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**FALL 2004**

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<tr>
<td>Aug. 7</td>
<td>Sat.</td>
<td>Orientation for international students.</td>
</tr>
<tr>
<td>Aug. 8</td>
<td>Sun.</td>
<td>Orientation for summer modules.</td>
</tr>
<tr>
<td>Aug. 9–27</td>
<td>Mon.–Fri.</td>
<td>Training modules in technical skills (Mon.–Fri. of each week).</td>
</tr>
<tr>
<td>Aug. 27</td>
<td>Fri.</td>
<td>Meeting with the dean and Course Expo.</td>
</tr>
<tr>
<td>Sept. 1</td>
<td>Wed.</td>
<td><em>Fall-term classes begin, 8:30 A.M.</em></td>
</tr>
<tr>
<td>Sept. 6</td>
<td>Mon.</td>
<td>Labor Day. School closed.</td>
</tr>
<tr>
<td>Sept. 8</td>
<td>Wed.</td>
<td>Course registration forms due, 5 P.M.</td>
</tr>
<tr>
<td>Sept. 22</td>
<td>Wed.</td>
<td>Add/Drop period ends, 5 P.M.</td>
</tr>
<tr>
<td>Nov. 19</td>
<td>Fri.</td>
<td>Fall recess begins, 5:30 P.M.</td>
</tr>
<tr>
<td>Nov. 29</td>
<td>Mon.</td>
<td>Classes resume, 8:30 A.M.</td>
</tr>
<tr>
<td>Dec. 3</td>
<td>Fri.</td>
<td><em>Classes end, 5:30 P.M.</em> Reading period begins.</td>
</tr>
<tr>
<td>Dec. 11</td>
<td>Sat.</td>
<td>Final examinations begin, 8:30 A.M.</td>
</tr>
<tr>
<td>Dec. 18</td>
<td>Sat.</td>
<td>Final examinations end, 5:30 P.M. Winter recess begins.</td>
</tr>
</tbody>
</table>

**SPRING 2005**

<table>
<thead>
<tr>
<th>Date</th>
<th>Day</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan. 10</td>
<td>Mon.</td>
<td><em>Spring-term classes begin, 8:30 A.M.</em></td>
</tr>
<tr>
<td>Jan. 18</td>
<td>Tues.</td>
<td>Course registration forms due, 5 P.M.</td>
</tr>
<tr>
<td>Feb. 1</td>
<td>Tues.</td>
<td>Add/Drop period ends, 5 P.M.</td>
</tr>
<tr>
<td>Mar. 4</td>
<td>Fri.</td>
<td>Spring recess begins, 5:30 P.M.</td>
</tr>
<tr>
<td>Mar. 21</td>
<td>Mon.</td>
<td>Classes resume, 8:30 A.M.</td>
</tr>
<tr>
<td>Apr. 22</td>
<td>Fri.</td>
<td><em>Classes end, 5:30 P.M.</em> Reading period begins.</td>
</tr>
<tr>
<td>Apr. 25</td>
<td>Mon.</td>
<td>Make-up class for Martin Luther King, Jr. Day.</td>
</tr>
<tr>
<td>May 3</td>
<td>Tues.</td>
<td>Final examinations begin, 8:30 A.M.</td>
</tr>
<tr>
<td>May 10</td>
<td>Tues.</td>
<td>Final examinations end, 5:30 P.M.</td>
</tr>
<tr>
<td>May 23</td>
<td>Mon.</td>
<td>University Commencement.</td>
</tr>
</tbody>
</table>
The President and Fellows of Yale University

President
Richard Charles Levin, b.a., b.litt., ph.d.

Fellows
Her Excellency the Governor of Connecticut, ex officio.
His Honor the Lieutenant Governor of Connecticut, ex officio.
George Leonard Baker, Jr., b.a., m.b.a., Palo Alto, California.
Edward Perry Bass, b.s., Fort Worth, Texas.
Roland Whitney Betts, b.a., j.d., New York, New York (June 2005).
Gerhard Casper, ll.m., ph.d., ll.d., Atherton, California.
Susan Crown, b.a., m.a., Chicago, Illinois.
Charles Daniel Ellis, b.a., m.b.a., ph.d., New Haven, Connecticut.
Holcombe Tucker Green, Jr., b.a., ll.b., Atlanta, Georgia.
Jeffrey Powell Koplan, b.a., m.d., m.p.h., Atlanta, Georgia (June 2009).
Maya Ying Lin, b.a., m.arch., d.f.a., New York, New York (June 2008).
Margaret Hilary Marshall, b.a., m.ed., j.d., Cambridge, Massachusetts (June 2010).
Linda Anne Mason, b.a., m.b.a., Belmont, Massachusetts.
Indra Nooyi, b.s., m.b.a., m.p.p.m., Greenwich, Connecticut.
Barrington Daniel Parker, Jr., b.a., ll.r., Stamford, Connecticut.
Theodore Ping Shen, b.a., m.b.a., Brooklyn Heights, New York (June 2007).
Janet Louise Yellen, b.a., ph.d., Berkeley, California (June 2006).
President
Richard Charles Levin, B.A., B.LITT., PH.D.

Provost
Susan Hockfield, B.A., PH.D.

Vice President and Secretary
Linda Koch Lorimer, B.A., J.D.

Vice President and General Counsel
Dorothy Kathryn Robinson, B.A., J.D.

Vice President for Development
Charles James Pagnam, B.S.

Vice President and Director of New Haven and State Affairs
Bruce Donald Alexander, B.A., J.D.

Vice President for Finance and Administration
John Ennis Pepper, Jr., B.A., M.A.
Faculty and Administration

Faculty Emeriti
Frederick Herbert Bormann, M.A., Ph.D., Oastler Professor Emeritus of Forest Ecology.
George Mason Furnival, M.F., D.F., J.P. Weyerhaeuser, Jr., Professor Emeritus of Forest Management.
Arthur W. Galston, Ph.D., Eaton Professor Emeritus of Botany in Molecular, Cellular, and Developmental Biology, Professor Emeritus of Forestry, and Lecturer in Political Science.
John Charles Gordon, Ph.D., Pinchot Professor Emeritus of Forestry and Environmental Studies.
William Edward Reifsnyder, M.F., Ph.D., Professor Emeritus of Forest Meteorology and Professor Emeritus of Public Health (Biometeorology).
Charles Lee Remington, M.S., Ph.D., Professor Emeritus of Biology and Professor Emeritus of Forest Entomology and Environmental Studies.
David Martyn Smith, M.F., Ph.D., S.C.D., Morris K. Jesup Professor Emeritus of Silviculture.
William Hulse Smith, M.F., Ph.D., Clifton R. Musser Professor Emeritus of Forest Biology.

Board of Permanent Officers
Richard Charles Levin, B.Litt., Ph.D., President of the University.
Susan Hockfield, Ph.D., Provost of the University.
James Gustave Speth, M.Litt., J.D., Dean and Professor in the Practice of Environmental Policy and Sustainable Development.
†Mark S. Ashton, M.F., Ph.D., Professor of Silviculture and Forest Ecology and Director of School Forests.
Gaboury Benoit, M.S., Ph.D., Professor of Environmental Chemistry, Professor of Environmental Engineering, Co-Director of the Hixon Center for Urban Ecology, and Director of the Center for Coastal and Watershed Systems.
Graeme Pierce Berlyn, Ph.D., E.H. Harriman Professor of Forest Management, Professor of Anatomy and Physiology of Trees, and Editor, Journal of Sustainable Forestry.
Garry D. Brewer, M.S., Ph.D., Frederick K. Weyerhaeuser Professor of Resource Policy and Management (jointly appointed with the Yale School of Management), Professor of Political Science, and Director of the Environment Management Center.
†William Richard Burch, Jr., M.S., Ph.D., Frederick C. Hixon Professor of Natural Resource Management, Professor at the Institution for Social and Policy Studies, and Director of the Urban Resources Initiative.
Michael Roger Dove, M.A., Ph.D., Margaret K. Musser Professor of Social Ecology, Professor of Anthropology, and Coordinator of the F&ES/Anthropology Degree Program.
Daniel C. Esty, M.A., J.D., Professor of Environmental Law and Policy; Clinical Professor, Law School; Director of the Yale Center for Environmental Law and Policy; and Director of the Yale World Fellows Program.

† On leave of absence, fall 2004.
†Thomas Eldon 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 of the Center for Industrial Ecology.

‡Timothy G. Gregoire, Ph.D., J. P. Weyerhaeuser, Jr., Professor of Forest Management.

Stephen Robert Kellert, Ph.D., Tweedy/Ordway Professor of Social Ecology and Co-Director of the Hixon Center for Urban Ecology.

Xuhui Lee, M.Sc., Ph.D., Professor of Forest Meteorology and Micrometeorology and Director of Doctoral Studies.

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 of the Global Institute of Sustainable Forestry.

‡Oswald J. Schmitz, M.Sc., Ph.D., Professor of Population and Community Ecology, Associate Dean for Academic Affairs, Director of the Center for Biodiversity Conservation and Science, and Professor of Ecology and Evolutionary Biology.

David K. Skelly, Ph.D., Professor of Ecology.

John Peter Wargo, Ph.D., Professor of Risk Analysis, Environmental Policy, and Political Science; Director of the Environment and Health Initiative; and Director of Undergraduate Studies, Environmental Studies Program, Yale College.

Ladder Faculty

Michelle L. Bell, M.S.E., Ph.D., Assistant Professor of Environmental Health.

*Benjamin Cashore, M.A., Ph.D., Associate Professor of Environmental Policy and Governance and Political Science and Director of the Program on Forest Certification.

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

Lisa M. Curran, M.A., Ph.D., Associate Professor of Tropical Resources and Director of the Tropical Resources Institute.

Erin T. Mansur, Ph.D., Assistant Professor of Environmental Economics and Assistant Professor of Economics in the School of Management.

Sheila Olmstead, M.P.A.F.F., Ph.D., Assistant Professor of Environmental Economics.

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

James E. Saiers, M.S., Ph.D., Associate Professor of Hydrology.

Non-Ladder Faculty

Shimon C. Anisfeld, Ph.D., Lecturer and Research Scientist in Water Resources and Environmental Chemistry.

Ann E. Camp, M.F.S., Ph.D., Lecturer and Research Scientist in Stand Dynamics and Forest Health.

Carol Carpenter, M.A., Ph.D., Lecturer and Associate Research Scholar in Natural Resource Social Science and Lecturer in Anthropology.

† On leave of absence, fall 2004.
‡ On leave of absence, spring 2005.
Timothy W. Clark, m.s., ph.d., Professor (Adjunct) of Wildlife Ecology and Policy.
Paul Alexander Draghi, m.a., m.a., ph.d., Director of Information and Library Systems and Lecturer in Forest History.
Gordon T. Geballe, m.s., ph.d., Associate Dean for Student and Alumni Affairs and Lecturer in Urban Ecology.
Bradford S. Gentry, j.d., Senior Lecturer in Sustainable Investments, Research Scholar, Co-Director of the Yale–UNDP Collaborative Program on the Urban Environment, and Director of the Research Program on Private Investment and the Environment.
Arnulf Grübler, ph.d., Professor in the Field of Energy and Technology.
Reid J. Lifset, m.s., M.P.P.M., Associate Research Scholar, Associate Director of the Industrial Environmental Management Program, and Editor-in-Chief, Journal of Industrial Ecology.
Florencia Montagnini, m.s., ph.d., Professor in the Practice of Tropical Forestry and Director of the Program in Tropical Forestry of the Global Institute of Sustainable Forestry.
Thomas G. Siccama, m.s., ph.d., Professor in the Practice of Forest Ecology and Director of Field Studies.

**Courtesy Joint Appointments**

James W. Axley, m.arch., m.s., ph.d., Professor of Architecture.
Ruth Elaine Blake, m.s., Ph.d., Assistant Professor of Geology and Geophysics.
Adalgisa (Gisella) Caccone, m.s., ph.d., Senior Scientist in Ecology and Evolutionary Biology.
Michael Donoghue, ph.d., Professor of Ecology and Evolutionary Biology.
Menachem Elimelech, ph.d., Professor of Environmental Engineering.
Roger Ely, Ph.d., Assistant Professor of Chemical Engineering.
Robert Eugene Evenson, Ph.d., Professor of Economics.
Jonathan Feinstein, Ph.d., Professor of Economics, School of Management.
Mary Helen Goldsmith, Ph.d., Professor of Molecular, Cellular, and Developmental Biology.
Nathaniel Keohane, Ph.d., Assistant Professor of Economics, School of Management.
Brian P. Leaderer, Ph.d., Professor of Epidemiology and Public Health, School of Medicine.
William Nordhaus, Ph.d., Sterling Professor of Economics.
Jeffrey Powell, Ph.d., Professor of Ecology and Evolutionary Biology.
James C. Scott, Ph.d., Eugene Mayer Professor of Political Science, Professor of Anthropology, and Director of the Program in Agrarian Studies, Yale Center for International and Area Studies.
Ronald B. Smith, Ph.d., Professor of Geology and Geophysics and Mechanical Engineering and Director of the Yale Center for Earth Observation.
Stephen C. Stearns, m.s., ph.d., Edward P. Bass Professor of Ecology and Evolutionary Biology.
Karl Turekian, Ph.d., Benjamin Silliman Professor of Geology and Geophysics and Director of the Institute for Biospheric Studies.
Eric Worby, Ph.d., Assistant Professor of Anthropology.
Visiting Faculty, Fellows, Adjunct Faculty, and Faculty with Primary Appointments Elsewhere

Mary Helena Allegretti, Ph.D., McCluskey Fellow.
Diana Balmori, Ph.D., Lecturer in Landscape and Urban History.
Ellen Brennan-Galvin, Ph.D., Lecturer and Senior Research Scholar.
Dale S. Bryk, M.A., J.D., Lecturer in Environmental Law.
Richard Burroughs, Ph.D., Professor (Adjunct) of Coastal Science and Policy.
Bill Butler, Ph.D., Visiting Professor.
Mary Cadenasso, Ph.D., Lecturer and Research Scientist in Urban Ecology.
J. Baird Callicott, Ph.D., Visiting Professor of Environmental Bioethics.
Michael Conroy, Ph.D., Senior Lecturer and Senior Research Scholar.
Douglas C. Daly, Ph.D., Associate Professor (Adjunct).
John Ehrenfeld, Ph.D., Senior Research Scholar.
Mohammed El-Ashry, Ph.D., Senior Lecturer.
William Ellis, Ph.D., Senior Visiting Fellow.
Michael Ferrucci, M.F., Lecturer in Forest Operations.
Andrew J. Henderson, Ph.D., Associate Professor (Adjunct).
Lloyd Irland, Ph.D., Lecturer and Senior Research Scientist.
Richard Jones, Ph.D., Senior Lecturer and Senior Research Scholar.
Lye Lin Heng, 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.
David McGrath, Ph.D., Lecturer.
Mohan Munasinghe, Ph.D., Visiting Professor.
Arvid Nelson, Ph.D., Assistant Professor (Adjunct).
Daniel Nepstad, Ph.D., Lecturer in Tropical Ecology.
John R. Nolon, J.D., Visiting Professor of Environmental Law.
Michael Northrop, M.P.A., Lecturer in Environmental Advocacy.
Christine Padoch, Ph.D., Associate Professor (Adjunct).
Charles M. Peters, M.F.S., Ph.D., Associate Professor (Adjunct) of Tropical Ecology.
Jonathan D. Reuning-Scherer, Ph.D., Lecturer in Statistics.
Dennis W. Stevenson, Ph.D., Professor (Adjunct) of Tropical Studies.
Fred Strebeigh, B.A., Lecturer in Environmental Writing.
Charles Dana Tomlin, Ph.D., Visiting Professor.
Andrew Willard, Ph.D., Lecturer in Natural Resource Policy.

Research Appointments

Ruth Allen, Ph.D., Research Affiliate.
An Li, Ph.D., Research Affiliate.
Donald E. Aylor, M.E.S., Ph.D., Research Affiliate in Biometeorology.
Xuemei Bai, Ph.D., Research Affiliate.
Mary K. Berlyn, Ph.D., Senior Research Scientist.
Bin Gao, Ph.D., Postdoctoral Associate.
Frederick Herbert Bormann, M.A., Ph.D., Senior Research Scientist.
Hooper Brooks, M.L.A., Associate Research Scholar.
Ian Cameron, M.F.R.P.E., Research Affiliate.
Dominika Anna Dziegielewska, Ph.D., Postdoctoral Fellow.
John Forgach, B.A., Research Affiliate.
A.L. Hammett III, Ph.D., Research Affiliate.
Lu Zhi, Ph.D., Research Affiliate.
Mark McClure, Ph.D., Research Affiliate.
Daniel Muller, Ph.D., Postdoctoral Associate.
Kazuyoshi Okazawa, M.A., Research Affiliate.
Linda Puth, Ph.D., Postdoctoral Associate.
Michael A. Rechlin, Ph.D., Research Affiliate.
Bart Robinson, Ph.D., Research Affiliate.
V. Alaric Sample, Ph.D., Research Affiliate.
Oliver Schabenberger, Ph.D., Research Affiliate.
Leigh Shemitz, Ph.D., Research Affiliate.
Yajie Song, Ph.D., Associate Research Scientist.
Robert Stanton, B.S., Research Affiliate.
Anitra Thorhaug, Ph.D., Research Affiliate.
Mark Twery, Ph.D., Research Affiliate.
Harry T. Valentine, Ph.D., Research Affiliate.
Philip M. Wargo, Ph.D., Research Affiliate.
Seth Wilson, Ph.D., Research Affiliate.
Tong Xin, Ph.D., Associate Research Scholar.
Zengwei Yuan, M.A., Research Scientist

Center and Program Staff

Monica Araya, M.M.M., Project Director, Sustainable Americas, Yale Center for Environmental Law.
Susan Rae Bolden, M.S., Research Assistant.
Ellen Denny, M.F.S., Research Assistant.
Amity Doolittle, M.E.S., Ph.D., Program Director, Tropical Resources Institute, and Lecturer in Resource Access and Development.
David Ellum, M.F., Research Coordinator, School Forests.
Alexander Evans, M.F., Mapping and GIS Coordinator, School Forests.
Alex Finkral, M.F., Manager, School Forests.
Melissa Goodall, M.S., Program Coordinator, Center for Environmental Law and Policy.
Elizabeth Gordon, m.e.m., Program Director, Program on Forest Certification.
Julie Jirikowic, b.s., Coordinator, Center for Industrial Ecology.
Megan Mattox, b.s., Program Director, Program on Landscape Management.
Alice McDonald, m.a., Research Associate, Tropical Resources Institute.
John McKenna, m.f.s., Research Associate, School Forests.
Kari Mull, b.s., Research Assistant.
Colleen Murphy-Dunning, m.s., Center Director, Hixon Center for Urban Ecology, and
  Program Director, Urban Resources Initiative.
Steven Mylon, ph.d., Research Associate.
Cheryl Myrup, m.l.s., Assistant Editor, Journal of Industrial Ecology.
Emily Noah, m.e.sc., Research Associate, Program on Forest Certification.
P. Christopher Ozyck, b.s., Greenspace Coordinator, Urban Resources Initiative.
Barbara Reck, m.s.eng., Research Associate, Center for Industrial Ecology.
Irene Ping Ren, m.b.a., Coordinator, Luce/Asia Project.
Gretchen Rings, b.a., Program Coordinator, Center for Industrial Ecology.
Barbara Ruth, m.phil., Coordinator, Global Institute for Sustainable Forestry.
Martha McCormick Smith, m.e.m., Program Director, Center for Coastal and
  Watershed Systems.
Mary Tyrrell, m.b.a., m.f.s., Center Director, Global Institute of Sustainable Forestry, and
  Program Director, Program on Private Forests.

Administrative Staff
Mariann Adams, Administrative Assistant, Career Development.
Elisabeth Barsa, b.a., Senior Administrative Assistant, Doctoral Program.
Jane Beamon, Senior Administrative Assistant, Development.
Grace Bianciardi, b.a., Administrative Assistant, Faculty Support.
J. Alan Brewster, m.p.a., Deputy Dean and Associate Research Scholar.
Deborah Broadwater, m.b.a., Assistant Director of Career Development, Career Services.
Jane Coppock, m.e.m., ph.d., Assistant Dean and Editor, F&ES Publication Series.
Irene Courtmanche, Senior Administrative Assistant, Alumni Affairs.
Sarah Crowley, b.s., Financial Assistant, Business Office.
Heather Deane, b.a., Senior Administrative Assistant, Dean’s Office.
Joanne E. DeBernardo, m.s., Registrar and Director of Student Affairs.
Timothy De Cerbo, Administrative Assistant, Faculty Support.
David DeFusco, b.s., Director of Communications.
Nancy DiLella, a.s., Office Assistant, Facilities.
Dolores Gee, a.a.s., Administrative Assistant, Faculty Support.
Eugénie I. Gentry, b.a., Development Officer.
Florence Grandelli, Assistant Business Manager.
Teena Marie Griggs, Office Assistant, Business Office.
Michael Kiernan, m.a., Development Officer.
Angela Kuhne, m.a., Assistant Director of Admissions.
Jennith Liner, Administrative Assistant, Faculty Support.
Carmela Lubenow, Financial Assistant, Business Office.
Catherine J. Marshall, M.P.A., Senior Administrative Assistant, Dean’s Office.
Emly McDiarmid, M.F.S., Director of Admissions.
Eleanor Migliore, M.S., M.L.S., Senior Administrative Assistant, Faculty Support.
Kelly Molloy, Senior Administrative Assistant, Information Systems.
Pilar M. Montalvo, M.A., Executive Assistant to the Dean.
William Moroz, Computer & Information Systems Support Specialist.
Roberta Mouheb, M.A., Administrative Assistant, Faculty Support.
Denise Mrazik, A.S., Administrative Assistant, Business Office.
Arvid Nelson, Jr., Web Site Technician.
Stanton C. Otis, Jr., M.Ed., Director of Career Development.
Julio Patron, Maintenance Assistant, Facilities.
Shiva Prasad, B.S., Computer & Information Systems Support Specialist.
Ann Prokop, M.A., Administrative Assistant, Faculty Support.
Frederick E. Regan, B.A., Chief Development Officer.
Quetcy Rivas Maldonado, Senior Administrative Assistant, Admissions and Financial Aid.
Constance L. Royster, J.D., Associate Director of Development.
Elnora Russell-Bell, B.S., Administrative Associate, Business Office.
Dominic Scalia, Facilities Manager.
Kathleen Schomaker, M.E.S., M.Phil., Director of Alumni Affairs.
Scott Speirs, M.A., Senior Administrative Assistant, Development.
Rosanne Stoddard, Senior Administrative Assistant, Registrar’s Office.
Frances Thornton, B.S., Computer & Information Systems Support Specialist.
Thomas Tuscano, M.B.A., Director of Finance and Administration.
Charles R. Waskiewicz, M.P.I.A., Assistant Business Manager.
Michèle Whitney, B.A., Coordinator, Development Office.

Henry S. Graves Memorial Library
Carla Heister, M.A., M.S., Librarian.
Adiba Nabizada, Library Services Assistant.
George Shao, Library Services Assistant.
A Message to Prospective Students from Dean James Gustave Speth

Over the one hundred years since its founding, the School of Forestry & Environmental Studies has evolved from a professional school of forestry of ten students and two faculty to perhaps the world’s finest training ground for tomorrow’s environmental leaders and managers. Research and teaching efforts have expanded to include not only forestry but also a wide set of concerns involving the interactions of human societies and natural systems.

As Yale’s environment school enters its second century, students and faculty alike are reflecting on its history, with a critical eye to the future. The School’s goal is to provide broad-gauged professional education that equips its graduates to assume influential roles in government, business, nongovernmental organizations, public and international affairs, journalism, research, and education. The faculty and I will continue to direct our teaching and research efforts to solving local, national, and global problems. Drawing on such considerations as those listed below, we will continue to evaluate and expand our existing programs.

- Human alterations of the biosphere have reached critical levels. As a result, nations face a new generation of global-scale environmental challenges, including climate change, ozone depletion, deforestation, loss of biological diversity, and the deterioration of agricultural resources. Meanwhile, challenges such as sustainable forest management and pollution abatement persist.

- Many solutions to today’s environmental challenges lie outside the established “environmental sector” and require approaches different from those previously adopted. Progress now requires a fusion of environmental and economic thinking and a willingness on the part of business, government, and environmental leaders to work together to integrate goals. Environmental objectives need to be incorporated into corporate planning, energy strategy, technology policy, R&D funding, tax policy, international trade and finance, development assistance, and other matters that once seemed far removed.

- Cooperation between developing and industrial countries is critical, with current progress hampered by a desperate shortage of trained personnel and human capacity.

- The increased awareness that environmental concerns are moving into the international arena will require that U.S. environmental policy be more in concert with other nations, thus giving birth to a new field of environmental diplomacy.

I hope and expect that those of you entering the School at this time as students will join me in shaping its future and exerting a positive influence on the prospects for environmental progress. I encourage you to use this bulletin as a means to explore how F&ES can help facilitate your goals. Please visit our Web site (www.yale.edu/environment) to get an inside view of the dynamics and energy that will make F&ES an ideal place to continue your education.
Mission of the School of Forestry & Environmental Studies

The Yale School of Forestry & Environmental Studies prepares new leadership 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 both resources and ourselves.

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

We seek to integrate concern for Earth’s ecosystems with equal concern for 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 effects 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.
Yale University has played a leading role in the development of American conservation and natural resource management since the 1800s, when such Yale graduates as William Henry Brewer, Othniel C. Marsh, Clarence King, and George Bird Grinnell were deeply involved with the exploration of the West and with the proper use of Western 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 from within the government’s Division of Forestry, they carried out on private lands the first examples of forest management 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 1940 was the School’s first head (and later, dean) and intellectual leader, Henry S. Graves. To Graves, graduate education, like that 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 the leading problems of the day. In 1972 its name was changed to the School of Forestry & Environmental Studies, in formal recognition of the School’s belief that it is concerned, in its broadest sense, with the scientific understanding and long-term management of ecosystems for human benefit.

During the academic year 2000–2001, the School of Forestry & Environmental Studies celebrated the achievements of its graduates and faculty and its first one hundred years of teaching and research with a series of centennial events. The School convened alumni/ae and friends from around the world for three days of celebration and discussion of the environmental challenges facing the world in coming decades. In addition, the School hosted eight major figures as centennial lecturers on critical global environmental issues, and cosponsored a panel discussion featuring four preeminent environmental journalists with Yale’s Poynter Fellows in Journalism program, the first such panel of Poynter Fellows to focus on environmental issues.

As Yale’s Environment School heads into its second century, 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 envi-ronmental management; policy, economics, and the law; urban ecology, environmental planning, design, and values; and coastal and watershed systems. Under the leadership of Dean James Gustave Speth, the School is determined to extend its scope to the greatest extent possible to meet the profound global environmental challenges the world faces in the twenty-first century.
Statement of Environmental Policy

As faculty, staff, and students of the Yale School of Forestry & Environmental Studies, we affirm our commitment to responsible stewardship of the environment of our School, our University, the city of New Haven, and the other sites of our teaching, research, professional, and social activities.

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 those wastes 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 serving as an active steward of our environment.
Faculty Profiles

Shimon C. Anisfeld, Lecturer and Research Scientist in Water Resources and Environmental Chemistry. A.B., Princeton University; Ph.D., Massachusetts Institute of Technology. Dr. Anisfeld’s primary research interests lie in understanding human impacts on rivers and wetlands, especially in urban coastal settings. His goal is to carry out integrated research that has direct relevance to watershed management. Areas of particular interest include: effects of sea level rise and local hydrologic change on tidal marshes; the relationship between land use and nonpoint source loading of nutrients and pathogens; issues of sampling frequency for water quality monitoring and TMDL development; and the complex interactions among hydrologic regime, socioeconomic setting, water chemistry, and ecosystem health. In addition, Dr. Anisfeld is interested in evaluating the flows of water and nitrogen into and out of urban ecosystems, with the goal of reducing the environmental impacts of cities.

Mark S. Ashton, Professor of Silviculture and Forest Ecology and Director of School Forests. B.S., University of Maine, College of Forest Resources; M.F., Ph.D., Yale University. Professor Ashton conducts research on the biological and physical processes governing the regeneration of natural forests and on the creation of their agroforestry analogs. In particular, he seeks a better understanding of regeneration establishment among assemblages of closely related trees. His long-term research concentrates on tropical and temperate forests of the Asian and American realms. His field sites within these regions were selected specifically to allow comparison of growth, adaptation, and plasticity within and among close assemblages of species that have evolved within forest climates with differing degrees of seasonality. Findings from these studies have theoretical implications for understanding the maintenance of diversity of tree species in forested ecosystems and the adaptability of forests to change in climate. The results of his research have been applied to the development and testing of silvicultural techniques.
for restoration of degraded lands and for the management of natural forests for a variety of timber and nontimber products. Field sites include tropical forests in Sri Lanka and Panama, temperate forests in India and New England, and boreal forests in Saskatchewan, Canada.

Michelle L. Bell, Assistant Professor of Environmental Health. B.S., Massachusetts Institute of Technology; M.S., Stanford University; M.S.E., Ph.D., Johns Hopkins University. Professor Bell teaches courses on environmental health and air pollution. She addresses air pollution and human health through research that integrates several disciplines, such as environmental engineering and epidemiology. She aims to combine her environmental engineering and public health background to examine the air pollution system from emissions to their impact on health. Her research interests are the statistical analysis of the health impacts of air pollution episodes, meteorological and air quality modeling, and policy implications. Her dissertation included analysis of the health impacts of the London smog of 1952. Her doctoral work involved tropospheric ozone modeling, which explored how changes in emissions of ozone precursors affect ambient air concentrations. She also analyzed the spatial and temporal compliance with regulatory standards and integrated air quality modeling systems with human health research.

Gaboury Benoit, Professor of Environmental Chemistry, Professor of Environmental Engineering, Co-Director of the Hixon Center for Urban Ecology, and Director of the Center for Coastal and Watershed Systems. B.S., Yale University; M.S., Ph.D., Massachusetts Institute of Technology–Woods Hole Oceanographic Institution. Professor Benoit’s research and teaching focus on the behavior, transport, and fate of chemicals in natural waters, soils, sediments, and biota. Two special areas of interest are nonpoint source pollutants and biogeochemistry of trace metals and radionuclides. Most of his research involves state-of-the-art analytical methods and carefully designed field sampling programs, with results verified by laboratory simulations or simple mathematical models. His research is conducted in a watershed context, and study sites include freshwater and terrestrial systems, as well as estuarine and coastal environments. Four current
research emphases are the use of modern clean techniques to investigate trace metals; micronutrient limitation by Cu and Fe; spatial and temporal variability of nonpoint source pollution; and human-environment interactions in urban areas. He is a fellow of Trumbull College.

Graeme P. Berlyn, E.H. Harriman Professor of Forest Management, Professor of Anatomy and Physiology of Trees, and Editor, *Journal of Sustainable Forestry*. B.S., Ph.D., Iowa State University. Professor Berlyn’s interests are the morphology and physiology of trees and forests in relation to environmental stress. Leaves are the most responsive and vulnerable organs of trees, and Professor Berlyn studies the ways that leaf structure and function reveal the effects of environmental change such as global warming or altitudinal and latitudinal gradients. In addition, these studies can help determine the optimum range of habitats for individual species and thus be of use in reforestation and afforestation. Some of the techniques used to study these problems are: light processing by leaves in relation to environmental factors as measured by chlorophyll fluorescence, photosynthesis, spectral reflectance, absorption, and transmission; and image analysis of leaf and tree structure. Professor Berlyn has also pioneered in the development of organic biostimulants that can help plants resist insect, disease, and other environmental stressors while reducing fertilizer use. Thus the Berlyn lab focuses on how to measure the stress of plant life and also on how to ameliorate it. Students in the Berlyn lab are currently working on such topics as structural and functional change along elevational gradients in mountains, molecular control of sun/shade leaf phenotypic plasticity, response of tropical pioneer species to gaps in tropical forests, and the role of antioxidants, stress vitamins, and mycorrhizas in organic biostimulants.

Garry D. Brewer, Frederick K. Weyerhaeuser Professor of Resource Policy and Management (jointly appointed with the Yale School of Management), Professor of Political Science, and Director of the Environment Management Center. A.B., University of California at Berkeley; M.S., San Diego State University; Ph.D., Yale University. Professor Brewer is a policy scientist who assumed his current position at Yale in July 2001. He was
first appointed to the faculty of the School of Management in 1974. In 1980 he joined the faculty of the School of Forestry & Environmental Studies, and became the first recipient of the Frederick K. Weyerhaeuser Chair from 1984 to 1990. He also occupied the Edwin W. Davis Chair from 1990 to 1991. Professor Brewer has served as Dean and professor of the University of Michigan’s School of Natural Resources & Environment, professor at the Michigan Business School, and as Dean and member of the faculty at the University of California at Berkeley. Professor Brewer has served on and chaired numerous national and international panels and commissions, including those of the National Academy of Sciences, the International Institute for Applied Systems Analysis, the Department of Energy, the Nuclear Waste Technical Review Board, the American Association for the Advancement of Science, and Sweden’s National Foundation for Strategic Environmental Research. He has received several awards for his work, including the 2000 Harold D. Lasswell Award from the Policy Studies Organization for “…contributing to our understanding of the substance and process of public policy.”

