

# EARTH SCIENCES, B.S.

**Begin Campus:** Any Penn State Campus

**End Campus:** University Park

## Program Description

This major provides a comprehensive program in environmental sciences based on a strong emphasis in Earth sciences. It is especially directed toward study of the problems that arise from the complex interaction of humanity's technological and social activities with the natural environment. Graduates are in demand for positions in government, industry, and consulting. Professional activities include gathering and evaluating data on environments; management and coordination of specialized programs in environmental control and modification; and industrial and government planning. Suitable choices of courses may qualify students for graduate work in several fields.

## What is Earth Sciences?

Earth sciences is the study of interactions between the lithosphere (solid Earth), hydrosphere (oceans and other bodies of water), atmosphere, and biosphere (humans and other animals). It involves a mixture of geosciences, geography, meteorology, and other natural sciences. Earth scientists seek to use a comprehensive understanding of the Earth and environmental processes to solve big picture problems in the world and answer outstanding questions about the universe. The flexible curriculum includes your choice of an interdisciplinary minor, which might include Climatology; Earth Systems; Earth and Sustainability; Energy Business and Finance; Marine Science; Planetary Science and Astronomy; or Watersheds and Water Resources. If you want to personalize your own curriculum, the Earth Sciences major may be right for you.

## You Might Like This Program If...

- You like learning about human interactions with the Earth.
- You enjoy collaborating with people who have different perspectives and backgrounds.
- You have a broad interest in geosciences, meteorology, and/or geography, and would like to explore all of these disciplines and learn where they intersect and overlap.
- You seek to personalize an interdisciplinary curriculum that combines Earth science with other natural sciences such as planetary science or marine science.

## Entrance to Major

In order to be eligible for entrance to this major, a student must:

1. attain at least a C (2.00) cumulative grade-point average for all courses taken at the University; and
2. have at least third-semester classification (<https://www.registrar.psu.edu/enrollment/semester-classification.cfm>).

READ SENATE POLICY 37-30: ENTRANCE TO AND CHANGES IN MAJOR PROGRAMS OF STUDY (<https://senate.psu.edu/policies-and-rules-for-undergraduate-students/37-00-entrance-to-a-college-or-major/>)

## Degree Requirements

**For the Bachelor of Science degree in Earth Sciences, a minimum of 123 credits is required:**

Requirement	Credits
General Education	45
Requirements for the Major	99-101

**21 of the 45 credits for General Education are included in the Requirements for the Major. This includes: 9 credits of GN courses; 6 credits of GQ courses; 6 credits of GWS courses.**

## Requirements for the Major

To graduate, a student enrolled in the major must earn a grade of C or better in each course designated by the major as a C-required course, as specified by Senate Policy 82-44 (<https://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#82-44>).

Code	Title	Credits
<b>Prescribed Courses</b>		
BIOL 110	Biology: Basic Concepts and Biodiversity	4
CHEM 110	Chemical Principles I	3
CHEM 111	Experimental Chemistry I	1
CHEM 112	Chemical Principles II	3
CHEM 113	Experimental Chemistry II	1
EMSC 100S	Earth and Mineral Sciences First-Year Seminar <sup>1</sup>	3
MATH 140	Calculus With Analytic Geometry I	4
MATH 141	Calculus with Analytic Geometry II	4
PHYS 211	General Physics: Mechanics	4
PHYS 212	General Physics: Electricity and Magnetism	4
<b>Additional Courses</b>		
ENGL 15	Rhetoric and Composition	3
or ENGL 30H	Honors Rhetoric and Composition	
Select 15 credits of introductory earth science of the following: <sup>2</sup>		15
EARTH 2	The Earth System and Global Change	
EARTH 101	Natural Disasters: Hollywood vs. Reality	
EARTH 103N	Earth in the Future: Predicting Climate Change and Its Impacts Over the Next Century	
EARTH 105N	Environments of Africa: Geology and Climate Change	
GEOG 30N	Environment and Society in a Changing World	
GEOG 110	Climates of the World	
GEOG 111		
GEOG 115	Landforms of the World	
GEOG 160	Mapping Our Changing World	
GEOSC 1	Physical Geology	
GEOSC 21	Earth and Life: Origin and Evolution	
METEO 3	Weather Revealed: Introductory Meteorology	
SOILS 101	Introductory Soil Science	
Select 3 credits of writing-intensive courses from within Earth and Mineral Sciences to include, but not limited to the following:		3
GEOG 310	Introduction to Global Climatic Systems	
GEOG 412		
GEOSC 402Y	Natural Disasters	
GEOSC 470W	Introduction to Field Geology	
METEO 471		
<i>Additional Courses: Require a grade of C or better</i>		
Select 15 credits of advanced earth science of the following: <sup>2</sup>		15

