

SUSTAINABLE DEVELOPMENT

Departmental Office: The Earth Institute, Office of Academic and Research Programs, Hogan, B-Level; <http://sdev.ei.columbia.edu>

Co-Directors of Undergraduate Studies:

Ruth DeFries, 212-851-1647; rd2402@columbia.edu

Jason Smerdon, 845-365-8493; jsmerdon@ideo.columbia.edu

Program Administrators:

Natalie Unwin-Kuruner, 212-854-8536; natalie@ei.columbia.edu

Cari Shimkus, 212-851-9350; cshimkus@ei.columbia.edu

Sustainable development is founded on the premise that human well-being should advance without irreparable harm to ecosystems and the vital services they provide, without depleting essential resources, and without posing risks to future generations. The term "sustainable" refers to managing the world's economy in a manner consistent with the continued healthy functioning of Earth's ecosystems, oceans, atmosphere and climate. In this context, "development" refers to continued social, political, and economic progress aimed at improving the well-being of the global community, especially for the poorest people.

Academic Programs

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 and Environmental Engineering—offers a major and a special concentration in sustainable development.

These programs are designed to: engage students in this emergent interdisciplinary discussion, provide knowledge of the theory and practice of sustainable development, stimulate a critical examination of historical and conceptual antecedents, provide experience in the complex challenges of sustainable development through direct engagement, and help them imagine alternative futures for our rapidly changing world. With help from the Earth Institute faculty, courses are specifically created to address the very real and complex issues of development as they relate to the interactions of the natural and social systems.

The major focuses heavily on the sciences and provides students with a working knowledge of issues on a range of interacting subject areas. After declaring the major, students are assigned an academic adviser from within the Earth Institute, who advises on class selection and career development. Students benefit from a support system of faculty, advisers, and program managers, and have access to the multitude of resources for internships, study abroad programs, and career development.

The special concentration is intentionally more flexible, but its structure allows students to benefit from the cross-disciplinary courses and to build the expertise to allow them to address the fundamental issue of how to move towards a trajectory of sustainability.

The sustainable development program is structured to ensure that students graduate with the skills and knowledge to enable them to advance professionally in the public, private, governmental, and nonprofit sectors, and to pursue advanced degrees. Those interested in sustainable development are encouraged to participate in lectures, conferences, and other programs sponsored by the Earth Institute.

Grading

A letter grade of C- or better is needed in all program-related courses in order to satisfy the program requirements.

Sustainable Development Faculty

- Susana Adamo (Center for International Earth Information Network)

Satyajit Bose (School of International and Public Affairs)

Steve Cohen (The Earth Institute; School of International and Public Affairs)

Lisa Dale (The Earth Institute; Ecology, Evolution, and Environmental Biology)

Ruth DeFries (Ecology, Evolution, and Environmental Biology) (Co-Director)

Stuart Gaffin (Center for Climate Systems Research)

Michael Gerrard (Center for Climate Change Law and Columbia Law School)

Adela Gondek (Ecology, Evolution and Environmental Biology)

Giovani Graziosi (Ecology, Evolution and Environmental Biology)

Radley Horton (Center for Climate Systems Research)

Jacqueline Klopp (The Earth Institute)

Upmanu Lall (Columbia Water Center; International Research Institute for Climate and Society)

Peter Marcotullio (Architecture, Planning and Preservation)

Kytt McManus (Ecology, Evolution and Environmental Biology)

Dara Mendeloff (Center for International Earth Science Information Network)

Rachel Moresky (Population and Family Health)

John Mutter (Earth and Environmental Sciences; School of International and Public Affairs)

Stephanie Pfirman (Lamont-Doherty Earth Observatory; Environmental Science; Barnard College)

Robert Pollack (Biological Sciences)

Peter Schlosser (Earth and Environmental Engineering)

Elliott Sclar (The Earth Institute; Architecture, Planning, and Preservation; School of International and Public Affairs)

Jason Smerdon (Lamont-Doherty Earth Observatory; School of International and Public Affairs) (Co-Director)

Marni Sommer (Mailman School of Public Health)

Martin Stute (Lamont-Doherty Earth Observatory)

Phil Weinberg (Ecology, Evolution and Environmental Biology)

Jason Wong (School of International and Public Affairs)

Major in Sustainable Development <http://sdev.ei.columbia.edu/curriculum/major/>

The sustainable development foundation courses should be taken first and students should then work with the program adviser on further course selection and sequencing.

