School of Forestry & Environmental Studies

2011–2012

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Managing Editor: Linda Koch Lorimer
Editor: Lesley K. Baier
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Telephone Numbers

800.825.0330	Prospective Students
203.432.5100	General School Number
203.432.7297	Admissions and Financial Aid Fax

E-mail for prospective students: fesinfo@yale.edu
Web site: www.environment.yale.edu

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Calendar

FALL 2011

Aug. 4–6	TH–SA	Orientation for international students
Aug. 7	SU	Orientation for summer modules
Aug. 8–25	M–TH	Training modules in technical skills & orientation events
Aug. 29	M	Meeting with the dean and academic orientation for first-year students (mandatory), 9 a.m.–noon, Burke Auditorium
Aug. 30	T	Course Expo, 9 a.m.
Aug. 31	W	Fall-term classes begin, 8:30 a.m.
Sept. 14	W	Course registration closes
Sept. 21	W	Add/Drop period ends
Nov. 18	F	Fall recess begins, 5:30 p.m.
Nov. 28	M	Classes resume, 8:30 a.m.
Dec. 2	F	Classes end, reading period begins, 5:30 p.m.
Dec. 12–16	M–F	Final examinations
Dec. 16	F	Winter recess begins, 5:30 p.m.

SPRING 2012

Jan. 4	W	Fall-term grades due
Jan. 9	M	Spring-term classes begin, 8:30 a.m.
Jan. 16	M	No classes. Martin Luther King, Jr. Day
Jan. 24	T	Course registration closes
Jan. 31	T	Add/Drop period ends
Mar. 2	F	Spring recess begins, 5:30 p.m.
Mar. 19	M	Classes resume, 8:30 a.m.
Apr. 23	M	Classes end, reading period begins, 5:30 p.m.
May 1–7	T–M	Final examinations
May 14	M	Spring-term grades due for graduating students
May 21	M	University Commencement
May 25	F	Spring-term grades due for continuing students

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Richard Charles Levin, B.A., B.Litt., Ph.D.

Fellows
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George Leonard Baker, Jr., B.A., M.B.A., Palo Alto, California
Edward Perry Bass, B.S., Fort Worth, Texas
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Francisco Gonzalez Cigarroa, B.S., M.D., Austin, Texas (*June 2016*)
Peter Brendan Dervan, B.S., Ph.D., San Marino, California (*June 2014*)
Donna Lee Dubinsky, B.A., M.B.A., Portola Valley, California
Mimi Gardner Gates, B.A., M.A., Ph.D., Seattle, Washington (*June 2013*)
Charles Waterhouse Goodyear IV, B.S., M.B.A., London, England
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Indra Nooyi, B.S., M.B.A., M.P.P.M., Greenwich, Connecticut
Emmett John Rice, Jr., B.A., M.B.A., Bethesda, Maryland (*June 2017*)
Douglas Alexander Warner III, B.A., New York, New York
Margaret Garrard Warner, B.A., Washington, D.C. (*June 2012*)
Fareed Zakaria, B.A., Ph.D., New York, New York

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Benjamin Cashore, M.A., Ph.D., Professor of Environmental Governance and Political Science; and Director, Program on Forest Policy and Governance (on leave, fall 2011)

Marian R. Chertow, M.P.P.M., Ph.D., Associate Professor of Industrial Environmental Management; Director, Program on Solid Waste Policy; and Director, Industrial Environmental Management Program

Michael R. Dove, M.A., Ph.D., Margaret K. Musser Professor of Social Ecology; Professor of Anthropology; Director, Tropical Resources Institute; and Coordinator, F&ES/Anthropology Degree Program (on leave, spring 2012)

Daniel C. Esty, M.A., J.D., Hillhouse Professor of Environmental Law and Policy; Clinical Professor, Law School; Director, Yale Center for Environmental Law and Policy; and Director, Yale Center for Business and the Environment (on leave, 2011–2012)

Thomas E. Graedel, M.A., M.S., Ph.D., Clifton R. Musser Professor of Industrial Ecology; Professor of Chemical Engineering; Professor of Geology and Geophysics; and Director, Center for Industrial Ecology (on leave, fall 2011)

Timothy G. Gregoire, Ph.D., J. P. Weyerhaeuser, Jr. Professor of Forest Management (on leave, fall 2011)

Xuhui Lee, M.Sc., Ph.D., Professor of Meteorology

Robert Mendelsohn, Ph.D., Edwin Weyerhaeuser Davis Professor of Forest Policy; Professor of Economics; and Professor, School of Management

Chadwick Dearing Oliver, M.F.S., Ph.D., Pinchot Professor of Forestry and Environmental Studies; and Director, Global Institute of Sustainable Forestry

Peter A. Raymond, Ph.D., Professor of Ecosystem Ecology

James E. Saiers, M.S., Ph.D., Professor of Hydrology and Associate Dean for Academic Affairs

Oswald J. Schmitz, M.Sc., Ph.D., Oastler Professor of Population and Community Ecology; Professor of Ecology and Evolutionary Biology; and Director, Yale Institute for Biospheric Studies

David K. Skelly, Ph.D., Professor of Ecology; Associate Dean for Research; Professor of Ecology and Evolutionary Biology; and Director of Doctoral Studies

John P. Wargo, Ph.D., Professor of Environmental Policy, Political Science, and Risk Analysis; and Chair, Yale College Environmental Studies Major and Program

Faculty Emeriti

Frederick H. Bormann, M.A., Ph.D., Oastler Professor Emeritus of Forest Ecology
William R. Burch, Jr., M.S., Ph.D., Frederick C. Hixon Professor Emeritus of Natural Resource Management
John C. Gordon, Ph.D., Pinchot Professor Emeritus of Forestry and Environmental Studies
Stephen R. Kellert, Ph.D., Tweedy/Ordway Professor Emeritus of Social Ecology
Thomas Siccama, Ph.D., Professor Emeritus in the Practice of Forest Ecology
William H. Smith, M.F., Ph.D., Clifton R. Musser Professor Emeritus of Forest Biology

Ladder Faculty

Robert Bailis, M.S., Ph.D., Assistant Professor of Environmental Social Science
Mark A. Bradford, Ph.D., Assistant Professor of Terrestrial Ecosystem Ecology (on leave, 2011–2012)
Alexander J. Felson, M.L.A., Ph.D., Assistant Professor, School of Forestry & Environmental Studies and School of Architecture (on leave, spring 2012)
Kenneth T. Gillingham, Ph.D., Assistant Professor of Economics
Karen Hébert, Ph.D., Assistant Professor of Environmental Anthropology and Assistant Professor of Anthropology (on leave, 2011–2012)
Matthew J. Kotchen, Ph.D., Associate Professor of Environmental Economics and Policy (on leave, 2011–2012)
Karen Seto, Ph.D., Associate Professor in the Urban Environment
Nadine Unger, Ph.D., Assistant Professor of Climate Science
Julie B. Zimmerman, Ph.D., Associate Professor of Green Engineering; Assistant Professor of Chemical Engineering; and Acting Director, Center for Green Chemistry and Green Engineering

Non-Ladder Faculty

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Shimon C. Anisfeld, Ph.D., Senior Lecturer and Research Scientist in Water Resources and Environmental Chemistry
Richard Burroughs, Ph.D., Professor (Adjunct) of Coastal Science and Policy
Ann Elizabeth Camp, M.F.S., Ph.D., Senior Lecturer and Research Scientist in Stand Dynamics and Forest Health
Carol Carpenter, M.A., Ph.D., Senior Lecturer and Associate Research Scholar in Natural Resource Social Science and Adjunct Lecturer in Anthropology
Susan G. Clark, M.S., Ph.D., Joseph F. Cullman 3rd Professor (Adjunct) of Wildlife Ecology and Policy
Amity Doolittle, M.E.S., Ph.D., Lecturer and Associate Research Scientist

Paul Alexander Draghi, M.A., M.A., Ph.D., Director of Information Technology and Lecturer in Forest History
Helmut Ernstberger, Ph.D., Lecturer, Associate Research Scientist, and Analytical Laboratory Manager
Gordon T. Geballe, M.S., Ph.D., Associate Dean for External and Alumni Affairs and Lecturer in Urban Ecology
Bradford S. Gentry, J.D., Senior Lecturer in Sustainable Investments; Research Scholar; Director, Yale Center for Business and the Environment; and Director, Research Program on Private Investment and the Environment
John Grim, Ph.D., Senior Lecturer and Senior Research Scholar
Arnulf Grubler, Ph.D., Professor in the Field of Energy and Technology
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Florencia Montagnini, M.S., Ph.D., Professor in the Practice of Tropical Forestry; and Director, Program in Tropical Forestry of the Global Institute of Sustainable Forestry
Rajendra K. Pachauri, Ph.D., Director, Yale Climate and Energy Institute; and Professor in the Practice of Sustainable Development
Jonathan D. Reuning-Scherer, Ph.D., Senior Lecturer in Statistics
Mary Evelyn Tucker, Ph.D., Senior Lecturer and Senior Research Scholar

Courtesy Joint Appointments

Michelle Addington, Ph.D., Associate Professor, School of Architecture
Ruth Elaine Blake, M.S., Ph.D., Professor of Geology and Geophysics
Kelly Brownell, Ph.D., Professor of Psychology
Adalgisa (Gisella) Caccone, M.S., Ph.D., Senior Research Scientist in Ecology and Evolutionary Biology
David Cromwell, Ph.D., Professor (Adjunct), School of Management
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Menachem Elimelech, Ph.D., Professor of Environmental Engineering
Durland Fish, Ph.D., Professor of Epidemiology and Public Health, School of Medicine
Willis Jenkins, Ph.D., Assistant Professor of Social Ethics, Divinity School
Douglas A. Kysar, J.D., Professor of Law, Law School
Brian P. Leaderer, Ph.D., Professor of Epidemiology and Public Health, School of Medicine
William Mitch, Ph.D., Assistant Professor of Chemical Engineering
William Nordhaus, Ph.D., Sterling Professor of Economics
Jeffrey Powell, Ph.D., Professor of Ecology and Evolutionary Biology
Richard Prum, Ph.D., William Robertson Coe Professor of Ecology and Evolutionary Biology; and Curator of Vertebrate Zoology, Peabody Museum of Natural History

James C. Scott, Ph.D., Eugene Mayer Professor of Political Science; Professor of Anthropology; and Director, Program in Agrarian Studies, MacMillan Center for International and Area Studies
Kalyanakrishnan Sivaramakrishnan, Ph.D., Professor of Anthropology
Ronald B. Smith, Ph.D., Professor of Geology and Geophysics and Mechanical Engineering; and Director, Yale Center for Earth Observation
Harvey Weiss, Ph.D., Professor of Near Eastern Archaeology
Ernesto Zedillo, Ph.D., Director, Yale Center for the Study of Globalization; and Professor in the Field of International Economics and International Relations

Visiting Faculty, Fellows, Adjunct Faculty, and Faculty with Primary Appointments Elsewhere

Maureen Burke, M.B.A., Lecturer
Douglas C. Daly, Ph.D., Professor (Adjunct)
Mary Beth Decker, Ph.D., Lecturer
Matthew Eckelman, Ph.D., Lecturer
William Ellis, Ph.D., Senior Visiting Fellow; Lecturer; and Resident Fellow in Industrial Environmental Management
Ona Ferguson, M.E.M., Lecturer
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James Fickle, Ph.D., Visiting Professor
Lawrence Kelly, Ph.D., Associate Professor (Adjunct)
Katherine Kennedy, J.D., Visiting Lecturer in Law
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Daniel Lashof, Ph.D., Lecturer; Senior Research Scientist; and Edward P. Bass Distinguished Visiting Environmental Scholar at YIBS
Roy S. Lee, Ph.D., Professor (Adjunct)
Lin Heng Lye, LL.M., Visiting Associate Professor
James R. Lyons, M.F., Lecturer and Research Scholar
James G. MacBroom, P.E., Lecturer in River Processes and Restoration
Joseph MacDougald, M.B.A., J.D., M.E.M., Lecturer
Fabian Michelangeli, Ph.D., Assistant Professor (Adjunct)
Kristin Morico, M.E.M., Lecturer
Julie Newman, Ph.D., Lecturer
John R. Nolon, J.D., Visiting Professor
Michael Northrop, M.P.A., Lecturer
Christine Padoch, Ph.D., Professor (Adjunct)
Charles M. Peters, M.F.S., Ph.D., Professor (Adjunct) of Tropical Ecology
Stephen Ramsey, Senior Visiting Fellow and Lecturer
Nicholas A. Robinson, Ph.D., Professor (Adjunct)
Marjorie Shansky, J.D., Lecturer
Deborah Spalding, M.A., M.B.A., M.F., Lecturer
Dennis W. Stevenson, Ph.D., Professor (Adjunct) of Tropical Studies
Fred Strebeigh, B.A., Senior Lecturer in Environmental Writing
Pavan Sukhdev, B.A., Lecturer; Research Scholar; and Dorothy S. McCluskey Fellow
Charles Dana Tomlin, Ph.D., Professor (Adjunct)

William Vance, Ph.D., Lecturer
Ina Vandebroek, Ph.D., Lecturer

Research Appointments
Ruth Allen, Ph.D., Visiting Fellow
James Axley, Ph.D., Senior Research Scholar
Donald E. Aylor, M.E.S., Ph.D., Visiting Fellow in Biometeorology
Adalberg Balog, Ph.D., Visiting Fellow
Paul Berkowitz, M.E.M., Visiting Fellow
Mary K. Berlyn, Ph.D., Senior Research Scientist
Frederick Herbert Bormann, M.A., Ph.D., Senior Research Scientist
J. Alan Brewster, M.P.A., Research Scholar
William Richard Burch, Jr., M.S., Ph.D., Senior Research Scientist
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David Mattson, Ph.D., Visiting Senior Research Scientist and Lecturer
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Barbara Reck, M.S.Eng., Associate Research Scientist
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Rajesh Thadani, Ph.D., Visiting Fellow
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Mark Twery, Ph.D., Visiting Fellow
Qinling Zhang, Ph.D., Research Scientist

Center, Program, and Research Staff
Amy Badner, Senior Administrative Assistant, Yale Center for Business and the Environment
Lisa Bassani, M.F., Program Director, Tropical Resources Institute
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Alice Matthews, M.A., Administrative Assistant, Environmental Leadership and Training Program
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Janice Mitchell, A.S., Administrative Assistant, Center for Green Chemistry and Green Engineering
Alex Muro, Director of Financial Aid
Colleen Murphy-Dunning, M.S., Center Director, Hixon Center for Urban Ecology, and Program Director, Urban Resources Initiative
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Brian Weeks, B.A., Research Assistant, Center for Green Chemistry and Green Engineering

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William Walker, Administrative Assistant, Faculty Support
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Bethany Zemba, M.P.A., Ph.D., Associate Director of Research and Postdoctoral Programs

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Carla Heister, M.A., M.S., Librarian

A Message from the Dean

In the century since its founding, the Yale School of Forestry & Environmental Studies has evolved from a pioneering professional school of forestry to perhaps the world's finest training ground for tomorrow's environmental leaders. Research and teaching have expanded to include not only forestry, but also the fundamental concerns that today constitute the challenge of environmental management.

The central goal of our School is to build interdisciplinary expertise on the environment and to train a new generation of leaders capable of tackling some of the most urgent and difficult issues of our time. These issues touch almost every aspect of people's lives; they transcend political boundaries; and they often bring into sharp focus fundamental questions about equality and justice nationally and internationally.

The need for a new focus on environmental management has never been more obvious. We face new global-scale environmental challenges at the same time that we seek to meet an increased demand for food, energy, water, and the many other goods and services that are crucial for healthy and productive lives. The continuing loss of biological diversity, the degradation of ecosystem services, and new kinds of pollution, as well as climate change, are an impediment to eradicating poverty, and they are also fundamentally international in nature. They can only be solved by cooperation among developing and industrial countries and by leaders with a global perspective.

The core of our program at F&ES involves a thoughtful analysis and rigorous scientific study of the interaction between human societies and the natural world as a basis for sound environmental management. And because many of the solutions to today's environmental challenges lie outside the established environmental sector, our programs also reach into many other areas, among them economics, business, law, engineering, and medicine.

We provide a broadly based educational experience that equips our graduates to assume influential roles in government, business, nongovernmental organizations, public and international affairs, journalism, research, and education by continuing to collaborate with others within and beyond Yale.

Solutions to today's urgent environmental concerns will require a revolution in personal choice, a fusion of environmental and economic thinking, and an increased willingness on the part of business, government, and environmental leaders to develop shared goals that are sustainable over the long term. Our aim is to develop professionals trained in environmental management who can also wield influence in these broader arenas. Environmental thinking needs to be incorporated into corporate planning, energy strategy, technology policy, R&D funding, tax policy, international trade and finance, development assistance, and many other areas that once seemed far removed from traditional environmental concerns.

I hope and expect that those of you entering the School at this critical moment will have the energy and vision to help shape our collective environmental future locally and globally. I encourage you to use this bulletin to explore how F&ES can help facilitate your goals and build a foundation of knowledge and experience that will equip you to help change the world.

Please visit our Web site (www.environment.yale.edu) to get an inside view of the dynamics and energy that will make F&ES an ideal place to continue your education.

Sir Peter R. Crane
Carl W. Knobloch, Jr. Dean
School of Forestry & Environmental Studies

Mission of the School of Forestry & Environmental Studies

The Yale School of Forestry & Environmental Studies prepares new leaders and creates new knowledge to sustain and restore the long-term health of the biosphere and the well-being of its people.

We recognize that environmental challenges are increasingly international and seek to build a truly global school of the environment.

We believe that the human enterprise can and must be conducted in harmony with the environment, using natural resources in ways that sustain those resources and ourselves.

We believe that solving environmental problems must incorporate human values and motivations and a deep respect for human and natural communities.

We seek to integrate concern for Earth's ecosystems with the goal of achieving social equity.

We believe that a school of the environment must also be a school of sustainable development.

We find strength in our collegiality, diversity, independence, and commitment to excellence.

We educate women and men to guide human activity at the local, national, and global levels with a comprehensive understanding of the environmental, economic, and social consequences of their choices.

We create new knowledge in the science of sustainability and new methods of applying that knowledge to the challenge of environmental management, the restoration of degraded environments, and the pursuit of sustainable development.

We collaborate with all sectors of society to achieve fair and effective solutions to environmental problems.

For over one hundred years, first as a pioneering school of forestry, Yale has marshaled the expertise of diverse disciplines in the service of responsible stewardship of the environment. As the world's population grows and development accelerates, conserving the beauty, diversity, and integrity of the natural world becomes at once more important and more challenging.

We reaffirm our belief that such conservation is a practical and moral imperative.

History of the School of Forestry & Environmental Studies

Yale University has played a leading role in the development of American conservation and natural resource management since the 1800s, when Yale graduates such as William Henry Brewer, Othniel C. Marsh, Clarence King, and George Bird Grinnell were deeply involved with the exploration of the West and the proper use of that region's resources. In 1900 that tradition was strengthened further when the University established the Yale Forest School. The men responsible for establishing the School were Gifford Pinchot, B.A. 1889, LL.D. 1925, and Henry S. Graves, B.A. 1892, LL.D. 1940. Pinchot was the first American to receive professional forestry training in Europe, and Graves the second. As consulting foresters, and later at the government's Division of Forestry, they demonstrated the first examples of forest management on private lands in the United States. The School was founded with a gift from the Pinchot family to ensure a continuing supply of professionals to carry out the work that lay ahead.

Pinchot, who became one of the leading figures in the administration of President Theodore Roosevelt, created the USDA Forest Service and served as its first chief. Credited with coining the phrase "conservation of natural resources," he defined conservation as the wise use of the Earth for the good of present and future generations.

Since its founding, it has been the School's mission to turn Pinchot's vision of conservation into educational and professional reality. Leading that quest until 1939 was the School's first dean and intellectual leader, Henry S. Graves. To Graves, graduate education, as in law and medicine, would define the new profession. Over the years, objectives have broadened, the mission has been interpreted differently, and methods of instruction have changed. Each decade has presented its singular challenges, and the School has responded vigorously to meeting them. In 1972 the School changed its name to School of Forestry & Environmental Studies to recognize that it is concerned, in the broadest sense, with the scientific understanding and long-term management of ecosystems for human benefit.

In its second century, the environment school's research and teaching are focused on the following broad areas: ecology, ecosystems, and biodiversity; environmental management and social ecology in developing societies; forest science and management; global change science and policy; health and environment; industrial environmental management; policy, economics, and law; urban ecology, environmental planning, design, and values; and coastal and watershed systems. Under the leadership of Dean Peter Crane, the School is determined to extend its scope to meet the profound global environmental challenges the world faces.

Statement of Environmental Policy

We the faculty, staff, and students of the Yale School of Forestry & Environmental Studies affirm our commitment to the responsible environmental stewardship of our School, the University, the city of New Haven, and the places where we teach and conduct research. In the course of these activities, we shall strive to:

- reduce our use of natural resources;
- support the sustainable production of the resources we must use by purchasing renewable, reusable, recyclable, and recycled materials;
- minimize our use of toxic substances and ensure that unavoidable use is in full compliance with federal, state, and local environmental regulations;
- reduce the amount of waste we generate and promote strategies to reuse and recycle waste that cannot be avoided; and
- restore the environment where possible.

Each member of the School community is encouraged to set an example for others by being a steward of our environment.

Master's Degree Programs

TWO-YEAR MASTER'S DEGREE PROGRAMS

The School of Forestry & Environmental Studies offers four two-year master's degrees: the professionally oriented Master of Environmental Management (M.E.M.) and the Master of Forestry (M.F.), and the research-oriented Master of Environmental Science (M.E.Sc.) and Master of Forestry Science (M.F.S.). The master's degree programs vary in their level of prescription, but all are sufficiently flexible to accommodate the diverse academic backgrounds, professional experiences, and career aspirations of a large and vibrant student body. The program curricula draw from more than one hundred courses taught by fifty F&ES faculty, as well as from courses taught elsewhere at Yale. Each student's course of study is customized through consultation with a faculty adviser who guides the student's learning experience from the first week at Yale until graduation. The master's degree programs require a minimum of two years in residence, 48 credits of course work at Yale, a summer internship or research experience, and completion of the Training Modules in Technical Skills prior to the student's first term (see below).

Master of Environmental Management

The Master of Environmental Management degree prepares students for careers in environmental policy and analysis, green business, design and planning, conservation and stewardship, education, consulting, or journalism. The program requires course work from the diverse perspectives of the natural and social sciences, with a focus on the complex relationship among science, management, and policy. The purpose of the program is to provide students with a scientific understanding of ecological and social systems that can be applied in a policy or management context. Students are also expected to hone their capacity as leaders and managers through summer internships, professional skills courses, and other opportunities.

The M.E.M. curriculum has recently been redesigned to ensure that F&ES graduates continue to be competitive in the ever-changing job market and ready to distinguish themselves as the next generation of leading environmental professionals. The redesigned M.E.M. consists of five main components: Foundations, Integrative Frameworks, Electives, Professional Skills, and a Capstone in applied problem solving.

FOUNDATIONS

Six Foundations courses in five subject areas – (1) biological and ecological sciences, (2) earth and atmospheric sciences, (3) environmental economics, (4) statistics, and (5) social and policy sciences – cover the essential knowledge and theory that every environmental manager should have, regardless of his or her intended areas of specialization. F&ES elective courses build on these Foundations in addressing long-standing and emerging environmental problems in the later stages of the curriculum. One course each is offered in areas 1–5.

Students are strongly encouraged to take a Foundations course in each of the five areas, as they cover concepts and principles that serve as starting points for F&ES's advanced elective offerings. Students may be proficient in the subject areas of one or more of the

Foundations courses. This proficiency should be determined through discussion with the student's academic adviser and through consultation with the School's Foundations Advisory Committee (FAC). This faculty committee considers a student's prior course work in relationship to the content of a Foundations course (specified by the student) to determine proficiency and the appropriateness of proficiency-based exemption from that course. A student seeking FAC counsel on proficiency exemption should submit a completed Foundations Course Exemption form to the registrar by September 5, 2011.

The Foundations courses are offered during the fall terms. Students are encouraged to take two or three Foundations courses during their first term and the remaining Foundations courses – those less central to their intended areas of specialization and hence less essential as prerequisites for their upper-level course selections – in their third term.

INTEGRATIVE FRAMEWORKS

The Integrative Frameworks courses explore the social, economic, political, and scientific interrelationships of some of today's most pressing environmental issues. These team-taught courses build on the Foundations courses by illustrating how practices, methodologies, and perspectives from multiple disciplines must be integrated to provide holistic answers to the challenges posed by environmental problems. Participation in the Integrative Frameworks courses will help students refine their goals and interests and illuminate gaps in understanding, which, in turn, will inform their decisions on advanced course work. Students are required to take one Integrative Frameworks course during either their first or second term.

ELECTIVES

The main body of the curriculum consists of elective courses that present advanced-level treatments of topics and disciplines. Students can choose from approximately 100 courses in developing expertise in an area of specialization relevant to their career goals, with the assistance of their adviser, the Career Development Office, and other mentors. Collectively, these courses explore the social, political, ecological, and physicochemical processes that affect freshwater, atmospheric, land, industrial, urban, and energy systems. Most elective courses assume student command of the knowledge and concepts covered in one or more of the Foundations courses and may list other courses as prerequisites.

PROFESSIONAL SKILLS

The Professional Skills component of the curriculum is intended to provide management, communications, and leadership training that is essential to success in environmental management and many other professions. Consisting of four 1-credit half-term courses, the optional Professional Skills Core lays a groundwork of professional training in project management, conflict resolution, communications, and financial management. These courses are supplemented by elective courses focusing on particular professional skills.

CAPSTONE

The final component of the M.E.M is a Capstone course or project focusing on applied problem solving, and relying on the application of knowledge, methodological approaches, and interpretive techniques gained from courses taken during the earlier stages of the M.E.M. To fulfill this requirement, students work alone or in groups on a

faculty-supervised Capstone project. This may involve service to a client (e.g., a government agency, company, not-for-profit, or individual); applied, nonacademic approaches to exploring environmental problems, such as filmmaking, journalism, or community-based projects; or a research project that culminates with a paper suitable for publication in a scientific or trade journal. The Capstone provides students with an opportunity to integrate academic study and research with real-world, hands-on problem solving. As the Capstone relies on integration of a body of knowledge, most Capstone courses have prerequisites.

Master of Forestry

The Master of Forestry program is aimed at training professionals for administration and management of forest lands, and for mediating and resolving the conflicting values of society that concern forests and their associated ecosystems. Forest systems cover one-third of the terrestrial surface of the earth. More important than this expansive distribution, however, are the numerous and critically important values that forests provide to human societies. Currently the pressures of economic development, population growth, and energy use challenge the sustainability of forest values as never before in human history.

Since 1900, the Master of Forestry program has provided leadership in the education of professional foresters. It is the oldest continuing forestry program in the Western Hemisphere. Almost all the early foresters in North America had their roots at Yale. Graduates include such notables as Aldo Leopold, M.F. '09 and Starker Leopold, M.F. '38; the fathers of forest ecology and silviculture in North America (Clarence Korstian, M.F. '26; Harold Lutz, M.F. '27; Stephen Spurr, M.F. '40; David Smith, M.F. '46); and nine of the first twelve chiefs of the USDA Forest Service. This program is designed for individuals who want to be at the forefront of forest resource management and policy. The Master of Forestry curriculum is a truly interdisciplinary approach rooted in the biological basis of ecosystems.

For the past ten years Master of Forestry graduates have taken a variety of professional opportunities in forestry. Most start as general practitioners and management officers and with experience move through management to become policymakers and organizers. Employment can be characterized as follows: (1) government and public land management agencies (e.g., Environmental Protection Agency, U.S. Department of Agriculture Forest Service); (2) international development and conservation organizations (e.g., Food and Agriculture Organization, CARE, OXFAM, USAID, Winrock International, World Wildlife Fund, Conservation International); (3) industry, finance, and investment in timber, ecosystem services, and forest carbon (e.g., World Bank, The Forestland Group, John Hancock Insurance Co.); (4) urban forestry and community development in cities; and (5) town land use planners, land trusts, and conservation organizations (e.g., The Nature Conservancy, Wilderness Society). An important proportion of graduates use the degree as preparation for advanced study in doctoral programs.

The broad objective of the two-year M.F. program is realized by requiring a multidisciplinary suite of formal course work coupled with a progressive synthesis of knowledge in a significant project. Course work is supplemented through the provision of an array of local, regional, national, and international trips to witness the practice of forestry in

diverse settings. Real-world professional experience is provided through the Yale Forest and a host of internships offered through the auspices of the Global Institute for Sustainable Forestry and the Tropical Resources Institute. Additionally, the School hosts workshops, visiting speakers of national and international repute, and publications of the Yale Forest Forum.

The teaching objectives of the M.F. program are (1) to integrate knowledge about forests, natural resources, and society to form a sound basis for making management decisions; (2) to provide electives and other educational opportunities to specialize by focusing on a particular land use or management issue concerning forest ecosystem management; and (3) to provide opportunities for independent problem solving, critical thinking, and self-development. All core courses at F&ES are designated as natural, social, or quantitative science, and all students must take a mixture. The capstone course addresses management skills and, in particular, leadership. Flexibility of the choice of course within the required topic areas of the M.F. curriculum allows the student to tailor required courses to a desired specialization. Sample specializations have included community development and social forestry; protected areas management; extension and education; consulting and business; watershed health and restoration; tropical forest management; agroforestry; and industrial forest management.

The two-year program leading to the Master of Forestry degree as the first professional degree in forestry is accredited by the Society of American Foresters (SAF). The SAF was founded in 1900 by Gifford Pinchot and six other pioneer foresters, and its role as accrediting body for forestry in the United States is recognized by the U.S. Department of Education and the Council on Post-Secondary Accreditation. For this reason, the degree is widely accepted in other regions and countries with similar professional standards. In recent years there has also been a growing recognition of required professional licensing and registration for all resource managers in the United States, particularly in the Northeast and West Coast regions, or for individuals working in any of the federal agencies, e.g., U.S. Department of Agriculture Forest Service. In most of these states and agencies, resource management can be practiced only by individuals who have met certain educational and experience standards. An accredited professional degree is usually the first requirement. *A minimum of two full years in residence and sixteen full courses (48 credits) is required for completion of this program*.

Master of Environmental Science/Master of Forest Science

The Master of Environmental Science and the Master of Forest Science degree programs are expressly designed for students wishing to conduct research that contributes to basic and applied knowledge in any of the fields taught at F&ES, such as ecology, hydrology, social ecology, economics, industrial ecology, or policy. These degrees are intended to facilitate a deeper disciplinary focus than the Management degrees, while allowing students the flexibility in course election that will allow them to meet diverse educational goals. The Master of Environmental Science is intended for students who wish to work broadly in different fields of environmental science. The Master of Forest Science is intended for students who wish to work in forest-related topics.

The course of study for both degrees includes formalized School-level training in the philosophy and practice of science. Training is provided through key courses in

combination with extended project research and disciplinary and nondisciplinary electives. The scientific research required for this degree will be conducted in close collaboration with an F&ES faculty adviser. *Therefore students must have a commitment from a faculty adviser before being admitted to these degree programs*. The Master of Environmental Science and Master of Forest Science programs require the student to produce a "scholarly product." This product may take the form of a traditional master's thesis or a paper submitted to a refereed journal.

Training Modules in Technical Skills

All incoming master's students participate in three weeks of summer modules, which impart field skills and techniques considered indispensable to students intending careers in environmental research, management, and policy. These modules are a necessary base for subsequent course work at the School of Forestry & Environmental Studies, provide an orientation to the School, and are offered only during the last three weeks of August.

These modules are *required* of all first-year master's students enrolled in two-year programs as well as for all one-year midcareer degree program students. Waivers will be granted from one, two, or all of the modules only upon evidence of attainment of these skills through previous course work or professional experience. Course work is primarily in the field and covers three technical areas:

Module I: Urban Ecosystem Analysis—use of the urban areas as a point of study on the patterns and processes that drive urban ecosystems.

Module II: Ecosystem Measurement—sampling methods, research design, data reduction and analysis.

Module III: Land Measurement—surveying, aerial photography, GPS, remote sensing and mapping.

ONE-YEAR MIDCAREER MASTER'S DEGREE PROGRAM

The midcareer M.E.M. or M.F. degree program is intended to permit environmental and forest managers to build on their work experience in order to acquire skills that will enable them to pursue their career goals more effectively. To this end, those admitted into the program must have at least seven years of directly relevant professional experience in the environmental or forestry field that is sufficient to provide a corpus of experiential learning equivalent to one year of academic study at F&ES. So that the admissions committee may fairly judge each applicant's work record in light of this requirement, an applicant must detail his or her career work experience. Relevant work experience is not the sole criterion for admission into this degree program; the breadth of prior academic training is also considered, and those applicants who are better prepared (see Preparation for Admission, in section on Admissions: Master's Degree Programs) are more likely to succeed in this competitive admission process.

The midcareer degree program is not appropriate for those seeking to make an abrupt career change, nor is it suitable for those who have acquired seven or more years of work experience that is tangentially related to environmental or forest management. Normally,

voluntary service will not be considered equivalent to career experience needed for acceptance into this degree program.

The one-year midcareer Master of Environmental Management and Master of Forestry degree programs have less structured curricula than the two-year programs. Attendance at the Training Modules (see Training Modules in Technical Skills, above) is required, and the successful completion of 24 credits of course work and independent study is required. One year in residence is normally required, as is initial enrollment at the start of the fall term.

JOINT MASTER'S DEGREE PROGRAMS

The School of Forestry & Environmental Studies supports several curricula that work concurrently toward two degrees from different academic units of Yale University. Opportunities for development of joint-degree programs exist with the School of Architecture, Divinity School, Law School, School of Management, School of Public Health, the Graduate School's International Relations program, and the International and Development Economics program of the Graduate School's Department of Economics. Joint-degree programs with Pace Law School and Vermont Law School constitute additional options. Applicants are urged to apply to both units at the same time. All of these programs are subject to the following general guidelines.

Applicants must apply to, and be accepted by, both units of the University according to normal admissions procedures. A minimum of one and one-half years (three terms) and 36 credits is required at the School of Forestry & Environmental Studies. For successful integration of the two programs, it is recommended that students spend a complete academic year (two terms) at one school, the following academic year at the other school, and then split the final year between the two schools.

Upon successful completion of the formal joint-degree program, the student will be awarded one of the four F&ES master's degrees, together with the joint degree. The joint-degree programs, sponsoring Yale academic units, and associated residency requirements (which are in addition to the three-term requirement of F&ES) are as follows:

1. School of Architecture: Master of Architecture I (five terms); Master of Architecture II (three terms).
2. Divinity School: Master of Arts in Religion (3 terms); Master of Divinity (five terms).
3. Schools of law (Yale Law School, Pace Law School, and Vermont Law School): Juris Doctor (five terms).
4. School of Management: Master of Business Administration (three terms).
5. School of Public Health: Master of Public Health (three terms).
6. International Relations (Graduate School of Arts and Sciences): Master of Arts (two to three terms).
7. Department of Economics, International Development and Economics program: Master of Arts (two to three terms).

For questions about the joint-degree programs, please consult the F&ES Office of Admissions at fesinfo@yale.edu or call 800.825.0330.

PART-TIME PROGRAM

Students who wish to obtain a degree through the part-time option must complete the same curriculum as full-time students. Participants must enroll for at least two courses per term and must complete the degree requirements within four years of matriculation.

SPECIAL STUDENTS

For those who do not wish to pursue a degree program, F&ES offers the option of special student status. Special students may be registered for a period as short as one term and may enroll in a minimum of one course or elect to take a full program of four courses per term. Special students are not eligible to participate in the summer Training Modules in Technical Skills. Under normal circumstances, no one may hold special student status for more than one academic year. No degree or certificate is granted for special student course work. Students will receive official transcripts recording course work completed.

Doctoral Degree Program

The Doctor of Philosophy (Ph.D.) degree is conferred through the Yale Graduate School Arts and Sciences. Work toward this doctoral degree is directed by the Department of Forestry & Environmental Studies of the Graduate School, which is composed of the faculty of the School of Forestry & Environmental Studies. Doctoral work is concentrated in areas of faculty research, which currently encompass the following broad foci: agroforestry; biodiversity conservation; biostatistics and biometry; community ecology; ecosystems ecology; ecosystems management; energy and the environment; environmental anthropology; environmental biophysics and meteorology; environmental chemistry; environmental ethics; environmental governance; environmental health risk assessment; environmental history; environmental law and politics; environmental management and social ecology in developing countries; environmental and resource policy; forest ecology; green chemistry and engineering; hydrology; industrial ecology; industrial environmental management; plant physiology and anatomy; pollution management; population ecology; resource economics; silviculture, social ecology; stand development, tropical ecology, and conservation; sustainable development; urban ecology; urban planning; urban land cover change; urban geography; and water resource management.

REQUIREMENTS FOR THE DOCTORAL DEGREE

All courses listed in this bulletin are open to students working for the doctoral degree. Additional courses are available in other departments – e.g., Anthropology; Chemistry; Ecology and Evolutionary Biology; Economics; Geology and Geophysics; Management; Mathematics; Molecular, Cellular, and Developmental Biology; Political Science; Sociology; and Statistics – and are listed in the bulletin of the Graduate School.

A doctoral committee will be appointed for each student no later than the student's second term in the program. The committee consists of a minimum of three faculty members from the Yale University community. When appropriate for their research areas, students are encouraged to suggest committee members from other universities. Doctoral students work under the supervision of their doctoral committees. The committee should be chaired or cochaired by an F&ES ladder faculty member.

Students are required to take the Doctoral Student Seminar, F&ES 900a, during the first year of their program.

Two Honors grades must be achieved before a student is eligible to sit for the qualifying examination. In addition, students are expected to serve four terms (10 hours per week) as teaching fellows, in partial fulfillment of their doctoral training.

A written and oral qualifying examination is required upon completion of the course requirements. Students are expected to take the examination by the end of their second year, although this can be extended to the third year in cases with appropriate extenuating circumstances. At the time of the qualifying examination, the student must present a prospectus of the research work proposed for the dissertation. Successful completion of the qualifying examination and submission of the prospectus will result in admission to candidacy.

The director of doctoral studies (DDS) of the School serves as director of graduate studies for the Department of Forestry & Environmental Studies of the Graduate School, administers the doctoral program, and may be consulted if questions arise.

Before beginning work, the student must secure approval from his or her committee and the DDS for a proposed program of study and for the general plan of the dissertation. Appropriate advanced work is required. Courses chosen should form a coherent plan of study and should support research work for the proposed dissertation.

The dissertation should demonstrate the student's mastery of his or her chosen field of study as well as the ability to do independent scholarly work and to formulate conclusions that may modify or enlarge previous knowledge.

Candidates must present themselves for the oral defense of the dissertation at such time and place as the student, the DDS, and the committee determine. Upon completion of the dissertation, the candidate must make unbound copies of the dissertation available to the faculty. Copies of the approved dissertation must be submitted to the Graduate School.

COMBINED DOCTORAL DEGREE

Department of Anthropology

The School of Forestry & Environmental Studies offers a combined doctoral degree with Yale's Department of Anthropology. The purpose and attraction of the degree are threefold: (1) it combines the disciplinary identity and strengths of the Anthropology department with the interdisciplinary character and possibilities of F&ES, especially in terms of bridging the social and natural sciences; (2) it combines the strengths in ecological and environmental studies of F&ES with the social science strengths of the Anthropology department; and (3) it combines the Anthropology department's strengths in theory with the emphasis within F&ES on linking theory with policy and practice. The combined doctoral degree offers its graduates great flexibility when entering the marketplace: they can represent themselves as anthropologists and/or environmental scientists, as theoreticians and/or practitioners. They have the credentials to apply for policy-oriented positions with international institutions as well as academic positions in teaching and research. The academic program of each student in the combined-degree program is to some extent tailored specifically to his or her particular history, interests, and needs, but there are general guidelines that combined students can be expected to follow.

Prospective combined-degree students must initially apply either to Anthropology or to F&ES but not to both at the same time. However, in keeping with the current Yale Graduate School application process, they should indicate their interest in the combined degree by marking the application form appropriately. Once the student is accepted in the initially chosen doctoral program, the application file will be considered in the second program and a decision on the combined-degree application will be communicated by the Graduate School by the usual deadline for acceptance of admission offers. Such students will be allocated to their initially chosen program as their primary administrative home but will enter Yale as members of the combined-degree program. Being turned down for entry into the combined-degree program at this point does not preclude reapplication after arriving at Yale the following fall term. More detailed guidelines for the

combined-degree program can be found on the F&ES Web site at www.environment.yale.edu/prospective/Joint-Doctoral-Degrees.

New York Botanical Garden

The School of Forestry & Environmental Studies offers a combined doctoral degree with the New York Botanical Garden, which is funded by the Lewis B. Cullman Fellowship. The objective is to train biological scientists to use an interdisciplinary approach to solving problems associated with tropical environments.

Areas of study include agroforestry and forest management, ecosystem analysis, economic botany, economic evaluation of tropical resources, ethnobotany, plant biodiversity and conservation, social processes affecting management of natural resources, tropical field studies, and tropical silviculture.

For more information about the combined doctoral degree, please contact the director of doctoral studies at 203.432.5146.

Subjects of Instruction

Courses offered by the School of Forestry & Environmental Studies are described below. The letters "a" and "b" following the course numbers indicate fall- and spring-term courses, respectively. Bracketed courses will not be offered during the 2011–2012 academic year.

Project courses involve individually assigned advanced field or laboratory work, or literature review, on topics of special interest to the student; credits and hours for these projects are determined for each student in consultation with the instructor.

Courses throughout the University are generally open to students enrolled in the School of Forestry & Environmental Studies, subject to limitations on class size and requirements for prerequisites.

Note For updated course listings, please see the School of Forestry & Environmental Studies Web site, www.environment.yale.edu/courses.

LIST OF COURSES BY TOPIC

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F&ES 510a	Introduction to Statistics in the Environmental Sciences	36
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F&ES 520a	Society and Environment: Introduction to Theory and Method	37
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F&ES 610a	Science to Solutions: How Should We Manage Water?	38
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Capstone

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F&ES 952b	Property Rights and Natural Resource Management	40
F&ES 953a,b	Business and the Environment Consulting Clinic	40
F&ES 954a	Management Plans for Protected Areas	41
F&ES 955a,b	Seminar in Research Analysis, Writing, and Communication	41
[F&ES 956a]	A Clinical View of Land Use Planning and Policy	41

[F&ES 963b] Emerging Markets for Ecosystem Services 41
[F&ES 964b] Large-Scale Conservation: Integrating Science, Management, and Policy 42
F&ES 965b Advanced Readings: Social Science of Development and Conservation 42
F&ES 966b The Entrepreneurial Approach to Environmental Problem Solving 43
[F&ES 967a] Biodiversity Conservation and Climate Adaptation 43

Ecology

ECOSYSTEM ECOLOGY

F&ES 730a Ecosystem Ecology 43
[F&ES 731b] Tropical Field Botany 43
F&ES 732a Tropical Forest Ecology: The Basis for Conservation and Management 44
[F&ES 733b] Ecosystem Pattern and Process 44
F&ES 734a Biological Oceanography 44
F&ES 735a Biogeography and Conservation 44
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WILDLIFE ECOLOGY AND CONSERVATION BIOLOGY

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ENVIRONMENTAL EDUCATION AND COMMUNICATION

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Forestry

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[F&ES 651b] Forest Ecosystem Health 47
F&ES 652b Seminar in Ecological Restoration 47
[F&ES 653b] Agroforestry Systems: Productivity, Environmental Services, and Rural Development 48
F&ES 654a Structure, Function, and Development of Trees and Other Vascular Plants 48
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F&ES 657a	Managing Resources	49
F&ES 659b	Principles in Applied Ecology: The Practice of Silviculture	49
F&ES 660a	Forest Dynamics: Growth and Development of Forest Stands	50
[F&ES 661b]	Analysis of Silvicultural Problems	50
F&ES 663b	Invasive Species: Ecology, Policy, and Management	50
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F&ES 668b	Field Trips in Forest Resource Management and Silviculture	51
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[F&ES 705b]	Climate and Air Pollution	53
F&ES 722b	Boundary Layer Meteorology	53
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F&ES 707b	Aquatic Chemistry	53
F&ES 708a	Biogeochemistry and Pollution	53
F&ES 743a	Environmental Chemical Analysis	54
F&ES 773a	Air Pollution (Chemical Engineering Department)	54
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SOIL SCIENCE

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F&ES 723b	Seminar in Soil Conservation and Management	54

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[F&ES 713a]	Coastal Ecosystems: Natural Processes and Anthropogenic Impacts	55

[F&ES 714b]	Environmental Hydrology	56
F&ES 719a	River Processes and Restoration	56
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F&ES 755b	Modeling Geographic Space	59
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COURSE DESCRIPTIONS

At F&ES, new courses are often added after this bulletin is printed. Our Web site at www.environment.yale.edu will have an updated list, as well as a list of environmental courses available in other departments at Yale. See also Yale University's online course information Web site: www.yale.edu/oci.

