School of Forestry & Environmental Studies

2001-2002



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Telephone Numbers

800.825.0330	Prospective Students
203.432.5100	General School Number
203.432.5942	General School Fax
203.432.5043	Student Career Room Fax

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

Application deadlines

Ph.D. Program	January 3, 2002
D.F.E.S. Program	February 1, 2002
Master's Programs	February 1, 2002

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Yale University NEW HAVEN, CONNECTICUT

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Calendar

FALL 2001

Sat.	Orientation for international students.
Sun.	Orientation for summer modules.
Mon	Training modules in technical skills.
Fri.	
Tues.	Course Expo.
Wed.	Fall-term classes begin, 8.30 A.M.
Wed.	Course registration forms due.
Wed.	Add/Drop period ends.
Fri.	Fall recess begins, 5.30 P.M.
Mon.	Classes resume, 8.30 A.M.
Fri.	Fall-term classes end, 5.30 P.M. Reading period begins.
Fri.	Final examinations begin, 9 л.м.
Fri.	Final examinations end, 5.30 р.м.
	Sat. Sun. Mon. – Fri. Tues. Wed. Wed. Wed. Fri. Mon. <i>Fri.</i> Fri. Fri.

SPRING 2002

Jan. 14	Mon.	Spring-term classes begin, 8.30 A.M.
Jan. 21	Mon.	Martin Luther King Day.
Jan. 28	Mon.	Course registration forms due.
Feb. 11	Mon.	Add/Drop period ends.
Mar. 8	Fri.	Spring recess begins, 5.30 P.M.
Mar. 25	Mon.	Classes resume, 8.30 л.м.
Apr. 26	Fri.	Spring-term classes end, 5.30 P.M. Reading period begins.
May 6	Mon.	Final examinations begin, 9 A.M.
May 14	Tues.	Final examinations end, 5 P.M.
May 27	Mon.	University Commencement.

The President and Fellows of Yale University

President

Richard Charles Levin, B.A., B.LITT., PH.D.

Fellows

His Excellency the Governor of Connecticut, ex officio. Her Honor the Lieutenant Governor of Connecticut, ex officio. George Leonard Baker, Jr., B.A., M.B.A., Palo Alto, California. Frances Beinecke, B.A., M.F.S., New York, New York (June 2001). Roland Whitney Betts, B.A., J.D., New York, New York (June 2005). Benjamin Solomon Carson, Sr., B.A., M.D., West Friendship, Maryland (June 2003). Gerhard Casper, LL.M., PH.D., Atherton, California. Susan Crown, B.A., M.A., Chicago, Illinois. Charles Daniel Ellis, B.A., M.B.A., PH.D., Greenwich, Connecticut. David Richmond Gergen, B.A., LL.B., McLean, Virginia (June 2002). Holcombe Turner Green, Jr., B.A., LL.B., Atlanta, Georgia. Linda Anne Mason, B.A., M.B.A., Belmont, Massachusetts (June 2004). The Rt. Rev. Victoria Matthews, B.A., M.DIV., Edmonton, Alberta, Canada. Barrington Daniel Parker, Jr., B.A., LL.B., Stamford, Connecticut. John Ennis Pepper, Jr., B.A., M.A., Cincinnati, Ohio. Kurt Lidell Schmoke, B.A., J.D., Baltimore, Maryland. Jaime Serra, B.A., PH.D., Mexico City, Mexico. Janet Louise Yellen, B.A., PH.D., Berkeley, California (June 2006).

The Officers of Yale University

President Richard Charles Levin, B.A., B.LITT., PH.D.

Provost Alison Fettes Richard, M.A., PH.D.

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

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

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

Acting Vice President for Finance and Administration Kemel Winston Dawkins, B.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 and Professor Emeritus of Forestry*.
- 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., SC.D., Morris K. Jesup Professor Emeritus of Silviculture.
- William Hulse Smith, M.F., PH.D., Clifton R. Musser Professor Emeritus of Forest Biology.
- Bruce Bernot Stowe, M.A., PH.D., Professor Emeritus of Biology and Professor Emeritus of Forestry.
- Garth Kenneth Voigt, M.S., PH.D., Margaret K. Musser Professor Emeritus of Forest Soils.

Board of Permanent Officers

Richard Charles Levin, B.LITT., PH.D., President of the University.

- Alison Fettes Richard, M.A., PH.D., Provost of the University, Professor of Anthropology, and Professor of Environmental Studies.
- 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, Co-Director of the Hixon Center for Urban Ecology, and Director of Coastal and Watershed Systems.

Graeme Pierce Berlyn, PH.D., E. H. Harriman Professor of Forest Management and Professor of Anatomy and Physiology of Trees.

- *William Richard Burch, Jr., M.S., PH.D., Frederick C. Hixon Professor of Natural Resource Management and Professor at the Institution for Social and Policy Studies.
- Michael Roger Dove, M.A., PH.D., Professor of Social Ecology and Professor of Anthropology.

Daniel C. Esty, M.A., J.D., Professor of Environmental Law and Policy; Associate Dean for Academic Affairs; Clinical Professor, Law School; Director of the Center for Environmental Law and Policy; and Co-Director of the Hixon Center for Urban Ecology.

Thomas Eldon Graedel, M.A., M.S., PH.D., Professor of Industrial Ecology, Professor of Chemical Engineering, Professor of Geology and Geophysics, and Director of the Center for Industrial Ecology.

^{*} On leave of absence, fall 2001.

- ‡Timothy G. Gregoire, рн.д., *J. P. Weyerbaeuser, Jr., Professor of Forest Management.* Stephen Robert Kellert, рн.д., *Tweedy/Ordway Professor of Social Ecology*.
- Robert Mendelsohn, PH.D., Edwin W. Davis Professor of Forest Policy, Professor of Economics, and Professor in the School of Management.
- Oswald J. Schmitz, M.S.C., PH.D., Professor of Population and Community Ecology.
- John Peter Wargo, M.L.A., PH.D., Professor of Environmental Risk Analysis and Policy, Professor of Political Science, and Director of the Environment and Health Initiative.

Ladder Faculty

- Greg J. Arthaud, M.S., PH.D., Associate Professor of Forest Management.
- Benjamin Cashore, M.A., PH.D., Assistant Professor of Sustainable Forestry Management.
- Lisa M. Curran, M.A., PH.D., Associate Professor of Tropical Resources and Director of the Tropical Resources Institute.
- Xuhui Lee, M.S.C., PH.D., Associate Professor of Forest Meteorology and Micrometeorology.
- Kathleen McAfee, M.A., PH.D., Assistant Professor of Social Ecology and Community Development.
- James E. Saiers, M.S., PH.D., Associate Professor of Hydrology.
- Hilary A. Sigman, M.PHIL., PH.D., Associate Professor of Environmental Economics.
- *David K. Skelly, PH.D., Associate Professor of Ecology.

Non-Ladder Faculty

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

- James A. Bryan, M.A., M.S., PH.D., Associate Research Scientist and Program Director of the Tropical Resources Institute.
- Ann E. Camp, M.F.S., PH.D., Lecturer in Stand Dynamics and Forest Health.
- Carol Carpenter, M.A., PH.D., Lecturer in Natural Resource Social Science and Lecturer in Anthropology.
- Marian R. Chertow, M.P.P.M., PH.D., Lecturer in Industrial Environmental Management, Director of the Program on Solid Waste Policy, and Director of the Industrial Environmental Management Program.

Timothy W. Clark, M.S., PH.D., Professor (Adjunct) of Wildlife Ecology and Policy.

- Paul Alexander Draghi, M.A., M.A., PH.D., Lecturer in Forest History and Director of Information and Library Systems.
- Gordon T. Geballe, M.S., PH.D., Associate Dean for Student and Alumni Affairs and Lecturer in Urban Ecology.
- Bradford S. Gentry, J.D., Lecturer in Sustainable Investments and Co-Director of the Yale–UNDP Collaborative Program on the Urban Environment.
- Reid J. Lifset, M.S., M.P.P.M., Associate Research Scholar, Associate Director of the Industrial Environmental Management Program, and Editor-in-Chief of the Journal of Industrial Ecology.
- James R. Lyons, M.F., *Professor in the Practice of Natural Resource Management*. Florencia Montagnini, M.S., PH.D., *Professor in the Practice of Tropical Forestry*.

‡ On leave of absence, spring 2002.

* On leave of absence, fall 2001.

Ofer Ovadia, PH.D., Lecturer in Ecology and Evolutionary Biology.

Robert Repetto, PH.D., Professor in the Practice of Economics and Sustainable Development. 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 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. 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. Alison Fettes Richard, M.A., PH.D., Provost of the University, Franklin Muzzy Crosby Professor of the Human Environment, and Professor of Anthropology. 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. Stephen C. Stearns, M.S., PH.D., Edward P. Bass Professor of Ecology and Evolutionary Biology. Christopher Timmins, PH.D., Assistant Professor of Economics. Karl Turekian, PH.D., Benjamin Silliman Professor of Geology and Geophysics and Director of the Institute for Biospheric Studies. Robin Winks, PH.D., Randolph W. Townsend, 7r., Professor of History. Visiting Faculty, Fellows, Adjunct Faculty, and Faculty with Primary Appointments Elsewhere Xuemei Bai, PH.D., Associate Professor in the Practice of Urban Ecology. Michael Jeffrey Balick, PH.D., Professor (Adjunct) of Tropical Studies. Diana Balmori, PH.D., Lecturer in Landscape and Urban History. Brian Boom, PH.D., Professor (Adjunct) of Tropical Dendrology. Edgar Brannon, рн.д., Senior Fellow. Richard Burroughs, PH.D., Professor (Adjunct) of Coastal Science and Policy. Douglas C. Daly, PH.D., Associate Professor (Adjunct). John Ehrenfeld, PH.D., Visiting Fellow in Industrial Ecology. William Ellis, PH.D., Senior Fellow. Emil H. Frankel, LL.B., Senior Fellow. Andrew J. Henderson, PH.D., Associate Professor (Adjunct).

Yolanda Kakabadse, Professor in the Practice of Biodiversity Conservation.
David L. Lentz, PH.D., Associate Professor (Adjunct) of Tropical Studies.
Wangari Maathai, PH.D., Dorothy McCluskey Fellow in Conservation.
James G. MacBroom, P.E., Lecturer in Rivers Processes and Restoration.
Scott A. Mori, PH.D., Associate Professor (Adjunct).
Arvid Nelson, PH.D., Associate Professor (Adjunct).
Daniel Nepstad, PH.D., Lecturer in Tropical Ecology.
John R. Nolon, J.D., Professor (Adjunct) of Environmental Law.
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 Politics.
Andrew Willard, PH.D., Lecturer in Natural Resource Policy.

Research Appointments

Ruth Allen, PH.D., Research Affiliate. Donald E. Aylor, M.E.S., PH.D., Research Affiliate in Biometeorology. Mary K. Berlyn, PH.D., Senior Research Scientist. Anne Todd Bockarie, PH.D., Research Affiliate. Frederick Herbert Bormann, M.A., PH.D., Senior Research Scientist. David Brown, PH.D., Research Affiliate. Anthony DiNicola, PH.D., Research Affiliate. John Charles Gordon, PH.D., Senior Research Scientist. George Gorman, PH.D., Postdoctoral Fellow. A. L. Hammett III, PH.D., Research Affiliate. John Lenhart, PH.D., Postdoctoral Associate. Mark McClure, PH.D., Research Affiliate. Steven Mylon, PH.D., Postdoctoral Associate. Joelisoa Ratsirarson, PH.D., Associate Research Scientist. Michael A. Rechlin, PH.D., Research Affiliate. V. Alaric Sample, PH.D., Research Affiliate. R. Neil Sampson, M.P.A., Research Scientist. Oliver Schabenberger, PH.D., Research Affiliate. Yajie Song, PH.D., Associate Research Scientist. Harry T. Valentine, PH.D., Research Affiliate. Philip M. Wargo, PH.D., Research Affiliate. Michael P. Washburn, PH.D., Research Scholar. Campbell Webb, PH.D., Postdoctoral Fellow. Lu Zhi, PH.D., Associate Research Scientist.

Center/Program Staff

Monica Araya, M.E.M., Project Director, Sustainable Americas, Yale Center for Environmental Law.

Heather Crawford, B.A., M.S., Connecticut Sea Grant College Program.
Gary Dunning, B.S., M.F., Program Director of the Yale Forest Forum.
Edward Gordon, M.S., PH.D., Assistant Editor, Journal of Industrial Ecology.
Tom Luben, M.S., Research Associate, Center for Coastal and Watershed Systems.
Martha McCormick Smith, M.F.S., Program Director, Coastal and Watershed Systems.
Colleen Murphy-Dunning, M.S., Program Director, Urban Resources Initiative.
Christopher Ozyck, Coordinator, Urban Resources Institute.
Sonja Plesset, B.A., Administrative Associate, Center for Industrial Ecology.
Michelle Portlock, B.A., Program Coordinator, Center for Industrial Ecology.
Sabrina Spatari, M.S.E., Coordinator, Center for Industrial Ecology.
Mary Tyrrell, M.B.A., M.F.S., Program Manager, Yale Forest Forum.

Administrative Staff

Mariann Adams, Administrative Assistant, Student Services. Elisabeth Barsa, B.A., Senior Administrative Assistant, Doctoral Program. Jane Beamon, Senior Administrative Assistant, Development Office. J. Alan Brewster, B.A., M.P.A., Associate Dean for Management and Resources. Josephine Brown, B.S., Administrative Assistant. Sandra Brown, Financial Assistant. Rosanne Colvano, Senior Administrative Assistant. Jane Coppock, M.E.S., PH.D., Assistant Dean and Editor of the F&ES Bulletin Series. David DeFusco, B.S., Director of Communications. Ellen Denny, M.F.S., Research Assistant. Maureen A. Devlin, A.S., Registrar and Director of Student Affairs. Carolyn T. Falls, B.A., Director of Financial Aid. Alex Finkral, M.F., School Forest Manager. Eugenie Gentry, B.A., Development Officer. Jack A. Gold, M.A., Corporate and Foundation Relations Officer, Development Office. Florence Grandelli, Assistant Business Manager. Jennith Liner, Administrative Assistant. Carmela Lubenow, Financial Assistant. Emly McDiarmid, M.F.S., Director of Admissions. William Moroz, Computer & Information Systems Support Specialist. Stanton C. Otis, Jr., M.ED., Director of Career Development. Shiva Prasad, B.S., Computer & Information Systems Support Specialist. Ann Prokop, M.A., Administrative Assistant. Frederick E. Regan, B.A., Chief Development Officer. Kathleen Schomaker, M.E.S., Alumni/ae Affairs Officer. Rosemary Teodosio, Senior Administrative Assistant.

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Henry S. Graves Memorial Library

Florence Johnson, B.S., *Library Services Assistant*. Suzette Reading, B.A., *Library Services Assistant*. Rochelle Smith, M.L.I.S., *Librarian*.

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 (http://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

MISSION

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.

CREDO

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

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.

STRATEGY

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.

History of the School of Forestry & Environmental Studies

Yale University has played a leading role in the development of American conservation and natural resource management since the 1800s, when 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 became the first American to receive professional forestry training in Europe, and Graves became 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 and served as first chief of the USDA Forest Service. Originator of 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 him, 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 the 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 environmental 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 twentyfirst century.



First graduating class of the Yale Forest School



Shimon C. Anisfeld



Greg J. Arthaud

Faculty Profiles

Shimon C. Anisfeld, Lecturer and Associate Research Scientist in Environmental Chemistry and Water Resources. A.B., Princeton University; Ph.D., Massachusetts Institute of Technology. Dr. Anisfeld's research interests are in the environmental chemistry and hydrology of degraded rivers and wetlands, especially in urban coastal settings. He is particularly interested in understanding the fate and effects of nutrients, sediments, and toxic organic compounds in urban watersheds; and in exploring the complex interactions among hydrologic regime, socioeconomic setting, water chemistry, and ecosystem health. Dr. Anisfeld has been involved in watershed-based nonpoint source pollution studies and an interdisciplinary investigation of the linkages between watershed health and human values/behaviors. He is also interested in methodological questions related to sampling frequency for nutrient export studies and analytical methods for measuring formaldehyde in industrial effluents. His goal is to carry out integrated research that has direct relevance to the management of watersheds.

Greg J. Arthaud, Associate Professor of Forest Management. B.S., University of Minnesota; M.S., Virginia Polytechnic Institute and State University; Ph.D., University of Minnesota. Professor Arthaud's research and teaching focus on forest management, specifically in the areas of optimal forest stand-level management and methods for integrating management of competing uses. His recent work has included the evaluation of dynamic programming in pine plantation management, the determination of trade-offs between wildlife and timber at the landscape scale, factors influencing land-use change, and forest management responses to changes in economic assumptions. Professor Arthaud has additional interests in forest landscape modeling, forest management applications of geographic information systems, and alternative dispute resolution methods.



Mark S. Ashton



Gaboury Benoit

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 Asian tropical and American temperate forests. 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 climatic change. 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.

Gaboury Benoit, Professor of Environmental Chemistry, Co-Director of the Hixon Center for Urban Ecology, and Director of 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 toxic contaminants, especially heavy 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. Two current research emphases are the use of modern clean techniques to investigate trace metals whose concentrations or fluxes occur at very low levels, and human-environment interactions in urban watersheds. He is a fellow of Trumbull College.



Graeme P. Berlyn



James A. Bryan

Graeme P. Berlyn, E. H. Harriman Professor of Forest Management and Professor of Anatomy and Physiology of Trees. B.S., Ph.D., Iowa State University. Professor Berlyn's interests center on anatomy and physiology of trees. He is especially interested in light processing by leaves in relation to environmental factors as measured by chlorophyll fluorescence, photosynthesis, and spectral reflectance, absorption, and transmission.

These studies are of importance because the adaptability of a given species to changes in light is instrumental to its success under or in the forest canopy. Another related area of interest is response of plants to natural stress (especially elevational and latitudinal gradients, drought, and predation) and anthropogenic stress (acid deposition, radionuclides, and toxic chemicals). Additional interests are plant embryology, tissue culture, genetic stability, interaction of environment and nuclear genome, biostimulants and mineral nutrition, cytochemistry, quantitative microscopy and microtechnique.

