

Environmental Science

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Students in the Environmental Science degree program take full advantage of Norwich University's location in the middle of the Green Mountain State, where we are ideally situated for field studies of our natural environment.

The Bachelor of Science in Environmental Science is an interdisciplinary degree for students with environmental interests and career goals. Environmental Science majors start their curriculum with the development of a firm base in the sciences and mathematics. Each student develops an area of specialization by selecting a Concentration from one of two Options. Selection of an Option I Concentration leads to a heavier emphasis in science and engineering, whereas selection of an Option II Concentration results in a stronger emphasis in the social sciences, humanities and business.

The program emphasizes experiential learning through field studies and outdoor education. Courses include real projects and original research participation. The program is enriched through department field trips across New England, eastern Canada, and the western United States. All Environmental Science majors take a pair of capstone courses involving

an original research project and a seminar designed to synthesize their education and tie scientific thought to issues in society.

The Department of Earth and Environmental Sciences is equipped for analysis of ground and surface water, soil, sediment, and rock. Equipment enables terrestrial and lake coring, collection of hydro-geochemical data, determination of sediment characteristics, subsurface studies, and more. In addition, majors have access to facilities in their departments of Concentration.

The ten selected Environmental Science Concentrations provide an education that is rigorous and makes graduates widely marketable within industry, graduate education, and the military.

B. S. in Environmental Science – Curriculum Map

For Those Pursuing Option I

Students electing Environmental Biology, Environmental Chemistry, Environmental Geology, Environmental Engineering, or Climate Science as the Concentration will share a common curriculum as upperclassmen that draws heavily from the sciences. Graduates in this Option will have broad interdisciplinary training with a strong science background. Their strength will be in this breadth as well as in the specific focus in which they concentrate their studies.

First Year			
Fall	Credits	Spring	Credits
EN 101 Composition and Literature I	3	EN 102 Composition and Literature II	3
MA 107 Precalculus Mathematics	4	MA 108 Applied Calculus ²	4
BI 101 Principles of Biology I ¹	4	BI 102 Principles of Biology II ¹	4
GL 110 Introduction to Geology	4	GL 111 Oceanography	4
	15		15
Second Year			
Fall	Credits	Spring	Credits
CH 103 General Chemistry I	4	CH 104 General Chemistry II	4
PH 323 Environmental Ethics (or Arts & Humanities Elective)	3	MA 232 Elementary Statistics	3
ES 251 Sophomores Seminar Environmental Science	1	Concentration Elective	4
Concentration Elective	4	Literature Elective (or ES 130)	3
ES 270 Fundamentals of Environmental Science (or Elective) ³	4-3	Elective ³	3-4
	16-15		17-18
Third Year			
Fall	Credits	Spring	Credits
PS 201 General Physics I	4	PS 202 General Physics II	4
EC 201 Principles of Economics (Macro) or 202 Principles of Economics (Micro)	3	ES 130 Introduction to Environmental Law (or Literature Elective)	3
Elective (or ES 270) ³	3-4	Concentration Elective	3-4
Arts & Humanities Elective (or PH 323)	3	Elective ³	4-3
Concentration Elective	3-4		
	16-18		14

Fourth Year			
Fall	Credits	Spring	Credits
ES 450 Directed Study in Environmental Science	4	ES 451 Environmental Seminar	3
BI 405 Ecology	4	History Elective ⁴	3
GL 255 Hydrogeology	3	Concentration Elective	3-4
Concentration Elective	3-4	Elective ³	4-3
	14-15		13
Total Credits: 120-123			

¹ EnvCH and EnvEG concentrations students take CH 103 and CH 104 as freshmen, and BI 101 and BI 102 in the second year.

² Or equivalent, especially if needed as a prerequisite for Concentration courses.

³ Can be used out of sequence and to take more than one concentration elective concurrently.

⁴ Except HI 209 Historical Methods.

Available Concentrations – Option I

Environmental Biology

BI 275	Environmental Biology	4
BI 316	Plant Taxonomy	4
or BI 351	Dendrology and Silvics	
BI 326	Natural History of the Vertebrates	4
or BI 424	Woodland Ecology and Management	
BI 220	Introductory Microbiology	4
or BI 240	Environmental and Food Microbiology	
GL 261	Field Geology	4
CH elective: CH204 or above, 3-4 cr. options only		3-4
Total Credits		23-24

Environmental Geology

GL 253	Geomorphology	4
GL 257	Sedimentation	4
GL 261	Field Geology	4
GL 263	Mineralogy	4
GL 2XX Elective or EG 203 Materials Science		3-4
CH elective: CH204 or above, 3-4 cr. options only		3-4
Total Credits		22-24

