


# YALE ENVIRONMENTAL NEWS

The Peabody Museum of Natural History, the School of Forestry & Environmental Studies, and the Yale Institute for Biospheric Studies

fall 2006 · vol. 12, no. 1

A photograph of two giraffes in a savanna landscape. The giraffe in the foreground is standing and facing left, while the one in the background is also facing left. They are surrounded by tall grass and dense green trees in the background.

## Interns Study Environmental Issues at Home and Abroad

The Environmental Studies Program offers Yale College students internships for independent research both here and around the world. An added bonus for participants abroad is the opportunity to enhance their language proficiency through conversation and teaching, while living with a local family.

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# The Business of Climate Change

Yale University, along with two other leading U.S. organizations, has announced a unique collaborative effort to educate hundreds of independent corporate board members about the potential liabilities and strategic business opportunities that global climate change can create for companies.

"Climate change is no longer the purview of scientists only," said Yale School of Forestry & Environmental Studies (F&ES) Dean Gus Speth. "The widespread ramifications of unchecked climate change require that more leaders in our society understand its implications." The announcement was made at a plenary session of the 2006 annual meeting of the Clinton Global Initiative hosted in New York in September by former President Bill Clinton.

The collaboration draws together institutions with complementary expertise in the area of climate change: Marsh, the world's leading risk and insurance services firm; Yale University, one of the nation's leading academic institutions; and Ceres, the nation's largest coalition of investors and environmental groups working with companies on environmental and social issues.



**LEFT TO RIGHT:** Brian Storms, chairman and chief executive officer of Marsh; former President Bill Clinton; Ceres president Mindy Lubber; and Gus Speth, Dean of the Yale School of Forestry & Environmental Studies.

*Initial training of more than 200 independent U.S. board members of Fortune 1000 companies will begin this winter through a newly created curriculum—the Sustainable Governance Forum.*

"Corporate directors are going to need a strategic and analytical underpinning to navigate the transformations that climate change will require in their businesses in the coming years," said Speth. "These changes offer great economic opportunity to those directors who act in a timely way. As a result of its combined academic, nongovernmental and corporate leadership, our new initiative will be well positioned to deliver needed training and support to participating corporations."

Brian Storms, chair and chief executive officer of Marsh, said, "Increasingly, corporate leaders are asking us to help them better understand their total spectrum of risk, and how it affects their overall business strategies. Aligning with Yale and Ceres to educate top corporate leaders about one of the most critical business risks of our time demonstrates our strong commitment to addressing this important issue."

Initial training of more than 200 independent U.S. board members of Fortune 1000 companies will begin this winter through a newly created curriculum—the Sustainable Governance Forum. The training sessions will be offered across the country through September 2008. Marsh, Yale and Ceres are combining their intellectual capital and research to develop the training program, and a \$250,000 contribution by Marsh will be used to produce the materials. Courses and materials are being designed to provide insights into the practical financial, legal, business and investment implications of climate change for corporations. An earlier seed grant of \$50,000 from the Betsy and Jesse Fink Foundation helped to launch the new initiative.

Many companies focus on avoiding the liabilities related to climate change. However, Storms believes that there are as many opportunities as risks associated with climate change. "Those companies that understand true enterprise risk will be the ones that seize upon the growth prospects that threats like climate change create," he said. "As more companies have begun to understand this and seek advice, we're seeing increased business."

Ceres president Mindy Lubber, who also directs the \$3 trillion Investor Network on Climate Risk, said: "This training program will prepare corporate directors for what is perhaps the biggest challenge companies will face in the 21st century. Major investors are increasingly demanding that companies sharpen their focus on the impacts of climate change, whether from new regulations, physical changes or growing global demand for low-carbon technologies. This program will help ensure that independent directors ask the tough, smart questions of the companies they oversee."

The concept for the new collaboration took shape at a high-level conference on climate change hosted late in 2005 by F&ES, which has long been committed to advancing rigorous science on climate change and has recently undertaken new initiatives to disseminate this science to major decision-makers, including the corporate directors addressed by this new collaboration.

The full program of action from Yale is described in a recently published book, *Americans and Climate Change: Closing the Gap Between Science and Action* ([www.environment.yale.edu/climate/](http://www.environment.yale.edu/climate/)).



## Professor Stephen Sparks

**2006/07 Edward P. Bass Distinguished Visiting Environmental Scholar in the Department of Geology & Geophysics**

The Yale Institute for Biospheric Studies (YIBS) is pleased to announce the appointment of Professor Stephen Sparks, a world-renowned volcanologist, as an Edward P. Bass Distinguished Visiting Environmental Scholar for 2006/07.

Professor Sparks's research interests include the generation of melts and the role of fluids in the earth's crust, nonlinear dynamics of volcanic eruptions, the transport of debris avalanches and submarine currents during volcanic eruptions, the effects of volcanism on climate and the environment, the prediction of eruptions, analysis of volcanic time series, and the assessment of hazards and risk related to volcanism. While at Yale he is based in the Department of Geology & Geophysics, where he will consider two major issues: global risks from extreme natural hazards and access to scientific knowledge in the developing world.

Professor Sparks is director of the Research Center for Environmental and Geophysical Flows at the University of Bristol, U.K. He is a fellow of the Royal Society and of the American Geophysical Union. He has been president of the Geological Society of London (1994–96) and of the International Association of Volcanology (1999–2003). He was formerly chief scientist at Montserrat Volcano Observatory and was recently a member of an advisory panel to Tony Blair on natural hazards.

Professor Sparks's interest in extreme natural hazards has been long standing. He is involved in the Global Risk Identification Programme (GRIP), which is supported by the World Bank and The United Nations. His work has already demonstrated that only about 20% of the world's volcanoes are well studied and most of these are in the developed world. His collaborations with scientists from the developing world have led to his engagement in issues such as training and knowledge trans-

fer, incentives to pursue a science career in the originating country and access to research funds to participate in international science.

Five hundred million people live close enough to volcanoes to be threatened when they erupt. With an increasing global population the effects of a major explosive volcanic eruption could be worldwide. Indeed very

large but rare explosive eruptions are the only natural phenomena apart from meteor impact that could cause a global catastrophe; the last eruption on that scale took place in southern Japan 7,300 years ago. Research and educational resources are needed to identify vulnerable areas and inform populations and authorities about the hazards they face.

### F&ES HOSTS VISITING SCHOLARS

The Yale School of Forestry & Environmental Studies (F&ES) is hosting an environmental practitioner and an expert on world religions and ecology as visiting scholars.

**Jerome Ringo**, chair of the board of the National Wildlife Federation (NWF), will be the Dorothy S. McCluskey Visiting Fellow for Conservation during the spring 2007 semester at F&ES. In 2005, Ringo was elected as chair of NWF and became president of the Apollo Alliance, a broad coalition of business, labor and environmental organizations.

As a champion of environmental justice and a vocal advocate of clean energy, Ringo has firsthand experience in these issues after working for more than 20 years in Louisiana's petrochemical industry. "He has a clear understanding of the impacts of poor environmental practices on the low-income communities that surround those petrochemical plants," said F&ES Dean Gus Speth.

While at F&ES, Ringo will not teach but will interact extensively with students, bringing them into contact with his wide array of contacts and undertakings and providing them with new opportunities and insights. He will also offer a number of public and small-group presentations. And Ringo will work closely with students who are studying the recovery efforts in New Orleans (his family was evacuated during Hurricanes Katrina and Rita).

**Mary Evelyn Tucker** is the Yale Bioethicist in Residence for the 2006–07 academic year. She is the co-founder and co-director of the Forum on Religion and Ecology. She is the author of *Worldly Wonder: Religions Enter Their Ecological Phase* (2003). She co-edited *Worldviews and Ecology: Religion, Philosophy, and the Environment* (1994); *Buddhism and Ecology* (1997); *Confucianism and Ecology* (1998); and *Hinduism and Ecology* (2000). She also co-edited a *Daedalus* volume, *Religion and Ecology: Can the Climate Change?* (2001).

Tucker received her Ph.D. in East Asian religions, with a concentration in Confucianism in China and Japan from Columbia University. Until 2005, she was a professor of religion at Bucknell University, where she taught courses in Asian religions and religion and ecology. From 1993 to 1996, she was a National Endowment for the Humanities Chair at Bucknell. She is currently a research associate at the Harvard-Yenching Institute and the Reischauer Institute of Japanese Studies at Harvard. While at Yale, she will teach "World Religions and Ecology: Asian Religions" this spring, and taught "Seminar on World Religions and Ecology" this fall.

# CONFERENCES, SEMINARS, SYMPOSIA



## YIBS/ESC FRIDAY NOON SEMINARS

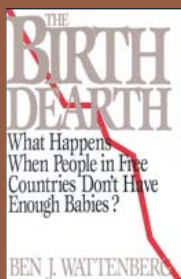
The Yale Institute for Biospheric Studies' (YIBS) continues its sponsorship of the weekly YIBS/ESC Friday Luncheon Seminars. The seminars are held in the Class of 1954 Environmental Science Center (ESC) during the fall and spring semesters. The Fall 2006 series featured the following speakers and topics:

**Jacques Gauthier**, Professor, Department of Geology & Geophysics, *The Making of the Torosaurus Statue* ■ **Roderick McIntosh**, Professor, Department of Anthropology, *When Cities Blow Away: Abrupt Climate Change and Regional Abandonment in the "Dead Delta" of the Middle Niger* ■ **Michael Teitelbaum**, Edward

P. Bass Distinguished Visiting Environmental Scholar; Vice President, Alfred P. Sloan Foundation, *21st Century Demography* ■ **Moshe Herzberg**, Postdoctoral Fellow, Department of Chemical Engineering, *Studies on Bacterial Biofilms: Harnessing Bacteria for Bioremediation Versus Biofouling Control* ■

**Paul Wignall**, Professor of Palaeoenvironments, School of Earth and Environment, University of Leeds, *The Link Between Volcanism and Mass Extinctions* ■ **Andrew Scott**, Professor of Applied Palaeobotany, Department of Geology, Royal Holloway, University of London, *The Burning Issue: Fire—Shaping Our Past and Future World* ■ **Antonia Monteiro**, Assistant Professor, Department of Ecology and Evolutionary Biology, *Evolution and Development of Butterfly Wing Patterns* ■ **H. Catherine Skinner**, Lecturer, Department of Geology & Geophysics, *The Earth: Source of Health and Hazard* ■ **Thomas Near**, Assistant Professor, Department of Ecology & Evolutionary Biology, *Evolution on Ice: Pattern and Tempo of Diversification in Antarctic Notothenioid Fishes* ■ **Maria Ana Diuk-Wasser**, Associate Research Scientist, Department of Epidemiology & Public Health, Yale School of Medicine ■ **Florencia Montagnini**, Professor in the Practice of Tropical Forestry, Yale School of Forestry & Environmental Studies, *Carbon Sequestration in Agroforestry Systems*.

For information and the speakers list, please visit the YIBS Web site at <http://www.yale.edu/yibs/>



## DEMOGRAPHY & POPULATION

### A Seminar Series

As part of his interactions with faculty and students at Yale as an Edward P. Bass Distinguished Visiting Environmental Scholar, Dr. Michael Teitelbaum, noted demographer and vice president of the Alfred P. Sloan Foundation in New York, organized a seminar series on "Demography & Population" during the Fall 2006 semester. Co-sponsored by the Interdisciplinary Bioethics Center at Yale and the Yale Institute for Biospheric Studies (YIBS), the seminar featured the following speakers:

**Michael S. Teitelbaum**, Edward P. Bass Distinguished Visiting Environmental Scholar, presented *The Spread of Very Low Fertility Rates: Wherefore, and Whither?*

**Jeffrey G. Williamson**, Professor of Economics, Harvard University, presented *The Demographic Transition and Globalization Connection*

**Hania Zlotnik**, Director, Population Division, United Nations presented *The 2006 U.N. High-Level Dialogue on International Migration and Development*

**David Bloom**, Professor of Economics and Demography, School of Public Health, Harvard University, presented *Do People's Subjective Expectations About How Long they will Live Affect Their Savings and Retirement Behaviors?*

Dr. Teitelbaum plans to continue this seminar series in the spring of 2007.

For information and a schedule of speakers for the Spring 2007 series, please visit the YIBS Web site at [www.yale.edu/yibs/](http://www.yale.edu/yibs/) or call (203) 432-9856 or (203) 432-9857.



## Edward P. Bass Distinguished Lecture

Two world-renowned marine biologists from Scripps Institution of Oceanography, Jeremy Jackson, professor of oceanography, Geosciences Research Division, and Nancy Knowlton, professor of marine biology and director of the Center for Marine Biodiversity and Conservation, presented a seminar, *Human Impacts on the Global Ocean*, on October 18, 2006. The seminar was sponsored by the Edward P. Bass Distinguished Visiting Environmental Scholars Program.

Professor Jackson's presentation, *The Rise of Slime*, described the decline of the oceans due to human impact, the disappearance of big animals (not least of which are the whales), the collapse of the world's fisheries, the decline of coral reefs, the impact of trawling on the seabed, and the rise of slime. Slime is Jackson's graphic shorthand for communities of bacteria and other microbes, as well as algae, that occur in great abundance where there are high concentrations of nutrients. As a consequence of our use of the world's oceans as a sewer, increasing areas are in danger of being reduced to a dead zone. While some places like Australia lead the way in marine conservation, other nations lag far behind. There is a tendency to justify doing little or nothing on the basis that prophecies of doom are only the "opinion" of environmentalists. But the rise of slime is a scientific observation, and the call for action is urgent.

Professor Knowlton's presentation, *Coral Reefs: Canaries in the Environmental Coal Mine*, focused on the state of the world's coral reefs as a litmus test of the health of the oceans. Coral reefs are the most diverse of all ecosystems and also the most threatened. Knowlton emphasized that we need to understand the biodiversity of reefs as a tool in their conservation: there are many cryptic species that can be identified only on a genetic basis, but whose diversity contributes to the resilience

of reefs. Investigations in remote areas of the Pacific, where reef ecosystems are relatively pristine, show unequivocally that the health of the reef reflects distance from human influence. Climate change, however, is also a major threat. Knowlton highlighted the effects of global warming on the bleaching of coral reefs, which follows the breakdown of the relationship between corals and their symbiotic algae. Corals are also particularly vulnerable to hurricane damage, disease, overfishing, and shifts in the acidity of the oceans.

While the message of *Human Impacts on the Global Ocean* was profoundly disturbing, it provided a wake-up call. The oceans are in urgent need of conservation and the scientific community must be more effective in communicating the nature of their decline to both the public and the policy makers.



Davey Kline

*As a consequence of our use of the world's oceans as a sewer, increasing areas are in danger of being reduced to a dead zone.*



Jennifer Smith

**TOP** Caribbean coral suffering from coral bleaching caused by excessively warm water.

**BOTTOM** Reefs of Palmyra Atoll, where low human impacts result in healthy corals and large numbers of top predators.

### Speth named Sara Shallenberger Brown Professor of Environmental Policy

The Yale School of Forestry & Environmental Studies (F&ES) Dean Gus Speth has been named the Sara Shallenberger Brown Professor in the Practice of Environmental Policy. “Dean Speth’s distinguished contributions as a scholar and a leader in the practice of environmental law, climate change and energy make him well deserving of this recognition,” said Yale President Richard Levin.