Professor Berlyn's current research is focused on two projects, the first of which is anatomical, physiological, and optical properties of leaves in relation to (1) light intensity and quality, (2) distribution in tree crowns, (3) nutrient status, and (4) ecology and silviculture. The second current 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. Professor 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.

James A. Bryan, Associate Research Scientist and Program Director of the Tropical Resources Institute. B.A., Oberlin College; M.A., Washington University; M.S., Virginia Polytechnic Institute and State University; Ph.D., Yale University. Dr. Bryan has worked with the nitrogen-fixing symbioses between legume trees and root bacteria, and with the symbioses between nitrogen-fixing trees and the people who use them in various traditional agroforestry systems. His interest in the diverse interactions between people and their environments is compatible with the School's many international research projects



William R. Burch, Jr.

that give attention both to biophysical issues and their social context or to social issues and their environmental context. His work in the Tropical Resources Institute focuses on helping develop collaborative interactions between F&ES students and their international counterparts, in working together to solve problems in management of natural resources.

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 1989. 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



Ann Elizabeth Camp



Carol Carpenter

fully includes human behavioral variables. This work has used a watershed unit and a ruralurban 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 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 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



Marian R. Chertow

Benjamin Cashore, Assistant Professor of Sustainable Forestry Management. B.A., M.A., Carleton University; Ph.D., University of Toronto. Professor Cashore's research interests include globalization and the privatization of environmental governance in the forest sector (forest certification eco-labeling programs), forest resource policies of Canada, the United States, Europe, and globally, the political economy of U.S.-Canada forest products trade, and forest industry environmental/sustainability initiatives. He has held positions as a legislation/policy adviser to the leader of the Canadian New Democratic Party (1990-93); research assistant to members of the Canadian Parliament (1987-88); and postdoctoral fellow, Forest Economics and Policy Analysis Research Unit, University of British Columbia (1997-98). He is also author or coauthor of chapters in several books published by the University of British Columbia Press, CAB International, Macmillan UK, and Oxford University Press. He is coauthor of In Search of Sustainability: The Politics of Forest Policy in British Columbia in the 1990s and is completing a manuscript comparing thirty years of environmental forest policy change in British Columbia and the U.S. Pacific Northwest. His new research project is a comparative analysis of forest certification (eco-labeling) politics and policies in North America and Europe.

Marian R. Chertow, Lecturer in 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. 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. Prior to Yale, Dr. Chertow spent ten years in environmental business and state and local government. She is a fellow of Jonathan Edwards College.



Timothy W. Clark



Lisa M. Curran

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 conservation 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



Michael R. Dove



Paul Alexander Draghi

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, Professor of Social Ecology and Professor of Anthropology. B.A., Northwestern University; M.A., Ph.D., Stanford University. Professor Dove's research focuses on interaction between local communities, national governments, and global agencies concerning the use of natural resources. 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 research, funded by the MacArthur Foundation, examines the impact of supra-community, institutional factors on biodiversity. Other research and teaching interests include the theory of sustainable development and resource use; contemporary and historical environmental relations in South and Southeast Asia; the history of market linkages in the tropical forest; the study of developmental and environmental institutions, discourses, and movements; and the sociology of resource-related sciences. Professor Dove is active in research networks bringing together environmental scientists from Asia, Europe, and North America. He is a fellow of Calhoun College.

Paul Alexander Draghi, Lecturer in Forest History and Director of Information and Library Systems. B.A., University of Connecticut; M.A., M.A., Ph.D., Indiana University. Dr. Draghi's teaching centers on two rather different areas. The first involves the application of information technology to environmental research, and communications and problem-solving, and includes the use of database, modeling, simulation, Geographic Information Systems (GIS), and other analytical software. His second teaching interest 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



Daniel C. Esty



Gordon T. Geballe

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 German, Sanskrit, Tibetan, and Bhutanese, and his previous work at Yale included the original 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 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; Associate Dean for Academic Affairs; Clinical Professor, Law School; Director of the Center for Environmental Law and Policy; and Co-Director of the Hixon Center for Urban Ecology. 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 indicators and the benefit of data-driven environmental decision making, environmental protection in the Information Age, private financing of environmental investments, environmental effects on competitiveness, the roles of nongovernment actors in environmental policy making, trade and environment linkages, global environmental governance, environmental performance measures, corporate environmental management, and environment and security. He is the author or editor of a number of books, including 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



Bradford S. Gentry



Thomas E. Graedel

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 the course "Designing the Ecocity" and numerous projects in New Haven. Dr. Geballe, with faculty and students, is involved in projects in the People's Republic of China. Current research is in Ganzu Province in northwest China looking at water/people relationships in this arid region and forestry in Fujian Province. With colleagues in the U.S., Hong Kong, and China, he is cofounder of the Sustainable Development Leadership Program, an executive program for business, government, and academic leadership in 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, Lecturer in Sustainable Investments 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 two major areas – increasing private investment in (r) the delivery of urban environmental services (particularly drinking water and sanitation), and (2) sustainable forest use and management. Projects in both areas are undertaken across a range of contexts from New Haven, to developing country megacities, to wilderness forest systems. He has written 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, 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., Uni-



Timothy G. Gregoire



Stephen R. Kellert

versity of Michigan. Professor Graedel's 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 he has followed it with three others: *Design for Environment; Industrial Ecology and the Automobile;* and *Streamlined Life-Cycle Assessment.* 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, and calibration estimators with sample survey data. 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, and he has received the award for research in Forest Science by the Society of American Foresters. He is a section editor of the multivolume *Encyclopedia of Environmetrics*.

Stephen R. Kellert, Tweedy/Ordway Professor of Social Ecology. B.A., Cornell University; Ph.D., Yale University. Professor Kellert's research has focused on policy and management issues relating to the interaction of people and the natural environment. Current research projects include studies of basic values and perceptions relating to the



Xuhui Lee



Reid J. Lifset

conservation of biological diversity; methods and concepts for valuing natural resources; environmental education and ethics; the biophilia hypothesis; and connecting natural systems with human values and socioeconomic behavior. He recently completed three books, *Kinship to Mastery: Biophilia in Human Evolution and Development; The Value of Life: Biological Diversity and Human Society;* and *The Biophilia Hypothesis,* co-edited with Edward O. Wilson, and he is currently writing another, *Ordinary Nature: Exploring and Restoring Nature in Everyday Life.* 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.

Xubui Lee, Associate Professor of Forest Meteorology and Micrometeorology. B.S.C., M.S.C., 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 of the *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 center on the emerging field of industrial ecology, which is the study of the environmental consequences of production and consumption. His research focuses on the intellectual and institutional development of the field of industrial ecology, which is the application of industrial ecology to solid waste problems, and the evolution of extended producer responsibility (EPR). 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*.



Kathleen McAfee



Robert Mendelsohn



Florencia Montagnini

Kathleen McAfee, Assistant Professor of Social Ecology and Community Development. B.A., Vassar College; M.A., Ph.D., University of California, Berkeley. Professor McAfee's research concerns new biotechnologies; intellectual property rights to genetic information and living organisms; and related challenges for agriculture, food security, the natural environment, and global governance. Her work on "Selling Nature to Save It?" analyzes problems of valuing and conserving biological variety and distributing environmental benefits and burdens in a world-market economy. She is author of *Storm Signals: Structural Adjustment and Development Alternatives in the Caribbean* (1991) and many articles on community development, gender, race, and social and environmental justice.

Robert Mendelsohn, Edwin W. Davis Professor of Forest Policy, Professor of Economics, and Professor in the School of Management. B.A., Harvard University; Ph.D., Yale University. During the past two decades, Professor Mendelsohn has concentrated his research work 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 to acid rain and, most recently, to greenhouse gases. He has also worked on valuing natural ecosystems, from tropical rainforests in Latin America to temperate forests in the Pacific Northwest and Alaska. Professor Mendelsohn hopes to extend integrated assessment to ecosystem management. He is a fellow of Ezra Stiles College.

Florencia Montagnini, Professor in the Practice of Tropical 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 role of native tree species in plantations and agroforestry ecosystems in reclaiming degraded areas; 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 human health factors in the design of sustainable land-use schemes for the rehabilitation of degraded lands in humid tropical regions.



James E. Saiers



Oswald J. Schmitz



Thomas G. Siccama

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. 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



Hilary A. Sigman



David K. Skelly

Ecosystem project in New Hampshire. He is also involved with natural areas documentation and land-use planning.

Hilary A. Sigman, Associate Professor of Environmental Economics. B.A., Yale College; M.Phil., Cambridge University; Ph.D., Massachusetts Institute of Technology. Professor Sigman specializes in the economics of public policies for environmental protection. She has focused her research on water quality in international rivers. Her paper "International Spillovers and Water Quality in Rivers: Do Countries Free Ride?" examines the extent to which environmental resources shared among countries suffer worse pollution than wholly domestic resources. She is a faculty research fellow of the National Bureau of Economic Research and currently serves on the Environmental Economics Advisory Committee of the U.S. Environmental Protection Agency's Science Advisory Board. Her research on hazardous waste, solid waste, and the federal Superfund program has appeared in the *RAND Journal of Economics, Journal of Environmental Economics and Management, Land Economics, Journal of Legal Studies, Journal of Law and Economics,* and in several books.

David K. Skelly, Associate Professor of Ecology. B.A., 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 larval amphibians have been directed at elucidating patterns of species distribution and community composition through an understanding of underlying mechanisms. In order to discover the links between land-scape-level distributions, performance across environmental gradients, and the attributes of individual species, he has employed field experiments and laboratory analyses in conjunction with long-term data on landscape structure. These data are being combined in models of amphibian metapopulations in order to test the ability of different hypotheses (spatial arrangement of habitats, landscape change) to explain distributional shifts. Additional projects include study of the ecology of disease in amphibians and an exploration of the interplay between human and nonhuman components of ecosystems.



James Gustave Speth



John P. Wargo

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, the Keystone Center's National Leadership Award, a 1997 Special Recognition Award from the Society for International Development, the 1998 Leadership Award of the Alliance for United Nations Sustainable Development Programs, and the Lifetime Achievement Award of the Environmental Law Institute. Publications include 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 Environmental Risk Analysis and Policy, Professor of Political Science, and Director of the Environment and Health Initiative. B.A., University of Pennsylvania; M.L.A., University of Massachusetts, Amherst; Ph.D., Yale University. Professor Wargo's current 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. He has conducted extensive research on childhood exposure to complex mixtures of toxic substances, especially pesticides. His recent book, *Our Children's Toxic Legacy: How Science*
and Law Fail to Protect Us from Pesticides, 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, and it won the American Association of Publishers award as the Best Scholarly Professional Book in Government and Political Science published 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 a fellow of Davenport College.



Degree Programs

MASTER'S DEGREE PROGRAMS

The School of Forestry & Environmental Studies offers four two-year master's degrees: Master of Environmental Management, Master of Environmental Science, Master of Forest Science, and Master of Forestry. Each of the degrees will serve as preparation for either professional employment or doctoral study. For individuals with seven or more years of relevant professional experience, a one-year 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.

Curricula of study leading to all master's programs are partially 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 other departments and professional schools at Yale. The amount of flexibility and structure varies considerably in individual cases depending upon preparation and degree interest. 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. Curricula of study leading to all degrees are fitted to the previous education and career objectives of the individual student. Students' programs are determined in continuing consultation with faculty advisers who guide their studies until graduation. Each program of study should be an extension of previous academic or professional achievement and should provide students with specialized knowledge and analytical skills that are logical for their objectives and their prospective contributions to their 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. The one-year Master of Environmental Management and Master of Forestry programs have less structured curricula than the two-year programs.

A minimum of *one independent project course* is required in the two-year Master of Environmental Management program. The Master of Forest Science program is a research-oriented program in forestry. The Master of Environmental Science program is a research-oriented program covering a broad array of natural and social science disciplines relating to the environment. Both of these programs require a minimum of *four research project courses*.

Project courses may involve research in laboratory, field, or library, or be analytical case studies designed to solve management problems. Typically the ideas for projects originate with the student. Project courses enable students or small groups to study relevant topics in a depth that is not always possible in regular courses; and they afford the

student interested in research an unusual opportunity to gain firsthand experience with the conduct and philosophy of independent inquiry. Introducing students to the literature dealing with localities, problems, or subjects with which they expect to be especially concerned in the future, projects provide a means of integrating and testing skills, knowledge, and judgment gained in formal courses. They have frequently permitted students to make a significant contribution to local communities or to the scientific literature.

Summer internships are an important component of master's programs in the School. Students pursue a variety of work situations in locations worldwide. Linkage of the summer internship and the independent project is very desirable but is not required.

Students interested in careers in research or teaching are advised to seek the Ph.D. degree in their field of major interest. *Unless applicants already have undergraduate or master's degrees representing appropriate preparation*, it is usually recommended that they begin with study for a master's degree.

The master's programs of the School of Forestry & Environmental Studies prepare students for professional practice or doctoral studies in environmental science and management. Two-year master's programs normally require a minimum of two full years in residence, sixteen full courses (forty-eight credits), and completion of the summer training modules in Technical Skills just prior to their first term.

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

Three one-week modules, run concurrently, impart field skills and techniques considered indispensable to students intending careers in natural resource management, forestry, and environmental management. These modules are a necessary base for subsequent course work at the School of Forestry & Environmental Studies, 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. *No one will be allowed to register for the fall term without successfully completing this program*. Course work is primarily in the field and covers three technical areas:

Module I: plant identification - field identification of trees, shrubs, and herbs.

Module II: ecosystem measurement – mensuration, cruising, and vegetation analysis.

Module III: land measurement – surveying, aerial photography, and mapping.

Master of Environmental Management

This degree is designed for students with primary interests in regulatory, stewardship, education, consulting, or management careers dealing with natural resource or environ-

mental issues. Requirements for the degree include core multidisciplinary courses, usually taken in the first year, and courses in an Advanced Study Area, taken primarily in the second year. Advanced Study Areas are broadly defined and currently include Ecosystem Science and Management; Conservation Biology; Coastal and Watershed Systems; Environmental Policy and Management; and Social Ecology and Community Development. The program requires course work in both the natural and social sciences, with a particular concern for the relation between science and management policy. The ultimate purpose of the degree program is to prepare students to manage complex ecological and social systems with scientific understanding and an ability to estimate the potential social and ecological effects of diverse policies.

One-Year Program. This degree program is restricted to selected individuals who have demonstrated competence during a minimum of seven years of responsible, full-time professional experience in the natural resource field. In addition, applicants should have relevant course experience in the natural and social sciences. The degree requirements are met by satisfactorily completing a two-term program of courses, seminars, and projects during one year in residence.

Two-Year Program. Most of the students in the Master of Environmental Management program attend the two-year program. A minimum of two full years in residence and sixteen full courses is required for successful completion of this program.

An acceptable program leading to the M.E.M. degree consists of a core curriculum, an advanced study program, and an independent project. With the guidance and approval of their advisers, students select core courses to meet distributional requirements from pre-approved groups of courses. Several advanced study areas have been identified by the faculty as representative of the strengths of the School and corresponding to professional opportunities. Students work with their advisers to define educational pathways within one of these advanced study areas.

ADVANCED STUDY AREAS

Ecosystem Science and Management emphasizes the application of principles of ecology and other appropriate disciplines to the solution of environmental and natural resource management problems. Biogeochemical cycling, energy flow in food webs, system productivity and sustainability, dynamics of perturbation, populations in ecosystems, and ecosystems in landscapes are representative areas of study. Students concentrating in this area might work professionally as ecologists in natural resource management and stewardship, restoration ecology, ecological and environmental education, land-use planning, ecological risk assessment, or environmental regulation.

Conservation Biology is a rapidly growing field founded on principles from ecology, evolutionary biology, biogeography, and the social sciences. The goal is to provide a sound basis for the management of ecological systems and the conservation of biological diversity. Two tracks of specialization are offered: Conservation Science and Conservation Policy. Students concentrating in this area go on to become conservation biologists, ecologists, stewards of lands and waters managed for conservation, and individuals involved in the formulation of conservation policy.

Coastal and Watershed Systems research and teaching activities emphasize, but are not limited to, the direct linkage between upland watersheds and estuaries. Natural and anthropogenic influences on the quantity, quality, and temporal availability of water, as well as resulting impacts on other components of terrestrial and aquatic ecosystems, are considered. Students concentrating in this area might work as hydrologists, aquatic chemists, water resource systems analysts, or in coastal and water resource management.

Environmental Policy and Management is intended to provide students with a mixture of natural science and social science relevant to environmental and resource policy and management problems. There are three tracks within this advanced study area. Environmental Health focuses on the link between pollution concentrations and specific damages to susceptible human populations. Industrial Environmental Management reviews how pollutants are emitted from industrial and residential activities, transported through the environment, and transformed, enabling students to understand how susceptible populations are physically affected, what kinds of damages they suffer, and how they might organize themselves legally, politically, and economically to protect themselves. Policy Analysis emphasizes exposure to the key social science disciplines that analyze public policy, and seeks to develop broad analytical skills, which students are asked to apply to one area of interest. The career objectives of students within Environmental Policy and Management include the broad areas of environmental policy analysis, industrial environmental management, pollution control, and environmental health policy.

Social Ecology and Community Development courses train students to analyze multiple influences on natural resource policy, management, and use from a range of temporal, managerial, and cultural perspectives. Students learn both top-down and bottom-up management approaches, qualitative and quantitative analytic skills, and the ways that resource management decisions may differentially affect individuals, local communities, social groups, management agencies, nation-states, and international interests. Students concentrating in this area might expect to work professionally on conservation and development policy, and on environmental education and communication practices and policies.

Master of Environmental Science

This degree 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 will require the student to produce a "scholarship 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.

Master of Forest Science

This degree 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 will require the student to produce a "scholarship 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.

