

Science of Natural and Environmental Systems (SNES)

Requirements for the Major

<http://snes.eas.cornell.edu>

Note: Please be aware that many upper level courses have pre-requisites and some courses are only offered alternate years. Courses designed for non-science majors will not fulfill a requirement. If you are not sure, please check with your advisor.

Foundation *The following courses are required.*

Biology	- 2 semesters (6 credits)	See: For the Life Sciences Major
http://www.cals.cornell.edu/cals/current/registrar/current-students/cals-graduation/lifebio.cfm		
Calculus	- 2 semesters	Math 1110/1120, or 1910/1920
Chemistry and Physics	- 4 semesters (at least 1 semester of each);	
	Chemistry 1560/2070 or 2080 (as a prereq for CSS 3650), 2090	
	Chemistry 2150/2160, 1570	
	Physics 1101/1102, 2207/2208 (prereq is Math 1120), 1112, 2213/2214 (prereq is Math 1190)	
	Physics 1103 (next offered 2009-2010), or Physics 1116	
Statistics	- 1 semester	AEM 2100 (S), ILRST 2100 (S), Math 1710 (F/S), NtRes 3130 (F), or PAM 2100 (F)
DEA 1500	- Introduction to Human-Environment Relationships	
	(special discussion section for "Writing in the major")	(Spring)
NTRES/SNES 1101	- Intro to the Science and Management of Environmental and Natural Resources	
	(required for Freshman only)	(Fall)
NTRES 2010	- Environmental Conservation	(Spring)

Environmental Core *The following courses are required.*

Biotic Systems	BIOEE	1610	Ecology and the Environment	(Fall)
Capstone Course	ALS	4770	Environmental Stewardship (recommended SR year)	(Spring)
Colloquium Series	SNES	2000	Environmental Sciences Colloquium	
			(required twice, recommended SO & SR years)	(Fall)
Earth Systems	CSS	3650	Environmental Chemistry: Soil, Air and Water	(Spring)
Economic Systems	AEM	2500	Environmental and Resource Economics	(Fall)
Social Systems	NtRes	2201	Society and Natural Resources	(Spring)

SNES Concentrations *Choose one of **four** concentrations (or design your own)*

The concentration component of the SNES major is intended to allow students to develop depth of knowledge and expertise in areas that are of specific interest to the student. A minimum of five courses is required. There are some common and popular concentration themes; however, students can be creative both in terms of the concept for the theme and in the courses chosen to develop the concept. The theme is one place where courses used for a minor or second major can be included.

Students may pursue one of four **Established Concentrations**:

Environmental Agriculture: Students obtain a solid background in agriculture, including the impact of agriculture (e.g., via biotechnology), and to introduce approaches to mitigate soil and water pollution and environmental degradation.

Environmental Biology: Greater depth in biology through basic biology courses (e.g., genetics, evolution), organismal-focused courses (e.g., insects, birds, microbes), and ecosystem-centered courses (e.g., forest, lakes, streams)

Environmental Economics: Students obtain a solid background in economic theory and learn how important static and dynamic allocation problems arise when managing resources and environmental quality

Environmental Information Science: Students obtain a critical understanding of the collection and use of environmental information, as well as to support students in developing skills necessary to acquire, process, and analyze environmental information.

Or, students may pursue a **Student-Designed Concentration**

Some examples:

Environment & Public Policy: In addition to courses in natural systems or in built environments, students will study ethics, democracy, and social problems, and pre-law.

Environmental Communications: Greater depth in the communication with courses on concepts and techniques can be combined with specialized courses dealing with environmental issues and policies.

Oceanography/Marine Science: Interest in the physical, biological, or public policy aspects of oceans can be obtained through a variety of specialized courses in the Shoals Program, Earth and Atmospheric Sciences, or the Hawaii course, among many choices.

Sustainability: The program of study can take many directions from in-depth work on technologies (e.g., energy, transportation), economic and social systems, systems analysis, to global environmental change.

Sustainable Communities: Students with interest in the built environment can utilize course in City and Regional Planning, Design and Environmental Analysis, and engineering disciplines

I. Environmental Agriculture

The goal of this concentration is to provide students with a solid background in agriculture, to convey in-depth knowledge of environmental impact of agriculture including biotechnology, and to introduce approaches to mitigation of soil and water pollution and environmental degradation.

