Sustainable Development and Conservation Biology

Master of Science Program

University of Maryland, College Park

The Graduate Program in Sustainable Development and Conservation Biology

Program Description

This Master of Science program was initiated in 1991 to provide a new training and educational emphasis in the area of conservation and sustainable development. The CONS program emphasizes an interdisciplinary and experiential approach to the problems of biological conservation in relation to economic development necessary to meet human needs. It includes four components:

1. Core courses in each of the following (14 credits):
   - ecology and conservation biology
   - resource economics
   - public policy; and
   - interdisciplinary problem-solving;
2. Elective courses from a wide array of disciplines (25 credits);
3. An internship experience for one semester, usually in a Washington-area agency, that is relevant to the student's career interests;
4. A scholarly paper that uses readily available data to analyze a conservation or development project from the perspective of biological conservation and economic benefits and leads to policy recommendations.

Course requirements for the program total 39 credits. This is intended to be a two to three year degree program.

Educational Objectives

The principal objective of the CONS program is to provide graduate training in Conservation Biology. This relatively new field of study is driven by the current and future demise of biodiversity, accelerating global change, environmental decay, and the complex relationship between resolving these concerns and meeting the needs of an expanding human population. More generally, the Program's objectives are to:

- provide broad, multidisciplinary training in the core areas of biological conservation, resource economics, and policy analysis;
- explicitly link the conflicting topics of sound conservation of natural resources with sustainable development to meet human needs;
- enhance our ties with other academic, governmental and non-governmental units in the Washington, D.C area;
- graduate Masters degree holders who will be well prepared to address conservation issues for employers in the private sector and in local, state, and national government posts; or to enter Ph.D. programs for further, specialized training;
- foster the maturation of new research initiatives in the area of conservation and sustainable development by involving diverse faculty in the supervision of integrated, multidisciplinary training.

Administrative Structure of Program

CONS is campus-wide in scope, but was originated by and is directed by faculty from the Department of Biology. A Graduate Admissions Committee is responsible for the selection of students. The Director is a tenured faculty member of the Department of Biology, whose responsibilities include supervising program activities, advertising, fund-raising, and public relations. CONS was created to have a particular emphasis on Latin America, and a few of the approximately 16 students admitted each year come from that geographical area.

Admission

We expect that applicants will have majored in a variety of disciplines as undergraduates, but most have training in at least one of the areas of ecology, resource economics, or public policy. Upper-level undergraduate courses in ecology, conservation biology, and microeconomics are strongly recommended, and applicants who have these courses at an advanced level will be preferred. However, because of the diverse, multidisciplinary nature of the subject area, it is expected that some of the elective courses will serve to fill in breadth where needed. The Graduate School requires as a minimum standard for admission a B average (3.0 on a 4.0 scale) from an accredited college or university. In addition, the Graduate Record Examination (GRE) general test is required for admission.

Prerequisites

Although we accept students with a variety of undergraduate majors, a minimum of one semester each of college level biology and calculus is essential for all conservation biology graduate students and deficiencies in these areas should be corrected prior to enrollment in the CONS Program. In addition, an upper-level undergraduate course in ecology (such as BSCI 462 (Population Ecology) or equivalent) is required prior to enrollment in any of the graduate courses in ecology and conservation biology. Most CONS students enroll in BSCI 462 their first semester in order to fulfill this prerequisite. A course in principles of microeconomics is suggested prior to enrollment in the natural resource economics core course. At least two core courses should be completed prior to enrolling in problem-solving, or students may take one core course concurrently with problem-solving. Prerequisites for elective courses include those listed in the University of Maryland Graduate Catalog. Because many of the electives are 400-level they will be accessible to individuals with strong undergraduate degrees (see preceding paragraph on admissions).

Advising

As a non-thesis master degree program, CONS does not require original research and therefore, does not assign individual thesis advisors. A group advising session will be held before the beginning of each semester to advise students about course selection. Students are especially encouraged to learn about courses from each other, and student course evaluations are kept in the CONS Office. The Director, other faculty, and senior students in the program are available for advising.

Application Procedure

Graduate Applications are available online at http://www.vprgs.umd.edu/. The completed application, an application fee, and one set of official transcripts for all previous academic work should be sent directly to the Graduate School. The following materials should also be submitted to the Graduate School (see http://www.gradschool.umd.edu/catalog/programs/CONS.html):

- Three letters of recommendation;
- Graduate Record Examination (GRE) score (Department Code 0299);
- Statement of goals and objectives for pursuing a CONS degree
- Statement of experiences that have helped prepare you for graduate work in CONS
- Curriculum Vitae or Resumé

The completed application is evaluated by the Admissions Committee on the basis of guidelines and criteria established by the Steering Committee. To be considered for Graduate School Fellowships, applications for the fall should be completed by January 31st. Otherwise, the preferred deadline for fall admission is January 15th and the final deadline is February 15th (applications received after that date are at a disadvantage as we will have already begun admissions by then). Applications are not encouraged for the spring semester, but exceptions can be made on a space available basis.

