EARTH AND CLIMATE SCIENCES (BA)

College of Arts and Sciences

Program Website (https://www.duffield.cornell.edu/eas/majors/ba-bs-earth-atmospheric-sciences/)

CIP: 40.0699 | **HEGIS:** 1999.10 | **NYSED:** 39374

Program Description

The global-scale environmental challenges our society faces today demands a new generation of earth scientists who want to join in the effort to make a more sustainable planet. We work at spatial scales from atoms to solar systems and time scales from seconds to billions of years. Our aim is to understand the fundamental dynamics of our earth, ocean, and atmosphere in sufficient detail to fully reveal our planet's past and to reliably predict its future. We study a wide range of topics that include paleontology, earthquakes, volcanos, geophysics, climate change, melting ice sheets and changes in global ocean ecosystems. Earth and Atmospheric Sciences department faculty members and graduate students carry out cutting-edge research on subjects as diverse as satellite monitoring of volcanic activity, the deep structure of the Andes Mountains and Tibetan Plateau, natural and man-made earthquakes, the nature of the earth's ionosphere, global ocean ecosystems and climate change.

The Earth and Climate Sciences (ECS) major is the undergraduate program offered by the Department of Earth and Atmospheric Sciences to Cornell students in the College of Engineering, the College of Arts and Sciences, and the College of Agriculture and Life Sciences. We offer four concentrations within the ECS major: Climate Science, Environmental Science, Geological Science, and Ocean Science. Each concentration will prepare students with a tailored set of skills and provide the flexibility to choose different pathways depending on their interests.

An abundance of opportunities exists for geological, oceanographic, and climate research in the field and for nationwide and international travel as well as paid research experience. Students have worked with faculty members in the Andes, the Aleutians, the Rocky Mountains, the Atacama Desert, the Caribbean, Tibet, and Hawaii, and have spent a semester at sea in the Sea Semester Program. Students are also able to probe the ionosphere of Earth and the surface of Mars by utilizing techniques in remote sensing.

The ECS major provides a strong preparation for graduate school in any one of the earth sciences, such as climate science, geological science, geophysics, geochemistry, oceanography, hydrology, biogeochemistry, and environmental science. Students seeking employment with the B.A. or B.S. degree will have many options in a wide variety of careers related to energy, the environment, and critical resources in both the private sector and government. Students with the strong science background provided by the ECS major are also highly valued by graduate programs in environmental law, public affairs, economics, and public policy.

Academic Standards

Program Policies

- All coursework for this major is in person, in Ithaca, unless otherwise noted.
- All major requirements must be taken for a letter grade.
- Students must have a C- or above in all courses taken for the Earth and Climate Sciences major.

Academic Standing

The criteria for good standing in the Earth and Climate Sciences major are as follows:

- Semester GPA ≥ 2.0
- Cumulative GPA ≥ 2.3

Honors Program

An honors program is offered by the Department of Earth and Atmospheric Sciences for qualified students. Students interested in applying should contact the Director of Undergraduate Studies during the second semester of their junior year or very early in the first semester of their senior year.

Program Information

- Program Mode of Delivery: In Person
- Program Location: Ithaca, NY
- Minimum Credits for Degree: 120

Program Requirements

In addition to the major requirements indicated below, students must meet Arts and Sciences graduation requirements.

Math and Sciences

This part of the EAS curriculum builds a strong and diverse knowledge of fundamental science and mathematics, providing the student with the basic tools needed in upper-level science classes.

Code	Title	Hours
Mathematics		
MATH 1910 & MATH 1920	Calculus for Engineers and Multivariable Calculus for Engineers	8
Physics		
PHYS 2207	Fundamentals of Physics I	4
or PHYS 1112	Physics I: Mechanics and Heat	
PHYS 2208	Fundamentals of Physics II	4
or PHYS 2213	Physics II: Electromagnetism	
Chemistry		
Select one of the following options:		4
CHEM 2070 & CHEM 2071	General Chemistry I and General Chemistry I Laboratory	
CHEM 2090 & CHEM 2091	Engineering General Chemistry and Engineering General Chemistry Laboratory	
Select one of the following options:		3-4
CHEM 2080 & CHEM 2081	General Chemistry II and General Chemistry II Laboratory	
CHEM 1570	Introduction to Organic and Biological Chemistry	
Biology		
Select one of the following:		3-5
BIOG 1140	Foundations of Biology	
BIOG 1440	Introductory Biology: Comparative Physiology	
BIOEE 1610	Introductory Biology: Ecology and the Environment	

BIOEE 1780	An Introduction to Evolutionary Biology and Diversity	
BIOMG 1350	Introductory Biology: Cell and Developmental Biology	
BIOSM 1610	Ecology and the Marine Environment	
BIOSM 1780	Evolution and Marine Diversity	
Complete one Advisor-Approved Course in Mathematics, 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). Students in the College of Agriculture and Life Sciences must select a second course in biology.

