

FALL 2011

OFFICE OF ACADEMIC AND RESEARCH PROGRAMS

A GUIDE TO EDUCATIONAL PROGRAMS IN ENVIRONMENT AND SUSTAINABLE DEVELOPMENT AT COLUMBIA UNIVERSITY



THE EARTH INSTITUTE
COLUMBIA UNIVERSITY

FALL 2011

**A GUIDE TO EDUCATIONAL
PROGRAMS IN ENVIRONMENT
AND SUSTAINABLE
DEVELOPMENT
AT COLUMBIA UNIVERSITY**

Office of Academic and Research Programs
The Earth Institute, Columbia University

PLEASE NOTE: This information is subject to change. For the most up-to-date information, please contact the program staff directly.

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Overview

Columbia University and its affiliates offer an array of undergraduate, masters and doctoral programs in the fields of environmental studies and sustainable development. Currently there are over 20 academic programs associated with The Earth Institute, representing one of the largest collections of environmental education programs in the world. This guide provides a brief overview of the educational programs at Columbia that address environmental and sustainable development issues. Each overview contains a brief description of the program, information about its admission and/or academic requirements, and a list of affiliated faculty. All of the information about academic programs contained in this guide was obtained from departmental websites and/or program viewbooks.

Columbia undergraduates who are interested in sustainable development and environmental studies have the option of pursuing a:

- **Special Concentration in Sustainable Development**
- **Major in:**
 - Sustainable Development
 - Earth Science
 - Environmental Science
 - Environmental Biology
 - Earth and Environmental Engineering
- **Concentration in:**
 - Earth Science
 - Environmental Biology
 - Environmental Science
- **Summer Ecosystem Experiences for Undergraduates (SEE-U)**

Barnard undergraduates can obtain a major in:

- Environmental Science
- Environmental Biology
- Environmental Policy

Students with a bachelor's who are interested in further study can pursue:

- Postbaccalaureate Program in Ecology, Evolution and Environmental Biology

Students interested in pursuing a master's degree related to the environment or sustainable development can pursue:

- M.S. in Sustainability Management
- M.A. in Conservation Biology
- M.A./M.S. in Earth and Environmental Science Journalism (on hiatus until further notice)
- M.S. in Earth Resources Engineering
- M.A. in Climate and Society
- M.P.H. in Environmental Health Sciences
- M.P.A. in Environmental Science and Policy
- M.P.A. in Development Practice
- M.I.A./M.P.A. in Energy and Environment

Graduate Students can also obtain a certificate in environmental policy or conservation biology.

Those interested in pursuing a doctoral degree in earth and environmental science or sustainable development will find a number of multidisciplinary Ph.D. program options offered by the University.

Doctoral Programs include:

- Ph.D. in Sustainable Development
- Ph.D. or Eng.Sc.D. in Earth and Environmental Engineering
- Ph.D. in Earth and Environmental Sciences
- Ph.D. in Atmospheric and Planetary Science
- Dr.P.H. or Ph.D. in Environmental Health Sciences
- Ph.D. in Ecology and Evolutionary Biology
- Ph.D. in Evolutionary Primatology

The Earth Institute, through its Office of Academic and Research Programs, works to assist these schools and departments, as well as to stimulate interaction among students and faculty.

This is accomplished through the following activities:

- A campus-wide student advisory council and research assistant program
- An intern program in units of The Earth Institute
- A small research project travel grant program
- A program to support field trips in environmental courses
- An annual meeting of academic program directors and department chairs
- Environmental career fairs
- Open houses for prospective students
- Co-curricular programming
- Administrative support for start-up programs
- Maintaining the education pages of The Earth Institute website
- A year-long Earth Institute practicum

Columbia University is in the process of building new environmental and sustainable development education programs and adding environmental and sustainable development education to existing programs. Through The Earth Institute, a wide range of conferences, lectures and seminars are presented each year on issues related to environmental science, policy and sustainable development.

UNDERGRADUATE PROGRAMS

Undergraduate Program in Sustainable Development

Ruth DeFries, Co-Program Director: rd2402@columbia.edu, (212) 851-1647

Jason E. Smerdon, Interim Co-Program Director: jsmerdon@ldeo.columbia.edu, (845) 365 8493

Natalie Unwin-Kuruner, Senior Program Manager: natalie@ei.columbia.edu, (212) 854-8536

The Earth Institute—in collaboration with Columbia College, the School of General Studies, the School of International and Public Affairs, and the Departments of Earth and Environmental Science; Ecology, Evolution and Environmental Biology; and Earth Engineering—offers both a major and a special concentration in sustainable development. The broadest definition of sustainable development is that each generation should be able to meet its own material needs without compromising the ability of future generations to meet their needs. Sustainable development signifies the ability of the world to narrow the gap between the rich and the poor, and the ability of all to pursue further progress in overall human well-being. The world as a whole and each major sub-region ought to be able to accomplish these goals without causing irreparable harm to ecosystems and the vital services they provide, depleting essential resources, or posing unjustifiable risks to future generations.

Undergraduate Major in Sustainable Development

COURSES

For a full list of courses in this program, please see:

- Columbia College: <http://www.college.columbia.edu/bulletin/depts/sustdev.php>
- General Studies: <http://www.gs.columbia.edu/major-title?majorid=2159>

PROGRAM OF STUDY

The major in sustainable development extends from the philosophical, ideological and structural traditions of the Columbia Core Curriculum. Students who wish to complete the major in sustainable development will work with their program adviser to decide on course selection and sequencing. Study abroad and internships are strongly encouraged, particularly to act as a basis for thesis research and to provide students with practical experience early on in their professional development.

The program benefits from the support of Earth Institute researchers—many of whom helped to design classes in the degree—and their pioneering work in the field. Drawing on the cutting-edge research and practical work at the Earth Institute, graduates of the program will be uniquely prepared to approach issues of sustainable development from all angles in the public, private and non-profit sectors.

UNDERGRADUATE REQUIREMENTS FOR THE MAJOR IN SUSTAINABLE DEVELOPMENT

Students wishing to complete the major in sustainable development should work with the program adviser to decide on course selection and sequencing. A minimum of 15 courses and a practicum are required for the major, divided as follows:

- I. Sustainable Development Foundation (3 courses):**
 - SDEV W1900 Introduction to Sustainable Development Seminar
 - SDEV W2300 Challenges of Sustainable Development
 - EESC W2330 Science for Sustainable Development
- II. Basic Disciplinary Foundation (5 courses):**
 - One of the following science sequences:
 - EEEB W2001 and W2002 Environmental Biology I and II
 - CHEM C1403 and C1404 General Chemistry
 - PHYS V1201 and V1202 General Physics
 - EESC V2100 and V2300 Earth Science
 - EAEE E1100 and E2002 Engineering Science

- Two social science courses to be chosen from an approved list in conjunction with the program adviser:
 - ECON W1105 Principles of Economics
 - SDEV W3400 Demography of Human Populations
 - POLS V1501 Introduction to Comparative Politics or V1601 International Politics
 - SOCI W1000 The Social World
 - ANTH V1002 The Interpretation of Culture
- One of the following Quantitative Foundations courses:
 - **Statistics**
 - STAT W1211 Introduction to Statistics (With Calculus)
 - STAT W2024 Applied Linear Regression Analysis
 - STAT W2025 Applied Statistical Methods
 - STAT W2026 Statistical Applications and Case Studies
 - STAT W3026 Applied Data Mining
 - STAT W3105 Introduction to Probability Models
 - STAT W3107 Introduction to Statistical Inference
 - STAT W4105 Introduction to Probability
 - STAT W4107 Statistical Inference
 - STAT W4315 Linear Regression Models
 - STAT W4606 Elementary Stochastic Processes
 - **Linear Algebra**
 - MATH V2010 Linear Algebra

III. Analysis and Solutions to Complex Problems (2 courses):

- EAIA W4200 Alternative Energy Resources
- SDEV W3330 Ecological and Social Systems for Sustainable Development
- PUBH W3100 Fundamentals of Global Health
- SDEV W3200 Global Food Systems
- SDEV W3360 Disasters and Development
- SDEV W3410 Urbanization and Sustainability
- ECIA W4100 Management and Development of Water Resources
- The Summer Ecosystems Experience for Undergraduates (SEE-U)

IV. Skills/Actions (2 courses):

- SDEV W3355 Climate Change and Law
- SDEV W3390 GIS for Sustainable Development
- SCNC W3010 Science, Technology and Society
- SDEV W3450 Spatial Analysis and Modeling for Sustainable Development
- EESC W4050 Global Assessment Remote Sensing
- SDEV W3320 Economic and Financial Methods for Sustainable Development
- SUMA K4100 Sustainability Management

V. Electives (1 practicum and 2 courses):

- One of the following practicums:
 - SUMA K4734 Earth Institute Practicum
 - INAF U 4420 Oil, Rights and Development
- Two of the following:
 - Additional courses from Analysis and Solutions to Complex Problems
 - Additional courses from Skills/Actions
 - Senior Thesis Seminar (EESC W3901 and EESC BC3800)
 - Upper division courses as approved by program adviser

VI. Capstone Workshop (1 course):

- SDEV W3280 Workshop in Sustainable Development

Undergraduate Special Concentration in Sustainable Development

COURSES

For a full list of courses in this program, please see:

- Columbia College: <http://www.college.columbia.edu/bulletin/depts/sustdev.php>
- General Studies: <http://www.gs.columbia.edu/major-title?majorid=2159>

PROGRAM OF STUDY

The special concentration in sustainable development is not a stand-alone concentration; it is intended to serve as a complement to the disciplinary specialization and methodological training inherent in a concentration or major.

Students wishing to complete a special concentration in sustainable development will work with a program adviser to decide upon course selection and sequencing.

The special concentration allows students to draw upon classes in a wide range of disciplines including political science, anthropology, environmental science and economics. The courses required for the special concentration are designed to provide Columbia students with an understanding of the theory and practice of sustainable development, provide experience with complex development challenges through direct engagement, and help students imagine and create alternative futures for our rapidly changing world.

UNDERGRADUATE REQUIREMENTS FOR A SPECIAL CONCENTRATION IN SUSTAINABLE DEVELOPMENT

Students wishing to complete the special concentration in sustainable development should work with the program adviser to decide on course selection and sequencing. A minimum of nine courses and a practicum are required for the concentration as follows:

I. Sustainable Development Foundation (3 courses):

- SDEV W1900 Introduction to Sustainable Development
- SDEV W2300 Challenges of Sustainable Development
- EESC W2330 Science for Sustainable Development

II. Natural Science Systems (1 course):

- PHYS V1201 General Physics I
- CHEM C1403 Chemistry I
- EAEE E1100 A Better Planet by Design
- EEEB W1001 Biodiversity
- EEEB W2002 Environmental Biology II
- EESC V1201 Environment Risks and Disasters
- EESC V2100 Earth's Environment Systems: Climate
- EESC 1011/1411 Earth: Origin, Evolution, Processes, Future
- EESC V1003 Climate and Society: Case Studies
- SCNC W1800 Energy and Energy Conservation

III. Human Science Systems (1 course):

- ECON W1105 Principles of Economics
- SDEV W3400 Demography of Human Populations
- POLS V1501 Introduction to Comparative Politics
- POLS V1601 International Politics
- SOCI W1000 The Social World
- ANTH V1002 The Interpretation of Culture

IV. Analysis and Solutions to Complex Problems (2 courses):

- EAIA W4200 Alternative Energy Resources

- SDEV W3330 Ecological and Social Systems for Sustainable Development
- PUBH W3100 Fundamentals of Global Health
- SDEV W3200 Global Food Systems
- SDEV W3360 Disasters and Development
- SDEV W3410 Urbanization and Sustainable Development
- ECIA W4100 Management and Development of Water Resources
- The Summer Ecosystem Experiences for Undergraduates (SEE-U)

V. Skills/Actions (1 course):

- SDEV W3355 Climate Change and Law
- SDEV W3390 GIS for Sustainable Development
- SCNC W3010 Science, Technology and Society
- SDEV W3450 Spatial Analysis and Modeling for Sustainable Development
- EESC W4050 Global Assessment Remote Sensing
- SDEV W3320 Economic and Financial Methods for Sustainable Development
- SUMA K4100 Sustainability Management

VI. Practicum (1 course):

- SUMA K4734 Earth Institute Practicum
- INAF U4420 Oil, Rights and Development

VII. Capstone Workshop (1 course)

- SDEV W3280 Workshop in Sustainable Development

PROGRAM FACULTY

Alastair Ager, Professor of Clinical Population and Family Health, Mailman School of Public Health

Mark Becker, Senior Staff Associate, Center for International Earth Information Network (CIESIN)

Satyajit Bose, Lecturer in Discipline of International and Public Affairs, School of International and Public Affairs

Robert Chen, Director, Center for International Earth Science Information Network (CIESIN)

Steven Cohen, Executive Director, The Earth Institute; Professor in the Practice of Public Affairs; Director, Master of Public Administration Program in Environmental Science and Policy & Energy and Environmental Policy Concentration, School of International and Public Affairs; Director, Master of Science in Sustainability Management, School of Continuing Education

Peter Coleman, Associate Professor of Psychology and Education; Director, International Center for Cooperation and Conflict Resolution, Teachers College

Patricia Culligan, Professor, Civil Engineering and Engineering Mechanics, Department of Civil Engineering and Engineering Mechanics, Fu

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Ruth DeFries, Co-Program Director. Denning Family Professor of Sustainable Development; Chair of the Department of Ecology, Evolution and Environmental Biology

Peter deMenocal, Professor, Department of Earth and Environmental Sciences

Stuart Gaffin, Associate Research Scientist, Center for Climate Systems Research

Michael Gerrard, Director, Center for Climate Change Law; Professor of Professional Practice, Columbia Law School

Adela J. Gondek, Lecturer in the Discipline of International and Public Affairs, School of International and Public Affairs (SIPA)

Joe Graziano, Professor of Environmental Health Sciences, Professor of Pharmacology, Mailman School of Public Health

Kevin L. Griffin, Co-Director of the Undergraduate Program in Sustainable Development; Professor, Department of Earth and Environmental Sciences (on leave AY 2011-12)

Klaus Lackner, Director, Lenfest Center for Sustainable Energy

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Edward Lloyd, Evan M. Frankel Clinical Professor in Environmental Law, Columbia Law School

John Mutter, Professor, Department of Earth and Environmental Sciences and School of International and Public Affairs

Shahid Naeem, Professor, Department of Ecology, Evolution and Environmental Biology

Anne Paxton, Director, Master's Program, Department of Epidemiology; Director, Global Health Track

Stephanie Pfirman, Hirschorn Professor and Department Chair, Department of Environmental Science, Barnard College

Robert Pollack, Director, Center for the Study of Science and Religion; Professor of Biological Sciences; Lecturer, Columbia University Center for Psychoanalytic Training and Research

Louise A. Rosen, Director, Office of Academic and Research Programs, The Earth Institute; Associate Director and Adjunct Lecturer, Master of Science in Sustainability Management, School of Continuing Education; Associate Director, Master of Public Administration Program in Environmental Science and Policy, School of International and Public Affairs

Jeffrey D. Sachs, Director, The Earth Institute; Quetelet Professor of Sustainable Development; Professor of Health Policy and Management

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Peter Schlosser, Associate Director of Research, The Earth Institute; Vinton Professor of Earth and Environmental Engineering, School of Engineering and Applied Science; Professor of Earth and Environmental Sciences

Elliot Sclar, Professor of Urban Planning, Graduate School of Architecture, Planning and Preservation; Professor of International Affairs, School of International and Public Affairs; Director, Center for Sustainable Urban Development, The Earth Institute

Sam Sia, Assistant Professor, Department of Biomedical Engineering, Fu Foundation School of Engineering and Applied Science

Jason E. Smerdon, Adjunct Assistant Professor of Public Affairs, School of International and Public Affairs; Storke-Doherty Lecturer, Lamont-Doherty Earth Observatory and the Department of Earth and Environmental Sciences, Late Holocene paleoclimate, statistical methods, geothermal climate signals

Marni Sommer, Assistant Professor, Sociomedical Science

Sara Tjossem, Senior Lecturer in Discipline of International and Public Affairs, School of International and Public Affairs

James Valentini, Professor and Director of Undergraduate Studies, Chemistry Department

B.A. in Earth and Environmental Sciences

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ADMISSION DEADLINE

Must apply to Columbia College or the School of General Studies: Check application deadlines on the Columbia University website.

For more information about the B.A. in earth and environmental sciences, visit the program website:
<http://eesc.columbia.edu/programs/undergraduate-program>

MISSION

The undergraduate major in earth and environmental sciences provides an understanding of the natural functioning of our planet and considers the consequences of human interactions with it. The program for majors aims to convey an understanding of how the complex earth system works at a level that will encourage students to think creatively about earth system processes and how to address multidisciplinary environmental problems. The breadth of material covered provides an excellent background for those planning to enter the professions of law, business, diplomacy, public policy, teaching, journalism, etc. At the same time, the program provides sufficient depth so that graduates will be prepared for graduate school in the earth sciences. The program can be adjusted to accommodate students with particular career goals in mind.

The Department's close affiliations with the Lamont-Doherty Earth Observatory (LDEO), the American Museum of Natural History (AMNH), NASA's Goddard Institute for Space Studies (GISS), The Earth Institute, and several departments within the Fu Foundation School of Engineering and Applied Sciences afford opportunities for students to participate in a wide variety of research programs. Summer employment, research and additional educational opportunities are available at Lamont and GISS. The Department encourages majors to become involved in a research project by their junior year.

All majors and concentrators, when planning their programs of study, should regularly consult the directors of undergraduate studies and make themselves aware of the requirements for their particular program.

ENVIRONMENTAL SCIENCE MAJOR

The environmental science major curriculum provides an introduction to a variety of fields of study relevant to the environment. Environmental science majors are required to take three semesters of introductory courses and to develop a grounding in basic physics, chemistry, biology and mathematics. Here, students are allowed some choice depending on interest. With this introduction to the earth's environment and equipped with a knowledge of the basic sciences, students are prepared to choose a set of upper-level courses in consultation with an undergraduate adviser. All environmental science majors are required to complete a research project, providing a practical application of mastered course work. This research culminates in a senior thesis. The research and the thesis are usually done at Lamont-Doherty Earth Observatory with guidance from a faculty member or research scientist (free shuttle bus service between Morningside and Lamont is provided for undergraduates). However, other options are also possible.

Environmental science majors have an option to complete the special concentration in environmental biology for environmental science majors.

EARTH SCIENCE MAJOR

The major in earth science follows a similar rationale, but is designed to allow students to pursue particular fields within the earth sciences in greater depth. Compared with the environmental science major, one fewer introductory course is required, while one additional advanced course should be part of the plan of study. The earth science major also offers the possibility of in-depth field experience through a six- to eight-week geology summer field course, arrangements for which are made through another university. The research and senior

thesis capstone requirements are the same as for the environmental science major. The geology summer field course may be used as an alternative means of fulfilling the capstone requirement in the earth science major.

CONCENTRATIONS

The program for concentrators serves students who want more exposure to earth and environmental science than is provided by introductory-level courses. The program aims to provide students with experience in data analysis and a thorough introduction to the Earth's systems.

The concentration in environmental science and the concentration in earth science are designed to give students an understanding of how the Earth works and an introduction to the methods used to investigate earth processes, including their capabilities and limitations. Concentrators often join social professions (business, law, medicine, etc.) and take with them a strong scientific background. They take the same introductory courses as the majors, but fewer basic science and upper-level courses are required.

In addition to the environmental science and earth science concentrations, the department sponsors a special concentration which must be done in conjunction with the environmental biology major. Students should be aware that they must complete the environmental biology major in order to receive credit for the special concentration. There is also a special concentration in environmental biology for environmental science majors sponsored by the Department of Ecology, Evolution and Environmental Biology.

All majors and concentrators, when planning their programs of study, should regularly consult the directors of undergraduate studies, who can be contacted through the department office on the fifth floor of Schermerhorn. The requirements are different for each major and concentration and must be met in conjunction with the general requirements for the bachelor's degree. Declaration of the major must be approved by the Department and filed in the departmental office.

MAJOR IN EARTH SCIENCE REQUIREMENTS (45.5 CREDITS)

I. Foundational Courses in DEES:

- V2200 Earth's Environmental Systems: Solid Earth (4.5 credits)
- One additional foundation course:
 - V2100 Earth's Environmental Systems: Climate (4.5 credits)
 - V2300 Earth's Environmental Systems: Life (4.5 credits)

Students who wish to take both V2100 and V2300 can include one of these under breadth and related fields below.

II. Supporting Math and Science Courses:

- Calculus I or Calculus II (3 credits)
- Three semesters of Chemistry and Physics:
 - C1403-C1404 Chemistry and V1201 Physics (10 credits)
 - V1201-V1202 Physics and C1403 Chemistry (9.5 credits)

III. Capstone Experience or Geology Field Course:

- Capstone Experience—Research and Thesis:
 - BC3800/BC3801 Research Seminar (3 credits)
 - W3901 Senior Seminar (3 credits)

Or

- 6-8 week long Summer Geology Field Course (6 credits)

IV. Depth, Breadth and Related Fields

Additional courses in earth science and related fields are required, for a minimum of 18 credits. A minimum of four courses should be chosen to provide depth in the field of earth science, building on the preparation described under requirements I and II.

Depth courses are courses with an earth science focus that build on the foundational and supportive courses listed under requirements I and II above. Courses in DEES specifically designed for this purpose and offered each year are:

- V3101 Geochemistry for a Habitable Planet
- V3201 Solid Earth Dynamics

Students should include at least one of these in their course of study. Several graduate-level courses offered in DEES are appropriate for undergraduates, and several advanced courses offered at Barnard College are also appropriate. See specific recommendations under plan of study below.

Breadth and related field courses are science courses relevant for an earth science major that do not require an earth science background. Several such courses are offered in DEES at the 2000, 3000 and 4000 level and at Barnard College:

- V2100 Earth's Environmental System: Climate
- V2300 Earth's Environmental System: Life
- W3010 Field Geology
- W3018 Weapons of Mass Destruction
- BC3017 Environmental Data Analysis
- W4050 Remote Sensing
- W4056 Teaching and Learning Concepts in Earth Science
- W4600 Earth Resources and Sustainable Development
- W4917 Earth/Human Interaction
- E2002 Alternative Energy Resources

Also included among breadth and related fields courses are science, mathematics, statistics and engineering courses offered by other departments that count toward fulfilling degree requirements in those departments.

PLAN OF STUDY

Students discuss and develop individual plans of study with their academic advisor. This ensures that the depth courses provide a coherent focus in some area of earth science. Normally, students wishing to focus in the following subdisciplines should include three or more of the listed courses in their plan of study:

For students wishing to focus in geological science*:

- V3101 Geochemistry for a Habitable Planet
- V3201 Solid Earth Dynamics
- W4076 Geologic Mapping
- W4090 Introduction to Geochronology and Thermochronology
- W4113 Introduction to Mineralogy
- W4223 Sedimentary Geology
- W4230 Crustal Deformation
- W4480 Paleobiology and Earth System History
- W4701 Introduction to Igneous Petrology
- W4887 Isotope Geology I
- W4947 Plate Tectonics

** The Geology Field Course option is strongly recommended*

For students wishing to focus in geochemistry:

- V3015 The Earth's Carbon Cycle
- V3101 Geochemistry for a Habitable Planet
- BC3016 Environmental Measurements
- BC3200 Ecotoxicology
- W4090 Introduction to Geochronology and Thermochronology
- W4113 Introduction to Mineralogy
- W4701 Introduction to Igneous Petrology

- W4885 The Chemistry of Continental Waters
- W4887 Isotope Geology I
- W4926 Principles of Chemical Oceanography
- Also recommended: Chemistry V1404

For students wishing to focus in atmosphere and ocean science:

- W4008 Introduction to Atmospheric Science
- W4924 Introduction to Atmospheric Chemistry
- W4925 Principles of Physical Oceanography
- W4926 Principles of Chemical Oceanography
- W4920 Paleoceanography
- W4937 Cenozoic Paleoceanography
- Also recommended: A course in fluid dynamics, differential equations

For students wishing to focus in solid earth geophysics:

- V3201 Solid Earth Dynamics
- W4230 Crustal Deformation
- W4300 The Earth's Deep Interior
- W4947 Plate Tectonics
- W4949 Introduction to Seismology
- Also recommended: Calculus III, Physics V1202

For students wishing to focus in climate:

- V3015 The Earth's Carbon Cycle
- BC 3025 Hydrology
- W4008 Introduction to Atmospheric Science
- W4330 Introduction to Terrestrial Paleoclimate
- W4835 Wetlands and Climate Change
- W4920 Paleoceanography
- W4924 Introduction to Atmospheric Chemistry
- W4925 Principles of Physical Oceanography
- W4937 Cenozoic Paleoceanography

For students wishing to focus in paleontology:

- V3101 Geochemistry for a Habitable Planet
- W4223 Sedimentary Geology
- W4480 Paleobiology and Earth System History
- W4550 Plant Ecophysiology
- W4920 Paleoceanography
- W4937 Cenozoic Paleoceanography
- Also recommended: V2300 Earth's Environmental Systems: Life

Substitutions

- Higher-level courses may be used to satisfy the requirements of section II for students with Advanced Placement preparation. These courses may be selected from depth, breadth and related fields courses under requirement IV.
- 1000-level DEES courses may not be used toward meeting degree course requirements.
- The following courses are not suitable for undergraduates and may not be used toward meeting degree course requirements:
 - W4001 Advanced General Geology
 - W4400 Dynamics of Climate Variability and Climate Change
 - W4401 Quantitative Models of Climate-Sensitive Natural and Human Systems
 - W4404 Regional Climate and Climate Impacts
 - W4930 Earth's Oceans and Atmosphere

EARTH SCIENCE CONCENTRATION REQUIREMENTS (25 CREDITS)

I. Foundational Courses in DEES:

- V2200 Earth's Environmental Systems: Solid Earth (4.5 credits)
- One additional foundation course:
 - V2100 Earth's Environmental Systems: Climate (4.5 credits)
 - V2300 Earth's Environmental Systems: Life (4.5 credits)

II. Supporting Math and Science Courses:

Two science or mathematics courses selected from among those listed under supporting math and science courses for the earth science major.