William R. Burch, Jr., Frederick C. Hixon Professor of Natural Resource Management and Professor at the Institution for Social and Policy Studies. B.S., M.S., University of Oregon; Ph.D., University of Minnesota. Professor Burch has held research and management positions with the USDA Forest Service, USAID, and the Connecticut Department of Environmental Protection. From 1984 to 1996, he was retained by the National Park Service in a research position. His work on wildland recreation behavior was among the earliest, and it has expanded to include parks, biosphere reserves, and ecotourist regions in rural and urban areas in Asia, South America, and Europe, as well as in North America. His recent work on protected areas has been in Nepal, Bhutan, and the parks and open spaces of Baltimore. Professor Burch is principal investigator of a six-year monitoring and evaluation project on the $26 million restoration of Philadelphia’s Fairmount Park system.

He conducted some of the original work on community/social forestry systems, which continues with work in Nepal, Thailand, China, and inner cities of the United States. Community forestry strategies for urban neighborhoods have been applied since
Research on such efforts began in 1988 when Professor Burch became co-principal investigator of an EPA/NSF-funded water and watersheds project and an NSF-funded Long Term Ecological Study (LTER) in the Baltimore/Chesapeake region. There are twenty-two such projects in the United States and this project is one of the two that examine urban areas as ecosystems. In 2000, he was awarded a John Eadie fellowship by the Scottish Forest Trust to work with colleagues and institutions in the United Kingdom on community forestry/urban ecology issues.

His work in institutional development has included technical training and higher education curriculum development in South and Southeast Asia. Another area of research and application has been in developing a unified ecosystem management approach that fully includes human behavioral variables. This work has used a watershed unit and a rural-urban gradient approach and has been conducted with an interdisciplinary team of collaborators. Initial work has been done in three watersheds in Baltimore, Maryland, since 1989 and is now carried forward by the LTER research.

Ann Elizabeth Camp, Lecturer and Associate Research Scientist in Stand Dynamics and Forest Health. B.S., Rutgers University; M.F.S., Yale University; Ph.D., University of Washington. Dr. Camp is interested in the dynamics of mixed species stands and the variables driving vegetation patterns at different hierarchical scales. Results of her research on sustainable patterns of late-successional and old forest habitats in fire-regulated landscapes have been widely incorporated in dry forest management and restoration efforts in the inland Northwest. Her research includes effects of biotic and abiotic disturbances on vegetation patterns at stand and landscape scales; interactions among disturbance agents and vegetation patterns, especially the roles of insects and pathogens in creating forest structures important to wildlife; and management alternatives for dense, marginally economic stands of small-diameter trees and consequences of different management practices on ancillary forest resources.
Carol Carpenter, Lecturer and Associate Research Scholar in Natural Resource Social Science and Lecturer in Anthropology. B.A., SUNY Binghamton; M.A., Ph.D., Cornell University. Dr. Carpenter’s teaching and research interests focus on theories of social ecology, social aspects of sustainable development and conservation, and gender in agrarian and ecological systems. She spent four years in Indonesia engaged in household and community-level research on rituals and social networks. She then spent four years in Pakistan working as a development consultant, primarily on social forestry issues, for USAID, the World Bank, and the Asia Foundation, among others. She has held teaching positions at Syracuse University, the University of Hawaii, and Hawaii-Pacific University, and a research position at the East-West Center. Her current interests involve the invisibility of women’s economic activities in agrarian households and the implications of this invisibility for sustainable development. She is a fellow of Calhoun College.

Benjamin Cashore, Associate Professor of Environmental Policy and Governance and Political Science, and Director of the Program on Forest Certification. B.A., M.A., Carleton University; Ph.D., University of Toronto. Professor Cashore’s research interests include the emergence of non-state, market-driven environmental governance; the impact of globalization, internationalization, and transnational networks on domestic policy choices; comparative environmental and forest policy development; and firm-level “beyond compliance” sustainability initiatives. He has held positions as Assistant Professor, School of Forestry and Wildlife Sciences, Auburn University (1998–2001); postdoctoral fellow, Forest Economics and Policy Analysis Research Unit, University of British Columbia (1997–1998); and policy adviser to the leader of the Canadian New Democratic Party (1990–1993). His new book, Governing Through Markets: Forest Certification and the Emergence of Non-state Authority (with G. Auld and D. Newsom), published by Yale University Press in 2004, compares and explains the emergence of non-state environmental governance in European and North American forest sectors. He is co-editor of Forest Policy for Private Forestry (with L. Teeter and D. Zhang), CAB International; and co-author of In Search of Sustainability: The Politics of Forest Policy in British
Columbia in the 1990s (with G. Hoberg, M. Howlett, J. Raynor, and J. Wilson) from the University of British Columbia Press. He is also author or co-author of several articles that have appeared in *Governance, Policy Sciences*, the *Canadian Journal of Political Science*, *Forest Policy and Economics*, the *Journal of Forestry*, *Canadian Public Administration*, *Canadian-American Public Policy*, and the *Forestry Chronicle*, as well as chapters in several edited books. Professor Cashore was awarded (with Steven Bernstein) the 2001 John McMenemy Prize for the best article to appear in the *Canadian Journal of Political Science* in the year 2000 for their article, “Globalization, Four Paths of Internationalization and Domestic Policy Change: The Case of Eco-forestry Policy Change in British Columbia, Canada.”

Marian R. Chertow, Assistant Professor of Industrial Environmental Management, Director of the Program on Solid Waste Policy, and Director of the Industrial Environmental Management Program. B.A., Barnard College, Columbia University; M.P.P.M., Ph.D., Yale University. Dr. Chertow's research and teaching concern environmental management and policy as they relate to the private sector. Primary research interests are the application of innovation theory to the development of environmental and energy technology and the study of industrial symbiosis: geographically based exchanges of wastes, materials, energy, and water within networks of businesses. She is the editor of *Thinking Ecologically: The Next Generation of Environmental Policy* (with Daniel Esty), to which she also contributed work on the relevance of industrial ecology to public policy, and the author of *Innovation and Environmental Technology*. Prior to Yale, Dr. Chertow spent ten years in environmental business and state and local government. She also serves on the faculty of the National University of Singapore and is a fellow of Jonathan Edwards College.

Timothy W. Clark, Professor (Adjunct) of Wildlife Ecology and Policy. B.S., Northeastern Oklahoma State College; M.S., University of Wyoming; Ph.D., University of Wisconsin-Madison. Professor Clark's primary goal in his research and teaching is to improve con-
servation of species and ecosystems at professional, scientific, organizational, and policy levels. He has conducted field ecological and behavioral research on thirty-five mammals and other species. He is interested in natural resource policy and management and has conducted research and applied projects, for example, in the Greater Yellowstone Ecosystem to develop ecosystem management policy and in Australia to evaluate endangered species policy (most recently for koalas). He is currently researching conservation policy in Central America. His work involves building case studies, evaluating policies and programs, helping organizations to incorporate reliable science into management, helping students develop proficiency in the policy sciences method of research and problem solving, and working with a wide range of groups to improve conservation problem solving through workshops and other analytic exercises. He has worked in North America, Australia, Asia, and Central America. Recent books include *Averting Extinction: Reconstructing Endangered Species Recovery* (1997), *Carnivores in Ecosystems: The Yellowstone Experience* (1999, co-edited), and *Foundations of Natural Resources Policy and Management* (2000, co-edited). He is a fellow of Pierson College and has an appointment at the Institution for Social and Policy Studies.

Lisa M. Curran, Associate Professor of Tropical Resources and Director of the Tropical Resources Institute. B.A., Harvard University; M.A., Ph.D., Princeton University. Professor Curran is interested in the mechanisms that underlie community structure and dynamics of tropical forests and how ecological interactions are altered by human activities. Her work aims to enhance equitable and responsible management of tropical forests by integrating knowledge of ecological processes in natural systems with the socio-political and economic realities as viewed by a diversity of users. Field research primarily in Indonesia has focused on long-term studies of the reproductive ecology, demography, and harvest of mast-fruiting *Dipterocarpaceae*, the most economically important family of tropical timber. Current research interests include: spatio-temporal scale of natural and anthropogenic processes and disturbance; plant-animal interactions,
especially seed predation, herbivory, and seed dispersal; canopy tree demography, phenology, and regeneration; ecological role of ectomycorrhizae in ecosystems; and effects of government policies and logging practices on ecosystem management and biodiversity in Asia.

*Michael R. Dove*, Margaret K. Musser Professor of Social Ecology, Professor of Anthropology, and Coordinator of the F&ES/Anthropology degree program. B.A., Northwestern University; M.A., Ph.D., Stanford University. Professor Dove’s research focuses on the links between the resource-use systems of local communities and wider societies, between urban and rural, rich and poor, and less- and more-developed countries, with a special focus on the environmental relations of local communities. He spent two years in a tribal longhouse in Borneo studying swidden agriculture, six years as a research adviser in Java studying the formation of government resource policy, and four years in Pakistan advising its Forest Service on social forestry policies. Recent collaborative research, funded by the MacArthur Foundation, examines the relationship between biodiversity and society in Southeast Asia. Other research and teaching interests include: human use of tropical forests and grasslands; the global circulation of environmental concepts; political dimensions of natural disaster and resource degradation; indigenous environmental knowledge; contemporary and historical environmental relations in South and Southeast Asia; the study of developmental and environmental institutions, discourses, and movements; and the sociology of resource-related sciences.

*Paul Alexander Draghi*, Director of Information and Library Systems and Lecturer in Forest History. B.A., University of Connecticut; M.A., M.A., Ph.D., Indiana University. Dr. Draghi’s teaching follows two main branches. The first involves the application of information technology to environmental research, communications, and problem-solving, and includes the use of database, modeling, simulation, and Geographic Information Systems (GIS), as well as a consideration of environmental semiotics. His second teaching focus is the cultural history of how humans in different civilizations and periods
relate to nature, and in particular how they characterize individuals whose role is to mediate between nature and society in literature, art, folklore, and myth. Dr. Draghi's research has included work with primary sources in Medieval Latin, Middle High and modern German, French, Sanskrit, Tibetan, Mongolian, and Bhutanese, and his previous work at Yale included the cataloguing of the Beinecke Library’s Tibetan Collection, one of the major collections of Tibetan blockprint and manuscript texts in the world. His current research involves work on the history of hunting and forestry in Britain and German-speaking Europe and the translation of an original Tibetan manuscript from the Beinecke Rare Book and Manuscript Library that deals with the classification, training, and care of horses in Inner Asia.

Daniel C. Esty, Professor of Environmental Law and Policy; Clinical Professor, Law School; Director of the Yale Center for Environmental Law and Policy; and Director of the Yale World Fellows Program. B.A., Harvard University; M.A., University of Oxford; J.D., Yale University. Professor Esty’s research interests cover a wide range of environmental policy issues. His recent work focuses on new approaches to environmental regulation, including the use of economic incentives and other market mechanisms, environmental performance measurement and the benefit of data-driven environmental decision making, environmental protection in the Information Age, environmental effects on competitiveness, the roles of nongovernment actors in environmental policy making, trade and environment linkages, global environmental governance, corporate environmental management, and environment and security. He is the author or editor of a number of books, including Global Environmental Governance: Options and Opportunities; Greening the Americas: NAFTA’s Lessons for Hemispheric Trade; Environmental Performance Measurement: The Global Report 2001–2002; Greening the GATT: Trade, Environment, and the Future; Thinking Ecologically: The Next Generation of Environmental Policy; Sustaining the Asia Pacific Miracle: Environmental Protection and Economic Integration; and Regulatory Competition and Economic Integration. He is a fellow of Jonathan Edwards College.
Gordon T. Geballe, Associate Dean for Student and Alumni Affairs and Lecturer in Urban Ecology. B.A., University of California, Berkeley; M.S., Ph.D., Yale University. Applying the concepts of ecosystem ecology to the study of humans is the principal focus of Dr. Geballe’s current interests. Cities can be analyzed as systems through which energy and material move. Of special interest to Dr. Geballe is the development of community organization, the role of formal and informal environmental education, and the identification of urban environmental issues. These topics are the focus of his teaching and numerous projects in New Haven. Dr. Geballe is currently teaching about and researching the role of international symposiums. In September 2004 he and students in his class attended the 5th World Parks Congress in Durban, South Africa. During spring 2004 the focus was on IUCN’s World Conservation Congress held in Bangkok, Thailand, in November 2005. Next, the focus shifts to UNEP and its council meeting in Kenya in February 2005. Dr. Geballe, with faculty and students, is also involved in projects in the People’s Republic of China. He is coauthor of the book *Redesigning the American Lawn: A Search for Environmental Harmony* (second edition, 2001). He is a fellow of Silliman College.

Bradford S. Gentry, Senior Lecturer in Sustainable Investments and Research Scholar, Director of the Research Program on Private Investment and the Environment, and Co-Director of the Yale–UNDP Collaborative Program on the Urban Environment. B.A., Swarthmore College; J.D., Harvard University. Mr. Gentry’s work explores the opportunities for using private investment to improve environmental performance. He works both across and within particular sectors/problems. The cross-sectoral work focuses on the steps policy makers can take to help develop opportunities for sustainable investments, including market frameworks, information systems, and shared investments/ partnerships. The sectoral work is concentrated in three major areas — increasing private investment in the delivery of urban environmental services (particularly drinking water and sanitation), and sustainable forest use and management and cleaner energy. Projects in all these areas are undertaken across a range of contexts from New Haven, to developing country megacities and to wilderness forest systems. He has writ-
ten extensively on the links between private investment and environmental performance, including the book *Private Capital Flows and the Environment: Lessons from Latin America.*

*Thomas E. Graedel,* Clifton R. Musser Professor of Industrial Ecology, Professor of Chemical Engineering, Professor of Geology and Geophysics, and Director of the Center for Industrial Ecology. B.S., Washington State University; M.A., Kent State University; M.S., Ph.D., University of Michigan. Professor Graedel was elected to the U.S. National Academy of Engineering for “outstanding contributions to the theory and practice of industrial ecology, 2002.” His research is centered on developing and enhancing industrial ecology, the organizing framework for the study of the interactions of the modern technological society with the environment. His textbook, *Industrial Ecology,* cowritten with B. R. Allenby of AT&T, was the first book in the field and is now in its second edition. It, and his 2004 textbook *Greening the Industrial Facility,* are used for F&ES courses of the same names. His current interests include studies of the flows of materials within the industrial ecosystem and the development of analytical tools to assess the environmental characteristics of products, processes, the service industry, and urban infrastructures. He is a fellow of Pierson College.

*Timothy G. Gregoire,* J. P. Weyerhaeuser, Jr., Professor of Forest Management. B.S., Princeton University; Ph.D., Yale University. Professor Gregoire’s research is directed to the application and development of statistical methods for natural resources and environmental phenomena. One focus has been on probability sampling with particular reference to sampling techniques applied to individual trees. A second focus has been on statistical modeling of longitudinal and spatially correlated data. The results of his research have been published widely in the forestry, ecology, and statistical literature of both subject areas. He is the coauthor of *Sampling Methods for Multiresource Forest Inventory* and co-editor of *Modeling Longitudinal and Spatially Correlated Data.* Recent pursuits include the development of sampling methods to estimate recreation use, the nature of statistical inference, calibration estimators with sample survey data, and sampling with
segmented line transects. Professionally, he has been a leader in organizations that promote the use of biometrics and environmental statistics. He is an elected Fellow of the American Statistical Association; a former regional president of the International Biometric Society; and the recipient of the Forest Science Award granted by the Society of American Foresters. He is a section editor of the multivolume Encyclopedia of Environmetrics, an associate editor of Silva Fennica, an editorial advisory board member of Environmental and Ecological Statistics, and he chairs the management committee of the Journal of Agricultural, Biological, and Environmental Statistics. He also serves on the board of directors of the Energy and Resources Institute–North America.

Stephen R. Kellert, Tweedy/Ordway Professor of Social Ecology and Co-Director of the Hixon Center for Urban Ecology. B.A., Cornell University; Ph.D., Yale University. Professor Kellert’s research has focused on science, policy, and management relating to the interaction of people and the natural environment. Current research projects include studies of the theory, science, and practice of restorative environmental design; the theory and application of the concept of biophilia; connecting human and natural systems in especially urban watersheds; and the biocultural basis for an ethic toward the natural world. His books published since 1993 include Kinship to Mastery: Biophilia in Human Evolution and Development (1997), The Value of Life: Biological Diversity and Human Society (1996), The Biophilia Hypothesis (co-edited with E. O. Wilson, 1993), The Good in Nature and Humanity: Connecting Science, Religion, and Spirituality with the Natural World (co-edited with T. Farnham, 2002), and Children and Nature: Psychological, Sociocultural, and Evolutionary Investigations (co-edited with P. H. Kahn, 2002). He recently completed another book, Ordinary Nature: Understanding and Designing Connections between the Natural and Human Built Environments. He is a fellow of Branford College, has an appointment at the Institution for Social and Policy Studies, and is a faculty affiliate at the Peabody Museum.
Xuhui Lee, Professor of Forest Meteorology and Micrometeorology and Director of Doctoral Studies. B.Sc., M.Sc., Nanjing Institute of Meteorology, China; Ph.D., University of British Columbia. Professor Lee's research concerns the states and principles that govern the exchanges of radiation, heat, water, and trace gases between vegetation and the atmosphere. His areas of interest include forest meteorology, boundary-layer meteorology, air quality, micrometeorological instrumentation, and remote sensing. His current research projects focus on surface-air exchange in nonideal conditions, the dynamics of air motion in vegetation, forest-water relations using isotopes, carbon sequestration by terrestrial ecosystems, and mercury emission to the atmosphere.

Reid J. Lifset, Associate Research Scholar, Associate Director of the Industrial Environmental Management Program, and Editor-in-Chief, *Journal of Industrial Ecology*. B.A., Swarthmore College; M.S., Massachusetts Institute of Technology; M.P.P.M., Yale School of Management. Mr. Lifset’s research and teaching focus on the emerging field of industrial ecology, the study of the environmental consequences of production and consumption. He is editor-in-chief of the *Journal of Industrial Ecology*, an international quarterly headquartered at and owned by Yale University and published by MIT Press. In addition, he is associate director of the Industrial Environmental Management Program. Mr. Lifset’s research focuses on the development of the field of industrial ecology, the application of industrial ecology to solid waste problems, and the evolution of extended producer responsibility (EPR). He is currently investigating the life-cycle environmental characteristics of the use of nonwood fiber for papermaking and of the environmental character of bio-based materials more broadly; flows and reservoirs of materials in the United States; and the environmental impact of e-commerce. He has published extensively on EPR and on solid waste issues in professional and academic publications and is editor of the *Yale Working Papers on Solid Waste Policy*. In the policy arena, his work focuses on waste prevention, market development for recycling and composting, siting conflict, and the implementation of EPR.
Erin T. Mansur, Assistant Professor of Environmental Economics and Assistant Professor of Economics in the School of Management. B.A., Colby College; Ph.D., University of California, Berkeley. Professor Mansur’s research and teaching focus on energy and environmental economics, specifically in the areas of electricity restructuring, incentive-based environmental regulation, and environmental implications of strategic behavior. His paper on Environmental Regulation in Oligopoly Markets: A Study of Electricity Restructuring examines the environmental effects of firms setting prices in restructured electricity markets. He has also written on the costs and benefits of the Clean Air Act Amendments, the environmental implications of retail deregulation in electricity, the responsiveness of electricity consumers to prices and conservation policies, the importance of contracts in restructured electricity markets, and the effectiveness of public policies in reducing homelessness.

Robert Mendelsohn, Edwin Weyerhaeuser Davis Professor of Forest Policy, Professor of Economics, and Professor, School of Management. B.A., Harvard University; Ph.D., Yale University. Professor Mendelsohn has concentrated his research on valuing the environment. His dissertation included an integrated assessment model of air pollution that could measure the damages of emissions. This work has been extended in recent years to greenhouse gases, where he has been trying to measure the impacts of climate change. Recently, he has returned to studying air pollution in the hope of measuring the marginal damages of emissions across the country. He has also worked on valuing natural ecosystems, from valuing nontimber forest products and ecotourism in tropical rainforests, to coral reefs in the Caribbean and Australia, to measuring recreation in the Pacific Northwest and Alaska. Professor Mendelsohn is a fellow of Ezra Stiles College.

Florence Montagnini, Professor in the Practice of Tropical Forestry and Director of the Program in Tropical Forestry of the Global Institute of Sustainable Forestry. B.S., National University of Rosario, Argentina; M.S., Venezuelan Institute for Scientific Research (IVIC); Ph.D., University of Georgia. Professor Montagnini’s research focuses
on variables controlling the sustainability of managed ecosystems (e.g., primary and secondary forests, plantations, and agroforestry systems) in the tropics, with special emphasis on Latin America; the identification and quantification of ecological services provided by forests (biodiversity conservation, carbon fixing and storage); reforestation of degraded lands with native species, including mixed-species designs; tropical plantation silviculture; the use of biological enrichment techniques with species of economic value as a forest restoration tool; and the integration of ecological principles with economic, social, and policy factors in the design of sustainable land-use schemes in humid tropical regions.

Chadwick Dearing Oliver, Pinchot Professor of Forestry and Environmental Studies and Director of the Global Institute of Sustainable Forestry. B.S. (Forestry), University of the South; M.F.S., Ph.D., Yale University. Professor Oliver’s initial research focused on the basic understanding of how forests develop and how silviculture can be applied to ecological systems most effectively. Much of this work is incorporated in a book he wrote entitled *Forest Stand Dynamics* (1990, and update edition in 1996) with a former student as coauthor. He has continued this work; during the past decade he has also examined how this understanding can help resolve scientific, technical, and management issues at the landscape and policy levels. He is currently working on landscape approaches to forest management and is involved in the technical tools, the policies, the management approaches, and the educational needs. Professor Oliver has considerable experience advising public and private forest resource organizations in the United States and abroad. His work has taken him to all parts of the United States and to Canada, Mexico, Turkey, Nepal, Japan, Thailand, Sweden, Finland, Russia, Ecuador, Germany, and France.

Sheila Olmstead, Assistant Professor of Environmental Economics. B.A., University of Virginia; M.P.Aff., University of Texas at Austin; Ph.D., Harvard University. Professor Cavanagh’s general research and teaching interests are in the area of environmental and
natural resource economics and policy, including both natural resource management and pollution control. Her current area of primary research is the economics of water supply and demand, with a focus on urban settings. In particular, she is interested in measuring the effectiveness of various policy instruments, such as increasing block pricing and non-price demand management programs, in dealing with urban water scarcity. Her long-term research interests include the determinants of access to clean drinking water among low-income populations in the United States and developing countries; efficiency losses due to economic underpricing of public water supply; and current and potential applications of water marketing and water quality trading.

Peter A. Raymond, Assistant Professor of Ecosystem Ecology. B.S., Marist College; Ph.D., College of William and Mary/Virginia Institute of Marine Science. Professor Raymond’s research focuses on biogeochemistry of natural systems. In particular, he is interested in the carbon cycle within the coastal zone. His research utilizes the natural isotopes of carbon (13C and 14C) to determine major sources, sinks, and ages of various carbon pools in the natural environment. In order to conduct this research, Professor Raymond’s lab has a 14C clean lab component where he can cryogenically purify natural carbon samples for AMS analysis. Current research includes determining how carbon pools are transformed in estuaries, the physics of air-sea CO2 exchange, and determining the age and composition of carbon being transported from land to the ocean.

James E. Saiers, Associate Professor of Hydrology. B.S., Indiana University of Pennsylvania; M.S., Ph.D., University of Virginia. Professor Saiers studies the circulation of water and the movement of waterborne chemicals in surface and subsurface environments. One element of his research centers on quantifying the effects that interactions between hydrological and geochemical processes have on the migration of contaminants in groundwater. Another focus is on the dynamics of surface water and groundwater flow in wetlands and the response of fluid flow characteristics to changes in climate and water management practices. His work couples field observations and laboratory-scale experimentation with mathematical modeling.
Oswald J. Schmitz, Professor of Population and Community Ecology, Associate Dean for Academic Affairs, Director of the Center for Biodiversity Conservation and Science, and Professor of Ecology and Evolutionary Biology. B.Sc., M.Sc., University of Guelph, Ontario; Ph.D., University of Michigan. Professor Schmitz’s research examines the dynamics and structure of terrestrial food webs. His specific focus is on plant-herbivore interactions and how they are shaped by carnivores and soil-nutrient levels, both at the level of herbivore foraging ecology and plant-herbivore population dynamics. He is also examining how natural systems are resistant and resilient to natural and human-induced disturbances. His approach involves developing mathematical theories of species interactions in food webs and testing these theories through field experiments. The work deals with a variety of ecosystems and herbivore species, ranging from moose deer and snowshoe hare in northern Canadian forests to insects in New England old-field ecosystems.

Thomas G. Siccama, Professor in the Practice of Forest Ecology and Director of Field Studies. B.S., M.S., Ph.D., University of Vermont. Professor Siccama’s interests involve trace element cycling in terrestrial ecosystems. In cooperation with the University of Pennsylvania, he is establishing baseline data on the accumulation of trace metals in the forest floor of the northeastern United States. He is also working on the suggested effects of environmental pollution on the growth of forest trees, especially in relation to pitch pine and red spruce, which are declining in the Northeast. Professor Siccama continues as an active participant in many aspects of the Hubbard Brook Experimental Watershed Ecosystem project in New Hampshire. He is also involved with natural areas documentation and land-use planning.

David K. Skelly, Professor of Ecology. A.B., Middlebury College; Ph.D., University of Michigan. Professor Skelly is interested in understanding the ecological mechanisms of animal distributions and in developing the means to apply that understanding to conservation and management. His studies of amphibians have been directed at determining the causes of patterns such as the extinction and establishment of populations. In order
to discover the links among landscape-level distributions, performance across environmental gradients, and the attributes of individual species, he has employed field and laboratory experiments in conjunction with long-term observations of populations and their environment. Current projects include an exploration of forest dynamics as a driver of amphibian population extinctions and an investigation of the role of infectious disease as a cause for amphibian deformities.

*James Gustave Speth*, Dean and Professor in the Practice of Environmental Policy and Sustainable Development. B.A., Yale University; M.Litt., Oxford University; J.D., Yale University. From 1993 to 1999, Dean Speth served as administrator of the United Nations Development Programme and chair of the UN Development Group. Prior to his service at the UN, he was founder and president of the World Resources Institute; professor of law at Georgetown University; chairman of the U.S. Council on Environmental Quality; and senior attorney and cofounder, Natural Resources Defense Council.

Throughout his career, Dean Speth has provided leadership and entrepreneurial initiatives to many task forces and committees whose roles have been to combat environmental degradation, including the President’s Task Force on Global Resources and Environment; the Western Hemisphere Dialogue on Environment and Development; and the National Commission on the Environment. Among his awards are the National Wildlife Federation’s Resources Defense Award, the Natural Resources Council of America’s Barbara Swain Award of Honor, a 1997 Special Recognition Award from the Society for International Development, the Lifetime Achievement Award of the Environmental Law Institute, and the Blue Planet Prize. Publications include *Red Sky at Morning: America and the Crisis of the Global Environment; Worlds Apart: Globalization and the Environment*; and articles in *Foreign Policy, Foreign Affairs, Environmental Science and Technology*, the *Columbia Journal World of Business*, and other journals and books.
John P. Wargo, Professor of Risk Analysis, Environmental Policy, and Political Science; Director of the Environment and Health Initiative; and Director of Undergraduate Studies, Environmental Studies Program, Yale College. B.A., University of Pennsylvania; M.L.A., University of Massachusetts, Amherst; Ph.D., Yale University. Professor Wargo’s most recent work has focused on children’s exposure to air pollution, especially diesel emissions. He has conducted extensive research on childhood vulnerability to complex mixtures of toxic substances, particularly pesticides. His research explores spatial, temporal, and demographic distribution of environmental health risks, providing a basis for evaluating past environmental and natural resource management policies, and for suggesting legal reform. *Our Children’s Toxic Legacy: How Science and Law Fail to Protect Us from Pesticides*, a book published by Professor Wargo in 1996, presents a history of law governing pesticides and a history of scientific evidence of pesticide risks during the second half of the twentieth century. The work suggests fundamental reforms of science and law necessary to identify and contain health risks. It won the American Association of Publishers award as the Best Scholarly Professional Book in Government and Political Science in 1996. Professor Wargo has also conducted extensive research on the ecological basis of park and protected area management, concentrating on the Adirondack Park in New York, barrier islands within U.S. National Seashores, and UNESCO Biosphere Reserves. He is affiliated with the Yale–New Haven Teachers Institute, and works with urban primary and secondary school teachers in developing environmental curriculum units. He is a fellow of Branford College.
Degree Programs

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.). Each of the degrees will serve as preparation for either professional employment or doctoral study. Two-year master’s programs normally require a minimum of four terms in residence, sixteen full courses (forty-eight credits), a summer internship, and completion of the training modules in Technical Skills in the summer just prior to the student's first term. For individuals with seven or more years of relevant professional experience, a one-year mid-career option is available for the Master of Environmental Management and Master of Forestry degrees.

Programs of study at the School are, by design, interdisciplinary. They involve application of a wide range of natural and social sciences to problems of natural resource and environmental management.

The required curricula leading to all master’s programs are somewhat flexible to accommodate varying background preparations and career aspirations, and partially structured to ensure professional competence and maximum exposure to the unique diversity of the School and the other departments and professional schools at Yale. The one-year mid-career Master of Environmental Management and Master of Forestry programs have less structured curricula than the two-year programs. In all cases, only work completed under the supervision of a Yale University faculty member is accepted as credit toward these degrees.

Regardless of their goals or their previous training, most students entering the School are embarking on a transitional process in their education. Each student’s program is determined in continuing consultation with faculty advisers who guide the student's learning experience from the first week at Yale until graduation. Each program of study is designed to be an extension of previous academic or professional achievement and should provide the student with specialized knowledge and analytical skills that are logical for the student's objectives and prospective contributions to his or her disciplines.

Programs of study leading to all degrees consist of formal courses, seminars, and individual and group projects. No formal thesis is required for the master’s degrees, but all require a master’s project or other capstone experience.

Summer internships are an important component of the School’s master’s curricula and are required for all two-year master’s students. Students pursue a variety of work and research projects in locations worldwide. The School provides significant assistance to students in helping them to identify meaningful internships.

Students interested in careers in research or teaching are advised to seek the Ph.D. in their field of major interest. A master’s degree can provide important preparation for a Ph.D.
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 two courses per term and must complete the degree requirements in four years.

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. They are optional for all one-year 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 II: ecosystem measurement — sampling methods, research design, data reduction and analysis.
- Module III: land measurement — surveying, aerial photography, GPS, remote sensing and mapping.

Master’s Project and Independent Study Courses

All students in the M.E.M., M.E.Sc., and M.F.S. degree programs must enroll in one or more courses that officially fulfill degree requirements for a master’s project. Course numbers for these project courses are provided near the end of the School bulletin. These are distinct from courses that allow for independent study that is additional to, and not intended for, fulfillment of the project requirement of the individual's degree program. Independent study course numbers are listed separately near the end of the bulletin. Project courses and independent study may be assigned three or more credits, and more than one project course may be taken toward fulfillment of the 48 credits needed to graduate.

Project courses can involve research in laboratory, field, or library, or analytical case studies designed to solve management problems. Typically, projects in the M.E.Sc. and M.F.S. degree programs will comprise intensive research of a scientific nature, whereas projects in the M.F. and M.E.M. degree programs will be more applied and aimed toward satisfying a particular management goal. Master’s degree projects often originate with the student, with input and advice from relevant faculty. M.E.Sc. and M.F.S. projects require an official faculty research adviser who oversees the research and with whom the student will work closely; the research adviser need not be the same as the student’s academic adviser. Projects for the two management degrees enable students or small groups
to study relevant topics in a depth that is not always possible in regular courses. Management projects acquaint students with the literature dealing with localities, problems, and issues relevant to the management of forest and environmental resources, and they provide a means of integrating and testing skills, knowledge, and judgment gained in formal course work. Master degree projects frequently have permitted students to make a significant contribution to local communities or to the academic literature.

Opportunities for other independent study are fulfilled through enrollment in independent study courses. Independent study courses are appropriate for all other non-project study or research in any master’s degree program.

Master of Environmental Management

This degree is designed for students with primary interests in careers in environmental policy and analysis, stewardship, education, consulting, or management dealing with natural resource or environmental issues. The program requires course work in both the natural and social sciences, with a particular focus on the relationship among science, resource management, and policy. The ultimate purpose of the degree program is to prepare students to address complex ecological and social issues with scientific understanding and an ability to make sense of the underlying social and political context.

Students pursuing the M.E.M. degree must take eight courses in fulfillment of a core curriculum. Each student will also select an advanced study program for further coursework — concluding his or her experience with a master’s project, a “capstone” course, or a semester-long internship project (separate from the required summer internship). With the guidance and approval of faculty advisers, each student selects core courses in various categories to meet distributional requirements from preapproved lists of courses. Each student also works with advisers to define educational pathways within one of nine advanced study areas that have been identified and defined by the F&ES faculty.

The core courses for the M.E.M. are divided into: (a) Foundations and (b) Problem Solving and Policy Making. The four Foundations course groups are: (1) physical sciences, (2) biological sciences, (3) social sciences, and (4) statistics and statistical methods. Each student must take at least one course in each of these disciplines, as well as one additional course in either the physical or biological sciences. Problem Solving and Policy Making is divided into three course groups: (1) economics, (2) decision analysis, and (3) policy making and institutions. Students are required to take at least one course in each course group.

