

Fall 2020 Course Descriptions as of 04/05/2020 08:11 PM

Information in Browse Course Catalog is subject to change. Information is term specific. Please refer to the appropriate term when searching for course content. Key to Course Descriptions may be found at: http://rcs.registrar.arizona.edu/course_descriptions_key.

Environmental Science (ENVS)

ENVS 170A1: Introduction to Environmental Science (3 units)

Description: This course will not be confined to one discipline but rather will include information from physics, chemistry, biology and the social sciences such as economics and anthropology. The central theme of the course will be that of change as a normal and natural process. It will consist of four major focus areas: Biodiversity, Pollution, Population, and Resources. Within each major focus area we shall explore how change has and is occurring at the local, regional and global scales. To facilitate the learning process we shall analyze local, national and international case histories. The case histories would include air pollution at the Grand Canyon, TCE groundwater contamination in Tucson, landfill and leaking underground storage tanks in Tucson, Chernobyl, and the Mt. Graham controversy.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Discussion May Be Offered
 Lecture Required

Equivalent to: ABE 170A2, CHEE 170A1, GC 170A1, GEOG 170A1, MSE 170A2

Course typically offered:

Main Campus: Fall, Spring

Enrollment requirement: Enrollment barred if you've taken NATS101 "Earth Envr:Intr Phys Geo", "Intro to Environ Sci", "Intro to Global Change", "Sci, Tech & Environ", "Sustain Society", or 'Energy Sys & Sustainability' or ABE170A2, CHEE170A1, GC170A1, GEOG170A1, or MSE170A2.

General Education: NATS 101

ENVS 195A: Careers in Environmental Science (1 unit)

Description: Want to learn about the environment and what environmental scientists do? Want to hear about real environmental science careers from practicing professionals? Want to learn how to use the resources of UA Career Services to find that career for you? Well then, this is the course for you. Join us.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Colloquium Required

Course typically offered:

Main Campus: Fall, Spring

Freshman Colloquia: Freshman Colloquia

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 195B: Careers in Crop Production (1 unit)

Description: Crop production fulfills a vital role in our society. The departments of Plant Sciences and Soil, Water and Environmental Science offer a degree program in this discipline that enables the student to pursue a rewarding career where there is an increasing demand for graduates. You will have the opportunity to learn about working with field crops, permanent tree crop production, turf science, and/or a broad array of horticultural crops that are grown throughout the western United States and other regions in the world. In this class we explore this degree program and career opportunities by offering weekly talks and opportunities for discussion with employers and faculty members. Each student will prepare an internship proposal in environmental science which will include a resume and cover letter. This class is for undecided students and new crop production majors.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Colloquium Required

Freshman Colloquia: Freshman Colloquia

ENVS 195C: Water Resources in the Tucson Basin: Natural Resources (1 unit)

Description: Description: In the Western U.S. it is said, "Whiskey is for drinking and water is for fighting." History has proved this to be all too true. Here's a chance to see what all the fighting is about, while developing library and presentation skills. The semester's results will be posted on class web page. Join us!

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Colloquium Required

Freshman Colloquia: Freshman Colloquia

ENVS 195D: Water and the Environment (1 unit)

Description: This colloquium will focus on issues related to water, water quality, quantity, water pollution, and water use and their relations to the environment and humans.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Colloquium Required

Course typically offered:

Main Campus: Fall

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

Description: Fundamental principles of soil science-origin, nature, and constitution of soils; their chemical, physical, and biological properties in relation to plant growth and the non-plant uses of soils.

Career: Undergraduate

Course typically offered:

Main Campus: Fall, Spring

ENVS 201: Soils Laboratory (1 unit)

Description: Laboratory exercises for ENVS 200.

Grading basis: Student Option ABCDE/PF

Career: Undergraduate

Flat Fee: \$25

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| Course Components: | Laboratory | Required |
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Course typically offered:

Main Campus: Fall, Spring

Recommendations and additional information: Students enrolling in ENVS 201 must also enroll in ENVS 200.

Description: This course is about how modern science and technology have increased our understanding of the Earth's environment and improved our ability to solve the important environmental challenges facing humanity, including climate change, pollution, loss of biodiversity, and water shortages.

Grading basis: Regular Grades

Career: Undergraduate

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| Course Components: | Lecture | Required |
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Course typically offered:

Main Campus: Fall, Spring

General Education: Tier 2 Natural Sciences

Honors Course: Honors Contract

Honors Course: Honors Contract

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 270: Critical Zone Science (3 units)

Description: The critical zone is defined as the "heterogeneous, near surface environment in which complex interactions involving rock, soil, water, air, and living organisms regulate the natural habitat and determine the availability of life-sustaining resources". Extending from the top of the vegetation canopy through the groundwater table, the critical zone supports nearly all terrestrial life on Earth. The critical zone provides us with clean air, drinkable water, fertile soil and much more. However, human activity has changed the structure and function of the critical zone by altering its constituent parts: the atmosphere, lithosphere, hydrosphere and biosphere. Now more than ever, understanding the critical zone is crucial to human flourishing and sustainability. This course integrates core concepts of geology, hydrology, ecology and soil science to provide a foundational understanding of the critical zone and its role in addressing environmental problems.

Grading basis: Regular Grades

Career: Undergraduate

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| Course Components: | Lecture | Required |
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Course typically offered:

Main Campus: Spring

Recommendations and additional information: Introductory Course in Environmental Science or Instructor Consent.

ENVS 275: Data analysis for life and environmental sciences (3 units)

Description: This course acquaints students with fundamental knowledge, skills, and abilities on quantitative approaches to natural sciences that is critical in understating, solving, and addressing natural science issues. Using computer software, students will explore and visualize real-world data and derive meaningful and useful outputs. Additionally, students will learn different ways to acquire scientific data, analyze and compare multiple data sets, and interpret and summarize the results.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Lecture Required

Course typically offered:

Main Campus: Fall

Enrollment requirement: PPL 60+ or MCLG 88+ or SAT I MSS 620 or ACT MATH 26+ or one course from MATH 112, 113, 116 , 120R, 122B, 125. Test scores expire after 1 year.

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 280: Microbes in the Environment (3 units)

Description: Evolution is the central driving force shaping the current diversity of microbes. Knowledge of this background is essential for understanding processes such as soil formation and bioremediation. This course provides a comprehensive introduction to the biology of three major groups of microbes: bacteria, protists, and viruses. Microbial diversity will be explored in the context of the structure, physiology, metabolism, and molecular genetics of various microbial taxa. We will discuss microbial diseases, non-specific and specific human immune responses, and general strategies used by microbes to overcome these defenses. The final section of the course will explore key concepts in microbial ecology. Special emphasis will be placed on the central role of bacteria in geochemical cycles and symbiotic associations with plants and animals.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Lecture Required

Recommendations and additional information: MCB 181R or PSIO 201 and CHEM 101B or CHEM 103A.

ENVS 285L: Principles of Microbiology Laboratory (1 unit)

Description: The course is the laboratory course to accompany MIC 285R.

Grading basis: Regular Grades

Career: Undergraduate

Flat Fee: \$40

Course Components: Laboratory Required

Equivalent to: MCB 285L, PLP 285L, SWES 285L, VSC 285L

Also offered as: ACBS 285L, MCB 285L, MIC 285L, PLP 285L

Course typically offered:

Main Campus: Spring

Recommendations and additional information: MCB 181R, MCB 181L, ECOL 182R, ECOL 182L, CHEM 103A, CHEM 103B, CHEM 104A, CHEM 104B. Concurrent registration, MIC 285R for MIC and V SC majors. Strongly recommended: MIC 285L, MIC 285R be taken together by all others.

Home department: Veterinary Science & Microbiology

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 285R: Principles of Microbiology (4 units)

Description: The course is an introductory microbiology class for majors, emphasizing cellular, biochemical and molecular aspects of metabolism, genetics, cell structure, and host-parasite interactions

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Lecture Required

Equivalent to: MCB 285R, PLP 285R, SWES 285R, VSC 285R

Also offered as: ACBS 285R, MCB 285R, MIC 285R, PLP 285R

Course typically offered:

Main Campus: Spring

Recommendations and additional information: MCB 181R, MCB 181L, ECOL 182R, ECOL 182L, CHEM 103A, CHEM 103B, CHEM 104A, CHEM 104B. Concurrent registration, MIC 285R for MIC and V SC majors. Strongly recommended MIC 285L, MIC 285R be taken together by all others.

Home department: Veterinary Science & Microbiology

ENVS 291: SWES Sophomore Preceptorship (1 unit)

Description: This Preceptorship Program involves specialized work on an individual basis, consisting of instructional support both in and out of the classroom for either ENVS 201 Intro Soils Lab or ENVS 270 Critical Zone Science, primarily assisting other students in the better understanding of the target course content.

Grading basis: Alternative Grading: S, P, F

Career: Undergraduate

Course Components: Independent Study Required

Course typically offered:

Main Campus: Fall, Spring

Recommendations and additional information: Sophomore status with completion or concurrent enrollment in ENVS 201 or ENVS 270 or Instructor Consent.

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 297C: Critical Zone & Earth Science Education Workshop (1 unit)

Description: Extending from the top of the vegetation canopy through the groundwater table, the critical zone supports nearly all terrestrial life on Earth. Earth's critical zone provides us with clean air, drinkable water, fertile soil and much more. However, human activity has changed the structure and function of the critical zone by altering its constituent parts: the atmosphere, lithosphere, hydrosphere and biosphere. Therefore, educating future generations about the critical zone is of utmost importance. This teaching practicum course applies basic science education principles and the fundamentals of critical zone science towards teaching K-12 students in hands-on Earth Science Discovery workshops at the Flandrau Science Center & Planetarium.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Workshop Required

Repeatable: Course can be repeated a maximum of 2 times.

Course typically offered:

Main Campus: Fall, Spring

Field trip: None

Enrollment requirement: ENVS 270.

Student Engagement Activity: Leadership

Student Engagement Competency: Professionalism

ENVS 299: Independent Study (1 - 3 units)

Description: Qualified students working on an individual basis with professors who have agreed to supervise such work.

Grading basis: Alternative Grading: S, P, F

Career: Undergraduate

Course Components: Independent Study Required

Repeatable: Course can be repeated a maximum of 99 times.

Course typically offered:

Main Campus: Fall, Spring, Summer

ENVS 299H: Honors Independent Study (1 - 3 units)

Description: Qualified students working on an individual basis with professors who have agreed to supervise such work.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Independent Study Required

Repeatable: Course can be repeated a maximum of 99 times.

Course typically offered:

Main Campus: Fall, Spring, Summer

Enrollment requirement: Student must be active in the Honors College.

Honors Course: Honors Course

Honors Course: Honors Course

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 300: Soil Ecology of Sustainable Systems (3 units)

Description: Properly functioning terrestrial systems, whether natural or agricultural, depend on interactions between diverse soil organisms and their micro-environments. This course will serve as an in-depth introduction to the rapidly evolving field of soil ecology, including soil food webs, microhabitats, plant interactions, linkages to critical ecosystem services, vulnerabilities to climate and land use changes, and real-world opportunities for applying soil ecological principles and mechanistic understanding to achieve sustainable environmental goals.

Grading basis: Regular Grades

Career: Undergraduate

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| Course Components: | Lecture | Required |
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Course typically offered:

Main Campus: Fall

Enrollment requirement: ENVS 200

Honors Course: Honors Contract

Honors Course: Honors Contract

ENVS 305: Pollution Science (3 units)

Description: Introduction to abiotic and biotic scientific processes within the soil/water/atmosphere continuum that affects the fate and transport of pollutants. Evaluation of the extent, fate, mitigation and impact of environmental pollution.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Lecture Required

Course typically offered:

Main Campus: Spring

Enrollment requirement: MIC 205A

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 310: Ecosystem Health and Justice (3 units)

Description: Across America, one in four Americans lives within 3 miles of a hazardous waste site (U.S. General Accounting Office, 2013). This means that one's zip code can be more important than their genetic code. Today's complex environmental science problems have far-reaching impacts and require an understanding of natural sciences, health, and justice. This course addresses this challenge by exploring and focusing on how to generate environmental science solutions at the intrapersonal, interpersonal, institutional, and community levels. Students will not only gain a fundamental understanding of the natural sciences, health, and justice, they will learn how to apply the science to solve real world problems. Through the lens of environmental justice, this class will emphasize race, socioeconomic, and gender to explore the ways in which diverse individuals and societies are generating solutions to environmental quality and health challenges. The course will focus on the United States but will incorporate case studies from Africa, Asia, Europe, Latin America, and/or Middle East.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Lecture Required

Course typically offered:

Main Campus: Fall

Recommendations and additional information: 2 courses from Tier One - Individuals/Societies.