The major in sustainable development requires a minimum of 15 courses and a practicum as follows:

Code	Title	Points
Sustainable Development Foundation		
SDEV UN1900	Introduction to Sustainable Development Seminar	
SDEV UN2300	Challenges of Sustainable Development	
EESC UN2330	Science for Sustainable Development	
Basic Disciplinary Foundation		
Select one of the following science sequences:		
PHYS UN1202 - PHYS UN1202	General Physics II and General Physics II	
CHEM UN1403 - CHEM UN1404	General Chemistry I (Lecture) and General Chemistry II (Lecture)	
EEEB UN2001 - EEEB UN2002	Environmental Biology I: Elements to Organisms and Environmental Biology II: Organisms to the Biosphere	
EESC UN2100 - EESC UN2200	Earth's Environmental Systems: The Climate System and Earth's Environmental Systems: The Solid Earth System	
EESC UN2100 - EESC UN2300	Earth's Environmental Systems: The Climate System and Earth's Environmental Systems: The Life System	
EESC UN2200 - EESC UN2300	Earth's Environmental Systems: The Solid Earth System and Earth's Environmental Systems: The Life System	
EESC UN1600 - EESC UN2100	Earth Resources and Sustainable Development and Earth's Environmental Systems: The Climate System	
EESC UN1600 - EESC UN2300	Earth Resources and Sustainable Development and Earth's Environmental Systems: The Life System	
Select two of the following social science courses:		
SOCI UN1000	The Social World	
ANTH UN1002	The Interpretation of Culture	
ECON UN1105	Principles of Economics	
POLS UN1501	Introduction to Comparative Politics	
POLS UN1601	Introduction to International Politics	
SDEV UN2000	Introduction to Environmental Law	
SDEV UN3400	Human Populations and Sustainable Development	
Select one of the following quantitative foundations courses:		
EEEB UN3005	Introduction to Statistics for Ecology and Evolutionary Biology	
EESC BC3017	Environmental Data Analysis	
MATH UN2010	Linear Algebra	
STAT UN1201	Calculus-Based Introduction to Statistics	

STAT UN2103	Applied Linear Regression Analysis
STAT UN3106	Applied Data Mining
STAT GU4203	PROBABILITY THEORY
STAT GU4204	Statistical Inference
STAT GU4207	Elementary Stochastic Processes

Analysis and Solutions to Complex Problems

Select two of the following courses:

CIEE E3260	Engineering for developing communities
EAAE W4304	Closing the carbon cycle
ECIA W4100	Management and development of water systems

EESC BC3032	Agricultural and Urban Land Use: Human- Environment Interactions
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EESC BC3045	Responding to Climate Change
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EESC GU4600	Earth Resources and Sustainable Development
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PLAN A4579	Introduction to Environmental Planning
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PUBH W3100	
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SDEV UN3330	Ecological and Social Systems for Sustainable Development
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SDEV UN3355	Climate Change and Law
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SDEV UN3360	Disasters and Development
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SDEV UN3366	Energy Law
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SDEV UN3410	Urbanization and Sustainable Development
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SOCI BC3932	Climate Change, Global Migration, and Human Rights in the Anthropocene
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URBS UN3565	Cities in Developing Countries: Problems and Prospects
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The Summer Ecosystems Experience for Undergraduates (SEE-U) *

Skills/Actions

Select two of the following courses:

EAAE E4257	Environmental data analysis and modeling
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EESC GU4050	Global Assessment and Monitoring Using Remote Sensing
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SDEV UN2320	Economic and Financial Methods for Sustainable Development
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SDEV UN3390	GIS for Sustainable Development
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SDEV UN3450	Spatial Analysis and Modeling for Sustainable Development
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SDEV GU4015	Complexity Science
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SOCI UN3010	Methods for Social Research
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SUMA PS4100	Sustainability Management
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The Summer Ecosystems Experience for Undergraduates (SEE-U) *

Electives

Select one of the following courses:

INAF U4420	Oil, Rights and Development
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SDEV UN3998	Sustainable Development Independent Study
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SUMA PS4310	Practicum in Innovation Sustainability Leadership
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SUMA PS4734	Earth Institute Practicum
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Select two of the following:

Additional courses from analysis and solutions to complex problem

Additional courses from skills/actions

Senior Thesis Seminar (EESC BC3800 and EESC UN3901)

Upper division courses from the list approved by program adviser

Capstone Workshop

SDEV UN3280	Workshop in Sustainable Development
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* The Summer Ecosystem Experiences for Undergraduates (SEE-U): Please note that students in the major or the special concentration who take SEE-U as a 6-point course can use 3 points towards the Complex Problems requirement and 3 points towards the Skills/Action requirement. If SEE-U is taken for 3 points, it can only count as one Complex Problems class.

Special Concentration in Sustainable Development <http://sdev.ei.columbia.edu/curriculum/special-concentration/>

In addition to the requirements of the special concentration, students must complete a major or a full concentration.