Faculty teaching and research at the School of Forestry & Environmental Studies are divided into nine focal areas (see the chapter “Focal Areas,” beginning on page 52), each of which serves as an advanced study area within the M.E.M. curriculum. These areas are: (1) Ecology, Ecosystems, and Biodiversity; (2) The Social Ecology of Conservation and Development: Assessing Social and Environmental Change; (3) Forestry, Forest Science, and the Management of Forests for Conservation and Development; (4) Global Change Science and Policy; (5) Environment, Health, and Policy; (6) Industrial Environmental Management; (7) Policy, Economics, and Law; (8) Urban Ecology and Environmental Design; and (9) Water Science, Policy, and Management. Each advanced study area offers one or more course “tracks” that students wishing to concentrate in the focal area
should examine for guidance on what courses provide a foundation for professional success in a particular area. Each M.E.M. student is required to choose an Advanced Study Area and to take two or more courses from the area's specified course lists.

**Master of Forestry**

Master of Forestry programs are professional studies aimed at training practitioners of forestry for administration and management of forest lands, and for mediating and resolving the conflicting values of society that concern forests. 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 moving resource management to new levels of education using a truly interdisciplinary approach rooted in the biological basis of ecosystems.

For the past ten years Master of Forestry graduates have joined the kaleidoscope of professional opportunities in forestry. Most start as general practitioners and management officers and with experience move through management to become policy makers and organizers. Employment can be characterized as follows: (i) government and public 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, Conservation International); (3) industry and investment (e.g., World Bank, International Paper Co., John Hancock Insurance Co.); and (4) town 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.

**Two-Year Program.** 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. It is realized through the provision of an array of local, regional, national, and international trips to witness the practice of forestry in diverse settings. It is realized further through the provision of employment in the management of the Yale Forest and a host of internships offered through the auspices of the Global Institute for Sustainable Forestry and the Tropical Resources Institute. Finally, it is realized through the active program of 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; (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). Founded in 1900 by Gifford Pinchot and six other pioneer foresters, SAF’s 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 (forty-eight credits) is required for completion of this program.

One-Year Mid-Career Program. This degree program is restricted to selected individuals who have demonstrated competence during a minimum of seven years of responsible, full-time professional forestry experience. The degree requirements are met by satisfactorily completing a custom-designed two-term program of courses, seminars, and projects during one year in residence.

Professionals pursuing the one-year M.F. degree are interested in acquiring new skills, filling voids in their educational background, and broadening their perspectives. Their career objectives are in the general area of forest management and administration. Admission to this program will be granted by the Admissions Committee only to individuals who appear to be able to achieve the level of professional competence represented by the M.F. degree in one year of residence work. A minimum of one year in residence and eight full courses is required for completion of this program.

Master of Environmental Science

The Master of Environmental Science program is intended for students who seek a master’s program with focus on disciplines within environmental natural and social science, most often as preparation for a research career or doctoral study. Each Master of
Environmental Science curriculum will have three components: disciplinary and research project courses, research methods courses, and electives. The Master of Environmental Science program requires the student to produce a “scholarly product.” This product may be in the form of a traditional master’s thesis or a paper submitted to a refereed journal. A minimum of two full years in residence and sixteen full courses is required for successful completion of this program. A minimum of four research project courses is also required.

**Master of Forest Science**

The Master of Forest Science is intended for students who seek a master’s program with focus on forest science, most often as preparation for a research career or doctoral study. Each Master of Forest Science curriculum will have three components: disciplinary and research project courses, research methods courses, and electives. The Master of Forest Science program requires the student to produce a “scholarly product.” This product may be in the form of a traditional master’s thesis or a paper submitted to a refereed journal. A minimum of two full years in residence and sixteen full courses is required for successful completion of this program. A minimum of four research project courses is also required.

**Joint Master’s Degree Programs**

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

Applicants must apply to, and be accepted by, both units of the University according to normal admissions procedures. A minimum residency at Yale and a minimum number of credit hours at the School of Forestry & Environmental Studies, dependent upon the degree program, are required. These courses must meet the curriculum requirements for one of the School’s degree programs. A minimum of one and one-half years is required at the School of Forestry & Environmental Studies.

On successful completion of the formal joint-degree program, the student will be awarded the Master of Forestry or the Master of Environmental Management, together with the joint degree as follows:

1. Law School — Juris Doctor; four years.
2. School of Medicine (Department of Epidemiology and Public Health) — Master of Public Health; three years.
3. School of Management — Master of Business Administration; three years.
4. Department of Economics, International Development and Economics program — Master of Arts; two and one-half to three years.
5. International Relations — Master of Arts; two and one-half to three years.
6. Divinity School — Master of Arts in Religion; three years.

For students interested in a joint environment/law degree, the School has recently launched joint-degree programs with Vermont Law School and the Pace University School of Law — in addition to the existing joint-degree program with Yale Law School. For questions about this and other joint-degree programs, please consult the admissions director at F&ES or the associate dean for academic affairs.

**SPECIAL STUDENTS**

For those who do not wish to pursue a full-time degree program, F&ES offers the option of special student status. Applicants interested in this option must follow normal admissions procedures and are expected to meet the regular admissions requirements. 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. Under normal circumstances, no one may hold special student status for more than one academic year.
DOCTORAL DEGREE PROGRAMS

The Doctor of Philosophy (Ph.D.) degree is conferred through the Graduate School of Yale University. 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. The degree of Doctor of Forestry and Environmental Studies (D.F.E.S., formerly designated as the Doctor of Forestry degree) is conferred through the School of Forestry & Environmental Studies. In the 2003–2004 academic year, the D.F.E.S. program merged with the Ph.D. program. The D.F.E.S. program will continue to exist until all its current students complete the program. No additional students will be admitted into the D.F.E.S. program. New students will be admitted into the Ph.D. program. 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; environmental biophysics and meteorology; environmental chemistry; environmental ethics; environmental governance; environmental health risk assessment; environmental history; environmental law and politics; environmental and resource policy; forest ecology; hydrology; industrial ecology; industrial environmental management; plant physiology and anatomy; pollution management; population ecology; resource economics; energy and the environment, silviculture, social ecology; stand development, tropical ecology, and conservation; urban planning; water resource management; environmental management and social ecology in developing countries.

Requirements for the Doctoral Degree

All courses listed in this bulletin are open to students working for the doctoral degree. Other courses are available in other departments — e.g., 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 co-chaired by an F&ES ladder faculty member.

Students are required to take the Doctoral Student Seminar, 824a, in the first term 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 two terms as teaching fellows, in partial fulfillment of their doctoral training.

A written and oral qualifying examination (or written comprehensive examination) must be passed in the student's area of interest and in such subordinate subjects as may
Degree Programs

be required by the student’s doctoral committee and major professor. The student will be advised as to the nature and scope of the examination prior to or at the start of the term in which it is to be administered. This examination must be completed before the start of the fifth term. It includes a thesis proposal that must be defended before the student’s doctoral committee and other interested faculty.

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 about specific problems or questions concerning the program.

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 technical mastery of the field as well as the ability to do independent scholarly work and to formulate conclusions that may modify or enlarge previous knowledge.

A guidance manual for preparing dissertations is available from the DDS. 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.

Joint Doctoral Degree

DEPARTMENT OF ANTHROPOLOGY

The School of Forestry & Environmental Studies offers a combined doctoral degree with Yale’s Department of Anthropology. The purpose of this program is threefold: (1) it combines the interdisciplinary character and possibilities of F&ES, especially in terms of bridging the social and natural sciences, with the disciplinary identity and strengths of the Anthropology department; (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 emphasis within F&ES on linking theory with policy and practice with the Anthropology department’s strengths in theory. 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. For further information, contact the director of doctoral studies or the coordinator of the combined degree program.

NEW YORK BOTANICAL GARDEN

The School of Forestry & Environmental Studies has entered into an agreement with the New York Botanical Garden to offer a joint doctoral degree. For more information, please contact the director of doctoral studies.
Focal Areas

The Yale School of Forestry & Environmental Studies recognizes that it is as important to solve problems for local watersheds as it is to address issues related to global climate change. Likewise, it is as important to coach tomorrow’s leaders to get their hands dirty with fieldwork as it is to train them to analyze and formulate policy. To address the breadth and scope of such a wide range of environmental challenges, the faculty of the School of Forestry & Environmental Studies created nine focal areas through which to channel teaching and research.

Some of these focal areas are new, and some have been at the heart of the School’s mission for a century. At the core of each area is the goal of facilitating outstanding teaching, research, and outreach.

Each focal area has a core group of faculty as its keystone. These faculty members, led by a coordinator from the School’s senior faculty, teach classes, guide students, and conduct research to meet the goals set forth by the mission statement of their focal areas. Most faculty are involved with more than one focal area.

ECOLOGY, ECOSYSTEMS, AND BIODIVERSITY

This focal area represents the School’s collective scientific endeavor to understand both the interactions of living organisms with each other and the physical and chemical components of their surrounding environment, and the cause of changes in global patterns in species distribution and abundance. This endeavor requires the integration of chemistry and biology, biophysics, physiology, genetics, behavior and evolution, mathematical modeling as well as sociology, anthropology, and policy. The goals of this area are to develop the body of natural, social, and political scientific knowledge needed to improve our understanding of the complex interrelationships between humans and the rich diversity of organisms living in ecosystems, and to provide students with a comprehensive set of courses that will enable them to develop an integrated understanding of these issues.

The faculty in this focal area teach a variety of graduate courses and seminars, including such issues as aquatic ecology; methods of ecosystem analysis; forest ecosystem health; wildlife conservation ecology; human dimensions in the conservation of biological diversity; and management plans for protected areas. Undergraduate courses are also offered, including the study of ecology and environmental problem solving and a study of the local flora.


Associated Center: Center for Biodiversity Conservation and Science
THE SOCIAL ECOLOGY OF CONSERVATION AND DEVELOPMENT: ASSESSING SOCIAL AND ENVIRONMENTAL CHANGE

This focal area developed out of the realization over the past generation that understanding the social, cultural, political, economic, and historic dimensions of the environment is as important as understanding its bio-physical dimensions. This area focuses on the links between the resource-use systems of local communities and wider societies, between urban and rural, rich and poor, and less- and more-developed countries. A distinguishing characteristic of this area is its special focus on the environmental relations of local communities. But teaching and research in this area encompass communities, local and national governments, and NGOs, and address such topics as indigenous environmental knowledge, community-based conservation, protected area management, environmental justice, and environmental values/movements/and discourses.

This area is the focal point within F&ES for the joint doctoral degree program with Anthropology and the joint master’s degree program with International Relations. The faculty teach courses and seminars on such topics as tropical ecosystem dynamics and anthropogenic change; risk and property; society and natural resources; environmental values; agrarian societies; the economics of sustainable development; and the foundations of natural resource management.


Associated Center: Tropical Resources Institute

FORESTRY, FOREST SCIENCE, AND THE MANAGEMENT OF FORESTS FOR CONSERVATION AND DEVELOPMENT

This faculty group embraces a new, more holistic, and more practical concept of forest management. The faculty recognizes that forests worldwide produce multiple products and services from timber supply to water to wildlife habitat. The group seeks to manage these ecosystems to yield equitable social, environmental, and economic outputs across the landscape. Moving from a focus on timber to a more encompassing perspective requires many changes in the ways forestry is practiced and forested ecosystems are managed.

Under this approach, students are required to have a thorough understanding of the entire forest ecosystem and how each component relates to the rest of the system. Forestry must adopt adaptive management techniques to test outcomes in the field and improve our understanding over time. Students are trained to create modeling scenarios for better forest management assessments and the development of more refined decision
support systems for generating management options and outcomes. They must then learn how society weighs these alternative outcomes, and must examine existing institutions and laws to understand whether they encourage optimal outcomes in forests across the world.

The faculty teach courses and seminars on such topics as biogeochemistry and pollution; the physiology of trees and forests; fire ecology; climate and life; sampling methodology and practice; natural resource economics; private investment and the environment; environmental law and policy; and management plans for protected areas.

Faculty: Mark S. Ashton (Coordinator), Graeme P. Berlyn, William R. Burch, Ann E. Camp, Benjamin Cashore, Timothy W. Clark, Lisa M. Curran, Michael R. Dove, Paul A. Draghi, Bradford S. Gentry, Timothy G. Gregoire, Xuhui Lee, Robert Mendelsohn, Florencia Montagnini, Chadwick D. Oliver, Oswald J. Schmitz, Thomas G. Siccama

Associated Centers & Programs: Global Institute of Sustainable Forestry, Tropical Resources Institute, Urban Resources Initiative, Center for Biodiversity Conservation

GLOBAL CHANGE SCIENCE AND POLICY

The goal of this focal area is to address issues arising from major environmental changes that are impacting a substantial portion of the world. The faculty in this focal area are particularly interested in the arena of climate change science and policy and seek to generate new scientific knowledge of the interactions among the atmosphere, the biosphere, and their human dimensions, and to explore innovative approaches to reducing the threats to the global climate system.

Through an interdisciplinary education curriculum, this area seeks to prepare students with the intellectual skills crucial for examining the major global change phenomena, their interactions with anthropogenic drivers, and the international policy and management responses. Courses and seminars in this area include observing the earth from space; patterns and processes in terrestrial ecosystems; domestic and global environmental governance; designing the ecocity; climate economics; and the global change agenda.

Faculty: Xuhui Lee (Coordinator), Garry D. Brewer, Ann E. Camp, Benjamin Cashore, Timothy W. Clark, Lisa M. Curran, Paul A. Draghi, William Ellis, Daniel C. Esty, Thomas E. Graedel, Erin T. Mansur, Robert Mendelsohn, Peter A. Raymond, Oswald J. Schmitz, James Gustave Speth

ENVIRONMENT, HEALTH, AND POLICY

This area promotes research and teaching to understand relations between environmental hazards, development, and human health. This knowledge provides a basis for understanding the potential of law and policy to protect health from hazardous substances in air, water, food, soil, and consumer products.
There are several themes around which students can focus their studies in this area, such as children’s exposure to hazardous substances; metals and the environment; exposure and risk assessment methods; land use, ecology, and vector-borne disease; air pollution; respiratory illness; agriculture, food safety, and human health; school environmental health; environmental health law and policy.

This area is the focal point within F&ES for the joint master’s degree program in Environmental Science, Management, and Public Health with the Department of Epidemiology and Public Health. Course and seminars offered include environmental hydrology; foundations of environmental policy and politics; international environmental policy and law; organic pollutants in the environment; and global environmental health.

Faculty: John P. Wargo (Coordinator), Shimon C. Anisfeld, Gaboury Benoit, Michelle Bell, Graeme P. Berlyn, Garry D. Brewer, Florencia Montagnini, Sheila Olmstead, James E. Saiers

Associated Center: Environmental Health Initiative

INDUSTRIAL ENVIRONMENTAL MANAGEMENT

This focal area is centered on using principles of ecology to transform industry through several research and teaching themes. One overarching theme in this area pertains to accounting for resource and product flows. The focus of materials accounting can be on a single element, a single resource, or on multiple resources such as energy, water, and materials. Students and faculty apply this focus at different scales: from the facility level, to the inter-firm level, to a river basin or other regional site, and indeed globally. Another major theme that is introduced to students addresses quantitative sustainability under the argument that in order to set sustainability as a target or goal for our industrial society, we must be able to quantify what that target or goal is.

The faculty and students in this area also work on the overarching theme of industrial ecology education for developing economies. This is seen in a major research project in Puerto Rico where preliminary investigative research has begun, using new ideas and tools of industrial ecology to examine the industrial systems of the island and to devise theoretical plans to reorient its economic development to include the notion of sustainability. Course work in this focal area includes environmental aspects of the technological society; industrial ecology; theory and practice of urban ecology; business concepts for environmental managers; and environmental management and strategy.

Faculty: Thomas E. Graedel (Coordinator), Shimon C. Anisfeld, Garry D. Brewer, Marian R. Chertow, William Ellis, Daniel C. Esty, Gordon T. Geballe, Reid J. Lifset, Erin T. Mansur

Associated Center: Center for Industrial Ecology
POLICY, ECONOMICS, AND LAW

This focal area was founded on the belief that natural resource and environmental policy should be based on cumulative knowledge about society and environmental processes. The faculty in this area teach students that the key to a great deal of environmental policy is the appropriate integration of the insights of many disciplines. There are three overarching themes that are the foundation of research and instruction by the Policy group. First, the group advocates that an organized combination of natural and social science theory be used to guide environmental policy in the best service of society. Second, the group recognizes the importance of empirical analysis. Third, the Policy group is involved in designing optimal and equitable programs to protect the environment. The governance of environmental protection is a central concern of the entire group.

There are a wide range of courses that apply to this area, including risk and property; integrated resource planning; natural resource economics; pollution economics; energy economics; valuing the environment; public-private partnerships for the urban environment; environmental protection clinic; and environmental law and policy.

Faculty: Robert Mendelsohn (Coordinator), Garry D. Brewer, Benjamin Cashore, Marian R. Chertow, Timothy W. Clark, William Ellis, Daniel C. Esty, Bradford S. Gentry, Reid J. Lifset, James R. Lyons, Erin T. Mansur, Sheila Olmstead, James Gustave Speth, John P. Wargo

Associated Center: Yale Center for Environmental Law and Policy

URBAN ECOLOGY AND ENVIRONMENTAL DESIGN

This faculty group works under the premise that the ecological health and integrity of urban ecosystems have a profound impact on urban economic productivity and quality of life. They believe that students must be prepared to carry out pioneering research, have a grounding in new theoretical understanding, and conduct innovative practices in order to gain the knowledge and tools necessary to foster healthy natural systems essential for the future well-being of the modern city.

Because this focal area is inherently interdisciplinary, there are a wide range of natural science, social science, and policy courses that are relevant, depending on student interest and specialty. Students are recommended to take at least one course in each of the following areas: biological environmental sciences; physical environmental sciences; social environmental sciences; quantitative methods and mapping; architecture and engineering; and policy and law. The faculty then encourage students to take courses at F&ES and other parts of Yale with a particular reference to this area, such as urban anthropology and global history; urban poverty and policy; the future of American cities; environmental aspects of the technological society; issues and approaches in environmental education; and ecological imagination and environmental design.
**Focal Areas**

**Faculty:** Stephen R. Kellert (Coordinator), Diana Balmori, Gaboury Benoit, William R. Burch, Marian R. Chertow, Gordon T. Geballe, Bradford S. Gentry, Thomas E. Graedel, James R. Lyons

**Associated Centers:** Hixon Center for Urban Ecology, Center for Sustainable Environmental Design

**WATER SCIENCE, POLICY, AND MANAGEMENT**

This focal area uses the watershed (stream or river basin) as its unit of analysis, instruction, and action. The global water crisis takes diverse forms, including water scarcity, polluted lakes and rivers, contaminated ground water, spread of water-related diseases, and extinction of aquatic species. The complexity and interdisciplinary nature of these problems necessitate a collaboration of biologists, physical scientists, policy experts, economists, lawyers, and social scientists to design and execute effective restoration and management activities.

Key research and teaching questions include: How can environmental managers wisely protect and restore ecosystems even when they lack full scientific understanding; and how can scientists make their work as useful as possible to environmental managers, without sacrificing objectivity? These are highlighted through course work such as water resource management; aquatic chemistry; coastal ecosystem governance; marine protected areas; environmental hydrology; water quality control; and water system economics.

**Faculty:** Gaboury Benoit (Coordinator), Shimon C. Anisfeld, Richard Burroughs, Bradford S. Gentry, Stephen R. Kellert, Sheila Olmstead, Peter A. Raymond, James E. Saiers, Thomas G. Siccama, David K. Skelly

**Associated Center:** Center for Coastal and Watershed Systems
## 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 academic year 2004–2005.

Project courses embrace 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. Courses numbered 500 and above are graduate courses. The sequence of numbers does not reflect level of advancement.

### LIST OF COURSES BY TOPIC

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### Industrial Environmental Management

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COURSE DESCRIPTIONS

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

Ecology

ECOSYSTEM ECOLOGY

F&ES 519b, Methods of Ecosystem Analysis. 3 credits. This course exposes students to ecosystem-level questions; demonstrates field-data collection and laboratory analyses; emphasizes data manipulation on the microcomputer; and introduces professional data presentation techniques (plotting, transparencies, slides, Web design). Some projects chosen by students have large enough data sets to test hypotheses and develop publishable conclusions. Class sessions consist of a morning lecture and afternoon in field and laboratory. See https://classes.yale.edu:444/fes519b. Thomas G. Siccama, Ann E. Camp.

F&ES 528b, Tropical Ecosystem Dynamics and Anthropogenic Change. 3 credits. This course has four major objectives: to introduce students to the major conceptual and theoretical questions and approach in tropical terrestrial ecology; to compare and contrast tropical ecosystems for insights into the similarities and differences of specific regions; to integrate empirical studies on tropical ecosystem dynamics with management concerns; and to explore how anthropogenic change has altered tropical ecosystems. Current topics to be addressed in depth from an ecological perspective include: land use and forest fragmentation; timber harvest and plantations; hunting and non-timber product extraction; and synergistic effects of climate, land use, fire, and ecological interactions. This course links an ecological understanding of terrestrial ecosystem dynamics at multiple spatio-temporal scales with problem solving and specific applications in major tropical biomes. Primary scientific literature supplements lectures and discussion. Participants complete a review paper and policy memoranda and a final interdisciplinary grant proposal. Prerequisites: a basic course in ecology or equivalent. Three hours lecture and discussion. Lisa M. Curran.

F&ES 556b, Seminar in the Conservation and Development of Amazonia. 3 credits. The human enterprise is exploiting and substituting the world’s tropical forests through a highly predictable process of frontier expansion and consolidation. Governance capacity and the prospect for natural resource conservation emerge only as the frontier boom economy goes “bust” and resources are largely depleted. In this seminar, we analyze the ecology, economics, and politics of Amazonia with the goal of learning to design robust, interdisciplinary approaches to the large-scale conservation of tropical forest ecosystems. We examine the biodiversity paradigm that dominates tropical conservation efforts today, the political constituencies (local, national, and international) in support of conservation and sustainable economies in Amazonia, and the emerging markets for ecological services performed by tropical forests (carbon storage, watershed function, biodiversity conservation). Finally, we review approaches to Amazon forest conservation in the context of scenarios of regional and global climate change. Lisa M. Curran, Daniel Nepstad, David McGrath.]
F&ES 557b, Reconciling Development and Conservation on the Amazon Frontier: A Tropical Conservation Field Course. 1 credit. The human enterprise is exploiting and substituting the world's tropical forests through a highly predictable process of frontier expansion and consolidation. In the typical sequence, geopolitical and economic policies drive frontier expansion into remote forest landscapes through investments in transportation systems and other infrastructure, and through fiscal incentives, stimulating “boom” economies of resource exploitation. Governance capacity and the prospect for forest conservation generally emerge only as the boom economy goes “bust” and the forests are already reduced to fragments. In this course, we examine the competing interests of private enterprise, environmental conservation, and social movements during three three-hour lecture/discussions in New Haven. We further explore the interactions among tropical frontier actors during a thirteen-day expedition along a portion of the Cuiabá-Santarém highway in east-central Amazonia (Brazil), which is slated for paving. Each student conducts an independent research project that draws on both the theoretical and field components of the course. Enrollment limited to twelve. Lisa M. Curran, Daniel Nepstad, David McGrath.

F&ES 571b/EVST 325b/MCDB 235b, Plants and Agriculture in Temperate and Tropical Ecosystems. 3 credits. An exploration of the scientific bases of plant productivity in natural and agricultural systems worldwide, the ecological effects of modern intensive agriculture, and the challenge of attaining a secure supply of food through ecologically sound and sustainable practices. Prerequisites: chemistry and a basic course in biology, ecology, or the equivalent. Seminar meets twice weekly for 1 hour 50 minutes each. Second period each week devoted to observation and discussion of plants in the laboratory and Marsh Botanical Garden. In addition to the regular class assignments, graduate students read and summarize relevant experimental work in the primary literature for the class as a whole. Other work includes short written reports, a midterm essay, and a final term paper on a relevant topic chosen by the student. Mary Helen Goldsmith.

F&ES 574a, Tropical Forest Ecology 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: Challenges of tropical forestry in the twenty-first century; environmentally friendly forestry systems for the tropics. Soils of the tropics: types, fertility, physical properties, and management. Nutrient cycling. Natural forest structure and composition. The forest microenvironment: light, temperature, and water. High-elevation forests and savannas. Tree growth and reproductive ecology; plant species diversity; plant-animal interactions. Effects of disturbance; forest succession and regeneration. Management of primary and secondary forests. Environmental services of forests. Non-timber forest products. Plantation forestry: productivity and environmental services. Community forestry. Ecological aspect of agroforestry. Rehabilitation of degraded tropical forest ecosystems. Three hours lecture. Florencia Montagnini.
F&ES 575a, Ecosystem Pattern and Process. 4 credits. Ecosystem science provides a unique vantage point from which scientists can begin to understand complex adaptive systems. The basis of ecosystem science is to determine how patterns in biological processes emerge from interactions between organisms and the abiotic environment. This course introduces the ecosystem concept, investigates the structure and functioning of ecological systems, studies the response of systems to changing environmental conditions, and applies resulting knowledge to preservation and management issues. Presentation is balanced between terrestrial and marine/aquatic systems. A cross-section of northeastern ecosystems is visited and studied. The class generally consists of three hours of lecture and four hours of fieldwork per week. There are weekly field trips, one weekend trip to New Hampshire, and one Saturday field trip to Fire Island National Seashore. Peter A. Raymond, Oswald J. Schmitz, Thomas G. Siccama.

F&ES 604b, Topics in the Tropics. 3 credits. Seminar course with topics suggested by the faculty and selected by the students based on class interest. The aim is to discuss current papers, review methods, and discuss our research in progress around the selected topical focus. Students critique papers, discuss and debate methods, and offer their work in progress for group input. The course is graded credit/noncredit only. There are no written submissions or examinations. Lisa M. Curran.

F&ES 621a, Biogeography, Biodiversity, 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 623b, Tropical Field Botany. 3 credits. This course teaches students how to identify the most important tropical plant families, with an emphasis on trees. Students learn key characteristics for identification. We concentrate on those families that have high economic or ethnobotanic value. We also discuss distribution, habitat, and ecology. Different families or groups of families are covered by instructors from the New York Botanical Garden, all world-class experts in their respective families/groups. The course has a strong practical component, and instructors emphasize vegetative characters with which to identify families. The course includes a one-week field trip to Puerto Rico. Next offered spring 2006. NYBG Faculty.]

WILDLIFE ECOSYSTEMS AND CONSERVATION BIOLOGY

F&ES 509a/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. M. Anders Halverson.
F&ES 520a, 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 apply relevant conservation sciences and at the same time know explicitly about the organizational and policy settings in which they work. The course combines the problem-solving approaches of the conservation sciences with the policy sciences by surveying a range of policy and organizational contexts, theories, and techniques, using a variety of case studies. The role of the individual professional in these complex contexts is emphasized. Timothy W. Clark.

F&ES 560b/E&EB 660b, Wildlife Conservation Ecology. 4 credits. The study of wildlife ecology from an evolutionary ecological perspective to understand the behavior and life history of animals. The course explores how behavior and life history evolve and what factors ultimately shape population demography. The course examines behavioral and evolutionary ecological theories like optimal activity budgets; optimal foraging; and habitat choice in the context of age and stage-based models of population dynamics. The course links an understanding of animal behavior and life history to solving current conservation problems related to wildlife habitat loss and population viability. Three hours lecture and one hour discussion. Oswald J. Schmitz.

F&ES 565a, Human Dimensions in the Conservation of Biological Diversity. 3 credits. An examination of socioeconomic, cultural, and political issues in the management and conservation of biological diversity. Topics include biodiversity loss, endangered species, human/wildlife conflicts, utilization, parks and protected areas, attitudes and values, and legal and organizational structures. Issues involving the conservation of biological diversity in the United States and internationally are covered. Three hours lecture. Stephen R. Kellert.

F&ES 578a/E&EB 375a/675a, Seminar in Molecular Approaches to Systematics, Conservation Genetics, and Behavioral Ecology. 2 credits. The seminar focuses on molecular techniques that either have been commonly used in the past to address ecology/systematic related questions or have recently become available. The idea is to provide students with knowledge of all possible molecular techniques in the field, so that they can evaluate results in the literature and be able to choose the best technological tool to address a specific research question.

The seminar is organized by techniques. In each session the technical aspects of a particular molecular method are discussed in detail, evaluating: (1) different protocols, (2) their limits and merits for different types of ecological and evolutionary questions, (3) the genetic assumptions inherent in each method, (4) the analytical aspects of the interpretation of the results. The discussion includes actual case studies, which students are challenged to critically evaluate. The two final weeks are devoted to relating these molecular approaches to problems in conservation biology. Adalgisa Caccone.]
F&ES 587a/E&EB 315La, Laboratory in Molecular Systematics. 3 credits. This course focuses on molecular techniques in evolutionary biology (DNA extraction, PCR, cloning, sequencing) and their application to field studies of natural history, population genetic structure, mating systems, paternity, and the historical analysis of lineages. The course consists of a series of lectures and independent research projects carried out by each student. Aside from the bench work, experimental design, statistical analysis of genetic data, and phylogenetic reconstruction within and among species are emphasized, illustrating how the disciplines of population biology and phylogenetic systematics increasingly overlap. The course revolves around a few class projects. Each student is supposed to carry out his/her part of these projects; data gathered by all students is then combined and analyzed together.

The primary objectives are to give students both a strong foundation in the systematics and conservation questions and issues that can be addressed with a molecular approach, and a working knowledge of the molecular tools necessary to address those issues. Both of these components are essential to the training of those individuals who will conduct research in these emerging and rapidly growing fields. Adalgisa Caccone.

F&ES 588b/E&EB 320b/620b, Seminar in Conservation Genetics. 3 credits. This seminar is intended to provide an introduction to conservation genetics for advanced undergraduate and graduate students. The goal is to provide students with an understanding of the importance of genetic diversity and the means for preserving it. Adalgisa Caccone.

F&ES 760a/E&EB 365a/665a, Landscape Ecology. 3 credits. This 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 landscape ecologists: species-area relationships, island biogeography, metapopulation theory, individual-based models, cellular automata, models of biodiversity, etc. The application of these concepts is addressed through consideration of species viability, ecosystem management, and the design of nature reserves. 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. David K. Skelly.

F&ES 762b, 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.
**Environmental Education and Communication**

[F&ES 582b, Issues and Approaches in Environmental Education. 3 credits. This course is intended for those with a career interest in environmental education. Topics include learning theory, environmental education curricula, content issues in environmental education, informal environmental education, interpretation, outdoor and experiential education, exhibitry, and mass media. Class presentations, final examination, and term project required. Stephen R. Kellert.]

F&ES 583a, 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, Atlantic, Sierra,* or *Smithsonian.* 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 https://classes.yale.edu/fes583a. Three-hour seminar and writing workshops. Enrollment limited to fifteen. Fred Strebeigh.

[F&ES 724a, Information Management for Environmental Professionals. 3 credits. This course has four major objectives. First, it seeks to acquaint students with the principal resources at Yale in print-based, electronic, and visual media that are useful for research in all aspects of environmental studies, and to provide skills in using any necessary databases, indexes, catalogues, and finding aids that give access to these sources. Second, it presents an overview of important information resources on environmental topics that are available worldwide. Third, the course outlines the basics of effective writing and correct documentation of sources and demonstrates the use of bibliographic software packages (i.e., Endnote). Finally, the class provides the opportunity to explore the impact of critical thinking and information design on each student’s research and writing interests. The course includes several visits to libraries and museums at Yale. Several classes include panel discussions involving visitors from the F&ES faculty, the Yale library system, and other Yale departments. Three hours lecture/discussion/computer lab. Taught alternate years. Paul A. Draghi.]

F&ES 745b, 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 824a, Doctoral Student Seminar. 3 credits. This course is required for all doctoral students during their first two terms; the course is open to all doctoral students at later stages in their programs. The seminar brings together researchers from the natural and social sciences to enhance students’ abilities to develop effective research proposals, to examine critically the positive and negative aspects of seminars and publications, and to present proposals and research results effectively. Xuhui Lee.

Forestry

F&ES 505b, Local Flora. 3 credits. A field course which studies the flora of the northeast at various local ecosystems one afternoon each week. Students are required to make a labeled collection of woody plants, prepare brief written site descriptions of each ecosystem visited, and carry out a small project and write a paper related to the local flora. Four-hour field trip weekly. See https://classes.yale.edu/fes220b. Thomas G. Siccama.

F&ES 524b, 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 551b, Forest 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 592b, Agroforestry in the Tropics: Productive, Social, and Environmental Services. 3 credits. Focuses on factors influencing sustainability of agroforestry systems in tropical regions of developing countries and on the environmental services that agroforestry can provide, such as biodiversity conservation, carbon sequestration, and restoration of degraded ecosystems. Topics include: Environmental variables in agroforestry: light and water. Soil productivity and sustainability in agroforestry. Nutrient cycling and nutrient use efficiency. Agroforestry components: multiple-purpose trees, nitrogen-fixing trees. Economic aspects. Examples of subsistence-oriented and commercial agroforestry: shifting agriculture and improved fallows, home gardens, agrosilvopastoral systems, and alley-cropping. Environmental services of agroforestry: biodiversity conservation and carbon storage. Social functions of agroforestry: agroforestry as
a tool for development. Agroforestry extension and education. Current trends in agro-
forestry research. In addition, seminar presentations by students and discussion sessions 
deal with particular aspects of agroforestry of interest to students. Florencia Montagnini.

