EARTH AND ENVIRONMENTAL SCIENCE

Professors – Jeffrey Myers, Stephen Taylor, Jeffrey Templeton
Assistant Professor – David Szpakowski

MISSION

The Earth and Environmental Science program at Western Oregon University provides a liberal arts education in geoscience with an emphasis on scientific methods, problem solving, and interdisciplinary science education. A key objective of the program is to prepare undergraduates for careers as professional geoscientists and educators. The program also promotes the development of an informed citizenry for wise decision-making on issues related to natural resources, environmental quality, and sustainability in Oregon and beyond.

LEARNING OUTCOMES

Upon completion of the program, the student will be able to:

1. Demonstrate knowledge of the physical, chemical, and biological processes operating in the Earth system.
2. Apply technology-based methods to solve geologic problems and communicate results.
3. Conduct scientific investigations in laboratory and field settings.

Western Oregon UNIVERSITY

Earth and Environmental Science

For More Information: Dr. Steve Taylor [taylors@wou.edu] or Dr. Jeff Templeton [templej@wou.edu]

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Earth and Environmental Science

Are you interested in the environment and saving planet Earth? The Earth and Environmental Science program at WOU has a career pathway for you. Our Earth and Environmental Science majors learn about the geosciences with an emphasis in solving environmental problems through application of technology and scientific methods. Students enjoy small interactive classes and engage with caring faculty. Students have opportunities to conduct research with faculty on topics such as environmental geology, geographic information systems, paleobiology, petrology, remote sensing and volcanology. Earth science courses are enhanced by hands-on field trips to locations in Oregon and throughout the Pacific Northwest.

With a degree in earth and environmental science, you will be prepared for careers in the growing fields of geoscience, environmental management, and natural hazards mitigation. Students can gain further experience for diverse career opportunities through minor programs in geographic information science and environmental studies. Our students are trained to make wise decisions on important issues related to natural resources, environmental quality and sustainability in the Pacific Northwest and beyond. Students who complete a degree in earth and environmental science are qualified to pursue professional licensure as registered geologists in Oregon.

"The WOU Earth and Environmental Science program is all about field experience, job training, internship opportunities, team building and collaboration. The professors care for WOU students and regularly go above and beyond their routine job duties to make sure that each individual is getting the most out of the program and is prepared for employment success after college. This program means so much more than just a building and homework; this department is women in science, it is first-generation students breaking a cycle, and it is students who care so much for their planet and communities that they enrolled at WOU to do something about it." ***~Nicole Niskanen '21***

SKILLS YOU'LL LEARN

- Application of the scientific method
- Enhanced observation skills
- Logic, reasoning, and problem solving
- Quantitative/math analysis
- Computer software applications
- Written and oral communication

WOU alumni, Nicole Niskanen '21 and Kyle Warren '18, working in the field.

JOB OPPORTUNITIES

- Geoscientist
- Environmental scientist
- Surveying and mapping technician
- GIS analyst
- Hydrologist
- Natural resource management
- Conservation science
- Science teacher (with masters in teaching)

SAMPLE FOUR-YEAR DEGREE PLAN

This sample plan is a planning tool for prospective students.
You will have an adviser to help navigate ***your individual program****.*

YEAR 1

ES 201, 202, 203 Principles of Geology
MTH 111 College Algebra
MTH 243 Intro to Probability & Statistics

YEAR 2

BI 101 General Biology: The Diversity of Life
CH 104 Chemistry and the Environment
ES 301 Earth Materials
ES 302 Quantitative Methods
ES 322 Geomorphology and Aerial Photo Interpretation
ES 340 Geospatial Techniques

YEAR 3

ES 321 Structural Geology
Upper-division Earth and Environmental Science courses

YEAR 4

ES 491 Sedimentary Systems I
ES 497 Senior Seminar
Upper-division Earth and Environmental Science courses

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Western Oregon University

BACHELOR OF SCIENCE

EARTH AND ENVIRONMENTAL SCIENCE

TOTAL CREDITS: 177 - 181

Sample 4-year Plan

This sample four-year plan is a planning tool for prospective students, intended for the current academic year.

Each student's situation is unique and **your** degree plan may differ from the sample presented here. Meet with your WOU advisor to create your personalized four-year degree plan.

Students must complete a minimum of 180 credit hours, including 60 upper-division, in order to earn a degree.

Current WOU students: Use the online Degree Tracks system to monitor progress towards your college degree.

