
EARTH SCIENCES AND GEOGRAPHY

FACULTY

- Chairperson:** Associate Professor Peter Saccocia
- Professors:** Vernon Domingo, Richard Enright, Jacek Sulanowski
- Associate Professors:** James Hayes-Bohanan, Sandra Clark, Madhusudana Rao
- Assistant Professors:** Bettina Aten, Robert Cicerone, Robert Hellström, Michael Krol

Department Telephone Number: (508) 531-1390

Web site: www.bridgew.edu/depts/earscgeo

DEGREE PROGRAMS

- BA in Earth Sciences
- BS in Earth Sciences
Concentrations: Environmental Geosciences, Geology
- BS in Chemistry/Geology (offered jointly with the Department of Chemical Sciences)
- BA in Geography
- BS in Geography
Concentrations: General, Environmental Geography, Geotechnology, Regional and Economic Planning
- MAT - Physical Sciences

UNDERGRADUATE MINORS

- Earth Sciences
 - Geography
 - Geophysics*
- *Interdisciplinary Minor

The Department of Earth Sciences and Geography offers undergraduate majors in earth sciences and geography. Majors in the BS earth sciences program may elect a concentration in environmental geosciences or geology. The BA or BS earth science programs may also be taken as a double major with education. Majors in geography may elect a concentra-

tion in environmental geography, geotechnology or regional and economic planning or double major with education. In addition, programs in chemistry-geology, oceanography and urban affairs and planning are available. The department is also active in the Asian Studies Minor, the Canadian Studies Minor, the Russian and East European Studies Minor, the Urban Affairs Minor, and the Women's Studies Minor, as well as the Graduate Certificate in Planning. See the *Interdisciplinary and Preprofessional Programs* section of this catalog.

The department works actively with state and regional agencies on socioeconomic and environmental problems. Past faculty research projects include coastal storm impacts, regional economic developments, transportation planning, the impact of PCBs in New Bedford Harbor, and the search for water supplies for the next century.

The department has been involved with assisting local organizations through faculty research and student internships. Examples of such involvement are with local banks, planning agencies, retailers, Boston's "Big Dig", the Massachusetts Bay Transit Authority (MBTA), the Massachusetts Forest Fire Bureau, the Natural Resources Trust of Bridgewater, and the Ocean Spray Cranberry Cooperative.

Additionally, this department has been selected as the only department in the state college system in Massachusetts to participate in the National Aeronautics and Space Administration (NASA) sponsored Joint Venture (JOVE) program. Members of the faculty collaborate with the Jet Propulsion Laboratory (on multi-spectral and hyperspectral remote sensing in Mexico, Alabama, and Southeastern Massachusetts), the Goddard Space Flight Center (on bolide impact), the U.S. Department of Transportation (on a national study of bus systems), Woods Hole Oceanographic Institution (on research problems in marine geochemistry and geology), the Massachusetts Department of Education (on statewide curriculum reform) and the U.S. Army Corps of Engineers (on wetlands). Faculty are also involved in watershed studies in cooperation with biology department faculty at the Raytheon Watershed Access Laboratory. In addition, a member of the faculty has an appointment as Guest Investigator at the Woods Hole Oceanographic Institution on Cape Cod and has research opportunities for students in marine geochemistry and geology. Two other professors are actively engaged in statewide curriculum reform. The geogra-

phy faculty maintains the Southeastern Massachusetts Global Education Center's Resource Center.

A program leading to the degree of Master of Arts in Teaching (M.A.T.) with a concentration in earth sciences is offered by the department. An M.A.T. in Social Sciences with an emphasis on geography is available in cooperation with the history department.

Modern equipment enables the department to offer investigation oriented laboratory experience. This equipment includes: (1) an X-ray Diffractometer with powder cameras; (2) thin section equipment; (3) polarizing and stereoscopic microscopes; (4) atomic absorption spectro-photometer; (5) a proton procession magnetometer; (6) earth resistivity unit; (7) Frantz Isodynamic Separator; (8) 14-foot coastal research vessel; (9) a portable gamma-ray spectrometer; (10) Sunsparc 20 UNIX work station; (11) Hewlett Packard capillary gas chromatograph; (12) GPS surveying equipment; (13) a portable visible-near infrared, spectroradiometer; and (14) groundwater sampling equipment.

In addition, the department has a well-equipped remote sensing laboratory, and a cartographic laboratory with a large format digitizer planimeter, a climatological station with solar radiation recording instrumentation, a solar greenhouse classroom at the Burnell Campus School, an astronomy observatory, a wet geochemistry laboratory, and a wet, as well as dry, sedimentology laboratory. Finally, this department has access to a scanning electron microscope through the Southeastern Massachusetts Consortium.