Focused Electives

Climate Science Focused Elective

The curriculum in Climate Science Focused Elective emphasizes the scientific study of the behavior of climate and applications to the important practical problems of understanding how humans are modifying the climate system, the changing hazards caused by climate change, and the impacts of proposed mitigation efforts on the climate system. Students develop a fundamental understanding of the climate system, focused on the atmosphere and ocean, and develop skills to allow the analysis of changes in climate and their impacts on hazards such as extreme precipitation, drought, air quality, and the interactions with renewable energies. The curriculum includes a strong foundation in basic mathematics and science courses; core courses in atmospheric thermodynamics, atmospheric dynamics, and climate dynamics among a variety of Climate Science electives, including electives that teach students about how science and policy interact, as well as understanding the controversies and conclusions from the United Nations Intergovernmental Panel on Climate Change.

Code	Title	Hours
Climate Science Core Required Courses- Must take all		
EAS 2250	The Earth System	4
EAS 3050	Climate Dynamics	3
EAS 3410	Atmospheric Thermodynamics and Hydrostatics	3
EAS 3420	Atmospheric Dynamics	3

Code	Title	Hours
Climate Science Focused Elective Courses (5 courses)		
EAS 1400	Introductory Undergrad Skills for Success	1
EAS 2400	Observing the Earth: Remote Sensing and GIS	3
EAS 3010	Evolution of the Earth System	4
EAS 3030	Introduction to Biogeochemistry	4
EAS 3340	Microclimatology	3
EAS 3530	Physical Oceanography	3
EAS 4350	Statistical Methods in Meteorology and Climatology	3
EAS 4470	Physical Meteorology	3
EAS 4720	Fundamentals of Glaciology	3
EAS 4800	Atmospheric Chemistry: From Air Pollution to Global Change	3
EAS 4860	Tropical Meteorology and Climate	3
EAS 5555	Theory and Practice of Earth System Modeling	3
BEE 2000	Perspectives on the Climate Change Challenge	1.5-3
BEE 4850	Environmental Data Analysis and Simulation	3

Climate Science Focused Elective Field Course

- EAS 2500 Meteorological Observations and Instruments

Other field options:

- Field courses offered by another college or university with prior advisor approval[1]
- Experience gained participating in field research with Cornell faculty (or REU at another institution)[1]
- Advisor-approved Undergraduate Research (EAS 4910/EAS 4920) totaling at least three credits. The research must conclude with formal paper describing results and conclusions or a poster or oral presentation presented at a public venue.

[1] Requires pre-approval by the faculty advisor and the EAS Curriculum Committee. These courses/internships/REUs should require observations to be taken in the field and interpreted by the student. Field courses should generally require 40+ hours of active observation and data collection in the field. Students using a non-credit research option for the field course requirement are required to complete an additional EAS concentration course.

Environmental Science Focused Elective

The curriculum in the Environmental Science focused elective focuses on the scientific study of the environment. Students in the Environmental Science focused elective of Earth and Atmospheric Sciences develop knowledge and understanding necessary to characterize environmental conditions, make informed predictions about the future, and prevent or address environmental problems. Environmental problems can involve physical, chemical, and biologic processes within the air, water, rock, and soil, and thus often require multidisciplinary solutions. The curriculum for the Environmental Science focused elective in Earth and Atmospheric Sciences prepares students to tackle these challenges through a strong foundation in basic math and science courses; core courses in Earth materials, environmental geophysics, and biogeochemistry; as well as elective focused elective courses involving the fields of groundwater and surface water hydrology, biogeochemistry, the geology sediments and soils, and geophysical methods of characterization; and includes field course options that focus on building practical experience. Beyond coursework, students also often take advantage of opportunities for work experience through internships, undergraduate research projects, and environmental-themed project teams.

