YALE ENVIRONMENTAL NEWS

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

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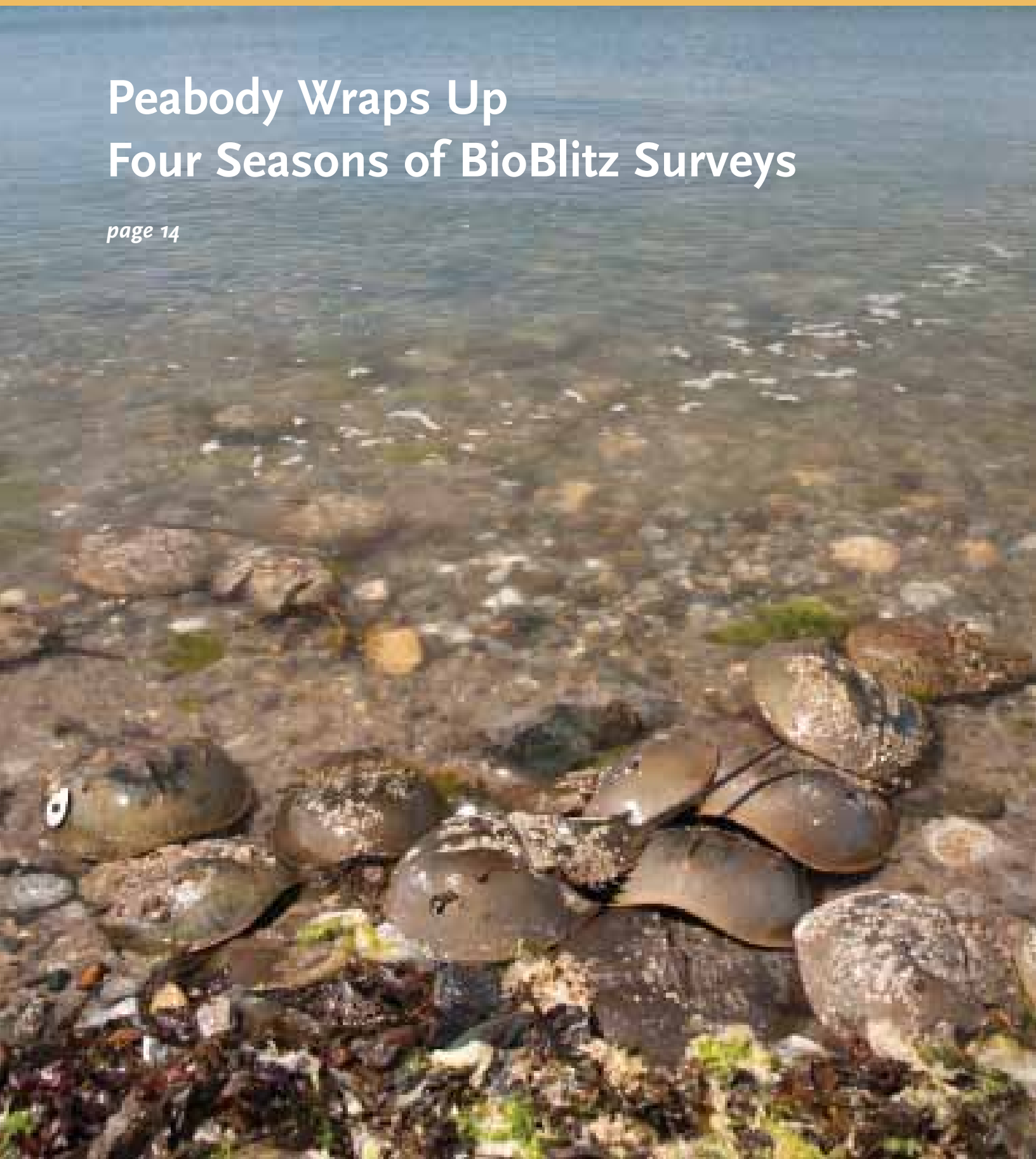
Peabody Wraps Up Four Seasons of BioBlitz Surveys

page 14



FROM THE DIRECTOR

JEFFREY J. PARK, DIRECTOR
YALE INSTITUTE FOR BIOSPHERIC STUDIES

The Environmental Studies Program strives to educate its majors to think across disciplines.

Cover: During the peak breeding season at Stratford Point multiple Horseshoe Crab (*Limulus polyphemus*) males try to mate with a much larger (partly buried) female. The crab on the left with a white US Fish and Wildlife Service tag is part of ongoing monitoring efforts by Project Limulus based at Sacred Heart University's Biology Department. Copyright Twan Leenders

With my final opportunity to editorialize as the director of the Yale Institute for Biospheric Studies (YIBS), I would like to highlight, from my own mid-career vantage point, some news from the entrance and the farewell of other careers in biospheric studies. At the starting point, YIBS applauds three graduating Yale seniors who received the 2011 Donnelley Prize in the Environmental Studies (EVST) major. At the cusp of his emeritus transition, YIBS recognizes the achievements of a longtime academic leader on the Yale faculty.

In a senior essay titled "Private Gardens, Public Streets: The Evolution of Istanbul's Urban Forest from 1922 to 2007," Reuben Fischer-Baum traces the history of park-land and flora in the former Ottoman and Byzantine capital city. Starting from a remarkably detailed fire-insurance map that was commissioned by the Sultan in 1920, and complemented by summer fieldwork, Fischer-Baum traces how urbanization and westernization after Ataturk's founding of the Turkish republic altered the urban ecosystem. Matching old and new views of Istanbul with Geographical Information System (GIS) technology, Fischer-Baum shows how the private enclaves of open space reflected Islamic principles of personal modesty, but were transformed in the face of rising population and the growth of an efficient transport grid.

In a senior essay titled "Changes in the Lakes: The Ecological History of Two Watersheds in South Central Connecticut," Cornelia Twining combines field-ecology data and a journey into the historical archives of coastal Connecticut towns and reconstructs events that governed the evolution of alewife fish in local lakes and ponds. Colonial towns built dams to harness hydropower for milling grain, and thereby isolated fish populations that had previously accessed the sea. Later, town residents might reverse this isolation by removing the dam, or enhance the dam to create a recreation area. Twining demonstrates, via zooplankton abundances and nitrogen isotopes in lake and pond sediments, how these changes affected the food chain differently in each ecosystem.

In a senior essay titled "The Desire for Car Ownership in China," Charles Zhu examines the paradoxes that attend the modernization of China's transportation system. The essay explores China's conflict between lifestyle aspiration and sustainability that could easily extrapolate to a global resource crisis within a decade. Zhu combines a survey he conducted of 963 Chinese college students with a media review and personal interviews to highlight how the desire of ambitious Chinese to own an automobile transcends any rational assessment of its utility as a transportation device. Zhu questions whether a car-centric transport system is inevitable in a modernizing China by exploring the alternative transportation culture of Copenhagen, Denmark.

The Environmental Studies Program strives to educate its majors to think across disciplines. The above senior essays are only three of a host of innovative projects, devised and executed by EVST majors, under the mentorship of EVST Chair John Wargo, Professor of the Yale School of Forestry & Environmental Studies, and EVST Program Manager Katy Prudic, formerly a Gaylord Donnelley Environmental Postdoctoral Fellow. Thinking broadly will be essential in solving future environmental problems. With the retirement of former YIBS Director Karl Turekian this year, we can also recognize that broad interdisciplinary thinking is essential to scientific discovery.

Karl Turekian became an assistant professor in the Department of Geology & Geophysics at Yale on July 1, 1956. Karl has 191 publications listed in the Web of Science, and has written several important books in geochemistry, the study of the chemical elements in their natural habitat. He is a long-standing member of the National Academy of Sciences and a Sterling Professor. Karl has mentored dozens of developing researchers in geochemistry, not only graduate PhDs such as Larry Grossman, Kirk Cochran and Greg Ravizza, but also Yale undergraduates who later rose to leadership in earth science, such as Richard Armstrong, Robert Poreda and Kenneth Farley. Karl not only edited scientific journals, he founded them.

Karl Turekian's high-fiber scientific career can be divided into three movements, in which Karl the concerto virtuoso harmonizes with a skilled orchestra of students, postdocs and other collaborators. In the first movement, Karl becomes a Titan of geochemistry. In Greek mythology, titans were the offspring of the earth god Gaia and the sky god Uranus. After writing his dissertation on the geologic prevalence of a single element, strontium, Karl reconciled the chemical budgets of his mythological parents with an inventory of all elements in Earth's crustal rocks, contrasting them with the chemical abundances of meteorites that fell from the sky. His 1961 paper on this topic with Karl Hans Wedepohl has garnered 1250 citations in the ISI Web of Science, and seeded the comprehensive *Handbook of Geochemistry*, compiled during 1968-71, which Karl co-edited.

The second movement of Karl's academic career is *molto vivace*, a dance through the periodic table to determine chemical exchanges throughout Earth's environment, and to use a variety of radioactive isotopes to determine the ages of rocks, the rates of biological processes in the ocean, and the transport of radiogenic nuclides in the atmosphere. During this time Karl's Coffee Room in Kline Geology Lab became renowned for bull sessions on the blackboard every morning from 10:30 to lunch, sharpening the minds of a generation of graduate students.

The third movement of Karl's academic career opens in 1980 with the crash of a meteorite at the Cretaceous-Tertiary boundary, and the Dammerung of the non-avian dinosaurs. Testing his skepticism about the meteorite-impact hypothesis, Karl found a new love within the periodic table, osmium, Nature's heaviest metal. Osmium is a platinum-group element with a distinct meteoritic signature, enabling Luck and Turekian (1983) to demonstrate that the mysterious clay layer found worldwide at the Cretaceous-Tertiary boundary was surely derived from an extraterrestrial impact. For a quarter-century, Karl followed the relative abundances of distinct osmium isotopes from sea to shore to mountain, elucidating problems in rock weathering, volcanic chemistry, and the ages of previously undatable black shales. Finally, Karl and BJ Pegram produced an oceanic history of osmium-isotope ratios that bookends Karl's original oceanic history of strontium isotopes. Both geochemical histories capture major events in Earth history via their fingerprints in planet-wide chemical interactions.

In 1997 the many academic Friends of Turekian organized a two-day festschrift at Yale in honor of Karl's 70th birthday. In 2011 Karl refused to allow the Geology & Geophysics Department to stage a farewell retirement party, claiming that it could not surpass the 1997 festschrift. However, Karl himself added a coda to his career concerto by co-editing the nine-volume *Treatise on Geochemistry* with Heinrich Holland, published in 2003 and soon to be updated. Karl, the springtime Titan, labored to estimate the abundance of each element with a primitive emission spectrograph. Karl, the autumnal Titan, picks up his office phone and commissions entire chapters on each relevant element in Earth's crust, ocean and atmosphere. We look forward to Karl's continued company in the Department of Geology & Geophysics as an emeritus professor.

I also look forward to continuing my dedication to the mission of YIBS from the ranks of past directors.

Jeffrey J. Park

YIBS Director Jeffrey J. Park Departing but Not Disappearing!

It has been my pleasure during the last three and a half years to work with Jeffrey J. Park as the director of the Yale Institute for Biospheric Studies. When Jeffrey took on the role as YIBS director in January of 2007, it was a surprise ending (or beginning!) to the sudden departure of then YIBS Director Derek Briggs when he was tapped to take the helm as Director of the Yale Peabody Museum of Natural History.

I had previously worked with Jeffrey when he served as chair of the Environmental Studies Program, but I had never had the distinct experience of interacting with him on a daily basis, and being witness to his unique and effective decision-making ability. When he took on the role of YIBS director, he did so with great enthusiasm and interest in every aspect of the Institute, and his passion to maintain YIBS presence on campus grew as the three and a half years seems to have flown by. His steady leadership and dedication to keeping YIBS as the foremost influence on campus for environmental initiatives is a testament to his many talents, especially under the recent economic downturn, all the while proving that it is possible to juggle teaching, research, leading YIBS, as well as being a full-time dad all at the same time!

I will miss working with Jeffrey on a day-to-day basis. However, knowing him as I do, I realize that his presence at YIBS will be forever on-going, and he will continue to support YIBS in any way that he is able to while keeping his juggling act going. Thank you Jeffrey, for sharing your time and talents the Yale Institute for Biospheric Studies, and with me!

