals’ pervasive presence in our environment.

Studies by other researchers have found that PBDEs are rapidly accumulating in rivers, oceans and other aquatic ecosystems in Europe and North America. Elevated concentrations of PBDEs have been found in the fat tissue of species as diverse as polar bears, killer whales and farmed salmon, in locations as geographically far-flung as Greenland, Norway, the Great Lakes and the Pacific Northwest.

High levels also have been documented in human breast milk and serum, especially in North America.

“Studies of breast milk and serum have shown that the U.S. population has the highest levels of contaminants in the world, probably because PBDEs are found in so many of the products we use every day,” says Stapleton.

In a paper published last year in Environmental Science & Technology, she reported finding high concentrations of the chemicals in materials as seemingly innocuous as house dust and clothes dryer lint. Editors of the journal have selected the article as one of the seven top environmental papers published in 2005, based on its potential implications for environmental and human health.

“We found elevated levels in about 5 percent of the households we tested. Smaller houses or apartments tended to have the highest levels,” Stapleton notes.

By using the U.S. Environmental Protection Agency’s estimates of how much dust a toddler between the ages of one and four can be expected to ingest, she and her colleagues determined that children in the homes with the highest levels could be ingesting as much 1,200 nanograms of PBDEs from dust each day.

“These are not lethal exposures,” she says, “but they are alarmingly close to the levels above which we see behavioral effects in laboratory animals. Over time, it’s possible that these sublethal exposures may affect IQ and learning in some children, as well as endocrine activity.”

Research by scientists in Europe and North America has shown that sublethal concentrations of PBDEs cause liver and neurodevelopmental toxicity and adversely affect thyroid hormone levels in test animals such as fish, rats and mice.

In light of growing concerns, the European Union banned the use of penta- and octa-BDEs in 2004. No federal regulatory action has yet been taken to ban or restrict their use in Canada or the United States, but several states, including California and Maine, have issued statewide bans and the U.S. Environmental Protection Agency reached a voluntary agreement with the sole domestic manufacturer of the penta- and octa-mixtures to cease their production at the end of 2004.

Providing policymakers with the information they need to make accurate risk assessments and prudent decisions about the future use of PBDEs is vital, Stapleton says. Having access to the resources and colleagues needed to meet that challenge is one of the main reasons she jumped at the chance to join the Nicholas School faculty.

“The great thing about the Nicholas School is that it has such incredible diversity,” she says. “You have ecologists, toxicologists, policy experts and others working side by side. Great science is often the result of great collaborations. This is definitely a place where that can happen.”

Tim Lucas is the Nicholas School’s national media relations and marketing specialist.
My wife, Lisa, and I were looking for something different for the holidays, so when Duke Alumni Travel asked if I would lead their trip to Antarctica, we jumped at the opportunity. On Dec. 21 we headed south, first to Miami, then on to Buenos Aires, and Ushuaia, Argentina, where we boarded the modern cruise ship, *Corinthian II*. After a bilious night in Drake Passage, some of the roughest seas on Earth, we awoke to the sounds of “anchors-away” off Penguin Island, on the Antarctic Peninsula.

Penguins are why you go to Antarctica—Adelies, with their wide-eyed childlike innocence; chinstraps, looking ready to join a marching band; and gentoos, whose colorful feet guide your eye to each of their awkward terrestrial footsteps. As with all ecotourism to Antarctica, our encounters with penguins were carefully regulated under the provisions of the Antarctic Conservation Act; one must keep a distance of 15 feet from the birds.

Penguins grace this otherwise stark landscape as the contrast between life and death. They have survived for millions of years in this ecosystem, where shoreline gravesites show the untimely end of many early human explorers and where the ocean’s waters and icy crevasses hide the fate of many others.

Of course, we sailed on in the warmth and luxury of our ship, enjoying the food and company with our fellow Duke travelers, and observing an ecosystem of simplicity—krill in the ocean, penguins that feed on it, and leopard seals that relish an unlucky penguin for Christmas dinner. Take a species out of a forest, and one might not immediately notice its loss, but remove a species from the Southern Ocean and its absence from the food chain will change this ecosystem forever.

There are signs of human impact at this far end of the Earth. In October, NASA’s Web site showed that the ozone hole had appeared earlier and deeper in austral spring of 2005 than ever before. Is the Montreal Protocol failing to protect it? Are exemptions, such as the request of U.S. farmers to continue to use methyl bromide, sapping its protective intent? With a light meter from the Nicholas School, I measured the ultraviolet light at noon each day. Even in December, when the ozone hole should have healed, ultraviolet-B increased from 1.46 Watts/m² in Buenos Aires, to 2.11 Watts/m² at 65° S, our southernmost excursion. And there are already reports of increasing cataract-like clouds in the eyes of penguins.

It was spring in Antarctica, and everywhere ice was melting. Long-term records show a dramatic trend of warming on the Antarctic peninsula, and other studies show declining populations of penguins in response to changes in the distribution of krill and sea ice. Recent studies of 6,000-year-old penguin bones from Antarctica document a slow evolution of their DNA compared to that of living Adelies, but will they adapt fast enough to the new, warmer climate that we are imposing from our industrialized world?

In earlier times, sailing ships made routine stops on Antarctic islands to restock their stores with fresh penguin meat. Mercifully that abuse ended many years ago, and today, I worried only that our excursions to shore might be disturbing penguins during the short season of their nesting. Such is the dilemma of ecotourism: each cruise ship carries about 100 passengers to this unique land, where they come to appreciate how critical it is to preserve Antarctic ecosystems and how vulnerable they are. Penguins may be indifferent to us, but Antarctic travelers become ambassadors for their protection.

I relish my next encounter with these creatures for the deeper perspective and understanding they bring of the marvels of life’s adaptation to an extreme environment and my renewed commitment to protect the planet from our effluent and impact. When I walked back into the dean’s office, I started 2006 knowing fully the importance of our work in the Nicholas School.

William H. Schlesinger is dean of the Nicholas School and James B. Duke Professor of Biogeochemistry.
can science save COASTAL DEVELOPMENT?

Nicholas School Faculty Members Play Key Roles in Documenting Threats and Offering Ways to Avoid Them

Photo by Scott Taylor
by John Manuel

Despite the recent hurricanes, a rise in sea levels and the erosion of our nation’s shoreline, people are still rushing to build on the coast. Forty percent of new commercial development and 46 percent of new residential development has happened near the coast in recent years.

This development brings much-needed jobs to coastal economies, but experts warn it also brings new risks. Nonsustainable development can accelerate beach erosion, wetlands loss and water pollution. And the buildings themselves are threatened with eventual destruction by natural forces.

A host of Nicholas School faculty members are playing key roles in documenting these threats and offering ways to avoid them.

But will decisionmakers listen to the voice of science?

Michael Orbach is professor of the practice of marine affairs and policy and director of the Duke Marine Laboratory in Beaufort, N.C. He has helped shape coastal and marine policy on all coasts of the United States, as well as in Mexico, Central America and the Caribbean.

Orbach hopes that construction of the Marine Lab’s $2.2 million Ocean Science Teaching Center (see Dukeenvironment Fall 2005) will serve as a model for sustainable development on the North Carolina coast.

Scheduled to open in July, the 5,600 square-foot center has been designed to the highest standards of energy and environmental efficiency adopted by the U.S. Green Building Council. Featuring solar panels and a geothermal heating and cooling system, the building is constructed largely of locally produced wood. Recycled material has been used wherever possible.