F&ES 600a/MCDB 660a, Structure, Function, and Development of Trees. 3 credits. 
This first 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, func-
tional, ecological, and evolutionary standpoints. Special attention is given to woody 
plants because they have both primary and secondary plant bodies and because of their 
importance in the biosphere and human life. Wood and bark structure and formation in 
tropical and temperate trees are discussed from the standpoints of evolution and eco-
physiology. Plant cell types are discussed in the context of how they evolved and their 
molecular and structural adaptations in terms of strength, storage, and water and solute 
transport. Prerequisites: general biology or botany or the equivalent, or permission of 
the instructor. Graeme P. Berlyn.

F&ES 601b, Research Methods in 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 instruc-
tor and prepares a minidissertation complete with literature review, materials and meth-
ods, results, and discussion. Weekly seminars and progress reports on the projects are 
required. Prerequisites: F&ES 600a and 610b and permission of the instructor. Four 
hours lecture/laboratory. Limited enrollment. Graeme P. Berlyn.

F&ES 610b, Physiology of Trees and Forests: The Pathway to Understanding the 
World’s Forests. 3 credits. Topics in the physiology of trees and forests, primarily at the 
individual tree level with extensions downward to the cellular and biochemical level and 
upward to the stand and ecosystem level. Topics covered include the ecology and adap-
tation of species, mineral nutrition, root structure and function, symbioses, nitrogen 
fixation, photosynthesis, water relations, respiration, bioenergetics, growth analysis, and 
environmental physiology and adaptation of forests, both temperate and tropical. Two 
one-and-one-half-hour lectures per week. Graeme P. Berlyn.

F&ES 916b, Contemporary Genetic Strategies for Tree Improvement: Current 
Methods in Plant Biotechnology. 3 credits. This course examines the basic science and 
philosophy shaping the future of tree biotechnology. Following a brief overview of tree 
genetics and biology, there is a review of basic and current strategies to manipulate the 
genetic constitution of plants. Approaches under consideration include plant breeding, 
tissue culture, genomics, and transgenic plant methodologies. Examples, where possible, 
are drawn from, or extrapolated to, tree models. The technical organization of the GMO 
process, together with the decision making encountered during the progression from the 
laboratory to the field, is emphasized. Discussions center on targeting traits, genetic
interventions, selection and evaluation steps, multiplication, and release and introduction. Comparative costs and the integration of existing technologies are evaluated. Regulatory and policy issues, including Intellectual Property Rights, are important components of the overall process and are integrated into the course. Richard Jones.

**FOREST MANAGEMENT**

**F&ES 602b, Forest Landscape Management.** 3 credits. The challenge of forest management is to provide the many objectives people demand from the forest 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 technical tools for landscape (forest) management. The course briefly 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 pools and changes; cash flow; operations scheduling; portfolio management; monitoring; and continuous quality improvement and adaptive management. Class includes lectures and computer laboratory work where students use the Landscape Management System (LMS) and companion technical tools to integrate these subjects by developing (and simulating implementation of) management plans on actual forest landscapes. By using landscapes in different parts of the world, the students learn comparative management issues. Chadwick D. Oliver.

**F&ES 605a, Global Forests: Biology and Sustainable Management.** 3 credits. Forests potentially cover 30 percent of the earth’s land surface, and most people live in, farm, and get water from these potentially forested ecosystems. This course examines the geographic, biological, socioeconomic, and management conditions of the world’s forests relative to many values. The course gives an overview and shows how to assess the condition of the world’s forests and related resources and their consumption, and it forms the basis for forest resource management and policy considerations in specific areas. Each of the seven Montreal Process “criteria of sustainable forestry” is examined from the natural and social science perspectives; these criteria include biodiversity, commodities, forest health, soil and water conservation, carbon sequestration, socioeconomic conditions, and the infrastructure to provide these. Course includes lectures and projects. Chadwick D. Oliver.

**F&ES 700b, 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. 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, water resources, urban resources, timber and nontimber products, and landscape design. Recommended: some knowledge of soils, ecology, plant physiology, human behavior, and resource economics. Four hours lecture. One hour tutorial. Seven days fieldwork. Mark S. Ashton.
F&ES 701a, **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 700b or 703a; F&ES 560b; F&ES 734b; or permission of the instructor. Eight days fieldwork. Limited enrollment. Alex Finkral, Thomas G. Siccama, Timothy W. Clark.

F&ES 702b, **Rapid Assessments in Forest Conservation.** 3 credits. An advanced interdisciplinary course concerned with protecting and maintaining the biological diversity of complex forested ecosystems while producing various goods and services. Examples of independent case analyses concern landscape management of biogeographic regions in the Pacific Northwest, Ecuador, 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 700b or 703a; F&ES 560b; F&ES 734b; or permission of the instructor. Three hours lecture. Eight days fieldwork. Limited enrollment. Mark S. Ashton, Timothy W. Clark.

F&ES 703a, **Growth and Development of Forest Stands.** 3 credits. This course introduces the study of forest stand dynamics — how the structure of different forest types changes over time. 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 and laboratory projects we explore forest development processes and pathways, concentrating on some key 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 704a, **Analysis of Silvicultural Problems.** 3 credits. An advanced course exploring the silvicultural options for problem stands. Problems can be both biological (fire, pathogens) and social (multiple value conflicts, property rights). Solutions are sought through synthesis and analysis of relevant literature for case studies. Quantitative silvicultural and economic techniques are used for comparative evaluation of solutions. Prerequisites: F&ES 700b or 703a; F&ES 733a or 734b; or permission of the instructor. Next offered fall 2005. Mark S. Ashton.]

[F&ES 705a, **Seminar in Advanced Silviculture.** 2 credits. This course considers selected topics in silviculture for students with previous instruction in silviculture. Two hours lecture. Next offered fall 2006. Mark S. Ashton.]
F&ES 708a,b, Field Trips in Forest Resource Management and Silviculture. 1 credit. Seven- to nine-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, Ann E. Camp.

F&ES 710a, Seminar on Invasive Species Biology and Ecology. 3 credits. The seminar focuses on current issues surrounding invasive species (both plants and animals) at several spatial and temporal scales. While the biology and ecology of invasive species are emphasized, the economics and policy implications of invasive species are also addressed. Ann E. Camp.

F&ES 727a, Forest Financial Analysis. 3 credits. This course provides a framework and techniques to address financial decisions in forest management. Major topics include: timber markets, forest capital analysis and budgeting, basic investment analysis calculations (IRR, NPV, etc.), risk and selection of interest rates, inflation, taxation, forest finance, and forest valuation and appraisal. Includes an overview of the developing fields of carbon offsets, green payments, and conservation land acquisitions in relation to forest finance. A substantial applied course project is required. Prerequisites: F&ES 734b and F&ES 700b or permission of the instructor. (F&ES 602b helpful.) Three hours lecture. Weekly problem sets. Lloyd Irland.

F&ES 741a, Professional Ethics: Orientation to the Field. 1 credit. This is a one-credit reading/discussion class. It requires several short written case notes to apply a simple set of ethics reflection guides that will be taught in opening sessions. It meets once a week. A short textbook is required, supplemented by short weekly case and related readings. The course concentrates on developing a clear understanding of what a profession is, and what professional ethics codes mean, and how they may be applied in making ethical judgments about situations that arise in environmental and forest management and administration, as well as in scientific research. Examples are offered by visiting resource people from a variety of fields including environmental agencies, consulting, and the nonprofit sector. On completing this course, students will be familiar with the major problem areas of professional ethics, and with a range of literature in the field. They will be able to understand and apply ethics codes of whatever professional societies they may enter when they graduate. Lloyd Irland.

F&ES 803a, Forest Management Operations for Professional Foresters. 3 credits. This course covers the operational aspects of managing forestland, including a range of topics essential to the professional practice of forest management. The course focuses on operational aspects of regeneration, intermediate tending, and harvesting (planning, layout, implementation, and post-operation evaluation), Best Management Practices, regulatory and wetlands considerations, and socio-economic dimensions of field operations. Included is a workshop on ethical and professional responsibilities of forest managers. Classes feature field trips to view forestry operations, including a five-day trip to
an important timber-producing region of the northeastern United States early in the term. The course is limited to twenty students, with preference given to second-year students. Michael Ferrucci.

**Physical Sciences**

**ATMOSPHERIC SCIENCES**

[F&ES 603a/GEOL 657a, Marine and Surficial Geochemistry. 3 credits. Geochemical processes at the Earth’s surface, including the atmosphere, oceans, ice caps, and the upper layers of the crust, are investigated using radioactive, radiogenic, and light stable isotopes. Next offered fall 2005. Karl Turekian.]

F&ES 612b, Alpine, Arctic, and Boreal Ecosystems. 3 credits. Biogeoclimatic analysis of these systems worldwide with special attention to biogeography, biometeorology, physiology, histology, morphology, autecology, and silviculture of high-elevation and high-latitude forests are studied through lectures, guest lectures and discussions, student seminars, and field experience. One and one-half hours lecture weekly. Student contributions are one or more seminars and a term paper. Prerequisites: F&ES 610b, 869a, 700b or the equivalent, or permission of the instructors. Graeme P. Berlyn, Ann E. Camp, Xuhui Lee, Mark S. Ashton.

F&ES 732a, Air Pollution. 3 credits. This course provides an introduction to the physics and chemistry of air pollution. It covers what air pollutants are of concern, their sources, and their chemical transformation in the atmosphere. Students also learn how pollution moves through the atmosphere, including the atmospheric dispersion equations, stability classes, and inversion layers. Other topics include air quality modeling, impacts from air pollution, and monitoring network design. Michelle Bell.

F&ES 834b, 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. Xuhui Lee.

F&ES 868b, 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 and human bioclimatology, air quality, air resources (wind and solar energy), and climate change. Three hours lecture. Problem sets. Xuhui Lee.
[**F&ES 869a, 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, with special attention to the role of the terrestrial biosphere in pollution deposition, photochemical smog, UVB radiation, greenhouse gas sources/sinks, and global warming. Students also establish familiarity with quantitative tools for analysis of global change impacts on the terrestrial ecosystems. Three hours lecture. Lab sessions/reports, term paper/presentation, and field trips. Xuhui Lee.]

**ENVIRONMENTAL CHEMISTRY**

**F&ES 502a,b, Seminar in Applied Environmental Chemistry.** 2 credits. A seminar exploring the chemical principles underlying the behavior of natural and anthropogenic materials in the environment. The objective of the course is to sharpen students’ understanding of environmental chemistry, but especially to enhance their ability to critically analyze technical literature, which can be useful in any field. All media are considered, but aquatic systems are emphasized. Both pristine and polluted environments are examined. Prerequisite: F&ES 545a, which may be taken concurrently, or equivalent. Interested students must attend the first class meeting. Two-hour participatory discussion, class presentation, dinners. Gaboury Benoit.

**F&ES 507b, Organic Pollutants in the Environment.** 3 credits. An overview of the pollution problems posed by synthetic organic chemicals (e.g., pesticides, PCBs, dioxins) and petroleum products. The course is appropriate both for students with no background in organic chemistry and for those who have taken college organic chemistry. The first two weeks are spent in a quick introduction to the language of organic chemistry, which provides those who have little chemistry background with the basic tools needed to “decode” organic structures. The course aims to give students an understanding of the processes governing the environmental fate of organic pollutants (e.g., evaporation, bioconcentration, biodegradation); and of how those processes apply to the pollution problems posed by specific groups of chemicals. We also discuss technologies for prevention and remediation of organic pollution, as well as issues related to specific classes of chemicals (e.g., oil spill response, pesticide choices). Several case studies are examined. Media covered include both surface and ground water. Three hours lecture, five problem sets, several field trips. Shimon C. Anisfeld.

**F&ES 544b, Aquatic Chemistry.** 4 credits. A detailed examination of the principles governing chemical reactions in water. Emphasis is on developing the ability to predict the aqueous chemistry of natural and perturbed systems based on a knowledge of their biogeochemical setting. Calculation of quantitative solutions to chemical equilibria. Focus is on inorganic chemistry, and topics include elementary thermodynamics, acid-base equilibria, alkalinity, speciation, solubility, mineral stability, redox chemistry, and surface complexation reactions. Illustrative examples are taken from the aquatic chemistry of estuaries, lakes, rivers, wetlands, soils, aquifers, and the atmosphere. A standard software package used to predict chemical equilibria may also be presented. Prerequisites: general chemistry, algebra, and F&ES 545a or equivalent. Three hours lecture, frequent problem sets. Gaboury Benoit.
F&ES 545a, 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 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 periodic characteristics of the elements, 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 596a/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. Faculty.

F&ES 598b/CENG 377b/ENVE 377b, Water Quality Control. 3 credits. Study of the preparation of water for domestic and other uses and treatment of waste water 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. L. Lee Wikstrom.

SOIL SCIENCE

F&ES 530a, Introduction to Soil Science. 3 credits. An introduction to the fundamental concepts of soil science. Soil topics are presented in relation to natural and managed ecosystems with emphasis on soil processes and their relationship to plant productivity. Two lectures a week. Four all-day Saturday field trips. See https://classes.yale.edu:444/fes530a. Thomas G. Siccama, Florencia Montagnini.

WATER RESOURCES

F&ES 515b, Coastal Ecosystem Governance. 3 credits. This introduction to coastal management links human impacts on the environment with existing or proposed governance solutions for protection or restoration. Examples of single sector initiatives include wastewater treatment, wetlands, and dredging. For each topic the natural science underlying the issue is introduced and the responding governance system is evaluated. Regional management, a currently practiced alternative to single use management, is evaluated with respect to its effectiveness for nonpoint source control, fisheries, and health of coastal environments. To enhance regional management, coastal ecosystem governance is introduced as an emerging concept and practice. Particular attention is
paid to program design and implementation in this new context. Three-hour seminar, term project. Prerequisite: F&ES 536a or equivalent. Richard Burroughs.

**F&ES 516b, Isotopes in Environmental Science. 3 credits.** The use of stable and radio-isotopes in environmental science has evolved as a powerful methodology to approach many questions from a variety of subfields, including ecology, biology, hydrology, biogeochemistry, and paleo-climatology. This course is intended to provide students with a working knowledge of the techniques and applications of using a range of isotopes and isotope tracers within different terrestrial, aquatic, and atmospheric systems. The course utilizes interactive lectures and the primary literature to introduce students to concepts. The course is also structured to allow students interested in pursuing specific isotopic approaches to incorporate these interests into the class. Three hours lecture, problem sets, term project. Shimon C. Anisfeld, Peter A. Raymond.

**F&ES 533b, Water Resource Management. 4 credits.** An examination of water resource issues at scales ranging from global to local. The course looks at multiple dimensions of the water problem, including both human and ecosystem impacts; both water quantity and water quality issues; and both the scientific understanding of problems and the management tools available for moving toward solutions. Topics include: water scarcity, water use projections, human impacts on aquatic ecosystems, water quality control, water allocation and conflict, the watershed framework, and restoration. Three hours lecture, one term project, several field trips. Prerequisites: some familiarity with hydrology and water quality (preferably F&ES 540a and F&ES 545a). Next offered spring 2006. Shimon C. Anisfeld.

**F&ES 536a, Estuarine Ecology and Anthropogenic Impacts. 3 credits.** An examination of the natural processes controlling coastal ecosystems (primarily tidal marshes and estuarine open-water systems), and the anthropogenic perturbations to these processes. The course covers a wide range of important processes, with greatest detail given to nutrient cycling and the controls on — and fate of — primary production. Anthropogenic impacts covered range from local to global, and include nutrient enrichment, hypoxia, sea level rise, invasive species, and wetland filling. Three hours lecture, several field trips. Shimon C. Anisfeld.

**F&ES 540a, Environmental Hydrology. 3 credits.** An introduction to the processes that govern the earth’s hydrologic cycle. Topics include land-atmosphere interactions, movement of water in subsurface environments, contaminant transport in groundwater systems, streamflow generation, and surface-water flow dynamics in wetlands. Computer software packages are used to reinforce concepts presented in class. Three hours lecture, problem sets. James E. Saiers.

**F&ES 541b, Hydrologic Modeling. 4 credits.** Application of computer models to solve problems related to water movement and chemical migration in subsurface environments. Unsaturated and saturated flow phenomena are considered, and the role of geochemical and microbiological processes in chemical fate and transport is examined. Three hours lecture. Term project and presentation. Prerequisites: F&ES 540a or equivalent. James E. Saiers.
F&ES 542b, Special Topics in Hydrology. 2 credits. This seminar centers on the discussion of issues at the forefront of hydrology. At the outset of the course, students identify a small set of topics that focus on important problems in hydrologic science and that also may have significant policy, management, and public-health components. Suitable topics include, but are not limited to, climate-change effects on water resources; waterborne infectious disease and water-related illness; linkages between water, carbon, and nutrient cycles; and human-induced variations in freshwater quality. Each class meeting involves the discussion of a group of closely related journal articles that fall under one of the student-identified topics. In addition to participating in class discussions and in selection of the journal articles, students write a term paper on one of the seminar themes. James F. Saiers.

F&ES 550a, The Science and Policy of the Coastal Nutrient Problem. 3 credits. Large enrichments of anthropogenic nutrients to estuaries and the coastal ocean can stimulate large deleterious phytoplankton blooms that alter the structure and function of coastal water bodies. The eutrophication problem and strategies for ecosystem restoration have been a primary focus of scientists, managers, and policy makers for past decades. Interesting system-specific responses to nutrient loading as well as policy and management strategies that need to cross local, state, and even country jurisdictions provide challenging aspects to the eutrophication problem. This course begins with a set of lectures to introduce students to the science and policy of the eutrophication problem and discusses past/present management models that strive to restore coastal systems to normal function by controlling nutrient loading. Students then interact with experts from around the world who present case studies on the eutrophication problem from different coastal systems. Next offered fall 2005. Shimon C. Anisfeld, Richard Burroughs, Peter A. Raymond.

F&ES 558b, Applied Hydrology. 3 credits. An intermediate-level treatment of surface and subsurface hydrology, with an emphasis on the application of computer models to address issues related to water quality, water supply, and restoration. The relationships between hydrologic variables and the movement of water and waterborne constituents in fluvial, wetland, and groundwater systems are explored. Three hours lecture, problem sets, field labs, and a team project. Prerequisite: F&ES 540a or equivalent. James E. Saiers, James G. MacBroom.

F&ES 829a, 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 540a or equivalent) is recommended. James G. MacBroom, assisted by Laura Wildman.
F&ES 866b, Caribbean Coastal Watershed Development: Science and Policy. 3 credits. Investigation of the environmental impacts of development in coastal watersheds of the Caribbean. Emphasis on coral reefs and other near-shore ecosystems. The course is co-taught by Benoit and a visiting lecturer, so emphasis changes from year to year. In general, links are made between policies and social forces promoting growth, their influence on the landscape, consequent accelerated erosion, and final effects on downstream ecosystems. Opportunities for GIS and remote sensing activities. One-week field trip to the Caribbean. Weekly lecture, readings, group or individual project. Taught only in alternate years. Gaboury Benoit and a visiting lecturer.

F&ES 881a, Conflicts at Sea: Values and Ethics in the Marine Environment. 1 credit. Much has been written about Aldo Leopold’s land ethic—an idea affirming the natural world’s right to existence. How does this idea transfer to the marine environment, a place where humans reside at the edges of their knowledge of the natural world? What is our rightful place in this ecosystem? What would we mean by a sea ethic? How would it affect what we do or not do, in the areas of resource extraction and consumption? This lecture series explores the idea of a sea ethic through examination of a number of conflicts presented by human interactions in the marine environment. Stephen Kellert, Gaboury Benoit, Richard Burroughs, Mary Beth Decker.

Quantitative and Research Methods

F&ES 506a/G&G 562a, Remote Sensing: Observing 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 in their 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, Archaeology, 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.

F&ES 510a, Research Methods. 3 credits. Elementary principles of the philosophy and methods of science; research planning, including problem analysis and project planning; preparation, criticism, and oral presentation of study plans; communication of research findings; limitations of research techniques; and structure of research organizations. Three hours lecture and student reports. David K. Skelly.

F&ES 513b, Social Science Research Methods. 3 credits. The class surveys the array of theoretical and epistemological approaches used in social science research. Emphasis is placed on understanding how choices over methodology shape data collection and results, and the various qualitative and quantitative efforts currently being employed to address complex social phenomena. Doctoral students and master's students doing research projects can use this course to develop their research project proposals. Amity Doolittle.
F&ES 529a,b, Preparation for Research. Preparation of dissertation prospectus and research plan for Ph.D. and D.F.E.S. candidates. Should be taken during the first year of doctoral studies. Xuhui Lee.

F&ES 622a, 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, 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 711a. Limited enrollment. Timothy G. Gregoire.

F&ES 711a, 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; double sampling; fixed- and variable-radius plot; and 3P/Poisson. Line-intersect and importance-sampling variants of probability proportional to size designs are also covered. The Horvitz-Thompson, ratio, regression, and other estimators are introduced throughout the course. Three hours lecture. Weekly and biweekly problem sets requiring the use of a computer spreadsheet. Timothy G. Gregoire.

[F&ES 713b, Statistics for Environmental Sciences. 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. Three hours lecture. Statistical computing, weekly problem exercises. Prerequisite: introductory statistics. Timothy G. Gregoire.]

F&ES 714a, 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 713b. There are weekly problem sets using MINITAB software, as well
as a final project. This course assumes no prior knowledge of statistics; this course (or equivalent) is a prerequisite for more advanced F&ES statistics courses. Three hours lecture. Jonathan D. Reuning-Scherer.

F&ES 715a, 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 716b, 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 716b, 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 715a, 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 719b, Statistical Design of Experiments. 3 credits. Principles of design for planned experiments, coupled with method 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. Prerequisite: a prior course in introductory statistics. Timothy G. Gregoire.]

F&ES 844b, Multivariate Statistical Analysis in the Environmental Sciences. 3 credits. An introduction to the analysis of multivariate data. Topics include multivariate analysis of variance (MANOVA), principle components analysis, cluster analysis (hierarchical clustering, k-means), canonical correlation, multidimensional scaling, and factor analysis. Some analysis of multivariate spatial data may be included. 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. Three hours lecture/discussion. Jonathan D. Reuning-Scherer.

Social Sciences

ECONOMICS

F&ES 733a, Economics of Pollution. 3 credits. This course is designed to teach students how to think about managing pollution. It explains why market economies produce pollution and why regulations are needed. Social solutions to the problem are explored, and students learn how to analyze the effectiveness of control alternatives and policies. Specific examples are discussed, including air and water pollution, acid rain, global warming, hazardous waste, and human waste. Three hours lecture. Robert Mendelsohn.
F&ES 734b, Economics of Natural Resource Management. 3 credits. This course provides an introductory survey, from the perspective of economics, of issues regarding the use and management of natural resources. The course covers both conceptual and methodological topics and applications. The first part of the course is an introduction to the principles of natural resource economics. We develop the basic theory required to understand the economic concept of efficiency, as well as conditions under which markets can and cannot be expected to allocate resources efficiently. Next, we develop an understanding of environmental benefit valuation techniques. The remaining three-quarters of class sessions are devoted to applying these theoretical concepts and methods to questions of managing both nonrenewable resources (oil and minerals) and renewable resources (water, fisheries, forests, and species). This applied portion of the course also includes class sessions on the economics of land-use change, as well as macroeconomic topics like economic growth, sustainability, and green accounting. Important themes in the course include the uses and limits of markets in natural resource management; measurement of the benefits of natural resource amenities like clean water and recreational public lands; economic and environmental implications of poorly defined property rights for resources like fisheries and groundwater; and economic definitions of sustainability. Sheila M. Olmstead.
F&ES 737b, 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 852b, Energy Economics and the Environment. 3 credits. This advanced economics course examines energy issues as they pertain to the environment. The course begins with an overview of energy markets and an introduction to the economics of extracting nonrenewable resources. In the second section, the class looks into the environmental implications associated with energy and methods regulators use to correct for these market failures. In particular, we examine the economics of air pollution and climate change. The next part of the course covers investment in renewables. We discuss what regulations have been used to encourage investment and examine their effectiveness. The final section includes lectures on the economics of transportation (e.g., CAFE standards), and of energy conservation (e.g., DSM programs). Each week, the lecture covers the economics behind a particular energy issue and then is followed by a class discussion about a related case study or article. This course places an emphasis on economics methodology and is intended for students with some economics background. Erin T. Mansur.

F&ES 863b, Economics of Water Quality and Water Scarcity. 3 credits. This limited-enrollment seminar is a survey of selected issues in the economics of water resources management. The course is divided into two parts, the first focusing on water quality, and the second on water scarcity. Issues covered in the first part of the course may include: efficiency and cost-effectiveness of U.S. federal water quality regulations, including the Clean Water Act and the Safe Drinking Water Act; methods used by economists to value the benefits of water quality regulation, as well as specific applications of such methods; cost-effective approaches to water quality regulation, including effluent trading; and the current and potential role of economics in wetlands protection policies. In the second part of the course, we discuss issues such as: water allocation and water marketing; urban water demand and pricing; the economics of water conservation; and the trend of privatization of water supply. Specific topics subject to change each year. The seminar format requires substantial student input, and there is a heavy writing component. Class sessions include a mix of discussion of study questions related to assigned readings and/or formal cases, followed by student presentations on relevant topics. Prerequisite: F&ES 733b, F&ES 734a, or an equivalent microeconomics course. Sheila M. Olmstead.

ENVIRONMENTAL POLICY

F&ES 503a, 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. Leaders from many areas make presentations to the class describing their leadership experiences in the field, reflecting on the qualities and characteristics that each associates with leadership, and assessing the challenges facing the next generation of environmental and natural resource leaders. Guest speakers come from government, business, private nonprofit organizations, philanthropy, academia, and/or the U.S. Congress. Through this experience, students have the opportunity to assess their own leadership capabilities and identify means to improve them. Chadwick D. Oliver.

[F&ES 521b, Seminar on Forest Certification. 3 credits. This seminar-style course teaches students the basics of forest certification systems and their differences, their histories, and the theory behind certification as a tool for conservation. Students learn from the instructors as well as expert guest lecturers about the evolution, structure, and application of forest certification systems globally. The seminar explores case studies comparing both forest certification politics in different jurisdictions/countries, as well as on actual certified forests. Benjamin Cashore.]

[F&ES 594a, Comparing Environmental Governance Across Countries: Theory and Evidence. 3 credits. This course explores theories of domestic and international environmental policy making in order to understand better the processes through which policy change (and stability) occurs. The course examines traditional domestic and international public policy-making processes, and emerging institutions that seek to privatize environmental governance and restructure power relations among organized interests. The course examines these questions from comparative and international perspectives. Special attention is placed on the international–domestic nexus, and the effects of economic globalization and international governance on domestic policy change. Benjamin Cashore.]

[F&ES 725b, Science and Politics of Environmental Regulation. 3 credits. This course explores the interplay among science, values, and power within diverse environmental decision contexts. Scientific uncertainty is examined as the focus of political conflict over appropriate levels of regulation. Regulation is used in its broadest sense, i.e., attempts to control human uses of natural systems. The course focuses on the underlying behavior of key actors as a foundation for evaluating the historical effectiveness of diverse regulatory regimes, domestic and international. The course includes case studies of many toxic substance and land-use issues. Three-hour seminar. John P. Wargo.]

[F&ES 731a, Foundations of Environmental Policy and Politics. 3 credits. This course examines theories of policy making and politics, applied to problems of environmental management. Theories of property rights, risk assessment, and decision making are explored and applied to problems in managing land use, air quality, water quality, food safety, hazardous site restoration, and vector-borne disease. Students take a final exam and prepare a research paper or project as the primary course requirements. Two lectures per week, one discussion section. John P. Wargo.]
**F&ES 739b, 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. 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 three policy analysis projects during the term. Following an initial organizational meeting, student teams meet with the instructor once a week to provide updates on project. James R. Lyons.

**F&ES 763b, Emerging Markets for Ecosystem Services.** 3 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 experimental efforts 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, by analyzing the scientific, business, and policy aspects of land managers’ decisions whether to manage their land to supply these emerging markets. Prerequisites: course work or experience in at least one of the following: silviculture, hydrology, business analysis/planning, or policy/law; Spanish language skills a plus. Enrollment limited to twelve. Taught alternate years. In spring 2005 the course focuses on sites in Panama, including a weeklong visit over spring break. Enrollment limited to twelve. Bradford S. Gentry, Mark Ashton, Shimon Anisfeld, and guest lecturers.

**F&ES 766b, Public-Private Partnerships: Lessons from the Water Sector.** 3 credits. Governments around the world are finding that they cannot meet pressing environmental problems alone. Nor can they compel the private sector to take all the necessary actions. Increasingly, they are looking to partnerships with businesses, NGOs, and communities as a tool for improving environmental performance in many different sectors and contexts. This is particularly true in the water sector. Private involvement in water is particularly controversial, however, raising fundamental issues about the roles of governments, businesses, and civil society in meeting basic human and environmental needs. In collaboration with the U.N. Development Program and universities around the world, this seminar explores the fundamentals of partnerships as a policy tool, as well as the opportunities and limits of its application in the urban water sector. Limited enrollment. Taught alternate years. Bradford S. Gentry.]
F&ES 768b/MGT 658b, Business and Environment Leadership. 3 credits. During the last decade, business and environmental leaders began to realize that understanding one another and working together, while unaccustomed and often difficult, offer many tangible benefits. The course focuses on the lives and experiences of such leaders, several of whom pioneered Yale’s joint M.B.A./M.E.M. degree program. Professional pathways, career development, challenges in the workplace, and many other topics are explored. Emergent opportunities as well as common problems are considered. Specific attention is given to differences that exist in the views, values, and cultures of the business and environmental worlds. Garry D. Brewer.

F&ES 769a/MGT 689a, Ecological Knowledge and Environmental Problem Solving. 3 credits. The “heart” of the course is a distillation of core ecological concepts and their translation into an accessible framework. The framework guides both scientists and decision makers through a series of steps and questions that allow them to frame environmental problems in a realistic way. The first half of the course concludes with increasingly complex cases that familiarize one with the approach. The remainder of the course focuses on specific environmental issues of current and continuing interest. Class members work in groups to confront these topics as scientists and decision makers might in actual circumstances. Topics may vary, although the following are illustrative: risk assessment and communication, fisheries management, offshore oil and gas exploration and development, nuclear waste disposal, and global warming and climate change. Garry D. Brewer.

F&ES 770b/MGT 676b, Scope of the Policy Sciences. 3 credits. Emphasizing a systematic and comprehensive approach to the study of policy, this course concentrates on a general sequence of decisions comprised of six distinct, interrelated phases of the “life” of a policy or problem. The course has served as a foundation upon which other substantive policy courses and work have been built. Furthermore, it works to integrate theory with practice in a variety of substantive fields. Garry D. Brewer.

F&ES 772a, International Environmental Organizations: UNEP and Global Governance. 3 credits. This class examines the development of global environmental governance by focusing on international environmental organizations. Using key theories in international relations and empirical analyses, the course assesses the effectiveness of the U.N. Environment Program (UNEP). The goal is to create an analytical framework for defining the problems in global environmental governance, develop an understanding of the underlying reasons behind the challenges, and outline possible pathways to overcome them linking broad theories and empirical work. The questions that guide our work include: Why is global environmental governance necessary? What are the roles of international environmental organizations? How effective have these organizations been? What should the optimal institutional structure for global environmental governance look like? The roles and functions of the Global Environmental Facility (GEF) and the U.N. Development Program (UNDP) are also analyzed. The class looks at the role of UNEP’s regular and special meetings, especially the upcoming Governing Council Meeting in Nairobi, Kenya, in February 2005, as a tool of governance and policy making. Gordon T. Geballe, Mohamed El-Ashry.
F&ES 797b, Transportation and Urban Land-Use Planning: Shaping the Twenty-First-Century City. 3 credits. The focus of this course is on the environmental impacts of alternative transportation and urban land-use policies, taught from a policy maker’s perspective. It begins with a historical overview, examining the profound changes in the structure of cities following the advent of the automobile. The course then focuses on present and future environmental impacts — air pollution, greenhouse gas emissions, urban sprawl — resulting from the exponential growth in motor vehicles, particularly in developing country cities, and examines alternative scenarios for mitigating these impacts. Additional topics include the role of public transit in the United States and the differing approaches to transportation and land-use planning in various European cities; in-depth case studies of the success stories in urban transit in the developing world (e.g., Bogotá, Curitiba, and Singapore); and the range of options for transporting the two billion new urban inhabitants to be added to the world’s cities in the next quarter-century. The course also examines policies to create compact, regional cities through the integration of transportation and land-use planning and focuses on next and future steps, including congestion costs and congestion pricing, intelligent transportation systems, new automobile technologies, and so forth. Ellen Brennan-Galvin.