YEAR 1	CREDITS
ES 201 Principles of Geology	4
ES 202 Principles of Geology	4
ES 203 Principles of Geology	4
MTH 111 College Algebra	4
MTH 243 Intro to Probability & Statistics	4
Recommended General Education courses:	
First Year Seminar - FYS 107 First Year Seminar: Writing Focused	4
First Year Seminar - FYS 207 First Year Seminar: Quantitative Focused	4
Foundations: Communication and Language	4
Foundations: Health Promotion	4
Foundations: Writing - WR 121 College Writing I	4
Foundations: Writing - WR 122 College Writing II	4
Total	**44**

YEAR 2	CREDITS
BI 101 General Biology: The Diversity of Life	4
CH 104 Chemistry and the Environment	4
ES 301 Earth Materials	4
ES 302 Quantitative Methods	3
ES 322 Geomorphology & Aerial Photo Interpretation	4
ES 340 Geospatial Techniques	4
Upper-division Earth Science course	3 - 4
Electives or minor coursework	4
Recommended General Education courses:	
Foundations: Critical Thinking	4
Exploring Knowledge: Literary & Aesthetic Perspectives	6 - 8
Exploring Knowledge: Social, Historic & Civic Perspectives	4
Total	**44 - 47**

YEAR 3	CREDITS
ES 321 Structural Geology	4
Upper-division Earth Science courses	8
Upper-division Environmental Science course	4
Electives or minor coursework	18
Recommended General Education courses:	
Exploring Knowledge: Social, Historic & Civic Perspectives	4
Integrating Knowledge: Citizenship, Social Responsibility & Global Awareness	3 - 4
Integrating Knowledge: Science, Technology & Society	4
Total	**45 - 46**

YEAR 4	CREDITS
ES 491 Sedimentary Systems I	4
ES 497 Senior Seminar	2
Upper-division Earth Science course	4
Upper-division Environmental Science course	4
Electives or minor coursework	30
Total	**44**

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EARTH and ENVIRONMENTAL SCIENCE Major: Bachelor of SCIENCE

Prefix Number	Course Name	Credits	MIN	MAX
Lower-Division Core			28	28
BI 101	General Biology: Diversity of Life	4		
CH 104	Chemistry and the Environment	4		
ES 201, 202, 203	Principles of Geology	12		
MTH 111	College Algebra	4		
MTH 243	Intro. Probability and Statistics	4		
Upper-Division Core			25	25
ES 301	Earth Materials	4		
ES 302	Quantitative Methods	3		
ES 321	Structural Geology	4		
ES 322	Geomorphology	4		
ES 340	Geospatial Techniques	4		
ES 491	Sedimentary Systems I	4		
ES 497	Senior Seminar	2		
Choose Four UD Earth Science Courses			15	16
ES 331	Introduction to Oceanography	3		
ES 341	Geog. Information Systems I	4		
ES 342	Geog. Information Systems II	4		
ES 343	Remote Sensing	4		
ES 354	Geology of Earthquakes	4		
ES 431	Paleobiology	4		
ES 450	Petrology	4		
ES 453	Geology of the Pacific Northwest	4		
ES 454	Volcanology	4		
ES 486	Petroleum Geology	4		
ES 492	Advanced GIS Applications in Earth Science	4		
ES 493	Sedimentary Systems II	4		
Choose Two UD Environmental Science Courses			6	8
BI 370	Humans and the Environment	4		
BI 461	Conservation Biology	4		
ES 324	Living with Earthquakes and Volcanoes	4		
ES 390	Basic Meteorology	3		
ES 420	Medical Geology	4		
ES 460	Energy and Mineral Resources	3		
ES 470	River Environments of Oregon	4		
ES 473	Environmental Geology	4		
ES 476	Hydrology	4		
GEOG 321	Field Geography	4		
GEOG 380	Environmental Conservation	4		
GEOG 390	Global Climate Change	4		
GEOG 393	Soils Geography	4		
GEOG 470	Energy, Environment and Society	4		
	Total credits in degree program		74	77
	Upper Division Credits		46	49

Western Oregon University

BACHELOR OF ARTS

EARTH AND ENVIRONMENTAL SCIENCE

TOTAL CREDITS: 176 - 180

Sample 4-year Plan

This sample four-year plan is a planning tool for prospective students, intended for the current academic year.

Each student's situation is unique and **your** degree plan may differ from the sample presented here. Meet with your WOU advisor to create your personalized four-year degree plan.

Students must complete a minimum of 180 credit hours, including 60 upper-division, in order to earn a degree.