Master of Forestry

Master of Forestry programs are professional studies aimed at training practitioners of forestry for administration and management of forest lands. Forest systems cover onethird 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: (1) 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 Conservacy, 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 Yale Forest Forum 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; 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 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.*

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 Medical School'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 Environmental Management degree, together with the joint degree as follows:

- 1. Law School Juris Doctor degree; four years.
- School of Medicine (Department of Epidemiology and Public Health) Master of Public Health degree; three years.
- 3. School of Management Master of Business Administration degree; three years.
- 4. Department of Economics, International Development and Economics program – Master of Arts degree; two and one-half to three years.
- 5. International Relations Master of Arts degree; two and one-half to three years.
- 6. Divinity School Master of Arts and Religion degree; 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 registrar 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, there is 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. Doctoral work is concentrated in areas of faculty research, which currently encompass the following broad foci: ecology, ecosystems, and biodiversity; environmental management and social ecology in developing societies; forest science and management; global change science and policy; health and environment; industrial environmental management; policy, economics, and the law; urban ecology, environmental planning, design, and values; and coastal and watershed systems.

Common Features of the Doctoral Degrees

Programs and requirements for both doctoral degrees share several basic features. All courses listed in this bulletin are open to students working for either 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.

Students are required to take the Doctoral Student Seminar, 824b, in the second term of their program.

Two Honors grades must be achieved before a student is eligible to sit for the qualifying examination in either doctoral program. In addition, students in both programs are expected to serve as teaching assistants.

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 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 both doctoral programs, and may be consulted about specific problems or questions concerning either 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.

The format for dissertations submitted for both degrees is identical. 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.

Differences between the Doctoral Degrees

The Ph.D. degree is oriented toward research in the natural and social sciences as applied to natural resource and environmental problems.

The D.F.E.S. degree is intended for people whose career interests are oriented toward problem solving. Students in this program usually choose dissertation problems that involve the application of the natural and social sciences to the management and protection of forests and other environmental systems. They often deal with the resolution of specific biological and socioeconomic conflicts in natural resource allocation, use, and conservation.

Topics selected by candidates for both degrees may overlap, because it is impossible to separate unequivocally basic from applied research, especially with respect to natural resources and the environment.

Joint Doctoral Degree

The School of Forestry & Environmental Studies has entered into an agreement with the New York Botanical Garden to offer a joint doctoral degree, either the Ph.D. or the D.F.E.S. For more information, please contact the director of doctoral studies.



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 2001–2002.

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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	Diversity	55
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F&ES 608a,b	Project in Structure and Development of Trees (Berlyn)	59
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[F&ES 702b]	Rapid Assessments in Forest Conservation for Diversity	
	and Productivity	60
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	Marine and Surficial Geochemistry Seminar in Alpine, Arctic, and Boreal Ecosystems Seminar on Climate Change Science and Policy Project in Biometeorology (Lee) Climate and Life A Biological Perspective of Global Change

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Conservation Distinguished Lecture Series	00
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COURSE DESCRIPTIONS

At F&ES, new courses are often added after this bulletin is printed. Our Web site at http://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 classes.yale.edu/fes519b/. Thomas G. Siccama.

[F&ES 523a, Historical Ecology. 3 credits. The purpose of this course is to familiarize students with the impact of pre-Columbian human technologies on the natural environments of the Western Hemisphere. At times, well-meaning citizens with conservationist agendas project the romantic impression that Europeans arriving on the shores of the Americas in the fifteenth and sixteenth centuries found basically undisturbed habitats wherever they landed; this is patently false. On the contrary, it seems likely that humans influenced the biotic landscape from the time of their first migration to the Americas approximately 15,000 years ago. Although many pre-Columbian land-use practices were conservative in nature, some were not. This course reviews the natural ecosystems of the Americas and the environmental modifications caused by human settlement prior to European contact. Next offered fall 2002. David L. Lentz, The New York Botanical Garden.]

F&ES 527a,b, Project in Tropical Ecology. Lisa M. Curran.

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 573a,b, Project in Restoration Ecology. Faculty.

F&ES 574a, Tropical Forect Ecology: The Ecological Basis for Conservation and Management. *3 credits*. The purpose of this course is to summarize ecological knowledge on tropical forest ecosystems and to show how it can be used for forest management, conservation and restoration, and for implementing other tree-based land utilization schemes such as plantation forestry and agroforestry. Topics include tropical forest environment; structure and composition; plant species diversity; nutrient cycling; effects of disturbance; forest succession and regeneration; deforestry and agroforestry; and utilization of primary and secondary forests; plantation forestry and agroforestry; and tropical forest restoration and conservation. Three hours lecture. Florencia Montagnini.

F&ES 575a, Patterns and Processes in Terrestrial Ecosystems. 4 *credits*. The objective of this course is to build a conceptual model of the terrestrial ecosystem to be used as a basis for the study of the spatial distribution of ecosystems; their development through time; and the impact of pollution, disease, and forest management practices on the health of ecosystems. A cross section of northeastern ecosystems is visited and studied. Three hours lecture and four hours laboratory. One weekend and one Saturday field trip. See www.yale.edu/edex/fes575a/terreco.htm/. Thomas G. Siccama.

F&ES 577a,b, Project in Tropical Ecology. Florencia Montagnini.

F&ES 579a,b, Project in Ecology. Thomas G. Siccama.

F&ES 580a,b, Project in Ecosystem Ecology. Faculty.

F&ES 591a,b, Project in Tropical Studies. New York Botanical Garden Faculty.

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 777a,b, Project in Ecosystem Ecology. Gordon T. Geballe.

F&ES 814a,b, Project in Tropical Forests. Daniel Nepstad.

F&ES 818b, Seminar in Tropical Forest Conservation. 3 credits. 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, emerges only as the boom economy goes "bust," and the forests are already reduced to fragments. In this seminar, we analyze the policies and economic forces that shape frontier expansion in the tropics to identify robust approaches to the conservation of tropical forests. We examine the biodiversity paradigm that dominates tropical conservation efforts today, its scientific underpinnings, and its effectiveness in conserving tropical forests. We investigate the political constituencies (local, national, and international) in support of forest conservation and forest-dependent economies, and the potential for expanding these constituencies. In this context, we evaluate the emerging markets for ecological services performed by tropical forests (carbon storage, watershed function, biodiversity conservation, etc.), and their potential for promoting the maintenance, or restoration, of forests in tropical frontiers. Finally, we review recent evidence of both an expanding threat to tropical forests posed by climate change, and an expanding contribution of tropical forest loss to climate change, and the implications of these discoveries for the future of tropical forest conservation. Daniel Nepstad.

WILDLIFE ECOLOGY AND CONSERVATION BIOLOGY

[F&ES 509a/E&EB 370a/509a, 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. Next offered fall 2002. David K. Skelly.]

F&ES 511a,b, Project in Ecology. David K. Skelly.

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 525a,b, Project in Natural Resource Policy. Timothy W. Clark.

F&ES 526a,b, Project in Biodiversity Conservation. Timothy W. Clark.

F&ES 560b/E&EB 560b, 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 563b/E&EB 532b, Community Ecology. 4 credits. This course provides students with the necessary tools to begin evaluating how ecological populations and communities are structured and how natural perturbations alter these systems. Students are introduced to important concepts such as density-dependence and density-independence, population limitation, population regulation, population equilibria and stability, stochastic population dynamics, and chaos. These concepts are explored through the use of mathematical models describing within- and between-species interactions such as predation, disease ecology, and competition. Multispecies interactions are examined in the context of food chain and food web dynamics to understand the relations between species diversity and the stability of natural ecosystems, and between environmental variability and equilibrium dynamics. Three hours lecture and two hours computer laboratory. Oswald J. Schmitz.]

F&ES 564b, Seminar in Wildlife Ecology. *3 credits.* A topic of current research in animal ecology, conservation, or behavior is explored in depth by the instructor and students in a seminar format. Prerequisites: F&ES 560b or equivalent and permission of the instructor. 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 567a,b, Project in Biodiversity Conservation. Stephen R. Kellert.

F&ES 569a,b, Project in Wildlife Ecology. Oswald J. Schmitz.

F&ES 578b/E&EB 375b/535b, 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 760a/E&EB 365a/760a, 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 an independent project resulting in a manuscript on a landscape-related topic. Ofer Ovadia for David K. Skelly.

F&ES 762b, Ecology Seminar. *I credit.* The ability to read and understand the primary 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 are selected over the course of the term; however, we plan to survey the major branches of modern ecology: behavioral, evolutionary, physiological, population, community, and ecosystem ecology. Many of the papers read have direct or indirect relevance to applied issues such as the conservation of species and ecosystems. Seminar responsibilities include active participation in weekly discussions and the leadership of one discussion. David K. Skelly.

F&ES 813a,b, Project in Molecular Systematics. Adalgisa Caccone.

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. *I 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. Three-hour seminar and writing workshops. Fred Strebeigh.

F&ES 584a,b, Project in Environmental Writing. *3 credits.* Prerequisite: F&ES 583a or comparable experience and a strong article proposal. Fred Strebeigh.

F&ES 589a,b, Project in Environmental Education. Stephen R. Kellert.

F&ES 723a,b, Project in Information Management. Paul A. Draghi.

[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. Next offered fall 2002. 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 Yale Center for British Art and the Yale Art Gallery. Three hours lecture/discussion. Paul A. Draghi.

F&ES 824b, 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. John P. Wargo.

Forestry

FOREST BIOLOGY

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. Thomas G. Siccama.

F&ES 592b, **Agroforestry in the Tropics: Sustainability and Services.** *3 credits*. Focus 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: Soil productivity and sustainability in agroforestry. Nutrient cycling and nutrient use efficiency in agroforestry systems. Agroforestry components: multiple-purpose trees, nitrogen-fixing trees, economic aspects. Examples of susbisistence-oriented and commercial agroforestry: biodiversity conservation and carbon storage. Agroforestry alternatives for restoration of degraded ecosystems. Agroforestry as a tool for development. Examples from the humid and from the semi-arid tropics. Current trends in agroforestry research. In addition, open discussions 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.* Reproductive processes such as fertilization, embryogeny, and seed development are discussed, and differences between different groups of vascular plants analyzed from structural, functional, ecological, and evolutionary standpoints. Tree growth is examined by focusing on the operational activities of the meristems that generate it. Wood formation in tropical and temperate trees is considered in an evolutionary and ecophysiological context. Prerequisite: MCBD 120, E&EB 122 (general biology), or equivalent. Two one-and-one-half hour lectures, final examination, and a term project or paper. 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 analysis. After a series of class exercises are completed, each student selects a personal project under the direction of the instructor and prepares a minidissertation complete with literature review, materials and methods, results, and discussion. Weekly seminars and progress reports on the projects are required. Prerequisites: F&ES 600a and 610b. Permission of the instructor required. Four hours lecture/laboratory. Graeme P. Berlyn.]

F&ES 608a,b, Project in Structure and Development of Trees. Graeme P. Berlyn.

F&ES 609a,b, Project in Identification and Comparative Anatomy of Woods. Prerequisite: F&ES 600a or equivalent. Graeme P. Berlyn.

F&ES 610b, Physiology of Trees and Forests. *3 credits.* The course covers physiology of trees, primarily at the individual tree level but integrating over the biochemical, cellular, stand, and ecosystem level. Topics covered include photosynthesis, water relations, respiration, bioenergetics, mineral nutrition and the potential role of biostimulants in forestry and agroforestry, growth analysis, and environmental physiology and adaptation with special reference to high elevation forests both temperate and tropical. Additional attention is paid to stress physiology of forests and their vulnerability to disturbance from natural and anthropogenic factors. Final examination and term paper or project required. Prerequisite: F&ES 600a or equivalent. Recommended: MCDB 265a, 665a (plant physiology), and some knowledge of basic chemistry, physics, and mathematics. Two one-and-one-half hour lectures. Graeme P. Berlyn.

F&ES 619a,b, Project in Tree Physiology. Graeme P. Berlyn.

F&ES 709a,b, Project in Plant Community Ecology. Mark S. Ashton.

FOREST MANAGEMENT

F&ES 576b, Botanical Resources of the Tropics. *3 credits.* This course addresses the botany, utilization, and economics of tropical plants used by people in the past and at present. The lecture and laboratory sessions provide an opportunity to learn about plants employed for food, fuel, construction materials, spices, perfumes, stimulants, narcotics, medicines, poisons, fatty oils and waxes, gums and resins, and rubber and other latexes.

The ecological impacts of exploiting these resources are also considered, and different ways to enhance the sustainability of tropic forest exploitation are examined. Three hours combined lecture and laboratory. NYBG Faculty.

F&ES 594a, Theoretical Lenses on Domestic and Global Environmental Governance: Analyzing Emerging Innovations in Sustainable Forest Management and Forest Certification. *3 credits*. This course explores theories of domestic and international policy-making process in order to understand better domestic and international innovations in Sustainable Forest Management. Particular attention is placed on the burgeoning case of Forest Certification (eco-labeling), which appears to be emerging as a new and dominant form of environmental governance initiated outside of traditional *public* policy arenas. Benjamin Cashore.

F&ES 597a,b, Project in Agroforestry. Florencia Montagnini.

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, timber and nontimber products, and landscape design. Recommended: some knowledge of soils, ecology, plant physiology, and socioeconomics. Four hours lecture. One hour tutorial. Seven days fieldwork. Mark S. Ashton.

F&ES 702a, 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 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, 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 734a or permission of the instructor. Eight days fieldwork. Mark S. Ashton, Thomas G. Siccama.

[F&ES 702b, Rapid Assessments in Forest Conservation for Diversity and Productivity. *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, 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 702b; F&ES 560b; F&ES 734a or permission of the instructor. Three hours lecture. Eight days fieldwork. Next offered spring 2003. Mark S. Ashton, Timothy W. Clark.] **F&ES 703a, Growth and Development of Forest Stands.** *3 credits.* Introduction to 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 western North America and elsewhere. The course also introduces growth and yield models that result from stand dynamics research and/or aid in predicting future stand development patterns. Ann E. Camp.

[F&ES 704b, 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 733b or 734a; or permission of instructors. Next offered spring 2003. Mark S. Ashton, Florencia Montagnini, Ann E. Camp.]

F&ES 705a, Seminar in Advanced Silviculture. *3 credits.* This course considers selected topics in silviculture for students with previous instruction in silviculture. The fieldwork of F&ES 700b may be taken in the spring term for one extra credit. Three hours lecture. Ann E. Camp, Florencia Montagnini, Mark S. Ashton.

F&ES 706a,b, Project in Silviculture. Mark S. Ashton.

F&ES 707a,b, Project in Silviculture. Faculty.

F&ES 708a,b, Field Trips in Forest Resource Management and Silviculture. *I credit.* Seven- to nine-day field trips to study the silviculture and forest management of particular forest regions. In previous years, classes have visited Germany, 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, Florencia Montagnini.

F&ES 712a,b, Project in Forest Planning. Greg J. Arthaud.

F&ES 726b, Integrated Resource Planning and Negotiation. *3 credits.* This course integrates material from previous F&ES coursework in management, economics, policy, and spatial analysis. Students work in a team to focus on developing and analyzing alternatives for a specific natural resource conflict. Students also serve as interest groups on other cases. The analyses from cases are developed into negotiation games, which are played out at the end of the term. Recent conflicts were set in Canadian, Montana, and

Southern Appalachian forests, a Georgia coastal island, and a New York watershed. Courses in economics and GIS are useful. Three hours, split between lecture and small group conferences. Midterm and written student reports. Greg J. Arthaud.

F&ES 727a, Forest Finance and Management. *3 credits.* This course introduces students to methods of addressing the financial and quantitative management aspects of forestry. This course is important for those who might prepare, or need to evaluate, forest management plans. Major topics include financial analysis of management alternatives; economic and management implications of silviculture, management assumptions and constraints, and taxation; and techniques of forest planning, including sustainable management and handling spatial requirements. Prerequisites/corequisites: F&ES 734a and F&ES 700b, or permission of instructor. Three hours lecture. Biweekly problem sets. Greg J. Arthaud.

F&ES 877b, Current Issues in Commercial Forestry. This seminar focuses on commercial forestry as practiced in the private sector as we enter the twenty-first century. It touches upon the changes now occurring in public expectations, technology, and regulation. Although the focus is on private lands in the United States, to establish a reasonable understanding of supply and demand, it is set against the background of international supply and the changes occurring in the management of public lands. There is a premium on class participation, discussion of current issues and trends.

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 2002. Karl Turekian.]

F&ES 612b, Seminar in 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 highelevation and high-latitude forests are studied through lectures, guest lectures and discussions, student seminars, and field experience. One and one-half hours lecture weekly plus field trip. 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, Xuhui Lee, Mark S. Ashton.

F&ES 834b, Seminar on Climate Change Science and Policy. 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 867a,b, Project in Biometeorology. 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, Catered Topics in Applied Environmental Chemistry. *1 credit.* An advanced seminar exploring the chemical principles underlying the behavior of natural and anthropogenic materials in the environment. The object 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. One-hour participatory discussion, class presentation, dinners. Students may take this course more than once, space permitting. 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, PAHs) and petroleum products. The course is appropriate both for students with no background in organic chemistry and for those who do have some background; more than 3/4 of the material presented is not covered in undergraduate organic chemistry classes. 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 cleanup 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 groundwater. Three hours lecture, five problem sets, optional field trip. Shimon C. Anisfeld.

F&ES 518a, Seminar in Environmental Organic Chemistry. 3 *credits.* An advanced seminar in the environmental fate of organic pollutants. Topics are determined by student interest and may include sorption, bioremediation, analytical techniques, multimedia models, groundwater remediation, and global transport of persistent pollutants. Meetings are divided between presentations by the instructor and by students. Two hours lecture, project/presentation. Prerequisite: F&ES 507b or permission of the instructor. 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 546a,b, Project in Environmental Chemistry. Gaboury Benoit.

F&ES 596a/CENG 373a/ENVE 373a, Air Pollution. *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. Liv Brakewood.

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. Sheryl Stuart.

F&ES 967a,b, Project in Environmental Chemistry. Shimon C. Anisfeld.

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. See classes.yale.edu/fes530a/. Two lectures a week. Four all-day Saturday field trips. Thomas G. Siccama, Florencia Montagnini.

F&ES 539a,b, Project in Soil Ecology. Faculty.

F&ES 550a,b, Project in Tropical Soils. Faculty.

WATER RESOURCES

F&ES 516a,b, Project in Watershed Management. Richard Burroughs.

