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by Tim Lucas

A landlocked reservoir in Utah’s southern desert may seem an unlikely place for oceanography research. But here, amid sagebrush and tumbleweeds, Lincoln Pratson is working to shed new light on one of the deep sea’s murkiest processes.

Pratson is associate professor of sedimentary geology in the Nicholas School’s Division of Earth and Ocean Sciences. This May, he’ll return to the arid environment of Utah’s Glen Canyon National Recreation Area for his third research expedition in five years to map the floor of Lake Powell, a beautiful but incongruous 186-mile stretch of blue-green water amid the region’s sun-bleached sands and red rock canyons.

His study of sediment buildup on the manmade lake’s bottom is adding new insights to scientists’ understanding of similar forces shaping the ocean’s floor in the murky depths beneath 3,000 meters, and it may aid oil companies’ search for new hydrocarbon deposits located there.

His work has implications here on land, too. Preliminary results from Pratson’s surveys of Lake Powell suggest it is now filling with sediment more quickly than in the past. This finding could add new fuel to the debate about development in the drought-prone Southwest—where a rapidly growing population is largely dependent on the holding capacity of reservoirs like Lake Powell for its water supply.

“An oceanographer in the desert is about as incongruous as Lake Powell itself,” he says with a grin, as he shows a visitor a photo of his research team untangling waterlogged tumbleweeds from their sonar device. “But sometimes, answers are found in unexpected places.”

Pratson, a calm, affable man with a love of the outdoors, has spent the past 20 years searching for them.

He received his PhD in geology from Columbia University in 1993, and continued his research in marine geology at Columbia’s Lamont-Doherty Earth Observatory before moving in 1996 to the University of Colorado. Two years later he joined the Nicholas School faculty. Since 2004, he also has served as head of the School’s certificate program in Energy and Environment.

His study of the dynamics of marine sedimentation—how mud, sand and other sediment are transported and formed into strata on the ocean’s floor—has taken him to far-flung conferences and research sites, from the Mediterranean to Minnesota, and from northern California to the southern oceans off New Zealand.
In recent years, he’s become especially interested in the role turbidity currents play in the sediment transport process.

Turbidity currents—so called because of their turbid and turbulent nature—are underwater avalanches that can occur without warning in nearly all parts of the world’s oceans and many inland waterways.

At the large end of their scale, they can move across the sea floor at speeds exceeding 20 miles per hour and push thousands, or even millions, of tons of mud, sand and gravel off the continental shelf and down the continental slope into the deep abyss, more than 3,000 meters beneath the ocean surface.

Sudden, violent events like earthquakes, volcanic activity and coastal landslides have all been known to trigger turbidity currents. But the currents also can have less dramatic causes, like the gradual buildup of excess sediment at the edge of the continental shelf.

Scientists believe these powerful currents have been one of the most important forces shaping and reshaping the seafloor.

Studying them in the ocean environment, however, can be tricky.

"Turbidity currents are very hard to observe,” Pratson says, "because they’re episodic in nature.”

Despite years of research, scientists still can’t predict with certainty where or when a turbidity current will occur, except in the relatively rare case when scientists know that a flooding river carries a concentration of suspended sediment that exceeds the concentration of sediment suspended in the basin into which it flows. Nor can scientists yet predict how big a current will be, how fast it will move, or where it will eventually deposit its sediment. Unless a research vessel or moored instrument happens to be in the right place at the right time, the best researchers can do is collect sediment samples from the seafloor after the event has occurred.

These samples provide a snapshot of what’s happened at the site, but their usefulness is limited by variables beyond researchers’ control, Pratson says.

"It’s difficult to discern how much of the sediment you’ve collected from the ocean floor comes from turbidity currents and how much comes from other events in the marine environment,” he explains.

To reduce variables, scientists can simulate small-scale turbidity currents in the controlled environment of the laboratory using a special tank of water called a flume tank. But the clearest picture, Pratson says, comes from observing and tracking natural-scale turbidity currents and the sediment strata they form in the field.

And that’s what brings him to Lake Powell. The lake, a ribbon of flat, blue water woven through a moonlike landscape of eroded mesas and jagged rock spires, was created in 1964 when the controversial Glen Canyon Dam was constructed on the Colorado River, just south of the Utah-Arizona state line.

Located about 15 miles upstream from Glen Canyon’s more famous neighbor, the Grand Canyon, the new dam was built to provide a fixed supply of water to towns and
farms downstream, and to regulate the flow of the erratic Colorado, whose raging spring flow often slowed to a barely ankle-high trickle by summer.

Fed by the upper Colorado and the San Juan rivers, Lake Powell gradually submerged the entire length of Glen Canyon north of the dam, as well as more than 50 side canyons.

With a mean depth of 132 feet and a maximum depth of 560 feet, the lake at full capacity could hold more than 21.5 million acre-feet of water, experts estimate, enough to meet the water needs of the rain-starved region for about three years.

Over time, however, sediment from the muddy waters of the Colorado and San Juan began to fill in the bottom of the lake.

Both rivers, Pratson says, carry unusually high volumes of suspended sediment. Near where the San Juan enters Lake Powell, he’s collected samples showing it contains more than 10 percent sediment by volume. By comparison, he says, wet concrete is only about 30 percent sediment.

“The mud and sand that used to flow downriver into the Grand Canyon, where it renourished beaches and sandbars on the canyon floor, is getting trapped in Lake Powell,” Pratson says. “The water flowing into the lake is brown. The water being discharged out of it is clear and cold.”

These conditions, coupled with the lack of marine events and phenomena to muddy the issue, make Lake Powell an ideal setting for studying the dynamics of turbidity currents.

“When the Colorado and San Juan rivers enter the lake, the density of their water is many times greater than that of the lake water, so it plunges and creates a turbidity current down the bottom slope,” Pratson says. “It’s a manmade but natural-scale laboratory where complications can be minimized and conditions like water level and sediment input are well known. I can make observations here that I can’t do in a flume tank or the ocean.”

To document changes on the lake bottom caused by turbidity currents, Pratson spent five days last May mapping the lake floor, assisted by Nicholas School doctoral student Thomas Gerber and National Park Service aquatic ecologist Mark Anderson.

They mapped the lake by day, doing their best to steer clear of the lake’s two chief dangers: submerged rocks and tourists’ houseboats. Lake Powell attracts more than two million visitors a year, many of whom tour the lake aboard rented houseboats.

“Since it was May, we didn’t see as many houseboats, jet skis and speedboats as we would have seen in summer,” Pratson says. “It could get busy at times, but we had some parts of the lake virtually to ourselves.”

At night, they would beach their boat and set up camp on the lake’s desolate shore, dwarfed by the eroded rock formations and towering canyon walls that ring Lake Powell. “It’s so remote there—at night you don’t hear a sound, you don’t see a light,” he recalls. “It’s just you and the stars. The feeling of solitude is incredible.”

A 32-foot metal-hulled National Park Service boat served as their research platform. Its shallow draft allowed them to enter twisting side canyons and other waters where boats with deeper drafts would have been grounded—an important practical consideration following six years of drought that has dropped the lake’s water level 117 feet.

“On the canyon walls you can see a clearly delineated white line about 117 feet high, marking where the water level used to be. It’s like a giant bathtub ring,” Pratson says. “When a houseboat passes by and you see how small it looks compared to the height of the watermark, you realize the scope of the drought’s impact.”

To map the lake’s floor and analyze its sediment strata, the team used a newly acquired chirp acoustic sonar profiler, purchased with support from the U.S. Office of Naval Research, the National Science Foundation and the Nicholas School.

Housed in a four-foot-long, 400-pound yellow plastic body, the $500,000 piece of high-tech hardware was lowered in and out of the water “very carefully” using a chain winch, Pratson says.

“We were a little nervous at first that it would hit the side of the boat or smack a submerged rock and be damaged its first time out,” he says. “But the only run-ins it had were with waterlogged tumbleweeds that kept getting tangled in it. That’s one of the unusual aspects of using oceanographic equipment in a desert environment.”

Freed of its tumbleweeds and towed behind the boat at a depth of about 10 feet, the profiler performed perfectly. It collected two types of data: sidescan sonar images that could be pieced together to map the lake bottom, and sub-bottom reflection profiles that provided acoustically derived cross-sections of the stacking patterns of sediment strata found there. These cross-sections allowed the scientists to determine the type of sediment and its thickness.
Pratson and Gerber are now analyzing data from their survey and comparing it to data from past geological surveys made before the Glen Canyon Dam was constructed and about once a decade following its completion. (Pratson himself conducted one of these surveys—covering the lake’s Colorado River arm, or about half its total area—in 2001.)

By comparing the data, they can document changes that have occurred over the years on the lake bottom as a result of turbidity currents, and get a better idea of the rate at which Lake Powell is filling in.

“The rate of infill determines the reservoir’s useful lifespan,” Pratson explains. With the drought lowering the lake’s water level at the same time sediment is filling in the lake floor, “Lake Powell is being squeezed from both top and bottom,” he says.

A 1986 survey, headed by scientists from the Bureau of Reclamation, estimated the reservoir had 100 years of useful life left if the rate of infill remained the same. Preliminary findings from Pratson’s team’s May 2004 survey, however, suggest that the rapidly dropping water levels caused by the drought may be exacerbating erosion in the lake’s deltas and causing more sediment than in past years to be carried into the lake.

The bottom slopes of the eroded deltas have grown so steep that turbidity currents can now quickly build up the speed, volume and velocity they need to carry sediment, and any contaminants the sediment may contain, farther and farther into the lake.

“There are contaminants that have been introduced into the Colorado arm of the lake and we’re watching to see if sediment transfer carries them farther downstream, where they could more broadly affect the lake’s ecosystem.” Pratson notes.

He can’t yet pinpoint how far down the lake turbidity currents have reached, in part because the underwater canyon walls are so steep in places that they interfere with accurate sonar measurements. But data from the 2004 survey is providing some interesting insights.

“Near the Rincon area of the lake, about midway down its length, we found evidence that some turbidity currents were still so strong they could climb up and over a pile of rockslide debris 25 meters high. That,” Pratson says excitedly, “was very unexpected.”

This May, Pratson and Gerber will return to the lake to pick up where they left off. They hope to publish their findings in the near future.

Dave Twichell, an oceanographer with the U.S. Geological Survey at Woods Hole, predicts they’ll find an eager audience for their publications.

“Many deep-sea hydrocarbon reservoirs originated as thick sand deposits from turbidity currents, so learning how they form is of great interest to the oil industry,” Twichell says. “Because of the work Lincoln and his students are doing mapping Lake Powell’s floor, we have the opportunity to understand the link between the processes of turbidity current sedimentation and the deposits that result from these flows.”

Pratson knows his data from Lake Powell will likely also generate interest outside the scientific community, among conservationists, urban planners and policy makers throughout the Southwest.

“It’s possible there’s been a fundamental shift in where sediment’s been accumulating in the lake. If it’s being distributed over a longer distance, that could have implications for communities and industries across the region,” he says. “The usability of the lake for recreation, the hydroelectric generating capacity of its dam, and the lake’s useful lifespan as a ‘water bank’ for the region could ultimately be affected, though to what degree presently remains unclear.”

Tim Lucas is the Nicholas School’s national media relations and marketing specialist.

Lincoln Pratson’s Bio: www.nicholas.duke.edu/people/faculty/pratson.html
Glen Canyon National Recreation Area: www.nps.gov/glca/index.htm

Tim Lucas is the Nicholas School’s national media relations and marketing specialist.
Duke University has named Timothy Profeta, counsel for the environment to U.S. Sen. Joseph Lieberman, as the first director of its new Nicholas Institute for Environmental Policy Solutions, President Richard H. Brodhead has announced.

Officials said they envision that the Nicholas Institute will have a global reach and will marshal the broad resources of the university to assist in setting a national environmental agenda.

"Tim Profeta represents the environmental leaders of the future," Brodhead said. "He is experienced, enthusiastic and savvy about science policy and the political arena, and strategic in thinking about how Duke can best work with others to forge a positive environmental agenda for our nation. He will be a strong leader for this important new institute."

As Lieberman’s counsel, Profeta was a principal architect of the Lieberman-McCain Climate Stewardship Act in 2003. He is credited with helping to build the coalition of support and coordinating a political and media campaign to promote the act’s passage. Profeta oversaw all activities of the Senate Subcommittee on Clean Air, Wetlands and Climate Change during Lieberman’s term as chair in the 107th Congress. He has represented Lieberman in legislative negotiations pertaining to environmental and energy issues. He also coordinated the senator’s energy and environmental portfolio during his runs for national office.

"By the end of the decade, I want the Nicholas Institute to be on the ‘first-call-made list’ by a wide range of groups interested in environmental issues," Profeta said. "It should be a resource for businesses seeking to craft strategies to address environmental problems, policymakers seeking to draft effective solutions, advocates seeking credible insight into environmental challenges, and reporters and the public seeking objective analysis."

Profeta, who will start his new job June 1, received his bachelor of arts degree in political science from Yale University in 1992, and earned a Master of Environmental Management degree at Duke’s Nicholas School of the Environment and Earth Sciences concurrently with a J.D. in the Duke Law School in 1997. At Duke, he was editor-in-chief of the Duke Environmental Law & Policy Forum and the recipient of both the Cummings Fellowship in Environmental Law and the 1996 Nicholas School Alumni Fellowship.

Profeta also has served as a visiting lecturer at Duke Law School, where he taught a weekly seminar on the evolution of environmental law and on the Endangered Species Act. Before joining Lieberman’s staff, he was a law clerk for Judge Paul L. Friedman, U.S. District Court for the District of Columbia. He has been a member of the New York Bar since July 1998.

Brodhead said the university is planning to build Nicholas Hall, a free-standing new “green” building on West Campus that will house the school, the Nicholas Institute and all related centers, programs and faculty that address environmental issues at Duke.

The Nicholas Institute will be the only environmental policy institute of its kind with a resident faculty, said William Schlesinger, dean of the Nicholas School, of which the institute will be a part. The institute will forecast important environmental problems and recommend effective policy based on unbiased data and careful analyses of issues.

"This is an exciting time for the Nicholas School, and we welcome back one of our most distinguished graduates to help us offer the best science and policy that academia can provide at a critical time for the environment, and for decision makers in corporations, government and nonprofits,” Schlesinger said. “With Tim Profeta at the helm of this new institute, we are poised to supply what is needed.”
A three-day environmental summit on the Duke campus Sept. 20-22 will launch the Nicholas Institute, introduce Profeta to the campus community and others, and provide an opportunity for participants to focus on current environmental issues.

Officials said the summit will showcase how the institute will work with partners from business, government and nonprofits to develop results-driven environmental plans.

The institute is made possible through a gift from Duke Board of Trustees Chairman Pete and Ginny Nicholas of Boston, who gave the school that bears their name $70 million in December 2003 to push ahead with the new institute and other activities for Duke to assume environmental leadership and achieve worldwide impact.

Check out Nicholas Institute Web site is at www.nicholas.duke.edu/institute

Duke Provost Peter Lange, the university’s chief academic officer:

“

At Duke we have long recognized that environmental studies demand interdisciplinary approaches, and the Nicholas School has led in developing cooperative research and programs across the university. A hallmark of the new institute will be to expand this approach well beyond the boundaries of the university. Tim Profeta already has embraced this approach in his career and shown considerable talent for bringing together a variety of partners to solve multifaceted issues.”

Law and environmental policy professor Jonathan B. Wiener, who chaired the search committee for the Nicholas Institute director:

“Tim Profeta launched his career as an outstanding student of environmental law and science here at Duke a decade ago—in fact, he was my first research assistant. Tim has now rocketed to the frontiers of environmental policymaking in Washington, where he has deftly led the ambitious and highly complex campaign to harness markets for global environmental protection. Tim will be a stellar leader of the Nicholas Institute’s mission to craft creative solutions to complex environmental problems.”

U.S. Sen. Joseph Lieberman, D-Conn:

“Tim has shown an innate and uncanny ability to translate a rough concept into a mature and sophisticated policy proposal. There is no better example of that than his consistent and creative leadership over the years in championing the Climate Stewardship Act—a massive intellectual, legislative and political undertaking to address the most critical, overarching environmental challenge of our times. I am supremely confident that Tim has the abilities, the energy and the commitment to turn the Nicholas Institute’s exciting vision for environmental leadership into a reality.”

Nicholas Institute benefactor and chairman of the Duke University Board of Trustees Peter Nicholas:

“I am very pleased that Tim Profeta and Bill Reilly will be in the key leadership positions at the Nicholas Institute. The institute is envisioned by Duke leaders to extend its reach from Durham, N.C., to Durham, England, and indeed across the globe, bringing together foundations, research institutions, governments, NGOs, corporations and other groups to improve our understanding of the great global environmental challenges. It’s an extraordinarily ambitious and exciting agenda, but one that is much needed if we are to find policy solutions to the environmental challenges facing our world.”

Former EPA Head to Serve as Institute’s Senior Adviser

Duke President Richard Brodhead also announced that William K. Reilly, U.S. Environmental Protection Agency administrator under 41st President George H.W. Bush and currently president and CEO of Aqua International Partners, has agreed to serve as senior adviser and chair of the board of advisers for the Nicholas Institute. Reilly also chairs the World Wildlife Fund board and is a trustee of the National Geographic Society and The Packard Foundation, among other positions.

Brodhead said the Nicholas Institute Board will be created to bring leaders and experts from industry, government, foundations, non-governmental organizations and other groups from across the globe to help its policy, research, outreach and advocacy missions.

“Bill Reilly is recognized as one of the best-informed and most creative leaders associated with environmental issues,” Brodhead said. “His career has been aimed at identifying environmental solutions. He will be a strong chair of the Nicholas Institute board and, with Tim Profeta, gives the institute unparalleled leadership.”

Said Reilly, “At a time of planetwide environmental transformation, the Nicholas Institute will not lament the problems but will hone in on solutions. And I look forward to helping it find them.”

Additional comments about Tim Profeta becoming the first director of the new Nicholas Institute for Environmental Policy Solutions at Duke:
A new Nicholas School-led initiative to assess the global impact of fisheries bycatch on declining populations of seabirds, sea turtles and marine mammals has received a $3 million grant from the Gordon and Betty Moore Foundation.

“This grant makes it possible for us to work on a scale never previously possible to develop effective international management measures and conservation efforts for these protected species,” said Larry B. Crowder, Stephen Toth Professor of Marine Biology.

Crowder, who also serves as director of the new Duke Center for Marine Conservation, is principal investigator on the fisheries bycatch project.

The project’s ambitious first objective is to develop a global database of declines in seabirds, sea turtles and marine mammals, and the impact fisheries bycatch may have on them.

When completed, it will be the most comprehensive database of its kind, Crowder said.