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YEAR 1	CREDITS
Choose 3:	12
ES 104 Earth System Science, ES 106 Earth System Science, ES 201 Principles of Geology, ES 202 Principles of Geology, ES 203 Principles of Geology	
MTH 110 Applied College Mathematics	4
Recommended General Education courses:	
First Year Seminar - FYS 107 First Year Seminar: Writing Focused	4
First Year Seminar - FYS 207 First Year Seminar: Quantitative Focused	4
Foundations: Communication and Language	4
Foundations: Critical Thinking	4
Foundations: Health Promotion	4
Foundations: Writing - WR 121 College Writing I	4
Foundations: Writing - WR 122 College Writing II	4
Total	**44**

YEAR 2	CREDITS
BI 101 General Biology: The Diversity of Life	4
CH 104 Chemistry and the Environment ES	4
301 Earth Materials	4
ES 340 Geospatial Techniques	4
Upper-division Earth Science courses	7 - 8
Electives or minor coursework	8
Recommended General Education courses:	
Exploring Knowledge: Literary & Aesthetic Perspectives	6 - 8
Exploring Knowledge: Social, Historic & Civic Perspectives	8
Total	**45 - 48**

YEAR 3	CREDITS
ES 473 Environmental Geology	4
Upper-division Earth Science courses	8
Upper-division Environmental Science course	4
Electives or minor coursework	20
Recommended General Education courses:	
Integrating Knowledge: Citizenship, Social Responsibility & Global Awareness	3 - 4
Integrating Knowledge: Science, Technology & Society	4
Total	**43 - 44**

YEAR 4	CREDITS
ES 491 Sedimentary Systems I	4
ES 497 Senior Seminar	
Upper-division Earth Science course	2
Upper-division Environmental Science course	4
Electives or minor coursework	4
	30
Total	**44**

EARTH and ENVIRONMENTAL SCIENCE Major: Bachelor of ARTS

Prefix Number	Course Name	Credits	MIN	MAX
Lower-Division Core			24	24
BI 101	General Biology: Diversity of Life	4		
CH 104	Chemistry and the Environment	4		
ES 100 or 200	Choose THREE: ES 104, 106, 201, 202, 203	12		
MTH 110	Applied College Mathematics	4		
Upper-Division Core			18	18
ES 301	Earth Materials	4		
ES 340	Geospatial Techniques	4		
ES 473	Environmental Geology	4		
ES 491	Sedimentary Systems I	4		
ES 497	Senior Seminar	2		
Choose FIVE UD Earth Science Courses			18	20
ES 302	Quantitative Methods	3		
ES 321	Structural Geology	4		
ES 322	Geomorphology	4		
ES 331	Introduction to Oceanography	3		
ES 341	Geog. Information Systems I	4		
ES 342	Geog. Information Systems II	4		
ES 343	Remote Sensing	4		
ES 354	Geology of Earthquakes	4		
ES 431	Paleobiology	4		
ES 450	Petrology	4		
ES 453	Geology of the Pacific Northwest	4		
ES 454	Volcanology	4		
ES 486	Petroleum Geology	4		
ES 492	Advanced GIS Applications in Earth Science	4		
ES 493	Sedimentary Systems II	4		
Choose TWO Environmental Science Courses			6	8
BI 370	Humans and the Environment	4		
BI 461	Conservation Biology	4		
ES 324	Living with Earthquakes and Volcanoes	4		
ES 390	Basic Meteorology	3		
ES 420	Medical Geology	4		
ES 460	Energy and Mineral Resources	3		
ES 470	River Environments of Oregon	4		
ES 476	Hydrology	4		
GEOG 321	Field Geography	4		
GEOG 380	Environmental Conservation	4		
GEOG 390	Global Climate Change	4		
GEOG 393	Soils Geography	4		
GEOG 470	Energy, Environment and Society	4		
	Total credits in degree program		66	70
	Upper Division Credits		42	46

Western Oregon University

BACHELOR OF SCIENCE
EARTH AND ENVIRONMENTAL SCIENCE: PRE-GRADUATE STUDIES CONCENTRATION

TOTAL CREDITS: 181 - 186

Sample 4-year Plan

This sample four-year plan is a planning tool for prospective students, intended for the current academic year.

Each student's situation is unique and **your** degree plan may differ from the sample presented here. Meet with your WOU advisor to create your personalized four-year degree plan.

Students must complete a minimum of 180 credit hours, including 60 upper-division, in order to earn a degree.