Foundations

[**F&ES 500a/E&EB 365a/665a, Landscape Ecology** 3 credits. This Foundations course is an introduction to the study of large-scale ecological patterns and processes. Landscape ecology is a relatively young, rapidly changing field. The topics covered reflect the diverse interests of ecologists: species-area relationships, island biogeography, metapopulation theory, individual-based models, cellular automata, models of biodiversity, etc. Throughout the course the emphasis is on when and how to integrate a spatial perspective into consideration of major ecological questions. Readings from the primary literature augment material covered in lectures. Students complete a project resulting in a manuscript on a landscape-related topic. Knowledge of the concepts and principles covered in Landscape Ecology is assumed for all other F&ES courses in ecology and is essential for informing many kinds of decisions regarding ecosystem management. David K. Skelly]

F&ES 505a, Economics of the Environment 3 credits. This course provides students with in-depth training using economic analysis to address environmental policies and management. Students are exposed to tools that allow them to assess the efficiency of different environmental policies and management strategies. The course examines when markets manage the environment efficiently and when they fail. It covers a range of topics including preventing pollution, managing renewable resources, and consuming nonrenewable resources. It stresses the importance of science and values in making efficient choices. The course is a prerequisite for all advanced economics courses and provides knowledge that is fundamental to success in F&ES courses on resource management. Kenneth Gillingham

F&ES 510a, Introduction to Statistics in the Environmental Sciences 3 credits. An introduction to probability and statistics with emphasis on applications in forestry and environmental sciences. Includes methods of graphical analysis, introduction of common probability distributions, and hypothesis testing. The final third of the course introduces the topics of regression and analysis of variance that are covered more thoroughly in F&ES 753b. There are weekly problem sets using MINITAB software, as well as a final project. This course is a prerequisite for all other statistics courses offered through F&ES, and it presents statistical methods used in many of the School's courses in both the natural and social sciences. Three hours lecture. Jonathan D. Reuning-Scherer

F&ES 515a, Physical Sciences for Environmental Management 3 credits. This Foundations course seeks to provide students with the physical science basics that they need in order to understand and manage environmental problems. The course covers fundamental concepts from the following disciplines: climatology, environmental chemistry, geology, hydrology, meteorology, oceanography, and soil science. Focus is on understanding

both the underlying concepts and how they apply to real-world environmental challenges. Useful both as a freestanding course and as a gateway to a wide spectrum of intermediate and advanced courses. Three hours lecture, weekly problem sets. Shimon C. Anisfeld

F&ES 520a/ANTH 581a, Society and Environment: Introduction to Theory and Method 3 credits. This is an introductory, graduate core course on the scope of social scientific contributions to environmental and natural resource issues. Section I presents an overview of the field and course. Section II deals with the way that environmental problems are initially framed. Case studies focus on placing problems in their wider political context, new approaches to uncertainty and failure, and the importance of how the analytical boundaries to resource systems are drawn. Section III focuses on questions of method, including the dynamics of working within development projects, and the art of rapid appraisal and short-term consultancies. Section IV is concerned with local peoples and the environment, with case studies addressing myths of tropical forest use and abuse development discourse, and with the question of indigenous peoples and knowledge. This is a Foundations course for the M.E.M. curriculum, a core course in the curriculum for the joint F&ES/Anthropology doctoral program, and a prerequisite for F&ES 869b/ANTH 572b. Three hours lecture/seminar. Michael R. Dove

[**F&ES 525a, The Politics and Practice of Environmental and Resource Policy** 3 credits. The purpose of this Foundations course is to provide a survey of public policy theory and practice, as related to development and implementation of environmental and natural resource policy. The course examines theories of policy formation; the intricacies of the policy-making process; the history of natural resource and environmental policy; and applied techniques in policy analysis and evaluation. The course has been specifically designed to provide both a theoretical and practical introduction to natural resource and environmental public policy. Upon completion of the course, the student will understand the political environment within which public policy is formulated, including the role of ideas, science, and learning. Students also will be able to demonstrate basic technical competence in environmental public policy development and the implementation process. The course has been developed to accommodate biologists and other natural scientists and assumes no prior knowledge of political science or the policymaking process. Benjamin Cashore]

F&ES 530a, Ecosystems and Landscapes 3 credits. This Foundations course is an introduction to concepts in ecosystem and landscape ecology. Topics covered include element cycling, food web interactions, species-area relationships, whole system metabolism, models of biodiversity, etc. The course emphasizes how to integrate knowledge to understand ecological patterns and processes at multiple scales in order to study and manage ecosystems. Peter A. Raymond, Oswald J. Schmitz

F&ES 535a/ANTH 597a, Social Science of Development and Conservation 3 credits. This course is designed to provide M.E.M., M.E.Sc., and doctoral students with the opportunity to master the essential social science literature on sustainable development and conservation. Social science makes two contributions to the practice of development and conservation. First, it provides ways of thinking about, researching, and working

with social groupings—including rural households and communities, but also development and conservation institutions, states, and NGOs. This aspect includes relations between groups at all these levels, and the role of power in these relations. Second, social science tackles the analysis of the knowledge systems that implicitly shape development and conservation policy and impinge on practice. In other words, we analyze communities but also our own ideas of what communities are. We also examine our ideas about sustainable development and conservation. Finally, we attempt to look at development and the institutions that implement it from the perspective of communities. The emphasis throughout is on how these things shape the practice of sustainable development and conservation. Case studies used in the course have been balanced as much as possible between Southeast Asia, South Asia, Africa, and Latin America; most are rural and third world (largely due to the development and conservation focus). The course includes readings from all non-economic social sciences. Readings are equally focused on conservation and development. The goal of the course is to stimulate students to apply informed and critical thinking (which means not criticizing others but questioning our own underlying assumptions) to whatever roles they may come to play in sustainable development and conservation, in order to move toward more environmentally and socially sustainable projects and policies. The course is also designed to help students shape future research by learning to ask questions that build on but are unanswered by the social science theory of conservation and development. No prerequisites. This is a Foundations course for the M.E.M. curriculum, a requirement for the joint F&ES/Anthropology doctoral program, and a prerequisite for some advanced F&ES courses. Three hours lecture/seminar. Carol Carpenter

Integrative Frameworks

F&ES 600b, Linkages of Sustainability 3 credits, lecture and discussion. The Earth system is made up of interdependent components—land, water, energy, biota, and nonrenewable resources, all of which have physical limits. Societies transform these resources into useable goods, and production and consumption cycles connect people and places across space and time. This team-taught course provides an overview of these linkages and explores their implications for applying and measuring the concept of sustainability. It examines the constraints to sustainability imposed by those linkages (e.g., the energy required to supply water), opportunities for their transformation, and challenges of implementing sustainability across complex social and cultural systems. Thomas E. Graedel, Karen Seto

F&ES 610a, Science to Solutions: How Should We Manage Water? 3 credits. While there are many different approaches to understanding and managing environmental problems, most involve several major steps: (1) describing/understanding the nature of the problem and its causes; (2) using technical, policy, social, and other management tools/processes to help address it; while (3) recognizing/making the value judgments embedded in each (what problems/data are "important"? what solutions are "best"?). The purpose of this introductory course is to illustrate how an M.E.M. student might integrate scientific understanding with management choices as part of an effort to address any particular environmental issue. Ideally, it should help students choose

areas of specialization, as well as improve their ability to engage in integrative problem solving—both in their final term and after they graduate. The class is focused on water issues, but the integrative structure of the class could be used on other problems as well. The class is built around a case-study approach, in which the faculty bring their different perspectives to bear on understanding and addressing the issues raised in a diverse set of cases, including the "dead zone" in the Gulf of Mexico; the New York City drinking water supply; Australia's response to water scarcity; the Cochabamba "water wars"; and one other case for the final. Preference given to first-year M.E.M. students. Three hours lecture, one hour discussion. Shimon C. Anisfeld, Bradford S. Gentry, Peter A. Raymond, Julie B. Zimmerman

[**F&ES 620b, Integrative Assessment** 3 credits. This course illustrates how to integrate the insights and models of different disciplines to address key environmental management questions facing society. Examples are drawn from across pollution and natural resource issues so that students can become familiar with a diverse set of issues. The course illustrates the merits of learning about the natural sciences, engineering, and economics in order to practice environmental management. Robert Mendelsohn and faculty]

F&ES 630b, Global Resources, International Resource Exchanges, and the Environment 3 credits. Students first learn the global distribution of resources—the amounts, importance, and causes of distribution, and potential changes of soils, water, biodiversity, human societies, energy sources, climates, agriculture, forests and forest products, minerals, and disturbances. They also learn how to analyze and interpret data on global resource distributions. Secondly, they gain an understanding of the value of multiple-country trading of resources. Thirdly, they gain an understanding of the many mechanisms that facilitate such exchanges, including policies and treaties; business, markets, trading partners, and economics; "good will"; social "taboos"; force; news media; philanthropy; skillful negotiations; cultural/social affiliation; technologies; shared infrastructures; and others. Four teaching methods are used: lectures on the different resources and policy mechanisms; analytical exercises for understanding how to use and interpret international data—and its limitations; a class negotiation exercise for learning the uses of international trade; and guest lectures by faculty and meetings with practitioners for learning the facilitation mechanisms. Three hours lecture; possible field trips. Chadwick D. Oliver, other faculty, and guest speakers

Capstone

F&ES 950a, Life Cycle Assessment Practicum 3 credits. Life Cycle Assessment (LCA) is an environmental modeling method that has become increasingly popular within business and academia for evaluating the environmental impacts of products or systems. LCA considers impacts along the entire life cycle, from production to consumption to disposal, and generally provides quantitative information for a range of different environmental issues. In this practicum course, students work on real projects with industry partners in order to achieve skills and training as analysts in this field. The course begins with a review of the intellectual foundation of LCA, the computational structure of the method, and the international standards that govern its use. Students then receive several

hands-on training modules for commercial LCA software packages, and work examples for model products and systems. This initial training prepares students to carry out their independent group projects over the remainder of the course. Special topics in LCA research and implementation are also covered later in the course, including carbon and water footprinting and a focus this year on the built environment. Regular project updates occur in class and individually with the instructor, and results are presented to industry partners at the end of the course in a professional consulting context. Prerequisite: F&ES 886a. Matthew Eckelman

[**F&ES 951b, Managing the Global Carbon Cycle** 3 credits. Managing atmospheric CO_2 entails managing the global carbon cycle. This class starts with a short series of lectures on the processes and fluxes that make up the global carbon cycle. The remainder of the class takes a case-study approach to aspects of managing the global carbon cycle. Instructors and students critically evaluate portions of the global carbon cycle that are under stress or are part of the proposed portfolio for carbon management and sequestration. Peter A. Raymond, Robert Bailis]

F&ES 952b, Property Rights and Natural Resource Management 3 credits. Rights to land and property are fundamental in most societies. Often secure land tenure is essential for the sustainable management of natural resources. Yet few natural resource managers understand the complexity of property rights, particularly in the developing world where there can be overlapping and competing land tenure regimes operating on any one piece of land. Around the world, ownership of, control over, and access to natural resources have meaning far beyond the traditional thinking of economic rationality and institutions of governance. Failure to understand the complex social relations embedded in property rights is a sure path to unsustainable use of natural resources. In this seminar we consider literature on the origins of Western property law, the fluidity in native customary law, the constraints and inequalities in legal pluralism, urban growth and property, and community and collective management of shared resources management. Our discussions include explorations into varying theoretical constructs of property as well as the applied implications (socially and ecologically) of different property systems. The majority of our case studies draw from the developing world. Prerequisite: F&ES 551a, F&ES 831b, EVST 285, F&ES 520a, or F&ES 839a. Amity Doolittle

F&ES 953a,b, Business and the Environment Consulting Clinic 3 credits. In this class, students work as a team on a specific project for an external organization. It provides students with an opportunity to apply their knowledge of business and environmental issues to real-life situations. It also provides a unique opportunity for students to manage a real-life consulting client engagement. Examples of projects include (1) developing a corporate sustainability scorecard for an organization's suppliers; (2) researching the market opportunity for a new environmentally friendly product or service; and (3) recommending operational improvements around energy usage, waste disposal, etc. The intent is to provide a "capstone" experience, calling for the application of skills and tools learned from previous classes. There are weekly in-class lectures and team meetings with the instructor. Lectures address topics such as project management, environmental science and technology issues, business evaluation and competitive analysis, and influencing

environmental policy, and include guest speakers from organizations tackling environmental issues. The clinic is open to both F&ES and SOM students. Prerequisites for F&ES students applying to the clinic are at least one of the following courses (or equivalent experience): F&ES 832a, F&ES 886a, F&ES 807a, or F&ES 578b. SOM students need to have completed their first term at the School. Maureen Burke

F&ES 954a, Management Plans for Protected Areas 6 credits. A seminar that comprises the documentation of land use history and zoning, mapping and interpretation, and the collection and analysis of socioeconomic, biological, and physical information for the construction of management plans. Plans are constructed for lands managed by the Nature Conservancy; Massachusetts Trustees of Reservations; private industrial and nonindustrial landowners; town land trusts; city parks and woodlands of New Haven, New York, and Boston; and the Appalachian Mountain Club. Prerequisites: F&ES 659b or 660a; F&ES 804a; or permission of the instructor. Ten days fieldwork. Limited enrollment. Mark S. Ashton

F&ES 955a,b, Seminar in Research Analysis, Writing, and Communication 3 credits. Students work through the peer-review publication process on data sets and projects in applied ecology. Discussions involve rationale and hypothesis testing for a project. Data analysis techniques and reporting and interpretation of results. It is expected that manuscripts developed in the course are worthy of publication and that oral presentations are of a caliber for subject area conferences and meetings. Three hours lecture. Mark S. Ashton

[**F&ES 956a, A Clinical View of Land Use Planning and Policy** 3 credits. This course introduces students to the real, complex, and sometimes political world that shapes land use practice and policy. The course uses real land use examples as a clinical vehicle to teach and engage the student in land use planning practice. Topics include: the transition from planning concepts to site proposals; the political and procedural realities of the land use hearing; planning, smart growth, and land use law; the role of the environment in land use planning; planning and brownfield remediation; environmental activism, intervention, and land use hearings. This clinical course combines traditional class work, in-depth clinical study of real applications accompanied by on-site visits, in-class simulated argument, presentations, guest speakers, and submission of a paper tied to one of the project examples explored during the term. Joseph MacDougald]

[**F&ES 963b, Emerging Markets for Ecosystem Services** 4 credits. The modern economy consumes many ecosystem services without paying for their production: forested areas protect water resources; plants sequester carbon; intact ecosystems protect biodiversity and its associated services (potential pharmaceuticals, existence value, etc.). In response, a growing number of experiments are under way to make consumers of ecosystem services pay the producers of the services, thus creating market incentives to sustain intact, biologically diverse areas. However, these experiments are in their infancy and raise a host of ethical, scientific, commercial, and policy questions. The purposes of this seminar are (1) to understand these opportunities and their limits by examining current scientific, commercial, and policy knowledge relevant to building markets for ecosystem services; and (2) to apply the lessons learned to actual properties or questions

by analyzing the scientific, business, and policy aspects of these issues. Prerequisite: course work or experience in at least one of the following: silviculture, business analysis/planning, or policy/law. Limited enrollment. Bradford S. Gentry, Mark S. Ashton, and guest lecturers]

[**F&ES 964b, Large-Scale Conservation: Integrating Science, Management, and Policy** 3 or 6 credits. Environmental sustainability and human dignity are important societal goals, but figuring out how to achieve them on large scales—geographic, temporal, and in terms of complexity—has proven to be extremely challenging. Abundant trend data show that many species, ecosystems, and other environmental and human systems are being overused, stressed, or degraded, thus undercutting the likelihood that we can reach sustainability and human rights for all. In addition, our institutions for science, management, and policy are not designed to address sustainability challenges on these scales. Over the last few decades numerous management and policy initiatives have been put forward to address large-scale resource use, including single and multiple use, parks and protected areas, ecosystem management, bioregional planning, integrated conservation and development, transboundary approaches, and adaptive governance. This course (a mixed seminar and practicum) explicitly uses an interdisciplinary framework to examine the conceptual and contextual basis for these efforts; compares and contrasts their scientific, management, and policy components; explores themes of leadership, problem solving, decision making, governance, change, and learning; and surveys cases from three arenas (terrestrial, aquatic, and marine). The course takes a problem-oriented, contextual, and multi-method approach that offers students conceptual, practical, and professional benefits. It includes readings, lectures, discussions, workshops, exercises, oral presentations, guest speakers, individual and small-group assignments, and possibly a field trip and group project. In past years the course took a field trip to the Connecticut River system to evaluate region-wide conservation efforts, the Greater Yellowstone Ecosystem, the Grand Canyon Ecosystem. It also organized an international workshop focused on the Yellowstone to Yukon initiative, and assisted a major U.S. NGO plan for transboundary projects along the U.S.-Canadian border. Extensive student participation is required throughout. Susan G. Clark]

F&ES 965b/ANTH 598b, Advanced Readings: Social Science of Development and Conservation 3 credits. An advanced seminar on the social science theory of sustainable development and conservation, designed as an M.E.M. capstone course and to provide theory for M.E.Sc. and doctoral students to use to place their own work in a wider theoretical context in analyzing and writing up their research. The course traces the conceptual history of the social science theory of sustainable development and conservation, focusing on theories of discursive power, governmentality, and capitalism. It examines relations between these theories, alternative theories, and how this history influences the field. The course covers the works of Michel Foucault most relevant to development and conservation, important social scientists who have used Foucault's ideas (e.g., James Ferguson, Arturo Escobar, Timothy Mitchell, Tania Li, Donald Moore), alternative theories of power (e.g., James Scott, Bruno Latour), applications of Foucault's ideas to development (selections change every year), applications of Foucault's ideas to the environment (especially Arun Agrawal, Timothy Luke, Bruce Braun), theories of

resistance (Michel Foucault, James Scott, and others), Foucauldian views of the economy, capitalism, and governmentality (Aiwa Ong, Anna Tsing), and other views of capitalism (Tania Li, James Ferguson, Timothy Mitchell). Students are expected to use the course to develop, and present in class, their own research and writing. Prerequisite: F&ES 839a, 877a, or 882b. Three hours lecture/seminar. Enrollment limited to twelve. Carol Carpenter

F&ES 966b, The Entrepreneurial Approach to Environmental Problem Solving 3 credits. This course provides a format for students ready to develop entrepreneurial plans for specific environmental businesses. There are two aspects to any business: knowing the technical subject, and understanding the business environment. It is assumed that students have a background in both aspects, and this course is to enable the students to work in groups to "flesh out" a business. The course has regular meetings, but much of the work—and reporting—is done by the students, with advice and input from the faculty and others at Yale and in the business world. The course (and its prerequisite) may be used in conjunction with competing for the Sabin Prize. Prerequisite: F&ES 657b. Chadwick D. Oliver

[**F&ES 967a, Biodiversity Conservation and Climate Adaptation** 3 credits. This capstone course provides a hands-on opportunity for students to apply skills and knowledge of biodiversity conservation to assess the effects of climate on New England biodiversity. The course teaches students how to use that insight to help land use practitioners and policymakers achieve effective and scientifically defensible adaptation strategies based on the best current approaches to wildlife and habitat conservation assessments, with the general purpose being to enhance the effectiveness of policy decisions related to wildlife and habitat preservation, climate change adaptation, and compatible land use. Students wishing to take this course need to have prior course preparation in ecological and landscape science, climate science, GIS, remote sensing, and geospatial data analysis. Next offered in fall 2012; students need to sign up for the course in spring 2012. Oswald J. Schmitz]

Ecology

ECOSYSTEM ECOLOGY

F&ES 730a/330a/E&EB 330a/EVST 330a, Ecosystem Ecology 3 credits. An outdoors, hands-on overview of the study of ecosystems, how the structure of ecosystems develops (e.g., biodiversity), and how ecosystems function (e.g., process nutrients or pollutants), with focus on the impact of global changes—such as climate change and eutrophication—on ecosystem structure and function. Field-based group and independent projects are carried out on New England ecosystems. Melinda Smith

[**F&ES 731b, Tropical Field Botany** 3 credits. This course teaches students how to identify the most important tropical plant families, with an emphasis on woody taxa. Students learn key characteristics for identification. We concentrate on families that have high economic, ecological, or ethnobotanical importance. We also discuss distribution, habitat, and ecology. The course has a strong practical component, and instructors emphasize vegetative characters to identify families and higher-level taxa. The course includes a

two-week field trip to Costa Rica over spring break. NYBG Faculty: Lawrence Kelly, Fabian Michelangeli]

F&ES 732a, Tropical Forest Ecology: The Basis for Conservation and Management 3 credits. This course summarizes ecological knowledge on tropical forest ecosystems and shows how this scientific basis can be used for forest management, conservation, and rehabilitation. Topics include importance of tropical forests: productive and environmental services; ecological characteristics of tropical forests; soils of the tropics: types, fertility, physical properties, and management; nutrient cycling; natural forest structure and composition; the forest microenvironment: light, temperature, and water; tree growth and reproductive ecology; plant species diversity; plant-animal interactions; effects of disturbance; forest succession and regeneration; high-elevation forests and savannas; management of primary and secondary forests; nontimber forest products; plantation forestry: productivity and environmental services; community forestry; ecological and social aspects of agroforestry; rehabilitation of degraded tropical forest ecosystems. In addition, seminar presentations by students deal with particular aspects of tropical forest ecology/conservation/management of interest to students. This course has no prerequisites. Background in ecology or forestry is useful but not indispensable. Yale undergraduate students can take it with permission of the instructor. Three hours lecture. Florencia Montagnini

[**F&ES 733b, Ecosystem Pattern and Process** 3 credits. Lectures on and discussions of ecosystem ecology and biogeochemistry. Topics cover the structure and functioning of ecological systems, their response to changing environmental conditions, and management of these responses and their consequences. The class covers both terrestrial and marine/aquatic systems. Prerequisites: F&ES 500a and 515a, or permission of the instructor. Peter A. Raymond]

F&ES 734a, Biological Oceanography 3 credits. Exploration of a range of coastal and pelagic ecosystems. Relationships between biological systems and the physical processes that control the movements of water and productivity of marine systems. Anthropogenic impacts on oceans, such as the effects of fishing and climate change. Includes three Friday field trips. Recommended prerequisite: college-level biology or ecology course. Three hours lecture. Enrollment limited to fifteen. Mary Beth Decker

F&ES 735a, Biogeography and Conservation 3 credits. This course is designed to apply the principles of systematics to historic and ecological biogeography and in turn apply these to the conservation of biodiversity. In doing so, consideration is given to the circumscription of terrestrial biomes and speciation and extinction models. Reconstruction of past geologic and climatic events as well as the impact of human activities is related to the current distribution of the biota. The use of this information as related to CITES legislation and the development of IUCN Action Plans is explored through case studies. Dennis W. Stevenson

F&ES 741b, Introduction to Indigenous Silviculture 3 credits. The course examines small-holder management systems in the tropics from several different perspectives. A brief overview of tropical forest ecology is provided first, with an emphasis on the factors that limit the nature and intensity of resource use. An analysis of silviculture as applied

forest ecology follows, together with a description of the major silvicultural systems employed commercially throughout the world. The distinct operational and contextual differences between conventional and indigenous forms of forest management are presented, and the three main types of indigenous silvicultural practice are defined and described in detail. Examples from Asia, Central America, South America, and Africa are provided to illustrate each system. The relative economic, social, and ecological benefits of community forest management are discussed in detail, and the major constraints to a greater acceptance and application of the "conservation through sustainable use" paradigm are highlighted. A selection of case studies is used to examine existing policies that regulate the use, management, and trade of forest resources by local communities. A final lecture and discussion weave together these themes to assess the overall potential of managed landscapes as a viable conservation strategy. Charles M. Peters

WILDLIFE ECOLOGY AND CONSERVATION BIOLOGY

[**F&ES 736b, Ecology Seminar** 1 credit. The ability to read and understand the literature is a critical skill. This seminar is structured to encourage participation in discussions of papers from the ecological literature. The specific papers to be read vary from year to year; however, each year we focus on papers that have made major contributions to the conceptual foundations of ecology. Many of the papers have direct or indirect relevance to applied issues such as the conservation of species and ecosystems. Seminar responsibilities include active participation in weekly meetings and the leadership of one discussion. David K. Skelly]

[**F&ES 738a/E&EB 370a/670a, Aquatic Ecology** 4 credits. An intensive introduction to the ecology of populations and communities in freshwater systems. The aim of this class is to learn the concepts, patterns, and organisms important in lakes and streams along with the major techniques of information collection and analysis. Weekly field trips are used to gather data that form the basis of lab exercises and research projects. The course presumes familiarity with ecological concepts and terminology. Permission of the instructor required. David K. Skelly]

F&ES 739b, Species and Ecosystem Conservation: An Interdisciplinary Approach 3 credits. The loss of global biodiversity is a major problem with profound repercussions for present and future human generations. Professional conservationists now living are the last generation that can prevent the extinction of large numbers of species and the disruption of large-scale ecosystem processes. Professionals must not only apply relevant conservation sciences to these problems, but also bring to bear explicit knowledge about the real-world organizational and policy settings in which they will work and expert skills in influencing those systems. The course combines the problem-solving approaches of the conservation sciences with those of the policy sciences by surveying a range of policy and organizational contexts, theories, techniques, and professional settings using a variety of case studies. We typically have guests who focus on contemporary challenges and offer successful cases from their own experience. Students learn an interdisciplinary analytic framework and apply it to a case of their choice. The role and problem-solving styles of the individual professional in these complex contexts are emphasized. Students must keep a journal. Active student participation is required, as well as a presentation and a paper. The course positions students to work for many nongovernmental, governmental,

and business organizations, assuming leadership and problem-solving positions. Enrollment limited to sixteen; application required. Susan G. Clark

F&ES 740b, Dynamics of Ecological Systems 3 credits. The course provides students in-depth understanding of theory on multiple species interactions and dynamics including predation, competition, food chain, and food web interactions. Considerable emphasis is placed on mathematical modeling to formalize ideas about how species interactions structure ecological communities and to specify the appropriate focus of empirical research, study design, and data gathering. The course addresses contemporary issues in community and ecosystem ecology including scaling from individual behavior to community and ecosystem dynamics, the link between biodiversity and system stability, alternative dynamic regimes, spatially extended systems, and metacommunities. A course in calculus is recommended. Oswald J. Schmitz

ENVIRONMENTAL EDUCATION AND COMMUNICATION

F&ES 745a, Environmental Writing 1 credit, half term, or 3 credits, full term. Students in this course should plan to produce one full-length article, 3,000 to 4,000 words, that could appear in a wide-circulation magazine such as *Audubon, Orion, Sierra,* or *The New Yorker*. One-credit students begin a potentially publishable article; three-credit students complete a publishable article. Admission is by application, which must include a proposed writing topic, at the beginning of the term. For information on applying, please see the course information at https://webspace.yale.edu/fes745a. Three hours seminar and writing workshops. Enrollment limited to fifteen. Fred Strebeigh

F&ES 746a, Archetypes and the Environment 3 credits. This course explores the mythologies, literatures, arts, and folklore of a variety of cultures in search of archetypal characters whose role is to mediate between nature and society. Beginning with sources as early as *The Epic of Gilgamesh* and ending with contemporary film and media, the course seeks to examine and understand the ways in which diverse peoples integrate an awareness of their traditional and popular arts and cultures. The course makes use of works from a variety of languages, including Akkadian, Greek, Tibetan, Bhutanese, Chinese, German, French, and Italian, but all readings are available in English; students with reading abilities in foreign languages will be encouraged to examine primary sources wherever possible. The course includes visits to the Beinecke Rare Book and Manuscript Library, the Yale Center for British Art, and the Yale Art Gallery. Three hours lecture/discussion. Paul A. Draghi

F&ES 747a, Global Communication Skills 3 credits. This course helps students to sharpen their language and strategy in professional communication. Course topics include accent reduction, language accuracy, writing styles, presentation skills, meeting leadership, barriers to communication, and types of persuasion in multicultural contexts. We first address aspects of intelligibility, exploring how improved word choices and speech clarity affect audience understanding. We then look at the problem of comprehension and discuss strategies for increasing the student's ability to listen accurately and read efficiently. We also examine common difficulties and cultural differences in the arrangement of information, use of evidence, and academic argumentation. Several sessions are devoted to specific skills, such as negotiating agreements and writing research reports.

The course meets for lecture (two hours), and students attend a weekly small group practicum (one hour). The practicum allows students to reinforce new communicative behaviors in oral and written assignments, while receiving feedback from peers and the instructor. As students polish their skills, they improve their ability to express ideas and to interact in both academic and professional contexts. William A. Vance

F&ES 900a, Doctoral Student Seminar 3 credits. This course provides an introduction to doctoral study at the School of Forestry & Environmental Studies. Students attend the F&ES seminar each week and then meet with the seminar speakers after their presentations. Weekly assigned readings support these discussions, which are used as a foundation to explore diverse approaches to formulating and addressing research questions. Students also work with their advisers to design an assignment to be completed during the term. Students may choose to write and submit a fellowship application (e.g., to NSF or EPA), carry out a literature review, or develop a collaborative research project. Students present their embryonic research ideas in class and use feedback from the group to further develop their ideas. Required of all doctoral students in their first term. David K. Skelly

Forestry

FOREST BIOLOGY

F&ES 650b, Fire: Science and Policy 3 credits. This course examines the ecological, social, and policy implications of forest and grassland fire. Topics include the historical and cultural role of fire, fire behavior, fire regimes, fire ecology, the use of fire in ecosystem restoration, fire policy in the United States and elsewhere, and controversies around suppressing fires and post-fire rehabilitation practices. Conditions permitting, the course also involves implementing a prescribed fire to achieve management goals in restoring meadow and oak savanna at Yale Myers Forest. Ann E. Camp

[**F&ES 651b, Forest Ecosystem Health** 3 credits. This course is an introduction to the biotic and abiotic agents affecting the health of forest ecosystems, including insects, pathogens, parasites, exotic invasive species, climate change, and acid deposition. The course emphasizes the ecological roles played by these agents, discusses how they affect the sustainability of forest ecosystems, and identifies when and how management can be used to return forests to healthier conditions. The course provides students with the necessary background to determine if stressors are negatively impacting management objectives, to identify the probable stress agents, and to decide what, if any, actions should be initiated to protect forests from further damage. The course includes several field trips. Ann E. Camp]

F&ES 652b, Seminar in Ecological Restoration 3 credits. The purpose of this course is to summarize theoretical and practical ecological knowledge on how to restore or rehabilitate degraded landscapes. Degraded landscapes usually exist in a complex mosaic that is constantly changing. Each of these conditions has characteristics that must be taken into account when developing restoration strategies. Topics include: Concepts and principles of ecological restoration. Types of disturbances. Strategies for rehabilitation of soil's physical and chemical properties. Plantations as catalysts of forest succession in degraded landscapes. Agroforestry systems as a tool for recovery and conservation

of biodiversity in managed landscapes. Biological and economic enrichment of overlogged and secondary forests. Mechanisms of pasture degradation and techniques to aid in pasture sustainability. Reforestation of degraded lands: productivity and preferences by farmers. Reclamation of mine spoils. Restoration of inland and coastal wetlands; mangroves. Techniques to control invasive species. Reclamation after fire. Who does restoration? Community participation and challenges to implementation of restoration projects. Monitoring and evaluation of restoration projects. In addition, seminar presentations by visitors and students deal with particular aspects of restoration. Three hours lecture; three field trips. Florencia Montagnini

[**F&ES 653b, Agroforestry Systems: Productivity, Environmental Services, and Rural Development** 3 credits. The course focuses on factors influencing sustainability of agroforestry systems, the role of agroforestry in rural development, and the environmental services that agroforestry can provide, such as biodiversity conservation, carbon sequestration, restoration of degraded ecosystems, and mitigation of climate change. We start by learning the principles needed to understand agroforestry systems: environmental variables in agroforestry (light and water); soil productivity and sustainability in agroforestry; nutrient cycling and nutrient use efficiency. Then we learn how to design agroforestry systems: agroforestry components: multiple-purpose trees; nitrogen-fixing trees; economic aspects. Examples of subsistence-oriented and commercial agroforestry: shifting agriculture and improved fallows, home gardens, alley-cropping, and silvopastoral systems. Specific types of agroforestry are more widely practiced, responding to ecological and socioeconomic conditions of each region: semi-arid ecosystems; highlands; temperate regions. Finally we focus on the functions that agroforestry can provide: environmental services: biodiversity conservation and carbon storage; climate mitigation; social functions: agroforestry as a tool for rural development; agroforestry and fuelwood production; current trends in agroforestry research and extension. In addition, seminar presentations by guest speakers and students deal with particular aspects of agroforestry of interest to students. Three hours lecture; two or three half-day field trips. Offered alternate years. Florencia Montagnini]

F&ES 654a/MCDB 660a, Structure, Function, and Development of Trees and Other Vascular Plants 3 credits. This course focuses on two aspects of plant life: (1) basic processes that drive plant systems, such as fertilization, embryogeny, seed development, germination, seedling establishment, maturation, and senescence; and (2) basic structure and function of plants (such as root systems, leaf formation and development, height, and diameter growth). Differences between different groups of seed plants are analyzed from structural, functional, ecological, and evolutionary standpoints. Special attention is given to woody plants and their importance in the biosphere and human life. Coverage includes tropical, temperate, and boreal trees. Plant biology is discussed in the context of physiological and structural adaptations in terms of strength, storage, and water and solute transport. Prerequisite: general biology or botany or the equivalent, or permission of the instructor. Graeme P. Berlyn

F&ES 655b, Research Methods of the Anatomy and Physiology of Trees 4 credits. Advanced investigative techniques with emphasis on instrumentation, experimental

design, execution, and analyses. After a series of class experiments and demonstrations are completed, each student selects a personal project under the direction of the instructor and prepares a minidissertation complete with literature review, materials and methods, results, and discussion. Weekly seminars and progress reports on the projects are required. Prerequisites: F&ES 654a and 656b and permission of the instructor. Four hours lecture/laboratory. Limited enrollment. Graeme P. Berlyn

F&ES 656b, Physiology of Trees and Forests 3 credits. Mineral nutrition and cycling; mycorrhizas; symbiosis; nitrogen fixation; light processing, photosynthesis, respiration; water relations including transpiration; ecophysiology. Effects of climate changes, past and present, on forests and other current topics are also considred. Term paper required. Prerequisite: F&ES 654a or permission of the instructor. Graeme P. Berlyn

F&ES 671a, Natural History and Taxonomy of Trees 3 credits. Knowledge of tree species and the evolutionary and ecological relationships among them is essential to the study and management of forest ecosystems. This course provides an introduction to the systematics, evolution, biogeography, and autecology of woody plants, as well as patterns of human utilization (both modern and historical), with an emphasis on taxa of temperate North America. Regular field trips in the New Haven area as well as to the Yale Myers Forest acquaint students with the major species and habitats of southern New England forests. Ann E. Camp

FOREST MANAGEMENT

F&ES 630b, Global Resources, International Resource Exchanges, and the Environment 3 credits. See description under Integrative Frameworks.

F&ES 657a, Managing Resources 3 credits. Resource sustainability requires knowing how to "get things done" with resources, whether one's goal is policy, investment, or on-the-ground management. The challenge of resource management is knowing how to provide the many commodity and noncommodity objectives people demand from the terrestrial ecosystems across time and space. This management can be cost-effective and applicable to many places with the proper integration of management and social scientific knowledge. Students master the scientific basis, methods (and reasons for the methods), and techniques for management of various resources. The course covers managing an ecosystem with concerns about water, agriculture, grazing, wildlife, timber, recreation, people, and hazards of wind, fire, avalanche, and flood. The class examines the basic issues and describes tools and techniques for analyzing and managing. Case studies of specific areas are used for many of the analyses. The course covers systems concepts; decision analysis; area, volume, and other regulatory systems; silvicultural pathways; growth models; wind and fire hazard analyses; habitat and biodiversity analyses; carbon sequestration; payment for ecosystem services; cash flow; operations scheduling; portfolio management; monitoring; and continuous quality improvement and adaptive management. Class includes lectures and exercises in which students integrate these subjects. Chadwick D. Oliver

F&ES 659b, Principles in Applied Ecology: The Practice of Silviculture 4 credits. The scientific principles and techniques of controlling, protecting, and restoring the

regeneration, composition, and growth of natural forest vegetation and its plantation analogs worldwide. Analysis of biological and socioeconomic problems affecting specific forest stands and design of silvicultural systems to solve these problems. Applications are discussed for management of wildlife habitat, bioenergy and carbon sequestration, water resources, urban environments, timber and nontimber products, and landscape design. Recommended: some knowledge of soils, ecology, plant physiology, human behavior, and resource economics. Four to six hours lecture. One hour tutorial. Seven days fieldwork. Mark S. Ashton

F&ES 660a, Forest Dynamics: Growth and Development of Forest Stands 3 credits. This course introduces the study of forest stand dynamics – how the structure and composition of different forest types change over time (from regeneration to old growth). Understanding the dynamic nature of forest stands is important for creating and maintaining a variety of critical wildlife habitats on the landscape, managing for sustainable supplies of wood products and other forest values, or predicting the risks and managing the effects of natural and anthropogenic disturbances. Through lectures, discussions, and field trips we explore forest development processes and pathways, concentrating on the biological mechanisms driving forest structural change and the roles of natural and human disturbances in initiating and altering stand development trajectories. We make use of New England forests as living laboratories, while discussing how similar patterns and processes of forest development are played out in forests around the globe. Ann E. Camp

[**F&ES 661b, Analysis of Silvicultural Problems** 3 credits. This course considers selected topics in silviculture or silviculture-related issues. It explores the silvicultural options for stands using field examples. Problems can be both biological (fire, pathogens) and social (multiple value conflicts, property rights). Solutions are sought through synthesis and analysis of relevant literature and from field data for case studies that are written up as prescriptions. Quantitative silvicultural and economic techniques are used for comparative evaluation of solutions. Prerequisites: F&ES 659b or 660a; F&ES 804a; or permission of the instructor. Mark S. Ashton]

F&ES 663b, Invasive Species: Ecology, Policy, and Management 3 credits. Invasive species are disrupting both ecosystems and economies at all scales from local to global. A clear understanding of the nature of the problem, the ecology and biology of the invasive species, the influence of globalization of trade, and advances in management strategies is critical for land managers, scientists, and policymakers. In this lecture/discussion/seminar we focus on current issues surrounding invasive species (both plants and animals) at various spatial and temporal scales in terrestrial, aquatic, and marine ecosystems. Emphasis is on the biology and ecology of invasive species along with a basic understanding of their economic impacts and public policy options to address prevention and management of invasive species. The course includes several local field trips with scientists and land managers. Ann E. Camp, Mary Tyrrell

F&ES 667b, Rapid Assessments in Forest Conservation 3 credits. An advanced interdisciplinary course concerned with assessing the protection and management of biologically diverse, complex forested ecosystems that produce various goods and services.

Examples of independent case analyses concern landscape management of biogeographic regions in the Pacific Northwest, Ecuador, Costa Rica, Venezuela, Belize, central and southern Mexico, and the Panama Canal Watersheds. Students are encouraged to travel on extended class field trips to these regions. Prerequisites: F&ES 659b or 660a; F&ES 804a; or permission of the instructor. Three hours lecture. Eight days fieldwork. Limited enrollment. Mark S. Ashton

F&ES 668b, Field Trips in Forest Resource Management and Silviculture 1 credit. Seven- to twelve-day field trips to study the silviculture and forest management of particular forest regions. In previous years, classes have visited Slovenia, Germany, Austria, the United Kingdom, British Columbia, and, in the United States, the southern Coastal Plain and Piedmont, and the Allegheny, Appalachian, Adirondack, and Green mountains. Mark S. Ashton

F&ES 669b, Forest Management Operations for Professional Foresters 2 or 3 credits. The operational aspects of managing forestland are taught, including topics essential to the professional practice of forest management. Operational aspects of regeneration, intermediate tending, and harvesting (planning, layout, implementation, and post-operation evaluation), best management practices, regulatory and wetlands considerations, and socioeconomic dimensions of field operations are the focus. The ethical and professional responsibilities of forest managers who are responsible for land-altering activities are also considered. The course includes considerable field time to help students utilize their existing knowledge about forests to rapidly assess stands and land parcels with respect to the planning and implementation of on-the-ground treatments. Classes feature local field trips to view forestry operations and to develop and refine field skills. Prerequisites include any silviculture courses. Optional: students can choose to participate in the Southern Forest and Forestry Field Trip for 1 additional credit. Michael Ferrucci

F&ES 670b, Southern Forest and Forestry Field Trip This course augments our forestry curriculum by providing a forum for viewing and discussing forestry and forest management with practitioners. The trip provides forestry and other interested students with an opportunity to experience the diversity of forested ecosystems and ownership objectives ranging from intensively managed pine plantations to restoration and protection of endangered habitats. Students discuss forest management issues—including forest health, fragmentation, policy, law, and business perspectives—with landowners and managers from large industries, nonindustrial private landowners, TIMOs, federal and state land managers, NGOs, and forestry consultants. We also tour sawmills, paper mills, and other kinds of forest products processing facilities, active logging operations, and, weather permitting, participate on prescribed fires. Not least, we experience the unique cultures, food, and hospitality of the southeastern United States. The course can be taken for 1 credit by any student at F&ES or combined with the 2-credit Forest Operations course for 3 credits. Ann E. Camp

F&ES 680a, Forest and Ecosystem Finance 3 credits. Understanding the tools used in financial analysis is an important component of successful forestland investment and forest management decision making. Moreover, as new ecosystem services markets develop,

these skills become even more critical in determining those management strategies that are both ecologically sound *and* financially viable. This course provides students with a basic suite of financial tools used in the acquisition and management of forestland/timber as well as in the management of ecosystem services. It includes an overview of traditional financial analysis metrics used in land acquisition, timber management, and risk management. It also applies these metrics in ecosystem services markets, which allows students to assess the financial impacts of various management choices. Concepts are reinforced through spreadsheet-based exercises and case studies. Prerequisite: F&ES 578b or permission of the instructor. Deborah Spalding

Physical Sciences

ATMOSPHERIC SCIENCES

F&ES 700b, Alpine, Arctic, and Boreal Ecosystems Seminar 3 credits. Biogeoclimatic analysis of arctic, alpine, and boreal ecosystems worldwide with special attention to biogeography, biometeorology, physiology, histology, morphology, autecology, and silviculture of high-elevation and high-latitude forests through lectures, guest lectures and discussions, student seminars, and field experience. Student contributions are one or more seminars and a term paper. Prerequisite: F&ES 656b, or permission of the instructors. One and one-half hours lecture. Graeme P. Berlyn, Ann E. Camp, Xuhui Lee, Mark S. Ashton

[**F&ES 702b, Climate Change Seminar** 2–3 credits. An advanced seminar that explores current topics in global climate change, including scientific evidence for global warming, climate change impacts on natural ecosystems and the human society, and policy and management options for mitigating climate change. Meetings are divided between student presentation, invited lecture, and panel debate on selected hot issues. Preference is given to second-year students, but first-year students with background and interest in the subject area are also encouraged to participate. Presentation/literature critique/term paper. Prerequisite: F&ES 703b or F&ES 704a. Xuhui Lee]

F&ES 703b, Climate and Life 3 credits. A descriptive overview of the earth's atmospheric environment. The basic principles of climatology and meteorology and their application to the environment are discussed. Topics include climate elements, energy flow in the atmosphere, atmospheric motions, effect on agricultural systems, climatological impact on forest resources and animal habitats, urban climate, human bioclimatology, air quality, air resources (wind and solar energy), and climate change. Three hours lecture. Problem sets. Group project. Xuhui Lee

F&ES 704a, A Biological Perspective of Global Change 3 credits. The course aims to promote understanding of the interface between major aspects of global change and the biospheric systems. Special attention is given to the biological significance of ozone layer depletion, anthropogenic and natural causes of photochemical smog, acid rain, sources and sinks of greenhouse gases, and impact of global warming on the terrestrial biosphere. Also discussed are global and national inventories of various source categories and methods for arriving at such inventories. Three hours lecture and discussion. Term paper/presentation/literature critique. Xuhui Lee

[**F&ES 705b, Climate and Air Pollution** 3 credits. In this seminar, we review current scientific understanding of the linkages between climate change and air pollution. Topics include short-lived climate forcers, climate sensitivity, impact of air pollution control measures on climate, geo-engineering and solar radiation management, metrics used in climate policy, and future climate change impacts on air quality in the United States and other regions. Active student participation is required. Meetings are divided between lecture, student presentation, structured discussion, and invited outside speakers. The course includes a group project to develop plausible multi-pollutant climate mitigation strategies that address key sectors in different world regions. Nadine Unger]

F&ES 722b, Boundary Layer Meteorology 3 credits. This course examines the interactions between the atmosphere and the earth's surface. Students gain an understanding of the surface energy and radiation balance, air motion in the atmospheric boundary layer, land surface parameterization for climate models, and field research methods. Three hours lecture and discussion. Data analysis/term paper/presentation. Permission of the instructor required. Xuhui Lee

F&ES 771a, Climate Modeling 3 credits. This course teaches the fundamentals of climate modeling. Students learn how to run models and apply them to research problems. Class meetings are composed of lectures, discussions, and hands-on experience using EdGCM and a NASA climate model developed for the forthcoming Intergovernmental Panel on Climate Change Fifth Assessment Report. Nadine Unger

ENVIRONMENTAL CHEMISTRY

[**F&ES 706b, Organic Pollutants in the Environment** 3 credits. An overview of the pollution problems posed by toxic organic chemicals, including petroleum, pesticides, PCBs, dioxins, chlorinated solvents, and emerging contaminants. Processes governing the environmental fate of organic pollutants, e.g., evaporation, bioconcentration, sorption, biodegradation. Technologies for prevention and remediation of organic pollution. Shimon C. Anisfeld]