“Past assessments have focused on specific regions, species or fisheries. That’s valuable information, but it’s piecemeal,” he explained. “We need the global perspective to help us achieve our second objective: working with major fishing nations, fishing commissions and conservation groups worldwide to develop a rational approach to management of these multinational resources.”

Nicholas School researchers who serve as co-principal investigators on the project are Andrew J. Read, Rachel Carson Associate Professor of Marine Conservation Biology;

Patrick N. Halpin, assistant professor of the practice of landscape ecology; and Rebecca Lewison, research associate at the Duke Center for Marine Conservation.

Carl Safina, cofounder and president of the Blue Ocean Institute of Cold Springs Harbor, N.Y., and Wallace J. Nichols MEM ‘92, Pacific Ocean Region director for Blue Ocean, are also co-principal investigators.

The Duke Center for Marine Conservation was established this year to promote interdisciplinary research, education and outreach in marine conservation, and to facilitate collaborations between Nicholas School faculty and the larger research community.

The Moore Foundation was established in 2000 to develop outcome-based projects that will improve the quality of life for future generations. It awards grants in four main areas of programmatic interest: environmental conservation, science, higher education and projects that benefit the San Francisco Bay area. The foundation’s headquarters are in San Francisco.
For the past 20 years, Nicholas School geology professor Peter Malin had waited for a moderate earthquake along the San Andreas fault in the vicinity of Parkfield, Calif. This village bills itself as the “earthquake capitol of the world.” Through much effort, his seismology group had seven seismometers ready at a ringside seat about 3,000 feet underground when a magnitude 6 temblor finally hit Sept. 28, 2004.

The members of Malin’s laboratory had pre-positioned those recording instruments within the first leg of the ambitious San Andreas Fault Observatory at Depth (SAFOD) project near Parkfield. SAFOD’s goal is to drill an angled shaft into the notorious fault to create an unprecedented underground observation site for earthquakes.

As the Duke group’s seismographs began reacting to the quake, Malin’s senior graduate student Tom Taylor was on station in an instrument hut beside SAFOD’s initial pilot hole. Taylor jumped as he felt the first jolt, which was followed by a string of thumping aftershocks, some nearer and others farther away. What one of the Duke group’s instruments recorded later was converted into an audio record for Web browsers called “The Sounds of the Parkfield Earthquake” at www.cisn.org/special/evt.04.09.28/sounds.html. All of this was very good news, recalls Malin in an interview at his office in the Nicholas School’s Division of Earth and Ocean Sciences. But there was one bit of very bad luck, and several surprises too.

The biggest surprise was that the break in the fault line started from the opposite direction than scientists had expected. Experts thought that the fault would crack from the north of Parkfield, with the slip moving to the south. That was the pattern followed by predecessor magnitude 6 quakes in 1966, 1934 and 1922. Instead, this one began where those previous episodes ended, and then moved north from an underground locus about 20 kilometers to the south of Parkfield.

Geologists later pinpointed that kick-off point as near and below the place where actor James Dean died in 1955 in a sports car crash, noted California native Malin. In fact, the quake occurred just two days before the 49th anniversary of Dean’s death.

The San Andreas fault has spawned some exceptionally powerful earthquakes in the past—the great 1906 San Francisco temblor being the most famous example. However the magnitude 6 events at Parkfield were interesting not for their power but rather for their apparent repeatability—supposedly once every 22 years or so.

This regularity caused Malin and other scientists to heavily wire the area with instruments, and the federal government to commit several millions of dollars to begin SAFOD. But last September’s magnitude 6 fell 16 years late, which “makes the idea of a 20- to 30-year Parkfield earthquake cycle less meaningful,” he acknowledges. “It shows you can use statistics from just a few data points to prove anything.”

Malin’s bad luck was a drilling mishap three months before the quake that destroyed a large fraction of the Duke group’s original complement of seismographs. “That cut out 25 of the 32 sensors,” Malin says. “We went from a total of 96 channels of information down to 21 channels.”

Each seismograph was designed with separate channels for the three directions of motion: up-down, left-right and back and forth, he explains. The deepest ones, roughly 7,000 feet underground, were lost and with them opportunity to listen even more closely to the September events.

Prior to that accident former Malin graduate student Andres Chavarria got his doctoral degree doing research at SAFOD with the full array of instruments. Chavarria used the Duke network as the equivalent of a three-dimensional ultrasound probe to trace out some of the fault zone’s underground features.

Work like that will no longer be possible with the diminished network. “It’s time to move on to something more,” says Malin.

Malin actually was in Australia designing devices for the next leg of SAFOD when he learned that disaster had struck. He and research instrument maker Michael Gladwin are crafting a seismometer that also can detect strains and tilt changes in surrounding rocks.

“We’re trying to move in now to understand earthquake sources in more detail,” he says. “One of the more interesting things to look at is how the ground is being distorted.”

They hope to make new instruments durable enough to work reliably under the extreme conditions expected at the 3.2 kilometer depths of the completed SAFOD observatory.

As a first step, his group will evaluate a prototype at the bottom of the 7,100 foot pilot hole, where temperatures reach 240 degrees Fahrenheit and pressures increase to 300 atmospheres. This work is planned for the summer of 2005, when SAFOD drilling toward the microearthquakes that repeat themselves on time scales much shorter than the magnitude 6 events will continue.

—Monte Basgall, Duke News & Communications

Visit the SAFOD site at www.icdp-online.de/sites/sanandres/index

Photos courtesy of Peter Malin
How tsunamis yield deadly waves
The massive death and destruction from tsunamis arise from a tragic confluence of phenomena involving geology and the physics of ocean waves, said Peter Malin, a professor of seismology in the Nicholas School’s Division of Earth and Ocean Sciences.

First of all, there is the fact that the magnitude 9.3 earthquake off Indonesia significantly changed the depth of the ocean floor over an area larger than the size of North Carolina in a minute or two. Such a “megathrust” earthquake is caused by one crustal plate abruptly slipping beneath another.

“You have to understand that it’s not just crust pushing into the ground and diving,” Malin said. “There will be other parts that get uplifted too. When you pick up the continental shelf many feet this quickly, the water doesn’t have time to adjust gradually. So suddenly you have an elevation difference on the sea surface, creating great long waves—a tsunami—as one might have from quickly tilting a bath tub a few inches.”

But in the deep ocean this vast wave stretches out over many miles, he said. Being exceptionally long, such a wave might be hardly noticeable to ships and boats passing over it as it moves across the ocean at the speed of a jetliner rather than the pace of a normal wind-driven wave.

“Think of the bathtub again,” Malin said. “If you make small waves on top of the water it takes time for that wave to propagate across the surface. But now slosh the tub. That sloshing moves much faster because it has a much longer wavelength.”

Also, said Malin, the sequence of a tsunami is insidiously deadly. When the spread-out waves finally reach beaches, they can first suck the surf line far down from the shore, exposing shallow stretches of ocean bottom and stranding sea life. This tempting opportunity often lures unsuspecting tourists and fish gatherers to venture out too far to escape when the water returns with a vengeance.

At that tragic moment, the waves that were long and wide in the depths of the sea consolidate in the shallow coastal waters into a series of onrushing walls, with the later waves being the tallest. This “wave group” behavior—well known to surfers—is caused by “dispersion effects,” Malin said. Such effects are caused by the interaction of waves of different lengths, in which some lengths reinforce one another, combining to cause large motions of the sea surface.

Residents of the East Coast of the United States should be aware of tsunamis, said Malin. He cited, for example, the possibility of waves generated in the Atlantic Ocean by large landslides from the volcanic island of La Palma in the Canaries off Africa.

La Palma’s Cumbre Vieja volcano is crumbling, with significant portions of it having slipped into the Atlantic every few thousand years. If that were to happen again, while different from the Sumatra event, “it’s quite possible that a negligible to significant tsunami could be set up and

After the Tsunami: Nicholas School Professors Talk about the Disaster

An agreement between Duke University and the North Carolina Department of Environment and Natural Resources (DENR) will preserve some of Duke Forest’s most significant natural areas for the education and enjoyment of generations to come.

The agreement enrolls 1,220 acres of the Forest in the Registry of Natural Heritage Areas.

Landowners who place their land in the Registry of Natural Heritage Areas are making a voluntary, nonbinding commitment with the state to preserve their land for the perpetuation of natural processes, natural communities and rare species populations.

Couch Mountain, Bald Mountain, Blackwood Mountain and Stony Creek Spring are among the Forest’s natural features now enrolled on the register. Slopes along the Eno River and New Hope Creek also are registered, as are the Forest’s rare Piedmont meadow flats, among other sites.

DENH Secretary Bill Ross presented the university with a certificate recognizing the registry agreement at the fall Duke Forest Annual Meeting at Couch Farm.

“This registry agreement gives formal recognition for something Duke has been doing for many years,” said Judson Edeburn, Duke Forest resource manager. “And it further demonstrates our commitment to good stewardship of our most significant natural areas.”

Enrolling the acres in the registry will preserve some of Duke Forest’s most scenic and ecologically significant areas for the enjoyment and education of future generations, said Linda Pearsall, program head of the North Carolina Natural Heritage Program. “We hope that other colleges and universities will follow the example Duke sets,” she said.
propagate across the ocean to North and South America,” Malin said. “Not tomorrow or next month, but just as frequently as in the past.”

Another warning against beachfront development
The deadly tsunami is the latest—albeit most extreme—example of the dangers of dwelling near the surf zone, said emeritus Nicholas School Professor Orrin Pilkey, who has long warned that hurricanes and other storms will inevitably destroy seaside structures.

“I think this is yet another nail in the coffin of the rationality of beachfront development,” Pilkey argued. “Maybe we should forgo the view of the sea and the breeze from the sea. Set the hotels way back, on the back sides of islands.”

Some areas of the tsunami-stricken region had already heeded warnings about such damage. For example, according to The New York Times, most new properties in Phuket, Thailand, conform to a law establishing a 150-foot setback from the shoreline, which limited damage from the tsunami. And the prime minister has said that damaged coastal areas should be rebuilt to observe such setback regulations.

Research by Pilkey has revealed that the North Carolina coast, in fact, might have experienced a tsunami about 16,000 years ago, when the sea level was some 300 to 400 feet lower than today. He studied the seafloor seaward of Cape Hatteras.

“We found a massive deposit of sediment,” Pilkey said. “It was more than 100 cubic kilometers in volume. By comparison, Mt. St. Helens produced one cubic kilometer.”

Ecosystem destruction might have contributed to damage
The scope of the tsunami destruction and its death toll might have been increased by humans’ destruction of forested hillsides, mangrove swamps and coral reefs, said Stuart Pimm, the Nicholas School’s Doris Duke Professor of Conservation Ecology.

“Throughout the world, and particularly in this region, large areas of mangroves have been cleared, sometimes for shrimp farming, sometimes for resorts and hotels,” he said, stressing that he is talking in general without knowledge of specific situations.

“I’m afraid a story that has been consistently missed, not only with this disaster but also, for example, with the flooding in Haiti last year, is that such natural ecosystems provide an enormous amount of protection, he said.

“When you get a disaster like this, one thing you would want to have between you and the ocean is a mangrove swamp to absorb the impact of a storm surge or a tsunami.”

—Monte Basgall, Duke News & Communications

Read what other Duke professors have to say at www.dukenuews.duke.edu/news/aftertsunami_0105.html.

See page 21 for Randall Kramer’s comments.

Joint Degree Candidate Receives Prestigious Knauss Fellowship

Elizabeth English, a joint degree candidate in the Nicholas School, has been named a Dean John A. Knauss Marine Policy Fellow for 2005.

English, who was selected as an executive fellow, will work in the National Oceanic and Atmospheric Administration’s Office of Sustainable Fisheries as its international affairs coordination fellow.

She graduated magna cum laude with a bachelor’s degree in environmental policy from Boston University. While a student intern, English helped facilitate negotiations between local fishers and indigenous populations on provincial fishery policies in British Columbia.

English is a joint MEM degree student in coastal environmental management and public policy at the Nicholas School and at Duke’s Terry Sanford Institute of Public Policy. As part of her studies she worked on a team in partnership with the North Carolina Zoological Park. The students analyzed the effect of rural sprawl on sustainable development in the region. County commissioners are using their model as a blueprint for smart growth. In summer 2003, English served as an intern with the United Nations Environmental Program in Geneva, Switzerland.
The Nicholas School has received a $1.78 million National Institutes of Health grant to launch the Duke Center for Geospatial Medicine. The grant was awarded by NIH’s Roadmap Initiative, which promotes research in new or emerging fields of critical importance to future medical and scientific progress.

Scientists at the new center will combine expertise in psychology, geospatial technology, molecular biology, genetic epidemiology, genomics, behavioral science and spatial statistics to craft powerful new tools to study the interplay of genetic, environmental and social factors that drive children’s health outcomes.

The center’s initial study will focus on understanding how these factors combine to cause neural tube defects.

“What researchers need—and what our center will work to provide—are wholly new methods for assessing the factors’ simultaneous, combined influence,” says Marie Lynn Miranda, Gabel Associate Professor of the Practice in Environmental Ethics and Sustainable Environmental Management and director of the Children’s Environmental Health Initiative at the Nicholas School. Miranda will serve as principal investigator and director of the new center.

The methods advanced at the center could be applied to studies of other childhood health problems such as autism, asthma, ADHD and obesity, she says. They also could be extended to adult conditions such as Parkinson’s disease, Alzheimer’s disease, psychiatric disorders and cardiovascular disease.

A key component of the new methods will be their use of advanced spatial statistical techniques and Geographic Information Systems applications.

To support its interdisciplinary approach, the center will leverage research partnerships among the Nicholas School, the Duke University Medical Center and Trinity College of Arts and Sciences.

Jonathan H. Freedman, associate professor of environmental toxicology at the Nicholas School, and Marcy C. Speer, associate professor at the Center for Human Genetics and the Departments of Medicine, Molecular Genetics and Microbiology, and Biostatistics and Bioinformatics, will serve as the center’s co-directors.

Alan Gelfand, professor of statistics, Christina Gibson, assistant professor at the Terry Sanford Institute of Public Policy, and Redford Williams, professor of psychiatry, will serve as co-investigators.

The Duke NIH grant was one of four such grants awarded to Triangle researchers. Three researchers at the University of North Carolina at Chapel Hill also received NIH funding. They are Barry Popkin, professor of nutrition at the Carolina Population Center, Daniel A. Reed, Kenan Eminent Professor and director of the Institute for Renaissance Computing, and Ryan B. Sartor, professor of medicine.

visit the site at www.nicholas.duke.edu/cgm

Nicholas School Welcomes Visiting Theologian Michael Northcott

Michael Northcott, Reader in Christian Ethics in the School of Divinity at the University of Edinburgh, visited Duke on sabbatical this spring and taught a new course for Nicholas School students: Ecology, Christian Ethics and Religion.

Co-listed at Duke Divinity School, Northcott’s course provided Nicholas students a rare classroom opportunity. “Putting future religious, community and environmental leaders in the same room week after week to discuss these difficult issues is an honest and necessary step,” says Nicholas School doctoral candidate Kyle Van Houtan.

An ordained Episcopal priest, Northcott was deeply influenced by time he spent teaching at a seminary in Malaysia, where he witnessed the ecological effects of rampant economic development and the frequent acquiescence of people of faith in environmental destruction. This experience stimulated his research and writing in the interrelations between Christianity and ecology.

William H. Schlesinger, dean of the Nicholas School, who was instrumental in bringing Northcott to the Nicholas School, says, “Michael Northcott represents the best in modern views of how Christianity must face up to the environmental crisis.”

The course drew on Northcott’s widely–praised book, The Environment and Christian Ethics (Cambridge University Press, 1996), critiquing the social and political forms of life that have become so damaging to both human communities and ecosystems, and exploring philosophical, scientific and faith–based alternatives.

While in Durham, Northcott researched the reasons many conservative Christians do not see ecological issues as a moral priority for his new book, Ethics on Earth: Conservative Christians and the Conservation of Nature.
1 Nicholas School’s Rob Jackson Named One of the World’s Most “Highly Cited” Scientists

Robert B. Jackson, professor of environmental sciences and biology, has been named one the world’s most highly cited researchers by the international research database “ISI Highly Cited.”

Inclusion on the list is based on authorship of papers considered by peers to be among the most important scientific developments of the last two decades. Only the most widely cited authors—less than half of one percent of all published researches—earned recognition. Citation is a direct measure of a researcher’s influence on the literature of a subject, and it is also a strong indicator of scientific contribution, since it is derived from pattern of interaction among millions of published articles.

Jackson holds joint appointments at the Nicholas School and Duke's Department of Biology.

He joins two other Nicholas School faculty members previously named to the ISI list: Stuart L. Pimm, Doris Duke Professor of Conservation Ecology, and William H. Schlesinger, James B. Duke Professor of Biogeochemistry and dean of the Nicholas School.

Twenty-two members of the Duke faculty are now included on the list, which is accessible online at www.isihighlycited.com.

2 Nicholas School Launches Environmental Media Fellows Program

This fall the Nicholas School launched the Nicholas Environmental Media Fellows, an exciting new program that brings up to four established environmental journalists to the Duke University campus yearly for month-long sessions.

The program is set up in conjunction with the DeWitt Wallace Center for Communications and Journalism's Media Fellows Program, which has brought more than 600 international journalists to campus during its 24-year history at the Terry Sanford Institute of Public Policy.

The first fellow, Ann Kellan, an on-air personality and science correspondent for CNN for more than 10 years, devoted her time at the Nicholas School to interviewing faculty and students to gain a better understanding of key environmental issues and how best to promote them to news gatekeepers.

She also spent a week in Beaufort learning about the Duke Marine Lab, and served as keynote speaker for Hindsight is 20/20, a program in which Nicholas School alumni share advice and discuss their career decisions and experiences with current students.

Science and nature writer Michael Tennesen is visiting Duke this spring as the Nicholas Fellow and as the science writer-in-residence for the Center on Global Change. He is the author of The Complete Idiot’s Guide to Global Warming.

Visit our media fellows site at www.nicholas.duke.edu/media/fellows

3 Rich, Dollar Receive University Awards

Simon B. Rich Jr. T'67, chairman of the board of visitors of the Nicholas School, was presented the 2004 Charles A. Dukes Award for Outstanding Service to Duke University at the university's Founder's Day ceremony in the fall. The award recognizes individuals who have tirelessly volunteered their time and expertise to help the university and its students.

Rich was cited not only for his leadership as chair of the board, but also for his commitment to the education of the school’s students and their future careers.

Last year, he voluntarily initiated, planned and taught a course, “Energy and the Environment.” In the class, which he is teaching again this year, Rich draws upon his professional expertise and experience as former chairman of Louis Dreyfus Natural Gas. To augment his own expertise, he brings in other executives from the energy industry as guest speakers, and each year leads his students on a field trip to Houston, Texas, where they meet with managers and scientists from many of the nation's top energy companies.