Code	Title	Hours
Environmental Science Core Required Courses-Must take all		
EAS 2250	The Earth System	4
EAS 3090	Earth Materials	3
EAS 3030	Introduction to Biogeochemistry	4
EAS 4710	Introduction to Groundwater	3

Code	Title	Hours
Environmental Science Focused Elective Courses (5 courses)		
BEE 4270	Water Measurement and Analysis Methods	3
BEE 4730	Watershed Engineering	4
BEE 4750	Environmental Systems Analysis	3

EAS 3010	Evolution of the Earth System	4
EAS 3050	Climate Dynamics	3
EAS 3530	Physical Oceanography	3
EAS 3540	Ocean Satellite Remote Sensing	3
PLSCI 3650	Environmental Chemistry: Soil, Air, and Water	3
EAS 4190	Geofluids	3
EAS 4710	Introduction to Groundwater	3
EAS 4720	Fundamentals of Glaciology	3
EAS 4740	Quantitative Data Analysis for the Geosciences	3
EAS 4870	Introduction to Radar Remote Sensing	3

Environmental Science Focused Elective Field Courses

- EAS 4370 Field Geophysics

Other field options:

- Field courses offered by another college or university with prior advisor approval.[1]
- Experience gained participating in field research with Cornell faculty (or REU at another institution)[1]
- Advisor-approved Undergraduate Research (EAS 4910/EAS 4920) totaling at least three credits. The research must conclude with formal paper describing results and conclusions or a poster or oral presentation presented at a public venue.

[1] Requires pre-approval by the faculty advisor and the EAS Curriculum Committee. These courses/internships/REUs should require observations to be taken in the field and interpreted by the student. Field courses should generally require 40+ hours of active observation and data collection in the field. Students using a non-credit research option for the field course requirement are required to complete an additional EAS concentration course.

Geological Sciences Focused Elective

Geological Science studies processes involved in Earth's origin and evolution, its relationship with the solar system, and its structure and composition. Geological Science is also interconnected to society's needs, including the responsible use of natural resources, preserving the environment, and studying and mitigating natural hazards (earthquakes, volcanic eruptions, landslides, etc.). With exponential population growth, we face the challenge of securing resources (water, minerals, food) sustainably. The focused elective on Geological Science focused elective focuses the Earth's fundamental processes with numerical, analytical, field, and communications skills needed to conduct scientific research and work on solving some of the most critical challenges of the 21st century. The focused elective requirements and flexibility to design your curriculum with many specialized focused elective courses to choose from, and field and lab opportunities provide excellent preparation for graduate school and careers in the geoscience industry, sustainable use of resources, land use planning, material science, remote sensing, law, etc. The gorgeous landscape of New York's Finger Lakes and the proximity to the Adirondack mountains provide natural laboratories to study geologic processes in the field as well as field opportunities abroad. The program features small classes with personalized mentorship offered by our world-class faculty.

Code	Title	Hours
Geological Sciences Core Required Courses-Must take all		
EAS 2250	The Earth System	4
EAS 3090	Earth Materials	3
EAS 3880	Global Geophysics	3
EAS 3010	Evolution of the Earth System	4

Code	Title	Hours
Geological Science Focused Elective Courses (5 courses)		
EAS 4010	Fundamentals of Energy and Mineral Resources	3
EAS 4040	Geodynamics	3
EAS 4050	Active Tectonics and Structural Geology	3
EAS 4060	Geodesy	3
EAS 4550	Geochemistry	3
EAS 4561	Isotope Geochemistry	3
EAS 4580	Volcanology	3
EAS 4720	Fundamentals of Glaciology	3
EAS 4740	Quantitative Data Analysis for the Geosciences	3
EAS 4790	Paleobiology	4
EAS 4840	Inverse Methods in the Natural Sciences	3
EAS 5770	Planetary Surface Processes	3

Geological Science Focused Elective Field Courses

- EAS 4370 Field Geophysics

Other field options:

- Field courses offered by another college or university with prior advisor approval.[1]
- Experience gained participating in field research with Cornell faculty (or REU at another institution)[1]
- Advisor-approved Undergraduate Research (EAS 4910/EAS 4920) totaling at least three credits. The research must conclude with formal paper describing results and conclusions or a poster or oral presentation presented at a public venue.