GEOG 412	
GEOG 430	Human Use of Environment
GEOG 438W	Human Dimensions of Global Warming
GEOSC 204	Geobiology
GEOSC 320	Geology of Climate Change
GEOSC 340	Geomorphology
GEOSC 402Y	Natural Disasters
GEOSC 416	Stable and Radioactive Isotopes in Geosciences: Introduction
METEO 300	Fundamentals of Atmospheric Science
METEO 431	Atmospheric Thermodynamics

#### Supporting Courses and Related Areas

Select 3-4 credits of advanced math, statistics, computer science in consultation with an adviser 3-4

Select 3 credits of field, laboratory experience in consultation with an adviser 3

Select 8-9 credits in other approved courses (students may apply 6 credits of ROTC) 8-9

*Supporting Courses and Related Areas: Require a grade of C or better*

Select 18 credits, in consultation from an adviser, from one of the following Earth and Mineral Sciences interdisciplinary minors: 18

Climatology
Marine Science
Watersheds & Water Resources
Earth Systems
Global Business Strategies for Earth and Environmental Industries

<sup>1</sup> The following substitutions are allowed for students attending campuses where the indicated course is not offered: CAS 100 or ENGL 202C can be substituted for EMSC 100S.

<sup>2</sup> Courses may not double count with minor requirements.

## General Education

Connecting career and curiosity, the General Education curriculum provides the opportunity for students to acquire transferable skills necessary to be successful in the future and to thrive while living in interconnected contexts. General Education aids students in developing intellectual curiosity, a strengthened ability to think, and a deeper sense of aesthetic appreciation. These are requirements for all baccalaureate students and are often partially incorporated into the requirements of a program. For additional information, see the General Education Requirements (<https://bulletins.psu.edu/undergraduate/general-education/baccalaureate-degree-general-education-program/>) section of the Bulletin and consult your academic adviser.

The keystone symbol appears next to the title of any course that is designated as a General Education course. Program requirements may also satisfy General Education requirements and vary for each program.

### Foundations (grade of C or better is required and Inter-Domain courses do not meet this requirement.)

- **Quantification (GQ):** 6 credits
- **Writing and Speaking (GWS):** 9 credits

### Breadth in the Knowledge Domains (Inter-Domain courses do not meet this requirement.)

- **Arts (GA):** 3 credits
- **Health and Wellness (GHW):** 3 credits

- **Humanities (GH):** 3 credits
- **Social and Behavioral Sciences (GS):** 3 credits
- **Natural Sciences (GN):** 3 credits

### Integrative Studies

- **Inter-Domain Courses (Inter-Domain):** 6 credits

### Exploration

- **GN**, may be completed with Inter-Domain courses: 3 credits
- **GA, GH, GN, GS, Inter-Domain courses.** This may include 3 credits of World Language course work beyond the 12th credit level or the requirements for the student's degree program, whichever is higher: 6 credits

## University Degree Requirements

### First Year Engagement

All students enrolled in a college or the Division of Undergraduate Studies at University Park, and the World Campus are required to take 1 to 3 credits of the First-Year Seminar, as specified by their college First-Year Engagement Plan.