Speth’s areas of interest include U.S. and international environmental policy; climate change and related energy issues; and sustainable development in developing societies. His role as an adviser, consultant and leader in initiatives to combat environmental degradation has earned him a reputation as one of the

world’s leading environmental stewards.

In his many publications, including *Red Sky at Morning: America and the Crisis of the Global Environment* (2004) and *Worlds Apart: Globalization and the Environment* (2003), Speth has emphasized a need for international action on global climate change. In *Global Environmental Governance* (2006), he and political scientist Peter Haas examine 10 major global environmental threats and how they can be addressed through treaties, governance and new forms of international cooperation.

As a member and chair of the President’s Council on Environmental Quality, Speth was President Carter’s principal White House adviser on environmental affairs. In 1979 and

1980, he led efforts to call attention to climate change and other challenges to the global environment that are now widely acknowledged. In 2002, he was awarded the Blue Planet Prize for his early efforts.

Prior to joining Yale in 1999, Speth was the administrator of the United Nations Development Programme and chair of the U.N. Development Group from 1993 to 1999. He founded and was president, from 1982 to 1992, of the World Resources Institute, a center for policy research and technical assistance on environmental and development issues. He also was a co-founder of the Natural Resources Defense Council in 1970.



### Esty named Hillhouse Professor of Environmental Law and Policy

Daniel Esty, J.D. '86, the newly named Hillhouse Professor of Environmental Law and Policy, is renowned for his research and teaching in those areas, as well as in the areas of world trade and the environment, and environmental performance measurement.

Esty holds a joint appointment at the Yale School of Forestry & Environmental Studies (F&ES) and the Yale Law School. He has served since 2001 as director of the Yale World Fellows Program, an initiative to bring emerging world leaders to campus for a special leadership training program, and has been director of the Yale Center for Environmental Law and Policy since 1994.

Esty is co-author of *Green to Gold: How Smart Companies Use Environmental Strategy to Innovate, Create Value, and Build Competitive Advantage* (2006), which demonstrates that companies that have employed environmentally friendly strategies to their advantage are more innovative and entrepreneurial than their competitors.

The most recent books that he has co-edited are *Global Environmental Governance: Options & Opportunities* (2002); *Greening the Americas: NAFTA's Lessons for Hemispheric Trade* (2002); *Environmental Performance Measurement: The Global Report, 2001–2002*; and *Regulatory Competition and Economic Integration: Comparative Perspectives* (2001).

A graduate of Harvard College, Esty studied at Oxford University as a Rhodes Scholar, and earned his J.D. in 1986 from the Yale Law School, where he was executive editor of the *Yale Journal on Regulation* and project coordinator of the Environmental Litigation Program.

Following graduation, he served as an attorney at the Washington, D.C. firm Arnold & Porter before being named special assistant to William Reilly, administrator of the U.S. Environmental Protection Agency (EPA), in 1989. He became deputy chief of staff in 1990 and deputy assistant administrator for policy a year later. At the EPA, he had responsibility for coordinating the agency’s entry into the international trade arena, and was the chief EPA negotiator for the environmental aspects of the



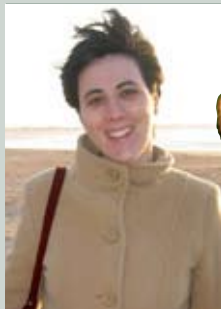


North American Free Trade Agreement, among other duties.

Esty joined the Yale faculty in 1994 after serving for a year as a senior fellow at the Institute for International Economics in Washington, D.C. He was an associate dean at F&ES from 1998 to 2002. He developed a pilot Environmental Sustainability Index in 1999 to measure the ability of economies to achieve environmentally sustainable development. He developed the methodology for the index, which provided the most comprehensive global report on the state of the environment, with support from the World Economic Forum.

The American Bar Association honored Esty with its Award for Distinguished Achievement in Environmental Law in 2002, and in 1998 and 2000 he was named by *Earth Times* as one of the world's "100 most influential environmental leaders." He has twice received the F&ES teaching award. His other honors include the EPA's Fitzhugh Green Award for contributions to international environmental protection.

## New Faculty



### GENOMICS RESEARCHER ANTÓNIA MONTEIRO JOINS YALE

Antónia Monteiro has recently joined Yale's Department of Ecology & Evolutionary Biology as an assistant professor, and has been named an assistant curator in the Peabody Museum of Natural History's Division of Entomology. Her research focuses on the evolution and development of wing patterns in butterflies and moths.

Monteiro's laboratory is investigating the function of several developmental genes in the production of color patterns on the wings of saturniid moths, and nymphalid and pierid butterflies, and is working to understand how those genes are regulated and how this regulation has evolved through time. Other goals involve testing the function of the wing patterns in mate recognition and in interactions with predators.

Monteiro is researching the genes that determine the eyespots on butterfly wings, as in the African nymphalid, *Bicyclus anynana*.

Monteiro earned a B.S. in Zoology at the University of Lisbon in 1991, a PhD in Evolutionary Developmental Biology from the University of Edinburgh in 1997, and did postdoctoral work at Harvard University in Molecular Phylogenetics from 1997 to 1999, and at Leiden University in Evolutionary Developmental Biology from 1999 to 2001. From 2001 to 2006—before coming to Yale—she was an Assistant Professor in the Department of Biological Sciences at the University of Buffalo.



### YALE WELCOMES ICHTHYOLOGIST THOMAS NEAR

Thomas J. Near has joined the Yale faculty as an assistant professor in the Department of Ecology & Evolutionary Biology, and has been named assistant curator in vertebrate zoology in the Peabody Museum of Natural History.

Near's research focuses on the evolutionary biology of fishes, with particular emphasis on examining patterns and mechanisms of speciation using molecular phylogenies. These studies are focused primarily on North American freshwater fishes (darters, sunfishes, rock basses and black basses) and an adaptive radiation of fishes found in the frigid marine waters surrounding Antarctica (nototheniids, dragonfishes, plunderfishes, and icefishes). Near has also developed new methods for using fossil and paleogeographic information to provide calibrations in converting observations of genetic divergence to absolute age estimates. These methods to calibrate "molecular clocks" are gaining wide application in evolutionary biology across taxonomic disciplines.

Already Near is taking advantage of the research opportunities provided by the Peabody Museum's ichthyology collection. Near and his students are in the process of accessioning collections of fishes from North American collecting trips to the Ozarks, the Cumberland Plateau, the Mobile Basin, and the Tennessee River Drainage, and from three Antarctic expeditions. These collections are estimated to total 1,000 specimen lots and this will represent a 6% increase in the Peabody's ichthyology holdings.

A native of Chicago, Near earned a B.S. in biological sciences and a B.A. in history at Northern Illinois University, and received his Ph.D. from the University of Illinois, Urbana-Champaign.



ZIMMERMAN



ANASTAS



TOWNSEND

### GREEN ENGINEER AND CHEMIST TO JOIN YALE FACULTY

An author of a treatise on the principles of green engineering and the father of green chemistry will join the full-time Yale faculty in January.

With the appointments of **Julie Zimmerman** of the U.S. Environmental Protection Agency (EPA), and **Paul Anastas** of the American Chemical Society, “Yale builds on its already world-class stature in industrial ecology and sustainability,” said Thomas Graedel, the Clifton R. Musser Professor of Industrial Ecology at the Yale School of Forestry & Environmental Studies (F&ES).

Zimmerman will hold a joint faculty appointment in Environmental Engineering and F&ES, and is supported in part by the Yale Institute for Biospheric Studies. Anastas will be professor in the Practice of Green Chemistry at F&ES, as well as have appointments in the Department of Chemistry and in Environmental Engineering.

Zimmerman, who obtained a Ph.D. from the University of Michigan in 2003, developed novel, environmentally friendly metalworking solvents for optimizing manufacturing machining processes without sacrificing performance. Her results are currently being implemented by the auto industry.

After getting her Ph.D., Zimmerman obtained her current position with the Office of Research and Development at the EPA. Chief among her responsibilities is managing grants to academia and small businesses in the areas of pollution prevention and sustainability. She is also managing several projects that will

integrate sustainability concepts into engineering education. She authored a widely known and highly regarded article, “Sustainable Development Through the Principles of Green Engineering,” which was published in *Environmental Science & Technology* in 2003. She is also a part-time faculty member at the University of Virginia, teaching these principles to engineers in training.

Anastas’s name is synonymous with green chemistry throughout much of the world. He is currently director of the Green Chemistry Institute, which is headquartered at the American Chemical Society in Washington, D.C., and has established 24 green chemistry chapters in countries including China, Ethiopia, India, Japan and South Africa. He recently was named the “father of green chemistry” and the 2006 winner of the \$250,000 Heinz Prize for the Environment by the Heinz Family Philanthropies.

Anastas originated the field of green chemistry at the EPA in the 1990s, and has published widely on topics of science through sustainability, including the books *Benign by Design: Alternative Synthetic Design for Pollution Prevention* (1994); *Designing Safer Polymers* (2000); *Green Engineering: Environmentally Conscious Design of Chemical Processes* (2002); and his seminal work, with co-author John Warner, *Green Chemistry: Theory and Practice* (2000).

He was assistant director for the environment in the White House Office of Science and Technology Policy from 1999 to 2004. Prior to joining that office, he was the chief of the Industrial Chemistry Branch of the EPA, where he was responsible for the regulatory

review of industrial chemicals under the Toxic Substances Control Act and the development of rules, policy and guidance. He holds a Ph.D. in organic chemistry from Brandeis University.

### JEFFREY TOWNSEND APPOINTED TO THE DEPARTMENT OF ECOLOGY & EVOLUTIONARY BIOLOGY

**Jeffrey Townsend**, a 2005 winner of the American Society of Naturalists’ Young Investigators Award, has been appointed Assistant Professor in the Department of Ecology & Evolutionary Biology at Yale University as of July 1, 2006. Townsend’s research is on how genes have evolved to modulate development in their environment to create the diverse organisms that populate the earth today. His work includes extensive use of computational, mathematical and experimental techniques.

Primarily, Townsend’s lab works on fungi, including the wine and bread yeast *Saccharomyces cerevisiae* and the “bread mold” *Neurospora crassa*, which he has collected from natural populations. His American Society of Naturalists’ Young Investigators’ Award was awarded to him for his work “revealing population genetic variation in genome-wide gene expression in *S. cerevisiae*,” work that revealed, for the first time, the extent of natural variation in the degree to which genes are expressed for every gene in an organism’s genome. Using microarrays with entire genomes printed on them, he has since gone on to apply such whole genome experimentation to other fungi, including *Neurospora crassa*, which is found on decomposing plants after wildfires, and *Coccidioides posadasii*, a soil fungus which can occasionally infect mammals to cause San



Joaquin Valley Fever. By understanding how diverse fungi integrate genome-wide gene expression to control their development and metabolism, Townsend plans to relate molecular and organismal biology with a new degree of holistic precision.

To perform such experiments, Townsend has worked extensively on the development of mathematical models and statistical approaches for experimental design, creating, for instance, a popular Bayesian approach for the analysis of DNA microarray data. Some of Townsend's most recent work has been on phylogenetic theory—which provides the fundamental basis for classification of the diversity of life. He has developed mathematical theory to help explain the population genetics of microbes that exchange DNA with distantly related organisms. His most recent theoretical work has been to develop mathematical and computational tools that will increase the efficiency of phylogenetic experimental designs. Researchers are increasingly using DNA sequencing of genes to characterize the relationships among organisms, elucidating which species are closely related to other species, and which taxonomic groups have shared evolutionary history. His theoretical advances are helping to quantify the informativeness of genes that researches sequence, resulting in experiments that are quicker and less costly, and conclusions that are more accurate as well.

## Awards and Grants



BELL



CURRAN



KELLERT

### ENVIRONMENTAL HEALTH PROFESSOR RECEIVES ONES AWARD

A Yale School of Forestry & Environmental Studies (F&ES) professor is one of eight scientists to receive an Outstanding New Environmental Scientist (ONES) award from the National Institutes of Health.

**Michelle Bell**, Assistant Professor of Environmental Health at F&ES, will receive \$500,000 to study the relationship between outdoor concentrations of ozone, a reactive form of oxygen that is a primary component of urban smog, and the incidence of respiratory disease and death in exposed populations. Bell is one of two Yale University professors to receive a ONES award. **Sven-Eric Jordt**, Assistant Professor of Pharmacology in the School of Medicine, will study the way in which certain airborne pollutants interact with sensory nerve cells in order to produce eye, nose and throat irritation.

The National Institute of Environmental Health Sciences (NIEHS), part of the National Institutes of Health, awarded grants totaling \$3.6 million that will support the eight scientists, each of whom is pursuing a career in environmental health research, over five years. "The ONES program is designed to provide a strong foundation for outstanding scientists who are in the early, formative stages of their careers," said David Schwartz, director of the NIEHS. "These grants will assist the scientists in launching innovative research programs that focus on human disease and the influence of the environment."

Research supported by the ONES grants will cover a broad range of environmental expo-

sure, as well as the biological responses they elicit. Each of the awardees will focus on a specific human disease or condition as it relates to a specific environmental exposure.

### TROPICAL RESOURCES PROFESSOR WINS MACARTHUR "GENIUS" GRANT

**Lisa Curran**, Professor of Tropical Resources and Director of the Tropical Resources Institute at the Yale School of Forestry & Environmental Studies (F&ES), has been awarded a five-year John D. and Catherine T. MacArthur Foundation Fellowship. She will receive \$500,000 in unconditional support over the next five years.

Like all MacArthur Fellows, the award came as a total surprise to Curran. "It's like winning the lottery after 20 years of *Survivor* in Borneo. Actually, this has been a tremendous team effort. I've worked with some of my Indonesian colleagues for 18 years. I'm part of all the people I've met: the villagers, the loggers, the scientists and the students—from both the U.S. and Indonesia."

In announcing the award, the MacArthur Foundation said, "Through diplomatic skill, cultural sensitivity, and rigorous scientific acumen, Lisa Curran synthesizes concepts from the natural and social sciences to forge new, practical solutions for sustainable natural resource extraction and development. By developing consensus and fostering communication between diverse stakeholders..., she is substantially increasing protection efforts in endangered regions."

Curran has focused her research on the forests of Borneo and the ecology of its most

economically important family of tropical timber, Philippine mahogany. She has worked to devise new strategies to address deforestation and its devastating environmental consequences. Curran and her research team study the structure and dynamics of tropical forests using satellite remote sensing, field ecology, and ground-based surveys and analysis to learn how the environment is altered by human activities and to improve the management of these forests by integrating scientific knowledge with sociological, political and economic realities. She has been instrumental in the establishment of national parks in Indonesia, and has worked to counter illegal logging and the corruption that allows it to take place.

"I've had an unusual career trajectory," Curran says. "I tend to be a problem solver, which requires me to think outside the box. I've had to use creative ways to acquire the information I've needed to address the issues in this emerging new field, sustainability science. I understand the needs of the activist seeking change, but fundamentally I am a scientist seeking knowledge. My research is collaborative and interdisciplinary. I provide sound science so Indonesians can address these complicated issues. I provide training and information for them."