Luke Dollar, an ecology doctoral student in the Nicholas School, received The Duke Humanitarian Service Award, sponsored by Duke Religious Life, during the Founder’s Day ceremony.

The award is given annually to an individual whose life demonstrates a long-term commitment to direct and personal service to others and simplicity of lifestyle. This award was first conceived by a group of Duke Campus ministers, faculty and students who felt that such exemplary lives might serve as challenging role models for Duke students as they considered the moral implications of their chosen vocation and lifestyle.

Dollar was recognized for his work in Madagascar, where he studies the elusive fossa, with the long-term goal of employing the Malagasy people to understand and manage their own resources.
The promise and peril of transgenic pine forests was the central topic of “Landscapes, Genomics & Transgenic Conifer Forests: A Nicholas Environmental Leadership Forum,” hosted in November by the Nicholas School.

Forests of fast-growing, disease-resistant genetically modified trees may hold the key to meeting the world’s future demands for wood, pulp and paper, said event organizer Claire Williams, visiting professor of environmental sciences and policy at the Nicholas School. They also could reduce the need to harvest wood from old growth or natural stands.

On the other hand, they may result in environmental chaos, promoting the spread of invasive genetically modified species into the world’s forest ecosystems, Williams said.

“Our goal at the forum was to identify major policy issues and identify gaps in the research framework, so we know what questions need to be answered next,” she said.

More than 70 policy specialists, research administrators, academicians, government agency representatives and leaders of the nonprofit sector attended the science-based dialogue held at the Washington Duke Hotel on Duke’s campus.

Speakers addressed broad biological, societal and political issues related to genetically modified conifers. They also discussed how the growing wealth of genomic data now available on conifers could be put to broader use.

Speakers included many leading researchers and policy experts in genomics, policy and ecology, such as Jeffrey Boore of the U.S. Department of Energy’s Joint Genome Institute, who gave a talk titled “Will Your Favorite Genome be Sequenced?” Other speakers included:

- Ann Bartuska, deputy chief of the USDA Forest Service
- Joseph Jen, U.S. Undersecretary of Agriculture
- Jesse H. Ausubel, Rockefeller University’s Program for the Human Environment
- David Richardson, University of Capetown
- Joerg Bohlmann of the University of British Columbia
- Maurice Lex of the European Union’s Commission on Biosafety

Forum sessions focused on four related themes: emerging genomics innovations, gene discovery and transgenic commercialization; ecological interface with biotechnology products; perspectives of private and public land ownership; and pending regulatory changes.
It has been raining for over an hour and I sit hunched over with my head in my hands. Soaking wet and shivering, I watch the rain run off my head into the bloody water collecting in the bottom of our wooden dugout canoe. The source of the blood is an enormous catfish, upwards of 60 pounds I estimate, lying lifeless in the bow. It was speared this morning by Manúel, one of the Sharanahua indigenous men from a nearby village that we’ve hired as our guides.

Despite my discomfort, the rain has made me feel optimistic about the long journey that lies ahead. It’s the first heavy rain we’ve had since leaving Puerto Esperanza 10 days ago, and hopefully it marks the start of the rainy season and a rising river. With any luck, we’ll be able to continue traveling upstream for two more days before low water forces us to finish the journey on foot.

It was October 2004, and we were deep within Peru’s Alto Purús Reserved Zone, a vast 2.7 million hectare rainforest wilderness in one of the most remote and poorly explored regions of southeastern Peru. Concerned with reports of loggers illegally extracting bigleaf mahogany (*Swietenia macrophylla*) from the reserve, the Ucayali state government asked for ParksWatch’s help. Since 2000, ParksWatch, a program of Duke’s Nicholas School’s Center for Tropical Conservation, has conducted threat assessments in more than 80 protected areas throughout Central and South America, and is considered to have great expertise on Peru’s protected areas. By documenting the illegal logging and disseminating the information, we hoped to catalyze actions to mitigate the threat and strengthen the protected area. Our intention was to traverse the reserve by boat and on foot to visit the supposed logging sites.

In addition, at the time of the investigation, the Peruvian government was
considering a new conservation category for the reserved zone, and we also were hopeful that our findings would support a pending proposal to elevate the Alto Purús to national park status, giving it the strictest protection possible under Peruvian law.

The Alto Purús Reserved Zone is one of the most important and best-preserved refuges for endemic and globally endangered species in all of Amazonia, and throughout our journey we were constantly reminded of the remarkable biodiversity that surrounds us.

One afternoon we watched a magnificent jaguar, pregnant and lethargic, sunning herself on the riverbank. Unaccustomed to humans, she sat unperturbed as our canoe, its motor coughing and sputtering, approached to within 30 feet of her before she sauntered into the forest. Each morning we were woken before dawn by bands of howler monkeys whose guttural, dinosaur-like roars seemed to literally shake our tents. At sunset, we watched the sky become as busy as a city street during rush hour with pairs of blue and yellow and scarlet macaws crisscrossing on their way to roost in the receding sunlight. One evening we counted more than 40 macaws fly over the beach where we were camped.

But perhaps even more remarkable than its biodiversity is the reserve’s importance as the home for some of the last indigenous people living in voluntary isolation on Earth. The Mashco-Piro, locally referred to as simply the Mashco, are the larger of at least two distinct tribes of these uncontacted indigenous people that use the reserve on their seasonal migration. These hunters and gatherers continue to resist modern society despite ever-increasing encroachment into their territory by missionaries, drug traffickers and, more recently, loggers.

As stands of commercially viable mahogany become increasingly rare throughout the Amazon, the still-lawless frontier that is the Alto Purús harbors one of the largest remaining populations of mahogany in Peru, has become a hot-spot for illicit logging. In addition to threatening the overall viability of the reserve, the illegal loggers threaten the survival of the Mashco, whose immune systems are susceptible to the unfamiliar viruses brought by outsiders.

Equally distressing are the consequences of violent encounters between the uncontacted tribes and loggers and other outsiders. Local men living near the reserve believe that there has been a marked change in behavior for the Mashco in recent years, from one of avoidance to one of aggression. One explanation is that the Mashco are trying to protect their shrinking territory and have finally drawn a line in the sand. Regardless of why more violence is occurring, any willingness by these tribes to engage in violence will ultimately prove disastrous. Although they are skilled hunters, their bows and arrows are no match for shotguns, and in recent years many of these encounters have had tragic consequences for the uncontacted.

While encounters with the Mashco or other uncontacted groups are very rare, we were acutely mindful of the possibility, albeit very small, of encountering them in the reserve.

However, we had researched what was known about the Mashco, and the unanimous opinion among the local men living near the reserve was that the Mashco only visit the area during the peak of the dry season, in July and August, when they search the exposed beaches for turtle eggs and collect bamboo with which to make arrows.

It was now early October and our guides assured us that the Mashco had already left the area on their migration towards Manú National Park to the south. “We don’t come here during the dry season,” they told us. “The Mashco are muy bravo—very fierce.”

The rain has stopped and I begin to discern the jungle wilderness slowly coming into focus through the rising mist. As we’ve ventured further upstream, the once wide and open river has become a narrow channel cut between steep banks and impenetrable, towering walls of forest. The crowns of the massive trees almost span the river, leaving just a narrow column of open sky directly overhead.

I’m jerked forward as the canoe runs aground yet again. Mateo, who has been operating the 10 horse-power “peque-peque” motor, lifts the propeller out of the water, and the mechanical scream of the motor reverberates off the riverbanks. The motor stalls and at once the forest is eerily quiet and dark.

I swing my legs over the side of the canoe and step carefully into the river. The water is the color of coffee with lots of cream, and I shuffle my feet along the sandy bottom to avoid stepping on a stingray. According to
our guides, the river is full of them, and their debilitating sting could be disastrous for the entire expedition. Alfredo, our lead guide, calls out the cadence: “uno, dos, tres,” and we lean into the canoe. Again, “uno, dos, tres,” and the bottom of the canoe slowly scrapes the sandy bottom. We plod along, heads down, one slow step in front of the other. Suddenly, from the back of the boat, Mateo loudly whispers, “Mashco!” I spin around and my eyes follow his pointed hand to the riverbank. There, not 25 feet away, are human footprints leading up the muddy riverbank and disappearing into the forest. My mind races as I try to grasp the magnitude of this discovery.

There is a moment of chaos as we pull our boats alongside the bank. In an instant I am following Mateo up the muddy trail. We find a cluster of six shelters each with a campfire and bedding made out of leaves. The bedding has fresh indentations where the Mashco slept, and bees swarm around a cracked turtle shell, remnants of a recent meal. I check the campfires and they are cold. We estimate that the camp has been occupied within the last few days.

We stay for only a few minutes and return to the boats to discuss our options. As I try to come to grips with the ramifications of finding the camp, almost simultaneously the guides stop their nervous chatter and turn their heads to the forest, intently listening. “Mashco!” Alfredo whispers. “They are calling to each other with the sound of the spider monkey.” We climb into the canoes and begin drifting back downstream with the other with the sound of the spider monkey. “Mashco!” I spin around and my eyes follow his pointed hand to the riverbank. There, not 25 feet away, are human footprints leading up the muddy riverbank and disappearing into the forest. My mind races as I try to grasp the magnitude of this discovery.

The following morning, after an interminable and restless night in which every snap of a twig caused momentary panic, we begin hearing similar sounds from the forest. Later, as we travel a bend in the river, two members of our group see two men—adorned with red paint, their long black hair held back in headbands, and holding bow and arrows—emerge from the dense forest. Later, as we travel a bend in the river, two members of our group see two men—adorned with red paint, their long black hair held back in headbands, and holding bow and arrows—emerge from the dense forest. We find a cluster of six shelters each with a campfire and bedding made out of leaves. The bedding has fresh indentations where the Mashco slept, and bees swarm around a cracked turtle shell, remnants of a recent meal. I check the campfires and they are cold. We estimate that the camp has been occupied within the last few days.

We try for only a few minutes and return to the boats to discuss our options. As I try to come to grips with the ramifications of finding the camp, almost simultaneously the guides stop their nervous chatter and turn their heads to the forest, intently listening. “Mashco!” Alfredo whispers. “They are calling to each other with the sound of the spider monkey.” We climb into the canoes and begin drifting back downstream with the motors off.

The following morning, after an interminable and restless night in which every snap of a twig caused momentary panic, we begin hearing similar sounds from the forest. Later, as we travel a bend in the river, two members of our group see two men—adorned with red paint, their long black hair held back in headbands, and holding bow and arrows—emerge from the dense riverbank and watch us leave. The Mashco have let us retreat peacefully.

Our decision to turn around and abandon our plan to traverse the reserve was a difficult one. We had been traveling for almost two weeks, and we were only a few days from our destination, the area of reported logging activity. However, our guides became extremely nervous once we knew that the Mashco were in the area. They believed that the Mashco would try to kill us to take our supplies or to avenge deaths from previous violent encounters with loggers. While we did not necessarily share those sentiments, we were not going to risk any violence, initiated by either the Mashco or members of our expedition.

As we began the journey downstream back to Puerto Esperanza where the expedition started 10 days earlier, we still held out hope that somehow we would be able to investigate the area of reported logging activity. However, regardless of whether that would happen, we knew that our documentation of the Mashco camps significantly bolstered the argument that the area deserved strict protection as a national park.

A week after turning around, we radioed a local mission and in a stroke of luck found a plane to fly us to the other side of the reserve. During the overflight, we located illegal logging camps inside the reserve in close proximity to where we found the Mashco camp. On the ground, we hired new guides and traveled upstream to the boundary of the reserve where we interviewed loggers who described how they were extracting mahogany from the reserved zone. We had confirmed what many had feared: logging was occurring in the reserve despite Peruvian and international laws intended to protect mahogany, uncontacted indigenous groups and resources within protected areas.

Back in the United States in November, we receive the fantastic news that the Peruvian government has declared the creation of the new Alto Purús National Park, covering 2.5 million hectares, 93 percent of the former reserved zone. The park becomes Peru’s largest, and the second largest in the entire Amazon basin. Together with Manú National Park to the south and Brazil’s Chandelier State Park to the east, the Alto Purús becomes the central link to the largest contiguous expanse of strictly protected land in the entire Amazon basin—an area almost the size of Costa Rica.

The Peruvian government should be commended for its bold decision to protect such a large expanse of forest, containing rich reserves of exceedingly valuable mahogany prized by powerful international logging companies. However, the park’s establishment is only half the battle. The other half is making sure the park is implemented and made viable for the long run.

As local populations of mahogany are depleted in other parts of the Amazon, logging pressure on the new park will continue to increase. The future of the Mashco and other uncontacted indigenous tribes in southeastern Peru depends to a great extent on whether the new Alto Purús National Park can be truly protected. By doing so, we will be taking advantage of a once in a lifetime opportunity to safeguard one of the most remarkable and pristine wilderness areas left on earth.

Chris Fagan MEM’00 is a research associate with ParksWatch, a program of the Nicholas School’s Center for Tropical Conservation.

Visit www.parkswatch.com for the comprehensive report and video of the expedition or contact Chris Fagan at chrisfagan33@yahoo.com.

wallpaper>>>
download wallpaper of the amazon: www.nicholas.duke.edu/wallpaper

web sites to note
Center for Tropical Conservation: www.duke.edu/web/ctc/
Check out CTC book Alto Purús
ParksWatch: www.parkswatch.org


Amazon photos by Chris Fagan
Americans would be willing to pay a one-time fee of $24 per household to protect tropical rain forests. A national park in Indonesia increases household incomes of nearby farmers by up to 10 percent annually. Taxpayers in North and South Carolina think it’s worth $139 apiece to maintain the water quality of the Catawba River.

These figures, calculated by environmental economist Randall Kramer and his research team, confirm what many environmentalists believe but few have been able to document: that environmental protection can be assigned a specific economic value. It is a concept that is increasingly important as governments in both developed and developing countries allocate spending for environmental projects.

Take the example of Ruteng Park on the small island of Flores, Indonesia. During a 1996 sabbatical in Indonesia, the Nicholas School professor worked with Indonesian counterparts and Duke doctoral student Subhrendu Pattanayak to determine how the establishment of this national park affected nearby villagers’ access to forest products and how the protected forest might affect the flow of irrigation water for domestic agriculture. Fieldworkers conducted household surveys that asked about income changes, and the team developed statistical models that estimated the effects of agricultural income based on increased irrigation flow.

They found that the ecosystem services provided by the new park, in the form of drought mitigation, augmented nearby farmers’ income by $3.50 to $30 annually, up to a 10 percent increase. “We were able to document the values that people talk about anecdotally when they discuss protecting an upstream watershed,” says Kramer. “This is really important to governments,” he says, especially governments in developing countries who are deciding whether to get involved in conservation activities.

Kramer has been active in Indonesia since the 1996 sabbatical, during which he also investigated how indigenous people worked with local academics to recruit interviewers, who receive several days of training before being sent into the field. Kramer or a member of the research team debriefs the interviewers each evening to discuss and solve problems that can range from a...
village leader wanting to sit in on inter-
views (and perhaps influence results) to
a variation in local dialect obscuring the
meaning of a question.

Working in the island nation of
Indonesia, Kramer has had to trouble-
shoot some unusual problems: washed-out
r roads preventing his survey team from
reaching target villages and an interviewer
contracting malaria, for instance. But
never a tsunami.

In the last week of December 2004,
Kramer watched with growing dismay the
news reports about the earthquake-
induced tsunami. Although none of his
research sites were affected, he had worked
in nearby provinces and knew that the
long-term economic toll would be devas-
tating, particularly amongst fishermen
whose boats and gear were destroyed.
"Up to 90 percent of employment in
these villages is based on fishing," he says.
While immediate aid money was needed
for medical facilities and rebuilding, he
predicts that in the long term, the fishing
economy will be devastated unless villagers
can obtain new boats and gear. (See story
page 21.)

Closer to home
While his research has taken him to exotic
locales like Indonesia and Madagascar,
about half of Kramer’s research is in the
United States, in part because it is easier
to involve his graduate students in state-
side projects, and in part because
determining the economic value of envi-
ronmental protection is just as important
in this country as in the developing world.
In 1997, he and a colleague published
the results of a survey in which they
determined Americans’ willingness to pay
$24 per household to preserve tropical
rainforests. This project was innovative in
its use of an approach that involves asking
people about their willingness to pay
for something like a beautiful view or
wilderness experience that they will not
actually own or use.

Closer to home, Kramer has recently
completed a cost–benefit analysis of water
quality protection in the Catawba River
basin in North and South Carolina. Used
for hydroelectric power generation and
the source of drinking water for many
surrounding municipalities, the river
and its reservoirs are also a mecca for
recreation. Concerned that population
growth could contribute to a decline in
water quality, Duke Power funded a survey
that Kramer and graduate student
Jonathan Eisen-Hecht used to estimate
the economic value of protecting the
watershed. After providing households
with a document describing a potential
management plan for the Catawba River
basin, Kramer and Eisen-Hecht, working
through a marketing firm, asked residents
what amount they would pay annually for
five years to fund the management plan.

To say that taxpayers expressed a
willingness to pay $139 per household is
an oversimplification of the complex
analysis of the survey responses (which
answered questions about the perceived
quality of tap water and the respondents’
trust of universities, amongst others). But
that local communities supported a water
management plan was clear, and different
parts of the plan are being taken up by
regional agencies.

In addition to determining the
economic value of environmental protection,
Kramer’s research also seeks to uncover
what types of incentives can be used to
eourage people to protect the environ-
ment as consumers and producers. In
North Carolina, he and several students
are investigating what incentives would
eourage landowners to participate in
wetland restoration projects. One finding:
while payment levels are important,
landowners also are interested in projects
with a high degree of local (rather than
federal) control and in their ability to use
the restored wetland for activities such as
hunting and fishing.

An award-winner in the classroom
Designing a survey, fine-tuning it with
focus groups, and pre-testing it on a
sample group are key components of
Kramer’s work. His popular Nicholas
School course, Survey Research Methods,
introduces master’s students to the fine art
of survey design and implementation. Over a semester, working in groups, student teams select a project and client, develop a survey, conduct a focus group, pretest the survey, implement it, analyze the results and present them in a report. They learn to determine whether a survey will best be conducted by phone or in face-to-face interviews and to design questions that are neutral, unambiguous and jargon-free.

In an early session of the course in January, Kramer and his students are trying to whittle a list of 19 suggested topics to six. He gently but firmly steers them toward projects suggested by potential clients, because, in his experience, a motivated client will help produce a more meaningful end result. In past years, results of student projects have been used by agencies to guide program decisions. “To see these projects come together, from a nebulous form at the beginning of the semester, through a draft survey, focus group, then final results, is exciting,” says Kramer. And he adds that it gives the students a specific, marketable skill that is not readily available in other degree programs.

