EARTH AND ENVIRONMENTAL SCIENCES

Earth and Environmental Sciences Department (https:// www.csuchico.edu/erth/) Science Building 258A 530-898-5262 Email: erth@csuchico.edu Chair. Todd J. Greene

Insight

Earth and Environmental Sciences encompasses an interdisciplinary suite of studies, all engaged to better understand the Earth and the environmental problems facing us. By integrating principles of physics, chemistry, biology, and mathematics, as well as quantitative and critical thinking skills, our graduates address geological and environmental issues related to the solid earth, the biosphere, hydrosphere, and the atmosphere. We are a department focused on providing students with opportunities to conduct applied and basic research in an effort to understand physical processes on and within the Earth and human influences that affect the environment.

The department offers two undergraduate degrees and two graduate degrees at the master's level. The BS in environmental science prepares students for careers in areas such as pollution remediation, resource conservation, or environmental management, as well as providing a firm foundation for graduate studies. Graduates with the BS in geology have gone on to careers in soil and water resources, mining, environmental protection, and as park naturalists. Graduate students use their advanced degrees to further their careers in the geological and environmental sciences, working for both public and private agencies. In keeping with the interdisciplinary nature of the department, the faculty represent diverse academic areas, complemented by industrial experience. All have a strong commitment to excellence in teaching and engage in professional development.

Experience

Our department offers many opportunities for students outside the classroom. Our student group, the Association of Geological and Environmental Students (AGES), is open to everyone. AGES hosts several off-campus field trips each semester. Many majors are also members of national organizations such as the American Geophysical Union, Groundwater Resources of America, American Meteorological Society, and the Geological Society of America. Lecture courses are accompanied by laboratories, discussions, and field trips. Internships and work experience are also available.

Students have many opportunities to engage in research with faculty. We are very proud of the excellent research facilities we have developed over the years with support from national funding sources such as the National Science Foundation, National Oceanic and Atmospheric Administration, and NASA. Department equipment and facilities are extensive and include equipment for field and laboratory work in environmental science, geology, and hydrology/hydrogeology including cutting edge geochemical analysis, field environmental sensors, and tools for studying wind and atmospheric turbulence. In recent years, our undergraduate students have been involved in a number of research studies from the effects of local wildfires to modeling volcanic eruptions and international projects in Europe, South America, and Africa.

Outlook

Employment opportunities are excellent and growing as society accepts the challenges we face with climate change and loss of water resources. Our graduates work for agencies such as the California Department of Water Resources, the United States Geological Survey, and the Environmental Protection Agency. Graduates are also employed by private companies specializing in mineral and petroleum exploration, engineering or environmental consulting, and pollution remediation. Graduates with a bachelor's degree find entry-level positions that involve gathering and interpreting scientific data, while management and fieldoriented research positions generally require a master's degree.

Programs

Undergraduate

Bachelor's

- Environmental Science BS (https://catalog.csuchico.edu/collegesdepartments/college-natural-sciences/earth-environmental-sciences/ environmental-science-bs/)
- Geology BS (https://catalog.csuchico.edu/colleges-departments/ college-natural-sciences/earth-environmental-sciences/geology-bs/)

Minors

 Geology Minor (https://catalog.csuchico.edu/colleges-departments/ college-natural-sciences/earth-environmental-sciences/geologyminor/)

Credentials

 Science Single Subject Matter Preparation Program (https:// catalog.csuchico.edu/colleges-departments/college-naturalsciences/earth-environmental-sciences/science-single-subjectmatter-preparation-program/)

Graduate

Master's

- Environmental Science MS (https://catalog.csuchico.edu/collegesdepartments/college-natural-sciences/earth-environmental-sciences/ environmental-science-ms/)
- Geosciences MS (https://catalog.csuchico.edu/collegesdepartments/college-natural-sciences/earth-environmental-sciences/ geosciences-ms/)

See Course Description Symbols and Terms (https:// catalog.csuchico.edu/academic-standards-policies/course-descriptionsymbols-terms/) for an explanation of course description terminology and symbols, the course numbering system, and course credit units.

ERTH 101 Our Changing Planet Typically Offered: Fall and spring

🏓 3 Units GE

Earth materials, processes, and history, and their significance to humans in California and societies around the world. No college credit for students who have passed ERTH 102. 2 hours activity, 2 hours lecture. (004067)

General Education: Laboratory Activity (B3); Physical Science (B1) Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Lower Division; Sustainable Course

ERTH 102 Physical Geology

🏓 3 Units GE

Prerequisite: High school chemistry or physics is recommended; students with no previous science courses are advised to enroll in ERTH 101. No college credit for those who have passed ERTH 101. Typically Offered: Fall and spring

Physical and chemical processes in the earth, including origin and identification of rocks and minerals; earth's interior; movements and major features of the earth's crust; erosion and sedimentation; geological structures; topographic maps; mineral resources. 3 hours laboratory, 2 hours lecture. (004069)

General Education: Laboratory Activity (B3); Physical Science (B1) Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units Course Attributes: Lower Division; Sustainable Course

ERTH 104 Inquiry into the Science of Climate Change 3 Units GE Typically Offered: Fall and spring

An experiential course that develops skills in critical thinking through inquiry into and analysis of arguments about climate change science (e.g. greenhouse effect, fossil fuels, evidence for human-caused global warming, predictions of our climate future, climate change solutions, etc.). 3 hours lecture. (021130)

General Education: Critical Thinking (A3)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units Course Attributes: Lower Division

ERTH 110 Oceanography

Typically Offered: Fall and spring

Introduction to the ocean environment with a special emphasis on exploring the interactions between the geological, physical, chemical and biological processes. Topics include how ocean basins developed and changed over geological time scales and how the properties of seawater are linked and provide the foundation for marine life, motion, and climate. 2 hours activity, 2 hours lecture. (021716)

General Education: Laboratory Activity (B3); Physical Science (B1) Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units Course Attributes: Lower Division

ERTH 130 Introduction to Environmental Science Typically Offered: Fall and spring

🏓 3 Units GE

🯓 2 Units

3 Units GE

An introduction to human impact upon planet Earth. Scientific principles applied to air pollution, water pollution, and solid and radioactive waste problems. Population dynamics, world hunger, and environmental issue analysis are also covered. 2 hours activity, 2 hours lecture. (004131) General Education: Laboratory Activity (B3); Physical Science (B1) Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units Course Attributes: Lower Division; Sustainable Course

ERTH 165 Principles of Environmental Science Typically Offered: Fall only

An introduction to environmental science as an integrative field of study and its parent disciplines. Field and laboratory techniques are introduced through examination of case studies. Students learn about the various professions engaged in environmental and resource management. 3 hours laboratory, 1 hour lecture. (020687)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 2 units Course Attributes: Lower Division; Sustainable Course

ERTH 170 Atmospheric Science

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Typically Offered: Spring only
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Composition and mean vertical structure of the atmosphere, energy and warming and cooling of the atmosphere and the surface, atmospheric water vapor, cloud types, static stability, the formation of clouds, precipitation, air pressure, and wind. 3 hours lecture. (004130) Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units Course Attributes: Lower Division

ERTH 198 Special Topics

Prerequisite: Department permission.