Earth Sciences and Geography faculty are using Bridgewater State's sophisticated computer facilities for classroom instruction, including demonstrating and displaying web-based and self-authored material and models. In a growing number of courses, students may submit assignments online, and in some courses, a majority of class time is spent in "virtual classrooms". To learn more, visit the department Web site at www.bridgew.edu/depts/earscego.

The department boasts an active Earth Sciences and Geography Club that sponsors both local (Harvard Mineral Museum), regional (New Hampshire's White Mountains), national (Hawaii), and international (Iceland, Mexico) field trips. Students may also qualify for Gamma Theta Upsilon the international geography

honor society, and Sigma Gamma Epsilon, the geology honor society.

UNDERGRADUATE PROGRAMS

EARTH SCIENCES

EARTH SCIENCES MAJOR

The major in Earth Sciences is a solid broad-based program that provides the student with an understanding and appreciation of the physical aspects of the earth and earth processes. Career opportunities for graduates exist in federal, state and local government service, industry, and environmental studies both with regulatory agencies and consulting firms. Teaching in the elementary, middle and secondary schools is another option. Many of our Earth Science majors have been awarded full fellowships at leading graduate schools. In addition, the faculty have an extensive program of undergraduate research, and many students have presented the results of their undergraduate research at various national meetings. Some of this research has been funded, and students are encouraged to contact the faculty if interested. Internships are also available for those students desiring to prepare themselves for employment upon graduation. However, the internships are in addition to the 36 credits required of the major. Interested students are encouraged to contact the earth science/geology faculty — Drs. Cicerone, Enright, Krol, Saccocia and Sulanowski for more information about Earth Science/Geology programs.

EARTH SCIENCES MAJOR — BACHELOR OF ARTS

ES 100 Physical Geology
ES 101 Historical Geology
ES 301 Solar System Astronomy
ES 305 Physical Oceanography
ES 496 Seminar in Geology
GE 203 Meteorology

A minimum of three additional Earth Science courses (nine credits) selected from the following: (other electives are possible if approved by the department)

ES 194 Environmental Geology
ES 240 Hydrology
ES 284 Geomorphology
ES 290 Dinosaur Paleobiology
ES 372 Mineralogy
ES 463 Petrology
ES 475 Paleontology

Plus,
 CH 131 General Chemistry I
 3 credits in biology or physics with laboratory

Not more than one “D” for a semester course in the major, taught in the department, shall be accepted to fulfill the requirements of this program.

General Education Requirements (GER)

A minimum of 120 earned hours is required for graduation. These earned hours include General Education Requirements as specified in the Undergraduate Academic Programs section of this catalog. For additional graduation requirements, see the Undergraduate Academic Policies section of this catalog.

EARTH SCIENCES MAJOR — BACHELOR OF SCIENCE

ES 100 Physical Geology
 ES 101 Historical Geology
 ES 284 Geomorphology
 ES 301 Solar System Astronomy
 or
 ES 302 Stellar and Galactic Astronomy
 ES 305 Physical Oceanography
 ES 372 Mineralogy
 ES 463 Petrology
 ES 496 Seminar in Geology
 GE 203 Meteorology

A minimum of three additional earth science courses selected **with the adviser’s approval** and

MA 151-152 Calculus I-II
 or
 MA 141-142 Elements of Calculus I-II

CH 131-132 General Chemistry I-II
 or
 CH 141-142 Chemical Principles I-II

Two semesters of physics courses or two semesters of biology courses **selected with adviser’s approval**.

Not more than one “D” for a course in the major, taught in the department, shall be accepted to fulfill the requirements for this program.

General Education Requirements (GER)

A minimum of 120 earned hours is required for graduation. These earned hours include General Education Requirements as specified in the Undergraduate Academic Programs section of this catalog. For

additional graduation requirements, see the Undergraduate Academic Policies section of this catalog.

ENVIRONMENTAL GEOSCIENCES CONCENTRATION

ES 100 Physical Geology
 ES 101 Historical Geology
 ES 240 Hydrology
 ES 283 Structural Geology
 ES 284 Geomorphology
 ES 372 Mineralogy
 ES 476 Sedimentology and Stratigraphy
 ES 496 Seminar in Geology

Plus a minimum of four other earth science courses selected with the **written concurrence of the adviser**. Other courses may be added or approved as substitutes **with approval of the adviser**.