After graduating from Harvard University with an A.B. in anthropology in 1984, Curran went to Indonesian Borneo. She remained there for most of the next eight years, living in logging camps and seeing firsthand how the tropical forests were being used and abused. Borneo, the third-largest island in the world, is divided into four political regions: Kalimantan belongs to Indonesia, while the remaining regions are part of Malaysia and Brunei.

Curran completed her Ph.D. at Princeton in 1994, after which she was a postdoctoral fellow at Harvard and an assistant professor at the University of Michigan. She joined the Yale faculty as an associate professor in 2001 and was promoted to professor with tenure in 2006.

Until recently, Curran has spent three to six months of the year in the field, hiking for miles through peat marshes and leech-infested swamps, drinking from springs and camping under a tarp in order to study the tropical ecosystem and the impact of illegal logging and agrobusiness. There were times her team was threatened and, she says, "I had a price on my head. It's a cowboy culture out there." For a couple of years, the situation was so dangerous in Indonesia that she shifted her studies to the Amazon rainforest. After Indonesia got its first democratically elected president in October 2004, she was able to resume work in the Kalimantan forest. She still travels to the field camp, training teams that stay on site year-round, but now she goes primarily during academic breaks.

The Tropical Resources Institute (TRI), which Curran heads, is an interdisciplinary, non-degree-granting program within F&ES. TRI supports student research projects aimed at finding practical solutions to conservation and management of resources in the tropics.

#### **SOCIAL ECOLOGY PROFESSOR WINS RESEARCH AWARD**

**Stephen Kellert**, Ph.D. '71, Tweedy/Ordway Professor of Social Ecology at the Yale School of Forestry & Environmental Studies (F&ES), has won the Outstanding Contributions to Research Award from the North American Association for Environmental Education. Kellert received the award at the association's annual conference in October in St. Paul, Minnesota. The award is given to an individual who has made outstanding theoretical and scientific contributions.

"Professor Kellert is a prolific writer, a superb teacher and a leader in his field," said F&ES Dean Gus Speth.

Much of Kellert's work focuses on understanding the connection between human and natural systems, with a particular interest in the value and conservation of nature and in designing ways to harmonize the natural and human-built environments.

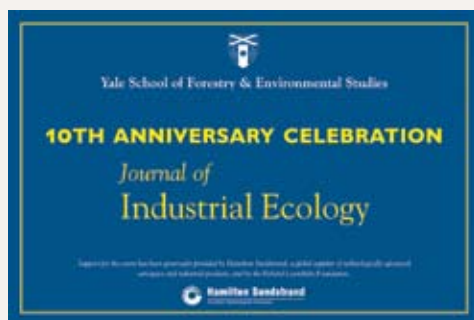
Kellert has authored more than 100 publications, including several books that explore people's relationship to nature. In 1993, he co-edited *The Biophilia Hypothesis* with Edward O. Wilson, an entomologist at Harvard. The book brought together 20 scientists from various disciplines to refine and examine biophilia, which asserts that humans possess a deep and biologically based urge to connect with the natural world.

He went on to publish *The Value of Life: Biological Diversity and Human Society* (1996); *Kinship to Mastery: Biophilia in Human Evolution and Development* (1997); *The Good in Nature and Humanity: Connecting Science, Religion, and Spirituality with the Natural World* (2002); *Children and Nature: Psychological, Sociocultural, and Evolutionary Investigations* (2002); and *Building for Life: Designing and Understanding the Human-Nature Connection* (2005).

Kellert's other recent awards include the National Conservation Achievement Award from the National Wildlife Federation and the Distinguished Individual Achievement Award from the Society for Conservation Biology. He is one of 300 individuals listed in *American Environmental Leaders: From Colonial Times to the Present*. He also has served on committees of the National Academy of Sciences, and is a member of the IUCN Species Survival Commission.



## Journal of Industrial Ecology Celebrates 10th Anniversary



The *Journal of Industrial Ecology* (JIE), an international quarterly dealing with industry and the environment, celebrated two major achievements in 2006—its 10th anniversary and its inclusion in the Science Citation Index Expanded (SCIExp), an important benchmark in scientific publishing.

The peer-reviewed journal is owned by Yale, published by MIT Press and headquartered at the Yale School of Forestry & Environmental Studies (F&ES). JIE's editor-in-chief is Reid Lifset, Associate Director of the Industrial Environmental Management Program at F&ES.

IE marked its 10th anniversary in May with a panel discussion at Yale on the past and future of industrial ecology. Among the distinguished speakers were John Ehrenfeld, executive director of the International Society for Industrial Ecology and co-editor of JIE; Faye Duchin, professor of economics at Rensselaer Polytechnic Institute and a world leader in input-output analysis for environmental assessment; Ramesh Ramaswamy, director

and founder of the Resource Optimization Initiative in Bangalore, India; and Charles Powers, chair of the Project on Industrial Ecology, Pollution Prevention, and the New York/New Jersey Harbor at the New York Academy of Sciences.

Support for the celebration was generously provided by Hamilton Sundstrand, a Connecticut-based global supplier of technologically advanced aerospace and industrial products.

JIE's acceptance into SCIExp, which is maintained by Thomson Scientific, means that the journal is carried by Current Contents, an abstracting and indexing service used by researchers worldwide. Approximately 2,000 new journals are reviewed every year by the Thomson Scientific staff, and only 10 percent to 12 percent are accepted for inclusion.

In addition, a recent article in the journal *Business Strategy and the Environment* ranked JIE as the top journal dedicated to publishing in the field of organizations and natural environment.



## Yale School of Forestry & Environmental Studies PUBLICATION SERIES

Yale F&ES faculty, staff, and students participate in exciting environmental projects each year, including innovative courses, conferences, and applied research. The goal of the F&ES Publication Series is to capture some of the best of that work and make it available to a broad professional audience. There are now more than 30 Series publications on a wide range of topics.

Examples of recent publications in the Series include:

- *Americans and Climate Change*, a report on the insights and recommendations of 110 top leaders convened by Yale F&ES in Aspen in the fall of 2005 to assess how to overcome the gap between science and action on climate change;
- *Confronting Sustainability: Forest Certification in Developing and Transitioning Countries*, a 622 page report on an international conference held at F&ES on that topic, with case studies by 16 in-country experts;
- *Can the Anchor Hold? Rethinking the United Nations Environment Programme for the 21st Century*, a report based on an F&ES course that included a trip to UNEP headquarters in Nairobi, Kenya, and presentation of the ideas in the report to the UNEP staff;
- *The Industrial Platinum Cycle for Russia: A Case Study of Materials Accounting*, a working paper on one piece of a much larger metals cycling project being conducted by the Center for Industrial Ecology at F&ES.

For free pdf downloads or to order printed volumes:

[www.yale.edu/environment/publications](http://www.yale.edu/environment/publications)

# YALE PEABODY MUSEUM OF NATURAL HISTORY

William Sacco



## EVENTS

### 11TH ANNUAL CELEBRATION OF MARTIN LUTHER KING, JR., DAY January 14 & 15, 2007

The Peabody Museum's renowned two-day festival in honor of Dr. Martin Luther King, Jr., and his efforts to ensure environmental and social justice among all people.

### ALIEN EARTHS On view through May 6, 2007

Join the search for planets around distant stars and for life beyond Earth in the Peabody Museum's exciting new exhibition *Alien Earths*, and learn about the technology and methods scientists are using to search our galactic neighborhood.

### FIESTA LATINA! March 3, 2007

Our annual celebration of Latin American cultures! This daylong festival features performances of traditional and contemporary Latin American music and dances, along with storytelling, face painting and mask making for kids.

### PEABODY SUMMER YOUTH PROGRAMS July and August 2007

Week-long summer camp programs for students entering 3rd to 9th grades, on topics as diverse as biodiversity, natural science illustration, ancient survival skills, ancient cultures and archaeology. See the Peabody Museum Web site for details.

For information and updates visit  
[www.peabody.yale.edu](http://www.peabody.yale.edu).

## Eric Sargis named Assistant Curator

Eric J. Sargis has been appointed Assistant Curator of Mammalogy in the Division of Vertebrate Zoology at the Yale Peabody Museum of Natural History. Sargis, who received his Ph.D. from the City University of New York in 2000 as a part of the New York Consortium in Evolutionary Primatology, was initially hired as a visiting lecturer in Yale's Department of Anthropology in 2000. He was appointed an assistant professor in 2001 and teaches undergraduate courses in primate evolution, human osteology, and human functional anatomy. Sargis uses the Peabody Museum osteological and fossil collections in the laboratory sections of these classes. He also teaches graduate seminars on evolutionary morphology, evolutionary theory, primate functional morphology, systematics and research methods.

Sargis is an evolutionary morphologist who has worked on living and fossil mammals, including both placentals and marsupials. His research, on 10 different groups of mammals,

has focused on primates and treeshrews. He is currently working on the systematics of Old World monkeys; the relationships of primates and treeshrews to other placental mammals; the systematics, biogeography and conservation of treeshrews; and the evolutionary morphology of Mesozoic mammals from the Kyzylkum Desert in Uzbekistan. His recent co-authored paper in the June 2, 2006, issue of *Science* named a new genus of extant African monkey, *Rungwecebus*. Sargis is the book review editor for the *Journal of Mammalian Evolution* and treasurer of the Society for the Study of Mammalian Evolution. He is currently co-editing a book on mammalian evolutionary morphology.

Sargis has conducted fieldwork on four continents, including mammalogical research in Cambodia, Madagascar and Malaysia; paleontological research in Peru, Bolivia, Brazil, Montana and Florida; and primatological research in Ethiopia and Indonesia. He plans to return to Malaysian Borneo in 2007 to



Jonathan Fiely

Conducting fieldwork in Cambodia.

conduct a small mammal survey (funded by the National Geographic Society), and hopes to contribute to the growth of the Peabody Museum's mammalogy collection.





David Heiser (4)

**LEFT** This family learns about global warming at one of the many interactive stations set up in the Peabody Museum's Great Hall.

**TOP** Peabody Museum Director Michael Donoghue welcomes visitors to the opening ceremony for Cool It: The Climate Change Challenge.

**MIDDLE** Lesly Derenoncourt addresses the crowd during the opening ceremony.

**BOTTOM** The opening ceremony speakers (left to right) Peabody Museum Director Michael Donoghue; Connecticut business leader Lesly Derenoncourt; Robert Sibley, Program Manager for Cool It: The Climate Change Challenge; middle school student Chad Vincente, winner of the Connecticut Department of Environmental Protection's 2006 Climate Change Leadership Award; and Stewart Hudson, president of the Emily Hall Tremain Foundation.

## The Peabody Joins Global Warming Outreach Collaborative

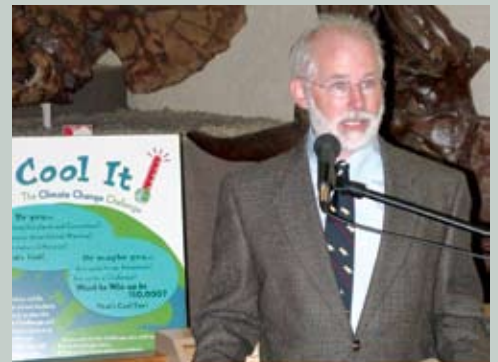
By Nathan L. Bixby, Membership Coordinator

In the fall of 2004 staff from dozens of science museums and nature centers around Connecticut attended a "meet the scientist" event at the Yale Peabody Museum of Natural History. In addition to helping Connecticut museums get up to speed on the science of climate change, the event launched the Connecticut Science Center Collaborative (CSCC). Speakers included Dean Gus Speth, the Sara Shallenberger Brown Professor in the Practice of Environmental Policy, Assistant Professor of Environmental Health Michelle Bell, and Professor of Meteorology Xuhui Lee of Yale's School of Forestry & Environmental Studies, as well as a panel from the New England Science Center Collaborative. The NESCC served as a model for the CSCC and partnered with Clean Air-Cool Planet and the Connecticut Department of Environmental Protection's Climate Change Initiative to develop the Connecticut organization, with funding from the Tremain Foundation.

Staff from the Peabody Museum participated in a steering committee that developed the structure, mission and program plan for the CSCC. The collaboration combines the latest scientific findings of research and academic institutions with the interpretive expertise of

science centers to develop exhibits, educational content and outreach projects for the more than three million annual visitors of its member institutions, which constitute more than 25 science education and research institutions, museums and nonprofit organizations in Connecticut. Also, in the spirit of leading by example, the Museum is currently upgrading its lighting and windows to significantly reduce energy consumption.

One exciting project developed by the collaborative is the Cool It! Climate Change Challenge. On Sunday, September 24, 2006, the Peabody Museum hosted the kick-off of this competition. Open to all Connecticut middle and high school students, Cool It! will encourage participating students to learn about climate science and the causes of climate change as they create local solutions to this global problem. The best of these solutions can win awards of up to \$10,000. Details for Cool It! are available at [www.coolitchallenge.org](http://www.coolitchallenge.org). For information about the collaborative, visit [www.sciencecentercollaborative.org](http://www.sciencecentercollaborative.org). To learn more about climate change in Connecticut, visit the state's official climate change site: [www.ctclimatechange.com](http://www.ctclimatechange.com).







Fossil branch of a dawn redwood.

H. Yang



Professors Hong Yang (left) and Leo Hickey at the *Metasequoia* tree at the entrance to the Peabody Museum.

## “Living Fossil” Brings International Scientists to New England

By Meizhong Li and Hong Yang, Bryant University

For a species that symbolizes the link between the past and the present, few can match *Metasequoia*, the dawn redwood. Since the discovery of living *Metasequoia* in China in the 1940s, this splendid tree—previously known only from the fossil record—keeps firing the imagination of both the scientific community and the general public. This summer the Yale Peabody Museum of Natural History and Bryant University co-hosted the Second International *Metasequoia* Symposium,

“*Metasequoia* and Associated Plants: Evolution, Physiology, Horticulture, and Conservation.” The symposium was co-chaired by Dr. Hong Yang of Bryant University, a visiting professor at Yale, and Yale’s Dr. Leo Hickey, and was co-sponsored by the U.S.–China Institute at Bryant University, Yale’s Department of Geology & Geophysics, the Yale Institute of Biospheric Studies, and the Yale Peabody Museum of Natural History.

## Recent News about the PhyloCode

By Nico Cellinese, Senior Collections Manager, Division of Botany, and Walter Joyce, Collections Manager, Division of Vertebrate Paleontology


Biological nomenclature is a critical tool that allows people to communicate clearly about organisms. In pre-Linnean times, all organisms were named with long Latin polynomials that described what was thought to be the essence of their morphological characteristics. Swedish naturalist Carl Linnaeus popularized binomial nomenclature (composed of a genus name and a species epithet, as in *Homo sapiens*) and thereby created some order in biology by grouping organisms into categories

or ranks. A major drawback of this system is that names are tied to the group and rank, so that a change in the classification of an existing group requires a change in its name. In addition, there is no reference to phylogeny, the evolutionary history of organisms, or to our current understanding of how organisms are related to each other.