Typically Offered: Fall and spring

This course is for special topics. Typically the topic is offered on a onetime-only basis and may vary from term to term and be different for different sections. See the Class Schedule for the specific topic being offered. 3 hours discussion. (004136)

Grade Basis: Graded

Repeatability: You may take this course more than once Course Attributes: Lower Division

ERTH 199 Special Problems

Prerequisite: Faculty permission.

Typically Offered: Fall and spring

This course is an independent study of special problems. 9 hours supervision. (020352)

Grade Basis: Credit/No Credit

Repeatability: You may take this course for a maximum of 6 units Course Attributes: Lower Division

ERTH 203 Evolution of the Earth

Prerequisite: GE Physical Sciences (B1) requirement.

Typically Offered: Fall only odd years

Study of the Earth as an evolving planet from its nebular origin through plate tectonics and the spread of life forms. 3 hours laboratory, 2 hours lecture. (004070)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units Course Attributes: Lower Division

ERTH 265 Soils and Surficial Processes

Prerequisite: CHEM 111 (may be taken concurrently); ERTH 101, ERTH 102, ERTH 165 or SCED 343 (may be taken concurrently).

Typically Offered: Fall only

In-depth survey of the hydrologic cycle, and soil systems. Interactions between these systems are examined through case studies. 3 hours laboratory, 2 hours lecture. (020723)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units Course Attributes: Lower Division; Sustainable Course

ERTH 289 Geoscience Internship Typically Offered: Fall and spring

1-3 Units

🏓 3 Units

This course is an internship. You must register directly with a supervising faculty member. 9 hours supervision. (021015)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 15 units Course Attributes: Lower Division

3 Units

1-3 Units

1-3 Units

3 Units

2 Units

3 Units

🯓 3 Units GE

3 Units

ERTH 299 Special Problems 1-3 Units Prerequisite: Faculty permission. Typically Offered: Fall and spring This course is an independent study of special problems. 9 hours supervision. (020353) Grade Basis: Credit/No Credit Repeatability: You may take this course for a maximum of 6 units Course Attributes: Lower Division ERTH 300W Earth System Science (W) 🏓 3 Units 🛛 W. GW Prerequisite: GE Written Communication (A2) requirement; CHEM 107 or CHEM 111; PHYS 202A or PHYS 204A or PHYS 341. Typically Offered: Fall only An intermediate treatment of astronomy, meteorology, and oceanography, with emphasis on climate change and its impacts. 3 hours discussion. (004137) Grade Basis: Graded Repeatability: You may take this course for a maximum of 3 units Course Attributes: Upper Division; Sustainable Course; Writing Course; Graduation Writing Assessment ERTH 303 Invertebrate Paleontology 3 Units Prerequisite: ERTH 102 or course in Biology.

Typically Offered: Spring only

Study of main groups of invertebrate fossils and their uses in biostratigraphy, paleobiogeography, and paleoecology. 3 hours laboratory, 2 hours lecture. (004138)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units Course Attributes: Upper Division

ERTH 304 Atmospheric Science II

Prerequisite: ERTH 170.

Typically Offered: Fall only even years

Air masses and fronts, midlatitudes cyclones, weather and climate prediction, severe weather including thunderstorms, tornadoes, and hurricanes, climate and global climate change, and air pollution. 3 hours lecture. (022010)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units Course Attributes: Upper Division

ERTH 306 Mineralogy and Lithology

4 Units

3 Units

Prerequisite: ERTH 101 or ERTH 102; CHEM 107 or CHEM 111 or equivalent; or faculty permission.

Typically Offered: Fall only

Identification and origins of the more common minerals and rocks. 4 hours activity, 2 hours lecture. (004080)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 4 units Course Attributes: Upper Division

ERTH 307 Stratigraphy

3 Units

Prerequisite: ERTH 203 and ERTH 306 (both may be taken concurrently), or faculty permission.

Typically Offered: Fall only

Basic concepts of stratigraphy. Methods of strata description,

correlation, mapping, and interpretation. Sedimentary tectonics and lithic associations. Graphic representation of data. 2 hours discussion, 3 hours laboratory. (004081)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units Course Attributes: Upper Division

ERTH 310 Geological Field Reconnaissance

Prerequisite: ERTH 101 or ERTH 102. Typically Offered: Spring only

Faculty permission required to take the course a second time for credit. Generalized field study of geologically noteworthy areas. (Minimum of eight consecutive days in the field during January intersession or spring vacation; and additional work or classroom meetings.) 6 hours supervision. (004083)

Grade Basis: Credit/No Credit

Repeatability: You may take this course for a maximum of 4 units Course Attributes: Upper Division

ERTH 315 Pollution Science

Prerequisite: CHEM 107 or CHEM 111; ERTH 265. Typically Offered: Spring only

Principles and applications of major natural and anthropogenic pollution processes which include origins, transport, and sinks of contaminants in the environment. Topics include acid rain, mine waste and drainage, and agricultural pesticides. Environmental impacts, remediation and control of pollution are discussed. 3 hours laboratory, 2 hours lecture. (020373) Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units Course Attributes: Upper Division

ERTH 320 Water Equity and Power

Prerequisite: GE Oral Communication (A1); GE Written Communication (A2); GE Critical Thinking (A3); GE Mathematics/Quantitative Reasoning (B4) requirements, or consent of the instructor.