F&ES 533b, Water Resource Management. *3 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 law, the watershed framework, and restoration. Three hours lecture, one term project, two field trips. Prerequisites: F&ES 540a and F&ES 545a, or instructor's permission. Shimon C. Anisfeld.

F&ES 536a, Estuaries and Coastal Wetlands: Processes and Perturbations. *3 credits.* An examination of the natural processes controlling coastal ecosystems and the anthropogenic perturbations to these processes. The focus of the course is primarily on hydrologic and biogeochemical processes, but an integrated approach is taken whenever possible. Ecosystems examined include: estuaries; salt marshes; tidal freshwater marshes; mangrove wetlands; and coral reefs. Perturbations covered range from local to global, and include nutrient enrichment, sea level rise, invasive species, and wetland filling. Detailed examination of local case studies supplements the general coverage. Three hours lecture, two field trips. Prerequisites (may be taken concurrently): F&ES 540a and F&ES 545a; or permission of the instructor. 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. *3 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 542a,b, Hydrology Seminar. *2 credits*. A seminar exploring current research topics in hydrology. An integrative analysis of hydrological, geochemical, and biological processes is emphasized. A theme for the seminar is chosen by consensus of the students during the first class meeting. Students may take this course more than once. James E. Saiers.

F&ES 543a,b, Project in Hydrology. James E. Saiers.

F&ES 866b, Caribbean Coastal Watershed Development: Science and Policy. *3 credits.* Investigation of the environmental impacts of development in coastal watersheds of a typical Caribbean island. 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 Roatan, Honduras. Weekly lecture, readings, group or individual project. Taught only in alternate years; next offered spring 2002. Gaboury Benoit and a visiting lecturer.

F&ES 881a, Marine Protected Areas: The Munson Marine Conservation Distinguished Lecture Series. *1 to 3 credits.* Lecture series to address critical biological, ecological, social, and economic issues surrounding Marine Protected Areas (MPAs). Students gain an introduction to current approaches, both theoretical and applied, to MPA theory, design, policy, and management. Twelve lectures, each given by a distinguished expert in the science and policy of Marine Protected Areas. May not be offered in the future. Gaboury Benoit, Stephen R. Kellert, Richard Burroughs.

Quantitative and Research Methods

[F&ES 506b/G&G 562b, 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, ecol-



ogy 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.]

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. Oswald J. Schmitz.

F&ES 512a,b, Project in Research Methods. Faculty.

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. Faculty.

F&ES 622a, Seminar in Forest Inventory. *1 credit.* 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; the use of remote sensing data

and GIS in forest inventory planning; forest inventory and consulting; the generation of forest inventory estimates at various scales of concern; acquisition of forest inventory data from Internet databases. Readings are assigned on a weekly basis and discussed during the seminar. A familiarity with the precepts and vernacular of probability sampling or statistics is presumed. Prerequisite: F&ES 711a or permission of the instructor. Limited enrollment. Timothy G. Gregoire.

F&ES 710a,b, Project in Statistics. 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 basis for inference in survey sampling. Natural resource applications of sampling are emphasized, with particular focus upon the sampling of forest-related resources. Sample designs to be studied include simple random; systematic; unequal probability; fixed- and variable-radius plot; and 3P/Poisson. Line-intersect and importance-sampling variants of probability proportional to size designs are also covered. Weekly problem sets requiring the use of a computer spread-sheet. 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 both experimental and observational data. After considering statistical and graphical summaries of data, the notion of a random variable, distributional properties, parameter estimation, and testing are reviewed. 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 major topics of the course are estimation and inference with linear and nonlinear regression models. Prerequisite: introductory statistics. Three hours lecture. Statistical computing, weekly problem exercises. Timothy G. Gregoire.]

F&ES 715a, Modeling Geographic Space. *3 credits.* An introduction to the conventions and capabilities of image-based 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. Faculty.

F&ES 716b, Modeling Geographic Objects. *3 credits.* This course offers a broad and practical introduction to the nature and use of drawing-based 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. Faculty.

F&ES 717a,b, Project in Geographic Information Systems. Faculty.

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. The latter half of the course focuses more on environmental and ecological field experiments and the challenges to statistical design that they pose. Prerequisite: a prior course in introductory statistics. Jonathan D. Reuning-Scherer for Timothy G. Gregoire.

Social Sciences

ECONOMICS

F&ES 733b, 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 734a, Natural Resource Economics. *3 credits*. This course is designed to teach students how to think about managing natural resources. Both renewable and nonrenewable resources are discussed. Distinctions are made between outputs traded in markets such as oil, timber, and commercial fish versus outputs not traded in markets such as recreation, genetic diversity, and preservation. The roles of markets and government are discussed in each case. Three hours lecture. Robert Mendelsohn.

F&ES 735a,b, Project in Resource Economics. Robert Mendelsohn.

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 738a,b, Project in Resource Economics. Hilary A. Sigman.

ENVIRONMENTAL POLICY

F&ES 720b, **Policy Science and Problem Solving in Complex Environments**. *3 credits*. In this course students develop practical skills in problem solving and their understanding of complex system dynamics. This course complements existing natural resource policy offerings and is designed for students who want to develop generic management skills and to explore the intellectual underpinnings of the policy sciences. The approach is interdisciplinary, incorporating, within the framework of the social sciences, management science, historical analysis, and political philosophy. Lessons from

economic, political, and intellectual history underscore and validate the policy science orientation and a humanist approach to problem solving. This furthers the ecological principles of the policy sciences, the importance of diversity and risk management to stability, the limits of rationality and control in complex environments, and the central value to policy making of self-orientation. Arvid Nelson.

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 728a,b, Project in Natural Resource Policy. John P. Wargo.

F&ES 766b, Public-Private Partnerships for the Urban Environment. 3 credits. Governments around the world are finding that they cannot meet pressing urban environmental needs acting alone. Nor can they compel the private sector to take all the actions that are necessary. Increasingly, they are turning to partnerships with businesses, NGOs, and communities to improve the delivery of urban environmental serviceswater, waste, and energy. Such efforts are extremely controversial, raising fundamental questions as to the roles of governments, businesses, and communities in meeting basic human and environmental needs. In collaboration with the United Nations Development Program and universities around the world, this course explores the use of publicprivate partnerships to address urban environmental issues, particularly in the developing world and economies in transition. An "analytical backbone" provides structure to the core readings, local class discussions, and research on local partnerships. Internetbased exchanges are used to help students compare and draw lessons learned from the partnership experience in different countries. For the spring term 2002, collaborating universities are expected to include those from Africa, Asia, the former Soviet Union, and Latin America. Class size limited. Bradford S. Gentry.

F&ES 795a,b, Project in Environmental Policy. Arvid Nelson.

F&ES 805b, Current Issues in Natural Resource Policy. *3 credits.* During the past decade, a number of factors have played an increasingly important role in affecting natural resource policy. Through case studies, lectures, and contributions by guest speakers the course explores the following factors as they affect the development and implementation of policy: organizational culture and change, science and scientists, the influence of advocacy groups, Congressional dynamics, influence of the courts and litigation, public participation and local decision making, urbanization and the views of urban society, and the role of the media. Students should develop an appreciation for the complex and dynamic nature of policy and, through this understanding, enhance their capacity to
influence its formulation and implementation. (Students are also afforded the opportunity to participate in a one-week field trip to Washington, D.C., during the spring break.) James R. Lyons.

F&ES 811a,b, Project in Environmental Policy Making in Latin America. Yolanda Kakabadse.

F&ES 819a, Social and Environmental Dimensions of Biotechnology. 3 credits. This course examines the rapid development of genetic engineering science and biotechnology-based industries, with an emphasis on agricultural biotechnologies. We survey the economic, health, environmental, legal, and social justice dimensions of new biotechnology applications: rDNA tools in medicine; genomic screening, cloning, and germline engineering; transgenic animals and crops; genetically altered food; and biodiversity prospecting. We investigate the economic stakes in biotechnology development and why intellectual property rights to genetic information are the focus of heated international disputes. We consider a range of scientific and ethical views on potential benefits and risks of genetically altered organisms: Is genomic biotechnology the key to ending hunger, eliminating disease, and even improving the human species? Do some, or even all, applications of biotechnology pose serious health and/or ecological hazards and moral problems? We also consider the origins and effects of ideas about genetics and biotechnology. Why do some scientists argue that the concept of "gene" is misleading? What do we know, and what is still unknown, now that the human genome has been "decoded"? Readings, lectures, Internet site reviews, student presentations, and papers address controversial choices faced now by scientists, farmers, doctors, consumers, governments, regulatory agencies, NGOs, and global governance institutions such as the World Trade Organization. Kathleen McAfee.

F&ES 821a/PLSC 392a, The Environmental Movement in Latin America. *3 credits.* What are the strengths and weaknesses of the environmental movement in Latin America? What political and social realities limit its ability to address the great problems of deforestation, urban sanitation, water pollution, air pollution, and industrial toxins? How does it differ from the U.S. environmental movement and from other social movements in Latin America? Sylvia Tesh.

F&ES 827a, Conflict Management and Sustainable Development in Latin America. *2 credits.* Most of the social problems in Latin America are related to land use, natural resources management, and the contradictions between environmental/social/economic policies. While policy makers perceive development mainly as economic development, social actors struggle to place other priorities in the development agenda, resulting in confrontation and conflict. A conflict management model has been developed to work with leaders of all sectors in the understanding of conflict and means to manage it. The seminar is centered on a conflict management model for Latin America and analyzes some case studies of regional, national, and local conflicts. Yolanda Kakabadse. **F&ES 828a, Environmental Policy Making in Latin America.** *3 credits.* Early in the 1990s a group of top decision makers of Latin America produced a document called "Our Own Agenda," an analysis of existing policies and recommendations to achieve sustainable development in the region. What has happened since then? What are the main struggles of Latin American countries to achieve sustainable development? Analysis of the situation of some countries in the region: Argentina, Bolivia, Brazil, Costa Rica, Cuba, Ecuador. Yolanda Kakabadse.

F&ES 836a,b, Project in Natural Resource Policy. James R. Lyons.

F&ES 842a, The Economics of Sustainable Development. *3 credits.* Exploration of interpretations and definitions of sustainable development with attention to indicators and measures of progress. The course emphasizes the principal economic obstacles to sustainable development, the policy options available with which to overcome such obstacles, and recent experience – largely in developing countries – in attempting to apply such policies. Among these obstacles are institutional, market, and government policy failures. Each is studied across several resource sectors, such as agriculture, forestry, and fisheries. The course also examines issues surrounding the role of international development institutions in overcoming these obstacles. It is assumed that students in the course will have varying levels of prior preparation in economics. Robert Repetto.

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. It introduces students to federal, state, and regional laws and programs that affect watershed protection and 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 practices particularly as they relate to controlling development in and around watershed areas. Nearby watersheds are visited, their functions assessed, and the local governmental structure affecting them discovered and discussed. These watersheds are used as a context for the students' understanding of the strengths and weaknesses of local planning and regulation. John R. Nolon, James G. MacBroom.

F&ES 853a/LAW 20174, Private Investment and the Environment. *3 credits.* This seminar examines the impact of private capital as a force that is reshaping environmental protection strategies. It begins by examining fundamental questions of environmental policy in light of the shifts away from "command and control" regulations toward market-based instruments, and from foreign aid to private investment as the driver of "sustainable development." The seminar then considers the motivations of private investors, as well as some of the new approaches being used to increase the incentives for improved environmental performance. Examples from around the world are used to illustrate the main themes. Students are expected to produce significant research papers. Enrollment limited. 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 859b, Seminar on the Global Change Agenda. 3 credits. This course examines a set of global-scale environmental challenges as they have been identified by intergovernmental bodies, e.g., ozone depletion, climate change, deforestation, biodiversity loss, desertification, persistent organic pollutants, etc. In each case the class examines the seriousness of the environmental risks involved and the values underlying that assessment, the process through which these challenges became public issues meriting international attention, and the nature of the policy responses to date. Students are asked to examine questions such as the following: How adequate is the available information on conditions and trends that characterize each challenge? What are the underlying forces or processes giving rise to these challenges, and are there common elements among them? Likewise, are there common elements or interactions among the responsive actions being considered? What are the constraints within which the policy process operates? Are there other, better ways to define the global change agenda? Participating students are expected to produce significant research papers. James Gustave Speth.]

[F&ES 860a, Transportation and the Environment. *3 credits*. This course explores the range of environmental tensions created by an American society defined by motor vehicles. Since the end of WWII, automobiles and trucks have shaped the values, politics, and quality of our lives. In this course we engage in the process of comparative institutional analysis. Working across policy issues to enable optimal institutional outcomes, we try to understand better how to make transportation policies environmentally sound and how to unravel the environmental impacts of transportation. Next offered fall 2002. Emil H. Frankel, Karyl Lee Hall.]

F&ES 861b, 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 864b, Environmental Protection Clinic. *3 credits.* A clinical seminar with biweekly class sessions and "engagement" with actual environmental law or policy problems on behalf of client organizations (environmental groups, government agencies, international bodies, etc.). Students work ten to twelve hours per week, generally in interdisciplinary groups (with students from the Law School and, occasionally, other parts of the Yale community) on projects with a specific legal or policy product (e.g., draft legislation or regulations, hearing testimony, analytic studies, policy proposals) to be produced by the end of the term. Students may propose projects and client organizations, subject to approval by the instructor. Limited enrollment. Faculty.

F&ES 890a,b, Project in Environmental Law. Daniel C. Esty.

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 892a,b, Project in Environmental Law. Bradford S. Gentry.

HEALTH AND ENVIRONMENT

[F&ES 72 Ib/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 722a/EHS 508a, Assessing Exposures to Environmental Stressors. 2 credits. This course examines human exposures to environmental stressors, as it applies to environmental epidemiology and risk assessment. Indirect and direct methods of assessing exposures are reviewed, and case studies are presented. Brian P. Leaderer.

INDUSTRIAL ENVIRONMENTAL MANAGEMENT

F&ES 500a, Environmental Aspects of the Technological Society. *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. Thomas E. Graedel, William Ellis.

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 is being applied in corporations to minimize the environmental impacts of products, processes, and services, and shows how industrial ecology serves as a framework for technology, policy, and resource management in government and society. Thomas E. Graedel, Marian R. Chertow.

F&ES 503a, Environmental Leadership. *3 credits.* This course explores the qualities, characteristics, and behaviors of leadership in the fields of natural resources and environmental science and management. Through lectures, contributions by guest speakers, and individual and team projects, students analyze pathways to leadership, leadership skills, the role of scientists in leadership and management decision making, and the attributes of leadership in individuals and organizations. Students have the opportunity to assess their own leadership skills and, through various exercises, work to overcome deficiencies. James R. Lyons.

F&ES 810b, 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 business development and strategy. Marian R. Chertow, William Ellis, Larry Schiffres.

F&ES 812a, 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. Marian R. Chertow.

F&ES 854a,b, Project in Industrial Environmental Management. Thomas E. Graedel, Marian R. Chertow.

F&ES 857a,b, Project in Solid Waste Management. Faculty.

SOCIAL AND POLITICAL ECOLOGY

[F&ES 572a, Designing the Ecocity. *3 credits*. An ecocity is a city that performs all the functions customary to a city, and does so in an environmentally responsible manner. This course is centered on designing such a city along industrial ecology principles through an exploration of the following question: If we did not have the present urban system of housing, food supply, transport, industry, infrastructure, and so on, would we reinvent and adopt something very like the present or, given what we know now, would we opt for (potentially radically) different alternatives? Student teams develop plans for growing cities in specified locales worldwide, drawing on information generated by previous classes. The result is intended to be a class consensus design for an ecocity of the future. Prerequisite: F&ES 501b, *Industrial Ecology*, or permission of the instructors. Limited to eighteen students. Thomas E. Graedel, Gordon T. Geballe.]

[F&ES 721a, Risk and Property. 3 credits. This course is designed as an advanced study seminar to explore the relations between risk and property in natural resource and environmental law and policy. Property is considered as a type of social relationship, one that assigns rights to some and obligations to others. Different forms of property are considered as are different sources of legitimacy. Risk is examined as a probability of an adverse outcome. Understanding the distribution of risk is a key concern in the course. Central questions include: How are property rights defined and assigned? How stable are property rights in the face of changing understanding of environmental health and ecological risks flowing from existing property systems? How are traditional or customary rights different from legally defined rights? Cases include: Land-Use Control in the Adiron-dack Park; Ecological Risk Management in National Parks; Managing Endangered Species or Diversity Loss; Restoration of Contaminated Urban Sites; Regulating International Markets for Pesticides; Creating Markets for Air Pollution: SO₂ and CO₂. John P. Wargo.]

[F&ES 740b, Seminar in Ecosystem Management: Community Forestry and Protected Area Applications. 6 credits. This seminar is directed to students planning on professional careers as natural resource planners, managers, or policy analysts. Emphasis is on community-based resource systems for protection and production actions in tropical/temperate; rural/urban; and developing/overdeveloped regions. Theory comes from four points along the path of coevolution for forestry and social ecology from conservation through environmental regulation to ecosystem management. Methods and measures come from use of emergent biosocial appraisal techniques. Visiting experts provide workshops on specific management skills for outreach, planning, marketing, management of problem wildlife. Case studies provide organizational insight. Peer teams complete a major applied ecosystem project. William R. Burch, Jr.]

F&ES 743b/PLSC 367b/ANTH 417b/EP&E 452b, Environment and Development: Dilemmas of Power and Place. 3 credits. An intensive, comparative investigation of conservation and development as they are conceptualized and practiced in specific regions of Africa and Asia. Examination of the interrelated concepts of modernity, rationality, postcolonialism, power and knowledge, and governmentalism, through analyses focused on the history, ethnography, and ecology of these regions. Arun Agrawal, Rebecca Hardin, Eric Worby, Estienne Rodary.

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 746a, Society and Natural Resources. I-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. 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 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 knowledge of local peoples. The course offers students an opportunity to develop analytic frameworks for past or proposed research projects. A prerequisite for F&ES 752b and F&ES 759b. Three hours lecture/discussion. 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 749a, Project in Ecosystem Management: General Applications. Work should be within six areas – wildland recreation management, environmental protection and planning, environmental interpretation and planning, urban community forestry, social dimensions of tropical forestry development, and renewable energy systems. A detailed study plan and work schedule are required prior to acceptance. William R. Burch, Jr.]

