

# Environmental and Sustainability Sciences and Chemistry, BS

The Departments of Marine and Environmental Sciences and Chemistry provide education in basic environmental and sustainability sciences and chemistry-related disciplines. The overall objective of this combined major is to provide the fundamental scientific background and practical training for students as they prepare for environmental and chemically related careers or advanced study in fields including the traditional specialties such as toxicology, pollution, bioremediation, environmental protection, education, law, and other endeavors that may draw upon an understanding of the chemical basis of the environment and the changes that will likely result from global environmental change.

Key general objectives are the development of qualitative and quantitative problem-solving skills and effective communication skills. This combined major includes the development of conceptual understanding and problem-solving abilities in the fundamental dynamics between the environment and its chemistry, be it analytical chemistry, biochemistry, inorganic chemistry, organic chemistry, and physical chemistry. Students will have the opportunity to perform quantitative measurements; learn proper laboratory practices, including safety; develop proficiency with modern instruments and computers for data acquisition and analysis; and learn the relevance of chemistry within the context of the abiotic and biotic environments.

Students also have the opportunity to participate in the cooperative education program and thereby gain invaluable professional experience to augment their classroom and laboratory work. Not only does that experience add immensely to the overall education received, it also has the potential to provide contacts and references for later employment or graduate school admissions. Students in this major may also undertake research projects for at least one semester under the supervision of a faculty member. Sufficient electives are available in the program either to take more advanced courses or research within the department or to add courses in an area of special interest.

There are a number of interdisciplinary opportunities involving ESS. Due to curricular overlap, combinations of any ESS major, including combined majors, cannot occur with majors or minors in ecology and evolutionary biology or environmental studies or with the minor in geoscience. ESS and chemistry combined majors are also restricted from a minor in environmental chemistry.

## Program Requirements

- Concentrations and course offerings may vary by campus and/or by program modality. Please consult with your advisor or admissions coach for the course availability each term at your campus or within your program modality.
- Certain options within the program may be *required* at certain campuses or for certain program modalities. Please consult with your advisor or admissions coach for requirements at your campus or for your program modality.

Complete all courses listed below unless otherwise indicated. Also complete any corequisite labs, recitations, clinicals, or tools courses where specified and complete any additional courses needed beyond specific college and major requirements to satisfy graduation credit requirements.

## Universitywide Requirements

All undergraduate students are required to complete the Universitywide Requirements (<https://catalog.northeastern.edu/undergraduate/university-academics/university-wide-requirements/>).

## NUPath Requirements

All undergraduate students are required to complete the NUPath Requirements (<https://catalog.northeastern.edu/undergraduate/university-academics/nupath/>).

## Environmental Science and Sustainability Requirements

Code	Title	Hours
<b>Introduction to College</b>		
ENVR 1000 or CHEM 1000 or INSC 1000	Marine and Environmental Sciences at Northeastern Chemistry/Chemical Biology at Northeastern Science at Northeastern	1
<b>Experiential Learning Introduction</b>		
EESC 2000	Professional Development for Co-op	1
<b>Core Courses</b>		
EEMB 2302 and EEMB 2303	Ecology and Lab for EEMB 2302	5
ENVR 1200 and ENVR 1201 or ENVR 2200	Dynamic Earth and Lab for ENVR 1200 Earth's Changing Cycles	4-5

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ENVR 1400 and ENVR 1401	Foundations in Environmental and Sustainability Sciences and Lab for ENVR 1400	5
ENVR 2515	Sustainable Development	4
Complete one of the following:		4-5
ENVR 1500 and ENVR 1501	Introduction to Environmental, Social, and Biological Data and Lab for ENVR 1500	
ENVR 3300 and ENVR 3301	Geographic Information Systems and Lab for ENVR 3300	
Complete four of the following (three of four must be above the 3000 level):		16
EEMB 2400	Introduction to Evolution	
EEMB 3460	Conservation Biology	
EEMB 4001	Landscape and Restoration Ecology	
ENVR 2310 and ENVR 2311	Earth Materials and Lab for ENVR 2310	
ENVR 2340	Earth Landforms and Processes	
ENVR 3125	Global Oceanic Change	
ENVR 3150	Food Security and Sustainability	
ENVR 3200	Water Resources	
ENVR 3600	Oceanography	
ENVR 4500 and ENVR 4501	Applied Hydrogeology and Lab for ENVR 4500	
ENVR 4505	Wetlands	
ENVR 5150	Climate and Atmospheric Change	
ENVR 5190	Soil Science	
ENVR 5210	Environmental Planning	
ENVR 5220	Ecosystem-Based Management	
ENVR 5350	Sustainable Energy and Climate Solutions	
ENVR 5450	Applied Social-Ecological Systems Modeling	
ENVR 5670	Global Biogeochemistry	
ENVR 5750	Urban Ecology	
ENVR 5800	Climate Adaptation and Nature-Based Solutions	
POLS 2395	Environmental Politics and Policy	
PPUA 5260	Ecological Economics	
SOCL 2485	Environment, Technology, and Society	