Current WOU students: Use the online Degree Tracks system to monitor progress towards your college degree.

YEAR 1	CREDITS
ES 201 Principles of Geology	4
ES 202 Principles of Geology	4
ES 203 Principles of Geology	4
ES 302 Quantitative Methods	3
MTH 111 College Algebra	4
MTH 112 Elementary Functions	4
Recommended General Education courses:	
First Year Seminar - FYS 107 First Year Seminar: Writing Focused	4
First Year Seminar - FYS 207 First Year Seminar: Quantitative Focused	4
Foundations: Communication and Language	3 - 4
Foundations: Health Promotion	4
Foundations: Writing - WR 121 College Writing I	4
Foundations: Writing - WR 122 College Writing II	4
Total	**46 - 47**

YEAR 2	CREDITS
CH 221 General Chemistry	5
CH 222 General Chemistry	5
CH 223 General Chemistry	5
ES 301 Earth Materials	4
ES 322 Geomorphology & Aerial Photo Interpretation	4
ES 450 Introduction to Petrology	4
MTH 251 Calculus I	4
MTH 252 Calculus II	4
Upper-division Earth Science elective	4
Recommended General Education courses:	
Foundations: Critical Thinking	3 - 4
Exploring Knowledge: Literary & Aesthetic Perspectives	3 - 4
Total	**45 - 47**

YEAR 3	CREDITS
ES 321 Structural Geology	4
ES 340 Geospatial Techniques	4
ES 473 Environmental Geology	4
Upper-division Earth Science elective	4
Choose 3:	12
PH 201 General Physics	
PH 202 General Physics	
PH 203 General Physics	
PH 211 General Physics with Calculus	
PH 212 General Physics with Calculus	
PH 213 General Physics with Calculus	
Recommended General Education courses:	
Exploring Knowledge: Literary & Aesthetic Perspectives	3 - 4
Exploring Knowledge: Social, Historic & Civic Perspectives	8
Integrating Knowledge: Citizenship, Social Responsibility & Global Awareness	3 - 4
Integrating Knowledge: Science, Technology & Society	4
Total	**46 - 48**

YEAR 4	CREDITS
ES 341 Geographic Information Systems I	4
ES 342 Geographic Information Systems II	4
ES 491 Sedimentary Systems I	4
ES 493 Sedimentary Systems II	
ES 497 Senior Seminar	4
Upper-division Earth Science electives	2
Electives or minor coursework	8
	18
Total	**44**

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EARTH and ENV SCIENCE Major: Pre-Graduate Studies Concentration (B.S.)

Prefix Number	Course Name	min Credits	max Credits
ES 201, 202, 203	Principles of Geology	12	12
CH 221, 222, 223	General Chemistry	15	15
PH 200 sequence	General Physics	12	12
MTH 251	Calculus I	4	4
MTH 252	Calculus I	4	4
ES 301	Earth Materials	4	4
ES 302	Quantitative Methods	3	3
ES 321	Structural Geology	4	4
ES 322	Geomorphology	4	4
ES 340	Geospatial Techniques	4	4
ES 341	Geog. Information Systems I	4	4
ES 342	Geog. Information Systems II	4	4
ES 450	Petrology	4	4
ES 473	Environmental Geology	4	4
ES 491	Sedimentary Systems I	4	4
ES 493	Sedimentary Systems II	4	4
ES 497	Senior Seminar	2	2
Upper Division Earth Science Electives *(Complete 4 classes from the list below)*		15	16
ES 343	Remote Sensing	4	
ES 354	Geology of Earthquakes	4	
ES 431	Paleobiology	4	
ES 453	Geology of Pacific Northwest	4	
ES 454	Volcanology	4	
ES 460	Energy and Mineral Resources	3	
ES 470	River Environments of Oregon	4	
ES 476	Hydrology	4	
ES 486	Petroleum Geology	4	
ES 492	Advanced GIS Applications in Earth Science	4	

Total credits in degree program	107	108
Upper Division Credits	60	61

Geographic Information Science Minor

Core Courses

- ES 340 Geospatial Techniques
- ES 341 Geographic Information Systems I
- ES 342 Geographic Information Systems II
- ES 343 Remote Sensing
- ES 492 Advanced GIS Applications in Earth Science

Choose One

- ES 202 Principles of Geology
- GEOG 105 Nature & Society
- GEOG 240 Map & Air Photo Interpretation

Total Credits: 24

Note:

In addition to the minor, the Geographic Information Science curriculum may also be completed as a professional development certificate program.