III. Depth, Breadth and Related Fields

Additional courses (typically three) in earth science and related fields, for a minimum of 10 credits. Two or three courses should be chosen from those described under depth courses for the earth science major, and should include either EESC V3101 or EESC 3201. The third course may be selected from those described under breadth and related fields for the earth science major.

MAJOR IN ENVIRONMENTAL SCIENCE REQUIREMENTS (47 CREDITS)

I. Foundational Courses in DEES:

- V2100 Earth's Environmental Systems: Climate (4.5 credits)
- V2200 Earth's Environmental Systems: Solid Earth (4.5 credits)
- V2300 Earth's Environmental Systems: Life (4.5 credits)

II. Supporting Math and Science Courses:

- Calculus I or Calculus II (3 credits)
- 3 semesters of Chemistry, Physics and Biology
 - C1403-C1404 Chemistry and V1201 Physics (10.0 credits)
 - V1201-V1202 Physics and C1403 Chemistry (9.5 credits)
 - V1201 Physics, C1403 Chemistry and EEEB 2001 Environmental Biology (10.5 credits)

III. Capstone Experience—Research and Thesis:

- BC3800/BC3801 Research Seminar (3 credits)
- W3901 Senior Seminar (3 credits)

IV. Depth, Breadth and Related Fields

Additional courses in earth and environmental science and in related fields for a minimum of 15 credits. A minimum of three courses should be chosen to provide depth in the field of earth and environmental science, building on the preparation described under requirements I and II.

Depth courses are courses with an earth and environmental science focus that build on the foundational and supportive courses listed under requirements I and II above. Courses in DEES specifically designed for this purpose and offered each year are:

- V3101 Geochemistry for a Habitable Planet
- V3201 Solid Earth Dynamics

Students should include at least one of these in their course of study. Several graduate-level courses offered in DEES are appropriate for undergraduates, and several advanced undergraduate courses offered at Barnard College and in other departments are also appropriate. See specific recommendations under plan of study below.

Breadth and related fields courses are science courses relevant for an environmental science major that do not require an earth science background. Several such courses are offered in DEES at the 2000, 3000 and 4000

level and at Barnard College:

- W3010 Field Geology
- W3018 Weapons of Mass Destruction
- BC3017 Environmental Data Analysis
- W4050 Remote Sensing
- W4056 Teaching and Learning Concepts in Earth Science
- W4600 Earth Resources and Sustainable Development
- W4917 Earth/Human Interaction

Also included among breadth and related fields are science, mathematics, statistics and engineering courses offered by other departments that count toward fulfilling degree requirements in those departments.

PLAN OF STUDY

Students discuss and develop individual plans of study with their academic adviser. This ensures that the depth courses provide a coherent focus in some area of earth science. Normally, students wishing to focus in the following subdisciplines should include three or more of the listed courses in their plan of study:

For students wishing to focus in environmental geology:

- Depth courses:
 - V3101 Geochemistry for a Habitable Planet
 - V3201 Solid Earth Dynamics
 - W4076 Geological Mapping
 - W4480 Paleobiology and Earth System History
 - E3221 Environmental Geophysics
 - Also recommended: W4050 Remote Sensing

For students wishing to focus in environmental geochemistry:

- Depth courses:
 - V3015 Carbon Cycle
 - V3101 Geochemistry for a Habitable Planet
 - W4885 Chemistry of Continental Waters
 - W4886 Isotope Hydrology
 - W4886 Isotope Geology I
 - W4886 Isotope Geology II
 - W4924 Introduction to Atmospheric Chemistry
 - W4926 Introduction to Chemical Oceanography

For students wishing to focus in hydrology:

- Depth courses:
 - V3101 Geochemistry for a Habitable Planet
 - V3201 Solid Earth Dynamics
 - W4076 Geological Mapping
 - W4835 Wetlands and Climate Change
 - W4885 Chemistry of Continental Waters
 - W4886 Isotope Hydrology
 - BC3019 Hydrology
 - E3221 Environmental Geophysics

For students wishing to focus in climate change:

- Depth courses:
 - W3015 Carbon Cycle
 - V3101 Geochemistry for a Habitable Planet
 - W4008 Introduction to Atmospheric Science
 - W4330 Terrestrial Paleoclimate
 - W4480 Paleobiology and Earth System History
 - W4835 Wetlands and Climate Change
 - W4920 Paleoceanography

- Also recommended: W4050 Remote Sensing

For students wishing to focus in energy and resources:

- Depth courses:
 - V3101 Geochemistry for a Habitable Planet
 - V3201 Solid Earth Dynamics
 - W4076 Geological Mapping
 - W4113 Mineralogy
 - W4701 Petrology
 - BC3019 Energy Resources
 - E2002 Alternative Energy Resources
 - Also recommended: W3018 Weapons of Mass Destruction

Substitutions:

- Higher-level courses may be used to satisfy the requirements of section II for students with Advanced Placement preparation. These courses may be selected from depth, breadth and related fields courses under requirement IV.
- 1000-level DEES courses may not be used toward meeting degree course requirements.
- The following courses are not suitable for undergraduates and may not be used toward meeting degree course requirements:
 - W4001 Advanced General Geology
 - W4400 Dynamics of Climate Variability and Climate Change
 - W4401 Quantitative Models of Climate-Sensitive Natural and Human Systems
 - W4404 Regional Climate and Climate Impacts
 - W4930 Earth's Oceans and Atmosphere

ENVIRONMENTAL SCIENCE CONCENTRATION REQUIREMENTS (25.5 credits)

I. Foundational Courses in DEES:

- V2100 Earth's Environmental Systems: Climate (4.5 credits)
- V2200 Earth's Environmental Systems: Solid Earth (4.5 credits)
- V2300 Earth's Environmental Systems: Life (4.5 credits)

II. Supporting Math and Science Courses:

Two science or mathematics courses selected from among those listed under supporting math and science courses for the environmental science major (6-7 credits).

III. Depth, Breadth and Related Fields

Two additional courses in earth and environmental science and in related fields for a minimum of six credits. The courses should be selected from those listed under depth, breadth and related fields and include either V3101 or V3201.

Special Concentration in Environmental Science for Majors in Environmental Biology

(31.5 credits)

I. Introductory Environmental Science (ALL of the following):

- EESC V2100 Earth's Environmental Systems: Climate
- EESC V2200 Earth's Environmental Systems: Solid Earth
- EESC V2300 Earth's Environmental Systems: Life

II. Introductory Science: One year of chemistry, physics, mathematics and/or biology chosen from the introductory science list for the environmental science major.

III. Advanced Courses*: Four additional courses from those recommended for the environmental science major (3000 level and above).

** Advanced courses that fulfill the major in environmental biology cannot also count toward fulfillment of the special concentration in environmental science.*

SPECIAL CONCENTRATION IN ENVIRONMENTAL BIOLOGY FOR MAJORS IN ENVIRONMENTAL SCIENCE

(39 credits)

I. Required:

- EEEB W2001 Environmental Biology I
- EEEB W2002 Environmental Biology II (equivalent to EESC V2300)
- EESC V2100 Earth's Environmental Systems: Climate
- EESC V2200 Earth's Environmental Systems: Solid Earth

II. Introductory Science:

- CHEM C1403 and C1404 (General Chemistry 1 and 2) or CHEM C2407 and C2507 (Advanced General Chemistry and Lab)
- STAT V1111, V1211 (Intro to Statistics) or BIOL BC2286 (Statistics and Research Design)
- EEEB W3087 (Conservation Biology)

III. Three additional advanced EEEB courses*:

- 3000 level and above, each chosen from a different curricular area (evolution, genetics ecology, behavior, conservation; anatomy, physiology, diversity; biology laboratory courses)

* Advanced courses that fulfill the major in environmental science cannot also count toward fulfillment of the special concentration in environmental biology.

FACULTY

Geoffrey A. Abers, Adjunct Professor, earthquakes, earth structure and their relationship to active tectonic processes

Mark H. Anders, Associate Professor, structural geology

Robert F. Anderson, Adjunct Professor, role of ocean circulation and ocean biology in regulating the concentration of CO₂ in the atmosphere, sensitivity of these processes to climate change

Roger N. Anderson, Lecturer, marine geophysics, energy

Anthony G. Barnston, Associate, forecasting climate variability and change, ENSO, statistical prediction methods

Natalie T. Boelman, Storke-Doherty Lecturer, terrestrial ecology, hyperspectral remote sensing, bioacoustics

Wallace S. Broecker, Newberry Professor, paleoclimate, ocean chemistry, radiocarbon dating

W. Roger Buck IV, Adjunct Professor, marine geophysics, geodynamics, tectonics

Mark A. Cane, G. Unger Vetlesen Professor (Joint with APAM), climate physics, climate prediction,

social impacts of climate, paleoclimate, oceanography

Nicholas Christie-Blick, Professor, sedimentation processes, crustal deformation, deep-time earth history

James R. Cochran, Lecturer, marine geophysics, gravity, geodesy, isostasy

Joel E. Cohen, Adjunct Professor, population science

Anthony D. Del Genio, Adjunct Professor, role of clouds and water vapor in climate, dynamics of planetary atmospheres

Peter B. deMenocal, Professor, Paleoclimatology, ocean circulation variability, tropical-extratropical paleoclimate linkages, Pliocene-Pleistocene evolution of tropical climates, African climate and human evolution

Peter M. Eisenberger, Professor, earth/human systems and interactions

Göran Ekström, Professor, seismology

Arlene M. Fiore, Associate Professor, atmospheric chemistry

John J. Flynn, Adjunct Professor, vertebrate paleontology

Alessandra Giannini, Adjunct Associate Professor, African climate science/policy

Lisa M. Goddard, Adjunct Associate Professor, climate prediction, near-term climate change

Steven L. Goldstein, Professor, isotope geology, climate change, mantle geochemistry, earth evolution

Arnold L. Gordon, Professor, physical oceanography

Kevin L. Griffin, Professor, plant ecophysiology
James E. Hansen, Adjunct Professor, unraveling the mechanisms of climate change and projecting the climatic impact of human activity

Sidney R. Hemming, Professor, geochronology and the sedimentary record of changes through earth history

Bärbel Hönisch, Assistant Professor, validation of paleo-proxies in living foraminifers and application of knowledge to reconstruct past climate change

Andrew Juhl, Adjunct Associate Professor, biological oceanography

Kim A. Kastens, Adjunct Professor, thinking and learning in geosciences, spatial cognition in geosciences, public understanding of the Earth and environment, marine geology

Peter B. Kelemen, Arthur D. Storke Memorial Professor, carbonation of peridotite for CO₂ storage, melt transport in the mantle and lower crust, mantle shear zones and intermediate depth earthquakes

Arthur L. Lerner-Lam, Adjunct Professor, seismology, natural hazards

Douglas G. Martinson, Adjunct Professor, physical oceanography, polar studies

Jerry F. McManus, Professor, paleoclimate

William H. Menke, Professor, seismology, solid earth geophysics, tomography

Ronald L. Miller, Lecturer, atmospheric and climate dynamics

John C. Mutter, Professor, marine seismic studies of mid-ocean ridges, natural disasters, sustainable development

Meredith Nettles, Assistant Professor, glacial seismology

Mark A. Norell, Adjunct Professor, vertebrate paleontology

Paul E. Olsen, Arthur D. Storke Memorial Professor, paleoecology, ecosystem evolution, vertebrate paleontology

Hsien Wang Ou, Adjunct Professor, ocean dynamics, planetary circulation, climate theories

Dorothy M. Peteet, Adjunct Professor, paleoecology, palynology

Stephanie L. Pfirman, Hirschorn Professor, environmental science, arctic oceanography

Walter C. Pitman III, Adjunct Professor, marine magnetism

Terry A. Plank, Professor, igneous geochemistry, magma generation, crustal recycling, magmatic water

Lorenzo M. Polvani, Professor (Joint with APAM), atmosphere, ocean and climate dynamics, geophysical fluid dynamics, planetary atmospheres

G. Michael Purdy, Professor, marine seismology

Paul G. Richards, Mellon Professor Emeritus and Special Lecturer, theoretical seismology, arms control, nuclear disarmament

Joerg M. Schaeferi, Adjunct Associate Professor, climate science cosmogenic dating

Peter Schlosser, Associate Director of Research, The Earth Institute; Vinton Professor of Earth and Environmental Engineering, School of Engineering and Applied Science; Professor of Earth and Environmental Sciences

Christopher H. Scholz, Professor (Joint with APAM), experimental and theoretical rock mechanics, especially friction, fracture, hydraulic transport properties, nonlinear systems, mechanics of earthquakes and faulting

Tiffany A. Shaw, Assistant Professor (Joint with APAM), atmospheric physics, geophysical fluid dynamics

Christopher Small, Adjunct Professor, imaging spatiotemporal dynamics of the earth surface with light, sound and gravity

Jason E. Smerdon, Adjunct Assistant Professor of Public Affairs, School of International and Public Affairs; Storke-Doherty Lecturer, Lamont-Doherty Earth Observatory and the Department of Earth and Environmental Sciences, Late Holocene paleoclimate, statistical methods, geothermal climate signals

Adam H. Sobel, Professor (Joint with APAM), atmospheric and climate dynamics, tropical meteorology

Marc W. Spiegelman, Arthur D. Storks Memorial Professor (Joint with APAM), coupled fluid/solid mechanics, reactive fluid flow, solid earth and magma dynamics, scientific computation/modeling

Martin Stute, Ann Olin Whitney Professor, aqueous geochemistry, hydrology

Taro Takahashi, Adjunct Professor, carbon cycle in the oceans, atmosphere and biosphere
Andreas M. Thurnherr, Lecturer, physical oceanography

Mingfang Ting, Adjunct Professor, climate dynamics

Maria Tolstoy, Associate Professor, marine seismology

David Walker, Higgins Professor, experimental petrology, geology, materials science, alternate energy

Spahr C. Webb, Adjunct Professor, marine geophysics, seismology, ocean bottom seismometry/instrumentation

B.A. and Post-Baccalaureate Programs in Ecology, Evolution and Environmental Biology

Matthew Palmer, Director of Undergraduate Studies: mp2434@columbia.edu, (212) 854-4767

Jill Shapiro, Major Adviser for Evolutionary Biology of the Human Species: jss19@columbia.edu, (212) 854-5819

Elisa Bone, Post-Baccalaureate Program Director: eb2801@columbia.edu, (212) 854-9987

Lourdes Gautier, Academic Department Administrator: lg2019@columbia.edu, (212) 854-8665

ADMISSION DEADLINES

Major declaration early-mid spring; post-baccalaureate students can enter in any semester through rolling admission.

Program website: <http://www.columbia.edu/cu/e3b/undergrad.html>

MISSION

Our mission is to educate a new generation of scientists and practitioners in the theory and methods of ecology, evolution and environmental biology. Our educational programs emphasize a multi-disciplinary perspective on the Earth's declining biodiversity, integrating an understanding from the biological sciences with insights from relevant fields in the physical and social sciences.

ACADEMIC PROGRAMS

The Department of Ecology, Evolution and Environmental Biology runs two undergraduate majors and affiliated concentrations: Environmental Biology and Evolutionary Biology of the Human Species. The foci and requirements vary substantially and are intended for students with different academic interests. The Department also offers a post-baccalaureate program in conjunction with the School of Continuing Education for students who have already completed a bachelor's degree.

Bachelor of Arts in Environmental Biology

The environmental biology major provides students with a strong foundation in areas of organismal biology including evolution, systematics, ecology, population biology, behavior and biodiversity conservation, as well as an exposure to social sciences such as economics and environmental policy. All majors complete an environmental biology research internship that serves as the basis for their senior thesis. The major provides the academic training required to either enter the rapidly evolving environmental work force or to pursue graduate studies. Within the major, there is an optional track in Ecology and Evolution which includes more organismal biology and less environmental and social science. Contact the Director of Undergraduate Studies for details.

Concentration in Environmental Biology

While students intending to pursue graduate education are advised to undertake the environmental biology major, E3B also offers a concentration in environmental biology for students whose main academic focus is elsewhere (e.g. law, economics, chemistry), but who wish to pursue some organized study in the field. The concentration includes fewer introductory and upper division courses, no internship and no research seminar. Details on the concentration are available in the Columbia College Bulletin.

ENVIRONMENTAL BIOLOGY MAJOR REQUIREMENTS

I. Lower division requirements (33 credits)

- Environmental Biology I and II (EEEEB W2001 and W2002)
- Climate Science (EESC V2100) and Earth Science (V2200)
- Introductory Chemistry (CHEM C1403 and C1404)
- Physics (PHYS V1201)
- Calculus (MATH V1101, V1102, V1105 or V1106)
- Statistics (STAT W1111, W1211, EEEB W3020 or BIOL BC3386)

II. Upper division requirements (18 credits)

Note: The course offerings that satisfy these requirements vary between semesters and years. A list of approved courses is available on the E3B website or from the Director of Undergraduate Studies.

- Environmental policy/economics (1 course):
 - ANTH V3004 Introduction to environmental anthropology
 - ANTH W3973 Environment and development
 - ANTH W4022 Political ecology
 - ANTH W4124 People and their environment
 - ECON BC3039 Environmental and natural resource economics
 - EESC BC3032 Agricultural and urban land use
 - EESC BC3035 Environmental hazards and disasters
 - EESC BC3040 Environmental law
 - EESC W3018 Weapons of mass destruction
 - EESC W4917 The earth/human system
 - INAF U4729 Alternative energy resources
 - INAF U4737 Economics of the environment
 - INAF U4740 Introduction to environmental sociology
 - SOCI W3290 Environmental sociology
 - SUSW W3300 Challenges of sustainable development
- Evolution/genetics (1 course):
 - ANEB W3204 Dynamics of human evolution
 - ANEB W3970 Biological basis of human variation
 - ANEB G4146 Human brain evolving
 - ANEB W4200 Fossil evidence of human evolution
 - BIOL BC2100 Molecular and Mendelian Genetics

- BIOL BC2240 Plant evolution and diversity
 - BIOL BC2262 Vertebrate biology
 - BIOL BC2278 Evolution
 - BIOL W3031 Genetics
 - BIOL W3208 Introduction to evolutionary biology
 - BIOL W4205 Origins of life
 - EEEB G4789 Biogeography
 - EEEB G4126 Conservation genetics
 - EEEB G4020 Population genetics
 - EEEB G4210 Herpetology
 - EEEB G4910 Field botany and plant systematics
- Ecology, behavior and conservation biology (1 course):
 - BIOL BC2280 Animal behavior
 - BIOL BC2272 Ecology
 - EEEB W3940 Current controversies in primate behavior and ecology
 - EEEB G4060 Invasion biology
 - EEEB G4086 Ethnobotany
 - EEEB G4100 Forest ecology
 - EEEB G4120 Islands: ecology, evolution and conservation
 - EEEB G4122 Fundamentals of Ecology and Evolution
 - EEEB G4127 Disease ecology and conservation
 - EEEB G4130 Restoration and urban ecology
 - EEEB G4205 Extinction science
 - EEEB G4650 Biodiversity and ecosystem function
 - EEEB G4126 Conservation genetics
 - EEEB W3011 Behavioral biology of the living primates
 - EEEB W3087 Conservation biology
 - EESC BC3021 Forests and environmental change
 - EESC W4550 Plant ecophysiology
 - EESC W4835 Wetlands and climate change
- Morphology, Physiology and Diversity (1 course):
 - ANEB G4147 Human skeletal biology I
 - ANEB G4148 Human skeletal biology II
 - BIOL BC2240 Plant evolution and diversity
 - BIOL BC2250 Invertebrate zoology
 - BIOL BC2262 Vertebrate biology
 - BIOL BC3340 Plant physiology
 - BIOL BC3360 Animal physiology
 - BIOL W3002 Animal structure and function
 - BIOL W3006 Physiology
 - BIOL W3022 Developmental biology
 - EEEB W3030 Biology, systematics and evolutionary history of the apes
 - EEEB W3204 Primate skeletal anatomy
 - EEEB W3215 Forensic osteology
 - EEEB G4140 Ornithology
 - EEEB G4200 Ecotoxicology
 - EEEB G4210 Herpetology
 - EEEB G4650 Biodiversity and ecosystem processes
 - EEEB G4660 Fish biodiversity, systematics, and evolution
 - EEEB W4666 Insect biodiversity
 - EEEB W4910 Field botany and plant systematics
 - EESC W4550 Plant ecophysiology

Environmental biology majors must also complete one additional course from the preceding four categories (i.e., five total courses that cover the four distributional requirements). At least one of these courses must include a laboratory component. Consult with the Director of Undergraduate Studies for further details.

- III. **Thesis research seminar:** EEEB W3991 and W3992 (three credits required, six credits strongly recommended).
- IV. **Internship requirement:** Students are required to complete an environmental biology research internship after their junior year. This research serves as the basis for the senior thesis, which is developed during the required thesis research seminars (EEEEB 3391 and/or 3392). Students develop research projects in consultation with a research mentor (often associated with the consortium institutions of the Center for Environmental Research and Conservation) and faculty thesis adviser.

Evolutionary Biology of the Human Species

The major in evolutionary biology of the human species provides students with a foundation in the interrelated spheres of behavior, ecology, genetics, evolution, morphology, patterns of growth, adaptation and forensics. Using the framework of evolution and with attention to the interplay between biology and culture, research in these areas is applied to our own species and to our closest relatives to understand who we are and from where we came. This integrated biological study of the human species is also known as biological anthropology. As this is an interdisciplinary major, students are also encouraged to draw on courses in related fields including biology, anthropology, geology and psychology as part of their studies.

DEGREE REQUIREMENTS

Major in the Evolutionary Biology of the Human Species (36 credits)

Students must take a minimum of 20 credits from EEEB or ANEB biological anthropology courses. Other credits may be taken either within or outside of EEEB with adviser approval.

Required Courses

- I. **Introductory Level:**
 - EEEB V1010 The Human Species: Its Place in Nature
 - EEEB V1011 Behavioral Biology of Living Primates
 - Alternatively, in place of Behavioral Biology of Living Primates students may take Environmental Biology II (EEEEB W2002) as long as they take the 3000 level version of the former course (EEEEB W3011) as well.
- II. **Advanced Level (9 credits) :**
 - EEEB V3087 Conservation Biology
- III. **Theoretical Foundation From Related Fields (6 credits)**
One course from each subset:
 - Cultural Anthropology
 - ANTH V1002 The Interpretation of Culture
 - ANTH V2004 Introduction to Social and Cultural Anthropology
 - ANTH V3041 Theories of Culture: Past and Present
 - Archeology
 - ANTH V3280 Archeological Theory and Method
 - ACLG V2028 Introduction to 21st Century Archeology
 - ANTH V1007 Origins of Human Society
- IV. **Breadth Requirement (9 credits):**
One course from each subset; can overlap seminar requirement:
 - Genetics/Human Variation
 - EEEB W4020 Population Genetics
 - BIOL W3031/C3032 or BIOL BC3200 Genetics
 - ANTH V3970 Biological Basis of Human Variation
 - EEEB W4700 Race: The Tangled History of a Biological Concept

- EEEB W4340 Human Adaptation
- Primate Behavioral Biology and Ecology
 - EEEB V3940 Current Controversies in Primate Behavior and Ecology
 - BIOL BC3280 Animal Behavior
 - PSYC W3540 The Evolution of Behavior
 - PSYC BC1119 Behavioral Neuroscience (“Apes” EEEB W3030 may be applied here if needed)
 - EEEB G4134 Behavioral Ecology
 - PSYC W3470 Brain Evolution: Becoming Human
 - PSYCH W3450 Evolution of Intelligence
- Human Evolution/Morphology
 - ANEB G4147, G4148 Human Skeletal Biology
 - EEEB W3208 Explorations in Primate Anatomy
 - ANTH W4200 Fossil Evidence for Human Evolution
 - EEEBW3204 Dynamics of Human Evolution
 - EEEB V3030 The Biology, Systematics and Evolutionary History of “The Apes”
 - BIOL BC3260 Vertebrate Zoology
 - BIOL W3002 Animal Structure and Function
 - BIOL 3006 Physiology or any of the BME Anatomy Courses
 - EEEB 3215 Forensic Osteology
 - ANTH G4002 Controversial Topics in Human Evolution

V. **At least one seminar (4 credits):** Current Controversies in Primate Behavior, Dynamics of Human Evolution, Controversial Topics in Human Evolution, Biological Basis of Human Variation. May overlap breadth requirement.