[1] Requires pre-approval by the faculty advisor and the EAS Curriculum Committee. These courses/internships/REUs should require observations to be taken in the field and interpreted by the student. Field courses should generally require 40+ hours of active observation and data collection in the field. Students using a non-credit research option for the field course requirement are required to complete an additional EAS concentration course.

Ocean Sciences Focused Elective

The field of ocean science encompasses four subdisciplines covering marine geology, marine chemistry, physical oceanography, and biological oceanography. There is a strong interdisciplinary overlap among all four of these sub-disciplines. An EAS focused elective in ocean sciences touches on all four subdisciplines but is often tailored to emphasize one of the sub-disciplines over the other three. Marine geology often involves the study of seafloor processes associated with plate tectonic motion (e.g., spreading centers and seafloor subduction). It may also address the issue of coastal erosion and the impact of sea-level rise on coastline stability. Marine chemistry involves the study of global-scale cycles of the major elements on earth such as carbon or nitrogen. Or it might involve the use of chemical tracers to delineate deep ocean water mass movements. More recently, this discipline has been in a race to understand human-caused ocean acidification and ocean de-oxygenation resulting from global warming. Physical oceanography is the study of fluid dynamics at geophysical scales. This involves the study of coastal wave dynamics, coastal upwelling, open-ocean eddies, air-sea exchanges of heat, freshwater and momentum or global-scale heat transport via

meridional overturning circulation (aka, conveyor belt circulation). Biological oceanography is the study of marine food webs and their role in the global biogeochemical cycling of major elements. More recently, biological oceanographers have been in a race to understand the impacts of global warming and ocean acidification on marine ecosystems.

Code	Title	Hours
Ocean Sciences Core Required Courses-Must take all		
EAS 2250	The Earth System	4
EAS 3050	Climate Dynamics	3
EAS 3530	Physical Oceanography	3
EAS 3030	Introduction to Biogeochemistry	4

Code	Title	Hours
Ocean Sciences Focused Elective Courses (5 courses)		
EAS 3010	Evolution of the Earth System	4
EAS 3420	Atmospheric Dynamics	3
EAS 3540	Ocean Satellite Remote Sensing	3
EAS 3555	Marine Microbes and Disease in a Changing Ocean	3
EAS 4720	Fundamentals of Glaciology	3

Ocean Sciences Field Courses

- Shoals Marine Lab Courses (https://www.shoalsmarinelaboratory.org/academics/undergraduate/courses)
- Sea Education Association Courses (https://sea.edu/)
- Woods Hole Oceanographic Courses (https://www.whoi.edu/)

Other field options:

- Field courses offered by another college or university with prior advisor approval.[1]
- Experience gained participating in field research with Cornell faculty (or REU at another institution)[1]
- Advisor-approved Undergraduate Research (EAS 4910/EAS 4920) totaling at least three credits. The research must conclude with formal paper describing results and conclusions or a poster or oral presentation presented at a public venue.

[1] Requires pre-approval by the faculty advisor and the EAS Curriculum Committee. These courses/internships/REUs should require observations to be taken in the field and interpreted by the student. Field courses should generally require 40+ hours of active observation and data collection in the field. Students using a non-credit research option for the field course requirement are required to complete an additional EAS concentration course.

University Graduation Requirements Requirements for All Students

In order to receive a Cornell degree, a student must satisfy academic and non-academic requirements.

Academic Requirements

A student's college determines degree requirements such as residency, number of credits, distribution of credits, and grade averages. It is the student's responsibility to be aware of the specific major, degree, distribution, college, and graduation requirements for completing their chosen program of study. See the individual requirements listed by each college or school or contact the college registrar's office (https://registrar.cornell.edu/service-resources/college-registrar-directory) for more information.

Non-academic Requirements

Conduct Matters. Students must satisfy any outstanding sanctions, penalties or remedies imposed or agreed to under the Student Code of Conduct (Code) or Policy 6.4. Where a formal complaint under the Code or Policy 6.4 is pending, the University will withhold awarding a degree otherwise earned until the adjudication process set forth in those procedures is complete, including the satisfaction of any sanctions, penalties or remedies imposed.