Environmental Studies Minor

Mission

Educate students about the physical, biological, and social dimensions of the environment. The program content focuses on specific topics and skills central to understanding environmental issues and promotes pathways to jobs in environmental professions.

Learning Outcomes

1. Explain the interconnectedness of humans and the environment.
2. Apply problem solving skills to real-world environmental issues.
3. Demonstrate knowledge of current environmental issues in a community context.

Choose one Foundational Natural Science Course

- BI 101 General Biology: The Diversity of Life
- CH 104 Chemistry and the Environment
- ES 104 Exploring the Physical Earth
- ES 105 Discoveries in Earth Science
- ES 106 Exploring the Oceans and Atmosphere
- ES 201 Principles of Geology
- ES 202 Principles of Geology
- ES 203 Principles of Geology

Choose one Foundational Social Science/Humanities Course

- ANTH 214 Physical Anthropology
- COM 380 Environmental Communication
- GEOG 105 Nature & Society
- GEOG 106 Sustainable World
- GEOG 240 Map & Air Photo Interpretation
- PHL 255 Environmental Ethics
- SOC 225 Social Problems

Choose Three Environmental Science Courses

- ANTH 311 Human Evolution
- BI 317 Vertebrate Natural History
- BI 321 Systematic Field Botany
- BI 370 Humans and the Environment
- BI 461 Conservation Biology
- ES 322 Geomorphology and Aerial Photo Interpretation
- ES 324 Living With Earthquakes and Volcanoes
- ES 331 Introduction to Oceanography
- ES 340 Geospatial Techniques

- ES 341 Geographic Information Systems I
- ES 354 Geology of Earthquakes
- ES 390 Basic Meteorology
- ES 420 Medical Geology
- ES 431 Paleobiology
- ES 453 Geology of the Pacific Northwest
- ES 454 Volcanology
- ES 460 Energy and Mineral Resources
- ES 470 River Environments of Oregon
- ES 473 Environmental Geology
- ES 476 Hydrology
- ES 486 Petroleum Geology
- ES 491 Sedimentary Systems I
- GEOG 321 Field Geography
- GEOG 385 Quantitative Methods in Geography
- GEOG 390 Global Climate Change
- GEOG 391 Biogeography
- GEOG 392 Physical Geography
- GEOG 393 Soils Geography

Choose Three Environmental Policy Courses

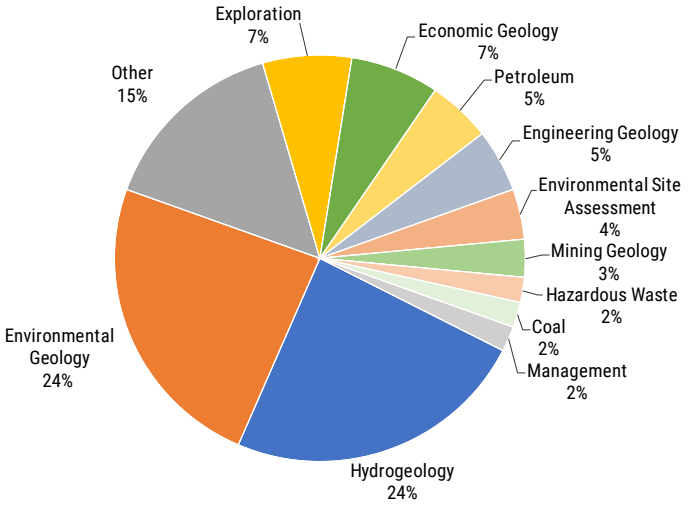
- ANTH 396 Environmental Anthropology
- GEOG 331 Environmental Justice
- GEOG 380 Environmental Conservation
- GEOG 425 Urban Planning and Policy
- GEOG 470 Energy, Environment and Society
- GEOG 480 Nature in the American West
- HST 460 The Black Death
- HST 489 Environmental History
- HST 492 Pacific Northwest History
- HST 496 Empire and Environment
- PS 447 Environmental Politics and Policy
- PS 449 Environmental Values and Political Action
- PS 477 International Environmental Politics
- SOC 290 World Population and Social Structure
- SOC 327 Social Research Methods
- SOC 400 Globalization and Development

Total Credits: 28-32

How do geologists make a living in 2019?