The PhyloCode is a new system to govern biological nomenclature. The core proposition of the PhyloCode abandons Linnean hierarchi-

cal ranks and recognizes only species and clades, a clade being a group composed of all organisms that share a common ancestor. The PhyloCode arose from the need to name clades with explicit reference to phylogeny. In doing so, the PhyloCode extends “tree-thinking” to biological nomenclature. Its theoretical basis was jointly developed by Jacques Gauthier, Professor of Geology & Geophysics at Yale, and Kevin de Queiroz of the Smithsonian Institution, but early supporters also include Michael Donoghue, the G. Evelyn Hutchinson Professor of Ecology & Evolutionary Biology at Yale and the Director of the Yale Peabody Museum of Natural History. The objective of the PhyloCode is to provide an alternative





The symposium, held from August 6–12, 2006, was organized into two sessions: the first, on the living plants, was held at Bryant University's Smithfield, Rhode Island, campus. For the second session, on fossil plants, the participants came to Yale University in New Haven. More than 30 researchers from the United States, China and other countries took part in the conference, which also included field trips to visit living *Metasequoia* at several botanical gardens, including Mt. Auburn Cemetery and Botanic Garden in Massachusetts, the Bailey Arboretum and the Brooklyn Botanic Garden in New York, the Morris Arboretum in Pennsylvania, and the National Arboretum in Washington, D.C. A reception at Harvard University's Arnold Arboretum under *Metasequoia* trees germinated from the original 1947 seeds was a special treat.

The symposium opened at the Bryant campus with keynote speaker Dr. Michael Donoghue, G. Evelyn Hutchinson Professor of Ecology & Evolutionary Biology at Yale and the Director of the Peabody Museum. On a perfectly sunny day, more than three dozen people participated in a *Metasequoia* tree-planting event on the campus of Bryant University.

Shortly after the discovery of *Metasequoia glyptostroboides* in south-central China, seeds of *Metasequoia* were distributed worldwide through the collaborative efforts of several

Chinese and American scientists. As a result, the United States is considered the second "home" of *Metasequoia*, deemed "the Tree of the Century." For scientists who study living and fossil *Metasequoia*, coming to New England was quite a draw, especially because the Peabody Museum houses the first fossil sample of *Metasequoia* collected from the Arctic. The highlight for participants was immersing themselves in both fossil and living *Metasequoia* at the Yale Peabody Museum.

At the second session and closing ceremony at Yale University several speakers discussed interdisciplinary research in geochemistry, biomolecules, paleoclimatic indicators, paleogeography, cuticle micro-morphology and fossil records. Participants started their Yale visit under the Peabody Museum's *Metasequoia* tree, moved on to see the Curator's Choice display on *Metasequoia* in the Peabody Museum's lobby at the front entrance, and finally toured the fossil collections in the Division of Paleobotany. They also visited other sections of the Museum, the Kline Geology Library, and the Earth System Center for Stable Isotopic Studies laboratory, as well as Yale's Marsh Botanic Garden and the fossil tree garden outside the Kline Geology Laboratory. The conference concluded with a talk by Dr. Hickey on his early expedition to the Arctic and dinner in the Peabody Museum's Great Hall.

system for governing the application of both existing and newly proposed names (for details, visit [www.phylocode.org](http://www.phylocode.org) and [www.phylonames.org](http://www.phylonames.org)).

In 1998 a group of scientists, including Jacques Gauthier and Michael Donoghue, gathered at Harvard University to discuss the scope and content of the PhyloCode, and there developed a first draft. At a second informal meeting, held at Yale University in 2002, it was decided that the PhyloCode was to govern only clade names, leaving species names to a different set of rules. Two years later, in the summer of 2004, about 70 scientists gathered in Paris for the First International Phylogenetic Nomenclature Meeting. This

was the first conference that focused entirely on phylogenetic nomenclature, and it provided the venue for the inauguration of a new association, the International Society for Phylogenetic Nomenclature (ISPN). The Second International Meeting of Phylogenetic Nomenclature was held at Yale University from June 28 to July 2, 2006. There about 50 scientists discussed some modification of the PhyloCode and its forthcoming implementation, which will be marked by formal publication and the launch of a name registration database. At this meeting, it was announced that Jacques Gauthier was elected president of the ISPN for 2007–08. Other members of the ISPN council include Michael Donoghue, Nico Cellinese and Walter Joyce.

## THE 2006 SIMPSON PRIZE AWARDS

Each year the Yale Peabody Museum of Natural History awards the George Gaylord Simpson Prize to a Yale University graduate student or recent doctoral candidate for a paper concerning evolution and the fossil record. The prize is named for George Gaylord Simpson (1902–1984; Yale Ph.D. '26), the most influential paleontologist of the 20th century and a major proponent of the modern evolutionary synthesis.

The co-recipients of the George Gaylord Simpson Prize for 2006 are **Julia A. Clarke** and **Ian M. Miller**.

**Julia Clarke** (Yale Ph.D. 2000) is an assistant professor in the Department of Marine, Earth and Atmospheric Sciences at North Carolina State University, a curator of paleontology at the North Carolina Museum of Natural Sciences, and a research associate in paleontology at the American Museum of Natural History. Her research interests include the timing and pattern of the origin of the lineages of extant birds and, more broadly, the systematics of *Dinosauria* and the evolution of flight. She serves on the editorial board of the *Journal of Anatomy* and is actively engaged in field work in Mongolia, China and Peru. Clarke was a co-author of the article "Definitive fossil evidence for the extant avian radiation in the Cretaceous," which appeared in the January 20, 2005, issue of *Nature*.

**Ian Miller** first discovered geology in rural Washington while scavenging mine tailings for fool's gold and pulling clams out of road cuts. He is currently working on his thesis, a treatise on paleobotanical proxies for paleolatitude, and is now a postdoctoral fellow at the Denver Museum of Nature and Science. His principal interests are in paleobotanical proxies for, and statistical analysis of, paleoclimate, paleolatitude and paleoelevation; the evolutionary history and ecological radiation of Cretaceous angiosperms; taxonomic analysis and nomenclature of whole Late Mesozoic floras; and tectonic evolution of the Western Cordillera of North America. Miller received the award for an article he co-authored entitled "Using leaf margin analysis to estimate the mid-Cretaceous (Albian) paleolatitude of the Baja BC block," which was published in the May 15, 2006, issue of *Earth and Planetary Science Letters*.



# Peabody Summer Youth Programs Double the Fun—and the Science

By David Heiser, Head of Education and Outreach

David Heiser (to)



The Biozone! I camp after a collecting trip to Horse Island, in the Thimble Islands.

A

B

C

D

E



Stephen Zepecki



The Yale Peabody Museum of Natural History Summer Youth Programs hit the ground running in 2006, doubling the number of camps offered from last year. Previous programs repeated this year included two sessions of *Biozone!*, one for younger children on the science and art behind the Museum's dioramas, and another in which older kids made their own collections of marine invertebrates or rocks and minerals. We again offered two sessions of *Bones & Stones*, which introduced participants to archaeology and anthropology through tours, activities, field trips and hands-on experiences, including a real archaeological dig in West Haven, Connecticut.

Last year's successful research science-based *Expeditions!* program, a more intensive two-week camp for 7th, 8th and 9th graders, was also revived with the help of Stephen Zepecki, a recent Eastern Connecticut State University graduate who was already a friend of the Peabody through an internship in the Division of Invertebrate Zoology. Stephen shifted the research focus to aquatic habitats, with the first week devoted to marine and estuarine systems and the second to freshwater lakes and streams. Participants measured water quality indicators in an effort to compare and contrast the many field sites they visited over the two weeks.

One of the new programs this year was *Terra Firma: How We Interpret the Earth*. This geology-based program was designed primarily by Joy Wuhlke and a team from the local performance art and education group Projects 2K, with assistance from Curator of Mineralogy Jay Ague, a professor in the Yale Department of Geology & Geophysics, and members of the Peabody educational staff.

*Around the World in Five Days*, a new camp for younger children, brought the participants behind the scenes to the Peabody Museum's greatest assets—the collections, representing the tremendous biological and cultural diver-



Forensic anthropology lecturer Katie Binetti showing skulls in the *Bones & Stones* camp.

sity of life on earth. The week included plenty of hands-on activities, plus games and snacks from different world cultures each day.

This year also saw the introduction of our first art camp, *Illustrating Nature*. From *The Age of Reptiles* mural in the Great Hall and the exquisitely painted backdrops of the dioramas to the life-size *Torosaurus* sculpture outside the Museum, natural history art is clearly an integral part of the Yale Peabody Museum. Peabody educator Armand Morgan provided much of the week's design and instruction, with cameos by the Museum Preparator Michael Anderson and Invertebrate Zoology Senior Collections Manager Eric Lazo-Wasem.

Given the Peabody's reputation, it was also high time to establish a paleontology camp, and *Fantastic Fossils* proved to be a highly successful first effort. Participants visited the Museum's paleontology collections and fossil preparation lab, learned how to make plaster casts and reconstruct skeletons, and enjoyed two fun field trips.

The final program, *Survival!*, was devoted to primitive technology and fundamental wilderness survival skills. Nearly 30 kids learned the basics of fire-making, tracking, flint-knapping and rope-making, with the Peabody's archaeological collections of primitive tools as the inspiration for their efforts. The week ended with a campout at the Yale Outdoor

Education Center, where kids slept in their own hand-built debris shelters!

Ideas are already taking shape for a fantastic summer in 2007, when the Yale Peabody Museum hopes to serve an even broader range of children.

#### LEFT TO RIGHT

A. Zabrina Roman studying the salt marsh at the Richards' Property in Branford, Connecticut, during the *Expeditions!* camp.

B. Water quality testing at Bantam Lake during the *Expeditions!* program.

C. A student working on her butterfly illustration during the *Illustrating Nature* camp.

D. Chris Cappello with one of the invertebrates he collected in *Biozone! I*.

E. Invertebrate Paleontology Collections Manager Susan Butts giving the kids in *Biozone! II* an appreciation for ammonites.

F. Invertebrate Paleontology Museum Assistant Cope MacClintock helping out with the *Biozone I* rocks and minerals identification.

G. Vertebrate Zoology Collections Manager Kristof Zyskowski shows the ornithology collection to the *Biozone! II* camp.

H. Brooke Mommsen checking out the tortoise at the Beardsley Zoo during a *Biozone! II* field trip.

I. One of the shelters built (and slept in) at the Yale Outdoor Education Center during the *Survival!* camp.

J. Children in the *Bones & Stones* camp at the Yale University Art Gallery in New Haven.

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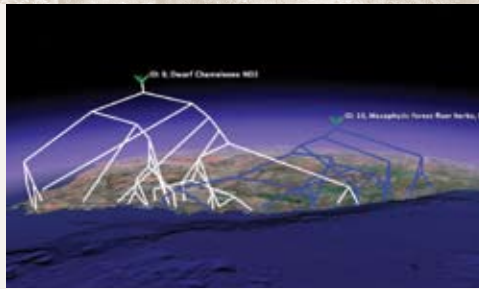
J



Derek J. Taylor



W. Piel



Phylogenies of dwarf chameleons and forest floor herbs in South Africa, drawn by the Google Earth software program as a prototype browser for geo-referenced phylogenies in TreeBASE.

### WILLIAM PIEL JOINS PEABODY INFORMATICS PROGRAM

The traditional role of natural history museums is to store specimens and artifacts as physical archives of information on biodiversity and human culture. Associate Director of Evolutionary Bioinformatics William H. Piel, who joined the Yale Peabody Museum of Natural History's Informatics Program in July, suggests that museums should also see their role as archiving the history of life on earth, that is, with added focus on the *history in natural history*.

For a biologist, history is commonly represented as a phylogeny, a kind of inverted pedigree that records the historical patterns of speciation and diversification. Piel has been trying to capture these phylogenies in a database that he runs, TreeBASE ([www.treebase.org](http://www.treebase.org)). This, however, is a monumental task. With the advent of inexpensive computers in the 1980s, and inexpensive DNA sequencing in the 1990s, there has been a virtual explosion in newly published phylogenies. But for Piel, this growth makes it all the more important that scientists capture and index digital records of

phylogenies before these historical records are completely buried in the scientific literature.

Phyloinformatics, or computation with collections of phylogenies, is in its infancy. Piel hopes that a complete reengineering of TreeBASE will better integrate it with other bioinformatics services and thereby promote the development of new methods and uses for phylogenetic knowledge. This reengineering is part of CIPRES, the Cyberinfrastructure for Phylogenetic Research project ([www.phylo.org](http://www.phylo.org)), a large collaborative project funded by the National Science Foundation that brings biologists together with computer scientists, among 13 member institutions, to develop computational tools for phylogenetic research. The new and improved version of TreeBASE will make it easier for scientists to use phylogenetic knowledge to solve questions in biodiversity, conservation, functional genomics, ecology and epidemiology.

Aside from his involvement in TreeBASE and CIPRES, Piel is also part of an NSF-funded Partnerships for Enhancing Expertise in

Taxonomy (PEET) project to train students in the systematics of water fleas, microcrustaceans that live in lakes and ponds the world over. Piel is developing a database that stores water flea literature, taxonomy, images, and specimen records in a single, unified, Web-accessible resource. Water fleas play an important role in lake ecology, and much of the groundbreaking research on them was done by the influential Yale ecologist G. Evelyn Hutchinson some 70 years ago. So for Piel, bringing this water flea informatics project to the Peabody Museum was very appropriate. But he is also pleased to return to working in a museum environment after a four-year hiatus at the University at Buffalo. Before that, he had earned his doctorate studying spider taxonomy at Harvard University's Museum of Comparative Zoology, and then went on to work on land snail molecular systematics at Leiden University and Naturalis, the national museum of natural history in The Netherlands.

Melanie Briggockas



## The Peabody's EVOLUTIONS After-School Program Awarded NSF Grant

By Jamie Alonzo, Coordinator, Education Special Projects

Students in the 2005–06 EVOLUTIONS program pose in front of their exhibition, "September 11, 2001: The Environmental Effects of the Fall of the Twin Towers."





## PEABODY ANTHROPOLOGY DIVISION RECEIVES IMLS AWARD

*By Roger Colten, Senior Collections Manager, Division of Anthropology*

The Yale Peabody Museum of Natural History's Division of Anthropology was recently awarded an Institute for Museum and Library Services Conservation Project Support grant that will enable it to upgrade the storage of the Division's Caribbean archaeological

collections. The funding from the IMLS grant will be used to purchase 54 new archival storage cabinets and packing supplies, and also to hire a half-time museum assistant for one year to rehouse a portion of these important Caribbean collections.

The Caribbean material is the largest and most frequently studied collection in the Anthropology Division, and improving its storage and accessibility is therefore more urgent than other conservation needs within the Division. This project is part of an overall strategy to improve the storage and accessibility of the Peabody Museum's anthropology collections. While significant improvements have been made in the storage conditions in six of the Peabody Museum's eleven curatorial divisions, the Division of Anthropology storerooms are well below modern museum standards.