Typically Offered: Fall and spring

California law mandates that every human has the right to safe, clean, affordable, and accessible water, yet inequities in water policy, resource allocation (quantities of water available), and water quality are prevalent throughout the state as well as globally. This course explores how water resource management (distribution and use of surface water and groundwater) is impacted by water law and policy, which in turn have critical equity issues associated with water supply and quality. Students examine the competing needs of industrial, agricultural, and residential water users in the context of economic impacts and pressures on the environment. The implications of water rights and key water policies are considered when evaluating how water is used. 3 hours lecture. (022290)

General Education: Upper-Division Scientific Ing/Quant Reason (UDB); Equity, Ethics, and Policy Pathway; Race, Ethnicity, and Sovereignty Pathway

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units Course Attributes: Upper Division; Sustainable Course

ERTH 321 Introduction to Meteorology

Prerequisite: ERTH 170.

Typically Offered: Fall only Survey of physical and dynamic meteorology. Topics covered include thermodynamics, radiation, clouds and precipitation formation, tropical and extratropical weather systems, forecasting, and climate change. 3

hours lecture. (004140) Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units

Course Attributes: Upper Division

ERTH 322 Mineral Resources

3 Units

Prerequisite: ERTH 102 or equivalent.

Typically Offered: Fall and spring

Where do the 82 elements in our cell phones come from? Why do we see the scars of historical mining across the landscape of northern California? What is acid mine drainage and how can we prevent or treat it? These questions and more are addressed in this course, which explores the mineral resources available on Earth, and the environmental impacts associated with their extraction and use. There are positive and negative aspects to the extraction and use of each resource, and we strive to consider the economic, societal, and political aspects of these topics in addition to the environmental aspects in order to gain a more rounded perspective. 3 hours laboratory, 2 hours lecture. (022042) **Grade Basis:** Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Upper Division

ERTH 325 Geology of California

3 Units

Prerequisite: ERTH 101 or ERTH 102.

Typically Offered: Spring only even years Geologic setting of California and historical development of its geologic provinces. The impact of earthquakes, volcanic activity, coastal erosion, and earth resources on California. Field trip required. 3 hours discussion. (004085)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Upper Division

ERTH 330 Environmental Science

🏓 3 Units GE

Prerequisite: GE Oral Communication (A1); GE Written Communication (A2); GE Critical Thinking (A3); GE Physical Sciences (B1); GE Life Sciences (B2); GE Mathematics/Quantitative Reasoning (B4) requirements, or consent of the instructor.

Typically Offered: Spring, summer, fall

Human impact on life-support systems; use of physical and ecological principles in environmental management and protection; discussion of land use and its environmental impact; and an evaluation of human influence on natural cycles. 3 hours lecture. (004141)

General Education: Upper-Division Scientific Inq/Quant Reason (UDB); Sustainability and Climate Change Pathway

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Upper Division; Sustainable Course

ERTH 330W Environmental Science (W)

🏓 3 Units 🛛 GE, W

Prerequisite: GE Oral Communication (A1); GE Written Communication (A2); GE Critical Thinking (A3); GE Physical Sciences (B1); GE Life Sciences (B2); GE Mathematics/Quantitative Reasoning (B4) requirements, or consent of the instructor.

Typically Offered: Fall and spring

Human impact on life-support systems; use of physical and ecological principles in environmental management and protection; discussion of land use and its environmental impact; and an evaluation of human influence on natural cycles. 3 hours lecture. (021331)

General Education: Upper-Division Scientific Inq/Quant Reason (UDB); Sustainability and Climate Change Pathway

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Upper Division; Sustainable Course; Writing Course

Prerequisite: GE Oral Communication (A1); GE Written Communication (A2); GE Critical Thinking (A3); GE Mathematics/Quantitative Reasoning (B4) requirements, or consent of the instructor.

Typically Offered: Fall and spring

In this course, students learn what is necessary to become good stewards of the ocean ecosystem. Discussions of stewardship focus on the importance of sustainable ocean management and explore how competing interests among countries impact international plans to use and manage ocean resources. In addition to this top-down approach of ocean management, this course also examines the role of individual responsibility for preservation of the ocean environment, as well as justice issues for marginalized communities who rely on the ocean. During these discussions, students also learn how the physio-chemical properties of seawater (i.e., temperature, density, salinity, sounds, light) are linked and provide the foundation for marine life, motion (i.e., currents, tides, waves, transportation), energy, and climate. 3 hours lecture. (022295)

General Education: Upper-Division Scientific Inq/Quant Reason (UDB); Sustainability and Climate Change Pathway

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Upper Division; Sustainable Course

ERTH 341 Teaching Practicum in Geological and Environmental Sciences 3 Units

Prerequisite: ERTH 102 or SCED 342.

Typically Offered: Inquire at department

This course provides students with classroom experience that utilizes a variety of interactive, engaging teaching styles that develop and reinforce skills and concepts through open-ended activities such as direct instruction, discourse, demonstrations, individual and cooperative learning explorations, peer instruction, and student-centered discussion. 9 hours supervision. (020329)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Upper Division

ERTH 342 Concepts in Earth and Space Science 3 Units

Prerequisite: SCED 141, SCED 142, GE Physical Sciences (B1), or GE Life Sciences (B2). Open to Liberal Studies online students only. **Typically Offered:** Fall and spring

Typically Offered. Fail and spring This course is for future elementary/m

This course is for future elementary/middle school teachers and designed to meet the Elementary Subject Matter Standards required by the California Commission on Teacher Credentialing. The overall goal is to provide a learning environment that fosters content knowledge and interest in teaching earth and space science and appreciation for the role that science plays in our everyday lives. 3 hours lecture. (022004) **Grade Basis:** Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Upper Division

ERTH 352 Recovery of Altered Ecosystems

3 Units

Prerequisite: BIOL 350W (may be taken concurrently), ERTH 265 and ERTH 315 (may be taken concurrently).

Typically Offered: Spring only

This course provides students with an understanding of the role of stresses and disturbances in aquatic and terrestrial ecosystems and natural processes of recovery. Students are introduced to the practices used to modify, restore, and remediate ecosystems altered by human activities and develop a restoration program for a nearby, altered ecosystem that contains both land and water components. In addition, we discuss policy and regulations as they relate to specific projects. 3 hours laboratory, 2 hours lecture. (021925)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Upper Division

ERTH 353 Environmental Fluid Mechanics

Prerequisite: MATH 109 or MATH 120; PHYS 202A or PHYS 204A.