The sustainable development foundation courses should be taken first and students should then work with the program adviser on further course selection and sequencing.

The special concentration in sustainable development requires a minimum of 9 courses and a practicum as follows:

Code	Title	Points
Sustainable Development Foundation		
SDEV UN1900	Introduction to Sustainable Development Seminar	
SDEV UN2300	Challenges of Sustainable Development	
EESC UN2330	Science for Sustainable Development	
Natural Science Systems		
Select one of the following courses:		
CHEM UN1403	General Chemistry I (Lecture)	
EEEB UN1001	Biodiversity	
EEEB UN2002	Environmental Biology II: Organisms to the Biosphere	
EESC UN1003	Climate and Society: Case Studies	
EESC UN1011	Earth: Origin, Evolution, Processes, Future	
EESC UN1600	Earth Resources and Sustainable Development	
EESC UN2100	Earth's Environmental Systems: The Climate System	
EESC UN2200	Earth's Environmental Systems: The Solid Earth System	
PHYS UN1201	General Physics I	
Human Science Systems		
Select one of the following courses:		
ANTH UN1002	The Interpretation of Culture	
ECON UN1105	Principles of Economics	
POLS UN1501	Introduction to Comparative Politics	
POLS UN1601	Introduction to International Politics	
SDEV UN2000	Introduction to Environmental Law	
SDEV UN3400	Human Populations and Sustainable Development	
SOCI UN1000	The Social World	
Analysis and Solutions to Complex Problems		
Select two of the following courses:		
CIEE E3260	Engineering for developing communities	

EAAE W4304	Closing the carbon cycle
ECIA W4100	Management and development of water systems
EESC BC3032	Agricultural and Urban Land Use: Human-Environment Interactions
EESC BC3045	Responding to Climate Change
EESC GU4600	Earth Resources and Sustainable Development
PLAN A4579	Introduction to Environmental Planning
PUBH W3100	
SDEV UN3330	Ecological and Social Systems for Sustainable Development
SDEV UN3355	Climate Change and Law
SDEV UN3360	Disasters and Development
SDEV UN3366	Energy Law
SDEV UN3410	Urbanization and Sustainable Development
SOCI BC3932	Climate Change, Global Migration, and Human Rights in the Anthropocene
URBS UN3565	Cities in Developing Countries: Problems and Prospects

The Summer Ecosystem Experiences for Undergraduates (SEE-U) *

Skills/Actions	
Select one of the following courses:	
EAAE E4257	Environmental data analysis and modeling
EESC GU4050	Global Assessment and Monitoring Using Remote Sensing
SCNC W3010	Science, technology and society
SDEV UN2320	Economic and Financial Methods for Sustainable Development
SDEV UN3390	GIS for Sustainable Development
SOCI UN3010	Methods for Social Research
SDEV UN3450	Spatial Analysis and Modeling for Sustainable Development
SDEV GU4015	Complexity Science
SUMA PS4100	Sustainability Management

The Summer Ecosystem Experiences for Undergraduates (SEE-U) *

Practicum	
Select one of the following courses:	
SDEV UN3998	Sustainable Development Independent Study
INAF U4420	Oil, Rights and Development
SUMA PS4310	Practicum in Innovation Sustainability Leadership
SUMA PS4734	Earth Institute Practicum
Capstone Workshop	
SDEV UN3280	Workshop in Sustainable Development

* The Summer Ecosystem Experiences for Undergraduates (SEE-U): Please note that students in the major or the special concentration who take SEE-U as a 6-point course can use 3 points towards the Complex Problems requirement and 3 points towards the Skills/Action requirement. If SEE-U is taken for 3 points, it can only count as one Complex Problems class.

SDEV UN1900 Introduction to Sustainable Development Seminar. 1 Point.

Open to prospective sustainable development majors and concentrators only.

The course is designed to be a free flowing discussion of the principals of sustainable development and the scope of this emerging discipline. This course will also serve to introduce the students to the requirements of the undergraduate program in sustainable development and the content of the required courses in both the special concentration and the major. The focus will be on the breadth of subject matter, the multidisciplinary nature of the scholarship and familiarity with the other key courses in the program. Offered in the Fall and Spring.

Term	Section	Call Number	Instructor	Times/Location
Fall 2017	001	71746	Jason Smerdon	M 11:40am - 12:55pm 834 Seeley W. Mudd Building
Spring 2018	001	20387	Jason Smerdon	T 11:40am - 12:55pm 227 Seeley W. Mudd Building

SDEV UN2000 Introduction to Environmental Law. 3 Points.

The course provides an overview of environmental law for students without a legal background. It examines U.S. statutes and regulations regarding air, water, hazardous and toxic materials, land use, climate change, endangered species, and the like, as well as international environmental issues. After completing the course students should be equipped to understand how the environmental laws operate, the role of the courts, international treaties and government agencies in implementing environmental protection, and techniques used in addressing these issues.

