

# DEPARTMENT OF ENVIRONMENTAL AND GEOSCIENCES

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**Chair:** Joseph Hill (jch031@shsu.edu) (936) 294-1452

**Website:** Department of Environmental and Geosciences (<https://www.shsu.edu/academics/geography-geology/>)

The Department of Environmental and Geosciences is an excellent blend of three disciplines that have a common thread: Environmental Science, Geography, and Geology. All three degrees are concerned with the physical environment, with resources – including energy resources – and with ways that humans interact with and modify the natural environment. Students may major or minor in all three areas.

## Mission

The primary mission of the Department of Environmental and Geosciences is to provide students a comprehensive understanding of the range and depth of these scientific disciplines which encompass, respectively, human and environmental interactions, the human and physical domains of geography, and the physical and historical domains of geology. This understanding is intended to enable our students to achieve their full potential as skilled professionals and well-qualified technical employees in a diverse range of companies and governmental organizations and to become effective teachers and community leaders. Our programs enable students to become informed users of a range of technologies and prudent stewards of our natural resources. This understanding of the world will promote successful careers, active life-long learning, and an ability and desire to provide a positive contribution to society.

## Geography Program

**Coordinator:** John Strait (jstrait@shsu.edu) (936) 294-4077

**Website:** Department of Environmental and Geosciences (<https://www.shsu.edu/academics/geography-geology/>)

Geography is an interdisciplinary field of study that provides students the skills and technical knowhow needed to address issues, challenges and opportunities associated with how humans interact with their local and global environments. As an academic subject, it focuses on both the physical and cultural environments and incorporates the use and application of a host of geospatial technologies as a means to study and analyze these subject matter, such as geographic information systems (GIS), remote sensing, digital image processing, and global positioning systems. Geographers can study an exceptionally eclectic range of phenomena, including demographics, landforms, soil fertility, plant and animal wildlife, weather and climate, religion, language, ethnicity, urban planning, and international affairs, just to name a few. Geographers are behind the maps you use every day, as well as the policies that shape our cities, and the analysis that sustains and protects our environment. Geographers help shape the future design of cities and infrastructure. Geographers assess the impacts of rising sea levels, volcanic eruptions, floods, heat waves, and tropical storms, while others study impacts of wildfires or manage wetlands. Geographers investigate the environmental and economic impacts of tourism, and gage the cultural impacts of globalization. Geographers use cutting edge satellite data to explore alternative energy sources and assess natural resource utilization and population growth. Geographers also work directly with local people on socioeconomic issues such as health, migration, and housing affordability. Moreover, geographers play a vital role in teaching this eclectic subject matter in school districts across the nation and around the world. If you want to learn about and change our world, there is no better discipline for people who thrive on complex challenges and want to make a real impact on lives and our environment. In the age of global markets, global culture, global transportation systems, and global telecommunications, we are increasingly faced with the reality that our welfare is highly interdependent with the rest of the world. A geographic education represents an excellent way to understand how to deal with environmental, social and economic issues associated with this reality. For an individual curious about the world, and his or her place in it, few disciplines satisfy that curiosity as much as geography.

## Academic Programs

The Geography program incorporates a two-track curriculum and is designed to fit the particular academic interests of our students and better prepare them for life beyond SHSU, particularly in terms of graduate study or employment opportunities. Students majoring in geography focus their studies within one of two concentrations; 1) Environment, Culture and Development, or 2) GIS (Geographic Information Science). Both concentrations are somewhat flexible and enable students to tailor their degree plans toward a mix of coursework most appropriate to their career goals. The Environment, Culture and Development Concentration truly integrates the strengths of environmental and human geography, with the application of geospatial techniques. For example, students choosing this concentration matriculate through a degree that integrates scientific study of the environment with the perspectives of such topics as hydrology, conservation, culture, economic change, development, population, and public health, while gaining experience using geospatial techniques. Students choosing this concentration can pursue either Bachelors of Arts (BA) or Bachelors of Science (BS) degrees. The GIS Concentration, available as a BS degree, is designed for students desiring more advanced and intensive training with a broad range geospatial tools and technologies, such as Advanced GIS, Remote Sensing, and Digital Image Processing.

## Highlights

Located on the third floor of the Lee Drain Building, the department maintains both a Geographic Information System (GIS) lab and a combination computer cartography and remote sensing lab. These labs contain state-of-the-art computers, software and scanners. We also have 2 vans available for fieldtrips, a coring device capable of taking up to 6m core samples, high-quality GPS receivers, a large-scale flume to demonstrate sedimentation processes, a Ground Penetrating Radar System, and a weather station. In order to enhance learning, all of our rooms are outfitted with video-projection systems, and our lecture rooms have sound systems and dedicated computers with Internet access that are used by the instructors for teaching

purposes. Many of our students obtain internships with Houston-area firms and organizations, and work with faculty members on a range of research projects. Beyond traditional in-class courses, the geography program does offer a number of on-line courses. The program also regularly offers a number of field courses that offer students opportunities to directly experience the geographical processes and concepts learned in the classroom. Some of these field courses involve travel and/or international experiences and have included trips to Hawaii, Mississippi Delta, Brazil, Ecuador, Spain, Italy and other locations.

## Career Opportunities

Because of the breadth of geography, there are a wide variety of career opportunities for geography graduates. These opportunities include careers in the following:

- urban and/or regional planning
- GIS analyst/programmer
- environmental consulting and management
- emergency management
- location analyst
- public health consulting and management
- state transportation departments
- city, county, state, and federal government
- education/teaching
- geoscientist/geo-technician
- travel writing
- energy companies
- tourism
- military

Geography's focus on spatial relationships, in conjunction with new advances in technology, have led to the development of a host of geographical tools used in a wide variety of fields. In fact, geospatial technology now affects almost every aspect of life, from navigating an unfamiliar neighborhood to locating the world's most wanted terrorists. Because these tools can be applied within virtually any field (government, business, military, etc.) geospatial technology is one of the fastest growing job fields and the demand for people with experience using them exceeds the supply. Aside from offering a major concentration that emphasizes these technologies, we also offer students an Interdisciplinary Minor in Geospatial Science (GSS) that emphasizes GIS, remote sensing and computer cartography. The combination of geography major and a GSS minor is highly marketable. In addition, we also offer a GIS certificate program for students desiring to pursue a limited number of geotechnical courses. With their broad background, geography graduates have an ability to see connections where others do not, and this enables geographers to work in many different fields. Geography literally offers a world of opportunities.