F&ES 707b/344b/ENAS 640b, Aquatic Chemistry 4 credits. A detailed examination of the principles governing chemical reactions in water. Emphasis on developing the ability to predict the aqueous chemistry of natural, engineered, and perturbed systems based on a knowledge of their biogeochemical setting. Calculation of quantitative solutions to chemical equilibria. Focus on inorganic chemistry. Topics include elementary thermodynamics, acid-base equilibria, alkalinity, speciation, solubility, mineral stability, redox chemistry, and surface complexation reactions. Prerequisites: general chemistry, algebra, and F&ES 708a or equivalent. Three hours lecture, weekly problem sets. Gaboury Benoit

F&ES 708a, Biogeochemistry and Pollution 3 credits. A descriptive overview of baseline biogeochemistry and the nature and behavior of pollutants in the environment. The course is designed to aid future environmental professionals who sometimes may find it necessary to make decisions based on chemical data. It is geared to the nonspecialist who needs to establish familiarity with various classes of pollutants and the chemical, biological, and physical processes that control their transport and fate. Topics include the fundamental classes of chemical reactions in the environment, critical analysis of chemical data, sampling techniques, analytical methods, natural biogeochemical controls

on environmental chemistry, as well as detailed examination of contaminants of special interest like acid precipitation, nutrients, and sewage. Recommended: college-level general chemistry. Three hours lecture. One class project, problem sets, midterm, final exam. Optional field trips. Gaboury Benoit

F&ES 743a/443a, Environmental Chemical Analysis 3 credits. An overview of techniques and instrumentation used for the chemical analysis of environmental samples. Theory is taught together with hands-on practical skills through a combination of weekly lectures and labs. Focus is on the principles for quantitative analysis of nutrients, major ions, trace metals, and trace organics. Techniques include titrations, spectrophotometry, chromatography, spectroscopy, and electrochemistry. The analysis procedures are relevant to water, soil, sediment, plants, and air analysis. Individuals currently engaged in or interested in lab-based research should benefit most from the course. Enrollment limited to twelve. Two hours lecture and three hours lab. Prerequisites: CHEM 113/114 or equivalent. Helmut Ernstberger

F&ES 773a/CENG 373a/ENVE 373a, Air Pollution (Chemical Engineering Department) 3 credits. Kinetics, thermodynamics, and transport of chemical reactions of common air pollutants including suspended particulate matter. The role of surface chemistry and transport phenomena in air pollution. Pollutant dispersion modeling. Technology available to prevent or control air pollutants is discussed in conjunction with their physics, chemistry, and design and performance characteristics. Prerequisite: CENG 210a or permission of the instructor. Yehia F. Khalil

F&ES 777b/CENG 377b/ENVE 377b, Water Quality Control 3 credits. Study of the preparation of water for domestic and other uses and treatment of wastewater for recycling or discharge to the environment. Topics include processes for removal of organics and inorganics, regulation of dissolved oxygen, and techniques such as ion exchange, electrodialysis, reverse osmosis, activated carbon adsorption, and biological methods. Prerequisite: CENG 210a or permission of the instructor. William Mitch

SOIL SCIENCE

[**F&ES 709a, Soil Science** 3 credits. Lectures and discussions of soil science, with emphasis on soil ecology. Topics cover the structure and functioning of soils, and how this relates to their responses and feedbacks to environmental changes. The class covers both natural and managed landscapes. Field trip with associated labs. Prerequisites: F&ES 500a and 515a, or permission of the instructor. Mark Bradford]

F&ES 723b, Seminar in Soil Conservation and Management 1, 2, or 3 credits. Soils are important to food security, providing food, fiber, and shelter for humans and terrestrial wildlife. Soils are also important sinks of atmospheric carbon, more so than the aboveground terrestrial vegetation for many types of ecosystems. Worldwide, soils are constantly impacted by unsustainable management practices in agriculture, forestry, and other human activities, as well as by climate change. However, sustainable techniques geared to increasing soil conservation can mitigate or reverse detrimental effects on soils. This is an advanced course in soil science, and enrolling students are expected to have sufficient background such as graduate or undergraduate courses in soil science. The

course offers one or two introductory lectures to refresh and update key concepts as needed: soil formation, classification, soil physical factors; organic matter and nutrients. The rest of the seminar is devoted to lectures and discussion sessions on more advanced topics, including rehabilitation of degraded soils through reforestation; soil sustainability in natural forest management and plantation forestry; soils as a sink for atmospheric carbon; carbon sequestration in pastures and forests; soil changes in shifting agriculture; soil changes during forest succession; soil productivity in agroforestry; soil erosion control; organic farming; mycorrhizae and organic biostimulants; wetland soils; urban soils; soil contaminants and bioremediation. Guest speakers include soil scientists from the USDA Natural Resources Conservation Service (NRCS) among others. We meet once a week for three hours. At each meeting, lectures are followed by discussion of relevant articles provided by the instructor or students. This class may be taken for one, two, or three credits. One-credit students attend all classes and seminars, and are expected to lead one discussion section. Two-credit students are expected to participate in lectures and discussions, lead a discussion session, and give an oral seminar on a relevant topic of interest. Three-credit students have similar requirements as two-credit students, and they write a term paper on a relevant subject of their choice. Field trips: wetlands (marshes) in Branford/Guilford, cattle farm, organic farm, among others. Prerequisite: undergraduate- or graduate-level soils courses. Florencia Montagnini

WATER RESOURCES

F&ES 710b, Coastal Governance 3 credits. Effective coastal management requires that an understanding of natural systems be incorporated into policy in a manner that reflects common values. This course describes policy frameworks and applies them to current topics. Examples are drawn from uses (energy development, wastewater treatment, wetland protection, dredging), from management techniques (spatial planning, protected areas), and from emerging practices in ecosystem-based management (watershed/bay systems, fisheries). Case studies focus on the use of information in policy design and execution. Sector-based and spatial management are contrasted with ecosystem-based management to demonstrate the content and effectiveness of different frameworks as well as their evolution in response to changes in society. F&ES 515a and 525a or equivalent knowledge recommended. Three hours seminar; term project. Richard Burroughs

F&ES 712b, Water Resource Management 3 credits. An intermediate-level exploration of water resource management at scales ranging from local to global. The course looks at multiple dimensions of the water crisis, including both human and ecosystem impacts, quantity and quality issues, and science and policy. Theory is illustrated through a variety of case studies. Topics covered include global water resources; flooding; water scarcity; residential, agricultural, and industrial water use; water and health; impacts of climate change and land use change; stormwater management; dams and other technologies for water management; human impacts on aquatic ecosystems; water and energy; water economics; water rights and water conflict and cooperation. Three hours lecture; several homework assignments; several field trips. Shimon C. Anisfeld

[**F&ES 713a, Coastal Ecosystems: Natural Processes and Anthropogenic Impacts** 3 credits. An examination of the natural processes controlling coastal ecosystems and

the anthropogenic threats to the health of these systems. Focus is primarily on tidal marshes and estuarine open-water systems. The course covers a wide range of important physical, chemical, and ecological processes, with greatest detail given to nutrient cycling, primary production, detrital pathways, and marsh accretion. Anthropogenic impacts covered range from local to global, and include nutrient enrichment, hypoxia, sea-level rise, invasive species, marsh drowning, and wetland filling. Three hours lecture, several field trips. Shimon C. Anisfeld]

[**F&ES 714b/ENAS 646b, Environmental Hydrology** 3 credits. Exploration of the roles of natural processes and anthropogenic activities in regulating the quantity, distribution, and chemical composition of the Earth's freshwater. Students gain exposure to theoretical and applied elements of surface and subsurface hydrology. The theory covered in the course focuses on hydrologic phenomena of societal and environmental importance, including stream-flow generation, wetland-water cycling, groundwater-flow dynamics, contaminant migration in surface and groundwater, and water use and redistribution by plants. Application of theory is accomplished through student use of hydrologic simulation models, which are expressions of theory and essential tools of water-resource management and assessment. Intended as a first course in scientific hydrology; appropriate for M.E.M., M.E.Sc., and Ph.D. students, as well as for advanced undergraduates. Because hydrology is a quantitative science, treatment of the course subject matter involves mathematics. F&ES 714b is designed for students who typically do not have previous course work in mathematics beyond one semester of college-level calculus. Students who have not completed a college-level calculus course can succeed in F&ES 714b provided that they are comfortable with arithmetic operations and algebra and are willing to learn a few, very basic principles of introductory calculus. Although students use hydrologic simulation models, the course does not involve any computer programming and requires no special computer skills. James E. Saiers]

F&ES 719a, River Processes and Restoration 3 credits. This course studies the geophysical processes of natural rivers with emphasis on qualitative and quantitative aspects of fluvial morphology; the course addresses channel dynamics, urban rivers, human impacts on rivers, and climate change. It also addresses restoration of degraded rivers, including dechannelization, dam removal, sediment transport, aquatic habitat improvements, and naturalistic design. Students learn to inspect, classify, identify, and measure river features. Quantitative analyses of river hydraulics and morphology are performed to predict river reactions to human activities and watershed change. The class includes class lectures, readings, problem sets, field labs, and a team project. A previous course in hydrology (F&ES 714b or equivalent) is recommended. James G. MacBroom

[**F&ES 724b, Watershed Cycles and Processes** 3 credits. This course explores abiotic and biotic controls on the cycling of water and chemicals within watershed systems. Students gain an understanding of the coupled roles of climate, hydrology, and biogeochemistry in regulating the fate of nutrients, carbon, and pollutants in watersheds. The class also features six guest lectures on issues at the forefront of watershed science. Upon successful completion of the course, students have acquired scientific knowledge that is relevant to interpreting watershed-based observations and to informing watershed-management decisions. Peter A. Raymond, James E. Saiers]

F&ES 729b, Caribbean Coastal Development: Cesium and CZM 3 credits. A field-intensive seminar exploring human-ecosystem interactions at the land-sea interface in the Caribbean, with St. Thomas, Virgin Islands, as the study site. Many tropical islands are undergoing rapid, uncontrolled development, placing severe local stress on several unique and vulnerable ecosystem types. In addition, human-induced environmental changes on scales up to global also impose stresses. This course examines the normal functioning of these ecosystems, scientific methods to evaluate and characterize ecosystem condition and processes, how human activities interfere with natural cycles in biophysical systems, and what management and policy tools can be applied to reduce impacts. An organizing framework for the course is the close coupling of coastal watersheds and adjacent marine ecosystems, especially coral reefs. A major part of the course is a one-week field trip to St. Thomas in the U.S. Virgin Islands during spring break. We also meet twice each week before the break to discuss readings and arrange logistics. Student presentations and projects. Class enrollment is limited to eight, and priority is given to F&ES students, with others admitted as space permits. Students are selected in December of the fall term. Gaboury Benoit

Quantitative and Research Methods

F&ES 550a/760a, Natural Science Research Methods 3 credits. The course prepares students to design and execute an intensive research project. It covers elementary principles and philosophy of science; research planning, including preparation, criticism, and oral presentation of study plans; communicating research findings; limitations of research techniques; the structure of research organizations; and professional scientific ethics. Oswald J. Schmitz

F&ES 551a, Social Science Qualitative Research Methods 3 credits. A broad introduction to issues of social sciences research methods and design. Emphasis in the readings and lectures is placed on qualitative methods such as interviews, participant observation, and participatory appraisal, although consideration is given to the ways that quantitative approaches can be used to support qualitative approaches to research. No prior knowledge of methodology or statistics is expected or assumed. The course is intended both for doctoral students who are in the beginning stage of their dissertation research, and for master's students developing research proposals for their thesis projects. The course covers the basic techniques for collecting, interpreting, and analyzing qualitative data. During the term we explore three interrelated dimensions of research. One focuses on the theoretical foundations of science and research, another focuses on the various methods available to researchers for data collection and analysis, and finally we complete exercises in the practical application of various methods. In the course we consciously address the unique nature of social science research within environmental studies. One significant premise underlies this class: some of the most important questions addressed in environmental studies have such complex solutions that traditional positivist scientific approaches have limited application. Amity Doolittle

F&ES 552b, Masters' Student Research Colloquium 1 credit. One of the most important aspects of scientific research involves the communication of research findings to the wider scientific community. Therefore, second-year M.E.Sc. and M.F.S. students are

required to present the results of their faculty-supervised research as participants in the Masters' Student Research Colloquium, a daylong event held near the end of the spring term. Student contributors participate by delivering a 15-minute oral presentation to the F&ES faculty and student body or by presenting a research poster in a session open to the F&ES community. Students receive a score of satisfactory completion for this effort. James E. Saiers

F&ES 725a, Remote Sensing of Land Cover and Land Use Change 3 credits. This is an advanced course on the use of satellite remote sensing to monitor terrestrial land use and land cover change. The course emphasizes digital image processing techniques to detect landscape dynamics using data from Landsat and Terra satellites. Topics include preprocessing data for change detection, accuracy assessment of change maps, and methodologies to detect changes such as urban expansion, deforestation, seasonal variations in vegetation, agricultural expansion, vegetation health, and wildfires. Prerequisite: F&ES 726b or permission of the instructor. Lecture and lab. Karen Seto

F&ES 726b/ARCG 762b/EMD 548b/G&G 562b, Remote Sensing of the Earth from Space 3 credits. Course topics include the spectrum of electromagnetic radiation, satellite-borne radiometers, data transmission and storage, computer image analysis, and merging satellite imagery with GIS. Applications to weather and climate, oceanography, surficial geology, ecology and epidemiology, forestry, agriculture, and watershed management. Preference to students in F&ES, Geology and Geophysics, Epidemiology, Anthropology, and Studies in the Environment. Prerequisites: college-level physics or chemistry, two courses in geology and natural science of the environment or equivalents, and computer literacy. Ronald B. Smith, Xuhui Lee, Mark S. Ashton, Karen Seto

[**F&ES 751a, Sampling Methodology and Practice** 3 credits. This course is intended to provide a fundamental understanding of the principles of statistical sampling, alternative estimators of population parameters, and the design basis for inference in survey sampling. Natural, ecological, and environmental resource applications of sampling are used to exemplify numerous sampling strategies. Sample designs to be studied include simple random; systematic; unequal probability, with and without replacement; stratified sampling; sampling with fixed-radius plots; horizontal point sampling; and line intercept. The Horvitz-Thompson, ratio, regression, and other estimators are introduced and used repeatedly throughout the course. Three hours lecture. Weekly and biweekly problem sets requiring the use of a computer spreadsheet. Timothy G. Gregoire]

F&ES 753b, Regression Modeling of Ecological and Environmental Data 3 credits. This course in applied statistics assists scientific researchers in the analysis and interpretation of observational and field data. After considering the notion of a random variable, a few frequently encountered discrete and continuous distributions are examined in greater detail, with specific emphasis on the Gaussian distribution and the role of the central limit theorem. The statistical properties of linear transformations and linear combinations of random data are established. The foregoing serves as a foundation for the major topics of the course, which explore the estimation and fitting of linear and nonlinear regression models to observed data. Prerequisite: a course in introductory statistics. Three hours lecture. Statistical computing with R, weekly problem exercises. Timothy G. Gregoire

F&ES 755b, Modeling Geographic Space 3 credits. An introduction to the conventions and capabilities of image-based (raster) geographic information systems (GIS) for the analysis and synthesis of spatial patterns and processes. In contrast to F&ES 756a, the course is oriented more toward the qualities of geographic space itself (e.g., proximity, density, or interspersion) than the discrete objects that may occupy such space (e.g., water bodies, land parcels, or structures). Three hours lecture, problem sets, one class project. No previous experience is required. Dana Tomlin

F&ES 756a, Modeling Geographic Objects 3 credits. This course offers a broad and practical introduction to the nature and use of drawing-based (vector) geographic information systems (GIS) for the preparation, interpretation, and presentation of digital cartographic data. In contrast to F&ES 755b, the course is oriented more toward discrete objects in geographical space (e.g., water bodies, land parcels, or structures) than the qualities of that space itself (e.g., proximity, density, or interspersion). Three hours lecture, problem sets, one class project. No previous experience is required. Dana Tomlin

[**F&ES 757b, Statistical Design of Experiments** 3 credits. Principles of design for planned experiments, coupled with methods of analysis of experimental data. The course is applications-oriented using the results of established theory. The nuances, strengths, and weaknesses of a number of classical designs are discussed. These include completely randomized design, block designs, and split plot designs. The analysis of data from these designs is treated at length. This course also deals with the question of sample size estimation. Students may use R or SAS for the completion of assignments. Prerequisite: a prior course in introductory statistics. Jonathan D. Reuning-Scherer or Timothy G. Gregoire]

F&ES 758b, Multivariate Statistical Analysis in the Environmental Sciences 3 credits. An introduction to the analysis of multivariate data. Topics include multivariate analysis of variance (MANOVA), principal components analysis, cluster analysis (hierarchical clustering, k-means), canonical correlation, multidimensional scaling ordination methods, discriminate analysis, and structural equations modeling. Emphasis is placed on practical application of multivariate techniques to a variety of natural and social examples in the environmental sciences. Students are required to select a dataset early in the term for use throughout the term. There are regular assignments and a final project. Extensive use of computers is required. Prerequisite: a prior course in introductory statistics. Three hours lecture/discussion. Jonathan D. Reuning-Scherer

[**F&ES 780a, Seminar in Forest Inventory** 2 credits. An advanced seminar that explores the design and implementation of forest inventory. Topics are varied to meet the interest of the class, but generally include the evolution and current status of broad regional and national inventories in the United States and abroad. Each week readings are assigned from primary sources that document the development of, and motivation for, various sampling methods for forest inventory. These include fixed and variable radius plot sampling, 3P sampling, double sampling for stratification in forest inventory, sampling with partial replacement, and line intersect sampling. Time and interest permitting, there is discussion of some newer, more specialized methods such as Monte Carlo methods and randomized branch sampling. A familiarity with the precepts and vernacular of

probability sampling or statistics is presumed. Prerequisite: F&ES 751a. Limited enrollment. Timothy G. Gregoire]

F&ES 781b, Applied Spatial Statistics 3 credits. An introduction to spatial statistical techniques with computer applications. Topics include spatial sampling, visualizing spatial data, quantifying spatial association and autocorrelation, interpolation methods, fitting variograms, kriging, and related modeling techniques for spatially correlated data. Examples are drawn from ecology, sociology, public health, and subjects proposed by students. Four to five lab/homework assignments and a final project. The class makes extensive use of the R programming language as well as ArcGIS. Timothy G. Gregoire, Jonathan D. Reuning-Scherer

Social Sciences

ECONOMICS

F&ES 802b, Valuing the Environment 3 credits. This quantitative course demonstrates alternative methods used to value environmental services. The course covers valuing pollution, ecosystems, and other natural resources. The focus of the course is on determining the "shadow price" of nonmarket resources that have no prices but yet are considered valuable by society. Taught every other year. Three hours lecture. Robert Mendelsohn

[**F&ES 803b, Green Markets: Voluntary and Information Approaches to Environmental Management** 3 credits. Two observations provide motivation for this seminar. First, voluntary and information-based approaches to environmental management are becoming increasingly common. Environmental managers should thus be familiar with the approaches, along with their advantages and limitations. Second, students, advocates, and managers are often searching for ways outside of formal regulatory contexts to promote more pro-environmental behavior. There exists a sizable academic literature on the subject, but rarely is it covered in courses on environmental management. Readings span economics, psychology, and political science. Class occasionally has a lecture format, but for the most part, we have structured discussion, rotating responsibility for presentation and critique. Matthew J. Kotchen]

[**F&ES 804a, Economics of Natural Resource Management** 3 credits. This course uses economic theory and empirical evidence to address nonrenewable resource extraction and renewable resource management. The course teaches students how to apply economics to real-world problems. The nonrenewable resource section focuses on how to consume a resource of limited size over time with applications to fossil fuels, metals, and minerals. The renewable resource section covers management of water, land, and ecosystems. Taught every other year. Prerequisite: F&ES 505a. Robert Mendelsohn]

F&ES 806b, Economics of Pollution Management 3 credits. This course uses economic theory, econometric evidence, and integrated assessment to address the broad issue of managing pollution. The course discusses both the source and consequence of pollution and identifies strategies to reduce the overall burden to society. The course covers air, water, and solid waste emissions. Air pollutants include threats to human health such as particulates, sulfur dioxide, and nitrogen oxides as well as greenhouse gases. Water pollutants include pathogens, fertilizers, and toxic chemicals. Solid waste includes

traditional household waste disposal as well as hazardous and radioactive wastes. Optimal strategies to manage both stationary source and nonpoint sources are addressed. Prerequisite: F&ES 505a. Robert Mendelsohn

[**F&ES 890a/MGT 820a, Energy Markets Strategy** 1.5 credits. In the past thirty years, energy markets have changed from quiet, often heavily regulated areas of the business landscape to some of the most dynamic markets in the world economy. Regulation of oil, natural gas, motor fuel, and electricity markets has been reduced dramatically in the United States and in many other countries. Electricity deregulation swept the industrialized and developing world, but it is now associated with the 2000–2001 California electricity crisis and the 2001–2002 Enron scandal. Oil prices have reached record levels with great uncertainty about where they are headed. Drawing on the tools of economics, we study the business and public policy issues that these changes have raised. Topics include the political economy of deregulation, competition in wholesale electricity markets, market power and antitrust, and the transportation of energy commodities. We examine the economic determinants of industry structure and evolution of competition among firms in these industries, investigate successful and unsuccessful strategies for entering new markets and competing in existing markets, and analyze the rationale for and effects of public policies in energy markets. Students play strategy games to learn about the oil and electricity industries. They simulate OPEC countries in the oil industry and for-profit firms in a restructured electricity market. The students solve for the collusive equilibria in the setting of a nonrenewable resource and develop their own strategies given that monitoring oil production is imperfect. They consider how to operate in electricity markets given that there are capacity constraints, inelastic demand, and lack of storage. Arthur Campbell]

[**F&ES 905b, Doctoral Seminar in Environmental Economics** 3 credits. This course critically examines a set of recent and also famous papers in environmental and resource economics. The purpose of each paper, its method, results, and conclusions are all discussed. The course is intended to prepare students for a career in economic research. Taught every other year. Robert Mendelsohn]

ENVIRONMENTAL POLICY

F&ES 807a/MGT 688a, Corporate Environmental Management and Strategy 3 credits. This course focuses on understanding how adroit environmental management and strategy can enhance business opportunities, reduce risk, promote cooperation, and decrease environmental impact. The course is divided into three broad areas: environmental management (within firms), environmental strategy (of firms and industries), and cooperative environmental business practices (across firms and with other stakeholders). The course combines weekly lectures on management theory, tools, and practice with class discussions of cases; legal and regulatory frameworks shaping the business-environment interface; and evolving requirements for business success. Marian R. Chertow, Stephen Ramsey

F&ES 814a, Energy Systems Analysis 3 credits. This lecture course offers a systems analysis approach to describe and explain the basics of energy systems, including all forms of energy (fossil and renewable), all sectors/activities of energy production/conversion,

and all energy end-uses, irrespective of the form of market transaction (commercial or noncommercial) or form of technology (traditional as well as novel advanced concepts) deployed. Students gain a comprehensive theoretical and empirical knowledge base from which to analyze energy-environmental issues as well as to participate effectively in policy debates. Special attention is given to introducing students to formal methods used to analyze energy systems or individual energy projects and also to discuss traditionally less-researched elements of energy systems (energy use in developing countries; energy densities and urban energy use; income, gender, and lifestyle differences in energy end-use patterns) in addition to currently dominant energy issues such as climate change. Active student participation is required, including completion of problem sets. Participation in extra-credit skill development exercises (presentations, fact-finding missions, etc.) is encouraged. Invited outside speakers complement topics covered in class. Arnulf Grubler

[**F&ES 815a, The New Corporate Social Responsibility: Public Problems, Private Solutions, and Strategic Responses** 3 credits. This seminar assesses the proliferation of policy innovations aimed at promoting and encouraging "corporate social responsibility" (CSR). We define CSR broadly to include the diverse range of self- and civil regulation, voluntary instruments, private authority, and non-state market driven (NSMD) initiatives that have emerged in the last fifteen years to engage firms directly, rather than working through traditional governmental process. Examples include firm-level initiatives, industry codes, product codes, third-party certification, ethical brands and labels, and "clean" investment funds. The course reviews the growing literature on these phenomena that now exists within political science, management, economics, sociology, environmental studies, and law. Our aim is to reflect on the broad array of scholarship on emergence and institutionalization of CSR innovations questions. While the class is interested in assessing the strategic advantage that CSR might bring firms, our emphasis is on whether, and how, CSR initiatives might address enduring policy problems where traditional governmental approaches have been ineffective. The course is organized into four components. First, we review and assess the different types of CSR or "private" policy instruments vying for firm-level support and distinguish them from traditional governmental mechanisms. Second, we discuss what is meant by "effectiveness" and the different ways of measuring success. Third, we assess the assumptions behind different theoretical frameworks about what types of CSR innovations firms are more likely to support, if any, and why. Fourth, we turn to empirical evidence to assess existing theories of support, and what this means for understanding support and effectiveness of CSR. This section draws on a variety of empirical methods including guest speakers from the world of CSR, analysis of large-N analyses on support, as well as detailed historical and comparative case studies. Benjamin Cashore]

F&ES 818a, Energy Technology Innovation 3 credits. This advanced seminar aims at providing essential knowledge as well as a forum for students to discuss energy technology innovation strategies and policies from a systemic perspective. The first half of the seminar provides basic knowledge on technological change in general and on energy technology innovation in particular from an interdisciplinary perspective, including history of technology, engineering, management science, systems theory, economics, and social sciences including diffusion theory. Focus is on introducing students to the

main patterns, drivers, policy leverages, and constraints in energy technology innovation systems. Core theoretical concepts introduced include *inter alia* technological inertia and lock-in, uncertainty, knowledge accumulation (learning) and depreciation, dynamic economic feedbacks like increasing returns to adoption, and knowledge and technology spillover effects. The second part of the seminar focuses on student-led discussions of selected case studies of energy technology innovation and/or policy approaches in both energy supply and energy end-use. Student proposals on case studies are welcome. Prerequisites: F&ES 814a, an equivalent of 3 credits of energy courses obtained outside F&ES, or two years professional experience in the energy industry including energy finance. Other highly motivated students, including undergraduates, can apply for admission through a motivational statement and a three-page summary of a relevant energy technology innovation publication chosen by the applicant. In order to maximize discourse possibilities and levels, enrollment limited to twelve. Arnulf Grubler

F&ES 819b, Strategies for Land Conservation 3 credits (or audit). This is a professional seminar on private land conservation strategies and techniques, with particular emphasis on the legal, financial, and management tools used in the United States. The seminar is built around presentations by guest speakers from land conservation organizations. Speakers are assigned topics across the land conservation spectrum, from identification of target sites, through the acquisition process, to ongoing stewardship of the land after the deal is done. The tools used to protect land are discussed, including the basics of real estate law, conservation finance, and project/organization management. Students are required to undertake a clinical project with a local land conservation organization. Enrollment limited to twenty; preference to second-year students if limit reached. Bradford S. Gentry

F&ES 820a, Land Use Law and Environmental Planning 3 credits. This course explores the regulation by local governments of land uses in urban, rural, and suburban areas and the effect of development on the natural environment. The course helps students understand, in a practical way, how the environment can be protected through effective regulation at the local level. It introduces students to federal, state, and regional laws and programs that affect watershed protection and to the laws that delegate to local governments primary responsibility for decision making in the land use field. Theories of federalism, regionalism, states' rights, and localism are studied. The history of the delegation of planning and land use authority to local governments is traced, leading to an examination of local land use practices particularly as they relate to controlling development in and around watershed areas. Course participants engage in empirical research working to identify, catalogue, and evaluate innovative local laws that successfully protect environmental functions and natural resources, and the manner in which towns, particularly on the coast, incorporate climate change into their planning and regulations. Nearby watersheds are used as a context for the students' understanding of the strengths and weaknesses of local planning and regulation. Attention is paid, in detail, to how the development of the land adversely affects natural resources and how these impacts can be mitigated through local planning and subsequent adoption of environmental regulations and regulations designed to promote sustainable development in a climate-changing world. The course includes examination of the state and local response

to climate change, sea-level rise, growth management, alternatives to Euclidean zoning, low-impact development, brownfields redevelopment, and innovative land use strategies. Marjorie Shansky

F&ES 821b, Private Investment and the Environment: Legal Foundations and Tools 3 credits. As environmental problems become harder to regulate and public funds available for environmental protection decline, more people are looking to private investment as a tool for improving environmental performance. This course explores the legal aspects of these initiatives, both opportunities and limits. It starts with an analysis of the goals of private investors—as a way to target efforts to change their decisions. It then moves to a review of the legal frameworks within which investors operate (property and tax law), as well as the legal tools that investors use to order their activities (contract law) and that governments use to address market failures (liability, regulation, information, and market mechanisms). The course concludes by examining efforts to use combinations of these legal tools to expand private investment in environmentally superior goods, services, and operations. Students are asked to use an issue about which they care as the focus for their class projects. Bradford S. Gentry

F&ES 824b/LAW 21033, Environmental Law and Policy 3 credits. Introduction to the legal requirements and policy underpinnings of the basic U.S. environmental laws, including the Clean Water Act, Clean Air Act, and various statutes governing waste, food safety, and toxic substances. This course examines and evaluates current approaches to pollution control and resource management as well as the "next generation" of regulatory strategies, including economic incentives and other market mechanisms, voluntary emissions reductions, and information disclosure requirements. Mechanisms for addressing environmental issues at the local, regional, and global levels are also considered. E.D. Elliott

F&ES 825a, International Environmental Law 3 credits. An introduction to public international law that both governs the global commons—atmosphere, climate, oceans, and stratospheric ozone layer—and guides the national obligations for ensuring transnational public health, advancing sustainable development, and managing the Earth's shared resources: sources of energy and renewable stocks of plants and animals, biodiversity, and ecosystems services. The course examines the emerging human rights to the environment, principles of international environmental law, and international duties for public participation in environmental decision making and access to justice. The major multilateral environmental agreements (MEAs) are studied, with examples of how States enact environmental law regimes to implement the MEAs. Decision-making procedures of United Nations agencies and other international and regional policy and legal decision-making bodies are critically examined. The main texts are a law school casebook, D. Hunter, D. Zaelke, and J. Salzman, *International Environmental Law and Policy* (Foundation Press, 2002), and the UN Environment Programme's commissioned restatement of this body of law, N.A. Robinson and L. Kurukulasuriya, *Manual on International Environmental Law* (UNEP, 2006). Nicholas A. Robinson

F&ES 826a, Foundations of Natural Resource Policy and Management 3 credits. This course offers an explicit interdisciplinary framework that is genuinely effective in practical

problem solving. It overcomes the routine ways of thinking and solving conservation problems common to many NGOs and government organizations by explicitly developing more rigorous and effective critical-thinking skills. It is genuinely interdisciplinary. By simultaneously addressing rational, political, and practical aspects of real-world problem solving, the course helps students understand and offer solutions to the policy problems of managing natural resources. The approach we use requires several things of students (or any problem solvers): that they be contextual in terms of social and decision-making processes; that they use multiple methods and epistemologies from any field that helps in understanding problems; that they strive to be both procedurally and substantively rational in their work; and, finally, that they be clear about their own standpoint relative to the problems at hand. The approach used in this course draws on the oldest and most comprehensive part of the modern policy analytic movement—the policy sciences (interdisciplinary method)—which is growing in its applications worldwide today. The course includes a mix of critical thinking, philosophical issues, history, as well as issues that students bring in. Among the topics covered are human rights, scientific management, decision making, community-based approaches, governance, common interest, sustainability, and professionalism. In their course work students apply the basic concepts and tools to a problem of their choice, circulating drafts of their papers to other seminar participants and lecturing on and leading discussions of their topics in class sessions. Papers of sufficient quality may be collected in a volume for publication. Active participation, reading, discussion, lectures, guests, and projects make up the course. The seminar supports and complements other courses in the School and at the University. Enrollment limited to sixteen; application required. Susan G. Clark

F&ES 828b, Comparative Environmental Law in Global Legal Systems 3 credits. This course examines environmental law in the various legal systems of the world—from the common and civil law traditions to socialist laws, customary law, and Islamic law. In particular, environmental law and case studies from a number of countries are examined, including Australia, Canada, China, Europe, New Zealand, the United States, Singapore, and the states of Southeast Asia. The objective is to understand the scope and evolution of national environmental law through the patterns of legislative, administrative, and judicial decision making in the various legal regimes. The systems of central/unitary governments are contrasted with those of federal systems. As corporations engage in the same manufacturing activities around the world, it is important that corporate managers and their legal advisers understand how these activities are regulated in the different legal systems. Additionally, as earth's natural systems are integrated throughout the biosphere, the effectiveness of one nation's environmental laws is complemented or undermined by the efficacy of another nation's comparable laws. Students are examined by a written paper that is a comparative study of some aspect of environmental law, involving at least two jurisdictions. Lye Lin Heng, Nicholas A. Robinson

F&ES 829b/245b/EVST 245b/PLSC 146b, International Environmental Policy and Governance 3 credits. The development of international environmental policy and the functioning of global environmental governance. Critical evaluation of theoretical claims in the literature, the reasoning of policymakers, the hypotheses of the instructor, and students' own suppositions. Introduction to analytical and theoretical tools used to examine

and assess environmental problems. An emphasis on climate, forestry, and fisheries as case studies. Designing innovative mechanisms for global environmental governance. Benjamin Cashore

F&ES 832a/MGT 618a, Entrepreneurial Business Planning 3 credits. Entrepreneurship is all about starting and running one's own business. In order to focus thinking and to help assemble the needed people and financial resources, many entrepreneurs write a business plan for their new venture. One of the best ways to learn how to write a business plan is to learn by doing—a real plan for a real new venture. The work is "hands-on," "learn by doing" in nature. Entrepreneurs should be flexible thinkers and highly motivated, with a large capacity for work. They must be persistent and able to thrive in an unstructured environment. Entrepreneurs should be confident self-starters with the ability to take the initiative, overcome obstacles, make things happen, and get things done. This course is for six teams of five students each, who want to write a business plan for their own real new start-up company. Students enter their plans in the Y50K Business Plan Contest sponsored by the Yale Entrepreneurial Society. The scope of the work includes doing in-depth market, product, and competitor research; creating a strategy for a sustainable business; and writing and presenting a professional-quality plan (including a financial model and deal structure). Enrollment limited to thirty, by permission of the instructors. Information session regarding the application process for this course: Thursday, September 15, 11:45 a.m.–12:45 p.m. in A74. David Cromwell, Maureen Burke

F&ES 834a,b/LAW 20316,21321, Environmental Protection Clinic 3 credits. A clinical program with weekly class sessions, alternating between seminars and project team meetings. The Environmental Law Clinic is designed to introduce students to several major environmental policy questions and a variety of methods of advocating for environmental improvement. Students work in small interdisciplinary teams (with students from the Law School and occasionally other parts of the Yale community), ten to twelve hours per week, for a single client organization, such as a local, national, or international environmental organization, a community group, or a local, state, or national governmental entity. Students work on a specific project or series of projects that involve environmental law and policy issues, and that may include litigation, drafting legislation, organizing community action, developing media campaigns, participating in stakeholder working groups, and developing policy proposals. Students may propose projects and client organizations, subject to approval by the instructor. Katherine Kennedy

F&ES 835a, Seminar on Land Use Planning 1 credit. Land use plans and the techniques used to implement them determine where development occurs on the American landscape. Planners play a key role in determining how the needs of the nation's growing population for housing and nonresidential development are accommodated and how natural resources and environmental functions are protected from the adverse impacts of land development. This course explores the multifaceted discipline of land use planning and its associated ecological implications, particularly related to climate change. Land use encompasses the interacting factors of land function, building design, and economic and community support. Strategic land use shrewdly identifies land purposes, incentivizes energy-efficient and climate-resilient structures, and harnesses community and

market support for effective land use decision making. In doing so, land use planning possesses the capacity to maximize utility while minimizing environmental damage. In this seminar, students learn from guest speakers and related readings. Speakers include professionals involved in sustainable development, land conservation, smart growth, and climate change adaptive planning. Each session focuses on a different issue that significantly influences land use decisions in an era of necessary sustainable development in the face of global climate change. Because of its interdisciplinary nature, this course provides students the opportunity to explore the ways in which complex planning projects must be managed and the manners by which policies are developed and implemented in order to create environmentally responsible, livable, healthy, dynamic, and equitable communities. John R. Nolon

F&ES 837b, Seminar on Leadership in Natural Resources and the Environment 3 credits. This seminar explores the qualities, characteristics, and behaviors of leaders in the fields of natural resources, science, and management. Through lectures, guest speakers, and individual and team projects, students analyze the attributes of leadership in individuals and organizations. They examine leaders and organizations and develop skills and techniques for leading and for assessing various organizations' leadership strengths and weaknesses. The class travels to Washington, D.C., and meets with leaders in the policy, environmental, industry, and information segments. Through this experience, students have the opportunity to assess their own leadership capabilities and identify means to improve them. Chadwick D. Oliver

F&ES 841a/LAW 20526, Green Energy Policy 2 credits. A major goal of the Obama Administration, as well as many other groups and authors, is to wean the United States from its dependence on fossil fuels by promoting energy efficiency and renewable sources of energy. This research seminar considers what legal policies and instruments may be available to accomplish these policy goals. The course begins with the arguments that a transformation of the U.S. energy system is needed for environmental as well as other reasons. Other cross-cutting goals such as national security, economic development, and decreasing dependence on foreign sources of energy are also considered. Next the course explores past attempts to develop and implement a national energy policy and to promote various technologies. Then we consider various existing policies and subsidies that discourage efficiency and renewable energy. Next we consider successful models, including Germany and California, and various proposals and suggestions to promote energy efficiency and green energy. Enrollment limited to thirty. Not open to undergraduates. E.D. Elliott

F&ES 843b/AMST 839b/HIST 743b/HSHM 744b, Readings in Environmental History 2 credits. Reading and discussion of key works in environmental history. The course explores major forces shaping human-environment relationships, such as markets, politics, and ecological dynamics, and compares different approaches to writing about social and environmental change. Paul Sabin

F&ES 849b, Natural Resource Policy Practicum 3 credits. This practicum provides opportunities for students to participate in the analysis and development of current issues/policies affecting natural resources in the United States and to learn about contemporary

issues affecting natural resources and the environment. Students are organized into teams and assigned a number of current policy issues for analysis and discussion. The identified issues originate from discussions with staff of national environmental organizations, Congressional offices, and federal natural resource agencies that serve as "clients" for the purposes of this practicum. Students are required to communicate directly with the organizations and individuals seeking policy analysis assistance, to conduct research and interdisciplinary analysis of the subject, to prepare a report and recommendations for the identified client, and to brief the client on the product of their analysis. Each team is responsible for a minimum of two policy analysis projects during the term. Following an initial organizational meeting, student teams meet with the instructor once a week to provide updates on projects and to discuss current national and international issues and concerns affecting natural resources and the environment. James R. Lyons

F&ES 850a, International Organizations and Conferences 3 credits. This course, taught in the fall term, focuses on an international conference or symposium and the organization that sponsors the event. Both theoretical and clinical approaches are used. The course studies the mission of the organization and the role of the conference. Students prepare individual and group papers suitable for presentation at the conference. Every attempt is made to have the students participate in the conference, even if it occurs in the next term, but attendance is not guaranteed. The class has studied and participated in the 5th World Parks Congress, Durban, South Africa, 2003; the World Conservation Congress in Bangkok, Thailand, 2004, and in Barcelona, Spain, 2008; and the UNEP Council Meeting, Nairobi, Kenya, 2005. In 2009, 30 students participated in the COP 15 in Copenhagen, Denmark.This course is co-taught with an advanced doctoral student or visiting faculty member who brings knowledge of the specific organization and subject matter being studied. Gordon T. Geballe

F&ES 851a,b, Environmental Diplomacy Practicum 3 credits per term. This course aims to provide experiential learning of environmental and sustainable development issues at the international level. Students are required to participate in weekly seminars at F&ES and internships at U.N. Missions in New York City (minimum one day per week). Weekly discussions focus on the decision-making process in the relevant international bodies regarding climate change, forestry, marine environment, fisheries, and renewable resources. Students are expected to conduct research and present findings on these and related topics. Work of internships at the U.N. Missions of Small Island Developing States and Least Developed Countries in New York involves research, drafting papers, attending meetings, and/or developing specific projects on selected topics, and starts in mid-September. Students are also required to prepare a substantive research paper or project document on topics of their choice at the end of the term. Enrollment requires application, interview, and approval of the instructor. Roy S. Lee

[F&ES 853a/270a/INRL 680a/MGT 697a, Capitalism: Success, Crisis, and Reform 3 credits. Examination of capitalism as it functions in practice, with extensive use of business cases. The role of capitalism in generating wealth and innovation is unprecedented in history. Negative consequences of capitalist development such as radical inequality, disruption of the natural environment, and intermittent social crises. Background ideas

from thinkers such as Adam Smith, Karl Marx, Joseph Schumpeter, Alfred Chandler, and Milton Friedman. Douglas W. Rae]

F&ES 860b, Understanding Environmental Campaigns and Policy Making: Strategies and Tactics 3 credits. This course taught from a practitioner's perspective helps the student to understand how the advocacy community operates to advance policymaking in the environmental arena by exposing students to well structured case examples from the environmental policy-making world of the past decade. Michael Northrop

F&ES 866b/LAW 21566, [The] Law of Climate Change 3 credits. This course explores legal and policy developments pertaining to climate change and the regulation of greenhouse gas emissions. Approaches considered range in scale (state, regional, national, international), temporal scope (incremental measures, multi-decade emissions goals, constitutional amendments), policy orientation (voluntary initiatives, disclosures rules, subsidization, tort litigation, command-and-control regulation, cap-and-trade schemes, emissions taxes), regulatory target (industry and manufacturing, commercial and retail firms, financial and insurance companies, consumers and workers), and regulatory objective (stabilization of greenhouse gas concentrations, reduction of emissions levels or intensity, energy security, optimal balancing of costs and benefits, adaption to unavoidable impacts). Although course readings and discussion focus on existing and actual proposed legal responses to climate change, the overarching aim of the course is to anticipate how the climate change conundrum will affect our laws and our lives in the long run. No prerequisites. Self-scheduled examination or paper option. D. Kysar

F&ES 895a/MGT 684a, Management and the Environment: Issues and Topics 3 credits. Environmental issues have long challenged managers to look beyond the corporate bottom line. Rules, regulations, litigation, and other indicators that the environment must be responsibly managed have become more prevalent in the last generation, and there is no hint that they will become any less so in the future. Indeed, the familiar issues related to safety, health, and environmental compliance are now expanding to include shareholder and customer demands for greater environmental presence and responsibility in complex topics such as global climate change, energy supply and use, sustainability, and a long list of more specific matters that corporations have seldom confronted directly, if at all. The situation is not necessarily all bleak. Many envision marvelous opportunities emerging from the burgeoning environmental sensibility. Reduced emissions from industrial processes can improve competitiveness as best available technologies are brought into play. A search for alternative energy supplies to lessen our dependence on a finite stock of oil and gas around the world creates numerous investment opportunities in an array of promising alternative energy sources, such as wind and solar. The search also redirects global scientific and investment attentions to existing but problematic sources, such as nuclear and coal.