Term	Section	Call Number	Instructor	Times/Location
Spring 2018	001	10924	Philip Weinberg	M W 10:10am - 11:25am 963 Ext Schermerhorn Hall

SDEV UN2300 Challenges of Sustainable Development. 3 Points.

This course provides an introduction to the field of sustainable development, drawing primarily from social science and policy studies. It offers a critical examination of the concept of sustainable development, showing how factors like economics, population, culture, politics and inequality complicate its goals. Students will learn how different social science disciplines (political science, demography, economics, geography, history, law, and sociology) approach challenges of sustainable development across a variety of topics (fisheries, climate change, air pollution, consumption, energy, conservation, and water management). The course provides students with some of the fundamental concepts, vocabulary, and analytical tools to pursue and think critically about sustainable development. Offered in the Spring.

Term	Section	Call Number	Instructor	Times/Location
Spring 2018	001	67747	Jason Chun Yu Wong, Lisa Dale	T Th 10:10am - 11:25am 312 Mathematics Building

SDEV UN2320 Economic and Financial Methods for Sustainable Development. 3 Points.

Prerequisites: Principles of Economics and one semester of calculus. The objective of this course is to introduce students to the skills and methods necessary to understand and evaluate the economic and financial aspects of sustainable development. Throughout the course, students will compare competing objectives and policies through the prism of economic & financial reasoning. Environmental economics and finance are broad areas covering all the multi-faceted and complex interactions between the economic system and the natural environment. Financial markets are the primary source of signals used to direct economic activity in a capitalist global economy. Economic activity is the primary determinant of the quality and sustainability of the natural environment. Students interested in sustainable development who are unfamiliar with economics and who do not develop a facility with economic and financial concepts are severely handicapped in their efforts to increase the level of environmental responsibility embedded in economic activity. This course is intended to provide students with a flying introduction to key analytical concepts required to understand topics in environmental economics and finance and to introduce them to selected topics within the field. The first part of the course (the Analytical Toolbox) is designed to provide a set of portable skills for two sets of students: a) those who will work in fields specifically devoted to sustainable development who, as part of their work, will need to engage with sources of economic & financial information and with discourses where sustainable development is not a focus; and b) students who may end up following careers in organizations where sustainability is not the primary objective. The topics and readings in the second part of the course were chosen to facilitate a critical engagement with the broad intellectual framework underlying sustainable development from the perspective of economics and finance. The topics are intended to create a community of intellectual discourse on sustainable development that will spill over beyond the classroom to the conversations of students and alumni that will far outlive graduation. Offered in the Fall.

Term	Section	Call Number	Instructor	Times/Location
Fall 2017	001	81196	Satyajit Bose	T Th 2:40pm - 3:55pm 318 Hamilton Hall

SDEV W3200 Global Food Systems. 3 Points.

Not offered during 2017-18 academic year.

Concerns about food shortages, land use, climate change and biodiversity have created an urgent need for interdisciplinary researchers, practitioners and policy-makers focused on agriculture. Developing sound solutions that improve agricultural production systems in a sustainable way demands in-depth knowledge of key disciplines underpinning tropical agricultural production systems as well as a good understanding of the broader biophysical, economic and socio-cultural context. Focusing on agricultural science, including biophysical and socioeconomic factors, farming systems, technology, crop and soil management, and current policy issues in agriculture and food production, with a focus on the tropics and subtropics, this course will give key insights into how to improve environmental quality, nutrition and farmers' incomes through sustainable agricultural practices in developing countries.

SDEV UN3280 Workshop in Sustainable Development. 4 Points.

Open to sustainable development seniors only.

The upper level undergraduate Sustainable Development Workshop will be modeled on client based graduate-level workshops, but with more time devoted to methods of applied policy analysis and issues in Sustainable Development. The heart of the course is the group project on an issue of sustainable development with a faculty advisor providing guidance and ultimately grading student performance. Students would receive instruction on methodology, group work, communication and the context of policy analysis. Much of the reading in the course would be project-specific and identified by the student research teams.

Offered in Fall and Spring. For registration issues contact Cari Shimkus (cshimkus@ei.columbia.edu).

Term	Section	Call Number	Instructor	Times/Location
Fall 2017	001	88146	Stuart Gaffin	T Th 10:10am - 12:00pm 252 Engineering Terrace
Fall 2017	002	90797	Radley Horton	M W 10:10am - 12:00pm 252 Engineering Terrace
Spring 2018	001	72903	Stuart Gaffin	T Th 9:00am - 10:50am 326 International Affairs Bldg
Spring 2018	002	77052	Radley Horton	T Th 12:10pm - 2:00pm 54 Thorndike Hall

SDEV UN3310 Ethics of Sustainable Development. 3 Points.

