Science of Earth Systems
Offered by the Department of Earth and Atmospheric Sciences
www.eas.cornell.edu

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The earth sciences have never been more critical to society than they are today. Global warming, dwindling energy resources, inadequate water supplies, political strife over strategic minerals, and mega disasters threatened by volcanic eruptions, earthquakes, tsunami, and hurricanes: these are but a few of the headlines that appear with increasing frequency. The Department of Earth and Atmospheric Sciences at Cornell University is a global leader in research directed toward understanding the fundamental processes that have shaped our planet, and is committed to providing students with the earth literacy needed to serve as informed citizens and wise stewards of the Earth.

The Science of Earth Systems major is an undergraduate program offered by the Department of Earth and Atmospheric Sciences to students in the College of Agriculture and Life Sciences, the College of Arts and Sciences, and the College of Engineering. The Science of Earth Systems program is unique in that it incorporates fundamentals of earth science with the emergence of a new and more complete approach, encompassing all components of the earth system—air, life, rock and water—to gain a comprehensive understanding of the world as we know it. Students may choose to focus on one of a number of disciplinary specialties such as geophysics or tectonics, or develop the broad expertise needed to understand the interactions between the diverse elements of earth and life in the past, present and future.

Science of Earth Systems graduates will be able to seek careers dealing with energy, mineral and water resources, natural hazards, weather and climate forecasting, ocean resources, and a host of environmental issues through employment in academia, government and the private sector. The major also prepares students for careers in environmental management and policy, law or medicine, science journalism and K-12 science education.
## Prerequisites for Admission to the Major

An understanding of the Earth requires a strong foundation in math and the basic physical and biological sciences. The requirements described below are the minimum requirements for the major. Students are strongly urged to complete additional math and basic science courses relevant to their concentration.

Students must be in good standing with their college and receive a **C- or better** in all prerequisite courses to be admitted to the major. Students still completing the prerequisites can be admitted to the major provisionally.

Students should visit [www.eas.cornell.edu](http://www.eas.cornell.edu) for specific course requirements

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<thead>
<tr>
<th>Requirement</th>
<th>Requirement Details</th>
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<tr>
<td>Mathematics</td>
<td>At least two courses in calculus</td>
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<tr>
<td>Physics</td>
<td>At least two courses in calculus-based physics</td>
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<tr>
<td>Chemistry</td>
<td>At least two courses in chemistry</td>
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<tr>
<td>Biology</td>
<td>At least one course in biology</td>
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<tr>
<td><strong>Advisor-Approved Course in Math, Statistics, Computer Science, or Natural Science</strong></td>
<td>An advisor-approved course in statistics or computer science, or an additional advisor-approved course in mathematics or natural science, including, but not limited to, a course in astronomy, a second course in biology, or an additional course in physics or chemistry</td>
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**Major Requirements**

Students must receive a **C- or better** in all major required courses and take all major required courses for a letter grade.

<table>
<thead>
<tr>
<th>Introduction</th>
<th>• EAS 2200 The Earth System</th>
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<tr>
<td>Core Courses</td>
<td>Three courses selected from the following five core course options:</td>
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<tr>
<td></td>
<td>• EAS 3010 Evolution of the Earth System</td>
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<td>• EAS 3030 Introduction to Biogeochemistry</td>
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<td>• EAS 3050 Climate Dynamics</td>
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<td>• EAS 4530 Mineralogy</td>
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<td></td>
<td>• Earth Physics (no more than one course may be selected from this option):</td>
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<td></td>
<td>• EAS 3420 Atmospheric Dynamics</td>
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<td></td>
<td>• EAS 3530 Physical Oceanography</td>
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<td>• EAS 4880 Global Geophysics</td>
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<td>Concentration Courses</td>
<td>Four concentration-appropriate courses at the 3000-level or above</td>
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<td>Field Experience</td>
<td>A concentration-appropriate field course such as:</td>
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<td>• EAS 2500 Meteorological Observations and Instruments</td>
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<td>• EAS 3400 Field Study of the Earth System—given as part of the Cornell University Earth and Environmental Systems Field Program in Hawaii</td>
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<td>• EAS 4170 Field Mapping in Argentina</td>
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<td>• Courses in SEA Semester</td>
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<td>• Field courses offered at Shoals Marine Laboratory*</td>
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<td>• Field courses taught by another college or university*</td>
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<td></td>
<td>• Experience gained participating in field research with Cornell faculty (or REU at another institution)*</td>
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<td>Field course options marked by an asterisk (*) require pre-approval by the faculty advisor and the SES Curriculum Committee</td>
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<td>Additional Required Courses</td>
<td>Students in the College of Engineering must also take a major approved elective at the 3000-level or above and three outside major electives. These courses must be approved by the student’s advisor.</td>
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</table>
“I’m interested in…
...predicting weather phenomena, helping society prepare for hazardous storms, and studying climate change.”