This course provides a basic introduction to both problems and opportunities that face managers today and well into the future. Issues include: some essentials of environmental science, including a discussion of the ecological and public health viewpoints and their contrasts with the economic one; environmental politics, with illustrations of special-interest influences, public perceptions, successful bargaining, negotiating, and

conflict resolution; and several emerging environmental management approaches and movements, including "green boards" and accounting, industrial ecology, and other techniques designed to improve sustainability. Several more comprehensive approaches such as those seeking a "Triple Bottom Line," "The Natural Step," or a life "Beyond Grey Pinstripes" are also described. The long forecasting horizons associated with many environmental issues, measured in decades, centuries, and sometimes longer, require different methods and procedures than those usually encountered in management curricula. An introduction to scenarios, long-range planning, and modeling tools and techniques is provided. Broad topics—including global warming/climate change and energy—are identified to provide a realistic grounding and to illustrate many complex environmental details. In addition, a third, sharply focused segment considers a practical case in some detail. Ecotourism (Triple Bottom Line, Sustainability, Certification) is featured this year. Each topic is covered over a two-week period and includes background readings, case materials, and when possible guest specialists and practitioners. Professor Mario Monzoni, Director of the Center for Sustainability at the Management School, FGV, in São Paulo, Brazil, will join the class for several weeks in October. Garry Brewer

SOCIAL AND POLITICAL ECOLOGY

[**F&ES 770b/MCDB 861b, Global Problems of Population Growth** 3 credits. The worldwide population explosion in its human, environmental, and economic dimensions. Sociobiological bases of reproductive behavior. Population history and the cause of demographic change. Interactions of population growth with economic development and environmental alteration. Political, religious, and ethical issues surrounding fertility; human rights; and the status of women. Robert Wyman]

F&ES 827b, Contemporary Environmental Challenges in Africa 3 credits. The objective of this seminar is to provide students with in-depth insight into the dynamics of human-environment interactions in sub-Saharan Africa in a collaborative and open discussion format. Families, communities, and nations in the African region face an array of environmental challenges ranging from periodic drought and food insecurity to loss of biodiversity, conflict over resources, and persistent poverty. Moreover, many countries in the region are saddled with histories of colonial rule that defined human-environment relationships in the simplest terms, often posing direct causal links between traditional practices and environmental degradation while ignoring the complex interplay of social, biophysical, and geographical factors that contribute to environmental outcomes. Throughout the course, we critically engage common perceptions of African environments, explore alternative theories, and seek deeper understandings of human-environment interactions in the region. The course is designed around five main themes: (1) environment, poverty, and development; (2) property rights and access to resources; (3) risk and adaptation to natural hazards and climate change; (4) conservation, deforestation, and biodiversity, and (5) transboundary issues and environmental politics. Within each theme, we devote a week to introducing the general concepts and a second week to discussing one or two in-depth case studies that illustrate the issue in detail. Student work consists of participation in class discussion and a course paper, which is presented to the class. Enrollment limited to fifteen. Robert Bailis

F&ES 831b, Society and Natural Resources 1–3 credits. This research seminar explores the relationship between society and natural resources in a genuinely interdisciplinary manner. Although the specific topic of the seminar varies from year to year, the consistent underlying theme is an examination of how societies organize themselves, use natural resources, and affect their environment. In past years, the seminar focused on energy and the environment, interdisciplinary problem solving, and other topics. The seminar overall looks at people seeking values using natural resources through institutions. This relationship (people, values, natural resources, and institutions) has been extensively written about and discussed in diverse fields. A few years ago, the seminar examined the relationship of human dignity as a universal value goal, professionalism and practice, and sustainability as an applied notion. Other versions of the seminar have looked at conceptual (theoretical) models about society and natural resources from policy sciences, social ecology, political ecology, and other knowledge areas. Still other seminars focused on "Bridging Local and Professional Knowledge in Environmental Sustainability" and "War and the Environment." This year's seminar is on "environmental psychology and sociology." It draws upon literature from psychology and sociology to deepen our understanding of intrapersonal, interpersonal, and human-nature relationships. Using literature reviews, case studies, guest speakers, our own self-examination, and research, we analyze how people's construction of self and "worldviews/window on the world" affect their decisions about their lives, nature, and the environment. Improvement and sustainability rest on change in ourselves and in other people. We focus on leadership (the lead and leader's relationships) too. Guests and students make presentations and carry out discussions each week. Readings, active participation, and student papers are required. Susan G. Clark

F&ES 836a/ANTH 541a/HIST 965a/PLSC 779a, Agrarian Societies: Culture, Society, History, and Development 3 credits. An interdisciplinary examination of agrarian societies, contemporary and historical, Western and non-Western. Major analytical perspectives from anthropology, economics, history, political science, and environmental studies are used to develop a historically grounded account of the transformation of rural societies. Four hours lecture plus discussion sections. James Scott, Michael McGovern, K. Sivaramakrishnan

[**F&ES 838a/ANTH 517a, Producing and Consuming Nature** 3 credits. This intermediate to advanced seminar brings together readings in social theory with ethnographic case studies to examine the changing means by which elements of the natural world are drawn into circuits of production, exchange, and consumption. How do environmental goods become conceptualized as natural resources for human ends, and, more specifically, remade into commodities that circulate in global markets? The course explores efforts to rethink classical theories of economic processes in light of shifting forms of natural resource transactions and use. Topics examined include agrarian and fisheries transformations; the rise of green consumerism and product certification regimes; and the market valuation of ecosystem goods and services. Course texts are drawn from anthropology and related disciplines, like cultural geography, sociology, and science and technology studies. Basic knowledge of social science is a prerequisite. Karen Hébert]

[**F&ES 845b, Energy Issues in Developing Countries** 3 credits. This graduate course is designed to provide students with an opportunity to explore the interrelationships among energy, environment, economic development, and social welfare in developing countries. Throughout the course, we consider the role that people, industries, and state institutions play in supplying and consuming energy-based resources in countries of sub-Saharan Africa, Latin America, and much of Asia. The goal of the course is to understand the many ways in which energy is used by the majority of the world's population and to examine some of the tensions that exist among environmental sustainability, economic growth, and quality of life within the context of non-Western, nonindustrialized, and/or industrializing populations. Class meetings consist of a short lecture followed by discussion; therefore reading and participation are critical components of the course and students are evaluated based on their contributions to the discussion. Students are strongly encouraged to have prior knowledge of basic energy issues. Robert Bailis]

F&ES 846b, Topics in Environmental Justice 3 credits. In this seminar we explore global environmental issues from a perspective that foregrounds questions of social justice. The field of environmental justice asks for fair treatment of all people regardless of race, ethnicity, gender, economic capacity, national origin, and education level with respect to environmental politics and their implementations. In this and other aspects, the environmental justice perspective differs from traditional environmental philosophies in that it seeks to combine a concern for the natural world with a consciousness of ethnic, class, and gender discrimination. From this vantage point it is argued that throughout the world there are marked and increasing disparities between those who have access to clean and safe resources and those who do not. This course is based on two fundamental premises: All individuals and communities, regardless of their social or economic conditions, have the right to a clean and healthy environment; and there is a connection between environmental exploitation, human exploitation, and social justice. With these premises as a starting point, we first define "What is environmental justice?" Then we turn to more difficult questions such as: Why and through what political, social, and economic processes are some people denied this basic right to a clean and safe environment? The course draws on both international and domestic case studies. Amity Doolittle

F&ES 848a, Climate Change: Impacts, Adaptation, and Mitigation 3 credits. This is an interdisciplinary graduate course designed for students who are familiar with the basic science of climate change and the international negotiations that have occurred since the drafting of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992. The course draws on diverse fields ranging from economics to international relations and energy systems analysis. We examine climate change from an international perspective, with particular emphasis placed on the world's developing countries. The course opens with a brief review of the latest scientific findings, the most recent developments in climate change policy, and an overview of common tools that analysts use to examine the climate question. We then devote roughly half of the term to examining climate change impacts and adaptation and half to mitigation. In looking at impacts and adaptation, we examine social and biophysical vulnerabilities to environmental change and explore the policies and measures that have been proposed to minimize the impacts of climate change. In examining mitigation, we discuss technological options, policies,

and socioeconomic impacts of mitigative measures. The course has a mixed lecture-discussion format. Participation during discussion is strongly encouraged and is incorporated in student evaluations. In addition, there are several guest speakers and potentially one field trip to the United Nations. Enrollment limited to twenty-five. Robert Bailis

F&ES 854b, Institutions and the Environment 3 credits. One of the most critically important questions facing those seeking to promote environmental stewardship of the world's biosphere is to understand better what types of local, domestic, global, and non-state institutions might best promote meaningful and enduring environmental problem solving. The purpose of this seminar is to review key works in political science and related disciplines on institutions to assess their direct or indirect implications for environmental governance and effectiveness. The course assesses perspectives from rational choice, historical, and sociological institutionalism that have permeated comparative public scholarship; the treatment of institutions with international relations literature; the attention that common property scholars have placed on understanding the development of local institutions; and the emergence and proliferation of private governance institutions. We are curious about understanding the theoretical underpinnings and scholarly debates about how support for such systems occurs. We also assess the various theories against empirical evidence that assess their support and influence ameliorating key resource and environmental problems. Benjamin Cashore

F&ES 856b/REL 876b, Ecology and Ethics in the Practice of Biodiversity Conservation 3 credits. This seminar explores ethical dimensions of ecological management and research. Working from problems in the practice of biodiversity conservation, it treats a series of basic questions in environmental ethics and considers changing relations of science, policy, and cultural change. Moving from a problem-based approach, it inquires about the role of philosophical and religious questioning in the adaptive learning required for sustainability science. Oswald J. Schmitz, Willis Jenkins

[**F&ES 857b, Urbanization, Global Change, and Sustainability** 3 credits. The conversion of land surface to urban uses is one of the most profound human impacts on the global biosphere. Urban growth and associated changes in human activities on the land (land use) and in the physical attributes of earth's surface (land cover) have profound environmental consequences, including local and regional climate change, loss of wildlife habitat and biodiversity, soil erosion, and a decrease in ecosystem services. Aggregated globally, these effects constitute the most significant human impacts on the functioning of earth as a system. The impacts of urban growth and land-cover change will affect both earth's biosphere and the quality of human life for generations to come. The interactions between human and ecological systems influence social marginalization and the vulnerability of people and places. This seminar examines the interactions and relationships between urbanization and global change at local, regional, and global scales. Topics include urban land-cover change, cities and local climate, urban vulnerability, urban diets and the challenges for agriculture, and the spatial evolution of cities. Karen Seto]

[**F&ES 858a/REL 768a, Environmental Theologies** 3 credits. This course interprets theological responses to environmental problems and examines major tensions in the relation of Christianity and ecology. Reading theological strategies of environmental

response—including ecojustice, stewardship, creation spirituality, and ecofeminism—the seminar examines how communities rethink their traditions as they interpret and address environmental problems. Because those theological communities include Catholic (including magisterial and liberationist), Protestant (including evangelical and anabaptist), and Eastern Orthodox, the course develops a cohesive overview of Christianity's changing relationship to its ecological context. Willis Jenkins]

[**F&ES 859b, American Environmental History and Values** 3 credits. The purpose of this course is to provide an overview of major figures, ideas, and institutions in American environmentalism. The course explores the development of environmental awareness in America as distinct historical strands with diverse ethical concerns. It begins with an examination of Native American perspectives on land and biodiversity. We then focus on writings from Thoreau and Emerson to explore early American voices in the discourse on "nature." To investigate the emergence of conservation and forest management, readings are selected from Pinchot, Muir, and Leopold. The beginnings of urban and park planning are considered in relation to these positions on the management of nature. Next, the environmental movements from the 1960s onward are surveyed in readings from the social sciences and humanities. We then explore the major debates in environmental ethics and the broader reach for global ethics. Writings celebrating biodiversity are examined along with the emergence of conservation biology as an example of engaged environmental scholarship. Finally, new efforts to widen the interdisciplinary approaches toward environmental issues are introduced in investigating world religions and ecology as well as cosmology and ecology. John Grim, Mary Evelyn Tucker]

[**F&ES 861a, American Indian Religions and Ecology** 3 credits. This course focuses on the North American continent from the standpoint of religion and ecology. A cultural-historical method is also used in conjunction with comparative-thematic and worldview approaches. These approaches emphasize embodied knowledge as a way of understanding native continuities in relationship with bioregions over time. Comparisons are also drawn between Native American traditions, and the concept of "lifeway" is developed as central to the course. In highlighting indigenous ways of knowing, the course focuses on conceptual metaphors of sharing, holism, reciprocity, and personhood. These modes of indigenous metaphoric thought are examined in terms of diverse rituals and oral statements describing the natural world. Mary Evelyn Tucker, John Grim]

[**F&ES 862b, Advanced Seminar in Social and Political Dimensions of Climate Change** 3 credits. This seminar explores advanced topics in social and political aspects of climate change. Topics vary from year to year and may include societal impacts of climate change, vulnerability and adaptation, ethics and justice, economics, international relations, or climate change mitigation strategies. Students work individually or in small groups and focus intensively on a single topic for the term. When possible, the topic(s) that students work on are derived from real projects and developed in conjunction with outside organizations that are actively working on climate-related issues. Each year, the course may involve a trip to the annual climate change negotiations (COP XX). There, students have an opportunity to see how the topics that they studied are debated at the highest level of global environmental governance. Students also have a chance to attend numerous side events, where civil society groups, multilateral organizations, and the private

sector converge to discuss the latest developments in climate policy. Students may have an opportunity to present at these events. Robert Bailis]

[**F&ES 869b/ANTH 572b, Disaster, Degradation, Dystopia: Social Science Approaches to Environmental Perturbation and Change** 3 credits. This is an advanced seminar on the long tradition of social science scholarship on environmental perturbation and natural disasters, the relevance of which has been heightened by the current global attention to climate change. The course is divided into three main sections. The first consists of central questions and debates in the field: social dimensions of natural disasters; the discursive dimensions of environmental degradation, focusing on deforestation; and the current debate about the relationship between resource wealth and political conflict, focusing on the "green war" thesis. The second section focuses on anthropological and interdisciplinary approaches to climate change and related topics, encompassing canonical anthropological work on flood and drought; cyclones, El Niño, and interannual cycles; ethno-ecology; and risk. Additional lectures focus on interdisciplinary work. The final section of the course consists of the classroom presentation of work by the students and Teaching Fellow. Prerequisite: F&ES 520a or F&ES 882b. Three hours lecture/seminar. Enrollment limited to twenty. Michael R. Dove]

[**F&ES 872a/REL 870a/RLST 872a, Seminar on World Religions and Ecology** 3 credits. This seminar explores the understanding of the emerging relationships of world religions to our global environmental crisis. Both the problems and the promise of these relationships are acknowledged. Religions are containers of symbolic language that often evoke nature's processes and reflect nature's rhythms. For many years science, engineering, policy, and law alone were considered indispensable for understanding and resolving environmental problems. We now have abundant knowledge from these disciplines about environmental issues, but still not sufficient will to change human behavior. Religion, spirituality, ethics, and values can make important contributions to address complex environmental issues. This course explores those contributions. Mary Evelyn Tucker, John Grim]

F&ES 873a, Global Environmental History 1 credit. The dynamic relationship between environmental and social forces from the Pleistocene glaciations to the Anthropocene present: Pleistocene extinctions; transitions from hunting to gathering to agriculture; Old World origins of cities, states, and civilization; adaptations and collapses of Old and New World civilizations in the face of climate disasters; the destruction and reconstruction of the New World by the Old. In the foreground of each analysis are the issues of adaptation, resilience, and sustainability: what forced long-term societal changes? Harvey Weiss

F&ES 875a, Global Ethics and Climate Change 3 credits. Do planetary problems require a global ethic? Is a global ethic possible in a pluralist world? This seminar examines ethical projects that attempt to work across national and cultural borders to protect human dignity and prevent ecological destruction. This year the course focuses on the case of climate change. In preparation it examines human rights and human development as global moral practices, treats the competing frameworks of justice evaluating those practices, considers roles for religious ethics amidst global ethics, and reads proposals for an

Earth Charter. Then it turns to conflicts over fairness and responsibility in addressing climate change. Willis Jenkins

F&ES 876a/REL 810a/RLST 875a, Indigenous Religions and Ecology 3 credits. This course explores how particular indigenous peoples relate to local bioregions and biodiversity. Opening with an examination of such terms as *indigenous, religion,* and *ecology,* the course investigates religious studies and ethnography related to small-scale societies and the many ways in which they relate to local bioregions and biodiversity. The course examines indigenous ethnic diversity and cultural relationships to place, and the ways values associated with physical places are articulated in symbols, myths, rituals, and other embodied practices. The emphasis on place and religious ecology in this course illustrates what indigenous peoples could bring to studies in environmental culture. Finally, this course necessarily involves questions of environmental justice, namely, the imposition of environmentally damaging projects on a people whose voice in decision making is diminished or eliminated. John Grim

F&ES 877a/ANTH 561a, Anthropology of the Global Economy for Development and Conservation 3 credits. This seminar explores topics in the anthropology of the global economy that are relevant to development and conservation policy and practice. Anthropologists are often assumed to focus on micro- or local-level research, and thus to have limited usefulness in the contemporary, global world of development and conservation policy. In fact, however, they have been examining global topics since at least the 1980s, and little current anthropological research is limited to the village level. More importantly, the anthropological perspective on the global economy is unique and important. This course examines the topics that make up this perspective, including how the rural, third-world household engages with the global economy (and how we understand the hybrid and multiple aspects of contemporary household economies); how the gendered division of labor and power over the allocation of labor plays out when migrant labor is added to the picture; how microcredit (the primary development solution to poverty) differs from traditional savings associations, and its variable effects across cultures; how capitalism dis-embedded economy from society, producing an "immoral" economy (and the history of theories of the moral economy); how property rights and the efforts to retain them shape indigenous livelihoods and the division of labor, as parks and private property claim land; how "nature" is commoditized, and how this creates poverty as well as the degradation of natural resources; and finally, what the capitalist frontier in the third world looks like, and how it reshapes landscapes and societies. Readings for the course come from the subfields of environmental anthropology, economic anthropology, the anthropology of development, and the anthropology of gender. No prerequisites. Three hours lecture/seminar. Carol Carpenter

F&ES 879b/REL 817b/RLST 872b, World Religions and Ecology: Asian Religions 3 credits. This course explores the various ways in which religious ideas and practices have contributed to cultural attitudes and human interactions with nature. Examples are selected from Hinduism, Buddhism, Confucianism, and Daoism. The course examines such topics as symbols, images, and metaphors of nature in canonical texts; views of the divine as transcendent to the world; the indwelling of the sacred in the earth; the ethics of using and valuing nature; ritual practices that link humans to the natural world; and

cosmology as orienting humans to the world and embedding them in place. Mary Evelyn Tucker, John Grim

F&ES 882b/ANTH 582b, The Black Box of Implementation: Households, Communities, Gender 3 credits. The implementation of development projects has been described as existing in a "black box": development and conservation policy (even participatory policy) is often not defined to inform effective implementation (Mosse 2004), and data on actual implementation is rarely incorporated into policy. This course examines the invisibility of implementation, and the common, mistaken assumptions about implementation targets (like households, communities, and gender) that take the place of absent data in policy. The course also makes an effort to use anthropology to shed light into this black box, to allow students to think more critically about the varied and dynamic social field in which project implementation occurs. Political and economic aspects of relations within households and communities, particularly gender relations, are examined in all of their complexity, variation, and dynamism. The real focus of the course, however, is not the contents of the black box, but the political and economic relations between households, communities, and gender, on the one hand, and the world of development and conservation, on the other. How do households and communities respond to the differential opportunities and restrictions that development and conservation introduce? What are the implications of the fact that those responses are often invisible to policymakers? No prerequisites. Three hours lecture/seminar. Carol Carpenter

F&ES 892a/ARCH 4021a, Introduction to Planning and Development 3 credits. This course demonstrates the ways in which financial and political feasibility determine the design of buildings and the character of the built environment. Students propose projects and then adjust them to the conflicting interests of the financial institutions, real estate developers, civic organizations, community groups, public officials, and the widest variety of participants in the planning process. Subjects covered include housing, commercial development, zoning, historic preservation, parks and public open space, suburban subdivisions, planned communities, and comprehensive plans. Alexander Garvin

HEALTH AND ENVIRONMENT

F&ES 889a, Environmental Risk Assessment 3 credits. This course focuses on fundamental aspects of risk, using environmental and health risks in the public and private sectors as its primary examples, and is designed to provide students with a broad understanding of the value of risk assessment and risk management (RA/RM) in the environmental engineering profession. Students learn how to identify potential hazards, quantify associated risks using probabilistic methods, and incorporate both probabilistic and deterministic results from environmental risk assessment (ERA) into the decision-making process after taking into consideration societal, environmental, and economic consequences. Yehia F. Khalil

F&ES 891a/EMD 572a, Ecoepidemiology 3 credits. This course uses an ecological perspective to study the factors influencing the emergence, maintenance, and transmission of human pathogens. Particular emphasis is on pathogens transmitted to humans by arthropods (vector-borne) or animal reservoirs (zoonotic) like malaria, dengue, West Nile virus, Lyme disease, rabies, etc. Students learn how human risk for these diseases

can be described and predicted by understanding the ecology of pathogens, vectors, and reservoirs. The course utilizes a combination of lectures, discussion of primary literature, practical exercises on modeling and risk mapping, and guest speakers. Maria Diuk-Wasser

F&ES 893b/EHS 511b, Applied Risk Assessment 3 credits. This course introduces students to the nomenclature, concepts, and basic skills of quantitative risk assessment (QRA). The goal is to provide an understanding necessary to read and critically evaluate QRA. Emphasis is on the intellectual and conceptual basis of risk assessment, particularly its dependence on toxicology and epidemiology, rather than its mathematical constructs and statistical models. Specific cases consider the use of risk assessment for setting occupational exposure limits, establishing community exposure limits, and quantifying the hazards of environmental exposures to chemicals in air and drinking water. Jonathan Borak, Cheryl Fields

F&ES 896a/EHS 503a, Introduction to Toxicology 3 credits. This course introduces students to the concepts and nomenclature of toxicology. Emphasis is placed on the absorption, distribution, metabolism, and elimination of foreign toxic materials. The goal is to provide a fundamental understanding of important toxicological principles and their relevance to the more general study of human health. The course utilizes case studies that require students to apply their knowledge of toxicologic concepts and processes to refine issues and solve problems in epidemiology and public health. The course includes a series of guest lectures by prominent content experts who illustrate the importance of general toxicological principles as applied to specific classes and types of toxicants and exposures. Jonathan Borak, Cheryl Fields

F&ES 897b/EHS 508b, Assessing Exposures to Environmental Stressors This course examines human exposure to environmental stressors as it applies to environmental epidemiology and risk assessment. Indirect and direct methods of assessing exposures are reviewed and case studies are presented. Brian Leaderer

F&ES 898a/EHS 585a, The Environment and Human Health 3 credits. This course provides an overview of the critical relationships between the environment and human health. The class explores the interaction between health and different parts of the environmental system including water, indoor and outdoor air, environmental justice, and occupational health. Other topics include exposure assessment, case studies of environmental health disasters, links between climate change and health, and integration of scientific evidence on environmental health. Students learn about current key topics in environmental health and how to critique and understand scientific studies. The course incorporates lectures and discussion. Michelle Bell

F&ES 899b, Sustainable Development in Post-Disaster Context: Haiti 3 credits. Sustainable development is studied using the case of Haiti. Haiti suffers from chronic environmental disasters, most notably deforestation that leads to mudslides and therefore crop loss during the rainy season, and acute disasters, for example the earthquake of 2010. F&ES has been asked by L'Hôpital Albert Schweitzer in the Artibonite Valley (north of Port-au-Prince) to provide assistance to projects in villages surrounding the hospital. This course uses lectures, student presentations of scholarly work, project development,

and field studies to explore our knowledge of sustainable development and to apply this knowledge. Gordon T. Geballe

INDUSTRIAL ECOLOGY, ENVIRONMENTAL PLANNING, AND TECHNOLOGY

F&ES 883b, Advanced Industrial Ecology Seminar: The Energy Industry 3 credits. This seminar examines specific industrial ecology-related topics in a small course, interactive setting. The theme for 2011–2012 is an exploration of the energy industry. Prerequisites: two completed industrial environmental management courses, or two completed business courses, and/or special permission from the instructors. Marian R. Chertow, William Ellis

F&ES 884b/ENAS 645b, Industrial Ecology 3 credits. Industrial ecology is an organizing concept that is increasingly applied to define the interactions of today's technological society with natural and altered environments. Technology and its potential for change are central to this subject, as are implications for government policy and corporate response. The course discusses how industrial ecology serves as an environmentally related framework for technology, policy, and resource management in government and society. Marian R. Chertow, Thomas E. Graedel

F&ES 885b/ENAS 360b/660b/ENVE 360b, Green Engineering and Sustainability 3 credits. This hands-on course highlights the key approaches to advancing sustainability through engineering design. The class begins with discussions on sustainability, metrics, general design processes, and challenges to sustainability. The current approach to design, manufacturing, and disposal is discussed in the context of examples and case studies from various sectors. This provides a basis for what and how to consider when designing products, processes, and systems to contribute to furthering sustainability. The fundamental engineering design topics to be addressed include toxicity and benign alternatives, pollution prevention and source reduction, separations and disassembly, material and energy efficiencies and flows, systems analysis, biomimicry, and life cycle design, management, and analysis. Students tackle current engineering and product design challenges in a series of class exercises and a final design project. Julie B. Zimmerman, Matthew Eckelman

[**F&ES 886a/380a, Greening Business Operations** 4 credits. The course examines various industries from engineering, environmental, financial perspectives, and emphasizes increasingly detailed analyses of corporate environmental performance. Methods are drawn from operations management, industrial ecology, and accounting and finance to investigate industrial processes, the potential to pollute, and the environmental and business implications of various sustainability approaches. Life cycle assessment and environmental cost accounting are typical tools that are taught; the class also involves several field trips to companies. Julie B. Zimmerman, Marian R. Chertow]

F&ES 888a/ARCH 4226a, Ecological Urban Design 3 credits. Ecologists are increasingly interested in studying urban systems and have recently moved beyond the traditional focus on "ecology in cities" to "the ecology of cities." This shift has catalyzed a new discourse in urban ecology, which has given rise to a number of questions: (1) How do we define urban ecosystems? (2) How do we combine science, design, and planning to

shape and manage urban ecosystems? (3) How do we implement effective and adaptable experimental and monitoring methods specific to urban sites and human subjects in order to conduct viable urban ecological research? Exploring these questions requires designers and ecologists to achieve more familiarity with each others' areas of expertise including research methods and the scientific process as well as the design process. This course focuses on the application of urban ecology to the design of cities. The course provides an overview of urban ecology and how designers (School of Architecture) and scientists (F&ES) can work in complementary ways to foster dialogue and integrate ecological research and analysis with city planning and design. The course seeks to reposition urban ecology as a practice focused not only on studying urban ecosystems, but also on a combined effort to study and reshape them. Alexander J. Felson

F&ES UNDERGRADUATE COURSES

Ecology

ECOSYSTEM ECOLOGY

F&ES 275a, Ecosystem Pattern and Process See F&ES 740a for description.

F&ES 330b/E&EB 330a/EVST 330a, Ecosystem Ecology See F&ES 730a for description. Prerequisite: E&EB 220a or permission of the instructor.

WILDLIFE ECOLOGY AND CONSERVATION BIOLOGY

F&ES 315a/E&EB 115a, Conservation Biology An introduction to the basic ecological and evolutionary principles underpinning efforts to conserve the earth's biodiversity. Efforts to halt the rapid increase in disappearance of both plants and animals. Discussion of sociological and economic issues. Jeffrey Powell

F&ES 340b, Community Ecology See F&ES 740b for description.

F&ES 365a/E&EB 365a, Landscape Ecology See F&ES 500a for description.

[**F&ES 370a/E&EB 370a, Aquatic Ecology** See F&ES 738a for description.]

Forestry

FOREST BIOLOGY

F&ES 260a, Structure, Function, and Development of Trees and Other Vascular Plants See F&ES 654a for description.

[**F&ES 261Lb, Laboratory for Structure, Function, and Development of Trees and other Vascular Plants**]

Physical Sciences

ENVIRONMENTAL CHEMISTRY

F&ES 261a/G&G 261a/EVST 261a, Minerals and Human Health Study of the interrelationships between Earth materials and processes and personal and public health. The transposition from the environment of the chemical elements essential for life.

Prerequisite: one year of college-level chemistry or permission of the instructor; G&G 110 recommended. Catherine Skinner

F&ES 307b/EVST 307b, Organic Pollutants in the Environment See F&ES 706b for description.

F&ES 344b, Aquatic Chemistry See F&ES 707b for description.

F&ES 443a, Environmental Chemical Analysis See F&ES 743a for description.

WATER RESOURCES

F&ES 367b/EVST 367b, Water Resources and Environmental Change The effects of variations in the hydrologic cycle on the global distribution of freshwater. The role of environmental change in regulating freshwater supply and quality. The influences of agriculture, industry, mining, urbanization, climate change, and energy-production alternatives on freshwater resources in the United States and abroad. James E. Saiers

[**F&ES 440b/EVST 440b, Environmental Hydrology** See F&ES 714b for description.]

Quantitative and Research Methods

F&ES 290a/EVST 290a, Geographic Information Systems 3 credits. A practical introduction to the nature and use of geographic information systems (GIS) in environmental science and management. Applied techniques for the acquisition, creation, storage, management, visualization, animation, transformation, analysis, and synthesis of cartographic data in digital form. Dana Tomlin

F&ES 441a or b/G&G 440a or b/EVST 441a or b/MCDB 441a or b, Methods in Geomicrobiology A laboratory-based course providing interdisciplinary practical training in geomicrobiological methods including microbial enrichment and cultivation techniques; light, epifluorescence, and electron microscopy; and molecular methods (DNA extraction, PCR, T-RFLP, FISH). Prerequisite: college-level chemistry. Ruth Blake

G&G 362b, Remote Sensing of the Earth from Space See F&ES 726a for description.

Social Sciences

ENVIRONMENTAL POLICY

F&ES 245b, International Environmental Policy and Governance See F&ES 829b for description.

F&ES 255b/EVST 255b/PLSC 215b, Environmental Politics and Law Exploration of the politics, policy, and law associated with attempts to manage environmental quality and natural resources. Themes of democracy, liberty, power, property, equality, causation, and risk are examined. Case histories include air quality, water quality and quantity, pesticides and toxic substances, land use, agriculture and food, parks and protected area, and energy. John P. Wargo

F&ES 270a/EP&E 371a/INTS 330a/PLSC 270a, Capitalism: Success, Crisis, and Reform See F&ES 853a for description.

SOCIAL AND POLITICAL ECOLOGY

F&ES 285a/EVST 285a, Political Ecology: Nature, Culture, and Power Study of the relationship between society and the environment. Global processes of environmental conservation, development, and conflicts over natural resource use; political-economic contexts of environmental change; ways in which understandings of nature are discursively bound up with notions of culture and identity. Amity Doolittle

[**F&ES 380a, Greening Business Operations** See F&ES 886a for description.]

[**F&ES 384a/ANTH 382a/EVST 345a, Environmental Anthropology: From Historic Origins to Current Debates** This is an upper-division undergraduate seminar on the history of the anthropological study of the environment. It is organized around a number of key, persisting themes in the field, including the nature-culture dichotomy, ecology and social organization, methodological debates, the politics of the environment, and knowledge of the environment. Each theme is examined through writings that are theoretically important but also readable, interesting, and relevant. Readings are grouped to stimulate critical thinking and in-depth discussion about anthropology and the environment. The core text for the course is *Environmental Anthropology* (Dove and Carpenter, eds., 2007, Wiley-Blackwell), written especially for this course. No prerequisites. Two hours lecture/seminar. Michael R. Dove/Carol Carpenter (alternate years)]

FRESHMAN SEMINAR

F&ES 012, Urban Ecology in New Haven 1 credit. Methods of ecosystem ecology, landscape ecology, and industrial ecology, applied to questions of how cities work and how they can become more sustainable. Guest speakers, community projects, and field trips in New Haven. Application of theory to New Haven and to cities around the world. Gordon T. Geballe

Centers and Programs at the School of Forestry & Environmental Studies

Teaching, research, and outreach at the Yale School of Forestry & Environmental Studies are greatly enhanced by the Centers and Programs, which have been initiated by faculty through the years. The Centers and Programs, each with a different concentration, are a key component of a student's learning experience. They allow students to gain hands-on clinical and research experience by sponsoring student internships and projects, coordinating faculty research in areas of common interest, and creating symposia, conferences, newsletters, and outreach programs.

Centers and Programs are funded primarily through private foundations, nongovernmental organizations, state and federal agencies, international granting agencies, and private corporations. The nature and number of Centers and Programs evolve over time, reflecting faculty and student interest. Under the current organizational structure, each program falls under the umbrella of a center, which enables further collaboration and resource sharing.

YALE CENTER FOR ENVIRONMENTAL LAW AND POLICY

The Yale Center for Environmental Law and Policy, which is a joint undertaking with Yale Law School, seeks to incorporate fresh thinking and analytically rigorous approaches into environmental decision making.

The center supports a wide-ranging program of teaching, research, and outreach on local, regional, national, and global pollution control and natural resource management issues. These efforts involve faculty, staff, and student collaboration and are aimed at shaping academic thinking and policymaking in the public, private, and NGO sectors. The center is focused on four program areas and an environmental protection clinic, as outlined below.

Environmental Performance Measurement

This program aims to encourage environmental policymaking that uses data-driven indicators and statistics. The program's primary product is the biennial Environmental Performance Index. The 2010 Environmental Performance Index ranks 163 countries on twenty-five performance indicators, which are tracked across ten policy categories covering both environmental public health and ecosystem vitality. These indicators provide a gauge for how close countries are to achieving established environmental policy goals.

Environmental Attitudes and Behavior

This program seeks to explore citizens' attitudes about the environment and how such attitudes translate into action, using polling, workshops, and focus groups to evaluate the effectiveness of environmental messages. Center researchers are currently testing which climate change messages and messengers resonate best with target audiences.

Environmental Law and Governance

This program examines how the principles of good governance can be applied in the context of environmental policymaking. The center works with its research partners at the University of Massachusetts to address the disciplines of law, political science, natural science, and economics – ultimately aiming to stimulate ideas and action for strengthening environmental policymaking.

Innovation and Environment

Research for this program explores creative public policy tactics for addressing environmental issues, with a focus on policy incentives that drive private-sector innovation in renewable energy development, energy efficiency, and other areas critical to sustainability.

Environmental Protection Clinic

The center coordinates an environmental protection clinic that undertakes long-term projects for clients (environmental groups, government agencies, community organizations, and private sector enterprises) and is staffed by interdisciplinary teams of law and environmental studies students. Projects include legislative drafting, litigation, multiparty negotiation, and policy development, and focus on topics including environmental justice, sustainable agriculture, and global warming.

For information on the Yale Center for Environmental Law and Policy, visit http://envirocenter.research.yale.edu.

YALE CENTER FOR BUSINESS AND THE ENVIRONMENT

The Yale Center for Business and the Environment provides a focal point for education, research, and outreach to advance business solutions to global environmental problems. The center focuses on (1) helping fold environmental thinking into business practice, (2) bringing business management principles into environmental organizations, and (3) fostering the creation of green businesses, products, and services.

The center joins the strengths of two world-renowned graduate schools – the Yale School of Management (SOM) and the Yale School of Forestry & Environmental Studies (F&ES) – together with a network of internal and external thought leaders at the business-environment interface. Professors, students, alumni, guest scholars, and affiliates of each school contribute to the center's mission through an integrated set of activities that address business approaches to the world's most significant environmental issues. Our work spans perspectives in finance, innovation, marketing, operations, and strategy on issues involving energy, water, carbon, forests, environmental health and safety, development, and policy.

The center's activities include, but are not limited to:

- Providing support for the three-year joint M.B.A.-Environment degree program and advancing joint programs between F&ES and SOM
- Organizing an annual conservation finance camp for conservation professionals

- Supporting research activities including seminars in forest carbon and environmental economics, fellowships in corporate environmental management and strategy, and the development of case studies
- Coordinating speaker series and prizes on environmental markets and finance and environmental entrepreneurship
- Facilitating networks like the Renewable Energy and International Law Network

Activities in each of these areas bring together students, faculty, staff, policy experts, and practitioners from a wide range of institutions around the world.

For more information about the Yale Center for Business and the Environment, visit www.yale.edu/cbey.

CENTER FOR GREEN CHEMISTRY AND GREEN ENGINEERING AT YALE

The mission of the Center for Green Chemistry and Green Engineering at Yale is to advance sustainability by catalyzing the effectiveness of the Green Chemistry and Green Engineering community. Green Chemistry and Green Engineering represent the fundamental building blocks of sustainability. Working in these disciplines, chemists and engineers are creating the scientific and technological breakthroughs that will be crucial to the future success of the human economy.

The Center for Green Chemistry and Green Engineering at Yale works to stimulate and accelerate these advances. Guided by four core operating principles—(1) Insist on scientific and technical excellence and rigor, (2) Focus on generating solutions rather than characterizing problems, (3) Work with a diverse group of stakeholders, and (4) Share information and perspectives broadly—we seek to accomplish four key objectives:

- Advance the science
- Prepare the next generation
- Catalyze implementation
- Raise awareness

The center concentrates on five focus areas, outlined below.

Research The center supports and advances research in Green Chemistry and Green Engineering (GC&GE), a critical component to building the community, designing and discovering innovative solutions, and achieving a sustainable future. The center serves as a catalyst to both Yale and the greater GC&GE communities for discipline-specific and cross-disciplinary research collaborations focused on key areas of GC&GE within science, technology, and policy for sustainability.

Policy and outreach The center engages in policy, communication, and outreach initiatives that raise awareness of—and support for—GC&GE. In this dialogue the center engages with a wide network of stakeholders, including NGOs, industry, academia, and government, as well as local communities and the general public.

Education A robust educational program is an essential element of the center. Center activities are focused on educating undergraduate and graduate students in the principles and practice of GC&GE. The center also serves the wider academic community

by providing opportunities for faculty training and by developing and disseminating GC&GE curriculum materials.

International collaborations GC&GE are rapidly spreading through both industrialized nations and the emerging economies. In all regions, the center engages with the network of scientists, engineers, policymakers, business people, and public health and environmental experts focused on sustainability science on behalf of the greater good.

Industrial collaborations GC&GE can only provide meaningful impact on the challenges of global sustainability when implemented on a large scale. For this reason, collaboration with industry is a key part of the center's work. Direct engagement creates a dialogue that informs industry of the latest research breakthroughs in the field of sustainable science and technology. Likewise, such engagement informs academic researchers on industry's most important concerns. This dialogue facilitates a direct line for implementation of these innovations.

CENTER FOR INDUSTRIAL ECOLOGY

The Center for Industrial Ecology (CIE) is dedicated to the development and promotion of research, teaching, and outreach in industrial ecology. The field is focused on the concept that an industrial system should be viewed not in isolation from its surrounding systems, but in concert with them. It is a systems approach that seeks to optimize the total materials cycle from virgin material, to finished material, to component, to product, to obsolete product, and to ultimate disposal. Among the programs and goals of the center are the following:

- Conducting pathbreaking research in industrial ecology
- Hosting of visiting domestic and international scholars in industrial ecology
- Master's, doctoral, and postdoctoral study programs in industrial ecology

Major foci include (1) the Stocks and Flows Project, in which investigators are evaluating current and historical flows of specific materials, with an emphasis on metals, estimating the stocks available in different types of reservoirs, and evaluating the environmental implications; (2) the Industrial Symbiosis Project, in which multiyear research is being conducted in India, China, and the United States to examine the environmental and economic rationale for intra-industry exchange of materials, water, and energy; and (3) the Program on Industrial Ecology in Developing Countries, which adapts industrial ecology theory and practice to issues related to energy access, water quality and quantity, waste and material management, and global warming in industrializing countries.

Other research includes (a) urban and industrial metabolism projects in collaboration with the National University of Singapore for study of high-density development in Asian cities, and with the Kohala Center on Hawaii island for a long-term study of human impacts on land and development, and (b) evaluation of extended producer responsibility (EPR), including investigation of how, when, and why cities and other local government units might adopt EPR and the conditions necessary for the implementation of individual producer responsibility.

Journal of Industrial Ecology

CIE is home to a highly regarded international journal. Published by Wiley-Blackwell and owned by Yale University, the *Journal of Industrial Ecology* is a peer-reviewed, multidisciplinary bimonthly on industry and the environment that is aimed at both researchers and practitioners in academe, industry, government, and advocacy organizations. It is indexed in Science Citation Index Expanded (ISI), and it is the official journal of the International Society for Industrial Ecology.

Industrial Environmental Management Program

The Industrial Environmental Management (IEM) program at Yale aims to equip students with an integrated set of skills with which to tackle the complex, multifaceted environmental problems facing industrial and corporate managers. Within the master's program, IEM students take courses in natural science, social science, and quantitative methods, followed by courses in environmental policy and management. The core intellectual framework for IEM is industrial ecology.

An active Industrial Environmental Management and Energy Student Interest Group sponsors field trips to industrial sites, on-campus talks by visiting managers, and symposia on current topics of interest. In addition, each year the IEM Lecture Series hosts speakers from industry who give presentations and meet with students.

Program on Solid Waste Policy

The program has two principal goals: (1) to inform contemporary policy discussions about solid waste and materials management by applying the methods and findings of social and environmental science and industrial ecology; and (2) to develop workable policy solutions that address the impediments to safe, cost-effective solid waste management and the complexities of comprehensive materials and life-cycle management.

HIXON CENTER FOR URBAN ECOLOGY

The Hixon Center for Urban Ecology provides an interdisciplinary forum for scholars and practitioners to work collaboratively on integrated research, teaching, and outreach to improve our understanding and management of urban environmental resources within the United States and around the globe.

The ecological health and integrity of urban ecosystems have a profound impact on urban economic productivity and quality of life. Pioneering research, new theoretical understanding, and innovative practice will be required to provide the knowledge and tools necessary to foster healthy natural systems essential for the future well-being of the modern city. This need has never been greater than today, when a majority of the world's population either resides in or is rapidly migrating to urban areas.

To accomplish its mission, the center builds upon and strengthens the work of several programs at the School, including the Urban Resources Initiative and the Urban Watershed Program.

The Hixon Center has a strong focus on collaboration within the School, across the University, and beyond. The center sponsors lectures as a means to disseminate ideas and information concerning the critical issues confronting urban ecosystems and related research.

The Hixon Center also supports Yale faculty initiatives focused on building models of stormwater management to optimize sustainability and resilience, and initiatives that build from observational to experimental research around vegetation, urban green spaces, and people. In addition, the center supports student fellowships based upon their research proposal's connection to current Hixon Center research, the outreach potential of that research, and its relevance to the continued study of urban ecology. The center will continue to build the urban environmental focus at Yale while strengthening the School's urban dimension, creating new models and approaches for addressing urban environmental changes.

Yale Program on Strategies for the Future of Conservation

The purpose of the Yale Program on Strategies for the Future of Conservation is to support the efforts of the Maine Coast Heritage Trust, the Land Trust Alliance, and similar private organizations to develop and apply new, innovative strategies for land conservation by linking the convening, research, and teaching activities at the Yale School of Forestry & Environmental Studies ever more closely to the needs of the land conservation community.

Established by a gift from Forrest Berkley and Marcie Tyre, the program has two parts:

- Sponsoring student internships and research projects (through the Berkley Conservation Scholars program), to bring the passion, experience, and creativity of Yale graduate students to bear on these issues; and
- Convening workshops and other conversations across sectors and perspectives in the search for new approaches to expanding the resources applied to land conservation in the United States.

Berkley Conservation Scholars are students of high potential who receive funding for their research and professional experiences at the cutting edge of land conservation. Support is available during both the school year and the summer, creating a virtual "R&D Department" for the U.S. land conservation community. Berkley Conservation Scholars play a critical role in helping to bring together practitioners and academics in the search for new conservation tools.

The Program on Strategies for the Future of Conservation is a major extension of F&ES's continuing efforts to enhance the effectiveness of land conservation. Working with an advisory group of land conservation leaders, the program hosts workshops, training programs, and other activities around the themes of engaging new communities in conservation; expanding the conservation toolkit; and ensuring the permanence of conservation gains.

Urban Resources Initiative

The Urban Resources Initiative (URI) is a not-for-profit/university partnership dedicated to community participation in urban ecosystem management. A substantial body of learning suggests that sustainable urban ecosystem management depends on the meaningful participation of local residents. Those who know local conditions and whose daily actions influence the health and quality of urban ecosystems must play a central role

in designing and implementing rehabilitation strategies. Sustainable natural resource management and conservation cannot be achieved by technical, scientific solutions alone. Conservation efforts, especially in urban areas where people represent a significant element of the ecosystem, must emphasize social revitalization alongside environmental restoration.

Yale's URI program draws on these essential elements to facilitate community participation in urban ecosystem management. "Community" is defined quite broadly: it includes the group of neighborhood leaders with whom interns work to restore abandoned lands near their homes. Community is a group of teens who are learning how to assess the tree canopy of their city. Community is the staff and leadership of city agencies who have the responsibility and resources to become the environmental stewards of their city. URI's approach responds to and engages all of these communities.

URI offers a number of clinical learning opportunities that allow F&ES students to gain real-world practice in their field. Listening to local concerns and developing environmental programs in cooperation with schools, neighborhood groups, and city agencies are the cornerstones of our work. Through these programs F&ES students can apply theory learned in the classroom with supervised clinical training to enrich their academic work while making a real contribution to the New Haven community. These programs include the Community Greenspace program, Green Skills, environmental education/job training program, research opportunities, and training in urban forestry practices.

Community Greenspace Each summer F&ES students work as community foresters as part of the Community Greenspace program, a citywide initiative to revitalize New Haven's neighborhoods by restoring vacant lots, planting trees along streets and in parks, remediating lead from soil in front yards, and building community. Each intern works with community groups to develop restoration goals and to design an implementation strategy for the summer. The interns help neighbors conduct an inventory of existing trees, select and prepare sites for new plantings, and plant perennials, shrubs, and trees.

The Greenspace program is an opportunity for Yale students to learn urban forestry practices. Neighbors initiate the process by identifying their environmental priorities in their community. URI looks to the local experts—the people who live in inner-city neighborhoods—as partners in defining and then assessing, designing, implementing, and sustaining urban restoration sites.

Environmental education Since 1991 URI education interns have taught hands-on environmental education programs to New Haven public school students. URI staff and interns have taught 1,700 elementary school students about environmental stewardship by exploring open space sites in New Haven using our Open Spaces as Learning Places curriculum. The pond and river units of this curriculum (repackaged as Watersheds as Learning Places) were officially incorporated into the district-wide science curriculum for the City of New Haven in the 2009–2010 academic year. Now students in every sixth-grade classroom have the opportunity to learn about watersheds as they canoe New Haven's rivers and explore local ponds.

URI's newest environmental education program, GreenSkills, creates opportunities for teens to learn about New Haven's tree canopy and to gain practical job skills. Launched in 2007, our GreenSkills program creates an opportunity to address a critical

predicament—a growing deficit in New Haven's street tree canopy that can be countered by a career development program bringing together Yale and high school interns. In 2010 the GreenSkills program was expanded to include adults recently released from incarceration, as well as those recovering from drug addiction. Our goals are to improve New Haven's street tree canopy by engaging vulnerable adults and urban high school students in the planting effort, thereby providing them with job skills and mentoring opportunities in environmental careers, and to foster a sense of environmental stewardship.