Aiming to improve human conditions within many diverse environments, sustainable development seeks to create, increase and perpetuate benefit and to cease, rectify and reverse harm. Sustainable development is consequently inextricable from the fabric of ethics, woven with determinations of benefit and harm to the existence and well-being of both humans and nonhumans. Underlying such determinations are those of self- and other-regarding motivation and behavior; and underlying these are still others, of sensitivity and rationality in decision-making, whether individual, social or public. Sustainable development is interlaced with and contingent upon all these determinations, at once prescriptive and judgmental, which can be called the ethics of sustainable development. This course is divided into four main sections, of which two are intended to show the ethical fallacies of unsustainable development, and two, the ethical pathways of sustainable development. The first section focuses upon ethically problematic basic assumptions, including human (species) hegemony, happy (hedonic) materialism, and selective (data) denial. The second focuses upon ethically problematic ensuing rationalizations, including those pertaining to damages, victims, consequences and situations of climatic, chemical, biological and ecological harm. The third section responds to these rationalizations with ethically vital considerations of earth justice, environmental justice, culturally-based ethics, and sector-based ethics (water, food, place and climate ethics). Finally, the fourth section responds to the initial, longstanding problematic assumptions with a newly emergent ethical paradigm, comprising biotic wholeness, environmental integrity and the deliberative zero-goal. Tying all sections together is the central theme: to be sustainable, development must be ethical. Reflecting the collaborative quality of the field of sustainable development, the course extends to readings whose authors have all pursued their work at intersections of science and ethics, environment and ethics, policy and ethics, business and ethics, and sustainable development and ethics.

Term	Section	Call Number	Instructor	Times/Location
Spring 2018	001	61945	Adela Gondek	T Th 1:10pm - 2:25pm 233 Seeley W. Mudd Building

SDEV UN3330 Ecological and Social Systems for Sustainable Development. 3 Points.

Prerequisites: *SDEV W2300* Challenges of Sustainable Development; *EESC W2330* Science for Sustainable Development.

The course provides an overview of the complex relationships between ecological and social systems. The course focuses on basic principles in understanding these relationships. After the students are introduced to these basic concepts, the course will focus on three current topics central to Sustainable Development for in-depth study. The emphasis is on the multiple perspectives - environmental, social and economic - required to understand and develop solutions to problems in sustainable development. The three topics are: conservation of biodiversity, payments for ecosystem services, and the ecology of food production. We expect these topics to vary from year to year to keep pace with current topics. The following areas will be covered.: -What is an ecosystem? How are social and ecological systems linked through the flow of energy and materials? -What are the characteristics of coupled human-natural systems? How do these systems function? -What are the current topics in sustainable development that require understanding of social and ecological systems? -For each topic (protection of biodiversity, ecosystem services, ecology of food production), what are the environmental, economic, and social perspectives important for sustainable solutions? How can critical thinking be applied to balance these perspectives to derive sustainable solution? -Data analysis and approaches to analyze ecosystems and options for sustainable development. Offered in the Fall.

Term	Section	Call Number	Instructor	Times/Location
Fall 2017	001	63005	Ruth DeFries	M W 6:10pm - 7:25pm 616 Hamilton Hall

SDEV UN3350 Environmental Policy and Governance for Sustainability. 3 Points.

Sustainability is a powerful framework for thinking about business, economics, politics and environmental impacts. An overview course, Environmental Policy & Governance will focus specifically on the policy elements of sustainability. With an emphasis on the American political system, the course will begin by exploring the way the American bureaucracy addresses environmental challenges. We will then use the foundations established through our understanding of the US system to study sustainable governance at the international level. With both US and international perspectives in place, we will then address a range of specific sustainability issues including land use, climate change, food and agriculture, air quality, water quality, and energy. Over the course of the semester, we will study current events through the lens of sustainability policy to help illustrate course concepts and theories.

Term	Section	Call Number	Instructor	Times/Location
Fall 2017	001	97797	Lisa Dale	M W 2:40pm - 3:55pm 407 Mathematics Building

SDEV UN3355 Climate Change and Law. 3 Points.

Enrollment limited to 15.