F&ES 750a,b, Project in Social Ecology. 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 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, F&ES 756b, or F&ES 757a. Limited enrollment. Three hours lecture/ seminar. Taught alternate years. 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. One-and-one-half-hour lecture and one-and-one-half-hour seminar. Michael R. Dove, James C. Scott, Robert Harms, and faculty.

F&ES 755a,b, Project in Social Ecology. Michael R. Dove.

[F&ES 756b/ANTH 589b, Gender and Natural Resources. 3 credits. This course examines gender and natural resources, particularly in the context of agrarian systems. The course includes three tiers of relations: (1) households, (2) communities, and (3) relations between households and the state, especially the taxation system and market relations of the state. The object of this course is twofold. First, it is intended to give students sufficient grounding in the theory of gender and natural resources to understand and critique it. Classes cover the three main branches of theory: ecofeminism; women, environment, and development theory; and theories concerning feminism and science. The course also problematizes concepts like patriarchy, the public-domestic dichotomy, the division of labor, and the household. The second object of the course is to provide students with a practical understanding of how gender works in agrarian and natural resource systems, with particular attention to methodologies and applications for research and development projects. Gender in this course means women and men, not just women. This course is a prerequisite for F&ES 752b. Three hours lecture/seminar. Not offered every year. Carol Carpenter.]

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, focusing on applied problems regarding the participation of people in projects and the impacts projects have on people. Communities are a major focus, particularly the social divisions and social ties relevant to the community management of resources. The course reviews different types of development and conservation projects and the particular problems they pose for indigenous people. It also examines short-term methodologies for evaluating the social aspects of projects. This course is a prerequisite for F&ES 752b. 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, F&ES 756b, or F&ES 757a. Limited enrollment. Three hours lecture/seminar. Taught alternate years. Michael R. Dove, Carol Carpenter.]

[F&ES 761a, Issues in Environment and Design. 3 credits. This is the first course being offered as a collaborative model between the School of Architecture and F&ES. 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, Diana Balmori (F&ES); James W. Axley, Victor Body-Lawson (Architecture).]

F&ES 764a,b, Project in Urban Ecology. Xuemei Bai.

F&ES 768b, Environmental Issues in North America: Topics in Political Ecology. 3 credits. In this advanced seminar on the relationship between society and the environment, environmental problems in North America are viewed through the analytical framework of political ecology. Political ecology draws on scholarship from the fields of human ecology and political economy. Rather than focusing on the supposedly closed relationship between a society and its ecosystem (as human ecologists tend to) or solely on events occurring in the larger political economy and their effect on the environment, practitioners of political ecology try to explain environmental conflicts in terms of the particularities of place, culture, and history. Political ecologists argue that environmental conflicts and management cannot be studied without careful examination of the pertinent political, economic, cultural, and historical factors that influence land-use decisions. Topics include: the early history of landscape changes focusing on America prior to 1492 and then on the effects of westward expansion; recent, large-scale manipulations of the environment such as diverting water for agriculture, elimination of large predators, forestry and fire suppression; conflicts over land rights including disputes surrounding access to public lands and questions over indigenous land rights. We also look at the ways in which our notions of "wilderness" are culturally constructed and how images of nature vary among different ethnic groups. Finally we discuss questions of environmental justice, toxic waste, and urban sprawl. Amity A. Doolittle.

F&ES 794a,b, Project in Social Ecology. Carol Carpenter.

F&ES 804a, Theory and Practice of Urban Ecology. *3 credits.* Urban ecology has recently developed from a scientific branch of biology toward a problem-oriented, interdisciplinary research field with applications in urban planning and urban environmental management. Many cities in Asia now recognize the urban ecological approach to be an effective means to cope with many urban problems and have begun to adopt it in practice. This course introduces the basic principles of urban ecology, and their applications in urban planning and urban environmental management in Asian cities. Students are exposed to background issues such as urban development and urban environmental issues in Asia, basic theories in urban ecology such as structure, material flow, energy flow, measurement of the outer extent of urban ecological systems, etc. The course also introduces the practice of urban ecology in Asia, including a review of the urban ecological concept in ancient China and its reflection in town planning, and examples of current experiences and lessons. Introduction of these practices is followed by discussions intended to analyze these activities employing urban ecological principles. Xuemei Bai.

F&ES 884a, Ecological Imagination and Environmental Design. 2 credits. This project-oriented 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. Class discussions and visiting lectures. Stephen R. Kellert.

F&ES UNDERGRADUATE COURSES

Ecology

ECOSYSTEM ECOLOGY

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 263 La/EVST263La, 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, Patterns and Processes in Terrestrial Ecosystems. See F&ES 575a for description.

F&ES 276 La, Laboratory for Patterns and Processes in Terrestrial Ecosystems. 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, Adalgisa Caccone, Oswald J. Schmitz.

[F&ES 340b/E&EB 340b, Community Ecology. See F&ES 563b for description.]

F&ES 36ob/E&EB 36ob, Wildlife Conservation Ecology. See F&ES 56ob for description.

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.

Quantitative and Research Methods

F&ES 205a/STAT 105a, Introduction to Statistics: Environmental Sciences. An introduction to probability and statistics with emphasis on application to forestry and environmental sciences. Jonathan D. Reuning-Scherer.

[GEOL 362b, Observing the Earth from Space. See F&ES 506b for description.]

Social Sciences

ECONOMICS

[F&ES 230b/EVST 230b, Environmental Economics and Policy. Basic economic analysis of environmental problems. Weighing the costs and benefits of major environmental issues. Problems include global warming, toxic waste, air pollution, wilderness protection, deforestation, and preserving biodiversity. Taught every other year. Next offered spring 2003. *For non-Economics majors*. 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. James Gustave Speth, 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. 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. Thomas E. Graedel.

F&ES 301b, Industrial Ecology. See F&ES 501b for description.

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. Stephen R. Kellert.



Special Centers and Programs

Over the years faculty and students have initiated special centers and programs to supplement the curriculum by sponsoring student internships and projects, coordinating faculty research in areas of common interest, and creating symposia, conferences, newsletters, and outreach programs. The nature and number of centers and programs change over time, reflecting faculty and student interest.

Centers and programs are funded primarily through external sources and have been very successful in attracting support from private foundations, nongovernmental organizations, state and federal agencies, international granting agencies, and private corporations.

CENTER FOR ENVIRONMENTAL LAW AND POLICY

A joint undertaking with Yale Law School, this center 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 issues. Projects have included an effort to develop a "next generation" of environmental policy tools and strategies; a series of studies examining the role of foreign investment in supporting sustainable development; work on the linkage between trade liberalization and environmental protection; a study focused on environmental issues in the context of the Free Trade Agreement of the Americas; 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 Environmental Sustainability Index ranking countries. In each case these efforts have involved faculty and student collaboration aimed at shaping both academic thinking and public policy making.

CENTER FOR INDUSTRIAL ECOLOGY

The Center for Industrial Ecology is the first in the world dedicated to the promotion of research, teaching, and outreach in industrial ecology. Industrial ecology is a specialty only a decade old that promotes the study of the twin goals of economic development and environmental quality.

The basic concept around which the field is focused is the idea that an industrial system should be viewed not in isolation from its surrounding systems, but in concert with them. It is a systems view in which one 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:

- · Promotion of research in industrial ecology
- · Hosting of visiting national and international scholars in industrial ecology
- · Doctoral and postdoctoral study programs in industrial ecology

A major research focus of the center is the Stocks and Flows Project. The impetus is the realization that the historical reservoir for the materials used by our technological society has been virgin stocks (ore bodies, mineral deposits, and the like). For a variety of reasons, those stocks may become inadequate or unavailable at some times or places in the future. Other reservoirs exist, however, a principal one being products stored or discarded over the years by corporations and individuals. These later reservoirs might become very important in the next few decades of rapid population growth and resource use, but we know little about their total abundance and the chemical and physical forms in which they exist. In this project, we are evaluating current and historical flows of specific materials, estimating the stocks available in different types of reservoirs, and evaluating the environmental implications. The information is acquired, assembled, and displayed in spatially gridded form. Detailed assessments are anticipated for the United States, the Antarctic Continent, and perhaps other regions.

The center maintains ongoing relationships with many corporations, large and small, in carrying out its programs. As of spring 2000, active collaborative relationships involve AT&T, General Electric, Hamilton Sundstrand, Philips Electronics, Pratt & Whitney, Southern New England Telecommunications, and United Technologies Corporation.

Journal of Industrial Ecology

The center is also home to a leading, peer-reviewed international journal, *The Journal of Industrial Ecology*, published by MIT Press. The editorial board consists of leading scholars, policy makers, and managers from industry, government, and the nonprofit sector.

Program on Solid Waste Policy

Solid waste management may be viewed as an issue of public health, of responsible community environmental practice, of sustainable global resource use, or of cost-effective provision of raw materials for industry. Even if they seem technically sound, solid waste policies often founder in the political arena locally, nationally, and internationally.

The nation as a whole has begun to look beyond traditional waste management systems of collection, processing, and disposal to an examination of materials use and how resources and responsibility might be better allocated. The Program on Solid Waste Policy examines the social, political, economic, and environmental dimensions of the current controversies surrounding solid waste and materials management.

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. The program examines solid waste management in the context of analyses and approaches developed in related fields and industries; in the context of the experiences and practices of other industrialized countries; and in the context of the larger set of environmental concerns facing the United States. Opportunities for independent study, ongoing research, a working paper series, and a solid-waste library are key components of the program.

Industrial Environmental Management Program

Industrial operations have had an enormous impact on global environmental quality. Their scale, their importance to the global economy, and the pressure they exert on natural resources worldwide make corporate behavior a crucial factor in every area of environmental concern. 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. The program's activities are based on one of the fundamental precepts of the School — namely, that sound management and effective policy must be informed by a scientific understanding of both ecological and social systems.

The core intellectual framework for IEM is the emerging field of industrial ecology, which looks at industrial systems not in isolation but rather in concert with surrounding systems. Within the master's program, IEM students take core courses in natural science, social science, and quantitative methods, followed by courses within the Environmental Policy and Management Advanced Study area including environmental aspects of a technological society, industrial ecology, a course on business concepts for environmental managers, and a project on a topic within industrial environmental management. Because many students come to the program with considerable experience, each student's particular course of study is individually designed in consultation with the faculty and within the requirements of the M.E.S. degree.

In addition to course work within the master's program, there is an active Industrial Environmental Management Student Interest Group that sponsors field trips to industrial sites, on-campus talks by visiting managers, and symposia on current topics of interest.

Each year, the IEM Spring Lecture Series hosts speakers from industry who give presentations and meet with students. Recent lecture series topics have been: "Corporate Redesign: Approaches to Sustainability"; "How Do You Know If You're Going Green? Measuring Corporate Environmental Performance"; "No Smokestack, No Problem? Service Industries and the Environment"; and "Forging a Green Chain: Adding Environment to the Supplier-Buyer Relationship." The lecture series is open to the public.

Corporate Environmental Leadership Seminar

In June of each year, the School runs the Corporate Environmental Leadership Seminar, a two-week intensive course in environmental management and policy for executives from industry and government. Begun in 1992, the seminar has attracted participation by major companies from across North America 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.

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.

To accomplish its mission, the center builds upon and strengthens the work of several programs at the School, including the program on Coastal and Watershed Systems, the Yale–UNDP Collaborative Program on the Urban Environment, and the Urban Resources Initiative (URI).

The center has a strong focus on collaboration within the School, across the University, and beyond. The center sponsors various programs to bring researchers together to discuss current and future critical issues in the field of urban ecology. Currently, the center's research agenda includes urban sprawl, brownfields, urban ecosystem restoration, and land use. 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 challenges.

Coastal and Watershed Systems

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 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.

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 program 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 program 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 — in the Quinnipiac, Mill, and West rivers — are currently the focus of long-term faculty and student research. The work of the program 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 program'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 program provides internships for students working on coastal restoration, preservation, and community outreach projects.

Recent student projects in the program include the study of anadromous fish in the Quinnipiac River; a survey of biological diversity in the Quinnipiac River; nitrogen loading and storm flow analysis on the Quinnipiac River; West River salt marsh hydrologic study; blue fin tuna fishery; breeding bird surveys along the Connecticut coast; and implications of harmful algal blooms on shellfish management.

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 or 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 program is currently co-directed by Bradford Gentry (Yale) and Peter Grohmann (UNDP).

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 (http://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.
- Interactive databases on public-private partnerships designed by PPPUE and Yale, and assembled by graduate researchers at Yale. As of September 1999, the databases included over 400 PPP reference cases, over 350 PPP contacts, and over 800 bibliographic entries. The databases are interactive: users can not only search them, but can also upload data on their own cases, contacts, and documents.
- 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 PPP; 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 distance 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. In 2001, over fifteen universities from Africa, Asia, Latin America, and Central Europe were involved. Faculty at each of the involved 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. The Chinese collaborators are now adapting the course materials for use with non-academic 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. For the next several years, particular attention will be paid to building the capacity for partnerships in countries such as Mozambique, Namibia, Uganda, Zambia, the Philippines, and Nepal.

As the School continues to confront the challenges of a rapidly urbanizing world, the Yale–UNDP Collaborative Program is poised to be an increasingly important part of the learning experience at F&ES.

Urban Resources Initiative

The Urban Resources Initiative (URI) is 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 policy and design and implementation. 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. Therefore, URI's approach stresses the integration of the biophysical sciences with the social sciences.

Yale's URI program draws upon these essential elements to both respond to and help define community participation in urban ecosystem management. It defines community quite broadly. Community includes a group of fifth graders at an inner-city elementary school who are learning how to analyze and assess the environmental attributes of their neighborhood. Community is the group of neighborhood leaders with whom researchers work to restore abandoned lands near their homes. 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.

Through this work URI has developed a well-earned reputation among community leaders and city department heads for outreach and community ties that has come back to the University in many forms. URI's Greenspace Program (part of resident-led management of urban ecosystems) was a key element in New Haven's designation as an All-American City. This award is illustrative of URI's contributions and stature within the New Haven community. Researchers collaborate with other departments at the University, including the Department of Epidemiology and Public Health, the Law School, the School of Art, and the School of Architecture.

Over the past decade the Urban Resources Initiative has created several community and urban forestry training programs. These 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) — 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.

Professional training increasingly leans toward experiential, authentic learning where students gain real-world practice in their field. Students in law, medicine, and education have followed this path for years. The Urban Resources Initiative has created a program where forestry students can grapple with the critical elements of environmental management while making a real contribution to the urban community we call home.

Each summer ten to fifteen students work as community foresters as part of the Community Greenspace Project, which provides Yale F&ES graduate students with supervised, clinical training to supplement their academic work. This field training is critical for environmental managers. Problems in the field play out differently than they appear in a classroom. Inventorying a community's natural resources may seem straightforward on paper. In the field, however, such issues as who owns and who uses a property often confuse the matter. URI interns get out and get dirty. They plant trees with neighbors, study the hydrology of urban natural areas, develop environmental management plans with consortiums of city agencies, and create and teach environmental education curricula.

Professional land managers (in urban areas or more wild lands) often define a landscape quite differently from residents. In land management programs researchers look 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.

One issue facing urban neighborhoods is the growing acreage of abandoned, derelict open spaces. These abandoned lands pose a current and future threat to the quality of life in our cities. These patches of urban land — each less than one acre but totaling hundreds of acres across a city — create great gaps in the landscape: sinkholes where environmental, economic, and community potential is wasted. The issues concerning the assessment, restoration, and maintenance of these lands are priority concerns.

The Urban Resources Initiative co-chairs an Abandoned Lands Task Force, which draws upon community, local government, nonprofit, and university resources to assess these urban lands, develop criteria (environmental, economic, and community-based), and create a long-term strategy for the sustainable recovery and maintenance of these areas. This project ultimately will have a local impact in New Haven, where hundreds of abandoned spaces need coordinated restoration, and a more far-reaching impact because this project may create a model for sustainable restoration of abandoned urban lands across the United States and around the world.

TROPICAL RESOURCES INSTITUTE

The mission of the Tropical Resources Institute (TRI) is to promote research, education, outreach, and information on the sustained utilization, restoration, and conservation of tropical ecosystems, and to provide expertise to decision makers concerned with the management and restoration of these ecosystems. TRI was created in 1983 to strengthen

the School's involvement in the management of tropical resources. The premise of TRI is that problems of tropical resource management and conservation cannot be solved by technical solutions alone. TRI programs therefore emphasize the integration of the biophysical and social sciences and encourage crossing professional, disciplinary, social, and land-use boundaries.

Through its two program areas (Research and Education), TRI sponsors seminars and symposia, tropical field trips, and overseas summer internships for master's and doctoral students. Students in tropical studies may specialize in a wide variety of topics in tropical biology and ecology, resource management and policy, agroforestry, tropical silviculture, rural development, and social ecology.

Much of the tropical research in the School takes place in the broad range of topics under the central theme of people and forests. Examples include the analysis of community and social forestry systems; human dimensions of wildlife conservation; the institutional context of development and environmental policy; the effects of disturbances on the productivity, soil ecology, nutrient cycling and fragmentation of tropical forests; behavioral and community ecology of wildlife; ecology, silviculture, ethnobotany, and economics of nontimber forest products; and the silviculture and management of tropical forests and techniques for their restoration on degraded lands. In addition to forestry, students may develop their research on a broad range of subjects.

TRI has received endowments for tropical research internships. Each year, about twenty students spend a summer working on tropical resource problems in Latin America, Asia, and Africa. In 2000, TRI summer interns performed research in China, India, Indonesia, Malaysia, Nepal, Sri Lanka, the Philippine Islands, Bolivia, Brazil, Costa Rica, Honduras, Mexico, Panama, Peru, Liberia, Tanzania, and Madagascar. Tropical research internships in the School may also cover a broad range of topics in addition to the people and forests theme. TRI internships have recently expanded to include urban environments in the tropics.

Four more permanent research practicum sites have been set up in collaboration with in-country partners in India, Panama, Peru, and Sri Lanka. At these sites TRI has made a commitment to the long-term research and management of upland watersheds and protected areas that concern people and the forest resources they use.