VI. **EBHS Senior Thesis Seminar EEEB W3993-3994 (4 credits):** While students are not required to complete a thesis, all are encouraged to undertake this year-long course in which they undertake independent original research.

It is strongly suggested that students intending to pursue graduate study in this field broaden their foundation by taking an introductory biology course (optimally Environmental Biology I), a 3000-level genetics course and a quantitative methods course. The major adviser will make additional recommendations dependent on the student’s area of focus.

Post-baccalaureate Program in Ecology, Evolution and Environmental Biology

For students who have recently completed a degree in a field other than environmental science or biology, but would like to further their education in this field, E3B offers a postbaccalaureate program through the School of Continuing Education. The program is geared toward students who expect to apply to graduate programs in an environmental discipline. The curriculum includes the core sciences of biology, chemistry, statistics and environmental science in addition to conservation biology and two upper-division electives. We also welcome those who simply desire to learn about environmental biology through a rigorous curriculum. The program requirements are described in detail on the program website: <http://ce.columbia.edu/Postbaccalaureate-Studies/Ecology-Evolution-and-Environmental-Biology-Certificate-Program-1>.

CORE FACULTY

Marina Cords, Professor

Ruth DeFries, Denning Family Professor of Sustainable Development; Chair of the Department of Ecology, Evolution and Environmental Biology

Don Melnick, Thomas Hunt Morgan Professor of Conservation Biology

Shahid Naeem, Professor

Maria Uriarte, Associate Professor

Dustin Rubenstein, Assistant Professor

Matthew Palmer, Lecturer in Discipline

Jill Shapiro, Lecturer in Discipline

Elisa Bone, Lecturer in Discipline

AFFILIATED FACULTY

Philip Ammirato, Professor Emeritus of Biological Sciences, Barnard College

Walter Bock, Professor of Biological Sciences

John Glendinning, Professor of Biological Sciences, Barnard College

Paul Hertz, Professor of Biological Sciences, Barnard College

Ralph Holloway, Professor of Anthropology

Darcy Kelley, Professor of Biological Sciences

Paul Olsen, Professor of Earth and Environmental Sciences

Robert Pollack, Professor of Biological Sciences

Jeanne Poindexter, Professor of Biological Sciences, Barnard College

Steven Cohen, Executive Director, The Earth Institute; Professor in the Practice of Public Affairs; Director, Master of Public Administration Program in Environmental Science and Policy & Energy and Environmental Policy Concentration, School of International and Public Affairs; Director, Master of Science in Sustainability Management, School of Continuing Education

Kevin Griffin, Co-Director of the Undergraduate Program in Sustainable Development; Professor, Department of Earth and Environmental Sciences (on leave AY 2011-12)

Brian Morton, Associate Professor of Biological Sciences, Barnard College

Paige West, Associate Professor of Anthropology, Barnard College

Hilary Callahan, Assistant Professor of Biological Sciences, Barnard College

Adjunct Faculty

The Department of E3B also has a large adjunct faculty (see http://www.columbia.edu/cu/e3b/faculty_adjunct.html), most of who are senior scientists at one of the following institutions: American Museum of Natural History, New York Botanical Garden, Wildlife Conservation Society and Wildlife Trust. These faculty members teach courses and advise student research.

B.S. in Earth and Environmental Engineering

Tuncel M. Yegulalp, Program Director: yegulalp@columbia.edu, (212) 854-2984

Gary Hill, Program Coordinator: gh2206@columbia.edu, (212) 854-2905

Dawn DeValle, Department Administrator: dd2264@columbia.edu, (212) 854-7065

ADMISSIONS DEADLINES

Early admission: November 1; Regular admission: January 2

Program website: <http://www.engineering.columbia.edu/bulletin/dept/earth.php>

MISSION

The Bachelor of Science in earth and environmental engineering (EEE) prepares students for careers in the public and private sector concerned with primary materials (minerals, fuels, water) and the environment. Graduates are also prepared to continue with further studies in earth/environmental sciences and engineering, business, public policy, international studies, law, and medicine. The EEE program is accredited as an environmental engineering program by the Accreditation Board for Engineering and Technology (ABET).

UNDERGRADUATE PROGRAM OBJECTIVES

1. Graduates equipped with the necessary tools (mathematics, chemistry, physics, earth sciences and engineering science) will understand and implement the underlying principles used in the engineering of processes and systems.
2. Graduates will be able to pursue careers in industry, government agencies and other organizations concerned with the environment and the provision of primary and secondary materials and energy, as well continue their education as graduate students in related disciplines.
3. Graduates will possess the basic concepts and skills needed for the practice of earth and environmental engineering, including measurement and control of material flows through the environment; assessment of environmental impacts of past, present, and future industrial activities; and analysis and design of processes for remediation, recycling and disposal of used materials.
4. Graduates will practice their profession with excellent written and oral communication skills and with professional ethics and responsibilities.

THE CURRICULUM

Earth and environmental engineering is an inherently broad and multidisciplinary field. Therefore the approach of the EEE curriculum is to expose students to multiple facets within this engineering specialty, while focusing in-depth on one of three particular problem areas that are of critical importance in the 21st century. A strong foundation in basic math/sciences and liberal arts is also an important part of the EEE curriculum, since these fundamentals are needed to understand and address the technical and socioeconomic aspects of all environmental problems.

The EEE curriculum also spans a broad spectrum of educational methods and research/professional experiences. Traditional lecture classes are complemented with physical laboratory and computer modeling components, and specific classes are devoted to laboratory and field methods relevant to EEE. A number of introductory and upper-level elective courses are taught using a project-based, team-oriented approach, with student groups working semester-long on a problem, or components of a larger problem, in a studio setting. Service learning (i.e., learning by doing) is also strongly emphasized via course projects, summer internships with local companies, undergraduate research opportunities and the EEE senior design project.

FIRST- AND SECOND-YEAR CURRICULUM

Our first- and second-year curriculum is consistent with the Columbia SEAS and liberal arts core requirements. In addition, there are a number of EEE-specific math and science courses. More importantly, there are two courses taught by EEE faculty that provide an early introduction to earth and environmental engineering and continuity throughout the four-year EEE curriculum:

- E1100: A Better Planet by Design. Scheduled for first-year spring semester. This is EEE's professional-level course, so it is not required by the EEE program but highly recommended.
- EAEE E2002: Alternative Energy Resources. Scheduled for second-year fall semester. This course is required by the EEE program.

JUNIOR/SENIOR CURRICULUM

Our junior- and senior-year curriculum consists of an intensive set of technical engineering courses with the following objectives:

- Build fundamental skills in applied math and sciences such as fluid mechanics, thermodynamics and statistics.
- Understand traditional environmental engineering topics related to pollution control, transport, and remediation.
- Introduce emerging 21st-century environmental engineering problems related to all three EEE concentration areas: Water Resources and Climate Risks, Sustainable Energy and Materials, and Environmental Health Engineering.
- In-depth focus on one concentration area to be selected by the student through technical electives.

Faculty

William Becker, Adjunct Professor of Earth and Environmental Engineering

Marco J. Castaldi, Assistant Professor of Earth and Environmental Engineering

Kartik Chandran, Associate Professor of Earth and Environmental Engineering

X Chen, Associate Professor, Earth and Environmental Engineering

Paul F. Duby, Professor of Mineral Engineering

Raymond Farinato, Adjunct Professor of Earth and Environmental Engineering

Robert Farrauto, Adjunct Professor of Earth and Environmental Engineering

Vasilis Fthenakis, Senior Research Scientist, Earth and Environmental Engineering

Pierre Gentine, Assistant Professor of Earth and Environmental engineering

Yuri Gorokovich, Adjunct Professor of Earth and Environmental Engineering

Klaus Lackner, Chair, Maurice Ewing and J. Lamar Worzel Professor of Geophysics

Upmanu Lall, Alan and Carol Silberstein Professor of Earth and Environmental Engineering and of Civil Engineering and Engineering Mechanics

Wade McGillis, Doherty Research Scientist, Earth and Environmental Engineering

Ismail Cevdet Noyan, Professor of Materials Science

Ah-Hyung (Alissa) Park, Lenfest Junior Professor in Applied Climate Science

Sri Rangarajan, Adjunct Assistant Professor of Earth and Environmental Engineering

Peter Schlosser, Associate Director of Research, The Earth Institute; Vinton Professor of Earth and Environmental Engineering, School of Engineering and Applied Science; Professor of Earth and Environmental Sciences

Ponisseril Somasundaran, LaVon Duddleson Krumb Professor of Earth and Environmental Engineering

Nickolas J. Themelis, Stanley-Thompson Professor Emeritus of Chemical Metallurgy

Nicholas J. Turro, William B. Schweitzer Professor of Chemistry

Tuncel M. Yegulalp, Professor of Mining Engineering

B.A. in Environmental Biology (Barnard)

Stephanie Pfirman, Program Co-Chair: spfirman@barnard.edu, (212) 854-5120

Martin Stute, Program Co-Chair: mstute@barnard.edu, (212) 854-8110

John Glendinning, Program Co-Chair: jglendinning@barnard.edu, (212) 854-4749

Hilary Callahan, Program Co-Chair: hcallahan@barnard.edu, (212) 854-5405

Catherine Cook, Administrator: ccook@barnard.edu, (212) 854-5618

Program website: <http://www.barnard.edu/envsci/programs/envbiomajor.htm>

MISSION

The environmental biology major is designed to provide students with a broad education in the field as well as an opportunity to cover a specific aspect of biology in depth if they desire. The major is suitable for students who intend to pursue a research career in conservation biology, ecology or environmental biology, as well as for students interested in environmental law or policy. Career opportunities are possible in natural history museums and parks, environmental education, environmental advocacy and government agencies, among others.

The Departments of Environmental Science and Biology jointly administer the environmental biology program. Majors take courses in both departments, and should maintain contact with advisers in each. The senior thesis requirement for the environmental biology major can be completed by enrolling in a senior seminar in either the

Environmental Science or Biology Departments or by completing guided research in biology.

MAJOR REQUIREMENTS

Biology: One year of introductory biology with lab at the 1500-level sequence; one lecture course in ecology with lab; one lecture course in organismal biology, one additional lecture course in Biology—not including organismal biology.

- BIOL BC1502y Molecular and Cellular Biology
- BIOL BC 1500x Physiology, Ecology and Evolutionary Biology
- BIOL BC1501x Biodiversity Laboratory
- BIOL BC1503y Biological Experimentation Laboratory
- BIOL BC2272y Ecology, BC3380 Applied Ecology and Evolution, or other ecology course
- BIOL BC2873y Laboratory in Ecology

Organismal biology (1 course):

- BIOL BC2240x Plant Biology
- BIOL BC2250 Invertebrate Zoology
- BIOL BC2262y Vertebrate Biology
- BIOL BC3320x Microbiology
- One additional lecture course in biology (not listed above)

Environmental science (3 courses):

- One year of introduction to environmental science with lab:
 - EESC V2100x,y Climate with Lab
 - EESC V2200x Solid Earth with lab
- One of the following in methodology:
 - EESC BC3014x Field Methods
 - EESC BC3016y Environmental Measurements
 - EESC BC3025y Hydrology
 - EESC NO36x Global Assessment Remote Sensing
 - EAEE E4009 GIS-Remote Sensing, Environmental Infrastructure Management
- One additional lecture course in environmental science (please see the electives listed under the environmental science major)

Introductory Chemistry with Lab (including 1 semester of Organic Chemistry):

- CHEM BC2001x General Chemistry I with lab
- CHEM BC3230y Organic Chemistry I with CHEM BC3328y Organic Lab

Data Handling (1 course):

- Research Design and Analysis, BIOL BC2286
- Data Analysis, EESC BC3017
- Statistics for Ecology and Evolutionary Biology, EEEB W3020.

Senior Thesis (completed in either biology or environmental science):

- BIOL BC3590x, y Senior Seminar in Biology
- BIOL BC3593x, 3594y Senior Thesis Research and Seminar
- EESC BC3800x Senior Research Seminar and EESC BC3801y Senior Research Seminar

CORE FACULTY

Stephanie Pfirman, Professor and Chair,
Environmental Science

Brian Mailloux, Assistant Professor, Environmental
Science

John Glendinning, Assistant Professor and Chair,
Physiology and Behavior

Hilary Callahan, Assistant Professor, Ecological
Genetics

AFFILIATED FACULTY

Philip V. Ammirato, Professor Emeritus, Plant Development and Physiology

Elizabeth S. Boylan, Provost

James Danoff-Burg, Part-time Faculty, Ecology
Paul Hertz, Professor, Biology

Brian Morton, Associate Professor, Molecular Evolution

Jeanne S. Poindexter, Professor Emeritus, Microbial Physiology and Ecology

Kristen Shepard, Assistant Professor, Plant Development and Physiology

Martin Stute, Associate Professor, Environmental Science

Jennifer Mansfield, Assistant Professor, Developmental Genetics

Matthew Wallenfang, Assistant Professor, Cell Biology

B.A. Environmental Science (Barnard)

Stephanie Pfirman, Program Co-Chair: spfirman@barnard.edu, (212) 854-5120

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Catherine Cook, Administrator: ccook@barnard.edu, (212) 854-5618

Program website: <http://www.barnard.edu/envsci/programs/envscimajor.htm>

MISSION

Environmental science provides a scientific basis for management of earth systems. It focuses on the interaction between human activities, resources and the environment. As the human population grows and technology advances, pressures on Earth's natural systems are becoming increasingly intense and complex. Environmental science is an exciting field where science is used to best serve society.

The environmental science curriculum recognizes the need for well-trained scientists to cope with balancing human requirements and environmental conservation. Majors acquire an understanding of earth systems by taking courses in the natural sciences as well as courses investigating environmental stress. The program aims to teach students to critically evaluate the diverse information necessary for sound environmental analysis. Courses foster an interdisciplinary approach to environmental problem-solving. Internships, research or field experience often form the basis for the senior thesis and are extremely valuable in preparing students for a variety of careers in environmental science.

MAJOR REQUIREMENTS

- I. **Part A—Core Sciences** (4 courses with labs):
 - EESC V2100x,y Earth's Environmental Systems: Climate with lab
 - EESC V2200x Earth's Environmental Systems: Solid Earth with lab
 - CHEM BC2001x General Chemistry I with lab
 - BIOL BC1500x Physiology, Ecology and Evolutionary Biology with BIOL BC1501x Biodiversity Laboratory
 - EESC V2300y Earth's Environmental Systems: Life with Lab (for students not planning on taking upper level courses in biology)

- II. **Part B—Basic Sciences** (2 courses):
 - CHEM BC3230y Organic Chemistry I
 - CHEM BC3328y Organic Laboratory (recommended)
 - CHEM BC2002 General Chemistry II with lab
 - CHEM BC3231x Organic Chemistry II
 - BIOL BC1502y Molecular, Cellular and Developmental Biology
 - BIOL BC1503y Biological Exp. Laboratory (recommended)
 - PHYS V1201x General Physics

- PHYS V1202y General Physics
- PHYS BC2001x Physics I: Mechanics
- PHYS BC2002y Physics II: Electricity and Magnetism
- PHYS BC3001x Physics III: Waves and Optics

III. **Part C—Quantitative Methods** (2 courses):

- Calculus I
- Calculus II
- EESC BC3017 Statistics/Data Analysis
- ECON BC1002, 1003, or 1105 Economics

IV. **Part D—Environmental Electives** (4 courses):

- ANTH V3004 Introduction to Environmental Anthropology
- ANTH V3971 Environment and Cultural Behavior
- EAEE E1100y A Better Planet by Design
- EESC BC1001x EESC BC1002y Introduction to Environmental Science I or II, (if taken before Earth's Environmental Systems)
- EESC V2300x Earth's Environmental Systems: Life with Lab (cannot count for both Part A and Part D)
- EESC W2330y Science for Sustainable Development
- EESC BC3013 Shorelines and Streams
- EESC BC3014x Field Methods in Environmental Science
- EESC V3015y Earth's Carbon Cycle*
- EESC BC3016x Environmental Measurements or CHEM BC3338y Quantitative and Instrumental Techniques
- EESC BC3017x Environmental Data Analysis (cannot count for both Part C and Part D)
- EESC W3018 Weapons of Mass Destruction
- EESC BC3019x Energy Resources*
- EESC BC3021x Forests and Environmental Change*
- EESC BC3025y Hydrology*
- EESC BC3026y Case Studies in Land Use Dynamics*
- EESC BC3032y Agricultural and Urban Land Use*
- EESC BC3033y Waste Management*
- ECON BC3039x Natural Resources and Environmental Economics
- EESC V1201y Environmental Risks and Disasters
- EESC BC3040y Environmental Law
- EESC BC3200x Ecotoxicology*
- EESC V3327x Principles of Geomorphology*
- EESC W4885y Chemistry of Continental Waters*
- EESC W4050x Global Assessment and Monitoring Using Remote Systems or EAEE W4009 GIS Applications to Environmental Problems*
- ECON W4625y Economics of the Environment
- BIOL BC3320x Microbiology
- BIOL BC3340y Plant Physiology
- BIOL BC2272x General Ecology or BIOL BC3279x Applied Ecology and Evolution
- EEEB W3087 Conservation Biology
- BIOL G4130 Restoration Ecology
- INAF U4727 International Politics and the Environment*

Check with the Environmental Science Department for other electives

* Course taught alternate years

V. **Part E—Senior Thesis:**

- EESC BC3800x Senior Research Seminar
- EESC BC3801y Senior Research Seminar

***Note that major requirements may change. Please consult the Department for more detailed information.*

REQUIREMENTS FOR THE MINOR

Students wishing to minor in environmental science must have a plan approved by the environmental science department chair. Five courses are required including two laboratory science courses (such as EESC BC1001, EESC BC1002, EESC V2100, EESC V2200, EESC V2300) and three electives that form a coherent program (Please see elective courses listed in the environmental science major). In some cases, courses in other sciences can be substituted with the approval of the chair.

Students wishing to minor in environmental science, interested in field programs, and seeking minor credit must contact the department chair, Stephanie Pfirman. The only current field program within Columbia University is SEE-U.

CORE FACULTY

Stephanie Pfirman, Department Co-Chair and Professor, Environmental Science

Martin Stute, Department Co-Chair and Professor, Environmental Science

Brian Mailloux, Assistant Professor, Environmental Science

Peter Bower, Senior Lecturer, Environmental Science

Terryanne Maenza-Gmelch, Lecturer and Laboratory Director, Environmental Science

Diane Dittrick, Laboratory Director, Environmental Science

AFFILIATED FACULTY

Cynthia Rosenzweig, Adjunct Professor, Goddard Institute for Space Studies and Center for Climate Systems Research

B.A. in Environmental Policy (Barnard)

Stephanie Pfirman, Program Co-Chair: spfirman@barnard.edu, (212) 854-5120

Martin Stute, Program Co-Chair: mstute@barnard.edu, (212) 854-8110

Catherine Cook, Administrator: ccook@barnard.edu, (212) 854-5618

Program website: <http://www.barnard.edu/envsci/programs/envaffmajor.htm>

MISSION

Environmental policy is a growing field at the intersection of science and society. It focuses on political institutions, societal processes and individual choices that lead to environmental stress, along with the impact of environmental stress on institutions, processes and individuals and the development of approaches to reduce environmental impact.

The environmental policy program is designed to equip students to play effective roles as citizens or career professionals who can actively engage in environmental decision-making and policy. Majors learn to analyze and evaluate environmental, political, and economic systems and public policies in the context of environmental concerns. While students are primarily affiliated with the Environmental Science Department, they choose a second adviser from the departments of political science, economics or anthropology. A required senior thesis is completed in the senior research seminar.

MAJOR REQUIREMENTS:

I. Part A1—Natural Science Foundation (3 courses):

- EESC V2100x,y Earth's Environmental Systems: Climate with lab
- CHEM BC 2001x General Chemistry I with Lab

- BIOL BC1500x Physiology, Ecology and Evolutionary Biology with BIOL BC1501x Biodiversity Laboratory
- BIOL W2002 Environmental Biology II with Lab,
- EESC V2300y Earth's Environmental Systems: Life with Lab
- Columbia's SEE-U summer program

II. Part A2—Natural Science Foundation (1 course):

- CHEM BC3230 Organic Chemistry (for students who intend to pursue advanced coursework in natural sciences)
- CHEM BC2002 General Chemistry II with Lab, (for students who prefer a general introduction to chemistry and do not intend to pursue advanced coursework in natural sciences)
- EESC V2200 Earth's Environmental Systems: Solid Earth with Lab,
- BIOL BC1502y Molecular, Cellular and Developmental Biology with BIOL BC1503y Biological Exp. Lab
- EESC BC1001 or 1002 Introduction to Environmental Science I with Lab

III. Part B—Quantitative Assessment (2 courses):

- EESC BC3017 Data Analysis
- EAEE E4009 GIS Applications to Environmental Problems
- EESC BC3016 Environmental Measurements
- EESC W4050 Global Assessment and Monitoring Using Remote Systems
- URBS V3200 GIS Methods and Case Studies

IV. Part C—Decision-making Foundation (3 courses, 1 from each group):

- Economics:
 - ECON BC1003x,y Introduction to Economic Reasoning
 - ECON W1105 Principles of Economics
- Politics:
 - POS V3212y Environmental Politics
 - POLS V1601 International Politics
 - POSL V1501y Comparative Politics
 - POLS 3616y/ INAF U6243y International Relations of the Environment
 - URBS V3565x Urban Planning in Developing Countries
 - HIST W342 Politics of the American Environment
- Culture:
 - ANTH V1002x,y Interpretation of Culture with ANTH V1112x,y, Discussion Section
 - EEEB V1010x Human Species-Place in Nature
 - ANTH V3004 Introduction to Environmental Anthropology (no longer offered)
 - SDEV3300x Challenges to Sustainable Development

V. Part D—Natural Science Elective (1 course):

- EAEE E2002 Alternate Energy Resources
- EESC W2330y Science for Sustainable Development
- EESC BC3016x Environmental Measurements (Counts only for Part B or D)
- EESC W3018y Weapons of Mass Destruction
- EESC BC3019x Energy Resources*
- EESC BC3021 Forests and Environmental Change*
- EESC BC3025y Hydrology*
- EESC BC3026 Case Studies in Land-use Dynamics*
- EESC BC3032y Agricultural and Urban Land Use*
- EESC BC3033x Waste Management*
- EESC BC3200x Ecotoxicology*
- EEAE E1100y A Better Planet by Design
- EAEE E4001x Applied Industrial Ecology
- EEEB G4130x Restoration and Urban Ecology

* Course taught alternate years

VI. Part E—Social Science Elective (1 course):

- ANTH V3924y Anthropology of Disaster
- ANTH V3950 Anthropology of Consumption
- ANTH V3971x Environmental and Cultural Behavior
- INAF U6243 International Relations of the Environment
- INAF U4727 Environmental Politics/Policy Management
- ECON W2257 The Global Economy
- EESC BC3040y Environmental Law
- SOCI W3290 Environmental Sociology
- HIST W4400y Americans in the Natural World
- HIST W3441 Making of the Modern American Landscape
- HIST W4582 Looking at Nature in the US 1835 to Present
- URBS V3525/HIST BC 3525y 20th Century Urbanization in Comparative Perspectives
- ECON BC3039 Environmental and Natural Resource Economics

VII. Part F—Junior Research (1 course): Junior research colloquium or other research experience in the social sciences (building on decision-making foundation and social science elective) selected from the following:

- ANTH W4022 Political Ecology
- ANTH V3973y Environment and Development
- ANTH BC3868 Ethnographic Field Work
- HIST BC3305x Science, Technology, and Modernity*
- HIST BC4909y History of Environmental Thought*
- POLS BC3331 Colloquium on American Political Decision-making
- POLS BC3800y Colloquium on International Political Economy
- POLS BC3805y International Organizations
- POLS W3922 American Politics Seminar: Executive Leadership
- POLS W3961 International Politics Seminar: National Security Policy
- INAF U4727y Environmental Politics/Policy Management
- URBS V3565 Urban Planning in Developing Countries (counts only for F or C)
- URBS V3546y Urban Studies Junior Colloquia: Contemporary Urban Issues
- URBS V3546y Urban Studies Junior Colloquia: Shaping Up the Modern City

* Course taught alternate years

VIII. Part G—Senior Research/Thesis:

- EESC BC3800x Senior Research Seminar
- EESC BC3801y Senior Research Seminar

** Note that major requirements may change. Please consult the department for more detailed information.

CORE FACULTY

Stephanie Pfirman, Department Chair and Professor, Environmental Science

Paige West, Associate Professor, Anthropology

Rajiv Sethi, Associate Professor, Economics

David Weiman, Professor, Economics

Kimberly Marten, Professor, Political Science

Martin Stute, Department Co-Chair and Professor, Environmental Science

Brian Mailloux, Assistant Professor, Environmental Science

Peter Bower, Senior Lecturer, Environmental Science

AFFILIATED FACULTY

Cynthia Rosenzweig, Research Scientist, Goddard Institute for Space Studies and Center for Climate Systems Research

Timothy Kenna, Adjunct Assistant Professor, Environmental Science

Summer Ecosystem Experiences for Undergraduates (SEE-U)

Center for Environmental Research and Conservation (CERC) Staff:

Desmond Beirne: djb2104@columbia.edu, (212) 854-0149

Program website: <http://www.cerc.columbia.edu/?id=see-u>

ADMISSION DEADLINE

CERC offers rolling admissions for the SEE-U program. You may apply at any time. *Applications will be considered as they are received and there are a limited number of spaces available for our various field sites. The earlier you apply, the better the chance that there will be space available at the field site of your choice.*

CERC's Summer Ecosystem Experiences for Undergraduates (SEE-U) provides undergraduate students of all majors an opportunity to learn about ecology and environmental sustainability in unique natural settings through applied research and field techniques.