Cost and Financial Support

Information about tuition and fees is available at http://www.umd.edu/bursar/Tuitionfees.html. Tuition for 2006 is currently set at $8,474 for 10 credits for out-of-state students. Mandatory fees are $456 for full-time graduate students. Most students who request financial support are awarded some form of support, most commonly Teaching Assistantships. There are also a few Graduate School fellowships, which are awarded on a competitive basis using academic achievement as the primary criterion.

Core and Elective Courses for Conservation Biology Students

I. Resource Economics

AREC 689P: Applications of Microeconomics to Environmental and Resource Issues (3 credits). A core course treating both macro- and microeconomic aspects of natural resource utilization. Predictive models relating to optimal depletion, sustainability and alternative uses of natural resources will be compared and contrasted. Offered in the fall semester. Currently, no prerequisites are required. However, a background course such as the following may be taken if needed:

PUAF 640: Microeconomic Theory and Policy Analysis (3 credits). Application of microeconomic theory to public policy problems. Theory of resource allocation; response of economic agents to changes in incentives; properties of market allocations; the nature of market failures; and government interventions to remedy those failures. The course prerequisites are knowledge of basic calculus and permission from the School of Public Affairs. This course is normally offered in both the spring and fall semesters. Credits from this course can be applied towards the CONS degree.

ECON 306: Intermediate Microeconomic Theory (3 credits). Analysis of the theories of consumer behavior and of the firm, market systems, distribution theory and the role of externalities. This course has prerequisites of an introductory course in economics and a background in elementary calculus, but Conservation Biology students can probably handle this material without the economics prerequisite. Credits from this course cannot be applied towards the CONS degree.

II. Ecology and Conservation Biology

(Either of the following courses will satisfy the ecology core requirement.)

BIOL 662: Concepts in Animal Ecology (4 credits). Five hours of lecture and discussion/recitation per week. A graduate-level treatment of ecological processes and their evolutionary implications. Review of classical and contemporary literature, with emphasis on current developments in ecological theories, and their testing in the laboratory and field. Prerequisite: a course in ecology (BSCI 462 or equivalent) or permission of instructor. This course is normally offered every spring.

ENTM 612: Insect Ecology (3 credits). An advanced course in population and community ecology, plant-insect interactions, and insect biogeography. Emphasis is on current entomological literature. Prerequisite: a course in general ecology or permission of instructor. This course is normally offered every other spring, and will be offered in spring 2005.

III. Environmental Policy

PUAF 740: Public Policy and the Environment (3 credits). A comprehensive overview of federal environmental legislation. This course covers the history of how the major U.S. environmental laws came to be enacted and the specific requirements of each law. It examines the scientific, economic, legal and ethical issues relating to the development and implementation of environmental legislation over the past 25 years. The course also explores a number of case studies in environmental policy, as well as the general policy problems and concerns that have emerged. Themes and issues that run throughout the course include: (1) Have environmental laws worked effectively to improve the quality of the environment? (2) How can society go about establishing environmental policies when there are large scientific uncertainties? (3) How useful are concepts and methods such as risk analysis, benefit-cost analysis, cost effectiveness, and others in addressing environmental policy problems? No prerequisites are required. This course is normally offered in the spring semester.

IV. Multidisciplinary Problem-Solving

CONS 680: Problem-Solving in Conservation and Development (4 credits). A problem-solving approach to issues in conservation and development from the perspective of multiple disciplines. Students in multidisciplinary teams will be charged with analyzing a development case with environmental consequences (e.g., construction of a new road across the Amazon to the Pacific) or a conservation plan with human consequences (e.g., constructing a new park in a region occupied by humans). Each problem must be assessed for its biological conservation impact and economic benefits, and a policy recommendation formulated. Prerequisite: at least two of the other core courses (e.g. ecology, economics, or policy) must be completed prior to registering for this course. This course is offered in the fall semester.