The Institute supports the production of a student-run, academically oriented magazine, the *TRI News*, and publishes the *TRI Working Paper* series based on student internships. TRI also supports the student chapter of the International Society of Tropical Foresters and helps to 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*.

YALE FOREST FORUM

The Yale Forest Forum (YFF) is a program at the School dedicated to the sustainable management of private forestlands through research, education, and outreach. Students play an integral role in all program activities. YFF, housed in historic Marsh Hall, was

established in 1994 by a diverse group of leaders in forestry to focus national attention on forest policy creation and the management of forests in the United States.

The first major initiative of YFF was the call to convene the Seventh American Forest Congress. A yearlong series of local roundtable meetings held around the country culminated in the 1,500-strong citizen's congress in February 1996 in Washington, D.C. The unique process that the Forest Congress organizers developed brought together an unprecedentedly diverse group of stakeholders. In all, over 4,500 individuals participated in the process, articulating their collective vision and set of guiding principles for clear and coherent forest policy for the forests of the U.S. YFF housed and staffed the Office of the Congress from January 1995 to April 1996. As the implementation of the results of the Forest Congress continues, the Forest Congress Information Center (FCIC) has been established at YFF to track activities from around the country and provide up-todate information to all interested parties.

One of the clear messages drawn from the Seventh American Forest Congress was the need to focus concentrated attention on the three-quarters of the country's forests that fall under private ownership. The implication of this forest ownership pattern is that three-quarters of all the environmental services we expect from our forested ecosystems (whether it is clean water, wildlife habitat, carbon sequestration, oxygen production, or other services) depend on those private owners. Economically, over 80 percent of all timber production comes from private lands. Although most of the science and debate has centered on defining what the nation wants to do with its publicly owned forests, the future environmental and economic health of the nation's forests rests largely on the shoulders of nonfederal owners. The greatest need, as well as the greatest potential for sustainable forest management, exists on private lands. The Yale Forest Forum is working to facilitate opportunities for students and the public to understand these issues and be leaders in developing tomorrow's solutions.

YFF's program goals are: (1) to promote sustainable management of private forests through research, education, and outreach; (2) to understand the potentials and consequences of private ownership of forests; (3) to promote mutual understanding among the general public, private forest owners, and interest groups; (4) to facilitate private-public and private-private partnerships; and (5) to provide comprehensive, accessible databases for better management of private forests.

To achieve these goals, YFF has developed several programs and activities. At the core is the Visiting Fellows Program. YFF coordinates and supports a term in residence for senior-level scientists or executives from the forest products industry and conservation community. While in residence, the fellows teach seminars and guest lecture in their specialty areas, pursue research interests, develop partnerships and collaborations, as well as interact informally with the School community.

YFF is also forming a Network for Private Forest Research. The goal of the network is to collaborate on research questions specific to private forests and to facilitate this research on regionally based sites around the country. Currently, studies are being conducted at sites in New England and the intermountain west, with expansion into the southern U.S. and Pacific northwest regions to follow. Studies focus on the socioeconomic as well as the biophysical aspects of sustainable forest management. Current research includes how public values affect private forest management; development of public and private programs to promote sustainable forest management; effects of product marketing on sustainable management; and development of integrated stewardship strategies.

A vital component in fulfilling YFF's education mission is the Isses and Leadership Forum series. YFF coordinates and sponsors these events to give in-depth exposure to students on the issues and individuals with whom they will work upon leaving Yale. The forums include large, open public dialogues; small, informal seminars; and facilitated meetings among several stakeholders. Integral to the development of many forums are student-researched case studies reviewing the issues in question and the lessons learned from each case and forum. Information from these forums and other YFF activities is accessible on YFF's Web site at http://www.yale.edu/yff/.

Integrated into all of YFF's activities are numerous paid summer internships and research scholarships that provide opportunities for students to learn more about real world aspects of private forests.

In the coming year, the Yale Forest Forum will undertake a major new initiative by establishing the Global Institute for Sustainable Forest Management. The new Institute will focus on public/private partnerships, forest certification, forest fragmentation, investment in sustainable forestry, world trade in forest products, and integrated information about world forests and forest aspects of global climate change. The new initiative will draw on existing resources at the School and will be carried out with Yale partners and cooperating institutions in the United States and abroad.

F&ES PUBLICATIONS

The School produces several publications, including its biannual magazine, *Environment: Yale*, the *Yale Environmental Newsletter* in cooperation with the Yale Institute for Biospheric Studies and the Peabody Museum of Natural History, several newsletters from its centers and programs, and the F&ES Bulletin Series. Begun in 1912, the F&ES Bulletin Series has recently published monographs, selected course papers, and proceedings from conferences. Recent titles from the series include *The Ecotourism Equation: Measuring the Impacts; Restoration of an Urban Salt Marsh: An Interdisciplinary Approach; Transformations of Middle Eastern Natural Environments: Legacies and Lessons; Resource Use in the Tri-national Sangba River Region of Equatorial Africa: Histories, Knowledge Forms, and Institutions* (available in French and English); and Developing Sustainable Management Policy for the National Elk Refuge, Wyoming. In addition, the School has recently published a book, *Climate Change and Development*, in association with UNDP, and a working paper by Professor Robert Repetto entitled *The Atlantic Sea-Scallop Fishery in the USA and Canada: A Natural Experiment in Fisheries Management Regimes*. For more information and order forms, go to http://www.yale.edu/environment/publications/.

ALLIED PROGRAMS

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. As such, Hubbard Brook has functioned as a national center and has attracted investigators from many fields of the biological and physical sciences.

The Hubbard Brook ecosystem has provided cooperators 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 investigators there are achieving the most fundamental aspect of ecosystem studies — the integration of data into a functioning scheme of ecosystem behavior through time.

Yale Institute for Biospheric Studies

Established in 1991, the Yale Institute for Biospheric Studies (YIBS) comprises five centers working in an interdisciplinary effort to investigate and preserve the Earth's biosphere. There is the Center for Biological Transformation (CBT); the Center for Computational Ecology (CCE); the Center for Earth Observation (CEO); the Center for Ecology and Systematics of Animals on the Verge of Extinction (ECOSAVE); and the Center for the Study of Global Change (CSGC). The School's current interests are most closely aligned with the Center for Earth Observation and the Center for Computational Ecology.

The Center for Earth Observation (CEO) provides opportunities for diverse multidisciplinary research, using remote sensing technology, on problems involving atmosphere-biosphere interactions, land use and related ecosystem changes, latitudinal variation of ecosystem structure and function, and spatial and temporal scaling of field research.

Participating faculty in the CEO include members of Forestry & Environmental Studies, the School of Medicine, the Department of Geology and Geophysics, and the Department of Anthropology.

The focus of the Center for Computational Ecology (CCE) is on developing, implementing, and validating computational models that simulate complex biological processes. Current research at CCE by School faculty and students addresses two questions of fundamental importance in ecology and policy formulation: What are the key elements of ecosystems that promote sustained organizational complexity? How does this complexity lead to the resilience of natural ecosystems in their responses to humaninduced and natural disturbances?

Yale Peabody Museum of Natural History

The Yale Peabody Museum of Natural History, founded in 1866, contains one of the great scientific collections in North America. Numbering more than eleven million objects and specimens, the collections are used for exhibition and for research by scholars from throughout the world. A growing Internet service makes catalogue data for more than one million of these specimens and objects available online (http://www. peabody.yale.edu/). The museum is open to the public, attracting 130,000 visitors annually including 35,000 schoolchildren on group visits. The exhibition areas feature the museum's anthropological and ornithological collections, a renowned paleontological exhibit that includes a mounted fossil of the dinosaurs Apatosaurus (Brontosaurus) and Deinonychus, a variety of displays surveying the animal, vegetable, and mineral worlds, and a series of dioramas illustrating a range of North American environments. The award-winning mural, The Age of Reptiles (the best-known painting of dinosaurs in the world), spans one wall of the museum's Great Hall of Dinosaurs and remains one of the Peabody's greatest attractions. 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 museum is a major source of science education for New Haven and the surrounding community, and its many outreach programs are among the principal ways in which Yale serves the public. The Peabody Museum charges a low general admission fee but is always free to Yale University students, faculty, and staff with Yale I.D.

The School of Forestry & Environmental Studies maintains a close association with the Peabody. The museum's director and curators, faculty members in many academic units including F&ES, collaborate in the two-year program in museology at the School of Forestry & Environmental Studies leading to the degree of Master of Environmental Studies. The Peabody Field Station in Guilford, Connecticut, is used collaboratively for research on coastal and estuarine systems.



Admission Requirements

MASTER'S DEGREE PROGRAMS

Faculty teams read all applications to the master's degree programs. Each applicant must be a graduate of a college or university and must provide a completed application form, a one-page essay discussing his/her reason for applying, GRE scores, TOEFL scores for international students, transcripts from colleges and universities attended, and three letters of recommendation.

Those applying to the one-year (two term) degree options for the M.E.M. and M.F. should first consult the director of admissions for permission to apply. The one-year programs are for practitioners who have worked for seven or more years in the natural resource and environmental fields.

All applicants to the master's degree programs are required to take the Graduate Record Examination (GRE). Applicants should indicate the School's institution code number, 3996, when taking the GRE. 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 this organization, or visit its Web sites at http://www.gre.org/com.html/ or http://www.toefl. org/index.html/. Test results should be sent directly to the Registrar, Yale School of Forestry & Environmental Studies, 205 Prospect Street, New Haven CT 06511.

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, and career goals are especially valuable. The School looks for students capable of making effective contributions to scientific knowledge or to professional service at the interface between humans and their environment. In particular, the School gives special weight to relevant experiences subsequent to graduating from college. Clarity regarding professional career goals is a critically important part of the applicant's statement.

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 natural sciences, engineering, social sciences, humanities, or interdisciplinary programs. A disciplinary focus with some interdisciplinary depth is as valuable in undergraduate programs as in graduate programs. Some exposure to the natural sciences, the social sciences, and college mathematics permits the faculty to offer course work at a more advanced 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 to gain the maximum advantage 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	c. linear algebra
b. statistics	d. discrete mathematics

- 2. Natural science four terms selected from:
 - a. general biology c. geology/earth science b. general chemistry d. general physics
- 3. Social science four terms selected from:
 - a. introductory economics c. sociology (micro and macro) d. anthropology
 - b. political science

Students who wish guidance in arranging their undergraduate programs in anticipation of graduate study at Yale are invited to correspond or consult with the associate dean for academic affairs at any time.

DOCTORAL DEGREE PROGRAMS

These programs are 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.

ENGLISH AS A SECOND LANGUAGE TRAINING REQUIREMENT

The Committees on Admissions for master's and doctoral applicants 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 five-week instructional program at Yale in written and spoken English.

This program begins in early July, 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. Details about tuition, housing, and general information on the program, which is conducted by the Yale Summer and Special Programs, will be forwarded upon notification of admission.

Application Procedures

MASTER'S DEGREE PROGRAMS

Application for admission to studies leading to the professional degrees of M.E.M., M.E.Sc., M.F.S., or M.F. must be made directly to the School of Forestry & Environmental Studies. *Students are admitted only in the fall*. Application forms for admission and for financial aid may be secured by writing to the Registrar, Yale School of Forestry & Environmental Studies, 205 Prospect Street, New Haven CT 06511. Applications may also be found on our Web site at http://www.yale.edu/environment/. *The deadline for applications is February 1*. There is a \$50 application fee.

Open Houses for prospective students are held twice a year: in November and in January. Visitors may attend classes, tour the school, speak with students and faculty, and hear presentations by the dean and members of the faculty. The Office of the Registrar at 203.432.6286 may be called for available dates.

Notification of admission (including award of scholarship aid) is sent by April 1. Acceptance of the offer of admission must be accompanied by a nonrefundable \$500 deposit which will be credited toward tuition.

DOCTORAL DEGREE PROGRAMS

Students seeking degrees of Ph.D., M.S., or M.Phil. are subject to the regulations of the Yale University Graduate School in matters pertaining to admission, candidacy, graduation, and tuition. Application materials and the Graduate School bulletin may be received by sending \$5 to the Office of Admissions, Yale Graduate School, PO Box 208236, New Haven CT 06520-8236. Specific questions about these degree programs should be addressed to the Director of Doctoral Studies, School of Forestry & Environmental Studies, 301 Prospect Street, New Haven CT 06511. Application forms for the D.F.E.S. degree differ from the Doctor of Philosophy applications and can be obtained by writing to Professor John P. Wargo, Director of Doctoral Studies, School of Forestry & Environmental Studies, 301 Prospect Street, New Haven CT 06511.

Those applying for admission to doctoral studies through either the School of Forestry & Environmental Studies or the Department of Forestry & Environmental Studies of the Yale University Graduate School are required to take the Graduate Record Examination (GRE). Test score reports must be received by January 3.

Applicants for whom English is not a native or customary language of instruction must take the Test of English as a Foreign Language (TOEFL). This test is administered by the TOEFL Program, Educational Testing Service, Princeton NJ 08541; for more information, applicants should write directly to this agency or visit its Web site at http://www.toefl.org/index.html/. Test score reports should be addressed to the Registrar, Yale School of Forestry & Environmental Studies, 205 Prospect Street, New Haven CT 06511 and must be received by January 3.



Formal application for admission to study for the D.F.E.S. degree must be submitted by February 1, and for the Pb.D. degree by January 3. Doctor of Forestry and Environmental Studies applications should be sent to the Director of Doctoral Studies, 205 Prospect Street, New Haven CT 06511. Doctor of Philosophy applications should be sent to the Office of Admissions, Yale Graduate School, PO Box 208236, New Haven CT 06520-8236. Notification of admission (including award of financial assistance) is sent on or before April 1.



Tuition, Fees, and Other Expenses

TUITION AND FEES, 200I - 2002

The tuition for the Doctor of Forestry and Environmental Studies degree is \$23,900. Most doctoral students receive a University fellowship that covers the costs of the first four years of tuition and will provide a stipend during the academic year. Doctoral students must pay a nominal continuing registration fee thereafter. The 2001–2002 tuition for master's degrees (Master of Environmental Management, Master of Forest Science, Master of Environmental Science, and Master of Forestry) is \$21,150. (Tuition fees for special students are 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. Doctoral students must pay full tuition for four years and may remain on continuing registration for only two years thereafter.

A fee of \$900, which may be revised at any time, is charged each participant in the training modules in technical skills to cover instructional expenses. A single student in the module program should anticipate living expenses of approximately \$800 for a three-week period.

For 2001–2002, students should also anticipate expenses of \$960 for hospitalization coverage and \$950 for books and supplies. A single student can expect living expenses of approximately \$9,395 for a nine-month period.

REGISTRATION

All students in the master's programs and the Doctor of Forestry and Environmental Studies program must make final registration of course enrollment at the Office of the Registrar of the School of Forestry & Environmental Studies, 205 Prospect Street, New Haven, within *two weeks of the first day of classes* in the fall and spring terms (see Calendar, page 6). A penalty of \$25 will be charged for late registration.

All international students are required to complete a nonacademic registration at the Office of International Students and Scholars (see pages 126-27) 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 oneyear 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 REFUND

Due to changes in federal regulations governing the return of federal student aid (Title IV) funds for withdrawn students, the tuition rebate and refund policy has changed from that of recent years. The following rules became effective on July 1, 2000.

- I. For purposes of determining the refund of federal student aid funds, any student who withdraws from the School of Forestry for any reason during the first 60 percent of the term will be subject to a pro rata schedule that will be used to determine the amount of Title IV funds a student has earned at the time of withdrawal. A student who withdraws after the 60 percent point has earned 100 percent of the Title IV funds. In 2001–02, the last days for refunding federal student aid funds will be October 26 (Year 1) and November 3 (Year 2) in the fall term and April 2 in the spring term.
- 2. For purposes of determining the refund of institutional aid funds and for students who have not received financial aid:
 - a. 100 percent of tuition will be rebated for withdrawals that occur on or before the end of the first 10 percent of the term (in 2001–02, August 23 [Year 1] and September 14 [Year 2] in the fall term and January 24 in the spring term).
 - b. A rebate of one-half (50 percent) of tuition will be granted for withdrawals that occur after the first 10 percent but on or before the last day of the first quarter of the term (in 2001–02, September 14 [Year 1] and September 29 [Year 2] in the fall term and February 8 in the spring term).
 - c. A rebate of one-quarter (25 percent) of tuition will be granted for withdrawals that occur after the first quarter of the term but on or before the day of midterm (in 2001-02, October 14 [Year 1] and October 24 [Year 2] in the fall term and March 7 in the spring term).
 - d. Students who withdraw for any reason after midterm will not receive a rebate of any portion of tuition.
- 3. The death of a student will cancel charges for tuition as of the date of death, and the bursar will adjust the tuition on a pro rata basis.
- 4. If the student has received student loans or other forms of financial aid, rebates will be refunded in the order prescribed by federal regulations; namely, first to the Unsubsidized Federal Stafford and/or Subsidized Federal Stafford loans, if any; 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.
- 5. Loan recipients (Stafford, Perkins, or Yale Student Loan) who withdraw are required to have an exit interview before leaving Yale, and should contact the Student Loan Collection Office at 246 Church Street (432.2727) to determine where the interview will be held.

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 \$50. The deadline for enrollment is June 22. Application forms will be mailed to all students. For additional information, please contact AMS at the number above or visit their Web site at http://www.amsweb.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:

If fall-term payment in full is not received	ed	Late charge
by August 1		\$110
by September 1	an additiona	l 110
by October 1	an additiona	l 110
If spring-term payment in full is not rec	eived	Late charge
by December 1		\$110
by January 2	an additiona	l 110
by February 1	an additiona	l 110

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.

MASTER'S FINANCIAL AID, 2001-2002

Policy and Procedures

The School, in order to assist students with demonstrated financial need and academic merit, offers a combination of scholarships, employment, and loan opportunities.

The level of funding for each student is determined at the time of admission; therefore, it is critical that all application deadlines are met. Although a student must apply for aid each year, the level of School aid will remain the same as long as there is demonstrated financial need.