Rose Rita Riccitelli, Assistant Director

CONFERENCES, SEMINARS, SYMPOSIA

YIBS/ESC AND YCEI FRIDAY NOON SEMINARS

Yale Institute for Biospheric Studies and the Yale Climate & Energy Institute continue their collaboration in presenting Friday noon seminars. The schedule serves both audiences of YIBS and YCEI with an outstanding speaker line-up. The spring 2011 seminars featured the following speakers and their topics:

YIBS/ESC Friday Noon Seminars:

John Wargo, Professor of Environmental Risk Analysis & Policy Political Science, Professor at the School of Forestry & Environmental Studies, Yale University: *Risk and Environmental Law in the 21st Century: Historical Reflections on 20th Century Success and Failure* ■ **William Mitch**, Associate Professor, Chemical Engineering and School of Forestry & Environmental Studies, Yale University: *A Role of Halides in Seawater Photochemistry* ■ **Paul Richards**, Professor of Technology & Agrarian Development, Wageningen University and Research Center; Edward P. Bass Distinguished Visiting Environmental Scholar, Department of Anthropology, Yale University: *Adaptation to Adversity–Inter-specific Rice Types as Products of Unsupervised Learning* ■ **Patricia Jaramillo**, Herbarium Curator, the Charles Darwin Foundation, and **G. Washington Tapia**, Director of Conservation, Sustainable Development and Research, The Galapagos National Park Service, Galapagos, Ecuador: *An Overview of the Role and Goals of the Galapagos National Park and Charles Darwin Foundation: Challenges and Opportunities* ■ **Kevin deQueiroz**, Curator and Research Zoologist, National Museum of Natural History, Smithsonian Institution; Edward P. Bass Distinguished Visiting Environmental Scholar, Department of Geology & Geophysics, Yale University: *Charles Darwin and the Evolution of the Species Concept* ■ **Chris Kuzawa**, Associate Professor of Anthropology, Faculty Fellow, Institute for Policy Research, Northwestern University: *Developmental Plasticity, Behavior and Human Evolution: Is Genetic Change the Cart or Horse in Evolutionary Change?* ■ **Andrea Gloria-Soria**, Donnelley Environmental Postdoctoral Associate, Department of Ecology & Evolutionary Biology, Yale University: *Allodiversity in Natural Populations of Hydractinia* ■ **Link Olson**, Associate Professor in the Department of Biology & Wildlife; Research Associate at the Institute of Arctic Biology, University of Alaska Museum of the North; Edward P. Bass Distinguished Visiting Environmental Scholar, Department of Anthropology, Yale University: *Alaska's Alpine Mammals: Canaries in the Coal Mine of Climate Change?*

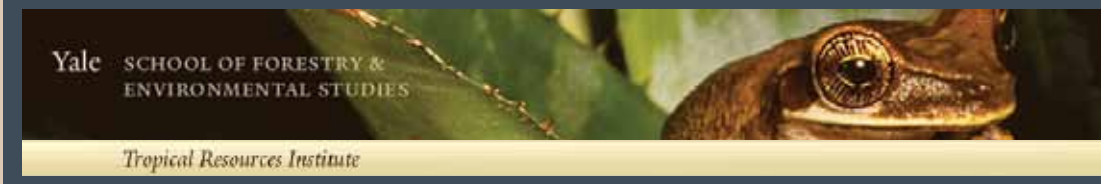
YCEI Friday Noon Seminars:

William Boos, Assistant Professor, Department of Geology & Geophysics, Yale University: *Towards an Understanding of Where Rain Falls over Tropical Continents* ■ **Charles Kolstad**, Environmental Economist, Professor and Chair, Bren School of Environmental Science and Management, UC Santa Barbara: *Climate Change: Is Economics the Problem or Part of the Solution?* ■ **Tony Leiserowitz**, Research Scientist, School of Forestry & Environmental Studies, Yale University: *Climate Change in the American Mind* ■ **Oswald Schmitz**, Oastler Professor of Population & Community Ecology and Associate Dean for Academic Affairs, School of Forestry & Environmental Studies and Professor of Ecology & Evolutionary Biology, Yale University: *Species Interactions, Climate Warming and Implications for Ecosystem Carbon Cycling* ■ **Rob Jackson**, Department of Biology and Nichols School of the Environment, Duke University: *Land-based Opportunities in Climate and Energy Policy* ■ **Jae Edmonds**, Chief Scientist and Laboratory Fellow at the Pacific Northwest National Laboratory's Joint Global Change Research Institute, and Adjunct Professor of Public Policy at the University of Maryland at College Drive: *Interactions between Energy and Terrestrial Ecosystems in Emissions Mitigation*

YIBS CENTER FOR THE STUDY OF GLOBAL CHANGE WEEKLY SEMINARS

The YIBS Center for the Study of Global Change director, Sterling Professor Karl K. Turekian, presented a program of Global Change Seminars in the spring of 2011 focusing on sea level variation and the cryosphere. Speakers and their topics were:

Donald Schutz, Geonuclear, Inc.: *Nuclear Power: Sustainable Power for the 21st Century and Beyond* ■ **Ellen Thomas**, Department of Geology & Geophysics, Yale University: *Sea Level Rise in Long Island Sound from the Early Holocene to Today* ■ **Jerry Mitrovica**, Harvard University Department of Earth and Planetary Science: *Taking the Fingerprints of Global Sea Level Change* ■ **Jordan Clark**, UC Santa Barbara: *Reorganization of Groundwater Flow in the Floridian Aquifer during Sea Level Rise following the Last Glacial Maximum* ■ **Maureen Raymo**, Boston University: *Sea Level Delta-O18 and Milankovitch: Some Thoughts on Antarctic Ice Sheet Stability* ■ **William Boos**, Department of Geology & Geophysics, Yale University: *The Hydrological Cycle of the Last Glacial Maximum* ■ **Steven D'Hondt**, University of Rhode Island: *The Role of the Meteorite Impact at the K/T Boundary on Planktonic Life* ■ **Jason Amundson**, University of Chicago: *Iceberg Calving as a Driver of Ice Sheet Wastage: Recent Observations, Insights, and Difficulties* ■ **Dana Royer**, Wesleyan University: *Atmospheric CO_2 Across the K/T Boundary: Evaluation of the Stomatal Proxy* ■ **O. Brian Toon**, University of Colorado Department of Atmospheric and Ocean Sciences: *The Greatest Who Done It: An Analysis of Proposed Extinction Mechanisms at the K/Pg Boundary* ■ **Andrea Dutton**, University of Florida: *Understanding the Timing and Magnitude of Sea Level Change during Warm Interglacials* ■ **Yair Rosenthal**, Rutgers University Institute for Marine and Coastal Sciences: *Deep-sea Temperature and Ice Volume Changes across the Pliocene-Pleistocene Climate Transitions*



The Andrew Sabin International Environmental Fellowship

An international environmental fellowship has been established to support the education and training of students from underdeveloped countries.

The Andrew Sabin International Environmental Fellowship will provide up to $30,000 in support for six master's students at the School of Forestry & Environmental Studies (F&ES) each in academic years 2010-2011 and 2011-2012 through the Tropical Resources Institute (TRI). The scholarships will encourage the recipients to return to their home region or country to work in the field of conservation and development.

Michael Dove, director of the Tropical Resources Institute and the Margaret K. Musser Professor of Social Ecology, said, "This generous and far-sighted grant from the Andrew Sabin Family Foundation will help to bring education at F&ES and Yale within reach of prospective students in less-developed countries. The fellowships will enrich the university with the perspectives and experiences of young people from other parts of the world and will contribute to the ongoing globalization of our campus."

The Sabin Fellowship will provide up to $20,000 in support for tuition for the second year of master's study and a $10,000 post-graduation award for professional development. The recipients will be eligible for the $10,000 post-graduation award provided they have secured employment in a developing country and have completed 12 months of work within 24 months of their graduation date.

The recipient must work for a governmental organization, nongovernmental organization or private firm engaged in conservation and development work.

Andrew Sabin, president of the Andrew Sabin Family Foundation, said, "Many countries in Africa, Latin America and Asia are on the front lines of environmental impacts from climate change, loss of biodiversity and forest degradation. I hope that our fellowships will provide the impetus for smart, dedicated professionals to come to F&ES for an education and then be able to return home to address these critical environmental challenges before it is too late."

For complete details of the award, visit www.environment.yale.edu/tri/ or contact Lisa Bassani, program manager for TRI, at (203) 432-3660 or lisa.bassani@yale.edu.TRI supports interdisciplinary student research on challenges confronting the management of tropical resources worldwide. The Andrew Sabin Family Foundation is a private charitable foundation located in New York State. Since 2007 the Foundation has provided grants to a wide range of nonprofit organizations to protect and preserve the environment.

College Basketball Similar to Life and Death in the Wild

Adam Aston
Originally published in Environment: Yale

Competition in college basketball bears a remarkable similarity to life and death in the wild, according to a Yale study published in the journal *PLoS ONE*.

The Yale researchers found that a few college basketball teams win many games and most win a few, a pattern similar to that for species in natural ecosystems where few species are abundant and the majority uncommon. Decades of debate in ecological science have failed to explain why this pattern is seen time and again. The Yale findings reveal that the textbook method used to explain this universal pattern of biodiversity likely is wrong.

"Ecologists increasingly fit mathematical models to infer why some species are common and others uncommon in an ecosystem," said Robert Warren, lead author of the study and a postdoctoral researcher at the Yale School of Forestry & Environmental Studies. "Some scientists say the world sorts out the winner species from the losers; some say it is just random. We picked a dataset generated by sorting college basketball records and tried to find the same pattern for tree species in the tropics."

To test these ideas, the researchers used won-loss records from the 327 NCAA Division I men's basketball teams. They treated each team as a species, and wins and losses as individuals, in their analysis of 20,000 games from 2004 to 2008. Warren said college basketball data are consistent with sorting theories to explain biodiversity in ecological communities. Each win by a team results in a loss by another team, and similarly in the wild a win by an individual of one species results in loss of an individual from another species.

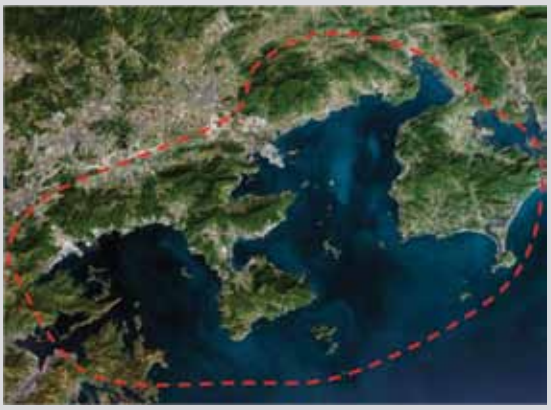
For example, an ecosystem may be dominated by a few very common species—crows and cockroaches—and many rarer species. Similarly in college basketball, a few teams dominate and win a lot of games, such as the Duke Blue Devils and the Kansas Jayhawks, and lots of teams win far fewer games. The winningest teams tend to have the most money, better coaches, better facilities and more talented recruits.

Their analysis challenges the popular view of how ecological communities are structured, called the unified neutral theory of biodiversity and biogeography, which assumes that differences between species are irrelevant to their success. The researchers argue that we know competition influences which teams generally win and lose in college basketball. Yet they found won-loss records that were no different when given to chance.

"It doesn't mean that the outcome of each basketball game is random," says Mark Bradford, a co-author and assistant professor of terrestrial ecosystem ecology at F&ES, "but rather the explanations for the patterns of biodiversity that we see are incorrect. If these neutral theories are correct, then the top seed in this year's tournament is no more likely to win than the last seed in each bracket. We know this isn't true, and the same applies to biodiversity—some species are more vulnerable to loss than others."

Warren added: "Instead of only fitting mathematical models to biodiversity patterns, we need to put on our boots and head back to the woods to figure out why some species are common and so many uncommon. Otherwise, we may find ourselves unable to manage species in the face of global environmental change."

David Skelly, professor of ecology, and Os Schmitz, Oastler Professor of Population and Community Ecology, are also co-authors of the paper, "Universal Ecological Patterns in College Basketball Communities" (*PLoS ONE* 6(3):e17342).



A

B

Yale's Collaborative Urban Environmental Crisis Management Research Project in China

Yajie Song, Research Scholar, and Haibao Yu, Postgraduate Fellow, Yale School of Forestry & Environmental Studies

The March 11, 2011 earthquake, tsunami and nuclear emergency in northeastern Japan not only triggered fear, but also serious concern about effective management of environmental crises in urban areas. Lessons from such devastation could serve as a valuable reference for urban environmental disaster prevention in China, especially for research done by the Yale Collaborative Urban Environmental Crisis Management Project (UECM) with principal investigator Dr. Yajie Song at the Yale School of Forestry & Environmental Studies.

The Dapeng Peninsula of Shenzhen in southern China, a critical case study of the UECM, has similarities in many ways with northeastern Japan. With a population of 377,000 spreading across an area of 295.33 km, the Dapeng serves as the "eco-lung" of Shenzhen with rich biodiversity, while its ecosystem safety is challenged from development of the major industries: the Daya Bay Nuclear Power Plant, known as "the father of China's nuclear power," the world's fourth largest container port, Yantian, and the controversial Kuichong Fine Chemical Park under construction. These industries provide the main source of local income, and also pose a potential threat to the natural environment and habitat. Therefore, an ecosystem perspective in management is particularly important for the development of this region.

Researchers from Yale and Chinese universities have been jointly "ground-truthing" this research site since 2007. UECM research proposes an overall urban environmental crisis prevention plan with analytic tools and index and managing strategies for the case site. It also helps urban leaders and residents allocate social, economic, and ecological resources with interdisciplinary ecosystem perspectives and an effective management mechanism. Therefore, the UECM research team probed into water resources, forestry resources, and the industrial ecosystems of Dapeng Peninsula and put forward a model of biomass with monetary calculation of the ecosystem services, demonstrating the strategic significance of the natural resources ecosystems. Based on the study, the team proposed a Dapeng Interdisciplinary Ecosystem Zone to cope with increasing complicated potential environmental crises. In the meantime, UECM training and practice have been provided to urban leaders, professionals and especially youths ranging from high school to graduate students in China. The training aims to promote the understanding of and partnership for effective prevention and preparedness towards environmental extreme events.

Yale's UECM research is drawing increasing attention, and welcomes feedback. During its mid-term assessment of progress in November 2010 in Shenzhen, the local government and professional evaluators and experts considered the research to be innovatively advanced in its focus from industrial ecology to regional. This research will continue to focus on one of "the world's most innovative urban laboratories of interdisciplinary ecosystems harmony."

C

A Satellite map of Dapeng Peninsula in Shenzhen, China, with proposed boundary of Dapeng Interdisciplinary Ecosystem Zone for Harmony of the East Pearl River Delta in southern China

B China Urban Environmental Crisis Management Forum in June 2007 by Yale UECM Program and China Association of Mayors, Shenzhen, China

C View of the Daya Bay Nuclear Power Plant (center of plant)

Making the economy more energy efficient and weaning it off fossil fuels will make it more competitive, according to a panel of experts at a January 2011 town hall event on climate change moderated by former NBC News anchor Tom Brokaw in Kroon Hall at the School of Forestry & Environmental Studies.