Choose one course from each group with at least **two** courses containing experimental work (*).

Group 1: Systems Course

ANSC/CSS	4120	Whole-Farm Nutrient Management	(Spring)
BIOEE	4730	Ecology of Agricultural Systems	(Fall)
CSS/IARD	4140	Tropical Cropping Systems: Biodiversity, Social, and Environmental Impacts	(Fall)
HORT	4600	Cropping Systems Ecology (*)	(Spring)
NTRES	4800	Global Seminar: Building Sustainable Environments and Secure Food Systems for a Modern World	(Spring)

Group 2: Biotechnology

BIOMI/CSS	3970	Environmental Microbiology	(Spring)
BIOPL	3430	Molecular Biology and Genetic Engineering of Plants	(Spring)
BIOPL/CSS	3470	Laboratory in Molecular Biology & Genetic Engineering of Plants (*)	(Spring)
CSS	4100	The GMO Debate: Environmental Impacts	(Spring)
PLBR	2010	Plants, Genes, and Global Food Production	(Fall)

Group 3: Crop Protection and the Environment

CSS	3150	Weed Biology and Management (*)	(Fall)
CSS/ENTOM	4440	Integrated Pest Management (*)	(Fall)
ENTOM	3700	Pesticides, the Environment and Human Health	(Fall)
PLPA	3010	Biology and Management of Plant Diseases	(Fall)

Group 4: Soil Management

CSS	3210	Soil Management for Sustainability	(Spring)
CSS	4720	Nutrient Management in Agroecosystems (*)	(Spring)
CSS/HORT	4660	Soil Ecology (*)	(Spring)
CSS/EAS	4830	Environmental Biophysics	(Fall)

Group 5: Crop and Animal Production

ANSC	3510	Dairy Herd Management	(Spring)
CSS	4050	Field Crop Systems	(Fall)
HORT	4420	Berry Crops: Culture and Management	(Fall)
HORT	4450	Ecological Orchard Management	(Spring)
NTRES	3250	Forest Management and Maple Syrup Production (or related course on production)	(Spring)

II. Environmental Biology

*The goal of this concentration is to provide students with a sound scientific understanding about plants, animals and microorganisms in their natural environments. Students take **six** courses to complete the concentration.*

Group 1: Foundations in Biology Choose **two** courses.

Biochemistry	BIOBM 3300	Principles of Biochemistry, Individual Instruction (Fall and Spring)	
or	BIOBM 3330	Principles of Biochemistry: Proteins, Metabolism, and Molecular Biology	(Summer)
or	the sequence BIOBM 3310/BIOBM 3320	Principles of Biochemistry: Proteins and Metabolism	(Fall)
Evolution	BIOEE 2780	Evolutionary Biology (Fall or Spring)	
or	BIOPL 4480	Plant Evolution & the Fossil Record	(Spring)
Genetics	BIOGD 2810	Genetics	(Fall & Spring)
	ENTOM 4700	Ecological Genetics	(Spring)
or	NTRES 2830	Genetics for Population Biologists	(Fall)

Group 2: The Physical and Biological Environment Choose **two** courses.

BEE	3710	Hydrology and the Environment	(Spring)
BIOEE	4570	Limnology: Ecology of Lakes	(Spring)
BIOEE	4580	Community Ecology (offered alternate years, next 2009-2010)	(Spring)
BIOEE	4620	Marine Ecology	(Fall)
BIOEE	4780	Ecosystem Biology	(Spring)
BIOSM	3090	Coastal Ecology & Bioclimates	(Summer)
BIOSM	3750	Field Marine Biology and Ecology	(Summer)
CSS	4660	Soil Ecology	(Spring)
CSS/EAS	4830	Environmental Biophysics (4)	(Fall)
EAS/BIOEE	3500	Dynamics of Marine Ecosystems	(Fall)
NTRES	3220	Global Ecology and Management	(Spring)
NTRES/BIOEE	4560	Stream Ecology	(Fall)

Group 3: Plants, Animals, Microbes and the Environment Choose **two** courses.