Financial aid materials are updated annually, incorporating new regulations, changes in eligibility requirements, and other pertinent information. New financial aid applications are available in late fall of the year prior to matriculation — in fall 2001 for matric-

ulation in fall 2002, for example. New forms are available at the School's Web site, http://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 http://www.fafsa. ed.gov/ and a School of Forestry & Environmental Studies Financial Aid Application, available from the School. International students must complete a Foreign Student Financial Aid Application and a School of Forestry & Environmental Studies Financial Aid Application.

SCHOLARSHIPS

For students demonstrating financial need, the School awards scholarships to help cover a portion of the tuition. Because funds are limited, scholarships are awarded to the top 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:

Students entering in 2001 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 *Rockefeller-Underhill Scholarship for Tropical Conservation* provides funding to a native of Central or South America who intends to pursue a career in tropical conservation in Latin America. Applicants must submit the Foreign Student Financial Aid Application and the Rockefeller-Underhill application.

The School offers *minority scholarships* to outstanding members of U.S. racial/ethnic minorities that are underrepresented in the student population. The *Philip Laurance Buttrick Fund* makes awards to selected students, with preference given to students of American Indian descent. Applicants must complete the Minority Scholarship Application in addition to the School's Financial Aid Application and the FAFSA.

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.

A number of additional endowed scholarships are available to second-year students. Grants range from \$1,000 to \$8,000 and are awarded on the basis of need, scholarship, professional promise, and other criteria specified by the donors. The *Crown Zellerbach Foundation Fund* provides graduate fellowships, with preference given to graduates of institutions in Oregon or Washington. 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 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 wish to 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 making 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 Scholarships are awarded to students interested in forestry. The Ray L. Wilson Scholarships are awarded to students interested in forestry.

NATIONAL FELLOWSHIPS AND SCHOLARSHIPS

All students and applicants 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 Fulbright Fellowships. Enrolled students can compete for fellowships offered by the Heinz Family Foundation to support master's project research. All outside awards may be held together with School awards up to combined levels that are no higher than the normal educational expense budget. More information is available on the Web or by contacting the Financial Aid Office.

EMPLOYMENT OPPORTUNITIES

Administrative Assistantships are offered to financial aid students. Positions are within the School working in the library or administrative offices, or for faculty or school programs. The hourly rate is \$10.50, and most students work approximately ten hours per week.

Teaching Fellowships are available throughout the University for qualified students. Each department or professor makes its own hiring decisions, so interested students must contact them directly. The usual salary is \$3,200 per term.

Student Employment opportunities are listed at the Student Employment Office at 246 Church Street, or on its Web site at http://www.yale.edu/seo/. Positions are throughout the University and the city of New Haven, with hourly rates of \$6 to \$15.

LOANS

Yale University participates in two federal loan programs: the Stafford program and the Perkins program. To qualify for these loans, a student must be a U.S. citizen and meet certain requirements determined by a federally approved need analysis.

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 \$5,000, 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 http://www.fafsa.ed.gov/.

For students who are not eligible for these programs or who need additional funds, several state and private loan programs also offer loans to students and their parents. The interest rate on these supplemental loans is generally tied to the lender's prime or base rate, and a standard commercial credit analysis is required. International students need a co-signer who is a U.S. citizen or permanent resident.

International Student Financial Aid

In order to apply for financial aid from the School, international students must complete two applications: the School of Forestry & Environmental Studies Financial Aid Application and the International Student Financial Aid Application. Both applications are available on the Web and must be completed and postmarked by February 15.

Three full scholarships will be offered to international students from Africa, Asia, and Latin America. All admitted students are automatically considered for this prize. 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 funding to scholarship recipients; combined funding covers full 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. The Financial Aid Office offers scholarships and employment opportunities to as many international students as our resources will allow; however, most students need additional support. It is for this reason that international students are encouraged to seek support from their government, employer, or various international agencies.

International students must certify full funding for their entire course of study before visa documents can be issued. The Financial Aid Office will mail instructions and forms shortly after admission decisions are made, but in the meantime information is available at the Web site of Yale's Office of International Students and Scholars (http://www.oiss. yale.edu/).



Life at Yale

EDUCATIONAL FACILITIES

The headquarters of the School are in Sage Hall, a four-story brownstone structure situated at 205 Prospect Street. 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. Bowers Hall was erected in 1931 as an addition to Sage Hall from funds provided by the bequest of Edward A. Bowers, B.A. 1879, and is equipped to handle large lectures and seminars or small group projects. The administrative offices and library of the School are housed in Sage Hall together with most of the classrooms. A microcomputer center and student lounge are also in Sage Hall.

Facilities for research and instruction in mensuration, silviculture, forest economics and policy, and biometry are in Marsh Hall at 360 Prospect Street in the Marsh Botanical Garden. This large, four-story brownstone 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 School of Forestry. 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 laboratories and other facilities for work in environmental chemistry, wood anatomy and developmental morphology, soils, plant and wildlife ecology, tree physiology, forest microbiology, and forest pathology. Completed with an adjacent greenhouse in 1959, Greeley Laboratory was funded by the forest industries, the John A. Hartford Foundation, and other benefactors.

The restored former residences at 210, 285, and 301 Prospect Street house the offices of many of the policy and social science faculty of the School, as well as doctoral student offices, the Doctoral Resource Center, and the Development and Alumni Office of the School.

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 pages 127 - 28.

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 and natural resource topics, such as Environmental Periodicals Bibliography and TREE-CD, is provided through the library's Web site at http://www.yale.edu/scilib/forest.html. These research tools and others, on such subjects as forestry, soils, fish, and wildlife, are accessible throughout the campus, and are supplemented by an in-house CD-ROM collection, which includes Wildlife Worldwide, Water Resources Abstracts, and Environmental 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.

Coastal Field Station

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

STUDENT ORGANIZATIONS

The School has many student-run interest groups. Current student groups include the student chapter of the American Water Resources Association, the Energy Interest Group, the Environment and Development Interest Group, the Forestry Club, the Industrial Environmental Management Interest Group, the Integrated Student Development Coalition, a student chapter of the International Society of Tropical Foresters (ISTF), 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, and the Student Advisory Committee. 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 regional gatherings around the country and around the world, especially at annual meetings like those of the Society of American Foresters, the Ecological Society of America, and the Land Trust Alliance. The Executive Council of the Association acts as an advisory board to the officers of the School. 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 program is to provide students with the information and assistance needed to conduct successful job searches and plan career paths. To meet this objective, the Career Development Office assists students and alumni/ae to assess the natural resources job market, network and conduct job searches, write résumés, interview, develop grant proposals, and seek internships as well as post-graduation employment, fellowships, and additional graduate study. Alumni/ae seminars and career days, as well as an extensive alumni/ae network, provide students with an opportunity to make contacts and explore career possibilities. The director is also available to all students and alumni/ae seeking career counseling and job search assistance.

Recently a new computer-based service, the Global eRecruiting Outreach (GEO) Program, was introduced by the office so that employers can easily view students' résumés and be connected to them.

The School's Career Resources Room includes an extensive collection of informational aids describing federal, state, for-profit, and not-for-profit natural resource organizations. It also subscribes to all the major job vacancy announcement publications relevant to our students' interests. The office's Web site at http://www.yale.edu/fescareers/ provides additional career information to users, including information on the activities of graduates six months following graduation, as well as details on each year's summer internship activities. Salary information of recent graduates is also included. Numerous computer listservs are also being used to direct job vacancy announcements and career information to both students and alumni/ae who have a need for timely updates. 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.

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 http://www.yale.edu/ fescareers/acdo_resources_alum/.

Summer 1999 Internships

PRIVATE PROFIT: BUSINESS AND INDUSTRY

AES Corporation, Auroras Group-Puerto Rico Team, Summer Associate, VA

Calvert Ventures, Research Associate, CT

CLF (Conservation Law Foundation) Services, Environmental Venture Capital, Analyst, MA

General Electric, Aircraft Engines, Summer Co-op Student - Remediation Issues, MA

General Electric, Corporate Environmental Programs, Environment, Health & Safety Analyst, CT

General Electric, Corporate Environmental Programs, Intern, CT

General Electric, Corporate Environmental Programs, Intern, International Team, CT GreenMountain.com, Manager, Environmental Standards, VT

OMG Americas, Inc., Regulatory Department, Summer Intern, OH

Recovery Solutions of Puerto Rico, Inc., Resource Recovery & Waste Energy Project, Environmental Policy Intern, PR

PRIVATE PROFIT: CONSULTING

Biohabitats, Inc., Biohabitats, Intern-Wetland Delineation, MD

The Forestland Group, LLC, Yale Forest Forum/Forest Stewards Guild Program, Summer Intern, VA

Jones & Stoke Associates, Ecosystem Planning & Restoration Intern, Environmental Specialist I, CA

Natural Logic, Inc., Gil Friend & Associates, Industry Researcher, CA

Recovery Solutions, Inc., Research Assistant-Eco-Industrial Park Design, PR

Tetra Tech, Inc., Environmental Scientist/Nonpoint Source Pollution, VA

Tetra Tech, Inc., Environmental Scientist/Technician, VA

PRIVATE NON-PROFIT

American Association for the Advancement of Science, Program on Population & Sustainable Development, Research Associate, DC Battelle Memorial Institute, Life Cycle Management Program, Researcher and Writer, OH Boy Scouts of America, Philmont Ranch, Chief Ranger, NM Coastal Enterprises, Inc. (CEI), Maine Fisheries Project, Fisheries-Related Loan Analyst, ME Community Resources, Administrative/Research Assistant, MD Connecticut Audubon, Researcher - Salt Marshes and Bird Habitats, CT Conservation Law Foundation, Legal Intern, MA E-The Environmental Magazine, Editorial Intern, CT Environmental Defense, International Program (Brazil), International Fellow-Deforestation & Human Development, DC Environmental Defense, Wildlife Intern, DC Environmental Defense Fund, Office of General Counsel, Science Intern, NY International Executive Service Corps, Central & Eastern Europe Department, Project Officer-Europe, CT KIDSGLOBE, We Have All the Instruments, Director, CT The Land Trust of Huntsville and North Alabama, Research Intern, AL Methow Conservancy, Education Coordinator, WA Mystic Aquarium, Exhibit Evaluator, CT Mystic Aquarium, Researcher on Visitor Experiences, CT National Fish & Wildlife Foundation, Partnership for Sustainable Forestry, Associate, CT National Parks Conservation Association, Alaska Campaign, Research Assistant, DC National Parks Conservation Association, Vital Signs, Vital Signs Intern, DC National Parks Conservation Association/National Park Service, Business Plan Initiative, Financial Management Analyst, WA National Parks Conservation Association/National Park Service, Business Plan Initiative, Financial Management Analyst, MA The Nature Conservancy, EcoEnterprises Fund, Associate - Investments & Fundraising, DC The Nature Conservancy, Independent Researcher-Distribution of a Rare Dragonfly, RI The Nature Conservancy, Islands Program, Plant Monitoring Intern, MA The Nature Conservancy, The Neversink River Program, Water Resource Specialist, NY The Neversink Association, Researcher and Writer, NY Save the Sound, Inc., Habitat Restoration-Long Island Sound, Habitat/Restoration Intern, CT Sierra Club, Grizzly Bear Ecosystems Project, Grizzly Bear Ecosystems Intern, MT

Weantinoge Heritage Land Trust, Ecologist/Warden, CT

White Buffalo, Inc., Researcher-Home Range Shifts of White Tailed Deer, CT

The Wilderness Society, Public Policy Intern-Forest & Wildlife Refuges, DC

- World Resources Institute, Biological Resources Program/Critical Flows, Research Assistant, DC
- World Resources Institute, International Financial Flows and the Environment, Research Associate, DC

Yale Forest Forum & NRDC, Research Assistant – Forest Initiatives, CA The Yellowstone Park Foundation, Writer/Development Assistant, MT

PUBLIC: STATE, LOCAL, REGIONAL

State of Rhode Island, Department of Environmental Management, RI

PUBLIC: FEDERAL

Inter-American Development Bank, Division of Integration & Trade Hemispheric Issues, DC

Smithsonian, Graduate Fellow-Invasive Species in Chesapeake Bay, MD

Smithsonian, Yale Forest Forum & NRDC, Research Assistant, CA

United Nations Development Program, Researcher-Forest Land Investments, DC

- USDA Forest Service, State & Private Forestry Cooperative, Program Assistant, DC
- U.S. Environmental Protection Agency, Atlantic Ecology Laboratory, Research Fellow, RI

U.S. Environmental Protection Agency, Office of Civil Rights & Environmental Justice, Environmental Justice Intern, OR

U.S. Environmental Protection Agency, Wetland Division, ECO Intern, DC

The World Bank, East Asia & Pacific, Coastal Resources Researcher, DC

The World Bank, Water & Sanitation Division, Summer Assistant, DC

EDUCATION

Research-Beaver Pond Distribution, CT

Research-Environmental Education and Conservation Facility, RI

Research-Hemlock Community Structure, NY

Research-High Elevation Mushrooms, OR

Research-Japanese Forest Policy

Research – Role of a Frog in Ecosystem Functions, PR

Research-Starting a Green Business, CT

Yale Cancer Center, Research Fellow, CT

- Yale University, Corporate Environmental Leadership Seminar, Assistant Coordinator, CT
- Yale University, New Haven Watershed Project, Field/Lab Assistant, CT

Yale University, New Haven Watershed Research Assistant-Hydrology Team, CT

Yale University, Research Assistant-Forest Dynamics, CT

Yale University, Silviculture Research Assistant, CT

Yale University, Sterling Memorial Library, GIS Computer Consultant, CT Yale University, UNDP PPP Program, Research Intern, CT Yale University, Urban Resources Initiative, Community Forester, CT Yale University, Urban Resources Initiative, Greenspace Intern, CT Yale University, Yale Forests, Forest Crew Member, CT Yale University, Yale Forests, Forest Crew Member & GIS Coordinator, CT University of Southern California, Los Angeles Coastal Ecosystem, Water Quality Data Researcher, CA University of Southern California, USC Beach Project, Researcher-GIS Mapping, CA **INTERNATIONAL** Chinese Academy of Sciences, Research Assistant-Conservation of White-Flag Dolphin in the Yangtze River, China Forestal Santa Barbara/The Candlewood Timber Group, Independent Internship, Researcher, Argentina Fundacion Nucanchi Yaracuna, Director & Researcher, Ecuador Government of Peru, PromPeru, Research Fellow-Forest Policy & Management, Peru Independent Researcher – Governments and Forest Management, Gabon Kasetsart University, Regional Community Forestry Training Center, Assistant, Thailand Mistik Management, Ltd., Ecologist, Canada The Nature Conservancy, Water Law Evaluator, Ecuador New York Botanical Garden, Department of Systematic Botany, Researcher-Bats and Plants, French Guyana New York Botanical Garden, Instituto de Ecologia, Independent Researcher-Sustainable Copal Harvest, Mexico Oxfam, America, Research - Role of NGO's in Sustainable Community Forestry, Bolivia Research-Agro-Biodiversity in House Gardens, China Research-Agroforestry, Panama Research-Community Forestry, Indonesia Research - Forest Ecology and Management, Taiwan Forestry Research Institute, Taiwan Research-Socioeconomic Study, Micronesia Research-Tropical Forestry, Thailand Research-Tropical Leaf Anatomy, Panama TATA Energy Research Institute, Visiting Researcher, India U.S. Agency for International Development, Clean Technology Initiative, Intern, India

UNIVERSITY SERVICES AND PRIVILEGES

Housing

The Graduate Housing Office has dormitory and apartment units for a small number of graduate and professional students. Approximate rates for 2001-2002 are: dormitory (single) housing, 4,020-4,780 per academic year; apartments (single and family housing), 580-838 per month. The School of Forestry & Environmental Studies will send the Graduate Housing brochure and application after acceptance of the admission offer is received. The application and your letter of acceptance may then be faxed to the appropriate department noted below. The assignment process generally starts in mid- to late April after current returning residents are offered renewals.

The Graduate Housing Office consists of two separate offices: the Graduate Dormitory Office and the Graduate Apartment Office, both located within Helen Hadley Hall, a graduate dormitory, at 420 Temple Street. Office hours are from 9 A.M. to 4 P.M., Monday through Friday. For facility descriptions, floor plans, and rates, visit the Graduate Housing Web site at http://www.yale.edu/graduatehousing/. For further information on graduate dormitories, contact Beverly Whitney at 203.432.2167, fax 203.432.4578, or beverly.whitney@yale.edu. For graduate apartment information, contact Betsy Rosenthal at 203.432.8270, fax 203.432.0177, or betsy.rosenthal@yale.edu.

The University's Off-Campus Listing 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 http://www.yale.edu/offcampuslisting/. Call 203.432.9756 to obtain the necessary passwords to access the system from other areas.

Food Service

Yale Dining Services has tailored its services to meet the particular concerns of graduate and professional school students by offering contract options for various meals. "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 Dining Services.

The following dining areas and snack bars are available to students: Designer's Alcove at the A&A building; the dining room of the Kline Biology Tower; Donaldson Commons at the School of Management; and Durfee's, a convenience store, coffee, and sandwich shop. 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 Dining Services, 246 Church Street, PO Box 208261, 246 Church Street, New Haven CT 06520-8261; telephone 1.888.678.9837 (toll free), or 203.432.0420. It can also be found on the Web at http://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 Students of Forestry & Environmental Studies

Yale University Health Services (YUHS) is located on campus at the University Health Services Center (UHSC) 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, internal medicine, gynecology, mental health, pediatrics, pharmacy, laboratory, radiology, a twenty-three-bed inpatient care facility (ICF), a twenty-fourhour urgent care clinic, and such specialty services as allergy, dermatology, and orthopedics, among others. 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 comprehensively described in the *YHP Student Handbook*, available through the YHP Member Services Department, 203.432.0246, located at 17 Hillhouse Avenue.

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 health (mental hygiene). In addition, through the Urgent Care Clinic, treatment for urgent medical problems can be obtained twenty-four hours a day. Students who need more acute care receive services in the ICF.

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 fee. 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-forservice 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 UHSC. 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 (http://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 (http://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 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 fee 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 (http://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 (http://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 FOR FORESTRY STUDENTS

Before matriculation, 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 one month 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.