Atmospheric Sciences is the study of the atmosphere, its processes, the effects other systems have on the atmosphere, and the effects of the atmosphere on these other systems.

Examples of Concentration Courses:
EAS 3340 Microclimatology
EAS 3410 Atmospheric Thermodynamics and Hydrostatics
EAS 3420 Atmospheric Dynamics
EAS 3520 Synoptic Meteorology I
EAS 4350 Statistical Methods in Meteorology and Climatology
EAS 4400 Seminar: Climate Change Science, Impacts, and Mitigation

Field Experience:
EAS 2500 Meteorological Observations and Instruments

Examples of Careers:
Air Quality Consultant
Environmental Planner/Consultant
Government Meteorologist
Hazard Remediation Consultant
National Weather Service Forecaster
Private Weather Consultant
Science Education Specialist
“I’m interested in…
...correcting environmental pollution,
and solving local to regional scale problems.”

**Biogeochemistry** is the study of the chemical, physical, geological, and biological processes and reactions that govern the composition of the natural environment.

**Examples of Concentration Courses:**
- BEE 3710 Physical Hydrology for Ecosystems
- BIOEE 4780 Ecosystem Biology
- CSS 3650 Environmental Chemistry: Soil, Air, and Water
- EAS 3220 Biogeochemistry of the Hawaiian Islands
- EAS 4550 Geochemistry
- EAS 4800 Our Changing Atmosphere

**Field Experience:**
- EAS 3400 Field Study of the Earth System

**Examples of Careers:**
- Environmental Planner/Consultant
- Government Researcher
- Groundwater Conservationist
- Hydrogeologist
- Science Education Specialist
“I’m interested in…
...the big picture of how the Earth works, and Earth’s past, present, and future.”

**Geological Sciences** is the study of the fundamental chemical, physical, and biological processes that operate in and on the Earth, how these processes interact, and how these interactions have changed over Earth’s History.

**Examples of Concentration Courses:**
- EAS 4010 Fundamentals of Energy and Mineral Resources
- EAS 4050 Active Tectonics
- EAS 4260 Structural Geology
- EAS 4340 Exploration Geophysics
- EAS 4540 Petrology and Geochemistry
- EAS 4780 Stratigraphy

**Field Experience:**
- EAS 4170 Field Mapping in Argentina

**Examples of Careers:**
- Environmental Planner/Consultant
- Hazard Remediation Consultant
- Government Researcher
- Petroleum and Mineral Exploration Geologist
- Science Education Specialist
- Soil Scientist
“I’m interested in…

...understanding the role of the ocean in regulating Earth’s climate and providing ecosystem services to society.”

Ocean Sciences is the study of the world ocean and the processes within it: marine ecology and ecosystem dynamics; marine biogeochemistry; physical oceanography; and marine geophysics and geology.

Examples of Concentration Courses:
- EAS 3500 Dynamics of Marine Ecosystems
- EAS 3510 Conservation Oceanography
- EAS 3530 Physical Oceanography
- EAS 3555 Biological Oceanography and Ocean Biogeochemistry
- EAS 4620 Marine Ecosystem Sustainability
- EAS 7500 Satellite Remote Sensing Training for Biological Oceanographers

Field Experience:
- EAS 3400 Field Study of the Earth System

Examples of Careers:
- Oceanographer
- Marine or Fisheries Ecologist
- Marine Fisheries Manager
- Environmental and/or Resource Manager
- Ocean Policy Maker
- Naval Oceanographer
The Cornell University Earth and Environmental Systems Field Program in Hawaii
(Offered: Every Spring)

The Cornell University Earth and Environmental Systems Field Program is based in the town of Waimea, on the Big Island of Hawaii.