Typically Offered: Fall only odd years

Fluids (gases and liquids) are ubiquitous and play central roles in shaping the environment and transporting heat, momentum, pollutants, and constituents that support life and control climate. This course provides students with an introduction to fundamental concepts in fluid mechanics and an illumination of the vital and fascinating, and often non-intuitive, world of fluid phenomena. 3 hours lecture. (022002) **Grade Basis:** Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Upper Division

ERTH 355 Natural Disasters

🏓 3 Units GE

3 Units

Prerequisite: GE Oral Communication (A1); GE Written Communication (A2); GE Critical Thinking (A3); GE Physical Sciences (B1), GE Life Sciences (B2); GE Mathematics/Quantitative Reasoning (B4) requirements, or consent of the instructor.

Typically Offered: Fall and spring

The purpose of this course is to provide students with the material and opportunity to learn the science behind geological and natural disasters and gain an appreciation of how these events shape both our lives and the development of societies with specific reference to California. The course focuses on, but not be limited to, a discussion of how much of a disaster is a natural phenomenon and how much a tragedy is imposed by the designs of populations. Along the way, we develop the methodology of science and build writing and quantitative skills. 3 hours lecture. (004148)

General Education: Upper-Division Scientific Inq/Quant Reason (UDB); California Studies Pathway; Sustainability and Climate Change Pathway **Grade Basis:** Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Upper Division; Sustainable Course

ERTH 360 Field Methods

2 Units

Prerequisite: ERTH 306, ERTH 307 with a grade of C- or higher. **Typically Offered:** Spring only

Elementary geologic field methods, descriptive geometry, photogeology, and geologic mapping. Ten days in the field during January intersession. 6 hours laboratory. (004074)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 2 units **Course Attributes:** Upper Division

ERTH 361W Preparation of the Geological Report (W) 1 Unit W, GW Prerequisite: GE Written Communication (A2) requirement. Corequisites: ERTH 360.

Typically Offered: Spring only

This course is a continuation of the writing experience that is initiated in ERTH 360. It deconstructs scientific writing through a re-writing of the ERTH 360 field report and analysis of other examples of geologic articles. 1 hour lecture. (004075)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 1 unit **Course Attributes:** Upper Division; Writing Course; Graduation Writing Assessment

(may be taken concurrently) or ERTH 306; and PHYS 202A or PHYS 204A (may be taken concurrently).

Typically Offered: Fall only

Analysis of present and long-term global energy crises; coverage of scientific concepts needed to understand energy and its environmental interactions; in-depth examination of alternative energy sources and their environmental impact. 3 hours lecture. (004149)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Upper Division; Sustainable Course; Writing Course; Graduation Writing Assessment

ERTH 375 Geology of Food and Health

3 Units GE

Prerequisite: GE Oral Communication (A1); GE Written Communication (A2); GE Critical Thinking (A3); GE Mathematics/Quantitative Reasoning (B4) requirements, or consent of the instructor.

Typically Offered: Fall and spring

Focuses on the relation between natural geological factors, food production, and health problems in humans and animals on a global scale, and explores the impacts of diverse proposed solutions on population health and public policy. 3 hours lecture. (021128) **General Education:** Upper-Division Scientific Inq/Quant Reason (UDB); Agriculture, Food, and Environment Pathway

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Upper Division

ERTH 380 Hydrology

🏓 3 Units

Prerequisite: PHYS 202A or PHYS 204A (may be taken concurrently). **Typically Offered:** Fall only

A survey of the mass transfer processes and storage elements within the hydrologic cycle: precipitation, interception, surface runoff, infiltration, evapo-transpiration, soil water and groundwater. Quantitative methods for estimating flow and storage, use of probability concepts to predict extreme hydrologic events in a time series. 3 hours laboratory, 2 hours lecture. (004150)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Upper Division; Sustainable Course

ERTH 382 Hydrologic Field Methods Prerequisite: ERTH 380 (may be taken concurrently) or faculty permission. Typically Offered: Spring only Develops field and related laboratory skills in performing common measurements in surface water and soil water components of the hydrologic cycle. Students learn to critically evaluate the theorem for field methods and hydrologic characterization approaches. 3 lecture. (020641) Grade Basis: Graded Repeatability: You may take this course for a maximum of 3 unit Course Attributes: Upper Division	he tical basis hours	ERTH 4 Prerequinstruct Typical A surves storage methoor resultat laborat Grade E Repeat Course
ERTH 398 Special Topics Prerequisite: Department permission. Typically Offered: Fall and spring This course is for special topics. Typically the topic is offered or time-only basis and may vary from term to term and be different different sections. See the Class Schedule for the specific topic offered. 3 hours discussion. (004092) Grade Basis: Graded Repeatability: You may take this course more than once Course Attributes: Upper Division	for	ERTH 4 Prerequ PHYS 2 Typical Theory propert aquifer hours le Grade E Repeat
ERTH 399 Special Problems Prerequisite: Faculty permission. Typically Offered: Fall and spring This course is an independent study of special problems. 3 hour supervision. (004154) Grade Basis: Credit/No Credit Repeatability: You may take this course for a maximum of 6 unit Course Attributes: Upper Division		Course ERTH 4 Prerequ ERTH 2 Typical This co and inter- climate
ERTH 403 Igneous and Metamorphic Petrology Prerequisite: ERTH 306 with grade of C- or higher. Typically Offered: Spring only	03 Igneous and Metamorphic Petrology 4 Units 03 isite: ERTH 306 with grade of C- or higher. F y Offered: Spring only G Il-chemical development and geotectonic settings of igneous and prphic rocks. Analysis of rock thin sections. Field trip required. 4 ctivity, 2 hours lecture. (004097) F ability: You may take this course for a maximum of 4 units F	
ERTH 408 Structural Geology Prerequisite: High school or college trigonometry; ERTH 203; EF with grade of C- or higher. Typically Offered: Fall only Behavior of geologic materials. Folds, faults, small-scale structures edimentary, igneous, and metamorphic rocks. Graphic methods activity, 2 hours lecture. (004082) Grade Basis: Graded Repeatability: You may take this course for a maximum of 4 unit Course Attributes: Upper Division	ires in s. 4 hours	includir surface transpo Grade E Repeat Course