The landscaping on Pivers Island, which the Marine Lab shares with laboratories of the National Oceanic and Atmospheric Administration, also showcases the benefits of sustainability. Typically, waterfront landowners install vertical bulkheads on the sound side of their properties to prevent erosion from waves. However, these structures deprive finfish and shellfish of valuable nursery grounds by eliminating the shallows and the vegetation that grows in them.

Instead, 500 feet of existing bulkhead on the west side of Pivers Island has been removed, and the earth has been graded and replanted with native vegetation above and below the waterline. The plants, now in their fourth year, are thriving.

“The state brings people by all the time to show them they don’t have to build on the shore,” Orbach says. “Building this way actually costs a little less than building a bulkhead.”

A cultural anthropologist by training, Orbach views coastal development from the human perspective, trying to accommodate people’s needs while protecting the environment. Following hurricanes Fran and Bertha, beaches on North Carolina’s Bogue Banks eroded by as much as 100 feet, cutting away the beach, dunes and maritime forest and threatening dozens of structures.

Oceanfront property owners demanded action. Carteret County responded by forming a Beach Preservation Task Force with Orbach as chair. He was able to steer the committee away from what he viewed as a drastic and environmentally unwise action.

“A lot of property owners on the task force wanted to challenge the state’s ban on hardened structures,” he says. “I wanted to find a way to protect owner’s property and the environment as well. In the end, the committee opted to pursue beach nourishment.”

Beach nourishment involves dredging sand from the ocean floor and dumping it on the shore.

Nicholas School MEMs acted as advisors to the task force, providing valuable information to guide the nourishment process. Tod Hall MEM’95 conducted a detailed study of sand compatibility—what types of sand work for beach nourishment and what don’t. Nancy Perkins MEM’97 detailed the state and federal regulations governing how nourishment must be done.

Some experts question whether beach nourishment is sustainable or whether the sand will simply be washed away in a few seasons. Orbach says that depends on the location. "Bogue Banks is a good candidate for nourishment because it has a good source of sand nearby, it’s high in elevation, and it has an east–west orientation that is less susceptible to erosion," he says. "Other sites might have to be nourished so often and at so great a cost that it’s not worth it. Science can give us data and information, but the tradeoffs between preservation of natural environments and human habitation—whether any particular action is ‘worth it’—has to be made through the governance process.”

A man who has written many op-eds questioning the wisdom of beach nourishment, Orrin Pilkey, James B. Duke Professor Emeritus of Earth Sciences, is considered one of the nation’s experts on coastal geology. He has coauthored two dozen books and more than 150 technical publications on the subject.

Pilkey has warned for decades that barrier islands, such as North Carolina’s Outer Banks, are constantly migrating and, therefore, poor places for development. Experts credit his research for the passage of North Carolina’s ban on hardened structures on the coast.

Pilkey heads the Program for the Study of Developed Shorelines (PSDS) within the Nicholas School’s Division of Earth and Ocean Sciences. Among other resources, PSDS maintains a regularly updated database on beach nourishment projects around the country. The database contains locations, primary finding sources, volumes of sand delivered, lengths and costs—everything officials might need to determine the viability of a nourishment project.

"It’s the most comprehensive table of beach nourishment in the country," says Andy Coburn, PSDS assistant director.

Despite the availability of this and other information to guide sustainable development, Pilkey doubts it can prevail over the political, economic, and emotional pressures to build and stay on the beaches.

"We’re trying hard to bring science into coastal management, but we find..."
ourselves stymied by a fundamental lack of interest in science,” he says. Pilkey laments that even in a state like North Carolina that has sound laws to govern coastal development, there are too few people to enforce them.

While Pilkey’s eyes are on the geology of the nation’s shorelines, Larry Crowder, Stephen Toth Professor of Marine Biology, keeps his focus on the fish and shellfish that inhabit the estuaries. Their fates, too, are affected by agriculture and development, not just along the coast but also hundreds of miles upstream.

“Nutrients that leak off the land enter into the watershed, and when they flow into the estuaries, they stimulate algal production,” Crowder explains. “What algae isn’t eaten by aquatic life drops to the bottom and decomposes, using up oxygen in the process. This state of hypoxia can have adverse effects on fish and shellfish populations.”

Hypoxic events occur around the world, but are especially bad in the Gulf of Mexico, where nutrients flowing down the Mississippi River from upstream farms and cities are creating an ever-expanding “dead zone.” Crowder and his associate, Kevin Craig, have been examining the link between hypoxia and the numbers and distribution of fish and shrimp in the Gulf.

“The dead zone forms every spring when large amounts of freshwater come down the Mississippi,” Crowder says. “All the critters that were on the bottom move to the edge of the zone and accumulate in high densities. That crowding affects physiological health.”

Crowder and Craig have observed that shrimp on the edge of the dead zone accumulate fewer lipids, delaying the molting of shells and reducing growth rates. This potentially translates into fewer and smaller shrimp, which could be bad news for the fishing industry. Further, shrimp suffer more predation when they are crowded together. Sea turtles gather on the edge of the dead zone to feed on the shrimp, as do commercial fishermen. The latter may catch more shrimp, but they also haul in many more sea turtles than usual in their trawling nets. This leads to increased mortality among these already endangered reptiles.

“If we made better use of the land, we’d be losing fewer nutrients into the water,” Crowder says. “Government is working with the people in the Mississippi watershed, aiming for a 30 percent reduction in nitrogen loading. It’s too early to tell if it’s going to work.”

William Kirby-Smith, associate professor of the practice of marine ecology, has spent more than 30 years examining the effects of nutrient runoff on estuaries in North Carolina. Some of his work has focused on the impact of the massive (40,000-acre) Open Grounds Farm, which drains into the Neuse River and adjoining estuaries.

“Any place where people come in and alter the landscape for any purpose, the adjacent shellfish waters suffer,” Kirby-Smith says. “When you drain the land, coliform bacteria is transmitted in surface runoff to the estuaries before it can die off. The state is then forced to close these waters for shellfish- ing, because of the potential for human illness.”
In central North Carolina, portions of another megafarm are being converted back to wetlands in hopes of improving water quality in the adjacent estuary. Kirby-Smith has received a grant from the North Carolina Coastal Federation and the North Carolina Department of Environment and Natural Resources to monitor the improvements. "Our overall goal is to see if we can reopen waters adjacent to the farm that have closed to shellfishing," Kirby-Smith says.

Kirby-Smith has been dismayed to find that current state regulations requiring stormwater controls and buffers around shellfish waters have proven to be largely ineffective in maintaining water quality. Shellfish closures are increasing, even around expensive residential developments.

He and other scientists have presented their findings to state officials. In light of these findings and of lawsuits threatened by environmental groups, the N.C. Coastal Resources Commission and the N.C. Division of Water Quality have recently announced they are reexamining their stormwater regulations. This gives Kirby-Smith reason for hope.

"I have found the staff of the state agencies are very interested in coming up with solutions based on the science," Kirby-Smith says. "Of course, science alone will not solve the problems. It is up to the politicians to make those decisions."

**Curtis Richardson**, director of the Duke University Wetland Center, is in the solution business. He is conducting groundbreaking research on the role that wetlands can play in protecting water quality. Wetlands serve as habitat for all manner of wildlife. They also play a vital role in filtering out pollutants.

Over the past three centuries, millions of acres of wetlands in the United States have been drained and filled to make way for agriculture and development. Federal and some state governments now have laws to prevent further loss. Richardson and his students are researching whether or not these laws are having the desired effect.