Michael Marsland

Tom Brokaw Moderates Climate Change Discussion

Linda Fisher, a panelist and Dupont's chief sustainability officer, said that her company has decreased its energy use by 19 percent and increased its revenues by 40 percent since 1990, saving $3 billion to $4 billion in the process. Dupont, she said, views climate change as an opportunity to invest in new ideas and technologies.

"Either we are going to create the technologies and the jobs in America or the technologies and the jobs will be created elsewhere," she said.

Fisher was one of four panelists who discussed climate change's impact on economic opportunity and competitiveness, human health, youth and moral and religious values at the NBC News town hall event, "Changing Planet: The Impact on Lives and Values."

"Today's youth are interested and engaged in trying to understand climate change and its impact on our world," Brokaw said. "It is important that we involve them in finding solutions through events like this."

When one Yale senior asked the panel how to promote sustainability in the face of the current economic recession, the panelists pointed out the costs that will be incurred if America doesn't take action against climate change, noting that the country spends $5 billion every week importing oil and that the revenue generated from putting a price on carbon, for instance, could help fund research into more sustainable forms of energy.

The other panelists were Rajendra Pachauri, director of the Yale Climate and Energy Institute and a Nobel Prize laureate; Billy Parish, founder and coordinator of the youth-oriented Energy Action Coalition; and Katherine Hayhoe, associate professor in the Department of Geosciences at Texas Tech University and an expert on the intersection between Christian fundamentalism and climate change.

From one NBC News segment that was aired during the event, the audience learned about the effects of climate change on other parts of the world and how a warmer, wetter world is already leading to more infectious disease outbreaks. Cases of dengue fever, for instance, have recently been reported in parts of the world like Australia and even Florida, which hadn't seen any cases of the mosquito-borne disease for 75 years.

While Pachauri stressed that the poorest countries in the world are being hardest hit by the effects of climate change—increased flooding, drought, heat waves and vanishing agricultural lands—Parish emphasized that climate change is going to have a major effect on Americans as well. "Almost every aspect of our economy is going to have to be redesigned, rethought and rebuilt," he said.

The audience was composed of Yale undergraduates and high school students from New Haven public schools. Anthony Leiserowitz, director of the Yale Project on Climate Change Communication at F&ES, and a team of researchers surveyed the audience before and after the event to gauge young people's attitudes toward climate change.

The program, which was sponsored by the National Science Foundation, *Discover* magazine and Yale, aired on the Weather Channel in April.

YALE CLIMATE & ENERGY INSTITUTE NEWS

The Yale Climate & Energy Institute administers interdisciplinary postdoctoral grants, and the following outstanding researchers are the recipients of the YCEI 2010 postdoctoral fellowships.


HERRMANN


HAZNEDAROGLU


KEMP


DWIVEDI


BARNES

Postdoctoral Awards

CARMEN HERRMANN

Carmen's focus is on molecular electronics, molecular magnetism, and vibrational spectroscopy. At Yale, she is working with leading academics in elucidating the structure and function of a manganese-based biomimetic water-oxidation catalyst on electron acceptor TiO_2 nanoparticles. The culmination of her work aims to investigate conditions for catalytic activity to occur and focus on exploring the influence of the Mn coordination environment on the properties of the catalyst when directly attached to TiO_2. Before coming to Yale, Carmen completed University study in chemistry at the University of Erlangen–Nuremberg, Germany, and Joseph Fourier University of Grenoble, France; PhD studies in Theoretical Chemistry at University of Bonn, Germany; University of Jena, Germany; and has held research fellowship positions at ETH Zurich, Switzerland and Northwestern University.

BERAT Z. HAZNEDAROGLU

Berat's research interests concentrate in functional genomics, environmental microbiology and biotechnology. At Yale he is working with the Environmental Engineering Department on advanced liquid biofuels from plants and microalgae feed stocks. This research is designed to create a renewable and sustainable alternative to fossil fuel petroleum energy. Berat received his B.Sc. in Biology from the Middle East Technical University, Ankara, Turkey; M.Sc. in Civil and Environmental Engineering Department of Villanova University; PhD in the Chemical and Environmental Engineering from the University of California, Riverside. In addition, he is actively affiliated with the American Society for Microbiology, Water Environment Federation, American Society of Civil Engineers, American Institute of Chemical Engineers, and American Chemical Society.

ANDREW KEMP

Andrew's research aims to produce high resolution reconstructions of sea-level change over the last 2000 years. Using composite chronologies to constrain the age of sediment samples and develop probabilistic age-depth models, Andrew is working to reconstruct sea levels using foraminifera preserved in salt-marsh sedimentary archives. The resulting sea-level records are then used to provide geological context and constraint for future projections of future sea-level rise. Before arriving at Yale, Andrew received a BSc in Physical Geography for the University of Durham (UK) and completed graduate and postdoctoral studies in the Department of Earth and Environmental Science at the University of Pennsylvania.

PUNEET DWIVEDI

Puneet's current research focus includes bioenergy development in developed and developing countries, economics of carbon sequestration on forestlands, life-cycle assessment of forest and agricultural products, non-market valuation of forest-based environmental services, and emergent behavior in rural communities with respect to sustainable forest management. He uses advanced econometric tools, optimization models, and various simulation approaches for his research. He has published extensively in his area of specialization. Puneet received his Bachelors of Engineering (Mechanical) from the Institute of Engineering & Technology, Devi Ahilya University, his MBA in Forestry Management at the Indian Institute of Forest Management, and his PhD from the School of Forest Resources and Conservation at the University of Florida.

JESSICA BARNES

Jessica's research examines the intersection of water management, agricultural policy, and climate change impacts in the Middle East. At Yale she is working on a book manuscript, provisionally titled *Governing Flow: The Politics of Water Distribution and Use in Egypt*. In addition, she is developing a new project that explores how government officials, scientists, and farmers variously understand the nature of Egypt's climate change challenge, and how those understandings translate into policies for managing the waters of the Nile and agricultural development. This project will provide insights into how climate change science is produced, interpreted, and negotiated in a region that has been largely marginalized within climate change debates. Jessica has a PhD in Sustainable Development from Columbia University, a master's in Environmental Management from Yale School of Forestry & Environmental Studies and a B.A. in Geography from Oxford University.

Yale Climate & Energy Institute Research Projects

Juliana Wang, Assistant Director

In the two years since the Yale Climate & Energy Institute (YCEI) was launched, the institute has served its mission by providing seed grants for research projects, funding for postdoctoral fellowships, and financial support for workshops organized by students and faculty that bring in speakers from both on and off campus. In 2010, the funded research projects included the following:

Photoautotrophic Production of Biodiesel Using Polyhydroxyalkanoate Feedstock

Principal Investigators

Evan Beach, *Center for Green Chemistry*

Berat Haznedaroglu, *Department of Chemical and Environmental Engineering*

Jordan Peccia, *Department of Chemical and Environmental Engineering*

Hamid Rismani-Yazdi, *Department of Chemical and Environmental Engineering*

Julie Zimmerman, *Center for Green Chemistry and Engineering*

This interdisciplinary project proposal seeks to produce liquid biofuels using polyhydroxyalkanoates (PHA) as feedstocks. PHAs are common storage polymers in bacteria and can be transformed to liquid fuels by esterification. To produce PHA biodiesel that meets the fuel characteristics specified by the U.S. Department of Energy, PHA monomers of medium chain length (C10-C14) poly-3-hydroxyalkanoates (mcl-PHAs) are required as feedstock. The goal is to determine the feasibility of using photoautotrophic bacteria to produce mcl-PHA's that are suitable for use as a biofuel feedstock.

Using Plasmonics to Enhance Photocatalytic Water Splitting

Principal Investigators

Hui Cao, *Department of Applied Physics*

Charles A. Schmuttenmaer, *Department of Chemistry*

In the broadest context, the ultimate goal of the proposed research is an alternative energy source which is carbon-neutral. More specifically, this research will explore new paradigms for splitting water by uniting plasmonics and photocatalysis. Finally, at the most basic and fundamental level, we will methodically quantify the advantages of coupling giant plasmonic field enhancement with cutting edge water oxidation catalysts on a nanoscopic scale.

Intelligent Buildings: Energy Monitoring/ Management and Related Impact on Utility Market Dynamics

Principal Investigators

Michelle Addington, *Yale School of Architecture*

Andreas Savvides, *Departments of Electrical Engineering and Computer Science*

Juliana Wang, *Yale Climate and Energy Institute*

Partners: Yale Office of Sustainability and Yale Utilities

This project will develop new methods for determining and evaluating how energy is consumed in large buildings by proposing new electric load disaggregation mechanisms, developing new metrics and examining the role of buildings in emerging energy markets. Using an experimental deployment on Yale Campus buildings, we will investigate the decomposition of electric loads, identify waste and develop new per capita metrics for evaluating building energy performance. The outcomes of this research will also be used to drive new policies and to create new opportunities in emerging energy markets that promote greener generation and carbon footprint reduction.

Climate Change, Water Insecurity, and Urban Dengue Transmission in Variable Landscapes

Principal Investigators

Maria Diuk-Wasser, *School of Public Health*

Menachem Elimelech, *Department of Chemical Engineering*

Durland Fish, *School of Public Health*

Alison Galvani, *School of Public Health*

Karen Seto, *School of Forestry and Environmental Studies*

Ronald Smith, *Department Geology and Geophysics*

This transdisciplinary project seeks to understand the effects household adaptation to climate-driven water insecurity has on the abundance and productivity of the mosquito vectors of the dengue virus. Using remotely sensed, field and experimental data, we will then model how reduction of *A. aegypti* production affects the risk of dengue epidemics in different types of neighborhoods. The results of this project will guide the development of sustained household water adaptation strategies to maximize the suppression of dengue transmission.

Transition to a Post-Fossil Fuel Economy—How Soon? How Feasible?

A most recent event hosted by the Yale Climate & Energy Institute was its second annual conference on April 9, 2011. Scientists, industry leaders, policymakers and government officials convened on campus to explore ways in which today's technology could help provide a secure energy future. The event included discussions on the latest breakthroughs in solar fuels, genetics and bioenergy, and battery technology. But the panels aren't just about science–they were each followed by discussions among industry leaders and policy officials about how to take those technological innovations from the lab so they can be put into practice by businesses, governments and communities. The high level roundtable was moderated by ABC News correspondent Bill Blakemore on the topic "Transition to a Post-Fossil Fuel Economy–How Soon? How Feasible?" Participants of the roundtable included Hon. Lykke Friis, Danish Minister for Climate and Energy and Minister of Gender Equality; Hon. Marc Spitzer, Commissioner, U.S. Federal Energy Regulatory Commission; Noubar Afeyan, CEO, Flagship Ventures; Arun Majumdar, Director, Advanced Research Projects Agency, U.S. Department of Energy; Ernest Moniz, Director, MIT Energy Initiative; Tom Pincince, CEO, Digital Lumens; James Woolsey, Former Director, CIA, and Rajendra Pachauri, director of the YCEI. The conference faculty director was Professor Mark Pagani, Department of Geology & Geophysics, Yale University.

YALE PEABODY MUSEUM OF NATURAL HISTORY

YALE CLIMATE AND ENERGY CONGRESS FOR STUDENTS AND SCHOLARS

We feel that the greatest strength of the Yale Climate & Energy Institute is its ability to bring together people from across campus and beyond who are all working on one piece of the larger climate and energy problem. This is true not only for faculty members to come together to work on research projects, but also for the students and scholars on campus.

In January 2011, Yale Climate and Energy Congress for Students and Scholars was also officially registered at the Vice Presidents Office. It was originally established in 2009 as the umbrella organization for students and scholars at Yale. Funded by the YCEI, the Congress is to foster an interdisciplinary community among students and scholars interested in climate change and energy in order to inspire an integrated approach to research, learning and action in these cross-cutting issues. Participating units of the Congress include the Undergraduate Energy Club, School of Forestry & Environmental Studies Energy Student Interest Group, School of Management Energy Club, and Environmental Law Association. Every year, the Congress hosts the Climate and Energy Congress Spring Symposium. This year, the spring symposium brought in former Democratic congressman Richard Swett, former Republican congressman Chris Shays, director of Levi Strauss Richard Kauffman, as well as green engineering experts Everett Anderson and Julie Zimmerman at the panel discussion on "The Interface of Energy Technology and Policy" moderated by science writer Carl Zimmer. The event was opened in the morning by a keynote by David Wells from Kleiner, Perkins, Caufield and Byers on the difficulties of commercializing research. The event was concluded by a poster session in the afternoon, a talk by Michael Caramanis from Boston College on the market viability of a smart-grid, and a keynote speech by Kathy Ayers from Proton Energy Systems on hydrogen energy. The co-presidents of the Congress for 2009-2010 were Frances Moore, School of Forestry & Environmental Studies, '10 and Deepak Kumar, School of Management, '10. The co-presidents for the Congress for 2010-2011 are Denina Hospodskey, PhD candidate, School of Engineering and Applied Science, and James Blakemore, PhD candidate, Department of Chemistry.

EVENTS

INVASION OF THE BLOODSUCKERS: BEDBUGS AND BEYOND

On view through January 8, 2012

How do you know bedbugs, lice, mosquitoes, fleas and other bloodsucking arthropods when you see them? Filled with family-friendly displays, interactive activities, bigger-than-life models and photographs, specimens from our collections and footage of blood feeding, this exhibition explores where and how these small but fascinating creatures live, and live with us.

Sponsored by a Science Education Partnership Award (SEPA, R25RR020818) from the National Center for Research Resources, part of the National Institutes of Health.

X-RAY VISION: FISH INSIDE OUT

On view July 2, 2011 to January 8, 2012

This stunningly beautiful exhibition features 40 black-and-white radiographs that reveal the complex and delicate skeletons of fish. Illustrated displays explore the scientific, environmental and photographic relevance of each fish and specimens from YPM's worldwide ichthyology collections tell the story of Yale's distinguished history of the study of fishes.