V. Internship Experience

Students must complete an internship experience with one or more non-government or government organizations. The internship can be completed either full-time during the summer or part-time during the school year. Each internship possibility should be discussed with Dr. Dietz prior to a commitment. Upon concurrence between the student, the internship organization representative acting as Advisor, and Dr. Dietz, a contract will be written, approved and signed by these individuals. After the internship is completed a letter from the internship Advisor is to be mailed to Dr. Dietz and will be included in the student's academic file. See "Detailed Program Requirements" for more information

VI. Scholarly Paper

The scholarly paper will consist of an in-depth research paper that analyzes a conservation problem from the perspective of multiple disciplines. It will provide an analysis of some proposed or historic development issue, including an economic analysis, an evaluation of associated issues in biological conservation, and recommended public policies. The student may choose to emphasize one of these areas, but each must be included. Since a primary goal of this program is to foster collaborative problem-solving and multidisciplinary thinking, students with different areas of expertise could overlap in their thesis projects. Students are encouraged to develop their thesis topic in association with their internship, if possible. Students may register for a maximum of 4 thesis credits (CONS 798).

VII. Typical Course Program

Most CONS students take two years to complete their degree. Full-time students register for 10-12 credits per semester. Be advised that Teaching Assistants receive tuition remission for 10 credits per semester, and fellowship students receive remission for 12 credits each semester. While many of our students work part-time either on or off campus, if you plan to work full-time, be advised that all of the core courses are taught during daytime hours. Please note that there are many variations on the sample course program below. Incoming students who feel they need addition economics experience before taking AREC 689P should take PUAF 640 their first semester. Also, the scholarly paper (or thesis) often takes students two semesters to complete.

	FALL	Example	Number of credits	**SPRING**	Example	Number of credits
YEAR ONE	Core course Elective Elective Seminar	AREC 689P BSCI 462 CONS608	3 3 3 1-2	Core course Core course Elective Seminar	BIOL 662 PUAF 740 CONS 608	4 3 3 1-2
Summer		internship				
YEAR TWO	Core course Elective Elective Seminar	CONS 680 CONS609 CONS 608	4 2 3 1-2	Thesis Elective Seminar	CONS 798 CONS 608	2 3 1-2

ELECTIVE COURSES

The Sustainable Development and Conservation Biology M.S. degree is open to students with a specialized interest in any area of the life or social sciences pertaining to the environment. For example, the ecology and conservation biology component could potentially be met by undergraduate preparation and graduate course work in (e.g.) agronomy, entomology, plant biology, or zoology. Furthermore, relevant coursework is available in a wide array of academic departments. The following list of electives reflects that breadth. It was developed in consultation with the Program Steering Committee, but it is not exhaustive. Students who wish to take an elective course that does not appear below should first have the course approved by the Program Director. Course descriptions can be found in the UMCP graduate catalog. The Graduate Catalog is published only on the world wide web at http://www.gradschool.umd.edu/catalog/.

Agriculture and Natural Resources		
	AGNR789	Special Topics: Ecosystems Based Management
Agriculture and Resource Economics		
	AREC 445	Sustainable Agricultural and Rural Development
	AREC 453	Natural Resources and Public Policy
	AREC 455	Economics of Land Use
	AREC 645	International Agricultural Development
Agronomy	AGRO 413	Soil and Water Conservation
	AGRO 415	Soil Survey and Land Use
	AGRO 441	Sustainable Agriculture
Anthropology	ANTH 464	Sustainable Grassroots Development
	ANTH 610	Culture, Health and Community Development
	ANTH 625	Applied Biological Anthropology
	ANTH 650	Resource Management and Cultural Process
	ANTH 689D	Special Problems in Anthropology: Computer Mapping and GIS
Biology		
	BIOL 660	Theoretical Population and Community Ecology
	BIOL 663	Ecology of Marine Communities
	BIOL 665	Behavioral Ecology
	BIOL 667	Mathematical Biology
	BIOL 670	Concepts in Evolution
	BIOL 760	Plantn Population Biology
	BSCI 460	Plant Ecology
	BSCI 462	Population Ecology
	BSCI 464	Microbial Ecology
	BSCI 466	Experimental Aquatic Ecology
	BSCI 467	Freshwater Biology
	BSCI 473	Marine Ecology
	BSCI 481	Insect Diversity and Classification
	BSCI 493	Medicinal and Poisonous Plants
Biometry	BIOM 401	Biostatistics I
	BIOM 602	Biostatistics II
Curriculum and Instruction		
	EDCI 473	Environmental Education
Economics	ECON 422	Quantitative Methods in Economics I
	ECON 603	Microeconomic Analysis I
	ECON 615	Economic Development of Less-Developed Areas
	ECON781	Environmental Economics
Biological Engineering		
	ENBE488B	Special Topics in Biological Engineering: Ecological Risk and Impact Assessment
	ENBE489	Special Problems in Biological Engineering