Financial Obligations. Outstanding financial obligations will not impact the awarding of a degree otherwise earned or a student's ability to access their official transcript. However, the University may withhold issuing a diploma until any outstanding financial obligations owing to the University are satisfied.

Additional Requirements for Undergraduate Students

The University has two requirements for graduation that must be fulfilled by all undergraduate students: the swim requirement, and completion of two physical education courses. For additional information about fulfilling University Graduation Requirements, see the Physical Education website (https://scl.cornell.edu/pe/).

Physical Education

All undergraduate students are required to take two credits (two courses) of Physical Education prior to graduation. It is recommended they complete the two courses during their first year at Cornell. Credit in Physical Education may be earned by participating in courses offered (https://catalog.cornell.edu/courses/pe/) by the Department of Athletics and Physical Education and Cornell Outdoor Education, by being a registered participant on a varsity athletic team, or performing in the marching band.

Students with medical concerns should contact the Office of Student Disability Services (http://sds.cornell.edu/).

Swim Requirement

The Faculty Advisory Committee on Athletics and Physical Education has established a basic swimming and water safety competency requirement for all undergraduate students. Normally, the requirement is taken during the Fall Orientation process at Helen Newman Hall or Teagle Hall pools. The requirement consists of the following: jump or step feet-first into the deep end of the pool, float or tread for one minute, turn around in a full circle, swim 25 yards using any stroke(s) of choice without touching the bottom or holding on to the sides (there is no time limit) and exit from the water. Students who do not complete the swim requirement during their first year, during a PE swim class or during orientation in subsequent years, will have to pay a $100 fee. Any student who cannot meet this requirement must register for PE 1100 Beginning Swimming as their physical education course before electives can be chosen.

If a student does not pass the swim requirement in their first Beginning Swimming PE class, then the student must take a second Beginning Swimming PE class (PE 1100 or PE 1101). Successful completion of two Beginning Swimming classes (based on attendance requirements) with the instructor's recommendation will fulfill the University's swim requirement.

Students unable to meet the swim requirement because of medical reasons should contact the Office of Student Disability Services (http://sds.cornell.edu/). When a waiver is granted by the Faculty Committee on Physical Education, an alternate requirement is imposed. The alternate requirement substitute is set by the Director of Physical Education.

College of Arts and Sciences Graduation Requirements

Undergraduate Degrees

Graduation Requirements for the Bachelor of Arts Degree

Credit Requirement

120 academic credits are required, 100 of which must be taken in the College of Arts & Sciences. 100 credits in Arts & Sciences is a minimum number, as is the 120 credit total. A minimum of 80 credits must be in courses for which a letter grade was received. AP, IB, CASE and A-Level credits count toward the 120 total credits but not toward the 100 A&S credits. Transfer credits for non-transfer students cannot count towards the 100 A&S credits. (See list of courses (https://as.cornell.edu/registrar/courses-that-dont-count) that do not count as academic credit.)

Residency Requirement

Eight full-time semesters in residence (in person) are expected to complete degree requirements with a minimum of six full-time semesters being required. External transfer students must complete a minimum of four full-time residence semesters.

First-year Writing Seminar (FWS) Requirement

Two courses are required. A 5 on either the AP English Composition or Literature exam, or a 7 on the IB HL English Literature or Language exam will count towards one of these seminars. First-year students should take an FWS during their first semester at Cornell and are required to complete two by the end of their sophomore year.

Foreign Language Requirement

A student must either pass an intermediate Cornell language course at the 2000-level or above (Option 1) or complete at least 11 credits in a single foreign language at Cornell (Option 2). AP and IB credits cannot complete this requirement, but usually indicate that a student can place into a higher level course. Note: Native speakers of a foreign language may be exempted from this requirement. For a list of language offerings and placement, see Language Study at Cornell.

Distribution Requirement

Must take a minimum of 8 courses of at least 3 credits to fulfill 10 distribution categories. How an individual course is categorized is indicated with the appropriate abbreviation in its course description. It is important to recognize that only courses with the proper designation in the catalog can be used toward fulfilling the distribution requirements in Arts and Sciences. Unless otherwise specified, variable credit courses, including independent study courses, may not be used for distribution credit.