This effort is the continuation of a pilot project that rehoused Caribbean archaeological collections in cabinetry inherited from the Division of Vertebrate Zoology, and will be the largest and most comprehensive upgrade to anthropology collections storage that has been undertaken in recent decades. So far artifacts and unmodified bones and shells for over 80,000 catalog entries have been rehoused. As these materials are inventoried, they are cleaned and placed in new specimen trays, which are then placed in drawers that are installed in cabinets. The objects' storage

locations are then updated in the Peabody Museum's enterprise electronic collections management system KE EMu.

This project has also provided the Division with the opportunity to upgrade catalog information and identify objects that have never been catalogued. For example, we have discovered significant amounts of unmodified bone and shell, which are food remains from prehistoric middens in the Caribbean region that were stored with the collections. Once catalogued, these materials, which are securely dated and from recorded archaeological sites, have wide-reaching research potential for anthropological and interdisciplinary research.

We hope that this will be the first of several rehousing projects in the Anthropology Division. While the Caribbean collections are the largest and most frequently studied of our collections, the Division has large archaeological and ethnographic collections from other parts of the world whose storage conditions also need upgrading. As the Peabody Museum plans improvements to our overall facility in conjunction with the University's Yale Tomorrow campaign, anthropology collections will receive particularly close attention.

**LEFT** Benjamin Diebold and Genevieve Raseman inventory and catalog collections in the Anthropology Division.

The Yale Peabody Museum of Natural History's EVOLUTIONS after school program had a promising opening for the 2006–07 school year. During the first month the program recruited 51 New Haven Public School students in grades 8 through 12 who, along with returning students, bring the total program enrollment to 80 participants. The program's four staff members, including two Yale undergraduates and a recent Yale graduate, will guide the students through a curriculum intended to engage them in the exploration of science careers and college preparation, exhibition development, and peer teaching.

Thanks to a National Science Foundation Communicating Research to Public Audiences grant, this year EVOLUTIONS students will be introduced to the work of Peabody Museum Curator of Vertebrate Zoology Dr. Dave Skelly, a professor in Yale's Department of Ecology & Evolutionary Biology and School of Forestry & Environmental Studies. This award extends the scope of Dr. Skelly's current NSF-funded work, which is centered around the long-term monitoring of the metacommunity dynamics of amphibians and their predators. Students will visit Dr. Skelly's lab and field site, host their own mini-seminar series, and produce an exhibition and lesson plans based on his lab's

research. A small number of summer internships will also be provided.

EVOLUTIONS students will again this year create their own podcasts (available on iTunes®), produce a monthly newsletter, and engage in fundraising and community service activities. As always, the program is free for students in the New Haven public school system, who receive academic credit for participating.

## Teacher Opportunities in Biodiversity Studies at the Peabody

By Laura Fawcett and Jim Sirch,  
Project Managers, Peabody Fellows Program

Teacher-led curriculum development is a key element of the Peabody Fellows Program, a partnership between the Yale Peabody Museum of Natural History and local, underserved public school districts.

Mary Anderson



Two Peabody Fellows teachers pour mud from New Haven harbor to make a Winogradsky column.

Since 1997, the Peabody Fellows Program has collaborated with teachers in New Haven and surrounding districts to create hands-on, inquiry-based curricula that explore biodiversity and its relevance in the lives of students. The program aims to encourage scientific careers and to strengthen the understanding and application of science process skills by 5th to 10th graders through laboratory research. It is modeled on Event-Based Science, a unique problem-based approach designed specifically for middle school students. EBS uses news footage of an actual event combined with additional primary sources to emphasize laboratory investigation, teamwork and student-driven learning. Russell Wright, Ed.D., creator and director of the EBS Institute in Rockville, Maryland, is the program's curriculum consultant.

The Peabody Fellows Program offers two tracks that explore different aspects of biodiversity. Both tracks feature week-long teacher institutes and hands-on BioAction kits (or BAK-paks, for short) that draw on the Yale Peabody Museum of Natural History's extensive teaching collections. The first track is funded by the Institute for Museum and Library Services (see "Peabody Fellows Program Expands to Include Biodiversity and Global Change," *Yale Environmental News*, Fall 2005, 11(1):13). This past summer, 23 Connecticut teachers completed institutes in preparation for field testing the Peabody Museum's new curriculum unit on local global change issues. Museum curators and staff as well as faculty from the University of Connecticut and the University of New Haven gave presentations ranging from "Emerging Disease in Amphibians" to "Incorporating Inquiry and State Science Standards in Your Teaching."

One curriculum unit, "Lobster Die-Off in Long Island Sound," includes a variety of hands-on activities, such as constructing a Winogradsky column. In this activity, students grow a "microbial city" in sediment from Long Island Sound to learn about hypoxia as a factor in the die-off. The accompanying BAK-pak kit contains lobster mounts, crayfish dissection materials, and other teacher resources. The unit now reaches more than 1,500 students. After testing and evaluation, it will be revised and available to teachers in Connecticut and

beyond. Plans are also in the works to offer teacher institutes on Long Island, New York.

Another program track, "Biodiversity and Vector-borne Disease," is funded by a five-year, \$1.3 million Science Education Partnership Award from the National Institutes of Health. This intensive curriculum development project promotes public understanding of infectious disease using two case studies of national notoriety: Lyme disease and the West Nile virus. Principal Investigator Leonard E. Munstermann is the Peabody Museum's Curator of Entomology and senior research scientist in the Department of Epidemiology & Public Health in the Yale School of Medicine. "We chose these two vector-borne disease cycles because of their public health significance and because they point to broader biological relationships," says Munstermann, who notes that "Yale University is also a major research center for these diseases and will provide scientific authority for the curriculum content." Program partners include the Yale School of Medicine and the Connecticut Agricultural Experiment Station.

The Peabody Museum selected nine exemplary Connecticut teachers for the curriculum development team. In collaboration with Peabody Museum educators and biomedical researchers, the teachers began designing the following resources during the July 2006 institute:

- Field and laboratory exercises for students (such as investigating vector life cycles by collecting and examining mosquito larvae)
- A teacher reference manual with extensive background information and assessment instruments
- A DVD featuring interviews with researchers and experimental datasets for student manipulation
- BAK-pak kits containing pertinent Peabody Museum specimens (such as preserved ticks, study skins and the skeletal materials of bird and mammal hosts)

The curriculum resources will be integrated into the science programming of Connecticut partner districts after rigorous field testing and refinement. Dissemination to a national audience will begin with three sites, in California, Wisconsin and Texas (geographic areas with a high incidence of either Lyme disease,



the West Nile virus, or both). The Peabody Museum will publish and place selected materials on its Web site for broad accessibility. The project will also design a traveling multimedia exhibit kiosk that shows the crucial links between vector biodiversity studies and biomedical research.

Sally Pallatto



Theodore Andreadis



Terri Stern



**TOP** A finished Winogradsky column, which is a "microbial city" made up of aerobic and anaerobic bacteria.

**MIDDLE** Curriculum Specialist Terri Stern and Peabody Fellow Jaimie Jannitto collect mosquito larvae from a vernal pool.

**BOTTOM** Peabody Fellows Minta White and Regina Milano examine mosquito larvae with Principal Investigator Leonard Munstermann.

## Undergraduate Summer Internships at the Peabody: Student Reports

In 2006 the Yale Peabody Museum of Natural History was delighted to announce a summer internship program for undergraduate students affiliated with the Peabody Museum. Interns participated in the rich variety of research taking place in the Yale Science Hill community, and worked on semi-independent projects with mentors from the Museum's staff using the Peabody Museum's diverse collections. Participating students this year were Katherine Kazimer (Yale '09), Rosa Li (Yale '09), Ali Logan (Yale '07) and John Mittimeir (Yale '09).

### Unearthing Fossils in the Field and the Lab

By Ali Logan, Yale '07

This summer, I had the opportunity to work as a summer intern with Dr. Walter Joyce in the Yale Peabody Museum of Natural History's Division of Vertebrate Paleontology. For two months I analyzed the fossil of a turtle that had been collected by G. Edward Lewis during the Yale North India Expedition of 1932 from the Upper Tatrot Formation of what is now Pakistan. Although the specimen represents an almost intact and uncrushed turtle shell, it had not yet been thoroughly studied despite its existence in the Division's collections for almost 75 years. Under Dr. Joyce's guidance, I described and illustrated the specimen using comparative anatomy traditional techniques combined with digital photography, image manipulation and cladistic analysis. Although work is still in progress, Dr. Joyce and I are confident that we have identified a new species of turtle from the clade *Pangshura*.

In addition to working on this project, I was fortunate to be able to accompany Dr. Joyce and fellow lab members on their annual field expedition to prospect and collect new fossils for the vertebrate paleontology collections. During our three-week stay in Marmarth, North Dakota, we prospected several square miles of public lands in Montana and North Dakota and collected many specimens such as tiny dinosaur and mammal teeth, the five-foot femur of a *Triceratops*, and skull pieces of the extremely rare dome-headed dinosaur *Stygimoloch*. During this trip I learned the intricacies of identifying fossils in the field, along with the excavation and preparation techniques used by paleontologists all over the world. As



a consequence, I decided to write my senior thesis on historical methods of paleontological excavation, laboratory preparation and fossil conservation. This experience was unforgettable and enlightening. I look forward to continuing my work with Dr. Joyce and the fantastic Peabody Museum vertebrate paleontology crew in the future!

**ABOVE** This fossil tooth was among the specimens collected on this year's vertebrate paleontology field expedition.

## Cataloguing the Cieurca Eurypterid Collection

By Rosa Li, Yale '09



Peabody Museum Summer Intern Rosa Li with *Acutiramus macropthalmus* (YPM.208194). This segment (probably the second segment) belonged to a pterygotid eurypterid estimated to have been three meters in length, including anteriorly extended pincers.

Eurypterids, now extinct, are the largest arthropods that ever lived. In their heyday, from the Ordovician Period (about 480 million years ago) to the end of the Permian Period (250 million years ago), they were the top predators of their environment. Though it is known that eurypterids lived in water, their specific habitats remain poorly understood.

In 2005, the Yale Peabody Museum of Natural History acquired about 54,000 pounds of rock containing an estimated 10,000 eurypterid specimens, the largest collection of eurypterids ever assembled. These specimens were collected over the course of nearly 50 years by Samuel J. Cieurca, Jr., a curatorial affiliate in the Peabody Museum's Division of Invertebrate Paleontology. The eurypterid-bearing slabs of rock also contain other organisms, including brachiopods, bivalves, plants and other clues to the nature of eurypterid environments, such as salt casts and desiccation cracks.

In the summer of 2006 I received a Peabody Museum summer internship to work with Dr. Susan Butts and Dr. Erik Tetlie in the Division of Invertebrate Paleontology to sort and catalog the thousands of specimens

from the nearly 300 localities of the Cieurca Collection. While major collecting localities had already been catalogued by volunteers, thousands of individually labeled specimens from many localities were yet to be sorted and documented.

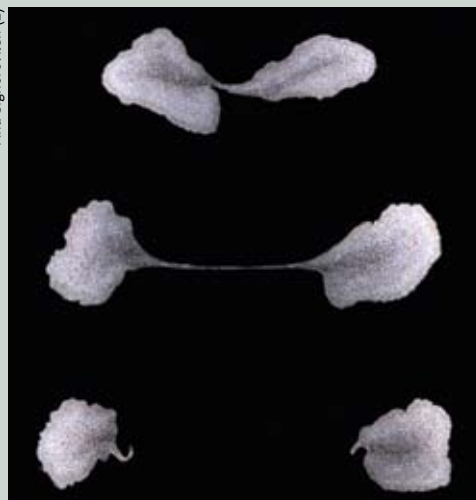
A seemingly endless number of rock-filled boxes were stored in the Division's collections in Kline Geology Laboratory, where Dr. Tetlie, two summer interns and I worked to unpack them. Some specimens were ready to be sorted by locality; others required more work and needed to be cut down to size with a hydraulic jack or rock saw. The worst was the dreaded Pittsford Shale, which needed a thorough cleaning before it could be sorted. Unfortunately, Pittsford Shale dissolves in water, so each specimen had to be painstakingly and individually vacuumed. After the last box of fossils was emptied, the specimens were entered into the Peabody Museum's database, KE EMu. Object records in the database are now searchable online from the Division of Invertebrate Paleontology Web site.

From start to finish, preparing a specimen for museum use was far more meticulous than

## Two Studies of the Placozoan *Trichoplax adhaerens*

By Katherine Kazimer, Yale '09

Ana Signorovitch (2)



Images of the *Trichoplax* organism showing its cell structure and growth by fission.



The Yale Peabody Museum of Natural History Summer Internship Program enabled me to design a project under the


auspices of the lab of Professor Leo Buss. I conducted two studies of the small marine invertebrate *Trichoplax adhaerens*. The first was an attempt to crossbreed different strains of the lab's cultures. The second endeavored to prove that *Trichoplax* contain neurotoxins.

In the 1970s, German biologist Karl Grell hypothesized that *Trichoplax* were once capable of reproduction, since they produce failed eggs. In 2005, Ana Signorovitch, Leo Buss, and Stephen Dellaporta at Yale published DNA evidence that *Trichoplax* were once sexual organisms, and subsequently organized the

*Trichoplax* specimens into clades. I attempted to create small-dish crosses within the clades, but the cross-cultures failed before breeding could occur. I then attempted large-dish cultures, which remained stable and grew through asexual fission. Time ran out before the success of the crosses could be determined. Perhaps the crosses failed because of a lack of environmental stimuli, or perhaps the different strains were different species.

The second experiment, based on the ideas of Grell and at the prompting of Buss, yielded conclusive evidence that *Trichoplax* contain neurotoxins, possibly in the "shiny spheres." The "shiny spheres" are lipid balls loosely contained between the epithelial cells. These seem designed to be a defense mechanism when released onto the predator. I used size standardization to offer hydroids *Trichoplax*





I had imagined. Each one had to be trimmed to fit into an acid-free archival tray, identified by an expert, and entered into the collections database. Each data entry required information about the taxon, collection site, collector, identifier and storage location of the specimen. Finally, individual specimen labels had to be made, cut, printed and placed in the drawers. By the end of my time as an intern, over 7,000 specimens were catalogued in the Ciurca Collection and, thanks to another recent generous donation by Mr. Ciurca, hundreds more await.

My ultimate goal was to facilitate a more comprehensive understanding of eurypterids and the ecosystem that they lived in. To achieve this, I collated detailed descriptions of each locality and compiled accompanying faunal lists, with the hope that the study of specimens of other taxa found on the same rocks as eurypterids will lend insight into the eurypterid environment.

The Ciurca Collection holds great promise in the investigation of the diversity of eurypterids and their paleoecology. I hope that my project of cataloguing and documenting the Ciurca Collection will enable Peabody Museum staff and other researchers to take full advantage of that potential.

at their size. A hydroid immediately ingested *Trichoplax* offered directly to its oral cavity. After ingestion and regurgitation, all hydroids became unresponsive to mechanical stimuli. The next day, the hydroids seemed to be normal, capable of catching and ingesting brine shrimp. However, if the hydroids ingested *Trichoplax* again, they deteriorated and most were dead by the third day. The cross-dishes will be maintained in the lab, while we develop future tests of the neurotoxin hypothesis.

I would like to thank the Peabody Museum, my mentor Leo Buss, Ana Signorovitch and Rafael Rosengarten for their support and guidance throughout this project.