Enrollment requirement: Enrollment not allowed if you have previously taken GEOG 374.

General Education: Gen Ed Diversity Emphasis

General Education: Tier 2 Individuals & Societies

ENVS 316: Soil Fertility and Plant Nutrition (3 units)

Description: Chemical and biological properties of soil as they affect soil nutrient availability and crop production. Principles of plant nutrition and nutrient acquisition also discussed. Additional topics: fertilizers and fertilization, irrigation water quality, soil salinity, environmental impacts of fertilizers, and principles of soil and plant tissue testing.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Lecture Required

Course typically offered:

Main Campus: Spring

Enrollment requirement: ENVS 200 must be completed prior to enrolling in ENVS 316.

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 330: Introduction to Remote Sensing (3 units)

Description: Introduction to remote sensing principles, techniques, and applications, designed principally for those with no background in the field.

Grading basis: Regular Grades

Career: Undergraduate

Flat Fee: \$50

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| Course Components: | Laboratory Lecture | May Be Offered Required |
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Equivalent to: GEN 330, GEOS 330, SW 330, SWES 330, WSM 330

Also offered as: GEN 330, GEOG 330, GEOS 330, GIST 330, WSM 330

Course typically offered:

Main Campus: Fall

Online Campus: Fall, Spring, Summer

Home department: School of Geography and Development

Student Engagement Activity: Discovery

Student Engagement Competency: Interdisciplinarity

ENVS 340: Environmental Chemistry (3 units)

Description: An introduction to the chemistry of air, water and terrestrial environments.

Application of general chemistry to understanding processes that affect the quality of Earth's near-surface air/water/land environments.

Grading basis: Student Option ABCDE/PF

Career: Undergraduate

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| Course Components: | Lecture | Required |
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Equivalent to: GEOS 340, HWRS 340

Also offered as: GEOS 340, HWRS 340

Course typically offered:

Main Campus: Fall

Recommendations and additional information: CHEM 103A, CHEM 103B.

Enrollment requirement: Students should complete CHEM 152 OR CHEM 162 prior to enrollment.

Honors Course: Honors Contract

Honors Course: Honors Contract

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 391: SWES Junior Preceptorship (1 unit)

Description: This Preceptorship Program involves specialized work on an individual basis, consisting of instructional support both in and out of the classroom for either ENVS 305 Pollution Science, ENVS 310 Ecosystem Health and Justice, ENVS 316 Soil Fertility and Plant Nutrition, or ENVS 340 Environmental Chemistry, for assisting other students in the better understanding of the target course content.

Grading basis: Alternative Grading: S, P, F

Career: Undergraduate

Course Components: Independent Study Required

Repeatable: Course can be repeated a maximum of 3 times.

Course typically offered:

Main Campus: Fall, Spring

Recommendations and additional information: Junior status with completion or concurrent enrollment in the following required courses listed in the department curriculum: ENVS 310 or ENVS 316, or ENVS 340 or ENVS 305.

ENVS 393: Internship (1 - 3 units)

Description: Specialized work on an individual basis, consisting of training and practice in actual service in a technical, business, or governmental establishment.

Grading basis: Alternative Grading: S, P, F

Career: Undergraduate

Course Components: Independent Study Required

Repeatable: Course can be repeated a maximum of 99 times.

Course typically offered:

Main Campus: Fall, Spring, Summer

Student Engagement Activity: Engagement Activity TBD

Student Engagement Competency: Engagement Competency TBD

ENVS 396A: Topics of Conservation Biology in Developing Countries (1 unit)

Description: This seminar class gives students interested in nature conservation in developing countries the opportunity to identify focal areas and develop research topics that cater to their interests and degree programs. Although not mandatory for UA study Abroad Summer Programs, including ¿Desert Ecology and Conservation Biology in Namibia¿, it is a great opportunity to focus interests and develop an individual or collective research project for the summer course in collaboration with other students. This class is available for Honors section.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Seminar Required

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 397A: Teaching Workshop (3 - 4 units)

Description: The practical application of theoretical learning within a group setting and involving an exchange of ideas and practical methods, skills, and principles.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Workshop Required

Repeatable: Course can be repeated for a maximum of 10 units.

Equivalent to: ABE 397A

Also offered as: BE 397A

Course typically offered:

Main Campus: Fall, Spring

Student Engagement Activity: Professional Development

Student Engagement Competency: Sustainability

ENVS 397S: Sustainability Workshop I: Students for Sustainability (3 units)

Description: Students will actively participate in teams on one or more of several existing projects, including composting, gardening, rainwater harvesting, recycling, environmental justice, food choices and their impacts, sustainability practices at athletic events, energy and climate, or environmental arts, while emphasizing scientific principles. Students also have the opportunity to develop new projects oriented around sustainable use and conservation of natural resources on the UA campus and in the surrounding community.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Workshop Required

Repeatable: Course can be repeated a maximum of 4 times.

Course typically offered:

Main Campus: Fall, Spring

Field trip: None

Student Engagement Activity: Discovery

Student Engagement Competency: Sustainability

ENVS 399: Independent Study (1 - 4 units)

Description: Qualified students working on an individual basis with professors who have agreed to supervise such work.

Grading basis: Alternative Grading: S, P, F

Career: Undergraduate

Course Components: Independent Study Required

Repeatable: Course can be repeated a maximum of 99 times.

Course typically offered:

Main Campus: Fall, Spring, Summer

Student Engagement Activity: Engagement Activity TBD

Student Engagement Competency: Engagement Competency TBD

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 399H: Honors Independent Study (1 - 3 units)

Description: Qualified students working on an individual basis with professors who have agreed to supervise such work.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Independent Study Required

Course typically offered:

Main Campus: Fall, Spring, Summer

Enrollment requirement: Student must be active in the Honors College.

Honors Course: Honors Course

Honors Course: Honors Course

ENVS 401: Sustainable Management of Arid Lands & Salt-Affected Soils (3 units)

Description: Principles and practices of soil, water and crop management under arid and semiarid conditions; the use of diagnostic procedures for evaluating soils and waters, reclamation, and economics of irrigation project development.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Lecture Required

Co-convened with: ENVS 501

Course typically offered:

Main Campus: Fall

Recommendations and additional information: ENVS 200.

Enrollment requirement: ENVS 200 or Introductory Soils course or instructor consent.

ENVS 404: Irrigation Principles and Management (3 units)

Description: Principles of operating farm irrigation systems, evaluation of systems, selection of systems, basic irrigation scheduling, measurements of water flow, soil moisture, pump and system efficiencies.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Laboratory May Be Offered
Lecture Required

Equivalent to: ABE 404, SW 404, SWES 404

Also offered as: ASM 404

Co-convened with: SWES 504

Course typically offered: Distance Campus: Fall (even years only)

Recommendations and additional information: SWES 200. Open to non-majors only.

Field trip: Field trip.

Home department: Agricultural Education

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 408: Scientific Writing for Environmental, Agricultural and Life Sciences (3 units)

Description: Effective writing is a valuable tool for any student aspiring for a career in the Environmental, Agricultural, and Life Sciences. This course will cover in-depth technical writing skills needed for scientific writing success, ranging from how to perform comprehensive reviews of the scientific literature, to performing peer reviews of the writing of fellow students. Ultimately, completion of this course will improve students' ability to write technical reports, theses and dissertations, and journal articles.

Grading basis: Student Option ABCDE/PF

Career: Undergraduate

Course Components: Lecture Required

Course typically offered:

Main Campus: Fall, Spring

ENVS 410: Microbial Biogeochemistry and Global Change (3 units)

Description: Microbes are the drivers of planetary biogeochemistry. They produce half the oxygen on the planet, and fix half the carbon. They introduce bioavailable forms of nitrogen into the biosphere. If human life ceased to exist, the central biogeochemical cycles would continue turning. However, while the planet's biogeochemistry can persist readily in the absence of human life, that does not mean that humankind's presence lacks impact. The Anthropocene (era of human impact) has seen significant changes to planetary stocks and fluxes of C, N, S, etc. Many of these changes involve or impact microbes, and have significant impacts on biogeochemical cycles. To understand microbial biogeochemistry in today's world, one must include the context of global change. And, conversely, one cannot understand the trajectory of global change without understanding microbial feedbacks via biogeochemical cycles. In this interdisciplinary undergraduate and graduate class we will cover major microbial biogeochemical cycles, and how these cycles are impacted by, and feedback to, global change. To understand the research in this area, we will discuss current methods in both microbial ecology and biogeochemistry, ranging from molecular meta-omics to the use of isotopes as biogeochemical tracers, with a particular emphasis on the challenges and opportunities of integrating these two disciplines. Lectures will be mixed with journal club-style readings and discussions, so active participation is essential. This course is designed for graduate students from diverse backgrounds and advanced undergraduates.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Lecture Required

Also offered as: ECOL 410, GEOS 410, PLS 410

Co-convened with: SWES 510

Course typically offered:

Main Campus: Spring

Recommendations and additional information: Background in biology or biogeochemistry, and openness to interdisciplinary learning.

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 412A: Ocean Sciences (3 units)

Description: This course offers an overview of the ocean sciences for undergraduate students with some scientific background. This course will broaden the exposure of UA undergraduates to marine science in a cross-disciplinary context. Students considering a career or graduate school in marine science will find this class a useful preview of the different areas of marine science, and students interested in natural or environmental sciences will gain a better understanding of the many linkages between the ocean and the broader natural world. We will cover the role of the ocean in diverse components of the Earth system, including geological, biological, climatic, and human aspects.

Grading basis: Regular Grades

Career: Undergraduate

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| Course Components: | Lecture | Required |
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Also offered as: ATMO 412A, ECOL 412A, GEOS 412A

Recommendations and additional information: One year of science, or consent of instructor.

Home department: Geosciences

ENVS 415: Translating Environmental Science (3 units)

Description: Scientists speak a different language, a dialect filled with abstract symbolism, hypotheses and references to Latin and Greek. In this course, students learn journalism techniques to translate environmental science topics into language a layperson could appreciate. The writing concepts will apply to any field of science, as well as grant proposals, public reports and media including web-based publishing. Students also learn techniques for converting numbers into relevant statistics. Students will "workshop" in groups and work closely with the instructor to produce publication-quality articles on assigned or agreed-upon topics. The best of these could be posted on university-affiliated websites, with credit given to the author.

Grading basis: Regular Grades

Career: Undergraduate

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| Course Components: | Lecture | Required |
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Co-convened with: ENVS 515

Course typically offered:

Main Campus: Spring

Recommendations and additional information: A, B, or better in ENGL 102 and any math class.

Honors Course: Honors Contract

Honors Course: Honors Contract

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

Description: The purpose of this course is to enhance students knowledge and skills related to environmental risk assessment, including hazard assessment, exposure assessment, toxicity assessment, and risk characterization.

Career: Undergraduate

Equivalent to: CPH 418

Also offered as: EHS 418

Co-convened with: SWES 518

Course typically offered:

Main Campus: Fall

Home department: Community, Environment & Pol

Description: Environmental Physics covers how solar energy input, the atmosphere, the oceans, the terrestrial environment and the biosphere interact with each other at global and regional scales. Earth's systems are not static and the course will deal with their evolution over geological times and cover recent and projected future changes to the climate and ozone layer, among other topics that are important for society and its decision makers. This course emphasizes conceptual understanding of mechanisms, data sets and modeling techniques and uses elementary math and physics principles to guide student to a comprehensive, but practical, understanding of the physical aspects of the environment of planet Earth.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Lecture Required

Co-convened with: ENVS 520

Course typically offered:

Main Campus: Fall, Spring

Enrollment requirement: Either Phys 102 or Phys 141 is a prerequisite and required for this course.

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 422: Critical Zone Science & Management (3 units)

Description: This course targets undergraduate science majors and graduates interested in learning more about integrated and interdisciplinary team science while learning about the cross-cutting research and observational strategies employed across NSF's Critical Zone Observatory network. At least half of the course will focus on guided data analysis based on CZO data sets.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Lecture Required

Also offered as: GEOS 422, HWRS 422

Co-convened with: SWES 522

Recommendations and additional information: Class participants must have completed at least one university/college-level lab-based science course and mathematics through pre-calculus

ENVS 424L: Plant Biotechnology (2 units)

Description: This laboratory course is designed for science undergraduates as well as graduate students who are interested in strengthening their hands-on experience with the techniques involved in developing superior food, feed and fiber crops.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Laboratory Required

Also offered as: MCB 424L, PLS 424L

Co-convened with: SWES 524L

Course typically offered:

Main Campus: Spring

Recommendations and additional information: PLS 340, 360

Home department: School of Plant Science

ENVS 424R: Plant Biotechnology (3 units)

Description: This course is designed for science undergraduates as well as graduate students who are interested in strengthening their knowledge of the techniques involved in developing superior food, feed and fiber crops.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Lecture Required

Also offered as: MCB 424R, PLS 424R

Course typically offered:

Main Campus: Spring

Recommendations and additional information: PLS 340, 360

Home department: School of Plant Science

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 425: Environmental Microbiology (3 units)

Description: Current concepts in microbiology across environments, including soil, aquatic and air. Emphasis on the role of microbes in remediation and biogeochemistry.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Lecture Required

Equivalent to: MIC 425, MICR 425, SW 425

Also offered as: MIC 425

Co-convened with: ENVS 525

Course typically offered:

Main Campus: Fall

Recommendations and additional information: MIC 205A.