Other Penn State colleges and campuses may require the First-Year Seminar; colleges and campuses that do not require a First-Year Seminar provide students with a first-year engagement experience.

First-year baccalaureate students entering Penn State should consult their academic adviser for these requirements.

### Cultures Requirement

6 credits are required and may satisfy other requirements

- United States Cultures: 3 credits
- International Cultures: 3 credits

### Writing Across the Curriculum

3 credits required from the college of graduation and likely prescribed as part of major requirements.

### Total Minimum Credits

A minimum of 120 degree credits must be earned for a baccalaureate degree. The requirements for some programs may exceed 120 credits. Students should consult with their college or department adviser for information on specific credit requirements.

### Quality of Work

Candidates must complete the degree requirements for their major and earn at least a 2.00 grade-point average for all courses completed within their degree program.

### Limitations on Source and Time for Credit Acquisition

The college dean or campus chancellor and program faculty may require up to 24 credits of course work in the major to be taken at the location or in the college or program where the degree is earned. Credit used toward degree programs may need to be earned from a particular source or within time constraints (see Senate Policy 83-80 (<https://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#83-80>)). For more information, check the Suggested Academic Plan for your intended program.

## Program Learning Objectives

- To produce graduates who can collect, analyze, understand, and use data and model results relevant to the Earth and environmental sciences.

- To produce graduates who possess an interdisciplinary understanding of Earth processes and resources through application of principles of meteorology, geography, and geosciences.
- To produce graduates who can communicate the results of scientific inquiry through writing and speaking to an audience with diverse backgrounds and perspectives.

## Academic Advising

The objectives of the university's academic advising program are to help advisees identify and achieve their academic goals, to promote their intellectual discovery, and to encourage students to take advantage of both in-and out-of class educational opportunities in order that they become self-directed learners and decision makers.

Both advisers and advisees share responsibility for making the advising relationship succeed. By encouraging their advisees to become engaged in their education, to meet their educational goals, and to develop the habit of learning, advisers assume a significant educational role. The advisee's unit of enrollment will provide each advisee with a primary academic adviser, the information needed to plan the chosen program of study, and referrals to other specialized resources.

READ SENATE POLICY 32-00: ADVISING POLICY (<https://senate.psu.edu/policies-and-rules-for-undergraduate-students/32-00-advising-policy/>)

## University Park

**Jacob Hoover**

Undergraduate Program Coordinator

542 Deike Building

University Park, PA 16802

814-865-7791

[undergrad@geosc.psu.edu](mailto:undergrad@geosc.psu.edu)

## Suggested Academic Plan

The suggested academic plan(s) listed on this page are the plan(s) that are in effect during the 2023-24 academic year. To access previous years' suggested academic plans, please visit the archive (<https://bulletins.psu.edu/undergraduate/archive/>) to view the appropriate Undergraduate Bulletin edition (*Note: the archive only contains suggested academic plans beginning with the 2018-19 edition of the Undergraduate Bulletin*).

## Earth Sciences, B.S. at University Park Campus

The course series listed below provides **only one** of the many possible ways to move through this curriculum. The University may make changes in policies, procedures, educational offerings, and requirements at any time. This plan should be used in conjunction with your degree audit (accessible in LionPATH as either an **Academic Requirements** or **What If** report). Please consult with a Penn State academic adviser on a regular basis to develop and refine an academic plan that is appropriate for you.

### First Year

Fall	Credits	Spring	Credits
MATH 140 or 140G <sup>††</sup>	4	MATH 141 or 141G <sup>††</sup>	4
CHEM 110 (GN) <sup>†</sup>	3	CHEM 112	3
CHEM 111 (GN) <sup>†</sup>	1	CHEM 113	1
EMSC 100S (GWS) <sup>††1</sup>	3	ENGL 15, 30H, or ESL 15 (GWS) <sup>††</sup>	3

Intro GEOSC/EARTH elective <sup>2</sup>	3	Intro GEOSC/EARTH elective <sup>2</sup>	3
<b>14</b>		<b>14</b>	