At Duke, Kramer is known for his teaching and university service as well as his research. He has been recognized as Professor of the Year in 1989 and 1998 by Nicholas School students. And in a Founders’ Day ceremony October 2004, he received the University Scholar/Teacher Award. This prestigious award was established by the Methodist Church’s Division of Higher Education and Ministry to recognize “outstanding faculty members for their dedication and contributions to the learning arts and to their institutions.”

“I thoroughly enjoy teaching at all levels,” reports Kramer. In the mid-1990s, when the Nicholas School introduced an undergraduate degree in environmental studies, Kramer assisted then-dean Norman L. Christensen Jr. with curriculum design, served as the first director of undergraduate studies and co-taught the core course Environment 101.

Kramer also offers a seminar for doctoral students in the environmental social sciences at Duke, who do their coursework in a number of different departments—the Nicholas School, economics department, Terry Sanford Institute, and the Fuqua School of Business. The seminar brings these students together to discuss their research ideas and approaches. “In a sense, it provides an intellectual community for … a cohort that seldom see each other in the classroom although they are working in closely related areas,” says Kramer. Last year, Kramer entered the brave new world of online instruction by offering Economics of Environmental Management, a course he developed especially for the Duke Environmental Leadership-Master of Environmental Management degree. (See related story on page 22.) A hybrid between a traditional residential program and distance learning, the degree is intended for environmental professionals who can’t leave their jobs for two years in a master’s program. DEL-MEM admitted its first class in fall 2004. Kramer spent a week with students in September, then delivered mini-lectures over the Internet that were followed by discussions via conference calls and online chats. Even though the eight students were spread out over four time zones, the evening discussions were lively, the students were engaged, and technology challenges were minimal, said Kramer, who prepared for the experience by taking an online training course offered by Duke’s Center for Instructional Technology.

“It was a successful launch for DEL-MEM,” he says, “and a major shift in the way we teach and deliver programs.”

From domestic agriculture to international issues

Born and raised in Knoxville, Tenn., Kramer received a bachelor of arts in economics from the University of North Carolina and a master of economics from North Carolina State University before heading west to pursue a doctoral degree in agricultural economics at the University of California, Davis. His first faculty position was in the Department of Agricultural Economics at Virginia Polytechnic Institute and State University, and his research at the time focused on the environmental impacts of agriculture. According to colleague V. Kerry Smith, a...
University Distinguished Professor of agricultural and resource economics at N.C. State, Kramer was becoming known at this stage in his career for tying environmental objectives to agricultural regulation. For instance, if a government is offering price incentives to farmers for reducing acreage, why not have them remove environmentally sensitive lands from planting?

His 1988 appointment at the Nicholas School enabled Kramer to pursue a wider set of environmental issues and their international dimensions. His work and that of his students, says Smith, is widely recognized by economists and by international organizations such as the World Bank, in part because the methodology is innovative and in part because it is always linked to a real policy problem. “It’s relevant,” says Smith. “That makes it more valuable to people, whether it’s in North Carolina or Indonesia.”

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

Loss of Fishing Fleets Will Slow Recovery in Tsunami-Hit Villages

Nicholas School Professor Randall A. Kramer, who has studied rural economic development in Indonesia and Sri Lanka, says the loss of coastal villages’ fishing fleets in the devastating December 2004 tsunami will be a major long-term obstacle to economic recovery there.

Kramer, professor of resource and environmental economics, has conducted house-to-house socioeconomic surveys in Indonesian coastal communities similar to those decimated in northern Sumatra.

“These communities are dependent on the ability to fish, to trade by boat and to travel by boat,” he said. “These villagers have very low incomes to begin with, and without their boats—their major source of income—recovery will be especially slow.”

In some villages, Kramer and his research team found that up to 90 percent of all households relied on fishing for all or part of their income. In other communities, the percentage dependent on fishing dropped to as low as 20 percent because villagers earned their incomes through farming or in low-paid trades.

The destruction of boats, vehicles, harbors and roads will make it extremely difficult for fishermen to travel to other villages in search of work, Kramer said.

“It will be a challenge to find ways to earn the money they’ll need to buy or build new boats,” he said. “They’ll have to scrape together what little they can, or borrow money from relatives in other communities, assuming those communities haven’t also been devastated. Government or commercial loans for small-scale fishermen to buy boats and fishing gear are rarely available.”

Aid efforts by governments and international agencies will likely focus on meeting short-term needs—food, shelter, medicine and burying the dead. Fewer resources will be available to address long-term economic needs.

“Governments in many of the worst-hit places—especially in places like Sri Lanka or northern Sumatra, where there are on-and-off civil wars—have very limited ability to help fishermen and coastal communities rebuild,” Kramer said. “UNICEF, the United Nations development program, and other donors may be able to offer some assistance, but with thousands of communities affected, you have to wonder how much they really can do.”

—Tim Lucas, Nicholas School

Other Nicholas School professors talk about the tsunami on page 10.
They aren’t your usual students. But then, this isn’t your usual environmental degree program.

The first eight DEL-MEM students are all experienced environmental professionals in the field working full-time jobs. They are able to pursue a graduate degree at the Nicholas School by taking advantage of a new cutting-edge professional program that’s made up of a flexible mix of distance learning and week-long sessions based at the Nicholas School: the Duke Environmental Leadership-Master of Environmental Management program.

In December, the DEL-MEMs came from around the country to Durham for their end-of-semester wrap-up. We joined their “reunion” briefly to talk to them about their first semester and what they think about the program. What follows is that experience in their own words.

The students enrolled in the DEL-MEM 2006 inaugural class are:

• Mark Boatwright, regional environmental protection specialist with the Bureau of Indian Affairs in Juneau, Alaska;
• Joele Doty, education coordinator with the National Park Service in Homestead, Fla.;
• Julie Elmore, an environmental scientist with Buck Engineering, an environmental engineering and consulting firm in Raleigh, N.C.;
• George E. “Gef” Fisher Jr., an environmental specialist specializing in water quality issues for SpecPro Inc. in Lorton, Va.;
• Kathleen Kutschenreuter, an environmental protection specialist at EPA headquarters in Washington, D.C.;
• Kathy Romaine, a senior project scientist with Blasland, Bouck & Lee Inc., an environmental consulting firm in Cranbury, N.J.;
• Christopher Smith, senior adviser, Global Environmental Health and Safety/Hazard Communication at Pfizer in New London, Conn.; and
• Susan Thorneloe, a senior environmental engineer at EPA’s Office of Research and Development in Research Triangle Park, N.C.

What attracted you to the DEL-MEM program?

Kathleen: I have two bachelor’s degrees and almost 10 years of experience in my field, and I’ve been wanting to get my master’s degree. … [When I visited] other graduate programs, I found that I was asking different questions from the other students, not because I was smarter, but because I have all this experience. I felt like I was on a different page, and I had a hard time with the idea that I would be in school with people who didn’t have any work experience. So this program gave me an alternative. Now my classmates have an average of 10 years of experience in the field, and we’re learning...
from each other. We’ve all had different experiences and are doing different things in the field, but the level of inquiry and debate is really compatible, and that makes for a much richer and more practical and rewarding experience.

**Joele:** I was looking to be able to go to grad school while I had other things going on in my life. . . . and I was looking for something that was applied to the real world. I have an undergraduate degree in biology, and I took all the purely academic hard sciences as an undergraduate. But I wanted to learn how to use that information in managing ecosystems in the real world. I enjoy that my classmates have already worked in the field, and it’s good to hear their perspectives. They have a lot of knowledge about what’s really going on out there.

**Mark:** I’m certainly going to benefit from having a second professionally oriented master’s degree. Looking at the program’s curriculum, the coursework has more to do with the kinds of things that I’m currently interested in learning and can apply to what I’m doing on the job. Though it doesn’t hurt that I’m at Duke.

**How do you fit your studies in with your life and your job?**

**Susan:** It’s my first semester in the program, but also I’ve had a lot of traveling to do the past several months. So the program has been built to be very flexible. . . . Being able to get access wherever you are, whether it’s in Australia or Japan, is very nice, and I’ve not had any problems being able to do that.

**Julie:** Well, sometimes I work 40- to 60-hour workweeks. I could probably ask to cut back, but I’m part of a team and many of our projects offer excellent learning opportunities for professional development. I guess I really don’t want to cut back, so many of my weekday evenings, plus Saturdays and Sundays, are spent reading and doing homework. That was a surprise—I had forgotten how long it can take to get through material.

When I was looking to go back to school, I couldn’t choose a night course or a weekend program, because I wouldn’t be able to travel, which is a big part of my job. I spent the month of October in Asheville, which was necessary as it was a huge learning experience on my career path. . . . That work experience was worth about a semester’s worth of learning, based on what I learned in the field. So . . . I’m getting the learning that I want for my personal development and maintain the learning that I need for my career development at work.

**Mark:** For me there’s a four-hour time difference [from the time zone of the other students], so that part has been a little hard. . . . It’s a lot to stay on top of, for any of us that has a family, has to travel, or has a relatively stressful full-time job.

All of that aside, I would still check the “highly recommended” box.

**Joele:** With a new baby, I can do my work while she’s sleeping. I couldn’t do it if I had to be at a classroom somewhere at, say, 1:00. I’m so interested in the classes and I see how they apply to my work and what I want to do in my career. I guess the most important thing is that I really do want to do the work.

**And how are the courses that you’re taking?**

**Kathleen:** I do have a background in ecology and ecosystem management, but the ecosystem management course that we’re taking really delves into the human dimensions of ecosystem management, which is absolutely practical and critical. When I was an undergraduate, we weren’t talking about human dimensions and ecosystem management in one class—you would have had to take several different classes and put the information together yourself. The interdisciplinary approach makes sense in terms of what I’m doing on a daily basis in watershed protection: I’m dealing with real communities, real bureaucratic systems, real economic constraints, real ecosystem scientific challenges . . . it’s very practical and applied.

**Julie:** There was something about the class project on Three Gorges Dam that was daunting to me: I thought, I don’t know anything about China; I don’t know...
anything about the fish in China … but it was just taking a problem and stepping back and seeing that it still had the same components that a smaller or local problem would have, and you could still manage it. That was a good learning experience.

Susan: The environmental economics class I’ve directly used already. One of the projects I’m on [at work] is looking at cap and trade [policies] for reducing mercury from coal–fired power plants. So to better understand how that’s been used, where it’s worked and where it’s not worked, has really helped me in terms of understanding it better in my current position.

Christopher: I’m actually exploring an independent study project that I’m excited about. … There’s a great host of well-known and reputable faculty to work with.

How was the rapport between the students?

Gef: I think the group projects were really the mechanism that had us work with each other and find out about our different personalities and mannerisms. I really think that was the primary tool for us to gel as a class.

Joelle: Getting together the first week of the semester was great. We’ve all learned a lot about each other. I feel like we’re all in this together—we all help each other out.

I couldn’t be at the get-together in December [Because of the recent birth of her daughter]. It’s a credit to the program that the professors are dedicated to making it work. They had me call in on a conference call, so I still was able to contribute to talking with the other students about the group projects.

What does your employer think of your participation in the program?

Kathy: My boss is very supportive of me being in this program. First of all, he’s an MEM graduate from Duke, so that helps, but also he understands the value that this degree will give me and bring to the company.

Christopher: I had to do some work to convince my company that this education would be worthwhile, but the VP of Environmental Health and Safety has totally embraced it—he’s actually going to be my adviser on my master’s or thesis project.

Julie: They are supportive. We have a number of MEM graduates working for the firm. As a result, I get class and professor recommendations around the water cooler from time to time. I’m looking forward to the day that I can bring something new into the firm that will be beneficial to my job and to our products.

Tell us about the technology part of the program.

Kathy: First I thought it would be a very impersonal experience, and that is not the case at all—I’ve gotten to know my fellow students very well. I certainly wouldn’t want anyone to be afraid of the program because of the technology. It’s very easy to use, the professors do a great job organizing the classes, and we’ve all done it and not had any technology problems.

Christopher: The technology is great. I don’t necessarily embrace the online chats, but about halfway through the semester we went to a teleconference approach, which was great. Four of us worked on our group projects by teleconferencing with each other.

Julie: I think if you have a really basic understanding of how the Internet works, it’s not really that difficult. … I think you just need to be able to type and navigate the Internet well.

Is there anything in particular that you think it would be important for a prospective student to know?

Kathleen: It’s a lot of hard work, and it’s really a prestigious program, a full-blown master’s degree. It’s not an on–line degree. People enrolling in this program should be prepared, because it’s like being a full–time student and a full–time employee, no doubt about it. It’s consuming. You have to be committed.

What’s your favorite thing about the program?

Susan: My favorite part of the experience is the learning. I’ve been with the EPA for 20 years now, so getting to learn about things that I wouldn’t have read about. It’s stimulating. … I think it’s made me more enthusiastic.

Kathy: My favorite part of this program has been meeting the seven other students in the program. … figuring out what it is that they do, what problems they run into and how they handle those problems. It’s been a valuable experience.

Gef: The best thing about the program is the integrated approach. I’m really excited to be chasing my Master’s in Environmental Management through Duke.

web sites to note

DEL Web site: www.nicholas.duke.edu/del/
Sometimes, late at night, when he’s almost certain there’s no one else around, Henrique Tono likes to play his trumpet in the lab.

If you stood outside the lab’s door in the basement of Old Chem, you’d hear him—softly at first, then exuberantly—playing the sensuous, syncopated rhythms of salsa. Mambo. Latin jazz. Music as hot as his hometown, the colonial seaport of Cartagena on Colombia’s sultry Caribbean coast.

But Tono isn’t just blowing off steam. He’s conducting research.

A Nicholas School doctoral candidate in sedimentary geology, he’s attempting to use new 3-D ultrasound seismic imaging technology he developed to analyze the frequency response of trumpets, so that instrument makers in the future can design ones that stay more in tune.

“This is just a side interest of mine, you understand, it’s not a use I had in mind when I developed the technology,” Tono, 44, says with a good-natured laugh. “The primary application of the imaging system is for undersea oil exploration. It allows researchers to see into the internal structure of submerged sediment deposits.”

But if it also helps future Tito Puentes make sweeter salsa, mambo and merengue music, well, that’s the beauty of research, the outgoing Colombian says with a grin. “You never know where a line of inquiry will lead. It’s an intellectual adventure.”

The same could be said of Tono’s life. Born in 1960 in Philadelphia—he holds dual U.S. and Colombian citizenship—Tono spent much of his youth in Cartagena, one of South America’s oldest and most historic cities, where we was surrounded by reminders of the rewards of exploration and adventure. Cartagena, after all, was founded in 1533 as the conquistadors’ port of entry into Spain’s

1. Tono seen through a column of water while adjusting the horizontal position of the ultrasonic transducer. 2. Tono holding a seismic section acquired from Saint Anthony Falls Lab and processed at Duke. 3. Contours of a channelized depositional surface, interpreted from the 3D seismic image. 4. Tono pondering observations in the lab.
Andean colonies, and as the port of exit back to Spain for the colonies’ gold and silver. The city’s ancient walls, grand architecture and the fort overlooking its busy harbor bear witness to the lure of the region’s underground riches.

But it wasn’t gold, silver or emeralds that stoked Tono’s imagination. It was oil.

Vast reserves of petroleum lay beneath the Andes, stretching from Venezuela in the east, westward through Colombia and south to Ecuador, Bolivia and Peru. La Luna, a type of oil-source rock found in the region, generates more oil than any other source rock in the world.

“There was a lot of activity, a lot of exploration going on in the Colombian oil industry. New fields were being discovered and opened. It was exciting,” Tono recalls.

After earning a bachelor of science degree in geophysics in 1986 from the University of California at Santa Barbara, and a master of science degree in exploration geophysics in 1988 from Stanford University, where he also received the prestigious Palmer Fellowship, he returned to Colombia for a piece of the action.

While in college, he’d spent two summer internships with Esso Colombia as a geophysicist on seismic reflection crews searching for oil in the Llanos Orientales—Colombia’s eastern plains that border Venezuela. Those experiences, coupled with his academic credentials, helped him land a yearlong stint as management trainee at a Bogota oil exploration firm, where he learned the business side of the oil industry.

For the following four years, he honed his skills in the field, evaluating prospects and exploring for oil in remote and sometimes dangerous locations: Bulgaria, the United Arab Emirates, Qatar, Guyana, Vietnam, Peru and insurgent-controlled regions of Colombia.

“I had a reputation as someone who could go into dangerous areas and deal with guerrillas, the paramilitary and indigenous tribes,” Tono says in a calm, detached tone that makes it clear he’s stating a fact, not bragging. “But for me, the main appeal of the job, the main thrill, was the science. The exploration and discovery.”

The picture of trumpet-playing, salsa-loving Tono, with his ready smile and self-effacing humor, holding his own against armed strongmen and backwater despots may seem contradictory. But as those who know him best will attest, his genial nature and deferential manner belie a tireless work ethic and steely inner resolve. Case in point: Although everyone told him he couldn’t do it, he is on track to complete his doctoral thesis and receive his PhD in less than three years.

Fed up with working for others, in 1992 Tono launched his own company, GAPS, or Geophysical Acquisition and Processing Services. GAPS soon spawned two corporate offshoots: La Luna Oil Co., which focused on oil exploration, and Drift, which did environmental remediation around oil facilities.

The companies grew quickly. Within five years, Tono had offices or operations in Colombia, Venezuela, Ecuador, Bolivia and Peru. With 360 full-time employees—and several thousand temporary workers on the payroll during big jobs—the companies posted annual revenues of more than $60 million in U.S. dollars.

But doing business in a remote and politically unstable part of the world began to take its toll.

“Over the years, the focus on my responsibilities as CEO shifted from being an entrepreneurial geophysicist to an expert in negotiating conflict,” he says. “More of my time was being spent working to help secure the release of kidnapped employees” or protecting corporate property from vandalism and theft.

The daily dangers and frustrations wore him down.

“I was at a real low point. I didn’t feel like I could go on. I wrote an e-mail to an old college professor from Santa Barbara, Peter Malin, and told him I remembered and missed the days when I did geophysical research without worrying about kidnapping and politics,” Tono says.

Malin—now on the faculty at the Nicholas School—wrote back and told Tono the door was open for him to return to research if he wanted.

In 2002, after a decade in business, Tono decided to take Malin up on his offer. He dissolved his companies and left Bogota, accompanied by his wife, Carolina Pungiluppi, for a six-month sabbatical to study with Malin at the Nicholas School.

Six months stretched into two years, however, when Tono met one of Malin’s colleagues, Lincoln Pratson, an associate professor of sedimentary geology, who made him an offer he couldn’t refuse.