Enrollment requirement: Completion of MIC 205A required for enrollment.

ENVS 426: Environmental Microbiology Laboratory (2 units)

Description: Basic techniques for isolation and characterization of environmental soil and water microflora including methods for enumeration and measurement of physiological activity.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Laboratory Required

Equivalent to: MIC 426, MICR 426, SW 426

Also offered as: MIC 426

Co-convened with: ENVS 526

Course typically offered:

Main Campus: Fall

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 428L: Microbial Genetics Laboratory (2 units)

Description: Laboratory associated with lecture course on Prokaryotic gene structure and function; methods of gene transfer and mapping, DNA structure, replication, transcription, and translation. Hands-on computer analysis of DNA sequences and gene cloning strategies. Principles of regulation of gene expression. Biology of plasmids and bacteriophages.

Grading basis: Regular Grades

Career: Undergraduate

Flat Fee: \$70

Course Components: Laboratory Required

Equivalent to: ECOL 428L, MCB 428L, MIC 428L, MICR 428L, PLS 428L, SWES 428L, VSC 428L

Also offered as: ACBS 428L, ECOL 428L, MIC 428L, PLP 428L, PLS 428L

Co-convened with: ENVS 528L

Course typically offered:

Main Campus: Spring

Recommendations and additional information: ECOL 320, PLS 312 and PLP 428R.

Home department: Plant Pathology

Writing Emphasis: Writing Emphasis Course

ENVS 428R: Microbial Genetics (3 units)

Description: Prokaryotic gene structure and function; methods of gene transfer and mapping, DNA structure, replication, transcription, and translation. Hands-on computer analysis of DNA sequences and gene cloning strategies. Principles of regulation of gene expression. Biology of plasmids and bacteriophages.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Lecture Required

Equivalent to: ECOL 428, ECOL 428R, GENE 428R, MCB 428, MIC 428, MIC 428R, MICR 428, MICR 428R, PLP 428, PLS 428R, SW 428, SWES 428, SWES 428R, VSC 428, VSC 428R

Also offered as: ACBS 428R, ECOL 428R, MIC 428R, PLP 428R, PLS 428R

Co-convened with: ENVS 528R

Course typically offered:

Main Campus: Spring

Distance Campus: Spring

Home department: Plant Pathology

Writing Emphasis: Writing Emphasis Course

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 430L: Environmental Monitoring and Remediation Lab (1 unit)

Description: The laboratory/field trip part (SWES 430L/530L) focuses on hands-on, laboratory and field experiences design to help the student better understand the principles of and the tools necessary for environmental monitoring. Basic principles and reviewed during lecture (SWES 430R/530R) as necessary to assist the student in connecting theory with hands-on experiences in the lab and the field. Students are required to complete several problems, review publications, and write weekly or bi-weekly reports that summarize each of the nine topics covered, their laboratory/field trip experiences, and provide answers to questions and exercises.

Grading basis: Regular Grades

Career: Undergraduate

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| Course Components: | Laboratory | Required |
| | Lecture | May Be Offered |

Co-convened with: ENVS 530L

Course typically offered:

Main Campus: Fall, Spring

Recommendations and additional information: Concurrent course, SWES 430R.

Student Engagement Activity: Professional Development

Student Engagement Competency: Sustainability

ENVS 430R: Environmental Monitoring and Remediation (3 units)

Description: Designed to provide the graduating students and interested graduates with a combination of lectures, labs and field trips that describe relevant topics in environmental monitoring, characterization and remediation. The topics covered include: basic statistics, data quality, field surveying, near-surface air measurement, automated data acquisition, soil, vadose zone and groundwater sampling and monitoring, soil and water biological properties, including pathogen monitoring and remote sensing. This course focuses on hands-on, laboratory and field experiences design to help the student better understand the principles of and the tools necessary for environmental monitoring. Basic principles and reviewed during lecture as necessary to assist the student in connecting theory with hands-on experiences in the lab and the field. Students are required to complete several problems, review publications, and write weekly or bi-weekly reports that summarize each of the nine topics covered, their laboratory/field trip experiences, and provide answers to questions and exercises.

Grading basis: Regular Grades

Career: Undergraduate

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| Course Components: | Lecture | Required |
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Co-convened with: SWES 530R

Course typically offered:

Main Campus: Fall, Spring

Recommendations and additional information: SWES 305; Concurrent registration, SWES 430L.

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 431: Soil Genesis and Classification (4 units)

Description: Theory and practice of describing characteristics of soils; principles of soil classification and classification systems; making soil interpretations for selected land uses.

Grading basis: Regular Grades

Career: Undergraduate

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| Course Components: | Laboratory | Required |
| | Lecture | Required |

Co-convened with:

Course typically offered:

Main Campus: Fall

Field trip: There will be 4 field trip reports and 1 final report. Field trip reports will summarize the major soil and landscape properties across the Tucson Basin as well as examine soils across the elevation gradient of the Santa Catalina Mountains.

Enrollment requirement: ENVS 200.

ENVS 431A: Traditional Ecological Knowledge (3 units)

Description: An introduction to the growing literature on traditional ecological knowledge and its relationships to the ecological and social sciences.

Grading basis: Regular Grades

Career: Undergraduate

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| Course Components: | Lecture | Required |
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Also offered as: AIS 431A, ANTH 431A, GEOG 431A, RAM 431A, RNR 431A, WFSC 431A, WSM 431A

Co-convened with: SWES 531A

Course typically offered:

Main Campus: Fall

Home department: American Indian Studies Committee

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 436: Agro-ecology (3 units)

Description: Agro-ecology is the application of ecological principles to the production of food and fiber. The underlying goals are to assess and promote the long-term sustainability of agricultural production systems. Through this course we will study how agro-ecosystems vary across time and space and will examine the trade-offs associated with different cropping systems and management practices. We will begin with a brief history of major trends in agriculture, then examine the ecological interactions involved in crop production, observe how these interactions shape agricultural practices and conclude with a discussion of domestic and international government policies that influence agricultural sustainability.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Lecture Required

Also offered as: ENTO 436, PLS 436, RNR 436

Co-convened with: SWES 536

Course typically offered:

Main Campus: Spring

Recommendations and additional information: ECOL 302.

Home department: Entomology

ENVS 440: Biodegradation of Pollutants in Soil and Groundwater (3 units)

Description: Description of modern pollution problems and potential biological remediation techniques focusing on the chemistry, biochemistry and molecular biology of biodegradation of hazardous and toxic compounds.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Lecture Required

Equivalent to: MIC 440, SW 440

Also offered as: MIC 440

Co-convened with: SWES 540

Course typically offered:

Main Campus: Spring

Recommendations and additional information: SWES 425.

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

Description: This course is a survey of basic issues and concepts in natural resource management and the environment in Native communities using integrated case studies that survey all the major varieties of environmental issues in Indian Country in the 21st century. A central theme will be developing tribally-specific solutions to rebuilding the resiliency of degraded ecosystems. We will consider particular case studies such as: tribal sovereignty, land tenure, reserved rights and Native claims; Native knowledge systems and Western science; co-management and restoration; water; fish and wildlife; agriculture and rangeland management; energy, mining and nuclear waste; and global climate change.

Career: Undergraduate

Equivalent to: ANTH 441A, ARL 441A, RAM 441A, RNR 441A, SWES 441A, WFSC 441A, WSM 441A

Also offered as: AIS 441A, ANTH 441A, ARL 441A, RAM 441A, RNR 441A, WFSC 441A, WSM 441A

Co-convener with: SWES 541A

Course typically offered:

Main Campus: Fall, Spring

Home department: American Indian Studies Committee

Description: Study of lakes and streams; biological characteristics, as related to physical, chemical, geological, and historical processes operating on fresh waters.

Grading basis: Regular Grades

Career: Undergraduate

Flat Fee: \$23

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| Course Components: | Laboratory | May Be Offered |
| | Lecture | Required |

Equivalent to: ECOL 441

Also offered as: ECOL 442, WFSC 442

Co-convened with:

Recommendations and additional information: Six units of biology, 3 units of chemistry and 3 units of ecology.

Description: A guided journey through real world environmental law; U.S. legal system, major environmental laws-criminal and civil; common marketplace problems and solutions; high profile cases: essential professional skills.

Grading basis: Regular Grades

Career: Undergraduate

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| Course Components: | Lecture | Required |
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Equivalent to: WSM 444

Also offered as: WSM 444

Co-convener with: SWES 544

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 450: Green Infrastructure (3 units)

Description: The goal of this course is the advancement of students' knowledge and capabilities regarding Green Infrastructure concepts and the issues and techniques involved in implementation of Green Infrastructure. The course provides an overview as well as more in-depth coverage of the science, practical context, and creation of Green Infrastructure. The built environment of arid regions is emphasized, with Tucson Case Studies providing practical focus to content and learning objectives. The term Green Infrastructure, as used in this course, aligns with the following EPA description: "Green infrastructure uses vegetation, soils, and natural processes to manage water and create healthier urban environments... at the scale of a neighborhood or site, green infrastructure refers to stormwater management systems that mimic nature by soaking up and storing water." The course features lectures, interactive discussions and presentations, and guest presentations and tours led by experts in their fields. Students take a series of quizzes, a mid-term and a final exam, along with a number of homework assignments / exercises. A special research report is required of Graduate Students.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Lecture Required

Also offered as: LAR 450, PLG 450, SBE 450

Co-convened with: ENVS 550

Course typically offered:

Main Campus: Fall

Recommendations and additional information: Prior coursework in related fields is recommended along with familiarity with office productivity software tools (Excel & PowerPoint) along with research, analytic, and writing skills.

Field trip: A number of potential tours are proposed to allow students to engage with applied contexts and professionals in the field.

Honors Course: Honors Contract

Honors Course: Honors Contract

Student Engagement Activity: Discovery

Student Engagement Competency: Sustainability

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 454: Water Harvesting (3 units)

Description: Course focuses on water harvesting principles and techniques at a variety of scales and settings. Students participate in hands-on implementation of water harvesting projects on the UA campus.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Lecture Required

Equivalent to: ECOL 454, WFSC 454

Also offered as: ECOL 454, WFSC 454

Co-convened with: SWES 554

Course typically offered:

Main Campus: Spring

Honors Course: Honors Contract

Honors Course: Honors Contract

Student Engagement Activity: Discovery

Student Engagement Competency: Sustainability

ENVS 460: Environmental Science Research from Field to Lab (3 units)

Description: In this course, we will explore the range of environmental research from field to laboratory. Students will visit various research sites, from disturbed, managed, and natural ecosystems. You will learn about research methods, instrumentation, as well as data and sample collection. You will collect samples, process them in a laboratory, and interpret the data.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Lecture Required

Co-convened with: ENVS 560

Course typically offered:

Main Campus: Summer

Recommendations and additional information: ENVS 200, ENVS 275, Junior or Senior.

Field trip: Sweetwater wetlands at WEST Center (Tucson); Waterman Mountains; San Simon, AZ; Maricopa Ag Center; Mt Bigelow; Santa Rita Experimental Range; Sahuarita, AZ

ENVS 461: Soil and Water Conservation (3 units)

Description: Consideration of major world soil and water conservation problems and solutions; principles of soil and water degradation by erosion, ground water overdraft, chemical transport in surface and ground water and their effects on world food production and environmental problems.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Lecture Required

Co-convened with: ENVS 561

Recommendations and additional information: SWES 200.

Field trip: Field trips

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 462: Environmental Soil and Water Chemistry (3 units)

Description: Introduction to the principal chemical constituents and processes occurring in soils and sediments. The objective of the course is to provide students with a conceptual framework for understanding chemical reactions in heterogeneous natural systems. Applications to biogeochemistry and environmental quality will be presented, but fundamental principles will be emphasized. A general chemistry text is a useful additional reference, and it should be consulted for questions regarding concepts that may not be fully reviewed in lecture or the required text.