Research URI activities provide valuable research opportunities in community organizing and development, urban forestry management, environmental education and monitoring, and evaluation of community-managed ecosystems. Some examples of student research activities are a community survey to determine human health impacts of vacant lands; measurement of biological communities found in Greenspace sites and abandoned lots; and measurement of how children's behavior at play is affected by the design of schoolyards. Most recently, URI and partners at the U.S.D.A. Forest Service, and the University of Vermont Spatial Analysis Laboratory have carried out a satellite imagery analysis of New Haven's tree canopy cover. This analysis served as a basis for the City of New Haven's Mayor launching an aggressive tree-planting campaign.

Urban forestry practices Over the past two decades, URI has created several community and urban forestry training programs, including training sessions for natural resource managers (for municipal employees), a tree stewardship training program (for community leaders), and a street tree inventory training project (for local high school students). These programs have created powerful learning experiences for F&ES students as well as for the target audience. Students gain expertise in developing and implementing training programs across a broad spectrum of topics and audiences. They also work with and learn from experienced mentors from F&ES and local, state, and federal forestry agencies.

Urban Watershed Program

The Urban Watershed Program promotes faculty and student research on the unique relationships, impacts, and demands of watersheds in urban areas.

Watersheds in urban areas encounter unique stresses, while sharing common characteristics and following natural laws of all water systems. Urban watersheds are often polluted, heavily engineered, and little understood by nearby residents. Stream courses are often transferred to pipes running underground. Population density exacerbates stresses on waterways.

As cities emerge from a period when they ignored their rivers and harbors, new relationships are being developed with adjacent waterways. Past practices that marginalized waterscapes from the urban environment are being reevaluated. Now, with more attention to urban environmental quality, there is a greater understanding of the vital role waterways play as sources of open space, transportation, recreation, and habitat.

The Urban Watershed Program promotes the interdisciplinary science and policy studies of these waterways. A convenient study site is offered in the greater New Haven area through the established relationships of the Hixon Center for Urban Ecology and those of the former Center for Coastal and Watershed Systems.

TROPICAL RESOURCES INSTITUTE

The mission of the Tropical Resources Institute (TRI) is to support interdisciplinary, problem-oriented student research on the most complex challenges confronting the conservation and management of tropical environments and natural resources worldwide. TRI also sponsors and promotes educational initiatives throughout the academic year that focus on timely conservation and development issues in the global tropics.

TRI was created in 1983 to strengthen the School's involvement in the study and management of tropical resources. The institute recognizes that the problems surrounding the conservation and management of tropical resources are rapidly increasing in complexity, while demands on those resources are expanding exponentially. Emerging structures of global environmental governance and local conflicts over land use and environmental conservation require new strategies and leaders able to function across diversity of disciplines and sectors, and at local and global scales. TRI aims to build linkages across the natural and social sciences and also aims to straddle theory and practice. TRI seeks to train students to be leaders in this new era, leveraging resources, knowledge, and expertise among governments, scientists, NGOs, and communities to provide the information and tools this new generation will require to equitably address the challenges ahead.

TRI serves as the nexus within F&ES through which students conduct interdisciplinary research and outreach activities throughout the tropics. Within the broader Yale community, TRI serves as a clearinghouse for research and educational activities pertaining to tropical countries, societies, and environments.

Research TRI administers the TRI Fellowship, an endowed fellowship program that supports several dozen master's and doctoral students conducting natural and social science research in the tropics each year. Following the mission of TRI, these research projects are typically interdisciplinary and problem-oriented and cover a wide range of issues concerning the management and conservation of tropical resources. More information on this program can be found on the Web site: www.environment.yale.edu/tri.

Education TRI provides mentoring and training to graduate students in research design, proposal writing, and field methods; and sponsors workshops, roundtable discussions, and guest speakers that focus on a variety of tropical resource issues.

TRI also hosts an annual Student Workshop Series for TRI Fellows, which is open to the Yale community. The purpose of the workshops is to provide the students with feedback on their research findings, to help develop articles for the TRI *Bulletin* or external publications, and to give the students an opportunity to make a professional meetings-style presentation.

TRI also administers the new Andrew Sabin International Environmental Fellowship. This fellowship provides up to $30,000 in support for the education and training of exceptional students from less-developed countries who intend to return home to work in the field of conservation and development. More information on the Sabin Fellowship can be found on the Web site: www.environment.yale.edu/tri.

Outreach TRI supports partnerships with international organizations in many tropical regions in order to create innovative research opportunities for F&ES students. TRI works

to build networks among scholars and international institutions to facilitate research and the dissemination of knowledge on tropical resource issues. Furthermore, TRI sponsors public lectures, supports an annual conference with the International Society of Tropical Foresters, mails its *Bulletin* internationally, and hosts a Web site, www.environment.yale.edu/tri. In 2004 TRI became a voting member of the World Conservation Congress.

Publications TRI publishes *Tropical Resources: The Bulletin of the Tropical Resources Institute,* an annual journal of student research. Each spring, the *Bulletin* is sent to an international mailing list; it can also be read online at www.environment.yale.edu/tri/bulletin. The *Bulletin* publishes the results of summer field research in the tropics carried out by F&ES students with support of grants from TRI. The *Bulletin* typically contains articles by a dozen or more students based on a wide range of field research experiences.

FORUM ON RELIGION AND ECOLOGY AT YALE

The Forum on Religion and Ecology at Yale is the largest international multireligious project of its kind. With its conferences, publications, and Web site (http://fore.research.yale.edu), it is engaged in exploring religious worldviews, texts, and ethics in order to broaden understanding of the complex nature of current environmental concerns. The forum recognizes that religions need to be in dialogue with other disciplines (e.g., science, economics, policy, gender studies) in seeking comprehensive solutions to both global and local environmental problems. The cofounders and codirectors of the forum and the series editors for the *World Religions and Ecology Series* are John Grim and Mary Evelyn Tucker.

The forum arose from a series of ten conferences on the world's religions and ecology held at Harvard from 1996 to 1998, which resulted in ten volumes distributed by Harvard University Press. Several of these volumes have been translated into other languages, including Chinese. One of the principal objectives of the forum was to help to create a new field of study that will assist environmental policy.

Ten years ago, religion and ecology was neither a field of study nor a force for transformation. Over the last decade, a new field of study has emerged within academia with courses being taught at colleges and high schools across North America and in some universities in Europe. Canada and Europe now have their own forums on religion and ecology, and Australia is planning one. Moreover, a new force of religious environmentalism is growing in churches, synagogues, temples, and mosques around the world. Now every major religion has statements on the importance of ecological protection, and hundreds of grassroots projects have emerged. The Forum on Religion and Ecology has played an active role in these developments.

The work of the Forum on Religion and Ecology at Yale includes:

Joint master's degree program at Yale The Yale School of Forestry & Environmental Studies (F&ES) and Yale Divinity School (YDS) offer a joint master's degree program in religion and ecology. It is aimed at students who wish to integrate the study of environmental issues and religious communities in their professional careers and at those who wish to study the cultural and ethical dimensions of environmental problems. The joint degree is supported by co-appointed faculty and by the forum.

This degree program provides an opportunity to study in two independent schools at Yale University, each with its own integrity. Students work toward both a Master of Environmental Management (M.E.M.) degree at F&ES and either a Master of Arts in Religion (M.A.R.) or Master of Divinity (M.Div.) degree at YDS. Within these schools, they are encouraged to take courses in environmental ethics and in religion and ecology. Students have the opportunity to work with faculty in both schools, as well as with a number of co-appointed faculty members.

This joint degree in religion and ecology is the first program of its kind in North America. It aims to attract students to a growing field of study with far-reaching implications for the future of the Earth community. The Interdisciplinary Center for Bioethics at Yale and the Religious Studies department in the Graduate School of Arts and Sciences enhance the degree program.

A new chair in Religion and Environmental Stewardship was announced in December 2010 at Yale Divinity School. This is the first chair of its kind in the world and marks an important milestone for the development of the field of religion and ecology.

Publications The forum has helped to create a new field of research and teaching in religion and ecology that has implications for environmental policy.

- With its scholarly network it published the ten-volume *World Religions and Ecology Series* from Harvard.
- It has supported the first journal in the field, *Worldviews: Global Religions, Culture, and Ecology*.
- It produced a *Daedalus* volume, *Religion and Ecology: Can the Climate Change?,* which was the first discussion of world religions and the ethics of climate change.
- The forum's founders have also served as editors for the twenty-volume *Ecology and Justice Series* from Orbis Books.
- The encyclopedia *The Spirit of Sustainability* (Berkshire Publishers, September 2009) edited by Willis Jenkins of Yale Divinity School and Whitney Bauman of Florida International University was also a project of the forum.
- The forum has edited a number of volumes by the late cultural historian Thomas Berry: *The Sacred Universe* (Columbia University Press, 2009), *The Christian Future and the Fate of Earth* (Orbis Books, 2009), *Evening Thoughts* (Sierra Club Books, 2006), and *The Great Work* (Random House, 1999).
- Most recently, the forum published the book *Journey of the Universe* (Yale University Press, 2011).

Conferences The forum has organized many conferences, including "Renewing Hope: Pathways of Grassroots Religious Environmentalism" (F&ES and YDS, Spring 2007), The Forum on Religion and Ecology's 10th Anniversary Symposium (Yale Club of New York, Fall 2008), and the Thomas Berry Memorial (Cathedral of St. John the Divine, New York City, Fall 2009). The forum cosponsored the conference "Environmental Dis/locations: Environmental Justice and Climate Change" (F&ES & YDS, Spring 2010) and organized an interdisciplinary conference for the premiere of the film *Journey of the Universe* at F&ES (Spring 2011). It has also assisted in organizing the Thomas Berry Award and Lecture since 1998. The forum organized with TERI University an interdisciplinary workshop focused on the Yamuna River and held in Delhi and Vrindavan in north India (January 2011).

In addition, the forum participates in interdisciplinary conferences, both national and international, that are policy oriented. These include conferences with the United Nations Environment Programme (UNEP); United Nations Educational, Scientific and Cultural Organization (UNESCO); the International Union for Conservation of Nature (IUCN); the Dialogue of Civilizations; the Earth Dialogues led by Gorbachev; the Earth Charter; the Religion, Science, and the Environment Symposia, led by the Greek Orthodox Patriarch, Bartholomew; and the Parliament of World Religions.

Web site The forum's Web site is a world-class international site for research, education, engagement, and outreach in the field of religion and ecology. It contains detailed information on the world's religions and their ecological contributions, including introductory essays, annotated bibliographies, selections from sacred texts, environmental statements from religious communities, and engaged projects of religious grassroots environmental movements. To facilitate interdisciplinary dialogue, there are resources that address environmental issues related to ethics, economics, policy, gender, and evolutionary and ecological sciences. To enhance teaching, the site includes syllabi, lists of educational videos and CD-ROMs, links to programs and institutions related to environmental education, and a variety of other resources for educators. The site provides current information on news, publications, and events related to world religions and ecology. This is available in a monthly online newsletter that is distributed to some 9,000 people.

Films The forum was a principal adviser for the film *Renewal: Inspiring Stories from America's Religious Environmental Movement* and organized a conference at Yale for its premiere in 2007. The forum has collaborated with evolutionary philosopher Brian Swimme on a major film project, *Journey of the Universe,* directed by David Kennard (director of the *Cosmos* series with Carl Sagan). The project includes a film to be broadcast on PBS, a book published by Yale University Press, a thirteen-part DVD educational series, curricular materials, and a Web site, www.journeyoftheuniverse.org. The forum oganized a conference for the film's premiere at F&ES in March 2011.

THE ENVIRONMENTAL LEADERSHIP AND TRAINING INITIATIVE

In April 2006 the Environmental Leadership and Training Initiative (ELTI)—www.environment.yale.edu/elti—was launched, thanks to a generous grant donated by Arcadia. For the execution of the project, F&ES has partnered with the Smithsonian Tropical Research Institute (STRI) in Panama and the National University of Singapore. The mission of the program is to enhance environmental management and leadership capacity in the tropics by offering cutting-edge learning and networking opportunities aimed at improving forest conservation and human welfare. Through complementary, applied, action-oriented training and leadership-building activities, ELTI aims to serve as a platform to promote and affect on-the-ground conservation efforts.

ELTI was created to significantly strengthen conservation and restoration in tropical forest regions, specifically in South and Southeast Asia and Latin America, by offering short-term courses, workshops, conferences, and symposiums for policymakers and conservation practitioners in these regions. Additionally through this program, ELTI works

on fostering professional development through post-training event opportunities for participants, enabling them to further strengthen their understanding of particular conservation issues and their capacity to address specific environmental threats or concerns. ELTI involves faculty, staff, and students from F&ES, in addition to research scientists from STRI, in various aspects of the program.

THE GLOBAL INSTITUTE OF SUSTAINABLE FORESTRY

Since its founding in 1900, the Yale School of Forestry & Environmental Studies has been in the forefront in developing a science-based approach to forest management and in training leaders to face their generation's challenges to sustaining forests.

The School's Global Institute of Sustainable Forestry continues this tradition in its mission to integrate, strengthen, and redirect the School's forestry research, education, and outreach to address the needs of the twenty-first century and a globalized environment. The Global Institute fosters leadership through dialogue and innovative programs, creates and tests new tools and methods, and conducts research to support sustainable forest management worldwide.

Forestry at Yale is broadly defined to include all aspects of forest management and conservation. The Global Institute works primarily through faculty-led programs and partnerships with other Yale centers and forestry institutions in the United States and abroad. Students participate as research assistants, interns, and School Forests field crew; are encouraged to take on high levels of leadership in planning activities and events; and regularly contribute to published documents that emerge from program activities. An External Advisory Board, made up of international leaders in the field of forestry, provides a connection to those who are involved in the more practical aspects of protecting, restoring, and managing the world's forests.

The Global Institute coordinates the School's participation in regional, national, and international forestry events such as the Society of American Foresters' Conventions and the World Forestry Congresses and coordinates activities with other institutions throughout the world.

Research Through its research programs, the Global Institute brings world-class scholarship to bear on the challenges facing the world's forests. Programs represent the diverse interests and expertise of the F&ES faculty, who conduct applied research in both ecological and social dimensions of forests and forestry.

Yale Forest Forum (YFF) The Yale Forest Forum (YFF) serves as the dialogue and convening function of the Global Institute of Sustainable Forestry. YFF was established in 1994 by a diverse group of leaders in forestry to focus national attention on broader public involvement in forest policy and management in the United States. In an attempt to articulate and communicate a common vision of forest management to diverse stakeholders, the first initiative of YFF was to convene the Seventh American Forest Congress (SAFC). After a series of local roundtables, the SAFC culminated in a 1,500-person citizens' congress in Washington, D.C. The principles discussed during the congress remain part of YFF's core philosophy of how forest policy discussions should take place: "collaboratively, based on the widest possible involvement of stakeholders."

YFF's activities are centered on bringing individuals together for open public dialogues to share experiences, explore emerging issues, and debate varying opinions constructively. In that light YFF sponsors many issues forums and leadership seminars throughout the academic year. YFF forums and seminars not only focus on emerging issues in forest management, they also give students exposure to leaders in the NGO, industry, landowner, and government sectors in sustainable forestry. YFF publishes the *YFF Review* to disseminate to a wide audience the outcomes and lessons learned from its work.

Several times a year, the Global Institute convenes forums on significant issues in forest sustainability, with participants drawn from the widest possible range of individuals who affect and are affected by forest policies, including those working in government, business, conservation, academia, and community-based organizations. Most forums include a formal panel presentation, open to the public, and a workshop session. They provide an opportunity for diverse interests to meet and exchange ideas and have led to ongoing dialogue concerning forestry problems and solutions.

Integral to the work of YFF and the development of many forums are student input and assistance.

Publications Global Institute publications, along with the Web site, are the primary means of communicating the work of the institute. The *YFF Review* series includes summaries of forums, workshops, internships, fellowships, seminars, and conferences. Faculty and staff research on selected forest issues is disseminated through working papers and research reports. Publications are available in both print and on the Web site. The institute also sponsors publication of the *Journal of Sustainable Forestry*.

YFF leadership seminar series The Global Institute's weekly lunchtime talks allow students and other members of the F&ES community to interact informally with individuals actively working in forestry and conservation. Speakers have included, among others, forest practitioners; forest landowners; government scientists and policymakers; community activists; authors and journalists; leaders of local, national, and international conservation organizations; academicians; and business executives.

Yale F&ES courses and seminars Global Institute faculty teach a wide array of graduate courses and seminars that explore the scientific underpinnings and policy implications of sustainable management of the world's forests.

Midcareer short courses Weeklong courses in Forest Stand Dynamics for forestry practitioners are taught on the West Coast in partnership with the University of Washington and the University of British Columbia. Executive short courses bring the latest thinking in sustainable forestry to business executives and forestry professionals. Specialized midcareer training in emerging issues in forestry is also provided to groups such as the Indian Forest Service.

Through the programs and Yale Forest Forum, the Global Institute has undertaken several initiatives, including examination of forest fragmentation and land use change, the total cost of forest wildfires, the impact of forest certification, rural community viability, global forest governance regimes, forest certification, tropical forest restoration, a

working definition of sustainable forestry, landscape and watershed management techniques and technical tools, management of mixed hardwood forests, conservation priority setting, forest health indicators, and forest health issues such as natural disturbance regimes and invasive species.

The Global Institute of Sustainable Forestry is governed by the dean of the School, a faculty director, an executive director, professional program staff, a group of faculty advisers, many of whom lead Global Institute programs, and an external advisory board. The main office is located in Marsh Hall.

Program in Tropical Forestry

The mission of the Program in Tropical Forestry is to become a world leader in research, education, information dissemination, promotion of sustainable forest management, plantation silviculture, and restoration of degraded ecosystems throughout the tropics. The program activities are carried out by F&ES faculty in collaboration with colleagues from academic institutions in the tropics. The program is closely linked to F&ES Tropical Resources Institute (TRI), sharing the overall philosophy of its mission but with a more focused approach toward tropical forestry research, education, and knowledge dissemination.

The program seeks to expand the work of Yale faculty, students, and staff by conducting research; offering relevant courses, seminars, and workshops; and promoting cooperation among faculty and students from F&ES and collaborating institutions worldwide. Courses in tropical forestry, agroforestry, tropical ecology, ecosystem restoration, and silviculture are taught by faculty at F&ES. Forum and roundtable discussions are also part of the program's information outreach.

The challenges that tropical forestry faces in the twenty-first century are very well known. In the early 1990s the total area of deforested and degraded tropical land surpassed the area of mature tropical forests. Similar trends persist in the current century. Tropical forestry is confronted with the task of finding strategies to alleviate pressure on remaining forests and techniques to enhance forest regeneration and restore abandoned lands, using productive alternatives that can be attractive to local communities. In addition, sustainable forestry in tropical countries must be supported by adequate policies to promote and maintain specific activities at local and regional scales.

Research by faculty of the Global Institute of Sustainable Forestry and collaborators in tropical countries includes ecosystem restoration; management of secondary forests and enrichment planting; reforestation with native species; plantation silviculture; recovery and conservation of plant and animal biodiversity; conservation and management of nontimber forest products; carbon sequestration by tropical forests and plantations; recovery and protection of watershed services, including water volume and quality; evaluation and quantification of ecosystems services; systems and policies for Payments for Environmental Services (PES) as tools to promote restoration, conservation, and rural development; community forestry projects; and productivity and environmental services of agroforestry systems. Special emphasis is placed on reforestation of degraded lands with native species, including mixed-species designs, enrichment planting, and agroforestry systems.

Governance, Environment and Markets (GEM) Initiative

The purpose of the Governance, Environment and Markets (GEM) initiative at Yale is to reorient relatively short-term and single-intervention approaches toward environmental governance research and practice aimed at fostering long-term problem solving.

The GEM initiative accomplishes this objective through a "governing for global environmental problems" approach in which innovative governance/policy proposals are assessed by their ability to develop enduring solutions that can help ameliorate leading global environmental challenges. Accordingly, we undertake research, teaching, extension, and outreach designed to identify viable pathways for government officials, firms, environmental groups, and other stakeholders. In order to uncover what are often productive but hidden opportunities, we focus on understanding and disseminating knowledge about:

- Interactions among government and market mechanisms across global, national, and local scales that might produce innovative, effective, and efficient results that cannot be achieved through single interventions or institutions
- Evolution of policies and institutions that foster results and durability over time

These questions are pursued through four themes: (1) privatization of environmental governance; (2) triggers of progressive incremental and rapid policy change; (3) determinants of effective policy learning; and (4) democratization and environmental rights. This focus is applied to a range of cross-cutting, substantive policy problems, including:

- Global forest degradation and deforestation policy such as legality verification, forest certification, "Forest Law Enforcement and Governance" (FLEG), "Reduced Emissions from Deforestation and Forest Degradation" and conservation (REDD+), and the international forest regime
- Climate change policy
- Such "path-dependent" interventions to address "super-wicked" policy challenges, REDD+, and voluntary carbon markets

GEM, which is led by Professor Benjamin Cashore, is located on the fourth floor of Sage Hall. Students have the opportunity to work as researchers and/or assist in the coordination of program activities.

We undertake these efforts through cutting-edge research, widespread dissemination, stakeholder interactions, student engagement, and development of policy briefs. We apply one or more of the above themes to substantively important global environmental policy problems. There are currently two flagship programs:

Forest Policy and Governance The mission of the Yale Program on Forest Policy and Governance is to document, research, teach, and conduct outreach to foster innovations in sustainable forestry management and policy. It is a core program within the Global Institute of Sustainable Forestry at F&ES. The program focuses on all forms of state and non-state policy and governance, from domestic forest policy to global intergovernmental negotiations, to market-based systems for promoting sustainable forest management.

The program focuses on three interrelated efforts: (1) research designed to understand the development of state and non-state forest policies and their impacts on sustainable forestry. Our research is organized around five key themes: comparative forest policy

and governance, from the local to the global level; the dynamics of legitimacy among state and non-state governance systems; the development and impacts of forest certification and other market-based instruments in developing countries; the environmental and social effects of certification; and market-supply dynamics; (2) teaching and training on forest governance and policy. Our teaching includes undergraduate and graduate courses on international forest policy and governance, including a comprehensive seminar on forest certification and training on how to conduct certification audits; and (3) outreach activities to the broader forestry community. The program hosts visiting speakers at Yale, as well as participates in key certification and sustainable forest policy conferences globally.

The program is located on the fourth floor of Sage Hall. Students have the opportunity to work as researchers and assist in the coordination of program activities and certification assessment training. Our office includes a comprehensive reference database of nearly 10,000 sources, including seminal journal articles and historical information relating to certification programs throughout the world, which we make available to students and faculty at Yale.

Climate Change as a "Super Wicked" Policy Problem Our substantive focus on climate departs from existing international relations research, which focuses primarily on why states do or do not cooperate in exploring policy interventions outside of this model. This leads us to apply key mechanisms to assess climate in three ways: (1) we identify how climate, as the leading case of a "super wicked problem," might benefit from attention to "path-dependency" policy analysis; (2) we focus on how symbiotic interaction among intergovernmental approaches, such as the CDM mechanisms, might interact synergistically with non-state, market-driven global governance, such as the CDM gold standard certification, to produce authoritative approaches in ways that neither intervention by itself could; and (3) we focus on how the intersection of climate and forests might shape the definition of problems and solutions to them unimaginable a generation earlier.

Other key sectors and resource challenges will also be developed in partnership with faculty and practitioners within and outside of Yale.

The Forests Dialogue

The Forests Dialogue (TFD) is an autonomous organization, with a Secretariat based at F&ES. TFD was created in 1998 to provide international leaders in the forest sector with an ongoing, multi-stakeholder dialogue (MSD) platform and process focused on developing mutual trust, a shared understanding, and collaborative solutions to challenges in achieving sustainable forest management and forest conservation around the world. The Secretariat has been based at Yale since 2000.

The goal of TFD is to reduce conflict among stakeholders over the use and protection of vital forest resources. Over the last ten years, TFD has brought together more than 2,000 diverse leaders to work through eight compelling forest issues. Current TFD initiatives to address these issues include: Assessing Country-Level REDD Readiness Processes; Promoting Investment in Locally Controlled Forests; and Implementing "Free, Prior, and Informed Consent" on the ground. TFD utilizes the MSD model to progress from building trust among participants to achieving substantive, tangible outcomes. A

primary reason for TFD's success is that participants are committed to advocate for and work to implement those consensus-based outcomes.

TFD is governed by a Steering Committee composed of a diverse group of individuals representing key stakeholder perspectives from around the world. TFD hires F&ES students as interns each term to work with the Secretariat and Steering Committee members. Internship duties include background research, Secretariat support, dialogue planning, and implementation.

Program on Forest Physiology and Biotechnology

The Program on Forest Physiology and Biotechnology (PFPB), under the leadership of Professor Graeme Berlyn, focuses primarily on the relationships of physiology, morphology, ecology, and genetics of forest plants to silviculture, sustainable forestry, forest carbon, and climate change. The main objectives of the biotechnology initiative are to analyze ecosystem impacts of biotechnology from biological, technical, and cultural perspectives; to evaluate strategies to minimize possible deleterious effects in these several dimensions; and to organize forums for discussion of the role of genetic techniques in forest health and forest tree improvement in ways that do not represent biological hazard to the future forests of the world. The use of genetically modified trees for restoration, increased forest productivity and carbon sequestration, and removal of pollutants is also a prime consideration.

Current work involves antioxidants, which inhibit pathogenesis and increase the natural resistance of the plant using chemical signaling to stimulate the production of protective compounds and protective tissues. Efforts are under way to improve the antioxidant systems (superoxide dismutase, ascorbic acid, glutathione, nitric oxide) in tree leaves in order to alleviate stress and carbon sequestration.

The program is located in the Greeley Laboratory, but the program's research involves many arctic, alpine, boreal, temperate, and tropical biomes. There are numerous opportunities for students to be involved with the research.

Program on Landscape Management

Forest ecosystems can be defined at a variety of scales—a stand, a landscape, a region, a continent. At all scales, they are dynamic—constantly changing from one condition to another. Managing forest ecosystems requires an understanding and appreciation of the biological, social, and economic dynamics of forest ecosystems. Past attempts to manage at the individual stand scale proved difficult, since stands exist naturally in a variety of structures, and each structure provides different values. To provide all values, all structures need to be maintained by different stands across the landscape. This is the basis of the landscape approach to forest management.

The Landscape Management System (LMS) at the School of Forestry & Environmental Studies is a cooperative project with the University of Washington, the USDA Forest Service, and other organizations throughout the world. Its purpose is to develop the scientific basis, concepts, and tools needed to help people manage forests to provide the wide range of values people want—including commodities, wildlife habitat, fire safety, employment, and carbon sequestration. These values are best provided by coordinating

the dynamic changes of forests across a landscape, rather than by trying to provide each or all values continuously on a single area.

The Program on Landscape Management is housed in Greeley Laboratory. Students have a range of opportunities to work with the program, from technical development of the modeling software to field data collection and synthesis.

Program on Private Forests

The Program on Private Forests is engaged in education and research on the status and management of private forestlands, focusing on land use change dynamics, ownership trends, and demographics affecting private lands in the United States.

Growing populations and burgeoning global economies are increasing demands for forest products and services, thereby placing intense pressures on the world's forests. It is a considerable challenge to supply the demand for products and services while maintaining healthy, viable forests. Much of the pressure will be on private forests. For example, of the roughly 747 million acres of forest in the United States, almost 60 percent—430 million acres—is privately owned. These private lands provide the majority of the country's environmental services and forest products. It is estimated that 89 percent of the timber harvested in the United States comes from private lands, an increase from 76 percent in the 1970s.

Yale's historic role as a convener of diverse stakeholders and a facilitator and adviser to "unexpected coalitions" makes it a potent advocate and force for conservation and stewardship of private forests and for promoting dialogue and intelligent assessment of issues related to sustainable forestry on private lands. Combining the academic and research expertise at Yale with the practical experience of private sector leaders, we work to find innovative ways to bring various stakeholder communities together and to move toward a more sustainable future. Through our research, forums, and publications, we provide landowners and the public with topical, scientifically based information so that they can make more informed decisions. There are three major initiatives:

Dynamic Models of Land Use Change We are developing analytic tools and techniques to assist community leaders, conservation organizations, and citizens to understand and predict land use change dynamics, in particular changes in forested lands. The research into forest fragmentation patterns and dynamics, done in collaboration with the State University of New York College of Science and Forestry, is being conducted in the northeastern United States.

Sustaining Family Forests Initiative The Yale Program on Private Forests is leading a U.S. national collaboration of government agencies, industry, NGOs, certification systems, landowners, and academics organized to gain comprehensive knowledge about family forest owners. Using social marketing methods, the project is aimed at creating credible, useful information about the family forest owners for those who wish to create a climate in which forest owners can easily find the information and services they desire to help them conserve and manage their land.

Understanding Connecticut Landowners Even though Connecticut is one of the nation's most densely populated states, it is also one of the most heavily forested: nearly

60 percent of the land base is in forest, and 77 percent is owned by private landowners. This means private landowner management and ownership decisions have enormous influence over the quality and extent of Connecticut forests. The Understanding Connecticut Landowners project involves social marketing research to support the goal of preserving Connecticut's forests.

The Program on Private Forests is located in Marsh Hall. Students have the opportunity to participate in all aspects of the program activities, including research, forums, workshops, and outreach.

School Forests

The Yale School of Forestry & Environmental Studies owns and manages 10,900 acres of forestland in Connecticut, New Hampshire, and Vermont. Maintained as working forests deriving income from timber and other products, the School Forests provide educational, research, and professional opportunities for the students and faculty of the School; they are used as a laboratory for teaching, management, and research.

Program on Forest Health

The Program on Forest Health is engaged in education, research, and dissemination of scientific information to inform policy decisions affecting the health of forested ecosystems and landscapes. We emphasize maintaining the long-term ecological health of forests despite biotic, abiotic, and societal pressures, and developing management solutions for sustaining and restoring healthy forests and the communities that depend on them.

Increasingly, forests face multiple stresses from insect outbreaks, invasive species, wildfires, disease, pollution, fragmentation, natural disturbances, and human impacts. In the face of these threats, forest managers are challenged to maintain forest ecosystems that provide environmental services, economic return, and recreational and aesthetic value to landowners and society. Good scientific information about emerging problems and complex interactions is crucial to ensure that management decisions today do not compromise the long-term health of forests.

Combining Yale's academic and research expertise with the practical experience of private sector leaders, we bring diverse stakeholder communities together to develop innovative management strategies and solutions to forest health problems, while promoting interdisciplinary assessments of critical forest health issues. Our research, forums, and publications provide policymakers and the public with topical, scientifically based information. We offer courses, seminars, and workshops for students and stakeholders and for public awareness. Graduate-level courses in forest health, fire science and policy, and invasive species are taught as part of the School of Forestry & Environmental Studies curriculum.

Projects include forums, seminar series, workshops, and publications on threats and effects of invasive species, and research on forest health indicators, managing invasives in fire-dependent ecosystems, control of invasive plants to protect endangered species habitat, and use of prescribed fire to achieve forest management goals. Research on fire effects on forest vegetation and the converse—the effects of forest composition and structure on fire behavior—is being undertaken in the "sky islands" of West Texas and Mexico,

as well as in boreal Alaska. We are participating in a statewide collaboration to monitor forest health in Connecticut and to derive a set of forest health indicators for tracking changes due to stressors, such as increasing forest fragmentation and climate change. Students are involved in all aspects of the program, including planning and organizing forums and speaker series and conducting research.

PARTNERSHIPS

The School of Forestry & Environmental Studies is a multidisciplinary learning center with tremendous resources, both within and outside the School. The School is engaged in partnerships that range from alliances with other Yale programs and schools to formal agreements with many external organizations and universities. These relationships enrich the School and add important dimensions to the F&ES learning experience.

Within Yale

Students of the School of Forestry & Environmental Studies often take advantage of the faculty and resources of other schools and departments within the Yale system. F&ES has several types of arrangements that enable students to fully benefit from the University.

The School has joint-degree agreements with the School of Architecture, Divinity School, School of Engineering & Applied Science, Law School, School of Management, School of Public Health, and the Graduate School's programs in International Relations and International Development Economics. For further information on joint degrees, please refer to Joint Master's Degree Programs and Combined Doctoral Degree.

The School has also cultivated relationships with key faculty members of other divisions of the University who have research and teaching interests that overlap with the School's foci. These faculty hail from the schools of Architecture, Engineering & Applied Science, Management, and Medicine, as well as the departments of Geology and Geophysics, Ecology and Evolutionary Biology, Economics, and Anthropology, among others. For a full list of the faculty with joint appointments, see Courtesy Joint Appointments.

YALE INSTITUTE FOR BIOSPHERIC STUDIES

Established in May 1990, the Yale Institute for Biospheric Studies (YIBS) serves as a key focus for Yale University's research and training efforts in the environmental sciences. YIBS is committed to the teaching of environmental studies to future generations and provides physical and intellectual centers for research and education that address fundamental questions that will inform the ability to generate solutions to the biosphere's most critical environmental problems. There are currently eight YIBS Research Centers: Center for Earth Observation; Center for Eco-Epidemiology; Center for the Ecology and Systematics of Animals on the Verge of Extinction (ECOSAVE); ECOSAVE Molecular Systematics and Conservation Genetics Laboratory; Center for Field Ecology; Center for Human and Primate Reproductive Ecology; Center for the Study of Global Change; and Earth System Center for Stable Isotopic Studies. The School's current interests are most closely aligned with the Centers for Earth Observation, Eco-Epidemiology, Molecular Systematics and Conservation Genetics, Field Ecology, and Stable Isotopic Studies. For

full information on the Yale Institute for Biospheric Studies and its associated centers, please refer to the YIBS Web site, www.yale.edu/yibs.

YALE PEABODY MUSEUM OF NATURAL HISTORY

The Yale Peabody Museum of Natural History, founded in 1866, contains one of the great scientific collections in North America. Numbering more than eleven million objects and specimens, the collections are used for exhibition and for research by scholars throughout the world. Each year, an increasing number of specimens from the collection are available online at www.peabody.yale.edu.

The mission of the Peabody Museum is to advance understanding of earth's history through geological, biological, and anthropological research, and by communicating the results of this research to the widest possible audience through publication, exhibition, and educational programs.

Fundamental to this mission is stewardship of the museum's collections, which provide a remarkable record of the history of the earth, its life, and its cultures. Conservation, augmentation, and use of these collections become increasingly urgent as modern threats to the diversity of life and culture continue to intensify.

The museum's collections are a major component of the research and teaching activities of the Peabody and Yale. The curators and staff are engaged in contributing new knowledge based on the museum's research materials. All collections are used in undergraduate and graduate teaching and research, as well as in public programs and exhibitions. The Yale Peabody Museum fills many important roles on the Yale University campus, particularly as it has expanded its role in the community and the region, thereby offering a "front door" to the University for the general public.

In 1995, a formal collaboration was established among the Peabody Museum, the Yale Institute for Biospheric Studies, and the School of Forestry & Environmental Studies. This environmental partnership recognizes the Peabody Museum as a resource and catalyst for interdisciplinary research on the earth's history and environment, and seeks to strengthen the intellectual ties between the museum and other groups with a shared interest in environmental research at Yale. The School of Forestry & Environmental Studies maintains a close association with the Peabody. Among other activities involving F&ES faculty, staff, and students, the Peabody Field Station in Guilford, Connecticut, is used collaboratively for research on coastal and estuarine systems.

Coastal Field Station A research facility is available to students and faculty of the School of Forestry & Environmental Studies at the Peabody Museum Field Station on Long Island Sound in Guilford. The station is a thirteen-mile drive east of Yale and provides centrally located access to one of the country's most important estuaries. The station includes a boat ramp, dock, deep-water moorings, and small boats. There is also a simple laboratory within the field station building, Beattie House. Nearby research lands available to F&ES students include an island (Horse Island), coastal pond (Guilford Pond), and salt marsh complex (the Richards Property). Along with the field station, these are all part of the Center for Field Ecology, sponsored by the Yale Institute for Biospheric Studies.

External Partnerships

The School of Forestry & Environmental Studies has partnership agreements with numerous local, national, and international organizations beyond the Yale campus. The following are a few examples of these arrangements.

HUBBARD BROOK

The Hubbard Brook Ecosystem Study in New Hampshire is a long-term multidisciplinary investigation of the structure, function, and interactions among atmospheric, terrestrial, and aquatic ecosystems. Proposed in 1960 by F.H. Bormann and started in 1963, Hubbard Brook is one of the oldest Long-Term Ecological Research sites supported by the National Science Foundation. As such, the facility has functioned as a national center and attracted investigators from a spectrum of biological and physical sciences. Faculty and students from F&ES continue to be active participants at "the Brook."

F&ES Professor Emeritus F. Herbert Bormann and Gene E. Likens founded the Hubbard Brook Ecosystem Study. Today the School's students and faculty benefit from more than forty years of data and hands-on clinical experience. The Hubbard Brook ecosystem provides collaborators with background data drawn from long-term records of climate, hydrology, precipitation, and stream-water chemistry; and with biological data from numerous ongoing studies. Cooperative research at Hubbard Brook has contributed to a better understanding of the northern forested ecosystem. The Hubbard Brook investigators are achieving the most fundamental aspect of ecosystem studies — the integration of data into a functioning scheme of ecosystem behavior through time.

NATIONAL UNIVERSITY OF SINGAPORE

The National University of Singapore is a top research university with a far-reaching faculty and a multinational student body. The university offers a Master of Science in Environmental Management that provides environmental management education for senior and mid-level managers in corporations, institutions, and government and nongovernmental organizations. This program is multidisciplinary, with the combined resources of seven of the university's faculties, as well as international, drawing on the expertise of established environmental agencies and institutions both locally and globally.

In 2001 the Yale School of Forestry & Environmental Studies entered into an official agreement with the National University of Singapore to share scientific, academic, and technical resources; exchange faculty and students; and cooperate in research, outreach, and conferences. There is an active faculty exchange and a joint research program examining industrial ecology and urban metabolism in Singapore.

NEW YORK BOTANICAL GARDEN

The School of Forestry & Environmental Studies has enjoyed a reciprocal relationship with the Graduate Studies Program at the New York Botanical Garden for many years. Begun in 1896, the Botanical Garden program currently enrolls several dozen students who are carrying out studies in systematic and economic botany at field sites around the world. The program's expertise spans the spectrum of both systematic and economic botany. It is operated in conjunction with several other academic institutions, including the Yale School of Forestry & Environmental Studies.

The resources of the New York Botanical Garden include one of the largest botanical libraries in the world, an herbarium and 10,000 species of living plants housed in several greenhouses, as well as an electron microscope, environmental chambers, and instrumentation for radiobiological, biochemical, anatomical, molecular, phytochemical, chemosystematic, numerical taxonomy, and vegetational studies. The School of Forestry & Environmental Studies offers a combined doctoral degree with the New York Botanical Garden, which is funded by the Lewis B. Cullman Fellowship. NYBG faculty teach courses at F&ES in tropical plant taxonomy and ethnobotany.

THE ENERGY AND RESOURCES INSTITUTE

The Energy and Resources Institute (TERI), a not-for-profit organization in New Delhi, India, was founded in 1974. Over the years, TERI has expanded from its initial purpose of documentation and information dissemination to become a dynamic and flexible organization with a global vision and a local focus. Twenty-five years ago, the institute initiated research projects in the fields of energy, environment, and sustainable development. Today, TERI is an internationally recognized center for research and outreach, and this reputation is rapidly being enhanced by the educational opportunities offered by TERI University.

The School of Forestry & Environmental Studies entered into an official agreement with TERI in 2001, whereby each organization agreed to support the other's faculty and student activities, thus expanding the resources of both learning institutions while fostering international relationships.

EXTERNAL JOINT-DEGREE PROGRAMS

The Yale School of Forestry & Environmental Studies also has joint-degree agreements with the Pace University School of Law and the Vermont Law School. Further information on these programs is available through the admissions office.

Admissions: Master's Degree Programs

The School of Forestry & Environmental Studies offers four two-year master's degrees: the professionally oriented Master of Environmental Management (M.E.M.) and Master of Forestry (M.F.), and the research-oriented Master of Environmental Science (M.E.Sc.) and Master of Forest Science (M.F.S.). For individuals with seven or more years of professional experience related to the environment or forestry, a one-year midcareer option is available for the Master of Environmental Management and Master of Forestry degrees.

LEARNING ABOUT F&ES

The best way to learn about the School is to visit New Haven before submitting an application. Three open houses for prospective students will be held on October 14, November 11, and December 2, 2011, and an open house for admitted students will be held at the end of March 2012. Participants will meet faculty, students, and staff to become familiar with the mission and goals, degree requirements and courses, opportunities for research and applied projects, career development, and life at Yale. F&ES faculty and staff also conduct outreach events around the United States and abroad. The Admissions event schedule is posted at www.environment.yale.edu/admissions.

Campus visits are available throughout the year, and we encourage prospective students to visit at a time that is convenient for them if they are unable to attend an open house. Please note that visits will not be scheduled between February 15 and March 31 because of the admissions decision-making process. It is best to visit Monday through Thursday. Few classes are held on Fridays, which are generally reserved for field trips and research. Visitors are welcome to sit in on classes of interest with no advance notice; the class schedule each term is posted at www.environment.yale.edu/currentstudents. Feel free to contact directly any faculty member whose work is of interest to you; e-mail is best. We do not conduct formal interviews. To schedule a visit, please contact us at fesinfo@yale.edu. If you want a tour of Kroon Hall, the School's new electric building, contact David DeFusco, director of communications, at 203.436.4842.

Finally, we are pleased to correspond with you about the School by e-mail, or you may schedule a telephone conversation with our Admissions staff. The Admissions Web site, www.environment.yale.edu/admissions, has extensive information about the School.

APPLICATION PROCEDURES

The application form for admission to the F&ES professional and research master's degrees (M.E.M., M.E.Sc., M.F., or M.F.S.) may be acquired online at https://apply.environment.yale.edu/apply. This form includes complete instructions for the application requirements.

Questions concerning admission or the application process should be directed to fesinfo@yale.edu, or 800.825.0330.

The priority deadline for master's application consideration is December 15, 2011. Completed individual admissions files submitted by 5 p.m. EST on this date are guaranteed to receive a review by the Admissions Committee. Application materials may be submitted after this date, but there is no guarantee that they will be acted upon this year.

Therefore we encourage serious applicants to submit all required items to the Office of Admissions prior to the December 15 deadline.

Previous applicants planning to reapply to F&ES must submit a new application form and current application fee, an updated résumé/curriculum vitae, and transcripts depicting all academic work not included in the previous application. We also recommend that applicants consider submitting an updated personal statement. Admissions records including application forms and supplemental materials are held for two years by the Office of Admissions. Provided reapplication occurs within two admissions cycles, all required materials previously submitted to the Office of Admissions will be incorporated into the new application. Documents submitted prior to the fall 2010 admissions cycle are no longer available.

PREPARATION FOR ADMISSION

The School welcomes individuals from a variety of undergraduate backgrounds including the biological and physical sciences, engineering, social sciences, mathematics, humanities, or interdisciplinary programs. A disciplinary focus with some interdisciplinary breadth is valuable. Introductory course work in the biological and physical sciences, the social sciences, and college mathematics allows students to take greater advantage of courses at the graduate level. Students with adequate undergraduate breadth also have better access to graduate course offerings in other professional schools and departments of the University.

Experience has demonstrated the special value of a short list of selected courses that provide a good foundation for all master's programs in the School. Therefore the Admissions Committee favors applicants who have successfully completed a combination of the courses listed below prior to beginning a degree program at the School. For this reason, it is highly recommended that applicants have at least (a) two college courses in mathematics, (b) two college courses in the biological sciences, (c) two college courses in the physical sciences, and (d) two college courses in the social sciences.

The specific courses listed under each distribution area are judged to be most suitable for helping students gain the maximum benefit from Yale course offerings. Students wishing to fulfill these recommendations can take courses at any accredited institution and must have been awarded a final grade of C or better (not taken pass/fail). Advanced Placement (AP) and International Baccalaureate (IB) courses will no longer be considered during our transcript review process.

1. College mathematics—two courses selected from:
   a. calculus
   b. statistics
   c. linear algebra
   d. discrete mathematics
2. Biological science—two courses selected from:
   a. evolutionary biology
   b. ecology
   c. botany
   d. zoology
3. Physical science—two courses selected from:
   a. general chemistry
   b. general physics
   c. geology/earth science
   d. hydrology/soil science

4. Social science—two courses selected from:
   a. anthropology
   b. economics (micro and macro)
   c. political science
   d. sociology

APPLICATION REQUIREMENTS

Candidates for admission must hold a four-year baccalaureate degree or an equivalent international degree, and are required to provide the following materials:

1. A completed online application form.
2. A résumé/curriculum vitae.
3. A personal statement discussing career plans and the reasons for applying to F&ES (600-word maximum).
4. One transcript or mark sheet from each college and/or university attended. Applicants who have completed a degree outside of the United States or Canada must submit a transcript evaluation. We encourage applicants to use EducationUSA advisers (www.educationusa.info/centers.php) or World Education Services (www.wes.org) for course-by-course or ICAP evaluation of all transcripts (undergraduate and graduate). Those who must secure WES evaluations should submit their official transcripts directly to WES and not to the Office of Admissions. Evaluations must be received in the Office of Admissions by the December 15 deadline for an application to be considered complete.
5. Three letters of reference (academic and/or professional). Submission of the recommendation form and a one-page letter is expected. Please note that we are unable to accept any additional recommendations beyond the required three.
6. An official GRE, GMAT, or LSAT score report. Applicants must complete the exam by the December 15 deadline. We only accept LSAT scores for those applicants currently applying to the joint law programs with Pace, Vermont, or Yale Law Schools. If submitting LSAT scores, please contact the Office of Admissions for instructions. We do not accept unofficial copies of score reports or other test formats such as MCAT or MAT.
7. An official TOEFL or IELTS score report if English is not a native or customary language of instruction (copies will not be accepted).
8. The $80 application fee.
9. If applying to the M.E.Sc. or M.F.S. program, please be sure to include a list of three potential advisers on the application form. Please also attach as an addendum to the personal statement short paragraphs (four to five sentences each) on why you would like to work with each of the advisers you identified on your application form.