Pratson told Tono about research he was conducting on experimental sediment strata at a unique research facility at St. Anthony Falls Laboratory at the University of Minnesota. The facility—a veritable Disneyland for scientists studying environmental hydraulics, turbulence and sedimentary geology—was equipped with flume tanks, vortex tanks, water tunnels and swimming pool-sized model flow basins sophisticated enough to simulate the complex interaction of natural features that affect sediment...
transport and strata formation in rivers, deltas and the ocean.

By observing and analyzing experimental sediment deposits as they formed in the basins, Pratson hoped to gain insights into the geological processes that form oil-bearing features beneath the ocean floor—information of critical interest to oil companies searching for new reserves.

The trouble was, no one had yet devised a 3-D imaging technology that could show Pratson what was happening inside the sediment as the features formed. Even the best technologies forced users to choose between high-resolution images with good detail, or good penetration into the sediment. It was like being an obstetrician who couldn’t use ultrasound to monitor fetal development in the womb.

With 15 years of experience using seismic reflection imaging technologies to search for oil in the Andes, Tono felt certain he could help. The challenge was irresistible. He and Pratson struck a deal.

“Lincoln agreed to fund my research if I agreed to go for a PhD,” Tono says. “It was one of the smartest deals I ever made.”

After reviewing the available technologies, Pratson and Tono settled on an ultrasound imaging method as the most promising base technology for Tono to build upon.

“The method we chose is a scaled (1:10,000) geophysical device, much like the seismic techniques used in oil exploration and scientific imaging of the Earth’s interior,” Tono explains. “To give it the full range of capabilities Lincoln needed, I took bits and pieces from other technologies and integrated them, so they could talk to each other.”

By fall 2003, his high-tech tinkering had produced a prototype technology for a hybridized time-lapse 3-D seismic imaging system that, in preliminary tests, delivered both high resolution and good penetration.

After further refinements, Tono and Pratson used the system in a series of experiments at Duke in which they were able to tie the physical properties of sediment, most notably permeability, to the geophysical properties of the 3-D images. It was a major milestone.

They were getting tantalizingly close to achieving their goal.

Finally, in October 2004, after more than two years of trial and error, they hit paydirt.

A series of time-lapse 3-D images of an experimental sediment deposit formed at St. Anthony Falls revealed internal structures of the sediment with a resolution of one millimeter. The images’ high resolution and deep penetration allowed Tono and Pratson to observe the development of geological processes as the deposit formed.

“The images were amazing. They showed us things we could never see before,” Pratson says. “By tweaking existing technologies, Henrique created an imaging process that opens new avenues for experimentally studying the formation of strata. And he did it in less time than anyone, other than perhaps Henrique himself, thought possible. It’s a pretty impressive piece of work.”

The chief use for the new technique will likely be for oil and gas exploration, Tono predicts, but “with a little tinkering,” it also could be used in oceanography, geology, mine detection or archaeology.

He’ll leave that tinkering to someone else, however. After completing his thesis, Tono plans to return to a career in the energy industry, most likely remaining in the United States as an entrepreneur who develops and commercializes promising technologies. It’s a career that plays to his dual strengths as scientist and salesman.

Before that, though, he must complete his last remaining academic challenge: finishing the final chapter of his doctoral dissertation.

Based on results from his October 2004 time-lapse study, the chapter documents the development of an incised valley—the equivalent of an underwater canyon—formed during a cycle of abrupt sea level drop and rise.

It’s complicated, exacting work that’s critical to his dissertation and requires painstakingly precise analysis. Given the complexity of the work, many people have told Tono he probably shouldn’t expect to be finished before October.

With characteristic chutzpah, however, Tono is shooting for an earlier date.

“If I push myself, I think I can wrap it up by May,” he says, in the same confident tone he uses to describe dealing with guerrillas or analyzing the frequency response of a trumpet. “When I put my mind to something, I generally get it done.”

Given his track record for exceeding expectations, he’s stating a fact, not blowing his own horn.

Tim Lucas is the Nicholas School’s national media relations and marketing specialist.

web sites to note
Henrique Tono’s bio: www.nicholas.duke.edu/eos/students/tono.php
St. Anthony Falls Laboratory Home Page: www.safl.umn.edu/
Marine Lab Director Brings an Anthropologist’s View and a Connection to the Sea to the Facilitation Table

by Monte Basgall

Social scientist Mike Orbach knows the math as well as he knows the environment, but he also knows a lot about the people who find their way into environmental controversies. These traits have made him a great facilitator, a man who can find ways to craft solutions. And they also lend themselves to his current job as director of the Duke Marine Laboratory.

A man whose commanding height and trademark handlebar mustache make him instantly recognizable, the coastal California native tries his best to stay close to the water despite his administrative duties. In fact, he sometimes rows from his home to the Marine Lab’s docks and buildings for the biggest blows.

And when Duke alumna Barbara Block brings her Stanford University research team to the area each winter to catch, tag and then release bluefin tuna for science, you may find him in the “fighting chair” reeling in one of the giant fishes.

Orbach first began teaching at the Marine Lab in 1985, recruited by the lab’s then-director John Costlow to start a marine policy program that initially ran just in the summer. Around that same time, Costlow convinced North Carolina Gov. Jim Martin to appoint Orbach to the Marine Fisheries Commission, a reorganized state policy making body that Costlow then chaired.

“I wanted an anthropologist,” the now retired biologist recalls in an interview. “And Mike performed very well.” By then Orbach already had made a reputation, having been lured to East Carolina University in 1983 to help develop its marine social science program. As both head of ECU’s anthropology program and as a senior scientist at its Institute for Coastal and Marine Resources, he began carving out a legacy of helping solve environmental disputes.

While he was at ECU, federal fisheries officials and commercial fishermen in Florida invited him to help them with problems in the spiny lobster industry there. Orbach, an ECU colleague and a group of students spent a whole year on location studying everything from how the lobsters are caught to the dynamics of local politics.

They found that “over the years the lobster harvests had stayed about constant,” he recalls. “But the number of traps had gone from 200,000 to more than a million, and that caused a lot of problems. Commercial fishermen were in conflict with each other over their territories. Commercial fishermen were against the recreational fishermen. Environmentalists were against everybody.”

He then began an extended series of “consensus building workshops” through Florida’s southern sections from Key West north. At each first workshop session he began by presenting the data his group had collected. “We first discussed their perceptions of problems in the lobster industry,” he recalls. “Then we said, ‘from our work with other fisheries around the world, here are some ways people have tried to solve problems like this.’”

After being walked through this process, the lobster fishermen ultimately agreed among themselves to reduce the numbers of traps they set under a transferable trap certificate system. With Orbach’s assistance, they then went to Florida’s Marine Fisheries commission and Florida’s legislature to adopt those rules.

“Once Florida had it in place, the federal government adopted the same system,” Orbach says. “Since then, we worked with the state of Georgia to design a new crab system in this same way. And I was the facilitator for a red snapper plan that has now gone into effect for the entire Gulf of Mexico.”

In a room full of so-called “hard” scientists, Orbach always stands out. “I would describe myself as an entrepreneur of the social sciences,” he declares. “Here at the Marine Lab, the natural science students go out and study the water, the marsh and the fish. And my social science students go out and talk to the fishermen and developers and coastal town managers.

“I’m a professor of the practice of marine affairs and policy, and for me there couldn’t be a better title.”

Orbach enjoys doing research, and until he became Marine Lab director, he still had an active research program in fisheries, oil and gas, coastal sediment issues and regional planning. “But I also enjoy taking the research and answering what I call the ‘so what?’ questions.” (“So what?” as in how his research impacts the person on the street, or on the boat, so to speak.)

A key to Orbach’s approach is “what I call ‘the curse of the cultural anthropologist,’” he says. “I really do see a little bit of almost
everybody’s point of view. I don’t think anybody has the corner on good ideas.”

Orbach has served on National Academy of Science and National Research Council committees and panels. In 2002 he delivered the National Academy’s Roger Revelle Commemorative Lecture in Washington, D.C., on “Freedom of the Seas—Ocean Policy for the Third Millennium,” the first social scientist to be given that honor.

He also is active with the Pew Charitable Trusts, serving as a consultant for the Pew Oceans Commission and as a advisory board member for the Pew Scholars in Marine Conservation Program. He proudly notes that Joshua Reichert, who leads Pew’s environmental division, once introduced Orbach as “the head of the new Duke marine conservation mafia” because of Nicholas School graduates’ strong and growing presence in marine policy.

Margaret Davidson, who directs the National Oceanic and Atmospheric Administration’s (NOAA) Coastal Services Center in Charleston, S.C., says, “We clearly need more people who have his interests and his skill sets in the coastal and ocean communities.” (In the late 1970s, Orbach spent three years working out of Washington, D.C., as a social anthropologist for NOAA).

Orbach “also has a talent for attracting bright young and capable people to Duke who I think are going to be tomorrow’s leaders,” adds Davidson, whose center provides technical assistance to non-profit coastal resource managers. “In a relatively short period of time I think he has built the Duke program into a contender.”

Orbach acknowledges that there is more than professional interest behind his drive. “Part of what originally drew me into a maritime context with my research is that I wanted to stay around the water,” he says.

From the time he could first be left alone with a boat, Orbach fondly remembers beginning his summers with a 26-mile sail from Orange County, Calif., to Catalina Island for two weeks of diving and spearfishing.

His mother, Betty, was one of Esther Williams’ synchronized-swimming troupe in the 1940s. And his father, Harry Kenneth, started out as a sailor in the U.S. Navy who loved sailing, body surfing and surf fishing. “Both my brother and I, and now my son, have all been fishermen and surfers and sailors in some mix,” says Orbach, who himself started teaching sailing at age 12 and by 15 was racing ocean-going Hawaiian outrigger canoes.

But more than a love of water got passed on from parents to son. His father, “Kenny”, was a plasma chemist, and his mother an English teacher. By high school, Orbach had grown into a math whiz who also was strongly attracted to the humanities.

As an undergraduate at the University of California, Irvine, he combined those counterbalancing proclivities by majoring in economics. During grad school he switched from econometrics to cultural anthropology, where he turned to answering his “So what?” questions. For his doctoral thesis at the University of California, San Diego, he joined Portuguese and Italian tuna fishermen as they plied the Pacific from California to Central America.

Around that time he also met Judi, the woman who would become his wife and would persuade him to first grow a moustache. Judi now runs a folk arts society in Carteret and Craven counties. In 1979 their son Matthew was born, who is now a Peace Corps volunteer teaching English in the Ukraine.

But his youthful ties to California, if not to water, finally began to fray after he became a young professor at the University of California at Santa Cruz. Life there had changed since he was a 19-year-old happily camping on beaches in a Volkswagen bus. Now he was 30 with a child, living amidst growing environmental degradation, declining schools and a rising cost of living.
So he responded to ECU’s redoubled efforts to persuade him to move east again, and eventually joined Duke full-time in 1993. And he hasn’t looked back. “It’s great to now be here, at one of the top institutions in the world, with a great faculty and great students,” he says of the deliberately, if deceptively, laid-back Marine Laboratory.

According to Orbach, he was originally recruited to Duke to bring a “formal social science and policy presence” to a campus previously noted for estuarine ecology. He adds that his 1998 appointment as director by then-Nicholas School dean Norman L. Christensen Jr. and his reappointment by current dean William H. Schlesinger signaled support for “my basic philosophy of interdisciplinary research.

“The faculty here has now decided that each new hire is going to be a person who wants to cross over into what I call ‘so what’ questions in the conservation world while still performing quality basic science,” he says. “Another thing that is happening here is that we’re entering a slightly different arena with ‘charismatic megafauna’—sea turtles, dolphins and large pelagic (sea-going) fishes and sharks.

“So we’re moving towards conservation, interdisciplinary research, large pelagic ocean resources, the social sciences and a more sustainable Pivers Island environment with a master plan. We don’t want to be bigger, but we want to be better. There’s a sense of scale we want to preserve here.”

Orbach says the Marine Lab is meeting annual enrollment targets of 30 professional masters degree students and 20-25 doctoral students, but is still short of its 50 student-per-semester goal for undergraduates—at least in the winter.

Actually, the Marine Lab hosts higher numbers of undergrads in the summer, about 50 percent from out-of-state institutions lacking their own marine labs. “So we’re a little over in the summer and under in the winter,” he says.

In recent years, the Lab has embarked on a campaign to reconnect its facilities in Beaufort to the main campus in Durham. Under a new arrangement, for example, the Duke Facilities Management Department manages the Marine Lab for building and maintenance projects. The lab now has two new emergency generators with autoswitching capabilities, and other significant upgrades because of this arrangement.

But when Facilities Management began designing the lab’s first new building in 30 years—a cinderblock maintenance structure—Orbach insisted that it look in character with the rest of the campus. “So they redesigned it a half story lower, and put on a hip roof and cedar shakes,” he says. “It’s a big building, but it looks nice and compatible.”

That was followed up with other additions, ranging from solar panels on the roofs of dormitories to the Marine Lab’s first Student Center.

Ground also was broken last April for the biggest new project to date: a “green,” $2 million 5,000-square-foot academic building that will provide a high-tech teaching center while conforming to the highest standards for energy and environmental efficiency.

“It will have geothermal heating and cooling and will be oriented to the natural prevailing winds for ventilation, with a courtyard that looks out toward the ocean and estuary,” he says excitedly. “That’s really a new concept on the island. Everything before has been inward—directed—inside your laboratory, inside the quad. We’ve never really looked out at this beautiful environment we’re in.”

Another accomplishment is recreating a natural marsh planted with natural grasses along 500 feet of shoreline that was formerly rimmed with a concrete bulkhead. “It’s the largest project of its kind that’s been done in North Carolina,” he says proudly. “It’s a natural protective environment.”

Orbach also is working with officials at adjoining NOAA marine research facilities to plan a jogging trail around the entirety of Pivers Island and other shared facilities.

Now that funding has been completed for the teaching center, Orbach says his next money-raising challenge will be to replace the leaky, energy-inefficient multistory Bookhout Research Lab with “three or maybe four lower profile, state-of-the-art, architecturally compatible buildings.

“The idea would be to build the new buildings first, and then take the Bookhout lab down, using its footprint for a new seawater research facility.

“Some of the brick rubble from that building could go in an artificial reef,” he adds. “I think C.G. Bookhout would think it a great honor for the building that originally bore his name to be a habitat for the marine organisms he loved.”

That may be Orbach’s greatest legacy at Duke—preserving tradition and helping to conserve ocean resources, while bringing the Duke Marine Lab into the 21st century.

Monte Basgall is a senior writer with Duke’s Office of News and Communications and specializes in science coverage.

web sites to note
Michael K. Orbach’s bio: www.nicholas.duke.edu/people/faculty/orbach.html
Duke Marine Lab: www.nicholas.duke.edu/marinelab

5. Orbach (2nd from right) with Newport Outrigger Club Junior Men and Coach Noah Kalama (kneeling), 1963. 6. Orbach on the rock sill that is part of the Pivers Island marsh restoration project, 2005.

#2, 3, and 6 photos by Scott Taylor; #1, 4, and 5 are courtesy of Mike Orbach.
Geology is Alive and Well at Duke University
Earth and Ocean Sciences is Positioning Itself at the Crossroads of Major Environmental Issues
by William H. Schlesinger

A tsunami in Indonesia, a new sink-hole in Florida, and pollution from gold mining in New Guinea—these are all examples of the problems that the earth sciences must address to determine a sustainable future for humans on our planet. Opportunities for the geosciences abound as well: the potential to provide geothermal energy in Kenya, to sequester carbon in sedimentary strata, and to provide hydrogen to power the world’s transport system for the next generation.

Studies of the biosphere demand that we know a lot about the solid Earth beneath us and the circulation of the atmosphere and oceans at Earth’s surface. Projections of the future of our planet are well informed by studies of its past. Some behavior is clearly cyclic, and we can expect to see past conditions reappear in the future. Some behavior is chaotic, making prediction extremely difficult.

To provide geoscientific insight to traditional studies of the environment, the Department of Geology joined the Nicholas School in 1997 as the Division of Earth and Ocean Sciences. It brought its history of expertise in coastal marine geology, climate change and hydrology to the school, where it has fused with and enriched ongoing studies of the coastal marine environment, forest response to climate change, and water quality. New horizons for the earth sciences at Duke include studies of energy and environment—a new program for the Masters of Environmental Management (MEM) degree to address the growing demand and dwindling supplies of traditional fossil fuel energy for the Earth’s people.

Geology has a long history at Duke, witnessed by the spirited social events of the student group, DUDOG (Duke University Department of Geology). Today Duke alumni occupy positions at the top of many of the major multinational energy companies. No visit to a Duke alumni club in Texas can fail to produce a past student of geology, who asks about what is happening in the Earth and Ocean Sciences (EOS) Division of the Nicholas School today.

And there is excitement here! Jeff Karson and his colleagues have just discovered an entirely new form of mid-ocean hydrothermal activity, which shows all potential of rewriting what we know about the mean residence time of the major chemical constituents of seawater. Susan Lozier’s studies of the warming and freshening of the North Atlantic, which might be consistent with an accelerated melting of the Greenland ice pack and Arctic sea ice, aim to understand changes in its deep circulation. Peter Malin has a wide network of sensors in place in southern California to record movements of the Earth’s crust and the next earthquake, perhaps the “big one.”

Particular enthusiasm surrounds the new program in energy and environment, spearheaded by Lincoln Pratson. While a generation of students was trained in petroleum geology at Duke by Ron Perkins, this new program will focus on the full suite of future energy options available worldwide—solar, tidal, wind, geothermal, nuclear and, yes, fossil energy. Rather than recognizing and adjudicating environmental damage after the exploitation of an energy source, we want to train the professionals who understand energy and environment beforehand and who can sit at the boardroom table in a decision to develop a new energy source, with the full recognition of the benefits, risks and costs to environment that it may entail.

Perhaps as critical as energy, future supplies of water may well determine peaceful relations among the world’s nations in arid land regions. The Earth and Ocean Sciences Division has a long history of work in hydrology and sediment transport, now coupled to new strength in the Pratt School of Engineering and a revitalized Center for Hydrologic Sciences at Duke.

Geology is alive and well at Duke—evolving to position itself at the crossroads of the major environmental issues facing humanity. Our studies of the Earth are informed by the best modern technology, yet we haven’t forgotten the importance of field work—the bond around the campfire that keeps a passion for studies of the earth sciences alive for a lifetime.

William H. Schlesinger is dean of the Nicholas School and James B. Duke Professor of Biogeochemistry
Presentations and Conferences

Paul A. Baker, professor of geochemistry, along with graduate student Ashley Ballantyne et al., were the invited presenters of “Reconstructing Late Quaternary Precipitation in the Tropical Andes,” at the Past Global Changes (PAGES) Human Impact on Lake Ecosystems (LIMPACS) workshop on Salinity, Climate, and Salinisation, held in Mildura, Australia, in September.