## Suggested Minors

- GSS (Geo-spatial Science)
- Environmental Science
- Environmental Studies
- Geology
- Foreign Language
- Biology or Environmental Science
- History
- International Business
- Sociology
- Mass Communication
- Computer Science
- Political Science
- Secondary Education

## Program Specific Requirements

Students must meet the academic standards established by the university.

## Geology Program

**Coordinator:** Brian J. Cooper (bio\_bjc@shsu.edu) (936) 294-1566

**Website:** Department of Environmental and Geosciences (<https://www.shsu.edu/academics/geography-geology/>)

Geology is the ultimate integrated science because all the principles and methods of the other sciences, as well as geologic principles and methods, are applied to an understanding of the **Earth** and the **Environment**. Geologists study rocks, of course, but Geology encompasses so much more - anything related to the Earth or Earth-systems and even other planets. Information derived from earth materials may eventually be used to forecast earthquakes, volcanic eruptions, and various environmental hazards. The information obtained may also be applied to help geologists locate various natural resources (water, metals and other mineral resources, and energy). Therefore, geology serves to enhance human existence by attempting to reduce risk and by providing the materials necessary for the expansion of civilization.

## Academic Programs

The Geology Degree is designed for the person seeking a position in industry or planning to attend graduate school. The Geoscience Plan is designed for the person with a general interest in geology. Each plan is designed to provide an education in the fundamentals of geology. The required geology courses will give the student an understanding of the Earth and will provide an opportunity to observe, investigate, analyze, and interpret geological materials, processes, and structures. Both plans can be tailored to an individual's interest with specific electives and minors. For example, if a student is interested in **Environmental Geology**, then they would be advised by their advisor to take Hydrogeology rather than Petroleum Geology for their required geology classes; choose advanced geology elective courses such as Environmental Geology, Hydrology, and other environmentally related courses. The student would also choose Environmental Science as their minor.

## Highlights

Located on the third floor of the Lee Drain Building, the department places considerable emphasis on the integration of lab-based analytical science with similarly rigorous analysis conducted by means of field work. In support, the department maintains a range of field and laboratory equipment which include: a Mackereth coring system, a vibracorer, a research flume, a portable XRF, an X-ray diffractometer, a catholuminescence microscope, a Scanning Electron Microscope equipped with an energy-dispersive spectrometer, plus a variety of GPS and GIS-linked surveying equipment. Many of our students obtain internships and work with faculty members on research projects.

## Career Opportunities

Geology majors generally pursue careers in these areas:

- the environmental industry
- mining industry
- the petroleum industry
- government
- teaching
- geotechnical engineering

Geology students are provided with the knowledge and skills required to pursue an applied profession, a career in education, and/or continued education at the graduate level.

## Suggested Minors

- Computer Sciences
- Environmental Science
- Environmental Studies
- Geography
- Geographic Information Systems
- Mathematics
- Other sciences (Biology, Chemistry, or Physics)

## Program Specific Requirements

Geology program specific requirements include 8 hours in each of CHEM and PHYS; plus 7-8 hours of MATH.

## Environmental Science Degree

**Coordinator:** Ross Guida (ross.guida@shsu.edu) (936) 294-1233

**Website:** Department of Environmental and Geosciences (<https://www.shsu.edu/academics/geography-geology/>)

Environmental scientists seek to protect both environmental and human health by assessing problems and seeking to find solutions through field, lab, and/or computer-based work. Working in environmental science-related jobs can involve collecting and analyzing soil, water, or air samples, mapping

wetlands and disasters, or modeling how pollution is moving through rivers, aquifers, and the air. Environmental Scientists may even find themselves informing the general public about hazards or testifying in court cases.

Environmental Scientists:

- Work in the private sector, government, or non-governmental positions
- Work in environmental consulting and for environmental engineering firms
- Work on enforcing or improving environmental regulations, laws, and policies
- Advise government officials responsible for developing policies
- Assess possible environmental and health impacts of development projects
- Serve as community advocates to ensure clean water and air for vulnerable populations.

No matter the sector they work in, environmental scientists are typically broadly trained across multiple disciplines. Course work for environment science is hands-on and lab-science heavy, including Biology, Chemistry, Geography, Geology, and Soil Science. In addition to being well versed in analyzing data using mathematical and statistical methods, environmental scientists must also have strong writing and oral communication skills. Further, it is important that environmental scientists understand societal impacts and the context of their physical science work through additional perspectives drawn from human geography, sociology, and political science.

### Academic Programs

The Environmental Science degree has a choice of and three tracks/concentrations and is designed to fit the particular academic interests of our students and better prepare them for life beyond SHSU, particularly in terms of employment opportunities or graduate study. Students majoring in Environmental Science focus their studies within one of three concentrations; 1) Sustainability; 2) Pollution Abatement; or 3) Water Resources. All three concentrations require several core lab science courses in Biology, Chemistry, Geography, and Geology to provide an interdisciplinary foundation for upper-level coursework. Sustainability allows for more elective courses for those that want a broad Environmental Science background and more social science courses. Pollution Abatement is designed for students that want to focus on Biology and Chemistry-related Environmental Science work. Water Resources provides students with a strong foundation to assess water-related issues and includes courses in Aquatic Biology, Surface Water, Groundwater, and Water Quality-related applications. Across the Environmental Science concentrations, students gain experience in labs and the field. Students are also encouraged to pursue internship opportunities that can be counted toward prescribed major elective hours.

### Highlights

Combining the strengths of SHSU's Biology, Chemistry, Geography, and Geology programs, Environmental Science is a great choice for students that want to help communities and solve problems. It's also a great choice for students that like science but have a hard time picking just one area of scientific interest. Students get diverse perspectives from different physical scientists and take some social science courses to understand how Environmental Science fits in a broad societal context. While the home of the program is located on the third floor of the Lee Drain Building, where the Geographic Information System (GIS) lab, remote sensing lab, Geology labs, and GPS units are located, students in Environmental Science have access to Chemistry labs and the state-of-the-art Biological Lab Sciences building. Multiple trips to SHSU's Field Station (<https://www.shsu.edu/centers/cbfs/>) are also included through multiple courses. Students in Environmental Science have access to the College of Science and Engineering Technologies' (<https://www.shsu.edu/academics/science-and-engineering-technology/>) two 12-passenger vans for field trips and equipment across multiple contributing physical science departments. In order to enhance learning, all of our rooms are outfitted with video-projection systems, and our lecture rooms have sound systems and dedicated computers with Internet access that are used by the instructors for teaching purposes. A number of our students obtain internships with Houston-area firms and organizations, and work with faculty members on a range of research projects. While there are some online elective course options, Environmental Science includes multiple hands-on, lab-oriented courses. The degree also regularly offers a number of field opportunities for students to learn outside the classroom. Some of these field courses involve travel and/or international experiences and have included trips to Central TX, the Texas coast, Hawaii, Central America, Europe, and Africa.