Organized by the Smithsonian's National Museum of Natural History and the Smithsonian Institution Traveling Exhibition Service (SITES) and inspired by Ichthyo: The Architecture of Fish *(Chronicle Books, 2008) by Stephanie Comer and Deborah Klocko, with essays by Jean-Michel Cousteau, Daniel Pauly and Lynne Parenti, and X-rays by Sandra J. Raredon.*

PEABODY SUMMER YOUTH PROGRAMS

July and August 2011

Summer youth camps can provide countless enriching and memorable experiences for children. Week-long camps at the Peabody Museum and at Yale's West Campus for students entering 1st to 9th grade provide fun and learning about natural history and cultural history—topics such as biodiversity, astronomy, natural science drawing, ancient survival skills, ancient cultures and archaeology—in a relaxed setting, through engaging hands-on experiences and YPM's world-class collections and exhibits.

EARTH SCIENCE DAY

October 10, 2011

On this day, part of the American Geological Institute's Earth Science Week 2011, the Museum will feature talks, hands-on activities, and research demonstrations about our ever-changing planet.

FIESTA LATINA!

October 15, 2011

Join us for our annual celebration of Latin American cultures! Enjoy performances of traditional and contemporary Latin American music and dance, along with games, crafts and storytelling for the whole family.

A PEABODY HALLOWEEN

October 29, 2011

Live snakes, spiders and more! Join us for our annual celebration of "spooky" animals and nature-based traditions associated with Halloween, with crafts, games and some of the strangest-looking specimens from our collection rooms that rarely see the light of day.

PALEO-KNOWLEDGE BOWL

November 13, 2011

In this annual competition, teams of students in grades 4, 5 and 6 from around Connecticut and beyond answer some very difficult questions about paleontology, especially dinosaurs. Each year this unique contest receives rave reviews from teachers, parents and students. An excellent opportunity for students with an interest in science to team up with their schoolmates and be rewarded for what they know! Visit our website for details.

Information and updates at (203) 432-5050 and *peabody.yale.edu*

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Songbirds Art Display Brings a Touch of Spring

The beauty and musicality of bird song has captivated us for millennia, inspiring poets, artists, composers and even the Paleolithic inventors of the earliest musical flutes and whistles. The variety of bird vocalizations we hear is created by a vocal apparatus, known as a syrinx, unique to the avian community. Songbirds (Order Passeriformes), which have the most complex syringeal structure and whose diverse array of songs attract mates and defend territories, are a welcome harbinger of spring in the eastern United States.

On view from January to June 2011, the latest exhibition of art in Yale's Class of 1954 Environmental Science Center (ESC), *Songbirds of the Eastern United States,* is a visual interpretation of the world of these effervescent masters of song. These 39 works by 23 members of the Guild of Natural Science Illustrators–Greater New York Chapter (GNSI-GNY) depict 33 bird species in a variety of media, including watercolor, gouache, oil, acrylic, colored pencil, silverpoint and graphite. The show was curated by GNSI-GNY member Dick Rauh and organized with the help of chapter members.

The Guild of Natural Science Illustrators (www.gnsi.org) is a non-profit membership organization of people engaged in the field of natural science art and illustration. The Guild strives to further the profession of the scientific illustrator, assist those interested in entering the field, promote high standards of competence and ethics, and encourage better understanding of the profession by the public and those requiring scientific illustration services. Each semester the ESC showcases works of natural history art and scientific illustration in the natural sciences.

A Cedar Waxwing (*Bombycilla cedrorum*)
Watercolor and gouache, 16 in. x 19 in. © Dorie Petrochko
Once called "Velveteen" by birders, the Cedar Waxwing's diet is mostly of fruit, flower petals and sap, with some insects. The vibrant red wax tips on the end of the secondaries are flattened extensions of the feather shafts, derived from a carotenoid pigment, astaxanthin, most likely from its diet of fruits and berries. The tips may be age markers that the female uses to assess a male's reproductive success during his side-hopping courtship dance—the older the male, the more red waxy tips he has, the more desirable as a mate.

B Northern Cardinals (*Cardinalis cardinalis*)
Watercolor and gouache, 20 in. x 20 in. © Cindy Gilbane
Prevalent in New England, the Northern Cardinal has both extended its range northward into southern Canada and increased dramatically in numbers within the last few decades, possibly because food is available year-round in feeders. These birds guard their territories aggressively. Pairs often mate for life, staying together through winters; they do not seem to migrate. Cardinals are named for the red robes worn by Roman Catholic cardinals.

The Age of Reptiles, a mural by Rudolph F. Zallinger. ©1966, 1975, 1985, 1989, Peabody Museum of Natural History, Yale University, New Haven, Connecticut USA. All rights reserved.

W. Piel (2)

On a recent bird-watching trip to Malaysia with a group of intrepid researchers affiliated with the Yale Institute for Biospheric Studies, we not only spotted 130 species of birds, but also found plenty of bird droppings, both real and imitation.

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Flies in the Ointment Make for Convincing Poop

By William Piel, Director of Informatics and Cryo Collection Manager, Yale Peabody Museum of Natural History, and Antónia Monteiro, Assistant Curator in Entomology, Yale Peabody Museum of Natural History, and Assistant Professor, Yale Department of Ecology and Evolutionary Biology

We encountered a particularly intriguing imitation bird-dropping on the dorsal wing surface of *Macrocilix maia*—a rare drepanid moth found only at higher elevations in the Asian tropics. Allan Lee reports that this species produces an unpleasant smell (see www.flickr.com/photos/allanlee/3506113435/), although we didn't notice this at the time. Finding exquisite bird-dropping imitations among moths, caterpillars and spiders is common in the tropics. Often these mimics also emit foul odors or use dashes of white glint to look especially fresh and wet. Typically, this mimicry functions either to cryptically hide the moth or to ward off predators by posing as something unprofitable. But in the case of *Macrocilix maia* the imitation bird dropping and odor was accompanied by a most extraordinary wing pattern.

To our astonishment, this moth, which we found outside our hotel on Frasers Hill, Malaysia (3°42'49.8"N, 101°44'48.0"E), seems to have false images of flies on its wings. It may be our imagination, but don't those red compound eyes, rounded thorax with legs, and blurred grey folded wings together form the images of flies? In butterflies, eyespots usually function to deflect predatory strikes to the margin of the wings, providing the butterfly with a chance of escape. Are flies functioning as the deflectors here? Or, alternatively, are these flies pretending to feed on the bird dropping, thus completing the entire picture: foul-smelling bird poop that has attracted flies? Only careful future research will answer this question.

Our thanks to Larry Gall, Torben Larsen and Henry Barlow, who all helped identify the moth.

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A The moth *Macrocilix maia* photographed on Fraser's Hill in peninsular Malaysia. ***Below:*** Flanking the imitation bird dropping on the hindwings are two patterns on the forewings that look remarkably like flies (one wing shown in detail).

B Trip members *(left to right)*: William Piel; Antónia Monteiro; Jon Beadell, former postdoctoral researcher in the YIBS Molecular Systematics and Conservation Genetics Laboratory; Yulia Bereshpolova, University of Connecticut, Storrs; Peabody Division of Vertebrate Zoology Collections Manager Kristof Zyskowski; Alana Beadell, postdoctoral researcher, University of Wisconsin–Madison; and Florence Piel, a student at the Bear Path School.

Peabody Wraps Up Four Seasons of BioBlitz Surveys

How many plants and animals do you see around you on any given day? You might guess, correctly, that there are more than are visible at any particular time, but how many do you think you would find if you went out to look for them? Would you see more in spring than summer? In fall than in winter?

Since 2007, the Yale Peabody Museum of Natural History (YPM) has partnered with Connecticut's Beardsley Zoo, and in 2010 also with the Connecticut Audubon Society, to organize five BioBlitz surveys to tally the number of species in the town of Stratford, Connecticut, particularly at Short Beach, Roosevelt Forest and Stratford Point. A BioBlitz is a 24-hour biological survey of the biodiversity of a specific place that aims to find out what species live in the area.

The first BioBlitz was held in Washington, D.C., in 1996. There are several organized each year throughout Connecticut, including by the University of Connecticut, and many by groups interested in learning what species inhabit the properties in their care. Most BioBlitz surveys occur in only a single season or cover a different place during the same month every year. One of the main goals of the five YPM BioBlitz surveys was to collect data in different seasons to see how the species diversity of a place changes annually.

The Stratford BioBlitz surveys were held in May 2007 (637 species), May 2008 (914 species), February 2009 (256 species), August 2009 (977 species) and October 2010 (835 species). They were organized around specialized collecting teams—taxonomic working groups, or TWGs—in mycology, entomology, herpetology, ichthyology, botany, ornithology, mammalogy and invertebrate zoology. These teams went into the field to observe and collect specimens in their respective specialties. Survey techniques varied by specialty and included motion-sensitive cameras, trackway traps, funnel net traps, cover object surveys, sweep-netting, light traps, seining, bird call-back surveys, and good old fashioned observation, either with the naked eye or using binoculars and spotting scopes. A team of scientists and high school students trawled for fish, algae and invertebrates in Long Island Sound, another team surveyed a forest for bats, a group of high school students searched their school grounds for plants and all the eighth graders at Wooster Middle School surveyed the pond behind their school. College students, including those from Yale and Sacred Heart University, focused on invertebrates, including insects. Each BioBlitz began at three in the afternoon and wrapped up at the same time the next day.

BioBlitz events often include public educational outreach activities that highlight conservation and ecological issues. Specimens were brought to a central sorting area where they were identified and recorded. The public was invited to watch the sorting and identification process and encouraged to ask

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questions of the scientists and volunteers. Each Stratford BioBlitz also provided opportunities for individuals and families to go on butterfly walks, help with invertebrate collecting and watch bird-banding demonstrations.

Each BioBlitz documented hundreds of species in the different seasons, ranging from fewer than 300 in winter 2009 to almost 1,000 in summer 2009. Not surprisingly, insects and plants were the most numerous among the taxonomic groups observed. There were 53 species that were seen only during the winter BioBlitz. The occurrence of some species might be expected, such as ducks seen only in winter and insects only in warmer seasons, but there were some surprises along the way. Highlights included a rare water scorpion, a state record isopod that had not been reported in more than 50 years, the federally listed Piping Plover (*Charadrius melodus*), a vagrant Purple Gallinule (*Porphyrio martinica*) that was several hundred miles from its normal distribution area, a White-tailed Kite (*Elanus leucurus*) rare to New England, and two Stratford town record amphibians.

The most unusual amphibian record was that of a Spotted Salamander (*Ambystoma maculatum*). Although common and expected within Stratford, what made this "observation" unusual was that it was a trackway (footprints left on paper in a trackway trap, a PVC pipe with ink on each end), possibly the first time a salamander track has been tabulated in a BioBlitz survey.

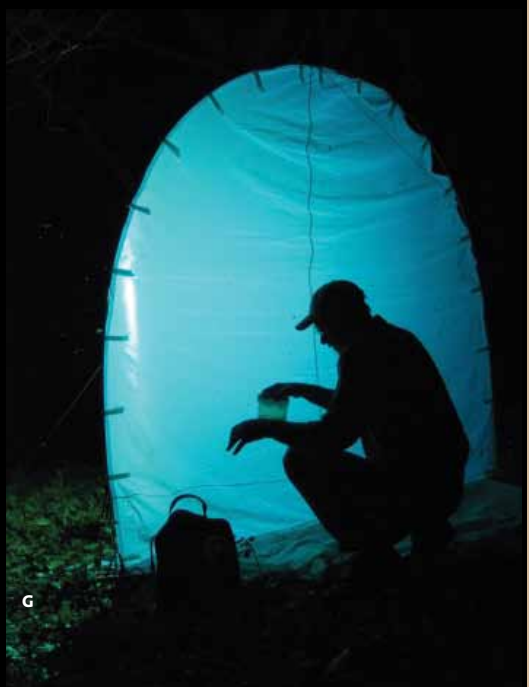
One unusual find from vegetation at Stratford Point during the summer 2009 BioBlitz included a two-inch antlion, *Brachynemurus abdominalis* (an insect that looks like a small dragonfly), a species rarely seen in Connecticut. Another was an interesting marine amphipod *(Gammarus mucronatus)* as a form that lacks the sharp points that characterize this crustacean species.

Two state-listed species were documented, the Eastern Box Turtle *(Terrapene carolina)* and the Eastern Prickly Pear Cactus *(Opuntia humifusa)*. Data on the state-listed species were submitted to the Connecticut Department of Environmental Protection database, where they may be useful in mapping the distribution of protected species. Some of the species collected during the surveys are available to researchers around the world as vouchers in the YPM collections and tissue samples from many species are now stored in the YPM–Yale Institute for Biospheric Studies cryofacility tissue collection.

Each BioBlitz brought together dozens of volunteers, with hundreds participating in the five Stratford BioBlitzes across the four seasons, from 2007 to 2010. Many volunteers returned each year. In some years, in addition to YPM staff, curators and affiliates and Yale postdoctoral fellows, educators and students from area middle and high schools participated in survey activities, often including the BioBlitz in their class studies. Whether the BioBlitz was held in a cold, driving spring rain with night temperatures in the forties (but nonetheless recording 637 species) or in the warmth of summer, TWG team members were eager and committed to the cause of tabulating as many species within the town as possible within 24 hours.

Many individuals and organizations in addition to Yale and YPM staff were involved in the success of the BioBlitz surveys, among them: Director Gregg Dancho and the staff of Connecticut's Beardsley Zoo; the Connecticut Audubon Society; the Connecticut Botanical Society; the Connecticut Mycological Society; the Connecticut Department of Environmental Protection; NOAA Northeast Fisheries Science Center Milford Laboratories; East Windsor High School; Ross-Woodward Classical Studies Magnet School in New Haven; David Wooster Middle School in Stratford; the ecology class of Dr. Jennifer Mattei, associate professor of biology at Sacred Heart University; and the Town of Stratford and the Stratford Conservation Commission.