   Note: Additional documents beyond those listed above will not be reviewed and may be discarded at the end of the admissions cycle.

All application materials should be uploaded to the electronic application form. Materials connot be returned, copied, or forwarded to third parties.

All applicants must hold a bachelor's-level degree and demonstrate satisfactory academic achievement, but there are no arbitrary standards or cutoffs for test scores or grade-point averages. Letters of reference from individuals who can evaluate the

applicant's scholarship, professional activities, leadership skills, and career goals are especially valuable. Letters from undergraduate professors and/or professional supervisors are preferred. The School looks for students capable of making effective contributions to scientific knowledge or to professional service in addressing environmental problems. Special weight is given to relevant experiences obtained subsequent to graduation from college. Clarity regarding professional career goals is a critically important part of the applicant's personal statement. Faculty review teams read the applications submitted to the master's degree programs. Final admissions decisions rest on an integrated assessment of the components described above.

When taking the Graduate Record Examination (GRE) or Graduate Management Admissions Test (GMAT), applicants should indicate the School's Institution Code Number 3996 or 3TJ-WT-45; no department code is necessary. Applicants taking the Law School Admissions Test (LSAT) must contact the Office of Admissions for special instructions. For further information, please visit the following Web sites: www.gre.org, www.mba.com/mba, or www.lsac.org. Official GRE and GMAT test results will be sent directly to the School by the testing services and generally arrive two to three weeks after the examination date. Please plan ahead so that scores will arrive by the December 15, 2011, application deadline.

ENGLISH AS A SECOND LANGUAGE TRAINING REQUIREMENT

Applicants for whom English is not a native or customary language of university instruction must take the Test of English as a Foreign Language (TOEFL) or the International English Language Testing System (IELTS). We require a minimum TOEFL score of 100 on the Internet test. A minimum score of band 7.0 is required for the IELTS. Please note that we will only accept the iBT version of the TOEFL examination. When taking either test, applicants should indicate the School's Institution Code Number 3996; no department code is necessary. Additional information about TOEFL can be found at www.ets.org/toefl. Information about IELTS can be found at www.ielts.org. Official test results will be sent directly to the School by the testing service and generally take two to three weeks to arrive.

Applicants who are required to submit the TOEFL or IELTS must also submit a supplemental essay (300 words maximum) detailing all educational, research, and/or work and internship experience related to the English language. The Admissions Committee may follow up with a phone interview to assist in determining English proficiency. As a condition of acceptance, it may be required that applicants for whom English is a second language, whose undergraduate degree work has not been conducted in English, or whose application suggests such a need, complete a six-week instructional program in written and spoken English conducted by Yale Summer Session. More information will be provided to those students who may qualify for this requirement.

Admissions: Doctoral Degree Program

The doctoral program is designed to develop the broad knowledge, analytical powers, technical skills, and creative thinking demanded of leaders in environmental and natural resources disciplines. Applicants should hold a bachelor's or master's degree in a field related to their intended program of study as expressed in the application.

APPLICATION PROCEDURES

The Doctor of Philosophy (Ph.D.) degree is administered jointly by the School of Forestry & Environmental Studies and the Yale Graduate School of Arts and Sciences.

Applications for the Ph.D. program can be obtained from the Web site of the Yale Graduate School of Arts and Sciences at www.yale.edu/graduateschool/admissions/index.html. The application deadline for the Ph.D. program is January 2, 2012. Doctoral education involves a close pairing between the student and a faculty adviser. Before applying to the doctoral program, applicants must identify and contact one or two faculty members who would serve as their major advisers if accepted to the program.

The Graduate Record Examination (GRE) general test is required of all applicants. For more information on the GRE, visit the Web site, www.gre.org.

The Test of English as a Foreign Language (TOEFL) is required of all applicants whose native language is not English. This requirement is waived only for applicants who will have received a baccalaureate degree, or its international equivalent, prior to matriculation at Yale and from a college or university where English is the primary language of instruction. If you do not qualify for a waiver but have taken the TOEFL within the last two years, you will need to have your TOEFL scores released to the Yale Graduate School of Arts and Sciences (code 3987). If your scores can no longer be released, you will need to take the test. The International English Language Testing System (IELTS) may be substituted for the TOEFL. For more information and the latest updates on the TOEFL and IELTS, visit the Web sites at www.ets.org/toefl and www.ielts.org.

Tuition, Fees, and Other Expenses

TUITION AND FEES, 2011–2012

Master's Programs

The 2011–2012 tuition for master's degrees (Master of Environmental Management, Master of Forest Science, Master of Environmental Science, and Master of Forestry) is $31,900. Tuition for special students is based on the number of courses taken. The School reserves the right to revise tuition as it deems appropriate. Tuition does not include health insurance as required by the University, or materials fees charged by other schools and departments in the University.

Two-year master's students must pay full tuition for two years, regardless of the number of courses taken.

For 2011–2012, a single student should also anticipate estimated expenses of $1,200 for books and supplies; $1,522 for health insurance; living expenses of $13,428 for room, board, transportation, and personal expenses for nine months; and $250 for the Student Activities Fee.

Doctor of Philosophy Program

The 2011–2012 tuition for the Ph.D. program is $34,500. Most doctoral students receive a School fellowship that covers the cost of their tuition and provides a twelve-month stipend for the first five years of their program. In 2011–2012 the stipend is $26,500. Doctoral students must pay a nominal continuing registration fee for no more than three years thereafter. In 2011–2012 the continuing registration fee is $780.

For 2011–2012, a single student can expect living expenses of approximately 25,430 for twelve months.

REGISTRATION

All students in the master's programs must register for courses using the online registration system (available at www.yale.edu/sis) within the normal shopping period. The shopping period is the first two weeks of classes for the fall and spring terms (see academic calendar). A penalty of $25 will be charged for late registration.

International students are required to complete a nonacademic registration at the Office of International Students and Scholars prior to their regular academic registration.

PART-TIME TUITION FEES

The tuition charge for part-time students is 25 percent of tuition for one course, 50 percent for two courses, 75 percent for three courses, and full tuition for four or more courses for each term of attendance.

CONTINUOUS REGISTRATION

Master's degree students who wish to pursue their research through a six-month or one-year internship are permitted to do so and are considered enrolled on a full-time basis

(student is entitled to continue membership in Yale Health and defer student loans). Upon return, the student will register as a full-time student and pay tuition for the period needed to complete his/her degree requirements. Students may not register for regular course work, or work as a teaching assistant, while on continuous registration status. The fee for continuous registration is $1,250 per term. Students are permitted to be on continuous registration for a maximum of two terms.

TUITION DEPOSIT

Upon acceptance of admission, a deposit of $500 payable directly to the Yale School of Forestry & Environmental Studies is required to hold a place in the entering class. If a decision is made not to matriculate, the deposit will not be refunded.

TUITION REBATE AND FINANCIAL AID REFUND POLICY

On the basis of the federal regulations governing the return of federal student aid (Title IV) funds for withdrawn students, the rebate and refund of tuition are subject to the following policy.

1. For purposes of determining the refund of federal student aid funds, any student who withdraws from the School of Forestry & Environmental Studies for any reason during the first 60 percent of the term will be subject to a pro rata schedule that will be used to determine the amount of Title IV funds a student has earned at the time of withdrawal. A student who withdraws after the 60 percent point has earned 100 percent of the Title IV funds. In 2011–2012, the last days for refunding federal student aid funds will be October 28, 2011, in the fall term and March 26, 2012, in the spring term.
2. For purposes of determining the refund of institutional aid funds and for students who have not received financial aid:
   a. 100 percent of tuition will be rebated for withdrawals that occur on or before the end of the first 10 percent of the term (September 9, 2011, in the fall term and January 18, 2012, in the spring term).
   b. A rebate of one-half (50 percent) of tuition will be granted for withdrawals that occur after the first 10 percent but on or before the last day of the first quarter of the term (September 24, 2011, in the fall term and February 3, 2012, in the spring term).
   c. A rebate of one-quarter (25 percent) of tuition will be granted for withdrawals that occur after the first quarter of a term but on or before the day of midterm (October 19, 2011, in the fall term and February 29, 2012, in the spring term).
   d. Students who withdraw for any reason after midterm will not receive a rebate of any portion of tuition.
3. The death of a student shall cancel charges for tuition as of the date of death, and the bursar will adjust the tuition on a pro rata basis.
4. If the student has received student loans or other forms of financial aid, rebates will be refunded in the order prescribed by federal regulations; namely, first to Federal Unsubsidized Direct Loans, if any; then to Federal Subsidized Direct Loans, if any;

then to Federal Perkins Loans; Federal Direct Graduate PLUS Loans; next to any other federal, state, private, or institutional scholarships and loans; and, finally, any remaining balance to the student.

5. Recipients of federal and/or institutional loans who graduate or withdraw are required to have an exit interview before leaving Yale. Students leaving Yale receive a mailing from Student Financial Services with an exit packet and instructions on completing this process.

STUDENT ACCOUNTS AND BILLS

Student accounts, billing, and related services are administered through the Office of Student Financial Services, which is located at 246 Church Street. The telephone number is 203.432.2700.

Bills

Yale University's official means of communicating monthly financial account statements is through the University's Internet-based system for electronic billing and payment, Yale University eBill-ePay.

Student account statements are prepared and made available twelve times a year at the beginning of each month. Payment is due in full by 4 p.m. Eastern Standard Time on the first business day of the following month. E-mail notifications that the account statement is available on the University eBill-ePay Web site (www.yale.edu/sis/ebep) are sent to all students at their official Yale e-mail addresses and to all student-designated authorized payers. It is imperative that all students monitor their Yale e-mail accounts on an ongoing basis.

Bills for tuition, room, and board are available to the student during the first week of July, due and payable by August 1 for the fall term; and during the first week of November, due and payable by December 1 for the spring term. The Office of Student Financial Services will impose late fees of $125 per month (up to a total of $375 per term) if any part of the term bill, less Yale-administered loans and scholarships that have been applied for on a timely basis, is not paid when due. Nonpayment of bills and failure to complete and submit financial aid application packages on a timely basis may result in the student's involuntary withdrawal from the University.

No degrees will be conferred and no transcripts will be furnished until all bills due the University are paid in full. In addition, transcripts will not be furnished to any student or former student who is in default on the payment of a student loan.

The University may withhold registration and certain University privileges from students who have not paid their term bills or made satisfactory payment arrangements by the day of registration. To avoid delay at registration, students must ensure that payments reach Student Financial Services by the due dates.

Charge for Rejected Payments

A processing charge of $25 will be assessed for payments rejected for any reason by the bank on which they were drawn. In addition, the following penalties may apply if a payment is rejected:

1. If the payment was for a term bill, a $125 late fee will be charged for the period the bill was unpaid.
2. If the payment was for a term bill to permit registration, the student's registration may be revoked.
3. If the payment was given to settle an unpaid balance in order to receive a diploma, the University may refer the account to an attorney for collection.

Yale University eBill-ePay

There are a variety of options offered for making payments. Yale University eBill-ePay is the preferred means for payment of bills. It can be found at www.yale.edu/sis/ebep. Electronic payments are easy and convenient—no checks to write, no stamps, no envelopes, no hassle. Payments are immediately posted to the student's account. There is no charge to use this service. Bank information is password-protected and secure, and there is a printable confirmation receipt. Payments can be made twenty-four hours a day, seven days a week, up to 4 p.m. Eastern Standard Time on the due date to avoid late fees. (The eBill-ePay system will not be available when the system is undergoing upgrade, maintenance, or repair.) Students can authorize up to three authorized payers to make payments electronically from their own computers to the student's account using Yale's system.

Use of the student's own bank payment service is not authorized by the University because it has no direct link to the student's Yale account. Payments made through such services arrive without proper account identification and always require manual processing that results in delayed crediting of the student's account, late fees, and anxiety. Students should use Yale eBill-ePay to pay online. For those who choose to pay by check, remittance advice with mailing instructions is available on the Web site.

Yale Payment Plan

The Yale Payment Plan (YPP) is a payment service that allows students and their families to pay tuition, room, and board in ten equal monthly installments throughout the year based on individual family budget requirements. It is administered by the University's Office of Student Financial Services. The cost to enroll in the YPP is $100 per contract. The deadline for enrollment is June 17. For additional information, please contact Student Financial Services at 203.432.2700 and select "Press 1" from the Main Menu. The enrollment form can be found online in the Yale Payment Plan section of the Student Accounts Web site: www.yale.edu/sfas/financial/accounts.html#payment.

MASTER'S FINANCIAL AID, 2011–2012

Policies and Procedures

The School offers financial aid packages that may include scholarships, student employment, and loans to students with demonstrated financial need. To be considered for financial aid, new and returning students must submit the required financial aid applications by the stated deadlines (see F&ES financial aid Web site for application requirements: www.environment.yale.edu/about/Financial-Aid). The level of funding for each student is determined at the time of admission; therefore, it is critical that all financial

aid application deadlines are met. Students must apply for aid each year; however, the amount of aid will remain the same in the second year as long as there is demonstrated financial need and the student remains in good academic standing.

Financial aid materials are updated annually, incorporating new regulations, changes in eligibility requirements, and other pertinent information. New financial aid applications are available in December of the year prior to matriculation—December 2011 for matriculation in fall 2012—on the F&ES financial aid Web site after December 1.

Yale College students applying for the Fifth Year Deferred program at F&ES apply for financial aid in the March before the term of enrollment; joint-degree applicants must apply for F&ES financial aid at the time they apply for admission to F&ES. A scholarship awarded at the time of admission remains the same when the student matriculates at F&ES.

U.S. citizens and Permanent Residents requesting financial aid must complete:

- the Free Application for Federal Student Aid (FAFSA), available on the Web: www.fafsa.ed.gov
- the School of Forestry & Environmental Studies online Financial Aid Application

International students requesting financial aid must complete:

- the School of Forestry & Environmental Studies online Financial Aid Application

SCHOLARSHIPS

Students who demonstrate financial need may receive a scholarship to cover a portion of the student budget, which includes estimated costs for tuition, living expenses, books and supplies, and health insurance. Because funds are limited, scholarships are awarded to the top admissions candidates with demonstrated financial need who complete their applications by the stated deadlines. In combination with employment and loans, these students can often meet the full cost of attendance. A majority of our scholarship budget is funded by private donors. Students are automatically considered for all named scholarships when they apply for financial aid. The named scholarships are *not* in addition to any general scholarship a student receives in his/her financial aid award package. Students meeting the criteria for a specific named scholarship are matched after students decide to enroll and accept their financial aid offers.

We are delighted to recognize here the generosity of the donors who have helped make the following scholarships possible.

NAMED SCHOLARSHIPS

Beinecke/F&ES Scholarship #1
Beinecke/F&ES Scholarship #2
Jabe Blumenthal Scholarship
Forrest Berkeley Conservation Scholars
Sara Shallenberger Brown Scholarship
Leland H. Burt ('30 B.S.) Endowed Scholarship Fund
Philip Laurance Buttrick (M.F. 1911) Fund
Paul Douglas Camp Memorial Scholarship Fund
Leonard G. Carpenter (B.A. 1924) Scholarship Fund

Elias and Ann Clark Scholarship
Class of 1980 Scholarship Fund
Abigail Disney and Pierre Hauser Scholarship
Strachan Donnelley Scholarship
Strachan and Vivian Donnelley Endowed Scholarship Fund
Michael P. Dowling Scholarship
Doris Duke Conservation Fellows
Enid Storm Dwyer Scholarship Fund
Boyd Evison Scholarship Fund
Edith and Johannes Fröndt Scholarship Fund
John S. Griswold (B.A. 1937) Scholarship Fund
H. Stuart Harrison (B.A. 1932) Fellowship Fund
Vira I. Heinz Endowment Scholarship
John and Catha Hesse Fund
Adelaide Hixon Endowed Scholarship Fund
Joseph M. Hixon III F&ES Scholarship
Jacqueline C. and John R. Hullar Scholarship Fund
Stephen and Betty Kahn Scholarship Fund
Marvin Klemme (M.F. 1935) Fellowship Fund
Kroon Environmental Studies Scholarship Fund
Fred Krupp Scholarship in Environmental Studies
Leadership Scholars Fund
John A. MacLean Scholarship
Preston R. Miller Jr. '71 F&ES Scholarship Fund
John M. Musser Fellowship
Caroline P. Niemczyk Scholarship
Carl F. Norden Family Scholarship Fund
Gilman Ordway (B.A. 1947) Family Scholarship Fund for Environmental Studies
Rockefeller-Underhill Scholarship for Tropical Conservation
Benjamin F. Stapleton, Jr. (LL.B. 1942) Scholarship Fund
John R. Twiss (1960) Student Conservation Association Fellowship
Rodney B. Wagner Class of 1954 International Scholarship Fund
Charles F. Wilson (B.A. 1939) Memorial Fund
Ray L. Wilson Scholarship Fund
Frank & Lynne Wisneski F&ES Scholarship Fund
Wyss Foundation Scholarship

OUTSIDE FUNDING FROM FELLOWSHIPS AND SCHOLARSHIPS

Students are strongly urged to compete for outside fellowships and scholarships that can be used at Yale. We encourage applicants to apply for these scholarships before being admitted. More than 350 outside scholarships are listed in the Outside Scholarship file located on the School's Web site: www.environment.yale.edu/about/Outside-Scholarship-Resources. In addition to financial advantages, a student who receives an award in a national competition earns genuine distinction. In the past, F&ES students have been recipients of awards from the Environmental Protection Agency, the National

Science Foundation, the Robert and Patricia Switzer Foundation, the Leopold Schepp Foundation, and the Institute of International Education (Fulbright), among others. Enrolled students can compete for fellowships offered by the Heinz Family Foundation to support master's project research. In addition, first-year students may apply to become Doris Duke Fellows and Wyss Scholars, which provide substantial tuition support.

EMPLOYMENT OPPORTUNITIES

Approximately one hundred F&ES Student Assistantships (work study) are available to F&ES students based on financial eligibility. These positions pay $15 per hour and vary from clerical work to research, editorial, or library work. A list of positions is available in late summer for students who are eligible (noted in financial aid award letter).

Student employment opportunities are listed on the Student Employment Office (SEO) Web site: www.yalestudentjobs.org. Positions are located throughout the University and the City of New Haven, with hourly rates of $11 to $15. The Web site job listings for F&ES positions are updated in late summer.

Teaching Fellowships are also available at the University. Each department makes its own hiring decisions; therefore, interested students must contact the departments directly. The typical salary is approximately $4,000 per term.

The Office of Admissions and Financial Aid is involved only with the administration of F&ES Student Assistantships.

LOANS FOR U.S. CITIZENS AND PERMANENT RESIDENTS

Yale University participates in the Federal Direct Loan program. To qualify, a student must be a U.S. citizen or Permanent Resident and meet certain other federal requirements.

In general, students are eligible to borrow up to $20,500 in Federal Direct Subsidized and Unsubsidized Loans, of which up to $8,500 may be subsidized. Students may also be eligible to borrow Federal Direct Grad PLUS Loans up to the cost of attendance less other financial aid received. Students must complete a separate form to request a Federal Direct Grad PLUS Loan; Federal Direct Subsidized and Unsubsidized Loans are included in the initial financial aid award. For more information refer to the F&ES financial aid Web site: www.environment.yale.edu/about/financing-your-fes-education.

LOANS FOR INTERNATIONAL STUDENTS

International students at Yale may be eligible for Yale International Loans. Students may borrow up to the full cost of attendance (single student budget), less any other financial aid received. For more information refer to the F&ES financial aid Web site: www.environment.yale.edu/about/financing-your-fes-education.

INTERNATIONAL STUDENTS — CERTIFICATION OF FINANCES FOR VISA

International students must certify full funding for their entire two-year course of study before visa documents can be issued. Instructions and forms are mailed after an admitted student accepts the offer of admission (April 15, 2011, for matriculation in the fall of 2011). More information is available at the Web site of Yale's Office of International Students and Scholars: www.yale.edu/oiss.

VETERANS

Eligible students are strongly encouraged to seek specific information about Veterans Administration benefits from their local Veterans Administration office or by calling 1.888.442.4551 or visiting www.gibill.va.gov. The School will be happy to assist students with claims once they are enrolled.

LEAVE OF ABSENCE

Students are expected to follow a continuous course of study at the School of Forestry & Environmental Studies. However, a student who wishes or needs to interrupt his or her study temporarily may request a leave of absence. There are three types of leave—personal, medical, and parental—all of which are described below. The general policies that apply to a leave of absence are:

1. Any student who is contemplating a leave of absence should see the director of student services to discuss the necessary application procedures.
2. All leaves of absence must be approved by the director of student services and the associate dean for academic affairs. Medical leaves also require the written recommendation of a physician on the staff of Yale Health, as described below.
3. A student may be granted a leave of absence of one to two years. Any leave approved by the director of student affairs and the associate dean for academic affairs will be for a specified period.
4. International students who apply for a leave of absence must consult with OISS regarding their visa status.
5. A student on a leave of absence may complete outstanding work in courses for which he or she has been granted extensions. He or she may not, however, fulfill any other degree requirements during the time on leave.
6. A student on a leave of absence is not eligible for financial aid, including loans; and in most cases, student loans are not deferred during periods of nonenrollment.
7. A student on a leave of absence is not eligible for the use of any University facilities normally available to enrolled students.
8. A student on leave of absence may continue to be enrolled in Yale Health by purchasing coverage through the Student Affiliate Coverage plan. In order to secure continuous coverage from Yale Health, enrollment in this plan must be requested prior to the beginning of the term in which the student will be on leave. If a leave of absence is granted during the term, the student must request Yale Health Affiliate Coverage enrollment within thirty days of the date when the leave is approved. Coverage is not automatic; enrollment forms are available from the Member Services Department of Yale Health, 203.432.0246, or can be downloaded from the Yale Health Web site (www.yale.edu/uhs).
9. A student on a leave of absence does not have to file a formal application for readmission. However, he or she must notify the director of student services in writing of his or her intention to return at least eight weeks prior to the end of the approved leave. In addition, if the returning student wishes to be considered for financial aid, he or she must submit appropriate financial aid applications to the School's financial aid office to determine eligibility.

10. A student on a leave of absence who does not return at the end of an approved leave, and does not request and receive an extension from the dean, is automatically dismissed from the School.

Personal leave of absence A student who wishes or needs to interrupt study temporarily because of personal exigencies may request a personal leave of absence. The general policies governing all leaves of absence are described above. A student who is current with his or her degree requirements is eligible for a personal leave after satisfactory completion of at least one term of study. Personal leaves cannot be granted retroactively and normally will not be approved after the tenth day of a term.

To request a personal leave of absence, the student must apply in writing before the beginning of the term for which the leave is requested, explaining the reasons for the proposed leave and stating both the proposed start and end dates of the leave, and the address at which the student can be reached during the period of the leave. If the director of student services and the associate dean for academic affairs find the student to be eligible, the leave will be approved. In any case, the student will be informed in writing of the action taken. A student who does not apply for a personal leave of absence, or whose application for a leave is denied, and who does not register for any term, will be considered to have withdrawn from the School.

Medical leave of absence A student who must interrupt study temporarily because of illness or injury may be granted a medical leave of absence with the approval of the director of student services and the associate dean for academic affairs, on the written recommendation of a physician on the staff of Yale Health. The general policies governing all leaves of absence are described above. A student who is making satisfactory progress toward his or her degree requirements is eligible for a medical leave any time after matriculation. The final decision concerning a request for a medical leave of absence will be communicated in writing by the director of student services.

The School of Forestry & Environmental Studies reserves the right to place a student on a medical leave of absence when, on the recommendation of the director of Yale Health or the chief of the Department of Mental Health and Counseling, the dean of the School determines that the student is a danger to self or others because of a serious medical problem.

A student who is placed on medical leave during any term will have his or her tuition adjusted according to the same schedule used for withdrawals (see Tuition Rebate and Refund Policy). Before re-registering, a student on medical leave must secure written permission to return from a Yale Health physician.

Leave of absence for parental responsibilities A student who wishes or needs to interrupt his or her study temporarily for reasons of pregnancy, maternity care, or paternity care may be granted a leave of absence for parental responsibilities. The general policies governing all leaves of absence are described above. A student who is making satisfactory progress toward his or her degree requirements is eligible for parental leave any time after matriculation.

Any student planning to have or care for a child is encouraged to meet with the director of student services to discuss leaves and other short-term arrangements. For many

students, short-term arrangements rather than a leave of absence are possible. Students living in University housing units are encouraged to review their housing contract and the related polices of the Graduate Housing Office before applying for a parental leave of absence. Students granted a parental leave may continue to reside in University housing to the end of the academic term for which the leave was first granted, but no longer.

U.S. MILITARY LEAVE READMISSIONS POLICY

Students who wish or need to interrupt their studies to perform U.S. military service are subject to a separate U.S. military leave readmissions policy. In the event a student withdraws or takes a leave of absence from the School of Forestry & Environmental Studies to serve in the U.S. military, the student will be entitled to guaranteed readmission under the following conditions:

1. The student must have served in the U.S. Armed Forces for a period of more than thirty consecutive days;
2. The student must give advance written or verbal notice of such service to the director of student services and the associate dean for academic affairs. In providing the advance notice the student does not need to indicate whether he or she intends to return. This advance notice need not come directly from the student, but rather, can be made by an appropriate officer of the U.S. Armed Forces or official of the U.S. Department of Defense. Notice is not required if precluded by military necessity. In all cases, this notice requirement can be fulfilled at the time the student seeks readmission, by submitting an attestation that the student performed the service.
3. The student must not be away from the School to perform U.S. military service for a period exceeding five years (this includes all previous absences to perform U.S. military service but does not include any initial period of obligated service). If a student's time away from the School to perform U.S. military service exceeds five years because the student is unable to obtain release orders through no fault of the student or the student was ordered to or retained on active duty, the student should contact the director of student services to determine if the student remains eligible for guaranteed readmission.
4. The student must notify the School within three years of the end of his or her U.S. military service of his or her intention to return. However, a student who is hospitalized or recovering from an illness or injury incurred in or aggravated during the U.S. military service has up until two years after recovering from the illness or injury to notify the School of his or her intent to return.
5. The student cannot have received a dishonorable or bad conduct discharge or have been sentenced in a court-martial.

A student who meets all of these conditions will be readmitted for the next term, unless the student requests a later date of readmission. Any student who fails to meet one of these requirements may still be readmitted under the general readmission policy but is not guaranteed readmission.

Upon returning to the School, the student will resume his or her education without repeating completed course work for courses interrupted by U.S. military service. The student will have the same enrolled status last held and with the same academic standing.

For the first academic year in which the student returns, the student will be charged the tuition and fees that would have been assessed for the academic year in which the student left the institution. Yale may charge up to the amount of tuition and fees other students are assessed, however, if veteran's education benefits will cover the difference between the amounts currently charged other students and the amount charged for the academic year in which the student left.

In the case of a student who is not prepared to resume his or her studies with the same academic status at the same point where the student left off or who will not be able to complete the program of study, the School of Forestry & Environmental Studies will undertake reasonable efforts to help the student become prepared. If after reasonable efforts, the School determines that the student remains unprepared or will be unable to complete the program, or after the School determines that there are no reasonable efforts it can take, the School may deny the student readmission.

Life at the School of Forestry & Environmental Studies

EDUCATIONAL FACILITIES

Kroon Hall, the ultra-green home of F&ES, expresses in physical form the School's best traditions, values, and aspirations. The building, which opened in January 2009, achieves its remarkable energy savings from a host of design elements and technical strategies molded to fit the building's New England weather and climate. Located in the area of the University known as Science Hill, Kroon Hall is named for the family of benefactor and Yale College alumnus Richard Kroon, B.A. 1964. With its high barrel-vaulted gable ends, simple lines, and curved rooftop, Kroon Hall is a modernist blend of cathedral nave and Connecticut barn.

The $33.5 million building was designed by Hopkins Architects of Great Britain in partnership with Connecticut-based Centerbrook Architects and Planners, and has been awarded the highest rating—platinum—in the green-building certification program, Leadership in Energy and Environmental Design (LEED). Kroon Hall provides 58,200 square feet and is designed to use 50 percent less energy than a comparably sized modern building. Its tall, thin shape and east-west orientation play a big role in heating and cooling. The lowest floor is set into a hillside, with only its south side exposed, providing thermal insulation, minimizing northern exposure, and increasing the amount of natural light that enters the building from adjacent courtyards. The long south facade maximizes solar gain during the winter, and red cedar louvers covering glass facades on the east and west ends keep out unwanted heat and glare. The building's shape, combined with the glass facades, enables daylight to provide much of the interior's illumination. Light and occupancy sensors dim artificial lighting when it is not needed.

Kroon Hall provides office space for seventy-five faculty and staff members and features three classrooms. The 125-seat Burke Auditorium is used for lectures and classes, and commands beautiful views of West Rock and the David S. Ingalls Rink across the street. The Knobloch Environment Center is meant for socializing, but students have also embraced it as a study space. The Ordway Learning Center on the ground floor also has ample space for quiet study.

A 100-kilowatt rooftop array of photovoltaic panels provides 25 percent of the building's electricity. Four 1,500-foot-deep wells use the relatively constant 55-degree (F) temperature of underground water for heating and cooling, replacing the need for conventional boilers and air conditioning. Four solar panels embedded in the southern facade provide hot water. Exposed concrete walls and ceilings provide thermal stability by retaining heat in winter and cold in summer. Instead of air being forced through overhead ducts, an energy-saving displacement ventilation system moves warm and cool air through an air plenum and multiple diffusers in elevated floors. Low-velocity fans in the basement keep the air circulating throughout the building. In winter, the ventilation system also transfers the heat from exhaust to incoming fresh air, and in summer, air handling units spray water on incoming fresh air, reducing its temperature by up to 18 degrees through evaporation. In mild weather, Kroon's occupants assist in the ventilation by opening windows in response to an electronic, color-coded prompt system.

A rainwater-harvesting system channels water from the roof and grounds to a garden in the south courtyard, where aquatic plants filter out sediment and contaminants. The gray water, held in underground storage tanks, is used for irrigation and pumped back into Kroon for flushing toilets. The system is designed to save 500,000 gallons of potable city water annually and to reduce the burden on city sewers by lessening the amount of storm runoff. Half of Kroon Hall's red oak paneling—15,000 board feet—came from the 7,840-acre Yale Myers Forest in northern Connecticut, which is managed by the School. The building's pale yellow exterior, composed of sandstone from Ohio, echoes other Yale buildings. The north and south courtyards were constructed to create a community from disparate buildings on Science Hill. The south courtyard, landscaped by Olin Studio of Philadelphia, is a raised platform, with a green roof of soil one foot deep and surrounded by twenty-five varieties of native plantings. Underneath the courtyard is a service node, centralizing all pickups for trash and recycling and deliveries for the southwest corner of Science Hill and accessible by a single driveway off Sachem Street.

Sage Hall, a four-story building located at 205 Prospect Street and a gift of William H. Sage, B.A. 1865, in memory of his son, DeWitt Linn Sage, B.A. 1897, was completed in 1923. Administrative, doctoral program, development, alumni, and program offices of the School are housed in Sage Hall, along with three classrooms. Sage Hall is home to a microcomputer center for students, with thirty-seven IBM computers, each with GIS capabilities. Sage also houses a 490-square-foot student lounge, appointed with a large table and comfortable couches, which students use for studying, special events, and weekly social events. Bowers Auditorium is designed to handle large lectures and seminars as well as small group projects. Bowers, which has a seating capacity of over 110 with tables and chairs, was built onto Sage Hall in 1931 with funds provided by the bequest of Edward A. Bowers, B.A. 1879.

Facilities for research and instruction in silviculture, natural resource and forest economics, forest policy, and biometry are in Marsh Hall at 360 Prospect Street in the Marsh Botanical Garden. This large, four-story mansion was originally the residence of Professor Othniel C. Marsh, B.A. 1860, a distinguished paleontologist and Western explorer of the nineteenth century. He bequeathed the building to the University in 1899, and for twenty-five years it housed the entire Forest School. Marsh Hall was designated a National Historic Landmark by the United States Department of the Interior in 1965.

The William B. Greeley Memorial Laboratory at 370 Prospect Street, named in honor of William Buckhout Greeley, M.F. 1904, houses a classroom and eight laboratories for research into the ecology and management of landscapes and ecosystems, urban sustainability, the biology of trees, and environmental chemistry. Adjacent to the Greeley lab is a 3,800-square-foot greenhouse, which is used for hands-on learning and research. Greeley Laboratory and its greenhouse were built in 1959 with funds from the forest industries, the John A. Hartford Foundation, and other benefactors.

The Class of 1954 Environmental Science Center at 21 Sachem Street is dedicated to the Class of 1954 in honor of the $70 million the class donated in 2000 to support new science buildings and other major University priorities. It is an interdisciplinary facility built by the University with the aim of further fostering leadership in teaching and research of science and engineering. The building was designed to encourage collaboration among faculty and students pursuing environmental studies. Four natural science

faculty members from F&ES have their laboratories in the Environmental Science Center, which also houses research laboratories for the Yale Science Departments of Ecology and Evolutionary Biology, Geology and Geophysics, and Anthropology as well as the Yale Institute for Biospheric Studies.

The restored former residences at 301 Prospect Street and 380 Edwards Street house the offices of many of the School's faculty and staff, as well as doctoral student offices; each building has a classroom.

Library Collection

The Henry S. Graves Memorial Library Collection for the School of Forestry & Environmental Studies, one of the oldest and largest collections of forestry publications in the world, is located in the Kline Science Library in Kline Biology Tower. It is named in honor of the School's first dean, Henry S. Graves, who purchased the initial collection of German forestry books and continued to support a strong library serving the School's graduate forestry program.

Current holdings in the Graves Collection consist of more than 100,000 books, documents, technical reports, and serial publications dealing with forestry, forest science, natural resource management, and environmental sciences and management. The collection receives more than 100 journal, periodical, and other serial publication titles. Older materials in the Graves Collection are housed in the Library Shelving Facility. All materials are accessible through the Yale Library electronic catalog, ORBIS.

The Graves Collection is committed to acquiring whatever books and journals are needed to support the School's teaching and research activities. In addition, students have access to the enormous holdings of the Yale University Library, described below.

Reference and information services are provided locally, with the F&ES librarian having an office in Sage Hall, while additional aid is available from reference librarians in the nearby Kline Science and Social Science libraries. Access to electronic databases covering the wide range of subjects of interest within the School (e.g., Environmental Science and Pollution Management Collection, CAB Abstracts, BIIOSIS, and Web of Science) is provided through the library's Web site at www.library.yale.edu/science/subject/forestry.html. These research tools and others, on such subjects as international affairs, water, soils, fish, wildlife, policy affairs, and law, are accessible throughout the campus. As a part of Yale University Library system, the Graves Collection participates in all library services offered to Yale patrons: paper-based, electronic, local, and through interlibrary loan services.

Note that from July through December 2011, the Kline Science Library will be closed for renovation, and staff and services will be temporarily relocated to 140 Prospect Street. The library will reopen in Kline Biology Tower in January 2012 as the Center for Science and Social Science Information (CSSSI), combining the resources of the former Kline Science Library and the Social Science Library.

Computer Resources

The mission of the Office of Information Technology is to support all aspects of computing for every member of the Yale School of Forestry & Environmental Studies, and to provide training in the fundamental use of computers in educational and administrative

applications. Because it is our policy to focus on supporting individuals rather than specific user configurations, we use and support multiple platforms, including IBM/Windows, Apple Macintosh, and Sun/Unix. Students are encouraged, but not required, to bring their own computers, and they may contact the director of Information Technology for advice on the selection of appropriate hardware and software. We currently encourage strongly the purchase of Apple Macintosh laptop computers. Because of the growing availability of wireless access throughout the Yale campus, students are encouraged to purchase laptops with wireless capability.

The F&ES IT department (F&ES-IT) maintains a student computing cluster in Sage 39, which has recently been upgraded with twenty-eight iMac computers, which feature 21.5-inch displays, Invidia 9400 video cards, 3.06 GHz Intel Core 2 Duo processors, and 4 GB of system RAM. The cluster iMacs run in both Macintosh OS and in Windows 7-64 bit OS with Bootcamp.

The student printing room in Sage 38 contains three high-capacity black-and-white printers and two high-capacity color printers. Additional wireless student printing is available in the Ordway Learning Center with one high-capacity black-and-white printer, and five e-mail/printing stations are also available to students at the Ordway Learning Center. These computers are iMacs with 20-inch displays, 2.26 Core 2 Duo processors, and 2 GB RAM.

F&ES-IT also loans, on a one- to two-week basis, laptop computers, GIS units, digital cameras, walkie-talkies, and compact audio recorders.

Information Technology Services (ITS) is the central organization at Yale for the support of all educational and administrative computing. It offers support to all members of the Yale community. The Yale library is also very active in the integration of information resources in digital format. Students and faculty have online access to a comprehensive variety of journals and databases, and the Sterling Memorial Library Map Collection now employs a full-time GIS librarian who is available to assist students in obtaining and working with GIS datasets to support their work in any part of the globe.

The School participates in two centers of the Yale Institute for Biospheric Studies that have established specialized computing facilities. These are the Center for Earth Observation (CEO) and the Center for Computational Ecology (CCE).

The CEO provides its users with access to an SGI Challenge 1 Server and hard-disk archive with nine SGI workstations; four SGI workstations in the four sponsoring departments, including one in Marsh Hall; network connections to any Unix-based workstation on campus; a ten-user license for Earth Resource Mapper, a multipurpose software package for image analysis; and a small but growing collection of Landsat MSS and TM data and GOES weather satellite data. A small staff of consultants assists users in the selection, procurement, and analysis of satellite images.

The CCE, housed in Osborn Memorial Laboratories, has a full-time computer programmer to assist in developing programs for research at the center. The center has seven state-of-the-art workstations to facilitate development of computational software and ecological simulation programs.

Faculty members have also developed many special computer applications for their projects, and some of these are available for student use in the Sage computing facilities.

School Forests

The Yale School of Forestry & Environmental Studies owns 10,900 acres of forestland in Connecticut, New Hampshire, and Vermont that are managed by the School Forests Program. The program manages seven discrete forests that were donated to the School between 1913 and 1986 that range in size and geography from the 75-acre Crowell Ravine in Vermont to the 7,860-acre Yale Myers Forest in Connecticut. The composition of the Yale Forests reflects a latitudinal gradient ranging from a central hardwood cover type in Connecticut to a northern hardwood cover type in New Hampshire and Vermont. Extensive stands of pine and hemlock exist in both regions. The area encompassed by the forests includes almost all of the topographical and soil conditions, site classifications, and cover types found in New England.

The management goals of the Yale Forests are to provide educational, research, and professional opportunities for the faculty and students and to serve as an asset to the School's investment portfolio. Faculty and students use the Yale Forests as a laboratory for teaching, management, demonstration, and research. While a member of the faculty serves as director and a University staff member serves as the manager, graduate students working as interns or coordinators carry out the bulk of the on-the-ground management and administration. The forests are maintained as working forests, and thus the tasks include selling timber and nontimber forest products from the land. The Yale Myers Forest is the largest and most heavily utilized parcel managed by the School Forests Program and is certified by the Forest Stewardship Council.

Students working on the Yale Forests receive training that covers aspects of forest ecology, silviculture, forest operations, and sociology in order to prepare them for careers as foresters and land managers. Every summer six to eight students are chosen for the apprentice forester program at the Yale Forests, which includes hands-on training in maintenance of infrastructure, property boundary research and delineation, timber inventories, and the design and implementation of silvicultural prescriptions. Several students from the apprentice program are selected to work for the School Forests Program the following academic year, where they receive additional training in geographical information systems (GIS) and in the administrative aspects of forest management.

Research performed at the Yale Forests is conducted under the supervision of any faculty member of the School and encompasses forest ecology, silviculture, aquatic and terrestrial wildlife ecology, hydrology, and economic, legal, and social studies. The forest is used for both doctoral and master's student research, the latter performed either as an independent project or in conjunction with student involvement with existing forest management.

The Yale Forests are used for both academic field trips and workshops held for professional or community organizations. Field trip and workshop topics include forest certification, wildlife habitat manipulation, ecosystem restoration, prescribed fire management, timber harvesting best management practices, silvicultural research, and pathways of forest stand development.

In addition to the forestland owned and managed by the School, close working relationships exist with other forests that are also used for education and research by faculty and students: the 6,800-acre Great Mountain Forest in northwestern Connecticut is available to the School through the courtesy of Edward C. Childs, B.A. '28, M.F. '32, and

his family; and the 20,000-acre forestland owned and managed by the South Central Connecticut Regional Water Authority in New Haven County is one of the oldest managed forests in the western hemisphere. The University also owns approximately 370 acres of ecological preserves that are available to faculty and students.

COMMUNICATIONS

The goal for the School's strategic communications is, in part, to contribute to public understanding and discourse on environmental issues and to encourage the integration of environmental issues into strategies for business, international development, government, and nongovernmental organizations.

The communications office publicizes faculty and student research and School-sponsored events through press releases, by promoting faculty and students as experts to the major media, and in the production of *Environment: Yale* magazine and video. For more information, contact David DeFusco, director of communications, at 203.436.4842 or david.defusco@yale.edu, or visit the Web site at www.environment.yale.edu.

Other major communications vehicles include the School's Web site (www.environment.yale.edu); the award-winning online magazine *Yale Environment 360;* the newsletter *Yale Environmental News;* the F&ES publication series; newsletters and reports from the School's centers and programs; and the student-edited *Sage Magazine*.

Yale Environment 360 features reporting, analysis, and opinion on global environmental issues from leading writers, scientists, policymakers, and journalists in the field. Launched in 2008, *Yale Environment 360* has established a broad global audience and received numerous awards and honors, including the 2010 National Magazine Award for Digital Media for Best Video. Accessible at www.e360.yale.edu.

Yale Environmental News is published in cooperation with the Yale Institute for Biospheric Studies and the Peabody Museum of Natural History. Accessible at www.yale.edu/yibs/yen_current.html.

The F&ES publication series issues books, reports, and working papers based on environmental conferences, courses, and events at Yale of special interest to professional colleagues in NGOs, government agencies, and business. The School has published work by its faculty and students in this format since 1912. For a complete listing of titles, free pdf downloads of all publications, and information on placing orders for printed copies, visit www.environment.yale.edu/publications.

For newsletters and reports of the individual programs and centers, see their Web sites, accessible through the main F&ES Web site at www.environment.yale.edu.

Sage Magazine is produced twice a year and contains a mix of reporting, short features, editorials, art, and prose. Accessible at www.sagemagazine.org.

STUDENT ORGANIZATIONS

The School has many student-run interest groups. Current student groups include the 100% Club–Outdoor Recreation SIG; Asia (ASIA) SIG; the Coalition for Agriculture, Food, and Environment (CAFÉ); the Climate Change SIG; Environmental Justice at Yale; Environmental Media & Arts; the Forestry Club (FC); Fresh & Salty SIG; Greening the Vote; the Industrial Environmental Management and Energy Group (IEME);

a student chapter of the International Society of Tropical Foresters (ISTF); the Latin American SIG (La SIG); the Multi-Ethnic Student Association (MESA); Risk Reduction, Adaptation, and Disaster Student Interest Group (RRAD); SCOPE; Ethnobotany and Economic Botany Student Interest Group (STIGMA); Lucy-StUDS; Walk the Talk (WTT); WESTIES; Yale Environment Women (YEW); Yale Environmental Health Group (YEHG); International Development and Environment (IDE); a student chapter of the Society of American Foresters (SAF); the Yale chapter of the Society for Conservation Biology (CONBIO); Religion, Spirituality and Nature; Environment in Africa Research Group (EIARG); and the Student Advisory Committee (SAC). The activities of these groups include sponsoring guest and student lectures, organizing field trips, sponsoring workshops, organizing social events, holding conferences, interacting with regional divisions of their respective societies, collaborating with the City of New Haven to hold conferences and workshops, planning holiday parties, conducting a spring auction, and holding weekly gatherings.

FUNDING FOR MASTER'S STUDENT PROJECTS AND ACTIVITIES

Master's students often seek funding for scholarship, research, professional activities, and social events. Sometimes the request is for individual activity, sometimes on behalf of a group. Our School and Yale University have many funds to which students can apply. Among the most useful are the Master's Student Travel fund to support attendance at a conference or symposium at which a student is giving a talk; MacMillan Center for International and Area Studies, which can help bring international visitors to Yale for a lecture or a conference; grants and contracts to faculty and centers for research; and the School's Student Affairs Committee (SAC), which supports activities by our many student interest groups (SIGs).

