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

Faculty: David Hysell (Chair); Geoffrey Abers; Richard Allmendinger; Warren Allmon; Toby Ault; Larry Brown; Lawrence Cathles; Stephen Colucci; Arthur DeGaetano; Louis Derry; Esteban Gazel; Charles Greene; Peter Hess; Teresa Jordan; Suzanne Kay; Katie Keranen; Rowena Lohman; Natalie Mahowald; Bruce Monger; Matthew Pritchard; Sara C. Pryor; Susan Riha; John Thompson; William White; Daniel Wilks; Mark Wysocki

Contact: Savannah Williams
Undergraduate Programs Coordinator
2124 Snee Hall
(607) 255-5466
ss376@cornell.edu

Contact: Larry Brown
Director of Undergraduate Studies
3120 Snee Hall
ldb7@cornell.edu
Study of the earth sciences has never been more critical to society than it is today. Global climate change, dwindling energy resources, inadequate water supplies, and political strife over strategic minerals are global problems that are becoming more and more acute, while volcanic eruptions, earthquakes, tsunamis, and hurricanes threaten our increasingly concentrated populations and complex infrastructure with disaster on unprecedented scales. 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 for specific course requirements

<table>
<thead>
<tr>
<th>Major Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prerequisites for Admission to the Major</strong></td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mathematics</th>
<th>At least two courses in calculus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics</td>
<td>At least two courses in calculus-based physics</td>
</tr>
<tr>
<td>Chemistry</td>
<td>At least two courses in chemistry</td>
</tr>
<tr>
<td>Biology</td>
<td>At least one course in biology</td>
</tr>
</tbody>
</table>

**Advisor-Approved Course in Math, Statistics, Computer Science, or Natural Science**

In addition to the math, physics, chemistry, and biology requirements listed above, students are required to take an advisor-approved course in statistics, computer science, 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).
**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 2250 The Earth System</th>
</tr>
</thead>
</table>
| Core Courses | Three courses selected from the following core course options:  
  • EAS 3010 Evolution of the Earth System  
  • EAS 3030 Introduction to Biogeochemistry  
  • EAS 3040 Interior of the Earth  
  • EAS 3050 Climate Dynamics |
| Concentration Courses | Four concentration-appropriate courses at the 3000-level or above |
| Field Experience | A concentration-appropriate field course such as:  
  • EAS 2500 Meteorological Observations and Instruments  
  • EAS 4370 Field Geophysics (*first offered Spring 2018*)  
  • Courses in SEA Semester  
  • Field courses offered at Shoals Marine Laboratory*  
  • Field courses offered by another college or university*  
  • Experience gained participating in field research with Cornell faculty (or REU at another institution)*  
  Field course options marked by an asterisk (*) require pre-approval by the faculty advisor and the SES Curriculum Committee |
| Additional Required Courses | 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. |
“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 3410 Atmospheric Thermodynamics and Hydrostatics
- EAS 3420 Atmospheric Dynamics
- EAS 3520 Synoptic Meteorology I
- EAS 4350 Statistical Methods in Meteorology and Climatology
- EAS 4470 Physical Meteorology
- EAS 4560 Mesoscale Meteorology

Example of Field Experience:
- EAS 2500 Meteorological Observations and Instruments

Examples of Careers:
- Government Meteorologist
- National Weather Service Forecaster
- Air Quality Consultant
- Hazard Remediation Consultant
- Environmental Planner/Consultant
- Private Weather Consultant
- Science Education Specialist
Environmental Geosciences is the study of the interaction between chemical, physical, geological, and biological processes that control the natural environment that sustains life on earth. Students may focus further on subject areas such as Biogeochemistry, Geohydrology, Energy and the Environment, and Surface Processes.