"We looked at North Carolina’s Coastal Area Management Act and other regulations to determine if they are actually slowing wetland loss on the coast," Richardson says. "We found that they are. However, the numbers can be deceptive. We may have lost only 160 acres of coastal wetlands in a particular year, but this can represent miles and miles of shoreline."

Recently, the Supreme Court ruled that "isolated" wetlands, those not adjacent to navigable waters, are not protected by federal law. Richardson says that in states without their own regulations, this ruling could result in a significant loss of wetlands as developers rush to drain and build on them. Master's student Liza Cushion MEM’06 is comparing the effects of this ruling in two states, North Carolina and Texas, the former with a strong state law protecting wetlands and the latter without one.

At a site near the urban edge of Duke Forest in Durham, Richardson and his students are conducting a multi-phased stream restoration and constructed wetlands project. Phase I of the project involved restoration of a badly degraded creek with riparian wetlands. This was followed by construction of a dam and a 1.6-hectare stormwater-retention reservoir.

A future phase will involve construction of a wetland just south of N.C. 751 near Wallace Wade Stadium. This wetland will be specifically designed to treat runoff from nearby rooftops, parking lots and streets on 60 acres of Duke’s campus.

Though these wetlands lie far from the coast, Richardson emphasizes that runoff from Duke’s campus eventually feeds into the Cape Fear River and from there into the Atlantic Ocean. "Wetlands start at the headwaters, and to understand their effects on water quality, you have to study on multiple scales," Richardson says. "It’s a piece of a much larger puzzle."

In addition to reducing pollution and providing wildlife habitat, coastal wetlands may also play a role in protecting inland towns and cities from storm surge.

The Federal Emergency Management Agency (FEMA) has hired Richardson to conduct an assessment to determine whether or not wetlands could have helped mitigate damage from Hurricane Katrina. Southeast Louisiana once supported enormous cypress forests that were nurtured by sediment from periodic flooding of the Mississippi River. When the river was channelized and floodwaters contained, the flow of sediment was cut off, the marsh subsided and much of the forests died due to salt water intrusion.

"Research scientists say a large number of towns and cities outside of New Orleans could have been protected from storm surge if the wetlands were intact," Richardson says. "Our role with FEMA is to make recommendations as to where to put research funds related to wetland restoration."

"The various Nicholas School researchers try to supply the best science they can with respect to the problems of coastal erosion and pollution," says William H. Schlesinger, dean of the Nicholas School. "We can hope that their work will guide how coastal development unfolds."

*John Manuel is a freelance writer in Durham.*
by Katherine Jennrich

Lisa Turner could smell the paper plant even before she drove into the city limits of Canton, N.C. But as the highway crested the last hill and she saw the Haywood County community spread out below her, it was the size and location of the enormous plant that shocked her.

“It looked like the mill was practically in a neighborhood,” she recalls.

Turner, a Duke undergraduate majoring in environmental sciences, was visiting the small mountain town to research its mortality rate as part of her Stanback Internship, conducted in conjunction with the Blue Ridge Environmental Defense League (BREDL).

The suicide rate in Haywood County is twice as high as is typically found in similar communities, and past studies by BREDL suggested that the alarming rate could be linked to hydrogen sulfide and other airborne toxins released from the local paper plant.

Turner’s job was to collect data that could support or refute the hypothesis.

BREDL is a regional, community-based, nonprofit environmental organization that aims to empower communities to fight social and environmental injustice. Based in Glendale Springs, N.C., it is one of many grassroots organizations that benefit from the Stanback Internship program, which is made possible through the support of Fred and Alice Stanback of Salisbury, N.C.

The Stanback program is a partnership between the Nicholas School and targeted conservation organizations.

The purpose is to provide Duke graduate and undergraduate students with significant work experience in conservation, advocacy, applied resource management or environmental policy.

Participating students, such as Turner, rate it as one of the most important experiences in their educational careers.

Many of them use the opportunity to pursue work that captures their interest, not just to meet their financial needs.

Richard Weisler, an adjunct assistant professor of psychiatry at Duke University Medical Center and an adjunct professor of psychiatry at the University of North Carolina at Chapel Hill, is the scientific advisor for the BREDL project.

He began working with BREDL as a volunteer in 2003 after his mother was diagnosed with cancer. She lived in one of two neighborhoods in Salisbury where researchers had noted higher than normal cancer rates.

“Our group helped identify what turned out to be elevated rates of brain cancer, lymphomas, pancreatic cancers and all cancers as a group,” Weisler says. “This represents North Carolina’s first documented cancer cluster.”

In the process of reviewing death certificates, Weisler’s team noticed a higher than normal rate of suicides, too. The suicide rate in the two affected neighborhoods in 2003 was found to be 128 per 100,000 individuals, which was approximately 10 times the statewide average that year. For the decade, the suicide rate was more than three times the statewide average.

Noting that more than 600 formal complaints had been filed about foul odors, “bad air” and breathing problems in the same neighborhoods, Weisler’s team began investigating links between the suicide rates to hydrogen sulfide and other airborne chemicals from nearby asphalt plants.

Assting Weisler on his research in Salisbury were two other Stanback interns and Duke undergraduates in environmental sciences, Stacey Tsougas and Melissa Fiffer.
Tsougas was Weisler’s first intern, working during the summer of 2003. “I went down to Salisbury to visit residents, and the smell of the asphalt plant was so prominent,” she says. “I’ll never forget the moment that Dr. Weisler and I discovered the unusual number of suicides in the area.”

Fiffer began working with BREDL in 2004, after her sophomore year. She initially worked with community organizer David Mickey on researching the air quality policy process. She attended policy meetings, held in-person interviews with policymakers, and even went to the state’s Rules Review Commission with a petition concerning the hydrogen sulfide rule.

“Typically, it is only industry groups that petition costly pollution rules. But this time we thought, ‘Why can’t an environmental group petition?’ So we petitioned the hydrogen sulfide rule because it had a glaring omission—it exempted the pulp and paper industry.”

While she was working with Mickey, she caught wind of the work going on in Salisbury. Intrigued, she helped Weisler with his work whenever possible.

In her junior year at Duke, Fiffer informally worked with Weisler, staying in the loop on his research. In the spring of that year, she formally reconnected with BREDL and Weisler through for-credit independent study.

“Most people don’t realize that you can do an independent study with people outside of your department, and even outside of Duke,” says Fiffer, “This was a great opportunity, and I was able to get credit for my work!” She studied hydrogen sulfide, learning that it is a neuro-modulator, meaning that it can cause mood swings and severe depression.

Weisler and his team have received national recognition for their work and have presented their findings at three national medical conferences. The air toxins study was featured in the January 2006 issue of O: The Oprah Magazine.

In her senior year at Duke, Fiffer drew on her Stanback internship experience. She incorporated her research with BREDL into a term paper for a public health class, using her research in the paper.

Lisa Turner is experiencing a similar advantage from her experience as a Stanback intern. Turner’s involvement in Weisler’s research has given her a leg up in her classes this year, especially Environmental Toxicology and Statistics.

Has the Stanback experience affected Fiffer’s career aspirations? “Oh, definitely,” she says. “My work with BREDL has solidified my interest in environmental and public health.”

After earning her master’s degree, she hopes to work in air pollution policy either at the government or non-profit level. Her long-term goal is to attend law school and become an environmental lawyer.