### Second Year

Fall	Credits	Spring	Credits
PHYS 211 or 250 (GN) <sup>†</sup>	4	PHYS 212 or 251	4
BIOL 110 (GN) <sup>†</sup>	4	Intro GEOSC/EARTH elective <sup>2</sup>	3
General Education knowledge domain	3	General Education knowledge domain	3
General Education knowledge domain	3	Minor course <sup>*5</sup>	3
Supporting Course <sup>3</sup>	3	Advanced EARTH elective <sup>*4</sup>	3
<b>17</b>		<b>16</b>	

### Third Year

Fall	Credits	Spring	Credits
Advanced EARTH elective <sup>*4</sup>	3	Advanced GEOSC/EARTH elective <sup>*4</sup>	3
Intro GEOSC/EARTH elective <sup>2</sup>	3	Intro GEOSC/EARTH elective <sup>2</sup>	3
Supporting Course <sup>3</sup>	2	Minor Course <sup>*5</sup>	3
Minor course <sup>*5</sup>	3	General Education knowledge domain	3
General Education knowledge domain	3	Supporting Course <sup>3</sup>	3
		General Education Health and Wellness (GHW)	1.5
<b>14</b>		<b>16.5</b>	

### Fourth Year

Fall	Credits	Spring	Credits
Advanced EARTH elective <sup>*4</sup>	3	Advanced EARTH elective <sup>*4</sup>	3
General Education Foundation selection (GWS) <sup>†</sup>	3	EARTH Field/lab experience	3
Minor Course <sup>*5</sup>	3	Writing across the curriculum course in EMS	3
General Education knowledge domain	3	Minor Course <sup>*5</sup>	3
General Education Health and Wellness (GHW)	1.5	Minor Course <sup>*5</sup>	3
Advanced Math/Stat/CMPSC/GEOSC 210	3-4		
<b>16.5-17.5</b>		<b>15</b>	

### Total Credits 123-124

\* Course requires a grade of C or better for the major

‡ Course requires a grade of C or better for General Education

# Course is an Entrance to Major requirement

† Course satisfies General Education and degree requirement

### University Requirements and General Education Notes:

US and IL are abbreviations used to designate courses that satisfy Cultural Diversity Requirements (United States and International Cultures).

W, M, X, and Y are the suffixes at the end of a course number used to designate courses that satisfy University Writing Across the Curriculum requirement.

General Education includes Foundations (GWS and GQ), Knowledge Domains (GHW, GN, GA, GH, GS) and Integrative Studies (Inter-domain) requirements. N or Q (Honors) is the suffix at the end of a course number used to help identify an Inter-domain course, but the inter-domain attribute is used to fill audit requirements. Foundations courses (GWS and GQ) require a grade of 'C' or better.

All incoming Schreyer Honors College first-year students at University Park will take ENGL 137H/CAS 137H in the fall semester and ENGL 138T/CAS 138T in the spring semester. These courses carry the GWS designation and satisfy a portion of that General Education requirement. If the student's program prescribes GWS these courses will replace both ENGL 15/ENGL 30H and CAS 100A/CAS 100B/CAS 100C. Each course is 3 credits.

- <sup>1</sup> Students who begin their studies at non-UP locations and/or join the college after their first year should substitute CAS 100 (GWS), CAS 100A, CAS 100B, or CAS 100C; or ENGL 202C (GWS) for EM SC 100S (GWS). EM SC 100S Earth and Mineral Sciences First year Seminar (3) is a required course only for students who begin their studies at UP in the College of Earth and Mineral Sciences.
- <sup>2</sup> Select 15 credits of introductory earth science from the following list (courses may not double count with minor requirements): EARTH 2 GN(3), EARTH 101 GN(3), EARTH 103N GN(3), EARTH 105 GN(3), METEO 3 GN(3), GEOG 30N GN/GS/US/IL(3), GEOG 110 GN(3), GEOG 115 GN(3), GEOG 160 GS(3), GEOSC 1(3), GEOSC 21 GN(3), SOILS 101 GN(3).
- <sup>3</sup> Supporting Course: Select 8-9 credits in other approved courses (Students may apply 6 credits of ROTC).
- <sup>4</sup> Advanced EARTH elective: Select 15 credits of advanced earth science from the following list (courses may not double count with minor requirements): GEOG 430(3), GEOG 438W(3), GEOG 412(3), GEOSC 204(4), GEOSC 320(3), GEOSC 340(3), GEOSC 402Y(3), GEOSC 416(3), METEO 300(4), METEO 431(3), METEO 475(3).
- <sup>5</sup> Complete one of the following interdisciplinary minors, in consultation from an adviser:  
CLIMATOLOGY  
MARINE SCIENCE  
WATERSHEDS & WATER RESOURCES  
EARTH SYSTEMS  
ENERGY BUSINESS & FINANCE