F&ES 801a, Energy Systems Analysis. 3 credits. This lecture course offers a systems analysis approach to describe and explain energy systems, including all forms of energy (fossil and renewable), all sectors/activities of energy production/conversion, and all 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. The evolution of energy systems is reviewed from a historical as well as futures (scenarios) perspective. Special attention is given to traditionally lesser-researched elements of energy systems (energy use in developing countries; urban energy use; income, gender, and lifestyle differences in energy end-use patterns). Particular emphasis is also given to market externalities and market failures characteristic of energy systems and a discussion of their policy implications. 1 credit for field trips. Arnulf Grübler.

F&ES 802a, Technological Change and the Environment. 3 credits. This seminar addresses technology’s dual role as both source and remedy of global environmental change. The seminar discusses both conceptual and theoretical aspects of technological change (one-third) as well as examples of technological change and its environmental impacts in agriculture, industries, and the service economy (two-thirds). Questions addressed include: Why are some technological innovations successful (e.g. cell-phones) while others (e.g. fast breeder reactors) are not? What determines rates of change in the adoption of new technologies and how can these be accelerated? How many people can the earth feed? Is dematerialization actually occurring, and why? What are the implications of the Internet’s digital North-South divide and what are strategies to overcome it? Active student participation reporting on assigned readings, empirical “fact finding missions,” and policy roundtable discussions are essential ingredient of the seminar. Arnulf Grübler.
F&ES 842a, Economics of Sustainable Development and Policy Considerations. 3 credits. This course explores sustainable development with attention to indicators and measures of progress. As a particularly relevant example, attention is given to the linkages between climate change, energy, and sustainable development, largely in developing countries. An objective is to evolve a transdisciplinary framework, analytical methods, and decision criteria for making development more sustainable — economically, environmentally, and socially. Policy-oriented case studies illustrate practical applications of the core theory, while classroom exercises help build problem-solving skills and provide experience in analyzing and presenting policy-relevant results to decision makers. The course also includes examination of the role of the World Bank and other international institutions in this context. Participants will have had prior preparation in environmental or energy/resource economics. Upon successful completion of the course, students will be able to (1) understand the critical issues underlying sustainable development in terms of its economic, social, and environmental dimensions; (2) recognize the basic concepts and indicators of sustainable development so as to be able to define, frame, and resolve issues; (3) assess and present alternative approaches to sustainable development from a decision-making perspective, in terms of the economic, social, and environmental impacts; and (4) identify and undertake graduate-level research in the field. Mohan Munasinghe.

F&ES 846b, Strategies for Land Conservation. 3 credits (or audit). This is a professional seminar on 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 whole spectrum of land conservation, 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 management. Students are required to undertake a project, preferably in partnership with a land conservation organization. Limited enrollment; preference to second-year students. Bradford S. Gentry.

F&ES 847b, Understanding Environmental Campaigns: Strategies and Tactics. 1–3 credits. This is a course about the strategies and tactics used in successful environmental campaigns, taught from a practitioner’s perspective. Though this topic is neither well documented nor regularly taught, there is a tactical toolkit that can be learned. Many environmental campaigners learn on the job. For those students interested in pursuing careers in environmental policy making and advocacy, this course is designed to be one that can jumpstart professional development. In a fashion comparable to the case study method offered in business schools, this course examines six cases, all from the past five years, and seeks to discern lessons for best practice. No single environmental campaign is the same, and strategies and tactics are always evolving, but there are several key lessons that can be drawn from such campaigns and there is also value in understanding current best practice even if it is constantly evolving. The six case topics examined in class are the Kyoto Protocol, protecting Alaska’s old growth rainforests, conserving the Pine
Barrens Watershed in Eastern Long Island, Home Depot’s decision to preference sustainably managed forest products, the Give Swordfish A Break Campaign, and the Persistent Organic Pollutants (POPs) Treaty. Resource people who have played leadership roles in each of these efforts join us for class. The class examines each case, synthesizes lessons learned, and seeks to formulate a practical understanding of key strategies and tactics used to affect positive outcomes. Michael Northrop.

F&ES 848b, 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 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. Lye Lin Heng.

F&ES 851b, Local Environmental Law and Land-Use Practices. 3 credits. This course explores the regulation by local governments of land uses in watershed 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. 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 environmental regulations. John R. Nolon.

F&ES 853a, Private Investment and the Environment. 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). It concludes by examining efforts to use combinations of these legal tools to expand private investment in environmentally superior goods, services, and operations. Bradford S. Gentry.

**F&ES 858a, History of the Environment and Ecological Science.** 3 credits. In this seminar, students explore the tools of historical research and analysis and develop their narrative writing skills. After focusing on environmental history and how it furthers current problem solving, the seminar turns to the history of ecology and ecology’s mixed influence on social and economic theory. Work centers on practical applications of historical research and analysis rather than the historical record, in the expectation that students will articulate their own narratives and gain increased power in problem analysis. History’s analytic tools and perspectives offer social and natural scientists an excellent platform for establishing context and for making long-term projections. The ecological orientation afforded by historical analysis further leads to more successful and ethical policy making through its emphasis on context, on emergent processes, and on the central role of individuals in system dynamics. Arvid Nelson.

**F&ES 861a/LAW 20348, 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, regulatory negotiation, and public disclosure requirements. Mechanisms for addressing environmental issues at the local, regional, and global levels are also considered. Daniel C. Esty.

**F&ES 864a,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 Protection 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. Dale Bryk.
F&ES 870a/LAW 20326, International Environmental Law and Policy. 3 credits. An introduction to international environmental law and policy. After reviewing the rise of the international environmental agenda, the course concentrates on how societies have responded to global-scale environmental challenges, including deforestation, biodiversity loss, desertification, climate change, ozone depletion, toxic substances, and the loss of living marine resources. The principal response to date has been in the area of international environmental law and policy, where a major new field of law and diplomacy has opened up and new multilateral institutions have been created. This first attempt at global environmental governance is surveyed and critically evaluated. Alternatives are examined. The main text for the course is a law casebook, David Hunter, Durwood Zaelke, James Salzman, *International Environmental Law and Policy* (University Casebook Series, 2002). William A. Butler.

[F&ES 891b, Foundations of Natural Resource Policy and Management. 3 credits. This research seminar focuses on the foundations of natural resource policy and management and is designed for students in any subfield of forestry and environmental studies, or in other disciplines. Comprehensive and integrated methods for thinking about and proposing solutions to problems in natural resource policy and management are explored. Students gain familiarity with the core methods of problem identification, clarification, and resolution and then apply these methods to particular issues in natural resource policy and management. Each student, alone or in collaboration, is responsible for researching a particular problem. Students circulate drafts of their papers to other seminar participants and lecture on and lead discussions of their topics in class sessions. Papers of sufficient quality may be collected in a volume for publication. The seminar is intended to complement, not duplicate, material in other courses in the School and at the University. Enrollment limited to sixteen; application required. Timothy W. Clark, Andrew R. Willard (Law).]

F&ES 909b, Large-Scale Conservation: Integrating Science, Management, and Policy. 3 or 6 credits. Environmental sustainability is an important societal goal, but figuring out how to achieve it at large scales has proven to be extremely challenging. Abundant trend data show that many species, ecosystems, and environmental systems are being overused, stressed, or degraded, thus undercutting the likelihood that we can reach sustainability. In addition, our institutions for science, management, and policy are not designed to address conservation at large scales. Over the last few decades there have been many management and policy initiatives to address large-scale conservation and resource use. Collectively, these efforts are a response to the growing awareness that many environmental problems can only be understood and addressed at large scales. All of these efforts are ambitious in scope. They are being undertaken or proposed at sub-national, national, international, or planetary levels. Each approach emphasizes different goals and methods and engages different communities of practitioners, decision makers, and publics. This course (a mixed seminar and practicum) examines the conceptual and contextual basis for these efforts, compares and contrasts formulae being used (e.g., science, management, policy), explores themes (problem solving, change, organization, leadership, monitoring, learning), and surveys cases from three arenas (terrestrial,
Subjects of Instruction

aquatic, and marine). The course takes a problem-oriented, contextual, and multimethod 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. Extensive student participation is required throughout. Timothy W. Clark

HEALTH AND ENVIRONMENT

[F&ES 721b/PLSC 855b, Environmental Health Policy. 3 credits. This course focuses on five types of environmental health problems. The first case is malaria, concentrating on the resurgence of drug-resistant strains in Southeast Asia, Latin America, and Western Africa. The second case explores age-related health risks from air pollution, especially small diameter particulate matter in urban centers, with cases considered in both the industrial and the developing world. The third case surrounds age-related risks from lead, especially the relative contribution of different contaminated media — air, water, food, and soil. The fourth case explores farmworker and childhood exposure to pesticides in the United States and abroad. The fifth case examines age and spatial distribution of breast and prostate cancer in Connecticut, considering variance in probable exposure to such different estrogenic environmental contaminants as DDT and PCBs. In each instance, the temporal, spatial, and demographic variances in the distribution of the problem are characterized to provide a basis for considering the effect of past policies—public and private—in promoting or diminishing the problem while providing a basis for considering policy reforms. John P. Wargo.]

F&ES 726a/EHS 511a, Applied Risk Assessment I. 2 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.

F&ES 730b, Environmental 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, agriculture, and food. Other topics include environmental justice, case studies of environmental health disasters, risk, urbanization, health in the workplace, and links between global warming and health. Michelle Bell.

INDUSTRIAL ENVIRONMENTAL MANAGEMENT

F&ES 500a, Greening the Industrial Facility. 3 credits. Industrial environmental managers need to be familiar with the technological processes by which modern society accomplishes its purposes, their potential to cause environmental damage, prospects for improvement, and anticipated change, and to do so in local, regional, and global perspectives. This course intersperses lectures and field trips to provide an introduction to
the environmental aspects of the production of materials, the manufacture of products, the construction of buildings and roadways, and the recycling of objects, components, and materials. Marian R. Chertow.

**F&ES 501b, 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. Thomas E. Graedel, Marian R. Chertow.

[F&ES 504a, Seminar in Industrial Ecology. 3 credits. A seminar exploring current research topics in industrial ecology. An overall theme for the seminar is chosen by consensus during the first class meeting. Attendance restricted to twelve students; preference given to doctoral and second-year M.E.M. students. One three-hour class per week. Each student writes and presents a term paper. Students may take this course more than once. Marian R. Chertow, Thomas E. Graedel.]

**F&ES 810b/MGT 693b, Business Concepts for Environmental Managers. 3 credits.** The objectives of this course are to offer environmental managers a basic understanding of accounting systems to enable them to interpret financial data in corporate and governmental settings, to integrate traditional business concepts with those of sustainable environmental management, and to recognize the role of environmental management among the multiple interests within business negotiations. The first part of the course develops skill in financial accounting, and this knowledge is then applied to areas in environmental financial management, including budgeting, project finance, and valuation. Marian R. Chertow, William Ellis.

[F&ES 812b/MGT 688b, Environmental Management and Strategy. 3 credits. The course focuses on understanding how adroit environmental management and strategy can enhance business opportunities and reduce environmental impact. The course seeks to analyze under what circumstances different competitive approaches are likely to be successful and to increase knowledge of programs, structures, and tools of environmental management. The course combines weekly lectures and class discussions on theory with sessions involving tools and applications. Enrollment limited to eighteen. Marian R. Chertow.]

**F&ES 905a,b/MGT 528a,b, Public and Private Management of the Environment. 4 credits.** This course explores the management of the environment and natural resources from the perspectives of private corporations, government regulators, and nonprofit organizations. A major theme is the consideration of various approaches to environmental protection: from conventional command and control regulation, to innovative market-based instruments such as tradeable emissions permits, to “demand-side” approaches such as product labeling, to voluntary “green business” practices by private firms. As its title suggests, the course examines environmental policies in both the public and private realms. The first part of the course, comprising lectures and case discussions,
employs the analytical framework of economics to understand the genesis of environmental problems and sketch the public policies that can help solve them. How should regulators design environmental policy? What should be the role of cost-benefit analysis in determining the level of environmental protection? How have markets for environmental protection been established in the real world, to tackle issues ranging from sulfur dioxide pollution to endangered species habitat? The second part of the course uses a series of case studies to develop an understanding of corporate and nonprofit environmental strategy. In the private sector, what opportunities exist for innovative environmental policies that preserve or even enhance the corporate bottom line? How do concerns about the environment fit into corporate competitive strategy? What obligations do private companies have toward the environment and natural resources? Finally, what role can nonprofit organizations play in influencing public policy and shaping corporate practices? Prerequisite: Economic Analysis or the equivalent. Nathaniel Keohane.

SOCIAL AND POLITICAL ECOLOGY

[F&ES 729b/REL 870b, Environmental Ethics. 3 credits. This course addresses contemporary ethical issues involved in sustaining the environment, and historical and contemporary perspectives on humanity and nature. The course aims to facilitate an integrated scientific, philosophical, religious, and spiritual understanding of current environmental issues. It is an interdisciplinary course; hence it aims to facilitate interdisciplinary dialogue and research. Its goals include the development of ethical positions relevant to environmental policy making. Permission of instructor required. Stephen R. Kellert, Margaret Farley.]

F&ES 744a/ARCH 903a, 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.

[F&ES 746b, Society and Natural Resources. 1–3 credits. This research seminar explores the relationship between society and natural resources. 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. The last seminar examined and compared conceptual (theoretical) models about society and natural resources from policy sciences, social ecology, and other knowledge areas. The applied utility of each model was examined through cases as appropriate. The next seminar focuses on “Complex Sustainability Cases.” Guests and
students make presentations and carry out discussions each week. Student papers are required. Timothy W. Clark, William R. Burch, Jr.

F&ES 747a/ANTH 581a, Society and Environment: Introduction to Theory and Method. 3 credits. An introductory course on the social scientific contributions to the study of the environment and natural resources, designed as the first course for students who specialize in the social sciences as well as the only course for students who take just one course in this field. The approach taken is inductive, problem-oriented, and case-study-based. Subjects covered include the framing of environmental “problems,” social science field methods, rethinking environmental perturbation and change, and the environmental relations of local communities. The course offers students an opportunity to develop analytic frameworks for past or proposed research projects. The course is a prerequisite for F&ES 752b and F&ES 759b. Three hours lecture/seminar. Enrollment limited to thirty. Michael R. Dove.

[F&ES 748b, Environmental Values. 3 credits. This course explores the meaning and, when possible, the measurement of diverse environmental values including utilitarian, scientific, aesthetic, naturalistic, symbolic, ethical, and spiritual values. The course also examines variations in these values among societal groups distinguished by education, income, occupation, age, gender, race, ethnicity, geography, and culture. Case studies are reviewed, emphasizing the importance of understanding and assessing environmental values in environmental policy and management. Stephen R. Kellert.]

[F&ES 752b/ANTH 610b, Society and Environment: Advanced Readings. 3 credits. An advanced seminar on the social science theory of the relationship between society and environment, intended for students interested in research design, and policy planning in this field. The course examines key theoretical developments and current issues in social/political/historical ecology and ecological anthropology. Topics discussed include conceptions of nature and culture, discourses of environmental degradation and restoration, and structural and post-structural theory. The course attempts to place current debates about human-environment relations in their historical and theoretical context. Students are expected to use the course to develop their own research and writing. Prerequisite: F&ES 747a or F&ES 756b or F&ES 757a. Three hours lecture/seminar. Enrollment limited to twelve. Taught alternate years; next offered spring 2006. Michael R. Dove, Carol Carpenter.]

F&ES 753a/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 meaning-centered and historically grounded account of the transformation of rural societies. Two-hour lecture and two-hour seminar. Michael R. Dove, Linda-Anne Rebhun, James C. Scott, Steven Stoll.
F&ES 757a/ANTH 597a, Sustainable Development and Conservation: Introduction to Social Aspects. 3 credits. This course provides a fundamental understanding of the social aspects involved in implementing sustainable development and conservation projects. Social science has two things to contribute 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. Second, social science tackles the analysis of the knowledge systems that implicitly shape development and conservation policy and impinge on practice. The goal of the course is to stimulate students to apply informed and critical thinking to whatever roles they play in sustainable development and conservation, in order to move toward more environmentally and socially sustainable projects and policies. A prerequisite for F&ES 752b and F&ES 759b. Three hours lecture/seminar. Carol Carpenter.

F&ES 759b/ANTH 598b, Sustainable Development and Conservation: Advanced Readings. 3 credits. An advanced seminar on the social science theory of sustainable development and conservation, intended for students interested in research design and policy planning in this field. It traces the conceptual history of the ideas of progress and development from the colonial period through the present and examines how these ideas are used by the parties who fund, design, and manage development projects, looking at both public expressions appearing in publications and underlying discourses. It also examines the response by local communities to development projects and compares development and conservation rationales with alternative local rationales. Finally, the linkage between the development project and the academy is examined. Students are expected to use the course to develop their own research and writing. Prerequisite: F&ES 747a or F&ES 757a. Three-hour lecture/seminar. Enrollment limited to twelve. Taught alternate years. Carol Carpenter, Michael R. Dove.

F&ES 761a, Issues in Environment and Design. 3 credits. This course is being offered in collaboration with the School of Architecture. It offers an ecological examination of the activity of architects and seeks to give future architects and ecologists an understanding of each others’ goals. Leading designers of communities, buildings, and the landscape have been increasingly concerned with environmental challenges that shape the built environment. This course investigates the positions, methods, and projects of the most promising of these designers. Students review the perspectives and practices of a select group of designers and undertake design exercises in a term-long project related to the designers’ activities. The course meets in a seminar for one and one-half hours and a studio for three hours every other week. Alternating weeks feature public lectures by leading designers, who also participate in design reviews. Written critical reviews of selected readings, case study presentations of built projects, and completion of a design project are required. Enrollment is limited to sixteen students, eight each from Architecture and F&ES. Stephen R. Kellert, James W. Axley.]
F&ES 767b, Monitoring and Evaluation Techniques: Theory and Methods Applied to Ecosystem Rehabilitation/Community Revitalization Interventions. 4–6 credits. This course is an introduction, exploration, and application of performance-based tracking of interventions to repair ecosystems and to revitalize their associated human communities. The underlying assumption is that one cannot occur without the other. Our task is to test that notion with qualitative and quantitative measures of real-life cases. Seminar members are grouped into three interdisciplinary, peer learning, service-oriented professional teams according to different organizational scales and different ecological approaches. Readings from the literature and case studies such as Chicago Wild and diffusion of innovation literature guide our effort. Studies and cases from Web sites are analyzed, data sets are collected for study locales. These studies and data sets are one source of theory, methods, and data for application to an actual, client-driven field analysis and diagnostic report that each team carries out. Field trips are made to the study sites. A binding thread in this effort is an interest in the use of generic “outdoor/environmental education” approaches as critical means for developing local knowledge and practices for rehabilitation/revitalization design and to monitor and sustain the system. William R. Burch, Jr., Colleen Murphy-Dunning.

F&ES 795a, Cities and Sustainability in the Developing World. 3 credits. Most population growth in the twenty-first century will occur in the urban areas of the developing world, which are expected to increase by 2.1 billion inhabitants between 2000 and 2030. Urban living poses environmental hazards, which affect the current population, and especially the poor, through immediate, local impacts on health and safety. It also causes environmental degradation, with longer-term, wider-area, and intergenerational consequences. Variations in the incidence and relative severity of a range of environmental problems across cities at different levels of development suggest differences in priorities for action. In coming decades, in order to support sustainable national development, urban areas will need to ensure a healthful and attractive environment for their rapidly expanding populations, while protecting natural resources and reducing harmful impacts on wider regions and later generations. The massive new investment in the capital stock of cities required for the doubling of urban population by 2030 will be critical to environmental outcomes. Using a number of city case studies, the course highlights local solutions, as well as new technologies for monitoring, planning, and managing urban growth. Ellen Brennan-Galvin.

F&ES 840a, Environment, Development, and Social Movements: An Amazonian Perspective. 3 credits. Developing countries face a complex task: to combine economic progress and poverty reduction, preventing, at the same time, the destruction of natural resources still available. The main questions examined during this course are: How to plan, implement, and evaluate public policies that bring together economic development, environmental protection, and social justice? How to reconcile conflicting interests related to access, use, and management of natural resources by different social groups? This seminar provides a unique opportunity to examine contemporary conservation and development problems from a developing country perspective, combining social science scholarship with hands-on social movement and environmental policy
experience. A particular emphasis of this class lies on the role of social movements in the search for solutions in environmentally sound management of natural resources. The alliances made with international environmental movements and multilateral organizations are also stressed. Examples from Brazil and the Amazon as well as other countries are examined. First, this class discusses conservation and development before the Rio 92 summit, mapping out resource conflicts, actors, alliances, and interests. Second, the class focuses on the policies implemented since the Rio 92 summit, the opportunities that these innovations have presented, and the new problems that have arisen. Third, the international dimension of conservation and development is discussed, particularly North-South conflicts over resource access and benefits as well as emerging reactions to international interests. Last, this class explores practical questions regarding current policy making in the Amazon and the role of social movements and their political empowerment in these processes. Mary Helena Allegretti, Daniel Nepstad.

F&ES 857a, Society and Environment in New England: A Regional History of Modernization and Environmentalism. 3 credits. This course examines the history of social and environmental change in New England from the late-colonial period to the present day. The focus is on understanding the interactions of ecological, technological, social, and cultural factors that jointly contribute to regional-scale modernization, as well as to reactionary and reformist movements that seek to cope with rapid social and ecological change. We examine these processes primarily at a regional scale that incorporates and ties together city and country, but also with an eye to interactions between local, regional, and global phenomena. After introducing key theories of modernization and regionalism, the course proceeds through successive historical periods, including: colonial and post-revolutionary frontiers; capitalist transitions in agriculture and manufacturing; the industrial revolution, agricultural decline, and management of urban and rural environments and populations; the automobile age, mass consumption, and the birth of regional thought and management; and late-modern capitalism and contemporary environmentalism(s). For students, the course provides: working knowledge of key geographical, social, and historical theories; an introduction to regional analysis and an in-depth understanding of the New England region; a critical evaluation of the utility of historical analysis for contemporary policy, planning, and social movements; and an opportunity to think reflectively, with increasing awareness of long-term change, about their own professional goals. Daniel S. Smith.

F&ES 884a, Ecological Imagination and Environmental Design. 3 credits. This course explores the integration of ecological values, issues, and processes with the design of commercial, residential, educational, and recreational facilities. It considers ways of capturing in the human built environment various physical, material, aesthetic, intellectual, and emotional benefits of nature. Lecture, discussions, and projects. Stephen R. Kellert, Gaboury Benoit.

F&ES 887a/PHIL 331a, Environmental Ethics. 3 credits. An examination of central topics in environmental ethics, including animal liberation and rights, biocentrism, land ethics, deep ecology, and ecofeminism. J. Baird Callicott.

[F&ES 908a, Global to Local Approaches for Developing Urban Ecosystem Theory, Methods, and Applications. 3–6 credits. This course examines classic and current theories of urban pattern and process. The trends and issues for a variety of international urban regions provide context. The techniques of cross-discipline measures and the application of community-based strategies for policy, planning, and management interventions serve as a base for professional action. Extensive readings in the literature, lectures by experts, field trips, and specific field project tasks in the New Haven/New York areas structure the learning process. A core of the theory and findings comes from the emerging data sets of the NSF-Long Term Urban Ecosystem Studies in Baltimore. Also, the lessons learned from over a decade of action research in Baltimore and New Haven inform the course. A focal interest is exploring the critical role that cities must play in ensuring a sustainable global future. William R. Burch, Jr., Colleen Murphy-Dunning.]

F&ES UNDERGRADUATE COURSES

Ecology

ECOSYSTEM ECOLOGY

F&ES 221a/E&EB 230a, Field Ecology. A field-based introduction to methodology used by ecologists in field studies. Descriptive studies, comparative analysis, modeling, and experimental approaches are explored using class or small-group projects relevant to major topics in ecology. After E&EB 122b and concurrently with or after E&EB 220a. Limited enrollment. Melinda Smith, David Post, Peter A. Raymond, Thomas G. Siccama.

F&ES 262a/EVST 262a, Ecology and Environmental Problem Solving. A study of ecological principles and their potential application to problems in conserving biodiversity. Topics of study include: the biosphere; organizational hierarchies and time scales; individual behavior in an evolutionary contest; ecology of species interactions; ecological complexity; and linkages among species and ecosystem functions. The lecture course is accompanied by laboratory and field exercises. Students learn to use basic ecological sampling methods and to apply these techniques to understanding of ecological patterns. Students conduct experiments to understand relations between biodiversity and ecosystem functions. Oswald J. Schmitz.

F&ES 263La/EVST 263La, Lab for Ecology and Environmental Problem Solving. The course provides grounding in the principles of sampling and quantifying biodiversity and defining landscape-level patterns. Students are given the opportunity to execute
experiments and run computer simulations that help to clarify the relationship between biodiversity and ecosystem function. Emphasis on quantitative aspects of sampling, analysis and modeling, and scientific communication through report writing. Oswald J. Schmitz.

**F&ES 275a, Ecosystem Patterns and Processes.** See F&ES 575a for description.

**F&ES 276La, Laboratory for Ecosystem Patterns and Processes.** Field trips to interpret the ecosystem-level functions of a wide variety of natural landscapes. *Must be taken concurrently with F&ES 275a.* Thomas G. Siccama.

**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. These principles are then examined in the context of efforts to halt the rapid increase in disappearance of both plants and animals. Case studies are examined in detail. While some sociological and economic issues are discussed, the emphasis is on the biological aspects of these crucial problems. Jeffrey Powell, David K. Skelly, Stephen C. Stearns.]


**F&ES 365a/E&EB 365a, Landscape Ecology.** See F&ES 760a for description.

**F&ES 370a/E&EB 370a, Aquatic Ecology.** See F&ES 509a for description.

**Forestry**

**FOREST BIOLOGY**

**F&ES 220b, Local Flora.** See F&ES 505b for description.

**F&ES 260a, Structure, Function, and Development of Trees.** See F&ES 600a for description.

**F&ES 261Lb, Laboratory for Structure, Function, and Development of Vascular Plants.**

**Physical Sciences**

**ENVIRONMENTAL CHEMISTRY**


**F&ES 344b, Aquatic Chemistry.** See F&ES 544b for description.

**WATER RESOURCES**

**F&ES 440a/EVST 440a, Environmental Hydrology.** See F&ES 540a for description.
Quantitative and Research Methods

GEOL 362a, Remote Sensing: Observing the Earth from Space. See F&ES 506a for description.

Social Sciences

ECONOMICS

F&ES 117a/ECON 117a, Microeconomics with Environmental Applications. The most important areas of introductory microeconomics. Emphasis on topics most relevant to the study of the environment, including externalities, regulation, public goods, and consumer surplus analysis. May be substituted for ECON 110a or 115a or b as a pre-requisite for other Economics courses. Robert Mendelsohn.


ENVIRONMENTAL POLICY

[F&ES 245b, International Environmental Policy and Governance. An examination of the emergence of global-scale environmental challenges, environmental diplomacy, and global environmental governance. Particular attention is given to the linked issues of climate change, deforestation, biodiversity loss, and desertification, and to the interplay of science and politics in framing policy responses to these issues. Permission of instructor not required. Benjamin Cashore.]

F&ES 255b/EVST 255b, Environmental Politics, Policy, and Law. This course explores 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.

INDUSTRIAL ENVIRONMENTAL MANAGEMENT

[F&ES 300b, Technology and Environment. An introduction to the environmental aspects of the production of materials, the manufacture of products, the construction of buildings and roadways, the provisioning of services, and the recycling of objects, components, and materials. Examination of the technological processes by which modern society accomplishes its purposes, their potential to cause environmental damage, and prospects for improvement, using local, regional, and global perspectives. Thomas E. Graedel.]
SOCIAL AND POLITICAL ECOLOGY

[F&ES 250b, Values and Perception of the Natural Environment. This course examines the way humans view and value the natural world. The biological and cultural bases for these values are explored, including historical, social, and ethical expression and their role in human motivation and behavior. The topic is related to current environmental issues including loss of biological diversity and environmental pollution. Next offered spring 2005. Stephen R. Kellert.]

F&ES 331a/PHIL 331a, Environmental Ethics. See F&ES 887a for description.

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, non-governmental 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.

CENTER FOR BIODIVERSITY AND CONSERVATION SCIENCE

The loss of biological diversity is one of the greatest threats facing society today. As we move into the twenty-first century, humanity is witnessing an unprecedented period of extinction. From Sri Lanka to the Western Ghats of India and from the uplands of Amazonia to the Pacific Northwestern United States, a staggering loss of species diversity and habitat is threatening both the integrity of natural systems and the health of human systems. In today’s society, priority conservation areas — those fragile and vital ecosystems threatened with the most severe loss of biodiversity — require more than the traditional, biological approach to protect species and their habitat. Multidimensional in scope, these problems require solutions that draw on the expertise of professionals from various disciplines. In recognition of the scale and dimension of this global threat, the Yale School of Forestry & Environmental Studies created the Center for Biodiversity and Conservation Science.

The goal of the Center for Biodiversity and Conservation Science is to foster the most advanced scientific research in the field and bring this knowledge to bear on solving environmental problems that exist on a human scale. The faculty of the School of Forestry & Environmental Studies, and other leading academic, nonprofit, and scientific organizations, work collaboratively across various disciplines to address complex problems that threaten conservation and the loss of biodiversity. By examining the natural, social, economic, and often political nature of these issues, the center offers creative, cutting-edge solutions to biodiversity problems in ways that allow for the protection of the ecological integrity of natural systems while incorporating the social and economic needs of local communities.

Yale’s Center for Biodiversity and Conservation Science is comprised of three research areas that work to maintain global biodiversity and ecosystem health: Ecology and Conservation Biology; Conservation Policy; and Human Dimensions.
Coastal and watershed systems are an integral part of the environment and an essential aspect of a holistic approach to environmental studies. The mission of the Center for Coastal and Watershed Systems is to incorporate interdisciplinary study of watersheds and adjacent coastal waters into academic life at Yale.

The small fraction of the earth’s surface occupied by the land-sea margin is enormously important to the environment and to society. A majority of the world’s population inhabits watersheds located within fifty miles of the coast, making these complex, fragile ecosystems especially vulnerable to human impact. The near-shore region includes some of the most unusual and diverse ecosystems, from salt marshes and coral reefs to mangrove forests and river deltas. The coastal zone supports the world’s richest fisheries and sustains significant recreational industries. The growing recognition of the importance and value of coastal and water resources has found expression in an increasing emphasis on public and private research programs.

The Center for Coastal and Watershed Systems promotes interdisciplinary studies and the education of professionals in the management of the special resources of terrestrial and aquatic ecosystems in the coastal region. Because ecological and social structure and function are inextricably linked, neither can be adequately comprehended nor effectively managed in isolation. The center emphasizes studies that help us elucidate the complex, poorly understood, but crucial ways in which human and biophysical systems shape each other. Several courses are available to students with an interest in coastal and watershed issues. In addition to courses in the regular listing, the center sponsors courses and lectures in marine conservation.

School faculty and students conduct physical, biological, and social research in local watersheds and educational outreach programs for the community. Three coastal watersheds in south central Connecticut — the Quinnipiac, Mill, and West rivers — are currently the focus of long-term faculty and student research. The work of the center on these watersheds includes community planning for habitat restoration of degraded urban rivers, studies of nonpoint source pollution, and research on the relation between watershed environmental health and human community performance and effectiveness.

The center’s office houses a growing library of reference materials, Geographic Information Systems (GIS) data, and computers dedicated to student projects. The summer training modules incorporate an optional day-long training session in coastal watershed field studies. In partnership with the Connecticut Sea Grant College Program, the center provides internships for students working on coastal restoration, preservation, and community outreach projects.

Recent student projects in the center include a survey of vegetation loss in the Quinnipiac River tidal marsh; an assessment of minimum stream flow for fish habitat; a quantification of stream restoration on a watershed scale; an assessment of conservation priorities in a Connecticut watershed using remote sensing and GIS; and a design investigation for a fishway installation.
Urban Watershed Program

The Urban Watershed Program promotes faculty and student research on the unique relationships, impacts, and demands of watersheds in urban areas. Jointly administered by the Center for Coastal and Watershed Systems and the Hixon Center for Urban Ecology, the program combines the interests and resources of the two centers.

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, inaccessible, and little understood by nearby residents; 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 Center for Coastal and Watershed Systems and the Hixon Center for Urban Ecology.

Coastal Field Station

A research facility is available to the Center for Coastal and Watershed Studies at the Peabody Museum Field Station on the Long Island Sound in Guilford. The station provides central access to one of the country’s most important estuaries.

CENTER FOR ENVIRONMENTAL LAW & POLICY

A joint undertaking with Yale Law School, the Center for Environmental Law & Policy seeks to engage students in dealing with real-world legal and policy issues. It coordinates an environmental protection “clinic” that undertakes term-long projects for clients (environmental groups, government agencies, community organizations, and private-sector enterprises) staffed by interdisciplinary teams of law and environmental studies students.

The center also supports a wide-ranging program of research and policy development aimed at local, regional, national, and global pollution control and natural resource management issues. Projects have included an effort to develop a “next generation” of environmental policy tools and strategies including “Information Age” opportunities and challenges; analyses of the role of nongovernmental organizations in environmental policy making; research on the design of environmental regulatory structures; rethinking of global environmental governance institutions; and an exploration of environmental performance measurement and an Environmental Sustainability Index ranking countries. These efforts involve faculty and student collaboration aimed at shaping both academic thinking and public policy making. Current research projects under the center include the following.
Environmental Performance Measurement

Aims to shift environmental decision making to firmer analytic foundations using environmental indicators and empirical data. In collaboration with the Center for International Earth Science Information Network at Columbia University and the World Economic Forum, the project produces a periodically updated Environmental Sustainability Index (ESI) that tracks 142 countries on 20 sustainability indicators. The pilot Environmental Performance Index (EPI) and the new Environmental Quality Index (EQI) focus on assessing key environmental policy outcomes using trend analysis and performance targets. Web site: www.yale.edu/envirocenter/esi.