Scott A. Eckert, assistant research scientist at the Duke Marine Lab, was an invited expert at the November meeting of the U.S. National Marine Fisheries Service Atlantic Leatherback Expert Working Group. The weeklong meeting, held in Miami, Fla., was organized to assess the current status of leatherback sea turtle populations in the Atlantic Ocean.

Gabriele Hegerl, associate research professor in the Division of Earth and Ocean Sciences, gave the invited presentation “Detection of Anthropogenic Climate Change” in October for the Department of Atmospheric Sciences at the University of Wisconsin, Madison.


In November, for the Conference to Celebrate the 75th Birthday of Kevin Burke of the University of Houston, Karson presented “The Atlantis Massif: An Ultramafic Oceanic Core Complex, Plate Tectonics, Plumes, and Planetary Lithospheres.” And, for a fall meeting of the American Geophysical Union (AGU) held in Northern Iceland, he presented “Upper Crustal Deformation on Onshore Exposures of the Tjörnes Fracture Zone.”

Lee Hill Snowdon Professor Emily M. Klein presented “A Small Ocean Rift Leads to a New View of the Galapagos Micro Plate: the Incipient Rift at 2 Degrees North, East of the East Pacific Rise,” at the fall meeting of the AGU in December, in San Francisco, Calif.


In September, Lynn A. Maguire, associate professor of the practice of environmental management, presented “Effective Negotiation and Collaboration for Environmental Advocates” with Dr. John Stephens, Institute of Government, UNC-Chapel Hill, at a workshop on conflict resolution for Students for Environmental Action at University of North Carolina.

In October, Maguire gave the invited lecture “Public Participation in Fire Management Decisions,” to The Nature Conservancy’s fire management course for state/federal land management agencies at Black Mountain, N.C.

Marie Lynn Miranda, Gabel Associate Professor of the Practice in Environmental Ethics and Sustainable Environmental Management, made two presentations in November at the 132nd Annual Meeting of the American Public Health Association in Washington, D.C.


In October, Miranda presented “Using Spatial Mapping to Address Children’s Environmental Health Issues” to the Department of Environmental Studies at Emory University.

A. Brad Murray, assistant professor of geomorphology and coastal processes in the Division of Earth and Ocean Sciences, presented “Extending a 1-Line Modeling Approach to Explore Emergent Coastal Behaviors,” for the 29th International Conference on Coastal Engineering at Lisbon, Spain, in September.

Michael K. Orbach, professor of the practice of marine affairs and policy and director, Duke Marine Lab, was a keynote speaker at the Renewable Natural Resources Foundation’s National Congress on Building Capacity for Coastal Solutions, in Washington, D.C. His December talk was entitled “Mobilizing and Empowering Communities.”

Lincoln F. Patson, associate professor of sedimentary geology, presented “Experiments on the Threshold Behavior of Turbidity Currents and its Potential Impact in Regulating the Slope of Deltas and the Continental Slope” for the International Geologic Conference at Florence, Italy, in August.

Kenneth H. Reckhow, professor of water resources, and chair, Division of Environmental Sciences and Policy, made two presentations to the Virginia Water Resources Symposium at Virginia Tech in October. The first was the keynote talk entitled “The Future of the EPA TMDL Program,” and the second talk was entitled “A Predictive Approach for Nutrient Criteria Development.”

Also in October, Reckhow organized and chaired a series of workshops to prepare a white paper for the U.S. EPA on adaptive implementation of TMDLs (total maximum daily load). The workshops took place on the Duke campus and at University of California—Irvine, and are supported by the U.S. EPA, Water Environment Research Foundation, Association of Metropolitan Sewerage Agencies, Federal Water Quality Coalition, and a group of southern California government agencies.
In Print
Recent publications by Nicholas School faculty or staff

Paul A. Baker, professor of geochemistry
- "Hydrologic Variation During the Last 170,000 Years in the South American Tropics," *Quaternary Research*, 2004 (coauthor w/ G. Dwyer et al)
- "Vegetation and Climate Change on the Bolivian Altiplano between 108,000 and 18,000 Years Ago," *Quaternary Research*, 2004 (coauthor)

Richard T. Barber, Harvey W. Smith Professor of Biological Oceanography, and chair, Division of Coastal Systems Science and Policy
- "The Heterotrophic Bacterial Response During the Southern Ocean Iron Experiment (SOFeX)," *Limnology Oceanography*, 2004 (coauthor)

Alan E. Boudreau, professor of geology and director of graduate studies, Earth and Ocean Sciences
- "Halogen Variations in the Paleoproterozoic Layered Mafic-Ultramafic Intrusions of the East Kimberley, Western Australia: Implications for Platinum-Group Element Mineralization.,” *Economic Geology*, 2004 (lead author)

James S. Clark, H.L. Blomquist Professor of Biology
- "Why Environmental Scientists are Becoming Bayesians," *Ecology Letters*, 2005
- "Fecundity of Trees and the Colonization-Competition Hypothesis,” *Ecological Monographs*, 2004 (lead author w/ S. LaDeau and I. Ibanez)

Larry B. Crowder, Stephen Toth Professor of Marine Biology

Thomas Crowley, Nicholas Professor of Earth Systems Science
- "Solar Irradiance Forcing of Centennial Climate Variability: Linear and Nonlinear Responses in a Coupled Model,” *Climate Dynamics*, 2004 (coauthor)

Karen Lind Eckert, assistant research scientist, and director of the Wider Caribbean Sea Turtle Conservation Network (WIDECAST)

Nicholas Hayman, research associate, Earth and Ocean Sciences

Gabriele Hegerl, associate research professor, Earth and Ocean Sciences
- "Detectability of Anthropogenic Changes in Temperature and Precipitation Extremes," *Journal of Climate*, 2004 (lead author)

Robert B. Jackson, professor of environmental sciences and biology
- "Curbing the U.S. Carbon Deficit,” *Proceedings of the National Academy of Sciences* (Perspective), 2004 (lead author w/ W.H. Schlesinger)

Jordi Julia, research scientist, Earth and Ocean Sciences
- "Evaluation of Deep Sediment Velocity Structure in the New Madrid Seismic


In November, William H. Schlesinger, James B. Duke Professor of Biogeochemistry and dean of the Nicholas School, testified before the Environmental Review Commission of the General Assembly of North Carolina in hearings on greenhouse gas emissions and global climate change.

Schlesinger also participated as a plenary panelist of “Meeting the Climate–Energy Challenge” held in October during U.S. Science & Higher Education Week at the Norwegian Embassy in Washington, D.C.

Martin D. Smith, assistant professor of environmental economics, along with Larry B. Crowder, Stephen Toth Professor of Marine Biology, gave the invited presentation “Valuing Ecosystem Services with Fishery Rents: A Lumped–Parameter Approach to Hypoxia in the Neuse River Estuary” for Triangle Environmental and Resource Economics Seminar Series at RTI International (RTP, N.C.) in October.

In August, Smith presented “Do Marine Protected Areas Enhance Fisheries in the Gulf of Mexico?” for the Camp Resources XII conference at Wilmington, N.C.

Molly Tamarkin, assistant dean for information technology, has been selected as one of five Duke representatives to participate in the 2004-2005 “Developing IT Leaders” program, along with representatives from Stanford, the University of Chicago, and Penn State. The seven-month program involves visits to all participating schools, group projects and individual program development.
Zone," Bulletin of the Seismological Society of America, 2004 (lead author)

**Jeffrey A. Karson**, professor of geology
- “Mid-Ocean Ridge Fault Zones Preserved on Macquarie Island: Faulting, Hydrothermal Processes and Magmatism in an Oblique-Spreading Environment,” Geology, 2004 (coauthor)

**Gabriel G. Katul**, professor of hydrology and environmental fluid mechanics
- “Human Effects on Long-Distance Wind Dispersion and Colonization by Grassland Plants,” Ecology, 2004 (coauthor)
- “Determinants of Long-Distance Seed Dispersion by Wind in Grasslands,” Ecology, 2004 (coauthor)

**M. Susan Lozier**, Truman and Nellie Semans Professor of Physical Oceanography

**Lynn A. Maguire**, associate professor of the practice of environmental management
- “What Can Decision Analysis Do for Invasive Species Management? Risk Analysis, 2004

**Peter E. Malin**, professor of seismology and of civil and environmental engineering

**Marie Lynn Miranda**, Gabel Associate Professor of the Practice in Environmental Ethics and Sustainable Environmental Management
- “GIS Modeling of Air Toxic Releases from TRI-Reporting and Non-TRI-Reporting Facilities: Impacts for Environmental Justice,” Environmental Health Perspectives, 2004 (coauthor w/ D. Dolinoy T’98)

**Ram Oren**, professor of ecology
- “Temporal Variability in 13C of Respired CO₂ in Pine and a Hardwood Forest Subject to Similar Climatic Conditions,” Ecosystem Ecology, 2005 (coauthor w/ A.C. Oishi, and G. Katul)

**Lincoln F. Pratson**, associate professor of sedimentary geology
- “Modeling Continental Shelf Formation in the Adriatic Sea and Elsewhere,” Oceanography, 2004 (lead author)

**James F. Reynolds**, professor and director of the National Phytoptron

**Curtis J. Richardson**, professor of resource ecology, and director, Duke University Wetland Center

**Daniel D. Richter Jr.**, professor of soils and forest ecology
- “Elemental Translocation and Loss from Three Highly Weathered Soil-Bedrock Profiles in the Southeastern United States, Geoderma, 2005 (coauthor)
- “Soil Acidification Induced by Elevated Atmospheric CO₂,” Global Change Biology, 2004 (coauthor)

**Dan Rittschof**, associate professor of zoology
- “Responses of Mud Snails from Low and High Imposex Sites to Sex Pheromones,” Marine Pollution Bulletin, 2004 (coauthor)

**William H. Schlesinger**, James B. Duke Professor of Biogeochemistry and Dean, Nicholas School
- “Better Living through Biogeochemistry,” Ecology, 2004

**Eylon Shalev**, research scientist, Earth and Ocean Sciences

**Martin D. Smith**, assistant professor of environmental economics
- “Marine Reserves with Endogenous Ports:
Empirical Bioeconomics of the California Sea Urchin Fishery,” Marine Resource Economics, 2004 (lead author)

• Limited Entry Licensing: Insights from a Duration Model,” American Journal of Agricultural Economics, 2004

**Dean L. Urban**, associate professor of landscape ecology

• “Forest Edges and Tree Growth Rates in the North Carolina Piedmont,” Ecology, 2004 (coauthor w/ R. McDonald Ph.D. ’04)

**Robert L. Wolpert**, professor of statistics and decision sciences and professor of the environment


**Memberships, Appointments and Awards**

Professor of the Practice of Marine Affairs and Policy and Director, Duke Marine Laboratory **Michael K. Orbach** assumed the presidency of the Southern Association of Marine Laboratories on Jan. 1. SAML is an association of more than 100 state, federal and academic marine laboratories located from the Chesapeake Bay to Texas, including Bermuda, Puerto Rico and the U.S. Virgin Islands.

**Martin D. Smith**, assistant professor of environmental economics, has been appointed associate editor for the journal Marine Resource Economics. The two-year term began summer 2004.

**Grants**

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

**Celia Bonaventura**, professor of cell biology, director, Duke University Marine/Freshwater Biomedical Center. Subcontract from Albert Einstein College of Medicine, $142,984, “Functional Analysis of Engineered Hemoglobins.” Duration: 8/1/04-7/31/05; Burroughs Wellcome Fund, $140,697, “Connecting Coastal Communities.” Duration: 7/1/04-6/30/07.

**Alan E. Boudreau**, professor of geology and director of graduate studies, National Science Foundation (NSF), $168,875, “Quantitative Modeling of Gas Migration in Layered Intrusions.” Duration: 7/01/04-6/30/06.


**Jonathan H. Freedman**, associate professor of environmental toxicology, and director, Toxicology Core Center for Environmental Genomics, National Alliance for Autism Research, $120,000, “Double Hit Hypothesis of Autism: Genetic Susceptibility and Environmental Exposure to Metals.” Duration: 7/1/04-6/30/06.


**Gabriel Katul**, professor of hydrology and environmental fluid mechanics, Subcontract from Indiana University, $308,880, “Scaling up of Carbon Exchange Dynamics from AmeriFlux Sites to a Super-Region in the Eastern United States.” Duration: 10/1/04-9/30/07.

**Seth Kullman**, assistant research professor, National Institutes of Health, $308,000, “In Vivo Transgenic Reporter for Hepatobiliary Toxicity.” Duration: 9/1/04-8/31/06.

**Peter E. Malin**, professor of seismology and of civil and environmental engineering, NSF, $249,636, Collaborative Research: “SEA-CALIPSO: An Offshore/Onshore Tomography and Magma-Chamber Seismic Imaging Experiment on Montserrat.” Duration: 1/1/05-12/31/05.

**Marie Lynn Miranda**, Gabel Associate Professor of the Practice in Environmental Ethics and Sustainable Environmental Management, National Institutes of Health Roadmap Initiative, $1,845,730, Duke Center for Geospatial Medicine. Duration: 9/1/04-8/31/07.


**James F. Reynolds**, professor and director of the National Phytotron, University of Georgia, $155,590, “Using Microbial Indicator Species to Distinguish Shifting Contributions from Soil Organic.” Duration: 8/15/04-8/14/07.


—Compiled by Donna Picard, Nicholas School communications assistant
Career Matters

Making Your Job a Richer Experience

Q. I’ve been working for the same organization since receiving my Nicholas School degree three years ago. I’ve gotten through the learning curve and am feeling a bit restless, but I don’t foresee any promotion opportunities for at least two more years. Any advice?

A. First, you should assess whether you’re working for an organization that you want to move up in, advises Nicholas School Assistant Dean for Career Services Karen Kirchof. Does the company’s mission match your core values? If not, it’s probably time to dust off the résumé and look for a new job.

If you want to stay put, you can launch your upward trajectory by demonstrating an ability to think beyond your own desk and be a part of the organization’s big picture. Talk to a mentor or supervisor about your ambitions and find out what you need to do to make the leap from young professional to middle or senior management.

In the meantime, Kirchof offers some ideas for making your routine job more rewarding. Suggest a collaboration with another team within your organization or with another company or community group with similar goals. Be willing to do this even if the collaboration takes you outside of your normal comfort zones.

Seek opportunities to meet other, more senior people in the organization, whether it’s inviting someone for a one-on-one coffee or organizing a brown-bag discussion group. You will learn more about the company and its mission and find out about the career paths of your organizations’ veterans.

Your future network will be stronger if you cultivate both ends of the organizational chart. Serve as a mentor to a younger person in your company or field, or make an effort to make new employees feel comfortable. Ask permission to develop an internship for a Nicholas School student.

If you make these kinds of efforts, you will find that you have not only enriched your daily work experience, but you have become the kind of employee who is noticed when promotions are handed out.

For more advice on career transitions or to organize an internship, contact Kirchof at the Career Services office, 919-613-8016; kgki@duke.edu.

What was your most memorable field trip while at the Nicholas School?

Send your stories—including the funny ones—and we’ll post them online and publish selections in the Fall 2005 issue of Dukenvironment. Respond online at www.nicholas.duke.edu/people/alumni/think.html

what are you Reading?

We asked Nicholas School alumni to recommend books or articles about the environment. Here are their suggestions for your summer reading list.

“I really enjoyed reading Enchantment and Exploitation: The Life and Hard Times of a New Mexico Mountain Range, by William deBuys. It’s a clearly written book that pulls strongly from local history and ecology to discuss today’s social and environmental complexities in northern New Mexico. I personally got a lot out of this read.”

Mike Dechter, MEM’03
Natural Resource Specialist/Presidential Management Fellow, USDA Forest Service

“An environmental classic worth reading over and over again is Silent Spring, by Rachel Carson. So many of today’s most pressing environmental issues, including global climate change and ocean ecosystem degradation, can be seen in Carson’s elegant analyses of the biggest conservation challenge of her day, and her calls to action remain inspiring almost 40 years later.”

Erin Vos, MEM’03
Sound Project Manager, U.S. Marine Mammal Commission

“I would recommend that anyone concerned with global climate change skip the rather predictable thriller State of Fear and go directly to Michael Crichton’s nonfiction inspiration, Meltdown: The Predictable Distortion of Global Warming by Scientists, Politicians, and the Media, by Patrick J. Michaels (Cato Institute, 2004).”

Peter C. Griffith, T’78, Lead Scientist, Science Systems & Applications Inc.
Shelley Kephart Zimmer lives in two worlds. As a senior manager in Nike’s footwear sustainability group, she has one foot firmly planted in corporate America and the other in the world of environmentalism. "Environmentalists see me as the business person and business people see me as the environmentalist," Zimmer says. "I have to act as a translator between the two groups."

The same was true when she attended Duke in the mid-1990s, receiving master’s degrees from both the Nicholas School and the Fuqua School of Business. "There was such a difference in the students and the focus at the two schools," Zimmer recalls.

But her double life makes her a perfect fit for the job at Nike, where Zimmer is looking for solutions that make both good business sense and good environmental sense. For example, Nike currently uses shoe-boxes that are made from 100 percent post-consumer material. But the recycled fiber must be shipped from the United States to its factories in Asia, where no market exists for recycled fibers. So the benefits of using recycled paper may be offset by the energy use involved in shipping materials from the United States and back again.

Perhaps the company could instead manufacture boxes from locally grown bamboo or sugar cane. But then the environmental effects of producing these fibers would need to be investigated. Would forests be clear-cut to plant these crops? And Nike would need to communicate effectively to consumers that boxes made of local fiber are environmentally better than those made from recycled paper.

"It’s always more complicated than it sounds," Zimmer says.

Sustainability through the Life Cycle of a Shoe
At Nike, Zimmer is part of a six-person team that guides the footwear division in its sustainability efforts. Their focus is on the entire life cycle of a shoe: using environmentally preferable materials without compromising quality, reducing toxins in the manufacturing process, cutting energy use and waste at their contract factories and in the shipping process, using environmentally friendly packaging, and determining what to do with unusable footwear.