The purpose of this course is to provide students with a broad introduction to the field of climate law in the United States and at the international level. The course begins with an overview of the causes and effects of global climate change and the methods available to control and adapt to it. We then examine the negotiation, implementation and current status of the United Nations Framework Convention on Climate Change, the Kyoto Protocol, and the Copenhagen Accord. The focus then turns to the past and proposed actions of the U.S. Congress, the executive branch and the courts, as well as regional, state and municipal efforts. The Clean Air Act, the National Environmental Policy Act and the Endangered Species Act will receive special attention. We evaluate the various legal tools that are available to address climate change, including cap-and-trade schemes; carbon taxation; command-and-control regulation; litigation; securities disclosures; and voluntary action. The roles of energy efficiency, renewable energy sources, carbon capture and sequestration, and forestry and agriculture each receive close attention. Implications for international human rights, international trade, environmental justice, and international and intergenerational equity are discussed. The course concludes with examination of the special challenges posed by China; proposals for adaptation and geoengineering; and business opportunities and the role of lawyers. Offered in the Spring.

Term	Section	Call Number	Instructor	Times/Location
Spring 2018	001	65569	Michael Gerrard	M 4:30pm - 5:30pm 423 Kent Hall
Spring 2018	001	65569	Michael Gerrard	T Th 9:10am - 10:30am 102b Green Hall Law Building

SDEV UN3360 Disasters and Development. 3 Points.

Prerequisites: *EESC 2330; SDEV W2300.*

Human welfare status is very unevenly distributed throughout the globe – some of us live very comfortable lives, others remain in desperate poverty showing little progress away from their condition. Between are countries that are rapidly developing and converging toward the welfare of the richest. At all levels of economic development human activities place significant pressure on the environment and threatens all of Earth's vital functions and support systems for human life. This challenge requires timely responses based on solid understanding of the human/environment interface, technological and economic approaches to mitigate adverse effects on the environment, and routes to understanding the complex dynamics of the coupled human/natural systems that can chart a pathway to improvement in the lives of the poorest and continued well-being for those who have achieved prosperity without forcing natural systems into decline or massive fluctuation. This course offers undergraduate students, for the first time, a comprehensive course on the link between natural disaster events and human development at all levels of welfare. It explores the role that natural disasters might have and have had in modulating development prospects. Any student seriously interested in sustainable development, especially in light of climate change, must study the nature of extreme events - their causes, global distribution and likelihood of future change. This course will cover not only the nature of extreme events, including earthquakes, hurricanes, floods and droughts but also their transformation into disaster through social processes. It will ultimately help students to understand the link between such extreme events, the economic/social shock they represent and development outcomes. The course will combine careful analysis of the natural and social systems dynamics that give rise to disasters and examine through group learning case studies from the many disasters that have occurred in the first decade of the 21st century. Offered in the Spring (odd years only).

SDEV W3360 Disasters and Development. 3 Points.

Prerequisites: *EESC 2330; SDEV W2300.*

Human welfare status is very unevenly distributed throughout the globe – some of us live very comfortable lives, others remain in desperate poverty showing little progress away from their condition. Between are countries that are rapidly developing and converging toward the welfare of the richest. At all levels of economic development human activities place significant pressure on the environment and threatens all of Earth's vital functions and support systems for human life. This challenge requires timely responses based on solid understanding of the human/environment interface, technological and economic approaches to mitigate adverse effects on the environment, and routes to understanding the complex dynamics of the coupled human/natural systems that can chart a pathway to improvement in the lives of the poorest and continued well-being for those who have achieved prosperity without forcing natural systems into decline or massive fluctuation. This course offers undergraduate students, for the first time, a comprehensive course on the link between natural disaster events and human development at all levels of welfare. It explores the role that natural disasters might have and have had in modulating development prospects. Any student seriously interested in sustainable development, especially in light of climate change, must study the nature of extreme events - their causes, global distribution and likelihood of future change. This course will cover not only the nature of extreme events, including earthquakes, hurricanes, floods and droughts but also their transformation into disaster through social processes. It will ultimately help students to understand the link between such extreme events, the economic/social shock they represent and development outcomes. The course will combine careful analysis of the natural and social systems dynamics that give rise to disasters and examine through group learning case studies from the many disasters that have occurred in the first decade of the 21st century. Offered in the Spring (odd years only).

SDEV UN3366 Energy Law. 3 Points.

This course concerns the regulation of energy, energy resources, and energy facilities. Among the topics will be the regulation of rates and services; the roles of the Federal Energy Regulatory Commission and the state public utility commissions; and the interaction with environmental law. Attention will be devoted to energy resources (such as oil, natural gas and coal) and to generating, transmission and distribution facilities. The current and future roles of renewable energy, energy efficiency, and nuclear energy will receive special attention, as will the regulation and deregulation of electricity.

Term	Section	Call Number	Instructor	Times/Location
Fall 2017	001	81346	Michael Gerrard	W 3:30pm - 4:30pm 303 Union Theological Seminary
Fall 2017	001	81346	Michael Gerrard	T 4:20pm - 6:10pm Room TBA

SDEV UN3390 GIS for Sustainable Development. 3 Points.