Grading basis: Regular Grades

Career: Undergraduate

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| Course Components: | Lecture | Required |
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Co-convened with: SWES 562

Course typically offered:

Main Campus: Spring

Enrollment requirement: Enrollment requirement is ENVS 200 AND (CHEM 152 OR CHEM 162).

ENVS 464: Environmental Organic Chemistry (3 units)

Description: Physical and chemical processes influencing the behavior of contaminants in the subsurface environment. Includes equilibrium and kinetic theory of solubilization-dissolution, volatilization, sorption, hydrolysis, photolysis, surface catalysis and radioactive decay.

Grading basis: Regular Grades

Career: Undergraduate

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| Course Components: | Lecture | Required |
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Repeatable: Course can be repeated a maximum of 4 times.

Co-convened with: ENVS 564

Course typically offered:

Main Campus: Fall

Enrollment requirement: Enrollment requirement is completion of CHEM 152 or CHEM 162.

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 470: Soil Physics (3 units)

Description: The course provides the theoretical and practical basis for understanding and quantifying physical and hydrological properties of soils. Hydro-physical processes taking place near the Earth's surface emphasizing mass and energy exchange, and transport processes in saturated and partially-saturated soils at multiple scales are discussed. The coupling with the atmosphere and the role of plants in the hydrological cycle will be studied. Modern measurement methods and analytical tools for hydrological data collection and interpretation will be reviewed.

Grading basis: Regular Grades

Career: Undergraduate

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| Course Components: | Laboratory | Required |
| | Lecture | Required |

Co-convened with: ENVS 570

Course typically offered:

Main Campus: Spring

Recommendations and additional information: SWES 200, PHYS 103; Concurrent registration, MATH 125.

Student Engagement Activity: Discovery

Student Engagement Competency: Innovation and Creativity

ENVS 474: Aquatic Plants and the Environment (4 units)

Description: The role of riparian areas, estuaries, and constructed wetlands in the environment. Emphasis on plants as wildlife habitat for nutrient cycling and bioremediation.

Grading basis: Regular Grades

Career: Undergraduate

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| Course Components: | Lecture | Required |
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Equivalent to: ECOL 474, WFSC 474

Also offered as: ECOL 474, WFSC 474

Co-convened with: ENVS 574

Course typically offered:

Main Campus: Fall

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 477: Principles of Ecotoxicology (3 units)

Description: Ecotoxicology is the study of the biochemical and molecular effects of chemical toxicants and non-chemical stressors, singly or in mixtures, on biological organization ranging from the individual to assemblages and ecosystems. Some of the detrimental effects of toxicants and stressors are acute causing immediate ecological and physiological harm, while many others are insidious and chronic causing long-term damage to populations over multiple generations. This course will provide knowledge to students of the very broad range of anthropogenic stressors and toxicants as well as their physiological and sometimes, behavioral, effects on individuals and populations of organisms. Ecotoxicology is a multidisciplinary endeavor involving ecology, biology (anatomy, physiology, genetics, microbiology), chemistry (inorganic, organic, biochemical, analytical), epidemiology, statistics, soil, water and atmospheric sciences. The goal of this course is to provide requisite tools for students to gain insight into understanding such a complex discipline as ecotoxicology. Specifically, this course will describe some known environmental toxins and their effects, methods to study the nature, extent, movement, and exposure routes of environmental contamination, and techniques to quantify toxicant effects on individual organisms and populations. This course will also describe the current regulatory framework that governs contaminants as well as tools used by scientists, managers, and regulators in efforts to protect, and reduce harm to, individuals, populations, and ecosystems.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Lecture Required

Co-convened with: ENVS 577

Course typically offered:

Main Campus: Spring

Field trip: 2 field trips are planned, 1 is required/in class (ALEC) and one will be voluntary to the Santa Cruz River.

Enrollment requirement: CHEM 142 OR CHEM 152 or CHEM 162, AND MCB 181R and ECOL 182R.

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 479: Economic Analysis of Water, Food & Environmental Policies (3 units)

Description: This course focuses on economic methods for designing and evaluating water, food and environmental policies. Topics include optimizing water as an input in producing food, energy, recreation, and other ecosystem services; water & environmental issues in food production; pricing and conservation incentives; managing shortage risks; and economic tools for addressing conflicts over water, food and the environment. Interactive seminar style course. Calculus proficiency is required.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Lecture Required

Equivalent to: GEOG 479, HWRS 479, RNR 479, SWES 479

Also offered as: AREC 479, HWRS 479, RNR 479

Course typically offered:

Main Campus: Spring

Recommendations and additional information: One semester of college calculus. One of the following courses: MATH 113, MATH 116, MATH 122B, MATH 125

Home department: Agricultural & Resource Economics

Enrollment requirement: Major in College of Engineering or major/minor in ABEM, ENVS, EWRE, HWRS, NTRS, or WSM. Junior or Senior status. MATH 113, MATH 116, MATH 122B, or MATH 125 (or AP credit for Calculus AB or BC).

ENVS 480: Environmental Assessment for Contaminated Sites (3 units)

Description: The goal of this course is to advance students' knowledge of various concepts and methods used in assessing human-impacted resources such as contaminated sites, waste places, and disturbed sites to ensure efficient and effective remediation and restoration programs. Focusing on contaminated sites, the course covers socioeconomic, biophysical, political, and cultural dimensions of the impacted sites as well as the assessment of the sustainability of remedial options. The course is delivered through interactive lectures, discussions, and classroom presentations, and is team taught by faculty with varied expertise.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Lecture Required

Co-convened with: ENVS 580

Course typically offered:

Main Campus: Fall

Recommendations and additional information: ENVS 210 Fundamentals of Environmental Science and Sustainability, or an Introductory Course in Environmental Science, or Instructor Consent.

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 482: Reclamation and Redevelopment of Impacted Lands (3 units)

Description: We are now living in the Anthropocene, meaning human activity has been the dominant influence on climate and the environment. Humans have impacted the land in numerous of ways, such as mining and other resource extraction activities, agriculture, urban development, industrial activities, and waste production. For example, in the U.S. alone, there are approximately 235,000-355,000 hazardous waste sites (USEPA, 2004). These activities have impacted our ecosystem and the services they provide for human health and well-being. It is critical to reclaim and redevelop these lands in order to improve ecosystem and public health. There is much work to be done and this is a time for innovation! It is critical to generate salient solutions to managing and redeveloping human impacted lands. This course will introduce the concepts and methods governing the sustainable management, restoration, and redevelopment of human-impacted lands. The topics covered include: soil quality concepts; the energy-water-food nexus; redevelopment of brownfields and other impacted lands; reclamation of mining and other resource-extraction sites; natural-disaster cleanup; urban agriculture and community gardens. Using an inquiry-based approach, students will learn how to develop solutions based on environmental science, ecological principles, and management efficacy. Through class projects and case studies, students will work through a multi-step process, including: site assessment, setting remediation/reclamation/restoration goals, developing possible solutions, and methods to determine effectiveness/indicators of success.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Lecture Required

Co-convened with:

Course typically offered:

Main Campus: Spring

Recommendations and additional information: It is recommended that ENVS 305 Pollution Science be taken prior to this course.

Field trip: Field trips to local sites in Tucson.

Student Engagement Activity: Professional Development

Student Engagement Competency: Sustainability

-SA represents a Student Abroad & Student Exchange offering

-**CC** represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 483: Geographic Applications of Remote Sensing (3 units)

Description: Use of aircraft and satellite imagery for monitoring landforms, soils, vegetation and land use, with the focus on problems of land-use planning, resource management and related topics.

Grading basis: Regular Grades

Career: Undergraduate

Flat Fee: \$50

Course Components: Lecture Required

Equivalent to: PLAN 483, PLN 483, PLNG 483, RNR 483, SWES 483

Also offered as: GEOG 483, GIST 483, PLG 483, RNR 483

Co-convened with: ENVS 583

Course typically offered:

Main Campus: Spring

Online Campus: Spring

Home department: School of Geography and Development

Enrollment requirement: GEOG/GEN/GEOS/ENVS/WSM/GIST 330.

Student Engagement Activity: Discovery

Student Engagement Competency: Interdisciplinarity

ENVS 490: Remote Sensing for the Study of Planet Earth (3 units)

Description: Remote Sensing for the Study of Planet Earth introduces basic and applied remote sensing science as a means to explore the diversity of our planetary environments (biosphere, atmosphere, lithosphere and hydrosphere) within the radiometric, spectral, spatial, angular and temporal domains of remote sensing systems. This survey course strikes a balance between theory, applications and hands-on labs and assignments. We explore how you can download, process, analyze and interpret multi-sensor data and integrate online remotely sensed data sources/products into your research of interest.

Grading basis: Regular Grades

Career: Undergraduate

Flat Fee: \$50

Course Components: Lecture Required

Equivalent to: ARL 490, ATMO 490, GEN 490, GEOG 490, GEOS 490, HWRS 490, MNE 490, OPTI 490, RNR 490, SW 490, SWES 490

Also offered as: ATMO 490, GEOG 490, GEOS 490, HWRS 490, OPTI 490, REM 490, RNR 490

Co-convened with: ENVS 590

Course typically offered:

Main Campus: Fall

Home department: Committee on Remote Sensing and Spatial Analysis

Enrollment requirement: GEOG/GEN/GEOS/ENVS/WSM/GIST 330.

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 491: SWES Senior Preceptorship (1 unit)

Description: This Preceptorship Program involves specialized work on an individual basis, consisting of instructional support both in and out of the classroom, by assisting enrolled students in the better understanding of the target course content for either ENVS 401 Sustainable Management of Arid Lands & Salt Affected Soils, ENVS 408 Scientific Writing for Environmental Science, ENVS 415 Translating Environmental Science, ENVS 420 Environmental Physics, ENVS 425 Environmental Microbiology, ENVS 430R/L Environmental Monitoring and Remediation, ENVS 431 Soil Genesis, ENVS 462 Env. Soil and Water Chemistry, ENVS 464 Env. Organic Chemistry, ENVS 480 Env. Assessment, or ENVS 482 Reclamation and Redevelopment Impacted Lands.

Grading basis: Alternative Grading: S, P, F

Career: Undergraduate

Course Components: Independent Study Required

Course typically offered:

Main Campus: Fall, Spring

Recommendations and additional information: Senior status with completion or concurrent enrollment in one or more of the following required courses listed in the dept curriculum: ENVS 401, ENVS 408, ENVS 415, ENVS 420, ENVS 425, ENVS 430R/L, ENVS 431, ENVS 462, ENVS 464, ENVS 480, or ENVS 482.

Student Engagement Activity: Leadership

Student Engagement Competency: Professionalism

ENVS 492: Directed Research (1 - 6 units)

Description: Individual or small group research under the guidance of faculty.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Independent Study Required

Repeatable: Course can be repeated a maximum of 12 times.

Course typically offered:

Main Campus: Fall, Spring, Summer

Student Engagement Activity: Engagement Activity TBD

Student Engagement Competency: Engagement Competency TBD

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 493: Internship (1 - 3 units)

Description: Specialized work on an individual basis, consisting of training and practice in actual service in a technical, business, or governmental establishment.

Grading basis: Alternative Grading: S, P, F

Career: Undergraduate

Course Components: Independent Study Required

Repeatable: Course can be repeated a maximum of 99 times.

Course typically offered:

Main Campus: Fall, Spring, Summer

Student Engagement Activity: Engagement Activity TBD

Student Engagement Competency: Engagement Competency TBD

ENVS 494R: Research (3 units)

Description: The practical application, on an individual basis, of previously studied theory and the collection of data for future theoretical interpretation.

Grading basis: Alternative Grading: S, P, F

Career: Undergraduate

Course Components: Independent Study Required

Repeatable: Course can be repeated a maximum of 2 times.

Course typically offered:

Main Campus: Fall, Spring, Summer

Recommendations and additional information: ENGL 101, ABE 120, consent of instructor.

Student Engagement Activity: Engagement Activity TBD

Student Engagement Competency: Engagement Competency TBD

ENVS 495A: Environmental Conservation in Australia (6 units)

Description: Australia hosts a large number of endemic plants and animals, with human settlement dating back over 20,000 years. With a combination of high biodiversity and long-term human interaction, it is an ideal location to explore topics in environmental science, including non-native species introductions, soil and water conservation, and fire management in the landscape. This class will allow participants to collaborate with Australian scientists and conservation organizations in current environmental research, while discovering the flora and fauna that make this country exceptional. Open to all majors, the multidisciplinary approach of the class also makes it an ideal capstone experience for the Environmental Science degree.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Colloquium Required

Co-convened with: ENVS 595A

Course typically offered:

Main Campus: Summer

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 495F: Conservation Biology: Field Studies in Developing Countries (3 - 6 units)

Description: Many of the worlds biological "hot spots", as well as some of the most critically threatened ecosystems are in developing nations and are in the greatest need for biological research. In this course, students will be able to step out of the classroom and into the real world to experience first hand the critical role that field biologists play in conservation. Students will be introduced to novel ecosystems and exposed to conservation issues faced by developing nations. Students will use the local environment as a laboratory to learn field research techniques and methodology. For students interested in the biological sciences, conducting field research "in situ" is invaluable in their professional development. The opportunity to visit a foreign country and be exposed to a different culture and environment can be a life changing experience. The objective of this course is to provide that experience in the context of biological research and the development of conservation professionals.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Colloquium Required

Repeatable: Course can be repeated a maximum of 3 times.