The five-week, six credit SEE-U programs are held in four distinct ecosystems sites in Jordan, Puerto Rico, Brazil and the Dominican Republic. Please check the CERC website for course dates and detailed field site descriptions.

The SEE-U program is designed to expose students to ecological fieldwork in unique and interesting natural settings. The "real world" laboratories of tropical, temperate and endangered ecosystems allow for firsthand knowledge and understanding that could be elusive in the more traditional classroom setting. SEE-U instructors engage students in thinking about the broader implications of the experience in relation to issues of biodiversity, climate change and sustainability.

Upon completion of the program, students receive **six undergraduate credits** from Columbia University. At Columbia, these credits fulfill two Core Curriculum Science requirements.

SEE-U AND THE UNDERGRADUATE SPECIAL CONCENTRATION IN SUSTAINABLE DEVELOPMENT

In addition to receiving six credits of credit toward required science coursework, students who are concentrators in sustainable development can use course credit from the SEE-U program to fulfill requirements/electives in the concentration.

Sustainable development is most commonly defined as meeting the needs of the present without compromising the ability of future generations to meet their own needs. It addresses the limited capacity of an ecosystem to absorb the impact of human activities.

CERC believes that sustainable development requires us to have a keen understanding of ecology and a sense of place in the natural world as a core component of the sustainability framework. This understanding is relatively new within the more "traditional" approach to sustainability, which is focused on political, social and economic factors alone.

Thus, SEE-U is a unique academic opportunity that allows students to work alongside scientists and their fellow students to develop an understanding of ecological processes and systems and how these systems relate to sustainable development. SEE-U is a thorough and robust introduction to field conservation ecology. It highlights major threats to biodiversity and equips students with tools useful in combating those threats. Students come away from the program with an appreciation for the scientific method and how to apply it, as well as an informed perspective on the role of nature and its conservation, and its connection to genuine sustainable development.

Columbia Students concentrating in sustainable development can use course credit from the SEE-U program to fulfill requirements and electives. The SEE-U Program fulfills courses in the skills and systems areas of the concentration as well as in the practicum. Students should speak with their academic adviser if they have any questions.

MASTER'S PROGRAMS

M.S. in Sustainability Management

Steven A. Cohen, Program Director: sc32@columbia.edu, (212) 854-4445

Louise A. Rosen, Program Associate Director: lar46@columbia.edu, (212) 854-0643

Allison Ladue, Program Manager: aladue@ei.columbia.edu, (212) 851-9361

ADMISSIONS DEADLINES

Early application deadline for fall admission: January 15

Regular application deadline for fall admission: May 1

Early application deadline for spring admission: October 1

Regular application deadline for fall admission: November 1

Program website: <http://ce.columbia.edu/Sustainability-Management>

The M.S. in Sustainability Management (M.S.S.M.) is co-sponsored by The Earth Institute and the School of Continuing Education. The program's curriculum includes specially developed courses taught by faculty and researchers at the University who are leaders in the fields of earth science, engineering, architecture, and environmental policy and management. The program utilizes environmental and sustainable development research to provide practical training for a new generation of professionals who will address critical interdisciplinary issues.

This program draws upon The Earth Institute's years of experience in bridging research and practice in the field of sustainability. In response to the increasing global challenges all organizations face, from limiting their carbon emissions to managing their water resources, the program melds academic leadership, scientific rigor and professional practice to form a unique interdisciplinary community dedicated to making lasting advances in global sustainability practice. The program draws upon the most sophisticated environmental measurement tools, cutting-edge environmental science, and world-class management and policy studies to help students fully understand the systematic and organizational role of sustainability in any organization. Taking a bold and innovative approach to sustainability that prioritizes the protection of earth systems and resources as well as the spread of social and economic opportunities for all people, the M.S.S.M. is training a new generation of problem solvers. Graduates should be able to appreciate environmental services, climate, water and energy in order to maximize efficient usage and minimize negative impacts.

The M.S.S.M. is a 36-point program that includes five required areas of study: integrative courses in sustainability management, economics and quantitative analysis, the physical dimensions of sustainability management, the public policy environment of sustainability management, and general and financial management.

The degree may be completed on a full- or part-time schedule. Full-time students will complete the degree in three intensive semesters (fall, spring and summer). Part-time students, taking two to three courses per semester, can complete the program over two academic years. All students must complete all requirements within three years with an overall grade point average of 3.0 (B) or better. Graduates receive a unique Master of Science degree, an essential set of skills and knowledge, and access to the placement services and networking opportunities offered by Columbia University, the School of Continuing Education and The Earth Institute.

ADMISSIONS REQUIREMENTS:

- Bachelor's degree
- College level science, math and economics are preferred but not essential if familiarity with these subjects has been developed through other means
- Practitioner experience is greatly valued and accomplishments in the fields of sustainability management will be considered

PROGRAM REQUIREMENTS:

I. Integrative Courses in Sustainability Management (9 credits)

- One required introductory course
 - SUMA K4100 Sustainability Management (3 credits)
- One capstone course
 - SUMA K4200 Integrative Capstone Workshop (3 credits)
- One elective course
 - SUMA K4120 Environmental Conflict Resolution Strategies (3 credits)
 - SUMA K4170 Sustainable Operations (3 credits)
 - SUMA K4734 Earth Institute Practicum (3 credits)
 - SUMA K4700 Ethics and Values for Sustainability Management (3 credits)
 - SUMA K4180 Writing About Global Science for Media (3 credits)
 - ARCH A4623 Sustainable Futures (3 credits)
- The following courses* can be taken from other schools across the University to fill this requirement:
 - INAF U6236 History of American Ecology and Environment
 - INAF U8909 Environmental Conflict and Resolution Strategy
 - NECR K5300 Networking and Sustainability
 - SOCI G8405 Science, Knowledge and Technology

** Note that the above courses are only examples of the courses that may be used to fulfill the requirements. Not all courses are offered every year.*

II. Economics and Quantitative Analysis

- Two courses in general and sustainability economics (6 credits)
 - SUMA K 4190 Economics of Sustainability Management (3 credits)
- One course in statistics (3 credits)
 - SUMA K 4193 Statistics for Sustainability Management (3 credits)
- The following courses* can be taken from other schools across the University to fill this requirement:
 - ACTU K4846 Quantitative Risk Management
 - EAEE E4361 Economics of Earth Resource Industries
 - EAEE E6210 Quantitative Environmental Risk Analysis
 - ECON W4228 Urban Economics
 - ECON S4412 Introduction to Econometrics
 - EEEB G5005 Introduction to Statistics: Ecology and Evolutionary Biology
 - ENVP U6250 Poverty, Inequality and the Environment
 - ENVP U6275 GIS for International Studies
 - INAF U6061 Cost-Benefit Analysis
 - INAF U6042 Energy Business and Economic Development
 - POLS W4360 Math Methods for Political Science
 - POLS W4910 Quantitative Political Research
 - POLS W4912 Multivariate Political Analysis
 - POPF P8640 Methods in Program Evaluation
 - SOCI G4074 Introduction to Social Data Analysis I
 - SIEO W4150 Intro to Probability and Statistics
 - STAT S4105 Probability
 - STAT W4107 Statistical Inference
 - STAT W4201 Advanced Data Analysis
 - STAT W4240 Data Mining
 - STAT S4315 Linear Regression Models
 - STAT W4201 Advanced Data Analysis
 - STAT W4335 Sample Surveys
 - STAT G6191 Applied Statistics for Researchers

** Note that the above courses are only examples of the courses that may be used to fulfill the requirements. Not all courses are offered every year.*

III. The Physical Dimensions of Sustainability Management

- Three courses (nine credits total) are to be taken out of the following categories, but all three courses may not come from only one category:
 - One or two courses in earth and environmental engineering
 - SUMA K4260 Dynamics of Energy Efficiency (3 credits)
 - One or two courses in environmental planning, design or architecture
 - ARCH A6170 Architecture and the Sustainable Built Environment (3 credits)
 - ARCH A4623 Sustainable Futures (3 credits)
 - SUMA KTBA Sustainable Cities (3 credits)
 - One or two courses in ecology or earth and environmental sciences
 - SUMA K4140 Sustainability Science (3 credits)
 - SUMA K4145 The Science of Sustainable Water (3 credits)
 - SUMA The Science of Urban Ecology (3 credits)

- The following courses* can be taken from other schools across the University to fill this requirement:
 - ARCH A4684 Sustainable Design
 - CIEE E4163 Environmental Engineering: Wastewater
 - CIEE E4252 Environmental Engineering
 - CIEE E4260 Urban Ecology Studio
 - CNAD K4130 Green Building and Sustainability: Tools and Technology
 - EAEE E4001 Industrial Ecology of Earth Resources
 - EAEE E4009 GIS Research, Environment, Infrastructure Management
 - EAEE E4150 Air Pollution Prevention/Control
 - EAEE E4010 Remote Sensing and Environmental Change
 - EAEE E4160 Solid and Hazardous Waste Management
 - EAEE E4190 Photovoltaic Systems Engineering and Sustainability
 - EAEE E4550 Catalysis of Emissions Control
 - EAEE E6212 Carbon Sequestration
 - EAIA W4200 Alternative Energy Resources
 - ECIA W4100 Management and Development of Water Systems
 - EEEB G4100 Forest Ecology
 - EEEB W4122 Fundamentals of Ecology and Evolution
 - EEEB G4127 Disease Ecology and Conservation
 - EEEB W4192 Introduction to Landscape Analysis
 - EEEB G4260 Food, Ecology and Globalization
 - EESC W4009 Chemical Geology
 - EESC W4050 Global Assessment and Monitoring Using Remote Sensing
 - EESC W4300 The Earth's Deep Interior
 - EESC W4085 Geodynamics
 - EESC W4400 Dynamics of Climate Variations and Climate Change
 - EESC W4401 Models of Climate Sensing in Natural and Human Systems
 - EESC W4600 Earth Resources and Sustainable Development
 - EESC W4930 Earth's Oceans and Atmosphere
 - EESC W4917 Earth/Human Interactions
 - EESC W4925 Introduction to Physical Oceanography
 - EESC W4926 Introduction to Chemical Oceanography
 - EESC W4949 Introduction to Seismology
 - EESC G6920 Dynamics of Climate
 - EESC W4090 Geochronology and Thermochronology
 - EESC W4040 Climate Thermodynamics and Energy Transfer
 - EHSC P8312 Fundamentals of Toxicology
 - EHSC P8320 Applied Environmental and Industrial Hygiene
 - INAF U8912 Technological Innovation and Sustainable Goals
 - PLAN A6090 Sustainable Transportation Policy
 - PLAN A6065 Environmental Impact Assessment
 - PLAN A6010 Planning for Urban Ecosystems
 - PLAN A4381 Sustainable Urban Development International Perspective

- PLAN A4214 Transportation and Land Use Planning
- PLAN A4112 Physical Structures of Cities
- PLAN A6382 Sustainable Urban Infrastructure Systems
- SDEV U6235 Climate Change, Rights and Development
- SDEV U6240 Environmental Science for Sustainable Development
- SDEV U9240 Human Ecology

** Note that the above courses are only examples of the courses that may be used to fulfill the requirements. Not all courses are offered every year.*

IV. The Public Policy Environment of Sustainability Management: one course in environmental or sustainability policy or law (3 credits)

- SUMA The Policy and Legal Context of Sustainability Management

The following courses* can be taken from other schools across the University to fill this requirement:

- ENVP U6228 Role of Government in Advancing Corporate Sustainable Development
- ENVP U6320 Political Context of Public and Private Environmental Management
- INAF U4727 Environmental Politics, Policy and Management
- INAF U4722 Introduction to Environmental Law
- INAF U6243 International Relations of the Environment
- INAF U6802 International Law
- INAF U6627 Marine Energy, Transportation, Technology, Economics and Policy
- INAF U8785 Gender, Politics and Development
- INAF U8560 Managing the UN System
- INAF U8778 Urban Energy Systems and Policy
- INAF U8909 Environmental Conflict and Resolution Strategy
- LAW L6038 Climate Change Law
- PLAN A4383 Issues in International Development Planning
- PLAN A4579 Introduction to Environmental Planning
- PUAU U4260 Critical Issues in Urban Public Policy
- PUAU U8238 Practical Problems—Urban Politics
- PUAU U8360 Social Movements and Social Change

** Note that the above courses are only examples of the courses that may be used to fulfill the requirements. Not all courses are offered every year.*

V. General and Financial Management: Two courses in public, private or nonprofit general or financial management (6 credits)

- SUMA K4197 Financing the Green Economy; Markets, Business and Politics (3 credits)
- SUMA K4175 Global Environmental Markets (3 credits)
- SUMA K4195 Green Accounting (3 credits)
- SUMA K4170 Sustainable Operations (3 credits)

• The following courses* can be taken from other schools across the University to fill this requirement:

- BUSI K4001 Introduction to Finance
- BUSI K4003 Corporate Finance
- BUSI K4008 Options and Futures
- BUSI K4009 Financial Accounting
- BUSI K4010 Managing Human Behavior in the Organization
- BUSI K4020 Introduction to Marketing/Marketing Management
- COMM K4010 Positioning and Communications Strategy
- COMM K4131 Corporate Communications
- CNAD K4100 Estimating Project Costs
- CNAD K4101 Finance and Accounting in Construction Industry
- CIEN E4133 Capital Facility Planning and Finance
- ENVP U6400 Financing the Green Economy
- ENVP U6235 Environmental Finance

- HPMN P8558 Strategic Management
- INAF U6016 Cost-Benefit Analysis
- INAF U6032 Investing in Emerging Markets
- INAF U6039 International Banking
- INAF U6051 Infrastructure Investment and Development
- TMGT K4132 Managing Emerging Technologies
- TMGT K4122 Strategic Project Management
- TMGT K4003 Corporate Finance
- TMGT K4132 Managing Emerging Technologies
- TMGT K4130 Supply Chain and Matrix Management

** Note that the above courses are only examples of the courses that may be used to fulfill the requirements. Not all courses are offered every year.*

FACULTY

Kevin Anchukaitis, Assistant Research Professor, Tree-Ring Laboratory, Lamont-Doherty Earth Observatory

Howard Apsan, Lecturer, M.S. in Sustainability Management, School of Continuing Education, Columbia University

Jitendra Bajpai, Director of Operations and Knowledge Services, Information Management and Technology Network, World Bank, Lecturer, M.S. in Sustainability Management, School of Continuing Education, Columbia University

Eron Bloomgarden, President, Environmental Markets, Equator, LLC, Lecturer, M.S. in Sustainability Management, School of Continuing Education, Columbia University

Satyajit Bose, Lecturer in Discipline, Department of Economics, Columbia University

Kizzy Charles-Guzman, Director, Climate Change and Public Health Program, NYC Department of Health and Mental Hygiene, Lecturer, M.S. in Sustainability Management, School of Continuing Education, Columbia University

Steven Cohen, Executive Director, The Earth Institute; Professor in the Practice of Public Affairs; Director, Master of Public Administration Program in Environmental Science and Policy & Energy and Environmental Policy Concentration, School of International and Public Affairs, Columbia University; Director, Master of Science in Sustainability Management, School of Continuing Education, Columbia University

Susanne DesRoches, Sustainable Design Manager, The Port Authority of New York and New Jersey, Lecturer, M.S. in Sustainability Management, School of Continuing Education, Columbia University

Claudia Driefus, Contributor, Science Section, *New York Times*, Lecturer, M.S. in Sustainability Management, School of Continuing Education, Columbia University

Luke Falk, Sustainability Manager at Related, Lecturer, M.S. in Sustainability Management, School of Continuing Education, Columbia University

Scott Fisher, Director, Policy Coordination at NRG Energy, Lecturer, M.S. in Sustainability Management, School of Continuing Education, Columbia University

Adela J. Gondek, Lecturer in the Discipline of International and Public Affairs, School of International and Public Affairs (SIPA), Lecturer, M.S. in Sustainability Management, School of Continuing Education, Columbia University

Carol Casazza Herman, Practicing attorney in environmental policy and sustainability programs for business, public interest and academic organizations, Lecturer, M.S. in Sustainability Management, School of Continuing Education, Columbia University

Amy Hill, Director, Academic Initiatives, Office of Academic and Research Programs, The Earth Institute; Lecturer, M.S. in Sustainability Management, School of Continuing Education, Columbia University

Richard Horsch, Partner, White & Case LLP, Lecturer, M.S. in Sustainability Management, School of Continuing Education, Columbia University

Jenna Lawrence, Instructor, Department of Ecology, Evolution and Environmental Biology, Lecturer, M.S. in Sustainability Management, School of Continuing Education, Columbia University

Alexander McQuoid, Ph.D. Candidate, Department of Economics, Lecturer, M.S. in Sustainability Management, School of Continuing Education, Columbia University

Davidson Norris, Adjunct Associate Professor, Graduate School of Architecture, Planning and Preservation

Kate Orff, Assistant Professor, Graduate School of Architecture, Planning and Preservation, Columbia University

Michael Puma, Associate Research Scientist, Center for Climate Systems Research, The Earth Institute, Lecturer, M.S. in Sustainability Management, School of Continuing Education, Columbia University

Louise A. Rosen, Director, Office of Academic and Research Programs, The Earth Institute; Associate Director and Adjunct Lecturer, Master of Science in Sustainability Management, School of Continuing Education, Columbia University; Associate Director, Master of Public Administration Program in Environmental Science and Policy, School of

International and Public Affairs, Columbia University

George Sarrinikolaou, Associate Director for Research, Office of Academic and Research Programs, The Earth Institute; Lecturer, M.S. in Sustainability Management, School of Continuing Education, Columbia University

Jeffrey Scott, Executive Vice President, Student and Administrative Services, Columbia University

Anna Tompsett, Ph.D. Candidate, Sustainable Development, Lecturer, M.S. in Sustainability Management, School of Continuing Education, Columbia University

Allen Zarkin, Adjunct Professor of Public Administration, Robert F. Wagner School of Public Service, New York University

M.A. in Conservation Biology

Andrés Gómez, Program Adviser: ag2112@columbia.edu, (212) 854-7807

Lourdes Gautier, Academic Department Administrator: lg2019@columbia.edu, (212) 854-8665

ADMISSION DEADLINE: JANUARY 15

Program website: <http://www.columbia.edu/cu/e3b/ma.html>

The Master of Arts in conservation biology focuses on biological sciences and integrates environmental policy and economics concepts. The interdisciplinary approach provides students with a range of options for building their careers. Graduates may continue their education in a Ph.D. program or enter the job market directly as scientific researchers, teachers or administrators in a non-governmental organization or government agency dedicated to the conservation of natural resources. Students have the option of tailoring their course work to follow the academic, professional or educational track. The academic track focuses on research and emphasizes the scientific aspects of conservation biology, the professional track focuses on applied conservation and emphasizes the policy aspects of conservation biology, and the educational track focuses on engaging the broader public on conservation biology issues.

ADMISSION REQUIREMENTS

- A background in ecology and evolutionary biology, including undergraduate courses in introductory biology and upper-division ecology, evolution and genetics (or equivalents).
- GRE general test. Biology subject test strongly recommended.
- Applicants interested in the thesis-based program are strongly encouraged to contact potential faculty mentors before applying although this is not a requirement for admission.

PROGRAM REQUIREMENTS

The M.A. in conservation biology is a two-year program. The M.A. program requires two full-time residence units (a residence unit equals one full-time semester). Part-time options are also available. Students may choose between a thesis-based or course-based program. The total number of credits in the course-based option is 47, while the total number of credits for the thesis-based M.A. is 49. The two credit difference results from the different course requirements for the two options.

Students following the thesis-based program will register for directed research and will spend a considerable portion of their registered time working on a research project that leads to a final thesis. Students following the course-based program will register for two additional required classes beyond those currently required for the M.A., either in conservation science or environmental policy. To complete their requirements, students write a take-home essay over a period of two weeks during the spring semester of their second year.

CORE COURSES

All M.A. students take the following core courses:

- EEEB G4122 Fundamentals of Ecology and Evolution during the first year
- EEEB 6905 and EEEB 6990 Conservation Biology (in the fall and spring semester of the first year)
- INAF U6241 Environmental policy, politics and management during the first year
- EEEB G6300 CERC seminar (four courses taken over both years)

OTHER REQUIRED COURSES

Students in all tracks take eight additional courses. Students in the academic track take two additional courses in conservation biology plus four electives in conservation science and two electives in environmental policy. Students in the professional tracks take two additional policy courses plus three electives in conservation science and three electives in environmental policy. Students in the education track take two courses in conservation and education plus two electives in conservation science, two electives in environmental policy, and two electives in education and communication.

Students have the option of replacing elective courses with directed reading or directed research to get credits for internships and/or research experience conducted outside of the normal coursework.

Students in all tracks enrolled in the course-based degree program add two more electives (for a total of 10). These two electives can be in either conservation science or environmental policy (or in education and communication for students in the educational track).

Students in all tracks enrolled in the thesis-based degree program are required to register for the thesis development seminar in the first semester of the first year. The goal of the seminar is to produce a thesis research proposal by the end of the semester.

For a complete outline of the various options, refer to the E3B Student Handbook available on the E3B website: http://www.columbia.edu/cu/e3b/resources_handbook.html

Possible Electives:

Conservation Science:	Environmental Policy:	Conservation Education
Forest Ecology	Economics of the Environment	Science in secondary school
Disease Ecology and Conservation	Environmental Science for Sustainable Development	Science in childhood education
Restoration and Urban Ecology	The Geopolitics of Energy	Science in the environment
Race: Tangled Historical-Biological Concept	Game Theory	Structure of science knowledge and curriculum design
Evolution I	Alternative Energy Resources	Middle School Living Environment Methods Laboratory
Intro to Conservation Genetics	The Economics of Energy	Introduction to science education practice

Understanding Nature-obs/exper	History of American Ecology and Environmentalism	Neurobiology of consciousness, constructivism and information processing
Teaching Conservation Biology	Quantitative Methods-Energy/Policy Analysis	Science curriculum improvement in the elementary school
Fundamentals of GIS in Ecology and Conservation	Urban Energy Systems and Policy	The nature and practice of science
Dynamics of Climate Variability and Climate Change	Law, Economics and Development	Science, Technology and Society
Managing and adapting climate	Environmental Science for Sustainable Development	Selected topics and issues in science education
Global Assessment and Monitoring Using Remote Sensing	Human Ecology and Sustainable Development	Science teacher education
Paleoceanography	Community Development Policy	Curriculum and pedagogy in science education
Environmental data analysis and modeling	Environment, Conflict and Resolution Strategies	
Statistics		

* Note that the above courses are only examples of the courses that may be used to fulfill the elective requirements. Other courses may also be available and eligible for the M.A. program. Not all courses are offered every year. If you would like more information about elective courses please contact the M.A. program adviser.

M.A. THESIS / M.A. ESSAY

Students in the thesis-based program prepare an M.A. thesis based on original research, which is evaluated by a three-member thesis committee tailored to the student's interests. The thesis research is presented to the entire department before graduation. During their fourth semester, students in the course-based program prepare an M.A. essay as a take-home assignment that is evaluated by a faculty committee.

CORE FACULTY

Marina Cords, Professor

Ruth DeFries, Denning Family Professor of Sustainable Development; Chair of the Department of Ecology, Evolution and Environmental Biology

Don Melnick, Thomas Hunt Morgan Professor of Conservation Biology

Shahid Naeem, Professor

Maria Uriarte, Associate Professor

Dustin Rubenstein, Assistant Professor

Matthew Palmer, Lecturer in Discipline

Jill Shapiro, Lecturer in Discipline

Elisa Bone, Lecturer in Discipline

Affiliated Faculty

Philip Ammirato, Professor Emeritus of Biological Sciences, Barnard College

Walter Bock, Professor of Biological Sciences

John Glendinning, Professor of Biological Sciences, Barnard College

Paul Hertz, Professor of Biological Sciences, Barnard College

Ralph Holloway, Professor of Anthropology
Darcy Kelley, Professor of Biological Sciences

Paul Olsen, Professor of Earth and Environmental Sciences

Robert Pollack, Professor of Biological Sciences

Jeanne Poindexter, Professor of Biological Sciences, Barnard College

Steven Cohen, Executive Director, The Earth Institute; Professor in the Practice of Public Affairs; Director, Master of Public Administration Program in Environmental Science and Policy & Energy and Environmental Policy Concentration, School of

International and Public Affairs; Director, Master of Science in Sustainability Management, School of Continuing Education

Kevin L. Griffin, Co-Director of the Undergraduate Program in Sustainable Development; Professor, Department of Earth and Environmental Sciences (on leave AY 2011-12)

Brian Morton, Associate Professor of Biological Sciences, Barnard College

Paige West, Associate Professor of Anthropology, Barnard College

Hilary Callahan, Assistant Professor of Biological Sciences, Barnard College

ADJUNCT FACULTY

The Department of E3B also has a large adjunct faculty (see http://www.columbia.edu/cu/e3b/faculty_adjunct.html), most of whom are senior scientists at one of the following institutions: American Museum of Natural History, New York Botanical Garden, Wildlife Conservation Society and Wildlife Trust. These faculty members teach courses and advise student research.