Entomology	ENTM 451	Insect Pests of Agricultural Crops
	ENTM611	Biological Suppression of Plant Pests
	ENTM 623	Insect Evolutionary Biology
	ENTM 654	Advanced Pest Management
	ENTM789	Field Experience in Pest Management
Geography	GEOG 434	Agricultural and Rural Development
	GEOG 473	Geographic Information Systems and Spatial Analysis
	GEOG 480	Advanced Remote Sensing
	GEOG 482	Geographic Information Systems
	GEOG 484	Biogeography
	GEOG 609C	Seminar in Remote Sensing
	GEOG 688	Seminar in Third World Development
Geology	GEOL 452	Watershed and Wetland Hydrology
Government and Politics		
	GVPT 482	Government and Politics of Latin America
	GVPT 808A	Global Environmental Politics
	GVPT 848A	Current Problems in Political Theory: Environment and Society
Marine-Estuarine Environmental Sciences		
	MEES 608	Seminar in MEES: Various topics offered each semester
	MEES 611	Systems Ecology of Estuaries
	MEES 612	Ecosystem Ecology
	MEES 641	Environmental Toxicology
	MEES 650	Wetland Ecology
	MEES 661	Physics of Estuarine and Marine Environments
	MEES 681	Coastal Resource Use, Law and Management: The Chesapeake
	MEES 682	Fishery Science and Management
	MEES 698	Special Topics in MEES: Various topics offered each semester
Natural Resources Management		
	NRMT461	Urban Wildlife Management
	NRMT470	Natural Resources Management
	NRMT 479	Tropical Ecology and Resource Management
	NRMT 489A	Field Experience: Wetland Ecology
	NRMT489E	Field Experience: Ecological Risk and Impact Assessment
	NRMT 489P	Field Techniques in Resource Management
Plant Biology	PBIO 450	Advanced Plant Taxonomy
	PBIO 440	Plant Ecology
	PBIO 441	Plant Ecology Laboratory
	PBIO 445	Evolutionary Biology of Plants
	PBIO 463	Ecology of Marsh and Dune Vegetation
	PBIO 687	Plant Population Biology
	PBIO 698D	Seminar in Plant Ecology
Public Affairs	PUAF 610	Quantitative Methods in Policy Analysis
	PUAF 640	Microeconomic Theory and Policy Analysis
	PUAF 743	Ecological Economics
	PUAF 698A	Selected Topics in Public Affairs: Urban Environmental Issues
	PUAF 689F	Environment and Development
	PUAF 698	Biodiversity and Public Policy
	PUAF 698U	Selected Topics in Public Affairs: Dynamic Modeling of Ecological &Economic Systems

	PUAF 698Z	Selected Topics in Public Affairs: Local Governance and Land Use Planning
	PUAF 700	U.S. Trade: Policy and Politics
	PUAF 741	Global Environmental Problems
	PUAF 743	Ecological Economics
	PUAF 745	Human Health and Environmental Policy
	PUAF 750	Environmental Ethics
Sustainable Development & Conservation Biology		
	CONS 608	Seminar in Sustainable Development and Conservation Biology
	CONS 670	Conservation Biology
Toxicology	TOXI 641	Environmental Toxicology
Urban Studies	URSP 488A	Computer Mapping (prerequisite for GEOG 482 - GIS)
	URSP 662	Urban and Regional Planning in Developing Countries
	URSP 688E	Recent Developments in Urban Studies: Environmental Resources
	URSP 688G	Growth Management and Environmental Planning
	URSP 688	Cases in Environmental Management in Maryland

INTERNSHIPS and JOBS

Below are some of the organizations with which CONS students have completed their required internships, or have held positions following graduation:

American Zoo and Aquarium Association
Biodiversity Action Network (BIONET)
Bronx Zoo
Brookfield Zoo
Bureau of Land Management
Bushmeat Crisis Task Force
Chesapeake Bay Foundation
Conservation International
- Ecotourism Department
- Aquatic Rapid Assessment Program

Dames and Moore, Environmental Consulting
Defenders of Wildlife
Earthwatch
Ecotourism Society
Habitat Institute for the Environment
IUCN - World Conservation Union
The Jane Goodall Institute
Maryland Department of Natural Resources
Missouri Department of Conservation, Natural Heritage Program
The Nature Conservancy
- Latin American and Caribbean Division
- Bioreserve Program
- State Programs
- Stewardship Program

Organization of American States
RARE Center for Tropical Studies
Science and Policy Associates Inc.
Smithsonian Institution
- Man and the Biosphere Program
- Migratory Bird Center
- National Zoo