## TOLKIN: Tree of Life Knowledge and Information Network

*By Reed Beaman, Director of Informatics Program, and Nico Cellinese, Senior Collections Manager, Division of Botany*

TOLKIN (the Tree of Life Knowledge and Information Network) is an online Web application providing comprehensive information management and analysis to support research in phylogenetic systematics, biogeography and evolutionary biology. By facilitating distant networked collaboration through seamless data compilation, access, analysis and electronic publication, TOLKIN addresses bottlenecks and impediments to effective information sharing between collaborating scientists. Through the TOLKIN Web portal, users have access to their project's gene sequences, morphological observations and images, taxonomic information, data and metadata on DNA and specimen vouchers, bibliographic resources, as well as a vast array of automatically linked Internet resources from GenBank, the Global Biodiversity Information Facility (GBIF), Integrated Taxonomic Information Service (ITIS) and other sources.

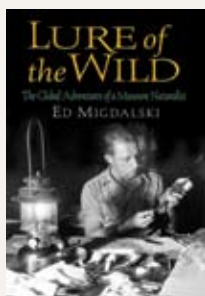
TOLKIN is being developed through the Yale Peabody Museum of Natural History's Informatics Program. Project team members include Reed Beaman, Nico Cellinese, Ashley Green and Stephen Smith of Yale's Department of Ecology & Evolutionary Biology. TOLKIN is funded by five grants from the National Science Foundation through the Assembling the Tree of Life (AToL) and Planetary Biodiversity Inventory (PBI) programs. It currently supports the Angiosperm, Liverwort, and Gymnosperm AToLs, and the Euphorbia PBI projects, in addition to several other systematics collaborations.

We are actively developing analytical components of TOLKIN, including workbench functionality for analysis of sequence data by automating the assemblage of Fasta files, alignments, and output of Nexus files, in addition to sequence "BLASTing" capability. Our current funding supports work to integrate tools for phylogeographical analyses, including estimation of phylogeographic diversity (PD Explorer) and phylogenetic tree navigation.

One objective of TOLKIN development is to relieve systematists from tedious database management tasks, allowing them more time to focus on their biological research. Systematics has become an increasingly collaborative discipline, in part as a strategic result of the AToL and PBI programs at the National Science Foundation. Our supported AToL and PBI projects include about 10 to 15 collaborators each in laboratories worldwide. Data management in a distributed environment is a complex task, but it has often been handled by passing data files and spreadsheets from lab to lab by e-mail. This method is not sustainable or scalable to larger collaborations, especially as versions of shared documents become unsynchronized. Users also tend to type the same information repeatedly into different spreadsheets or permanent data repositories. Therefore, another objective of TOLKIN is to automate data submission to long-term data repositories such as GenBank and MorphBank.

Objectives such as these are part of our broader bioinformatics research goals to improve integration with other funded and proposed informatics projects. Several initiatives (such as MorphBank, Morphobank, CIPRes, SEEK, TreeBASE, BioCorder, GBIF, GenBank, IPNI, UBio, Lifemapper and BioGeomancer) are developing tools useful for ToL and biodiversity research, and there has been growing interest in coordinating informatics research across the AToL and PBI communities. For example, we are actively collaborating with the MorphBank project at Florida State University for long-term management of morphological images used in phylogenetic analysis. We have also recently partnered on another AToL-funded project with researchers in computer science at University of Pennsylvania and University of California–Davis to enable and implement core database technologies and scientific workflows to support increased interoperability across ToL and related database initiatives.

## New from the Yale Peabody Museum



**Lure of the Wild**  
**The Global: Adventures of a Museum Naturalist**  
 By Ed Miggalski  
 October 2006, Cloth,  
 \$34.95  
 6 in. x 9 in., 294 pages, 51  
 b/w photographs  
 ISBN: 0-912532-74-2  
 ISBN-13: 978-0-912532-74-5

Fresh out of high school in 1936, Ed Miggalski entered the administrative offices of Yale's Peabody Museum of Natural History and announced to the secretary, "May I see the boss? I'd like to become a museum man." Thus began the global adventures of this naturalist and outdoorsman, whose nearly 30-year career as a museum preparator and expedition coordinator for Yale's Peabody Museum and Bingham Oceanographic Laboratory sent him around the world on more than 20 scientific expeditions—at a time when our planet was larger, and more exotic and remote, than it is today—to collect birds, fish and mammals for science.

The Peabody Museum is pleased to announce the publication of Ed Miggalski's *Lure of the Wild*. In this memoir Miggalski brings the reader along on his worldwide adventures, and also entertainingly provides insight into the fascinating field of behind-the-scenes science and exhibit planning at a natural history museum. With the author we hunt for the great hornbill in northeastern India, visit Katmandu when Nepal was still the Forbidden Kingdom, travel the grasslands of Tierra del Fuego to collect waterfowl, and fish for specimens in Alaska and New Zealand. The fruits of at least two of these expeditions—a jaguar from the Petén territory of Guatemala and mule deer from the Grand Canyon's Kaibab Plateau—can be seen today in habitat dioramas at the Peabody Museum. Along the way we meet native peoples and transplanted westerners, and learn more than a little about the skills and techniques required for successful field collecting.

Educated in the natural sciences at both Yale and Cornell, Miggalski has shared his experiences and knowledge with generations of students at Yale and elsewhere, and with read-

ers of his many articles and books on topics as diverse as taxidermy and trap shooting. He is the author of *The Inquisitive Angler* and *The Fresh and Salt Water Fishes of the World* (with George S. Fichter), and has published articles in many journals, including *The Anglers' Club Bulletin*, *Shootin' Trap*, *Columbia*, and *The Yale Scientific Magazine*.

After his retirement from the Peabody Museum, Ed Miggalski went on to another career in Yale's Department of Athletics. A national leader and pioneer in outdoor recreation and club sports, he is former director of Club Sports at Yale. He personally founded the Yale Fishing Club and the Yale Shooting Club, and is the former coach of the Skeet and Trap Shooting Team. It was through his extended efforts that Yale's Outdoor Education Center was established. Ed Miggalski has served Yale as a volunteer in extraordinary ways. In 2001, he received the Yale Medal, the highest honor presented by the Association of Yale Alumni.

*Lure of the Wild* is available from The Museum Store at the Peabody Museum by calling (203) 432-3740, or visiting [www.peabodystore.com](http://www.peabodystore.com).



**The Prehistory of Nevis, a Small Island in the Lesser Antilles**  
 By Samuel M. Wilson  
 With contributions by Laura Kozuch, Lee Newsom, J. Daniel Rogers & Elizabeth Wing  
 Foreword by Irving Rouse  
 YUPA 87  
 248 pages, 42 tables,  
 63 figures, index  
 ISBN 0-913516-23-6

People have lived on the small West Indian island of Nevis for more than 3,000 years, yet little was known about the prehistory of the island. This latest monograph on Caribbean archaeology from the *Yale University Publications in Anthropology* series, generously illustrated with tables, photographs and line drawings, reports the results of archaeological investigations undertaken on Nevis between 1984 and 1995 by an interdisciplinary team

headed by archaeologist Samuel Wilson, chair of the Department of Anthropology at the University of Texas, Austin. This research gives the results of a prehistoric settlement survey of the island, and of excavations carried out at five archaeological sites. It addresses general questions of settlement history and chronology—who lived on the island, when, and where—as well as questions of changing dietary preferences and environmental adaptations.

Excellent faunal and floral preservation at the sites made it possible to compare dietary preferences, and explore the effect the island's people had on the plant and animal populations they used for food. Information on this aspect of the Nevisian archaeological investigations are presented through chapters contributed by specialists Lee Newsom (paleo-ethnobotany), J. Daniel Rogers (ceramics and chronology), and Laura Kozuch and Elizabeth Wing (animal remains).

Compared to other parts of the Americas, the Caribbean archipelago is underresearched. Although the broad outlines of the region's chronology are fairly well established, there is considerable variation from island to island. The archaeological evidence from Nevis reflects the great complexity of Caribbean prehistory, and this monograph is a step toward filling a major gap in our knowledge of the prehistory of the West Indies.

The *Yale University Publications in Anthropology* series publishes research conducted or sponsored by the Yale Peabody Museum's Division of Anthropology and the Yale Department of Anthropology. YUPA is supported by the Theodore and Ruth Wilmanns Lidz Endowment Fund for Excellence in Scholarly Publications, dedicated to the dissemination of scholarly research and study of the world and its cultures. To order current YUPA titles visit [www.peabody.yale.edu/scipubs/](http://www.peabody.yale.edu/scipubs/) or contact the Publications Office at (203) 432-3786 or [peabody.publications@yale.edu](mailto:peabody.publications@yale.edu).





Young girl carrying her younger sister in a traditional sling.

## Yale Students Disperse to Four Continents on Summer Environmental Internships

By Mary Helen M. Goldsmith, Department of Molecular, Cellular and Developmental Biology, Program in Environmental Studies

Emily Jack-Scott (2)



Traditional hand-carved fishing canoes, Wasini Island, Kenya.

The Environmental Studies Program (EVST) supports Yale College students investigating environment questions at Yale, in the United States, or abroad. In 2006, fifteen juniors, ten sophomores, and three freshmen were selected from among 42 applicants for awards totaling \$80,820. This year's interns are majors in Art, Anthropology, Environmental Studies, Ecology & Evolutionary Biology, Environmental Engineering and International Studies. Juniors usually work on projects anticipating their senior research and essays, while first- and second-year students often explore other ecosystems through summer field courses such as those offered by Duke University's Organization for Tropical Studies.

We encourage students to gain training and real-world experience. Interns engage in independent research and study supervised by an adviser or volunteer with an environmental NGO or governmental agency. We assist students in establishing working relations with mentors on site where they are interning.

An internship abroad offers students the added bonus of living in a different culture and enhancing their language proficiency while residing with a local family and through conversations, teaching and discussions with the local people. Several students also received funding from Yale international education programs and extended their stays abroad for intensive study of the language.

Synopses of the students' activities during their internships follow.

## STUDENT NEWS



### profile

Ashley Roberts '07

**TOP** Discharge of water from coal bed methane mine. Cattle drink from runoff below weir.

**BOTTOM** Dead Cottonwood trees on a site with drainage from coal bed methane mining. Spotted Horse Creek watershed, Wyoming.



### profile

Mark Havel '07

**TOP LEFT** Spiny lobster (*Panulirus argus*) catch on opening day of the fishing season, South Caicos Island.

**TOP RIGHT** Terminal male stoplight parrot fish (*Sparisoma viride*).

**BOTTOM** Great barracuda (*Sphyræna barracuda*).

## THE UNITED STATES

**Ashley Roberts '07** chose to investigate the environmental consequences of recovery of natural gas from coal beds in her home state of Wyoming. She examined the effects of the saline water discharged at the surface during extraction of methane from coal beds. Ashley surveyed changes in vegetation and collected samples of water and soil for later analysis. She compared drainages with and without saline discharge from coal beds. This summer's work in the field provides the basis for her senior essay.

**Betsy Scherzer '07** interned with the Environmental Law Institute (ELI) researching and writing reports on a wide variety of topics. Her diverse assignments included researching regulations governing indoor air quality, working on a tool kit to assist community activists seeking environmental justice along the U.S.-Mexican border, and revising the ELI publication "Conservation Thresholds for Land Use Planners." She covered a conference at the Woodrow Wilson Center on "media coverage of climate science." Her biggest project was assisting a senior attorney in writing a

200-page report on hydroelectric dams around the world for the United Nations Environment Programme. Through the Yale in Washington program she talked with Senator McCain and others about better energy strategy.

**Sonia Cooke '08** worked in northern California toward more sustainable viticulture. She joined a research team from UC Davis determining the coincidence of Pierce's disease with woodland riparian habitats. This bacterial infection, responsible for over \$9 million in losses of grapevines annually, is spread by a leafhopper, the blue-green sharpshooter, an insect vector inhabiting riparian zones. Sonia also interviewed viticulturalists on the practices they follow to curtail the infection in their vineyards.

## CENTRAL AND SOUTH AMERICA

**Mark Havel '07** took a course in management of marine resources offered by the School for Field Studies on South Caicos Island in the Turks and Caicos Islands. The island's economy is based on harvesting queen conches and Caribbean spiny lobsters. He learned to identify and observe marine organisms underwater,

participated in ongoing research monitoring and tagging species of fish and sea turtles in the nearby marine protected area, and interacted with the local fishing community of South Caicos.

**John Hinkle '09** interned with Global Visions International on a pristine portion of coast on the Yucatan peninsula, Mexico, within view of the lights of Playa del Carmen at night. Although he had never scuba dived or even snorkled before, he attained PADI certification as an advanced open water diver within five weeks. After learning to accurately identify 100 adult and 25 juvenile species of fish both in the lab and underwater, he was allowed to monitor fish on the MesoAmerican barrier reef. This involved two dives daily, following a rigorous protocol for collecting data on the number, size, and species observed on the reef. This monitoring provides data for conservation of the reef on changes resulting from the rapid development along the Yucatan coast.

Both **Adenike Adeyeye '07** and **Tanya Martinez '07** lived and interned in a small rural community (or batey) for agricultural workers in





## profile

Erin Lin '07

**TOP** Erin with children at an orphanage in Phnom Penh, Cambodia.

**BOTTOM** Erin (left) with her Khmer friend at a fruit market.



## profile

Gideon Bradburd '08 and John Mittermeier '08

**TOP LEFT TO RIGHT** John and Gideon in rapids on the Sipaliwini River, Suriname; John showing birds to school children, Werehpai Village, Suriname.

**BOTTOM** Looking for birds in the jungle at Werehpai.



the Dominican Republic. Adenike and Tanya worked with local leaders and organizations to access the success of public sanitation programs. First they mapped the location of water sources, houses and latrines in the batey and then observed and conducted randomized surveys to discover residents' understanding of the relation between water quality and public sanitation, disposal of trash and garbage, and use of latrines.

**Katherine Rostkowsi '07** Following an internship for advanced training in testing water quality at the Institute of Urban Water Management in Berlin, Germany, Katherine joined the Yale chapter of Engineers Without Borders in El Rosaria, Honduras, where she had worked the previous summer. The group worked alongside townspeople constructing a new water filtration system for the town. Katherine collected and tested water samples from the town's spring and water taps in an effort to determine whether the contamination of the local water supply is the source of long-standing problems with gastrointestinal diseases among the people of El Rosaria. If contamination with *E. coli* is confirmed in

further tests at Yale, she plans to participate in designing a low-tech water treatment and distribution system that can be implemented by the people of El Rosaria.

**Mary Stoddard '08** says the realization that "conservation must begin with education, sustainable development and new economic programs at the local level" was one of the greatest lessons she learned from the Organization for Tropical Studies course in Costa Rica. In a comparative approach, this course takes students to biologically diverse ecosystems, páramo, montane cloud forests, lowland tropical rainforests, dry forests and salt marsh in different regions of Costa Rica. They worked in groups identifying and observing the plants, insects and birds and determining soil composition at each site. In a research project, Mary and a fellow student recorded the species of birds visiting a fruiting fig tree and differences in feeding behaviors with the size of the forager.