To see the lists of species from each Stratford BioBlitz visit *http://peabody.yale.edu/events/yale-peabody museums-bioblitz* and find photographs of the October 2010 Stratford BioBlitz on our Facebook page.



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A Fall 2010: An assortment of insects collected by the entomology group from Sacred Heart University. Copyright Twan Leenders

B Fall 2010: This sea star (*Astarias* sp.) was among the many marine invertebrates collected. Photo by L Rojas

C Fall 2010: An American Kestrel (*Falco sparveius*) rests at the Stratford Point base camp. Copyright Twan Leenders

D Fall 2010: The Semipalmated Sandpiper (*Callidris pusilla*) stops at Stratford Point both on its northbound trek to its breeding grounds and on the return trip in late summer, when many thousands of birds may be present. Copyright Twan Leenders

E Spring 2007: Mike Mosher and Sacred Heart University student Angela Luberto examine a snapping turtle (*Chelydra serpentina*) found at Roosevelt Forest. Copyright Twan Leenders

F Spring 2007: Mike Mosher and Brian Roach removing turtle traps from Roosevelt Forest. A large snapping turtle (*Chelydra serpentina*) is in the trap. Copyright Twan Leenders

G Spring 2008: Silhouetted against an insect trap sheet, Entomology Senior Collections Manager Ray Pupedis collects specimens during the night. Copyright Twan Leenders

H Spring 2007: Invertebrate Zoology Senior Collections Manager Eric Lazo-Wasem leads a beach walk to look for marine invertebrates. Copyright Twan Leenders

I Fall 2010: Raccoons (*Procyon lotor*) are caught on camera strolling through Roosevelt Forest. Photo by G Watkins-Colwell

J Summer 2009: A Common Tern (*Sterna hirundo*) nabs a meal. Copyright Twan Leenders

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A This Tube-nosed Fruit Bat (*Nyctimene aello*; YPM MAM 005636) comes from New Guinea. Photo by Jordan Colosi

B Jordan Colosi (Yale '09) measures the forearm of a bat to identify it. Photo by Jessamy Doman

C Fans of Jordan's blog "The Life You (And I) Never Knew" can also follow her on Twitter.

Blogging through the Peabody's Strangest Vertebrate Specimens

by Bill McDonald, Volunteer, Public Relations Office

Some might call much of Jordan Colosi's work tedious. But in combing through an estimated 50,000 old jars transferring vertebrate specimens into new containers at the Yale Peabody Museum of Natural History she's getting to see some of the world's most bizarre animals close-up and blogging about them as she goes.

Colosi has been posting to her blog, "The Life You (And I) Never Knew" (www.thelifeyouandineverknew.blogspot.com) about once a week since April 2010. "As I re-curate my way through the collection, each day I discover incredible species with fascinating stories, many of which I never knew existed," said Colosi (Yale '09), who earned her bachelor of science degree with a double major in biology and religious studies.

On why she started the blog, the Tampa, Florida, native says, "Essentially at my job I'm getting a tour of the vertebrate tree of life, as our collection has representatives from a good number of the tree's branches. I feel lucky to have this daily glimpse of our planet's vertebrate diversity, and I feel selfish keeping these little-known creatures to myself."

With the help of a National Science Foundation Collections Improvement Grant to re-curate the YPM Division of Vertebrate Zoology's entire fluid collection, Colosi gets through about 40 to 50 jars a day in a process that entails re-jarring specimens, replacing old fluids with new, cataloguing data into the YPM database, and re-labeling the specimens. She has also documented many previously unidentified specimens along the way and handled vertebrates of all kinds from every continent: fish, reptiles, amphibians, birds and mammals.

Each blog post highlights a different specimen with photographs and facts about the species. These are some of the strangest Colosi has written about so far:

- An Arowana *(Osteoglossum bicirrhosum)*, a fish collected in 1953 from the Amazon River in the former British Guiana (now Guyana). This species grows up to four feet long and can jump out of the water to grab birds and monkeys from low tree branches.
- A Hero Shrew *(Scutisorex somereni)*, collected in 1970 from Cameroon. About six inches long, this animal can support on its back the weight of an adult human.
- A Pug-nosed Eel *(Simenchelys parasitica)*, collected in 1995 from Hudson Canyon in the Atlantic Ocean. About 10 inches long, this species swims into shark gills and latches onto their hearts to suck blood.
- A Tube-nosed Fruit Bat *(Nyctimene aello)*, collected in 1969 from New Guinea. This bat uses small tubes that stick out of its nose like snorkels when it bites deeply into fruit.

These specimens, a scientific research collection amassed by Yale-affiliated researchers over a span of 160 years—since the 1850s—has never been re-curated before and it is not available to the public. It contains all types of jars, mostly mason jars, with all forms of liquid preservatives, including isopropyl alcohol, formaldehyde, whiskey, rum and anisette. Some labels inside the jars are barely legible, while those that hang outside are in danger of dropping off.

Colosi puts the specimens into new screw-top jars with fluid made up of a standard concentration of 70% ethanol and 30% water. She enters the data for each specimen into the YPM database and gives each jar a new thermal-printed archival label.

"So far we've finished re-curating all of the mammals, all of the birds, about 40% of the fish, and we haven't started on the reptiles and amphibians yet," Colosi said. The project, expected to last three years, involves Yale undergraduates as well and Colosi oversees a team of five students.

Thomas Near, assistant professor of ecology and evolutionary biology at Yale and assistant curator in the YPM Division of Vertebrate Zoology, advised Colosi while she was an undergraduate and recommended her for the grant position.

"We're after uniform curation across the specimens," Near said, "but Jordan has the intellect and curiosity to dig deeper. She's sharing about our specimens with the public through her blog, and beyond this, some of the

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specimens she's identified in her work represent range extensions for their species. She's doing a lot of scholarship to share these discoveries with the scientific community."

Gregory Watkins-Colwell, senior museum assistant in the Division of Vertebrate Zoology and Colosi's supervisor, also complimented her. "Jordan's work within the Division of Vertebrate Zoology is important because our job is to maintain specimens (and their associated data) in perpetuity," he said. "By re-curating the specimens, and updating the database with the collection data on each specimen, we are better able to ensure that the specimen has a lasting value to science. Jordan is keen of eye and able to recognize a good mystery when she sees one. She's very good at figuring out the details about each specimen."

"Sometimes I get a specimen with two different labels with conflicting dates and locality information," Colosi said. "So I have to look up old field journals or in our card catalog to determine which information is correct."

Colosi emphasizes the importance of the work by noting that each specimen is irreplaceable. "Losing one of our specimens through poor preservation or otherwise would be akin to losing an important historical document, but worse," she said. "Documents can be easily copied, re-printed, backed up, etc., but these specimens cannot. If our specimens were to be lost, we could not recover them in any sense—they would be lost to science."

Learn more about the YPM vertebrate zoology collections at *http://peabody.yale.edu/collections/vertebrate-zoology*.

D The sectioned, cleared and stained prepared head (on left, showing the inside anatomy; on right, the outside musculature) of an Arowana (*Osteoglossum bicirrhosum*; YPM ICH 008524). The specimen has been stained with alizarin red dye to highlight the bone. This fish was collected on January 31, 1953 from the Amazon River in what was then British Guiana (now Guyana) by E.C. Migdalski during the Yale South American Expedition. Photo by Jordan Colosi

E The Hero Shrew (*Scutisorex somereni*; YPM MAM 014547) can support the weight of an adult human on its back. Photo by Jordan Colosi

F This specimen of a fluid-preserved Pug-nosed Eel (*Simenchelys parasitica*; YPM ICH 011443) was collected from a depth of 715 meters (more than 2,300 feet) in Hudson Canyon in the Atlantic Ocean. Photo by Jordan Colosi

Peabody Celebrates Curatorial Staff Long Service Achievements

COPE MACCLINTOCK

After 47 years, 4 months and 3 days at the Yale Peabody Museum of Natural History, Senior Museum Assistant Cope MacClintock retired from YPM's Division of Invertebrate Paleontology in May 2010. Staff and colleagues celebrated Cope's decades of dedicated service to the Peabody and his wonderful career at a gathering in his honor in October.

Cope's affiliation with the Peabody began as a field assistant collecting Cretaceous rocks and fossils in the West in the early 1950s for Yale professor Karl M. Waage, a former director of the Yale Peabody Museum and curator in the Division of Invertebrate Paleontology. After receiving his PhD in geology from the University of California, Berkeley, in 1963, Cope returned to the Peabody as a postdoctoral associate in the Division of Invertebrate Paleontology. This was followed by 11 years as the Museum's assistant to the director for

Paul Sharp/Sharppix, Dublin

Yale Human Resources 2009LSY

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general operations. In those days that included managing the collections, public programs, exhibits, facilities and operations, roles now filled by several individuals.

In 1985, Cope, along with Mary Ann Turner in the Division of Vertebrate Paleontology, orchestrated one of the largest operations in the Museum's history, the acquisition of Princeton University's vertebrate fossil collections. After leaving his position in the Director's Office, Cope returned to his roots in invertebrate paleontology, beginning a second career in collections management. In many respects the quality of the invertebrate fossil collections and its associated database is in large part due to Cope's efforts.

Cope's passions have been his love of geology and nature—cats, dogs, birds, raccoons, squirrels, ferrets—and the Brooklyn Dodgers. He has left his mark at East Rock Park and Lighthouse Point in New Haven, where he helped produce the explanatory kiosks about the local geology. Although Cope and his wife Dorcas have been enjoying life in retirement, he still comes regularly to the Division's offices to work on projects and to share his enthusiasm for all things Peabody.

MARY ANN TURNER

After 35 years of dedicated service to the Yale Peabody Museum of Natural History, Mary Ann Turner, registrar in YPM's Division of Vertebrate Paleontology, retired in December 2010. Staff and colleagues celebrated Mary Ann's many accomplishments at the Peabody and in the vertebrate paleontology community at a gathering in her honor.

Mary Ann began her career at the Yale Peabody Museum in 1975 as a curatorial affiliate in vertebrate paleontology and soon was appointed collections manager for vertebrate paleontology, one of the first professional museum collections management positions in North America.

In 1985, Mary Ann orchestrated one of the Yale Peabody Museum's most significant historical events, the acquisition and transfer of Princeton University's vertebrate fossil collections to Yale. For six weeks Mary Ann and her team of museum staff packed, wrapped, crated and stabilized these collections for transport to the Peabody. In the late 1970s and in the 1980s Mary Ann also led several National Science Foundation collection improvement grants to re-house the YPM vertebrate paleontology collections in state-of-the-art mobile storage equipment and compactors at the Museum.

As collections registrar, Mary Ann was responsible for the enormous task of coordinating the compilation of vertebrate paleontology collections data into YPM's collections management database. She was also responsible for the care and management of the Division of Vertebrate Paleontology's extensive historical archives, including the completion of a project to digitize the Division's original catalog ledgers and other related archives. Her matchless knowledge of the history of vertebrate paleontology at Yale and of Yale's collections made her a peerless resource for scholars. In later years, she coordinated the move of the Division's collections from the basement of the Kline Geology Laboratory in New Haven to YPM's facilities at Yale's West Campus.

Newly Named Hutchinson Professor Derek Briggs Receives Honorary Degree from Dublin's Trinity College

Derek E.G. Briggs has been named the G. Evelyn Hutchinson Professor of Geology and Geophysics at Yale. Recognized internationally for his research on the preservation and evolutionary significance of exceptionally preserved fossils that provide information on animal soft tissues as well as skeletons, Briggs is the director of Yale Peabody Museum of Natural History and the former director of the Yale Institute for Biospheric Studies. On December 10, 2010, Briggs received an honorary degree from Trinity College, Dublin, Ireland, in recognition of his distinguished career as a paleontologist and presented a public lecture there at its School of Natural Sciences on "Extraordinary Fossils: Windows on the History of Life on Earth" (see *http://www.youtube.com/trinitycollegedublin#p/a/u/1/EYiD_o4VW88*).

Briggs is a fellow of the United Kingdom's Royal Society and an honorary member of the Royal Irish Academy, and has received other honors for his research. He was one of three paleontologists responsible for the now classical and critically acclaimed reinterpretation of the fossils of the Cambrian Burgess Shale. A major focus of his work continues to be the Cambrian explosion, the first appearance as fossils more than 500 million years ago of all major animal groups. He is author and editor of several books that have become benchmarks in paleontology, including *The Fossils of the Burgess Shale, Paleobiology—A Synthesis* and *Paleobiology 2*. Briggs also edited *Evolving Form and Function: Fossils and Development*, the 2005 proceedings of a symposium held in honor of YPM Invertebrate Paleontology Curator Emeritus Adolf Seilacher published by the Yale Peabody Museum.

LOOKING BACK AND FORWARD:

The YIBS Molecular Systematics and Conservation Genetics Center

By Gisella Caccone, Director, and Senior Research Scientist, Yale Department of Ecology and Evolutionary Biology

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Conservation Biology. Giant Galapagos tortoises program: research and education. **For the past 15 years students and scientists from the YIBS-MSCG center have been involved in several projects aiming at understanding the evolution of these tortoises using genetic, morphometric, and environmental data.**

A Lonesome George, the last Giant Galapagos tortoises from its species, looking at one of the two females from another species with whom he is housed in captivity. Photo: H. Nichols.

B C Training in conservation genetics. Yale alumnus Chaz Hyseni, graduate Scott Glaberman and postdoctoral researcher Ylenia Chiari taking morphological measures of Giant Galapagos tortoises during a field trip on the island of Santa Cruz (Galapagos). Photo: James Gibbs.