According to recent American Geosciences Institute (AGI) workforce data, less than 11% of geoscience graduates receiving a BA/BS or MA/MS degree develop a career in academia and/or research. Given this statistic, the question then arises: How are geologists making a living upon graduation in 2019? The majority of graduates are developing careers by applying knowledge as opposed to deriving new knowledge as done in academic and/or research positions.

Areas of expertise for geologists who are members of the American Institute of Professional Geologists

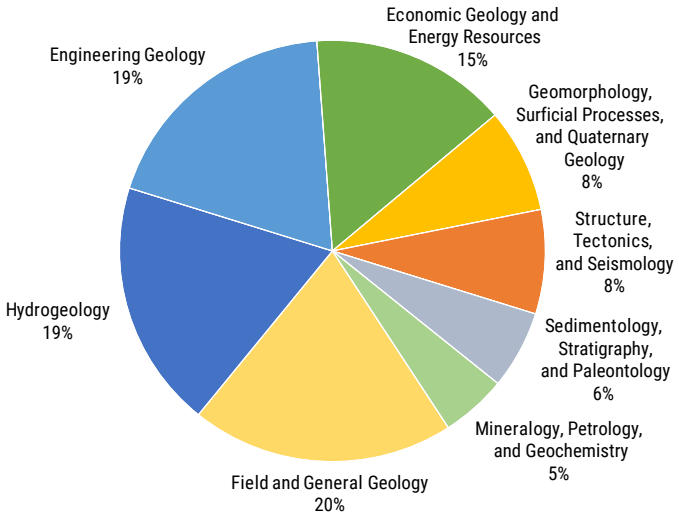


Credit: American Institute of Professional Geologists

Although the most common perception is that geologists look for oil, gas, and coal, the fact is that nearly everything a person touches on a given day, will have required the work of a geologist at some point along the way. Based on workforce surveys conducted by the American Institute of Professional Geologists (AIPG), National Association of State Boards of Geology (ASBOG®), and AGI, geologists are predominantly securing employment in three broad sectors:

- Environmental remediation and management
- Natural resource discovery and utilization
- Engineering and Construction

ASBOG® Task Analysis Survey
Practice of Geology Blueprint - Domain Percentages



Credit: National Association of State Boards of Geology

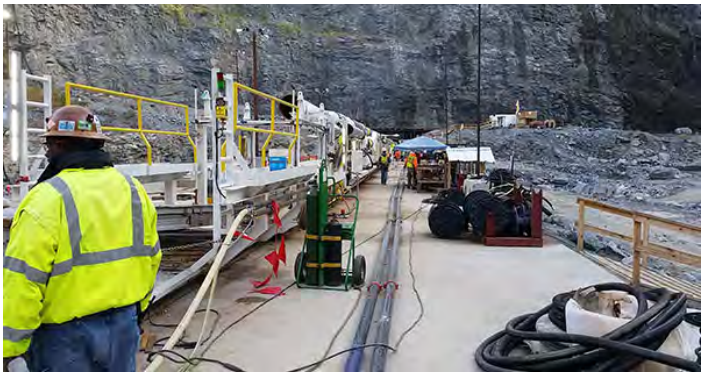
Geologists working in environmental remediation and management strive to mitigate human impacts. Geologists in this sector respond to spills and accidents, work to clean up sites where past human activities have created negative impacts, and work with companies, municipalities, and individuals to minimize the impacts of new projects. This work requires that geologists conduct field site assessments, using state-of-the-art technology to identify and understand the distribution of contaminants, determine the sources and pathways along which those chemical species move, and develop a mechanism to remove or otherwise mitigate the impact of those species on the environment.

Geologists working in natural resource discovery and utilization are tasked with finding the raw materials to provide the resources necessary to support modern society. Geologists working in this field use cutting edge technology to locate and define specific resources, and to plan for the extraction of those resources. All metals, building stone, as well as coal, oil, and gas, are located by geologists in this sector. As we transition from hydrocarbons to renewable sources of energy, the types of resources these geologists locate will change, but

the work must continue. Every wind turbine, solar panel, and hydroelectric plant requires copper, cobalt, silicon, aggregate, and a vast number of other metals and minerals. As society determines its best way forward, geologists will be there to help find and provide the raw materials that are needed.

Field photograph of the Emerson Barite Mine.
Credit: R. Kath, 2015

Geologists working in engineering and construction work directly with architects and geotechnical/civil engineers to characterize the earth materials upon which new construction projects will be sited. These engineering geologists may also work with geologists in other subdisciplines to help design treatment facilities, retention structures, mine plans, or other structures that are required for geologic projects. Geologists in this field may conduct rock- and soil-strength tests to determine if rocks and other earth materials exhibit the correct properties to be used in the project at hand.