ALUMNI ASSOCIATION

The F&ES Alumni Association, led by a board that holds regular meetings to conduct the business of the association, hosts regional gatherings around the country and around the world, especially at annual meetings of the Land Trust Alliance, the Ecological Society of America, and the Society of American Foresters. The board functions both as a committee of the whole and through several standing committees; officers of the board welcome inquiries from F&ES alums who want to be considered for seats on the board or any of its standing committees. Standing committees oversee nominations of officers and of recipients of the Distinguished Alumnus Award, host the annual reunion and regional gatherings, and assist staff with the Annual Fund and other fundraising initiatives. The School's Web site, an emerging set of shared interest Web sites, and a quarterly newsletter, in addition to e-mail blasts, keep alumni/ae throughout the world in touch with each other and with the School.

The F&ES Alumni Association is also affiliated with the Association of Yale Alumni (AYA), which serves all alumni/ae of Yale University. The F&ES Office of Development and Alumni Services works directly with the AYA on several critical services for F&ES alumni/ae, including the Virtual Yale Station (e-mail forwarding), Online Alumni

Directory (secure access contact database), and the Yale Career Network (professional profiles). Alumni/ae are encouraged to contact the Office of Development and Alumni Services at alumni.fes@yale.edu.

JOB SEARCH SKILLS DEVELOPMENT

Career Development Office

The mission of the School's Career Development Office (CDO) is to educate, empower, and support students as they actively seek internships and employment to advance their career visions, and to develop linkages with organizations to enhance the hiring of the world's future environmental leaders.

The overall goal of the CDO is to equip students with excellent job search skills and assist them in charting a course leading to a professional career fitting their interests, skills, and abilities. Our diverse resources and services enable users to learn about themselves, determine how their accumulated experiences translate into meaningful career goals, and conduct effective job searches.

CDO conducts programs and provides Web-based resources geared toward supporting the development of students' career and job search skills. Programs include:

Introduction to Environmental Careers with expert Kevin Doyle
Job Search Skills Intensives: Half-Day Programs:

- Jumpstarting the Job and Internship Part 1: Focus on strategies, résumé, cover letter, and networking
- Jumpstarting the Job and Internship Part 2: Focus on interview preparation, interview skills, and salary negotiations

How to Work a Career Fair
Success Stories: Job and Internship Search Strategies
Writing the Personal Statement
Applying for the Ph.D. Workshop
Using Optimal Resume
Using GeO: eRecruiting at F&ES
U.S. Business Etiquette for International Students
How to Launch an International Career
Cover Letter Writing for International Students
Writing the Cover Letter
Writing the Résumé
Salary Negotiations
Interview Skills
Networking at Yale and Beyond
Mock Interviews with the Experts
Job Search Discussion Groups

Internships and Summer Research

Internships and summer research have long been an important part of the educational program at Yale. They provide a unique opportunity to combine academic knowledge with practical experience, to enhance skills, and to gain professional confidence.

Students are assisted by the Career Development Office, faculty, alumni/ae, and other students in their search for internships and summer research experiences. Attention is given to students to help them locate opportunities that meet their individual needs and interests.

Given the School's strong ties with natural-resource, environmental, and conservation organizations worldwide, internship and research possibilities are virtually unlimited. Typical internships and research projects occur between the first and second years of the program; occasionally, however, they last for longer periods. The following list shows the rich and diverse experiences that F&ES students had during a recent summer. Similarly impressive lists can be found on the Web at www.environment.yale.edu/current/Employment-and-Summer-InternshipResearch-Projects-Data.

Summer 2010 Internships and Research Projects

BUSINESS AND INDUSTRY

Axio Power, Summer Associate, N.Y.
Cityscape Farms, Intern, Calif.
Curtis Packaging Corporation, Project Assistant, Conn.
Ecos Consulting, Research Team, Intern-Researcher, Colo.
Emergent Ventures India, Climate Value Advisory Intern, India
Except, Design and Research Intern, The Netherlands
First Wind, Development Intern, Mass.
Flagship Ventures, Fellowship Summer Program, Fellow, Mass.
GE, Corporate Environmental Programs, Supplier Responsibility Intern, Conn.
GE, Corporate Environmental Programs, Intern, Conn.
General Motors, Global Battery Systems Engineering, Engineering Intern, Mich.
Samsung Economic Research Institute (SERI), Public Policy Researcher, South Korea
Solutions Journal, Editorial Intern, Vt.
Tecnoma, SA, Intern Aide for Marine Issues, Spain
Whole Trees Architecture & Construction, Researcher, Wis.

EDUCATION

FES & Kew Millennium Seed Bank Partnership, Intern, Conn.
Fu Dan University, Center of Environmental Economics, Research Assistant, China
The Global Institute of Sustainable Forestry at Yale F&ES, Researcher, Conn.
Urban Resources Initiative, Community Forester, Conn.
Urban Resources Initiative, Yale President's Public Service Fellow, Community Forester, Conn.
Urban Resources Initiative, Greenspace Program, Community Forester, Conn. (2)
Yale Center for Environmental Law and Policy, Research Assistant, Conn. and China
Yale Center for Environmental Law and Policy, Research Associate, Conn. (2)
Yale Center for Industrial Ecology, Criticality Project, Researcher, Conn.
Yale Myers Forest, Yale University, Researcher, Conn.
Yale Recycling, Recycling Intervention Coordinator, Conn.
Yale School of Forestry & Environmental Studies, Lab of Dr. Peter Raymond, Research Assistant, Conn.

Yale School Forests, Apprentice Forester, Conn. (2)
Yale University, Center for Industrial Ecology, Research Assistant, Singapore

GOVERNMENT AND PUBLIC SECTOR

Bonneville Power Administration, U.S. Department of Energy, Corporate Strategy, Program Analyst, Ore. (2)
City of New Haven, Office of Sustainability, Intern, Conn.
Connecticut Department of Environmental Protection, Office of Legal Counsel, Legal Intern, Conn.
Department of Justice, Environment & Natural Resources Division (ENRD), Wildlife & Marine Resources Section, Summer Intern, Washington, D.C.
Environmental Protection Agency, Office of Policy, Intern, Washington, D.C.
Maldives Mission at the UN, Intern, N.Y.
Ministry of Environment, Energy, and Climate Change, Consultant, Greece
National Park Service, Wilderness Stewardship Division/Fire and Aviation, Researcher, Washington, D.C.
United Nations Development Programme, Environment and Energy Unit, Climate Change Mitigation Initiation Plan (MIP) Intern, Cambodia
United Nations Development Programme, Environment and Energy Group, Intern, N.Y.
United Nations Development Programme, Human Development Report Office, Research Team Intern, N.Y.
United Nations Economic Commission for Latin America and The Caribbean, Project Assistant and Independent Researcher, Mexico
U.S. Department of Energy, Office of General Counsel, Summer Clerk, Washington, D.C.
U.S. Fish and Wildlife Service, Division of Migratory Bird Management, Research Assistant, Alaska
U.S. Fish and Wildlife Service, Maine Coastal Islands National Wildlife Refuge, Park Ranger/Community Outreach Coordinator, Mexico
U.S. Fish and Wildlife Service, New England Field Office, Fish and Wildlife Biologist–SCEP, N.H.
U.S. Forest Service, Inyo National Forest, Forestry Technician, Calif.
U.S. House of Representatives, Committee on Energy and Commerce, Subcommittee on Energy and Environment, Graduate Intern, Washington, D.C.
U.S. National Park Service, The Santa Monica Mountains National Recreation Area (SAMO), Volunteer/Researcher, Calif.
USDA Forest Service/PNW Research Station, LaGrande Forestry Science Laboratory, Researcher, Ore.

NGOS AND OTHER NOT-FOR-PROFIT GROUPS

The Breakthrough Institute, Research Assistant in Energy Policy, Calif.
Centered Life Ministries, Colorado Springs, Intern, Colo.
Climate Solutions/Land Trust Alliance/University of Washington, New Energy Cities/Climate Change Working Group, Brazil Exploration Program Coordinator, Intern, Program Assistant, Wash.

William J. Clinton Foundation, Clinton Climate Initiative East Africa Program, Research and program support for Tanzania's REDD Program, Tanzania
Common Ground Farm, Apprentice, N.Y.
The Conservation Fund, North Coast Conservation Initiative, Forestry Intern, Calif.
Conservation International, Critical Ecosystem Partnership Fund (CEPF), Intern/Researcher, Washington, D.C., and Conn.
Conservation Trust of Puerto Rico, Natural Protected Areas Division, Researcher, Puerto Rico
DenizTemiz TURMEPA (Turkish Marine Environment Protection Association), Project Intern, Turkey
Doğa Koruma Merkezi Nature Conservation Centre, Summer Intern, Turkey
Doğa Koruma Merkezi Nature Conservation Centre, Program Assistant/Researcher, Turkey
Ecotrust, Knowledge Systems, Intern, Ore.
ELI Africa, Summer Program Leader, Environmental Program Research and Development, Mauritius
Gateway Christian Fellowship/Mt. Varick AME Zion Church, Youth Programs, Researcher, Conn.
Indian Youth Climate Network/TERI, Division of Social Transformation (TERI), Research Analyst, India
The Kohala Center and Prof. Marian Chertow, Long-Term Industrial Ecosystem Model, Hawaii, Researcher, Hawaii
National Institute of Ecology (INE), Mexico, International Affairs Division, Environmental Policy Research Assistant, Mexico
Natural Heritage Institute, Intern/Researcher, Calif.
The Nature Conservancy, Corporate Practices and Global Partnerships Practice, M.B.A./M.E.M. Intern, Conn.
The Nature Conservancy, Oregon, Portland Office, Oregon Coast Field Intern, Ore.
The Nature Conservancy, San Francisco Field Office, Researcher—Forest and Biodiversity Policy, Calif.
Northern Rockies Conservation Cooperative, Researcher, Canada (2)
Red Cross/Red Crescent Climate Center, Researcher, Mexico
Rocky Mountain Institute, Built Environment Team, Intern/Researcher, Mexico
Smithsonian Tropical Research Institute, Agua Salud, Researcher, Panama
Southern Environmental Law Center, Charlottesville Office, Intern, Va.
TERI, GRIHA Development Group, Researcher, India
TERI North America, Lighting a Billion Lives Project, Intern, Conn.
World Bank, Latin America and Caribbean, Intern, Washington, D.C.
World Resources Institute, China Vulnerability and Adaptation Project, Intern, Washington, D.C.
World Resources Institute, Renewable Energy Initiatives, Intern, Washington, D.C.
World Wildlife Fund, Mozambique, Summer Intern, Mozambique
Zoological Society of London, EDGE of Existence Project, Researcher, United Kingdom

INDEPENDENT NON-U.S. RESEARCH

Analysis of indigenous knowledge transfer and community food sovereignty in Kuna Yala, Panama and Guatemala

Assessing landscape conservation models such as ecoregion and human dimensions in planning and management as well as its governance of the Eastern Himalayas, a biological hotspot which spreads across three countries, i.e., Nepal and India in South Asia, Taplejung, Mechi District, Nepal

Comparative study of coal mining regulation in the United States and South Africa: Incentives for a transition toward renewable resources, Potchefstroom, South Africa, Ky., and W.Va.

Environmental identity, ecosystem productivity, and land-cover hange in the Eastern Desert Red Sea Region, Egypt

Field research in a Peruvian catchment, entitled: Hydrological services of an Andean Amazon cloud forest: the role of soils and the influence of land use change, Oxapampa, Pasco, Peru

Gender, labor, and sanitation: A case study in Ekiti State, Nigeria, Ado-Ekiti, Ekiti State, Nigeria

A household survey of production of the crop Digitaria exilis in the Fouta Djallon region of West Africa, Kedougou, Senegal

Protected areas and their impact on the livelihood of local communities: the case of Mnazi-Bay Ruvuma Estuary Marine Park (MBREMP) in Tanzania, Mtwara, Tanzania

Research on issues related to indigenous agriculture and biodiversity issues in the state of Punjab, India, Chandigarh, India

Research on the premise that developing countries will be the largest emitters of greenhouse gases (GHG) and the most impacted by global climate change (GCC), New Haven, Conn., and São Paulo, Brazil

Research into inter-urban transportation on the island of Java, Indonesia, Semarang, Central Java, Indonesia

Research on how Reducing Emissions from Deforestation and Degradation (REDD) project frameworks may begin to address indigenous communities' apprehensions by understanding what the specific concerns and reservations of local indigenous communities are with regards to REDD projects using the Ecuadorian Socio Bosque program as a pilot study, Quito, Ecuador

Role of the White-winged Guan in seed dispersal in Tumbesian Dry Forest biodiversity, Olmos, Peru

Toward a comprehensive land use based REDD. A case study in Ghana and Peru, Bia National Park, Ghana/Madre de Dios, Peru

INDEPENDENT U.S. RESEARCH

Chemical responses to changing shade levels on Hawaiian teas, Hilo, Hawaii

Creating a systems dynamic model of the Great Lakes Watershed, working on a system dynamics model of wastewater reuse and a literature review of system dynamics modeling for water resources management, New Haven, Conn.

The effect of fiddler crab behaviors on salt marsh ecosystem function in the presence or absence of avian predation, Guilford, Conn.

Greening Main Street: integrating extensive vegetated roofs and economic revitalization in Washington, D.C., Washington, D.C.

Habitat segregation of dengue vectors within heterogeneous urban areas in Patillas, Puerto Rico, using high resolution satellite data, Patillas, Puerto Rico

Native and non-native struggles for justice: a participatory action study of the Eagle Mine Conflict in Michigan's Upper Peninsula, Baraga and Marquette, Mich.

The only long-term collaborative field study on the Colville National Forest in eastern Washington, examining the first old growth fuel reduction treatments conducted there and comparing stand density and composition of single structure and multistory stands, Republic, Wash.

Research on the effects of trades of sulfur dioxide emissions allowances and their effects on human health, New Haven, Conn.

Testing a method designed for detecting and identifying sources of fecal contamination in beaches following the East Shore Department of Health locations and protocols, Branford, Conn.

Testing a sustainable landscape management program on campus, creating a pilot composting tea with a series of experimental plots around Yale comparing soils amended with compost and those under current management, New Haven, Conn.

Using fire/grazing dynamics to restore a grassland ecosystem in New England, Southbury, Conn.

The above list was compiled by the Career Development Office, Yale School of Forestry & Environmental Studies. For more information, please contact Director, Peter Otis, telephone, 203.432.8920; e-mail, peter.otis@yale.edu

The School and its students thank donors, host organizations, and supervisors for making these valuable professional experiences possible.

Immediately Following Graduation

Each year our graduates enjoy employment success in environmental science, policy, and management within the United States and around the world, or they pursue admission for further academic study. Details including salary information can be found on the most recent as well as previous classes at www.environment.yale.edu/current/Employment-and-Summer-InternshipResearch-Projects-Data.

Summary data from the class of 2010 master's graduates six months after graduation (124 reporting): 30 percent went into the private for-profit and law sectors; 24 percent entered the public sector/government; 19 percent entered the NGO not-for-profit sector; 17 percent are working in education; and 10 percent have pursued further study.

University Services and Resources

A GLOBAL UNIVERSITY

In a speech entitled "The Global University," Yale President Richard C. Levin declared that as Yale enters its fourth century, its goal is to become a truly global university—educating leaders and advancing the frontiers of knowledge not simply for the United States, but for the entire world: "The globalization of the University is in part an evolutionary development. Yale has drawn students from outside the United States for nearly two centuries, and international issues have been represented in its curriculum for the past hundred years and more. But creating the global university is also a revolutionary development—signaling distinct changes in the substance of teaching and research, the demographic characteristics of students, the scope and breadth of external collaborations, and the engagement of the University with new audiences."

Yale University's goals and strategies for internationalization are described in a report entitled "International Framework: Yale's Agenda for 2009 to 2012," which is available online at www.world.yale.edu/framework.

International activity is coordinated by several University-wide organizations in addition to the efforts within the individual schools and programs.

The Office of International Affairs supports the international activities of all schools, departments, offices, centers, and organizations at Yale; promotes Yale and its faculty to international audiences; and works to increase the visibility of Yale's international activities around the globe. See www.yale.edu/oia.

The Office of International Students and Scholars is a resource on immigration matters and hosts orientation programs and social activities for the University's international community. See description in this bulletin and www.yale.edu/oiss.

The Whitney and Betty MacMillan Center for International and Area Studies is the University's principal agency for encouraging and coordinating teaching and research on international affairs, societies, and cultures. See description in this bulletin and www.yale.edu/macmillan.

Opened in fall 2010, the Jackson Institute for Global Affairs seeks to institutionalize the teaching of global affairs throughout the University and to inspire and prepare Yale students for global citizenship and leadership. See http://jackson.yale.edu.

The Yale Center for the Study of Globalization draws on the intellectual resources of the Yale community, scholars from other universities, and experts from around the world to support teaching and research on the many facets of globalization, and to enrich debate through workshops, conferences, and public programs. See www.ycsg.yale.edu.

The Yale World Fellows Program hosts fifteen emerging leaders from outside the United States each year for an intensive semester of individualized research, weekly seminars, leadership training, and regular interactions with the Yale community. See www.yale.edu/worldfellows.

For additional information, the "Yale and the World" Web site offers a compilation of resources for international students, scholars, and other Yale affiliates interested in the University's global initiatives. See www.world.yale.edu.

HOUSING

The Graduate Housing Department has dormitory and apartment units for a small number of graduate and professional students. The Graduate Dormitory Office provides dormitory rooms of varying sizes and prices for single occupancy only. The Graduate Apartments Office provides unfurnished apartments consisting of efficiencies and one-, two-, and three-bedroom apartments for singles and families. Both offices are located in Helen Hadley Hall, a graduate dormitory at 420 Temple Street, and have office hours from 9 a.m. to 4 p.m., Monday through Friday.

Applications for 2011–2012 are available as of April 1 online and can be submitted directly from the Web site (www.yale.edu/graduatehousing/application.html). For new students at the University, a copy of the letter of acceptance from Yale will need to be submitted to the Dormitory or Apartments office. The Web site is the venue for graduate housing information and includes procedures, facility descriptions, floor plans, and rates. For more dormitory information, contact grad.dorms@yale.edu, tel. 203.432.2167, fax 203.432.4578. For more apartment information, contact grad.apts@yale.edu, tel. 203.432.8270, fax 203.432.4578.

Yale Off Campus Housing is a database of rental and sale listings available to the Yale community. The system has been designed to allow incoming affiliates to the University access to the online database at www.yale.edu/och. The use of your University NetID allows you immediate access to search the listings. It also allows you to set up a profile to be a roommate or search for roommates. Those without a NetID can set themselves up as guests by following the simple instructions. For answers to questions, please e-mail offcampushousing@yale.edu or call 203.432.9756.

DINING AT YALE

Yale Dining (YD) has tailored its services to meet the particular needs of graduate and professional school students by offering meal plan options that allow flexibility and value. The *Any 10 Meal Plan* offers meal service at the Hall of Graduate Studies dining hall and University Commons. It provides ten meals per week, plus six bonus meals per year and $75 per term in points to be used for additional meals during the week or at our retail locations on campus. Nonresident students may purchase a *5 Meal Plan* with three bonus meals, good Monday through Friday.

YD locations are a popular option for all members of the Yale community. In addition to Commons and the Hall of Graduate Studies, the following retail locations are available: Divinity School Café on Prospect Street, the Café at Kline Biology Tower, the Health Center Café, Marigolds at the School of Medicine, the Thain Family Café at Bass Library, Triple E's at 221 Whitney Avenue, Triple E's at Payne Whitney Gymnasium, Durfee's Convenience Store at 200 Elm Street, and uncommon at Commons. For students and staff choosing to dine in any of Yale's residential college dining rooms, "all-you-care-to-eat" meals are offered at one affordable price for breakfast ($5), lunch ($10.25), and/or dinner ($13.25) and require the diner to be accompanied by a host from that college.

Inquiries concerning food services should be addressed to Yale Dining, 246 Church Street, PO Box 208261, New Haven CT 06520-8261; tel., 203.432.0420. More information can be found online at www.yale.edu/dining.

SECURITY

As with most universities in urban settings, the security of persons and property is a primary concern of the School of Forestry & Environmental Studies. The University police and the fire marshal, in cooperation with the police and fire services of the City of New Haven, strive constantly to maintain a safe environment for the Yale community. At an orientation session during the summer modules, incoming students receive detailed information on emergency communications, personal safety tips, and other ways to protect themselves, equipment, and buildings.

HEALTH SERVICES FOR F&ES STUDENTS

The Yale Health Center is located on campus at 55 Lock Street. The center is home to Yale Health, a not-for-profit, physician-led health coverage option that offers a wide variety of health care services for students and other members of the Yale community. Services include student medicine, gynecology, mental health, pediatrics, pharmacy, laboratory, radiology, a seventeen-bed inpatient care unit, a round-the-clock acute care clinic, and specialty services such as allergy, dermatology, orthopedics, and a travel clinic. Yale Health coordinates and provides payment for the services provided at the Yale Health Center, as well as for emergency treatment, off-site specialty services, inpatient hospital care, and other ancillary services. Yale Health's services are detailed in the *Yale Health Student Handbook,* available through the Yale Health Member Services Department, 203.432.0246, or online at www.yalehealth.yale.edu.

Eligibility for Services

All full-time Yale degree-candidate students who are paying at least half tuition are enrolled automatically for Yale Health Basic Coverage. Yale Health Basic Coverage is offered at no charge and includes preventive health and medical services in the departments of Student Health, Gynecology, Health Education, and Mental Health & Counseling. In addition, treatment for urgent medical problems can be obtained twenty-four hours a day through Acute Care.

Students on leave of absence or on extended study and paying less than half tuition are not eligible for Yale Health Basic Coverage but may enroll in Yale Health Student Affiliate Coverage. Students enrolled in the Division of Special Registration as nondegree special students or visiting scholars are not eligible for Yale Health Basic Coverage but may enroll in the Yale Health Billed Associates Plan and pay a monthly premium. Associates must register for a minimum of one term within the first thirty days of affiliation with the University.

Students not eligible for Yale Health Basic Coverage may also use the services on a fee-for-service basis. Students who wish to be seen fee-for-service must register with the Member Services Department. Enrollment applications for the Yale Health Student Affiliate Coverage, Billed Associates Plan, or Fee-for-Service Program are available from the Member Services Department.

All students who purchase Yale Health Hospitalization/Specialty Coverage (see below) are welcome to use specialty and ancillary services at Yale Health Center. Upon

referral, Yale Health will cover the cost of specialty and ancillary services for these students. Students with an alternate insurance plan should seek specialty services from a provider who accepts their alternate insurance.

Health Coverage Enrollment

The University also requires all students eligible for Yale Health Basic Coverage to have adequate hospital insurance coverage. Students may choose Yale Health Hospitalization/Specialty Coverage or elect to waive the plan if they have other hospitalization coverage, such as coverage through a spouse or parent. The waiver must be renewed annually, and it is the student's responsibility to confirm receipt of the waiver by the University's deadlines noted below.

YALE HEALTH HOSPITALIZATION/SPECIALTY COVERAGE

For a detailed explanation of this plan, see the *Yale Health Student Handbook,* available online at www.yalehealth.yale.edu/handbooks/documents/student_handbook.pdf.

Students are automatically enrolled and charged a fee each term on their Student Financial Services bill for Yale Health Hospitalization/Specialty Coverage. Students with no break in coverage who are enrolled during both the fall and spring terms are billed each term and are covered from August 1 through July 31. For students entering Yale for the first time, readmitted students, and students returning from a leave of absence who have not been covered during their leave, Yale Health Hospitalization/Specialty Coverage begins on the day the dormitories officially open. A student who is enrolled for the fall term only is covered for services through January 31; a student enrolled for the spring term only is covered for services through July 31.

Waiving Yale Health Hospitalization/Specialty Coverage Students are permitted to waive Yale Health Hospitalization/Specialty Coverage by completing an online waiver form at www.yhpstudentwaiver.yale.edu that demonstrates proof of alternate coverage. It is the student's responsibility to report any changes in alternate insurance coverage to the Member Services Department. Students are encouraged to review their present coverage and compare its benefits to those available under Yale Health. The waiver form must be filed annually and must be received by September 15 for the full year or fall term or by January 31 for the spring term only.

Revoking the waiver Students who waive Yale Health Hospitalization/Specialty Coverage but later wish to be covered must complete and send a form voiding their waiver to the Member Services Department by September 15 for the full year or fall term, or by January 31 for the spring term only. Students who wish to revoke their waiver during the term may do so, provided they show proof of loss of the alternate insurance plan and enroll within thirty days of the loss of this coverage. Yale Health premiums will not be prorated.

YALE HEALTH STUDENT TWO-PERSON AND FAMILY PLANS

A student may enroll his or her lawfully married spouse or civil union partner and/or legally dependent child(ren) under the age of twenty-six in one of two student dependent plans: the Two-Person Plan or the Student Family Plan. These plans include services

described in both Yale Health Basic Coverage and Yale Health Hospitalization/Specialty Coverage. Yale Health Prescription Plus Coverage may be added at an additional cost. Coverage is not automatic and enrollment is by application. Applications are available from the Member Services Department or can be downloaded from the Web site (www.yalehealth.yale.edu) and must be renewed annually. Applications must be received by September 15 for full-year or fall-term coverage, or by January 31 for spring-term coverage only.

YALE HEALTH STUDENT AFFILIATE COVERAGE

Students on leave of absence or extended study, students paying less than half tuition, or students enrolled in the Eli Whitney Program prior to September 2007 may enroll in Yale Health Student Affiliate Coverage, which includes services described in both Yale Health Basic and Yale Health Hospitalization/Specialty Coverage. Prescription Plus Coverage may also be added for an additional cost. Applications are available from the Member Services Department or can be downloaded from the Web site (www.yalehealth.yale.edu) and must be received by September 15 for full-year or fall-term coverage, or by January 31 for spring-term coverage only.

YALE HEALTH PRESCRIPTION PLUS COVERAGE

This plan has been designed for Yale students who purchase Yale Health Hospitalization/Specialty Coverage and student dependents who are enrolled in either the Two-Person Plan, the Student Family Plan, or Student Affiliate Coverage. Yale Health Prescription Plus Coverage provides protection for some types of medical expenses not covered under Yale Health Hospitalization/Specialty Coverage. Students are billed for this plan and may waive this coverage. The online waiver (www.yhpstudentwaiver.yale.edu) must be filed annually and must be received by September 15 for the full year or fall term or by January 31 for the spring term only. For a detailed explanation, please refer to the *Yale Health Student Handbook*.

Eligibility Changes

Withdrawal A student who withdraws from the University during the first ten days of the term will be refunded the premium paid for Yale Health Hospitalization/Specialty Coverage and/or Yale Health Prescription Plus Coverage. The student will not be eligible for any Yale Health benefits, and the student's Yale Health membership will be terminated retroactive to the beginning of the term. The medical record will be reviewed, and any services rendered and/or claims paid will be billed to the student on a fee-for-service basis. At all other times, a student who withdraws from the University will be covered by Yale Health for thirty days following the date of withdrawal or to the last day of the term, whichever comes first. Premiums will not be prorated or refunded. Students who withdraw are not eligible to enroll in Yale Health Student Affiliate Coverage.

Leaves of absence Students who are granted a leave of absence are eligible to purchase Yale Health Student Affiliate Coverage during the term(s) of the leave. If the leave occurs during the term, Yale Health Hospitalization/Specialty Coverage will end on the date the leave is granted and students may enroll in Yale Health Student Affiliate Coverage.

Students must enroll in Affiliate Coverage prior to the beginning of the term during which the leave is taken or within thirty days of the start of the leave. Premiums paid for Yale Health Hospitalization/Specialty Coverage will be applied toward the cost of Affiliate Coverage. Coverage is not automatic and enrollment forms are available at the Member Services Department or can be downloaded from the Web site (www.yalehealth.yale.edu). Premiums will not be prorated or refunded.

Extended study or reduced tuition Students who are granted extended study status or pay less than half tuition are not eligible for Yale Health Hospitalization/Specialty Coverage and Yale Health Prescription Plus Coverage. They may purchase Yale Health Student Affiliate Coverage during the term(s) of extended study. This plan includes services described in both Yale Health Basic and Yale Health Hospitalization/Specialty Coverage. Coverage is not automatic, and enrollment forms are available at the Member Services Department or can be downloaded from the Web site (www.yalehealth.yale.edu). Students must complete an enrollment application for the plan prior to September 15 for the full year or fall term, or by January 31 for the spring term only.

For a full description of the services and benefits provided by Yale Health, please refer to the *Yale Health Student Handbook,* available from the Member Services Department, 203.432.0246, 55 Lock Street, PO Box 208237, New Haven CT 06520-8237.

Required Immunizations

Measles (rubeola), German measles (rubella), and mumps All students who were born after January 1, 1957, are required to provide proof of immunization against measles (rubeola), German measles (rubella), and mumps. Connecticut state law requires two doses of measles vaccine. The first dose must have been given on or after January 1, 1980, *and* after the student's first birthday; the second dose must have been given at least thirty (30) days after the first dose. Connecticut state law requires proof of two doses of rubella vaccine administered on or after January 1, 1980, *and* after the student's first birthday. Connecticut state law requires proof of two mumps vaccine immunizations administered on or after January 1, 1980, *and* after the student's first birthday; the second dose must have been given at least thirty (30) days after the first dose. The law applies to all students unless they present (a) a certificate from a physician stating that such immunization is contraindicated, (b) a statement that such immunization would be contrary to the student's religious beliefs, or (c) documentation of a positive blood titer for measles, rubella, and mumps.

Meningitis All students living in on-campus housing must be vaccinated against meningitis. The vaccine must have been received after January 1, 2007. Students who are not compliant with this state law will not be permitted to register for classes or move into the dormitories for the fall term, 2011. Please note that the State of Connecticut does not require this vaccine for students who intend to reside off campus.

Varicella (chicken pox) All students are required to provide proof of immunization against varicella. Connecticut state law requires two doses of varicella vaccine. The first dose must have been given on or after the student's first birthday; the second dose must

have been given at least twenty-eight (28) days after the first dose. Documentation from a health care provider that the student has had a confirmed case of the disease is also acceptable.

TB screening The University requires tuberculosis screening for all incoming students. This screening includes a short questionnaire to determine high-risk exposure and, if necessary, asks for information regarding resulting treatment. Please see the Yale Health student Web site (www.yalehealth.yale.edu/students) for more details and the screening form.

Note: Students who have not met these requirements prior to arrival at Yale University must receive the immunizations from Yale Health and will be charged accordingly.

RESOURCE OFFICE ON DISABILITIES

The Resource Office on Disabilities facilitates accommodations for undergraduate and graduate and professional school students with disabilities who register with and have appropriate documentation on file in the Resource Office. Early planning is critical. Documentation may be submitted to the Resource Office even though a specific accommodation request is not anticipated at the time of registration. It is recommended that matriculating students in need of disability-related accommodations at Yale University contact the Resource Office by June 4. Special requests for University housing need to be made in the housing application. Returning students must contact the Resource Office at the beginning of each term to arrange for course and exam accommodations.

The Resource Office also provides assistance to students with temporary disabilities. General informational inquiries are welcome from students and members of the Yale community and from the public. The mailing address is Resource Office on Disabilities, Yale University, PO Box 208305, New Haven CT 06520-8305. The Resource Office is located at 35 Broadway (rear entrance), Room 222. Office hours are Monday through Friday, 8:30 a.m. to 4:30 p.m. Voice callers may reach staff at 203.432.2324; fax at 203.432.8250. The Resource Office may also be reached by e-mail (judith.york@yale.edu) or through its Web site (www.yale.edu/rod).

CAMPUS RESOURCES ON SEXUAL MISCONDUCT

Yale University is committed to maintaining and strengthening an educational, employment, and living environment founded on civility and mutual respect. Sexual misconduct is antithetical to the standards and ideals of our community and will not be tolerated. Sexual misconduct incorporates a range of behaviors including rape, sexual assault, sexual harassment, intimate partner violence, stalking, and any other conduct of a sexual nature that is nonconsensual, or has the purpose or effect of threatening or intimidating a person or persons. Sexual activity requires consent, which is defined as voluntary, positive agreement between the participants to engage in specific sexual activity. Violations of Yale's Policy on Teacher-Student Consensual Relations also constitute sexual misconduct. Yale aims to eradicate sexual misconduct through education, training, clear policies, and serious consequences for violations of these policies. In addition to being

subject to University disciplinary action, sexual misconduct may lead to civil liability and criminal prosecution.

SHARE: Advocacy, Information, and Counseling

24/7 hotline: 203.432.6653
http://yalehealth.yale.edu/med_services/share.html

SHARE, the Sexual Harassment and Assault Resources and Education Center, provides trained counselors at any time of day or night via its direct hotline to speak with victims, their supporters, or other community members with questions or concerns. Along with providing support, SHARE counselors can provide information about medical, legal, and disciplinary options to help callers make their own decisions about how to proceed. For community members who do choose to take legal or disciplinary action, SHARE counselors can facilitate those processes and serve as advocates. SHARE works closely with the Yale Police Department as well as the various disciplinary boards.

If you would like to make use of SHARE's services, you can call the crisis number (203.432.6653) at any time. Some legal and medical options are very time-sensitive, so if you have been assaulted we encourage you to call SHARE and/or the Yale Police as soon as you can. Counselors can talk to you over the phone or meet you in person at the Yale Health Center or the Yale-New Haven Emergency Room. If it is not an acute situation and you would like to speak to Dr. Carole Goldberg, the director of SHARE, she can be reached at 203.432.0290 during business hours or via e-mail at carole.goldberg@yale.edu.

The Yale Police Department: Legal Action

24/7 hotline: 203.432.4406
http://publicsafety.yale.edu/sexual-assault-harassment-resources

The Yale Police Department has officers who are trained sexual assault/rape investigators. They work closely with the New Haven State's Attorney, SHARE, the Title IX Coordinators, and various other departments within the University. Talking to the police does not commit you to collecting evidence or pressing charges; with very few exceptions, all decisions about how to proceed are up to you. All reports are kept confidential.

Title IX Coordinators

Valarie Stanley, 203.432.0849, valarie.stanley@yale.edu
Joanne DeBernardo, 203.432.6286, joanne.debernardo@yale.edu
www.yale.edu/equalopportunity

Title IX protects students from sex discrimination on campus. Sex discrimination includes sexual harassment, sexual assault, and other forms of misconduct. The Title IX Coordinator can help address any concerns you might have about sexual misconduct. You can contact Valarie Stanley, the University's Title IX Coordinator, or Joanne DeBernardo, the Title IX Coordinator for the Yale School of Forestry & Environmental Studies.

The University-Wide Committee on Sexual Misconduct: Formal and Informal Disciplinary Action

203.432.1834 (business hours)
http://provost.yale.edu/uwc

The University-Wide Committee on Sexual Misconduct (UWC) provides an accessible, representative, and trained body to answer informal inquiries and fairly and expeditiously address formal and informal complaints of sexual misconduct. Any current or former Yale faculty member, trainee, student, or managerial professional employee who wishes to bring a claim that he or she has been harmed as the result of sexual misconduct may bring a complaint to the UWC. Operating out of the Provost's Office, the UWC is comprised of faculty, administrative, and student representatives from across the University. Core UWC members (listed on the UWC Web site) are available for exploratory conversations or to receive complaints.

OFFICE OF INTERNATIONAL STUDENTS AND SCHOLARS

The Office of International Students and Scholars (OISS) coordinates services and support for Yale's international students, faculty, staff, and their dependents. OISS assists members of the Yale international community with all matters of special concern to them and serves as a source of referral to other University offices and departments. OISS staff provide assistance with employment, immigration, personal and cultural adjustment, and family and financial matters, as well as serve as a source of general information about living at Yale and in New Haven. In addition, as Yale University's representative for immigration concerns, OISS provides information and assistance to students, staff, and faculty on how to obtain and maintain legal status in the United States, issues the visa documents needed to request entry into the United States under Yale's immigration sponsorship, and processes requests for extensions of authorized periods of stay, school transfers, and employment authorization. All international students and scholars must register with OISS as soon as they arrive at Yale, at which time OISS will provide a brief orientation about immigration compliance issues as well as information about orientation activities for newly arrived students, scholars, and family members. OISS programs, like the Community Friends hosting program, daily English conversation groups and conversation partners program, U.S. culture workshops and discussions, the *Taking Care of Business* practical matters series, and receptions and socials for newly arrived graduate students, postdoctoral associates, and visiting scholars, provide an opportunity to meet members of Yale's international community and become acquainted with the many resources of Yale University and New Haven. OISS welcomes volunteers from the Yale community to serve as local hosts and as English conversation partners. Interested individuals should contact OISS at oiss@yale.edu or 203.432.2305.

OISS maintains an extensive Web site (www.yale.edu/oiss) with useful information for students and scholars prior to and upon arrival in New Haven, as well as throughout their stay at Yale. As U.S. immigration regulations are complex and change rather

frequently, we urge international students and scholars to check the Web site for the most recent updates or to visit the office to speak with an OISS adviser.

International students, scholars, and their families and partners can connect with OISS and the international community at Yale by several virtual means.*OISS-L* is the OISS electronic newsletter for Yale's international community. *YaleInternational* is an interactive e-mail listserv through which more than 5,000 people connect to find roommates, rent apartments, sell cars and household goods, and keep each other informed about events in the area. Spouses and partners of Yale students and scholars will want to get involved with the organization called International Spouses and Partners at Yale (ISPY), which organizes a variety of programs for the spouse and partner community. ISPY has its own e-mail listserv. The newest additions to our communications are the OISS Facebook page and the various constituent Facebook groups. For more information, go to www.yale.edu/oiss/programs/email/index.html.

Housed in the International Center for Yale Students and Scholars at 421 Temple Street, the Office of International Students and Scholars is open Monday through Friday from 8:30 a.m. to 5 p.m., except Tuesday, when the office is open from 10 a.m. to 5 p.m.; tel., 203.432.2305.

INTERNATIONAL CENTER FOR YALE STUDENTS AND SCHOLARS

The International Center for Yale Students and Scholars, located at 421 Temple Street, across the street from Helen Hadley Hall, offers a central location for programs that both support the international community and promote cross-cultural understanding on campus. The center, home to the Office of International Students and Scholars (OISS), provides a welcoming venue for students and scholars who want to peruse resource materials, check their e-mail, and meet up with a friend or colleague. Open until 9 p.m. on weekdays during the academic year, the center also provides meeting space for student groups and a venue for events organized by both student groups and University departments. In addition, the center has nine work carrels that can be reserved by academic departments for short-term international visitors. For more information abour reserving space at the center, send a message to oiss@yale.edu or call 203.432.2305.

RELIGIOUS RESOURCES

The religious and spiritual resources of Yale University serve all students, faculty, and staff. These resources are coordinated and/or supported through the University Chaplaincy (located on the lower level of Bingham Hall on Old Campus); the Yale University Church at Battell Chapel, an open and affirming church; and Yale Religious Ministry, the on-campus association of clergy and nonordained representatives of various religious faiths. The ministry includes the Chapel of St. Thomas More, the parish church for all Roman Catholic students at the University; the Joseph Slifka Center for Jewish Life at Yale, a religious and cultural center for students of the Jewish faith; Indigo Blue: A Center for Buddhist Life at Yale; several Protestant denominational ministries and nondenominational ministries; and student religious groups such as the Baha'i Association,

the Yale Hindu Council, the Muslim Student Association, and many others. Hours for the Chaplain's Office during the academic term are Monday through Friday, 8:30 a.m. to 5 p.m., as well as evenings Sunday through Thursday, 5 to 11. Additional information is available at www.yale.edu/chaplain.

LIBRARIES

The Yale University Library consists of the central libraries – Sterling Memorial Library, Bass Library, and the Beinecke Rare Book and Manuscript Library – and numerous school and department libraries and special collections, including the Henry S. Graves Memorial Library Collection (described in the previous chapter). Second-largest among the university libraries in the United States, the Yale University Library contains approximately thirteen million volumes, half of which are in the central libraries. Students have access to the collections in all the libraries at Yale. For more information, visit www.library.yale.edu.

CULTURAL AND RECREATIONAL OPPORTUNITIES

Cultural Opportunities

Two sources of information about the broad range of events at the University are the *Yale Daily Bulletin* Web site at http://dailybulletin.yale.edu and the Yale Calendar of Events, an interactive calendar available online at http://events.yale.edu/opa. The *YDB* also features news about Yale people and programs, as well as videos, slide-shows, and a link to the real-time Yale Shuttle map.

The collections of the Yale Peabody Museum of Natural History comprise more than twelve million specimens and artifacts in thirteen curatorial divisions: anthropology, archives, botany, cryo facility, entomology, historical scientific instruments, invertebrate and vertebrate paleontology, meteorites and planetary science, mineralogy, paleobotany, and invertebrate and vertebrate zoology.

Founded in 1832, when patriot-artist John Trumbull donated more than 100 of his paintings to Yale College, the Yale University Art Gallery is the oldest college art museum in the United States. Today the gallery's encyclopedic collection numbers more than 185,000 objects ranging in date from ancient times to the present day. These holdings comprise a world-renowned collection of American paintings and decorative arts; outstanding collections of Greek and Roman art, including the artifacts excavated at the ancient Roman city of Dura-Europos; the Jarves, Griggs, and Rabinowitz collections of early Italian paintings; European, Asian, and African art from diverse cultures, including the recently acquired Charles B. Benenson Collection of African art; art of the ancient Americas; the Société Anonyme Collection of early-twentieth-century European and American art; and Impressionist, modern, and contemporary works. The gallery is currently completing an expansion project, which includes the renovation of the Swartwout building and Street Hall, the two historic structures adjacent to the recently renovated Kahn building. The gallery is both a collecting and an educational institution, and all activities are aimed at providing an invaluable resource and experience for Yale faculty, staff, and students, as well as for the general public. Learn more from the gallery's Web site: http://artgallery.yale.edu.

The Yale Center for British Art is home to the largest and most comprehensive collection of British paintings, sculpture, prints, drawings, and rare books outside the United Kingdom. Given to the University by Paul Mellon, Yale Class of 1929, it is housed in a landmark building by Louis Kahn.

There are more than eighty endowed lecture series held at Yale each year on subjects ranging from anatomy to theology, and including virtually all disciplines.

More than four hundred musical events take place at the University during the academic year. In addition to recitals by graduate and faculty performers, the School of Music presents the Philharmonia Orchestra of Yale, the Oneppo Chamber Music Series at Yale, the Duke Ellington Jazz Series, the Horowitz Piano Series, New Music New Haven, Yale Opera, and concerts at the Yale Collection of Musical Instruments. Undergraduate organizations include the Yale Concert and Jazz bands, the Yale Glee Club, the Yale Symphony Orchestra, and numerous other singing and instrumental groups. The Department of Music sponsors the Yale Collegium, Yale Baroque Opera Project, productions of new music and opera, and undergraduate recitals. The Institute of Sacred Music presents Great Organ Music at Yale, the Yale Camerata, the Yale Schola Cantorum, and numerous special events.

For theatergoers, Yale and New Haven offer a wide range of dramatic productions at the University Theatre, Yale Repertory Theatre, Iseman Theater, Yale Cabaret, Long Wharf Theatre, and Shubert Performing Arts Center.

Recreational Opportunities

The Payne Whitney Gymnasium is one of the most elaborate and extensive indoor athletic facilities in the world. This complex includes the 3,100-seat John J. Lee Amphitheater, the site for many indoor varsity sports contests; the Robert J. H. Kiphuth Exhibition Pool; the Brady Squash Center, a world-class facility with fifteen international-style courts; the Adrian C. Israel Fitness Center, a state-of-the-art exercise and weight-training complex; the Brooks-Dwyer Varsity Strength and Conditioning Center; the Colonel William K. Lanman, Jr. Center, a 30,000-square-foot space for recreational/intramural play and varsity team practice; the Greenberg Brothers Track, an eighth-mile indoor jogging track; the David Paterson Golf Technology Center; and other rooms devoted to fencing, gymnastics, rowing, wrestling, martial arts, general exercise, and dance. Numerous physical education classes in dance (ballet, modern, and ballroom, among others), martial arts, zumba, yoga, pilates, aerobic exercise, and sport skills are offered throughout the year. Yale undergraduates and graduate and professional school students may use the gym at no charge throughout the year. Academic term and summer memberships at reasonable fees are available for faculty, employees, postdoctoral and visiting fellows, alumni, and student spouses. Additional information is available online at http://sportsandrecreation.yale.edu.

During the year various recreational opportunities are available at the David S. Ingalls Rink, the McNay Family Sailing Center in Branford, the Yale Outdoor Education Center in East Lyme, the Yale Tennis Complex, and the Golf Course at Yale. Students, faculty, employees, students' spouses, and guests of the University may participate at each of these venues for a modest fee. Up-to-date information on programs, hours, and specific costs is available online at http://sportsandrecreation.yale.edu.

Approximately fifty club sports come under the jurisdiction of the Office of Outdoor Education and Club Sports. Most of the teams are for undergraduates, but a few are available to graduate and professional school students. Yale undergraduates, graduate and professional school students, faculty, staff, and alumni/ae may use the Yale Outdoor Education Center (OEC), which consists of 1,500 acres surrounding a mile-long lake in East Lyme, Connecticut. The facility includes overnight cabins and campsites, a pavilion and dining hall available for group rental, and a waterfront area with supervised swimming, rowboats, canoes, and kayaks. Adjacent to the lake, a shaded picnic grove and gazebo are available to visitors. In another area of the property, hiking trails surround a wildlife marsh. The OEC runs seven days a week from the fourth week of June through Labor Day. For more information, call 203.432.2492 or visit http://sportsandrecreation.yale.edu.