### Career Opportunities

Because of the breadth of Environmental Science, there is a wide variety of career opportunities for graduates. These opportunities include careers in the following:

- Environmental Consulting
- Environmental Planning
- Environmental Policy and Politics
- Environmental compliance (inc. for Construction and Oil and Gas companies)
- Waste remediation and management
- Environmental Engineering
- Sustainability officer
- Conservation
- Environmental Protection
- Environmental Law

- Emergency Management
- Lab analyst (Air, soil, water, contamination, etc.)
- Public Health
- Dept. of Transportation
- City, county, state, and federal government
- Education
- Military

Environmental Scientists' broad backgrounds allow them to solve problems that require multiple disciplinary perspectives. Environmental scientists often work in the field, lab, or both. Many also write up reports that relate to development and current regulations and policies.

### Suggested Minors

- NO MINOR IS REQUIRED WITH AN ENVIRONMENTAL SCIENCE MAJOR
- If students choose to do a minor, it may add time to their degree plan.
- Bachelor of Arts, Major in Geography (Environment, Culture, and Development) (<https://catalog.shsu.edu/archives/2025-2026/undergraduate/colleges-academic-departments/science-and-engineering-technology/environmental-geosciences/ba-geography-environment-culture-and-development/#text>)
- Bachelor of Science, Major in Environmental Science (Pollution Abatement) (<https://catalog.shsu.edu/archives/2025-2026/undergraduate/colleges-academic-departments/science-and-engineering-technology/environmental-geosciences/bs-environmental-science-pollution-abatement/>)
- Bachelor of Science, Major in Environmental Science (Sustainability) (<https://catalog.shsu.edu/archives/2025-2026/undergraduate/colleges-academic-departments/science-and-engineering-technology/environmental-geosciences/bs-environmental-science-sustainability/>)
- Bachelor of Science, Major in Environmental Science (Water Resources) (<https://catalog.shsu.edu/archives/2025-2026/undergraduate/colleges-academic-departments/science-and-engineering-technology/environmental-geosciences/bs-environmental-science-water-resources/>)
- Bachelor of Science, Major in Geography (Environment, Culture, and Development) (<https://catalog.shsu.edu/archives/2025-2026/undergraduate/colleges-academic-departments/science-and-engineering-technology/environmental-geosciences/bs-geography-environment-culture-and-development/>)
- Bachelor of Science, Major in Geography, Geo-spatial Information Sciences (<https://catalog.shsu.edu/archives/2025-2026/undergraduate/colleges-academic-departments/science-and-engineering-technology/environmental-geosciences/bs-geography-geo-spatial-information-sciences/>)
- Bachelor of Science, Major in Geology (<https://catalog.shsu.edu/archives/2025-2026/undergraduate/colleges-academic-departments/science-and-engineering-technology/environmental-geosciences/bs-geology/>)
- Bachelor of Science, Major in Geology (Geoscience) (<https://catalog.shsu.edu/archives/2025-2026/undergraduate/colleges-academic-departments/science-and-engineering-technology/environmental-geosciences/bs-geology-geoscience/>)
- Bachelor of Science, Major in Integrated Studies: Environmental and Occupational Health Concentration (<https://catalog.shsu.edu/archives/2025-2026/undergraduate/colleges-academic-departments/humanities-social-sciences/integrated-studies/bs-integrated-studies-concentration-environmental-and-occupational-health/>)
- Bachelor of Science, Major in Integrated Studies: Land and Urban Property Development Concentration (<https://catalog.shsu.edu/archives/2025-2026/undergraduate/colleges-academic-departments/humanities-social-sciences/integrated-studies/bs-integrated-studies-concentration-land-and-urban-property-development/>)
- Bachelor of Science, Major in Integrated Studies: Sustainable Community Management Concentration (<https://catalog.shsu.edu/archives/2025-2026/undergraduate/colleges-academic-departments/humanities-social-sciences/integrated-studies/bs-integrated-studies-concentration-sustainable-community-management/>)
- Undergraduate Certificate in Crime Analysis and Mapping (<https://catalog.shsu.edu/archives/2025-2026/undergraduate/colleges-academic-departments/science-and-engineering-technology/environmental-geosciences/undergraduate-certificate-crime-analysis-and-mapping/>)
- Undergraduate Certificate in Geospatial Applications (<https://catalog.shsu.edu/archives/2025-2026/undergraduate/colleges-academic-departments/science-and-engineering-technology/environmental-geosciences/geospatial-applications-certificate/>)
- Undergraduate Certificate in Gulf Studies (<https://catalog.shsu.edu/archives/2025-2026/undergraduate/colleges-academic-departments/science-and-engineering-technology/environmental-geosciences/gulf-studies-certificate/>)
- Minor in Crime Analysis and Mapping (<https://catalog.shsu.edu/archives/2025-2026/undergraduate/colleges-academic-departments/science-and-engineering-technology/environmental-geosciences/minor-crime-analysis-and-mapping/>)
- Minor in Environmental Science (<https://catalog.shsu.edu/archives/2025-2026/undergraduate/colleges-academic-departments/science-and-engineering-technology/environmental-geosciences/minor-environmental-science/>)
- Minor in Environmental Studies (<https://catalog.shsu.edu/archives/2025-2026/undergraduate/colleges-academic-departments/science-and-engineering-technology/environmental-geosciences/minor-environmental-studies/>)

- Minor in Geography (<https://catalog.shsu.edu/archives/2025-2026/undergraduate/colleges-academic-departments/science-and-engineering-technology/environmental-geosciences/minor-geography/>)
- Minor in Geology (<https://catalog.shsu.edu/archives/2025-2026/undergraduate/colleges-academic-departments/science-and-engineering-technology/environmental-geosciences/minor-geology/>)
- Minor in Geo-Spatial Science (<https://catalog.shsu.edu/archives/2025-2026/undergraduate/colleges-academic-departments/science-and-engineering-technology/environmental-geosciences/minor-geo-spatial-science/>)

## Environmental Science

### Internships

Educational and research opportunities in Environmental Science are available through a variety of internship opportunities that will increase students' skills and employment opportunities.