Equivalent to: SWES 495F

Also offered as: RNR 495F

Co-convened with: ENVS 595F

Course typically offered:

Main Campus: Summer

Home department: Renewable Natural Resources

Student Engagement Activity: Intercultural Exploration

Student Engagement Competency: Global and Intercultural

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 495G: Amazon Rainforest Conservation Biology in Ecuador (3 units)

Description: Located in the Amazon rainforest near the Equator, the Shiripuno River/Yasuni National Park region is considered to have the world's greatest biodiversity. After arriving in Quito, the capitol of Ecuador, we will travel to Puerto Francisco de Orellana, the gateway to the Amazon rainforest. From there we will travel by bus to the Shiripuno River (a tributary of the Amazon River) where Huaorani Guides will take us by boat to the Shiripuno Field Station. Along the way we will see several species of macaws, tapirs, monkeys, and turtles. The Shiripuno Field Station is maintained by the local Huaorani tribe and will function as our field station for the majority of the class. With comfortable accommodations and an extensive network of well-maintained trails in pristine rainforest, it is an ideal location to have a once-in-a-lifetime experience. We will conduct multiple tours of the area guided by Huaorani field experts to observe plants, birds, amphibians, reptiles, mammals, and many other unique features of this amazing area. Each student will be given the opportunity to develop and implement a unique research project. Research topics can include a biological inventory, soil analysis, working with Huaoranis to understand their perspectives of the environment, and investigate the conflict of oil development with the tremendous natural resources of the region in one of the last untouched rainforests on Earth.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Colloquium Required

Also offered as: RNR 495G

Co-convened with:

Course typically offered:

Main Campus: Summer

Home department: Renewable Natural Resources

ENVS 496D: Redesigning Food Systems for Sustainability, Security and Health (3 units)

Description: Understanding how regional food systems function to serve or not serve local people, economies and ecosystems in the Sonoran Borderlands.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Lecture Required

Also offered as: PLS 496D, RNR 496D

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 497F: Community and School Garden Workshop (2 - 6 units)

Description: This workshop-based course is designed to enable UA undergraduate and graduate students to work in Tucson-area schools and community sites helping stakeholders to plant, harvest and prepare foods from their garden as well as use the garden as a learning space. As a member of a school or community garden team, students are likely to cover a wide range of activities from maintaining a compost pile to administering lesson plans for teaching in the garden to weeding, planting, and organizing work crews. In addition to attending one 3-hour weekend workshop, students are required to attend weekly class meetings on the UA campus. Most of the course, however, revolves around independent and sustained involvement with a Tucson school or community garden. No teaching or gardening experience is required.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Workshop Required

Repeatable: Course can be repeated for a maximum of 9 units.

Also offered as: AIS 497F, GEOG 497F, HPS 497F, LAS 497F, NSC 497F, PLS 497F, STCH 497F, TLS 497F

Co-convened with: SWES 597F

Course typically offered:

Main Campus: Fall, Spring

Home department: School of Geography and Development

Student Engagement Activity: Community Partnership

Student Engagement Competency: Sustainability

ENVS 497S: Sustainability Workshop II: Students for Sustainability (3 units)

Description: Students will participate as leaders on teams on one or more of several existing projects, including composting, gardening, rainwater harvesting, recycling, environmental justice, food choices and their impacts, sustainability practices at athletic events, energy and climate, or environmental arts, while emphasizing scientific principles. Students also have the opportunity to develop new projects oriented around sustainable use and conservation of natural resources on the UA campus and in the surrounding community.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Workshop Required

Repeatable: Course can be repeated a maximum of 3 times.

Field trip: None

Enrollment requirement: ENVS 397S.

Student Engagement Activity: Leadership

Student Engagement Competency: Sustainability

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 498: Senior Capstone (1 - 3 units)

Description: A culminating experience for majors involving a substantive project that demonstrates a synthesis of learning accumulated in the major, including broadly comprehensive knowledge of the discipline and its methodologies. Senior standing required.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Independent Study Required

Course typically offered:

Main Campus: Fall, Spring

Student Engagement Activity: Engagement Activity TBD

Student Engagement Competency: Engagement Competency TBD

ENVS 498A: Senior Capstone: Introduction to Research I (2 units)

Description: This is an undergraduate research course designed to promote students' engagement in scientific inquiry and in the application of the course contents in understanding and solving environmental issues, which in turn prepare them for specialized work and/or graduate school. In this course, students engage in developing an original research proposal by selecting a research area, a research approach, and an advisor of their choice. Research approaches covered in this course include local field observation and experimentation, laboratory experimental and observation, resource analysis, survey, database research, GIS, and environmental action plans. Each student works with a UA faculty members as a primary advisor, and a specialized non-faculty or subject expert can serve as a second advisor. The student could work with a graduate student who is performing research supervised by the UA faculty member. A student is responsible for finding an advisor; however, the Department of Soil, Water, and Environmental Science Program can assist in choosing an advisor if needed.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Independent Study Required

Enrollment requirement: Senior status only.

Student Engagement Activity: Discovery

Student Engagement Competency: Sustainability

ENVS 498B: Senior Capstone: Introduction to Research II (2 units)

Description: This is an undergraduate research course designed to promote students' engagement in scientific inquiry and in the application of the course contents in understanding and solving environmental issues, which in turn prepare them for specialized work and/or graduate school. In this course, students engage in data collection, analysis, and write a publishable research paper under the supervision of a faculty advisor. ENVS 498A Senior Capstone: Introduction to Research 1 is required.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Independent Study Required

Enrollment requirement: ENVS 498A.

Student Engagement Activity: Professional Development

Student Engagement Competency: Innovation and Creativity

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 498H: Honors Thesis (3 units)

Description: An honors thesis is required of all the students graduating with honors. Students ordinarily sign up for this course as a two-semester sequence. The first semester the student performs research under the supervision of a faculty member; the second semester the student writes an honors thesis.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Independent Study Required

Repeatable: Course can be repeated for a maximum of 9 units.

Course typically offered:

Main Campus: Fall, Spring, Summer

Enrollment requirement: Student must be active in the Honors College.

Honors Course: Honors Course

Honors Course: Honors Course

Writing Emphasis: Writing Emphasis Course

ENVS 499: Independent Study (1 - 4 units)

Description: Qualified students working on an individual basis with professors who have agreed to supervise such work.

Grading basis: Alternative Grading: S, P, F

Career: Undergraduate

Course Components: Independent Study Required

Repeatable: Course can be repeated a maximum of 99 times.

Course typically offered:

Main Campus: Fall, Spring, Summer

Student Engagement Activity: Engagement Activity TBD

Student Engagement Competency: Engagement Competency TBD

ENVS 499H: Honors Independent Study (1 - 3 units)

Description: Qualified students working on an individual basis with professors who have agreed to supervise such work.

Grading basis: Regular Grades

Career: Undergraduate

Course Components: Independent Study Required

Repeatable: Course can be repeated a maximum of 99 times.

Course typically offered:

Main Campus: Fall, Spring, Summer

Enrollment requirement: Student must be active in the Honors College.

Honors Course: Honors Course

Honors Course: Honors Course

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 501: Sustainable Management of Arid Lands & Salt-Affected Soils (3 units)

Description: [Usually offered Spring, even numbered years] Principles and practices of soil, water and crop management under arid and semiarid conditions; the use of diagnostic procedures for evaluating soils and waters, reclamation, and economics of irrigation project development. Graduate-level requirements include an in-depth research paper on a single aspect of a current topic.

Grading basis: Regular Grades

Career: Graduate

Course Components: Lecture Required

Co-convened with: SWES 401

Course typically offered:

Main Campus: Spring

Enrollment requirement: ENVS 200 or Introductory Soils course or instructor consent.

ENVS 502: Nutrient Dynamics in Soils (3 units)

Description: Nutrient uptake by plant roots, soil microbial ecology, and soil chemical reactions affecting nutrients will be discussed and applied to environmental challenges related to nutrient cycling in arid land soils.

Grading basis: Regular Grades

Career: Graduate

Course Components: Lecture Required

Course typically offered:

Main Campus: Fall

Recommendations and additional information: ENVS 200.

ENVS 504: Irrigation Principles and Management (3 units)

Description: Principles of operating farm irrigation systems, evaluation of systems, selection of systems, basic irrigation scheduling, measurements of water flow, soil moisture, pump and system efficiencies. Graduate-level requirements include a special project on a current irrigation topic.

Grading basis: Regular Grades

Career: Graduate

Course Components: Lecture Required

Equivalent to: SWES 504

Also offered as: ASM 504

Co-convened with: SWES 404

Home department: Agricultural Education

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 506: Modeling of Mass and Energy Flow in Soils (3 units)

Description: Water flow in soils; closely related problems of solute, pollutant, and heat transfer; emphasis on current concepts and research.

Grading basis: Regular Grades

Career: Graduate

Course Components: Lecture Required

Equivalent to: ABE 605, ABT 605, AEN 605, HWRS 605, HYDR 605, SW 605

Also offered as: BE 506, HWRS 506

Course typically offered:

Main Campus: Fall

Recommendations and additional information: MATH 254.

ENVS 508: Scientific Writing for Environmental, Agricultural and Life Sciences (3 units)

Description: Effective writing is a valuable tool for any student aspiring for a career in the Environmental, Agricultural, and Life Sciences. This course will cover in-depth technical writing skills needed for scientific writing success, ranging from how to perform comprehensive reviews of the scientific literature, to performing peer reviews of the writing of fellow students. Ultimately, completion of this course will improve students' ability to write technical reports, theses and dissertations, and journal articles. Graduate-level requirements include work on theses, dissertations or journal articles.

Grading basis: Regular Grades

Career: Graduate

Course Components: Lecture Required

Course typically offered:

Main Campus: Spring

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 510: Microbial Biogeochemistry and Global Change (3 units)

Description: Microbes are the drivers of planetary biogeochemistry. They produce half the oxygen on the planet, and fix half the carbon. They introduce bioavailable forms of nitrogen into the biosphere. If human life ceased to exist, the central biogeochemical cycles would continue turning. However, while the planet's biogeochemistry can persist readily in the absence of human life, that does not mean that humankind's presence lacks impact. The Anthropocene (era of human impact) has seen significant changes to planetary stocks and fluxes of C, N, S, etc. Many of these changes involve or impact microbes, and have significant impacts on biogeochemical cycles. To understand microbial biogeochemistry in today's world, one must include the context of global change. And, conversely, one cannot understand the trajectory of global change without understanding microbial feedbacks via biogeochemical cycles. In this interdisciplinary undergraduate and graduate class we will cover major microbial biogeochemical cycles, and how these cycles are impacted by, and feedback to, global change. To understand the research in this area, we will discuss current methods in both microbial ecology and biogeochemistry, ranging from molecular meta-omics to the use of isotopes as biogeochemical tracers, with a particular emphasis on the challenges and opportunities of integrating these two disciplines. Lectures will be mixed with journal club-style readings and discussions, so active participation is essential. This course is designed for graduate students from diverse backgrounds and advanced undergraduates. Graduate-level requirements include (i) a twice-as-extensive background reading and synthesis component for their final presentation as the undergraduates, (ii) an active leadership role in group discussions.

Grading basis: Regular Grades

Career: Graduate

Course Components: Lecture Required

Also offered as: ECOL 510, GEOS 510, PLS 510

Co-convened with: SWES 410

Course typically offered:

Main Campus: Spring

Recommendations and additional information: Background in biology or biogeochemistry, and openness to interdisciplinary learning.

Interdisciplinary Interest Area: ECOL - Ecology & Evolution Bio

Interdisciplinary Interest Area: GEOS - Geosciences

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 511: Environmental Metabolomics (3 units)

Description: This is a 3 credit hours course aimed to provide an introduction to metabolomics, describes the tools and techniques we use to study the metabolome and explains why we want to study it.