Arts & Sciences Distribution Requirement Categories:

- Arts, Literature, and Culture (ALC-AS)
- Biological Sciences (BIO-AS)
- Ethics and the Mind (ETM-AS)
- Global Citizenship (GLC-AS)
- Historical Analysis (HST-AS)
- Physical Sciences (PHS-AS)
- Social Difference (SCD-AS)
- Social Sciences (SSC-AS)
- Statistics and Data Science (SDS-AS)
- Symbolic and Mathematical Reasoning (SMR-AS)

To review distribution requirement definitions and course lists, please visit the College of Arts and Sciences Distribution Requirement List (https://cornell-test.courseleaf.com/enrollment-credit-requirements/distribution-codes/arts-sciences/) section of this catalog.

Major Requirement

Students must complete the requirements for at least one major in A&S. See individual major listings for major requirements.

Policies on Applying Cornell and Non-Cornell Courses and Credits to Distribution Requirements

Restrictions on Applying AP/Test Credit and Courses from Other Institutions to the Distribution Requirements

- Students may not apply AP/test credit or transfer credit from another institution to the distribution requirements.
- Students who transfer to the college from another institution are under the above rules for advanced placement credit, but are eligible to have credit for post–high school course work taken during regular full-time semesters (not summer terms) at their previous institution count toward all distribution requirements. Transfer students receive a detailed credit evaluation when they are accepted for admission.

Restrictions on Applying Cornell Courses to the Distribution Requirements

- First-year writing seminars and ENGL 2860 Creative, Lyric, and Expository Writing or ENGL 2880 Expository Writing taken to satisfy a first-year writing seminar requirement may not count toward any other college or major requirement.
- Only courses with the proper designation in the Courses of Study can be used toward fulfilling the distribution requirements in Arts and Sciences.
- Students may not petition to change the category of any given course, nor may any faculty member change the category of a course for an individual student. Faculty members wishing to change the category for a course in which they are the primary instructor must petition the Educational Policy Committee for a change in category. If granted, the new category must be applied to the course as a whole and not for an individual student.

Courses That May Fulfill More Than One Requirement

- A course may fulfill more than one college requirement in any of the following situations:
- A course may be used to fulfill distribution and a major requirement (except if prohibited by one of the restrictions noted on applying AP/test credit, transfer credit, and Cornell courses to distribution requirements).
- A course may satisfy a maximum of two distribution categories. Students can only double-count distribution requirements on a maximum of two courses.
- A one-semester course in foreign literature (not language) or culture that is acceptable for certifying Option 1 in that language may also be applied to the relevant distribution requirement.
- Courses may count toward any other requirement except first-year writing seminars.

Credit Requirement

Credits and Courses

Students must earn a minimum of 120 academic credits (which may include AP/test credits). Of the 120, a minimum of 100 must be from courses taken in the College of Arts and Sciences at Cornell.

Courses that do not count toward the 120 credits required for the degree

The College of Arts and Sciences does not grant credit toward the degree for every course offered by the university. Courses in service as a teaching assistant, physical education, remedial or developmental training, precalculus mathematics, supplemental science and mathematics, offered by the Learning Strategies Center, and English as a second language are among those for which degree credit is not awarded. Students can view the list of courses that do not count for academic credit here (https://as.cornell.edu/registrar/courses-that-dont-count).

Other cases in which a course may not receive credit include the following:

- A course identified as a prerequisite for a subsequent course may not be taken for credit once a student completes that subsequent course.
- A repeated course. (For more information, see "Repeating courses," below.)
- A "forbidden overlap," that is, a course with material that significantly overlaps with material in a course a student has already taken. Students should consult the list of Forbidden Overlaps for more information.

Courses that count toward the 100 required Arts and Sciences credits

May include liberal arts courses approved for study abroad during a semester or academic year of full-time study (not summer abroad study), courses taken in certain off-campus Cornell residential programs, and a maximum of three courses that majors may accept from other colleges at Cornell as fulfilling major requirements. A&S courses taken in Cornell's summer session may count towards the 100 A&S credits.

Courses that do not count toward the 100 required Arts and Sciences credits

Include credits earned in other colleges at Cornell (except in the cases specifically noted in this section), transfer credits earned in any subject at institutions other than Cornell, and advanced placement/test credits. AP/test credits count as part of the 120 credits required for the degree but not as part of the 100 Arts and Sciences credits and may not be applied to distribution requirements. AP credits are posted on the transcript. If, subsequently, a student takes the course out of which they had placed, the AP credit will be removed because of the overlap in content. Students may use up to 12 credits of college approved ROTC courses as electives counting towards the 120 degree credits.