🏓 3 Units 10 Introduction to Watershed Hydrology

uisite: ERTH 380 or prior hydrology course work and consent of tor

ly Offered: Spring only

ey of the hydrologic processes governing the movement and e of water at the watershed scale. Emphasis is on computer-based ds for characterizing the physical framework and quantifying the nt hydrology in terms of its temporal and spatial variability. 3 hours ory, 2 hours lecture. (004161)

Basis: Graded

ability: You may take this course for a maximum of 3 units Attributes: Upper Division; Sustainable Course

15 Hydrogeology

🏓 3 Units

🏓 3 Units

uisite: CHEM 111, ERTH 306, ERTH 380, MATH 120; PHYS 202A or 204A. Recommended: ERTH 307.

ly Offered: Spring only

and analysis of groundwater flow, including fluid physics, aquifer ties, soil water, groundwater recharge, hydrogeologic environments, mechanics, and water quality degradation. 3 hours laboratory, 2 ecture. (004102)

Basis: Graded

ability: You may take this course for a maximum of 3 units Attributes: Upper Division; Sustainable Course

20 Earth Systems Modeling

3 Units uisite: BIOL 350W; CHEM 107 or CHEM 111; ERTH 102, ERTH 170, 265; PHYS 202A, PHYS 204A, or PHYS 341.

ly Offered: Spring only

ourse will seek to understand fundamental earth system processes eractions on a global scale. Particular emphasis is placed on change and its impacts. 3 hours lecture. (021924)

Basis: Graded

ability: You may take this course for a maximum of 3 units Attributes: Upper Division

125 Surficial Processes

uisite: ERTH 101 or ERTH 102; MATH 120; PHYS 202A or 204A

ly Offered: Fall only odd years

ey of the processes governing uplift and denudation of landscapes, ng isostasy, chemical and physical weathering, mass movements, e water erosion, formation of channels, and flow and sediment ort. 3 hours laboratory, 2 hours lecture. (004152)

Basis: Graded

ability: You may take this course for a maximum of 3 units Attributes: Upper Division; Sustainable Course

3 Units

3 Units

🏓 3 Units

3 Units

ERTH 430 Wetland Ecology and Management

3 Units

Prerequisite: Upper division standing in BS Environmental Science, BA Biological Sciences, BS Biological Sciences, BS Microbiology, BA Geography, or BS Agriculture. Highly recommended: BIOL 161 and/or BIOL 350W.

Typically Offered: Fall only even years

This course examines the ecology, management, and restoration of wetland ecosystems, including biotic and abiotic processes, functions, wildlife and policy discussions. We place emphasis on biological, physical, chemical, and ecological aspects of major wetland ecosystems found in North America. We also discuss ecosystem services, wetland classification/delineation, legal protection of wetlands, and the relationship between wetlands and climate change. 3 hours laboratory, 2 hours lecture. (022003)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Upper Division

ERTH 435 Boundary Layer Meteorology

3 Units

Prerequisite: MATH 109 or MATH 120; PHYS 202A or PHYS 204A. **Typically Offered:** Spring only

The atmospheric boundary layer (ABL) is the lowest part of the Earth's atmosphere that is in constant contact with the surface of the Earth and responds quickly to the thermal and mechanical forcings. The ABL has a very strong role in the vertical fluxes of heat, momentum, and trace gases. Turbulence is the main physical process by which those fluxes occur and hence statistical descriptions are the norm. Therefore, this course focuses on small scale meteorology (also know as micrometeorology), turbulence, and the behavior of the atmosphere near the surface. 3 hours lecture. (022043)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Upper Division

ERTH 436 Volcanology

3 Units

Prerequisite: ERTH 101 or ERTH 102, ERTH 306, or faculty permission. **Typically Offered:** Spring only odd years

An introduction to physical processes associated with terrestrial and extraterrestrial volcanoes and their products. Specific topics include volcano monitoring, rheologic properties of magma and volcanic flows, experimental volcanology, theoretical and analog flow modeling, as well as in-depth examination of local volcanoes and various eruptions (past, present, and future). This course includes an extended (4-5 days) field trip, required for all students. Students participate in the field by collecting data for future course projects, presenting prepared information at various field trip stops, or both. Students also complete research projects throughout the semester. 3 hours lecture. (020293) **Grade Basis:** Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Upper Division

ERTH 440 Environmental Sensing

Prerequisite: PHYS 202B, PHYS 204B, or PHYS 204C (may be taken concurrently).

Typically Offered: Fall only

Instruments are critical to making quantitative observations, and observations are critical to the scientific method. The subject of environmental instrumentation is vast and constantly changing as new technologies emerge. Through a combination of lectures and handson projects, students are (1) introduced to the process of assembling and characterizing an electronic instrument of their own, (2) forming a hypothesis and testing it by collecting data, and (3) writing reports and giving presentations on their results. 3 hours laboratory, 2 hours lecture. (020639)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Upper Division

ERTH 455 Sedimentary Basin Analysis

Prerequisite: ERTH 307, ERTH 403 (may be taken concurrently) both with a grade of C- or higher.

Typically Offered: Spring only even years

Study of the paleographic evolution of sedimentary basins. Includes stratigraphic and paleontologic correlation, facies analysis, sedimentary petrology, depositional systems, and the tectonic framework of sedimentary basins. 3 hours laboratory, 2 hours lecture. (004114) **Grade Basis:** Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Upper Division

ERTH 460 Water Resources Management

Prerequisite: ERTH 380 (may be taken concurrently).

Typically Offered: Spring only even years

Water-resources, management plans of world; emphasis on California and Israeli plans. Water plans in primitive, agrarian, and industrial societies. Data gathering and interpretation, regulation of water resources, and control of water pollution. 3 hours lecture. (004168) **Grade Basis:** Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Upper Division; Sustainable Course

ERTH 470 Renewable Energy

Prerequisite: ERTH 370W.

Typically Offered: Fall only odd years

Teach students about the wide range of renewable energy technologies that are available, how they harvest energy from the environment, how they impact the environment, and their varying degrees of competitiveness with fossil fuels. Major forms of renewable energy covered include solar thermal, solar photovoltaics, bioenergy, hydroelectricity, tidal power, wind energy, wave energy, and geothermal energy. Students also gain experience reading, researching, and presenting findings. 3 hours lecture. (021766)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Upper Division

ERTH 471 Field Geology

Prerequisite: ERTH 360, ERTH 403, ERTH 408 all with grade of C- or higher.