D "Extinction may not be forever." Dr Nikos Poulakakis inspecting a museum sample from an extinct species of Giant Galapagos tortoises. We are using DNA from extinct and extant species to evaluate the possibility of rescuing from extinction two species. Photo: A. Caccone.

E Katy Richards-Hrdlika swabbing the skin of a museum specimen of the golden toad *(Bufo periglenes)*, to test for the presence of *Batrachochytrium dendrobatidis* (Bd), an emerging infectious fungal pathogen, linked to the extinction of this species and to global amphibian population declines. Her thesis focuses on comparative genomics of the fungus.

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Mission and Accomplishments

The YIBS Molecular Systematics and Conservation Genetics Center (YIBS-MSCG) is a multidisciplinary center aimed at stimulating research and training on a broad range of environmental issues that can benefit from DNA technology. The Center partially supports student research projects, and also provides seed funds for collection of preliminary data for research proposals for faculty who do not have a molecular laboratory or genetic expertise.

Since 1998, MSCG has trained and fostered research for more than 200 Yale scientists at various stages of their careers. From 1998 to 2010, their work has produced preliminary data, which has generated nearly $27 million in research grants to Yale, and on average 30 papers per year.

Two examples below, from conservation biology and epidemiology, explain how these seemingly different disciplines benefit from the use of genetic data when done within an explicit environmental and evolutionary framework. In conservation biology, we tend to devise methods to protect species and populations. Usually we deal with small populations and worry about means to protect their evolutionary potential and improve their chance of survival. In epidemiology, we look at vectors and parasites involved in human disease, and try to develop a strategy to reduce their large populations and capacity to rapidly evolve (antibiotic and insecticide resistance). Although the overall goals of these two disciplines are different, they both are able to benefit from the use of genetic data. Below is a brief list of the main applications of DNA–based analyses in these fields.

Conservation Biology

- Measure the amount of genetic variation of dwindling populations to assess their "evolvability" (for instance, their potential to respond to changes such as global warming or the spread of novel pathogens).
- Understand whether populations are stable in space and time. This can help design data-based conservation strategies that take into account the actual population dynamics (for instance, many endangered species are composed of populations whose permanence may depend on the maintenance of complex migration patterns; genetic analyses can help define these patterns).
- Help define conservation "units" to manage threatened species so that resources can be allocated efficiently.
- Assess the consequences on native populations of intentional or unintentional introductions of individuals from non-native species that hybridize with native forms (for instance, accidental introductions of hatchery-raised individuals or the release of genetically modified organisms and their potential effect on native flora and fauna).

Epidemiology

- Understand how vector and parasite populations change over time. This affects control strategies such as when populations do shrink in certain seasons or frequently exchange migrants or when they do not provide valuable information to develop control measures that target populations when they are at their minimum. Both the geographic scale and duration of these efforts can be improved using empirically derived information.
- Monitor the success of control efforts by providing genetic diagnostic tools that monitor whether re-infestations in the treated area result from invasions or re-emergence from relict populations that escaped control measures.
- Monitor the emergence and spread of alleles that affect traits of epidemiological interest (for instance, resistance to insecticides or antibiotics).

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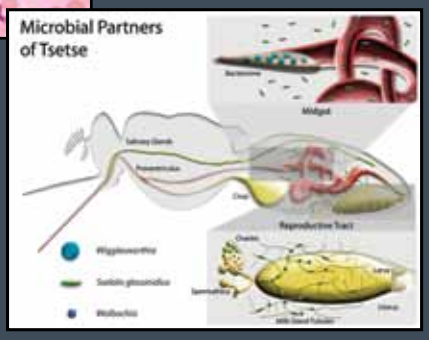

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- Understand which genomic regions are involved in conferring phenotypes of epidemiological interest so that these regions can be targeted for novel control measures.
- Evaluate water quality to assess human or non-human biological contamination.

Where Are We Going?

For the past 13 years we have helped students and faculty integrate DNA analyses into their research agenda. We have been using a gene-by-gene approach, as this was the only one available for population and field biologists working on organisms for which whole genome data were not available.

Looking ahead at the next 5 to 10 years, this will be changing. Thanks to developments in both genomics and environmental data analyses, we can now screen for genetic variation whole genomes of multiple individuals and look for associations between genetic and environmental data. Methodologies for sequencing, assembling, and analyzing whole genomes are becoming more affordable. Similarly, the computing power and software to analyze large genetic and environmental datasets are becoming increasingly available and user friendly. As we look ahead, the role of the YIBS-MSCG Center will include these new technologies in the toolbox for each Yale student and faculty, thus continuing to fulfill its mission of enhancing training and research opportunities in environmental science at Yale.

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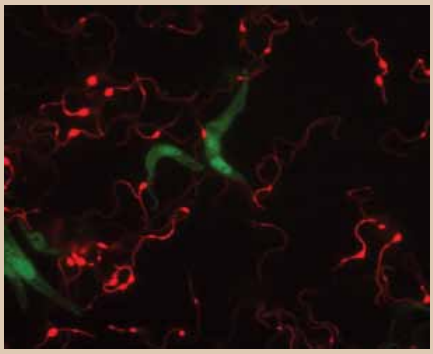
A Final Comment

Although there were more than three individuals involved in the process of putting together this laboratory, I want to acknowledge the role of two scientists that had the vision, wisdom, and perseverance to make the YIBS-MSCG Center a reality—a center that does not have a parallel in any university in the United States or abroad. They are Elisabeth Vrba, a faculty member of the Yale Department of Geology & Geophysics, and Alison Richard, a faculty member of the Yale Anthropology Department and the Yale Provost when the Center was established. These two brilliant scientists and visionaries, together with YIBS Assistant Director Rose Rita Riccitelli, helped put the pieces in place and have continued through the years to facilitate our work. All of the students, postdocs, and faculty that used and are using the YIBS-MSCG Center are indebted to these three women.

Please visit the lab Web site (http://www.yale.edu/caccone/ecosave/index.html) for past and current research projects.



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Epidemiology. Physical settings for HAT and Nagana.

F The Ngorongoro crater (Tanzania) hosts large mammal populations and tsetse flies. Photo by O. Balmer.

G A quarter million zebra and 1.6 million wildebeest participate in the annual migration across the plains of the Serengeti and Masai Mara National Parks, carrying trypanosomes with them. Convincing experimental evidence indicates that the zebra patterns help fend off tsetse flies. Photo by O. Balmer.

H A village near Lake Kyoga, Uganda. Photo by A. Caccone.

Epidemiology. Field work and training.

I Former Ecology & Evolutionary Biology graduate student Oliver Balmer collecting tsetse flies in Uganda for his PhD thesis project on *Trypanosoma* spatial and temporal genetic diversity. The biconical traps are used both for tsetse sampling and control. Photo: Astrid Vonderschmitt.

J Agapitus Kato, a PhD student from Makarere University (Uganda) collecting tsetse flies. Kato is currently carrying out genetic analyses in the YIBS-MSCG center thanks to a National Institutes of Health Fogarty training grant to A. Caccone. Photo: Husein Sebaggala.

Epidemiology. Tsese flies and their phylogeography.

K Side view of a pregnant bloodfed female tsetse fly. Photo by Dr. Geoffrey M. Attardo.

Epidemiology. Anopheles mosquitoes insecticide resistance.

L Michael Reddy, graduate student from the School of Epidemiology and Public Health, collecting *Anopheles* spp. mosquito larvae, Bata, Equatorial Guinea. His doctoral thesis focuses on describing the spatial and temporal dynamics of insecticide resistance emergence in mosquitoes in order to develop mathematical models for predicting the efficacy of insecticide-based interventions against these vectors. Photo by Sisnio Nzambo.

Conservation Biology. Invasion genetics and biological control.

M Nathan Havill, a past graduate student from the Department of Ecology and Evolutionary Biology, now a research scientist with the US Forest Service, sampling hemlock woolly adelgids in the field. This species invaded the US from Japan and is destroying hemlock forests in the Northeast. Nathan and students in the YIBS-MSCG center are using genetic data to understand the history of the colonization and to find natural predators suitable for biological control. Photo by Ashley Lamb.

Epidemiology. Description of the diseases.

N Human African Trypanosomiasis (HAT) and Nagana (the animal form of the disease) occur throughout the countries of sub-Saharan Africa. HAT is lethal if undetected or untreated. The disease is primarily found in poor, rural and remote populations. Nagana has a tremendous economic cost and prevents the development of livestock agriculture in affected areas. Undergraduates, graduate students and postdoctoral associates in the YIBS MSCG Center are involved in a variety of projects on tsetse, its symbionts, and parasites in collaboration with Serap Aksoy's laboratory that is aimed at understanding the comparative phylogeography of these organisms with the ultimate goal of using this knowledge to design efficient control and monitor strategies. Photo by Geoffrey M. Attardo.

Epidemiology. Parasites population genomics.

O Two strains of *Trypanosoma brucei*, the causal agent of human African sleeping sickness and Nagana, transfected with green and red fluorescent protein genes to make their population dynamics trackable. We are involved in a comparative genomic project aimed at developing markers to distinguish between strains using whole genome sequencing. Photo by O. Balmer

The Yale Center for Earth Observation

Going Beyond Google Earth

Ronald B. Smith, Damon Wells Professor of Geophysics, YCEO Director, and Larry Bonneau, YCEO Manager

As global and regional environmental monitoring has grown more important, the role of earth-orbiting environmental satellites has increased. Led by the United States with more than $5 billion per year in satellite investment, many other countries, including the European Union, India, Russia, China, Japan and Brazil, are now developing their own environmental satellite programs. Today, with nearly one hundred such satellites in orbit, the data comes back to Earth in a flood of bits and bytes. The information captured by the satellite-borne sensors includes the so-called passive radiation: sunlight reflected from Earth in all wavelengths (ultraviolet, visible and infrared) and emitted radiation from the earth, the ocean and the atmosphere. Equally important are the "active" sensors that generate their own illuminating radiation (near infrared laser or microwave) and measure how this energy is scattered back to the satellite. The list of critical environmental variables routinely monitored from space is almost endless. From the land, we can map the changing land cover, as well as observe surface temperature, moisture content, leaf area concentration, roughness and woody biomass. In the atmosphere, we observe winds, temperature, humidity, aerosols and trace gas composition, along with cloud height, thickness and precipitation. From the ocean, we observe sea surface temperature, wave height, primary productivity through chlorophyll concentration and sea surface "topography," clues to ocean currents and subsurface temperature. From the cryosphere, we observe daily snow cover, sea ice concentration and glacier height and movement.

The challenge faced by a university is to make this huge stream of data available to students, staff and faculty across disciplines. At Yale this need is met by the Yale Center for Earth Observation (YCEO), founded in 1992 as one of the original Yale Institute of Biospheric Studies centers. The YCEO is located in the Class of 1954 Environmental Science Center, near the Peabody Museum of Natural History and many other environmental laboratories.

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Its resources include computer hardware and image analysis software, data archives and a portable field spectrometer. More important, however, are its advising and teaching activities. Visitors to the YCEO are assisted by Center staff on how to select, obtain and analyze satellite images. Undergraduate and graduate students can enroll in one of several YCEO workshops, or in the course "Observing the Earth from Space." This course has the distinction of being cross-listed in four different departments, an indication of the broad relevance of its material. Trained students have access to all the YCEO facilities. Typically the Center supports forty student projects each year and a smaller number of multi-year faculty projects.

While the Center does not offer its own degree or certificate, we do track and take pride in our YCEO "alumni." These are Yale graduates who started their remote sensing (RS) training with us and have developed careers in the field.

A David Butman and others

B Dea Doklestic and Chris Mackey

Some recent YCEO Alumni:

Ben Zaitchik
After a postdoc at NASA and an internship at the US State Department, Ben is now an assistant professor at The Johns Hopkins University, where he has started an RS center.

Sarah Parcak
Sarah is now an assistant professor at the University of Alabama in Birmingham, and has started an RS center there. Her book *Satellite Remote Sensing for Archeology* was just published.

Doug Morton
After completing a PhD at the University of Maryland, Doug joined NASA, where he is the lead analyst for the global efforts of Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD) program.

Heidi Brown
After a postdoc in Cambridge, Heidi worked at the Centers for Disease Control in Fort Collins, Colorado, using remote sensing analysis to study disease vectors. She now teaches RS and Geographic Information Systems at San Antonio College.

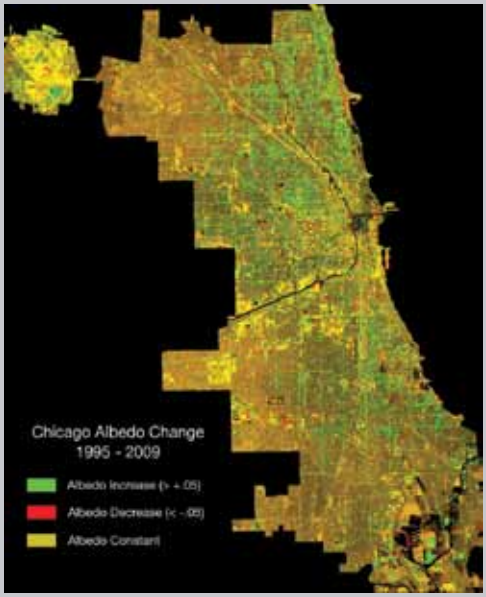
Karina Yager
Karina has a NASA postdoc position studying climate change and endangered species in the Andes.

John Brownstein
John is a remote sensing expert at the School of Medicine at Harvard University and a board member of Harvard's Center for Geographic Analysis.

Nick Kouchoukos
Nick is vice president for natural resource intellence operations at Lanworth, Inc.

Two student projects illustrate YCEO activities.

Chris Mackey (Yale '10) graduated last year with an undergraduate degree in architecture. He studies the intensity of Chicago's urban heat island and the attempts to abate severe heat waves there. Dea Doklestic received her undergraduate degree from Zagreb in Croatia in 2007 and is now a graduate student in climatology in the Yale Department of Geology & Geophysics. She is studying land surface feedbacks on climate in the southwestern United States.