Zimmer’s responsibilities include addressing delivery. When shipping products across the water, how can we reduce greenhouse
environmental implications of their purchases. That is, most consumers. the buying behavior of consumers not already predisposed to consider the purchases. The benefits will be enormous, Zimmer says, if we can change goal has been to move ordinary consumers to make more sustainable accommodate her interest in positive environmental change, Zimmer's From the time she was searching for an MBA program that would how to make shoe packaging innovations work for them. she also will be working directly with Nike's retail store customers on contributed to the footwear sustainability group, says its director, Bill Malloch. “We'll be talking about something technical, for instance, learning that the shoebox is optional for consumers was an important outcome of that test. But that doesn't mean the shoebox can be eliminated. Zimmer points out that reducing packaging at the consumer endpoint is easy. But she must consider the entire supply chain, and unboxed shoes could cause chaos in retail store stockrooms, in warehouses, and on ships. "This is going to take a long time to figure out," she says. Zimmer’s focus on what the consumer wants is the hallmark of her contribution to the footwear sustainability group, says its director, Bill Malloch. "We'll be talking about something technical, for instance, how much better is environmentally preferred rubber versus standard rubber," he says. "Shelley uses her experience and instinct to guide the conversation back to consumer benefits." In the coming years, he says, she also will be working directly with Nike's retail store customers on how to make shoe packaging innovations work for them. Laying the Groundwork for a Career From the time she was searching for an MBA program that would accommodate her interest in positive environmental change, Zimmer’s goal has been to move ordinary consumers to make more sustainable purchases. The benefits will be enormous, Zimmer says, if we can change the buying behavior of consumers not already predisposed to consider the environmental implications of their purchases. That is, most consumers. emissions? One answer may lie in how shoes are packed, and she is applying for a patent for a method of bulk-packing footwear to allow more shoes to travel in each shipment. She has also looked for ways of using shoes that have material or workmanship flaws that prevent them from being sold. "Let's get athletic shoes onto the feet of kids and people who really need them," she says. Zimmer's business background and marketing skills have earned her a leadership role in consumer research at Nike. A year ago, she designed a test in which customers at selected Niketown stores were asked at the cash register whether they wanted to keep their shoeboxes or have them recycled. The question took a lot of people by surprise, she reports. "But sometimes, when you surprise consumers, you also delight them." Consumers accustomed to getting both a shoebox and a bag were often quite happy to carry their purchases home in a bag and leave the box behind. Learning that the shoebox is optional for consumers was an important outcome of that test. But that doesn't mean the shoebox can be eliminated. As an undergraduate, Zimmer attended Yale and majored in environmental history. After working in executive education for several years, Zimmer chose Duke because, at the time, it was the only school to offer a joint environment-business master’s program. Her program area in the Nicholas School was Water and Air Resources, and she jokes that she was probably the only member of her Fuqua School class who got to wear hip waders during her coursework. An avid Duke basketball fan to this day, Zimmer camped out all three years for tickets in the graduate student cheering section—the first year in driving rain—finally scoring season tickets in her third year. "I'd do anything to get into a Duke basketball game at Cameron," says this Nike employee. Once she completed her degrees at Duke, Zimmer pursued an admirable career trajectory, with each successive job a building block for her eventual position at Nike. First, she headed west—a longtime dream—for a position at Boise Cascade. There, in an extension of her Nicholas School Master’s Project, she worked on a marketing plan for a building product made of recycled plastic and wood. Then, she moved to a job with Monsanto in which she test-marketed a genetically modified potato, introducing it into two markets and gauging consumer response. When Monsanto reorganized, she went to work for Hewlett-Packard, where for four years she honed her Internet marketing skills by working with a team developing a business-to-business Web site. In addition to solidifying her business credentials, the job with Hewlett-Packard enabled Zimmer to remain in Boise, where she had met her husband, Chris Zimmer. It was Chris, then her fiancé, who noticed a job posting on Nike's Web site and pointed it out to Zimmer. "This is your job," he told her. "Go after it." She immediately contacted Malloch, who had interviewed her for a position eight years earlier when she was fresh out of the Nicholas School. At the time, he reports, he was looking for someone with engineering skills. But the second time was the charm, and Malloch invited her to join the relatively new footwear sustainability group in 2002. "I was elated," Zimmer reports. "The opportunity to work at Nike, a big brand—it was everything I'd hoped for."
After three years with the company, Zimmer is beginning to see her influence on new products. Nike has just unveiled Considered, a design philosophy and product line that calls for less waste, less energy use and reduced solvents. Zimmer provided consumer research data, offered packaging ideas and prepared information that has helped the company communicate the benefits of the products to consumers.

Living in environmentally friendly Portland, Ore., is ideal for an environmentalist who loves telemark skiing, backpacking and camping. “There is so much more to do outdoors in the west because there is so much more public land,” she says. “And living in Portland is in itself a great education in sustainability and environmental issues.” The city is home to a number of cutting-edge environmental organizations that provide educational programs as well as opportunities for partnerships with Nike. Portland also has one of the highest rates of recycling in the country and boasts a number of retailers promoting organic or sustainable products.

Outside of Nike, Zimmer has been active in the Portland-based Northwest Earth Institute’s self-taught education programs, organizing a neighborhood discussion group on raising children without so much commercialization and exposure to television. That topic has been of greater interest to her since the birth of daughter, Marlee, in June 2004. Additionally, as a member of the Religious Society of Friends, she is interested in peace. In some way—in her future career, in her retirement, or through her community work—she hopes to advance the cause of peace, perhaps through the prism of environmental justice.

Her contributions were recently recognized when she was chosen as an Environmental Leadership Program (ELP) Fellow for 2004–2005. This five-year-old program, based in New Haven, Conn., provides funding for emerging environmental leaders to hone their leadership skills and develop a network of peers. With an emphasis on geographic, social, and professional diversity, the program offers fellowships to academics, activists, community organizers, and business professionals.

Each ELP class meets for two retreats a year. Before her first retreat, Zimmer was concerned that, as an employee of one of the country’s most visible corporations, she would be perceived as the “enemy” by those in the group who worked for nonprofits and activist groups. But ELP is about “creating bridges,” says classmate John Anderson, who organizes educational programs at the New England Aquarium. “We talk about how to broaden the community of people interested in environmental work, and ELP helps us to meet colleagues with different skill sets.” Zimmer has been introduced to the concept of environmental justice by her classmates and has, she hopes, given her classmates insights on communicating with corporate America.

Anderson describes Zimmer as attentive to the needs of a group and thoughtful in her speech. Malloch agrees: “She is not a person of many words but a person who thinks deeply about the words she uses,” Malloch says. “Except when she’s talking about Duke basketball. Then we have to get out the duct tape.”

Joking aside, Malloch is elaborate in his praise for Zimmer, saying that her professionalism and enthusiasm could take her far at Nike. “Her interest in and passion for the work she does comes through at all times.”

As for Zimmer, she knows that she still faces exciting challenges at Nike in reaching the ordinary consumer with her message of environmental sustainability. “Most consumers do not realize they’re purchasing products that take the environment into account when they buy the Nike brand. I hope that, in the future, I can help bring about that shift in consumers’ minds.”

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

web sites to note

Nike Considered, the new design philosophy and product line with sustainable features: www.nikeconsidered.com

An overview of Nike’s overall environmental efforts: www.nikeresponsibility.com

Environment Leadership Program, which offers training and a peer network to emerging environmental professionals through its fellowship program: www.elpnet.org

Northwest Earth Institute, which offers self-facilitated discussion courses: www.nwei.org
Sylvia Earle, Emily Lindow
Receive Alumni Awards

A scientist and a government policy adviser, both specializing in oceans and marine life, have been selected to receive alumni awards from the Nicholas School.

Sylvia A. Earle G’56 PhD’66 Hon’93 has been given the Ralston Distinguished Alumni Award. A pioneering marine biologist and underwater explorer, Earle is an explorer-in-residence at the National Geographic Society and CEO of Deep Ocean Exploration and Research.

Emily R. Lindow MEM’01 received the inaugural Rising Star Award for young alumni. She is a senior policy adviser to Secretary of Commerce Carlos Gutierrez, responsible for monitoring National Oceanic and Atmospheric Administration (NOAA) issues, including living marine resources, climate change, earth observations, and coastal management.

After receiving her PhD at Duke, working with botany professor Harold Humm on seaweed systematics, Earle held positions at University of California at Berkeley and Harvard University before coming to the attention of President Jimmy Carter, who tapped her to serve on the President’s Advisory Committee on Oceans and Atmosphere. In 1990, she became the first woman to serve as chief scientist at NOAA.

Earle is equally concerned with the technology that makes underwater research possible, and in 1992, she founded Deep Ocean Exploration and Research, a company that provides consulting and engineering services for underwater explorers at government and research organizations.

She has been recognized by the Library of Congress as a Living Legend and was named by Time magazine as a “hero for the planet” in 1998. Earle serves on the Marine Lab Advisory Board.

Lindow, a graduate of the Coastal Environmental Management program, has worked in government since her graduation, first as a Knauss Legislative Fellow on Capitol Hill and subsequently as a congressional affairs specialist in NOAA’s Office of Legislative Affairs and as a senior policy adviser to the NOAA Under Secretary.

In her current position, she serves as the Department of Commerce’s lead adviser on NOAA, which comprises approximately 60 percent of the department’s budget. In addition to tracking critical NOAA issues for the Secretary, she is responsible for providing policy analysis and recommendations to the Secretary and Deputy Secretary, and serves as a Department representative on multiple White House working groups and task forces.

Lindow cites the multifaceted education she received at the Nicholas School as a factor in her rise in the government. “It was the perfect education to prepare me for what I’m doing now,” she says. “Understanding the science, economics, and legal aspects of these issues is critical to making sound public policy decisions.”

The awards will be given at a ceremony at the annual student banquet on April 8.
Class Notes

Gregory N. Brown PhD’63 (Forestry), retired dean of the College of Natural Resources, has been named Dean Emeritus by the Virginia Polytechnic Institute and State University Board of Visitors. Brown had a 41-year career as a college administrator and forestry professor at five different universities. He joined the Virginia Tech faculty in 1992 and was the founding dean of the College of Natural Resources.

Lee Krohn MEM ’81, who has served as planning director for the Town of Manchester, VT., since 1989, was honored recently with two awards: 2004 Outstanding Planning Professional for Vermont, and (along with another planner from Maine) 2004 Outstanding Planning Professional for the Northern New England Chapter of the American Planning Association.

Tim McLean T’90 and his wife, Grace Jendrasiak McLean, are 1989 Marine Lab alumni. They were married in 1993 in Beaufort. Tim received his doctoral degree in genetics and molecular biology from the University of North Carolina at Chapel Hill, and is employed now in the Biological Sciences Division at the University of Southern California. Grace has a joint J.D./M.R.P. from UNC, and currently works for the Los Angeles Office of the Federal Public Defender. Their daughter, Charleston Annetta McLean, was born on Oct. 1, 2003, in Los Angeles.

Elizabeth A. Brantley MF’92 and Craig Houghton were married on June 12, 2004. Beth and Craig are both forestry instructors at Penn State Mont Alto’s Forest Technology Program.

Susan (McCarthy) Herz MEM’95 and Raphael Herz MEM’96, both CEM-track alumni living outside of Boston, proudly announce the birth of Jacob Crossan Herz on June 1, 2004. Jacob is busy teaching Susan and Raphael how to be parents! Susan is back at work three days a week at ESS Group Inc., an environmental consulting firm in Wellesley, Mass. She has been involved in several coastal- and marine-related projects, including working on the Draft EIS for the proposed offshore wind development project in Nantucket Sound. Raphael works with a quasi-public, independent technology economic development agency, Massachusetts Technology Collaborative, which administers the $250 million Renewable Energy Trust Fund. Susan and Raphael are looking forward to hearing from classmates and say “Hello to everyone in Beaufort!”

Karen Christiansen MEM’97 received her law degree from New York University Law School in 2004. She is now an associate with Fish & Neave LLP in Palo Alto, Calif.

Kim Woodbury Drye MEM’97 and her husband, Mark, proudly announce the birth of their second son, Luke Foster, on Sept. 9, 2004. Luke’s big brother Jack also is very pleased with the addition to the family.


Kelly Meadows MEM’98 and Meredith Bennett MEM’01 were married in June 2004. Both are now working for Tetra Tech in Virginia.

Scott Babcock MEM’99 and his wife, Kelly, are the proud parents of a baby daughter, Claire Jessica, born Jan. 3. Scott is still working with ERO (www.eroresources.com) in Denver, Colo., and focuses on NEPA compliance and natural resource planning projects at the local and state levels.

Charlotte Gray Hudson MEM’99 took part in an expedition that has received widespread news coverage and fantastic results. She volunteered to join an Oceana Europe group aboard a Spanish pelagic longline boat with a film crew to document sea turtle bycatch and to collect data. Charlotte brought along a new circle fishing hook to show the fishermen. Research shows that these

Attention Nicholas School Alumni Groups

Although the Nicholas School doesn’t officially sponsor alumni clubs, we know that many of you have informal regional get-togethers. If your group meets on a regular basis, we can alert other alumni in your area by posting information on our Web site or in dukenvironment.

Please send contact information and information about schedule and location to Krista Bofill, director of alumni affairs and the annual fund, 919-613-8035; k.bofill@duke.edu.
hooks reduce the number of turtles being caught with the current gear. After a skeptical discussion, the fisherman agreed to try the circle hooks. The results were fish with no turtle by-catch.

Crystal G. Lovett-Tibbs MEM’99 has joined Husch & Eppenberger, LLC, in St. Louis, Mo., as an associate attorney in the firm’s Environmental and Regulatory Practice Group. Prior to joining Husch, Crystal served as a judicial clerk with the Honorable Henry Coke Morgan Jr., of the United States District Court for the Eastern District of Virginia.

Matt Brett T’00 (ESP) joined the Board of Directors of the Lake Michigan Federation, which works to restore fish and wildlife habitat, conserve land and water, and eliminate pollution in the watershed of America’s largest lake. While at Duke, Matt interned for the Federation, helping to coordinate the Illinois Beach Sweep, now the Adopt-A-Beach program. Matt practices law with the Chicago firm of Sidley Austin Brown & Wood.

Matt Grove PhD’00 (Geology) reports that 2004 was a very busy year, full of changes. In May, Matt left his job with Anadarko Petroleum Corp. in Houston and drove back to New England with fiancée, Diane Specht, stopping to visit friends along the way, including Lisa Cioci T’97 and Greg T’94 and Ann Farley T’93. Once in Massachusetts, he started a new job in the Boston office of Brown & Caldwell, an environmental engineering and consulting firm. Diane and Matt were married on Aug. 7 (with a number of Duke alums there to share the day including Lisa Cioci, Greg and Ann Farley, Craig Webb G’95, Charlie Willmore G’99 and John Stinchcombe PhD’01. Then they embarked on a 12-day honeymoon in Hawaii. In November, they bought a house in Tewksbury, Mass. Both are hoping that 2005 is a bit more sedate.

Exploring Biomass Power Generation for Georgia

In November 2004, Nicholas School Board of Visitors member Blake Sullivan MF’89 and MEM candidate Mandy Schmitt visited the McNeil Generating Station, a biomass power generating plant in Burlington, Vt. They were members of a team coordinated by Georgia Power that is looking at the possibilities of bringing a major alternative energy power plant to Georgia.

Currently, Georgia Power only uses nuclear, coal and hydropower to generate electricity. Georgia is limited in alternative power generation possibilities because of natural barriers to options such as wind power. So biomass from the timber industry is an attractive option for the state. The McNeil Station visit offered the team the opportunity to see and understand a major power station that runs off of forest biomass. The McNeil Station also has recently completed a cutting-edge $18 million biomass gasification project, a process of interest to the team.

Continue Your Nicholas School Education

The Duke Environmental Leadership (DEL) Program of the Nicholas School of the Environment and Earth Sciences allows environmental professionals to enhance their environmental management skills and stay on top of new developments in the field. We provide these opportunities through both our Continuing and Executive Education Program and a DEL-Master of Environmental Management (MEM) degree program.

Continuing and Executive Education
The Law of NEPA
May 24-26, 2005 Register by May 6

Preparing and Documenting Environmental Impact Analyses
June 6-9, 2005 Register by May 11

Current and Emerging Issues in Environmental Policy
June 15-17, 2005 Register by May 25

Understanding and Implementing Ecosystem Management
July 18-22, 2005 Register by June 27
Julia Kintsch MEM’00 left The Nature Conservancy in Michigan to be program director for the Denver-based Southern Rockies Ecosystem Project (SREP), a non-profit conservation biology organization working to protect and restore large, continuous networks of land in the Southern Rockies ecoregion of Colorado, Wyoming and New Mexico.

Fielding Arnold T’01 (ESP) was living in Spain last fall and returned to the United States in January. She has accepted a job offer to serve as the science curriculum coordinator for a New York-based nonprofit called Reach the World (www.reachtheworld.org). For the next two-and-a-half years she will be a member of the crew of the Makulu, a 42-foot ketch-rigged sailboat on a round-the-world expedition. The purpose of the expedition is to provide content for the Reach the World Web site, which is used as a curricular resource for underfunded public elementary schools in New York. The students can follow their voyage via the Internet and interact with them via e-mail.

Craig Harper MEM/MPP’02 has left “the Hill,” where he was a legislative fellow in the office of U.S. Senator Dianne Feinstein. He is back working on Department of Interior issues at the Office of Management and Budget (where he interned in 2002). He and wife, Claire Lankford Harper MEM’02, are still living in Washington, D.C.

Trina Hedrick MEM/MPP’03 is working for the Nongame and Endangered Wildlife Program of the Arizona Game and Fish Department in Phoenix. She is a native fish conservation planner. Although Arizona is a desert state, it has 35 native fish, one of which is extinct, and almost 75 percent of which are federally listed, candidates for listing or listed as a wildlife species of special concern.

On Sept. 19, 2004, Madeleine Shepard Lawrence was born. Her parents, Meg Athey Lawrence MEM’03, G’03 and Robb Lawrence B’03, report that everything went well and they are still trying to figure parenting out, but having a great (and sleepless) time. Madeleine was 8 lbs., 3.5 oz., and 20 inches long and is the most beautiful baby in the world. The family is living in Philadelphia.

Valerie Chan MEM’04 is starting a job in D.C. with the Environmental Protection Agency. It is a two-year internship and she will have opportunities to explore several offices, though she’ll be based in the Office of Science Policy. Valerie also noted that she’s aware of two other recent graduates who are with the EPA: Elaine Lai MEM/MPP’04 is an intern in the Office of International Affairs and Caitlyn Hunt MEM’04 is an intern at Region 2 in New York.

Arthur Fisher MEM’04 has accepted a GIS analyst position with AMEC in Boston, Mass. AMEC operates a leading earth and environmental consulting business and provides multi-disciplined solutions for all aspects of environmental services, geotechnical engineering, infrastructure, materials testing and engineering and water resources. Arthur and his new puppy, Wookie, are excited about the new job!

Shannon Lyons MEM’04 just started a new job with the Mid-Atlantic Fishery Management Council in Delaware and she says it is going well so far. The Council is responsible for the management of fisheries in federal waters that occur predominantly off the mid-Atlantic coast. States with voting representation on the Council include New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, and North Carolina.
Obituaries

James E. Hobbs MF’47 died Oct. 7, 2004. He earned a bachelor’s degree in forestry from North Carolina State University in 1942 and a master of forestry degree from the Duke University School of Forestry. Widely respected across North Carolina as one of the state’s first private consulting foresters, he served as a cooperative extension forestry agent for N.C. State University and was later a forestry consultant based in Rocky Mount, N.C. In more recent years, his passions included cultivation of a floral garden and staying in touch with classmates from N.C. State.