Minimum cognate requirements include:

MA 141-142 Elements of Calculus I-II
 or
 MA 151-152 Calculus I-II
 CH 131-132 General Chemistry I-II
 or
 CH 141-142 Chemical Principles I-II
 PH 181-182 Elements of Physics I-II
 or
 PH 243-244 General Physics I-II
 or

Two approved Biology courses

Students are also encouraged to take the following courses:

EN 201 Technical Writing I
 BI 117 The Biological Environment
 BI 225 Ecology
 BI 240 Plant Morphology
 BI 327 Wetlands Biology
 CH 343-344 Organic Chemistry I-II

General Education Requirements (GER)

A minimum of 120 earned hours is required for graduation. These earned hours include General Education Requirements as specified in the Undergraduate Academic Programs section of this catalog. For additional graduation requirements, see the Undergraduate Academic Policies section of this catalog.

GEOLOGY CONCENTRATION

The concentration provides students with an understanding of the physical and chemical aspects of the earth and its internal as well as surface processes. Career

opportunities for graduates exist in federal, state and local government service, industry and environmental studies both with regulatory agencies and consulting firms. With the selection of appropriate electives, students will be prepared for government service, for environmental work related to the detection and monitoring of pollutants as well as for remediation of affected areas, and for careers in such fields as environmental geology, mining or petroleum geology and hydrology. This concentration gives students a solid background in geology and the cognate sciences required to successfully pursue graduate work at leading universities.

ES 100 Physical Geology
 ES 101 Historical Geology
 ES 283 Structural Geology
 ES 284 Geomorphology
 ES 372 Mineralogy
 ES 463 Petrology
 ES 475 Paleontology
 ES 496 Seminar in Geology
 Four additional earth science courses selected with the adviser's approval.

Plus:

MA 151-152 Calculus I-II
 or
 MA 141-142 Elements of Calculus I-II
 CH 141-142 Chemical Principles I-II
 or
 CH 131-132 General Chemistry I-II

Physics or Biology:

PH 243-244 General Physics I-II
 or
 PH 181-182 Elements of Physics I-II
 or

Two semesters of biology courses selected with the adviser's approval

Not more than one "D" for a semester course in the major, taught in the department, shall be accepted to fulfill the requirements for this program.

General Education Requirements (GER)

A minimum of 120 earned hours is required for graduation. These earned hours include General Education Requirements as specified in the Undergraduate Academic Programs section of this catalog. For additional graduation requirements, see the Undergraduate Academic Policies section of this catalog.

CHEMISTRY-GEOLOGY MAJOR

A major in chemistry-geology is offered jointly with the Department of Chemical Sciences. See the catalog section *Interdisciplinary and Preprofessional Programs* for details.

EARTH SCIENCES MINOR

ES 100 Physical Geology
 ES 101 Historical Geology
 Four additional earth sciences courses (**departmental approval required**)

GEOPHYSICS MINOR

A minor is jointly offered with the Department of Physics. For further information, contact the department chairpersons.

MINOR IN SECONDARY EDUCATION (HIGH SCHOOL, MIDDLE SCHOOL OR PREK-12 SPECIALIST)

Students may minor in secondary education (High School, Middle School or PreK-12 Specialist). Successful completion of this minor will lead to Massachusetts Initial Teacher Licensure. Please refer to the *Department of Secondary Education and Professional Programs* for specific teacher licensure and program requirements.

DOUBLE MAJOR WITH ELEMENTARY EDUCATION, EARLY CHILDHOOD EDUCATION OR SPECIAL EDUCATION

Students may choose a double major in earth sciences or geography and elementary education, early childhood education or special education for licensure purposes. Please contact the Department of Earth Sciences and Geography and the appropriate education department for further information.

GEOGRAPHY

GEOGRAPHY MAJOR

A major or minor in geography can provide a student with a way to examine the world with objectivity. The student can be trained to analyze the water-use and land-use opportunities in your communities, to understand the interrelated systems which keep the land and sea resources in balance, and to appreciate the varied ways in which people all over the world use those resources. BSC graduates have found employ-

ment as planners, environmental analysts, teachers, market researchers, cartographers and administrators. Many of our geography majors have gone on to earn advanced degrees from leading graduate schools.

The following concentrations are found within the geography major. They are of relevance to careers or graduate study.

CONCENTRATION EMPLOYMENT OPPORTUNITIES

General	Teaching at both elementary and secondary school levels
Environmental	Federal, state, and local agencies; private consulting firms
Geotechnology	Private firms; government agencies
Regional and Economic Planning	Government agencies—state and local planning agencies

Students are invited to meet with any of the geography faculty—Professors Clark, Domingo, Hayes-Bohanan, Hellström, Rao, or Aten—to discuss the program.