Global Environmental Governance (GEG)

Seeks ways to revitalize the international environmental regime. This project aims to facilitate thinking on how to strengthen environmental cooperation in the face of global-scale threats. The goal is to contribute to more effective governance by developing a sound analytical foundation, expanding the policy dialogue, and creating a public policy network of interested individuals. Web site: www.yale.edu/gegproject.

Information Age Environmental Protection

Explores the ways that Digital Age breakthroughs (computers, remote sensing, advanced statistical analysis, and so on) can be brought to bear on pollution control and natural resource management challenges.

Corporate Environmental Strategy

Examines the quest for corporate sustainability, analyzing the successes and failures of recent corporate “green” initiatives, with the aim of identifying the elements of a successful corporate environmental strategy. The overarching goal of this project is to foster a world of sustainable production and consumption by addressing one critical leverage point — the business world and its approach to environmental strategy.

Center for Industrial Ecology

The Center for Industrial Ecology (CIE) is dedicated to the 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 which seeks to optimize the total materials cycle from virgin material, to finished material, to component, to product, to obsolete product, and to ultimate disposal. Factors to be optimized include resources, energy, and capital.

Among the programs and goals of the center are the following:

- Conducting path-breaking research in industrial ecology
- Hosting of visiting national and international scholars in industrial ecology
- 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, estimating the stocks available in different types of reservoirs, and evaluating the environmental implications; (2) the Industrial Symbiosis Project, in which multi-year research is being conducted primarily in Puerto Rico to establish the environmental and economic rationale for intra-industry exchange of materials, water, and energy; and (3) outreach and training focused on the environmental opportunities and challenges from the enormous expansion of Asian industrial activity with the aim of institutionalizing the understanding and use of industrial ecology in Asia.

Other research projects include (a) evaluation of the environmental consequences on a life cycle basis of industrial production based on biologically sourced raw materials and residuals; (b) development of quantitative goals or targets for sustainability; and (c) evaluation of extended producer responsibility (EPR) including investigation of how, when, and why cities and other local government units might adopt EPR.

**Journal of Industrial Ecology**

CIE is home to a highly regarded, international, peer-reviewed journal. Published by MIT Press, the *Journal of Industrial Ecology* is a multi-disciplinary quarterly designed to foster understanding and practice in industrial ecology and aimed at both researchers and practitioners in academe, industry, government, and advocacy organizations.

**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 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 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 Spring 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; (2) to develop workable policy solutions that address the impediments to safe, cost-effective solid waste management and the complexities of comprehensive materials management.
ENVIRONMENT AND HEALTH INITIATIVE

The Environment and Health Initiative is a new research effort being developed to explore important environmental threats to human health. The initiative has a special focus on the risks faced by infants, children, women, and other susceptible populations, and on the common overlap of poverty and environmental health threats. The research is problem-focused and interdisciplinary, and is intended to result in concrete suggestions for improving health and environmental quality through development, education, law, and private investment. Most projects have lives between two and four years, and now include: (1) Food Security, Trade, and Agriculture: GMOs, Beef, Pesticides; (2) Vector-Borne Disease: Malaria and West Nile Encephalitis; (3) Water Availability and Quantity: Israeli Treatment, Urban Supply; (4) Air Quality: Diesel, TRI, and Land Use; (5) Urban Environmental Quality and Health: Asthma in Connecticut Schools; (6) Institutional Capacity for Risk Management: Tanzania and Cameroon; (7) Risk Assessment Methods: Computer Modeling of Exposure and Risk; and (8) Education and Outreach: Curricular Development, Video Production.

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 Yale–UNDP Public-Private Partnerships for the Urban Environment, the Urban Resources Initiative, the Program for Sustainable Environmental Design, 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 both lecture series and conferences as a means to disseminate ideas and information concerning the critical issues confronting urban ecosystems and related research required for the foreseeable future.

The Hixon Center also supports Yale faculty scholarly research or initiatives focusing on aspects of environmental science, conservation, policy, or management in an urban context. In addition, the center supports student internships 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–UNDP Collaborative Program on the Urban Environment**

The Yale–UNDP Collaborative Program was created in 1996 as one part of a larger UNDP Program on Public-Private Partnerships for the Urban Environment (PPPUE). The purpose is to collect, analyze, and disseminate lessons learned using public-private partnerships (PPP) to improve the delivery of urban water, waste, and energy services in developing countries. The program helps address some of the most pressing public health and environmental issues facing the developing world, particularly the lack of access to clean drinking water and adequate sanitation services.

The partnership between Yale and UNDP grew out of UNDP’s need to involve more private businesses in solving urban environmental issues and the School’s research on how private investment can be used to improve environmental performance. The partnership builds on UNDP’s network of over 130 offices in developing countries, as well as Yale’s research and teaching.

The Yale–UNDP Collaborative Program is one part of a Global Learning Network (GLN) involving individuals and institutions around the world. The goal of the GLN is to serve as a worldwide focal point for partnership analysis, knowledge transfer, as well as local, regional, and global exchanges of experience. Its activities include:

- A Web page (www.undp.org/pppue) designed and written by PPPUE and Yale, containing: information on the PPPUE program; searchable databases; articles, research, and policy papers; materials for distance learning; links to related sites; information on PPP courses and events; and other facilities for information exchange among practitioners and experts.

- Publications, training materials, policy and research papers prepared by PPPUE personnel, faculty and graduate researchers at Yale, and other collaborators. Topics covered include the spectrum of public-private structures being used; the links between public-procurement requirements and PPP; the Clean Development Mechanism as a method for increasing private investment in developing countries; lessons learned about joint venture PPPs; methods for linking formal and informal providers of urban water and waste services; and many more. The vast majority of these materials are available on the Web site, and more are being added.

- A collaborative learning course designed and led by Yale personnel. Entitled “Using Public-Private Collaboration to Improve the Delivery of Urban Environmental Services in Developing Countries,” the course pulls together the lessons learned to date in a thirteen-session seminar. In 1999, the course involved students in South Africa, China, the UK, and the U.S. Since then, over twenty universities from Africa, Asia, Latin America, and Central Europe have been involved. Faculty at each of these institutions work with local students to explore the course content and see how it fits their local environmental priorities. Lecture notes, charts, and
class summaries are posted on the PPPUE Web page, and Internet-based interactions are encouraged among students and faculty. Several collaborators have adapted the course materials for use with nonacademic audiences—precisely the desired result.

- Application of the lessons learned through work with UNDP country offices by PPPUE and Yale personnel. The information collected on PPP has been used by UNDP country office personnel in locations ranging from the Philippines, to China, to Lebanon.

As the School continues to confront the challenges of a rapidly urbanizing world, the Yale–UNDP Collaborative Program adds an international component to the learning experience at F&ES.

**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 fifth graders at an inner-city elementary school who are learning how to assess the environmental attributes of their neighborhood. 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, environmental education initiatives, 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 city-wide initiative to revitalize New Haven’s neighborhoods by restoring vacant lots, planting street trees and front yards, and building community. Each intern works with community groups to develop restoration goals and 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 focuses especially on vacant lots, which pose a current and future threat to the quality of life in New Haven. As in many northeastern and midwestern industrialized cities in the United States, these patches of urban land — each typically less than one acre, but together making up hundreds of acres across urban neighborhoods — create great gaps in the landscape: sinkholes where environmental, economic, and community potential is wasted. 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 interns have taught hands-on environmental education programs to more than 2,500 New Haven students in twenty public schools. Our current environmental education initiative, Open Spaces as Learning Places, teaches New Haven elementary school students about environmental stewardship through exploration of open space sites in their communities.

Research
The URI programmatic activities in environmental education and urban community forestry create rich research opportunities. For example, using data from the Community Greenspace sites, F&ES student Alexis Dinno initiated a community survey to determine the human health impacts of vacant land. Adrian Camacho investigated differences in biological communities found in different urban locations, using Greenspace sites for comparison against abandoned lots. Another Yale F&ES student, Lianne Fisman, researched how children’s play behavior is affected by the design of schoolyards.

Urban Forestry Practices
Over the past decade, URI has created several community and urban forestry training programs, including natural resource managers’ training sessions (for municipal employees), a tree steward training program (for community leaders), and a street tree inventory training project (targeting local residents). These programs have created powerful learning experiences for Yale 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 and work with and learn from experienced mentors from F&ES and local, state, and federal forestry agencies.
TROPICAL RESOURCES INSTITUTE

The mission of the Tropical Resources Institute is to provide a forum to support and connect the initiatives of the Yale community in developing applied research, partnerships, and programs in the tropics. We support projects that aim to develop practical solutions to issues relating to conservation and management of tropical resources.

TRI was created in 1983 to strengthen the School’s involvement in the management of tropical resources. The institute recognizes that the problems surrounding the 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 natural and social sciences and among government agencies, academia, and practitioners, enabling the formation of successful partnerships and collaborations among researchers, activists, and governments. 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 the Yale School of Forestry & Environmental Studies through which faculty and students conduct interdisciplinary research and outreach activities throughout the tropics. Through the institute’s long-term presence in particular locations, TRI serves as a focal point for collaboration with local and international organizations to address particularly important and complex environmental challenges, and extends the School’s educational and training activities to local partners.

Research

TRI administers an endowed fellowship program that supports more than twenty graduate students conducting research in the tropics each year; administers structured long-term research sites to address issues of environmental restoration, protected areas and watershed management, environmental policy and governance, forest fragmentation, community rights to natural resources, and biodiversity conservation in Panama, Sri Lanka, and Indonesia; and supports faculty research in Asia, Africa, and the Americas.

Education

TRI provides mentoring and training to graduate students in research design, proposal writing, and field methods; sponsors faculty-led courses, workshops, round table discussions, and guest speakers; and trains practitioners through its presence overseas.

With a grant from the Class of 1980, TRI has established a documentary video editing center. Documentary films provide a powerful medium by which students can communicate their research to a wide audience. Students who are interested can combine independent research projects with the production of a documentary video.
Outreach
TRI maintains memoranda of understanding and collaborative research partnerships with more than three dozen leading tropical research and education institutions worldwide, sponsors open public lecture series, assists educational institutions in tropical nations with natural resources curriculum development, cosponsors an annual conference with the International Society of Tropical Foresters, helps publish conference proceedings and assessments of tropical resource issues in the *Yale School of Forestry & Environmental Studies Bulletin Series* and the *Journal of Sustainable Forestry*, and hosts an institute Web site (www.yale.edu/tri).

Publications

THE GLOBAL INSTITUTE OF SUSTAINABLE FORESTRY
The Yale School of Forestry & Environmental Studies has had a rich history in the pursuit of sustainable forestry for over 100 years. The School was established in 1901 in response to the need to train highly effective and innovative leaders in forestry. The
School expanded in scope in the 1970s so that it could use its resource leadership experience to produce leaders who are prepared to confront other environmental challenges as well as forestry.

The Global Institute of Sustainable Forestry focuses the School’s forestry activities and continues this rich tradition. Established by the dean and a group of F&ES faculty members in 2000, the Global Institute has launched innovative initiatives while coalescing and coordinating the many activities related to sustainable forest management at the School. The mission of the Global Institute is to foster leadership through innovative programs and activities in research, education, and outreach; to create and test new tools and methods; and to understand and support sustainable forest management worldwide.

The Global Institute of Sustainable Forestry was created to address the management and conservation of both domestic and international forestlands in a holistic and comprehensive fashion. In pursuit of these ideals, the Global Institute has developed several formal programs, core activities, and initiatives. The programs include the Program on Forest Certification (PFC), The Forests Dialogue (TFD), the Program on Forest Physiology and Biotechnology (PFPB), the Program on Landscape Management Systems (LMS), the Program on Private Forests (PPF), the School Forests, the Program on Tropical Forestry (PTF), the Program on Forest Health (PFH), and the Yale Forest Forum (YFF). The programs are described in greater detail below.

The Global Institute of Sustainable Forestry also sponsors publication of the *Journal of Sustainable Forestry*.

Core activities of the Global Institute of Sustainable Forestry are coordinated through the Yale Forest Forum. These activities include Forums/Workshops that convene interested parties to discuss timely issues in an academic atmosphere (see Web site for recent and upcoming Forums/Workshops); summary YFF Reviews are published afterward. Seminars and Seminar Series are held on timely topics, open to the Yale community and the public. Weekly luncheon seminars are held with guest speakers from all aspects of forestry and from around the world (also see Web site). A summer internship program helps provide opportunities for students to gain experience working with public and private forestry organizations. A Research Paper Series provides information produced by the Global Institute faculty, staff, and students on current forestry issues. The Yale Forest Forum also 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, coordinates activities with other institutions throughout the world, and supports the activities of the Global Institute programs. The Yale Forest Forum is also initiating a series of mid-career short courses for forestry professionals and executives.

Through the programs and Yale Forest Forum, the Global Institute has undertaken several initiatives — subject areas to be analyzed or developed for various periods of time. These initiatives include examination of forest fragmentation, the total cost impacts of recent forest wildfires, the impact of forest certification, exotic insect tree pests, rural community viability, a working definition of sustainable forestry, landscape and watershed management techniques and technical tools, and management of mixed hardwood forests. Other initiatives are being developed.
To carry out these activities and initiatives, the Global Institute of Sustainable Forestry draws on faculty and staff expertise of the School of Forestry & Environmental Studies, partners with other Yale centers, and cooperates with many institutions in the United States and abroad. In the past, students have participated in these programs as research assistants and interns, and as field crew members at the School Forests. They have also helped organize and participated in forums and seminars and have contributed to published documents that have emerged from program activities. While students provide valuable assistance to the operation of the Global Institute, they in turn receive the benefits of working and interacting with global leaders in the field of sustainable management.

The Global Institute of Sustainable Forestry is governed by the dean of the School, a faculty director, and a group of faculty advisers as well as professional administrators in charge of the Global Institute and many of its programs. The main office and bulk of the work of the institute are housed in Marsh Hall.

Program on Forest Certification

The mission of the Yale Program on Forest Certification 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 in the Yale School of Forestry & Environmental Studies. Forest certification is a unique market-based policy approach that has emerged recently to address global and domestic environmental deterioration. Business associations, landowners, and environmental organizations are attracted to forest certification because it harnesses the power of the marketplace to encourage compliance with environmental and socially responsible standards. Companies and forest owners are audited for compliance and, if successful, are certified as practicing responsible forestry. The promise of forest certification is that it offers an alternative to traditional “stick” approaches that often characterize governmental regulations and boycott campaigns, with “economic based carrot” incentives instead.

The program focuses on three interrelated efforts:

1. Research designed to understand the impacts of forest certification in the promotion of sustainable forestry. Our research is organized around four key themes: governance and certification; the consequences of forest certification in developing countries; environmental effects of certification; and market supply dynamics.

2. Teaching and training on forest certification. Our teaching includes a comprehensive seminar on forest certification, as well as training on how to conduct certification audits.

3. Outreach activities to the broader forestry community. The program hosts a number of visitors to speak at Yale on forest certification, as well as attending the key certification and sustainable forest policy conferences globally.
The program is housed at 230 Prospect Street. Students have the opportunity to work as researchers and/or assist in the coordination of program activities and certification assessment training. Our office includes a comprehensive reference database of nearly 5,000 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.

For details see www.yale.edu/forestcertification.

**The Forests Dialogue**

The Forests Dialogue (TFD) is a group of individuals from the private sector and civil society from diverse backgrounds and regions who are committed to the conservation and sustainable use of forests. Through a shared understanding of forest issues from their own discussions, members of The Forests Dialogue work together in a spirit of teamwork, trust, and commitment. They believe that their actions and relationships can help catalyze a broader consensus on forest issues and encourage constructive, collaborative action by individual leaders that will improve the condition and value of forests.

Members of TFD participate as individuals, rather than organizational delegates, and they aim to speak for a diversity of perspectives. TFD processes and activities are transparent, complement the actions of others, and seek to advance progress by creating leadership cadres on key issues based on individuals with broader personal consensus. Currently, TFD is focusing on issues related to illegal logging, forest certification, intensive forest management, forests and poverty alleviation, conservation forestry, and identifying a vision for conservation and management of the world’s forests.

GISF hosts the secretariat of TFD. Students have the opportunity to work with the secretariat to conduct background research on issues of interest to TFD and to assist the secretariat in dialogue planning and implementation.

**Program on Forest Physiology and Biotechnology**

The Program on Forest Physiology and Biotechnology (PFPB) focuses on the relationships of physiology, morphology, and genetics of forest plants to silviculture and sustainable forestry. The main objectives 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.

Current research is focused around two projects, the first of which is the anatomical, physiological, and optical properties of leaves in relation to (a) light intensity and quality, (b) distribution in tree crowns, (c) nutrient status, and (d) ecology and silviculture. A goal of this work is to scale up from the leaf to the tree to the canopy and forest by interfacing reflectance and fluorescence with hyperspectral data from high-resolution remote sensing. It is thought that these methods can provide reliable measurements of forest health. Ultimately, these signals may also identify distribution of species within forest canopies along with measurements of foliar function such as photosynthesis, and cellular phenotypic plasticity (palisade versus spongy mesophyll). Such evaluations can be
useful in evaluating sustainability under a variety of site conditions. In conjunction with these approaches, we are cooperating on studies of the anatomy and physiology of trees in many different areas of the world to determine optimal habitats for native species for sustainable forestry.

The second ongoing project concerns the development and use of organic biostimulants to maintain optimum plant growth while reducing fertilizer requirements and increasing natural stress resistance with respect to water, disease, insects, and toxic substances. Graeme P. Berlyn was one of the originators of the biostimulant concept for amplifying plant growth and stress resistance. Current work involves adding beneficial microbes (or their byproducts) to the biostimulant such as mycorrhizas and organisms that 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, and glutathione) in tree leaves in order to alleviate stress and increase photosynthesis.

The program is located in the Greeley Laboratory. There are numerous opportunities for students to be involved with the research taking place through the program.

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. To manage 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 College of Forest Resources Silviculture Laboratory and the USDA Forest Service. Its purpose is to develop the scientific basis, concepts, and tools needed to help forests 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 health and sustainable management of private forestlands. Our mission is to advance the state of knowledge about sustainable forestry on private forestlands at multiple scales and within multiple contexts. Program initiatives currently focus on forest fragmentation, forest
health, sustainability of family forests, management of eastern hardwoods, and changes in forestland ownership.

In order to advance the understanding and management of hardwood forests in the eastern United States, we are working on collaborative efforts on southern bottomland hardwoods. The goals are to enhance communication and collaboration among hardwood silviculturists to build the scientific knowledge base required to meet the future needs of private landowners focused on forest management in an ever more complex and challenging environment.

Faced with urban and suburban sprawl, forests in many parts of the United States are becoming increasingly fragmented, with implications for wildlife, invasive species, forest management, and local forest-based economies. 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 project is being piloted in the northeastern United States.

On the Family Forests Sustainability project, we are collaborating with a broad group of public and private institutions on a market research initiative to gain comprehensive knowledge about family forest owners in the United States. The goal is to ensure that the broad array of organizations working to improve sustainable forestry and conservation practices on private lands will have credible, useful, and compelling information about the landowners they are trying to reach and motivate.

Other projects currently under way include creation of an annotated bibliography and clearinghouse for forest fragmentation literature; organizing forums and workshops to foster informed dialogue about critical forest health risks, such as invasive species and wildfire, and developing strategies for dealing with those risks; and exploring changing ownership patterns on industrial timberlands and the implications of these changes for the conservation of environmental values of forests worldwide.

The Program on Private Forests is housed 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 10,880 acres of forestland in Connecticut, New Hampshire, and Vermont, which are maintained as working forests. 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 (a) maintaining the long-term ecological health of forests despite biotic, abiotic, and societal pressures, and (b) developing management solutions for restoring healthy forests and the communities that depend on them.
Increasingly, forests face multiple stresses from pest outbreaks, exotic invasive species, wildfires, disease, pollution, fragmentation, and human impacts. 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 policy makers and the public with topical, scientifically based information. As part of the School’s curriculum, we offer courses, seminars, and workshops for students and stakeholders, and for public awareness.

**Yale Forest Forum**

The Yale Forest Forum (YFF) is a program that serves as the dialogue and convening function of the institute. YFF was established in 1994 by a diverse group of leaders in forestry to focus national attention on broader public involvement in forest policy creation and the management of forests 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 be created: “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 constructively debate varying opinions. 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 but 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.

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

**CORPORATE ENVIRONMENTAL LEADERSHIP SEMINAR**

In June of each year, the School runs the Corporate Environmental Leadership Seminar (CELS), an intensive course in environmental management and policy for executives from industry, government, and NGOs. Begun in 1992, the seminar has attracted international participation by major companies and has established itself as the principal executive program in the United States to focus on environmental issues. The faculty for the seminar is interdisciplinary, drawn from many schools and departments within Yale, as well as invited industry experts.
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 external organizations and universities. These relationships enrich the School and add 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 Yale Divinity School, Law School, School of Management, the School of Medicine’s Department of Epidemiology and Public Health, and the Graduate School’s programs in International Relations, International Economics, and Development Economics. For further information on joint degrees, please refer to pages 48 and 51.

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, Management, Medicine, and the Faculty of Engineering, as well as the departments of Geology and Geophysics, Ecology and Evolutionary Biology, and Anthropology, among others. For a full list of the faculty with joint appointments, see page 12.

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 seven YIBS Research Centers: YIBS Center for Earth Observation; YIBS Center for the Study of Global Change, YIBS Center for the Ecology and Systematics of Animals on the Verge of Extinction (ECOSAVE); YIBS Field Ecology Center; YIBS Center for Stable Isotopic Studies of the Environment; and YIBS Microbial Diversity Center. The School’s current interests are most closely aligned with the Center for Earth Observation and the Field Ecology Center. 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 schol-
ars throughout the world. A growing Internet service makes catalogue data for more than one million of these specimens and objects available online at www.peabody.yale.edu. Workshops and laboratories in the fields of paleontology, archaeology, zoology, and evolutionary biology make the Peabody a working museum, where public exhibition, research, and teaching intersect.

The School of Forestry & Environmental Studies maintains a close association with the Peabody. The museum’s director and curators provide support for a concentration in museology under the F&ES Master of Environmental Studies program. The Peabody Field Station in Guilford, Connecticut, is used collaboratively for research on coastal and estuarine systems.

**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.

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 thirty-five 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 streamwater chemistry; and with biological data from numerous ongoing studies. Cooperative research at Hubbard Brook has contributed to a better understanding of the northern hardwood 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 midlevel managers in corporations, institutions, and government and nongovernmental organizations. This new program is multidisciplinary, with the combined resources of seven of the University’s faculties, and 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 to share scientific, academic, and technical resources; exchange faculty and students; and cooperate in research, outreach, and conferences.

**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 thirty-nine 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, with more than 1.25 million accessions, an herbarium with over six million specimens 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, chemoecological, numerical taxonomy, and vegetational studies.

**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 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 the TERI School of Advanced Studies, which was granted “Deemed-to-be-University” status by the government of India in 1998.

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.

**TSINGHUA UNIVERSITY**

Tsinghua University in Beijing is one of the leading universities in China. The School of Forestry & Environmental Studies and the Department of Environmental Sciences and Engineering at Tsinghua University are partners in the Environment and Sustainable Development Leadership Program (ESDLP). ESDLP provides leadership training for municipal officials from cities throughout China. ESDLP offers mayors and other officials in charge of city planning, construction, and environmental protection an intensive
week of seminars on urban sustainable development trends, challenges, and opportunities; sustainable development in urban ecosystems; and the principles and methods of industrial ecology and cleaner production. The initial week of seminars is followed by a two-week study tour in the United States or Europe.

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

Each applicant must be a graduate of a college or university and must provide a completed application form, a résumé/curriculum vitae, an essay discussing his/her reasons for applying, GRE scores, TOEFL scores for international students, transcripts from colleges and universities attended, and three letters of reference. (See Application Procedures, page 128, for detailed instructions.)

The Mid-Career Program is a one-year (two-term) M.E.M. or M.F. degree program for professionals who have worked for seven or more years in the natural resource and environmental fields and who wish to advance their current careers through additional training. The Mid-Career Program is not intended for those who are contemplating a major shift in fields of interest; for this purpose, the two-year degree program is more appropriate.

Applicants to the master’s degree programs are required to take the Graduate Record Examination (GRE). When taking the GRE, applicants should indicate the School’s Institution Code Number 3996; no department code is necessary. Applicants for whom English is not a native or customary language of instruction must take the Test of English as a Foreign Language (TOEFL). Both these tests are administered by the Educational Testing Service, Princeton, NJ 08541. For further information applicants should write directly to these organizations, or visit their Web sites at www.gre.org/com.html or www.toefl.org/index.html. Official test results should be sent directly to the Office of Admissions, Yale School of Forestry & Environmental Studies, 205 Prospect Street, New Haven CT 06511-2509.

All applicants must have satisfactory undergraduate records, but there are no arbitrary standards or cutoffs for GRE 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. The School looks for students capable of making effective contributions to scientific knowledge or to professional service in addressing environmental problems. The School gives special weight to relevant experiences obtained subsequent to graduating from college. Clarity regarding professional career goals is a critically important part of the applicant’s statement.

Faculty teams read all applications to the master’s degree programs. The final decision on admission rests on an integrated assessment of all the components described above.

PREPARATION FOR ADMISSION

The School welcomes applications from individuals who have undergraduate degrees in the biological and physical sciences, engineering, social sciences, humanities, or interdisciplinary programs. A disciplinary focus with some interdisciplinary breadth is valuable. Exposure to the biophysical sciences, the social sciences, and college mathematics permits students to take greater advantage of course work 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. The Committee on Admissions therefore favors applicants who have successfully completed the courses listed below before beginning a degree program at the School. 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. The ideal applicant has had the first two courses listed under each of the following three categories:

1. **College mathematics — two terms selected from:**
   a. calculus
   b. statistics
   c. linear algebra
   d. discrete mathematics

2. **Natural science — four terms selected from:**
   a. general biology
   b. general chemistry
   c. geology/earth science
   d. general physics

3. **Social science — four terms selected from:**
   a. introductory economics
   b. political science
   (micro and macro)
   c. sociology
   d. anthropology

Students who wish guidance in arranging their undergraduate programs in anticipation of graduate study at Yale are invited to correspond or consult with the Director of Admissions.

**ENGLISH AS A SECOND LANGUAGE TRAINING REQUIREMENT**

The Admissions Committee may require as a condition of acceptance 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’s Summer and Special Programs (or an equivalent program elsewhere).

This program begins in late June, preceding the summer training modules in technical skills, and includes fourteen hours per week of language instruction as well as general orientation to the United States, New Haven, and the Yale School of Forestry & Environmental Studies. For information about this program, please contact the Yale English Language Institute, PO Box 208355, New Haven CT 06520-8355, U.S.A., or visit their Web site at www.yale.edu/eli.

**APPLICATION PROCEDURES**

Application forms for admission to studies leading to the professional degrees of M.E.M., M.E.Sc., M.F.S., or M.F. may be acquired in several ways. The application form explains in detail the supporting documents required by the School. The application fee for the online application is $70.00; for a paper application the fee is $90.00.

2. Download application forms from our Web site at www.yale.edu/environment/admissions/masters_ap.pdf. They should be mailed directly to the Office of Admissions, Yale School of Forestry & Environmental Studies, 205 Prospect Street, New Haven CT 06511-2509, U.S.A.

3. E-mail fesinfo@yale.edu for application forms and they will be mailed to you.

4. Call the Office of Admissions at 1.800.825.0330 to request the forms.

5. Write directly to the Director of Admissions, Yale School of Forestry & Environmental Studies, 205 Prospect Street, New Haven CT 06511-2509, U.S.A.

The deadline for applications is January 14, 2005. Students are admitted only in the fall.

Learning About F&ES

Our Web site is full of information about the School, and hard copies of information may be requested at fesinfo@yale.edu. But the best way to get to know the School is to come to New Haven to visit, if possible.

Two Open Houses for prospective students are held during the fall term; a third is held in April for admitted students. Please visit the F&ES Web site at www.yale.edu/environment/ for the schedule. The Open Houses are full-day programs, including breakfast and lunch, where participants will learn from faculty, students, and staff about the mission and goals of the School, opportunities for research and applied projects, career development, and life at Yale.

Each Thursday morning when School is open (please check calendar on page 7), Information Sessions will be held from 9 to 11 a.m. Prospective will meet with members of the Admissions staff and current students. To register for an information session please e-mail us at fesinfo@yale.edu, or call the Office of Admissions at 1.800.825.0330.

We encourage prospective students to visit campus at other times if they are unable to attend an Open House or Information Session. It is best to visit campus on Monday through Thursday if possible. Fridays are generally reserved for field trips. You are welcome to sit in on any classes of interest with no advance notice; the class schedule each term is posted on our Web site. Feel free to contact faculty whose work is of interest to you directly; e-mail is best. We do not conduct formal interviews. To schedule a visit, please contact us as described above.

Finally, we will be pleased to correspond with you about the School by e-mail, or you may schedule a telephone conversation with our Admissions staff.
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 natural resources such as forestry, or in a relevant discipline of the natural or social sciences such as biology, chemistry, economics, or mathematics.

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, or by contacting the Yale Graduate Admissions Office, 320 York Street, New Haven CT 06511; telephone, 203.432.2771. The application deadline for the Ph.D. program is January 3, 2005. Before applying to the doctoral program, applicants are encouraged to discuss their career interest with one or more F&ES faculty members.

The Graduate Record Examination (GRE) general test is required of all applicants. Contact GRE-ETS, PO Box 6000, Princeton NJ 08541-7670; telephone, 609.771.7670; Web site, www.gre.org.

International applicants whose native language is not English and who have not studied for at least two years at a university where English is the primary language of instruction are required to present evidence of proficiency in English by satisfactorily completing the Test of English as a Foreign Language (TOEFL). Applicants should take the test no later than November, and no earlier than eighteen months prior to application. For information regarding registration, dates, and test centers, contact TOEFL/TSE Services-ETS, PO Box 6151, Princeton NJ 08541-6151; telephone, 609.711.7100; e-mail, toefl@ets.org; Web site, www.toefl.org.
Tuition, Fees, and Other Expenses

TUITION AND FEES, 2004 – 2005

Master’s Programs

The 2004–2005 tuition for master’s degrees (Master of Environmental Management, Master of Forest Science, Master of Environmental Science, and Master of Forestry) is $22,760. 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 the summer training modules in technical skills, the required University hospitalization insurance fee, 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 they take.

A fee of $900 is charged each participant in the training modules in technical skills. A single student in the module program should anticipate living expenses of approximately $865 for a three-week period.

Doctor of Philosophy Program

The tuition for the Ph.D. degree is $26,880. Most doctoral students receive a School fellowship that covers the cost of their tuition and provides a stipend for the nine-month academic year, for the first four years of their program. Doctoral students must pay a nominal continuing registration fee for no more than four years thereafter.

For 2004–2005, students should also anticipate expenses of $1,025 for books and supplies. A single student can expect living expenses of approximately $12,000 for room and board.

Registration

All students in the master’s programs must register for courses at the Office of the Registrar of the School of Forestry & Environmental Studies within two weeks of the first day of classes in the fall and spring terms (see calendar, page 7). 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 (see pages 157–58) prior to their regular academic registration.

Part-time Program

The charge per term 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.
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. This sequence must be followed by a related project course upon return to the School. A fee of $250 per term for this continuous registration is charged under this option.

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 POLICIES

Students enrolled at F&ES who withdraw during an academic term are subject to the following policies.

1. Students must submit a written request for withdrawal to the associate dean of academic affairs.

2. Tuition will be rebated on the following schedule:
   a. The summer module fee will be refunded in full if the student withdraws before the modules begin; thereafter no fee will be refunded.
   b. 100 percent of tuition will be rebated for withdrawals on or before the end of the first 10 percent of the term. In the fall term, that date is September 10, 2004; in the spring, that date is January 20, 2005.
   c. One-half (50 percent) of tuition will be rebated for withdrawals after the first 10 percent of the term but on or before the last day of the first quarter. The first-quarter date is September 25, 2004 in the fall term and February 4, 2005 in the spring term.
   d. One-quarter (25 percent) of tuition will be rebated for withdrawals after the first quarter of the term but before the midterm. In the fall, the midterm date is October 20, 2004; in the spring the date is March 3, 2005.
   e. Students who withdraw after the midterm date will not be eligible for a tuition rebate.
   f. The death of a student shall cancel tuition charges pro rata to the date of death.

3. Financial aid is refunded pro rata up to 60 percent of the term. The last day for refunds of federal student aid in the fall term is October 30, 2004; March 29, 2005 is the 60 percent date for the spring term. Federal regulations require that aid be refunded in the following order: first to the Unsubsidized and Subsidized Federal Stafford Loan; then to Federal Perkins Loan; next to any other federal, state, private, or institutional scholarships and loans; and finally, any remaining balance to the student.

Loan recipients must complete an exit interview in compliance with federal regulations. The Student Loan Office will contact recipients.
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.