### Awards and Scholarships

- **G. SCOTT AND MARY S. MC CARLEY ENVIRONMENTAL SCIENCE EDDOWED SCHOLARSHIP FOR ENVIRONMENTAL SCIENCE STUDENTS:** \$1,000 annually. Must have a 3.0 GPA and be an Environmental Science student.

Request information from:

Ross Guida  
Environmental Science Degree Coordinator  
(936) 294-1233  
Department of Environmental and Geosciences  
Box 2148  
Huntsville, TX 77341-2148

## Geography

### Student Organizations

- **Geographers of Sam Houston (GOSH)** - GOSH is intended to enhance appreciation for geography through club-sponsored field trips, guest lectures, and other activities, and to promote camaraderie among geography students.
- **Gamma Theta Upsilon (GTU)** - GTU is the National Geography Honor Society and was established to promote geographic awareness and the pursuit of geographic knowledge. To be eligible for membership in this honor society, students must have at least 9 hours of geography coursework, a minimum GPA of 3.3 in their geography coursework and overall, and the equivalent of 3 full-time college semesters completed.

### Internships

Educational and research opportunities using GIS are available through a variety of internship opportunities that will increase students' skills and employment opportunities.

### Richardson Endowment Awards

- **C. ALLEN WILLIAMS AWARD FOR GEOGRAPHY STUDENTS:** \$500-\$700 one semester.  
Geography majors or minors, senior status.
- **CODY BARRON AWARD FOR GEOGRAPHY STUDENTS:** \$500-\$700 one semester.  
Geography majors or minors, senior status.
- **GERALD L. HOLDER AWARD FOR GEOGRAPHY STUDENTS:** \$500 – \$700 one semester.  
Geography majors or minors, senior status, 3.0 GPA Geography overall.
- **JAMES ELLISON KIRKLEY AWARD:** Two awards (amounts vary) to majors in history, political science, geography, or sociology.  
Recipients are selected on basis of high academic achievement.
- **JOHN H. BOUNDS AWARD FOR GEOGRAPHY STUDENTS:** \$500-\$700 for one semester.  
Geography majors or minors, senior status.
- **THE ELTON M. SCOTT AWARD FOR GEOGRAPHY STUDENTS:** \$500 – \$700 one semester.  
Geography majors or minors, senior status. 3.0 GPA Geography overall.

Request information from:

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## Geology

### Student Organizations

**American Association of Petroleum Geologists (AAPG) Student Chapter** - AAPG is an international professional geological society that exists to foster scientific research, to advance the science of geology, to promote technology, and to inspire high professional conduct. The student chapter is run by students to facilitate networking with professional geologists, and provide other professional development opportunities.

**Sam Houston Association of Geology Students (SHAGS)** - SHAGS is a very active student organization that sponsors field trips to sites in Texas, Oklahoma, and Arkansas. Alumni, professors, and other professional geologists are invited to speak at SHAGS meetings. Geology majors benefit greatly from the sense of camaraderie gained during the field trips, meetings, and other activities.

### Internships

Educational and research opportunities are available through a variety of internship opportunities in the fields of GIS, hydrocarbons, and environmental geology that will increase students' skills and employment opportunities.

### Awards and Scholarships

- **CANNAN GEOLOGICAL SCHOLARSHIPS:** \$600 per year, junior or senior status, Geology majors, minimum GPA of 3.2 in Geology and overall 3.0, faculty recommendations required.
- **CHUCK CAUGHEY GEOSCIENCE ENDOWED SCHOLARSHIP:** Award covers the full cost of attending Sam Houston State University (full tuition, fees, books, and room and board) must be a geology major, must maintain an overall GPA of 3.0 or better, and demonstrate financial need.
- **HOUSTON GEOLOGICAL SOCIETY OUTSTANDING SENIOR AWARD:** Awards and scholarships funded by the Houston Geological Society given to just seven universities in Texas.
- **HOUSTON GEOLOGICAL SOCIETY SCHOLARSHIP:** Award recipients are determined by a faculty committee during the Spring semester.
- **BRIAN COOPER GEOLOGY SCHOLARSHIP:** Award recipients are determined by a faculty committee during the Spring semester.
- **SHAGS Award:** \$500 per year, awarded to two students, junior or senior status, Geology majors, minimum GPA of 3.0, faculty recommendations required.

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## Geography

### **GEOG 1300. People, Places, and the Environment. 3 Hours. [TCCN: GEOG 1302]**

Students are introduced to the discipline of geography, or the study of the world from a spatial perspective. This includes an examination of both the cultural and physical environments and the social, economic, political, and environmental factors that influence human activities and societies across the globe. Students will also be introduced to geospatial technologies (e.g., GPS and Google Satellite Imagery) currently utilized to investigate geographical issues. The course may involve field trips that incorporate course material. Course Equivalents: GEOG 1321 .

### **GEOG 1401. Weather and Climate. 4 Hours. [TCCN: GEOL 1447]**

The basic concepts of meteorology and climatology are introduced. Atmospheric temperature, pressure, winds, moisture, and air masses and storms are systematically covered, followed by an overview of the major climates and ecosystems of the earth. Environmental problems related to weather, climate, and ecosystems are considered throughout. The lab portion of weather and climate is an activity-related treatment of the basic components of meteorology and climatology. Specific topics covered are similar to the lecture. Course Equivalents: GEOG 1301 .

### **GEOG 2341. Physical Geography. 3 Hours. [TCCN: GEOG 1301]**

Students examine the basic physical and biological systems of planet Earth, including the atmosphere, oceans, landforms, soils, and ecosystems. Emphasis is placed on understanding the distribution, scale, and dynamic inter-relationships and processes, which shape the physical and biological landscape as well as the ways in which humans alter the environment and are, in turn, affected by the environment.

### **GEOG 2355. World Regional Geography: Europe, Asia, and Australia. 3 Hours. [TCCN: GEOG 1303]**

Students are provided a general overview of the land and people. Topics discussed may include the physical environment, cultural characteristics and the various ways people live and make their living. Attention is focused upon the relationships which exist between location, the physical environment and human activity. Examples of countries covered are Russia, Germany, France, China, Japan, and United Kingdom.