M.S. in Earth Resources Engineering

Marco J. Castaldi, Program Director: mc2352@columbia.edu

Gary Hill, Program Coordinator: gh2206@columbia.edu, (212) 854-2905

Dawn DelValle, Department Administrator: dd2264@columbia.edu, (212) 854-7065

ADMISSION DEADLINES

Fall: February 15

Spring: October 1

Program website: <http://www.engineering.columbia.edu/bulletin/dept/earth.php>

MISSION

The M.S. in earth resources engineering (M.S. E.R.E.) is designed for engineers and scientists who plan to pursue, or are already engaged in, environmental management/development careers. The focus of the program is the environmentally-sound development and processing of resources (minerals, energy and water) and the recycling or proper disposal of used materials. The program also includes technologies for assessment and remediation of past damage to the environment. Students can choose a pace that allows them to complete the M.S. E.R.E. requirements while being employed.

M.S. E.R.E. graduates are specially qualified to work for engineering, financial and operating companies engaged in mining and mineral processing ventures; the environmental industry; environmental groups in all industries; and for city, state and federal agencies responsible for the environment and energy/resource conservation.

Details of these concentrations, including suggested and required classes for each concentration, are available from the Department.

ADMISSION REQUIREMENTS

- Official B.S./B.A. transcript
- Personal statement
- Resume or curriculum vitae
- Three letters of recommendation
- The Graduate Record Examination (GRE)
- TOEFL test (for students who received their bachelor's degree in a country where English is not the spoken language)

PROGRAM REQUIREMENTS

For students with a B.S. in engineering, at least 30 credits (10 courses) are required. It is recommended that students take eight courses and complete a six-credit thesis. However, variations are acceptable. For students

with a B.S. or a B.A., preferably with a science major, up to 48 credits (16 courses) may be required for make-up courses. A number of concentrations are available for the M.S.E. E.R.E., and students may choose courses that match their interests and career plans.

These areas include:

- Environmental health engineering
- Integrated waste management
- Sustainable energy
- Water resources and climate risks

OTHER REQUIRED COURSES

DEPENDING ON THE STUDENT'S BACKGROUND, OTHER COURSES WILL BE REQUIRED UPON RECOMMENDATION OF THE ADVISER.

M.S. THESIS / M.S. ESSAY

M.S. candidates are required to carry out a research project and write a master's thesis worth three to six credits.

FACULTY

William Becker, Adjunct Professor

Marco J. Castaldi, Assistant Professor

Kartik Chandran, Associate Professor

Xi Chen, Associate Professor

Paul F. Duby, Professor of Mineral Engineering

Raymond Farinato, Adjunct Professor

Robert Farrauto, Adjunct Professor

Vasilis Fthenakis, Senior Research Scientist

Pierre Gentine, Assistant Professor

Yuri Gorokovich, Adjunct Professor

Scott Kaufman, Adjunct Assistant Professor

Klaus Lackner, Chair, Maurice Ewing and J. Lamar Worzel Professor of Geophysics

Upmanu Lall, Alan and Carol Silberstein Professor of Earth and Environmental Engineering and of Civil Engineering and Engineering Mechanics

Wade McGillis, Doherty Research Scientist

Cevdet Noyan, Professor

Ah-Hyung (Alissa) Park, Lenfest Junior Professor in Applied Climate Science

Sri Rangarajan, Adjunct Assistant Professor

Peter Schlosser, Associate Director of Research, The Earth Institute; Vinton Professor of Earth and Environmental Engineering, School of Engineering and Applied Science; Professor of Earth and Environmental Sciences

Ponisseril Somasundaran, LaVon Duddleson Krumb Professor of Earth and Environmental Engineering

Nickolas J. Themelis, Stanely-Tompson Professor Emeritus of Chemical Metallurgy

Nicholas J. Turro, William B. Schweitzer Professor of Chemistry

Tuncel Yegulalp, Professor of Mining Engineering

M.A. in Climate and Society

Mark A. Cane, Program Director: mcane@ldeo.columbia.edu, (845) 365-8344

Ben Orlove, Associate Director, SIPA Faculty: bs05@columbia.edu

Mingfang Ting, Associate Director, Lamont Research Professor, Lamont-Doherty Earth Observatory; Adjunct Professor, Department of Earth and Environmental Sciences: ting@ldeo.columbia.edu, (845) 365-8374

Cynthia Thomson, Assistant Director: cthomson@iri.columbia.edu, (212) 854-9896

ADMISSIONS DEADLINES

Priority deadline: February 15

Final deadline: April 1

Program website: <http://www.columbia.edu/cu/climatesociety/>

MISSION

The 12-month M.A. in climate and society trains professionals and academics to understand and cope with the impacts of climate variability and climate change on society and the environment. This rigorous program emphasizes the problems of developing societies. Students complete the program in three semesters: autumn, spring and summer.

Columbia is at the forefront of research on climate and climate applications, and is supported by an extensive network of research units and faculty. Drawing on the educational and research facilities of Columbia University, the M.A. in climate and society combines elements of established programs in earth sciences, earth engineering, international relations, political science, sociology and economics with unique classes in interdisciplinary applications specially designed for the program's students.

A set of tailor-made core courses provide a scientific basis for inquiry and stress interdisciplinary problem solving.

At the end of 12 intensive and rewarding months, graduates are prepared to address environmental issues from positions in government, business, teaching and non-governmental organizations. Others continue their academic careers in the social or natural sciences.

ADMISSION REQUIREMENTS:

- A completed bachelor's degree in physical sciences, engineering, social sciences, or planning and policy studies
- Work experience in a related field is considered desirable
- The General Test of the Graduate Record Examination (GRE) is required. Students who live in countries where the GRE test is not available must include a note requesting a waiver for the exam.
- The Test of English as a Foreign Language (TOEFL) or International English Language Testing System (IELTS) exam is required for non-native English speakers. Students who have completed their bachelor's degree in a country where English is the primary language may have this requirement waived.

Note: Earlier submission of applications is encouraged for full consideration for financial aid.

PROGRAM REQUIREMENTS

This is a 12-month program. Students begin study as a cohort in the fall semester.

To provide a common set of skills and a shared professional working knowledge, there is a significant component of core courses.

All students in the program take part in the core courses. Electives are chosen in consultation with an academic adviser. All students participate in the summer seminar and have a choice between a local internship and a thesis. Thirty credits are required for the M.A.

CORE COURSES

W4400: Dynamics of Climate Variability and Change (3 credits)	W4404: Regional Climate and Climate Impacts (3 credits)
W4401: Quantitative Models of Climate-Sensitive Natural and Human Systems (4 credits)	A professional development seminar

G4403: Managing Climate Variability and Adapting to Climate Change; (two-semester course, 6 credits total)	A choice between a summer internship or research thesis
Summer Seminar	

POSSIBLE ELECTIVES

Students have a wide variety of electives from which to choose; below are just a few. After consulting with the faculty adviser, each student selects one social science elective in the fall semester and three electives from any relevant discipline in the spring semester.

W4022 Political Ecology Anthropology	W4204 The Anthropology of Science Anthropology
W4625 Economics of the Environment Economics	U6230 Economics of Sustainable Development Economics
INAF U4729 Alternative Energy Resources International Affairs	W4100 Management and Development of Water Systems Earth and Environmental Engineering
E6240 Physical Hydrology Earth and Environmental Engineering	G6921 Atmospheric Dynamics Earth and Environmental Sciences
W4030 Climatic Change Earth and Environmental Sciences	W4050 Global Assessment and Monitoring Using Remote Sensing Earth and Environmental Sciences
W4051 Advanced Applications of Remote Sensing and Image Processing Earth and Environmental Sciences	W4835 Wetlands and Climate Change Earth and Environmental Sciences
W4924 Introduction to Atmospheric Chemistry Earth and Environmental Sciences	W4925 Principles of Physical Oceanography Earth and Environmental Sciences
E6212 Carbon Sequestration Earth and Environmental Engineering	W4060 Invasion Biology Ecology, Evolution and Environmental Biology
G4101 Tropical Field Ecology Ecology, Evolution and Environmental Biology	G4127 Disease Ecology and Conservation Ecology, Evolution and Environmental Biology
P9317 Case Studies in Risk Assessment and Environmental Policy Environmental Health Sciences	P9320 Water and Infectious Diseases Environmental Health Sciences
W4582 Looking at Nature History	U6243 International Relations of the Environment International Affairs
U6240 Environmental Science for Sustainable Development International Affairs	U6827 Project Management for Economic and Political Development International Affairs
U8143 Local Level Development International Affairs	U6235 Climate Change, Rights, and Development International Affairs
W4285 Multidisciplinary Approaches to Human Decision Making Psychology	U6042 Energy, Business, and Economic Development International Affairs
L6242 Environmental Law Law School	L6038 Climate Change Law Law School
INAF U6259 Adaptation to Climate Change	

ASSOCIATED FACULTY

Tony Barnston, Lead Forecaster, IRI

Wallace S. Broecker, Newberry Professor of Earth
and Environmental Sciences

Mark A. Cane, Director of M.A. Climate and Society and G. Unger Vetlesen Professor of Earth and Climate Sciences

Steven Cohen, Executive Director, The Earth Institute; Professor in the Practice of Public Affairs; Director, Master of Public Administration Program in Environmental Science and Policy & Energy and Environmental Policy Concentration, School of International and Public Affairs; Director, Master of Science in Sustainability Management, School of Continuing Education

Peter B. deMenocal, Professor, Department of Earth and Environmental Sciences

Anthony D. Del Genio, Physical Scientist, Goddard Institute for Space Studies; Adjunct Professor, Earth and Environmental Sciences

Alessandra Giannini, Research Scientist, IRI; Adjunct Associate Professor, Earth and Environmental Sciences

Lisa M. Goddard, Research Scientist, Forecasting and Prediction Research, IRI; Adjunct Associate Professor, Department of Earth and Environmental Sciences

Upmanu Lall, Alan and Carol Silberstein Professor of Earth and Environmental Engineering and of Civil Engineering and Engineering Mechanics

Douglas G. Martinson, Lamont Research Professor, Climate Modeling and Diagnostics Groups, Lamont-Doherty Earth Observatory; Adjunct Professor, Earth and Environmental Sciences

Vijay Modi, Professor, Department of Mechanical Engineering

John C. Mutter, Professor of Earth and Environmental Sciences and of International and Public Affairs

Benjamin Orlove, Professor, Department of International and Public Affairs

Dorothy M. Peteet, Senior Research Scientist, NASA/ Goddard Institute for Space Studies/Lamont-Doherty Earth Observatory; Adjunct Professor, Earth and Environmental Sciences

David H. Rind, Adjunct Professor Emeritus, Earth and Environmental Sciences
Andrew W. Robertson, Research Scientist, IRI; Lecturer, Earth and Environmental Sciences

Cynthia Rosenzweig, Research Scientist at the Goddard Institute for Space Studies

Christopher Small, Lamont Research Professor, Marine Geology and Geophysics, Lamont-Doherty Earth Observatory; Adjunct Professor, Earth and Environmental Sciences

Shiv Someshwar, Research Scientist, IRI

Awash Teklehaimonot, Senior Staff member of the World Health Organization

Mingfang Ting, Lamont Research Professor, Lamont-Doherty Earth Observatory; Adjunct Professor, Earth and Environmental Sciences

M.P.H. in Environmental Health Sciences

Tomás R. Guilarte, Department Chair: trguilarte@columbia.edu, (212) 305-3959

Greg Freyer, Program Director of Educational Affairs: gaf1@columbia.edu, (212) 342-0457

ADMISSION DEADLINES

Early decision consideration is December 1, 2011

Final deadline is Jan 15, 2012

Program website: <http://www.mailman.hs.columbia.edu/ehs/index.html>

Environmental health sciences (EHS) is a rapidly expanding field that requires a broad range of basic and applied scientific skills. The M.P.H. in environmental health sciences is designed to prepare students for employment in settings concerned with environmental and occupational exposures to chemical and physical agents. Research activities of the faculty aim to generate scientific data to serve as the underpinnings of environmental policy decisions. Because EHS is a broad field, students choose a concentration by enrolling in one of the following tracks: environmental and molecular epidemiology, environmental and molecular

toxicology, environmental policy or global health. Each of these tracks considers national, international and global environmental policy issues.

Our students find employment in varied settings including chemical and pharmaceutical industries, federal or local environmental protection agencies, domestic and international health departments, hospitals, environmental consulting firms, international organizations and public interest groups. Some of our students also go on to pursue doctoral and other advanced degree programs.

ADMISSION REQUIREMENTS

- Mailman School of Public Health requirement: One year of math (algebra or calculus)
- One year of undergraduate biology
- One year of general and organic chemistry (exception: policy track)

Note: Qualified students who demonstrate high potential but are lacking required science coursework will be considered on a case-by-case basis and will be expected to address the deficiency through additional coursework.

PROGRAM REQUIREMENTS

Course requirements for the M.P.H. vary among tracks. All students are expected to have a basic understanding of environmental health and therefore some courses are taken by essentially all students. For example, students interested in environmental and molecular epidemiology are expected to take Fundamentals of Toxicology and additional requirements in epidemiology and biostatistics; those pursuing the environmental and molecular toxicology track take classes in toxicology and then have the flexibility to take appropriate electives in molecular epidemiology or genetics. The policy track is a unique program that features a summer-long practicum experience. Policy track students take courses that provide them with the scientific and policy-analytic background necessary to develop sound environmental policies. Finally, students in the global health track are required to complete a six-course global public health-specific core in addition to the general departmental requirements. Some flexibility in required courses may be allowed depending upon each student's background and career goals.

For a closer review of the coursework for each track, please view the program website:

<http://www.mailman.hs.columbia.edu/academic-departments/environmental-health/academic-programs/mp-program>

PRACTICUM REQUIREMENT

All students in the department are required to fulfill a practicum experience. The practicum experience varies from laboratory research to governmental agency involvement to relevant summer or part-time corporate or interest group employment. Global health track students in the Department must carry out a structured overseas practicum project. Students in the environmental policy track complete a structured practicum/capstone during the summer between their first and second year.

CAPSTONE REQUIREMENT

The capstone requirement in EHS is satisfied by either writing a master's essay or successfully completing P9300: Topics in Environmental Health Sciences. However, the master's essay is required for students in the global health track. Completion of a master's essay is also strongly recommended for students who are considering a doctoral degree.

CORE COURSES

All M.P.H. students take the following core courses:

- P6104 Introduction to Biostatistics¹
- P6300 Environmental Health Sciences
- P6400 Principles of Epidemiology I
- P6530 Issues and Approaches in Health Policy and Management

¹ The Department recommends that all EHS students take the placement exam for P6104. Students may only take P6103 if they do not pass the advanced placement exam for P6104.

- P6700 Introduction to Sociomedical Sciences

OTHER REQUIRED COURSES AND POSSIBLE ELECTIVES

For additional course information, please select environmental health sciences from the course description drop-down menu: <http://www.mailman.columbia.edu/academics/courses>

Course Number	Environmental Sciences Required Courses and Relevant Electives
P6300	Environmental Health Sciences
P6301	Environmental Health Science Applications
P6385	Principles of Genetics and the Environment I
P6390	Tutorial in Environmental Health Sciences
P8304	Public Health Impacts of Climate Change
P8306	Occupational and Environmental Hygiene
P8307	Molecular Epidemiology
P8308	Molecular Toxicology
P8309	Air Pollution
P8311	Basic and Applied Nutritional Science: Emerging Global Issues
P8312	Fundamentals of Toxicology
P8313	Toxicokinetics
P8317	Frameworks for Environmental Policy
P8318	Science Basic for Environmental Health Policy
P8319	Biological Markers of Chemical Exposure
P8320	Applied Environmental and Industrial Hygiene
P8325	Risk Assessment, Communication and Management
P8371	GIS for Public Health
P8390	Tutorial Environmental Health Sciences
P8475	Topics in Emerging Infectious Diseases
P9300	Topics in Environmental Health Sciences
P9303	Hazardous Waste and Public Health
P9317	Case Studies in Risk Assessment and Environmental Policy
P9320	Water and Infectious Disease
P9350	Global Master's Essay I
P9351	Global Master's Essay II
P9360	Master's Essay: Critical Literature Review
P9361	Research Master's Essay I in Environmental Health Sciences
P9362	Research Master's Essay II in Environmental Health Sciences
P9370	Journal Club in Environmental Health Sciences
P9390	Tutorial in Environmental Health Sciences

EHS FACULTY AND AREAS OF INTEREST

Greg Freyer, Ph.D.—DNA repair, cancer

Mary Gamble, Ph.D.—nutritional biochemistry, epigenetics, metal toxicology

Joseph Graziano, Ph.D.—metal toxicology and metabolism

Tomás R. Guilarte, Ph.D.— mechanism based neurotoxicology, neuroscience

Julie Herbstman, PhD—prenatal exposure to environmental chemicals, endocrine-disruptors, effects on child neurodevelopment

Darby Jack, Ph.D.—environmental health policy, environmental health in developing countries

Patrick Kinney, Sc.D.—respiratory disease, climate change and health

Frederica Perera, Dr.P.H.—cancer, children's health

Matthew Perzanowski, Ph.D.—respiratory disease, asthma and allergens

Regina Santella, Ph.D.—cancer, biomarkers of chemical exposure

Jeffrey Shaman, Ph.D.—climate dynamics, tropical meteorology, the hydrologic cycle, medical entomology, mosquito ecology, infectious disease, and climate and disease forecast

Jing Shen, M.D., Ph.D.—cancer

Deliang Tang, Dr.P.H.—cancer

Robin Whyatt, Dr.P.H.—pesticides, children's health, reproductive health

AFFILIATED FACULTY

Muhammad Akram, Ph.D. – Environmental health and safety

Leslie Andrews, Dr.P.H.—Occupational and Environmental Hygiene

Paul Brandt-Rauf, Dr.P.H.—occupational and environmental carcinogenesis

David Brenner, Ph.D. —radiation, health physics

Ginger Chew, Sc.D.—indoor biogenic agents, respiratory illness, asthma

Dickson Despommier, Ph.D.—infectious disease, ecology

Herman Ellis, M.D.—occupational medicine, workers compensation determination, delivery of public health services

Peter Esser, Ph.D.—cancer, radiation, fiber toxicology

Tom Hei, Ph.D.—cancer, radiation, fiber toxicology

Alan Jeffrey, Ph. D.—DNA damage, cancer, exposure estimation

Norman Kleiman, Ph.D.—DNA damage and repair, oxidative stress, cataracts

Kim Knowlton, Dr.P.H.—public health impacts of climate change

Sylvie Le Blancq, Ph.D.—parasites biology, infectious diseases

Robert Lewy, M.P.H.—radiation and environmental health safety, occupational and student health

Howard Lieberman, Ph.D.—radiation biology

Mary Matsui, Ph.D.—Dermatology

Rachel Miller, M.D.—respiratory disease

Edward Nickoloff, Sc.D.—radiation physics, medical imaging

Manuela Orjuela, M.D.—cancer, retinoblastoma, pediatrics

Marco Pedone, Dr.P.H.—hazardous site remediation, abatement, decontamination, safety engineering and design

Neil Schluger, M.D.—respiratory disease

Bradford H. Sewell, J.D., M.P.H.—environmental law and policy

John Whysner, M.D., Ph.D.—toxicology, carcinogenesis

Gabriele Windgasse, Dr.P.H.—occupational safety, health risk assessments

Marco Zaider, Ph.D.—brachytherapy, radiation oncology, microdosimetry, biostatistics

Yu-Jing Zhang, M.D.—cancer

For a review of EHS faculty members, please visit the department website:
<http://www.mailman.columbia.edu/our-faculty/faculty-directory?dept=Environm>

M.P.A. in Environmental Science and Policy

Steven A. Cohen, Program Director: sc32@columbia.edu, (212) 854-4445

Louise A. Rosen, Associate Director: lar46@columbia.edu, (212) 854-0643

Sara Tjossem, Associate Director: sft2101@columbia.edu, (212) 854-0424

Sarah Tweedie, Assistant Director: st2745@columbia.edu, (212) 851-0261

ADMISSIONS DEADLINES

Early admission deadline: November 1

Admission with fellowship consideration deadline: January 15

Regular admission deadline: February 15

Program website: <http://www.columbia.edu/cu/mpaenvironment/>

The Master of Public Administration in Environmental Science and Policy (M.P.A. E.S.P.) trains public managers and policymakers to apply innovative, systems-based thinking to environmental issues. The program challenges students to think systemically and act pragmatically through a high-quality graduate program in management and policy analysis that emphasizes practical skills and is enriched by ecological and planetary science.

Graduates are creating a new profession of earth systems problem-solvers—individuals who are prepared for leadership positions in local, state and federal government agencies, as well as in nonprofit organizations and the environmental divisions of private corporations. They are also well-suited for designing cost-effective programs and implementing policies. Most importantly, a deep understanding of earth systems guides their work, allowing them to craft the kinds of solutions necessary for our increasingly complex environmental problems.

This 12-month program takes place at Columbia University's Morningside Heights campus in New York City in coordination with the Lamont-Doherty Earth Observatory.

ADMISSION REQUIREMENTS

- Bachelor's degree or evidence of equivalent preparation
- Background in biology, chemistry and economics

PROGRAM REQUIREMENTS

Students enrolled in the M.P.A. in Environmental Science and Policy Program are awarded a Master of Public Administration degree from Columbia University's School of International and Public Affairs after a single year of intensive study. The curriculum, outlined below, provides a management and policy analytic core and a natural and social science earth systems concentration. Students complete a total of 54 credits over three semesters.

The intensive course of study begins in late May or early June with an orientation program. The summer term begins immediately afterward, followed by the fall and spring terms. The summer term features the fundamental science of earth systems and conservation biology, as well as an introduction to environmental policy and management issues. In the fall and spring, students delve deeper into the formulation and management of public policy. The physical and social sciences are linked throughout the program so that students gain an integrated understanding of Earth systems.

REQUIRED COURSES:

ENVP U6234 Sustainability Management (3 credits)	ENVP U8201 Financial Management (3 credits)
ENVP U8213-U8216 Microeconomics and Policy Analysis I and II (3 credits)	ENVP U6310 Quantitative Techniques and Systems Analysis in Policymaking and Management (3 credits)

ENVP U6220 Environmental Chemistry (2 credits)	ENVP U6221 Risk Assessment and Environmental Toxicology (2 credits)
ENVP U6115 Climatology (2 credits)	ENVP U6116 Hydrology (2 credits)
ENVP U6111 Principles of Ecology (2 credits)	ENVP U6112 Urban Ecology (2 credits)
ENVP U6225 Ethics, Values and Justice (3 credits)	ENVP U6241 Earth Systems and Environmental Politics, Policy, and Management (3 credits)
ENVP U9229 The Workshop in Applied Earth Systems Management I (3 credits)	ENVP U9230 The Workshop in Applied Earth Systems Management II (3 credits)
ENVP U9232 The Workshop in Applied Earth Systems Policy Analysis (6 credits)	

Recommended Courses (not required):

ENVP U6320 Political Context of Public and Private Management (3 credits)	ENVP U6230 The Economics of Sustainable Development (3 credits)
ENVP U6224 Environmental Data Analysis (3 credits)	

FACULTY

Howard N. Apsan, Adjunct Professor of Public Affairs

Kathy Callahan, Deputy Director for Research Management Lamont-Doherty Earth Observatory, Adjunct Lecturer, School of International and Public Affairs

Steven Cohen, Executive Director, The Earth Institute; Professor in the Practice of Public Affairs; Director, Master of Public Administration Program in Environmental Science and Policy & Energy and Environmental Policy Concentration, School of International and Public Affairs; Director, Master of Science in Sustainability Management, School of Continuing Education

Nancy Degnan, Executive Director of the Center for Environmental Research and Conservation (CERC) and Lecturer, School of International and Public Affairs

Adela J. Gondek, Lecturer in the Discipline of International and Public Affairs, School of International and Public Affairs (SIPA).