Edward L. Berry T’57 (Geology) died May 20, 2004, in Raleigh, N.C. Berry was a retired hydrogeologist with the State of North Carolina and a veteran of the U.S. Army, having served in the Korean conflict. He is survived by his wife, Ellen Jones Berry, and their children.

Robert M. Allen PhD’58 died Sept. 16, 2004 in Seneca, S.C. Allen earned his bachelor’s and master’s degrees in forestry from Iowa State University. In 1948, he took a job in forestry research with the United States Forest Service in South Mississippi and was transferred to Duke University, where he earned a PhD in tree physiology. In 1966, Allen moved to Clemson, S.C., where he became the Belle W. Baruch Professor of Forestry at Clemson University. He was named Head of the Department of Forestry in 1970 and remained in that capacity for 12 years before requesting to return to teaching and research. He retired in 1991 but continued to work for another two years. Allen is survived by his wife of 58 years, Billie Mansell Allen, and their children, Betty Allen Boyles, Mary Bizzigotti, and Reed Allen.

William L. Harrison T’59, MF’60 of Wake Forest, N.C., passed away on Aug. 21, 2004, after a brief illness. Harrison was a consultant at Engineering Design & Testing Corp. where he specialized in damage assessment of major losses in the chemical and textile industry. As a member of the Iron Dukes, he could be found in Cameron Indoor Stadium at each basketball home game, loudly cheering or lamenting the fortunes of his team. Harrison is survived by his wife, Pamela Gattis; son, Lee Harrison; daughters, Barbara Hansen, Susan McClure, Sharon Murphy and Kathryn Wade; stepson, Max McGlohon; and 13 grandchildren.

What’s Your News?

New job? New baby? Professional honor? Recent wedding? Your classmates want to know! Send your news to:

Krista Bofill
Director of Alumni Affairs & the Annual Fund
Nicholas School of the Environment and Earth Sciences
Duke University
Box 90328
Durham, NC 27708-0328
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Perhaps It Was Something in the Water

DUML Undergraduates from 1977 Maintain Lifelong Bonds

by Lisa M. Dellwo

The roughly 40 undergraduates who spent the spring of 1977 at the Duke Marine Laboratory had no Gameboys or iPods and maybe just one stereo between them. Cell phones and personal computers didn’t exist, the Internet wasn’t invented yet, and Beaufort had not become a fashionable stop for yachters on the Intercoastal Waterway. Cable or satellite television? Forget about it. One TV channel would broadcast only intermittently. Some of the women lived in a trailer and everyone else in old dorms.

It was the time of their lives.

Maybe it was the enforced togetherness that made the Marine Lab experience so much fun for the 1977 undergraduates, mostly juniors. “We were constantly with each other,” recalls Nancy Freund Heller, now an executive with TIAA-CREF Asset Management. “Only a few classes were offered, so we took most of them together. Everyone lived in close contact. We ate together and we partied together. You didn’t want to stay in that little trailer alone.”

“Perhaps it was something in the water at the time,” speculates Mei Ling Yee, an ophthalmologist in private practice in New Jersey, who adds, “There was something magical about our group in 1977.” An undergraduate at Colgate, Yee was one of a handful of Marine Lab students who came from colleges other than Duke. She says her ties to a group that spent just five months together remain stronger than those to her Colgate classmates.

Other than swimming off the Marine Lab dock and boating over to Shackleford Banks for picnics and shell collecting, the group’s main form of entertainment was music. “Some of us had musical instruments, and some of us could sing, or thought we could,” says Peter Griffith, now a contract scientist at NASA’s Goddard Space Flight Center and president of the Nicholas School Alumni Council. They formed the Beaufort Blues Band and commandeered the dining hall for music and dancing.

Salt Air and High-Caliber Field Trips

Lifelong friendships were forged at the Marine Lab that summer. But Griffith says that the academic challenges also made their stay memorable. “For a lot of us, it might have been our first time in really small classes where we could question and challenge research scientists. For our independent study projects, we could devise our own research questions, collect organisms at sea or from the marshes, and follow through with weeks of laboratory analysis.” If students were awake at 3 a.m., it wasn’t just because they were breaking into the dining hall for ice cream. They were more frequently in the labs, often helping each other pour chromatography columns or load the ultracentrifuge.

Many of the professors at the Marine Lab then are familiar presences today, Joseph Bonaventura, Celia Bonaventura and Richard Forward, for example. Heller recalls a Parents Weekend field trip led by Orrin Pilkey that had a “profound effect” on her family. “That caliber of field trip, waking up smelling the salt air, having professors who were really excited to be there”—these all combined to make the academic experience unforgettable.

The classes offered at the Marine Lab in those days were upper level science courses, and most of the students were botany or zoology majors, “or something closely related,” says Griffith. Many of the students went into medical fields, including Yee, the ophthalmologist, and Christopher Newgard, who was recently named director of the
“Perhaps it was something in the water at the time. There was something magical about our group in 1977.” — Mei Ling Yee

Sarah W. Stedman Nutrition Center at Duke University Medical Center. Some of them left science altogether, including fund manager Heller, art therapist Julie Deal, and a handful of at-home moms. Like Griffith, many continued as research scientists, inspired in part by their Marine Lab semester.

Doing Something for the Marine Lab
And they stayed in touch. In 1997, Griffith helped organize a 20th-anniversary reunion. It was for just the former students, no spouses. As Yee says, “We would not have enough time to reminisce without explaining it all to them.” So successful was that reunion that they planned another for 2002, this one including families. Former Marine Lab director John Costlow made an appearance, and, partly inspired by his presence, the classmates decided to raise funds to assist undergraduates studying at the Marine Lab today.

By that time, the friends were out of the “student impoverished zone” and the “new parent impoverished zone,” says Griffith, and probably in their peak earning years. It was a good time to do something for the Marine Lab.

They created the Undergraduate Research Endowment, a discretionary fund that the Marine Lab director can use to enhance the undergraduate research experience there, by allowing students to obtain specialized supplies, travel to do sampling, or purchase boat time.

Although the Fund was conceived by the Class of 1977, Griffith says, “We don’t consider it ‘ours,’” and adds that other Marine Lab alumni are encouraged to participate. Just under $3,500 is needed for the Fund to reach its goal of $25,000, which will generate an income of about $1,000 per year for student grants.

These days, the Marine Lab welcomes undergraduates from Duke and other colleges during spring, fall, and summer terms, and offers a sufficient variety of courses so that even non-science majors can enjoy the Beaufort experience. The Undergraduate Research Fund will help make that experience even more meaningful for some of them, thanks to the lifelong friends from the Class of 1977.

The DUML Spring Semester Class of 1977 invites anyone who spent time at the Marine Lab to assist current students by giving to the Undergraduate Research Endowment. For further information, contact Krista Bofill, director of alumni affairs and the annual fund, 919-613-8035; k.bofill@duke.edu

Nicholas School Appoints Susan Berndt Associate Dean for External Affairs

Susan Berndt is the new associate dean for external affairs at the Nicholas School.

In this position, Berndt directs alumni and donor relations for the school, heads its major gifts program and oversees development activities for its annual fund. She also coordinates its Board of Visitors and the Duke Marine Lab Advisory Board.

Prior to joining the Nicholas School staff this fall, Berndt served for seven years as associate director of development at Arts & Sciences and Trinity College at Duke, and was a member of the team that raised more than $417 million for the college in Duke’s recent $2 billion comprehensive campaign. Before that, she was director of development at Appalachian State University in Boone, N.C.

A native of Wausau, Wis., Berndt earned a bachelor’s degree from the University of Wisconsin-Stout, and a master’s degree from Appalachian State.

If you haven’t had a chance to meet her, drop by A233 in the Levine Science Research Center on the Duke campus to say hello or e-mail her at susan.berndt@duke.edu

photos courtesy of Peter Griffith
Consistently Generous

Environmental Pacesetters club recognizes consecutive years of giving—several alumni go back more than three decades

by Laura Ertel

When the Nicholas School decided to create a new giving club to recognize contributors who had faithfully supported the school over consecutive years, Annual Fund staff culled the records to see how many donors would qualify.

Knowing the generosity of alumni and friends, they weren’t surprised to find that 282 individuals had given to the Annual Fund every year for 10 years or more. They weren’t even that shocked to find that 58 had given to the school for 20 years running. But they were amazed to learn that four gentlemen—all alumni of the Duke School of Forestry’s master’s program in the 1950s and 1960s—had given to the school annually for at least 32 years!

These men are among the inaugural members of the Environmental Pacesetters. All donors who have contributed to the Nicholas School Annual Fund for two or more years in a row are automatically members of the club. To kick it off, donors celebrating five, 10, 15, 20 or 30–plus year anniversaries of consecutive giving received a beautiful, matted nature photograph to acknowledge their loyal generosity.

“Through all the years and the changes that this school has gone through—from its origins as the Duke School of Forestry through its evolution into today’s Nicholas School of the Environment and Earth Sciences—we have been fortunate to have a loyal group of alumni who have contributed to the school, year in and year out,” said Krista Bofill, director of Alumni Affairs and the Annual Fund. “Environmental Pacesetters is a wonderful way to recognize people who make giving to the Nicholas School an annual tradition.”

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.

Men of Strong Commitments

For this article, we interviewed three of our long-term donors. Besides their master’s degrees from the Duke School of Forestry, Brian Payne, George Morris and Elton Underwood have another thing in common: these men aren’t afraid of commitment.

Not only has each contributed to the Nicholas School Annual Fund for more than three decades running—each also spent his entire career with one employer, and each has been married to the same woman for more than four decades.

Brian Payne, a 1962 graduate who lives in Fairfax, Va., worked for the USDA Forest Service for more than 37 years. His assignments took him all over the country and around the world, from economics and urban forestry research in Oregon and Massachusetts, to helping to start a pre-forestry program at Tuskegee Institute in Alabama to bring more African-Americans into the profession. In Paris, he helped UNESCO coordinate an international program on ecological research; in Vienna, he helped secure funding for developing countries to strengthen their forestry research programs. Before retiring in 2000, he coordinated recreation, wilderness, and social science research for the service.

For Payne, the Forest Service is the family business. His father also retired from the service; his father’s stepfather died while working on a forest fire.

Payne now plays slow-pitch softball in his wife of 4 decades. He and his wife of 41 years, Almuth, also travel and spend time with their two granddaughters. In addition, he finds time to serve on the Nicholas School’s Alumni Council.

“I was only at Duke for one year, but it made an enormous difference, particularly through personal and professional contacts,” says Payne, who also earned a PhD in forest economics at University of California-Berkeley. “Duke graduates are very influential in the natural resources world, and it’s always nice to discover fellow alums in important jobs.”

Payne was surprised to learn that his giving streak extended more than three decades, but he was clear on why he gives to Duke. “Duke asks for money, and does it appropriately and at the right time, and we always get a lot of bang for our buck. Another thing is, I feel very thanked and valued by the university. It is amazing how careful folks have been in sending thanks and sharing what the money has been used for.”

“Natural resources in the country and in the world are stronger as a result of Duke being there. It is marvelous to feel that we’re helping to support a fantastic faculty and the tremendous students they are training. Contributing to Duke is a meaningful investment. You start small, but it’s easy to give a little bit more every year, and soon it becomes a habit.”

George A. Morris’s path to Duke led through Thiel College in Greenville, Pa., where he took advantage of a five–year program to earn a liberal arts degree from Thiel and a master’s in forestry from Duke in 1962. For Morris, it was a chance to choose a different career than his father, a steel worker.

Morris, like Payne, joined the Forest Service and forged a career that spanned 33 years and six states.

“Most of my career was in management, which was out of sync with my academic career at Duke,” Morris admits. “The School of Forestry’s emphasis was on forest utilization and forest management, and my master’s thesis was on direct seeding of short-leaf pines in the coastal plains of Virginia—and I haven’t seen a short-leaf pine since I finished the thesis! But Duke was definitely a good deal. I was raised in Pittsburgh, and Durham is totally different socially, politically, and environmentally. The combination of the technical forestry at Duke and the other aspects of being in North Carolina just added to the package.”

Morris added that he also had a great mentor in Professor Fred White.
Morris’s career with the Forest Service included assignments as center director for the Jobs Corps, manager for educational and vocational programs, program analyst and ski area manager in Aspen, and forest planner in Glenwood Springs, Colo., where he and Ginny, his wife of 43 years, now live. Before retiring in 1994, he was a forest supervisor at a national forest in Utah. He also earned a master’s in systems analysis at MIT.

Today, Morris and his wife, who have two sons and five grandchildren, run an Indian trading company, selling rugs, jewelry, and other items they buy from the Hopi and Navajo reservations in New Mexico and Arizona.

“None of what I’ve done pertains to the flatlands of Virginia!” Morris laughs. “But Duke and Thiel permitted me to grow up, and provided an avenue for this kid from Pittsburgh to become a professional forester. I still contribute to both schools.”

Elton H. Underwood came to Duke after serving in the Army Map Service and in the U.S. Air Force in the Korean War. He returned to the Army Map Service in the Department of Engineer Intelligence (DEI) after earning his master’s degree in 1956.

“The study of forestry prepares you for many fields of work in addition to forestry,” Underwood explains. During his early years with the DEI, he worked on intelligence studies in support of the U.S. Army and other intelligence agencies. He then spent five years with the new Defense Intelligence Agency before joining the U.S. Army Corp of Engineers’ Engineer Studies Center. As a project manager on quick reaction studies in support of the Army and the Department of Defense, he investigated the effectiveness of Agent Orange in South Vietnam, located North Korean infiltration tunnels into South Korea along the Demilitarized Zone (DMZ), and studied the adequacy of South Korean defense along the DMZ.

Underwood, who was in federal service for 33 years before retiring in 1984, says that his career focused more on intelligence than forestry, despite his degrees in the field from West Virginia University and Duke. “I didn’t go out and cruise timber!” Still, having a forestry degree from Duke opened up possibilities: “When you have to choose between two people for a job, showing that you went the extra step to get a master’s from Duke, it gave you a little extra leverage.”

Underwood and his wife, Alice, have been married for 52 years. They live on a small lake in Warrenton, Va., and spend time with their three children and three grandchildren and on their farm in West Virginia. They have enjoyed their 20 years of retirement, taking exciting trips to Alaska, Australia, New Zealand and South Korea.

Although the Nicholas School’s computerized fundraising records date back 32 years, Underwood knows that he has given to both Duke and West Virginia University every year since the late 1950s or early 1960s—nearly 50 years. “The main reason I give to Duke is because they helped me out. I got a $500 scholarship, and back then that was more than it is now! Duke helped me, and they added to my career.”

These three men have inspired the Nicholas School faculty, staff and students with their consistent generosity.

Loyal support provides a reliable funding base, which is vital to sustaining quality environmental education and providing valuable learning opportunities to the future policymakers and scientists of our world,” said Bofill. “It is the accumulation of funds, whether by one person over many years, or by a group of alumni and friends each year that makes the Annual Fund such a powerful force.

“It is really heartwarming and inspiring to those of us who work at the Nicholas School to know that these alumni still feel connected to the school, interested in what we are doing, and that they still want to contribute. It makes us feel that they value us as much as we value them.”

Laura Ertel is a freelance writer based in Durham, N.C.
Mark your calendar for the following dates and monitor our Web site at www.nicholas.duke.edu for additional events.

April 14, 2005
Henry J. Oosting Memorial Lecture
Stuart Fisher, Arizona State University
LSRC, Duke University
Contact: Emily Bernhardt, 919-660-7318 or emily.bernhardt@duke.edu

April 15, 2005
Alumni Council Meeting
Nicholas School
Contact: Michele Wittman, 919-613-8003 or mwittman@duke.edu

April 15-17, 2005
Alumni Reunion Weekend
Contact: Michele Wittman, 919-613-8003 or mwittman@duke.edu or www.dukealumni.com and click on Reunions

April 16, 2005
Speaker Presentation by Dr. Curt Richardson
“Wetlands of Mass Destruction in Iraq”
Contact: Michele Wittman, 919-613-8003 or mwittman@duke.edu

Field Day
Couch Farm Site in Duke Forest
Contact: Michele Wittman, 919-613-8003 or mwittman@duke.edu

April 28-29, 2005
MP Symposium at the Marine Lab
MEM candidates masters presentations
Marine Lab Auditorium
Beaufort, N.C.
Contact: Gail Cannon, 252-504-7605 or gcannon@duke.edu

April 29-30, 2005
Marine Lab Advisory Board Meeting
Beaufort, N.C.
Contact: Michele Wittman, 919-613-8003 or mwittman@duke.edu

The Nicholas Experience at the Duke Marine Lab
Duke University Marine Lab
Contact: Michele Wittman, 919-613-8003 or mwittman@duke.edu

May 14, 2005
9 a.m.
Nicholas School Recognition Ceremony for graduating graduate and professional degree candidates
LSRC Courtyard
Contact: Enrollment Services, 919-613-8070 or envadm@duke.edu for details

May 15, 2005
10 a.m.
Duke University Commencement Exercises
Wallace Wade Stadium
Duke University
Contact: Enrollment Services, 919-613-8070 or envadm@duke.edu for details

June 19-22, 2005
American Association of Petroleum Geologists Annual Meeting
Calgary, Canada
Contact the AAPG: 800-364-2274 or convene2@aapg.org

Aug. 7-12, 2005
90th Annual Meeting of the Ecological Society of America (ESA)
Montréal, Canada
Contact: Assistant Program Chair for ESA and INTECOL, 520-319-9609 or www.esa.org/montreal/

Sept. 16-17, 2005
Alumni Council Meeting
LSRC
Contact: Michele Wittman, 919-613-8003 or mwittman@duke.edu

Oct. 21-23, 2005
Nicholas Environmental Explorers Gift Club Field Trip to White Sulphur Springs
Contact: Michele Wittman, 919-613-8003 or mwittman@duke.edu

Oct. 26
Perkins Distinguished Lecture
Peter R. Rose, President, American Association of Petroleum Geologists
LSRC
Contact: Chris Murphy, 919-668-3893 or christopher.murphy@duke.edu

Nov. 4-5, 2005
Nicholas School Board of Visitors Meeting
LSRC
Contact: Michele Wittman, 919-613-8003 or mwittman@duke.edu

eco audit

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be a part of the
Pito Deep expedition

During the austral summer of 2005, Professors Emily Klein and Jeff Karson and their teams undertook a geological, geophysical and geochemical study of the upper ocean crust exposed at the Pito Deep, located at the northeast corner of the Easter Microplate. Share their discoveries through “Dispatches from Sea.”

visit www.nicholas.duke.edu/pitodeep