Environmental Chemistry

CH 204	Quantitative Analysis	4
CH 205	Survey of Organic Chemistry	4
GL 263	Mineralogy	4
BI 240	Environmental and Food Microbiology	4
Two of the following:		4-7
GL 261	Field Geology	4
CH 314	Instrumental Methods	3-1

or CH 315 Analysis Laboratory

EG 203	Materials Science	3
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Total Credits		20-23
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Environmental Engineering

EG 109	Introduction to Engineering I	3
CE 211	Surveying	3
EG 203	Materials Science	3
AP 221	Site Development and Design	3
GL 253	Geomorphology	4
One of the following:		3-4
GL 261	Field Geology	4
BI 275	Environmental Biology	4
MA 241	Mathematical Computation and Modeling	3
CH elective: CH 204 or above, 3-4 cr. options only		3-4
Total Credits		19-20

Climate Science

CH elective: (CH 204 Quant. Analysis recommended) (must be CH 204 or above, 3-4 cr. options only)		3-4
GL 265	Glacial Geology and Paleoclimate	4
GL 253	Geomorphology	4
PS 207	Meteorology and Climatology	4
MA 241	Mathematical Computation and Modeling	3
One of the following:		3
PO 215	International Relations	3
PO 305	Geopolitics (recommended)	3
PO 415	International Law	3
Total Credits		21-22

For those pursuing Option II

Students pursuing Concentrations in Environmental Policy and Management, Environmental Law and Protection, Environmental Writing, Green Design, or Education share a curriculum during their last three years that has a strong emphasis on social sciences, business, and humanities with less emphasis in the pure sciences. These students will be prepared to enter careers in which social responsibility toward the environment is emphasized.

First Year			
Fall	Credits	Spring	Credits
EN 101 Composition and Literature I	3	EN 102 Composition and Literature II	3
MA 107 Precalculus Mathematics	4	MA 108 Applied Calculus	4
BI 101 Principles of Biology I	4	BI 102 Principles of Biology II	4
GL 110 Introduction to Geology	4	GL 111 Oceanography	4
	15		15
Second Year			
Fall	Credits	Spring	Credits
PH 323 Environmental Ethics or EN 203 Advanced Composition	3	PY 211 Introduction to Psychology	3
ES 251 Sophomores Seminar Environmental Science	1	Literature Elective (or ES 130)	3
PO Elective 1 ¹	3	PO Elective 2 ¹	3
Concentration Elective	4-3	MA 232 Elementary Statistics	3
ES 270 Fundamentals of Environmental Science (or EC 201 or EC 202)	3-4	Concentration Elective	3-4
	14		15-16
Third Year			
Fall	Credits	Spring	Credits
CH XXX Chemistry Elective	4	GL 253 Geomorphology (or Elective) ²	4-3
EC 201 Principles of Economics (Macro), 202 Principles of Economics (Micro), or ES 270 Fundamentals of Environmental Science	3-4	ES 130 Introduction to Environmental Law (or Literature Elective)	3
SO 201 Introduction to Sociology	3	Concentration Elective	3
EN 203 Advanced Composition or PH 323 Environmental Ethics	3	History Elective ³	3
Concentration Elective	3	Elective ²	3-4
	16-17		16
Fourth Year			
Fall	Credits	Spring	Credits
ES 450 Directed Study in Environmental Science	4	ES 451 Environmental Seminar	3
BI 405 Ecology	4	Concentration Elective	3
Concentration Elective	3	Elective (or GL 253) ²	3-4
Arts & Humanities Elective	3	Elective ²	3-4
		Elective ²	3-4
	14		15-18
Total Credits: 120-125			

¹ Selected from PO 105 American Politics, PO 215 International Relations and PO 305 Geopolitics; Green Design concentration students take EG 109 Introduction to Engineering I and EG 110 Introduction to Engineering II.

² Can be used out of sequence and to take more than one concentration elective concurrently.

³ Except HI 209 Historical Methods.