Office of Environmental Awareness
Center for Tropical Forest Science
United States Department of Interior
Bureau of Land Management
Fish and Wildlife Service
United States Environmental Protection Agency
USDA Soil Conservation Service
United States Department of the Interior
Bureau of Land Management
Fish and Wildlife Service
University of Maryland Ph.D. programs
Agricultural and Resource Economics
School of Business
Public Affairs
Biology
University of Michigan
Universidad Nacional Experimental, Venezuela
Washington University at St. Louis, Missouri
The World Bank
World Wildlife Fund
Biodiversity Support Program
Brazil Program
Environmental Education Department
TRAFFIC US

Faculty Participating in the Sustainable Development and Conservation Biology Program

One of the strengths of the CONS program is the diversity of resources offered by a major university. A large number of faculty from a variety of campus units, as well as staff from government and non-government conservation and development organizations work closely with the CONS program. Because CONS is a non-thesis program, you are not required to have a specific advisor as is common in thesis-based program. However, many students often seek academic and career advice from this diverse group of faculty. These units of the University and off-campus organizations include[1]:

I. University of Maryland, College Park Campus

A. Sustainable Development and Conservation Biology Program

Program Directors

Dr. David W. Inouye (Ph.D., University of North Carolina, 1976). Dr. Inouye's research has focused on a variety of projects at the Rocky Mountain Biological Laboratory in Colorado but has also included field work in Australia, Austria, and Costa Rica. His long-term association with a field site has made possible studies that span 30+ years on variation in flowering phenology of wildflowers, the population biology of several species of plants, and the population biology of hummingbirds. Dr. Inouye has also worked on resource partitioning in bumblebees, ant-plant mutualisms, the cost of reproduction of glacier lilies, the population biology of flies and the flowers they visit for pollen and nectar,

[1] Please contact the departments directly if you would like a complete list of faculty and their research.

and the consequences of climate change. At the University of Maryland, Dr. Inouye teaches courses in plant-animal interactions, ecology, and conservation biology. Currently, he is Professor in the Department of Biology and Director of the CONS program. Email: inouye@umd.edu

Dr. James M. Dietz (Ph.D., Michigan State University, 1981). Dr. Dietz is a conservation biologist and behavioral ecologist. He defines conservation biology as the emerging discipline that focuses theoretical concepts derived from studies of ecology and evolutionary biology on problems related to extinctions, biological diversity, and the maintenance of ecological processes. He is currently involved in multidisciplinary conservation projects targeting several species of endangered canids and primates in Brazil. His research interests include the effects of environmental resources on mating systems and reproductive success of primates. Dr. Dietz collaborates extensively with conservation organizations in the Washington area and teaches courses in conservation biology. He is Professor in the Department of Biology and Assistant Director of the CONS program. Email: jmdietz@umd.edu

Adjunct Faculty

Adjunct Faculty are not regular University faculty members, but people from outside the University who make significant contributions to the CONS program. They teach occasional seminars or lectures in CONS courses, mentor interns, and help provide advice to students.

Dr. Jonathan Ballou (Ph.D. Population Genetics, University of Maryland) is the Population Manager at the National Zoological Park of the Smithsonian Institution. He specializes in the genetic and demographic problems of small populations, both in captivity and the wild. Much of his research has focused on the effects of inbreeding in populations of mammals and the implications of inbreeding related problems on the long term viability of small populations. He has also worked closely with the international zoo community to develop the theory and tools for managing genetic diversity in zoo populations. He consults with the Conservation Breeding Specialist Group of the IUCN and has been involved in numerous Population and Habitat Viability Analyses organized by that group to aid in developing conservation strategies for severely endangered species. Dr. Ballou is also the studbook keeper and coordinator of the international captive breeding program for the endangered golden lion tamarin.
E-mail: Jballou (at) nzp.si.edu

Dr. Katrina Brandon is a Senior Technical Advisor in the Human Dimensions Program in the Center for Applied Biodiversity Science at Conservation International. A social scientist, she began researching the human side of conservation while an undergraduate at the University of Miami, studying the impacts of South Florida development and water use on Everglades National Park and the Miccosukee Indians living near the park. Her research includes work on: protected area design and management, root causes of biodiversity loss, training needs for biodiversity conservation, human-wildlife conflict, reserve design and edge effects, tourism, and poverty and human welfare, indigenous peoples and conservation, payments for environmental services, and macroeconomic and policy reforms leading to biodiversity conservation. She is also a Senior Fellow in Environmental Science and Policy with the Organization for Tropical Studies, building training programs for U.S. and Latin American decision-makers. Before joining CABS,

she worked as a social scientist at the World Wildlife Fund, the World Bank's Environment Department, and The Nature Conservancy. Two of Dr. Brandon's publications are People and Parks: Linking Protected Area Management with Local Communities and Parks in Peril: People, Politics, and Protected Areas. She has also published many journal articles, book chapters, and other publications. She was recently elected to a three-year term with the Board of Directors of the Society for Conservation Biology. More information can be found at: http://portals.conservation.org/cabs/staff/staff_bio.cfm?classID=2&objectID=3F21BD9C-8670-11D4-BAF9-001083FC49A3