Grading basis: Regular Grades

Career: Graduate

Course Components: Lecture Required

Course typically offered:

Main Campus: Spring

Recommendations and additional information: CHEM 142/144 or CHEM 152 or CHEM 162/164 and MCB 181R; or equivalent or instructor consent

Field trip: None

ENVS 515: Translating Environmental Science (3 units)

Description: Scientists speak a different language, a dialect filled with abstract symbolism, hypotheses and references to Latin and Greek. In this course, students learn journalism techniques to translate environmental science topics into language a layperson could appreciate. The writing concepts will apply to any field of science, as well as grant proposals, public reports and media including web-based publishing. Students also learn techniques for converting numbers into relevant statistics. Students will "workshop" in groups and work closely with the instructor to produce publication-quality articles on assigned or agreed-upon topics. The best of these could be posted on university-affiliated websites, with credit given to the author. Graduate-level requirements include an additional final project writing a grant proposal or writing a feature article for a specified magazine or newspaper worth 50 points and a higher level of expectation regarding writing and reviews of their peers' work.

Grading basis: Regular Grades

Career: Graduate

Course Components: Lecture Required

Co-convened with: SWES 415

Course typically offered:

Main Campus: Spring

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

Description: The purpose of this course is to enhance students knowledge and skills related to environmental risk assessment, including hazard assessment, exposure assessment, toxicity assessment, and risk characterization. Graduate-level requirements include conducting a case study that will require them to collect secondary data in the field.

Career: Graduate

Equivalent to: CPH 518

Co-convened with: SWES 418

Course typically offered:

Main Campus: Fall

ENVS 520: Environmental Physics (3 units)

Description: Environmental Physics covers how solar energy input, the atmosphere, the oceans, the terrestrial environment and the biosphere interact with each other at global and regional scales. Earth's systems are not static and the course will deal with their evolution over geological times and cover recent and projected future changes to the climate and ozone layer, among other topics that are important for society and its decision makers. This course emphasizes conceptual understanding of mechanisms, data sets and modeling techniques and uses elementary math and physics principles to guide student to a comprehensive, but practical, understanding of the physical aspects of the environment of planet Earth. Graduate students should have completed an introductory course in Calculus and Physics.

Career: Graduate

Co-convended with: SWES 420

Course typically offered:

Main Campus: Fall, Spring

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 522: Critical Zone Science & Management (3 units)

Description: This course targets undergraduate science majors and graduates interested in learning more about integrated and interdisciplinary team science while learning about the cross-cutting research and observational strategies employed across NSF's Critical Zone Observatory network. At least half of the course will focus on guided data analysis based on CZO data sets. Graduate-level requirements include working with more complex data sets and a 10-page research paper. In general, most seasonal-annual or multi-site data sets will qualify. Please discuss with your instructor prior to turning in a research paper proposal.

Grading basis: Regular Grades

Career: Graduate

Course Components: Lecture Required

Also offered as: GEOS 522, HWRS 522

Co-convened with:

Recommendations and additional information: Class participants must have completed at least one university/college-level lab-based science course and mathematics through pre-calculus

ENVS 524L: Plant Biotechnology (2 units)

Description: This course is designed for science undergraduates as well as graduate students who are interested in strengthening their hands-on experience with the techniques involved in developing superior food, feed and fiber crops.

Grading basis: Regular Grades

Career: Graduate

Course Components: Laboratory Required

Also offered as: MCB 524L, PLS 524L

Co-convened with: SWES 424L

Course typically offered:

Main Campus: Spring

Recommendations and additional information: PLS 340, 360

Home department: School of Plant Science

ENVS 524R: Plant Biotechnology (3 units)

Description: This course is designed for science undergraduates as well as graduate students who are interested in strengthening their knowledge of the techniques involved in developing superior food, feed and fiber crops.

Grading basis: Regular Grades

Career: Graduate

Course Components: Lecture Required

Also offered as: MCB 524R, PLS 524R

Course typically offered:

Main Campus: Spring

Recommendations and additional information: PLS 340, 360

Home department: School of Plant Science

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 525: Environmental Microbiology (3 units)

Description: Current concepts in water quality, aerobiology and microbial biogeochemistry. Graduate-level requirements include extra journal readings and more comprehensive exams.

Grading basis: Regular Grades

Career: Graduate

Course Components: Lecture Required

Equivalent to: IMB 525, MBIM 525, MICR 525, SW 525

Also offered as: IMB 525

Co-convened with: SWES 425

Course typically offered:

Main Campus: Fall

ENVS 526: Environmental Microbiology Laboratory (2 units)

Description: Basic techniques for isolation and characterization of environmental soil and water microflora including methods for enumeration and measurement of physiological activity.

Graduate-level requirements include additional assignments.

Grading basis: Regular Grades

Career: Graduate

Course Components: Laboratory Required

Equivalent to: IMB 526, MBIM 526, MICR 526, SW 526

Also offered as: IMB 526

Co-convened with:

Course typically offered:

Main Campus: Fall

ENVS 528L: Microbial Genetics Laboratory (2 units)

Description: Laboratory associated with lecture course on Prokaryotic gene structure and function; methods of gene transfer and mapping, DNA structure, replication, transcription, and translation. Hands-on computer analysis of DNA sequences and gene cloning strategies. Graduate-level requirements include the DNA sequence of an entire operon from any one of a variety of bacteria and additionally analyze one product from the operon using several GCG protein analysis programs. Also extra exam questions.

Grading basis: Regular Grades

Career: Graduate

Flat Fee: \$70

Course Components: Laboratory Required

Equivalent to: ECOL 528L, MCB 528L, MIC 528L, MICR 528L, PLS 528L, SWES 528L, VSC 528L

Also offered as: ACBS 528L, ECOL 528L, MCB 528L, MIC 528L, PLP 528L, PLS 528L

Co-convened with: ENVS 428L

Course typically offered:

Main Campus: Spring

Home department: Plant Pathology

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 528R: Microbial Genetics (3 units)

Description: Prokaryotic gene structure and function; methods of gene transfer and mapping, DNA structure, replication, transcription, and translation. Hands-on computer analysis of DNA sequences and gene cloning strategies. Principles of regulation of gene expression. Graduate-level requirements include a DNA sequence of an entire operon from any one of a variety of bacteria and additionally analyze one product from the operon using several GCG protein analysis programs plus an extensive exam.

Grading basis: Regular Grades

Career: Graduate

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| Course Components: | Lecture | Required |
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Equivalent to: ECOL 528R, GENE 528, GENE 528R, MCB 528R, MIC 528R, MICR 528R, PLP 528, PLS 528R, SWES 528R, VSC 528R

Also offered as: ACBS 528R, ECOL 528R, MCB 528R, MIC 528R, PLP 528R, PLS 528R

Co-convened with:

Course typically offered:

Main Campus: Spring

Distance Campus: Spring

Home department: Plant Pathology

ENVS 530L: Environmental Monitoring and Remediation Lab (1 unit)

Description: The laboratory/field trip part (SWES 430L/530L) focuses on hands-on, laboratory and field experiences design to help the student better understand the principles of and the tools necessary for environmental monitoring. Basic principles and reviewed during lecture (SWES 430R/530R) as necessary to assist the student in connecting theory with hands-on experiences in the lab and the field. Students are required to complete several problems, review publications, and write weekly or bi-weekly reports that summarize each of the nine topics covered, their laboratory/field trip experiences, and provide answers to questions and exercises. Graduate-level requirements include completion of an independent project for an additional 100 points. This project will consist of either a research paper or a special field/data collection/report on topics agreed upon. The exact format and length of this project is to be determined.

Grading basis: Regular Grades

Career: Graduate

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| Course Components: | Laboratory | Required |
| | Lecture | May Be Offered |

Co-convened with: SWES 430L

Course typically offered:

Main Campus: Fall, Spring

Recommendations and additional information: Concurrent registration, SWES 530R.

-SA represents a Student Abroad & Student Exchange offering

-**CC** represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

Description: Designed to provide the graduating students and interested graduates with a combination of lectures, labs and field trips that describe relevant topics in environmental monitoring, characterization and remediation. The topics covered include: basic statistics, data quality, field surveying, near-surface air measurement, automated data acquisition, soil, vadose zone and groundwater sampling and monitoring, soil and water biological properties, including pathogen monitoring and remote sensing. This course focuses on hands-on, laboratory and field experiences design to help the student better understand the principles of and the tools necessary for environmental monitoring. Basic principles and reviewed during lecture as necessary to assist the student in connecting theory with hands-on experiences in the lab and the field. Students are required to complete several problems, review publications, and write weekly or bi-weekly reports that summarize each of the nine topics covered, their laboratory/field trip experiences, and provide answers to questions and exercises. Graduate-level requirements include an independent project for an additional 100 points. This project will consist of either a research paper or a special field/data collection/report on topics agreed upon. The exact format and length of this project is to be determined.

Main Campus: Fall, Spring

Field trip: There will be 4 field trip reports and 1 final report. Field trip reports will summarize the major soil and landscape properties across the Tucson Basin as well as examine soils across the elevation gradient of the Santa Catalina Mountains.

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 531A: Traditional Ecological Knowledge (3 units)

Description: An introduction to the growing literature on traditional ecological knowledge and its relationships to the ecological and social sciences. Graduate-level requirements include preparing for and leading a class discussion on a specific topic.

Grading basis: Regular Grades

Career: Graduate

Course Components: Lecture Required

Also offered as: AIS 531A, ANTH 531A, GEOG 531A, RAM 531A, RNR 531A, WFSC 531A, WSM 531A

Co-convener with: SWES 431A

Course typically offered:

Main Campus: Fall

Home department: American Indian Studies Committee

ENVS 536: Agro-ecology (3 units)

Description: Agro-ecology is the application of ecological principles to the production of food and fiber. The underlying goals are to assess and promote the long-term sustainability of agricultural production systems. Through this course we will study how agro-ecosystems vary across time and space and will examine the trade-offs associated with different cropping systems and management practices. We will begin with a brief history of major trends in agriculture, then examine the ecological interactions involved in crop production, observe how these interactions shape agricultural practices and conclude with a discussion of domestic and international government policies that influence agricultural sustainability. Graduate-level requirements include leading one class discussion and taking a more in-depth take-home midterm exam.

Grading basis: Regular Grades

Career: Graduate

Course Components: Lecture Required

Also offered as: EIS 536, PLS 536, RNR 536

Co-convened with: SWES 436

Course typically offered:

Main Campus: Spring

Home department: Committee on Entomology and Insect Science

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

Description: Broadly covers fundamental topics in the atmospheric sciences. Topics include composition of the atmosphere, atmospheric thermodynamics, atmospheric chemistry, cloud physics, radiative transfer, atmospheric dynamics, and climate. Graduate-level requirements include additional questions on homework and exams plus a term paper on a specialized research topic.

Career: Graduate

Equivalent to: GEOG 536A, GEOS 536A, HWRS 536A, PHYS 536A, SWES 536A

Also offered as: ATMO 536A, GEOG 536A, HWRS 536A

Co-convened with:

Course typically offered:

Main Campus: Spring

Home department: Hydrology and Atmospheric Sciences

Interdisciplinary Interest Area: GEOS - Geosciences

Interdisciplinary Interest Area: PHYS - Physics

Description: Description of modern pollution problems and potential biological remediation techniques focusing on the chemistry, biochemistry and molecular biology of biodegradation of hazardous and toxic compounds. Graduate-level requirements include analysis and oral presentation of a remediation case study and more comprehensive exams.

Grading basis: Regular Grades

Career: Graduate

Course Components: Lecture Required

Equivalent to: IMB 540, MBIM 540, SW 540

Also offered as: IMB 540

Co-convened with: SWES 440

Course typically offered:

Main Campus: Spring

Description: Physical and chemical processes and mineralogy of weathering and soil formation; quantitative pedology; the soil as part of the ecosystem.

Grading basis: Regular Grades

Career: Graduate

Course Components: Lecture Required

Equivalent to: GEOS 541, SW 541

Also offered as: GEOS 541

Course typically offered:

Main Campus: Spring (odd years only)

Recommendations and additional information: GEOS 251, CHEM 103B.

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

Description: This course is a survey of basic issues and concepts in natural resource management and the environment in Native communities using integrated case studies that survey all the major varieties of environmental issues in Indian Country in the 21st century. A central theme will be developing tribally-specific solutions to rebuilding the resiliency of degraded ecosystems. We will consider particular case studies such as: tribal sovereignty, land tenure, reserved rights and Native claims; Native knowledge systems and Western science; co-management and restoration; water; fish and wildlife; agriculture and rangeland management; energy, mining and nuclear waste; and global climate change. Graduate-level requirements include Increased length of writing assignments.