Repeating Courses

Students occasionally need to repeat courses. Some courses, such as independent study, some music and performance courses, and specific topical seminars, in which content is significantly different, do grant credit when the course is taken more than once. For all repeated courses, both grades appear on the transcript and are included in both the term and cumulative GPA. For repeated courses that do not grant credit more than once, only one instance counts toward degree credits and requirements.

Residency Requirement

The College of Arts & Sciences is a residential community and students typically spend eight semesters of full-time study in residence to earn the B.A. degree.

The completion of a fall or spring term as a full-time registered student at Cornell counts as a semester in residence. Summer and winter terms at Cornell, study in Cornell's School of Continuing Education and at other institutions do not count as semesters of residence.

The residency requirement has two components: a minimum number of semesters in residence and a requirement to spend the last full-time semester of study in residence.

Students matriculating into the College of Arts & Sciences as first-year students must have a minimum of six semesters in residence before graduating. First-year matriculants into A&S can count up to two semesters in an approved off-campus program as semesters in residence. Approved off-campus programs include A&S approved study abroad programs, Cornell in Washington, Cornell in Rome, Cornell in Los Angeles, and the Cornell-China & Asia-Pacific Studies (CAPS) Program.

Students who transfer into the College of Arts & Sciences after matriculating in their first-year in another Cornell college (internal transfers) must have a minimum of six semesters in residence, and a minimum of two semesters in the College of Arts and Sciences before graduating. Internal transfers can count up to two semesters in an approved off-campus program as semesters in residence.

Students who transfer into Cornell from another institution (external transfers) must have a minimum of four semesters in residence, and a minimum of two semesters in the College of Arts & Sciences, before graduating. External transfers can count up to one semester in an approved off-campus program as a semester in residence.

In addition to the minimum number of semesters in residence, all students must complete their final full-time semester of study (i.e., the last semester in which at least 9 academic credits are needed to meet graduation requirements) in residence. Students who have fewer than 9 credits to complete degree requirements, and have met the minimum number of semesters residency requirement, may elect to complete their degree requirements during Cornell summer and winter terms registered as an A&S student or at another institution with approved transfer credit. Students cannot meet final degree requirements registered as an extramural student at Cornell.

Exceptions to the residence requirement are not petitionable.

Foreign Language Requirement

The faculty considers competence in a foreign language essential for an educated person. Studying a language other than one's own helps students understand the dynamics of language, our fundamental intellectual tool, and enables students to understand another culture. The sooner a student acquires this competence, the sooner it will be useful. Hence, work toward the foreign language requirement should be undertaken in the first two years. Students postponing the language requirement for junior and senior years risk not graduating on time. Courses in foreign languages and/or literature are taught in the College of Arts and Sciences by the following departments: Africana Studies and Research Center, Asian Studies, Classics, Comparative Literature, German Studies, Linguistics, Near Eastern Studies, and Romance Studies. For a list of languages and placement see Language Study at Cornell.

The language requirement may be satisfied in one of the following ways:

Option 1 (FLOPI-AS)
Passing (a) a non-introductory foreign language course of 3 or more credits at Cornell at the 2000-level or above or (b) any other non-introductory course at the 2000-level or above conducted in a foreign language at Cornell. These courses are labeled in the roster with the distribution code FLOPI-AS (Foreign Language Option 1).

OR

Option 2
Passing at least 11 credits of study in a single foreign language (taken in the appropriate sequence) at Cornell.

Any exceptions to these rules will be noted elsewhere in individual department descriptions.

Students whose speaking, reading, and writing competence in a language other than English is at the same level we would expect our entering first-year students to have in English (as shown by completing high school in that language or by special examination during their first year here at Cornell) are exempt from the college's language requirement.

Major Requirement
Most departments and programs specify certain prerequisites for admission to the major; they are found on the pages for each department and program available at Degree Programs.

Students may apply for acceptance into the major as soon as they have completed the prerequisites and are confident of their choice. This may be as early as the second semester of their first year, and must be no later than the end of the second semester of sophomore year. A student without a major at the beginning of the junior year is not making satisfactory progress toward the degree and risks not being allowed to continue in the college. Undeclared first-term juniors must file a Late Declaration of Major form with Student Services and may be placed on a leave of absence during their junior year if they have not yet declared a major.