Dr. John R. Cannon (Ph.D. in Psychology, State University of New York at Buffalo, 1968). Dr. Cannon is Chief Executive Officer of Human Technology, Inc., a private corporation that specializes in human interaction skills development, and human productivity improvement, through training and organizational change. Recently, he has conducted research on conservation problem-solving and the human interaction skills needed by conservation professionals. Dr. Cannon is also investigating the processes involved in the planning and implementation of successful endangered species recovery programs. He has a particular interest in the worldwide conservation of cranes and their wetland habitats. Dr. Cannon is a consultant to the International Crane Foundation and the Aldo Leopold Shack Foundation. He is an Adjunct Faculty member in the CONS program.

Dr. Michael Hutchins (Ph.D. in Animal Behavior, minors in Ecology and Statistics, University of Washington, 1984). Dr.Hutchins is currently Executive Director/CEO of The Wildlife Society based in Bethesda , MD. Established in 1937, TWS is a scientific and educational society dedicated to the responsible stewardship of wildlife in North America and worldwide (www.wildlife.org). He served as Director /William Conway Chair of the Department of Conservation and Science, American Zoo and Aquarium Association from 1990-2005. Dr. Hutchins is currently associate editor for Zoo Biology and Editor of International Zoo Yearbook. Additionally, he is series editor for Grzimeks Animal Life Encyclopedia and Johns Hopkins University Press' book series, Studies in Zoo and Aquarium Biology and Conservation. Dr. Hutchins is also senior fellow at Georgia Instituite for Technology's Center for Conservation and Behavior. His research interests include the application of animal behavior to wildlife management and conservation, conservation biology, environmental ethics and conservation education, and the evolution of social behavior in vertebrates. He has published numerous articles, books, and reports on behavioral ecology and conservation. He led the creation of the Bushmeat Crisis Task Force (www.bushmeat .org) and the Butterfly Conservation Initiative (www.butterflyrecovery.org) and is currently helping to create a multi-organizational consortium focused on human-wildlife conflicts.

Dr. Taylor Ricketts (Ph.D., Stanford University, 2000). Taylor is the Director of the Conservation Science Program at World Wildlife Fund. Taylor's interests span a broad range of topics in ecology and conservation biology, from global analyses of biodiversity patterns and threats, to field studies on the causes and effects of habitat fragmentation. Taylor led WWF's conservation assessment of North American ecoregions, the first in a continuing series published by Island Press. He continues to analyze large-scale datasets for insights into (i) why biodiversity is distributed the way it is, (ii) how these patterns relate to those of human threats, and (iii) how this information can improve conservation. Taylor's field studies currently focus on ecosystem services; he is investigating the value of tropical forest fragments as sources of wild pollinators to

surrounding coffee crops. This field project is part of a long-term interest in the interactions between habitat fragments and surrounding agricultural areas, and in improving the potential of these landscapes to support native biodiversity. Taylor received both his Ph.D. and post-doctoral training from Stanford University. He is also a nature photographer, a soccer player, and a (mostly former) expedition leader for eco-tours around the world.

B. Department of Biology

The Department of Biology includes faculty members with primary interests in ecology, evolution, and behavioral biology. Research is conducted in marine, freshwater and terrestrial environments, and in tropical as well as temperate locales (the University is a member of the Organization for Tropical Studies). A number of Adjunct Faculty members from the Smithsonian Institution's National Zoological Park (see below) contribute to the diversity of the faculty and its expertise in conservation biology.

Dr. Gerald Borgia (Ph.D., University of Michigan, 1978). Dr. Borgia studies the evolution of social behavior with specific emphasis on sexual selection. He is currently studying the evolution of mate choice in Australian bowerbirds in natural habitats. Dr. Borgia teaches courses in ecology, behavior and evolution.

Dr. Douglas E. Gill (Ph.D., University of Michigan, 1971). Dr. Gill is an evolutionary ecologist who has extensive experience with the Organization for Tropical Studies (OTS) in Costa Rica. He is currently working in Virginia on speciation in orchids and evolution of complex life cycles in aphids. Other areas of continuing research are interspecific competition in encrusting lichens, community structure and island biogeography of ants in the bull-thorn acacias mutualism, and pollutant stream ecology in Costa Rica. He teaches courses in ecology.