Typically Offered: Spring only

Mapping, recording, and interpreting data in the field; use of Brunton compass and topographic maps emphasized. Reports required. Field work during January Intersession totaling at least 10 days. 6 hours laboratory. (004105)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 2 units **Course Attributes:** Upper Division

ERTH 475 Senior Seminar

Prerequisite: Senior standing in Environmental Science.

Typically Offered: Spring only

This seminar provides a culminating experience for students to draw on their accumulated content knowledge and skills to address one or more environmental problems. Select problems addressed by students working in interdisciplinary teams. Project plans and timelines described in individually-prepared proposals. Relevant policies and regulations indentified, and this guidance informs student projects. Existing comparative data employed and analyzed to develop project plans and reports. Computer skills employed, possibly including spreadsheets, statistical software, and GIS. 3 hours discussion. (004169) **Grade Basis:** Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Upper Division

ERTH 480 Seminar in Earth and Environmental Sciences

Prerequisite: Earth and Environmental Sciences (ERTH) majors only. **Typically Offered:** Fall and spring

The seminar series engages students in recent research and developments in the Earth and Environmental Sciences, and develops skills in scientific literature retrieval. 1 hour seminar. (021562) **Grade Basis:** Credit/No Credit

Repeatability: You may take this course for a maximum of 8 units **Course Attributes:** Upper Division; Sustainable Course

ERTH 489 Geoscience Internship

Typically Offered: Fall and spring

This course is an internship. You must register directly with a supervising faculty member. 9 hours supervision. (021016)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 15 units **Course Attributes:** Upper Division

ERTH 489T Internship in Geoscience Teaching

Prerequisite: ERTH 101 or ERTH 102, ERTH 203.

Typically Offered: Fall and spring

This is a supervised internship in geoscience teaching which takes place in a local junior high or high school geoscience classroom, supervised by the classroom teacher and by a faculty member of the CSUC Department of Earth and Environmental Sciences. 9 hours supervision. (020620) **Grade Basis:** Credit/No Credit

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Upper Division

ERTH 498 Special Topics

2 Units

3 Units

🏓 1 Unit

1-3 Units

3 Units

Prerequisite: Department permission.

Typically Offered: Fall and spring

This course is for special topics. Typically the topic is offered on a onetime-only basis and may vary from term to term and be different for different sections. See the Class Schedule for the specific topic being offered. 3 hours discussion. (004172)

Grade Basis: Graded

Repeatability: You may take this course more than once **Course Attributes:** Upper Division

ERTH 499 Special Problems

Prerequisite: Faculty permission.

Typically Offered: Fall and spring

This course is an independent study of special problems. You must register directly with a supervising faculty member. 3 hours supervision. (004175)

Grade Basis: Credit/No Credit

Repeatability: You may take this course for a maximum of 6 units **Course Attributes:** Upper Division

ERTH 499H Honors Research in the Geosciences

Prerequisite: First semester: 9 upper-division units in major, B average, faculty permission. Second semester: B or higher in first semester, faculty permission.

Typically Offered: Fall and spring

An intensive two-semester course in research within a subdiscipline of the physical sciences. Students enroll for 3 units each semester. Open only to students with at least a 3.0 GPA in the major. The course consists of a research project done under the supervision of a faculty member, a formal written paper, and a public presentation. This course may be used to fulfill a maximum of 3 units of the upper-division requirement for the major. 9 hours supervision. (004176)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 6 units **Course Attributes:** Upper Division

ERTH 536 Applied Ecology

Prerequisite: BIOL 350W, MATH 315. **Typically Offered:** Spring only

Examination of the mechanisms, directions, and magnitude of an organism's or ecosystem's response to human perturbation. 3 hours discussion. (004166)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Upper Division; Sustainable Course

ERTH 537 Ecohydrology

Prerequisite: BIOL 350W, ERTH 380, or instructor consent. Typically Offered: Spring only odd years

The study of linkages between hydrologic processes and ecosystem functions; field methods for data gathering; hydrologic transport of nutrients and pollutants through ecosystems; case studies of problems in ecohydrology. 3 hours lecture. (020330)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Upper Division; Sustainable Course

1-3 Units

1-3 Units

3 Units

🏓 3 Units

🏓 3 Units

ERTH 565 Geochemistry

3 Units

3 Units W. GW

Prerequisite: CHEM 111, ERTH 102. Recommended: ERTH 306. Typically Offered: Fall only even years

Investigation of the chemistry of minerals, rocks, and natural waters. Provides students with interests in geology, hydrology, environmental science, and other disciplines a background on the chemical compositions of rocks, minerals, and natural waters; chemical processes in the formation of rocks and waters; principles of reaction chemistry, thermodynamics, and kinetics applied to geochemical systems; and migration of chemical contaminants in the environment. 3 hours lecture. (004115)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units Course Attributes: Upper Division

ERTH 572W Advanced Field Geology (W)

Prerequisite: GE Written Communication (A2) requirement; ERTH 403 with a grade of C- or higher.

Corequisites: ERTH 471 (winter field - grade of C- or higher).

Typically Offered: Spring only

Independent geologic mapping of a difficult area. Report required. Field work on weekends or during spring recess, totaling at least 10 days. 6 hours laboratory. (004107)

Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units Course Attributes: Upper Division; Writing Course; Graduation Writing Assessment

ERTH 580 Geological Evolution of North America

3 Units

1-4 Units

1-3 Units

Prerequisite: ERTH 408, ERTH 455 (with grade of C- or higher for both). Typically Offered: Spring only

Group study of topics related to the geological evolution of North America. Student presentations and group discussion will focus on common themes or geologic regions. 3 hours lecture. (004170) Grade Basis: Graded

Repeatability: You may take this course for a maximum of 3 units Course Attributes: Upper Division

ERTH 598 Special Topics

Prerequisite: Department permission.

Typically Offered: Fall and spring

This course is for special topics. Typically the topic is offered on a onetime-only basis and may vary from term to term and be different for different sections. See the Class Schedule for the specific topic being offered. 3 hours discussion. (020063)

Grade Basis: Graded

Repeatability: You may take this course more than once Course Attributes: Upper Division

ERTH 599 Special Problems

Prerequisite: Faculty permission.