**GEOG 2356. World Regional Geography: Latin America, Africa, South Asia. 3 Hours. [TCCN: GEOG 1303]**

Students are provided a general overview of the land and people. Topics discussed may include the physical environment, cultural characteristics and the various ways people live and make their living. Attention is focused upon the relationships which exist between location, the physical environment and human activity. Examples of countries covered are Mexico, Brazil, Argentina, Egypt, Republic of South Africa, Israel, Iran, and India.

**GEOG 2364. Geo-Spatial Technology. 3 Hours.**

Students are introduced to technologies, such as geographic information systems (GIS) and global positioning systems (GPS), that are used to map and study the Earth. The emphasis is placed on the application of these technologies in areas of environmental and natural resources management, business and marketing, and law enforcement and national security. Course Equivalents: GEOG 3364 .

**GEOG 2464. Introduction to Geographic Information Systems (GIS). 4 Hours.**

Students are introduced to the basics of geographic information systems (GIS) with an emphasis on environmental and resource management applications. Students design and develop a digital spatial database, perform spatial analyses, create hardcopy maps, and generate reports. Students are introduced to several GIS software packages. This course does incorporate a laboratory component. Course Equivalents: GEOG 4464 .

**GEOG 3301. Environmental Geography. 3 Hours.**

Environmental Geography is a study of the spatial dimensions of the interaction between humans and their physical environment. Key principles of how the earth and the earth's ecosystems work, how they are interconnected, and how humans use and impact these natural resource systems will be introduced. Course Equivalents: GEOG 2301 .

**GEOG 3310. Sustainable Development. 3 Hours.**

Sustainable development is both a fundamental concept used to understand the modern world and a tool to address global issues. Students examine this concept using the framework of geography and a global perspective. Students focus on the intersections of environment and society, including environmental, economic, and social barriers to development, environmental and social impacts of development, and the role of environmental sustainability in achieving global development goals.

**Prerequisite:** 60 credit hours and 3hrs of GEOG.

**GEOG 3320. Sustainability & Environment. 3 Hours.**

Students investigate and assess the impacts that human activity can have on the environment and will seek to identify innovative, cross-disciplinary solutions to many of the world's most pressing environmental challenges. Given that Sustainability Science involves making decisions and taking actions that are in the interest of protecting the natural world, course topics will include current sustainability issues related to population growth, agriculture, natural resources, energy usage, habitat degradation and ecological economics. This course is typically be offered every other fall semester. Also offered as BIOL 3320. Course Equivalents: BIOL 2320, BIOL 3320, GEOG 2320

**Prerequisite:** BIOL 1401 or (60 credit hours and 3 hours of GEOG).

**GEOG 3340. Meteorology. 3 Hours.**

Students explore weather phenomena and the atmospheric processes that generate them as well the methods used to measure the controlling factors. Topics may include atmospheric thermodynamics, black body radiation, weather instruments, weather forecasting, satellite imagery, Doppler radar, and numerical models.

**Prerequisite:** GEOG 1401; MATH 1314 or MATH 1410; or permission of instructor.

**GEOG 3342. Climatology. 3 Hours.**

Students explore the meaning of the term climate, processes that affect climate, how Earth's climate has changed, and effects of climate change on humans and the environment. Topics may include characteristics of Earth's atmosphere, climate teleconnections, climate interactions with other components of the Earth system, water cycle, climate classifications, potential causes of climate change, climate modeling, and climate policy.

**Prerequisite:** GEOG 1401; MATH 1314 or MATH 1410; or permission of instructor.

**GEOG 3350. Cultural Geography. 3 Hours.**

Students focus on the concept of culture from a spatial or geographical perspective, examining culture as it relates to the geographic landscape. Topics may include the spatial dynamics of language, religion, race, ethnicity, music, sport, folk and popular cultures, and the built environment. In addition, students are provided an examination of symbolic landscapes, contested spaces, subaltern geographies, representations of place in film and literature, gendered spaces, and place-situated identities.

**GEOG 3352. Tourism Geography. 3 Hours.**

Students are provided an introduction to the geography of tourism. Topics may include the historical development of travel and tourism, place promotion, location of tourism destinations, geographic resources of tourism, and the physical and social outcomes of tourism.

**Prerequisite:** GEOG 1321 or GEOG 2355 or GEOG 2356.

**GEOG 3358. Historical Geography of the United States. 3 Hours.**

Students survey the changing geography of the United States including initial exploration, European perception of North America, geographical expansion of the United States to the Pacific, and geographical factors underlying the urbanization and industrialization of the nation.

**GEOG 3359. Regional Geography: the United States and Canada. 3 Hours.**

Students are provided a general overview of the land and people of the United States and Canada. Topics covered may include the physical environment (weather patterns, landforms and water resources), cultural differences, and the various ways people live and make their living. Attention is focused upon the relationships which exist between location, the physical environment and human activity. This course is available on-line and via traditional classroom delivery.

**GEOG 3362. Map Use & Map Interpretation. 3 Hours.**

Students learn how to use and interpret topographic maps and helps them to develop an appreciation of their use as tools by geographers. Students are familiarized to map projections and their limitations, various coordinate systems, map measurements, GPS, and the basics of air photo interpretation.

**GEOG 3363. Computer Cartography. 3 Hours.**

Fundamentals of thematic mapping, including appropriate usage, projections, base-map compilation, data measurement and analysis, map design and construction, color principles, and other cartographic concepts are emphasized.

**Prerequisite:** GEOG 2464.

**GEOG 3398. Gulf Seminar. 3 Hours.**

Students learn about issues in the Gulf of Mexico region from multidisciplinary perspectives, including physical science, social science, humanities, and the arts. Students focus on systems thinking, including issues of scale from local to global, to assess environmental, societal, economic, policy, and community-related challenges in the Houston metro area, Southeast Texas, and the broader Gulf region. Readings, discussion, and undergraduate research methods are emphasized.

**Prerequisite:** Junior standing and approval of the instructor.

**GEOG 3399. Gulf Field Studies. 3 Hours.**

Students explore the complex issues facing the Houston metro area, Southeast Texas, and the larger Gulf region. Students visit sites across the area to discuss energy development, historically underserved neighborhoods, street art and architecture, urban and rural development, and communities impacted by natural disasters and environmental challenges. As part of site visits, students will build relationships with community leaders, government officials, private sector companies, and non-profits.