Dr. Marjorie L. Reaka-Kudla (Ph.D., University of California, Berkeley, 1975). Dr. Reaka is a marine ecologist interested in benthic coral reef communities. Her ongoing research is on the life history, behavior, ecology, biogeography, and evolution of stomatopods (mantis shrimps) and on the role of bioerosion in the evolution of high diversity in coral reef communities. Her work on coral reef dynamics relates to global carbon balance and global environmental change. Most of her work is done in the Caribbean and East Pacific, but she also works in field sites in the Central and West Pacific. She teaches courses in marine ecology and animal diversity.

Dr. Gerald S. Wilkinson (Ph.D., University of California, 1984). Dr. Wilkinson studies the evolution of social behavior. He has worked with a variety of problems, including the evolution of altruistic behavior in bats and sexual dimorphism in stalk-eyed flies. He has worked at field sites in Costa Rica, Kenya, and Malaysia. He teaches courses in animal behavior and evolution.

C. Department of Entomology

The Department of Entomology has particular expertise in the areas of crop protection and pest management, biosystematics, ecology and behavior, medical entomology, economic entomology, and toxicology.

Dr. Dale Bottrell (Ph.D., Oklahoma State University, 1968). Dr. Bottrell is an internationally recognized expert in crop protection and integrated pest management. His current interests involve the misuse of pesticides in agricultural systems in developing countries. He has reported to the President's Council on the Environment and most recently for the Congressional Office of Technology Assessment in relation to pesticide abuse on locusts in Africa. He teaches courses in international pesticide problems and solutions and plant protection.

Dr. Robert F. Denno (Ph.D., University of California, 1973). Dr. Denno is an ecologist interested in host plant-herbivore relationships, insect migration, and species interactions. He teaches courses in ecology and has taught an OTS course in Costa Rica.

Dr. Charles W. Mitter (Ph.D., University of New York, 1977). Dr. Mitter is a systematist interested in evolutionary biology and the evolution of insect-host plant associations. He teaches courses in biosystematics and morphology.

D. Department of Agricultural and Resource Economics

This department provides two areas of specialization: agricultural economics and resource economics. Areas of study and research include agricultural development, international trade, farm management and production economics, agricultural policy, econometrics, land use, marine resources, water resources, and environmental quality.

Dr. Darrell Hueth (Ph.D., University of California at Berkeley, 1973). Dr. Hueth's research is centered around three objectives: the economics of pest management, biotechnology policy and analysis, and natural resource management. He teaches courses in agricultural and natural resource economics.

Dr. Kenneth E. McConnell (Ph.D., Economics, University of Maryland, 1973). Dr. McConnell works in the area of environmental and natural resource economics, with special emphasis on the nonmarket value of natural resources. He has worked on theoretical problems such as the value of the existence of irreplaceable resources and the optimal rotation of timber growth, as well as applied problems such as the value of improvements in the water quality of the Chesapeake Bay. He teaches courses in natural resource economics.

Dr. Ivar E. Strand (Ph.D., Economics, University of Rhode Island, 1975). Dr. Strand works in the area of natural resource economics, with special emphasis on the management of natural resources. He has worked on problems related to valuing, in economic terms, consumptive and non-consumptive uses of natural resources. He has been active in local and regional fisheries, as well as international management issues. He teaches courses in natural resource policy.

E. The Department of Geography and the Remote Sensing Laboratory

The remote sensing laboratory has a mini-computer-based image analysis system consisting of a Hewlett-Packard 1000 mini-computer interfaced with a ramtech display device, using software developed through cooperative research conducted with the Goddard Space Flight Center. The central focus of research conducted in the remote sensing laboratory is on regional to global scale vegetation phenomena, including assessments of net primary production and climate-vegetation interactions. Field

equipment also maintained by the lab provides spectral reflectance information, relating satellite data to on-ground measurements.

Dr. Sam Goward (Ph.D., Indiana State University, 1979). Dr. Goward's research concentrates on the use of remotely sensed observations for analysis of macroscale bioclimatology and habitat modification.

Dr. Steve Prince (Ph.D., University of Lancaster, 1971). Dr. Prince has worked internationally in plant ecology and is currently involved in the remote sensing of primary production by means of visible and near infrared reflectance and thermal measurements of evapotranspiration. He teaches a course in tropical investigations in biogeography.

F. School of Public Policy

The School of Public Policy offers graduate degrees in Public Management and Public Policy. Students may specialize in the areas of environmental policy, social policy, international security and economic policy, or public sector financial management. CONS students with an interest in environmental policy may take courses in ecological economics, biodiversity and public policy, environmental ethics, and related courses in public affairs.