**Gideon Bradburd '08 and John Mittermeier '08** joined the Yale Peabody Museum of Natural History expedition to study the ecology and

survey the little-known birds of Surinam. They surveyed and collected birds at two sites. In the Sipaliwini savannah, they identified species of birds similar to ones known from similar habitat in Brazil. The second survey and collection site was in lowland rainforest near Werehpai. Specimens were collected and preserved for the Peabody Museum.

**Six students took courses or volunteered with different NGOs in Ecuador.**

Last summer while interning with the NGO Save America's Forests (SAF) in Washington D.C., **Caitlin Clark '07** learned of the efforts of indigenous Waorani people to protect their traditions and ancestral lands in the Amazonian rainforest from development of oil reserves. Part of the Waorani territory lies within Yasuni Biosphere Reserve. In the 1970s, Texaco built a road deep into Waorani lands. This summer she wanted to assess for herself the environmental damage from swidden agriculture and illegal logging along this road. She also traveled into the rainforest by river to talk with the Waorani leaders and people. Roadless drilling began recently in Yasuni. SAF supported this

## STUDENT NEWS



### profile

#### Angel Hertslet 'o8

**TOP LEFT TO RIGHT** Giant tortoise closeup, Galápagos Islands; green iguana, at the Tiputini Biodiversity Station near the Yasuni Biosphere Reserve, Ecuador; sea lion, Galápagos Islands.

**LEFT** Angel and sea lions, Galápagos Islands; **Pair of Wave Albatrosses, *Phoebastria irrorata*, on their nest, Galapagos Islands, Ecuador**

development because roadless drilling should reduce the environmental destruction that follows road building.

#### Micah Ziegler 'o8 and Angel Hertslet 'o8

took courses on Ecuadorian Ecosystems, Conservation and Public Policy in Ecuador, and advanced Spanish with the International Education of Students (IES) Program and Faculty at the University of San Francisco in Quito, Ecuador, and the Galápagos Academic Institute. Living with a host family in Quito provided opportunities for conversing in Spanish and learning about Ecuadorian cultures. The Ecosystems course was largely taught in the field during trips to lowland tropical rainforests, to the cloud forest of Mindo, to montane forests and páramo, and during a final ten-day trip to the Galapagos Islands.

**Jerry Guo '09 and Chaz Hyseni '07** interned with Dr. Gisella Caccone at the YIBS Molecular Systematic and Conservation Genetics Laboratory learning molecular techniques. Then they joined the three-week Yale expedition to the Galápagos Islands, where they assisted in making morphological measurements on Giant Tortoises and collecting blood

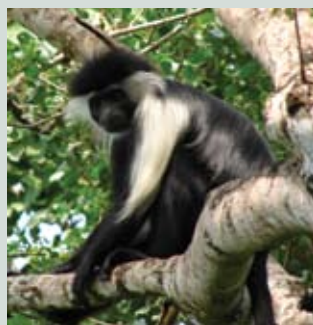
samples for genetic analysis at Yale. In all they obtained measurements and blood from 120 adult tortoises and 40 juveniles representing populations on two different islands. Jerry Guo described the expedition to the Galápagos as “eye-opening and inspiring” and the opportunity to work with an international group of scientists “truly remarkable.”

**Jacob Marcus 'o8** volunteered at the Ecuadorian NGO Jatun Sacha's La Hesperia Biological Station, where he worked on a variety of conservation projects. Jake absorbed the fundamentals of sustainable agriculture while working in the station's organic vegetable garden, where new crops and techniques are being tested for local farmers. He helped restore degraded pastures by planting local tree species raised in the station's nursery. The station encourages volunteers to interact with the local people by teaching classes at the Esperie school and playing in a weekly soccer game between volunteers and the community. Jake enjoyed brief stays with a farm family in Esperie and taught classes in basic mathematics at the school.

**Margaret Howard 'o8** volunteered at Iracambi, a research farm and conservation center

in the Atlantic forest region of Brazil and an international partner of the Tropical Resources Institute at Yale School of Forestry & Environmental Studies (F&ES). Meg reports that Iracambi's goal is to “make the conservation of the remaining forest more attractive than its destruction.” Meg worked clearing overgrown trails through the forest used for research and teaching local people about conservation. This work gave her an opportunity to observe the primary forest and forests in different stages of regrowth. She participated in a mapping project with GPS and came to appreciate the importance of mapping in environmental work. She learned a lot in conversation with the other international volunteers and prepared dinner for the entire group one evening. The experience raised questions for her: “Is replanting with rapidly growing non-natives such as eucalyptus and bamboo really environmentally sound? How useful are forest corridors in promoting biodiversity?” To practice her Portuguese, she engaged townspeople in conversations. Following Iracambi, she spent a month in Rio “on her own dime” studying Portuguese.





## profile

Emily Jack-Scott '08

**TOP LEFT TO RIGHT** teens celebrate after winning the Wasini Island GVI Soccer Championship Cup, Kenya; the last two giraffes of Shimba Hills NP, Kenya.

**BOTTOM LEFT TO RIGHT** Elephants at a waterhole, Tsavo East NP, Kenya; adult Angolan colobus monkey (*Colobus angolensis*) in Shimoni Coastal Forest, primate behavior study, Kenya.

## AFRICA

Because of her interest in lemurs, **Samara Fox '09** volunteered with a Madagascar Pioneer program run by Azafady, a British NGO, observing how these primates behave in their natural habitat and conserving their vanishing forest habitat. Samara worked with Malagasy staff and local people on a variety of conservation, public health and education projects in the southeast. Her team transplanted palm seedlings from the remnants of a coastal forest to a nursery for later replanting in a degraded area of the forest. They showed local people in several villages how to build more economical clay stoves that spare trees by reducing consumption of scarce firewood. They helped people plant gardens and taught them the importance of rotating vegetables. They assisted Malagasy construction workers in building a school.

**Emily Jack-Scott '08** interned with Global Vision International on Wasini Island in the Indian Ocean off the coast of southern Kenya. GVI works with Kenyan Wildlife Services in documenting both marine and terrestrial biodiversity. Whales, dolphins, sea turtles, fish and

tourists frequent the marine park off Wasini Island. Several species of monkey inhabit the coastal forests of the mainland and the island. She also participated in helping local communities with their plans to develop sustainable ecotourism in the region. Emily says, "I gained invaluable experience with solid methodologies of ecology research. Being so immersed in a world where the forces of nature are so all powerful and impressive brought to heart the lessons about ecosystems and biology that I'd learned only in academic settings."

## ASIA

Working with scientists at the School of Renewable Energy Technology (SERT) at Narsuran University in Thailand, **Michael Gold '07** wrote and filmed a 30-minute documentary that featured a solar-powered office park and solar-powered dryers developed at SERT. The dryers are now being used by Thai farmers for drying bananas and other tropical fruits.

**Erin Lin '07** says she discovered her future career working on Cambodian land law and property rights at the Center for Khmer Studies

in Phnom Penh. She came to understand the enormous loopholes that allow the poor to be displaced from their homes without compensation. She hopes to pursue a J.D.-Ph.D. and become an advocate for land rights based on law and effective legal policies (*see photos p. 27*).

**Mirko Serkovic '07** spent a second summer in India with The Energy Resources Institute to investigate the extent of pollution of the Ganges River at Varanasi. He surveyed whether the public, many of whom regard the river as sacred and use its water daily for bathing as well drinking, are aware of the health hazard and the importance of cleaning up the river to prevent waterborne diseases and epidemics.

**Duncan Cheung '07** and **Bjorn Fredrickson '07** traveled to China. Duncan worked with NRDC in Beijing on reforms in urban water management. He also worked at the Tsinghu University Water Policy Research Center (WPRC), the only research center devoted to water policy in the country, where he translated into English the first Chinese book about reforming China's water sector. He interviewed numerous officials working on water manage-



## profile

Samara Fox '09

**LEFT** Shifaka lemur, Madagascar.

**TOP** Ringtail lemur, Madagascar.

**BOTTOM LEFT TO RIGHT** Nahampoana Reserve, southeastern Madagascar; Welcome to Andromnake, Madagascar.

ment, including wastewater management. This experience along with access to Chinese libraries and one of the country's largest environmental databases has provided information for his senior project.

**Bjorn Fredrickson '07** interviewed people who will be displaced by the Chinese government's plan to build 13 cascade dams along the Nujiang River in Yunnan province to generate hydroelectric power. Most people were aware of rumors about the project but were woefully uninformed and lacked any reliable information from the government. He conducted open-ended conversations with "farmers, local officials and the directors of several NGOs" at 11 of the 13 proposed dam sites in Tibet and Yunnan. These interviews lead him to conclude "that the lack of transparency and public participation in project planning along with failures of previous resettlement schemes provide people in the Nujiang River Valley with little hope for improved livelihoods in the future."

**Allison Guy '08** attributes her interest in the interaction between poverty and the environment to living in the Philippines from 1997 to 1999. This summer she returned to intern at the Decabobo Multipurpose Cooperative on the island of Busuanga. She helped construct an irrigation and water storage system and build a lightweight plywood sailing kayak as a demonstration. If accepted, this system will spare the old-growth trees used in construction of the traditional dugout fishing boats. Allison witnessed the destruction of the Cooperative's successful experiment with seaweed aquaculture by traces of cyanide. Presumably the contamination came from cyanide used by fishers coming from other parts of the country. Allison says the internship strengthened her resolve "to study marine conservation, and to learn methods of assisting coastal communities to manage their resources."

Further details of interns' activities may be found in their individual reports posted at: [www.yale.edu/evst/interno6.html](http://www.yale.edu/evst/interno6.html)

An Environmental Studies faculty committee co-chaired by Mary Helen Goldsmith and Sheila Olmstead administered the internship program. Other members were professors Leo Buss, John Wargo and Steven Stoll. The environmental internship program receives generous support from Environmental Studies and the Department of Ecology and Evolutionary Biology. The Program in Environmental Studies was endowed by the Gaylord and Dorothy Donnelley Foundation, the William Bingham Foundation, and the Montgomery Family Fund.



# RESEARCH AND PROGRAM HIGHLIGHTS



**INSET (Fig. 1)** Map of Middle East showing the Tigris/Euphrates catchment (red line).

**LEFT TO RIGHT: (Fig. 2)** The “haboob” sand storm approaching in Syria; Ben Zaitchik leaving through the main entrance to the abandoned desert city of Resafa.

## West Asia Hydrological Monitoring at the Yale Center for Earth Observation

### West Asia hydrology research at Yale

The semi-arid lands of southwest and central Asia are of great interest to climatology as the cradle of agriculture and as a region of current environmental stress and change. The 6,000-year legacy of rain-fed and irrigated cropping and widespread animal grazing has degraded a landscape that now must support increasing populations, changing economics, civil unrest and climate change. The result is a rapidly changing landscape on a vast scale.

As environmental scientists and planners try to understand and track these swift changes, the field of satellite remote sensing is suddenly playing a key role. Two types of satellite monitoring are being used. Satellite sensors such as AVHRR and MODIS are able to map the monthly distribution of vegetation over three decades and over thousands of square kilometers, with resolved scales of 250 to 1,000 meters. Satellites such as Landsat and ASTER can resolve surface features as

small as 15 meters, but over a small area, and only a few images of this sort are taken each year. With optimal blending of fine and coarse imagery, valuable insights into the landscape trends and fluctuations can be derived.

Two West Asia satellite monitoring projects are ongoing at the Yale Center for Earth Observation, funded by NASA. Team members include Drs. Roland Geerken and Jason Evans, and Ph.D. student Ben Zaitchik, all from the Department of Geology & Geophysics (G&G), and Larry Bonneau at the Center. Also active in these projects are Professors Frank Hole and Ronald Smith. Students in the Yale course “Observing the Earth from Space” have also contributed to the project. Close collaboration is maintained with nongovernmental agencies such as the International Center for Agricultural Research in Dry Areas (ICARDA) and the International Water Management Institute (IWMI).

While the two projects have several distinct features, they share several objectives.

- What is the growth rate and distribution of irrigated lands? When will water demands for irrigation outstrip the river flow?
- What is the physical role of mountains in precipitation and snow storage?
- What is the relative role of water vapor sources inside and outside the river catchments?
- What changes in the cropping and range-land areas will impact the river hydrology?
- How will global warming alter the water resources in the region?

## Middle East Project



Fig. 3. Dr. Geerken and Ph.D. student Ben Zaitchik taking measurements inside an olive orchard in Syria.



Fig. 4. The Syria fieldwork team: Abdul-kareem\*, Roland Geerken†, Ben Zaitchik‡, Nabile Batika\*, Jason Evans†, Jawad Youssef\*. \*ICARDA. †CEO.

### Middle East Project

In the Yale Middle East project, the focus of the investigation is the watershed of the Tigris and Euphrates rivers, including the source regions in Turkey and historic lands that they supply with water in Syria and Iraq (Fig. 1).

While the Middle East receives moderate amounts of rain in the winter months, its summer months are dry and hot under the influence of descending air from the Hadley cell and the mountain-plain circulation from the Zagros Mountains. For 6,000 years, melting mountain snows have supplied the rivers with adequate water supplies for irrigation in Mesopotamia. This balance is now threatened. Satellite estimates of irrigated land area show a doubling since 1975, bringing the average water use dangerously close to the annual river flow. Similar rapid changes are seen from space in the patterns of rangeland degradation.

One rangeland study at Yale used ~20 years of AVHRR (Advanced Very High Resolution Radiometer) Normalized Difference

Vegetation Index (NDVI), along with in situ precipitation data, to identify rangeland areas undergoing human-induced degradation. Identifying these locations before significant degradation (or even desertification) occurs enables authorities to take preventive measures. The earlier degrading areas are identified, including the causes of degradation, the more successful are remediation efforts.

For the identification of degrading rangelands it is important to differentiate shrub varieties from one another. Different shrubs are more or less palatable to the flocks of sheep relied upon by the Bedouin population. The camels, on the other hand, seem to find anything vaguely resembling vegetation palatable, so palatability is not an absolute quality of the species of shrub. For the sheep, though, the first sign of degradation is often the replacement of a palatable (for the sheep) shrub species with a nonpalatable species. Using an annual time series of the Normalized Difference Vegetation Index (NDVI) derived from satellite data, it is possible to differentiate several varieties of shrubs and grasses,

along with the density/vigor of coverage. Thanks in large part to Roland Geerken, the team has developed a land cover classification technique called “Fourier Filtered Cycle Similarity” that has shown promise in differentiating shrub species and coverage.

A field trip designed to collect ground truthing data for this classification was undertaken in May/June 2005 in Syria (Figs. 2, 3, 4, 5). The field work required extensive travel around the mostly arid and semi-arid country noting vegetation types along with their density/coverages. Syria is rich in manmade historical structures. Direct human influence over the landscape has been happening here as long as any other place on Earth. The capital, Damascus, and Aleppo rival for the oldest continuously occupied city on the planet. Traveling around Syria, you can see that great structures trace the history of the area back through time, ranging from large mosques built during the Islamic era (the last several hundred years), to the Crusader and Arabic castles built during the centuries of Crusader wars, to Christian cathedrals built by the Byzantines, to the remarkably intact remains of Roman cities, back even to pre-Roman civilizations.