**Prerequisite:** GEOG 3398 OR POLS 3398; Junior standing and approval of the instructor.

**GEOG 4075. Readings in Geography. 1-3 Hours.**

A course designed specifically for advanced students of geography who are capable of independent study. Registration is permitted only upon approval of the program coordinator. This course may be taken for Academic Distinction credit. See Academic Distinction Program in this catalog. Variable Credit (1-3). Course Equivalents: GEOG 4375 .

**GEOG 4076. Special Topics. 1-3 Hours.**

This course of faculty-led study is designed to explore geographical topics and concepts in a course setting. Students engage in either an in-depth, interdisciplinary study of a particular geographic region in the world, or a systematic study of a geographic topic. The course is repeatable for different regions or different topics. Variable Credit (1 to 3).

**Prerequisite:** GEOG 1321, or GEOG 2355, or GEOG 2356, or permission of instructor.

**GEOG 4100. Earth and Environment Seminar. 1 Hour.**

Students majoring in Environmental Science, Geography, or Geology discuss environmental problems and career opportunities with professionals in the field.

**Prerequisite:** Senior Standing.

**GEOG 4311. GIS in Law Enforcement. 3 Hours.**

Students learn applications of geospatial technologies in law enforcement. Topics include methodologies and characteristics of GIS, intelligence, and crime incident data, GPS, imagery, heat mapping, and change detection related to law enforcement.

**Prerequisite:** GEOG 2464.

**GEOG 4330. Hydrology and Water Resources. 3 Hours.**

Students examine the hydrologic cycle with an emphasis on surface water processes. Specific topics may include precipitation, infiltration, evapotranspiration, fluvial processes, and sediment transport. Using the physical concepts and equations related to these topics, students analyze water-related hazards, including flooding and drought, as well as water management and policy. While Texas-specific issues are emphasized, students explore both U.S. and international geographies of hydrology, water resources, and water management. Course Equivalents: GEOG 4430

**Prerequisite:** (GEOL 1403 or GEOG 2341 or GEOL 1405 or GEOG 4432) and (MATH 1314 or MATH 1342 or MATH 1420); or permission of instructor.

**GEOG 4331. Conservation of Natural Resources. 3 Hours.**

Students explore the impact of human activities on the natural world, environmental protection, and the wise use of the earth's resources. Topics may include: environmental history, economics, law and ethics, ecology, population issues, agriculture and grazing, soil conservation, forestry, endangered and exotic species, water availability and water pollution, hazardous and solid waste management, air pollution (including global warming), energy resources (fossil, nuclear, and renewable), and the impact of technology on the future health of the planet.

**GEOG 4333. Field Studies. 3 Hours.**

Use of geospatial technologies such as Global Positioning Systems (GPS), laser surveying, digital aerial photography and computerized mapping (GIS) are stressed. Applications of these technologies will include surveying, water resources, forestry, soil science, wetlands delineation, urban and transportation planning, automobile accident reconstruction and crime scene evidence recovery. Half of the class meetings take place at a variety of outdoor locations.

**GEOG 4351. Economic Geography. 3 Hours.**

Students examine of the importance of location to human activity. The locational characteristics of primary, secondary, and tertiary economic activities are examined, with an emphasis on land use and urban form, its theory, and descriptive analysis as well as an explanation of market forces and their consequences. Writing enhanced. Course Equivalents: GEOG 3351 .

**GEOG 4356. Urban Geography. 3 Hours.**

Students are introduced to the scope and nature of urban areas from a geographical or spatial perspective. Students focus on the spatial structure of urban areas and examine the geography of cities using an urban systems approach. Emphasis is placed on the North American city and its problems: land use, transportation, political fragmentation, physical environment, demographic and social change, economic dynamics, residential patterns, urban culture, poverty, etc. Trends in urbanization in both developed and developing worlds are discussed. Writing enhanced. **Prerequisite:** GEOG 1321 or GEOG 2355 or GEOG 2356.

**GEOG 4357. Population Geography. 3 Hours.**

Students examine spatial patterns and processes influencing the distribution, density, composition, and growth in human populations. Students focus on migration, and to a lesser extent, on fertility and mortality together with socio-economic, political, and environmental causes and consequences of population dynamics that vary between regions and over time. Writing enhanced.

**Prerequisite:** GEOG 1321 or GEOG 2355 or GEOG 2356.

**GEOG 4358. Geography of Texas. 3 Hours.**

Students engage in a survey of the regional geography of Texas. Consideration is given to the significance of primary and secondary activity within the state, urbanization, and potential for development.

**GEOG 4359. Transportation Geography. 3 Hours.**

Students are introduced to the concepts, theories, and methods of transportation geography. Students cover transportation infrastructure, modes of terminals, transportation economics, urban transportation, logistics, and transportation planning. In addition, students course cover various analytical techniques applied in transportation analysis, such as network analysis, gravity models, location-allocation modeling, and geographic information systems in transportation studies.

**Prerequisite:** GEOG 1321 or GEOG 2355 or GEOG 2356 or permission of instructor.

**GEOG 4360. Cultural Field Study. 3 Hours.**

Students focus on a number of topics and concepts that fall within the sub-discipline of cultural geography. Students engage in place-based learning, with the primary emphasis being a field experience that directly exposes students to processes and concepts introduced and discussed in the classroom. These may include migration, urbanization, economic transformations, demographic change, social and technological change, racial segregation, civil rights, heritage tourism and other topics. Writing enhanced.

**Prerequisite:** 6 GEOG advanced hours or permission of Instructor.

**GEOG 4361. Geographic Information Systems for Public Health. 3 Hours.**

Students cover the theory and application of Geographic Information Systems (GIS) for public health. Topics include an overview of the principles of GIS in public health and practical experience in its use. In addition, students cover the application of GIS mapping and analyzing the geographic distribution of populations at risk and health outcomes. The practical component involves the use of desktop GIS software packages.

**GEOG 4365. Applied Geographic Information Systems (GIS). 3 Hours.**

Applied GIS is designed to meet the needs for a highly applied course with realistic practical training extending the fundamental principles learned in Introduction to Geographic Information Systems (GEOG 2464). The application of GIS technology to mapping, modeling and management of large data bases are emphasized.