Dr. Herman Daly (Ph.D., Vanderbilt, 1967). Before coming to the University of Maryland in 1994, Dr. Daly taught economics at Louisiana State University for twenty years. In 1988, he became Senior Economist at the World Bank's Environment Department. At the World Bank he helped develop policy guidelines related to sustainable development and was engaged in environmental operations work in Latin America. Dr. Daly is co-founder and associate editor of the journal *Ecological Economics*. His books include *Steady-State Economics* (1977, second edition 1991), *For the Common Good* (with John Cobb, 1989, second edition 1994), and *Valuing the Earth: Economics, Ecology, Ethics* (edited with Kenneth Townsend, 1993). Dr. Daly teaches courses in ecological economics and sustainable development.

Dr. Robert Nelson (Ph.D., Economics, Princeton University). Prior to joining the faculty of the School of Public Affairs in 1993, Dr. Nelson was with the Office of Policy Analysis at the U.S. Department of the Interior. He worked there on many policy issues involving public lands -- including the management of public range land, forest, and coal reserves. Dr. Nelson teaches courses in environmental policy.

G. Institute for Philosophy and Public Policy

The Institute conducts an interdisciplinary program of research and curriculum development, investigating the structure of arguments and the nature of values relevant to the formation, justification, and criticism of public policy. Most research efforts, chosen from topics expected to be a focus of public policy debate during the next decade, are coordinated by Institute research staff and conducted cooperatively by working groups composed of philosophers, policy makers, analysts, and other experts from within and without the government. Current research areas include: regulatory policy, environmental ethics, the nature of ecology, and the ethics of legal negotiation.

Dr. Mark Sagoff (Ph.D., University of Rochester, 1970). Dr. Sagoff received his doctorate in philosophy and has published widely in journals of philosophy, law, and public policy.

His current interests lie in the distinction between a natural and artificial life and how the integrity of nature is dependant upon the regulation and balance between biotechnology and the environment.

H. Natural Resources Management Program

The Natural Resources Management Program is one of the oldest non-departmental programs at College Park. It trains undergraduates in specialties such as Plant and Wildlife Resource Management, Land and Water Resource Management, and Environmental Education and park Management.

Dr. Patrick Kangas (Ph.D., University of Florida,1983). Dr. Kangas is a ecologist interested in issues of environmental science and technology. His research has emphasized wetland ecosystems and the tropical deforestation problem. He teaches courses in natural resources policy and management and in tropical ecology.

II. The Smithsonian Institution

A. National Zoological Park

The National Zoological Park represents a unique and diverse resource for the CONS program. The Park occupies 163 acres in Washington's Rock Creek Park and maintains a collection of more than two thousand five hundred specimens of over four hundred and twenty five species of mammals, birds, amphibians, reptiles, and invertebrates. The National Zoo's research programs are in fields of conservation biology, comparative pathology, animal behavior, ecology, evolutionary biology, nutrition, reproductive physiology, and comparative medicine. The Park is divided into five divisions: Department of Animal Health; Departments of Mammalogy, Herpetology, and Ornithology; Department of Conservation; Department of Pathology; and Department of Zoological Research. Facilities are available for guest scientists, including those whose projects are grant-supported. Zoo staff offer several conservation courses to foreign biologists and two currently hold adjunct status in the Department of Biology.

Dr. Devra Kleiman (Ph.D., University of London, 1969). Dr. Kleiman studies the reproductive and social behavior of mammals. She works actively in the field of conservation and captive breeding and received the Distinguished Achievement Award from the Society for Conservation Biology. She is currently involved with the conservation and reintroduction of the lion tamarin in Brazil. She is an Adjunct Professor in the Department of Biology.

Dr. Eugene Morton (Ph.D., Yale University, 1969). Dr. Morton studies avian communication and has been involved with many conservation studies. He was involved with a study of endangered rail populations in Guam and is currently also studying the reproductive ecology of purple martins and communication in the Carolina wren. Dr. Morton also is an Adjunct Professor in the Department of Biology, University of Maryland.

B. The Conservation and Research Center

The Conservation and Research Center (CRC) is a site operated by the National Zoological Park on 3,150 acres near Front Royal, Virginia. This setting provides the space

needed for programs of behavioral and reproductive research on rare mammals and birds as well as on the native fauna and flora. CRC differs from the traditional zoo in that it has a semi-natural setting for captive animals, with spacious paddocks ranging in size from ten to fifty acres and is closed to the public. CRC is used as a training site to teach wildlife field research methods to foreign students.

Dr. Scott Derrickson (Ph.D., Univ. of Minnesota, 1977). Dr. Derrickson is Curator of Ornithology. His research interests include avian behavioral ecology and mating systems, avian communication, and captive breeding and reintroduction.

Additional Information:

For more information on the Graduate Program in Sustainable Development and Conservation Biology:
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