**Examples of Concentration Courses:**
- BIOEE 6680 Principles of Biogeochemistry
- CEE 4320 Hydrology
- EAS 4010 Fundamentals of Energy and Mineral Resources
- EAS 4740 Quantitative Data Analysis for the Geosciences
- EAS 4800 Our Changing Atmosphere
- PLSCS 3650 Environmental Chemistry: Soil, Air, and Water

**Example of Field Experience:**
- EAS 4370 Field Geophysics

**Examples of Careers:**
- Environmental Planner/Consultant
- Academic or Government Researcher
- Hydrogeologist
- Science Education Specialist
- Conservationist
- Environmental Policy Maker

“I’m interested in…
...correcting environmental pollution,
and solving local to regional scale problems.”
“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 4040 Geodynamics
- EAS 4050 Active Tectonics
- EAS 4260 Structural Geology
- EAS 4530 Mineralogy
- EAS 4540 Petrology and Geochemistry
- EAS 4780 Stratigraphy

**Example of Field Experience:**
- EAS 4370 Field Geophysics

**Examples of Careers:**
- Academic or Government Researcher
- Petroleum or Mineral Exploration Geoscientist
- Natural Hazard Risk Assessor
- Science Education Specialist
- Conservationist
- Environmental Policy Maker
“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 in a Changing Ocean
EAS 3530 Physical Oceanography
EAS 3540 Ocean Satellite Remote Sensing
EAS 3555 Biological Oceanography and Ocean Biogeochemistry
EAS 4620 Marine Ecosystem Sustainability
EAS 5050 Fluid Dynamics in the Earth Sciences

Example of Field Experience:
SEA Semester

Examples of Careers:
Oceanographer
Marine or Fisheries Ecologist
Marine Fisheries Manager
Environmental and/or Resource Manager
Ocean Policy Maker
Naval Oceanographer
Additional Concentrations

Other concentrations can be tailored to a student’s interests in consultation with the student’s advisor and upon approval of the Science of Earth Systems Curriculum Committee. Popular examples include Mathematical Geosciences and Planetary Science.

Field Study

Exposure to the basic observations of earth science in the field is necessary to fully understand the chosen area of concentration in the major. A minimum of three credits of appropriate course work is required, although more experience with field work is encouraged.

This requirement may be met with courses offered at Cornell (EAS 2500 Meteorological Observations and Instruments, EAS 4370 Field Geophysics) or with a field-oriented course offered at another university. Students wishing to study abroad may be able to find an appropriate field course at their abroad institution.
Students in the Field

Bennett Kapili ’16 with the Curiosity Rover during an internship at the Jet Propulsion Lab!

Jillian Lyles ’13 engaged in quantitative whale surveying!

Tim Clements ’15 in the field at Mount St. Helens!

Luke Baranek ’16 in Argentina!

Kelsey Kingsbury ’15 exploring sediment habitats!
Cornell University is an international leader in research on key aspects of earth structure and evolution.

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.
Examples of Recent Senior Honors Theses

“Does Forest Age Affect Carbon and Nitrogen Adsorption in Mineral Horizons?”—Paloma Spina ’17

“Satellite-Derived Glacier Speeds and Elevation Change Rates for Ross Island, Antarctica”—Nicole Abib ’16

“Grassland Restoration: The Effects of Organic Amendments on Carbon Emissions”—Mariela Garcia ’16

“Secondary Mission Objectives and Payload for a Mars Sample Return Lander”—Bennett Kapili ’16

“A Theoretical Apex System Using Morphometric Methods to Address Taphonomic Problems with High-Spired Gastropods”—Erynn Johnson ’15

“An InSAR Study of the Western U.S.”—Alana Semple ’15

“The Relationship Between Carbon Fluxes, Precipitation, and Soil Properties, Along a Climate Gradient, Kohala Volcano, Hawai‘i”—Kathryn Bland ’14

“Dead Snails Do Tell Tales: Invasive Rat Predation on Fossilized Endemic Snails at Makauwahi Cave, Kaua‘i”—Emma Reed ’14
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

According to a survey of Science of Earth Systems alumni conducted in 2011 by the Department of Earth and Atmospheric Sciences

Average Income (6-7 years after graduation): $60,000-$70,000
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!

EAS Global Research Map