Juerg Matter, Assistant Professor; Science Coordinator, Master of Public Administration in Environmental Science and Policy, School of

International and Public Affairs and Lamont Associate Research Professor, Lamont-Doherty Earth Observatory

Michael Musso, Adjunct Lecturer, Master of Public Administration in Environmental Science and Policy, School of International and Public Affairs and Environmental Health Sciences, Mailman School of Public Health

Suresh Naidu, Assistant Professor, Master of Public Administration in Environmental Science and Policy and of International and Public Affairs and Economics, School of International and Public Affairs

Irene Nielson, Lecturer, School of International and Public Affairs, Columbia University

Matthew I. Palmer, Adjunct Faculty, Master of Public Administration in Environmental Science and Policy, School of International and Public Affairs; Lecturer and Director of Undergraduate Studies, Department of Ecology, Evolution and Environmental Biology

Michael Puma, Associate Research Scientist, Columbia University Center for Climate Systems Research, The Earth Institute

Louise A. Rosen, Director, Office of Academic and Research Programs, The Earth Institute; Associate Director and Adjunct Lecturer, Master of Science in Sustainability Management, School of Continuing Education; Associate Director, Master of Public Administration Program in Environmental Science and Policy, School of International and Public Affairs

Jason E. Smerdon, Adjunct Assistant Professor of Public Affairs, School of International and Public Affairs; Storke-Doherty Lecturer, Lamont-Doherty Earth Observatory and the Department of Earth and Environmental Sciences

Martha Stark, Adjunct Lecturer, Master of Public Administration in Environmental Science and Policy, School of International and Public Affairs
Gail Suchman, Adjunct Professor, School of International and Public Affairs

Sara Tjossem, Associate Director of Curriculum, M.P.A. in Environmental Science and Policy,

Senior Lecturer in Discipline of International and Public Affairs, School of International and Public Affairs

Bogdan Vasi, Assistant Professor of International and Public Affairs and Sociology

M.P.A. in Development Practice

Glenn Denning, Program Director: gd2147@columbia.edu
André Corrêa d'Almeida, Program Manager: ac3133@columbia.edu

ADMISSION DEADLINE

January 6, 2012, for fall admission only. All materials, including GRE test scores and letters of reference, must be received by SIPA's Office of Admissions by this date. Applications completed after this date will be reviewed on a space-available basis only.

Previous work experience in a low or middle income country setting is required. Most successful candidates will have a minimum of two years of relevant work experience.

Program website: www.sipa.columbia.edu/mpa-dp

M.P.A. IN DEVELOPMENT PRACTICE

The M.P.A. in development practice (M.P.A. D.P.) trains current and aspiring practitioners to understand, develop and implement integrated approaches to sustainable development. Drawing on the educational and research facilities of Columbia University, the M.P.A. D.P. emphasizes practical knowledge and skills in food systems, public health, education, infrastructure, environmental sustainability, business enterprise, economics and management. During the 22-month program, these areas are covered through a combination of formal courses, seminars, special events and internship opportunities. Direct, hands-on field experience in all areas is obtained through the mid-program field internship.

PRACTITIONERS OF A CROSS-DISCIPLINARY APPROACH

Drawing upon The Earth Institute's rich scientific expertise and SIPA's outstanding international record in public policy research and education, the M.P.A. D.P. curriculum trains students to integrate the many fields of development, including food systems, public health, education, infrastructure, environmental sustainability and business enterprise. Technical knowledge in each sector is underscored by practical, crosscutting skills such as project design and management, monitoring and evaluation, budgeting and financial management, decision-making, and human resource management.

PROGRAM REQUIREMENTS

All students in the program take part in the core and elective courses, complemented by a three-month structured field internship that emphasizes integrated approaches to sustainable development.

The four main components of the curriculum are:

1. **Core and Elective Courses:** Students must take a minimum of 45 credits in the core and elective courses of health sciences, natural sciences and engineering, social sciences, and management over four semesters. Core courses are determined annually by the program director. Elective courses must relate to the program goals and also require the approval of the program director.
2. **Global Course:** Students must take the three-point Global Classroom: Integrated Approaches to Sustainable Development Practice course. This is an information technology-based interactive course that fosters cross-border and cross-disciplinary collaboration and allows students and teachers to participate in collective assignments and learning experiences.
3. **Language:** Student must take three or more credits of a foreign language, or demonstrate proficiency in a second language. Exempted students can take additional credits in a core or elective course or choose to learn another language.
4. **Field Internship:** Students undertake a three-month structured field internship during the summer between their first and second years of study. The internship will normally involve teams of students working on integrated development projects in low- or middle-income countries. All summer internships require the approval of the program director. Additional internships throughout the year are encouraged.

Students are also required to attend a one-week pre-master's program seminar called Getting Started, which takes place the week before general SIPA orientation.

CORE CURRICULUM:

- INAF U6043 Integrated Approaches to Sustainable Development
- SIPA U4040 Professional Development
- INAF U6827x Methods for Development Practice
- SIPA U6400 Economic Analysis for International and Public Affairs I
- SIPA U6401 Economic Analysis for International and Public Affairs II
- SIPA U6500 Quantitative Analysis I
- PUAF U6411 Global Food Systems
- PUAF U6413 Global Health Practice
- MECE E4210 Energy Infrastructure Planning
- SDEV U9240 Human Ecology and Sustainable Development
- PUAF U6260x or y Management for Development Professionals

CORE AND AFFILIATED FACULTY

Tony Barclay, President, Development Practitioners Forum; Adjunct Professor of Management for Development Professionals

André Corrêa d'Almeida, Program Manager, M.P.A. in Development Practice, School of International and Public Affairs and The Earth Institute

Glenn Denning, Professor of Professional Practice, School for International and Public Affairs; Program Director, M.P.A. in Development Practice, School of International and Public Affairs and The Earth Institute

Sara Minard, Associate Professor of Methods of Development Practice, Social Enterprise and Social

Entrepreneurship for Development, School of International and Public Affairs

Vijay Modi, Professor of Mechanical Engineering, School of Engineering and Applied Sciences
Cheryl Palm, Senior Research Scientist, International Research Institute for Climate and Society (IRI), Tropical Agriculture Program; Associate Director, Center on Globalization and Sustainable Development

Paul Pronyk, Director of Monitoring and Evaluation, Millennium Villages Project, Center for Global Health and Economic Development (CGHED), HIV/AIDS Technical Adviser, Millennium Villages Project, CGHED

Lucia Rodriguez, Director, Global MDP Secretariat,
The Earth Institute

Jeffrey D. Sachs, Director, The Earth Institute;
Quetelet Professor of Sustainable Development;
Professor, Health Policy and Management

Pedro Sanchez, Director, Tropical Agriculture and
Rural Environment Program, The Earth Institute;
Director, Millennium Villages Project, The Earth
Institute

Prabhjot Singh, Assistant Professor of International
and Public Affairs, SIPA

M.I.A./M.P.A. Energy and Environment Concentration (EE)

Steven A. Cohen, EE Concentration Director and Environment Track Director: sc32@columbia.edu,
(212) 854-4445

Ellen Morris, Energy Tracks Director: em2507@columbia.edu, (973) 748-4669

ADMISSION DEADLINE: January 5, 2012

Program website: <http://sipa.columbia.edu/academics/concentrations/eep/index.html>

The energy and environment (EE) concentration of the Master's in Public Administration (M.P.A.) or Master's in International Affairs (M.I.A.) at the School of International and Public Affairs (SIPA) provides students with the analytical tools and substantive knowledge required to address the key economic, environmental, and energy challenges of the 21st century and to pursue leadership careers in the fields of energy and environment in the public, private or nonprofit sectors.

While shortages of many finite natural resources such as water and food must be addressed to create a truly sustainable economy, no single resource issue is more problematic than the need for energy to power the developed and developing nations of the world. Because energy and the environment are intimately connected to society's productivity and sustainability, our ability to properly protect, develop and manage our natural assets requires well-trained leaders. Energy and environmental leaders need a solid background in earth sciences, politics, management, economics, quantitative techniques, business, enterprise development, market and regulatory structures, and policy analysis. EE incorporates this interdisciplinary approach to the study of energy and environmental issues so its graduates are well-equipped to prove themselves as the leaders and policy-makers of their generation.

There are three tracks within EE: the international energy policy and management track, the sustainable energy policy track, and the environmental policy and management track. The international energy management and policy track focuses on energy development and production, particularly large-scale infrastructure projects that involve extensive interaction between the private and public sectors for energy management and policy. The sustainable energy policy track, which was launched in the Fall 2010, focuses on the national and international policies and practices aimed at ensuring a sustainable energy future, with a particular focus on policies and practices that support small-scale energy production and enterprise development. The environmental policy track focuses on the policy and management knowledge required to address the most pressing environmental sustainability issues. Each track consists of a carefully developed sequence of courses, including one course from each of the three tracks. Given the complex and multifaceted nature of EE, students have some flexibility to design the track to include courses that will be tailored to their particular interest. Students are encouraged to meet with one of the co-directors of the tracks to discuss the various options.

ADMISSION REQUIREMENTS FOR THE M.P.A. / M.I.A. AT SIPA:

- Bachelor's degree or evidence of equivalent preparation
- At least two prior courses in economics (macro and microeconomics)
- The study of at least one foreign language (for M.I.A. applicants only)

PROGRAM REQUIREMENTS

The energy and environment concentration (EE) ensures that all students gain the essential background and tools for energy and environmental analysis, while offering them the flexibility to choose a track. Students must fulfill the requirements for an M.I.A. or an M.P.A., including a capstone workshop to gain hands-on experience in environmental or energy policy analysis by working with clients from industry or the public sector. Students have substantial opportunity to be involved in choosing a workshop based on their interest in an issue and client

agency. Students in the M.I.A. and M.P.A. programs are required to take a year-long course in international economics, two international politics courses (Conceptual Foundations of International Politics and one course in interstate relations), and one-semester courses in statistics, management and financial management. M.I.A. candidates must also fulfill a foreign language requirement. In addition to fulfilling M.I.A. or M.P.A. requirements, students in EE must also complete the following concentration requirements:

INTERNSHIPS

All SIPA students are required to fulfill a minimum of three credits through an internship. Internships may be completed during the academic year or the summer between the first and second years. Internships provide an opportunity not only to test your value in the job market, but also to explore and better define areas of professional interest. Students should commence investigating internship possibilities through the Office of Career Services (OCS) as soon as possible, and may also wish to consult the energy and environment alumni list, faculty and the program coordinator for further suggestions.

Environmental Policy and Management Track

Steven A. Cohen, Track Director: sc32@columbia.edu, (212) 854-4445

Environmental issues arise today in almost every policy field, and this track provides an unmatched setting in which to undertake professional study in environmental policy. This track is designed for students interested in national and international environmental policy, law, economics, journalism and business. This interdisciplinary program provides a rigorous academic background and practical experience in environmental policy. In classes and outside activities, environmental policy and management students mingle with future environmental professionals pursuing degrees in business, conservation biology, earth and environmental engineering, law, and Columbia's innovative program in environmental journalism. Given the diversity of backgrounds and career goals of program participants, students learn from each other as well as from faculty, and build life-long connections that enrich their careers.

ENVIRONMENTAL POLICY AND MANAGEMENT REQUIREMENTS

This track requires 15 credits consisting of five three-point courses: one required course, two environment policy courses, one environmental economics and finance course, and one energy course. All energy and environment students must take an energy, environmental or other approved capstone workshop in their final semester.

Environment Track Concentration Requirement:

- SDEV U6240 Environmental Science for Sustainable Development (3 credits)

Environment Policy Electives (at least 2 of the following or another approved course):

- INAF U4727 Environmental Politics and Policy Management (3 credits)
- INAF U6243 International Relations of the Environment (3 credits)
- ENVP U6320 Political Context of Public and Private Management (3 credits)
- INAF U6065 Political Economics and Environmental Policy (3 credits)
- INAF U4722 Introduction to Environmental Law (3 credits)
- INAF U6234 Public Opinion, Energy and Environment (3 credits)
- INAF U8537 Climate Change Policy (3 credits)
- INAF U8537 Climate Change Law (3 credits)

Environment Economics and Finance Elective (one of the following or another approved course)

- ENVP U6250 Poverty, Inequality and the Environment (3 credits)
- INAF U6068 Economic Analysis of Environmental Policies (3 credits)
- INAF U6056 Political Economy and the Environment (3 credits)
- SUMA K4195 Green Accounting (3 credits)
- INAF U6235 Environmental Finance (3 credits)
- INAF U6056 Political Economics and Environmental Policy (3 credits)
- SUMA K4197 Financing the Green Economy (3 credits)

Energy Elective (one of the following or another approved course)

- INAF U6242 Energy Policy (3 credits)
- INAF U8778 Urban Energy Systems and Policy (3 credits)

International Energy Management and Policy Track

Ellen Morris, Track Director: em2507@columbia.edu

This track is designed for students interested in international energy resource management and related public policy issues. The curriculum provides a thorough understanding of energy industry fundamentals, including the structure and operation of international energy systems and of the business organizations involved in producing, transporting and marketing energy products. It examines economic, environmental and social policies applicable to energy development and consumption; political and strategic issues arising from the unequal distribution of global energy resources; and the impact of technological change on the future role of energy in the global economy. Electives permit students to pursue detailed study in more specific areas such as energy project finance, petroleum markets and trading, electricity markets, alternative energy technologies, the geopolitics of oil, and marine transportation systems.

INTERNATIONAL ENERGY MANAGEMENT AND POLICY REQUIREMENTS

This track requires 15 credits, consisting of five three-point courses: three required courses, one additional energy elective and one environment elective. In addition to the SIPA core, IEMP students must take Economic Analysis for International Affairs, Accounting and Corporate Finance. All energy and environment students must take energy, environmental or other approved capstone workshop in their final semester.

IEMP Track Concentration Requirements

- INAF U6060 International Energy Systems and Business Structures (3 credits).
- INAF U6031 Corporate Finance (3 credits)
- INAF U6065 Economics of Energy (3 credits)

IEMP Track Electives (select at least one of the following):

- EAIA W4200 Alternative Energy Resources (3 credits)
- INAF U6680 U.S. Energy Security: Geopolitics of Oil and Gas (3 credits)
- INAF U6325 Energy Modeling (3 credits)
- INAF U8562 Maritime Transportation, Law and Public Policy (3 credits)
- INAF U6057 Electricity Markets (3 credits)
- INAF U6042 Energy Business and Economic Development (3 credits)
- INAF U6080 Energy Industry in the Middle East and Africa (3 credits)
- INAF U6082 Energy Industry in East Asia (3 credits)
- INAF U6242 Energy Policy (3 credits)
- INAF U8778 Urban Energy Systems and Policy (3 credits)
- INAF U6040 Energy Project Finance and Valuation (3 credits)
- INAF U6054 Petroleum Markets and Trading (3 credits)
- INAF U6048 Risk and Scenario Analysis (3 credits)
- INAF U6135 Renewable Energy Project Development and Finance (3 credits)
- INAF U6062 Energy Markets and Innovation (3 credits)
- INAF U6061 International Energy Policy: Growth, Energy, Technology and Environment (3 credits)
- INAF U6064 Geopolitics of Natural Gas (3 credits)

Environment Elective (one of the following or another approved course):

- INAFU6243 International Relations of the Environment (3 credits)
- INAFU6056y Political Economics and Environmental Policy (3 credits)

Sustainable Energy Policy Track

Ellen Morris, Track Director: em2507@columbia.edu

The sustainable energy track is designed for students interested in renewable energy, energy efficiency and the relationship of energy to sustainable economic development. The curriculum provides a thorough understanding of the challenges facing the formulation and implementation of sustainable energy policy, including the connection of energy systems to business and political structures. This track permits the study of sustainable energy policy on a global, national and local scale. It permits the study of urban energy systems, alternative energy resources, governmental energy policy, energy industry fundamentals and the business organizations involved in all aspects of energy production, distribution and consumption. Courses are available to permit students to pursue detailed study in sustainable energy policy, energy and development, energy law, climate policy, carbon management, political and strategic issues arising from the unequal distribution of global energy resources, and the environmental impacts of energy use and development.

SUSTAINABLE ENERGY POLICY TRACK REQUIREMENTS

This track requires 15 credits consisting of five three-point courses: two required courses, two additional energy courses and one environment course. Sustainable energy policy students must satisfy their SIPA economics requirement with Economic Analysis for International Affairs (U6400/U6401). All energy and environment students must take energy, environmental or other approved capstone workshop in their final semester.

Sustainable Energy Policy Track Concentration Requirements

- INAF U6065 Economics of Energy (3 credits)
- INAF U6242 Energy Policy (3 credits)

Sustainable Energy Policy Electives (select at least two of the following):

- EAIA W4200 Alternative Energy Resources (3 credits)
- INAF U6042 Energy, Business and Economic Development (3 credits)
- INAF U6061 International Energy Policy: Growth, Energy, Technology and Environment (3 credits)
- INAF U6080 Energy Industry in the Middle East and Africa (3 credits)
- INAF U6082 Energy Industry in East Asia (3 credits)
- INAF U8537 Climate Change Policy (3 credits)
- SDEV U6235 Environmental Finance (3 credits)
- INAF U6234 Public Opinion, Energy and Environment (3 credits)
- INAF U6325 Energy Modeling (3 credits)
- SUMA K4260 Dynamics of Energy Efficiency (3 credits)
- SUMA K4197 Financing the Green Economy (3 credits)
- INAF U6062 Energy: Markets and Innovation (3 credits)
- INAF U6135 Renewable Energy Project Development and Finance (3 credits)

Environment Elective (one of the following or another approved course)

- ENVP U6056 Political Economic and Environmental Policy (3 credits)
- INAF U6243 International Relations of the Environment (3 credits)

FACULTY

Daniel Ahn, Adjunct Assistant Professor of International and Public Affairs, SIPA

Scott Barrett, Lenfest-Earth Institute Professor of Natural Resource Economics, SIPA

Travis Bradford, Adjunct Professor of International and Public Affairs, SIPA

Albert Bressand, Professor of Professional Practice of International and Public Affairs, SIPA

Mark Brownstein, Adjunct Professor of International and Public Affairs, SIPA

Louise Burke, Adjunct Professor of International and Public Affairs, SIPA

Jonathan Chanis, Adjunct Associate Professor of International and Public Affairs, SIPA

Steven Cohen, Executive Director, The Earth Institute; Professor in the Practice of Public Affairs; Director, Master of Public Administration Program in Environmental Science and Policy & Energy and Environmental Policy Concentration, School of International and Public Affairs; Director, Master of Science in Sustainability Management, School of Continuing Education

Olle Folke, Assistant Professor of International and Public Affairs, SIPA

Peter Fusaro, Adjunct Professor of International and Public Affairs, SIPA

Joshua R. Ginsberg, Adjunct Professor of International and Public Affairs, SIPA

AJ Goulding, Adjunct Assistant Professor of International and Public Affairs, SIPA

Antoine Halff, Adjunct Professor of International and Public Affairs, SIPA

Klaus Jacob, Adjunct Professor of International and Public Affairs; Special Research Scientist, Lamont-Doherty Earth Observatory

Urvashi Kaul, Adjunct Assistant Professor of International and Public Affairs

Linda Krueger, Adjunct Professor of International and Public Affairs, SIPA

Phillip J. LaRocco, Adjunct Professor of International and Public Affairs, SIPA

Marc Levy, Adjunct Professor of International and Public Affairs, SIPA, Deputy Director, Center for International Earth Science Information Network

Samantha MacBride, Adjunct Assistant Professor of International and Public Affairs, SIPA

Sergej Mahnovski, Adjunct Professor of International and Public Affairs, SIPA

John McArthur, Adjunct Assistant Professor of International and Public Affairs, SIPA

Ellen Morris, Adjunct Professor of International and Public Affairs, Director of the International Energy

Management and Policy track and the Sustainable Energy Policy track, SIPA

Roy Nersesian, Associate Professor of Professional Practice of International and Public Affairs, SIPA

Ben Orlove, Professor of International and Public Affairs, SIPA

Manuel Pihno, Visiting Professor of International and Public Affairs, SIPA

Jeffrey Potent, Adjunct Professor of International and Public Affairs, SIPA

Neil Quartaro, Esq., Adjunct Associate Professor of International and Public Affairs, SIPA

Gina Rodolico, Adjunct Professor of International and Public Affairs, SIPA

Louise A. Rosen, Director, Office of Academic and Research Programs, The Earth Institute; Associate Director and Adjunct Lecturer, Master of Science in Sustainability Management, School of Continuing Education; Associate Director, Master of Public Administration Program in Environmental Science and Policy, School of International and Public Affairs

Wolfram Schlencker, Assistant Professor, International and Public Affairs and Economics, SIPA

Adam Shrier, Adjunct Professor of International and Public Affairs, SIPA

Gail Suchman, Adjunct Lecturer of International and Public Affairs, SIPA

Sara Tjossem, Senior Lecturer in Discipline of International and Public Affairs, School of International and Public Affairs

Bogdan Vasi, Assistant Professor of International and Public Affairs and Sociology, SIPA

Gernot Wagner, Adjunct Assistant Professor of International and Public Affairs, SIPA

Philip Weinberg, Adjunct Professor of International and Public Affairs, SIPA

DOCTORAL PROGRAMS

Ph.D. Sustainable Development

John Mutter, Director of Graduate Studies: jcm7@columbia.edu

Jeffrey D. Sachs, Program Co-Director: sachs@columbia.edu

Joseph Stiglitz, Program Co-Director: jes322@columbia.edu

Mona Khalidi, Assistant Director of Graduate Studies: mk2388@columbia.edu

ADMISSION DEADLINE: December 15

Program website: <http://www.sipa.columbia.edu/phd/index.html>

The interdisciplinary Ph.D. in sustainable development is designed to train future researchers, university teachers and world leaders in the social and natural science disciplines germane to sustainable development. By combining elements of a traditional graduate education in social science—particularly economics—with graduate level training in the natural sciences, the program's graduates will be uniquely situated to undertake serious quantitative analytical research and policy assessments with the goal of sustainable development.

There are a wide variety of potential employers for the program's graduates. Many graduates pursue academic careers in interdisciplinary graduate and undergraduate programs with foci that could include policy and the environment, development economics, and energy policy as well as in the more traditional disciplines. Others choose nonacademic positions, taking leadership roles in government agencies in the United States and throughout the world; working on environmental protection and sustainable development programs as well as in a variety of international and non-governmental organizations such as the UN, the IMF and the World Bank; in private firms engaged in large-scale development projects; or in consulting firms analyzing development issues for private and public clients.

Any additional questions about the program can be emailed to Mona Khalidi, Assistant Director of Graduate Studies, at: sipa_phd@columbia.edu.

ADMISSION REQUIREMENTS

- Four semesters of college-level social science including two semesters of economics and six semesters of college-level math and science including two semesters of college-level calculus
- Submission of scores from the GRE General test
- The English Placement Test and submission of TOEFL scores (only for non-native English speakers)

PROGRAM REQUIREMENTS

The curriculum consists of ten core courses including three semesters of economics, three quantitative methods (econometrics) courses, Environmental Economics, Human Ecology, Politics of Sustainable Development, Environmental Science for Sustainable Development, and Science and Technology Policy for Development. Students must also complete two social science electives and a coherent sequence of four natural science courses. Students must complete 60 credits with a B+ average (no grade can be less than B-). In addition to this coursework, students will participate in mandatory integrative seminars, complete an M.A. thesis reviewed by advisors before the end of the second year, successfully complete the M. Phil. Qualifying Exams and submit the dissertation prospectus before the end of the fourth year, and write a Ph.D. dissertation. Students are expected to complete their studies in five years. A sixth year is permitted but normally cannot be funded by the School.

THE PH.D. DISSERTATION

The Ph.D. dissertation will be on a topic in sustainable development. Social science research toward the degree will be matched with a deep understanding of physical and natural systems influencing economic development.

Students should possess at least two research tools before starting the dissertation portion of this program. Among these is an advanced understanding of quantitative methods, to be gained through the mandatory core courses. The other research tool should be appropriate to the student's dissertation work. In consultation with the student's academic advisers, this second tool could be a two-course sequence in GIS or other analytic modeling systems or a proficiency exam in a language other than English.

Students with a regional area of interest to their dissertation may wish to conduct research abroad, either for the collection of field data, for the use of archives, to improve language skills or to confer with local experts. In order to ensure that students complete the Ph.D. program without delay, it is preferred that they make use of summers to conduct such research. Students may not receive extended residence credit for study or research away from Columbia before the completion of all coursework requirements and comprehensive examinations.

TEACHING REQUIREMENTS

Students have to fulfill a teaching and research requirement by working six semesters as a teaching or research assistant as assigned by the program director. Students who secure external funding may reduce this requirement, but in all cases every student must teach at least two semesters.