Turner is equally passionate about her Stanback experience. “Everyone should do this,” she says, “There are so many options. Jump on this opportunity while you can.”

Weisler, too, is appreciative of the Stanback program, and the interns he’s had.

Real-World Study on Suicide Rates, Cancers and Environmental Toxins

“Fred and Alice Stanback’s very thoughtful gift to the Nicholas School in the form of funding internships with nonprofit environmental groups was truly a brilliant idea,” Weisler says. “With the help of our three great Stanback interns to date, we have been able to investigate important topics that we could have never explored in the community public health, environmental, and medical arena.”

Katherine Jennrich MEM’07 is the 2005-2006 Nicholas School Student Communications Assistant.
In Print
Recent publications by Nicholas School faculty or staff

James S. Clark, H.L. Blomquist Professor of Biology
- “Molecular Indicators of Tree Migration Capacity Under Rapid Climate Change,” Ecology, 2005 (coauthor)

Michael Coyne, research scientist

Kevin J. Craig, assistant research scientist
- “Spatial Distribution of Brown Shrimp (Farfantepenus aequus) on the Northwestern Gulf of Mexico Shelf: Effects of Abundance and Hypoxia,” Canadian Journal of Fisheries and Aquatic Sciences, 2005 (w/ L.B. Crowder et al.)
- “Hypoxia-induced Habitat Shifts and Energetic Consequences in Atlantic Croaker and Brown Shrimp on the Gulf of Mexico Shelf,” Marine Ecology Progress Series, 2005 (w/ L.B. Crowder)

Gabriele C. Hegerl, associate research professor
- “A Bayesian Approach to Climate Change Detection and Attribution,” Climate, 2005 (coauthor)

David E. Hinton, Nicholas Professor of Environmental Quality
- “Resolving Mechanisms of Toxicity While Pursuing Ecotoxicological Relevance,” Marine Pollution Bulletin, (lead author w/ S. Kullman et al.)

Robert B. Jackson, professor of environmental sciences and biology

Jeffrey A. Priddy, data processing specialist
- “Testing a Spatially Explicit Individual-Based Model of Red-Cockaded Woodpecker Population Dynamics,”
- “The Diversity and Biogeography of Soil Bacterial Communities,” Proceedings of the National Academy of Sciences, January 2005 (coauthor)

Clinton N. Jenkins, research associate
- “Refining Biodiversity Conservation Priorities,” Conservation Biology, 2005 (coauthor w/ S. Pimm et al.)

Lynn A. Maguire, professor of the practice of environmental decision analysis

Marie Lynn Miranda, associate research professor
- “Local Extinctions in Flocking Birds in Amazonian Forest Fragments,” Evolutionary Ecology Research, 2006 (coauthor)

Stuart L. Pimm, Doris Duke Professor of Conservation Ecology
- “What Paying for Ecosystem Services Means,” PERC Reports, July 2005 (author)

Chantel D. Reid, lecturer
- “Elevated CO2 Reduces Disease Incidence and Severity of a Red Maple Fungal Pathogen via Changes in Host,” Global Change Biology, April 2005 (coauthor w/ R. Jackson et al.)

James Salzman, professor of law and Nicholas Institute professor of environmental policy
- “Creating Markets for Ecosystem Services: Notes From the Field,” NYU Law Review, 2005 (author)

Martin D. Smith, assistant professor of environmental economics
Grants

Grants of $50,000 or more awarded to faculty in the past six months

James S. Clark, H. L. Blomquist Professor of Biology, National Science Foundation (NSF), $126,000, "The 2nd Summer Institute: Uncertainty in Ecological Inference, Forecasting, and Decision—Modern Statistical Computation.” Duration: 12 months; NSF, $1,247,842. Collaborative Research: "SEI (BIO)-Automated Methods for Generating High-Resolution GIS Databases from Remotely Sensed Data for Biodiversity Predictions." Duration: 48 months.

Gabriele Hegerl, associate research professor, NSF, $400,002, Collaborative QEIB Research: "Spatio-temporal Modeling of Species Distributions and Biodiversity—Integrating Climate and Population Responses." Duration: 24 months.

Patrick N. Halpin, Gabel Associate Professor of the Practice of Geospatial Analysis, David and Lucille Packard Foundation, $378,244, "Geospatial Analysis Tool Development for Marine Ecosystem-based Management and Conservation Planning." Duration: 12 months.

Robert B. Jackson, professor of environmental sciences and biology, National Institute for Global Environmental Change, $100,000, "Woody Encroachment and Carbon Storage Across Regional Gradients in Precipitation and Land Use.” Duration: 12 months.


Peter E. Malin, professor of seismology and of civil and environmental engineering, Stanford University, $60,000, "An Easily Removable Instrumentation System for SAFOD Pilot Hole Geophysical Monitoring and Sensor Evaluation (Supplement).” Duration: 11 months.

Marie Lynn Miranda, associate research professor, Wallace Genetic Foundation, $92,000, "Exploring the Contribution of Geneties to the Elevated Blood Lead Levels in African-American Children.” Duration: 18 months.


Curtis J. Richardson, professor of resource ecology, Natural Resources Conservation Service, $52,000, "Duke Forest Stormwater Improvement and Wetlands Restoration Project.” Duration: 12 months.


Dean L. Urban, associate professor of landscape ecology, NASA, $120,000, "Carbon Dynamics in Heterogeneous Landscapes: Fusing Remote Sensing and Spatial Ecological Models.” Duration: 12 months.

—Compiled by Donna Sell, Nicholas School communications assistant
When Jim Reilly gives speeches about Great Britain’s successes in reducing carbon emissions, he often has to reassure audiences baffled by his lack of a British accent. He has only been “British” since January 2005, when he began work as an energy and environment advisor to the British Embassy in Washington, D.C., a position he took after spending four years as an environmental aide for Sen. Tom Carper (D-Del.).

The embassy’s job, says Reilly, “is to take care of what London says are priorities. And what London says right now is ‘Climate change, climate change, climate change.’” Reilly began the job in a year when the United Kingdom was preparing to lead both the European Union and the G8. At last year’s G8 meeting in Gleneagles, Scotland, climate change was one of Prime Minister Tony Blair’s two main focuses—the other was poverty in Africa—and he succeeded in urging G8 leaders to agree that climate change is indeed a problem, that it needs to be tackled urgently, and that reducing greenhouse gas emissions is the key to the solution.

At the embassy, where he is part of the Global Issues Group and reports to First Secretary for Energy and Environment Christian Turner, Reilly is a conduit of environmental information between the British government and the United States. He spends a good deal of time in the halls of Congress and in public forums highlighting British success stories such as the suburban town of Woking, which between 1990 and 2004 reduced energy consumption by 49 percent and carbon dioxide emissions by 78 percent. Reilly also highlights the work of corporations with a major U.K. presence, like British Telecom, Alcoa and DuPont, that have succeeded in reducing their energy costs and greenhouse gas emissions.

The first question Reilly is always asked is “How much does this cost?” He points out that the town of Woking has not raised taxes or energy rates and that the corporations have not suffered financially. “None of these CEOs would do this if they couldn’t justify it to their shareholders,” Reilly says. “They all have come to understand that doing this is a net positive, and done correctly, it reduces their energy cost and it reduces their financial risk, so long-term, they will be better off than competitors.”

U.K. and U.S. approaches to emissions
In his talks, Reilly sometimes displays a chart showing that U.K. greenhouse gas emissions have dropped 15 percent since 1990, a reduction largely due to a transition from coal to natural gas for generating electricity. U.S. emissions rose more than 11 percent in the same time period.