Fieldwork in Syria at this time of year is generally hot and dusty. Surprisingly, we were also treated to an early summer downpour and the spectacle of a haboob. This is a special kind of sand storm that forms when moist enough air masses pass over dry, hot areas, encountering significant convection and generating thunderstorms. Raindrops under the clouds evaporate rapidly, cooling the air and

Fig. 5. The Watersheds of Central Asia (outlined in blue). The Caspian Sea is center left, Aral Sea is center and Lake Balkash in the upper right. Light-blue areas are snow-cover detected from satellite image analysis.





## Central Asia Project

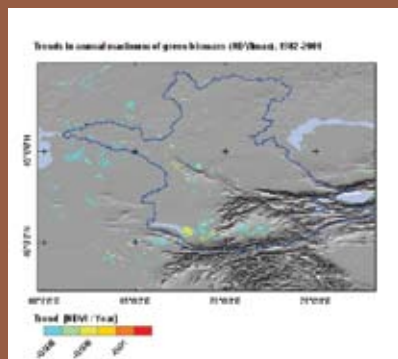


Fig. 6. Negative NDVI trends in Central Asia derived from satellite images.

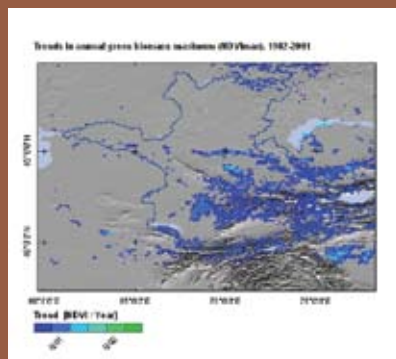


Fig. 7. Positive NDVI trends in Central Asia derived from satellite images.



Fig. 8. Harvesting cotton in the fall season in Uzbekistan.

creating strong downdrafts. These thunderstorm downdrafts cause gust fronts in which the descending air hits the ground and picks up large amounts of dust. This downdraft-produced dust storm then precedes the thunderstorm across the desert, often traveling 30–50 mph, but usually only lasting for several hours.

### Central Asia Project

In the Yale Central Asia Project, the research is focused on a large region east of the Caspian Sea and west of Lake Balkash (Fig. 5).

This climate is colder than in the Middle East, but still dry most of the year, cut off from oceanic water vapor sources by the high mountains of the Zagros, Kara Kum and Himalayas. The major rivers such as the Syr-Darja flow northward and end in closed basins.

The project's spatial extent and temporal dimension make remote sensing data an indispensable source of information for landscape monitoring. Twenty years of satellite data reveals several change "hotspots," e.g., locations with significant biomass loss (Fig. 6) concentrating in the agricultural areas of the Ferghana Valley and in Syr-Darja province. Decreases in biomass productivity are related to already existing shortages in irrigation water but also to salinization processes. Degradation processes caused by the shrinking of the Aral Sea are not apparent in this product. An increase in biomass productivity over the same period (Fig. 7) can be observed in the mountain ranges, suggesting a shrinking of the snow/ice pack. It is also apparent in the Takla Makan

due to newly established irrigation projects or along the southern coast of Lake Balkash related to dropping sea levels. Winter energy generation in upstream Kyrgyzstan is responsible for positive biomass trends in the Steppe area along the southern shore of Lake Ayderkul. To prevent downstream flooding along the frozen Syr Darja, waters are redirected into the unproductive depression of Lake Aydarkul, where waters are left unused. Apparently both non-adapted water use and mismanagement are to blame for environmental changes.

For a detailed description of these processes and to quantify feedbacks, hydrologic models are being used, with the parametrization of vegetation's hydro-meteorological influence constituting a major challenge. One of the objectives of the hydrologic modeling is to identify not only impacts but also alternatives for the agricultural sector. A key component of the model formulation is the mapping of natural and agricultural vegetation patterns. New methods for vegetation mapping using the seasonal cycle of NDVI have been developed at Yale, but these approaches require detailed ground truthing before they can be applied to predictive models. The field survey in Uzbekistan in fall 2006 was designed to provide this check on the remote sensing methods. Field trip photographs (Figs. 8, 9) provide some sense of the landscape and agriculture of the region.



Fig. 9. Agriculture, orchards and eroded highlands in Uzbekistan.

## YIBS Center for EcoEpidemiology Sponsors Forums and Fellowships

The Yale Institute for Biospheric Studies (YIBS) Center for EcoEpidemiology (YIBSCEE) was established in July 2005 with the goal of merging the disciplinary boundaries of the medical and the environmental sciences to provide a broader understanding of relationships between the environment and human health. Many human health issues are medical problems with environmental solutions, but the environmental and medical sciences are not equal players either in defining the problems or in developing solutions. This is particularly true for infectious diseases, which have become increasingly important due to the emergence of new infectious disease agents and the threat of bioterrorism. The discipline of environmental health would seem to capture the environmental aspects of all human disease threats, but disciplinary boundaries usually exclude infectious agents from environmental health both in academic public health programs and in U.S. government public health agencies. Bridging the public health disciplines of environmental health and infectious disease is a major focus of the YIBSCEE's activities, but infectious disease lacks strong ties with ecology and other environmental sciences which have traditionally embraced environmental health. A serious effort to engage the environmental sciences in infectious disease epidemiology at Yale is long overdue and a high priority for YIBSCEE.

YIBSCEE participants include faculty from the Divisions of Environmental Health Sciences, Epidemiology of Microbial Diseases, and Biostatistics in the Department of Epidemiology & Public Health, Yale School of Medicine, as well as faculty from Yale School of Forestry & Environmental Studies and the Department of Ecology & Evolutionary Biology. Yale is fortunate to be one of the few major universities with both medical and environmental sciences on the same campus. The

multidisciplinary YIBSCEE faculty have effectively worked together over the past year to provide a series of forums on contemporary issues in ecoepidemiology and to provide fellowships for graduate students to pursue interdisciplinary research topics.

The first forum was held December 10, 2005, and addressed the issue of climate change and human disease. An international list of top researchers who study how climate influences risk of infectious disease presented their findings during the two-day meeting. Their conclusions were that while climate can influence risk for diseases such as malaria, dengue fever, hantavirus and influenza, our understanding of the complex relationship between climate and disease agents and vectors (mosquitoes, ticks, etc.) is not sufficient to make accurate predictions on how climate change will influence these diseases. The epidemiology of each disease is unique, and sweeping generalizations on the impact of climate change upon human disease may not be accurate. A more detailed synopsis can be found in the last issue of the Yale Environmental Newsletter and the presentations are available for viewing at the YIBSCEE Web site, [www.yale.edu/yibs/research/cee](http://www.yale.edu/yibs/research/cee).

A Forum of Avian Reservoirs of Human Pathogens was held on April 21, 2006, at Harkness Auditorium at Yale Medical School. This forum addressed the role of birds in the global dissemination of pathogens that have potential for causing epidemic disease in humans. A leading expert on avian influenza in the U.S. and another from Europe explained how infections in migrating birds pose a constant risk of pandemic influenza in humans. Other presenters showed how birds serve as long-distance transporters of infectious agents for West Nile virus and Lyme disease. Presentations from wildlife biologists specializing in bird migration and population studies

questioned some of the assumptions epidemiologists were making concerning avian ecology in their assessments about the roles of birds in transporting and maintaining pathogens. The general conclusions from this forum, which are also available for viewing at the YIBSCEE Web site, were that wildlife ecologists and medical epidemiologists must work more closely together to understand the significance of pathogens migrating with wild birds for epidemic disease in humans.

The most recent forum was held on September 14, 2006, at the American Museum of Natural History in Washington, D.C. and was co-sponsored by the National Center for Environmental Research of the U.S. Environmental Protection Agency. The topic for this forum was "Biodiversity and Human Health." It addressed issues of how biodiversity loss might increase human risk for infectious disease. Examples were provided from Lyme disease and West Nile virus. Other topics covered were drug exploration in marine and terrestrial ecosystems, wildlife preserves as sources of human pathogens, bush meat consumption and disease emergence in underdeveloped tropical countries, and microbial ecology in human health. The forum was attended by more than 250 people, many of whom were representatives of various government agencies headquartered in the Washington, D.C. area. The complete program and presentations are available on the YIBSCEE Web site. The EPA held a workshop the next day to discuss the most important issues addressed by the forum speakers. The forum and workshop will aid EPA in developing a new research program on biodiversity and human health.

In other activities, YIBSCEE has also been working with the U.S. National Oceanic and Atmospheric Administration (NOAA) to promote health applications of the Global Earth Observation System of Systems (GEOSS).



Yale representatives to the EPA/YIBSCEE Forum on Biodiversity and Human Health at the American Museum of Natural History. Jean Tsao, Heidi Brown, Jonathan Cox, Maria Diuk-Wasser, David Skelly, Durland Fish and John Brownstein.



More than 64 countries have signed on to support GEOSS, which will ultimately link all international environmental monitoring systems into a single network and be made available to researchers and other users for the development of predictive models of disease emergence and epidemics, as well as floods, famines, and other applications. At the invitation of the Under-Secretary of Commerce, Vice Admiral Conrad Lautenbacher, YIBSCEE participated in a NOAA-organized symposium on GEOSS Applications in Human Health at the recent International Congress of Public Health held in Rio de Janeiro in August 2006. Other participating organizations included NOAA, the Group on Earth Observation based in Geneva, Switzerland and the Brazilian Space Agency. A summary of this symposium will appear in the November issue of "The Nation's Health," a publication of the American Public Health Association ([www.apha.org/tnh](http://www.apha.org/tnh)).

Four Graduate Summer Fellowships were awarded to support interdisciplinary research projects in ecoepidemiology during 2006. The criteria were that proposals be truly innovative, cross-disciplinary projects that address contemporary issues on environment/disease relationships. A total of eight applications were reviewed by the YIBSCEE Fellowship Committee, and the following projects were selected for \$4,000 awards: Maggie Montgomery, Ph.D. Candidate, Environmental Engineering Program, Department of Chemical Engineering, for a project titled "Utilizing principles of epidemiology and engineering to improve prevention, control, and monitoring of water-related diseases in East Africa"; Maya Leonard-Cahn, Master's of Environmental Science Candidate, Yale School of Forestry & Environmental Studies, for a project on "Modeling population viability in the context of disease ecology for endangered Sierra Nevada bighorn sheep"; Bridgid Curry, Master's Candidate, Joint Program in Environmental Health Sciences and Forestry & Environmental Studies, for her project on "Health effects of Canadian forest fires on asthmatic children in southern New England." Reports on these projects will be presented at a special YIBSCEE meeting to be held later this semester.



## Developing World Gaining Access to Environmental Research

To help reduce great disparities in scientific resources between developed and developing nations, Yale University, the United Nations Environment Programme (UNEP), and leading science and technology publishers have launched a new collaborative initiative to make global scientific research in the environmental sciences available online to environmental scientists, researchers and policy-makers in the developing world for free or at a nominal cost.

Through Online Access to Research in the Environment (OARE), more than 200 prestigious publishers, societies and associations will offer one of the world's largest collections of scholarly, peer-reviewed environmental science journals to over 1,200 public and non-profit environmental institutions in 106 developing nations in Africa, Asia and the Pacific, Latin America and the Caribbean, and Eastern Europe. Every institution enrolled in OARE will receive resources with an annual retail subscription value in the hundreds of thousands of dollars.

Institutions eligible to enroll in OARE include universities and colleges, research institutes, ministries of the environment and other government agencies, libraries, and national nongovernmental organizations. Access for institutions in the 70 poorest countries will be free. Access for institutions in 38 lower-middle-income countries will be for a nominal charge; monies raised will be reinvested to support continued training and outreach activities in eligible countries.

"OARE is a new and inspiring example of international cooperation that can contribute to the reduction of the North-South scientific gap and digital divide, which are at the top of the United Nations' agenda and the U.N. Millennium Development Goals," said Achim Steiner, undersecretary general of the United Nations and executive director of UNEP.

"Thanks to advances in information and communication technologies and the great generosity of many leading scientific publishers and

foundations, we have an unprecedented opportunity to provide environmental institutions in developing countries with intellectual resources that we in the developed world so often take for granted," said Gus Speth, Dean of the Yale School of Forestry & Environmental Studies.

Over 1,000 scholarly scientific and technical journal titles in such fields as biotechnology, botany, climate change, ecology, energy, environmental chemistry, environmental economics, environmental engineering and planning, environmental law and policy, environmental toxicology and pollution, geography, geology, hydrology, meteorology, oceanography, urban planning, and zoology will be provided through a portal presented in English, Spanish and French. OARE will also provide important Abstract and Index Research Databases, which are intellectual tools that the scientific and professional communities use to search for information within thousands of scholarly publications.

OARE aims to contribute to the development of expert professional and academic communities and an informed public, encourage scientific creativity and productivity and facilitate the development of progressive science-based national policies. It will also help enable countries to build their own higher-education programs in the environmental sciences, educate their own leaders, conduct their own research, publish their own scientific findings, and disseminate information to policy-makers and the public.

"Scientific publishers welcome this opportunity to provide access to the latest published research in environmental and related sciences to researchers and other professionals in developing countries," said Michael Mabe, CEO of the International Association of Scientific, Technical and Medical Publishers (STM). "We expect that, in turn, higher-quality research will emerge from those countries, to the benefit of all of us."

## RESEARCH AND PROGRAM HIGHLIGHTS

"The Hewlett Foundation is committed to providing high-quality educational materials to students and scholars in the developing world. We are pleased to join with Yale, UNEP and the many participating publishers, societies and associations to make scientific resources available in developing countries, where the need is so great," said Paul Brest, president of the William and Flora Hewlett Foundation.

Organizations providing scientific content through OARE include leading scientific publishers (e.g., Annual Reviews, Blackwell, Cambridge, Elsevier, John Wiley, Nature Publishing Group, Springer, Taylor & Francis, Oxford and many others) and more than 200 scientific societies and associations (e.g., Académie des Sciences de France, American Association for the Advancement of Science, National Academy of Sciences, Nordic Society OIKOS, Oceanographic Society of Japan, Real Sociedad Española de Química, Royal Geographical Society, Royal Meteorological Society of Great Britain, Società Botanica

Italiana, Zoological Society of London). A complete listing of collaborating institutions is available at [www.oaresciences.org](http://www.oaresciences.org).

OARE will be coordinated by UNEP and Yale University in association with STM and 30 leading science and technology publishing houses. Support is provided by the William and Flora Hewlett Foundation and the John D. and Catherine T. MacArthur Foundation. OARE will be managed in close cooperation with the Health Internetwork Access to Research Initiative, launched by the World Health Organization in 2001 to provide research to the medical community in developing nations, and Access to Global Online Research in Agriculture, launched by the U.N. Food and Agriculture Organization and Cornell University in 2003 to provide research to the agricultural community.

For more information about OARE, visit [www.oaresciences.org](http://www.oaresciences.org).

Yale Environmental News  
Yale University  
P.O. Box 208105  
New Haven, Connecticut 06520-8105

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Design: Yale RIS  
Maura Gianakos

**Submission Deadline for Next Issue**  
Spring 2007: March 23, 2007



printed on recycled paper