Career: Graduate

Equivalent to: ARL 541A, RAM 541A, RNR 541A, SWES 541A, WFSC 541A, WSM 541A

Also offered as: AIS 541A, ARL 541A, RAM 541A, RNR 541A, WFSC 541A, WSM 541A

Co-convened with: SWES 441A

Course typically offered:

Main Campus: Fall, Spring

Home department: American Indian Studies Committee

Description: Study of lakes and streams; biological characteristics, as related to physical, chemical, geological, and historical processes operating on fresh waters. Graduate-level requirements include a report that synthesizes literature on a research issue of current concern, an in-class presentation and several discussion meetings.

Career: Graduate

Flat Fee: \$23

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| Course Components: | Laboratory Lecture | May Be Offered Required |
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Equivalent to: ECOL 541

Also offered as: ECOL 542, WFSC 542

Co-convended with: WFSC 441

Field trip: Weekend field trip

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 544: Applied Environmental Law (3 units)

Description: A guided journey through real world environmental law; U.S. legal system, major environmental laws-criminal and civil; common marketplace problems and solutions; high profile cases; essential professional skills. Graduate-level requirements include extra term papers and case studies.

Grading basis: Regular Grades

Career: Graduate

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| Course Components: | Lecture | Required |
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Equivalent to: WSM 544

Also offered as: WSM 544

Co-convened with: SWES 444

ENVS 550: Green Infrastructure (3 units)

Description: The goal of this course is the advancement of students' knowledge and capabilities regarding Green Infrastructure concepts and the issues and techniques involved in implementation of Green Infrastructure. The course provides an overview as well as more in-depth coverage of the science, practical context, and creation of Green Infrastructure. The built environment of arid regions is emphasized, with Tucson Case Studies providing practical focus to content and learning objectives. The term Green Infrastructure, as used in this course, aligns with the following EPA description: "Green infrastructure uses vegetation, soils, and natural processes to manage water and create healthier urban environments... at the scale of a neighborhood or site, green infrastructure refers to stormwater management systems that mimic nature by soaking up and storing water." The course features lectures, interactive discussions and presentations, and guest presentations and tours led by experts in their fields. Students take a series of quizzes, a mid-term and a final exam, along with a number of homework assignments / exercises. A special research report is required of Graduate Students.

Grading basis: Regular Grades

Career: Graduate

Course Components: Lecture Required

Also offered as: LAR 550, PLG 550, SBE 550

Co-convened with: ENVS 450

Course typically offered:

Main Campus: Fall

Field trip: A number of potential tours are proposed to allow students to engage with applied contexts and professionals in the field.

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 554: Water Harvesting (3 units)

Description: Course focuses on water harvesting principles and techniques at a variety of scales and settings. Students participate in hands-on implementation of water harvesting projects on the UA campus.

Grading basis: Regular Grades

Career: Graduate

Course Components: Lecture Required

Equivalent to: ECOL 554, WFSC 554

Also offered as: ECOL 554, WFSC 554

Co-convened with: SWES 454

Course typically offered:

Main Campus: Spring

ENVS 555: Introduction to Atmospheric and Hydrology Remote Sensing (3 units)

Description: The purpose of this course is to introduce the basic remote sensing techniques and their applications to the atmosphere, hydrology and other fields. This includes understanding the basic concepts of radiation transfer, passive and active remote sensing, satellite and ground-based remote sensing and their retrieval techniques. Finally, inversion techniques in remote sensing will be briefly introduced and the uncertainties/errors of the retrieved cloud and precipitation properties will be estimated. Graduate students will do some homework, but primarily work on processing and analyzing the aircraft, ground-based and satellite remote sensing data collected from instructors research projects. Graduate students will get hands-on experience by doing these projects using IDL, MATLAB, FORTRAN, or other programs. For some projects, I may provide key codes as a reference.

Grading basis: Regular Grades

Career: Graduate

Course Components: Lecture Required

Also offered as: ARL 555, ATMO 555, GEOS 555, HWRS 555, OPTI 555, REM 555

Course typically offered:

Main Campus: Spring

Home department: Hydrology and Atmospheric Sciences

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 560: Environmental Science Research from Field to Lab (3 units)

Description: In this course, we will explore the range of environmental research from field to laboratory. Students will visit various research sites, from disturbed, managed, and natural ecosystems. You will learn about research methods, instrumentation, as well as data and sample collection. You will collect samples, process them in a laboratory, and interpret the data.

Grading basis: Regular Grades

Career: Graduate

Course Components: Lecture Required

Co-convened with: ENVS 460

Course typically offered:

Main Campus: Summer

Recommendations and additional information: Graduate Students; introductory coursework in soils, introductory coursework in statistics.

Field trip: Sweetwater wetlands at WEST Center; Waterman Mountains; San Simon, AZ; Biosphere II Hillslope; Maricopa Ag Center; Mt Bigelow; Santa Rita Experimental Range;

ENVS 561: Soil and Water Conservation (3 units)

Description: Consideration of major world soil and water conservation problems and solutions; principles of soil and water degradation by erosion, ground water overdraft, chemical transport in surface and ground water and their effects on world food production and environmental problems. Graduate-level requirements include an in-depth research paper on a single aspect of a current topic.

Grading basis: Regular Grades

Career: Graduate

Course Components: Lecture Required

Co-convened with: SWES 461

ENVS 562: Environmental Soil and Water Chemistry (3 units)

Description: Introduction to the principal chemical constituents and processes occurring in soils and sediments. The objective of the course is to provide students with a conceptual framework for understanding chemical reactions in heterogeneous natural systems. Applications to biogeochemistry and environmental quality will be presented, but fundamental principles will be emphasized. A general chemistry text is a useful additional reference, and it should be consulted for questions regarding concepts that may not be fully reviewed in lecture or the required text. Graduate-level requirements include a term paper that involves independent literature research in a course-related subject of the student's choice.

Grading basis: Regular Grades

Career: Graduate

Course Components: Lecture Required

Co-convened with: ENVS 462

Course typically offered:

Main Campus: Spring

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 563: Advanced Soil and Water Chemistry (3 units)

Description: Natural soils and waters are heterogeneous systems with many important reactions occurring at the interface between solid, liquid and gas phases. The fate of chemicals that impact on terrestrial and aquatic systems is controlled largely by their behavior at these interfaces, particularly as that behavior influences chemical speciation and the relative affinity for solid and aqueous phases. Our objective is to understand how molecular-scale solution-phase and surface reactions influence macroscopic chemical processes such as sorption-desorption, precipitation-dissolution, oxidation-reduction and particle interactions. The course will cover fundamentals of aqueous surface and colloid chemistry through lecture and assigned readings. Current research in the field will be explored through independent literature research and the preparation of a term paper.

Grading basis: Regular Grades

Career: Graduate

Course Components: Lecture Required

Recommendations and additional information: SWES 462, CHEM 103B, CHEM 480A.

ENVS 564: Environmental Organic Chemistry (3 units)

Description: Physical and chemical processes influencing the behavior of contaminants in the subsurface environment. Includes equilibrium and kinetic theory of solubilization-dissolution, volatilization, sorption, hydrolysis, photolysis, surface catalysis and radioactive decay. Graduate-level requirements include a project involving literature research in environmental chemistry.

Grading basis: Regular Grades

Career: Graduate

Course Components: Lecture Required

Repeatable: Course can be repeated a maximum of 4 times.

Co-convened with: SWES 464

Course typically offered:

Main Campus: Fall

ENVS 565: Contaminant Transport in Porous Media (3 units)

Description: This course examines the transport and fate of contaminants in other constituents in the subsurface environment (including the vadose zone and groundwater systems). The emphasis is on developing a thorough understanding of the critical processes and factors that influence transport and fate, including advection, dispersion, interphase mass transfer, transformation reactions, and physical and biogeochemical heterogeneity of porous media. Topics covered include aqueous (dissolved) constituents, nanoparticles and colloids in multi-phase systems (admissible liquids, vapor).

Grading basis: Regular Grades

Career: Graduate

Course Components: Lecture Required

Course typically offered:

Main Campus: Spring (odd years only)

Recommendations and additional information: ENVS 570 or HWRS 518 or HWRS 531.

-SA represents a Student Abroad & Student Exchange offering

-**CC** represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 566: Soil and Groundwater Remediation (3 units)

Description: This course examines the characterization and remediation of contaminated hazardous waste sites. The course is focused on the scientific and engineering principles supporting site characterization and remediation activities. Standard and innovative technologies are covered. Multiple individual and team projects based on real-world examples are used to provide hands-on practical experience

Grading basis: Regular Grades

Career: Graduate

Course Components: Lecture Required

Equivalent to: HWRS 566, SW 566

Also offered as: HWRS 566

Course typically offered:

Main Campus: Spring (even years only)

Recommendations and additional information: HWRS 531 or equivalent; SWES 564 or equivalent.

ENVS 567: Introductory Statistics and Multivariate Statistics with R (3 units)

Description: The course (3 unit class) will teach the fundamentals of coding and programming using the R language (<https://www.r-project.org/>). The students will use code examples and practice problems to understand the statistical as well as the scientific viewpoint. Using R, students will explore and visualize real-world data and derive meaningful interpretations. The course will cover introductory statistics (descriptive statistics, hypothesis testing, t-test, ANOVA, correlation, regression) and multivariate statistics with a focus on ecological analyses (diversity, cluster analysis, unconstrained ordination, constrained ordination).

Grading basis: Regular Grades

Career: Graduate

Course Components: Lecture Required

Course typically offered:

Main Campus: Spring

Recommendations and additional information: ENVS 275 or Math 263, an introductory college-level, statistics course, or instructor consent.

Field trip: None

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 568: Molecular Biogeochemistry (2 units)

Description: The course is devoted to reading and discussion of papers in the emerging field of environmental molecular biogeochemistry. Through reading and discussion, we will explore experiments and models designed to understand coupled biotic-abiotic (e.g., biomineralization, oxidation-reduction) processes in environmental systems. Emphasis is placed on how molecular-scale techniques (e.g., spectroscopy) may be used to probe interactions between chemicals and natural media such as minerals, organic matter and biomass.

Grading basis: Regular Grades

Career: Graduate

Course Components: Lecture Required

Recommendations and additional information: SWES 462/562 and CHEM 152, or permission of instructor.

ENVS 569B: Air Pollution II: Aerosols (3 units)

Description: An introduction to the chemistry and physics of atmospheric aerosols. Topics include aerosol sources and sinks; basic aerosol properties; single aerosol mechanics; aerosol population dynamics; atmospheric aerosol optics; aerosols and climate; aerosols and health; regional haze; aerosol measurement techniques. Graduate-level requirements include additional homework and other exercises.

Grading basis: Regular Grades

Career: Graduate

Course Components: Lecture Required

Equivalent to: CHEE 569B, CHEE 596B, SWES 569B

Also offered as: ATMO 569B, CHEE 569B

Co-convened with: SWES 469B

Course typically offered:

Main Campus: Spring (odd years only)

Home department: Hydrology and Atmospheric Sciences

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 570: Soil Physics (3 units)

Description: The course provides the theoretical and practical basis for understanding and quantifying physical and hydrological properties of soils. Hydro-physical processes taking place near the Earth's surface emphasizing mass and energy exchange, and transport processes in saturated and partially-saturated soils at multiple scales are discussed. The coupling with the atmosphere and the role of plants in the hydrological cycle will be studied. Modern measurement methods and analytical tools for hydrological data collection and interpretation will be reviewed. Graduate-level requirements include an in-depth research paper on a single aspect of a current topic.

Grading basis: Regular Grades

Career: Graduate

| | | |
|---------------------------|------------|----------|
| Course Components: | Laboratory | Required |
| | Lecture | Required |

Co-convened with: ENVS 470

Course typically offered:

Main Campus: Spring

ENVS 572: Interfacial Chemistry of Biomolecules in Environmental Systems (3 units)

Description: Taught in even years. Introduction to the chemical and adhesive properties of macromolecules at interfaces. The fundamental physico-chemical forces that govern adsorption of macromolecules at interfaces and inter-particle adhesion will be discussed. Topics such as surface tension, self-assembly, adsorption of polymers and biomolecules, and bacterial cell adhesion will be discussed with emphasis on environmental applications.

Grading basis: Regular Grades

Career: Graduate

| | | |
|---------------------------|---------|----------|
| Course Components: | Lecture | Required |
|---------------------------|---------|----------|

Equivalent to: CHEE 572

Also offered as: CHEE 572

Course typically offered:

Main Campus: Spring (even years only)

Recommendations and additional information: CHEM 152 or CHEM 162 required or permission of instructor.

ENVS 573: Monitoring Biosphere Process (3 units)

Description: Global-scale interactions of soils with their plant cover and climate. The spatial distributions and dynamics of soil-plant-water processes with emphasis on measurements from space.

Grading basis: Regular Grades

Career: Graduate

| | | |
|---------------------------|---------|----------|
| Course Components: | Lecture | Required |
|---------------------------|---------|----------|

Recommendations and additional information: SWES 330 or SWES 453; SWES 200.