One of the reasons for the difference, says Reilly, is that the U.K. and the European Union now have significant legislation regarding emissions, whereas currently the U.S. favors a voluntary approach. While both the U.S. and the U.K. both import increasing amounts of energy to satisfy demand, England is perhaps more energy-aware, Reilly believes. The country has a culture and ethic of energy efficiency, with smaller cars and less energy used per person.

Although the U.S. is not a Kyoto Protocol signatory, Reilly says that Tony Blair “needs the U.S. at the table” in order to move forward on a global climate change agreement. Blair “has put his head...
around the science and decided the right thing to do is to bring countries together to work on this.” Having President George W. Bush attribute (at Gleneagles) climate change to human activities and committing the U.S. to the long-term process was critical, Reilly says.

The importance of U.S. participation in climate change discussions is a key reason Reilly, an American, is employed by the British Embassy. Working on Capitol Hill for a centrist Democratic senator, Reilly developed “a very laudable reputation in the D.C. community for doing tremendous work on environmental issues,” according to Tim Profeta MEM/JD’97, director of the Nicholas Institute for Environmental Policy Solutions. Profeta was Reilly’s counterpart in Sen. Joseph Lieberman’s office, and the two worked closely together on the Senate Environment and Public Works Committee. “His hiring by the British Embassy,” says Profeta, “symbolized the need for help in understanding the American political position, especially about climate change.”

A Delaware connection and a love of the coast
Until his employment at the embassy, Reilly had been associated almost exclusively with Delaware. Born in Texas on Delaware Day (Dec. 7), he moved with his parents to the state about a year later. At age 8, he began attending YMCA Camp Tockwogh on the eastern shore of the Chesapeake Bay. He worked at the camp every summer while attending the University of Delaware, where he received a bachelor of science in plant science, and then served as the camp’s assistant director for five years afterwards.

Reilly’s years at Camp Tockwogh imbued in him a passion for sailing and a love of the Chesapeake Bay. In efforts to protect the bay, he saw a disconnect between scientists and policymakers, and he went looking for a graduate program that would help him to bridge that gap. That search brought him to the Nicholas School, where he concentrated in coastal environmental management and spent a year studying at the Marine Lab. “There’s no better place to go to graduate school,” Reilly says. “I could look out my office window and see the shrimp boats going by, and I could sail across to Shackleford Banks. And North Carolina has all of the coastal management issues.”

One of those issues is the intersection of development and shellfish safety, and for his master’s project, Reilly studied an oyster bed at the mouth of a creek near Beaufort that had been shut down due to high bacteria levels. Reilly sampled the creek in various locations, mapping bacteria counts using Geographic Information Systems (GIS) technology, identified the source of the problem as neighborhood dogs and other animals using the creek as a toilet, and developed a management plan for the residents to consider. William Kirby-Smith, an ecologist at the Marine Lab and Reilly’s project advisor, says that...
Reilly’s management plan is cited frequently by the Shellfish Sanitation Section of the N.C. Department of Environment and Natural Resources in discussions of how to approach the problem. “It’s a national problem,” says Kirby-Smith, “but the causes are always local and the solutions have to be done locally.”

Reilly took a year off from his master’s program in 1997 to be a John A. Knauss Marine Policy Fellow, working in the U.S. Senate’s Commerce, Science and Transportation Committee. He drafted coastal policy legislation, advised the Senate’s policy response to a *Pfiesteria* outbreak in the Chesapeake Bay, and participated in oversight of the Coast Guard and National Oceanographic and Atmospheric Administration. In 1999, he met Delaware Gov. Tom Carper, who was then preparing to run for the U.S. Senate. That meeting led to an offer to work in fundraising for Carper’s campaign. “It’s a job I’m thrilled I did once,” says Reilly. “It taught me about a rarely seen but fundamental piece of the political process. The work was eye-opening, but I wouldn’t want to make a career of it.”

**Working in the Senate**

No need. After Carper’s election, Reilly came on board as a legislative aide whose turf included energy, the environment and agriculture. He worked with issues ranging from avian flu (chicken production is a huge industry in Delaware) to beach nourishment, but his major effort was helping Carper introduce the Clean Air Planning Act, which would have legislated reductions in greenhouse gases and other pollutants like mercury, nitrogen oxide, and sulfur dioxide that are emitted from power plants. The act didn’t pass, but Reilly developed a reputation for getting things done and creating bipartisanship around environmental issues, according to Profeta.

“I loved that position,” says Reilly. “I would still be there if it weren’t for the unique timing of the job at the British Embassy.”

Although his work has taken him further and further away from the coastal problems he studied at Duke, Reilly maintains his relationship with the coast by escaping frequently to the eastern shore of Maryland—just around the point from Camp Tockwogh—where he sails a 1965 Pearson Vanguard sailboat named *Rosalie* after the camp cook. “It’s my escape from the Beltway,” says Reilly.

For the future, Reilly sees a professional life in public service, although not necessarily public office. He may return to his coastal roots by working in some capacity to help preserve the Chesapeake Bay, or he may remain inside the Beltway. The Marine Lab’s Kirby-Smith sees him as “head of the EPA or another agency like that,” but also wouldn’t be surprised to see him continue advancing in the diplomatic world.

It is clear that Reilly has the ability and patience to continue working on environmental issues from within a government. “Having been inside the legislative process and watched another government function, I see some incredibly dedicated and talented people who understand how important the work of the government is,” he says. “We are making real progress. At times, it is painfully slow and the course is not always in a straight line, but overall we are heading in the right direction.”

Lisa M. Dellwo is a freelance writer in Durham, N.C.

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**Web sites**

British Embassy, Washington, D.C.  
www.britainusa.org

The Climate Group, with case studies on Woking, British Telecom, and other organizations working to reduce greenhouse gas emissions  
www.theclimategroup.org
Receiving Alumni Awards

Timothy J. Creem (MF’66) and Paul W. Parker (MEM’97) have been selected to receive alumni awards from the Nicholas School.

Creem, recipient of the Ralston Distinguished Alumni Award, is “a longtime and generous supporter of the school,” according to Peggy Dean Glenn, associate dean for new initiatives at the Nicholas School. He served on the Board of Visitors from 1989 to 2004.

He established the Timothy J. Creem and Anne G. Creem Scholarship Endowment Fund to support master of forestry students, and he was an early supporter of the Norman L. Christensen Scholarship Fund, established in honor of founding dean Christensen. Glenn says that he was “an adored member of his class” who organized reunions and stayed active in alumni groups.

Creem is a retired partner with Creem & Creem, a brokerage firm, and he lives in Bridgeton, Maine.

Parker, executive director of the Cape Cod Commercial Hook Fishermen’s Association, has been given the Rising Star Award for young alumni. Under his leadership, the association has grown from 200 to 2,000 members and has developed a strong reputation for grass-roots advocacy to protect fishing communities in New England through practices that encourage sustainable harvest of fresh seafood. Parker’s staff includes several Nicholas School graduates, and almost every summer, at least one master’s student interns for the organization.

“The secret of Paul’s success is that he is just as effective in the halls of Congress as he is on the water,” says Amy Schick Kenney MEM’98, president of the Nicholas School Alumni Council and a marine policy consultant.

An avid scuba diver and lifelong sailor, Parker also is a commercial fisherman.