Priority given to sustainable development senior and juniors.

This course is designed to provide students with a comprehensive overview of theoretical concepts underlying GIS systems and to give students a strong set of practical skills to use GIS for sustainable development research. Geographic Information Systems (GIS) are a system of computer software, data and analysis methods used to create, store, manage, digital information that allow us to create maps and dynamic models to analyze the physical and social processes of the world. Through a mixture of lectures, readings, focused discussions, and hands-on exercises, students will acquire an understanding of the variety and structure of spatial data and databases, gain knowledge of the principles behind raster and vector based spatial analysis, and learn basic cartographic principles for producing maps that effectively communicate a message. Student will also learn to use newly emerging web based mapping tools such as Google Earth, Google Maps and similar tools to develop on-line interactive maps and graphics. The use of other geospatial technologies such as the Global Positioning System will also be explored in this class. Case studies examined in class will draw examples from a wide ranges of GIS applications developed to assist in the development, implementation and evaluation of sustainable development projects and programs. On completion of the course, students will: 1. use a variety of GIS software programs to create maps and reports; 2. develop a sound knowledge of methods to search, obtain, and evaluate a wide variety of spatial data resources; 3. develop skills needed to determine best practices for managing spatial data resources; 4. use GIS to analyze the economic, social and environmental processes underlying the concept of building a sustainable world; 5. Gain an understanding of the limits of these technologies and make assessments of uncertainty associated with spatial data and spatial analysis models. Offered in the fall and spring.

Term	Section	Call Number	Instructor	Times/Location
Fall 2017	001	88547	Kytt MacManus	M 1:10pm - 2:25pm 252 Engineering Terrace
Fall 2017	001	88547	Kytt MacManus	W 1:10pm - 3:25pm 252 Engineering Terrace
Spring 2018	001	62105	Linda Pistolesi, Kytt MacManus	M W 2:40pm - 3:55pm 252 Engineering Terrace
Spring 2018	001	62105	Linda Pistolesi, Kytt MacManus	W 4:00pm - 5:00pm 252 Engineering Terrace

SDEV UN3400 Human Populations and Sustainable Development. 3 Points.

Population processes and their outcomes in terms of population size and distribution have a fundamental role in sustainable development and also broad policy implications. This course will introduce students to the scientific study of human populations as a contribution toward understanding social structure, relations, and dynamics, as well as society-nature interactions. The aim is to offer a basic introduction to the main theories, concepts, measures, and uses of demography. The course will cover the issues of population size, distribution and composition, and consumption, at different scales from global to regional to local, as well as the implications for population-environment relationships. It will also address the fundamental demographic processes of mortality, fertility and migration, including their trends and transitions, We will consider these topics in the context of economic development, sustainability and cultural change. The course will also include an overview of basic demographic techniques and tools used for identifying, managing, analyzing and interpreting population data, and an introduction to population projections. Lab sessions will supplement readings and lectures by enabling students to explore data sources, calculate rates, and graphically represent demographic data. Offered in the Fall (even years).

SDEV W3400 Human Populations and Sustainable Development. 3 Points.

Population processes and their outcomes in terms of population size and distribution have a fundamental role in sustainable development and also broad policy implications. This course will introduce students to the scientific study of human populations as a contribution toward understanding social structure, relations, and dynamics, as well as society-nature interactions. The aim is to offer a basic introduction to the main theories, concepts, measures, and uses of demography. The course will cover the issues of population size, distribution and composition, and consumption, at different scales from global to regional to local, as well as the implications for population-environment relationships. It will also address the fundamental demographic processes of mortality, fertility and migration, including their trends and transitions, We will consider these topics in the context of economic development, sustainability and cultural change. The course will also include an overview of basic demographic techniques and tools used for identifying, managing, analyzing and interpreting population data, and an introduction to population projections. Lab sessions will supplement readings and lectures by enabling students to explore data sources, calculate rates, and graphically represent demographic data. Offered in the Fall (even years).

SDEV UN3410 Urbanization and Sustainable Development. 3 Points.

The first decade of the 21st century marked the first time in human history when more of world's population lived in urban as distinct from rural places. It is impossible to achieve sustainable development in a physical, social or economic manner absent an understanding of the powerful and interdependent relationship between these concepts of sustainability and urbanization. This course explores this vital nexus. Students will gain a more detailed understanding of the ways in which urban life provides opportunities and challenges for addressing climate change, access to water and energy efficiency, among other topics. The intention is to provide students majoring in Sustainable Development with an historic and contemporary understanding of the connections between the process of urbanization that now dominates the world and the range of ways in which that process, directly and indirectly, shapes the challenge of sustainable development. Offered in the Fall (even years).