Double Majors
Completion of one major is required for graduation. Some students choose to complete more than one major. No special permission or procedure is required; students simply become accepted into multiple majors and are assigned to an advisor in each department. All completed majors are posted on the official transcript. Students are not allowed to continue their studies past their eighth semester to complete additional majors.

Early and Delayed Graduation
Graduating Early
A student may elect to graduate early if they are able to complete all graduation requirements in fewer than eight semesters.

Students must still satisfy the college's residency requirement as part of the graduation requirements. This residency requirement requires that students who are first-year matriculants into Cornell spend a minimum of six semesters in residence, external transfers must spend a minimum of four. To request an early graduation, students must notify the A&S Registrar's Office in KG 17 Klarman Hall or at as-studentservices@cornell.edu (as-studentservices@cornell.edu?subject=Early%20Graduation%20Request).

The earliest a student can request to graduate early and officially change their graduation date is immediately following the pre-enrollment period for their anticipated final semester. The student should have pre-enrolled in the classes required to meet the graduation requirements by the requested graduation date. The student must then complete Part I in DUST and have Part II completed by their major advisor.

Graduating Late: Ninth Term Enrollment
The Bachelor of Arts degree is expected to be completed in eight terms. If degree requirements cannot be completed in eight terms, students may seek permission to continue their studies. Requests will only be granted for students who have found themselves in emergent circumstances beyond their control which have prevented them from completing the degree in eight terms. Requests cannot be made until a student's final expected graduation term and will not be reviewed and approved until after the university drop deadline for that semester. Study beyond the eighth term is not automatically granted for the purposes of changing a major. Such requests must be discussed with a college academic advisor and require registrar approval. Requests to add an additional major or minor will not be approved for study beyond the eighth term.

If approved, students in the ninth and tenth term will be on a conditional status and will have restrictions placed on their enrollment to ensure successful completion of their degree. To request a ninth term, students must have their faculty advisor update Part II for any remaining major requirements. They will also need to submit a study plan to their college advisor listing the specific courses that will meet degree requirements for one major.

Student may elect to prorate credits if enrolling in 9 or fewer credits or take a full-time load if they desire. However, enrollment will be limited to 18 credits for the term so students can focus on their remaining required courses. In the rare case where a student may need to enroll in a tenth term to complete their degree, they will be required to prorate tuition and their enrollment will be limited to only the courses/credits needed for successful completion of one major. Additional enrollments will not be allowed.

Graduation Procedures
Application to Graduate
In the first semester of their senior year, students are prompted by Arts & Sciences Student Services to complete an online application to graduate. The application is intended to help seniors identify problems early enough in the final year to make any necessary changes in course selection to satisfy those requirements. Nonetheless, ensuring graduation requirements are fully met is the student's responsibility and any problems that are discovered, even late in the final semester, must be resolved by the student before the degree can be granted. Students are responsible for checking their DUST (https://data.arts.cornell.edu/as-stus/degree_reqts.cfm) reports and transcripts each term and alerting Student Services of any problems with their academic record. To check on their progress in the major, students should consult with their major advisors.

Degree Dates
Cornell has three official degree conferral dates in the year: December, May, and August. Students who plan to graduate in August may attend commencement ceremonies in the preceding or subsequent May. Students graduating in December are invited to a special recognition ceremony in December and may also attend Commencement the following May. All academic work must be complete by the official

conferral date in order to receive a degree on that date. Incomplete academic work will result in a later conferral date.

Learning Outcomes

- Obtain working knowledge of scientific method.
- Discover the way that data are collected.
- Construct and evaluate scientific hypotheses from Earth sciences data.
- Design, conduct and analyze experiments to test hypotheses.
- Collect, analyze, and interpret field and laboratory data.
- Identify, formulate, and solve scientific problems using appropriate mathematical tools.
- Compile and interpret spatial and temporal earth science data.
- Explain and assess important concepts in the chosen concentration.
- Utilize computer systems and programming to find, analyze and present data and evaluate hypotheses.
- Communicate the earth sciences effectively in written and oral mediums.
- Demonstrate the ability to work in teams.
- Have a broad education, including liberal studies.