**Prerequisite:** GEOG 2464.

**GEOG 4367. GIS Programming. 3 Hours.**

Students learn computer programming principles and their applications in a Geographic Information Systems (GIS) environment, as well as modern programming languages for working within a variety of GIS software platforms. Students master the use of programming scripts to manipulate basic mapping objects, complete geo-processing tasks, debug and error handling, and create custom geospatial tools.

**Prerequisite:** GEOG 2464 or approval of instructor.

**GEOG 4374. Geostatistics. 3 Hours.**

Students apply statistical concepts and geospatial computing tools to analyze data. Topics may include geospatial patterns and trends, spatial autocorrelation, spatial regression, interpolation techniques, and reliability of environmental and geoscience data. An emphasis is placed on applied techniques and current software tools.

**Prerequisite:** GEOG 2464 and one of MATH 1342 or MATH 3379.

**GEOG 4399. Environmental and Geoscience Internship. 3 Hours.**

Students apply environmental, geoscience, and/or GIS skills in a work environment. Students work with a faculty advisor and their employer to complete employer-assigned internship requirements.

**Prerequisite:** Junior Standing.

**GEOG 4432. Geomorphology. 4 Hours.**

Students focus on surficial processes and the resulting landforms. Specific topics may include landscape processes associated with streams, glaciers, wind, coasts, mass wasting, weathering and soil development, and geologic structure. Surface processes are also discussed in the context of human impacts and the environment. Labs emphasize landform analysis and applied problems through interpretation of topographic maps and aerial imagery and field trips. Two-hour laboratory.

**Prerequisite:** (GEOL 1403 or GEOL 1405 or GEOG 2341) and (MATH 1314 or MATH 1342 or MATH 1420 or MATH 3379); or permission of instructor.

**GEOG 4468. Remote Sensing. 4 Hours.**

Students are introduced to the methods used to analyze and interpret aerial photography and satellite imagery. Emphasis is placed on multispectral satellite imagery, digital image processing, and land use and land cover analysis using remotely sensed imagery. Lab included.

**Prerequisite:** GEOG 2464.

## Geology

**GEOL 1403. Physical Geology. 4 Hours. [TCCN: GEOL 1403]**

Students are introduced to the materials, processes, and structure of the earth. Topics may include earthquakes, volcanoes, plate tectonics, mountain building, weathering and erosion, glaciation, oceans, and mineral resources. The laboratory taken concurrently with the lecture includes experiences that involve the study of rocks, minerals, and map interpretations. Course Equivalents: GEOL 1303 .

**GEOL 1404. Historical Geology. 4 Hours. [TCCN: GEOL 1404]**

Students are introduced to the history of the earth and its past inhabitants, including a section on the dinosaurs and their extinction. Students are given a broad overview of the tectonic evolution of the planet, indicated by various major mountain-building events; ancient environments and changing sea levels recorded in sedimentary deposits; and the evolution of life represented by the fossil record. The laboratory taken concurrently with the lecture includes the study of common animal and plant fossils and problems that illustrate practical applications of geological principles. Course Equivalents: GEOL 1304 .

**GEOL 1405. Geologic & Environmental Hazards. 4 Hours. [TCCN: GEOL 1405]**

Students are introduced to the interrelationship between humans and the geologic environment, which includes the potential hazards posed by geologic processes and the planning that needs to be done to lessen their impact. It is designed to give students an overview of the fundamental Earth Science and natural hazards, including causes and effects of earthquakes, tsunamis, volcanoes, floods, landslides, hurricanes, climate change, etc. Earth materials and their uses by humans are also emphasized. Discussion will focus on personal and societal adjustments to these hazards. Course Equivalents: GEOL 1305 .

**GEOL 1436. Foundations of Science. 4 Hours.**

Students focus on the nature of science as a reliable method of acquiring knowledge about the natural world. Students learn how to apply key scientific facts, concepts, laws and theories to distinguish science from non-science, bad science, and pseudoscience by analyzing a variety of claims and case studies. By employing an innovative, interdisciplinary approach to science education, this course is designed to increase science literacy and critical thinking skills for introductory-level science students. Students must enroll concurrently in the corresponding lab for this course. Course Equivalents: BIOL 1436, GEOG 1436, ISCI 1436 .

**GEOL 3301. Field Methods. 3 Hours.**

Students are provided experience with common field techniques used in geologic mapping and geologic investigations. An emphasis is placed on techniques and skills used for systematic field observations and data collection for construction of stratigraphic columns, structural cross-sections, and the development of geologic maps. The course has a mandatory two-week field component.

**Prerequisite:** GEOL 1304/GEOL 1104 or GEOL 1404 and GEOL 1303/GEOL 1103 or GEOL 1403 or GEOL 1305/GEOL 1105 or GEOL 1405.

**GEOL 3326. Environmental Geology. 3 Hours.**

Students are introduced to geological processes and materials, and how they affect people and the environment. Specific topics include earthquakes, volcanism, mass wasting, floods, coastal hazards, and climatic change. Optional topics may include such items as energy and water resources, subsidence, and waste disposal.

**Prerequisite:** GEOL 1303/GEOL 1103 or GEOL 1403 or GEOL 1305/ GEOL 1105 or GEOL 1405.

**GEOL 3330. Oceanography. 3 Hours.**

Students engage in a survey of the general principles of oceanography is made. The geology of ocean basins, tide-water processes and the chemistry of sea water are studied. Biophysics of the sea and environmental problems are considered.

**Prerequisite:** GEOL 1303/1103 or GEOL 1403 or GEOL 1305/1105 or GEOL 1405.

**GEOL 3332. Forensic Geology. 3 Hours.**

Students cover many of the basic geological principles and techniques used in solving crime. A significant part of the course involves case studies as well as hands-on field and laboratory analyses.

**Prerequisite:** GEOL 1303, GEOL 1103 or GEOL 1403 plus CHEM 1311, CHEM 1111 or CHEM 1411 plus CHEM 1312, CHEM 1112, or CHEM 1412, and MATH 1316.

**GEOL 3404. Mineralogy. 4 Hours.**

Students cover crystallography, genesis of minerals, identification and classification of minerals, and optical mineralogy. Includes lab work.

**Prerequisite:** GEOL 1303/GEOL 1103 or GEOL 1403 or GEOL 1305/GEOL 1105 or GEOL 1405 and GEOL 1304/GEOL 1104 or GEOL 1404 and CHEM 1311/CHEM 1111 or CHEM 1411 and CHEM 1312/CHEM 1112 or CHEM 1412 and MATH 1316 or MATH 1410.

