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**
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 (http://catalog.northeastern.edu/undergraduate/university-academics/university-wide-requirements/).

**NUpath Requirements**
All undergraduate students are required to complete the NUpath Requirements (http://catalog.northeastern.edu/undergraduate/university-academics/nupath/).

**Environmental Science and Sustainability Requirements**

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Core Courses

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<td>Foundations in Environmental and Sustainability Sciences and Lab for ENVR 1400</td>
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<td>Sustainable Development</td>
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Complete one of the following: 4-5

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<td>Geographic Information Systems and Lab for ENVR 3300</td>
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Complete four of the following (three of four must be above the 3000 level): 16
Environmental and Sustainability Sciences and Chemistry, BS

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<td>ENVR 3150</td>
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<td>ENVR 5190</td>
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<td>Applied Social-Ecological Systems Modeling</td>
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<td>POLS 2395</td>
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### Chemistry Requirements

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<td>and Lab for CHEM 1161</td>
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<td>and CHEM 1163</td>
<td>and Recitation for CHEM 1161</td>
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<td>CHEM 2161</td>
<td>Concepts in Chemistry</td>
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<td>and CHEM 2163</td>
<td>and Recitation for CHEM 2161</td>
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**Intermediate-Level Chemistry**

| CHEM 2311   | Organic Chemistry 1                       | 5     |
| and CHEM 2312 | and Lab for CHEM 2311          |       |
| CHEM 2313   | Organic Chemistry 2                       | 5     |
| and CHEM 2314 | and Lab for CHEM 2313          |       |
| CHEM 2321   | Analytical Chemistry                     | 5     |
| and CHEM 2322 | and Lab for CHEM 2321          |       |
| and CHEM 2323 | and Recitation for CHEM 2321 |       |

**Advanced-Level Chemistry**

| CHEM 3401   | Chemical Thermodynamics and Kinetics       | 5     |
| and CHEM 3402 | and Lab for CHEM 3401          |       |

Complete one of the following:

| CHEM 3331   | Bioanalytical Chemistry                   | 5     |
| and CHEM 3332 | and Lab for CHEM 3331          |       |

| CHEM 3403   | Quantum Chemistry and Spectroscopy        | 5     |
| and CHEM 3404 | and Lab for CHEM 3403          |       |

**Math Requirements**

Complete two of the following:

| MATH 1241  | Calculus 1                                 | 8-9   |
| or MATH 1251 | Calculus and Differential Equations for Biology 1 |
| or MATH 1341 | Calculus 1 for Science and Engineering     |
MATH 1242 or MATH 1252 or MATH 1342
Calculus 2
Calculus and Differential Equations for Biology 2
Calculus 2 for Science and Engineering

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

**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

**Integrative Requirements**

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**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**

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