Yale Charge Account

Students who sign and return a Yale Charge Card Account Authorization form will be able to charge designated optional items and services to their student accounts. Students who want to charge toll calls made through the University’s telephone system to their accounts must sign and return this Charge Card Account Authorization. The University may withdraw this privilege from students who do not pay their monthly bills on a timely basis. For more information, contact the Office of Student Financial Services at 246 Church Street, PO Box 208232, New Haven CT 06520-8232; telephone, 203.432.2700; fax, 203.432.7557; e-mail, sfs@yale.edu.

Yale Payment Plan

The Yale Payment Plan is a payment service that allows students and their families to pay tuition, room, and board in eleven or twelve equal monthly installments throughout the year based on individual family budget requirements. It is administered for the University by Academic Management Services (AMS). To enroll by telephone, call 800.635.0120. The fee to cover administration of the plan is $65. The deadline for enrollment is June 18. For additional information, please contact AMS at the number above or visit their Web site at www.tuitionpay.com.

Bills

A student may not register for any term unless all bills due for that and for any prior term are paid in full.

Bills for tuition, room, and board are mailed 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 a late charge 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. The late charge will be imposed as follows:

<table>
<thead>
<tr>
<th>If full-term payment in full is not received</th>
<th>Late charge</th>
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<tbody>
<tr>
<td>by August 1</td>
<td>$110</td>
</tr>
<tr>
<td>by September 1</td>
<td>an additional $110</td>
</tr>
<tr>
<td>by October 1</td>
<td>an additional $110</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>If spring-term payment in full is not received</th>
<th>Late charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>by December 1</td>
<td>$110</td>
</tr>
<tr>
<td>by January 2</td>
<td>an additional $110</td>
</tr>
<tr>
<td>by February 1</td>
<td>an additional $110</td>
</tr>
</tbody>
</table>
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.

**Charge for Returned Checks**

A processing charge of $20 will be assessed for checks returned for any reason by the bank on which they were drawn. In addition, the following penalties may apply if a check is returned:

1. If the check was in payment of a term bill, a $110 late fee will be charged for the period the bill was unpaid.
2. If the check was in payment of a term bill to permit registration, the student’s registration may be revoked.
3. If the check was given in payment of an unpaid balance in order to receive a diploma, the University may refer the account to an attorney for collection.

**M A S T E R ’ S  F I N A N C I A L A I D , 2 0 0 4 – 2 0 0 5**

**Policy and Procedures**

The School offers a combination of scholarships, employment, and loans to students with demonstrated financial need. 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 level of School aid will remain the same 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 November of the year prior to matriculation—November 2004 for matriculation in fall 2005, for example. New forms are available at the School’s Web site, www.yale.edu/environment/ or from the Financial Aid Office anytime after November 1. **Financial Aid applications must be postmarked by February 15.**

U.S. citizens requesting financial aid must complete the Free Application for Federal Student Aid (FAFSA), available in public libraries and on the Web at www.fafsa.ed.gov/ and a School of Forestry & Environmental Studies Financial Aid Application, available on the School Web site. International students need only to complete a School of Forestry & Environmental Studies Financial Aid Application.

**SCHOLARSHIPS**

Students who demonstrate financial need may receive a scholarship to cover a portion of the student budget. Because funds are limited, scholarships are awarded to the top admissions candidates only. In combination with employment and loans, these students can meet the full cost of their education. In addition to School scholarships, there are several special scholarship awards:
The Rockefeller-Underhill Scholarship for Tropical Conservation provides full funding to a native of Central or South America who intends to pursue a career in tropical conservation in Latin America (not available 2005–2006). The Evan Frankel Fellowships are funded under a grant from the Evan Frankel Foundation, and are geared to providing deep scholarship support to students from developing countries, particularly those countries with high biodiversity.

The GE Fund Environmental Scholars Program has been established to provide scholarship assistance for students from traditionally underrepresented communities in the United States. Applicants must complete the School’s Financial Aid Application and the FAFSA.

A number of additional endowed scholarships are also available. Grants range from $2,000 to $8,000 and are awarded on the basis of need, scholarship, professional promise, and other criteria specified by the donors. The Philip Laurance Buttrick Fund makes awards to selected students, with preference given to students of American Indian descent. The Paul Douglas Camp Scholarship is awarded to a student or students interested in forestry, forest management, or the use of forest products. The recipient of this scholarship must be a resident of Virginia, North Carolina, South Carolina, Florida, or Georgia. The Crown Zellerbach Foundation Fund provides graduate fellowships, with preference given to graduates of institutions in Oregon or Washington. Students entering in 2004 who are planning to pursue conservation careers may apply for approximately ten Doris Duke Conservation Fellowships provided by the Doris Duke Charitable Foundation to assist them with one subsequent year of tuition support. Funds are also available to aid these Fellows in summer internships with nonprofit and public agencies in the conservation field and for loan repayment assistance. The Enid Storm Dwyer Scholarship is awarded to a student with an interest in conservation and the environment. The John S. Griswold Scholarship is awarded to a student demonstrating financial need. The H. Stuart Harrison Fellowships are awarded to students of environmental studies. The Marvin Klemme Fellowship is awarded to a student interested in research on the genetics of oaks or other slow-growing tree species, or to a student interested in research on tropical ecosystems. The Kroon Family Tercentennial Fund provides scholarships to Yale College graduates interested in pursuing an advanced degree in Forestry & Environmental Studies. The Fred Krupp Scholarship in Environmental Studies is awarded to graduate students who intend to pursue a position with an American nongovernmental environmental organization upon graduation. The John A. MacLean Scholarships are awarded to graduate students interested in forest conservation. The John M. Musser Fellowships in Population and Environment are awarded to candidates who study the relationship between human population and the use and management of the environment, with priority given to women and minority students. The Alan N. Mann Memorial Fellowships are awarded to students demonstrating financial need. The Carl F. Norden Scholarship is awarded to a student demonstrating financial need. The Gilman Ordway Family Scholarship Fund for Environmental Studies makes awards to students who will give serious consideration to a career in environmental studies either with a nongovernmental private organization or in a government job devoted to national resource protection. The Leonard Carpenter Scholarships
are awarded to students engaged in the study of environmental and natural-resource topics. The Mrs. James Wiley Scholarship Fund makes awards to students interested in conservation and conservation biology. The Charles F. Wilson and the Ray L. Wilson Scholarships are awarded to students interested in forestry.

**NATIONAL FELLOWSHIPS AND SCHOLARSHIPS**

Students are strongly urged to compete for outside fellowships and scholarships which can be used at Yale. These fellowships are sponsored by both public and private agencies and are often generous. In addition to financial advantages, the student who wins 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. Outside awards may be matched with School awards up to combined levels that are no higher than the normal educational expense budget.

**EMPLOYMENT OPPORTUNITIES**

Student Employment opportunities are listed at the Student Employment Office at 246 Church Street, or on its Web site at www.yale.edu/seo. Positions are located throughout the University and the City of New Haven, with hourly rates of $11 to $15. A list of jobs at the School is available in late summer.

Teaching Fellowships are also available at the University. Each department makes its own hiring decisions; therefore, interested students must contact them directly. The typical salary is $3,500 per term.

**LOANS**

Yale University participates in two federal student loan programs: the Stafford program and the Perkins program. To qualify, a student must be a U.S. citizen and meet certain requirements determined by the FAFSA.

Graduate students are eligible to borrow up to $18,500 in Stafford loans, of which up to $8,500 may be subsidized by the federal government. Perkins loans, capped at $6,000, are available to students who demonstrate need beyond the level of a subsidized Stafford loan. While Stafford loans are available to all eligible borrowers, Perkins loans are limited by available funds. For more details on these programs, refer to the government Web site at www.fafsa.ed.gov.

**International Student Financial Aid**

In order to apply for financial aid from the School, international students must complete the School of Forestry & Environmental Studies Financial Aid Application, available on the School Web site. It must be completed and postmarked by February 15. The Financial Aid Office offers scholarships and employment opportunities to as many international students as our resources will allow; however, most students need additional sup-
port. It is for this reason that international students are encouraged to seek support from their government, employer, or various international agencies.

Three full scholarships will be offered to international students from Africa, Asia, and Latin America. All admitted students are automatically considered. Awards are based on the strength of the applicant’s admissions material and will cover all costs for the two-year program. The School also has agreements with a number of international organizations to provide matching funds in order to cover all costs for two years. Students are encouraged to contact organizations such as the Muskie Program administered by the Open Society Institute (a Soros foundation) for students from countries once belonging to the former Soviet Union, the Joint Japan/World Bank Scholarship Program for students from countries supported by the World Bank, the LASPAU program for Latin Americans, and the ATLAS program for African students.

International students must certify full funding for their entire course of study before visa documents can be issued. Instructions and forms are mailed with admission decisions. More information is available at the Web site of Yale’s Office of International Students and Scholars (www.oiss.yale.edu).
Life at the School of Forestry & Environmental Studies

EDUCATIONAL FACILITIES

Sage Hall, a four-story building located at 205 Prospect Street, is the headquarters of the School of Forestry & Environmental Studies. The building, the gift of William H. Sage, B.A. 1865, in memory of his son, DeWitt Linn Sage, B.A. 1897, was completed in 1923. The administrative offices and library of the School are housed in Sage Hall, along with three classrooms. Sage Hall is home to a microcomputer center for students, with over thirty-five IBM and Apple computers, each with GIS capabilities. Sage also houses an 800-square-foot student lounge, appointed with a large table and comfortable couches, which students use for studying, special events, and weekly social events. The dean’s office and some faculty offices are also located in Sage.

Bowers Auditorium is a room 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, is a modern, one-story building with a classroom and seven laboratories for work in environmental chemistry, wood anatomy and developmental morphology, soils, plant and wildlife ecology, tree physiology, forest microbiology, and forest pathology. 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 210, 230, and 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, the Doctoral Program Office, and the Development and Alumni/ae Office of the School. In addition, the buildings at 230 and 301 Prospect Street and 380 Edwards have a classroom each.

Library
The Henry S. Graves Memorial Library at the School of Forestry & Environmental Studies is one of the oldest and largest collections of forestry, natural resource, and related publications in the world. It is named in honor of the School’s first dean, 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 Library consist of more than 135,000 books, documents, technical reports, and serial publications dealing with forestry, forest science, natural resource management, and environmental sciences and management. The library receives some 650 journals, periodicals, and other serial publications. The greater portion of the library’s collection, comprising material dating from the eighteenth century to the 1960s and periodical backfiles, is housed in the Seeley G. Mudd Library, one block from Sage Hall. The more recent part of the collection is housed on the fourth floor of Sage Hall.

The library 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 on page 159.

Reference and information services are provided locally, and additional aid is available from reference librarians in the nearby Kline Science and Social Science libraries. Access to electronic databases covering environmental, forestry, and natural resource topics, such as CSA’s Environmental Science and Pollution Management and TREE-CD, 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, and wildlife, are accessible throughout the campus, and are supplemented by an in-house CD-ROM resource, Wildlife and Ecology Studies Worldwide and Water Resources Abstracts.

Library resources outside of Yale are accessed primarily through the Research Libraries Information Network (RLIN), the communications link between Yale and some eighty research libraries belonging to the Research Libraries Group (RLG). These network and membership connections have become increasingly important for arranging interlibrary loans and photocopies of highly specialized research materials.

School Forests
The School owns and manages approximately 11,000 acres of forest land. The main goals of this ownership are to provide education, research, and professional opportunities for the faculty and students. The forest consists of eight tracts located in Connecticut, New Hampshire, and Vermont. A majority of the activity is concentrated on the Yale-Myers
Forest, a contiguous parcel of 7,840 acres in northeastern Connecticut. Most of the School forests are mixed hardwoods (central hardwoods in the South and northern hardwoods in Vermont), but extensive stands of conifers exist, including some plantations. Almost all New England soil conditions are found on these lands from wetlands to droughty alluvial sand deposits.

The forests are used by faculty and students as laboratories for teaching and research. A member of the faculty serves as director, and all day-to-day management is carried out by students working as interns or managers. The forest is maintained as a working forest, which includes selling timber and other products from the land. Students working on the forest get experience as land managers, including such social aspects of management as relationships with neighbors and compliance with local and state regulations.

Much of the research on the forest involves experimentation on the effects of management, including harvesting, as well as a significant number of aquatic and terrestrial wildlife ecology research projects. Research opportunities are under the supervision of any faculty member of the School and include biological, silvicultural, wildlife, economic, legal, and social studies. Wildlife ecology, hydrology, and silviculture are current major emphases. The forest is used for doctoral research. Many students complete summer internships on the forest either as managers or as research assistants.

The forest is used for field trips in many courses, and workshops are frequently held on these lands on such topics as timber harvesting and prescribed burning. Students often do their independent projects on the forest or in conjunction with the management of these lands. Short courses and demonstrations held on the forest show management techniques in wetland areas, wildlife habitat manipulation, ecosystem restoration, and pathways of forest stand development.

Students working on the management of the forest use Geographic Information Systems as well as other databases to incorporate physical site characteristics (like topography and watercourses) with biological information (like the Continuous Forest Inventory system) and management information (like harvest maps). On the ground, students mark trees for thinning and harvest, lay out timber sales, conduct stand examinations and inventories, and maintain roads. In the office, students prepare tax documents, analyze data, prepare contracts, and write management plans.

In addition to the land controlled outright by the School, close working relationships exist with other forests that are used for education and research by faculty and students. The Great Mountain Forest in northwestern Connecticut (approximately 6,800 acres) is available to the School through the courtesy of Edward C. Childs, B.A. ’28, M.F. ’32, and his family. The lands of the South Central Connecticut Regional Water Authority (approximately 20,000 acres) in New Haven county are one of the oldest managed forests in the western hemisphere. The University also owns several ecological preserves (approximately 370 acres) that are available to faculty and students.
The School produces both general interest and scholarly publications. The School’s general interest publications include the biannual magazine Environment: Yale, the newsletter Yale Environmental News in cooperation with the Yale Institute for Biospheric Studies and the Peabody Museum of Natural History, and newsletters and bulletins from its centers and programs. On the scholarly side, the Yale F&ES Publication Series produces books and working papers based on environmental conferences, courses, and events at Yale of special interest to a wider professional audience. Recent titles include Global Environmental Governance: Options and Opportunities; Human Population and Freshwater Resources: U.S. Cases and International Perspectives; Developing Industrial Ecosystems: Approaches, Cases, and Tools; Climate Change and Development; Species and Ecosystem Conservation: An Interdisciplinary Approach; and Transformations of Middle Eastern Natural Environments: Legacies and Lessons. For a complete listing of titles, free downloadable PDFs of individual chapters, and ordering information for printed copies, go to www.yale.edu/environment/publications.

The School has many student-run interest groups. Current student groups include the student chapter of the American Water Resources Association (AWRA), the Coalition for Agriculture, Food, and Environment (CAFÉ), the Energy Interest Group, the Environment and Development Interest Group, the Faith Environment Religion Nature Spirituality Network, the Forestry Club, the Forest Stewards Guild, the Industrial Environmental Management Interest Group, the Information Technology Interest Group, the Integrated Student Development Coalition, a student chapter of the International Society of Tropical Foresters (ISTF), the Latin American SIG, the Land Use Coalition at Yale (LUCY), Loggerrhythms (LOGS), the Multi-Ethnic Student Association (MESA), the New England Student Interest Group, Other Voices—Alternative Perspectives on Environmental Problems, Social and Community Oriented Research on the Environment (SCORE), the Social Ecology Interest Group, a student chapter of the Society of American Foresters (SAF), the Yale chapter of the Society for Conservation Biology, the Society for Marine and Coastal Studies, the Student Advisory Committee (SAC), Special Trees in the Forest (STIF), the Western Resource Group (Westies), the Yale Environmental Health Association (YEHA), and the Yale Environmental Law Association (YELA). 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, maintaining electronic lists, organizing a first-year/second-year mentor program, holding a welcome reception prior to fall registration, planning holiday parties, conducting a spring auction, and holding weekly gatherings. Many groups also use such facilities as the Peabody Museum Field Station, with its associated salt marsh and seventeen-acre island, and the Yale-Myers Forest.
ALUMNI/AE ASSOCIATION

Alumni/ae of the School are organized into an active body known as the Alumni Association, Yale School of Forestry & Environmental Studies. This association is part of the Association of Yale Alumni, which serves all alumni/ae of the University. The association holds regular meetings at the School and hosts regional gatherings around the country and around the world, especially at annual meetings such as those of the Land Trust Alliance, the Ecological Society of America, and the Society of American Foresters. The Executive Council administers the Distinguished Alumnus Award and advises the director of Alumni/ae Affairs and the officers of the School on the Annual Fund and the Annual Reunion. The School’s journal Environment: Yale, published twice each year, keeps alumni/ae throughout the world in touch with each other and with the School. All graduates are encouraged to stay in touch with each other and the School through an electronic database maintained by Yale.

PROFESSIONAL DEVELOPMENT

Career Development Office

The overall goal of the School’s Career Development Office (CDO) is to assist students in charting a course that will lead them to a career fitting their interests, skills, and abilities. Our diverse resources and services enable users to learn about themselves, determine how their accumulated experiences will translate into meaningful career goals, and how to conduct effective job searches. To meet this goal, the office offers an extensive collection of resources and programs to help students set personal and career goals, assess the natural resources market, network and conduct job searches, write resumes, interview, prepare grant proposals, seek internships, look for fellowships and other funding opportunities, and address other contemporary career-related issues. Alumni/ae seminars, career days, and recruiting fairs, as well as our worldwide alumni/ae network, provide students with an opportunity to make contacts and explore career possibilities. The CDO’s Global eRecruiting Outreach (GeO) Program links students, alumni/ae, and employers through job and internship postings and on and off campus recruiting events; see http://yalefesgeo.erecruiting.com/er.

The Career Development Office has an extensive collection of informational aids describing federal, state, for-profit, and not-for-profit natural resource organizations and opportunities in the United States and around the world. The office subscribes to all the major job vacancy announcement publications and receives them either in paper form or in a format that is accessible to students and alumni/ae anywhere via the World Wide Web. The office’s Web site at www.yale.edu/fescareers/ provides much additional career information to users, including activities of graduates six months following graduation, as well as details on each year’s summer internship activities. Salary information about recent graduates is also included. Students attending the School have the most important career resources available to them on a daily basis — faculty and fellow students. Individual professors provide a wealth of information and career assistance, and the School’s student body represents an exceptional degree of experience and expertise. Students interacting with one another develop a lifetime resource of professional contacts.
The office is open to all master’s and doctoral students and alumni/ae of the School of Forestry & Environmental Studies. Students’ spouses and significant others may also use the service to assist their local job searches. Yale College students and other Yale graduate and professional students seeking environmental careers may also use many of the resources.

**Internships**

Internships 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. Attention is given to students to help them enter programs that meet their individual needs and interests.

Given the School’s strong ties with natural resource organizations worldwide, internship possibilities are virtually unlimited. Typical internships occur between the first and second years of the program; occasionally internships last for longer periods of time. The following list shows the rich and diverse experiences that F&ES students had in a recent summer. Similarly impressive lists can be found on the Web at www.yale.edu/fescareers/cdostud_info.htm.

**Summer 2003 Internships**

**NGOS AND OTHER NOT-FOR-PROFIT GROUPS**

1000 Friends of Washington, Intern, WA  
Archbold Biological Station, Intern, FL  
The Brookings Institution, Summer Intern, DC  
Center for Biological Diversity, Wildlands and Endangered Species, Desert Conservation Associate, CA  
Center for International Forestry Research, Research Intern, Belize  
Chicago Field Museum, Field Researcher, Peru (2)  
Connecticut Association of Conservation and Inland Wetland Commissions, Intern, CT  
The Consensus Building Institute, Graduate Associate, MA  
Conservation International, Intern, DC  
Defenders of Wildlife, Habitat Conservation Intern, DC  
Ecotrust-Forestland Investment Fund, Intern, OR  
Environmental Defense, Independent Researcher, DC  
Environmental Resources Trust, Inc., Researcher, DC  
Geneva Point Center, Curriculum Coordinator, NH  
Instituto de Estudos Socio-Ambientais do Sul da Bahia — Perceptions of Participation between an NGO and a Community Association, Brazil  
Instituto de Pesquisa Ambiental da Amazônia, Contributing Researcher, Brazil  
Inter-American Development Bank, Intern, DC  
IUCN – The World Conservation Union, Research Intern, Vietnam  
Kalpavriksh, Independent Research — Developing Visions: Discourse and Participation in a Biodiversity Planning Process, India
Land Trust of Napa County, Land Management Intern, CA
Maine Coast Heritage Trust, Conservation Planner, ME
Montana Smart Growth Coalition, Planning Intern, MT
Natural Resources Defense Council, Intern, CA
The Nature Conservancy, Conservation Intern, CA
The Nature Conservancy, Intern, CA
Norfolk Land Trust, Volunteer/Independent Researcher, CT
OceanA, Policy Intern, DC
QLF/Atlantic Center for the Environment, Community Forest Intern, MA
QLF/Atlantic Center for the Environment, Intern, ME
Rocky Mountain Institute, Summer Associate, CO (2)
Shareholder Action Network, Summer Intern, DC
Tellus Institute — Center for Impact Assessment and Management, Intern, MA
Temperate Forest Foundation, Intern, OR
Urban Ecology Institute, Community Forester, MA
World Agroforestry Centre — ICRAF, Independent Researcher, Kenya
World Resources Institute, Intern — EMBARQ Project, DC
World Resources Institute, Intern — GHG Protocol Initiative, DC
Frank Lloyd Wright Foundation, Land Trust Legal Intern, AZ

BUSINESS AND INDUSTRY
Cherokee Investment Partners, LLC, Intern, NC
Chicago Climate Exchange, Summer Associate, NY
E Magazine, Intern, NY
ENEL SpA, Intern — CDM Projects in the Mediterranean Region, Italy
Environmental Resources Management, Assistant to Project Manager, China
Evolution Markets LLC, Intern, NY
GE Corporate — Environmental Programs, Health and Safety Intern, CT (2)
GE Corporate — Environmental Programs, Transactions Intern, CT
Haley & Aldrich, Inc., Environmental Management Specialist, CT
Industrial Economics, Inc., Summer Intern, MA
Institute for Public-Private Partnerships, Intern, DC
MeadWestvaco Corporation, Independent Researcher, WV
Northeast Utilities, Associate Environmental Specialist, CT
Shell Oil Company, Climate Change Analyst, United Kingdom
Steptoe & Johnson, LLP, Legal Floater Secretary/Research Assistant, DC

GOVERNMENTAL AND PUBLIC SECTOR GROUPS
Agro-Farm Forester's Association, Independent Researcher, Nepal
California State Resources Agency, Policy Intern, CA
City of New York, Intern, NY
City of New York/Parks & Recreation, Forester, NY
City of New York/Parks & Recreation, Research Intern, NY
City of Seattle, Forest Ecology Intern, WA
International Council for Local Environmental Initiatives, Environmental Assistant/Intern, CT (2)
Korea Environment Institute, EIA Assistant, Korea
State of Massachusetts – Metropolitan District Commission, Division of Watershed Management, Apprenticing Field Forester, MA
Massachusetts Division of Energy Resources, Research/Policy Intern, MA
National Park Service, Biological Technician, MA
New York City Law Department, Student Legal Specialist — Environmental Law Division, NY
Paris City Hall/Mairie de Paris, Intern — Development and Large-Scale Projects, France
State Environmental Protection Administration, Researcher — Department of Nature Conservation, China
United Nations Development Program, Intern
United Nations Economic & Social Commission for Asia & Pacific, Summer Intern, Thailand
United Nations Industrial Development Organization, Intern, Indonesia
USDA – Forest Service, Researcher, MD
U.S. Environmental Protection Agency, Environmental Scientist, DC
U.S. Environmental Protection Agency, Intern, DC
U.S. Environmental Protection Agency — New England, Region 1, Student Intern, MA
U.S. Environmental Protection Agency, Intern — Office of Policy, Economics & Innovation, DC
WGBH Educational Foundation, Intern, MA
The World Bank, Consultant, DC
The World Bank, Summer Intern, DC

EDUCATION
Global Institute of Sustainable Forestry, Assistant, CT
Global Institute of Sustainable Forestry, Program Director, CT
Harvard Forest — Red Maple Redux, MA
Hixon Center for Urban Ecology, Independent Researcher, CT
Institute for Central American Development Studies, Student/Volunteer, Costa Rica
Madagascar Institute Conservation des Environnements Tropicaux, Researcher, Madagascar
Pace University — School of Law, Research Assistant, NY
Yale School Forests, Apprentice Forester, CT (4)
Yale University — Peabody Museum of Natural History, NSF Teaching Fellow, CT
Yale University — Program on Forest Certification, Independent Research-Forest Certification Policy, Finland
Yale University — School of Forestry & Environmental Studies, Field Researcher, CT
Yale University — School of Forestry & Environmental Studies, Research Assistant, CT (5)
Yale University – School of Medicine, Research Assistant, CT
U.S. RESEARCH (NON-HOSTED)
Independent Research: A Case Study of Sustainable Practices in the Fashion Industry, Multi-country
Independent Research — Assisting Coalition for Sound Growth in Efforts to Address the Yale Farm Golf Project, CT
Independent Research — Community Gardens in the South Bronx: A Case Study of Social Benefits and Management Schemes, CT
Independent Research — Interfacing Hydrology with the Landscape Management System, CT
Independent Research — Natural Processes that Human Activity and Development Have Made More Severe, in the Eastern Edge of Metropolitan Development, LA

NON-U.S. RESEARCH (NON-HOSTED)
Independent Research — Cease-Fire Concessions: The Political Ecology of Natural Resource Extraction in Kachin State, Burma
Independent Research — Community Responses to International Reforms: A Case Study of Nuevo San Juan’s Response to Privatization, Mexico
Independent Research — Irrigation Water Pricing in the Chao Phraya Basin, Thailand
Independent Research — Land-Use Change and Deforestation in the Extractive Reserves, Brazil
Independent Research — Watershed Governance in the Antigua River Basin, Mexico

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

The School and its students would like to thank donors and 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.yale.edu/cdostud_info.htm.

Following each graduation about 15 percent of the master’s students go on for further study, primarily in Ph.D. programs. The remaining graduates’ employment is split, with about a quarter of the class in NGOs and other not-for-profit groups and a quarter in business and industry (including consulting). The remainder is divided between governmental/public-sector groups and education employers.
University Services and Privileges

A GLOBAL UNIVERSITY

In celebrating the Yale Tercentennial in 2001, President Richard C. Levin gave special weight to “Yale's intention to become a truly global institution” by building on existing relationships and international activity. Since that time, the University has made great strides to intensify and broaden its efforts in the international arena. Exchanges of students, faculty, researchers, and fellows have grown significantly. Programs of study and research across the University increasingly incorporate international subject matter. To enhance all its initiatives in this direction, the administration has created a number of organizations and other specialized resources.

The most recently established organizational unit, inaugurated in 2003–2004, is the Office of International Affairs, which serves as an administrative resource to support the international activities of all schools, departments, offices, centers, and organizations at Yale; to promote Yale and its faculty to international audiences; and to increase the visibility of Yale's international activities around the globe. Web site: www.yale.edu/oia.

The Office of International Affairs joins a range of other institutional resources, including:

Yale Center for International and Area Studies (YCIAS), the University’s principal agency for encouraging and coordinating teaching and research on international affairs, societies and cultures; www.yale.edu/ycias.

Yale Center for the Study of Globalization, which draws on the rich 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, while helping to enrich debate through workshops, conferences, and public programs; www.ycsg.yale.edu.

Office of International Students and Scholars (OISS); www.oiss.yale.edu. See the description on pages 157–58.

Yale World Fellows Program, which hosts twelve to eighteen Fellows from outside the U.S. each year for a term of concentrated study and close contact on the Yale campus; www.yale.edu/worldfellows.

For additional information: “Yale and the World” is a compilation, on the Yale Web site, of resources for international students, scholars and other Yale affiliates interested in the University’s global initiatives: http://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 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 2004–2005 are available as of April 1 online and can be submitted directly from the Web site (www.yale.edu/graduatehousing). A copy of your letter of acceptance from Yale will need to be submitted to the address on the application form. The Web site is the venue for graduate housing information and includes procedures, facility descriptions, floor plans, and rates. For more dormitory information, contact beverly.whitney@yale.edu, tel. 203.432.2167, fax 203.432.4578. For more apartment information, contact betsy.rosenthal@yale.edu, tel. 203.432.8270, fax 203.432.0177.

The University’s Off-Campus Housing service, limited to current or incoming members of the Yale community, is located at 155 Whitney Avenue, 3d floor, and is open from 8.30 a.m. to 3.30 p.m., Monday through Friday. The listings may also be accessed from any computer at Yale through the intranet at www.yale.edu/offcampushousing. Call 203.432.9756 to obtain the necessary passwords to access the system from other areas.

DINING AT YALE

Yale University Dining Services has tailored its services to meet the particular concerns of graduate and professional school students by offering meal plan options. “Eli Bucks,” a favorite choice based on declining points, are accepted in all campus locations in lieu of cash. Whether residents or nonresidents of University housing, students are invited to take advantage of Yale University Dining Services.

The following dining areas and snack bars are available to students: A&A Penthouse at the School of Architecture; the Divinity School Cafe on Prospect Street; the dining room of the Kline Biology Tower; Donaldson Commons at the School of Management; and Durfee’s, a traditional convenience store offering coffee, snacks, sandwiches, soft yogurt, and a variety of convenience items. Students are also encouraged to dine in any of Yale’s residential college dining rooms, where students without meal contracts may purchase “all-you-care-to-eat” meals at fixed prices for breakfast, lunch, and dinner. Payment for these meals can be arranged by securing a Yale charge account from the Office of Student Financial Services at 246 Church Street.

Inquiries concerning food services should be addressed to Yale University Dining Services, 246 Church Street, PO Box 208261, New Haven CT 06520-8261; telephone 1.888.678.9837 (toll free), or 203.432.0412. Dining Services can also be found on the Web 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

Yale University Health Services (YUHS) is located on campus at 17 Hillhouse Avenue. YUHS 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 twenty-three-bed inpatient care facility (ICF), a round-the-clock urgent care clinic, and such specialty services as allergy, dermatology, orthopedics, and a travel clinic. YUHS also includes the Yale Health Plan (YHP), a health coverage option that coordinates and provides payment for the services outlined above, as well as for emergency treatment, off-site specialty services, inpatient hospital care, and other ancillary services. YUHS’s services are detailed in the YHP Student Handbook, available through the YHP Member Services Department, 203.432.0246, or on the YHP Web site at www.yale.edu/uhs.

Eligibility for Services

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

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

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

All students are welcome to use specialty and ancillary services at YUHS. Upon referral, YHP will cover the cost of these services if the student is a member of YHP Hospitalization/Specialty Care Coverage (see below). If the student has an alternate insurance plan, YHP will assist in submitting the claims for specialty and ancillary services to the other plan and will bill through the Office of Student Financial Services for noncovered charges and services.

Health Coverage Enrollment

The University also requires all students eligible for YHP Basic Coverage to have adequate hospital insurance coverage. Students may choose YHP 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 form by the University’s deadlines noted below.

**YHP HOSPITALIZATION/SPECIALTY COVERAGE**

Students are automatically enrolled and charged a fee each term on their Student Financial Services bill for YHP 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 September 1 through August 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, YHP 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 August 31.

For a detailed explanation of this plan, see the *YHP Student Handbook*.

**Waiving the YHP Hospitalization/Specialty Coverage:** Students are permitted to waive YHP Hospitalization/Specialty Coverage by completing a waiver form that demonstrates proof of alternate coverage. Waiver forms are available from the YHP Member Services Department. It is the student’s responsibility to report any changes in alternate insurance coverage to the YHP Member Services Department. Students are encouraged to review their present coverage and compare its benefits to those available under the YHP. 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 YHP Hospitalization/Specialty Coverage but later wish to be covered must complete and send a form voiding their waiver to the YHP 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. YHP premiums will not be prorated.

**YHP STUDENT TWO-PERSON AND FAMILY PLANS**

A student may enroll his or her lawfully married spouse or same-sex domestic partner and/or legally dependent child(ren) under the age of nineteen in one of two student dependent plans: the Two-Person Plan or the Student Family Plan. These plans include coverage for YHP Basic Coverage and for coverage under YHP Hospitalization/Specialty Coverage. YHP Prescription Plus Coverage may be added at an additional cost. Coverage is not automatic and enrollment is by application. Applications are available from the YHP Member Services Department or can be downloaded from the YUHS Web site (www.yale.edu/uhs) 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.
YHP STUDENT AFFILIATE COVERAGE

Students on leave of absence or extended study or students paying less than half tuition may enroll in YHP Student Affiliate Coverage, which includes coverage for YHP Basic and for the benefits offered under YHP Hospitalization/Specialty Coverage. Prescription Plus Coverage may also be added for an additional cost. Applications are available from the YHP Member Services Department or can be downloaded from the YUHS Web site (www.yale.edu/uhs) and must be received by September 15 for full-year or fall-term coverage, or by January 31 for spring-term coverage only.