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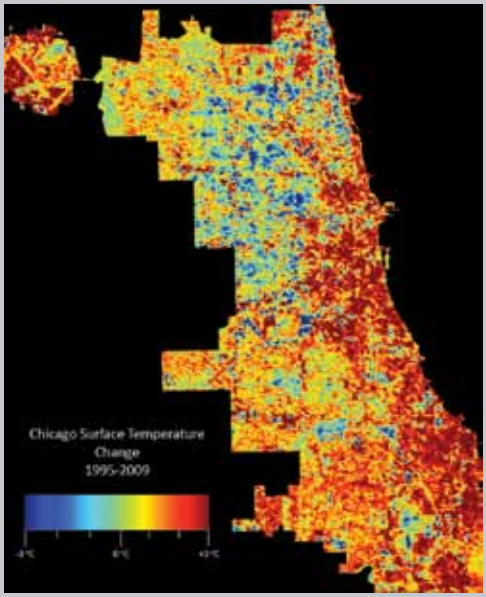

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Chicago's Heat Island
Chris Mackey

The Chicago heat wave of 1995, together with concern about future global warming, has caused city planners to imagine how the summer temperature in the urban center might be reduced. Two strategies are used. The "green strategy" adds trees and grass to the urban landscape to increase shading and evaporative cooling. The "white strategy" increases the albedo (reflectivity) of the buildings and streets to reduce the heat absorbed from sunlight. Chris Mackey has used satellite images to test the effectiveness of these two strategies by comparing the vegetation density, the albedo and the resulting surface temperature in Chicago. His study spans a 15-year period and the results are surprising. While the vegetation seems to control the spatial variation of temperature in the city, the albedo has a much bigger effect in regard to changes over time. This suggests that the "white strategy" is the more effective approach for Chicago.

The Monsoon in the Desert Southwest
Dea Doklestic

The hot and dry climate in the southwestern United States and northern Mexico is usually relieved in late summer by a burst of thunderstorm precipitation, the so-called North American Monsoon (NAM). The onset of the NAM is driven by the heated surface of the earth, which lowers the atmospheric pressure and draws in moist air from the Gulf of California. The rain quickly invigorates the grasses and shrubs of the region which evaporate much of the fallen rain, further cooling the surface. This interaction between atmospheric and surface properties seems to be at the core of the NAM phenomenon. Dea Doklestic is using satellite images and surface flux towers to monitor the seasonal and inter-annual variation of the NAM. Her results show a sudden increase in vegetation and surface evaporation in mid July, but this varies from year to year. These new data may improve our understanding and prediction of the onset and retreat of the NAM.

Further information about the YCEO can found at *http://www.yale.edu/ceo/index.html*

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C Chicago Albedo Change

D Chicago Surface Temperature

E Flux Tower

Seasonally Affected Dating Disorder in Butterflies

Kathleen Prudic, PhD, Department of Ecology and Evolutionary Biology, Yale University

If not for sex, much that is beautiful would not exist in the natural world. Flowers would not bloom; birds would not sing; fish would not migrate; and butterflies would not dance in your summer garden. The act of finding and wooing the opposite sex has produced a dizzying array of forms, displays, and behaviors in animals and plants. Garish costumes and outlandish dances decorate the tree of life all with the simple suggestion "Choose me, choose me! I am your mate." Butterflies too partake in these elaborate advertisements to attract mates. Their wings are a moving billboard announcing their identity and sometimes their strength to any interested party. The ritualized courtship dances also carry more information to the hesitant sex convincing her or him that their potential mate is the same species and able to triumph over the slings and arrows of disease, parasites, and predators.

But wait, you ask "Did the author just say her or him? I thought females were always the coy sex while males were always the pursuing sex." The short answer is no, not always. There is accumulating evidence in mammals, birds, fish, and especially insects that A.J. Bateman's 1948 principle describing females as chaste and males as philanderers is not the norm. There are times, places, and opportunities for either sex to be a saint or a cad, it all depends on the circumstances. Butterflies have a particular female-male dynamic that lends them to have complex sexual roles. The males provide the female with a nuptial gift, or spermatophore, in addition to the sperm. This nuptial gift is a packet of nutrients, water, and chemicals the female uses to further her own survival or the survival of her offspring (but not necessarily his). Thus, female and male butterflies want different things from each other when mating, resulting in a complex dance of who is pursuing whom.

Several researchers have shown that the butterflies found in your garden, such as sulfurs, emperors, or blues, have certain sex roles within a species. Sometimes the female is the courting sex, other times it is the male. Sometimes the male does the choosing, other times it is the female. Yet, other times the sexual roles are dynamic in space and time. In the ubiquitous cabbage white, male courtship behavior changes with the seasons. Spring males court more than the males of the next generation, which flies in summer. My January article in *Science* magazine with Cheon Jeon, Hui Cao, and Antonia Monteiro at Yale University, went farther afield to Africa and found some butterfly species that reverse their sexual roles in both sexes across seasons.

The butterfly in question is *Bicyclus anynana*, the squinting bush brown butterfly, (Nymphalidae). It inhabits the sand forests of sub-Saharan Africa and is well studied for its seasonal polyphenism. This butterfly changes its adult wing patterns based on the temperature they experience as larvae. In the warm African wet season, these butterflies have large ventral eyespots presumably to scare or redirect predator attack to the wing margins. In the cool dry season, the bush brown has much reduced ventral eyespots to hide from predators as their behavior changes to a more sedentary lifestyle to wait for the summer rains.

But not all eyespots on *B. anynana* change between wet season and dry season, at least to our eyes. The dorsal eyespots are flashy sexual ornaments constant across the seasons and used to woo the opposite sex during a mating dance. However, from a butterfly's perspective, there are marked differences in the eyespots between the seasons and the sexes. In the wet season, the male eyespot reflects more ultraviolet light, while in the dry season, the female reflects more ultraviolet light. The reflection of more light makes the eyespot more conspicuous to the opposite sex and harder to ignore. These subtle changes in sexual ornaments hint that there may be something going on with the sexual roles of this butterfly, but how and why still remained elusive.

Using a laboratory experiment, we found that caterpillars raised in warm environments mimicking natural wet season conditions grow into what some would consider traditional roles, males pursuing females and females choosing the better male. However, when the temperatures during larval development are dropped to levels mimicking dry season conditions, the females become the flirtatious adults while the males choose particular females. This sexual role reversal corresponds to a change in nuptial gift quality. Mating with a dry-season male increases female longevity and fecundity regardless of the temperature she grew in. In this case, it pays to wait for the cool guy.

Beside amusement, what do these findings mean to butterflies, to insects, and to science as a whole? Butterflies and many other insects have a short amount of time to find a mate and reproduce. Thus, they have evolved the ability to use information during their caterpillar stage to predict their future adult environment in order to increase their mating success. In this specific case, *B. anynana* uses larval temperature as a cue to wire its brain in such a way that both sexes are ready to perform the correct mating behavior as soon as they emerge to the world as butterflies. The implications of these findings build on a growing understanding that butterflies and other insects have evolved complex and dynamic mating behaviors responding to predictable changes in their environment. Furthermore, our study showed how early larval experiences can drastically affect adult mating behavior. Dating is never simple, even in butterflies.

For more information about this research, listen to my interview podcast at *http://www.sciencemag.org/content/331/6013/73/suppl/DC2* or to see *Bicyclus anynana* courtship video go to *http://www.youtube.com/watch?v=_1AjNkJuyXo*

Professor Kaare Nielson Visitor to Townsend Lab

Kaare M. Nielsen is currently visiting the research group of Professor Jeffrey Townsend in the Department of Ecology & Evolutionary Biology. Nielsen is professor of microbiology in the Department of Pharmacy, the University of Tromsø, Norway, the northernmost university in the world (*www.uit.no*). There he heads a thematic research group in microbiology, molecular and pharmaco-epidemiology that focuses on understanding the multitude of factors causing and preventing the worldwide evolution and spread of antimicrobial resistance in bacteria (www.uit.no/forskning/mmpe).

Professors Nielsen and Townsend have maintained a scientific collaboration for more than 10 years. Recently, Nielsen, Townsend, and collaborators from the University of Tromsø calculated how long-evolved antibiotic resistance in microbes might last, and it is a long time. Over the last six decades, bacterial populations have responded to the selective pressure of antimicrobial drugs by evolving resistance to all commercially available agents. Decreased discovery rates of novel classes of antimicrobial agents have substantiated a notion that for some bacterial species we may face clinical infections for which there are no treatment options. One proposed solution has been the "antibiotic holiday," in which nations facilitate the evolved loss of antibiotic resistance in infectious microbes by banning usage for a time. This approach is appealing, because the antibiotics for which usage would be banned are the ones that are currently least medically useful because of high current frequencies of resistance. Because maintaining antibiotic resistance is costly to infectious agents, banning their usage results in slow evolution of loss of antibiotic resistance in microbial populations. However, because antibiotic holidays have rarely been tried, it has been difficult to predict the evolutionary response. Analyzing data from Norway and Denmark, Nielsen and Townsend have predicted that it may take 45 years or more for vancomycin resistance to return to background levels. Given the decreasing rate of discovery of novel antimicrobial agents, it appears that antibiotic holidays alone have little chance of refurbishing our supply of antimicrobial agents. Our only options may be the permanent application of more restricted usage, preventing the evolution of resistance in the first place.

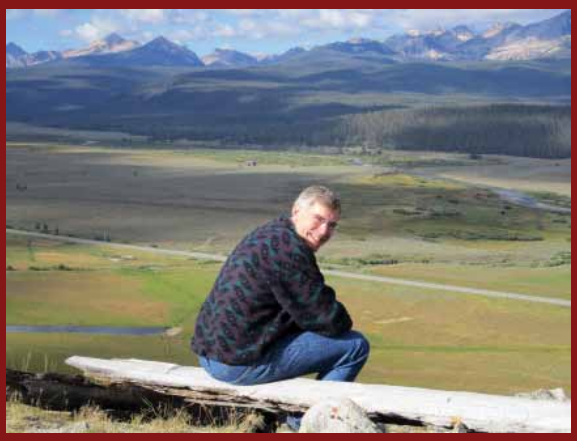
Nielsen is looking forward to completing manuscripts co-authored with Professor Townsend, developing new research directions, and interacting fruitfully with other Yale faculty. Nielsen has a long-standing interest in identifying the factors governing horizontal flow of genetic material between species. He has pioneered research providing a detailed understanding horizontal gene transfer (HGT) by natural transformation in bacteria. He plays key roles in efforts to understand the barriers to flow of genetic material between species and assess the biological risk of horizontal gene transfer of genetically modified material from genetically modified organisms. In addition to his tenured faculty position, Nielsen is an advisor to Genøk-Center for Biosafety, Tromso, Norway, and appointed member of the expert panels on genetically modified organisms (GMO) of the Norwegian Scientific Committee for Food Safety (Oslo, Norway), and the European Food Safety Authority (Parma, Italy). Internationally, Nielsen has also contributed to numerous GMO biosafety capacity building initiatives and training courses in Europe, Latin America, Africa and Asia.

How Environmental Changes Affect Bird Behaviors

A new study has shown an important link between the natural variation in climate conditions and complex behaviors among birds. Researchers Walter Jetz from Yale University's Department of Ecology & Evolutionary Biology and Dustin Rubenstein from Columbia University have suggested that the study may have implications for understanding how organisms respond behaviorally to increased climate variability resulting from climate change. They argued that species that live in families might be better guarded against the effects of unpredictable climatic conditions. Using a behavioral data set of more than 95 percent of the world's birds, and a global 40-year climate dataset, the researchers examined how environmental factors like mean and variation in temperature, and rainfall and biotic factors like body mass, diet breadth and type, influence the incidence and global distribution of family-living in birds. By combining behavioral and climate data in a statistical modeling framework, the researchers found dramatic spatial and environmental variation in social behavior globally. "We discovered 'hot-spots' in places like Australia and Africa where family-living species are overrepresented, as well as 'cold-spots' in places like South and Central America where there are fewer family-living species than we would have expected," said Jetz. The study demonstrates that even on a global scale, the incidence of complex avian social behavior may be greatly influenced by the consequences of living in unpredictable environments. Variable environments encompass a broad range of climate conditions that pose a greater range of challenges to survival and reproduction than predictable ones. Family-living among birds may therefore be a conservative 'best of a bad job" strategy to maximize fitness when breeding conditions vary unpredictably from year to year. The findings appeared in the journal *Current Biology*.

BASS DISTINGUISHED VISITING SCOLARS

RICHARD



LASHOF

ALISON RICHARD RETURNS TO YALE

YIBS Director Jeffrey J. Park is pleased to announce that after a much-too-long absence from Yale, Alison Richard returns as of July 1, 2011 for a six-month term as the Edward P. Bass Distinguished Visiting Environmental Scholar in the Department of Anthropology. Richard, who last served Yale as provost from 1994 to 2002, most recently served as the first female Vice-Chancellor of Cambridge University from 2003 to 2010. In 2010 Birthday Honours, Richard was appointed Dame Commander of the Order of the British Empire by Queen Elizabeth II.

Chair and Professor Richard Bribiescas is especially delighted and excited to have Alison Richard back in the department, where she is well known for her research on the evolutionary socioecology and demography of non-human primates, primarily prosimians such as sifakas (*Propithecus verreauxi*) in Madagascar. During her term as a Bass Distinguished Visiting Environmental Scholar, she will work on a paper in collaboration with her husband, Emeritus Professor Robert Dewar, for the *Annual Review of Anthropology* on the evolutionary biology of Madagascar. She will also be involved with developing new collaborations with colleagues and graduate students in order to continue her long-term research at Beza Mahafaly in Madagascar. And, during the fall 2011 academic semester, Dame Richard will co-teach a graduate seminar on primate life histories with Professor Bribiescas.