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, 100 Wall Street, PO Box 208305, New Haven CT 06520-8305. Access to the Resource Office is through the College Street entrance to William L. Harkness Hall (WLH). Office hours are Monday through Friday, 8.30 A.M. to 5 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 (http://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 can 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 maintains an extensive Web site (http://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. In addition, OISS maintains an electronic newsletter, which is distributed by e-mail on a regular basis. To subscribe, e-mail your e-mail address and name to oiss@yale.edu.

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.

The International Center

Established in 1949, the International Center of New Haven is a nonprofit communitybased 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 Thursday, and from 9 A.M. to noon on 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, trips, picnics, and special events, as well as English as a Second Language (ESL) classes, in addition to a number of programs including the International Host 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 sixteen students and scholars. Rooms are available for the academic year and summer. For more information on any of these programs, or on International House, telephone 203.432.6460, fax 203.432.6462, e-mail international.centernh@yale.edu, or visit the Web site at http://www.oiss.yale.edu/ icnh/.

Religious Ministry

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 oncampus 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; several Protestant denominational ministries and nondenominational groups; and religious groups such as the Baha'i Association, the Unification Church, the New Haven Zen Center, and the Muslim Student Association. Additional information is available at http://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 pages 113–14). Second largest among the university libraries in the



United States, the Yale Library contains more than ten 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 4.6 million records of materials acquired since 1977. 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 and Library Systems for advice on the selection of appropriate hardware and software.

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 twelve IBM and two Apple Macintosh personal computers and a high-speed printer capable of producing double-sided output. The GIS Lab, located next door in Sage 31, contains eleven IBM computers and several printers, including a color printer capable of printing large-format 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 Intellistation workstations configured for GIS and computational applications, as well as several computers intended mainly for e-mail and Web access.

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 and maintains a showroom at the Yale Bookstore where students and faculty can purchase computers and software at educational discounts.

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.

CULTURAL AND RECREATIONAL OPPORTUNITIES

Cultural Opportunities

A calendar of events in the University is issued each week during the academic year in the *Yale Bulletin & Calendar*. The hours when special as well as permanent collections of the University may be seen are also recorded in this publication.

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 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, 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 Theater, 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 amazing 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, an architectural marvel; the Brady Squash Center, a world-class facility with fifteen international-style courts; the Adrian C. Israel Fitness Center, a state-of-theart exercise and weight-training complex; the Brooks-Dwyer Varsity Strength and Conditioning Center, the envy of the Ivy League; 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 undergraduate 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.

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 undergraduate 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://yale. edu/athletics/ (click on Sport and Rec, then on Outdoor Education). Throughout the year, Yale University graduate and professional 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 at http://www.yale. edu/athletics/.

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, 2001

Kristal Racasa Aliyas (B.S. Univ. Michigan), Texas. Donna Duckjwa An (B.A. Oberlin Coll.), New Jersey. Colin Apse (B.A. Duke Univ.), New Jersey. Alexandra Catharine Michener Baillie (B.S. Queen's Univ.), Canada. Frank J. Barros (B.A. College of the Holy Cross), Massachusetts. Michael Anthony Benjamin (B.A. Middlebury Coll.), Massachusetts. Eric Biber (A.B. Harvard Univ.), Virginia. Marcela Beatriz Bocchetto (B.S. Universidad Catolica de Cordoba; M.S. Pontificai Universidad Gregoriana de Roam-ILADES), Argentina. Andrea Brewer (B.A. Univ. California [Los Angeles]), California. Daniel Joseph Byrd (B.A. Univ. Pennsylvania), New Jersey. Heather A. Cabrera (B.S. Cornell Univ.; M.S. Fordham Univ.), Connecticut. William George Caldicott (B.A. Southern Cross Univ.), Australia. Adriana Casas (J.D. Los Andes Univ.), Colombia. Leigh Jackson Cash (B.s. Univ. Georgia), Tennessee. Kerry Michele Cesareo (B.S. Univ. North Carolina [Chapel Hill]), New Jersey. Rajendra Kumar Chaini (B.S. Sambalpur Univ.), India. Adam Sebastian Chambers (B.s. Murray State Univ.), Kentucky. Sam Yee (Sandy) Chan (B.S. State Univ. New York [Stony Brook]), New York. Yenyen Felicia Chan (B.A. Yale Univ.), California. Karma Chhimi (B.A. Indrarrasta Coll.), Bhutan. Matthew Roberts Clark (B.A. Stanford Univ.), Oregon. John E. Daly (B.A. Colby Coll.), Massachusetts. Dechen Dorji (B.sc. Univ. Wales), Bhutan. Matthew Eddy (B.A. Yale Univ.), California. Roberta Phyllis Elias (B.S., B.A. Binghamton Univ.), Connecticut. David Scot Ellum (B.S. North Carolina State Univ.), Connecticut. Eden Enclona (B.S. Visayas State Coll.; M.S. Asian Institute of Technology), Philippines. Maria Claudia Fandino (B.Sc. Andes Univ.), Columbia. Lianne Fisman (B.sc. McGill Univ.), Canada. Matthew Fladeland (B.A. Gustavus Adolphus Coll.), North Dakota. Mary Ford (A.B. Harvard Univ.), Minnesota. Herrick Sanford Fox (B.s. Univ. California [Berkeley]), Pennsylvania. Valerie Diane Fraser (B.A. Duke Univ.), Arkansas. Uromi Manage Goodale (B.sc. Univ. Colombo), Sri Lanka. Jennifer Grimm (B.A. Mount Holyoke Coll.), Massachusetts.

Catherine Claire Guimond (B.A. Wellesley Coll.), New Jersey.

Catherine Hardy (B.A. Cornell Univ.), Washington, D.C. Scott Hedges (B.s. Univ. Maine), Pennsylvania. Katina Henderson (B.S. Texas A&M Univ.), Texas. Peter Hill (B.A. Evergreen State), Michigan. Aya Hirata (в.а. Sophia Univ.), Japan. Matthew Hollamby (B.S., B.A. Binghamton Univ.), New York. Nicholas Holland (B.A. Connecticut Coll.; M.S. ADL Management & Educational Inst.), Massachusetts. Marjorie Huang (B.A. Tufts Univ.), New York. Omari O. Ilambu (B.S. National Education Institute), Zaire. Jesse D. Johnson (A.B. Princeton Univ.), Colorado. Gregory Cameron Jones (B.SC.H. Queen's Univ.), Canada. Stephanie Hanna Jones (A.B. Princeton Univ.), Virginia. Neel Kamath (B.A. St. Xavier's Coll.), India. Christian F. Kemos (B.s. Univ. California [Davis]), California. Calvin Edward Kiehn (B.A. Whitman Coll.), Washington. Dong-Young Kim (B.s. Yonsei Univ.), Korea. Pia Kohler (B.sc. McGill Univ.), Switzerland. Lisbet Birgitta Kugler (B.S. Brown Univ.), Switzerland. Pradeep Kurukulasuriya (м.s. Univ. Aberdeen; м.рнп. Univ. Cambridge), Sri Lanka. Ashley Lanfer (A.B. Dartmouth Coll.), Georgia. Heather Lorraine Langford (B.S. Cornell Univ.), Alabama. Eugene Thean Hock Lee (B.A. Middlebury Coll.), Malaysia. Christian Lentz (B.A. Cornell Univ.), Rhode Island. Laura Lynne Letson (B.S. Univ. Kentucky), Kentucky. Christopher J. Losi (A.B. Princeton Univ.), New Jersey. Jeffrey W. Luoma (B.A. Wittenberg Univ.), Washington. Jane E. MacLellan (B.A. Connecticut Coll.), New Jersey. Smita J. Malpani (B.A. Wellesley Coll.), Massachusetts. Kristen Michaelides (B.S. Yale Univ.), Massachusetts. Aurelia J. Micko (I.S.P. Northwestern Univ.), Illinois. Michael Edward Montag (B.A. Williams Coll.), Minnesota. Mari Morikawa (B.A. Sophia Univ.), Japan. Jeffrey Morton (B.S., B.A. Univ. Kansas), Kansas. Barry Muchnick (B.A. Emory Univ.), Pennsylvania. Chie Nakaniwa (B.A. Meiji Univ.), Japan. Lech Naumovich (B.S. Univ. Wisconsin [Madison]), Missouri. David William Newcomer (B.A. Univ. Missouri), South Carolina. Christopher Markley Nyce (B.A. Reed Coll.), California. Kristen Ohlson (B.A. Marlboro Coll.), Connecticut. Andrew Christopher Oishi (B.A. Duke Univ.), Oregon. Jennifer Osha (B.A. Univ. Virginia), Virginia. Noriko Oshima (в.а., м.а. Keio Univ.), Japan.

Jonathan Padwe (B.A. Univ. Virginia), Virginia. Eric Peter Palkovacs (B.s. Univ. Michigan), Ohio. Robert Baxter Powell (A.B. Univ. North Carolina), North Carolina. Shimona Annoor Quazi (B.S. State Univ. New York [Stony Brook]), Bangladesh. Luis Gustavo Rodriguez (B.A., B.S. Univ. San Francisco de Quito), Ecuador. Diane Russell (B.A. Barnard Coll.; PH.D. Boston Univ.), New York. Maud Sandbo (A.s. Westchester Community Coll.; B.A., B.S. State Univ. New York [Purchase]), New York. Richard Emil Sappé (B.s. Ursinus Coll.), Switzerland. Abigail Bagasao Sarmac (B.S.F.S. Georgetown Univ.), Virginia. Tracy Scheffler (B.A. Gettysburg Coll.), Missouri. Lisa Joy Schulman (B.S. James Madison Univ.), New Jersey. Marina Sekine (B.A. International Christian Univ.), Japan. Gregg Serenbetz (A.B. Dartmouth Coll.), Pennsylvania. Sasha Silver (A.B. Princeton Univ.), Florida. Georgia Norma Silvera (B.A. Wesleyan Univ.), New Jersey. Scott W. Smith (B.s. Univ. Vermont), Connecticut. Michael Steven Sterner (B.A. Dickinson Coll.), Maryland. Elizabeth Fraser Stewart (B.A. Bowdoin Coll.), Massachusetts. Mochammad Luthfi Susanto (J.D. Brawijaya Univ.), Indonesia. Francis Roger Taylor (E.S. Western Washington Univ.; M.A. Yale Univ.), Washington. Julio Teran (B.A. Bates Coll.), Michigan. Michael Terrell (B.S. Univ. of the South), Alabama. Anna Tikina (м.л. Mari State Teacher's Training Institute; м.sc. Central European Univ.), Russia. Tracy Triplett (B.S. Cornell Univ.), Connecticut. Mariana McMullen Upmeyer (B.A. Colby Coll.), New Jersey. Mark Christopher Urban (B.S. Muhlenberg Coll.), Pennsylvania. Charles Lincoln Vaughan (B.A. Boston Univ.), Connecticut. Anna Birgitta Viggh (B.A. Univ. Vermont, Stockholm Univ.; M.A. George Washington Univ.), Massachusetts. Ray Wan (B.S., B.A. Univ. California [Berkeley]), California. Jennifer Wells (B.A. Ramapo Coll. of New Jersey), New York. Bruce Westerman (B.S. Univ. Arkansas), Arkansas. Allison H. Willcox (B.A. Colgate Univ.), Massachusetts. Joshua Wilson (B.A. Connecticut Coll.), Connecticut. Christian Wippermann (Diploma George-August Univ. of Gottingen), Germany. Mark Wishnie (B.S. Univ. Washington), Massachusetts. Michel Elizabeth Woodard (B.A. Williams Coll.), Washington, D.C. James Willard Woodworth, Jr. (B.S. Trinity Coll.), Connecticut. Karma Yangzom (B.sc. Sherubtse Coll.), Bhutan. Deki Yonten (B.sc. Univ. Adelaide), Bhutan. Yinlan Zhang (B.A. Univ. California [Los Angeles]), California.

Yujun Zhang (в.е., м.е. Xián Univ.), China. Qian Zhu (в.а., м.м.s. Shanghai Jiao Tong Univ.), China. Kim Ziegelmayer (в.а. Rhode Island Coll.), Rhode Island.

DOCTORAL DEGREES CONFERRED, 2001

Doctor of Forestry and Environmental Studies

Laura Lynn Ahearn Meyerson (B.A. City Univ. New York [Hunter College]; M.F.S. Yale Univ.), New York.

Toral Patel-Weynand (в.а. Univ. Bombay [India], Temple Univ.; м.ғ.s. Yale Univ.), India.

Helga Rodriguez von Platen (B.S. Univ. Javeriana [Colombia]; M.S.C. Centro Agronomico Tropical de Investigacion y Ensenanza [Colombia]), Colombia.

Doctor of Philosophy

Karen Heather Beard (B.A. Univ. California [Berkeley]; M.E.S. Yale Univ.), California. Eva Chalia Cuadrado Worden (B.S. Univ. Florida; M.S. Univ. Maryland), Florida.

Rosa Garay-Fluhmann (в.а., в.s., м.а. Universidad de Chile; м.е.s. Yale Univ.), Chile. Emily Evans Harwell (в.s. Univ. of the South), New York.

Neil Hendrickson (B.S. Rutgers Univ.; M.S. Univ. New Hampshire), Connecticut. Xinzhang Hu (B.S., M.S. Peking Univ. [Beijing]), China.

Fred A. Meyerson (A.B. Dartmouth Coll.; J.D. Columbia Univ.; м.E.s. Yale Univ.), New York.

Sorrayut Ratanapojnard (B.Sc. Mahidol Univ. [Thailand]), Thailand

Ragnhildur Sigurdardottir (B.S. Univ. Iceland; M.F.S. Yale Univ.), Iceland.

Saroj Sivaramakrishnan (в.л., м.s.w. Univ. Delhi [Kirori Mal Coll., India]; м.е.s. Yale Univ.), India.

Joel Preston Tilley (B.S., M.S. Ohio State Univ.), Massachusetts.

STUDENTS WORKING TOWARD MASTER'S DEGREES, 2001

Mahua Acharya (B.sc. St. Joseph's Coll.; M.sc. Univ. Strathclyde), India.

Cintra Cady Agee (в.а. Hunter Coll., Univ. California [Berkeley]), New York, California.

Cesar Alcacer-Santos (B.A. Univ. Lleida), Spain.

Elizabeth Aileen Allison (B.A. Williams Coll.), California.

Elizabeth Elsie Alves (B.S. Chestnut Hill Coll.), Connecticut.

Maria Paola Amador (B.S. Universidad Catolica Santiago de Guayaquil), Ecuador.

Dimos Panayiotis Anastasiou (B.S. Univ. Lamia [Karpenisi Campus]), Greece.

Patricia Nicole Aronhalt (B.A. California State Univ. [Sacramento]), California.

Catherine Marie Ashcraft (B.A. Univ. Pensylvania), New York.

Kimberely Michele Awbrey (B.A. Skidmore Coll.), New Jersey.

Youngah Bae (в.s. Seoul National Univ.; м.s. Seoul Univ.), Korea.

Elizabeth Joy Ban (B.A. William Smith Coll.), Illinois.



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Peter Jon Deschenes (B.S. Univ. of the South), North Carolina. Erika Sloane Diamond (B.A. Vassar Coll.), New York. Aspasia Alexandra Dimizas (B.A. The American Coll. of Greece), Greece. Kelly Morgan Droege (B.A. Univ. Oregon), Oregon. Shane Patrick Duigan (B.S. Univ. Maine), Connecticut. Travis Leigh Dynes (B.A. Luther Coll.), Minnesota. Matthew Whitney Russell Eddy (B.A. Yale Univ.), California. Victor Seton Edgerton (B.A. Univ. California), California. Aliya Ercelawn (B.A. Carleton Coll.), Pakistan. Neal Alfred Etre (B.A. Bowdoin Coll.), Massachusetts. Scott Collins Fenimore (B.S. Bates Coll.), Pennsylvania. Jill Elizabeth Ferguson (B.S. State Univ. New York), New York. Rachel Margaret Fertik (B.A. School for Field Studies – Center for Tropical Ecology and Conservation Biology), Pennsylvania. Roberto Jose Frau (B.A. Boston Univ.), Puerto Rico. Rebekah Elizabeth Frederick (B.A. Northwestern Univ.), Indiana. Derik R. Frederiksen (B.S. Univ. Washington), Arkansas. Takaaki Fujiwara (LL.B. Keio Univ.), Japan. Michael Edward Funaro (B.S. Univ. Connecticut), Connecticut. Kenuske Fuse (B.E. Meiji Univ.), Japan. Molly Kate Giese (B.A. Washington and Lee Univ.), South Carolina. Dmytro Glazkov (B.S., M.S. Kharkov State Polytechnic Univ.), Ukraine. Larisa Renee Grawe (B.S. Univ. California [Berkeley]), California. Erin Gray (B.A. Smith Coll.), Pannsylvania. Brett Travis Greene (B.A. Reed Coll.), Pennsylvania. Shalini Gupta (B.s. Univ. Chicago), Minnesota. Alissa Anne Hamilton (B.A. Yale Univ.; LL.B., Univ. Toronto), Canada. Nathan Hale Hart (B.S. Univ. Maine), Connecticut. Iona Fairlight Hawken (A.B. Brown Univ.), California Cassie Megan Hays (B.A. Smith Coll.), Kansas. Scott Andrew Hedges (B.s. Univ. Maine), Pennsylvania. David Scott Howlett (B.A. Vassar Coll.; M.IA. Columbia Univ.), Nevada. Amy Smith Hughes (B.A. Oberlin Coll.), California. John Bradley Hunter (B.A. Univ. of the South), North Carolina. Lucy Hutyra (B.s. Univ. Washington), Virginia. Su Jin Hwang (B.S. Sungshin Women's Univ.), Korea. Rusaslina Idrus (B.SC. Cornell Univ.), Malaysia. Rebecca Marie Jensen (B.A. Carleton Coll.), Washington, D.C. Elizabeth Ralston Jones (A.B. Dartmouth Coll.), California. Akiko Kawaguchi (а.в. Dartmouth Coll.), Japan. Tierney Kelly (B.S. Univ. Richmond), Pennsylvania. Kristen Holopainen Kimball (B.A., M.S. Univ. Connecticut), Connecticut. Kendra Ashley Kinscherf (B.A. Coll. of New Jersey), New Jersey.

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