Typically Offered: Fall and spring

This course is an independent study of special problems. You must register directly with a supervising faculty member. 3 hours supervision. (021283)

Grade Basis: Credit/No Credit

Repeatability: You may take this course for a maximum of 6 units Course Attributes: Upper Division

ERTH 600 Graduate Seminar I Typically Offered: Fall only

This course is the first of a series of writing courses specifically for students in the M.S. Geosciences or Environmental Science programs. The goal of the course is to introduce students to the M.S. program, and aid them in putting together the preliminary literature review for their thesis research. This course introduces the principles of excellent academic writing for scientists while also utilizing peer support to improve communication. 1 hour seminar. (004177)

Grade Basis: Graduate Graded

Repeatability: You may take this course for a maximum of 1 unit Course Attributes: Graduate Division

ERTH 601 Graduate Seminar II

Typically Offered: Spring only

This course is the second of a series of writing courses specifically for students in the M.S. Geosciences or Environmental Science programs. The goal of the course is to support students through writing their research proposal. Emphasis placed on students completing an approved written thesis proposal, and giving a public oral presentation of their proposal by the end of the course. 1 hour seminar. (004178) Grade Basis: Graduate Graded

Repeatability: You may take this course for a maximum of 1 unit Course Attributes: Graduate Division

ERTH 602 Graduate Seminar III

Prerequisite: ERTH 600. ERTH 601.

1 Unit

1 Unit

Typically Offered: Fall only

This course is the third of a series of writing courses specifically for students in the M.S. Geosciences or Environmental Science programs. The goal of the course is to build on the previous courses while focusing on the thesis or project itself. This course provides a forum for intensive analysis of the principles of excellent academic writing for scientists while also utilizing peer support to improve communication. 1 hour seminar. (022020)

Grade Basis: Graduate Graded

Repeatability: You may take this course for a maximum of 1 unit Course Attributes: Graduate Division

ERTH 606 Teaching Assistant Preparation 2 Units Prerequisite: Graduate status. Typically Offered: Fall only

This is a seminar course for teaching assistants focusing on the theory and practice of active learning in science laboratory settings. The overall goals of the course; 1) To increase participants understanding of strategies to engage students in active learning, 2) to provide opportunities for modeling best practices in science teaching and 3) confidence in his/her ability as effective science lab instructors. 2 hours seminar. (021000)

Grade Basis: Graduate Graded

Repeatability: You may take this course for a maximum of 2 units Course Attributes: Graduate Division

ERTH 616 Natural Water Systems

🏓 3 Units

Prerequisite: CHEM 111, ERTH 315. Recommended: CHEM 112. Typically Offered: Fall only odd years

Fundamentals of processes in environmental aquatic systems emphasizing acid-base and pE-pH relationships, solubility of carbon species in natural waters, and interactions at the solid-liquid interface. Students in this course interpret these processes in light of new ideas, problems, and materials. 3 hours lecture. (020287)

Grade Basis: Graduate Graded

Repeatability: You may take this course for a maximum of 3 units Course Attributes: Graduate Division; Sustainable Course

ERTH 617 Advanced Topics in Geology

Typically Offered: Fall and spring

You must register directly with a supervising faculty member. Discussions and library research into selected topics; may include some lab or field work. Different topics presented each semester. May be repeated for credit, with permission of instructor. 9 hours supervision. (004180)

Grade Basis: Graduate Graded

Repeatability: You may take this course for a maximum of 9 units **Course Attributes:** Graduate Division

ERTH 619 Advanced Topics in Atmospheric Science

Typically Offered: Fall and spring

You must register directly with a supervising faculty member.

Discussions and library research into selected topics; may include some lab work. Different topics presented each semester. May be repeated for credit, with permission of instructor. 9 hours supervision. (004181) **Grade Basis:** Graduate Graded

Repeatability: You may take this course for a maximum of 9 units **Course Attributes:** Graduate Division

ERTH 621 Advanced Topics in Hydrology

Typically Offered: Fall and spring

You must register directly with a supervising faculty member.

Discussions and library research into selected topics; may include some lab work. Different topics presented each semester. May be repeated for credit, with permission of instructor. 9 hours supervision. (004182) **Grade Basis:** Graduate Graded

Repeatability: You may take this course for a maximum of 9 units **Course Attributes:** Graduate Division

ERTH 625 Advanced Topics in Environmental Science3 UnitsTypically Offered: Fall and spring

You must register directly with a supervising faculty member.

Discussions and library research into selected topics; may include some lab work. Different topics presented each semester. May be repeated for credit, with permission of instructor. 9 hours supervision. (004184) **Grade Basis:** Graduate Graded

Repeatability: You may take this course for a maximum of 9 units **Course Attributes:** Graduate Division

ERTH 630 Geotectonic Development of California

Prerequisite: Graduate standing or consent of instructor.

Typically Offered: Spring only

Geological and geophysical characteristics of the geomorphic provinces of California. Formation of surficial features, such as mountain ranges, drainage networks, and valleys as a response to active tectonic processes. Detailed geologic and physiographic framework of Northern California as a setting for field-based studies in the geosciences. 3 hours

lecture. (004185)

Grade Basis: Graduate Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Graduate Division

ERTH 640 Hydrogeochemistry

3 Units

3 Units

3 Units

3 Units

Prerequisite: CHEM 111, CHEM 112. Recommended: ERTH 565 or ERTH 616.

Typically Offered: Spring only

Origins and sources of chemical constituents of natural waters, including water-rock interactions, equilibrium aqueous speciation, reaction-path modeling, oxidation-reduction reactions, mineral solubility relations, geochemical transport, reaction kinetics, and aqueous isotopic systems. 3 hours seminar. (004186)

Grade Basis: Graduate Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Graduate Division

ERTH 645 Applied Geophysics

Prerequisite: One year of physics, ERTH 102, or faculty permission. **Typically Offered:** Spring only even years

Introduction to solid-earth geophysical exploration techniques and data analysis. Includes electrical, electromagnetic, gravimetric, and seismic surveying, and wireline well logging. Concentration on problems in environmental science, hydrology, mineral prospecting, and oil exploration. Students apply these techniques to solve real-world

problems. 3 hours discussion. (004112)

Grade Basis: Graduate Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Graduate Division

ERTH 649 Economic Geology

3 Units

Prerequisite: ERTH 306, ERTH 307, or faculty permission.