## Chemistry Requirements

Code	Title	Hours
<b>General Chemistry</b>		
CHEM 1161 and CHEM 1162 and CHEM 1163	General Chemistry for Science Majors and Lab for CHEM 1161 and Recitation for CHEM 1161	5
CHEM 2161 and CHEM 2162 and CHEM 2163	Concepts in Chemistry and Lab for CHEM 2161 and Recitation for CHEM 2161	5
<b>Intermediate-Level Chemistry</b>		
CHEM 2311 and CHEM 2312	Organic Chemistry 1 and Lab for CHEM 2311	5
CHEM 2313 and CHEM 2314	Organic Chemistry 2 and Lab for CHEM 2313	5
CHEM 2321 and CHEM 2322 and CHEM 2323	Analytical Chemistry and Lab for CHEM 2321 and Recitation for CHEM 2321	5
<b>Advanced-Level Chemistry</b>		
CHEM 3401 and CHEM 3402	Chemical Thermodynamics and Kinetics and Lab for CHEM 3401	5
Complete one of the following:		5

CHEM 3331 and CHEM 3332	Bioanalytical Chemistry and Lab for CHEM 3331
CHEM 3403 and CHEM 3404	Quantum Chemistry and Spectroscopy and Lab for CHEM 3403

**Math Requirements**

Complete two of the following: 8-9

MATH 1241 or MATH 1251 or MATH 1341	Calculus 1 Calculus and Differential Equations for Biology 1 Calculus 1 for Science and Engineering
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MATH 1242 or MATH 1252 or MATH 1342	Calculus 2 Calculus and Differential Equations for Biology 2 Calculus 2 for Science and Engineering
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ENVR 2500 and ENVR 2501 or ECON 2350 or POLS 2400 or SOCL 2321	Biostatistics and Lab for ENVR 2500 Statistics for Economists Quantitative Techniques Research Methods in Sociology
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**Physics Requirement**

PHYS 1151 and PHYS 1152 and PHYS 1153	Physics for Engineering 1 and Lab for PHYS 1151 and Interactive Learning Seminar for PHYS 1151	5
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**Integrative Requirements**

<b>Code</b>	<b>Title</b>	<b>Hours</b>
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**Integrative Requirements**

Complete two of the following: 8

CHEM 3410	Environmental Geochemistry
CHEM 4750	Senior Research
ENVR 4050	Solving Emerging Environmental Challenges through Capstone
ENVR 4504	Environmental Pollution
ENVR 5190	Soil Science

**Major Credit Requirement**

94 total semester hours required in the major

**Program Credit Requirement**

140 total semester hours required in the major

**Plan of Study****Sample Plan of Study - Four Years, Two Co-ops in Summer 2/Fall**

Year 1							
Fall	Hours	Spring	Hours	Summer 1	Hours	Summer 2	Hours
CHEM 1161 and CHEM 1162 and CHEM 1163	5	CHEM 2161 and CHEM 2162 and CHEM 2163	5	General elective 2	4	General elective 4	4
ENVR 1000, CHEM 1000, or INSC 1000	1	EEMB 2302 and EEMB 2303	5	General elective 3	4	General elective 5	4
ENVR 1200 and ENVR 1201	5	ENGW 1111	4				
ENVR 1400 and ENVR 1401	5	ENVR 2515	4				
General elective 1	4						
	<b>20</b>		<b>18</b>		<b>8</b>		<b>8</b>

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Year 2							
Fall	Hours	Spring	Hours	Summer 1	Hours	Summer 2	Hours
CHEM 2311 and CHEM 2312		5 CHEM 2313 and CHEM 2314		5 CHEM 2321 and CHEM 2322 and CHEM 2323		5 Co-op	
ENVR elective; 1 of 4		4 EESC 2000		1 Math requirement; 2 of 2		4	
Math requirement; 1 of 2		4 PHYS 1151 and PHYS 1152 and PHYS 1153		5			
General elective 6		4 ENVR skills requirement		4			
		ENVR elective; 2 of 4		4			
		<b>17</b>		<b>19</b>		<b>9</b>	<b>0</b>
Year 3							
Fall	Hours	Spring	Hours	Summer 1	Hours	Summer 2	Hours
Co-op		CHEM 3401 and CHEM 3402		5 General elective 7		4 Co-op	
		ENGW 3307		4 General elective 8		4	
		Advanced CHEM elective		5			
		ENVR elective; 3 of 4		4			
		<b>0</b>		<b>18</b>		<b>8</b>	<b>0</b>
Year 4							
Fall	Hours	Spring	Hours				
Co-op		ENVR elective; 4 of 4	4				
		Integrative course; 1 of 2	4				
		Integrative course; 2 of 2	4				
		General elective 9	4				
		<b>0</b>	<b>16</b>				

**Total Hours: 141**