FACULTY

Douglas Almond, Assistant Professor of International and Public Affairs and Economics

Lisa Anderson, James T. Shotwell Professor of International Relations

Scott Barrett, Professor of Natural Resource Economics

Guillermo Calvo, Professor of International and Public Affairs

Mark Cane, G. Unger Vetlesen Professor, Earth and Environmental Sciences and Professor of Applied Physics and Applied Mathematics, School of Engineering and Applied Sciences

Pierre Andre Chiappori, E. Rowan and Barbara Steinschneider Professor of Economics

John Coatsworth, Professor of International and Public Affairs and of History; Dean, School of International and Public Affairs; Interim Provost, Columbia University

Geoffrey Heal, Paul Garrett Professor of Public Policy and Business Responsibility, Business School

Macartan Humphreys, Associate Professor Political Science

Patrick Kinney, Professor of Environmental Health Sciences, Mailman School of Public Health

Klaus Lackner, Maurice Ewing and J. Lamar Worzel Professor of Geophysics

Upmanu Lall, Alan and Carol Silberstein Professor of Earth and Environmental Engineering and of Civil Engineering and Engineering Mechanics; Department Chair, Earth and Environmental Engineering

W. Bentley MacLeod, Professor of International and Public Affairs and Economics

Vijay Modi, Professor of Mechanical Engineering

John C. Mutter, Professor of Earth and Environmental Sciences and of International and Public Affairs; Director of Graduate Studies

Shahid Naeem, Professor of Ecology, Evolution and Environmental Biology

Jose Antonio Ocampo, Professor in the Professional Practice of International and Public Affairs

Arvind Panagariya, Jagdish Bhagwati Professor of Indian Political Economy, International and Public Affairs and of Economics

Christian Pop-Eleches, Assistant Professor International and Public Affairs, and Economics

Jeffrey D. Sachs, Director of The Earth Institute; Quetelet Professor of Sustainable Development; Professor of Health Policy and Management; Co-Director of PhD Program in Sustainable Development

Bernard Salanie, Professor of Economics

Bhaven Sampat, Assistant Professor of Health Policy and Management

Pedro Sanchez, Senior Research Scholar, Tropical Agriculture and Rural Environment Program, The Earth Institute

Wolfram Schlenker, Assistant Professor of International and Public Affairs, and Economics

Joseph E. Stiglitz, University Professor; Co-Director of PhD Program, SDEV

Miguel Urquiola, Assistant Professor of International and Public Affairs

Eric Verhoogen, Assistant Professor of International and Public Affairs, and Economics

Bogdan Vasi, Assistant Professor of International and Public Affairs And Sociology

Paige West, Assistant Professor of Anthropology, Barnard College

Ph.D. in Earth and Environmental Engineering

Marco J. Castaldi, Program Director: mc2352@columbia.edu, (212) 854-6390

Gary Hill, Program Director: gh2206@columbia.edu, (212) 854-2905

Dawn DelValle, Department Administrator: dd2264@columbia.edu, (212) 854-7065

ADMISSION DEADLINES

December 1 for fall admission

October 1 for spring admission

Program website: <http://www.engineering.columbia.edu/bulletin/dept/earth.php>

The Department of Earth and Environmental Engineering offers two doctoral degrees: the Eng.Sc.D. administered by the Fu Foundation School of Engineering and Applied Science and the Ph.D. administered by the Graduate School of Arts and Science. Qualifying examinations and all other intellectual and performance requirements for these degrees are the same. The scope includes the design and use of sensors for measurement at molecular scale; the understanding of surface, colloid, aqueous and high-temperature phenomena; the integrated management of multiple resources and the mitigation of natural and environmental hazards at regional to global scales. The management of the interaction between human activities, earth resources and ecosystems is of primary interest.

ADMISSION REQUIREMENTS

- Official B.S./B.A. transcript
- Official M.S./M.A. transcript
- Personal statement
- Resume or curriculum vitae
- Three letters of recommendation
- Submission of Graduate Record Examination (general) scores
- Submission of TOEFL scores (if bachelor's degree was received in a non-English speaking country)

The engineering objectives of EEE research and education include:

- **Provision and disposal of materials:** environmentally sustainable extraction and processing of primary materials, manufacturing of derivative products, recycling of used materials, management of industrial residues and used products, materials-related application of industrial ecology
- **Management of water resources:** understanding, prediction, and management of the processes that govern the quantity and quality of water resources, including the role of climate; development/operation of water resource facilities; management of water-related hazards
- **Energy resources and carbon management:** mitigation of environmental impacts of energy production, energy recovery from waste materials, advancement of energy efficient systems, new energy sources, development of carbon sequestration strategies
- **Sensing and remediation:** understanding of transport processes at different scales and in different media, containment systems, modeling flow and transport in surface and subsurface systems, soil/water decontamination and bioremediation

FACULTY

William Becker, Adjunct Professor

Marco J. Castaldi, Assistant Professor

Kartik Chandran, Associate Professor

Xi Chen, Associate Professor

Paul F. Duby, Professor of Mineral Engineering

Raymond Farinato, Adjunct Professor

Robert Farrauto, Adjunct Professor

Vasilis Fthenakis, Senior Research Scientist

Pierre Gentine, Assistant Professor

Yuri Gorokovich, Adjunct Professor

Scott Kaufman, Adjunct Assistant Professor

Klaus Lackner, Chair, Maurice Ewing and J. Lamar Worzel Professor of Geophysics

Upmanu Lall, Alan and Carol Silberstein Professor of Earth and Environmental Engineering and of Civil Engineering and Engineering Mechanics

Wade McGillis, Doherty Research Scientist

Cevdet Noyan, Professor of Materials Science

Ah-Hyung (Alissa) Park, Lenfest Junior Professor in Applied Climate Science

Sri Rangarajan, Adjunct Assistant Professor

Peter Schlosser, Associate Director of Research, The Earth Institute; Vinton Professor of Earth and Environmental Engineering, School of Engineering and Applied Science; Professor of Earth and Environmental Sciences

Ponisseril Somasundaran, LaVon Duddleson Krumb Professor of Earth and Environmental Engineering

Nickolas J. Themelis, Stanley-Thompson Professor Emeritus of Chemical Metallurgy

Nicholas J. Turro, William B. Schweitzer Professor of Chemistry

Tuncel M. Yegulalp, Professor of Mining Engineering

Ph.D. in Earth and Environmental Sciences

Steven L. Goldstein, Program Director: steveg@ldeo.columbia.edu, (845) 365-8787

Mia Leo, Administrator: mia@ldeo.columbia.edu, (845) 365-8633

ADMISSION DEADLINE: January 1

Program website: <http://eesc.columbia.edu/programs/graduate-programs>

The Ph.D. program aims to train broadly educated earth scientists for careers in academia, research, government and industry. Along the way, our students move swiftly from receiving knowledge to creating it. All the facilities and equipment necessary for modern studies in the earth sciences are available for the use of students in the department whose research is conducted at one of three affiliated institutions: the Lamont-Doherty Earth Observatory, the American Museum of Natural History or the Goddard Institute for Space Studies.

ADMISSION REQUIREMENTS

Ours is a full-time Ph.D. program; students who can attend classes only in the late afternoons and evenings and on Saturdays or during the summer session may not matriculate in this Department. With the exception of our terminal masters program in climate and society, a terminal M.A. is not offered. All students must sign on for the full Ph.D. program (and will acquire the M.A. degree along the way). Applicants for the Ph.D. program must have completed at least a bachelor's degree.

REQUIREMENTS:

- We require applicants to have an undergraduate major in one of the following disciplines:

Biology	Environmental Sciences/Policy
Chemistry	Mathematics/Engineering
Geoscience	Physics

- At least one college year with a high record in chemistry, mathematics and physics is strongly recommended. Additional competence is required for graduate work in certain disciplines.
- GRE Aptitude Test
- GRE Advanced Tests are welcomed, but not required.

DEGREE REQUIREMENTS FOR THE PH.D. IN EARTH AND ENVIRONMENTAL SCIENCES

A student may not become a candidate for the Ph.D. degree without first fulfilling the requirements for the M.A. and M.Phil. degrees. Specific course requirements will vary depending on the student's chosen area of research.

REQUIREMENTS FOR THE M.A. DEGREE

This degree is prerequisite to the M.Phil. and Ph.D. degrees unless the student has been awarded two residence units of advanced standing.

- **Program of study:** To be approved by an advisory committee designated by the department
- **Length of program:** No fewer than two residence units
- **Points of E-credit:** 20 approved course credits; removal of admissions deficiencies
- **Field requirement:** Students in terrestrial and marine geology, solid earth geophysics, and planetary science programs are advised to take a field course
- **Languages:** No requirements
- **Examination:** Written submission of the results of two research projects, and successful oral presentation of these results to the student's advisory committee

REQUIREMENTS FOR THE M. PHIL. DEGREE

This degree is prerequisite to the Ph.D. degree.

- **Length of program:** The degree is to be completed by the end of the fourth year of study, except for those students granted advanced standing, who must complete the degree by the end of the third year of study.
- **Residence units:** Six full-time, including those earned for the M.A. degree.
- **Points of E-credit:** Minimum of 45 approved course credits (including those earned for the M.A. degree), including seminar courses but excluding research credits.
- **Required courses:**
 1. At least 10 credits outside the student's program of study and in a major subdivision within the department (geology/petrology/mineralogy, marine geology and geophysics, solid earth geophysics, terrestrial geology/paleontology, oceanography, atmospheric science).
 2. An approved field course is required of candidates in the first four subdivisions listed above.
 3. Courses prescribed by the department subdivision.
- **Languages:** No formal requirement; students in certain disciplines may be asked to show proficiency in a foreign language if their adviser or their research requires it.
- **Apprenticeship:** To be served in laboratory or field research and approved by the student's advisory committee.
- **Examination:** A two-hour oral certifying examination, which must be taken by the end of the third academic year, consisting of questioning and discussion centered on the student's major and minor fields and research, but also in general earth sciences. Performance in the certifying examination determines whether or not the student may continue in residence toward the Ph.D. degree upon completion of the M. Phil. degree
- **Thesis Proposal:** Within six months of successfully completing the certifying exam, students must present a public thesis proposal to their advisory committee (and invited guests).

REQUIREMENTS FOR THE PH.D. DEGREE

The M.A. and M.Phil. degrees are prerequisite to the Ph.D. degree.

- **Recommended length of program:** Five years, including the earning of the M.A. and M.Phil. degrees, at least one year of which should be spent in preparing the dissertation.
- **For certification to the Ph.D. examination:** Dissertation must have been approved by the candidate's advisory committee.

FACULTY

Geoffrey A. Abers, Adjunct Professor, Earthquakes, Earth structure, and their relationship to active tectonic processes

Mark H. Anders, Associate Professor, Structural geology

Robert F. Anderson, Adjunct Professor, Role of ocean circulation and ocean biology in regulating the concentration of CO₂ in the atmosphere; sensitivity of these processes to climate change

Roger N. Anderson, Lecturer, Marine geophysics, energy

Anthony G. Barnston, Associate, Forecasting climate variability and change, ENSO, statistical prediction methods

Natalie T. Boelman, Storke-Doherty Lecturer, Terrestrial ecology, hyperspectral remote sensing, bioacoustics

Wallace S. Broecker, Newberry Professor, Paleoclimate, ocean chemistry, radiocarbon dating

W. Roger Buck IV, Adjunct Professor, Marine geophysics, geodynamics, tectonics

Mark A. Cane, G. Unger Vetlesen Professor (Joint with APAM), Climate physics, climate prediction, social impacts of climate; paleoclimate; oceanography

Nicholas Christie-Blick, Professor, Sedimentation processes, crustal deformation, deep-time Earth history

James R. Cochran, Lecturer, Marine geophysics, gravity, geodesy, isostasy

Joel E. Cohen, Adjunct Professor, Population science

Anthony D. Del Genio, Adjunct Professor, Role of clouds and water vapor in climate, dynamics of planetary atmospheres

Peter B. deMenocal, Professor, Paleoclimatology, ocean circulation variability, tropical-extratropical paleoclimate linkages, Pliocene-Pleistocene

evolution of tropical climates, African climate and human evolution

Peter M. Eisenberger, Professor, Earth/human systems and interactions

Göran Ekström, Professor, Seismology

Arlene M. Fiore, Associate Professor, Atmospheric chemistry

John J. Flynn, Adjunct Professor, Vertebrate paleontology

Alessandra Giannini, Adjunct Associate Professor, African climate science/climate change policy

Lisa M. Goddard, Adjunct Associate Professor, Climate prediction, near-term climate change

Steven L. Goldstein, Professor, Isotope geology, climate change, mantle geochemistry, Earth evolution

Arnold L. Gordon, Professor, Physical oceanography

Kevin L. Griffin, Professor, Plant ecophysiology

James E. Hansen, Adjunct Professor, Unraveling the mechanisms of climate change, and projecting the climatic impact of human activity

Sidney R. Hemming, Professor, Geochronology and the sedimentary record of changes through Earth history

Bärbel Hönlisch, Assistant Professor, Validation of paleo-proxies in living foraminifers and application of knowledge to reconstruct past climate change

Andrew R. Juhl, Adjunct Associate Professor, Biological Oceanography

Kim A. Kastens, Adjunct Professor, Research on thinking and learning in geosciences; spatial cognition in geosciences; public understanding of the Earth and environment; marine geology

Peter B. Kelemen, Arthur D. Storke Memorial Professor, Carbonation of peridotite for CO₂ storage, melt transport in the mantle and lower

crust, mantle shear zones and intermediate depth earthquakes

Arthur L. Lerner-Lam, Adjunct Professor, Seismology, natural hazards

Douglas G. Martinson, Adjunct Professor, Physical oceanography, polar studies

Jerry F. McManus, Professor, Paleoclimate

William H. Menke, Professor, Seismology, solid Earth geophysics, tomography

Ronald L. Miller, Lecturer, Atmospheric and climate dynamics

John C. Mutter, Professor (Joint with SIPA), Marine seismic studies of mid-ocean ridges, natural disasters, sustainable development

Meredith Nettles, Assistant Professor, Glacial seismology

Mark A. Norell, Adjunct Professor, Vertebrate paleontology

Paul E. Olsen, Arthur D. Storke Memorial Professor, Paleocology, ecosystem evolution, vertebrate paleontology

Hsien Wang Ou, Adjunct Professor, Ocean dynamics, planetary circulation, climate theories

Dorothy M. Peteet, Adjunct Professor, Paleocology, palynology

Stephanie L. Pfirman, Hirschorn Professor, Environmental Science, Barnard College, Arctic oceanography

Walter C. Pitman III, Adjunct Professor, Marine magnetics

Terry A. Plank, Professor, Igneous geochemistry, magma generation, crustal recycling, magmatic water

Lorenzo M. Polvani, Professor (Joint with APAM), atmosphere, ocean and climate dynamics, geophysical fluid dynamics, planetary atmospheres

G. Michael Purdy, Professor, Marine seismology
Paul G Richards, Mellon Professor Emeritus and Special Lecturer, Theoretical Seismology, Arms Control/Nuclear Disarmament

Joerg M. Schaefer, Adjunct Associate Professor, Climate Science, Cosmogenic Dating

Peter Schlosser, Associate Director of Research, The Earth Institute; Vinton Professor of Earth and Environmental Engineering, School of Engineering and Applied Science; Professor of Earth and Environmental Sciences. Aqueous geochemistry, hydrology

Christopher H. Scholz, Professor (Joint with APAM), Experimental and theoretical rock mechanics, especially friction, fracture, hydraulic transport properties, nonlinear systems, mechanics of earthquakes and faulting

Tiffany A. Shaw, Assistant Professor (joint with APAM), Atmospheric physics, geophysical fluid dynamics

Christopher Small, Adjunct Professor, Imaging spatio-temporal dynamics of the Earth surface with light, sound and gravity

Jason E. Smerdon, Adjunct Assistant Professor of Public Affairs, School of International and Public Affairs; Storke-Doherty Lecturer, Lamont-Doherty Earth Observatory and the Department of Earth and Environmental Sciences, Late-Holocene paleoclimate, statistical methods, geothermal climate signals

Adam H. Sobel, Professor (Joint with APAM), Atmospheric and climate dynamics, tropical meteorology

Marc W. Spiegelman, Arthur D. Storke Memorial Professor (Joint with APAM), Coupled fluid/solid mechanics, reactive fluid flow, solid Earth and magma dynamics, scientific computation/modeling

Martin Stute, Ann Olin Whitney Professor, Barnard College, Aqueous geochemistry, hydrology

Taro Takahashi, Adjunct Professor, Carbon cycle in the oceans, atmosphere and biosphere

Andreas M. Thurnherr, Lecturer, Physical Oceanography

Mingfang Ting, Adjunct Professor, Climate dynamics

Maria Tolstoy, Associate Professor, Marine Seismology

David Walker, Higgins Professor, Experimental petrology, geology, materials science, alternate energy

Spahr C. Webb, Adjunct Professor, Marine geophysics, seismology, ocean bottom seismometry/instrumentation

Gisela Winckler, Adjunct Associate Professor Marine Geochemistry

Program in Atmospheric Science (AS)

Adam H. Sobel, Program Director: ahs129@columbia.edu, (212) 854-6587

ADMISSION DEADLINE: January 1

The Departments of Earth and Environmental Science, Applied Physics and Applied Mathematics, Earth and Environmental Engineering, and Chemical Engineering cooperate with each other and with the Lamont-Doherty Earth Observatory, NASA Goddard Institute for Space Studies, and International Research Institute for Climate and Society in offering a graduate program in atmospheric science. The program supports research on atmospheres and climates in all their aspects. Each graduate student is enrolled in an academic department and follows the normal procedures of that department regarding admission and progression toward their degree. However, course offerings have been designed collaboratively with the needs of multiple departments in mind, and advisory committees commonly include faculty from multiple departments. Relevant seminars and other activities occur in all participating departments and institutes, providing a uniquely broad and stimulating intellectual environment for graduate study.

Students in the atmospheric science program must apply to and be admitted by one of the following participating departments and must satisfy the degree requirements of that department: Applied Physics and Applied Mathematics, Earth and Environmental Engineering, Chemical Engineering (in the Fu Foundation School of Engineering and Applied Science), or Earth and Environmental Sciences (in the Graduate School of Arts and Sciences). Applicants should demonstrate a strong undergraduate background in basic physical sciences and mathematics, including advanced calculus and differential equations. Undergraduate courses in atmospheric sciences or earth sciences are helpful but not necessary. Any student admitted with deficiencies in his or her academic background should expect to remedy them within the first year. Prospective students should identify an area of interest and contact potential advisors in one of the participating units described below. Faculty who represent that unit on the program's interdepartmental committee can serve as points of initial contact for students who need help identifying potential advisors.

The **Department of Earth and Environmental Sciences (DEES)** has research programs in many aspects of modern climate, atmospheric science and physical oceanography. It also has major programs in paleoclimate and geochemistry, which complement the study of the modern climate. Committee representatives: Mark Cane, Anthony Del Genio, Lorenzo Polvani, Adam Sobel, Mingfang Ting.

The **Department of Applied Physics and Applied Mathematics (APAM)** has research programs in atmospheric and climate dynamics, focusing on numerical modeling, theory and diagnostics. Committee representatives: Lorenzo Polvani, Adam Sobel

The **Department of Earth and Environmental Engineering (DEEE)** has research programs in climate, particularly through connections to water resources and geochemistry, as well as on engineering responses to the climate change problem. Representative: Upmanu Lall

In the **Department of Chemical Engineering (CHEN)** has research programs in atmospheric chemistry and atmospheric aerosols. Committee representative: V. Faye McNeill

The **Lamont-Doherty Earth Observatory (LDEO)** is the physical home of graduate research in the Department of Earth and Environmental Sciences, but also has a distinct identity as a major laboratory for earth science. In addition to the DEES faculty, Lamont employs a staff of Lamont Research Professors, all of whom are potential advisors for Ph.D. students. Committee representatives: Richard Seager, Mingfang Ting

The **NASA Goddard Institute for Space Studies (GISS)** has research programs in climate modeling, climate change, remote sensing, and atmospheric physics and chemistry. Ph.D. students in any department in the program may work with GISS scientists. Committee representatives: Anthony Del Genio, Ronald Miller

International Research Institute for Climate and Society (IRI) has research programs in climate prediction and predictability on all time scales, as well as modeling and regional dynamics studies, societal impacts of climate, and the application of climate science to achieve societal benefit. Ph.D. students in any department in the program may work with IRI scientists. Committee representative: Lisa Goddard

For more information on the program in atmospheric science and related areas, see <http://eesc.columbia.edu/disciplines/atmospheric-science> .

CONTACT FACULTY

Mark A. Cane, G. Unger Vetlesen Professor of Earth and Climate Science, and Professor of Applied Physics and Applied Mathematics

Anthony D. Del Genio, Adjunct Professor, Earth and Environmental Sciences, Applied Physics and Applied Mathematics

Lisa M. Goddard, Adjunct Professor, Earth and Environmental Sciences

Upmanu Lall, Alan and Carol Silberstein Professor of Earth and Environmental Engineering, and

Professor of Civil Engineering and Engineering Mechanics

Ronald L. Miller, Adjunct Professor, Applied Physics and Applied Mathematics

Lorenzo M. Polvani, Professor of Applied Physics and Applied Mathematics, and of Earth and Environmental Sciences

Adam H. Sobel, Professor of Applied Physics and Applied Mathematics, and of Earth and Environmental Sciences

Ph.D. in Environmental Health Sciences

Tomas R. Guilarte, Ph.D.

Leon Hess Professor and Chairman

Director, NIEHS Training Grant

Deputy Director, NIEHS Center for Environmental Health in Northern Manhattan

Department of Environmental Health Sciences

Mailman School of Public Health

Columbia University

722 West 168th Street, Room 1105-E

New York, NY 10032

Phone: (212) 305-3959

Fax: (212) 305-3857

E-mail: trguilarte@columbia.edu

Greg A. Freyer, Ph.D.

Program Director of Educational Affairs, M.A. Adviser

60 Haven Avenue, B-1 New York, NY 10032

Email: gaf1@columbia.edu

Tel: (212) 342-0457

Fax: (212) 781-4993

Ph.D. Overview

Our program seeks to integrate skills in basic biomedical sciences and public health into an interdisciplinary training experience for the next generation of environmental health scientists. Ph.D. candidates will acquire skills in modern scientific methods and techniques to enable them to solve problems related to environmental exposures and their effects on human health. This includes understanding of the physiological, cellular and molecular mechanisms of environmental agents on various disease processes, as well as an appreciation for environmental health risk assessment and policy. The program is designed specifically to develop scientists

who can establish successful research careers in academia. However, the skills they acquire through their training can also be applied to careers in government and/or private research sectors.

Each candidate's research is focused on one of the following themes in environmental health sciences: environmental cancer, climate and health effects, environmental respiratory disease, environmental neurodegenerative disease, radiation biology or environmental neurotoxicology. Trainees choose from one of three possible tracks: molecular epidemiology, molecular toxicology or climate and health. Molecular epidemiology encompasses research in human populations, while molecular toxicology is generally more mechanistic and laboratory-based. The health and climate track coursework provides candidates with the knowledge and skills needed to advance society's capacity to understand, anticipate and prevent adverse health consequences of climate variability and change. The Ph.D. program utilizes classroom instruction, a journal club, seminars, qualifying exams and most importantly research to train candidates as independent authorities in environmental health sciences. Candidates are also encouraged to enhance their educational experience by taking elective courses related to their thesis topic at the main Columbia campus and the Medical Center campus.

REQUIREMENTS

As a minimum requirement, applicants must have completed one year of the following courses: general chemistry, organic chemistry, biology and mathematics.

CAREERS

Potential Career Paths: Graduates are qualified to obtain senior positions within health-related organizations. Our graduates also obtain employment in research programs in academic settings. The following is a sampling of career opportunities available to graduates:

- Academic positions within universities and hospitals as faculty members and senior-level researchers
- Senior roles in research, management or data analysis with governmental regulatory agencies at the local, state, national and international levels
- Researchers within private industry, including pharmaceutical companies
- Leadership/senior roles at government organizations involved in environment and health protection, such as the Environmental Protection Agency (EPA) health departments and the Center for Disease Control and Prevention (CDC)
- Consulting roles, such as within pharmaceutical and healthcare companies
- Community-based organizations concerned with health issues related to environmental exposures

For more information about the Ph.D. program, please review the program website:

<http://www.mailman.hs.columbia.edu/academic-departments/environmental-health/academic-programs/phd-program>

Dr.P.H. (Public Health) Overview

The Dr.P.H. program is designed for professionals interested in advancing their careers particularly in research, advocacy, policy and administrative positions in an area of specialization within the field of environmental health. The Dr.P.H. program shares the learning objectives of the Ph.D. program, but is better suited for students interested in a focus on applied, practical or real-world research problems in a subspecialty area within environmental health sciences. Our students pursue work in government agencies such as those responsible for developing environmental policy, roles within private and public institutions in the area of health and safety, or non-government organizations whose interests are in the effects of environmental exposure to human health. These students are well prepared for leadership roles in the field of environmental health sciences.

REQUIREMENTS

M.P.H. or another master's degree appropriate to the public health field

CAREERS

- Senior roles in research, management or data analysis at governmental regulatory agencies at the local, state, national and international level
- Researchers within industries including pharmaceutical companies
- Leadership/senior roles at government organizations involved in environmental and health protection, such as the Environmental Protection Agency (EPA), health departments and the Center for Disease Control (CDC)
- Consulting firms
- Community based organizations concerned with health issues related to environmental pollutants
- Non-government organizations involved in developing and advocating for sound environmental policy

For more information about the Dr.P.H. program, please review the program website:

<http://www.mailman.hs.columbia.edu/academic-departments/environmental-health/academic-programs/drph-program>

EHS Faculty

FACULTY AND AREAS OF INTEREST

Greg Freyer, Ph.D.—DNA repair, cancer

Mary Gamble, Ph.D.—nutritional biochemistry, epigenetics, metal toxicology

Joseph Graziano, Ph.D.—metal toxicology and metabolism

Tomás R. Guilarte, Ph.D.—mechanism based neurotoxicology, neuroscience

Julie Herbstman, Ph.D.—Prenatal exposure to environmental chemicals, endocrine-disruptors, effects on child neurodevelopment.

Darby Jack, Ph.D.—environmental health policy; environmental health in developing countries

Patrick Kinney, Sc.D.—respiratory disease, climate change and health

Frederica Perera, Dr.P.H.—cancer, children's health

Matthew Perzanowski, Ph.D.—respiratory disease, asthma and allergens

Regina Santella, Ph.D.—cancer, biomarkers of chemical exposure

Jeffrey Shaman, Ph.D.—climate dynamics, tropical meteorology, the hydrologic cycle, medical entomology, mosquito ecology, infectious disease, and climate and disease forecast.