**GEOL 3405. Petrology. 4 Hours.**

Students engage in the classification, origin, occurrence and associations of igneous, sedimentary, and metamorphic rocks. Includes optical petrology using thin sections.

**Prerequisite:** GEOL 3404.

**GEOL 3415. Paleontology of Invertebrates. 4 Hours.**

Students focus on the fundamental concepts, principles, and methods involved in deciphering the origin, development, and extinction of past life as revealed through the study of invertebrate fossils.

**Prerequisite:** GEOL 1304/GEOL 1104 or GEOL 1404.

**GEOL 4095. Special Topics in Geology. 1-3 Hours.**

Individual study in special areas of geology. Topic content is usually selected and agreed upon by the student and a member of the Geology faculty. Sometimes special topics courses are offered by the Geology faculty. This course may be taken for Academic Distinction credit. See Academic Distinction Program in this catalog.. Variable Credit (1-3). May be repeated for credit. May be repeated for credit. Course Equivalents: GEOL 4395

**Prerequisite:** Prerequisites and credit will be determined by the faculty member.

**GEOL 4100. Earth and Environment Seminar. 1 Hour.**

Students majoring in Environmental Science, Geography, or Geology discuss environmental problems and career opportunities with professionals in the field.

**Prerequisite:** Senior Standing.

**GEOL 4304. Geochemistry. 3 Hours.**

Students are provided a general introduction to all types of geochemistry that includes a discussion of the underlying chemical concepts, with an emphasis on the applications to geological environments. The chemical concepts include isotopic chemistry, thermodynamics, crystal chemistry, and aqueous solutions. The geological metasomatism, geothermobarometry, and environmental geochemistry. and C or better in CHEM 1412, and C or better in MATH 1420, and C or better in GEOL 1403 or GEOL 1405. Course Equivalents: GEOL 3304

**Prerequisite:** GEOL 3404 OR 60 hrs.

**GEOL 4312. Economic Geology. 3 Hours.**

Students explore the origin and occurrence of economically important minerals. A portion of the course is devoted to petroleum.

**Prerequisite:** GEOL 1403 or GEOL 1405 plus GEOL 1404.

**GEOL 4320. Petroleum Geology. 3 Hours.**

Students review the origin and development of petroleum and natural gas deposits, and surveys the various tools used to prospect for commercial deposits of oil and natural gas.

**Prerequisite:** GEOL 1403 or GEOL 1405 plus GEOL 1404.

**GEOL 4331. Geology of North America. 3 Hours.**

Students study of the geologic history of the continent of North America. Topics may include paleogeography, major depositional areas and stratigraphic units, and paleotectonics.

**Prerequisite:** GEOL 1403 or GEOL 1405 plus GEOL 1404.

**GEOL 4337. Plate Tectonics. 3 Hours.**

Students are introduced to the movement of lithospheric plates. Topics to be covered may include earthquakes, volcanism, seismic tomography, the evolution of continents and ocean basins, and the influence of the earth's interior on these processes. Lecture only.

**Prerequisite:** GEOL 1303/1103 or GEOL 1403 or GEOL 1305/1105 or GEOL 1405 and GEOL 1304/1104 or GEOL 1404.

**GEOL 4360. Field Geology. 3 Hours.**

These courses will consist of on-site studies in structure, stratigraphy, petrology and paleontology. Field trips are taken to appropriate areas in Texas and/or surrounding states. T

**Prerequisite:** Senior standing.

**GEOL 4361. Field Geology. 3 Hours.**

These courses will consist of on-site studies in structure, stratigraphy, petrology and paleontology. Field trips will be taken to appropriate areas in Texas and/or surrounding states. T

**Prerequisite:** Senior standing.

**GEOL 4399. Environmental and Geoscience Internship. 3 Hours.**

Students apply environmental, geoscience, and/or GIS skills in a work environment. Students work with a faculty advisor and their employer to complete employer-assigned internship requirements.

**Prerequisite:** Junior Standing.

**GEOL 4400. Stratigraphy & Sedimentation. 4 Hours.**

Students study the principles and methods used in describing, classifying, and correlating strata, which includes studies of modern and ancient depositional environments. Lab/field work included.

**Prerequisite:** GEOL 3404.

**GEOL 4402. Structural Geology. 4 Hours.**

Students cover the principles of deformation of the Earth's lithosphere with emphasis on mechanical principles, identification and interpretation of structures from the microscopic scale to the scale of mountain belts. Other topics may include regional tectonics and application in petroleum exploration. Lab work focuses on graphical and quantitative techniques of analyzing geologic structures.

**Prerequisite:** GEOL 4400, PHYS 1301, PHYS 1101, and MATH 1316.

**GEOL 4413. Methods in Applied Geophysics. 4 Hours.**

Applied Geophysics involves measurements made on the surface of the Earth that are interpreted to yield the distribution of subsurface properties, particularly those having economic and engineering importance. Students are provided an introduction to the latest methods used to map the distribution of physical properties beneath the surface of the Earth and is widely recommended for students who plan to pursue careers that directly or indirectly involve subsurface imaging and analysis.

**Prerequisite:** GEOL 1403 or GEOL 1405, MATH 1420, PHYS 1301, PHYS 1101, PHYS 1302, PHYS 1102, or by permission of instructor.

**GEOL 4414. Sea Level Change and the Geological Record. 4 Hours.**

Students examine the various modern causes of relative and absolute sea level change. In addition, students engage in an analysis of ancient geological sedimentary and stratigraphic records from the perspective of what they reveal about rates and scales of sea level change in the past as well as implications for the future. Sequence stratigraphic concepts (commonly used in the petroleum industry) are critically examined via field-based and paper and core-based studies.

**Prerequisite:** GEOL 1403 or GEOL 1405 plus GEOL 1404.

**GEOL 4426. Hydrogeology. 4 Hours.**

Students are introduced to the study of groundwater and its role in the hydrologic cycle. Topics may include properties and distribution of water on the surface, in the vadose zone and in aquifers; behavior, modeling, and geology of groundwater aquifers; human use and abuse of water resources, including groundwater contamination and extraction; and water law economics, and aquatic ecology. A lab with field trips focus on measurement and modeling of groundwater.

**Prerequisite:** MATH 1420 or permission of instructor, and GEOL 1403 or GEOL 1405 or GEOG 2341.

Director/Chair: **Joseph C Hill**

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