YHP PRESCRIPTION PLUS COVERAGE

This plan has been designed for Yale students who purchase YHP Hospitalization/Specialty Coverage and student dependents who are enrolled in either the Two-Person Plan, the Student Family Plan, or Student Affiliate Coverage. YHP Prescription Plus Coverage provides protection for some types of medical expenses not covered under YHP Hospitalization/Specialty Coverage. Students are billed for this plan and may waive this coverage. 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. For a detailed explanation, please refer to the YHP 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 YHP Hospitalization/Specialty Coverage and/or YHP Prescription Plus Coverage. The student will not be eligible for any YHP benefits, and the student's YHP 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 YHP for thirty days following the date of withdrawal or to the last day of the term, whichever comes first. Premiums will not be prorated. Students who withdraw are not eligible to enroll in YHP Student Affiliate Coverage.

Leaves of Absence: Students who are granted leaves of absence are eligible to purchase YHP Student Affiliate Coverage during the term(s) of the leave. If the leave occurs during the term, YHP Hospitalization/Specialty Coverage will end on the date the leave is granted and students may enroll in YHP 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. Coverage is not automatic and enrollment forms are available at the YHP Member Services Department or can be downloaded from the YUHS Web site (www.yale.edu/uhs).

Extended Study or Reduced Tuition: Students who are granted extended study status or pay less than half tuition are not eligible for YHP Hospitalization/Specialty Coverage and YHP Prescription Plus Coverage. They may purchase YHP Student Affiliate Coverage
during the term(s) of extended study. This plan includes coverage for YHP Basic and for the benefits offered under YHP Hospitalization/Specialty Coverage. Coverage is not automatic and enrollment forms are available at the YHP Member Services Department or can be downloaded from the YUHS Web site (www.yale.edu/uhs). Students must complete an enrollment application for the plan prior to the start of the term.

For a full description of the services and benefits provided by YHP, please refer to the YHP Student Handbook, available from the YHP Member Services Department, 203.432.0246, 17 Hillhouse Avenue, PO Box 208237, New Haven CT 06520-8237.

**Required Immunizations**

*Measles (Rubeola) and German Measles:* All students who were born after December 31, 1956, are required to provide proof of immunization against measles (rubeola) and German measles (rubella). Connecticut state law requires two doses of measles vaccine. The first dose must have been given after January 1, 1969, and after the student’s first birthday. The second dose must have been given after January 1, 1980. These doses must be at least 30 days apart. Connecticut state law requires proof of one dose of rubella vaccine administered after January 1, 1969, and after the student’s first birthday. 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 and rubella.

*Meningococcus (Meningitis):* All students living in on-campus housing must be vaccinated against Meningococcal disease. The law went into effect in September 2002, meaning that all returning students who plan to live in University housing must be immunized or show proof of immunization within the last five years. Students who are not compliant with this law will not be permitted to register for classes or move into the dormitories for the fall term, 2004. Please note that the State of Connecticut does not require this vaccine for students who intend to reside off campus.

Students who have not met these requirements prior to arrival at Yale University must receive the immunizations from YHP 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 1. 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 in William L. Harkness Hall (WLH), Rooms 102 and 103. Access to the Resource Office is through the College Street entrance to WLH. Office hours are Monday through Friday, 8:30 a.m. to 4:30 p.m. Voice callers may reach staff at 203.432.2324; TTY/TDD callers 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).

OFFICE OF INTERNATIONAL STUDENTS AND SCHOLARS
The Office of International Students and Scholars (OISS) coordinates services and support to 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. OISS 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 in the United States, 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 information about orientation activities for newly arrived students, scholars, and family members. OISS programs, like the monthly international coffee hours, daily English conversation programs, and orientation receptions for newly arrived graduate students and postdocs, 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 maintains an extensive Web site (www.oiss.yale.edu) with useful information for students and scholars prior to and upon arrival in New Haven. As U.S. immigration regulations are complex and change rather frequently, we urge international students and scholars to visit the office and check the Web site for the most recent updates. International graduate students, postdocs, and visiting scholars can get connected with OISS by subscribing to one or both of the OISS e-mail lists. OISS-L is the electronic newsletter with important information for Yale’s international community. YaleInternational E-Group is an interactive list through which over 1,000 international students and scholars keep each other informed about events in the area. Check the Web site for more information. To subscribe to either list, send a message to oiss@yale.edu.

Spouses and partners of international students and scholars will want to know about ISPY — International Spouses and Partners at Yale. Information about ISPY and other OISS programs can be found on the OISS Web site.

The Office of International Students and Scholars, located at 246 Church Street, Suite 201, 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.

THE INTERNATIONAL CENTER

Established in 1949, the International Center of New Haven is a nonprofit community-based organization. The Center’s programs are based on the idea that both the international community in Greater New Haven and the local community can benefit from each other. The Center is located at 442 Temple Street, and the office is open from 9 a.m. to 4:30 p.m., Monday through Friday. The work of the International Center is carried out by a small professional staff and by many volunteers in the community. The Center organizes lectures and special events, as well as offering English as a Second Language (ESL) classes, in addition to a number of programs including the International Community Friendship Program, ‘Round The World Women, and the International Classroom Project. The International House, a large Tudor mansion located at 406 Prospect Street in New Haven, is the venue of most of the International Center’s activities and the home of fifteen students and scholars. Rooms are available for the academic year and summer. For more information on any of these programs, or on the International House, telephone 203.432.6460, fax 203.432.6462, e-mail info@icnh.org, or visit the Web site at www.icnh.org.
RELIGIOUS RESOURCES

The religious resources of Yale University serve all students, faculty, and staff. These resources are the University Chaplaincy (located on the lower level of Bingham Hall on Old Campus); the Church of Christ in Yale University, an open and affirming member congregation of the United Church of Christ; 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 religious groups such as the Baha’i Association, the New Haven Zen Center, the Yale Vedanta Society and Yale Hindu Council, and the Muslim Student Association. Additional information is available at www.yale.edu/chaplain.

LIBRARIES

The Yale University Library consists of the central libraries — Sterling Memorial, Cross Campus, Beinecke Rare Book and Manuscript, Seeley G. Mudd — and thirty school and department libraries and special collections, including the Henry S. Graves Memorial Library (described on page 142). Second largest among the university libraries in the United States, the Yale Library contains more than 10.5 million volumes. The collections of all these libraries and their numerous services are available to students, and their use is actively encouraged.

In 1989, the University Library introduced Orbis, its online public catalogue, which provides electronic access to 5 million records identifying books, journals, and other library materials. In addition to bibliographic information, the system can inform users about books on order, being catalogued, or on loan.

Libraries in the Yale system which are most closely allied to the interests of Forestry & Environmental Studies students include Kline Science Library, the Government Documents Center, and the Geology, Social Science, Engineering, and Law libraries. Books requested by F&ES students from these other libraries are delivered by an express service to the Forestry library within one working day.

COMPUTER RESOURCES

The mission of the Office of Information and Library Systems 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. Because of the growing availability of wireless access throughout the Yale campus, students are encouraged to purchase laptops with wireless capability.
The School maintains several facilities that offer computing capabilities to students on a 24-hour-a-day, seven-day-a-week basis. The Student Cluster, located in Sage 39, contains twenty-one IBM personal computers and a high-speed printer capable of producing double-sided output. The GIS Lab, located next door in Sage 31, contains seventeen IBM computers and several printers, including a color printer capable of printing maps and graphics. All computers in both rooms access the Web, the Yale e-mail server, and the F&ES file server, which is used by students to store large files, and by faculty to distribute course materials to students. A third facility at Greeley Labs contains four IBM PCs configured for GIS and computational applications.

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 Osborne Memorial Laboratory, 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.

CULTURAL AND RECREATIONAL OPPORTUNITIES

Cultural Opportunities

A calendar listing the broad range of events at the University is issued weekly during the academic year in the Yale Bulletin & Calendar. The hours when special exhibitions and the University’s permanent collections are open to the public are also recorded in this publication. Free copies of the Yale Bulletin & Calendar are available at many locations throughout the campus, and the paper is sent via U.S. Mail to subscribers; for more information, call 203.432.1316. The paper is also available online at www.yale.edu/opa/yb&c.

The Yale Peabody Museum of Natural History contains collections in anthropology, mineralogy, oceanography, paleontology, and some aspects of geology.
The Yale University Art Gallery contains representative collections of ancient, medieval, and Renaissance art, Near and Far Eastern art, archaeological material from the University’s excavations, Pre-Columbian and African art, works of European and American masters from virtually every period, and a rich collection of modern art. The landmark Louis I. Kahn building is closed for a two-year renovation. The hub of the museum’s activities during this period will be the adjacent Swartwout building, housing Yale’s world-renowned collections of American paintings, sculpture, and decorative arts, as well as a selection of masterworks from all other departments.

The Yale Center for British Art houses an extraordinary collection of British paintings, sculpture, drawings, and books given to the University by the late Paul Mellon, Yale Class of 1929.

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. These include concerts presented by students and faculty of the School of Music, the Department of Music, the Yale Concert and Jazz bands, the Yale Glee Club, the Yale Symphony Orchestra, and other undergraduate singing and instrumental groups. In addition to graduate recitals and ensemble performances, the School of Music features the Philharmonia Orchestra of Yale, the Chamber Music Society at Yale, the Duke Ellington Series, the Horowitz Piano Series, Great Organ Music at Yale, New Music New Haven, Yale Opera performances and public master classes, and the Faculty Artist Series. Among New Haven’s numerous performing organizations are Orchestra New England, the New Haven Chorale, and the New Haven Symphony Orchestra.

For theatergoers, Yale and New Haven offer a wide range of dramatic productions at the University Theatre, Yale Repertory Theatre, Yale Cabaret, Long Wharf Theatre, Palace Theater, 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; and other rooms devoted to fencing, gymnastics, rowing, wrestling, martial arts, general exercise, and dance. Numerous physical education classes in dance, martial arts, aerobic exercise, and sport skills are offered throughout the year. Graduate and professional school students may use the gym at no charge during the academic year and for a nominal fee during the summer term. Academic and summer memberships at reasonable fees are available for faculty, employees, postdoctoral and visiting fellows, and student spouses.
The David S. Ingalls Rink, the Sailing Center in Branford, the Outdoor Education Center (OEC), the tennis courts, and the golf course are open to faculty, students, and employees of the University at established fees. Ingalls Rink has public skating Monday through Thursday from 11:30 A.M. to 12:45 P.M. and on weekends as the training schedule permits. Up-to-date information on hours is available at 203.432.0875. Skate sharpening is available daily; however, skate rentals are not available.

Approximately thirty-five club sports and outdoor activities come under the jurisdiction of the Office of Outdoor Education and Club Sports. Many of the activities, both purely recreational and instructional, are open to graduate and professional school students. Faculty, staff, and alumni, as well as groups, may use the Outdoor Education Center (OEC). The center consists of two thousand acres in East Lyme, Connecticut, and includes cabins, campsites, pavilion, dining hall, swimming, boating, canoeing, and picnic groves beside a mile-long lake. Hiking trails surround a wildlife marsh. The OEC season extends from the third weekend in June through Labor Day and September weekends. For more information, telephone 203.432.2492 or visit the Web page at http://yalebulldogs.collegesports.com/ (click on Sports Rec, then on Outdoor Education).

Throughout the year, Yale University 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, 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://yalebulldogs.collegesports.com.

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, 2004

Melissa Leigh Aikens (b.a. Bowdoin Coll.), Massachusetts.
Nikhil Surinder Anand (b.a. Reed Coll.), India.
Misalalatiana Andriamihaja (m.s. Univ. Antananarivo), Madagascar.
Irene Anna-maria Angeletti (b.s. Univ. Florence), Ecuador.
Jessica Emily Barnes (b.a. Oxford Univ.), United Kingdom.
Sarah Elizabeth Bendit (b.s. Univ. Michigan), Maryland.
Keith Roland Bisson (b.a. McGill Univ.), Maine.
Cecilia Marta Blasco Hernandez (b.a. Dartmouth Coll.), Argentina.
Elizabeth Borden (b.a. Radcliff Coll.), Connecticut.
Marco Buttazzoni (m.sc. London School of Economics and Social Sciences; b.a. Bocconi Univ.), Italy.
Kathleen Elizabeth Campbell (b.a. Harvard Univ.), New Jersey.
Javier Gonzalez Campana (Univ. Nacional de La Plata), Argentina.
Brandon Enrique Carter (b.s. Western Washington Univ.), Washington.
Suzette Anne Carty (b.s. Univ. Wisconsin), Jamaica.
Philip Schaeffer Caspar (m.s. Univ. Vermont; b.s. Univ. Notre Dame), Connecticut.
Chih-Kuo George Chiang (b.s. Tufts Univ.), Taiwan.
Hahn-Ning Chou (b.s. Sirindhorn International Inst. of Technology – Thammasat Univ.), Thailand.
Avery Simon Cohn (b.s. Univ. California [Davis]), California.
Valerie Anne Craig (b.a. Univ. California [Davis/Irvine]), California.
Sarah Elizabeth Davidson (b.a. Smith Coll.), Texas.
Michela De Palo (b.sc. Univ. Rome), Italy.
Heather Katherine Dempsey (b.s. Willamette Univ.), California.
Raji Dhital (m.sc. School of Environmental Management and Sustainable Development; b.sc. St. Xavier’s Coll.), Nepal.
Manmita Dutta (m.s. Calcutta Univ.; b.s. Loreto Coll.), India.
Elizabeth Browning Egan (b.a. Bowdoin Coll.), New Hampshire.
Tasha Kristin Eichenseher (b.a. Univ. Oregon), Wisconsin.
Juan Carlos Espinosa (b.s. Univ. Los Andes), Colombia.
Amanda Maria Farris (b.a. Yale Univ.), New Jersey.
Ona Ferguson (b.a. Smith Coll.), Massachusetts.
Margarita Fernandez (b.s. Tufts Univ.), New Jersey.
Jie Gao (b.a. Wuhan Univ.), China.
Lisa Gomes-Casseres (b.a. Princeton Univ.), Netherlands Antilles.
David Andrew Hobson (b.a. Princeton Univ.), California.
Morgan Elizabeth Holen (b.s. Univ. Washington), Washington.
Beatrice Chen-Yin Huang (b.s. National Taiwan Univ.), Taiwan.
Michelle Ann Huang (b.a. Harvard Univ.), Pennsylvania.
Chavanond Intarakomalyasut (m.a. Yale Univ.; m.sc. Chulalongkorn Univ.; b.a. Mahidol Univ.), Thailand.
Betony Lee Jones (b.s. Univ. Michigan), Michigan.
Elizabeth (Liz) Leigh Kalies (b.s. Cornell Univ.), New York.
Geri Elissa Kantor (b.s. Univ. Minnesota), Minnesota.
Heather Sue Kaplan (b.a. Univ. Vermont), Massachusetts.
Diana Louise Karwan (b.s. Univ. Michigan), Michigan.
Kristen Kimball (b.a., b.s., m.s. Univ. Connecticut), Connecticut.
Michael William Kisgen (b.a. Univ. California [Santa Barbara]), California.
Arcady Petrovich Kropov (St. Petersburg Forest Acad.), Russia.
Cindy Anne Kushner (b.a. Univ. Michigan), Massachusetts.
Rosemarie Mannik (b.s.e., b.a. Univ. Pennsylvania), New York.
Brian Thomas Marcarelle (b.a. Bowdoin Coll.), Massachusetts.
Elizabeth Christine Martin (m.p.h. Hunter Coll. at CUNY; b.a. Dickinson Coll.), Maryland.
Susan Tambi Matambo (b.sc. Univ. Zambia), Zambia.
Megan Lisa Mattox (b.s. Univ. Washington), California.
Vincent De Paul Medjibe (m.sc. Univ. Bangui), Central African Republic.
Neha Ajit Menon (m.m.s. Univ. Mumbai; b.a. St. Xavier’s Coll.), India.
Jennifer Lynne Molnar (b.s. Harvard Univ.), New Jersey.
Kimberlee Anne Mortimer (b.a. Eckerd Coll.), Florida.
Ken Odaka (b.a. Waseda Univ. [Japan]), Japan.
Sarah Elizabeth Owen (b.a. Brown Univ.), Vermont.
Christian Tobler Palmer (b.s. Brigham Young Univ.), Hawaii.
Elizabeth Anne Petruska (b.a. Univ. Notre Dame), New Jersey.
Alison Rae Pierce (b.a., b.s. Virginia Tech), Virginia.
Justin Benjamin Pollard (b.a. Stanford Univ.), Maine.
Ying Qiu (b.s. Tsinghua Univ.), China.
Shona Barton Quinn (b.s. Fashion Inst. of Technology), Connecticut.
Marni Rapoport (b.a. Univ. California [Santa Cruz]), California.
Fulton Ewing Rockwell (b.a. Yale Univ.), New York.
Nalin Sahni (b.eng. Queen’s Univ.), Canada.
Daisuke Sasatani (b.s. Osaka Prefecture Univ.), Japan.
Emily Danielle Shelton (b.a., b.s. San Jose State Univ.), California.
Kenichi Shono (b.s. Univ. Tsukuba), Japan.
Dani Lynn Simons (b.s. Brown Univ.), Virginia.
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Ho Seok Song (b.a. Seoul National Univ.), Korea.
Corrina Dawn Steward (b.a. Oberlin Coll.), Massachusetts.
Brynn Taylor (b.s. Univ. Redlands), Connecticut.
Nao Anna Teshima (b.s. Univ. Michigan), Florida.
Alison Claire Van Gorp (b.a. Univ. Colorado-Boulder), Minnesota.
Daniela Vizcaino (b.s. Universidad Simón Bolívar), Venezuela.
Jennifer Elizabeth Vogel (b.a. Tufts Univ.), Vermont.
Abigail Weinberg (b.a. St. John’s Coll.), New Jersey.
Ellen Wells (b.a. Oberlin Coll.), Ohio.
Jeremy James West (b.s. North Carolina State Univ.), Ohio.
Ethan Hamill Winter (b.a. Bowdoin Coll.), Illinois.
Kevin Michael Woods (b.s. Univ. Dayton), Wisconsin.
Laura Elizabeth Wooley (b.a. Grinnell Coll.), Ohio.
Heather Eileen Wright (b.s. Univ. California [Los Angeles]), California.
Elizabeth Wyman (b.s. Univ. Miami), New Hampshire.
Hillary Suzanne Young (b.a. Princeton Univ.), California.
Austin Gabriel Zeiderman (b.a. Colgate Univ.), California.
Baohui Zhang (b.s., b.a. Peking Univ.), China.
Zhizhou Zhang (b.s. Shanghai Jiao Tong Univ.), China.
Kathryn Ann Zyla (b.s. Swarthmore Coll.), Michigan.

DOCTORAL DEGREES CONFERRED, DECEMBER 2003

Carlos Alejandro Gonzalez (b.s. Cornell Univ.; m.e.s. Yale Univ.), West Virginia.
Jason Simpson Grear (b.a. Connecticut Coll.; m.s. Univ. Florida [Gainesville]),
Connecticut.
Pamela Dawn McElwee (b.a. Univ. Kansas; m.sc. Oxford Univ. [United Kingdom]),
Kansas.
Leigh Winters Shemitz (b.a. Harvard Univ.; m.f.s. Yale Univ.), Connecticut.
Daniel Somers Smith (b.a. Univ. Pennsylvania; m.f.s. Yale Univ.), New Hampshire.
Heinrich zu Dohna (Diploma Swiss Fed. Inst. Tech. [Switzerland]; m.f.s. Yale Univ.),
Germany.

DOCTORAL DEGREES CONFERRED, MAY 2004

Amit Kapur (b.e. Delhi Coll. Engineering [India]; m.s.c.e. Purdue Univ.), India.
Cheryl Margoluis (b.a. Univ. California [San Diego]; m.s. George Mason Univ.),
California.
Andrew Salvador Mathews (b.sc. Leeds Univ. [United Kingdom]; m.sc. Oxford Univ.
[United Kingdom]), United Kingdom.
Keely Beth Maxwell (b.a. Williams Coll.; m.f.s. Yale Univ.), New York.
STUDENTS WORKING TOWARD MASTER’S DEGREES, 2004

Azalea Artemiza Aguilar-Mitch (b.s. Univ. California [Berkeley]), California.
Melissa Jo Andersen (b.s. Yale Univ.), Minnesota.
Inés Susana Angulo de Aviles (b.s. Univ. Nacional Agraria La Molina), Peru.
Olga Alexandrovna Babakina (b.s., m.s. Moscow State Univ.), Russia.
Lauren Miyoko Baker (b.a. Univ. California [Berkeley]), California.
Rafael Eduardo Bernardi de Leon (b.s. Liceo San Juan Bautista; civ. eng. Univ. de la República), Uruguay.
Cherelle Antoinette Blazer (b.s. Southern A&M Univ.; m.s. Hampton Univ.), Oregon.
Alice Campbell Bond (b.a. Univ. Georgia), Georgia.
Lisa Elena Botero (b.a. Univ. Miami), Florida.
Ellen LeAnne Brown (b.a. Univ. Illinois), Illinois.
Melisa Chan (b.a. Barnard Coll., Columbia Univ.), Texas.
Fuphan Chou (b.a. Yale Univ.), New Jersey.
Kelly Augustina Coleman (b.s. Brown Univ.), Vermont.
Victoria Ann Critchley (b.sc. Univ. Sydney), Australia.
James Brewster Cronan (b.s. Univ. Vermont), Massachusetts.
Dora Nsuwa Cudjoe (b.sc. Univ. Science & Technology), Ghana.
Laura Beth Cuoco (b.a. Univ. California [Berkeley]), New York.
Curt Tavis DellaValle (b.s. Univ. Connecticut), Connecticut.
Seth Simrall Dunn (b.a. Yale Univ.), Connecticut.
Julie Anne Earle (b.a. St. Olaf Coll.), Minnesota.
Isao Endo (b.a. Sophia Univ.; m.b.a. Keio Univ.), Japan.
Trisha Renee Eyler (b.s. Wake Forest Univ.), Maryland.
James Julius Fergusson (b.a., m.a. Cambridge Univ.), United Kingdom.
Jordana Michelle Fish (b.a. Tufts Univ.; b.f.a. School of the Museum of Fine Arts), New York.
Brett Jacob Galimidi (b.s. Univ. California [Los Angeles]), California.
Loni Stewart Gardner (b.s. Univ. South Carolina Honors Coll.), Tennessee.
Jeremy Michael Goetz (b.s. Univ. Maryland [College Park]), Maryland.
Carishma Prakash Gokhale (b.com. Univ. Mumbai), India.
Alicia Loudon Gray (b.a. Lewis and Clark Coll.), Massachusetts.
Ann Jennifer Grodnik (b.a. Univ. Vermont), California.
Sharifa Mansur Gulamhussein (b.a. Univ. California [Berkeley]), California.
Sharon Marie Gulick (b.a. Univ. Virginia), Maryland.
Jaqueline Annette Guzman (b.s. St. Edward’s Univ.), Texas.
Jocelyn Eileen Hittle (b.a. Princeton Univ.), Colorado.
Bruce Jing-Hai Ho (b.a. Univ. Texas [Austin]), Texas.
Alexander Steven Hovani (b.s. Univ. Michigan), New York.
Drena Marie Howard (b.s. South Carolina State Univ.), North Carolina.
Beatrice Chen-Yin Huang (b.s. National Taiwan Univ.), Taiwan.
Po-Yi Hung (b.a. Fu-Jen Catholic Univ.; m.s. National Taiwan Univ.), Taiwan.
Anna Louise Jetmore (b.a. Earlham Coll.), Indiana.
Andrea Eleanor Johnson (b.a. Harvard Univ.), Colorado.
Kyle Elizabeth Jones (b.s. Univ. Michigan), Michigan.
Hyun Sook Kim (b.s. Ewha Womans Univ.), South Korea.
Amy Kimball (b.a. Earlham Coll.), Pennsylvania.
Teruo Kogu (ll.b. Kyoto Univ.), Japan.
Samuel Paul Krasnow (b.a. Oberlin Coll.), Vermont.
Monika Kumar (b.a. Queens Coll.), New York.
Radha Sharaschandra Kuppalli (b.a. American Univ.), Virginia.
Cho Yi Kwan (b.a. Claremont McKenna Coll.), New York.
Virginia Rheutan Lacy (b.a. Univ. Virginia), South Carolina.
Robert Ian Lamb (b.a. Colorado Coll.), Georgia.
Maura Kathleen Leahy (b.a. Univ. Wisconsin), Wisconsin.
Emily Chapin Levin (b.a. Amherst Coll.), Connecticut.
Qing Li (b.sc. Beijing Normal Univ.), China.
Zijun Li (b.s. Renmin Univ. China), China.
Woon Kwong Liew (b.eng. Univ. Manchester; m.s. National Univ. Singapore), Singapore.
Virginia Esperanza Lorne (b.a., b.s. Univ. California [Berkeley]), California.
Trent Richard Malcolm (b.s. Univ. Michigan), Hawaii.
Sarah Kay Matheson (b.s. James Madison Univ.), Virginia.
Jessica Frances Watkins McCormack (b.s., b.a. Univ. Texas [Austin]), Texas.
Alexander Gilbert McIntosh (b.a. Duke Univ.), Maine.
Mary Kathleen McNealy (b.a. Princeton Univ.), New Jersey.
Robyn Christine Meeks (b.a. Brown Univ.), Massachusetts.
Cesar Augusto Moran Cahuasac (b.s. Univ. Nacional Agraria-La Molina), Peru.
Tetsuya Motoshige (b.s. Univ. Tokyo), Japan.
Michelle Bella Murdock (b.a. Columbia Univ.), California.
Kara Elizabeth Murphy (b.a. SUNY Binghamton), New York.
Matthew Muspratt (b.a. Carleton Coll.), Massachusetts.
Lisa Harshad Patel (b.s. Stanford Univ.), Texas.
Kaisone Phengsopha (b.s. National Univ. Laos), Laos.
Octavio Pires Junior (b.a. Faculdade de Belas Artes de São Paulo), Brazil.
Jeffrey Collier Possick (b.a. Yale Univ.), Connecticut.
Theodora Erlinda Angela Lopez Quiros (b.a. Wellesley Coll.), Philippines.
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Amy Elena Shatzkin (b.a. Oberlin Coll.), New York.
Amina Hussein Soud (b.sc. Nairobi Univ.), Kenya.
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Yusuke Taishi (b.p.s. Chuo Univ.), Japan.
Mark Shepherd Thomas (b.s., m.d. Univ. Wisconsin [Madison]), Pennsylvania.
Victoria Mireille Thompson (b.a. Amherst Coll.), New York.
Kevin Martin Tidwell (b.a. Rice Univ.), Oregon.
Elena Martina Traister (b.a. Williams Coll.), California.
Erin Marie Walsh (b.s.e. Princeton Univ.), Virginia.
Ju-Han Zoe Wang (b.s. National Taiwan Univ.), Taiwan.
Linda Jane Wan (b.a. Univ. Pennsylvania), Washington, D.C.
Songlin Wang (b.s., m.s. Ocean Univ. Qingdao), China.
Aaron Randall Welch (b.a. Univ. Colorado [Boulder]), Colorado.
Alexandra Rae Williamson (b.a. Columbia Univ.), Maryland.
Nicolette Ruth Witcher (b.a. SUNY New Paltz), New York.
Daniel Yohannes (b.a. SUNY Stonybrook), New York.
Huiyan Zhao (b.s. Peking Univ.), China.

STUDENTS WORKING TOWARD DOCTORAL DEGREES

Doctor of Forestry and Environmental Studies
Harry Robert Bader (b.a. Washington State Univ.; J.D. Harvard Univ.), Nebraska.

Doctor of Philosophy
David Lionel Roy Affleck (b.s.f., m.s. Univ. British Colombia [Canada]), Canada.
Mónica Araya (b.a., m.a. Univ. Nacional; M.E.M. Yale Univ.), Costa Rica.
Nicole Michele Ardoin (b.b.a. James Madison Univ.; M.S. Univ. Madison [Stevens Point]), Virginia.
Weslynne Ashton (b.s. Massachusetts Inst. of Technology), Trinidad.
Graeme Stewart Auld (b.s. Univ. British Columbia [Canada]; M.S. Auburn Univ.), Canada.
Cristina Marie Balboa (b.a. Univ. Michigan [Ann Arbor]; M.S. Johns Hopkins Univ.), Washington, D.C.
Michael Gabriel Booth (b.s. Principia Coll.), Illinois.
Janette Patricia Balkan (b.a. Univ. Manitoba [Canada]; M.A. Univ. Texas), Guyana.
Marina Campos (b.s., m.s. Univ. São Paulo [Brazil]), Brazil.
Seth Nathan Cook (b.a. Amherst Coll.; M.E.S., M.A. Yale Univ.), California.
Christiane Ehringhaus (dipl. Univ. Bayreuth [Germany]; m.sc. Florida International Univ.), Germany.
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Uromi Manage Goodale (b.sc. Univ. Colombo; m.f.s. Yale Univ.), Sri Lanka.
Achim Halpaap (b.sc. Univ. Bonn [Germany]; m.a. Univ. Oregon), Germany.
M. Anders Halverson (b.a. Dartmouth Coll.; m.f.s. Yale Univ.), Colorado.
Liola Fairlight Hawken (b.a. Brown Univ.; m.e.m. Yale Univ.), California.
Aaron Hohl (b.s. John Carroll Univ.; m.e.m. Duke Univ.), Ohio.
Haiying Hu (b.s., m.s. Peking Univ. [China]), China.
Shafqat Hussain (b.a. Indiana Univ. [Pennsylvania]; m.s. Univ. Hull [United Kingdom]; m.e.m. Yale Univ.), Pakistan.
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Olaf Kuegler (dipl. Albert-Ludwigs Univ. [Germany]), Germany.
Pradeep Kurukulasuriya (m.s. Univ. Aberdeen; m.phil. Univ. Cambridge; m.e.s. Yale Univ.), Sri Lanka.
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Philip Marshall (b.s. Cornell Univ.; m.e.sc. Yale Univ.), New York.
Helen Rose Mills (b.s., b.a. Pepperdine Univ.; m.s. Pennsylvania State Univ.),
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Nicholas Zander Muller (b.s. Univ. Oregon; m.p.a. Indiana Univ.), Pennsylvania.
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Suk Steve Rhee (b.a. Washington Univ.; m.e.s. Yale Univ.), Georgia.
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Han Shi (B.Eng., M.Eng. Tsinghua Univ. [China]), China.

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Terry Louise Terhaar (B.A. Univ. California [Santa Cruz]; M.F.S. Yale Univ.), California.


Mark Christopher Urban (B.S. Muhlenberg Coll.; M.E.Sc. Yale Univ.), Pennsylvania.


Tao Wang (B.C.H.E., M.S. Tsinghua Univ. [China]), China.

Hui-Ju Wu (LL.B. National Taiwan Univ.; LL.M. Univ. California [Berkeley]; M.F.S. Yale Univ.), Taiwan.
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For additional information, please write to the Director of Admissions, Office of Admissions, Yale University School of Medicine, 367 Cedar Street, New Haven CT 06510; telephone, 203.785.2643; fax, 203.785.3234; e-mail, medical.admissions@yale.edu; Web site, http://info.med.yale.edu/education/admissions/

For additional information about the Department of Epidemiology and Public Health, an accredited School of Public Health, please write to the Director of Admissions, Yale School of Public Health, PO Box 208034, New Haven CT 06520-8034; e-mail, eph.admissions@yale.edu; Web site, http://publichealth.yale.edu/

**Divinity School:** 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.).

For additional information, please write to the Admissions Office, Yale Divinity School, 409 Prospect Street, New Haven CT 06511; telephone, 203.432.5360; fax, 203.432.7475; e-mail, divinityadmissions@yale.edu; Web site, www.yale.edu/divinity/. Online application, http://apply.embark.com/grad/yale/divinity/

**Law School:** Courses for college graduates. Juris Doctor (J.D.). For additional information, please write to the Admissions Office, Yale Law School, PO Box 208329, New Haven CT 06520-8329; telephone, 203.432.4995; e-mail, admissions.law@yale.edu; Web site, www.law.yale.edu/

Graduate Programs: Master of Laws (L.L.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 20815, New Haven CT 06520-8215; telephone, 203.432.1696; e-mail, gradpro.law@yale.edu; Web site, www.law.yale.edu/
School of Art: 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 University School of Art, PO Box 208339, New Haven CT 06520-8339; telephone, 203.432.2600; e-mail, artschool.info@yale.edu; Web site, www.yale.edu/art/


For additional information, please write to the Yale School of Music, PO Box 208246, New Haven CT 06520-8246; telephone, 203.432.4155; fax, 203.432.7448; e-mail, gradmusic.admissions@yale.edu; Web site, www.yale.edu/music/

School of Forestry & Environmental Studies: 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.).

For additional information, please write to the Office of Academic Services, Yale School of Forestry & Environmental Studies, 205 Prospect Street, New Haven CT 06511; telephone, 800.825.0330 or 203.432.5100; e-mail, fesinfo@yale.edu; Web site, www.yale.edu/environment/

School of Architecture: Courses for college graduates. Professional degree: Master of Architecture (M.Arch.); nonprofessional degree: Master of Environmental Design (M.E.D.).

For additional information, please write to the Yale School of Architecture, PO Box 208242, New Haven CT 06520-8242; telephone, 203.432.2296; e-mail, gradarch.admissions@yale.edu; Web site, www.architecture.yale.edu/

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For additional information, please write to the Yale School of Nursing, PO Box 9740, New Haven CT 06536-0740; telephone, 203.737.2257; Web site, www.nursing.yale.edu/


For additional information, please write to the Registrar's Office, Yale School of Drama, PO Box 208325, New Haven CT 06520-8325; telephone, 203.432.1507; Web site, www.yale.edu/drama/

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