Jing Shen, M.D., Ph.D.—cancer

Deliang Tang, Dr.P.H.—cancer

Robin Whyatt, Dr.P.H.—pesticides, children's health, reproductive health

Affiliated Faculty

Muhammad Akram, Ph.D.—environmental health and safety

Leslie Andrews, Dr.P.H.—occupational and Environmental Hygiene

Paul Brandt-Rauf, Dr.P.H.—occupational and environmental carcinogenesis

David Brenner, Ph.D.—radiation, health physics

Ginger Chew, Sc.D.—indoor biogenic agents, respiratory illness, asthma

Dickson Despommier, Ph.D.—infectious disease, ecology

Herman Ellis, M.D.—occupational medicine, workers compensation determination, delivery of public health services

Peter Esser, Ph.D.—cancer, radiation, fiber toxicology

Tom Hei, Ph.D.—cancer, radiation, fiber toxicology

Alan Jeffrey, Ph. D.—DNA damage, cancer, exposure estimation

Norman Kleiman, Ph.D.—DNA damage and repair, oxidative stress, cataracts

Kim Knowlton, Dr.P.H.—public health impacts of climate change

Sylvie Le Blancq, Ph.D.—parasites biology, infectious diseases

Robert Lewy, M.P.H.—radiation and environmental health safety, occupational and student health

Howard Lieberman, Ph.D.—radiation biology

Mary Matsui, Ph.D.—Dermatology

Rachel Miller, M.D.—respiratory disease

Edward Nickoloff, Sc.D.—radiation physics, medical imaging

Manuela Orjuela, M.D.—cancer, retinoblastoma, pediatrics

Marco Pedone, Dr.P.H.—hazardous site remediation, abatement, decontamination, safety engineering and design

Neil Schluger, M.D.—respiratory disease

Bradford H. Sewell, J.D., M.P.H.—environmental law and policy

John Whysner, M.D., Ph.D.—toxicology, carcinogenesis

Gabriele Windgasse, Dr.P.H.—occupational safety, health risk assessments

Marco Zaider, Ph.D.—brachytherapy, radiation oncology, microdosimetry, biostatistics

Yu-Jing Zhang, M.D.—cancer

For a review of EHS faculty members please see the link via the program website:
<http://www.mailman.columbia.edu/our-faculty/faculty-directory?dept=Environm>

Ph.D. Programs in the Department of Ecology, Evolution and Environmental Biology (E3B)

Maria Uriarte, Co-Director of Graduate Studies: mu2126@columbia.edu, (212) 854-1494

Eleanor Sterling, Co-Director of Graduate Studies: es443@columbia.edu, (212) 854-9987

Lourdes Gautier, Academic Department Administrator: lg2019@columbia.edu, (212) 854-8665

Program website: <http://www.columbia.edu/cu/e3b/phd.html>

E3B offers two Ph.D. programs: one in ecology and evolutionary biology and one in evolutionary primatology.

The ecology and evolutionary biology (EEB) program is designed to provide the broad education needed to describe, understand and conserve the Earth's biological diversity in all its forms. Matriculating students will develop the skills needed to conduct ecological, behavioral, systematic, molecular and other evolutionary biological research and develop the ability to formulate and implement environmental policy. Graduates often pursue academic careers as researchers and teachers, or professional positions in national or international conservation, environmental and multilateral aid organizations. All Ph.D. students in EEB must complete the environmental policy certificate program, for which they receive a separate degree.

Columbia has offered a Ph.D. program in evolutionary primatology for over a decade. Many aspects of this program are coordinated with the New York Consortium of Evolutionary Primatology (NYCEP). NYCEP, a consortium of the City University of New York, New York University, the American Museum of Natural History and the Wildlife Conservation Society, provides a multi-institutional venue for graduate training leading to the Ph.D., which emphasizes all aspects of the behavioral, ecological, morphological and evolutionary biology of primates. Course offerings in this program are coordinated across the NYCEP institutions. While in the past this Ph.D. program was administered by the Anthropology Department, it is now housed within E3B, and is funded by a multi-institutional NSF IGERT grant.

CORE FACULTY (E3B)

Marina Cords, Professor

Ruth DeFries, Denning Family Professor of Sustainable Development; Chair of the Department of Ecology, Evolution and Environmental Biology

Don Melnick, Thomas Hunt Morgan Professor of Conservation Biology

Shahid Naeem, Professor

Maria Uriarte, Associate Professor

Dustin Rubenstein, Assistant Professor

Matthew Palmer, Lecturer in Discipline

Jill Shapiro, Lecturer in Discipline

Elisa Bone, Lecturer in Discipline

AFFILIATED FACULTY

Philip Ammirato, Professor Emeritus of Biological Sciences, Barnard College

Walter Bock, Professor of Biological Sciences

John Glendinning, Professor of Biological Sciences, Barnard College

Paul Hertz, Professor of Biological Sciences, Barnard College

Ralph Holloway, Professor of Anthropology

Darcy Kelley, Professor of Biological Sciences

Paul Olsen, Professor of Earth and Environmental Sciences

Robert Pollack, Professor of Biological Sciences

Jeanne Poindexter, Professor of Biological Sciences, Barnard College

Steven Cohen, Executive Director, The Earth Institute; Professor in the Practice of Public Affairs; Director, Master of Public Administration Program in Environmental Science and Policy & Energy and Environmental Policy Concentration, School of International and Public Affairs; Director, Master of Science in Sustainability Management, School of Continuing Education

Kevin L. Griffin, Co-Director of the Undergraduate Program in Sustainable Development; Professor, Department of Earth and Environmental Sciences (on leave AY 2011-12)

Brian Morton, Associate Professor of Biological Sciences, Barnard College

Paige West, Associate Professor of Anthropology, Barnard College

Hilary Callahan, Assistant Professor of Biological Sciences, Barnard College

ADJUNCT FACULTY

The Department of E3B also has a large adjunct faculty (see http://www.columbia.edu/cu/e3b/faculty_adjunct.html), most of whom are senior scientists at one of the following institutions: American Museum of Natural History, New York Botanical Garden, Wildlife Conservation Society and Wildlife Trust. These faculty members teach courses and advise student research.

NYCEP Faculty

Students in the evolutionary primatology program also have the larger NYCEP faculty to serve as internship and research advisers, instructors, and committee members. This faculty includes full-time faculty members at City University of New York and New York University, as well as research scientists at the American Museum of Natural History and the Wildlife Conservation Society. For a full listing see <http://www.nycep.org/pages/faculty/index.php>.

Ph.D. in Ecology and Evolutionary Biology

Maria Uriarte, Co-Director of Graduate Studies: mu2126@columbia.edu, (212) 854-1494

Eleanor Sterling, Co-Director of Graduate Studies: es443@columbia.edu, (212) 854-9987

Lourdes Gautier, Academic Department Administrator: lg2019@columbia.edu, (212) 854-8665

ADMISSION DEADLINE: December 1

Full-time residence units (RU): Six units of full-time residency are required by the Graduate School of Arts and Sciences (four to five for students with advanced standing). These RUs include the two that make up the linked environmental policy certificate.

Admission Requirements

- An undergraduate major in one of the natural sciences
- It is desirable that students have had coursework in calculus, physics, chemistry, statistics, genetics, evolution, ecology and organismal biology
- Prior field biology experience is strongly recommended

Advisers

Students are admitted to the program with a primary research adviser already identified. By the end of the second semester, each EEB student, in consultation with their adviser and the director of Graduate Studies (DGS), will select a three-member advisory committee from the faculty associated with the EEB program. This committee has primary responsibility for student supervision and designing the student's individual program. In most cases, the committee members become part of the five-member dissertation committee.

CORE COURSES

All first-year students must take the following core courses:

- EEEB 4122 Fundamentals of Ecology and Evolution (4 credits)
- EEEB G6990 Conservation Biology (3 credits)

Note: Students receiving a grade of less than B+ in any of these courses will be required to take a written exam at the end of the first summer based on the core course material.

OTHER REQUIRED COURSES:

- Enrollment in the CERC Seminar (EEEEB G6300) is required for the first four years (three years for those with advanced standing), and attendance is expected thereafter for students in residence in New York.
- Students in the ecology and evolution Ph.D. program are required to complete a certificate in environmental policy, which is a separate but linked degree. The certificate requires 24 credits of coursework, including one course each in the areas of environmental policy/politics, environmental law, environmental economics and anthropology/public health. In addition, students must take a workshop in environmental policy, and complete two elective courses.

ELECTIVE COURSES

Elective courses provide highly specialized training in one or more of the areas of program specialization, e.g. evolution, ecology, population biology, systematics, behavior and ethnobiology. Students choose elective courses in consultation with the program director and their advisory committees. Most students take five to six elective courses.

BIOLOGY INTERNSHIPS

Two internships are required, either with the student's adviser or in different areas. Sponsors should be from different institutions. The internships may be outside of the CERC consortium if a CERC/E3B faculty member takes official and serious responsibility for approving the internship proposal and its successful completion.

SCHOLARLY LANGUAGE REQUIREMENT

Students will be required to demonstrate proficiency in foreign languages as needed for their specific fieldwork locations. Proficiency will be assessed by university examination.

TEACHING ASSISTANTSHIP

All Ph.D. students will serve as teaching assistants, usually for a combination of undergraduate and graduate courses, for two to four semesters. This experience provides students an opportunity to develop skills related to many professional directions they may eventually follow. Service as a TA is a component of all fellowships. Students may not register for courses for which they are the TA.

ADVANCED EXAMINATIONS

The purpose of the advanced exams is to test a student's ability to think like a professional. Each student takes two advanced exams, normally during the third year. Advanced exams are taken in a three-day take-home format, and the student prepares an essay similar to a short article that might appear in a publication like *TREE (Trends in Ecology and Evolution)*.

LITERATURE REVIEW

One in-depth review of the scholarly literature most relevant to the proposed dissertation research, written in the style of an article submitted to a scholarly journal or an introductory chapter of a dissertation, will be submitted for committee approval in the third year of study.

ORAL GENERAL KNOWLEDGE EXAM

The oral exam is designed to test breadth of biological knowledge. Much of the learning takes place in the broad reading that students will do in preparation for the exam, and in conversations with committee members about what the student should prepare.

The oral exam is designed to broadly test students' knowledge in ecology, evolution and environmental biology. The exam will consist of a two to three hour oral examination by an orals committee. Students will be judged on their abilities to think critically and demonstrate a broad base in biological and environmental knowledge. Although the timing of the exam will vary, most students will be expected to take the exam by the end of their fourth semester.

ADVANCING TO CANDIDACY

Students advance to candidacy if they pass their oral exam (proposal defense), and have completed all other requirements of the Ph.D. degree other than the dissertation. Completion of the environmental policy certificate is not required for advancement to candidacy. A student advanced to candidacy is eligible for the M. Phil. degree (see below).

DISSERTATION RESEARCH

Once a student is advanced to Ph.D. candidacy, s/he is expected to submit the proposal to granting agencies for outside funding.

M.A., M. Phil. and Ph.D.

The sequential M.A. degree is awarded to Ph.D. students who have completed all M.A. degree requirements (usually lasting one full year in the program).

The M. Phil. degree is awarded upon successful completion of all the Ph.D. requirements other than the preparation and defense of the dissertation. This degree is to be completed by the end of the fourth year of study, except for those students granted advanced standing, who must complete the degree by the end of the third year of study. Six units of residency and 40 E-credits approved by the program director and the student's advisory committee are required for this degree.

The Ph.D. degree is earned after the defense and final deposition of the dissertation. The written dissertation is first submitted to the student's sponsor and other readers as recommended. After revisions, the dissertation is submitted to the full five-member dissertation committee, and the students defend the dissertation orally. Students are required to present a seminar to the department around the time of their dissertation defense.

Ph.D. in Evolutionary Primatology

Marina Cords, Adviser of Evolutionary Primatology Program: mc51@columbia.edu, (212) 854-7337

Lourdes Gautier, Academic Department Administrator: lg2019@columbia.edu, (212) 854-8665

The evolutionary primatology program is part of a consortium graduate program, the New York Consortium in Evolutionary Primatology (NYCEP), which includes City University of New York, New York University, the American Museum of Natural History and the Wildlife Conservation Society. This program is currently funded by an NSF IGERT grant. To find out more about the consortium, please see <http://www.nycep.org/>. Graduates of this program have gone on to positions in academia and research, as well as conservation organizations.

Six units of full-time residency (four to five for students with advanced standing) are required by the Graduate School of Arts and Sciences.

ADVISERS

Students are admitted to the program to work with a particular research adviser. During the first two years, they develop a five-member dissertation committee, which normally includes the readers of their advanced exams and literature review, as well as the research adviser. Some committee members may be members of institutions other than Columbia, but three must be on the GSAS list of approved advisers, and preferably faculty at Columbia.

CORE COURSES

Students are required in their first two years to take a set of three core courses in the following areas:

- Evolutionary morphology
- Genetics
- Primate behavior, ecology and conservation

Note: Students receiving a grade of less than B+ in any of these courses are required to take a written exam at the end of the first summer based on the core course material.

OTHER REQUIRED COURSES

Students must take the NYCEP seminar in both semesters of the first two years of study, and attendance is expected thereafter if the student is a resident of New York.

ADVANCED COURSES

Advanced courses provide highly specialized training in one or more of the major subdivisions of evolutionary primatology, e.g. behavior/ecology/conservation, evolutionary morphology and genetics. Students will select at least three such courses from an approved list, which includes courses in other departments at Columbia, as well as through the consortium with CUNY and NYU. Students are expected to take advanced statistics courses to gain the proficiency they will need for their research.

INTERNSHIPS

Three research internships are required. They must focus on three distinct topics. One must be outside of Columbia, and one must be outside the student's chosen area of expertise. Internship sponsors are usually faculty members of the NYCEP consortium.

SCHOLARLY LANGUAGE REQUIREMENT

Students are required to demonstrate proficiency in foreign languages as needed for their specific fieldwork locations. Proficiency is assessed by university examination or by the department.

Teaching Assistantship

All Ph.D. students will serve as teaching assistants for undergraduate and/or graduate courses for two to four semesters. This experience provides students an opportunity to develop skills related to many professional directions they may eventually follow. Service as a TA is a component of all fellowships. Students may not register for courses for which they are a TA.

FINANCIAL AID

A comprehensive program of financial aid, including fellowships and appointments in teaching is available to Ph.D. students. All Ph.D. students admitted to the program receive annually the prevailing stipend and appropriate tuition and health fees through the fifth year, provided that they remain in good academic standing.

ADVANCED EXAMINATIONS

Two advanced written examinations on general topics relevant to the dissertation research must be taken by the end of the third year of study (second for those with advanced standing), and normally by the end of the fifth semester. Each exam is read by two faculty members of the student's committee.

LITERATURE REVIEW

One in-depth review of the scholarly literature most relevant to the proposed dissertation research, written in the style of an article submitted to a scholarly journal or an introductory chapter of a dissertation, will be submitted for approval by two faculty readers by the end of the third year of study (second for those with advanced standing).

ORAL EXAMINATION OF THE DISSERTATION PROPOSAL

Development of a high-level research proposal in a style necessary for submission to a specific granting agency (e.g. NSF), is required. Once completed, the proposal is submitted for provisional approval by two faculty members on the student's dissertation committee. After receiving faculty approval, and before the end of the third year of study (or second for students with advanced standing), students defend their dissertation proposal orally before a five-member dissertation committee. Final revisions to the dissertation proposal are discussed and the committee may then recommend advancement to Ph.D. candidacy.

ADVANCING TO CANDIDACY

Students advance to candidacy if they pass their oral exam (proposal defense) and have completed all other requirements of the Ph.D. degree beside the dissertation. A student advanced to candidacy is eligible for the M. Phil. degree (see below).

DISSERTATION RESEARCH

Once a student is advanced to Ph.D. candidacy, s/he is expected to submit their proposal to granting agencies for outside funding.

M.A., M. Phil. and Ph.D.

The sequential M.A. degree is awarded to Ph.D. students who have completed all M.A. requirements (usually lasting one full year in the program).

The M. Phil. degree is awarded upon successful completion of all the Ph.D. requirements other than the preparation and defense of the dissertation. This degree is to be completed by the end of the fourth year of study, except for those students granted advanced standing, who must complete the degree by the end of the third year of study. Six units of residency and 40 E-credits approved by the program director and the student's advisory committee are required for this degree.

The Ph.D. is earned after the defense and final deposition of the dissertation. The written dissertation is first submitted to the student's sponsor and other readers as recommended. After revisions, the dissertation is submitted to the full five-member dissertation committee, and the student defends the dissertation orally. An oral presentation of the research is also made to the entire department in the form of a departmental seminar.

CERTIFICATE PROGRAMS

Environmental Policy Certificate

This certificate program is designed to provide ecology and evolutionary biology (EEB) Ph.D. candidates and students in other GSAS natural or social science programs with a strong foundation in the social sciences that will best enable them to contribute, as scientists, to creating dynamic environmental policy. All EEB Ph.D. students are required to complete this program, for which they receive a separate degree. Additional certificate candidates are expected to declare their candidacy as soon as possible after admission to one of the University's graduate degree programs. Students admitted to the certificate program must discuss their course of certificate study with the environmental policy certificate director (currently Steven A. Cohen, director of the M.P.A. in environmental science and policy) at the beginning of each semester.

PROGRAM REQUIREMENTS

At least two residence units and 24 credits taken for E-credit are required for the certificate. One course is required in each of the following four areas (a few example courses are included here):

- Environmental politics and policy (U6243. International relations of the environment)
- Environmental law (L6242. Environmental Law; L8036. Seminar: environmentalism and the protection of natural resources; L9056. Seminar in Hazardous Waste Law; L9379. Seminar in International Environmental Law)
- Economics (W4329. Economics of Sustainable Development; W4625. Economics of the Environment)
- Cultural anthropology or public health (G4124. People and Their Environment; G4086. Ethnobotany; U4740. Introduction to Environmental Sociology)

In addition to these courses, students must complete three electives. Upon recommendation of the environmental policy certificate director, up to six credits of advanced standing credit for similar courses taken at another university may be accepted, and students may be able to substitute some of the above coursework with internships. All students must enroll in the problem solving workshop (G6103 Environmental Policy Workshop, U8903 Workshop in Cross National Environmental Problems) at Columbia. The workshop is usually taken with an associated directed readings course, which counts as one of the three required electives. The certificate is awarded on the recommendation of the environmental policy certificate director.

Evening Certificate in Conservation and Environmental Sustainability

Center for Environmental Research and Conservation (CERC) Staff:

- **Rita Ricobelli:** rricobelli@ei.columbia.edu, (212) 854-6005
- **Desmond Beirne:** djb2104@columbia.edu, (212) 854-0149

Program website: <http://www.cerc.columbia.edu/?id=certificate>

CERC's Evening Certificate Program provides professionals with the knowledge and tools to be effective environmental leaders and decision makers in the 21st century. It is an evening program in which environmental issues are discussed, debated and examined—where participants develop an in-depth understanding of conservation science and practice through case studies and a focus on environmental policy, management and finance.

Certificate courses are taught by Columbia University professors and researchers from the CERC Consortium as well as adjunct faculty and current practitioners in the public and private sector. This breadth of experience and diverse set of perspectives inform curriculum development to reflect scientific expertise and current hands-on approaches to environmental sustainability. Through the certificate program, professionals from all sectors can gain the knowledge and tools to make sound decisions about business activities and policy practices that impact the environment.

CERC's certificate is ideal for candidates with a professional and/or civic interest in environmental sustainability, those interested in the science behind environmental issues and cutting-edge sustainability practices, and managers interested in translating this knowledge into sound decision-making and action. CERC's certificate attracts professionals across sectors, including finance, media, engineering, insurance, law, public policy/relations, art and design, architecture, health care, social development, construction, and marketing. This program is an opportunity to learn firsthand about current developments in sustainability, increase your general knowledge about a specific topic or work toward your own professional development goals.

CERC's Certificate Program Accommodates the Working Professional:

- Classes are held from 6 p.m. to 8 p.m. at Columbia University in New York City (with access to all University facilities)
- Courses meet once a week for five weeks
- Weekend field courses are offered but not required
- Rolling admission deadlines
- No previous coursework or scientific knowledge is required
- The certificate, which grants an official transcript from Columbia University, can be done in as little as nine months or as long as three years. Twelve courses must be completed to graduate

PROGRAM FEATURES:

Relevance: With an increasing "green economy," sustainability issues are progressively more important in both the public and private sectors. CERC courses offer new insights on the scientific and physical dimension of sustainability, providing a vocabulary and general background in conservation science, skills for critical analysis and tools for sustainable thinking and action. This allows professionals to have important, positive "green" impacts and make sound decisions in areas such as land use management, project finance, supply chains and environmental metrics, to name a few.

Flexibility: Courses are shorter in length than regular university classes. They typically run in five-week sessions with courses taking place one evening a week. To receive a certificate with an official transcript from Columbia University there is a 12-course curriculum, but anyone is welcome to register for individual classes that interest them.

University access: CERC's executive education provides access to Columbia University talks, workshops and networking opportunities as well as libraries and facilities on campus. There is also the benefit of interacting with the 350+ graduates of the program at alumni meetings as well as with sustainability leaders at the many Earth Institute events throughout the year (i.e., <http://www.stateoftheplanet.org/content/video>). As part of The Earth Institute, CERC works with The Earth Institute's 650 environmental scientists, managers, policy analysts, lawyers, engineers and others experts working on sustainability around the globe.

Link to other programs: Successful completion of the certificate's core science fundamental courses will be recognized as preparation by the following graduate programs at Columbia University:

- M.P.A. in environmental science and policy
- M.S. in sustainability management

FELLOWSHIPS

The Marie Tharp Visiting Fellowship

Kuheli Dutt, Program Director, Assistant Director for Academic Affairs and Diversity:
kuheli.dutt@columbia.edu, (845) 365-8603

The Marie Tharp Fellowships are three-month fellowships that can be taken at any of the research units of departments affiliated with The Earth Institute. Typically, two to three fellowships are awarded per year. These prestigious fellowships are awarded to earth scientists outside of Columbia University to collaborate with researchers at Columbia. This fellowship was started with an NSF-ADVANCE grant to promote the cause of women in science. The fellowship is named after Marie Tharp, who was the first to map the details of the ocean floor on a global scale. She published the pivotal interpretation of mid-ocean ridges that was crucial to the eventual acceptance of theories of plate tectonics and continental drift. Tharp based her work on data from sonar readings obtained by Maurice Ewing and his team. Piecing together data from the late 1940s and early 1950s, she and colleague Bruce Heezen discovered a 40,999-mile underwater ridge girdling the globe and established the foundation for the conclusion that the sea floor spreads from central ridges and that the continents are in motion with respect to one another—a revolutionary geological theory. Years later, satellite images proved that Tharp's maps were accurate. Tharp came to the Lamont Geological Observatory (now the Lamont-Doherty Earth Observatory) in 1948, where she began work on contributions by the Library of Congress, the Woods Hole Oceanographic Institution and the Lamont-Doherty Earth Observatory. Her map of the ocean floor is still a key foundation for research and education in the ocean sciences.

Application Deadline: The application deadline for 2011-2012 has passed. The application deadline for 2012-2013 is expected to be in January 2012. For additional information, please contact Kuheli Dutt at kdutt@ldeo.columbia.edu.

OTHER GRADUATE CREDIT-BEARING PROGRAMS

The Inquire Institute

Center for Environmental Research and Conservation (CERC) staff:

- Minosca Alcantara: mva2107@columbia.edu, (212) 854-2992
- Desmond Beirne: djb2104@columbia.edu, (212) 854-0149

Program website: <http://www.cerc.columbia.edu/?id=tt>

CERC's Inquire Institute provides up to six graduate credits in conservation biology and human ecology. The Institute is designed to support teachers in increasing their own exposure and understanding of the inquiry process, as well as how to translate this new understanding to the classroom. Graduate credits meet the New York State Department of Education's science certification requirements and can be applied to a master's degree or to the "30 points above" requirement for a salary increase in New York City.

The Institute focuses on New York City urban ecosystems and the areas of water, biodiversity and energy. It is a combination of lectures, fieldwork, labs and curriculum development. Participants work collaboratively on projects to develop basic skills and understandings of the inquiry process and scientific methods. Projects form the basis of an inquiry-driven curriculum unit with an accompanying teacher resource plan, designed to be used in the classroom in the upcoming academic year. For public school teachers, this unit(s) coincides with the *New York City Science Scope and Sequence*, Pre-K-High School.

The Inquire Institute is designed so that educators and CERC faculty work together in inquiry-based education, experiential learning and the use of "living laboratories," all within the required framework of formative and summative assessment.

Now entering its seventh year, the Institute welcomes educators from public and private school systems. Moreover, because we also approach our curriculum and the Institute's mission from a perspective of inquiry, teachers from all disciplines can benefit. Thus, past participants have included math, social studies, literacy, art and special education teachers.

Students currently enrolled in graduate schools of education or in graduate programs in conservation education are encouraged to attend.

FACULTY

Nancy Degnan, Executive Director, CERC

Jenna Lawrence, Lecturer in Discipline, E3B
(Department of Ecology, Evolution and
Environmental Biology)

Matthew Palmer, Lecturer in Discipline, E3B

Robert Newton, Research Scientist, LDEO,
Geochemistry

Ellen Meier, Associate Professor of Computing and
Education, Mathematics, Science and Technology,
Teachers College

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