Available Concentrations – Option II Environmental Policy and Management

MG 101	Introduction to Business	3
IS 120	Business Applications & Problem Solving Techniques	3
PO 314	The Legislative Process	3
PO 321	U.S. Constitutional Law	3
MG 309	Management of Organizations	3

MG 341	Business Law I	3
Total Credits		18

Environmental Law and Protection

CJ 101	Introduction to Criminal Justice	3
CJ 102	Substantive Criminal Law	3
CJ 402	Law and Society	3
Two of the following three:		6
PO 321	U.S. Constitutional Law	3
PO 314	The Legislative Process	3
PO 331	State and Local Politics	3
SO 202	Problems of Modern Society	3
Total Credits		18

Environmental Writing

EN Elective ¹		3
EN 251	Literature of the Sea	3
EN 320	Literature of the Developing World	3
EN 274	Introduction to Creative Writing	3
CM 109	Introduction to Mass Media	3
CM 209	Broadcast Writing	3
Total Credits		18

¹ English elective approved by the Environmental Science Program.

Green Design

AP 111	Fundamentals of Architecture	4
AP 118	Fundamentals of Architecture II	4
AP 221	Site Development and Design	3
AP 225	Introduction to Passive Environmental Systems	3
AP 325	Materials, Construction, and Design	3
One of the following three:		3
FA 201	History/Theory of Architecture I	3
FA 202	History/Theory of Architecture II	3
FA 308	History/Theory of Architectural III	3
Total Credits		20

Education ¹

PY 220	Developmental Psychology	3
ED 234	Learning and Teaching Strategies	4
ED 315	Special Needs Child	3
ED 351	Methods of Teaching Science to Elementary Students	3
ED 360	Language Arts and Teaching Reading in the Elementary School	4
MA 360	Teaching Mathematics at the Elementary - Middle School Level	3
Total Credits		20

¹ For Education concentration students seeking licensure, electives must be used to take PY 352 Learning and Memory and ED 425 Student Teaching, and ED 104 Foundations of Education must be taken as an overload.

Courses

ES 115 Geographic Info. Systems 3 Credits

Open to all majors; an introduction to Geographic Information Systems (GIS). GIS is a powerful computer mapping tool essential in: the natural, health, and social sciences; engineering; architecture; and the military. It is used for a wide-range of spatial analyses and data management. Students learn basic GIS and cartographic concepts, ArcGIS software, and application of GIS to their own discipline. During the final 4 weeks of the semester students design, implement, and present a GIS project. Offered Fall of odd numbered years.

ES 130 Introduction to Environmental Law 3 Credits

Major Federal pollution regulation schemes, environmental economics, risk analysis, relevant common law, and constitutional and procedural issues are introduced. Vermont Environmental Law is addressed, as is a survey of the extensive and often novel regulatory approaches of the state of Vermont. The course introduces the law pertaining to environmental issues such as population, economic growth, energy, and pollution. Environmental problems are defined and alternative approaches for dealing with them are examined. Existing statutory efforts such as the National Environmental Policy Act, the Clean Air Act, and the Resource Conservation and Recovery Act are analyzed. Does not fulfill a science requirement. Three lecture hours per week. Offered Spring of even numbered years.

ES 251 Sophomores Seminar Environmental Science 1 Credit

This course introduces the fundamentals of scientific investigation and communication. A research project introduces the Scientific Method, while reading and comprehension of scientific literature is coupled with instruction in and application of technical and scientific writing. Other forms of scientific communication, including poster and oral presentations, are addressed. Students learn the appropriate techniques for displaying and interpreting scientific data. Students may not earn credit for both ES 251 and GL 251. Offered Fall semester.

ES 270 Fundamentals of Environmental Science 4 Credits

This lab science course investigates the atmosphere, hydrosphere, lithosphere, and pedosphere and their interrelations as well as the affect they have on humans and the role that humans play in large-scale change within these spheres. Subjects include modern climate principles and global climate change, water as a natural resource, natural hazards such as landslides, earthquakes and volcanoes, soil nutrient loss and erosion, sustainable agriculture, and other topics related to natural-human interactions. Prerequisite, one introductory Geology lab science. Offered Fall semester of even numbered years.

ES 399 Junior Topics 4 Credits

ES 450 Directed Study in Environmental Science 4 Credits

A capstone project carried out under the direction of a faculty member and in coordination with others taking this course. A laboratory and/or field component of the project will generate new data on an expanding base, and an environmental science report will be prepared based in part on the results of that work. Prerequisite: permission of the instructor. Credit cannot be received both for this course and GL 450. Offered fall semesters.

ES 451 Environmental Seminar 3 Credits

A capstone course offered in a seminar format with required reading, writing, and group participation. Designed to provide an integrating experience with sufficient flexibility to pursue individual interests. This course also includes oral and poster presentations of senior research projects and examination of codes of ethics in the environmental sciences. Classroom 3 hours. Prerequisite: junior or senior standing and permission of the instructor. Credit cannot be received both for this course and GL 451. Offered spring semesters.

ES 499 Env Sci 4 Credits