## Earth Sciences, B.S. at Commonwealth Campuses

The course series listed below provides **only one** of the many possible ways to move through this curriculum. The University may make changes in policies, procedures, educational offerings, and requirements at any time. This plan should be used in conjunction with your degree audit (accessible in LionPATH as either an **Academic Requirements** or **What If** report). Please consult with a Penn State academic adviser on a regular basis to develop and refine an academic plan that is appropriate for you.

### First Year

Fall	Credits Spring	Credits
MATH 140 <sup>††</sup>	4 MATH 141 <sup>††</sup>	4
CHEM 110 (GN) <sup>†</sup>	3 CHEM 112	3
CHEM 111 (GN) <sup>†</sup>	1 CHEM 113	1
Intro GEOSC/EARTH elective <sup>2</sup>	3 Intro GEOSC/EARTH elective <sup>2</sup>	3
ENGL 15, 30H, or ESL 15 (GWS) <sup>††</sup>	3 General Education Foundation selection (GWS) <sup>†1</sup>	3
	<b>14</b>	<b>14</b>

### Second Year

Fall	Credits Spring	Credits
PHYS 211 or 250 (GN) <sup>†</sup>	4 PHYS 212 or 251	4
BIOL 110 (GN) <sup>†</sup>	4 Intro GEOSC/EARTH elective <sup>2</sup>	3
General Education knowledge domain	3 General Education knowledge domain	3
General Education knowledge domain	3 Advanced Math/Stat/CMPSC/GEOSC 210	3-4
Supporting Course <sup>3</sup>	3 General Education knowledge domain	3
	<b>17</b>	<b>16-17</b>

### Third Year

Fall	Credits Spring	Credits
Advanced EARTH elective <sup>*4</sup>	3 Advanced GEOSC/EARTH elective <sup>*4</sup>	3
Intro GEOSC/EARTH elective <sup>2</sup>	3 Intro GEOSC/EARTH elective <sup>2</sup>	3
Supporting Course <sup>3</sup>	2 Minor Course <sup>*5</sup>	3
Minor course <sup>*5</sup>	3 Supporting Course <sup>3</sup>	3
General Education knowledge domain	3 Minor Course <sup>*5</sup>	3
	General Education Health and Wellness (GHW)	1.5
	<b>14</b>	<b>16.5</b>

### Fourth Year

Fall	Credits Spring	Credits
Advanced EARTH elective <sup>*4</sup>	3 Advanced EARTH elective <sup>*4</sup>	3
General Education Foundation selection (GWS) <sup>†</sup>	3 EARTH Field/lab experience	3
Minor Course <sup>*5</sup>	3 Writing across the curriculum course in EMS	3
General Education knowledge domain	3 Minor Course <sup>*5</sup>	3

General Education Health and Wellness (GHW)	1.5 Minor Course <sup>*5</sup>	3
Advanced EARTH elective <sup>*4</sup>	3	
	<b>16.5</b>	<b>15</b>

### Total Credits 123-124

\* Course requires a grade of C or better for the major

‡ Course requires a grade of C or better for General Education

# Course is an Entrance to Major requirement

† Course satisfies General Education and degree requirement

### University Requirements and General Education Notes:

US and IL are abbreviations used to designate courses that satisfy Cultural Diversity Requirements (United States and International Cultures).