The awards will be given at a ceremony during the annual student banquet on April 7.
Career Matters

Nicholas Networking

Creating More Options
Many jobs are advertised only by word of mouth, and according to the Nicholas School Career Services Office, 75 percent of professionals find jobs through networking—more than all other methods combined. That’s why establishing a professional network has become a critical job search and job advancement skill.

The Career Services Office offers advice on networking on its Web site, with topics including establishing a network, understanding networking, and sample questions to ask your networking contacts. The online advice columns are geared to anyone from recent graduates to seasoned professionals.

A networking action plan is continuous and consists of self assessment, setting clear goals, developing contact lists and effectively communicating your goals and desires through writing and informational interviewing.

One of the key ways in which Nicholas School alumni can network with each other is via the Alumni Career Network. This Web-based tool is available to alumni and current students seeking advice about career fields, employment and internship opportunities, and general career assistance. If you’re looking for fellow alums who have moved to your area, you can search by city or state. Alumni working in a particular field or for a certain organization can be found by searching under employer or professional expertise. You also can search for a specific person by name. (And it’s a great way to find old friends.)

Alumni are urged to participate in this voluntary network by completing or updating a survey that asks for information about your job history, professional expertise, and professional affiliations.

For privacy purposes, the network is password protected so that it can be accessed only by members of the Nicholas School community. Contact the Alumni Affairs office or Career Services office if you need assistance with a password.

Networking Advice
www.nicholas.duke.edu/career/current/networking.html

Alumni Career Network
www.nicholas.duke.edu/career/alumni_network.html

Survey for Alumni Career Network
www.nicholas.duke.edu/career/allsurvey

Photos courtesy of Ryan Finnem
In the Shadow of Shackleton’s Hut

Ryan Fimmen PhD’04 has finished a second season of field research on the biogeochemistry of Pony Lake in Antarctica. His work involves collecting and analyzing natural organic matter from the lake, which is adjacent to a penguin rookery and is one of the few locations in the world where the dissolved organic matter does not derive from higher plants. He receives funding from the International Humic Substance Society.

Ryan is a postdoctoral research associate at The Ohio State University, with a joint appointment in the departments of chemistry and geological studies. While at Duke, Ryan studied the organic geochemistry of the South Carolina piedmont with Daniel Richter and Dharni Vasudevan as co-advisors. He and his wife recently had their first child, Liam Ray.

Pony Lake is situated near Cape Royds, where Sir Ernest Shackleton staged his base camp during his 1907–09 bid for the South Pole. Shackleton’s hut still stands today, not far from where Ryan and his associates work during the field season.

One of the highlights of Ryan’s 2006 field season was an encounter with Sen. John McCain (R-Ariz.), who toured the penguin rookery and visited Shackleton’s hut with a group of senators and representatives. Ryan also met up with Jonathan Cohen PhD’04, who was visiting Antarctica as part of the Antarctic Biology Field Course funded by the National Science Foundation. Jon is a postdoctoral researcher at Harbor Branch Oceanographic Institution in Ft. Pierce, Fla.
Mike Mascia PhD’00 left the Environmental Protection Agency in July 2005 to join the Conservation Science Program at World Wildlife Fund–US as a senior program officer/social scientist. He is leading an initiative to strengthen conservation social science research and its application to conservation practice—both at WWF and across the conservation community—through research, technical assistance and coordination of the Society for Conservation Biology’s Social Science Working Group. The MacArthur Foundation gave Mike the initial support for this work through a three–year, $350,000 grant.

Fielding Arnold T’01 has left Reach the World and is now with Thompson Island Outward Bound Education Center in Boston Harbor, Mass., as the marine operations manager (a.k.a. MOM) of the island. She is in charge of the fleet of sail boats, called pulling boats, used on expeditions and coordinating the training of new pulling boat captains. Fielding both works and lives on the island.

Aimee Lunde Maruyama MEM’01 is coauthor of “Planning for Restoration: A Decision Analysis Approach to Prioritization,” a paper published in the September 2005 issue of the journal *Restoration Ecology*.

Leigh Morgan MEM’01 received her JD from the University of Texas in summer 2005.

Maria Calvi MEM’04 is working in Washington state as a restoration ecologist for the Tulalip Tribes Natural Resources. The program’s mission is to carry out the tribes’ co-management responsibilities with the government in a manner consistent with treaty rights as well as protection and perpetuation of the resources upon which the native people have depended for more than 10,000 years.

Elena Arensman MEM’05 writes that things continue to go well as she learns more about the National Park Service and continues to enjoy her job there. She is a business analyst with the Business Management Group in Herndon, Va., hiring and supervising interns to develop business plans for national parks. Elena held one of these internships in summer 2004.

### Learning is a lifelong endeavor at the Nicholas School

The Duke Environmental Leadership (DEL) Program serves as the continuing education arm of the Nicholas School, providing unique opportunities for environmental professionals to hone environmental management skills and stay on top of new developments in the field.
After traveling in Quebec and India, Ilana Moir MEM'05 accepted a Colorado Conservation Fellowship and is now working with the Mesa Land Trust in Western Colorado, in the same county where her parents live. She works on projects including conservation easement transactions, conservation planning and a public finance initiative. She’s enjoying the variety of experiences in her job and has already found some hiking buddies.

Haley Schoenfeld MEM’05 is an environmental analyst II at Research Triangle International (RTI) in Research Triangle Park, N.C. RTI is an independent organization dedicated to conducting innovative, multidisciplinary research that improves the human condition. Universities in North Carolina founded RTI in 1958 as the first scientific organization in and centerpiece of the Research Triangle Park.

What’s your news?

New job? New baby? Professional honor? Recent wedding?

Your classmates want to know! Send your news (and photos) to:

Jeanine Holland
Associate Director of Development for Alumni Affairs and Outreach Programs
Nicholas School of the Environment and Earth Sciences
Duke University • Box 90328 • Durham, NC 27708-0328
Fax: 919-613-8077 • E-mail: jholland@duke.edu

Obituary Notices

Robert Guy Buckner MF’59, on July 15.
Charles Edward Cordell F’64, Ph.D.’76, on Nov. 13.
Andrew R. Biederman T/ML’76, on June 7.
Nicholas School commits to raise $5 million in endowed financial aid funds for professional degree students

by Laura Ertel

As part of Duke University’s recently announced campaign to raise $300 million in endowment funds for financial aid, the Nicholas School has launched an initiative to raise $5 million in fellowship endowments for graduate students in its professional program. Like the universitywide campaign, the Nicholas School’s three-year endeavor was publicly announced in January and runs through December 2008.

A matching gift challenge provided by the Duke Endowment and several individual donors is helping the Nicholas School in its fundraising efforts. The first $2 million raised by the school will be matched dollar for dollar for gifts of $100,000 to $1 million. So a gift of $100,000, with its $100,000 match, will provide the $200,000 needed to establish an unrestricted fellowship endowment. Endowment funds are particularly critical to educational institutions because the invested principal generates income annually to use toward financial aid. And because the principal remains intact, the endowment generates income in perpetuity, providing ongoing, essential support for the school.

The Nicholas School’s campaign focuses solely on raising endowed funds to support students in the Master of Environment Management and Master of Forestry program. Since undergraduate students who major in environmental studies at the Nicholas School actually receive their degrees from Trinity College or the Pratt School of Engineering, these students receive financial assistance through the university’s Undergraduate Financial Aid Office.