Trailing gear of TBM, Bellwood Quarry, Atlanta, Georgia.
Credit: R. Kath, 2015

While geologists comprise a small percentage of the global workforce, their work extends support to nearly every aspect of modern society. Since less than 11% of graduating BA/BS and MA/MS students work in academia, it is incumbent upon college and university educators to align academic requirements for undergraduate and graduate degree programs with skills that are needed for professionals to hit the ground running in the largest areas of employment for geologists.

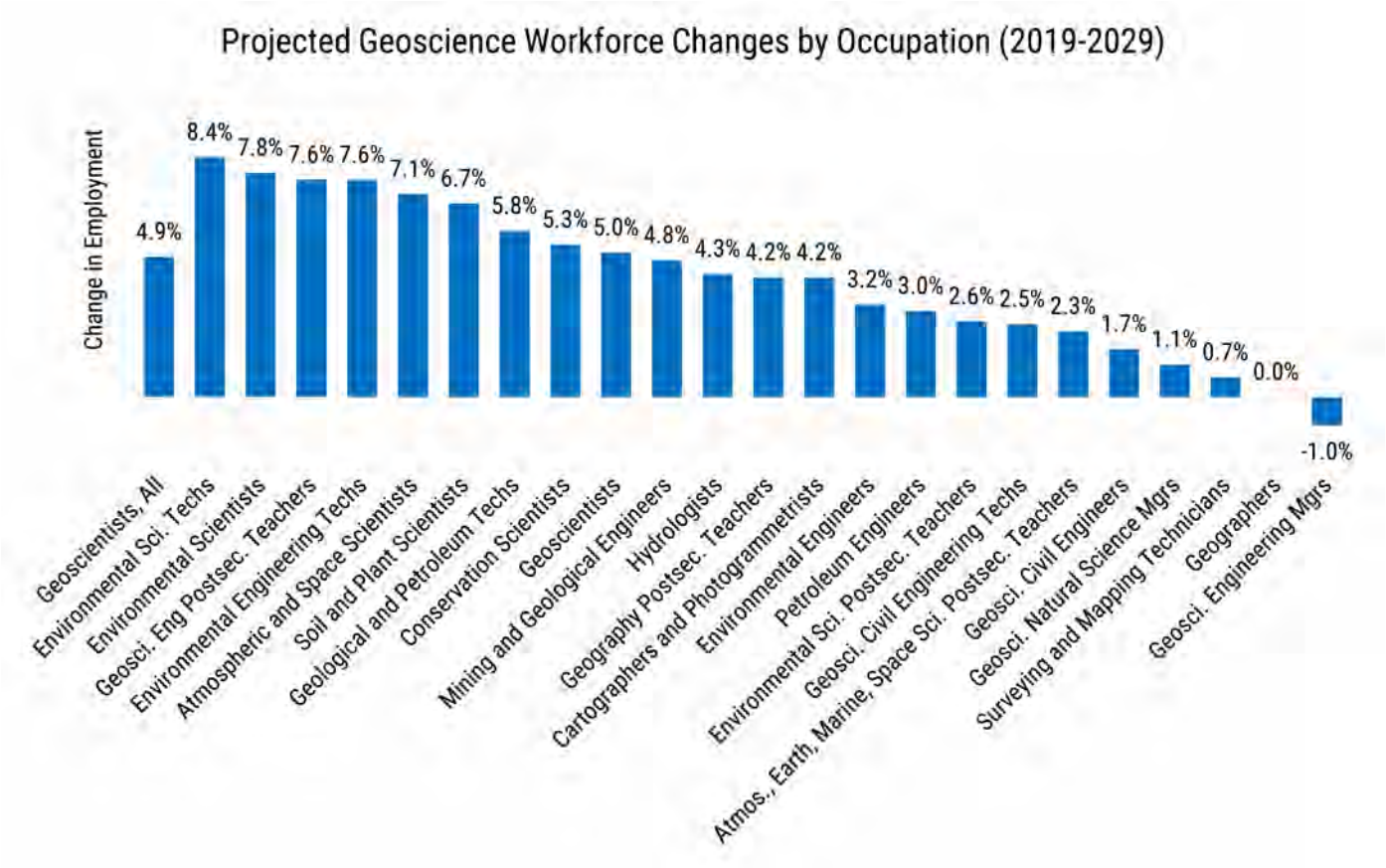
Geologists make use of their special knowledge for the benefit of others. No profession affects the public more than geology. "Civilization exists by geological consent, subject to change without notice"