BIOEE	4660	Physiological Plant Ecology, Lectures	(Spring)
BIOEE	4700/4720	Herpetology Lectures/Laboratory	(Spring)
BIOEE	4750	Ornithology	(Spring)
BIOEE	4760	Biology of Fishes	(Fall)
BIOMI	2900	General Microbiology	(Fall & Spring)
BIOMI/CSS	3970	Environmental Microbiology	(Spring)

BIOMI	4180	Microbial Ecology	(Spring)
BIOSM	3080	Field Microbial Ecology	(Summer)
CSS	3150	Weed Biology and Management	(Fall)
ENTOM	2120	Insect Biology	(Fall)
ENTOM	3440	Insect Conservation Biology	(Spring)
ENTOM	3700	Pesticides, the Environment and Human Health	(Fall)
ENTOM/BIOEE	4550	Insect Ecology	(Fall)
HORT	4400	Restoration Ecology	(Fall)
HORT	4600	Cropping Systems Ecology (formerly Plant-Plant Interactions)	
NTRES	3110	Fish Ecology, Conservation and Management	(Spring)
NTRES	3140	Conservation of Birds	(Summer)
NTRES	4100	Conservation Biology	(Fall)
NTRES	4110	Quantitative Ecology and Management of Fisheries Resources	(Spring)
NTRES	4120	Wildlife Population Analysis	(Spring)
NTRES	4200	Forest Ecology	(Fall)
NTRES	4220	Wetland Ecology and Management	(Fall)
PLPA	3010	Biology and Management of Plant Diseases	(Fall)
PLPA	3090	Fungi	(Fall)

III. Environmental Economics

The goal of this concentration is to provide students with a solid background in economic theory and to show them how important static and dynamic allocation problems arise when managing natural resources and environmental quality.

Required.

AEM	4500	Resource Economics	(Fall)
AEM	4510	Environmental Economics	(Spring)
ECON	1110	Introductory Microeconomics	(Fall, Spring, Winter & Summer)
ECON	1120	Introductory Macroeconomics	(Fall, Spring, Winter & Summer)
ECON	3130	Intermediate Microeconomic Theory	(Fall, Spring, & Summer)
ECON	3140	Intermediate Macroeconomic Theory	(Fall, Spring, & Summer)

Choose one course.

AEM	4110	Introduction to Econometrics	(Fall)
AEM	4120	Computational Methods for Management and Economics	(Spring)
BEE	4750	Environmental Systems Analysis	(Fall)
CRP/NTRES	4440	Resource Management and Environmental Law	(Spring)

IV. Environmental Information Science

The goal of this concentration is to provide students with a critical understanding of the collection and use of environmental information, as well as to support students in developing skills necessary to acquire, process, and analyze environmental information.

Information Acquisition

Group 1: Remote Information Acquisition *Choose **one** course.*

CSS/CEE	4110	Resource Inventory Methods	(Spring)
CSS 6600/CEE	6100	Remote Sensing Fundamentals	(Fall)

Group 2: Ground-based Information Acquisition *Choose **two** courses.*

BEE	4270	Water Sampling and Measurement	(Fall)
BIOEE	2630	Field Ecology	(Fall)
BIOEE	4560	Stream Ecology	(Fall)
COMM	2820	Research Methods in Communication Studies	(Fall)
DSOC	3130	Social Indicators and Research	(Fall)
EAS	3010	Evolution of the Earth System	(Fall)
EAS	4170	Field Mapping in Argentina	(Summer)
EAS	4370	Geophysical Field Methods	(Fall)
NTRES	4200/4201	Forest Ecology	(Fall)
NTRES	4220/4221	Wetland Ecology and Management	(Fall)

Information Processing *Choose **one** course.*

CEE	6150	Digital Image Processing	(Spring)
CRP	4080	Introduction to GIS	(Spring)
CSS	4200	Geographic Information Systems	(Fall)
CSS	6200	Spatial Modeling and Analysis	(Spring)

Information Analysis *Choose **one** course.*

BEE	4750	Environmental Systems Analysis	(Fall)
BIOEE	3620	Dynamic Models in Biology	(Spring)
NTRES	3100	Applied Population Ecology	(Fall)
NTRES	4110	Quantitative Ecology and Management of Fisheries Resources	(Spring)
NTRES	4120	Wildlife Population Analysis: Techniques and Models	(Spring)
NTRES	4240	Landscape Impact Analysis	(Spring)