**Funds greatly needed**

Of the nearly $1 million in financial aid that the Nicholas School currently provides for graduate students each year, less than 15 percent comes from endowed funds dedicated to the financial needs of students, notes Susan Berndt, former associate dean for external affairs who helped launch the campaign and ensure its early success. She is currently regional major gifts director for the university.

"The other 85 percent of those financial aid funds have to come from the school’s overall budget: from non-financial aid endowments, annual fund contributions and other sources,” she explains. "By building our financial aid endowment significantly, we can free up those other funds to use toward programs, student field trips, special visitors and other initiatives that enhance the quality of education the school offers."

For many students, a financial aid package makes the difference between being able to attend the Nicholas School and having to go elsewhere. Building financial aid endowment is essential for the school to be able to compete for the best and brightest students.

Douglass F. Rohrman, former chair of the Nicholas School Board of Visitors, is the school’s representative on the Duke Financial Aid Initiative Development Committee. Rohrman, an attorney in Chicago, says the campaign is making good progress.

“The Nicholas School’s pride and joy is its graduate program, and it is absolutely essential that we have enough funds to assist all students who need financial aid to get a master’s degree here. There isn’t a better cause to contribute to at the university than to support financial aid for students of the environment, because there is no area that is more critical to the future of the world than solving environmental problems. The people committed to solving those problems come from a wide variety of backgrounds and abilities to pay, so it is essential for us to make that financial aid support available to them.”
Tallying the costs
Graduate tuition at the Nicholas School now stands at $24,300. Add other expenses, and it costs roughly $40,000 a year for two years to earn a master’s degree at the school. With a few exceptions, the largest financial aid award the Nicholas School can currently afford to offer is $12,000—less than half the cost of tuition. More than 80 percent of the professional degree students get some amount of merit-based assistance. Many students also sign up for federal Stafford or Perkins loans, which could cover another $21,500 to $24,500 at best. Work-study opportunities can help cover slightly more.

“At these levels, even a student who gets the maximum financial aid award from us and the maximum federal loans will still have a gap of $4,000 a year that has to come from somewhere—and most students have a bigger gap,” Assistant Dean for Enrollment Services Cynthia Peters explains. “Students either have to have some resource in their family or get a private loan. Add to this the fact that, while these students will go on to fulfilling careers, they are not generally careers with high salaries, so the prospect of carrying a debt can be daunting.”

Reducing debt gives students more options
Joe Scarfo, assistant director for enrollment services, has worked with students to plan how they are going to underwrite the cost of their professional education. “Our students are willing to take on the additional debt incurred by coming to Duke for their graduate education because they value the education they receive here. They are willing to make that investment in their professional futures, and no one has ever told us they regretted their decision.”

But last year, one in four students who declined the Nicholas School’s offer of admission said they did so for financial reasons. Scarfo adds, “Even though many of the students who come to Duke walk away with a significant debt burden in addition to their degrees, they are willing to do so because of the professional potential their degree brings them. Unfortunately, we do lose very good students who make educational decisions based on financial aid. We’d like to be able to take that factor out of the equation so students could just look at where they can get the best education.”

“At the Nicholas School in particular, we have not always been on an even footing with other schools in terms of what we can offer financially to prospective students,” adds Berndt. “This campaign will help us balance the playing field. We certainly still have an edge in being Duke University, but we want to make sure that the best and brightest future environmentalists do not turn away from Duke because of financial restrictions.”

The success of this $5 million campaign will enable the Nicholas School to increase the dollar amount of the financial aid awards.

“The more the school can offset the cost of attending, the more attractive we become,” says Peters. “The good news is that students who commit to coming to the Nicholas School are definitely committed to improving and taking care of the environment. When you make a gift to create a fellowship endowment, you are supporting a person who will make a difference in the future of our environment, and in the lives of our children and grandchildren. And because endowments provide ongoing support, it won’t just be one person—it will be a succession of talented people who are dedicated to making the world better.”

Laura Ertel is a freelance writer based in Durham, N.C.
Kerry Williams will graduate from the Nicholas School’s Master of Environmental Management program in the environmental health and security track this May. Back when she was looking at graduate schools, she checked out both environment and public health schools that offered environmental health concentrations. Out of all those schools, the Nicholas School was the only one to offer her a financial aid package.

“The Nicholas School was a great choice for me, because Duke has a wide range of resources available to its students, through not only the Nicholas School, but also the other graduate schools on campus. I was even able to take classes at the UNC School of Public Health and through inter-institutional enrollment. The Children’s Environmental Health Initiative here at the Nicholas School also made Duke attractive since its research corresponds to my career interests. Those things, coupled with the fact that they had offered me some money, were key in determining what school to choose. The aid helped take some of the financial pressure off me so I could focus more on my studies than on finding extra jobs to help pay off some of my loans.”

For Williams, a Fairfax, Va., native who made it through her undergraduate studies at James Madison University without loans, the Stafford loans she took out to make her graduate studies possible comprise her first debt. As she explores post-graduation career options in the field of children’s environmental health, she has vowed not to take money into account in looking for a job. “I’m looking for something that strikes my interest and not putting money as the first issue in what kind of job I take.”

The financial aid award Williams is receiving from the Nicholas School has come from the Muchnic Foundation Fellowship Endowment. In 1993, Dr. Anne Brownson Mize, a Duke University graduate who is a program officer for her family’s foundation, convinced her family to endow a fellowship at the Nicholas School.

“Over the years, I have become an environmentalist as my avocation,” says the psychologist. “I am on the board of the African Wildlife Foundation and I do a lot of work in Africa. I was thrilled when the Nicholas School was established at Duke, and I am delighted at the incredible environmental research that the school has been doing all these years, particularly regarding issues that, for me, are so critical: marine and coastal degradation, sustainable energy and global warming.”

The Muchnic Foundation contributes to the fellowship endowment each year. Mize, who has worked with staff from a variety of environmental organizations all over the world, hopes that the fellowship “will add to that pool of educated, committed, wise environmental activists, researchers and conservationists. Whatever role you play in preserving the planet, the more hard science you have to support your work, the more effective you will be.”

Second-year MEM student Bronwyn Llewellyn will graduate in May with a concentration in conservation science and policy. She is receiving financial aid through the Nancy A. and Simon B. Rich Fellowship Endowment.
For Llewellyn, who was deciding whether to go to graduate school directly from Mount Holyoke College or whether to go into the working world for a few years, the Nicholas School’s offer of financial aid was a big draw.

“I really didn’t want to have to take on any unsubsidized loans. I did have to take out all the government loans I could, including the maximum amount of the Stafford loans. But with the fellowship and the government loans, basically everything with school is covered. It’s nice to not worry about that while I’m in school.”

As part of her financial aid package, Llewellyn was awarded an assistantship working with the school’s Office of External Affairs. “That provided money for living expenses, which makes a huge difference for me.”

Thanks to her parents, Llewellyn is debt-free from her undergraduate days. Still, when she graduates from the Nicholas School this spring, she’ll have debt from the Stafford loans to repay. Ultimately, Llewellyn plans to pursue a career in international conservation, working with a nongovernmental agency like World Wildlife Fund or a government organization like the U.S. Agency for International Development (USAID). The path to that career may wind through a PhD program in ecology at Duke.

Wherever that path leads, Llewellyn appreciates the opportunities the fellowship provides. “It opens a lot of doors and makes me more comfortable choosing this path. My first job, whether I have a PhD or go straight out of the MEM, I’ll be lucky if I make $40,000 a year to start. Eventually I could be making more, but since I want to work with NGOs, I’m certainly not going to make a lot. And it’s difficult to pay off $100,000 in debt on that salary—I’d be paying it off for the rest of my life! So I will have debt, but I’m freer to take jobs that I want.”