- William Durant

Geoscience Workforce Projections 2019-2029

Geoscience workforce expected to grow by 4.9%

Employment projections from the U.S. Bureau of Labor Statistics (BLS) indicate an overall 4.9% increase in geoscience jobs between 2019 and 2029, from 460,242 jobs in 2019 to 482,726 jobs in 2029. For comparison, the projected growth of the U.S. workforce over the same timeframe is expected to be 3.7%. While growth rates for individual geoscience occupations range between 0% and 8.4% for all but geoscience engineering managers (-1%), those occupations projected to gain the greatest number of jobs are environmental scientists (7,100 jobs), environmental science technicians (2,900 jobs), and environmental engineers (1,800 jobs).

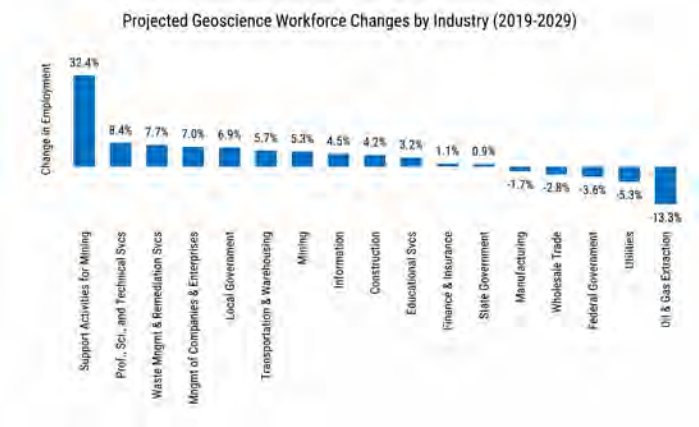


Credit: AGI; data derived from the U.S. Bureau of Labor Statistics, Employment Projections

Data Brief 2020-025; October 26, 2020

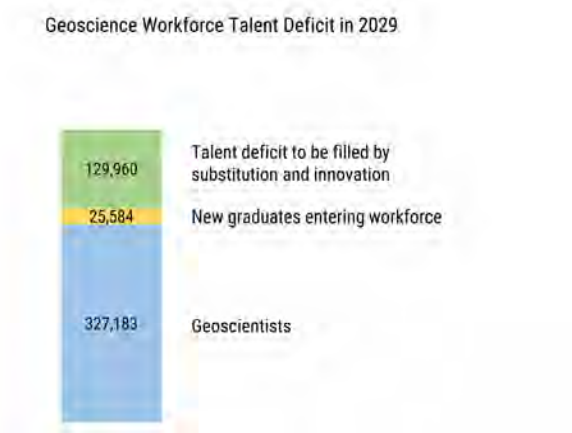
The majority of geoscience job growth over the coming decade will be within the professional, scientific and technical services sector where 39% of geoscientists currently work. This sector is projected to gain just over 16,000 jobs between 2019 and 2029, an 8.4% increase over this period. The support activities for mining sector which includes oil and gas support activities, currently employs approximately 2% of geoscientists and is expected to grow by 32% gaining just over 3,500 jobs.

Of those industries projected to see a decline in total geoscience employment between 2019 and 2029, the oil and gas extraction industry is projected to contract the most with a reduction of just over 2,800 jobs, followed by the federal government which is projected to shed just over 1,000 jobs. The utilities, wholesale trade, and manufacturing sectors are projected to shed a total of 700 jobs by 2029.



Credit: AGI; data derived from the U.S. Bureau of Labor Statistics, Employment Projections

Based on the age demographics of the current geosciences workforce as identified by the BLS, with an average retirement age of 65, then 27% of the existing geoscience workforce will be retiring by 2029. The number of geoscience graduates entering the workforce each year will not be sufficient to fill the gap created by these retirements and the addition of over 22,000 new jobs that are projected to be created in the profession by 2029. As a result, the expected geoscience workforce deficit will be approximately 130,000 full-time equivalent geoscientists by 2029.



Credit: AGI; data derived from the U.S. Bureau of Labor Statistics, Employment Projections and Current Population Survey, and from AGI's Directory of Geoscience Departments

Full employment in the geosciences is expected to continue over the coming decade and we expect there will be a continued increase in the use of innovative technologies such as artificial intelligence and machine learning to fill the expected talent gap by increasing workplace efficiencies.