Throughout the year, Yale graduate and professional school students have the opportunity to participate in numerous intramural sports activities. These seasonal, team-oriented activities include volleyball, soccer, and softball in the fall; basketball and volleyball in the winter; softball, soccer, ultimate, and volleyball in the spring; and softball in the summer. With few exceptions, all academic-year graduate-professional student sports activities are scheduled on weekends, and most sports activities are open to competitive, recreational, and coeducational teams. More information is available from the Intramurals Office in Payne Whitney Gymnasium, 203.432.2487, or online at http://sportsandrecreation.yale.edu.

City and Countryside

Only a short bike ride away from the center of New Haven lies the countryside of a state that is over one-half forest land. Farms, parks, lakes, trails, beaches, and nature preserves all await the student seeking to spend a few hours away from his or her studies. Although much of New Haven's countryside has been marred by sprawl, like most American cities, beautiful land still remains close to town.

The most spectacular local features are the region's traprock ridges, the largest being East Rock, West Rock, and the Sleeping Giant. All three of these have been preserved as parks. East Rock and West Rock actually extend into New Haven, and their rusty-orange cliffs form a dramatic backdrop for the city. Sleeping Giant lies a pleasant ninety-minute bicycle ride from town.

New Haven is also surrounded by water supply forests. For a small annual fee, the Water Authority's twenty thousand acres of woods, traprock ridges, lakes, and streams are open for hiking, cross-country skiing, and fishing.

Tucked away in pockets off the main corridors of development lie some of the country's most fertile farmland. The Central Valley of New England, in which New Haven is situated, was once famous for its tobacco, onions, potatoes, apples, and seed growers. The remaining acres are now mostly in dairy farms and pick-your-own orchards, providing the region with rural scenery and fresh produce.

Farther out from the city, the land gets progressively hillier and less inhabited. The most dramatic region of the state is the Northwest Highlands of Litchfield County, where the School maintains its Great Mountain Forest Camp. Just a two-hour drive from New

Haven, the Northwest Highlands boast the Appalachian Trail, New England's largest caves, a portion of the Taconic Mountains, and the vibrant fall colors of the Litchfield Hills.

But there is no need to travel so far to experience nature's bounty. New Haven itself is fortunate to have five major parks, including Edgewood Park, designed by Frederick Law Olmsted, designer of Central Park in New York City and also much of Boston's and Chicago's park systems. Seventeen percent of New Haven is parkland, a figure that few cities in the world can match.

With so much nature near at hand and foot, New Haven comes close to maintaining the elusive ideal balance of the convenience and culture of the city with the pleasures of the countryside.

Enrollment

MASTER'S DEGREES CONFERRED, 2011

Adenike Sade Adeyeye (B.A. Yale Univ.), Md.
Natalie Lyn Allan (B.A. Dartmouth Coll.), Calif.
Margaret Wilde Arbuthnot (A.B. Princeton Univ.), Washington, D.C.
Naina Arora (B.A. Univ. Washington), Wash.
Bidisha Banerjee (B.A. Yale Univ.), Kans.
Rachel Malka Barr (B.Com. McGill Univ), Va.
Lucien Abraham Bouffard (B.S. Southern Conn. State Univ.), Conn.
Andrew Hudson Breck (B.A. Wesleyan Univ. [Conn.]), Conn.
Lauren Elisabeth Brooks (B.S. Marshall Univ.), W.Va.
Jason Minton Brown (B.A. Brigham Young Univ.), Calif.
Stephanie Caius Carlisle (B.A. Wesleyan Univ. [Conn.]), Tex.
Temperance Louise Carter (B.E. Univ. Michigan [Ann Arbor]), Mich.
Eliza Frances Cava (B.A. Swarthmore Coll.), Conn.
Charlotta Mary Wilhelmina Chan (B.A. Univ. California [Los Angeles]), Calif.
Thomas Robert Chase (M.A. Wesleyan University [Conn.]), N.H.
Xiaojiao Chen (B.A. Renmin Univ. [China]), China
Esther Sekyoung Choi (B.S. Univ. California [Berkeley]), Calif.
Erin D. Clark (B.A. Colby College), Conn.
James Robert Collins (B.A. Yale Univ.), N.Y.
Christopher Platt Cooke (B.S. New York Univ.), N.Y.
Kevin Thomas Currey (B.A. Yale Univ.), Calif.
Stuart M. DeCew (B.A. Colorado Coll.), Conn.
Guilherme Medeiros DePaula (B.S. Pontificia Univ. Católica; M.B.A. Univ. North Carolina [Chapel Hill]), Brazil
Erin M. Derrington (B.A. Univ. Washington), Wash.
Selin Devranoglu (B.A. Connecticut Coll.), Turkey
Alisha Eisenstein (B.A. Trinity Univ. [Texas]), Tex.
Yasemin Erboy (B.A. Columbia Univ.)
Elizabeth Banning Hoffman Friedlander (B.A. Yale Univ.), Wis.
Rebecca Lee Funk (B.A., B.S. Pennsylvania State Univ.; M.A. Yale Univ.), Conn.
Alyssa Kaori Go (B.A. Univ. California [Santa Barbara]), Conn.
John Patrick Good (B.A. Yale Univ.), Mich.
David Dickinson Henry (B.A. Haverford Coll.), N.H.
C. Walker Holmes (B.A. Dartmouth Coll.), Va.
Rachel Ching-Mei Hsu (B.S. Stanford University), Calif.
Melissa Nicole Ivins (A.B. Princeton Univ.), Mo.
Matthew Robert Jokajtys (B.S. Univ. Vermont), N.Y.
Salima Monik Jones-Daley (B.A. Barnard Coll.), Conn.
Torjia Sahr Karimu (B.S., M.S. Univ. Sierra Leone), Sierra Leone
Christopher Liam Kieran (B.A. Vassar Coll.), Pa.
Jessica Lynn Koski (B.S. Michigan Technological Univ.), Mich.

Kevin Kromash (B.A. Wesleyan Univ. [Conn.]), Conn.
Pamela Abdel Moneim Labib (B.S. American Univ. [Cairo]), Egypt
Ben Larson (B.A. Oberlin Coll.), Md.
Jason Denny Lawhon (B.S. Univ. Washington), Utah
Keith Chun Leem Lee (B.A. Univ. Chicago), Ill.
Aitong Li (B.E. Peking Univ.), China
Eliza A. Little (B.S. McGill Univ.), Conn.
Ginamarie Jane Lopez (B.A., B.S. Univ. California [Berkeley]), Calif.
Bandana K. Malik (B.A. Barnard Coll.), N.Y.
Manuel Mavila Loli (B.S. Univ. Nacional Agraria La Molina), Peru
Brian S. McCurdy (B.S. Middlebury Coll.), Vt.
Mary Caroline McGrath (B.A. Univ. Chicago), Ill.
Gabriel Andres Mejias Arismendi (B.E. Univ. Simón Bolivar), Venezuela
Danielle Suzanne Miley (B.A. Connecticut Coll.), Conn.
David Robert Mitchell (B.A. Univ. Oxford), England
Campbell Moore (B.A. St. Mary's Coll.), Md.
Mayanka Mudgal (B.A. Yale Univ.), N.Y.
Lukas Mueller (B.S. Munich Technological Univ.), Germany
Charles Sims Munford (B.A. Yale Univ.), Miss.
Geofrey Robson Mwanjela (B.S. Univ. Dar Es Salaam), Tanzania
Nedal Talal Nassar (B.E. Univ. Minnesota [Twin Cities]; M.B.A. Cornell Univ.), Calif.
Weixin Ng (B.S. Tsinghua Univ.), China
Jesse Daniel Oppenheimer (B.A. Washington Univ. St. Louis), Tex.
Angela Lynn Orthmeyer (B.S. Univ. Richmond), Minn.
Grady Whitman O'Shaughnessy (B.S. Lehigh Univ.), Conn.
Stefania Panousi (B.E. National Technical Univ. Athens), Greece
David C. Parsons (B.A. Bowdoin Coll.), Conn.
Mario Martins Peixoto Netto (B.A. Fundacao Armando Alvares P.), Brazil
Kristin Janin Pene (B.A. Univ. Notre Dame), Calif.
Ana Karla Perea (B.S. Inst. Tecnólogico y de Estudios Superiores de Occidente), Mexico
Max Robert Piana (B.A. Wesleyan Univ. [Conn.]), Conn.
Casey Scotford Pickett (B.A. Oberlin Coll.), Vt.
Jamie Ryan Pool (B.S. Univ. Delaware), Md.
Jessica Rocelle Price (B.A. Berea Coll.), Conn.
Pragyajan Yalamber Rai (B.S. St. Xavier's Campus; M.S. School of Environmental Science & Sustainable Development), Nepal
Giancarlo Raschio (B.E., M.S. Univ. Nacional Agraria La Molina), Peru
Pablo Eduardo Reed (B.S. Univ. Washington), Conn.
Lauren Joanna Richie (B.A. Swarthmore Coll.), Md.
Mariana Sarmiento (B.A. Tulane Univ.), Fla.
Katie Julane Schindall (B.A. Wellesley Coll.), Mass.
Claire Elizabeth Schlemme (B.A. Wellesley Coll.), N.Y.
Gina Marie Schrader (B.A. Western Michigan Univ.), Conn.
Shelby Leigh Semmes (B.A. Barnard Coll.), Conn.

Jaime Severino Romo (B.S. Inst. Tecnológico y de Estudios Superiores de Occidente), Mexico
David Arie Shimoni (B.A. Swarthmore Coll.), N.Y.
Kartikeya Singh (B.S. Furman Univ.), Conn.
Ian James Starr (B. A. Colgate Univ.), N.Y.
Rebecca McKay Steinberg (B.A. Barnard Coll.), N.Y.
Emily Elizabeth Stevenson (B.A. Yale Univ.), N.Y.
Randal Alan Strobo (B.S., J.D. Univ. Kentucky [Lexington]), Ky.
Bertrand Ngankam Tessa (B.S., M.S. Univ. Dschang), Cameroon
Christine Jane Trac (B.S. Univ. Washington), Wash.
Dania Maria Trespalacios (B.A. New Coll. Florida), Fla.
Elizabeth Dickson Turnbull (B.A. Colby Coll.), W.Va.
Kari Lynn Twaite (B.A. Bowdoin Coll.), N.J.
Juan Pablo Vallejo (B.A. Univ. Los Andes), Colombia
Dylan Walsh (B.A. Univ. Chicago), Ore.
Debbie Sheng Wang (B.A. Bryn Mawr Coll.), N.Y.
Tian Wang (B.S. Peking Univ), China
Steven Cristopher Williams (B.A. Howard Univ.), Calif.
Stephen Andrew Wood (B.A. George Washington Univ.), Mass.
Yang Wu (B.E. Beijin Jiaotong Univ.), China
Cong Xu (B.E. Beijing Univ. of Science and Technology; M.S. Chinese Acad. of Science), China
Man-Yu Yang (B.A., M.S. National Taiwan Univ.), Taiwan
Wanting Zhang (B.E., LL.B. Peking Univ.), China
Eva Tiffany Zlotnicka (B.S. Univ. Pennsylvania), Conn.

DOCTORAL DEGREES CONFERRED, DECEMBER 2010

Diana Karwan (B.S. Univ. Michigan [Ann Arbor]; M.E.Sc. Yale Univ.), Mich.
Barry Ross Harrison Muchnick (B.A. Emory Univ.; M.E.Sc., M.A. Yale Univ.), Pa.
Catherine Hyde Picard (B.S. Univ. California [Berkeley]; M.S. Univ. Michigan [Ann Arbor]), South Africa

DOCTORAL DEGREES CONFERRED, MAY 2011

Xuemei Han (B.S. Beijing Normal Univ.; M.S. Yale Univ.), China
Kyounghee Kim (B.S. Yonsei Univ. [Korea]; M.S. Seoul National Univ. [Korea]), Republic of Korea
Daniel Piotto (B.E. São Paulo State Univ.; M.F. Yale Univ.), Brazil
Christian Eduardo Salas (B.S. Univ. de la Frontera [Chile]; M.S. Univ. Idaho), Chile

STUDENTS WORKING TOWARD MASTER'S DEGREES

Michele Lisa Abbene (B.S. Loyola Univ. [Louisiana]), N.Y.
Iro Beulah Sandra Altraide (B.S. Univ. Port Harcourt), Nigeria
Amit Ashkenazy (B.A. Interdisciplinary Center [Israel]), Israel
Gillian Thayer Baine (A.B. Princeton Univ.), Conn.

Alaine Alexandria Ball (B.A. Sarah Lawrence Coll.), N.Mex.
Shelly Renee Barnes (B.S. Univ. California [Santa Barbara]), Calif.
Andrew Kreussel Barnett (B.A., B.M. Oberlin Coll.), Minn.
Paulo Barreiro Sanjines (B.S. Beloit Coll.), Bolivia
Alex Logan Barrett (B.A. Middlebury Coll.), Mass.
Kevin Jarden Barrett (B.S. Northern Arizona Univ.), Colo.
Hannah Erin Bement (B.S. Univ. Akron), Va.
Daniel Adam Berkman (B.A. Middlebury Coll.), Pa.
Joshua Cherubin Brau (B.A. Brown Univ.), Conn.
Maya Sarah Breitburg-Smith (B.S. Univ. Maryland [College Park]), Md.
Stephen Huel Brooks (B.S. Univ. Florida), Fla.
Mackenzie Elise Brown (B.A. Washington & Lee Univ.), W.Va.
Matthew Herbert Emerson Mutel Browning (B.A. Oberlin Coll.), Iowa
Kyra Rachelle Busch (B.A. Indiana Univ. [Bloomington]), Ind.
Bryant Barber Cannon (B.A. Pomona Coll.), N.Y.
Charles Jeffrey William Carroll (B.A. Colby Coll.), Conn.
Michael Healy Carroll (A.B. Princeton Univ.), Mass.
Randy Joseph Caruso (B.A. George Washington Univ.), La.
Wilson Mun Fei Chan (B.S. Univ. London [Queen Mary]), England
Howard Kai-hao Chang (B.A. Johns Hopkins Univ.), N.J.
Anna Ching (B.S. Univ. California [Berkeley]), Calif.
Carla Virginia Chizmar (B.S. Univ. Panama), Panama
Jason Arlen Clark (B.A. Pomona Coll.), Wash.
George Michael Collins (A.B. Harvard Univ.), Ill.
Daniel Star Constable (Univ. California [Davis]), Calif.
Matthew Marshall Cooperrider (B.A. Case Western Reserve Univ.), Ohio
Amy Katherine Coplen (B.A., B.S Univ. New Mexico [Albuquerque]), N.Mex.
John R. D'Agostino (B.S. Rutgers Univ.; M.S. Univ. Vermont), N.J.
Shereen Lillian D'Souza (B.S. Georgetown Univ.), Fla.
Simon De Stercke (B.A. Univ. Ghent), Belgium
Matthew Decker (B.S. State Univ. New York), Conn.
Anuj Manubhai Desai (Wesleyan Univ. [Connecticut]), Conn.
Patricia Grace Devlin (Univ. Richmond), Conn.
Zhouwei Diao (B.E., B.S Tsinghua Univ.), China
Christina Ellen Olson Dietrich (B.A. Connecticut Coll.), Conn.
Sangay Thinley Dorji (B.A. Sherubtse Coll.; M.B.A. Assumption Univ.), Bhutan
Christopher Lee Dutton (B.S. Indiana Univ. [Bloomington]), Ga.
Elyzabeth Adrienne Earnley (B.A. Trinity Univ.), Tex.
Naazia Ebrahim (B.E. Univ. Toronto), Canada
Joseph Edgar (B.A. Northeastern Univ. [Boston]), N.Y.
Rita Effah (B.S. Kwame Nkrumah Univ. of Science and Technology), Ghana
Tania Maria Ellersick (B.S. Univ. Washington), Wash.
Merisha Elizabeth Enoe (B.A. Middlebury Coll.), N.J.
Sarah Federman (B.A. Barnard Coll.), Pa.
Jessica Feingold (B.A. Dartmouth Coll.), Pa.

Jessamine Williams Fitzpatrick (B.S. Georgetown Univ.), Calif.
Benjamin Stephen Fryer (B.A. Univ. California [Berkeley]), Calif.
Erik Fyfe (B.S. Emory Univ.), Ga.
Erin Burns Gill (B.A. Univ. Notre Dame [Indiana]), Tenn.
Matthew S. Goldstein (B.A. Yale Univ.), Conn.
Andres Gonzalez (B.S. Diego Portales Univ./Ramon Llull Univ.), Chile
Dominick Nathan Grant (B.A. Yale Univ.), Conn.
Aaron Greenfield (B.S. Stanford Univ.; M.S. Carnegie Mellon Univ.), Conn.
Ilan Gutherz (B.A. Univ. Virginia), Washington, D.C.
Aliya Haq (B.S. Cornell Univ.), Conn.
Kandice Lyn Harper (B.S. Iowa State Univ.; M.S. Ohio State Univ.), Conn.
Yan He (B.S. Fudan Univ.), China
Benjamin Goldman Healey (B.A., M.B.A. Yale Univ.), Conn.
Shane Michael Hetzler (B.A. Univ. the Pacific [California]), Ore.
Amy Kathleen Higgins (B.A. Dartmouth Coll.), Vt.
Patrick William Hook (B.A. Univ. Pennsylvania), Calif.
Shumpei Iida (B.A., M.A. Univ. Tokyo), Japan
Melissa Lucia Jenkins (B.A. George Washington Univ.), Mass.
Joanna Christine Julian (B.A. Univ. California [Berkeley]), Conn.
Heidi Elizabeth Jump (B.S. Beloit Coll.), Wash.
Brian Edward Kauffman (B.A. Columbia Univ.), Conn.
Renee Kaufman (B.A. New York Univ.; M.Arch. Harvard Univ.), N.Y.
Goksin Kavlak (B.S. Bogazici Univ.), Turkey
Bassem Magdi Khalifa (B.S. American Univ. [Cairo]), Egypt
Maisah Aniqa Khan (B.S. Arizona State Univ.), Ariz.
Soojin Kim (Seoul National Univ.), Republic of Korea
Rachel Anne Kramer (B.S. Brandeis Univ.), Va.
Lakshmi Krishnan (B.S. Univ. Madras), India
Brea Katrin Kroeker (B.S. Princeton Univ.), Ontario, Canada
Sameer Kwatra (B.E. Regional Engineering Coll.; M.B.A. Indian Inst. of Management), India
Raul Eduardo Lamas Bregante (B.E. Univ. Nacional Agraria La Molina), Peru
Sarah Rose Langberg (A.B. Princeton Univ.), Fla.
Harrison Michael Rhodes Leaf (Univ. of London), England
Michelle Lewis (B.A. Elizabeth City State Univ.; M.A. Regent Univ.), Ga.
Zhimin Li (B.S. Shantou Univ.), China
Stephen Constantine Liapis (B.S. Stockton State Coll.), N.J.
Alexandra Tabitha Lieberman (B.A. Univ. Pennsylvania), Conn.
Ainsley Marie Lloyd (B.A. Univ. Arizona), Ariz.
Jing Ma (B.A. Renmin Univ. China), China
Ashley Elizabeth MacDonald (B.S. State Univ. New York), N.Y.
Kendra Adelaide Mack (B.A. Yale Univ.), Conn.
Daniela Ayelen Marini (B.S. Univ. Nacional de Rio Cuarto), Conn.
Brian David Marrs (B.A. Univ. Virginia), Va.
Meredith Pearl Martin (B.A. Columbia Univ.), N.Y.

Alisa May (B.A. Univ. Southern California), Calif.
Melissa Lee McPike (B.A. Univ. Colorado [Denver]; M.A. Vermont Law School), Vt.
Megan Catherine McVey (B.A., B.S. Univ. Virginia), Va.
Dustin William Meyer (A.B. Princeton Univ.), Iowa
Joseph Michelangelo (B.E. Univ. New Haven), Conn.
Margo Christen Mosher (B.S. Univ. New Hampshire [Durham]), Mass.
Munjed Murad (B.A. George Washington Univ.), Conn.
Dania M. Nasser (Univ. Vermont), N.Y.
Brian Josepn Owino Oduor (B.A. Connecticut Coll.), Conn.
Arnab Pal (B.A. Univ. California [Los Angeles]), Calif.
Jaimini Parekh (B.S. Univ. California [Berkeley]), Calif.
Michael Adams Parks (B.A. Washington Univ. [St. Louis]), Tex.
Ariel Patashnik (B.A. Yale Univ.), Calif.
Aaron Samual Paul (B.A. Reed Coll.), Va.
Jonathan S. Peterson (B.A. Middlebury Coll.), Mass.
Mollie Ann Pickens (B.A. Columbia Univ.; M.S. Dublin Inst. of Technology), Ireland
Mark Picton (B.S. Univ. New Hampshire [Durham]), Conn.
Erica Jean Pohnan (B.A. Univ. Chicago), Ill.
Kyle Alexander Wadde Poorman (B.S. Iowa State Univ.), Iowa
Richard Alan Press (B.A. Cornell Univ.), Conn.
Chen Qian (B.A., B.E. Tsinghua Univ.), China
Paulo Quadri Barba (B.S. Univ. de las Americas), Mexico
Juan Sebastian Ramirez (B.E. Inst. Tecnológico y de Estudios Superiores de Occidente), Mexico
Danielle Ivonne Rappaport (B.A. George Washington Univ.), Washington, D.C.
Evan Fullen Ray (B.A. New York Univ.), Conn.
Aaron Sameul Reuben (B.A. Wesleyan Univ. [Connecticut]), S.C.
David Ross (B.A. Ithaca Coll.), Md.
Nathan Eustis Rutenbeck (B.A. Bard Coll.), Maine
Srinath Sabapathy (B.E. Marine Engineering Research Inst.), India
Kevin Ram Samy (B.S. Miami Univ. [Ohio]), Tex.
Troy R. Savage (B.E. Princeton Univ.), Conn.
Alison Claire Schaffer (B.S. Bucknell Univ.), Md.
Tina Schneider (B.A. Reed Coll.), Conn.
Emily Megan Schosid (B.A. Univ. Colorado [Boulder]), Colo.
Jake Harris Seligman (B.S. Cornell Univ.), N.Y.
Spenser Todd Shadle (B.A. Colorado Coll.), Idaho
Kavita Sharma (B.S. St. Vincent Coll.), Conn.
Kanchan Shrestha (B.S. Univ. Texas [Arlington]), Conn.
Kathryn Veronica Siegel (B.S. Univ. Illinois [Urbana-Champaign]), Ill.
Chandra Simon (B.F.A. New York Univ.), N.Y.
Jonathan James Smith (B.A. Univ. Florida), Fla.
Sharon Janelle Smith (B.S. Univ. California [Berkeley]), Calif.
Ran Song (B.E. Tsinghua Univ.), China
Bhavya Sridhar (B.S. Univ. Michigan [Ann Arbor]), India

Matthew William Strausser (B.A., B.S. Univ. California [Berkeley]), Tex.
Lori Jean Summers (B.S. Oregon State Univ.), Ore.
Nicholas William Tapert (B.A. Davidson Coll.), Conn.
Joseph Twu Teng (B.S Univ. Illinois [Urbana-Champaign]), Tex.
Paul Dixon Thomson (B.S. Univ. Michigan [Ann Arbor]), Calif.
Yang Tian (B.S. Zhongshan Univ.), China
Christopher Grant Tolley (B.S., B.A. Univ. Hawaii [Manoa]), Hawaii
Pablo Torres (B.S. Univ. North Carolina [Chapel Hill]), Conn.
Rafael E. Torres (B.S. Babson Coll.), Conn.
Blake Troxel (B.A. Wittenberg Univ.), Ind.
Sarah Ann Uhl (B.A. Dartmouth Coll.), Conn.
Luis Gonzalo Pablo Urbina Roca (B.S. Univ. Nacional Agraria La Molina), Peru
Tara Lisa Ursell (B.A. Pomona Coll.), Calif.
Tara Varghese (B.A. Case Western Reserve Univ.), Washington, D.C.
Theodore Sugato Varns (B.A. Washington Univ. [St. Louis]), Ore.
Shiyue Wang (B.A. Renmin Univ. China), China
Yushuang Wang (B.A., B.S. Peking Univ.), China
Zhuohao Wang (B.S. Sichuan Univ.), China
Kayanna Warren (B.A., B.S. Univ. Washington), Conn.
Sarah Marie Jennifer Welch (A.B. Harvard Univ.), Conn.
Leigh Ann Whelpton (B.S. Univ. California [Berkeley]), Ohio
Reade Elliott Wilson (B.A. Columbia Univ.), N.H.
Angela Yi Wu (A.B. Harvard Univ.), N.Y.
Sarah Amy Wyatt (B.S. Coll. William and Mary), Va.
Angela Yi-Chen Yeh (B.S. National Taiwan Univ.), Taiwan
Byungman Yoon (B.A. Univ. Washington), Republic of Korea
Lily Zeng (B.S. Queens Univ.), Canada
Yupu Zhao (B.A. Franklin & Marshall Coll.), China
Gregory William Zimmerman (B.A. Colorado Coll.), Colo.
Andrew Benito Zingale (B.A. Univ. San Diego), Wash.
Amy Elizabeth Zvonar (B.A. Agnes Scott Coll.), Conn.

STUDENTS WORKING TOWARD DOCTORAL DEGREES

Doctor of Philosophy

Agha Ali Akram (B.S. Lahore Univ. [Pakistan]; M.E.S. Yale Univ.), Pakistan
Noel Ramesh Aloysius (B.Sc. Univ. Peradeniya [Sri Lanka]; M.S. Univ. North Dakota), Sri Lanka
Dwi Astiani (B.S. Tanjungpura Univ. [Indonesia]; M.S. Univ. Kentucky), Indonesia
Jennifer Elnora Baka (B.S. George Washington Univ.; M.P.P., Univ. California [Berkeley]), Pa.
Lauren Miyoko Baker (B.A. Univ. California [Berkeley]; M.E.M. Yale Univ.), Calif.
Laura Ann Bakkensen (B.A. Whitman Coll.; M.S. London School of Economics), Ore.
Alexandra Mochary Bergstein (B.A. Wesleyan Univ.; J.D. Univ. Chicago Law School), Conn.

Seth Binder (B.S. Georgetown Univ.; M.S. London School of Economics), N.J.
Martin Bouda (B.A. Univ. Pennsylvania; M.E.Sc. Yale Univ.), Czech Republic
Maura Bozeman (B.S. Virginia Polytechnic Inst. & State Univ.; M.S. Utah State Univ.), Va.
Laura Bozzi (B.S., M.E.S. Yale Univ.), N.C.
Steven Patrick Brady (B.A. St. Michael's Coll.; M.E.Sc. Yale Univ.), Vt.
Mercedes Aurelia Bravo (B.S. Univ. North Carolina [Chapel Hill]; M.E.Sc. Yale Univ.), N.C.
David Ellison Butman (B.A. Connecticut Coll.; M.E.Sc. Yale Univ.), Mass.
Kimberly Marie Carlson (B.S. Stanford Univ.), Mont.
Adrian Caballero Cerezo (B.A. Univ. Sagrado Corazon [Puerto Rico]; M.E.Sc. Yale Univ.), Puerto Rico
Nathan Wankit Chan (B.S. California Inst. of Technology; M.P.A. Columbia Univ.), Tex.
Jeffrey Chow (B.S. Arizona State Univ.; M.F. Duke Univ.), Ariz.
Peter Anton Christensen (B.A. Univ. California [Davis]; M.E.Sc. Yale Univ.), Calif.
C. Anne Claus (B.A. Univ. Iowa; M.A. Univ. Hawaii), Nebr.
Luisa Cortesi (B.A. Univ. Torino [Italy]; M.A. Univ. London), Italy
Kristofer Ron Covey (B.A., B.S. SUNY [Potsdam]; M.E.Sc. Yale Univ.), N.Y.
Dylan James Craven (B.A. Univ. Wyoming; M.F.S. Yale Univ.), Wash.
Maria Gabriela Doria Ramirez (B.S. Univ. Nacional Colombia; M.A. Wesleyan Univ.), Colombia
Keita Ebisu (B.A. International Christian Univ. [Japan]; M.S. Yale Univ.), Japan
Theodore Robert Fetter (B.S., M.S. Univ. Massachusetts [Amherst]), Calif.
Catherine Genevieve Fontana (B.A. Albion Coll.; M.S. Univ. Dublin Trinity Coll.), Mich.
Brent Regan Frey (B.S. Univ. Winnipeg [Canada]; M.S. Univ. Alberta [Canada]), Canada
Jennifer Elaine Gaddis (B.S. Univ. Illinois), Ill.
Edgardo Gonzalez (B.S. Univ. Puerto Rico; M.F. Yale Univ.), Puerto Rico
Dana Johanna Graef (A.B. Princeton Univ.), Vt.
Gabriel Bauchat Grant (B.S., M.S. Purdue Univ.), Mich.
Shaila Seshia Galvin (B.A. Univ. British Columbia; M.Phil., Univ. Sussex), Canada
Anobha Gurung (B.A. Univ. Colorado; M.E.Sc. Yale Univ.), Colo.
Christopher Rene Hakkenberg van Gaasbeek (B.A. Reed Coll.; A.M. Harvard Univ.), Bonaire
Iona Fairlight Hawken (B.A. Brown Univ.; M.E.M. Yale Univ.), Calif.
Troy Derek Hill (B.A. Clark Univ.; M.E.Sc. Yale Univ.), Mass.
Elaine Rosamond Hooper (B.S. Saskatchewan Univ.; M.S. McGill Univ.), Canada
Angel Hsu (B.A., B.S. Wake Forest Univ.; M.Phil. Univ. Cambridge [UK]), S.C.
Yitian Huang (LL.B. Peking Univ. [China]; LL.M. Univ. Cambridge [UK]), China
Jasmine Hyman (B.A. Columbia Univ.; M.Sc. London School of Economics), Calif.
Thomas Mattson James (B.S. Univ. Washington; M.F.S. Yale Univ.), Wash.
Sébastien Jodoin (LL.B., B.C.L. McGill Univ.; LL.M., L.S.E., M.Phil. Univ. Cambridge), Canada

Matto Mildenberger (Hon. B.Sc. Univ. Toronto; M.A. Univ. Waterloo), Canada
BinBin Jiang (B.S., M.S. Stanford Univ.), Calif.
Philip R. S. Johnson (B.A. Northwestern Univ.; M.Sc., M.P.H. Yale Univ.), Mass.
Sean Demars Johnson (B.S. Iowa State Univ.), Ill.
Namrata Kala (B.A. Lady Shri Ram Coll. [India]; M.A. Yale Univ.), India
Ashley Dawn Keiser (B.S. Univ. New Hampshire), N.H.
David Andrew Keiser (B.A. Univ. Virginia; M.S. Univ. Georgia [Athens]), Va.
Alder Keleman (B.A. Scripps Coll.; M.E.S., M.A. Yale Univ.), Wash.
David Michael Kneas (B.A. DePauw Univ.; M.E.Sc. Yale Univ.), Mich.
Alicia Marie Senauer Loge (B.A. Smith Coll.; M.E.M. Yale Univ.), Minn.
Philip Marshall (B.S. Cornell Univ.; M.E.Sc. Yale Univ.), N.Y.
Kevin Anthony McLean (B.S., M.S. Stanford Univ.), Minn.
Jennifer Rose Bunnell Miller (B.A. Claremont McKenna Coll.), Calif.
Sarah Rae Osterhoudt (B.A. Wesleyan Univ.; M.E.M. Yale Univ.), N.Y.
Jonathan Padwe (B.A. Univ. Virginia; M.E.M. Yale Univ.), Va.
Joo Young Park (B.S., M.S. Seoul National Univ. [Korea]), Republic of Korea
Stefan Renckens (B.A., M.A. Catholic Univ. Louvain [Belgium]), Belgium
Karthryn Richards-Hrdlicka (B.S. Arizona State Univ.), N.H.
Jonathan Lars Richardson (B.S. Univ. Virginia), Wash.
Laura Marie Robb (B.E. Duke Univ.; M.E. Stanford Univ.; M.D. Washington Univ.), Ill.
Mary Alta Rogalski (B.S. Coll. of William & Mary; M.E.S. Yale Univ.), Va.
Alark Saxena (B.Sc. Barkatullah Univ. [India]; M.A., M.F. Indian Inst. of Forest Management; M.E.M. Yale Univ.), India
Sara Elizabeth Smiley Smith (B.A. Middlebury Coll.; M.E.Sc., M.P.H. Yale Univ.), Maine
Jeffrey James Stoike (B.A. Univ. California [Berkeley]; M.S. Univ. Georgia [Athens]), Calif.
Michael William Stone (B.A., M.S. Michigan State Univ.), Mich.
Yaniv Stopnitzky (B.A. Univ. California [Berkeley]; M.Sc. London School of Economics), Calif.
Timothy Michael Terway (B.L.A. Pennsylvania State Univ.; M.C.P. Massachusetts Inst. of Technology), Pa.
Erin Marie Walsh (B.E. Princeton Univ.; M.E.M. Yale Univ.), Va.
Peng Paul Wang (B.S. Xiamen Univ. [China]; M.S. Univ. Maine [Orono]), China
Na Xu (B.S., M.S. Tsinghua Univ. [China]), China
Amy Zhang (B.A. Simon Fraser Univ.; M.A. McMaster Univ.), Canada
Xin Zhang (B.S. Ocean Univ. Qingdao [China]; M.E.S. Peking Univ. [China]), China
Lei Zhao (B.S. Nanjing Univ.), China
Yong Zhao (B.S. Peking Univ. [China]; M.E.S. Yale Univ.), China

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For additional information, please write to the Director of Admissions, Office of Admissions, Yale School of Medicine, 367 Cedar Street, New Haven CT 06510; tel., 203.785.2643; fax, 203.785.3234; e-mail, medical.admissions@yale.edu; Web site, http://medicine.yale.edu/education/admissions

Divinity School Est. 1822. Courses for college graduates. Master of Divinity (M.Div.), Master of Arts in Religion (M.A.R.). Individuals with an M.Div. degree may apply for the program leading to the degree of Master of Sacred Theology (S.T.M.).

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Law School Est. 1824. Courses for college graduates. Juris Doctor (J.D.). For additional information, please write to the Admissions Office, Yale Law School, PO Box 208215, New Haven CT 06520-8215; tel., 203.432.4995; e-mail, admissions.law@yale.edu; Web site, www.law.yale.edu

Graduate Programs: Master of Laws (LL.M.), Doctor of the Science of Law (J.S.D.), Master of Studies in Law (M.S.L.). For additional information, please write to Graduate Programs, Yale Law School, PO Box 208215, New Haven CT 06520-8215; tel., 203.432.1696; e-mail, gradpro.law@yale.edu; Web site, www.law.yale.edu

School of Engineering & Applied Science Est. 1852. Courses for college graduates. Master of Science (M.S.), Master of Engineering (M.Eng.), and Doctor of Philosophy (Ph.D.) awarded by the Graduate School of Arts and Sciences.

For additional information, please write to the Office of Graduate Studies, Yale School of Engineering & Applied Science, PO Box 208267, New Haven CT 06520-8267; tel., 203.432.4250; e-mail, grad.engineering@yale.edu; Web site, http://seas.yale.edu

School of Art Est. 1869. Professional courses for college and art school graduates. Master of Fine Arts (M.F.A.).

For additional information, please write to the Office of Academic Affairs, Yale School of Art, PO Box 208339, New Haven CT 06520-8339; tel., 203.432.2600; e-mail, artschool.info@yale.edu; Web site, http://art.yale.edu

School of Music Est. 1894. Graduate professional studies in performance, composition, and conducting. Certificate in Performance, Master of Music (M.M.), Master of Musical Arts (M.M.A.), Artist Diploma, Doctor of Musical Arts (D.M.A.).

For additional information, please write to the Yale School of Music, PO Box 208246, New Haven CT 06520-8246; tel., 203.432.4155; fax, 203.432.7448; e-mail, gradmusic.admissions@yale.edu; Web site, http://music.yale.edu

School of Forestry & Environmental Studies Est. 1900. Courses for college graduates. Master of Forestry (M.F.), Master of Forest Science (M.F.S.), Master of Environmental Science (M.E.Sc.), Master of Environmental Management (M.E.M.). Doctor of Philosophy (Ph.D.) awarded by the Graduate School of Arts and Sciences.

For additional information, please write to the Office of Admissions, Yale School of Forestry & Environmental Studies, 205 Prospect Street, New Haven CT 06511; tel., 800.825.0330; e-mail, fesinfo@yale.edu; Web site, www.environment.yale.edu

School of Public Health Est. 1915. Courses for college graduates. Master of Public Health (M.P.H.). Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) awarded by the Graduate School of Arts and Sciences.

For additional information, please write to the Director of Admissions, Yale School of Public Health, PO Box 208034, New Haven CT 06520-8034; tel., 203.785.2844; e-mail, ysph.admissions@yale.edu; Web site, http://publichealth.yale.edu

School of Architecture Est. 1916. Courses for college graduates. Professional degree: Master of Architecture (M.Arch.); nonprofessional degree: Master of Environmental Design (M.E.D.). Doctor of Philosophy (Ph.D.) awarded by the Graduate School of Arts and Sciences.

For additional information, please write to the Yale School of Architecture, PO Box 208242, New Haven CT 06520-8242; tel., 203.432.2296; e-mail, gradarch.admissions@yale.edu; Web site, www.architecture.yale.edu

School of Nursing Est. 1923. Courses for college graduates. Master of Science in Nursing (M.S.N.), Post Master's Certificate. Doctor of Philosophy (Ph.D.) awarded by the Graduate School of Arts and Sciences.

For additional information, please write to the Yale School of Nursing, PO Box 9740, New Haven CT 06536-0740; tel., 203.785.2389; Web site, http://nursing.yale.edu

School of Drama Est. 1955. Courses for college graduates and certificate students. Master of Fine Arts (M.F.A.), Certificate in Drama, One-year Technical Internship (Certificate), Doctor of Fine Arts (D.F.A.).

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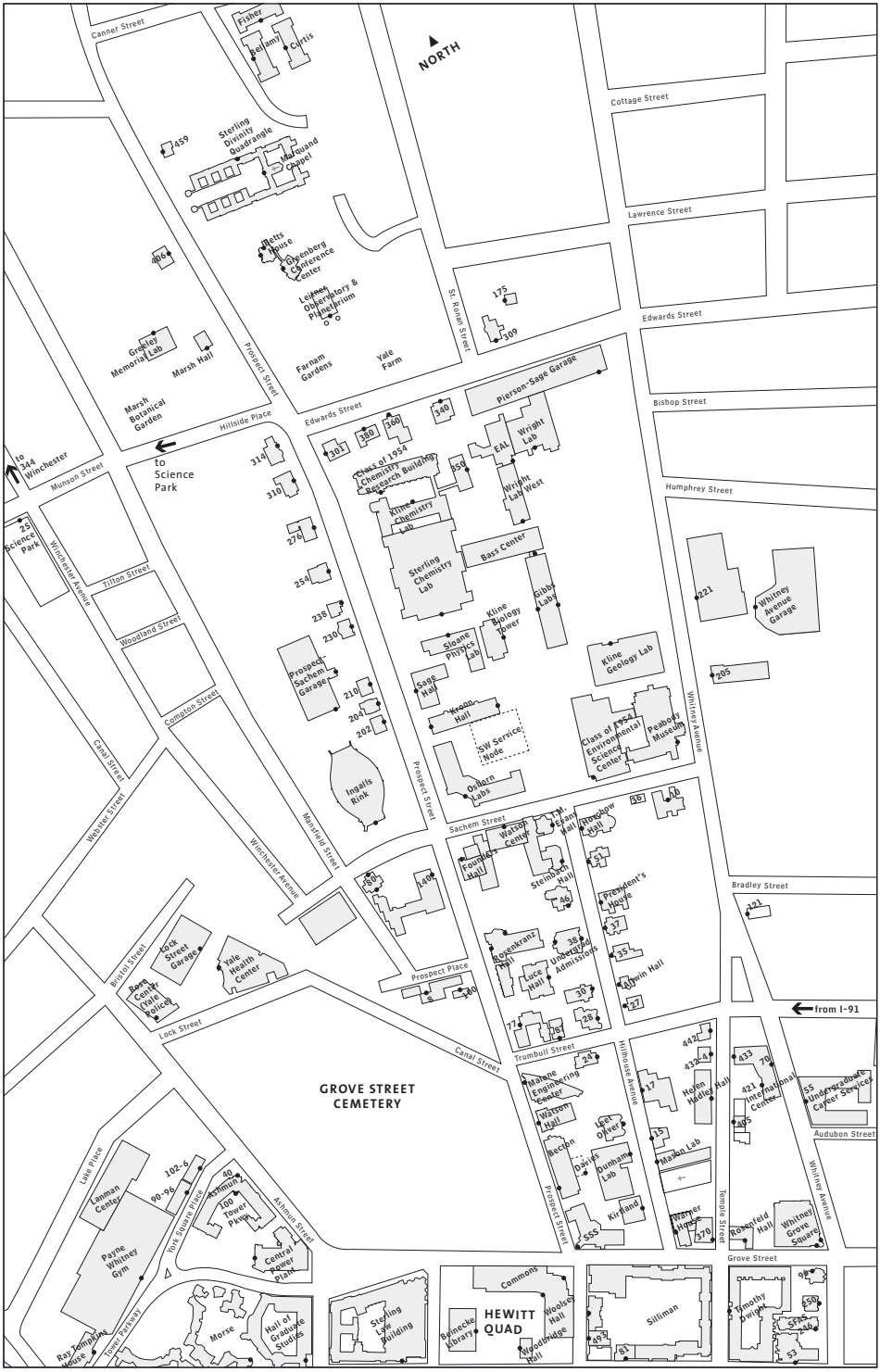

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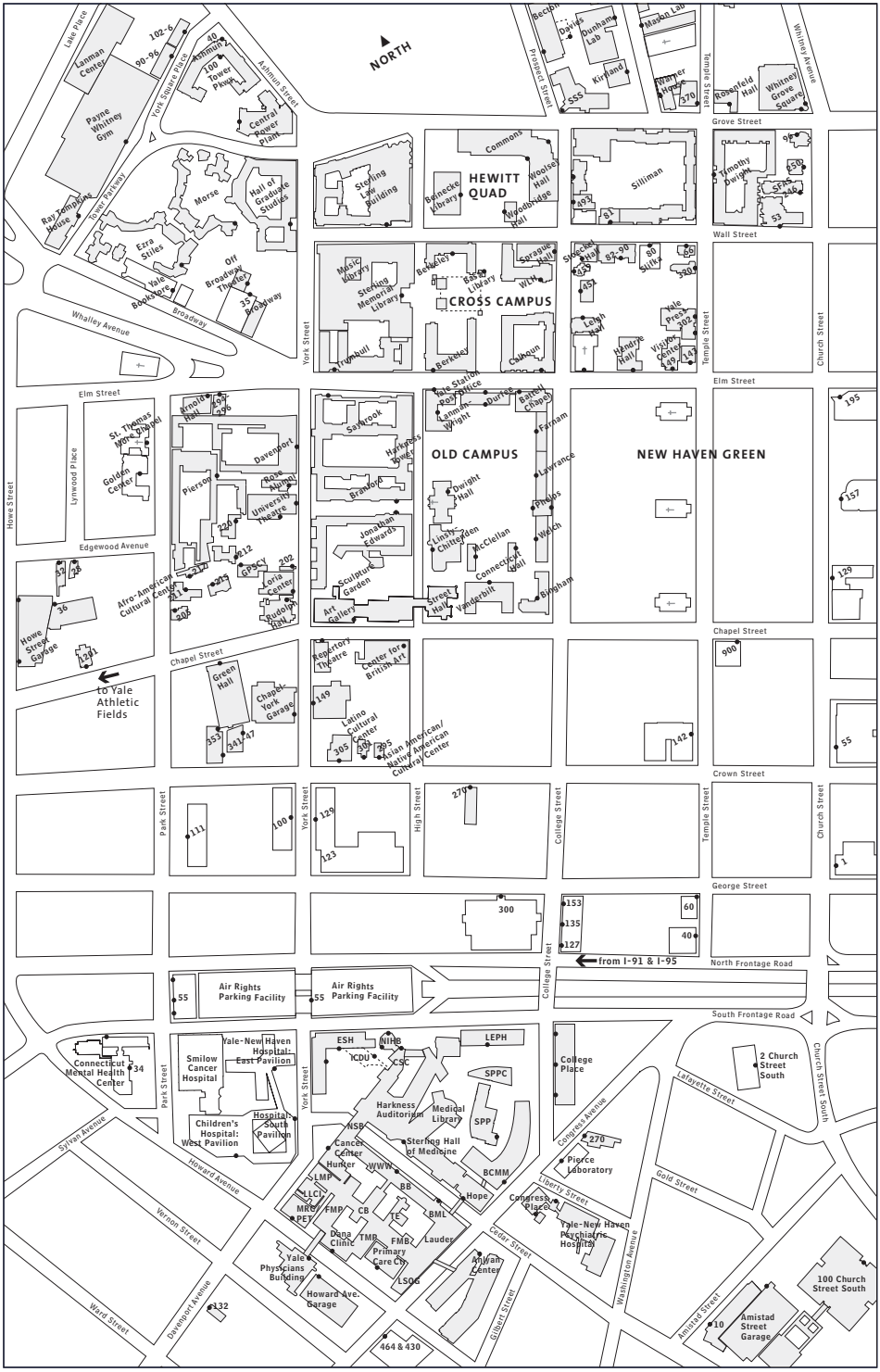

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