Students enrolled in the field program complete 19 credits of coursework during the spring semester:

EAS 3220 Biogeochemistry of the Hawaiian Islands
EAS 3400 Field Study of the Earth System
EAS 3510 Conservation Oceanography
EAS 4960 Internship Experience
AIS 3400 Contested Terrain: An Introduction to Hawaiian History and Culture

EAS 3220, EAS 3400, and EAS 3510 satisfy degree requirements for students majoring in Science of Earth Systems. Additionally, AIS 3400 satisfies liberal studies/distribution requirements for students in the College of Agriculture and Life Sciences, the College of Arts and Sciences, and the College of Engineering.

http://www.geo.cornell.edu/hawaii/
Field Mapping in Argentina
(Offered: Every Other Summer)

The Cornell University/University of Buenos Aires summer course in field mapping and geology of the Central Andes is based in the Precordillera range in San Juan Province, Argentina.

The field area is marked by spectacular rock exposures and superb examples of geologic phenomena in an active tectonic environment. The first part of the course is based on field exercises that include mapping of recently active faults, Precambrian metamorphic rocks including a Precambrian ophiolite, Paleozoic to Tertiary sedimentary rocks, and Tertiary volcanic rocks. The second part includes two mapping projects and a four day field trip with study exercises in the adjacent Frontal and Main Andean Cordilleras.

Students enroll in the course (EAS 4170 Field Mapping in Argentina) through Cornell University Summer Sessions. The course fulfills the field course requirement for students majoring in Science of Earth Systems.

http://www.eas.cornell.edu/eas/academics/camps/andes.cfm
Cornell University is a premier research institution with the aim of being the best research university at which to be an undergraduate.

Faculty in the Department of Earth and Atmospheric Sciences are deeply committed to a mixture of basic and applied research, to the training of graduate students to be future international leaders in research in both academe and industry, to engaging individual undergraduate students in research experiences, and to infusing our courses with insights that come from our research.

We strongly encourage all students majoring in Science of Earth Systems to participate in undergraduate research during their time at Cornell University. Participating in undergraduate research is one of the best ways for students to learn about their field, gain experience, and make contacts that will help them throughout their career.

We also encourage students majoring in Science of Earth Systems to consider completing a senior honors thesis as part of the Science of Earth Systems Honors Program.
Recent Senior Honors Theses


“An Analysis of Tsunami Signals From Ocean-Bottom Magnetic Measurements”—Neesha Schnepf ‘13

“Classifying Causes of River Flooding in Upstate NY and Predicting Future Flooding Patterns With Global Climate Change”—Meagan Mnich ‘12

“Morphology of Aperture-Breaking Scars in Recent and Fossil Turritelline Gastropods”—Nadia Pierrehumbert ‘12
70% of graduates from the Science of Earth Systems major at Cornell University are attending or have attended graduate school.

Universities that our alumni are attending or have attended for graduate education include:

Brown University
Columbia University
Cornell University
Harvard University
Johns Hopkins University
Massachusetts Institute of Technology
University of Arizona
University of California—Berkeley
University of California—Davis
University of California—Santa Cruz
University of Michigan
University of Washington
Yale University

According to a survey of Science of Earth Systems alumni conducted in 2011 by the Department of Earth and Atmospheric Sciences
Science of Earth Systems graduates have careers in a wide range of fields. Some examples include:

- Air Pollution
- Climate Change
- Disaster Recovery and Business Continuity Planning
- Ecosystem Ecology
- Education
- Environmental Consulting
- Environmental Law
- Geophysics
- Hazardous Waste Policy and Analysis
- Hydrology
- Mineral Exploration
- Paleontology
- Physical Oceanography
- Planetary Science
- Radiation Protection Services
- Structural Geology
- Volcanology
- Water Resources Engineering

Average Income (1-3 years after graduation): $40,000-$50,000
Average Income (6-7 years after graduation): $60,000-$70,000

According to a survey of Science of Earth Systems alumni conducted in 2011 by the Department of Earth and Atmospheric Sciences
Interesting Things in Snee Hall…

...Timothy N. Heasley Mineralogical Museum
See rare and beautiful gemstones!

...Seismographs
Watch earthquakes as they happen around the world!

...Fossils
See dinosaur footprints and mastodon tusks!

...Science of Earth Systems Program Office
Learn about the Science of Earth Systems major!

Visit us in Snee Hall!