W, M, X, and Y are the suffixes at the end of a course number used to designate courses that satisfy University Writing Across the Curriculum requirement.

General Education includes Foundations (GWS and GQ), Knowledge Domains (GHW, GN, GA, GH, GS) and Integrative Studies (Inter-domain) requirements. N or Q (Honors) is the suffix at the end of a course number used to help identify an Inter-domain course, but the inter-domain attribute is used to fill audit requirements. Foundations courses (GWS and GQ) require a grade of 'C' or better.

<sup>1</sup> Students who begin their studies at non-UP locations and/or join the college after their first year should substitute CAS 100 (GWS), CAS 100A, CAS 100B, or CAS 100C; or ENGL 202C (GWS) for EM SC 100S (GWS). EM SC 100S Earth and Mineral Sciences First year Seminar (3) is a required course only for students who begin their studies at UP in the College of Earth and Mineral Sciences.

<sup>2</sup> Select 15 credits of introductory earth science from the following list (courses may not double count with minor requirements): EARTH 2 GN(3), EARTH 101 GN(3), EARTH 103N GN(3), EARTH 105 GN(3), METEO 3 GN(3), GEOG 30N GN/GS/US/IL(3), GEOG 110 GN(3), GEOG 115 GN(3), GEOG 160 GS(3), GEOSC 1(3), GEOSC 21 GN(3), SOILS 101 GN(3).

<sup>3</sup> Supporting Course: Select 8-9 credits in other approved courses (Students may apply 6 credits of ROTC).

<sup>4</sup> Advanced EARTH elective: Select 15 credits of advanced earth science from the following list (courses may not double count with minor requirements): GEOG 430(3), GEOG 438W(3), GEOG 412(3), GEOSC 204(4), GEOSC 320(3), GEOSC 340(3), GEOSC 402Y(3), GEOSC 416(3), METEO 300(4), METEO 431(3), METEO 475(3).

<sup>5</sup> Complete one of the following interdisciplinary minors, in consultation from an adviser:  
CLIMATOLOGY  
MARINE SCIENCE  
WATERSHEDS & WATER RESOURCES  
EARTH SYSTEMS  
ENERGY BUSINESS & FINANCE

## Career Paths

The interdisciplinary nature of Earth sciences makes it a suitable degree for a variety of Earth- and environment-related industries, as well as for postgraduate studies in a variety of environmental sciences fields. It is also excellent preparation for a career in science education.

## Careers

Graduates are in demand for positions dealing with environmental science, teaching, or environmental law or policy within government, industry, and consulting. These roles focus on gathering and evaluating data on environments, managing and coordinating specialized programs in environmental control and modification, and industrial and government planning.

MORE INFORMATION ABOUT POTENTIAL CAREER OPTIONS  
FOR GRADUATES OF THE EARTH SCIENCES PROGRAM (<https://www.geosc.psu.edu/undergraduate/why-geosciences/career-outlook/>)

## Opportunities for Graduate Studies

Graduates of the program may continue on to graduate-level studies in the geosciences, environmental science, meteorology, oceanography, planetary science, or other Earth sciences, as well as environmental law and related programs.

MORE INFORMATION ABOUT OPPORTUNITIES FOR GRADUATE STUDIES  
(<https://www.geosc.psu.edu/graduate/>)

## Professional Resources

- Geosciences Club (<https://www.facebook.com/groups/46384419817/>)
- Association for Women Geoscientists (<https://sites.psu.edu/awgpennstate/>)
- American Water Resources Association Penn State Student Chapter (<https://agsci.psu.edu/students/clubs/list/other/>)

## Contact

### University Park

DEPARTMENT OF GEOSCIENCES  
503 Deike Building  
University Park, PA 16802  
814-865-6711  
[contact@geosc.psu.edu](mailto:contact@geosc.psu.edu)

<https://www.geosc.psu.edu>