The fellowship that Llewellyn is receiving was established by Simon “Cy” Rich Jr. and his wife, Nancy, in 2000. The Riches have had a close connection with the Nicholas School for many years. Mr. Rich, a Trinity College alumnus, is chair of the Nicholas School Board of Visitors, and since 2002, he has been teaching at the school courses in energy and its relationship to the environment.

“Financial aid is probably the most pressing need for graduate students,” he says. “Most are going to graduate with a large debt. And because careers in environmental fields don’t generally pay well, they will have relatively low starting salaries. Yet, their expertise and passion is needed if we’re going to change the way we’re operating our world.”

Rich notes that, with the matching funds that are currently available through the Duke Financial Aid Initiative, a unique opportunity exists right now to meet Duke’s most pressing need. “Capable people, no matter what their economic situation is, should be able to get the education that Duke affords. We will all be better off if they can. If Duke can continue to admit people based on their abilities, rather than their ability to pay, it will be a benefit to all of us.”

Laura Ertel is a freelance writer based in Durham, N.C.

With Sincere Gratitude…

Already distinguished for their philanthropy to Duke University and many other worthy causes, these friends of the Nicholas School have stepped forward again and made leadership gifts to kick off the Nicholas School Financial Aid initiative campaign. The students, faculty and administration of the Nicholas School extend their deepest thanks to these individuals who have set a wonderful example of generosity. We ask our alumni and friends to join them in supporting this important Initiative that will have a lasting impact on the school and on our world.

Marshall Field V P’02 and Jamee J. Field P’02 of Chicago, Ill. with a gift of $400,000 and a Financial Aid Initiative match of $400,000

Truman T. Semans Sr. P’90, P’91 and Nellie M. Semans P’90, P’91 of Baltimore, Md., with a gift of $400,000 and a Financial Aid Initiative match of $400,000

F. Daniel Gabel Jr. T’60, P’02 and Margaret Ann (Bunny) Gabel W’60, P’02 of New York, N.Y., with a gift of $100,000 and a Financial Aid Initiative match of $100,000

Paul O’Connell of the Thoresen Foundation of Beech Mountain, N.C., with a gift of $100,000 and a Financial Aid Initiative match of $100,000

The Financial Aid Initiative began in December 2005 with the Nicholas School goal of $5 million. To date, we have a commitment of $2 million. For more information or to establish an endowment, contact the Office of External Affairs at 919-613-8003.
Couple Gives Record Annual Fund Gift

The Nicholas School Annual Fund received the largest gift in its history this fiscal year. Brad Stanback and Shelli Lodge-Stanback of Canton, N.C., have made a $100,000 contribution.

The Stanback family is well known in North Carolina for its commitment to the state’s environment, and Brad Stanback has continued that legacy. After graduating from Duke in 1981 with a bachelor of arts in economics, he received his master’s of business administration from New York University and now devotes his time and resources to those organizations he believed would most benefit the people and environment of North Carolina.

Stanback is on the Southern Environmental Law Center president’s council and the American Chestnut Foundation’s board of directors, and is a member of the North Carolina Sustainable Energy Association. An American chestnut grower under TACF’s program to re-establish the species, he is involved in wildlands conservation and ecological restoration, primarily in the southern Appalachian region.

Nicholas School Annual Fund contributions help provide financial aid for students, upgrades to educational technology and laboratory equipment, and support for educational enhancements such as student research, visiting lecturers and field trips. To find out more, contact Krista Bofill, Nicholas School Office of External Affairs, 919-613-8003 or k.bofill@duke.edu.

New Endowment Donor Wall Established in Nicholas School

Have you seen the new Nicholas School Endowment Donor Wall located in Levine Science Research Center’s Hug Commons on the Duke campus?

Established in the fall, the wall offers the school an opportunity to thank those endowment donors whose generosity has provided funds that generate a dependable income stream and ensure the continued excellence of our programs and initiatives. Students, faculty, staff, and visitors can read the names of endowments and their donors.

“The Donor Wall also can encourage new donors who see the names of people they know—friends or peers—to realize they want to make a gift that matters, said Krista Bofill, interim director of Development and External Affairs.

“And, very simply, it reminds people that we need the financial support of alumni and friends. Philanthropy is vital for our students, for our faculty and for the school.”

Explorers Travel to West Virginia for Fossil Field Trip

As part of the Nicholas School’s annual recognition program for its Explorers Gift Club ($1,000+ donors), the Annual Fund and Alumni Affairs staff organized a special adventure Oct. 21-23 to examine the formation and evolution of the Appalachian Mountains.

Led by Bruce H. Corliss, professor of Earth and Ocean Sciences, the group traveled to West Virginia in search of 475-million-year-old trilobites. They also visited the Lost World Caverns to experience spectacular stalagmites and stalactites. The group ended their excursion at Gibson’s of the Greenbrier, a fossil and rock shop that offers the finest in natural fossil art.
save the date

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

April 21-22
9 a.m.
Nicholas School Alumni Council Meeting
Levine Science Research Center (LSRC), Durham
Contact: Jeanine Holland
919-613-8039 or jholland@duke.edu

April 22
Field Day—Alumni Reunion Weekend and Duke Forest 75th Anniversary Kickoff Celebration
Troy Couch Farm Site, Duke Forest
Contact: Jeanine Holland
919-613-8039 or jholland@duke.edu

April 26
Time: TBA
Wetland Restoration Dedication Ceremony
Duke Forest on Cameron Boulevard
(next to Washington Duke Inn and Golf Club)
Contact: Nancy Kelly
919-613-8090 or nkelly@duke.edu

April 27-28
MP Symposium
CEM candidate masters presentations
Duke Marine Lab, Beaufort
Contact: Gail Cannon
252-504-7605 or gcannon@duke.edu

April 28-29
Marine Lab Advisory Board Meeting
Duke Marine Lab, Beaufort
Contact: Jeanine Holland
919-613-8039 or jholland@duke.edu

The Nicholas Experience at the Duke Marine Lab
Duke Marine Lab, Beaufort
Contact: Jeanine Holland
919-613-8039 or jholland@duke.edu

May 10-13
Duke Environmental Leadership Program—MEM Graduation
LSRC
Contact: del@nicholas.duke.edu

May 13
9 a.m.
Nicholas School Recognition Ceremony for graduating graduate and professional degree candidates
Guest Speaker: Eileen Clausen, president, Pew Center on Global Climate Change
LSRC courtyard, Durham
Contact: Erika Lovelace
919-613-8070 or admissions@nicholas.duke.edu

May 14
10 a.m.
Duke University Commencement Exercises
Wallace Wade Stadium
Duke University
Contact: Erika Lovelace
919-613-8070 or admissions@nicholas.duke.edu

May 23-26
American Geophysical Union 2006 Joint Assembly
Baltimore Convention Center
Baltimore, Md.
Contact: AGU
1-800-966-2481, ext. 333 or ja-help@agu.org

Aug. 6-11
91th Annual Meeting of the Ecological Society of America (ESA)
Cook Convention Center
Memphis, Tenn.
Contact: Program Assistant Devon Rothschild
202-833-8773 x 218 or devon@esa.org
celebrating 75 years

Dukenvironment Fall 2006 will take a look at Duke Forest as it observes its anniversary.

For details, check out the Forest’s new Web site at www.dukeforest.duke.edu