Geography Major (Core) Requirements

- GE 100 Physical Geography
or
GE 120 The Physical World (with department consent)
- GE 203 Meteorology
or
GE 204 Climatology
or
GE 361 Geography of Environmental Problems
- GS 110 Human Geography

- Upper level technique course (choose one course from the following courses):
GE 216 Cartography
GE 317 Air Photo Interpretation — Remote Sensing
GE 318 Computer Cartography
GE 417 Satellite Image Processing Applications to the Environment
GE 419 Geographic Information Systems

- Any Regional Geography course at the 300 level

- GE 474 Quantitative Geography

- GS 353 Urban Geography
or
GS 473 Political Geography
- GS 362 Economic Geography
or
GS 363 Locational Analysis
- GS 490 Seminar in Geography
- Cognate:
MA 141 Elements of Calculus I

No more than one “D” for a course in the major, taught in the department, shall be accepted to fulfill the requirements for these programs.

General Education Requirements (GER)

A minimum of 120 earned hours is required for graduation. These earned hours include General Education Requirements as specified in the Undergraduate Academic Programs section of this catalog. For additional graduation requirements, see the Undergraduate Academic Policies section of this catalog.

GENERAL GEOGRAPHY CONCENTRATION

Core Requirements (see Geography major) in addition to the following:

GS 473 Political Geography (taken in core)
Any three courses with at least one from each category:

- a) GS 300/400 Additional regional geography course
- b) GS/GE 300/400 Additional systematic courses

Students intending to teach are strongly urged to take GS 320 Geography Materials and Methods.

ENVIRONMENTAL GEOGRAPHY CONCENTRATION

Core Requirements (see Geography major) in addition to the following:

GE 361 Geography of Environmental Problems (taken in core)

Three courses (select one course each from three of the four categories):

- a) ES 240 Hydrology
or
ES 284 Geomorphology
- b) GE 203 Meteorology
or
GE 204 Climatology

- c) GE 307 Management and Preservation of the Natural Environment
- d) GE 498 Internship (maximum three credits towards concentration)

GEOTECHNOLOGY CONCENTRATION

Core Requirements (see Geography major) in addition to the following:

- GE 419 Geographic Information Systems (GIS) (taken in core)
- Any three courses out of at least two of the following categories:
 - a) GE 216 Cartography
or
GE 318 Computer Cartography
 - b) GE 317 Air Photo Interpretation – Remote Sensing
 - c) GS 420 Principles of Urban and Regional Planning
or
GS 430 Geography of Transportation
or
GS 498 Internship (maximum three credits toward concentration)

REGIONAL AND ECONOMIC PLANNING CONCENTRATION

Core Requirements (see Geography major) in addition to the following:

- GS 353 Urban Geography (taken in core)
- Any three of the following courses:
 - GS 362 Economic Geography
 - GS 363 Locational Analysis
 - GS 420 Principles of Urban and Regional Planning
 - GS 430 Geography of Transportation
 - GE 498 Internship—highly recommended (maximum of 3 credits toward concentration)

DOUBLE MAJOR WITH ELEMENTARY EDUCATION, EARLY CHILDHOOD EDUCATION OR SPECIAL EDUCATION

Students may choose a double major in earth sciences or geography and elementary education, early childhood education or special education for licensure purposes. Please contact the Department of Earth Sciences and Geography and the appropriate education department for further information.

GEOGRAPHY MINOR

- GE 100 Physical Geography
- GS 110 Human Geography

- Four additional geography courses (departmental approval required). Two courses must be at the 200 level or higher and must be from at least two of the following areas:
- a) a systematic course
 - b) a topical course
 - c) a techniques course

GRADUATE PROGRAMS

GRADUATE CERTIFICATE PROGRAM IN GEOTECHNOLOGY

The Certificate Program in Geotechnology is designed to provide students with a good foundation in the fields of Geographic Information Systems and Satellite Remote Sensing technologies with a supporting background in the areas of computer science and management information systems. This program provides an understanding of geotechnologies to produce solutions to practical planning and management problems in the cultural and natural environments.

Required Courses:

	Credits
GE 419 Geographic Information Systems	3
GS 565 Geotechnology	3
CS 410 Database Applications	3
or	
CS 580 Database Systems	
or	
SO 403 Seminar: Social Data Analysis	
or	
GE 474 Quantitative Geography	
One advanced CS programming course (C or C++)	3

Electives

- Choose any four of the following..... 12
- CS 520 Operating Systems Principles
or
CS 430 Computer Networks
- CS 536 Graphics
or
CS 436 Computer Graphics
- CS 594 Computer Networks
or
CS 430 Computer Networks
- GE 417 Satellite Image Processing Applications to the Environment
- GE 502 Research

GE 503 Directed Study
MG 445 Information Systems Management
MG 450 Problems in Information Systems
MG 480 Systems Analysis
Total Number of Credits for Certificate Program 24

**MASTER OF ARTS IN TEACHING
EARTH SCIENCES**

This program is inactive.

PHYSICAL SCIENCES

For current information concerning this program,
contact the Department of Physics.