Term	Section	Call Number	Instructor	Times/Location
Spring 2018	001	64434	Elliott Sclar	M 2:10pm - 4:00pm 201 80 Claremont

SDEV UN3450 Spatial Analysis and Modeling for Sustainable Development. 3 Points.

Priority given to sustainable development senior and juniors.

This is an intermediate course in spatial modeling developed specifically for students in the undergraduate Sustainable Development program. This course will provide a foundation for understanding a variety of issues related to spatial analysis and modeling. Students will explore the concepts, tools, and techniques of GIS modeling and review and critique modeling applications used for environmental planning and policy development. The course will also offer students the opportunity to design, build and evaluate their own spatial analysis models. The course will cover both vector and raster based methods of analysis with a strong focus on raster-based modeling. Participants will also learn how to develop and publish online maps, spatial applications, metadata, and mobile Apps in a geodatabase environment to support fieldwork research and geospatial data gathering and analysis. Course registration includes online mapping user license and credits to store, analyze, and serve geospatial data and apps. We will draw examples from a wide range of applications in such areas as modeling Land Use and Land Cover for biodiversity and conservation, hydrological modeling, and site suitability modeling. The course will consist of lectures, reading assignments, lab assignments, and a final project. **Students must register for required lab: SDEV W3452.**

Term	Section	Call Number	Instructor	Times/Location
Spring 2018	001	68355	Giovani Graziosi	T 4:10pm - 5:25pm 252 Engineering Terrace
Spring 2018	001	68355	Giovani Graziosi	Th 4:10pm - 7:25pm 252 Engineering Terrace

SDEV W3550 Bangladesh: Life on a Tectonically Active Delta. 3 Points.

Open to sustainable development seniors only.

This course will explore the interaction of riverine processes, water and hydrology, sedimentary processes, tectonics, land subsidence and sea level rise, environmental issues, cultural setting, and sustainable development in the world's largest delta. The course will explore both the hazards and resources for life in this dynamic environment through lectures, a field trip to Bangladesh during Spring Break and guest lecturers in earth and social sciences. Offered in Spring.

SDEV UN3998 Sustainable Development Independent Study. 1-3 Points.

Sustainable development majors and special concentrators must register for this independent study to use internship hours for the practicum credit. Students must consult with their program adviser and department before registering. Offered fall, spring and summer.

Term	Section	Call Number	Instructor	Times/Location
Fall 2017	001	96846	Ruth DeFries	
Spring 2018	001	64945	Ruth DeFries	

SDEV W4015 Complexity Science. 3 Points.

The Complexity Course is a survey of techniques, applications, and implications of complexity science and complex systems. This course aims to be both an introduction for students from other fields, and a forum for continued discussion within the complexity community. Topics include systems dynamics, chaos, scaling, fatted distributions, fractals, information theory, emergence, criticality, agentbased models, graph theory, and social networks.

Of Related Interest

Code	Title	Points
Anthropology		
ANTH V3924	Anthropology and Disaster	
Civil Engineering and Engineering Mechanics		
CIEE E3250	Hydrosystems engineering	
CIEE E4163	Sustainable Water Treatment and Reuse	
Earth and Environmental Engineering (SEAS)		
EAAE E3103	Energy, minerals and materials systems	
EAAE E4001	Industrial ecology of earth resources	
EAAE E4009	Geographic information systems (GIS) for resource, environmental and infrastructure management	
EAAE E4160	Solid and hazardous waste management	
EAAE E4350	Planning and management of urban hydrologic systems	
ECIA W4100	Management and development of water systems	
Earth and Environmental Sciences		
EESC GU4008	Introduction to Atmospheric Science	
EESC GU4400	Dynamics of Climate Variability and Climate Change	
Economics		
ECON UN2257	Global Economy	
ECON UN3211	Intermediate Microeconomics	
ECON GU4301	Economic Growth and Development	
ECON GU4370	Political Economy	
ECON GU4500	International Trade	
ECON G4527	Economic Organization and Development of China	
ECON W4625	Economics of the Environment	
Economics (Barnard)		
ECON BC3029	Empirical Development Economics	
Ecology, Evolution, and Environmental Biology		
EEEB UN3087	Conservation Biology	
EEEB W4122	Fundamentals of Ecology and Evolution	
EEEB GU4321	Human Nature: DNA, Race & Identity	
History		
HIST W4400	Americans and the Natural World, 1800 to the Present	
Sociology		

SOCI V2230	Food and the Social Order
SOCI W3290	Environmental Sociology
SOCI UN3960	Law, Science, and Society
Urban Studies	
URBS UN3200	
URBS UN3550	
URBS UN3565	Cities in Developing Countries: Problems and Prospects