Typically Offered: Fall only odd years The integrative course dealing with origins and occurrences of metallic

and non-metallic mineral deposits, including factors in their use. 3 hours discussion. (004111)

Grade Basis: Graduate Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Graduate Division

ERTH 650 Environmental Monitoring Typically Offered: Fall only

🏓 2 Units

3 Units

Survey of environmental monitoring for air quality, water quality, pollution, waste disposal, environmental resources, etc., including field and laboratory observations and exercises. An individual term project in environmental monitoring is required and may involve collection of field data, interpretation of field data, development of analytical capabilities, or other subjects pertinent to the student's research interests. 1 hour discussion, 3 hours laboratory. (004187)

Grade Basis: Graduate Graded

Repeatability: You may take this course for a maximum of 2 units **Course Attributes:** Graduate Division; Sustainable Course

ERTH 652 Science and Environmental Regulations

Prerequisite: CHEM 270 or CHEM 320, MATH 120, PHYS 202B. Recommended: BIOL 350W or BIOL 360.

Typically Offered: Fall only

Examination of the scientific basis of environmental regulations, case studies. 3 hours lecture. (020466)

Grade Basis: Graduate Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Graduate Division

3 Units

3 Units

ERTH 654 Environmental Risk Assessment

3 Units

Prerequisite: CHEM 270 or CHEM 320, MATH 120, PHYS 202B. Recommended: BIOL 350W or BIOL 360.

Typically Offered: Spring only

The scientific basis of risk assessment in various sectors of human activity, with particular emphasis on business, industrial, governmental agency, and planning concerns. 3 hours lecture. (020467)

Grade Basis: Graduate Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Graduate Division

ERTH 655 Fossil Fuels

3 Units

3 Units

3 Units

Prerequisite: ERTH 307 or faculty permission.

Typically Offered: Fall only even years

Geological principles and environmental impacts of exploring for and exploiting resources of petroleum, natural gas, oil shales, oil sands, coal, and coalbed-methane. Applications using geological data, potential sites for CO2 sequestration and environmental impact assessments are emphasized. This course involves the application of theory to new ideas, problems, and materials. 3 hours lecture. (020574)

Grade Basis: Graduate Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Graduate Division

ERTH 656 Environmental Sciences Capstone

Prerequisite: Completion of three semesters of coursework in either the Environmental Sciences MS program or the proposed PSM option of the Environmental Sciences MS program.

Typically Offered: Spring only

Overview of environmental science issues, including biological, chemical, and engineering examples. Particular focus is on future issues and approaches. Social and ethical issues are also examined. 9 hours supervision. (020465)

Grade Basis: Graduate Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Graduate Division

ERTH 660 Numerical Analysis

Prerequisite: MATH 120.

Typically Offered: Fall only

Survey and implementation of common numerical techniques in use in geoscientific data analysis, including multivariate data analysis, geostatistics, finite difference and finite element analyses, time-series analysis, and fractal geometry. 3 hours lecture. (004188) **Grade Basis:** Graduate Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Graduate Division

ERTH 670 Environmental and Engineering Geology 🦻 3 Units

Prerequisite: ERTH 102, ERTH 203, ERTH 306. For majors in related sciences and technical fields, ERTH 102 only.

Typically Offered: Fall only odd years

Practical application of techniques to solve geological engineering and environmental problems. Techniques of surface investigations and remote sensing; borehole and surface geophysics; soil descriptions and properties; landslide mapping, mechanics and remediation, subsurface investigation of rock masses; mapping of discontinuities, establishing rock quality, tunneling techniques. Seismic studies; surface and trench mapping of faults, seismic risk analysis. Ground water monitoring, site assessment, techniques of hazardous waste cleanup, state and federal regulations on hazardous waste, siting of landfills. Students in this course apply these theories to new ideas. 3 hours lecture. (004116) **Grade Basis:** Graduate Graded

Repeatability: You may take this course for a maximum of 3 units **Course Attributes:** Graduate Division; Sustainable Course

ERTH 697 Independent Study

Typically Offered: Fall and spring

This course is a graduate-level independent study. You must register directly with a supervising faculty member. 0 hours supervision. (004189)

Grade Basis: Graduate Graded

Repeatability: You may take this course for a maximum of 4 units **Course Attributes:** Graduate Division

ERTH 699P Master's Project

Prerequisite: Faculty permission.

Typically Offered: Fall and spring

This course is a master's project. You must register directly with a supervising faculty member. 9 hours supervision. (020469) **Grade Basis:** Report in Progress: CR/NC

Repeatability: You may take this course for a maximum of 6 units **Course Attributes:** Graduate Division

ERTH 699T Master's Thesis

Typically Offered: Fall and spring

This course is a master's thesis. You must register directly with a supervising faculty member. 3 hours supervision. (004194) Grade Basis: Report in Progress: CR/NC Repeatability: You may take this course for a maximum of 6 units

Course Attributes: Graduate Division

Earth and Environmental Sciences Department

The Faculty

Hannah M Aird 2015 Associate Professor Doctor of Philosophy Duke Univ

Ann Bykerk-Kauffman 1990

Professor Doctor of Philosophy Univ Of Arizona

Todd J Greene 2007 Chair Doctor of Philosophy Stanford Univ

David M Haasl 2000 Lecturer Doctor of Philosophy Univ Of Cal-Davis

а

1-6 Units

1-6 Units

1-4 Units

Andrew G Harp 2012 Lecturer Doctor of Philosophy Other US Institution

Kristen M Kaczynski 2015 Associate Professor Doctor of Philosophy Colorado St Univ

John F Knowles 2021 Assistant Professor Doctor of Philosophy Univ Of Colorado At Boulder

Sandrine J Matiasek 2013 Associate Professor Doctor of Philosophy Univ Of Cal-Davis

Shane D Mayor 2008 Professor Doctor of Philosophy Univ Of Wisconsin-Madison

Carrie E Monohan 2011 Lecturer Doctor of Philosophy Univ Of Washington

Jochen Nuester 2014 Lecturer Doctor of Science University of Bremen

Susan G Riggins 2011 Lecturer Doctor of Philosophy Univ Of Colorado At Boulder

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Rachel A Teasdale 2004 Professor Doctor of Philosophy Univ Of Idaho

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