Richard received her undergraduate degree at Newnham College, Cambridge, before gaining a PhD at King's College, London, and went on to have an academic career in biological anthropology with a specialization in primatology. While at Yale, she chaired the Department of Anthropology from 1986 to 1990, and later served as director of the Yale Peabody Museum of Natural History before taking on the post of Provost of Yale.

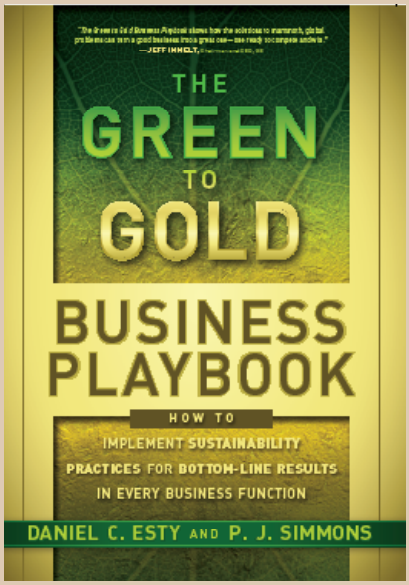
DAN LASHOF TO SERVE AS AN EDWARD P. BASS DISTINGUISHED VISITING ENVIRONMENTAL SCHOLAR

YIBS Director Jeffrey Park is pleased to announce the appointment of Dan Lashof, the Climate Center Director at the Natural Resources Defense Council (NRDC), as the Edward P. Bass Distinguished Visiting Environmental Scholar in the School of Forestry & Environmental Studies during the fall 2011 academic semester. Lashof, who was nominated by Yale Climate & Energy Institute director Rajendra Kumar Pachuari for this honor, is currently working on climate change issues, developing extensive experience in the field of climate change at the global level and specifically United States climate policy at NRDC, and has been responsible for important research on American climate policy, including the first comprehensive sector-based analysis of climate change solutions in the United States. He is also a lead author and reviewer for the Nobel Peace Prize-winning Intergovernmental Panel on Climate Charge (IPCC).

As a Bass Distinguished Visiting Environmental Scholar, Pachauri notes that Lashof can profoundly enrich the learning of students, faculty and research groups as they explore climate change policy issues.

His term will run from August 30, 2011 through December 31, 2011.

Bestseller Follow-up Helps Executives Put Sustainability to Work for the Bottom Line



C-level executives and line managers at companies big and small—from the manufacturing to the service sector—now have a trusted, no-nonsense resource for leveraging the power of green to generate business value throughout every aspect of their operations. While the groundbreaking *Green to Gold* made a compelling case for why every business now needs a sustainability strategy, the all-new *The Green to Gold Business Playbook* provides the how. It offers essential, step-by-step guidance and practical tools for business leaders and managers in every job function: IT, supply chain and logistics, fleet, buildings and facilities, product R&D, sales and marketing, accounting and finance, and more.

"There are many books out there exhorting companies to reduce their environmental impacts, but very few that give detailed practical guidance. From product design to facilities management, from information technology to logistics and transport, this book contains insightful suggestions as to how businesses can be more sustainable, reduce carbon emissions, and yet at the same time save money and drive top line growth," says Unilever CEO Paul Polman.

Avon CEO Andrea Jung calls *The Green to Gold Business Playbook* "a terrific practical road map to help companies reduce their environmental impact while also improving economic performance. The advice is sensible and executable, with concrete examples spanning multiple business disciplines."

The Green to Gold Business Playbook is the follow-up to the international bestseller *Green to Gold: How Smart Companies Use Environmental Strategy to Innovate, Create Value, and Build Competitive Advantage*, which was translated into nine languages and dubbed by *The Economist* as "book of the meeting" at the 2007 World Economic Forum in Davos. *Green to Gold* established that sustainability issues cannot be ignored in today's corporate world. Rising energy and natural resource costs, intensified regulations, investor pressures, and a growing demand for environmentally friendly products mean sustainability is no longer an option—it's a business imperative. The *Playbook* offers practical advice and tools based on proven strategies to cut costs, reduce risks, drive revenues, and build brand identity.

The Green to Gold Business Playbook is a must-read for anyone looking to make both environmental and bottom-line gains. "*The Green to Gold Business Playbook* shows how the solutions to mammoth, global problems can turn a good business into a great one," says GE Chairman and CEO Jeff Immelt, "one ready to compete and win."

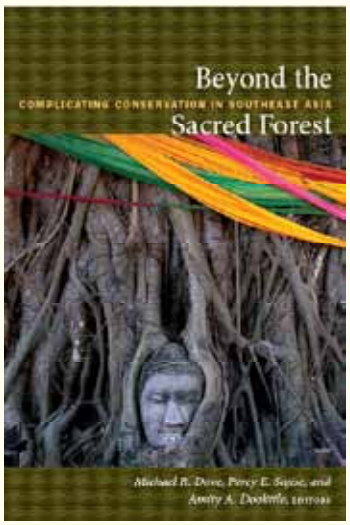
To learn more about *The Green to Gold Business Playbook*, visit *www.greentogoldplaybook.com*.

About the Authors

Daniel. C. Esty (New Haven, CT) is the co-author of the sustainable business bestseller *Green to Gold*. He is the Hillhouse Professor at Yale University and director of the Yale Center for Environmental Law & Policy (*www.yale.edu/envirocenter*) and the Center for Business and the Environment at Yale (*www.yale.edu/cbey*). He served as a senior official at the U.S. Environmental Protection Agency and more recently as energy and environmental advisor to the Obama presidential campaign and transition team. As Chairman of Esty Environmental Partners (*www.EstyEP.com*), he's advised CEOs across the world and designed strategies for more than 100 companies in dozens of industries.

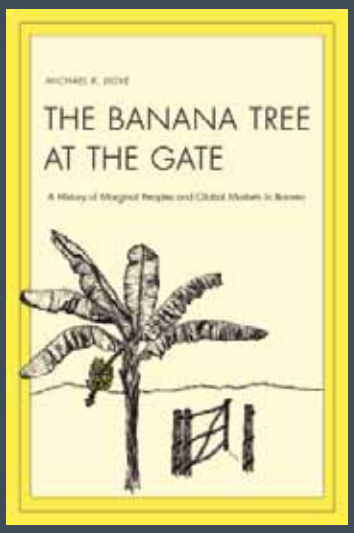
P.J. Simmons (New York, NY) is chairman of the Corporate Eco Forum (*www.ecoforum.com*), a preeminent network of senior Global 500 executives focused on sharing best and "next" practices in corporate sustainability and driving eco-innovation. He has worked as a sustainability analyst, strategist, and bridge-builder for 15 years, was founder of the Wilson Center's Environmental Change and Security Program, and Deputy Chair for Climate and Energy at the Clinton Global Initiative. He is a life member of the Council on Foreign Relations.

New Thinking About Conservation in Southeast Asia



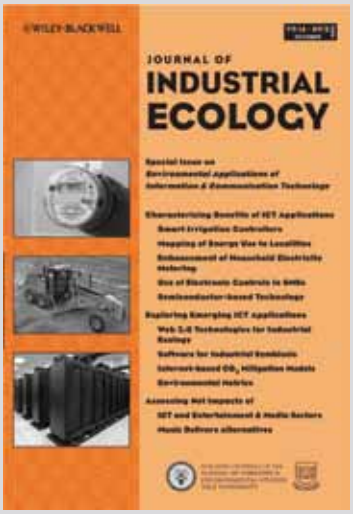
Beyond the Sacred Forest: Complicating Conservation in Southeast Asia (Duke University Press, 2011) is a collaboration of Michael Dove, Margaret K Musser Professor of Social Ecology at the School of Forestry & Environmental Studies (F&ES), Professor of Anthropology, and Curator at the Yale Peabody Museum of Natural History; Amity A. Doolittle, Associate Research Scientist, Lecturer at F&ES, and Program Director for Tropical Resource Institute; and Percy E. Sajise, Honorary Research Fellow, Biodiversity International and Adjunct Professor, School of Environmental Science and Management–University of the Philippines at Los Baños (SESAM-UPLB). This book is the product of a unique and decade-long interdisciplinary collaboration involving research in Indonesia, Malaysia and the Philippines, and reflects new thinking about conservation in Southeast Asia. Scholars from these countries and the United States rethink the translation of environmental concepts between East and West, particularly ideas of *nature* and *culture*; the meaning of *conservation*; and the ways that conservation policy is applied and transformed in the everyday landscapes of Southeast Asia.

Borneo's Native Peoples in Commodity Production for Global Markets Is Ancient and Highly Successful



The "Hikayat Banjar," a 17-century native court chronicle from southeast Borneo, characterizes the irresistibility of natural resource wealth to outsiders as "the banana tree at the gate." Author Michael R. Dove uses this phrase as a root metaphor to frame the history of resource relations between the indigenous peoples of Borneo and the world system, standing on its head the prevailing view of resource-poor and economically marginal tropical forest dwellers in his book *The Banana Tree at the Gate: The History of Marginal Peoples and Global Markets in Borneo* (Yale University Press, 2011). Based on analyses of production and trade in forest products, pepper and, especially, natural rubber, this study shows that the involvement of Borneo's native peoples in commodity production for global markets is ancient and highly successful. This success is based on the development of a "dual" household economy, with distinct subsistence- and market-oriented sectors, which has historically made these smallholders extremely competitive with the large-scale, heavily capitalized, state-supported plantation sector. This study sheds new light on the nature of "smallholders" and in particular their relationship with the global economic system. It shows that processes of globalization began millennia ago and that they have been more diverse, and less teleological, than often thought. This study replaces the image of the isolated tropical forest community that needs to be helped into the global system with the reality of communities that have been so successful and competitive that they have had to fight political elites to keep from being forced out. The ubiquitous but historically inaccurate emphasis on isolation and resource poverty disguises the fact that the overweening characteristic of these communities is their political marginality and that their greatest want is not to be uplifted economically but to be empowered politically.

Yale Journal Examines Environmental Applications of Information Technology



New applications of information and communication technology (ICT) that could save society significant amounts of energy and money and reduce greenhouse gas emissions that are warming the planet are explored in a special issue of Yale's *Journal of Industrial Ecology*.

These applications exploit recent advances in ICT, such as social networking, Web 2.0, smart energy monitoring and geographic information systems, and are explored in depth in the special issue Environmental Applications of ICT, published with support from the Leading Edge Forum of CSC, a global information technology services firm. The research examines the following:

- computer models that estimate quantities and types of residential energy use with striking geographic detail—to the zip code level;
- electronic systems that provide continuous appliance-level energy monitoring for households;
- smart irrigation technologies that lower the associated costs of water use and carbon emissions;
- energy-saving electronic control systems for small- and medium-sized manufacturers;
- applications of Web 2.0 for streamlining the organization of knowledge in industrial ecology; and
- Internet-based modeling of carbon-reduction technologies for use in large cities.

Additional studies in the special issue assess the environmental impacts of the ICT and entertainment and media sectors, investigate digital music technology's potential for reducing carbon emissions, and estimate the net environmental impact—considering the positive and negative—of the ICT industry.

"It is easy to see that information and communication technology is transforming our society," says Sir Peter Crane, Dean of the Yale School of Forestry & Environmental Studies (F&ES). "This research brings insight and clarity to less-obvious dimensions of their environmental impacts."

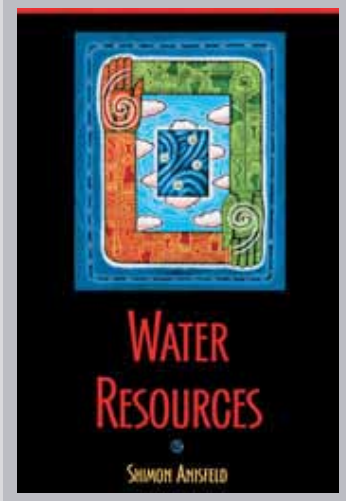
The *Journal of Industrial Ecology* (*www.wileyonlinelibrary.com/journal/jie*) is a peer-reviewed, international bimonthly journal that examines the relationship between industry and the environment from the perspective of the emerging field of industrial ecology. It is owned by Yale, headquartered at F&ES and published by Wiley-Blackwell.

Articles are free at *http://onlinelibrary.wiley.com/doi/10.1111/jiec.2010.14.issue-5/issuetoc*. Journalists, students and representatives from developing countries or nongovernmental organizations can request a print copy of the special issue by writing to indecol@yale.edu.

Eric Masanet, deputy leader of the International Energy Studies Group at Lawrence Berkeley National Laboratory, and H. Scott Matthews, professor of civil and environmental engineering and public policy at Carnegie Mellon University, served as guest editors for this special issue.

Funding for the special issue was provided by the Leading Edge Forum of CSC (*www.csc.com*). The Leading Edge Forum (*www.lef.csc.com*) is a research and advisory program, focusing on the intersection of business, IT and management.

Exploring Complex Interactions



Shimon C. Anisfeld, Senior Lecturer and Research Scientist at the School of Forestry & Environmental Studies (F&ES), recently published *Water Resources* (Island Press, 2010), as part of the Foundations of Contemporary Environmental Studies series. In this concise but wide-ranging primer, Anisfeld explores the complex interactions between humans and water, from power production and agriculture to drinking water and sanitation. The book, designed to be useful to professionals and laypeople as well as students, familiarizes readers with the current water crisis and with approaches for managing this essential resource more effectively in a time of rapid change. Anisfeld addresses both social and ecological problems, including water scarcity, pollution, disease, flooding, conflict over water, and degradation of aquatic ecosystems. In addition to providing the background necessary to understand each of these problems, the book discusses ways to move towards better management. *Water Resources* provides a comprehensive one-volume guide to a complex but vital field of study.

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We welcome submissions from faculty, staff and students.

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