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 574: Aquatic Plants and the Environment (4 units)

Description: The role of riparian areas, estuaries, and constructed wetlands in the environment. Emphasis on plants as wildlife habitat for nutrient cycling and bioremediation. Graduate-level requirements include an additional research project and class presentation.

Grading basis: Regular Grades

Career: Graduate

Course Components: Lecture Required

Also offered as: ECOL 574, WFSC 574

Co-convened with: SWES 474

Course typically offered:

Main Campus: Fall

ENVS 575: Freshwater and Marine Algae (4 units)

Description: Systematics, ecology, and evolution of planktonic and benthic species; field techniques and lab culture. Graduate-level requirements include a special topic report on an aspect of freshwater algae.

Grading basis: Regular Grades

Career: Graduate

Flat Fee: \$25

Course Components: Lecture Required

Equivalent to: SWES 575, WFSC 575

Also offered as: ECOL 575, WFSC 575

Course typically offered:

Main Campus: Spring

Home department: Ecology & Evolutionary Biology

ENVS 576: Natural Resource Law and Economics (3 units)

Description: Advanced economic and legal analysis of environmental and natural resource policies.

Grading basis: Regular Grades

Career: Graduate

Course Components: Lecture Required

Equivalent to: ECON 576, HWRS 576, RNR 576

Also offered as: AREC 576, ECON 576, HWRS 576, LAW 576, RNR 576

Course typically offered:

Main Campus: Spring

Recommendations and additional information: ECON 361 recommended but not required. Must have graduate standing to enroll.

Home department: Agricultural & Resource Economics

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 577: Principles of Ecotoxicology (3 units)

Description: Ecotoxicology is the study of the biochemical and molecular effects of chemical toxicants and non-chemical stressors, singly or in mixtures, on biological organization ranging from the individual to assemblages and ecosystems. Some of the detrimental effects of toxicants and stressors are acute causing immediate ecological and physiological harm, while many others are insidious and chronic causing long-term damage to populations over multiple generations. This course will provide knowledge to students of the very broad range of anthropogenic stressors and toxicants as well as their physiological and sometimes, behavioral, effects on individuals and populations of organisms. Ecotoxicology is a multidisciplinary endeavor involving ecology, biology (anatomy, physiology, genetics, microbiology), chemistry (inorganic, organic, biochemical, analytical), epidemiology, statistics, soil, water and atmospheric sciences. The goal of this course is to provide requisite tools for students to gain insight into understanding such a complex discipline as ecotoxicology. Specifically, this course will describe some known environmental toxins and their effects, methods to study the nature, extent, movement, and exposure routes of environmental contamination, and techniques to quantify toxicant effects on individual organisms and populations. This course will also describe the current regulatory framework that governs contaminants as well as tools used by scientists, managers, and regulators.

Grading basis: Regular Grades

Career: Graduate

Course Components: Lecture Required

Co-convened with: ENVS 477

Course typically offered:

Main Campus: Spring

Field trip: 2 scheduled, 1 mandatory in-class trip to ALEC Lab and 1 optional on a Saturday to the Santa Cruz River.

ENVS 579: Boundary Layer Meteorology & Surface Processes (3 units)

Description: Designed for students in the atmospheric sciences, hydrology and related fields. It provides a framework for understanding the basic physical processes that govern mass and heat transfer in the atmospheric boundary layer and the vegetated land surface. In addition to the theoretical part of the course, there is a strong focus on modeling and students will be required to program numerical codes to represent these physical processes.

Grading basis: Regular Grades

Career: Graduate

Course Components: Lecture Required

Repeatable: Course can be repeated a maximum of 2 times.

Also offered as: ATMO 579, HWRS 579, PTYS 579, WSM 579

Course typically offered:

Main Campus: Spring (even years only)

Recommendations and additional information: MATH 223, PHYS 141, PHYS 253.

Home department: Hydrology and Atmospheric Sciences

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

Description: The goal of this course is to advance students' knowledge of various concepts and methods used in assessing human-impacted resources such as contaminated sites, waste places, and disturbed sites to ensure efficient and effective remediation and restoration programs. Focusing on contaminated sites, the course covers socioeconomic, biophysical, political, and cultural dimensions of the impacted sites as well as the assessment of the sustainability of remedial options. The course is delivered through interactive lectures, discussions, and classroom presentations, and is team taught by faculty with varied expertise.

Career: Graduate

Co-convened with: ENVS 480

Main Campus: Fall

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

Description: We are now living in the Anthropocene, meaning human activity has been the dominant influence on climate and the environment. Humans have impacted the land in numerous ways, such as mining and other resource extraction activities, agriculture, urban development, industrial activities, and waste production. For example, in the U.S. alone, there are approximately 235,000-355,000 hazardous waste sites (USEPA, 2004). These activities have impacted our ecosystem and the services they provide for human health and well-being. It is critical to reclaim and redevelop these lands in order to improve ecosystem and public health. There is much work to be done and this is a time for innovation! It is critical to generate salient solutions to managing and redeveloping human impacted lands. This course will introduce the concepts and methods governing the sustainable management, restoration, and redevelopment of human-impacted lands. The topics covered include: soil quality concepts; the energy-water-food nexus; redevelopment of brownfields and other impacted lands; reclamation of mining and other resource-extraction sites; natural-disaster cleanup; urban agriculture and community gardens. Using an inquiry-based approach, students will learn how to develop solutions based on environmental science, ecological principles, and management efficacy. Through class projects and case studies, students will work through a multi-step process, including: site assessment, setting remediation/reclamation/restoration goals, developing possible solutions, and methods to determine effectiveness/indicators of success. Graduate-level requirements include an additional report and a demonstration of undergraduate mentoring and team leadership. At the graduate-level there is a higher level of expectation with regards to writing and peer review. These activities are worth 30 points.

Career: Graduate

Co-convened with: ENVS 482

Main Campus: Spring

Field trip: Field trips to local sites in Tucson.

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 583: Geographic Applications of Remote Sensing (3 units)

Description: Use of aircraft and satellite imagery for monitoring landforms, soils, vegetation and land use, with the focus on problems of land-use planning, resource management and related topics. Graduate-level requirements include the completion of a project report.

Grading basis: Regular Grades

Career: Graduate

Flat Fee: \$50

Course Components: Lecture Required

Equivalent to: PLAN 583, PLN 583, PLNG 583, RNR 583, SWES 583

Also offered as: GEOG 583, PLG 583, RNR 583

Co-convened with: ENVS 483

Course typically offered:

Main Campus: Spring

Online Campus: Spring

Field trip: Field trip.

Home department: School of Geography and Development

ENVS 590: Remote Sensing for the Study of Planet Earth (3 units)

Description: Remote Sensing for the Study of Planet Earth introduces basic and applied remote sensing science as a means to explore the diversity of our planetary environments (biosphere, atmosphere, lithosphere and hydrosphere) within the radiometric, spectral, spatial, angular and temporal domains of remote sensing systems. This survey course strikes a balance between theory, applications and hands-on labs and assignments. We explore how you can download, process, analyze and interpret multi-sensor data and integrate online remotely sensed data sources/products into your research of interest.

Grading basis: Regular Grades

Career: Graduate

Flat Fee: \$50

Course Components: Lecture Required

Equivalent to: ARL 590, ARL 590, ATMO 590, GEN 590, GEOG 590, GEOS 590, HWRS 590, MNE 590, OPTI 590, RNR 590, SW 590, SWES 590

Also offered as: ARL 590, ATMO 590, GEOG 590, GEOS 590, HWRS 590, MNE 590, OPTI 590, REM 590, RNR 590

Co-convened with: ENVS 490

Course typically offered:

Main Campus: Fall

Home department: GIDP on Remote Sensing and Spatial Analysis

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 593: Internship (1 - 3 units)

Description: Specialized work on an individual basis, consisting of training and practice in actual service in a technical, business, or governmental establishment.

Grading basis: Alternative Grading: S, P, F

Career: Graduate

Course Components: Independent Study Required

Repeatable: Course can be repeated a maximum of 99 times.

Course typically offered:

Main Campus: Fall, Spring, Summer

ENVS 595: Colloquium (1 unit)

Description: The exchange of scholarly information and/or secondary research. Instruction often includes lectures by several different persons. Research projects may or may not be required of course registrants.

Grading basis: Alternative Grading: S, P, F

Career: Graduate

Course Components: Colloquium Required

Repeatable: Course can be repeated for a maximum of 2 units.

Course typically offered:

Main Campus: Fall, Spring

ENVS 595A: Environmental Conservation in Australia (6 units)

Description: Australia hosts a large number of endemic plants and animals, with human settlement dating back over 20,000 years. With a combination of high biodiversity and long-term human interaction, it is an ideal location to explore topics in environmental science, including non-native species introductions, soil and water conservation, and fire management in the landscape. This class will allow participants to collaborate with Australian scientists and conservation organizations in current environmental research, while discovering the flora and fauna that make this country exceptional. Open to all majors, the multidisciplinary approach of the class also makes it an ideal capstone experience for the Environmental Science degree. Graduate level requirements include a research paper or project as described in syllabus.

Grading basis: Regular Grades

Career: Graduate

Course Components: Colloquium Required

Co-convened with: ENVS 495A

Course typically offered:

Main Campus: Summer

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 595F: Conservation Biology: Field Studies in Developing Countries (3 - 6 units)

Description: Many of the world's biological "hot spots", as well as some of the most critically threatened ecosystems are in developing nations and are in the greatest need for biological research. In this course, students will be able to step out of the classroom and into the real world to experience first hand the critical role that field biologists play in conservation. Students will be introduced to novel ecosystems and exposed to conservation issues faced by developing nations. Students will use the local environment as a laboratory to learn field research techniques and methodology. For students interested in the biological sciences, conducting field research "in situ" is invaluable in their professional development. The opportunity to visit a foreign country and be exposed to a different culture and environment can be a life-changing experience. The objective of this course is to provide that experience in the context of biological research and the development of conservation professionals. Graduate-level requirements include developing an individual field project including a separate paper (in scientific format) to be submitted with the final deliverables.

Grading basis: Regular Grades

Career: Graduate

Course Components: Colloquium Required

Repeatable: Course can be repeated a maximum of 3 times.

Equivalent to: SWES 595F

Also offered as: RNR 595F

Co-convened with: ENVS 495F

Course typically offered:

Main Campus: Summer

Home department: Renewable Natural Resources

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 595G: Amazon Rainforest Conservation Biology in Ecuador (3 units)

Description: Located in the Amazon rainforest near the Equator, the Shiripuno River/Yasuni National Park region is considered to have the world's greatest biodiversity. After arriving in Quito, the capitol of Ecuador, we will travel to Puerto Francisco de Orellana, the gateway to the Amazon rainforest. From there we will travel by bus to the Shiripuno River (a tributary of the Amazon River) where Huaorani Guides will take us by boat to the Shiripuno Field Station. Along the way we will see several species of macaws, tapirs, monkeys, and turtles. The Shiripuno Field Station is maintained by the local Huaorani tribe and will function as our field station for the majority of the class. With comfortable accommodations and an extensive network of well-maintained trails in pristine rainforest, it is an ideal location to have a once-in-a-lifetime experience. We will conduct multiple tours of the area guided by Huaorani field experts to observe plants, birds, amphibians, reptiles, mammals, and many other unique features of this amazing area. Each student will be given the opportunity to develop and implement a unique research project. Research topics can include a biological inventory, soil analysis, working with Huaoranis to understand their perspectives of the environment, and investigate the conflict of oil development with the tremendous natural resources of the region in one of the last untouched rainforests on Earth. Graduate level requirements will be the same as for the undergraduate level.

Grading basis: Regular Grades

Career: Graduate

Course Components: Colloquium Required

Also offered as: RNR 595G

Co-convened with:

Course typically offered:

Main Campus: Summer

Home department: Renewable Natural Resources

ENVS 596B: Water Policy in Arizona and Semi-arid Regions (3 units)

Description: This course focuses on current water policy in Arizona, the Colorado River Basin, and other semi-arid regions from a multi-disciplinary perspective. Through readings, research, lectures, discussions, and presentations, the student is exposed to major, current water resource issues and policies to address them. The professor and guest lecturers draw upon their experiences to demonstrate the development, analysis and implementation of real-world water policy.

Grading basis: Regular Grades

Career: Graduate

Course Components: Seminar Required

Equivalent to: GEOG 596B, HWRS 596B, LAW 596B

Also offered as: GEOG 596B, HWRS 596B, LAW 596B, PLG 596B

Course typically offered:

Main Campus: Spring

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 597F: Community and School Garden Workshop (2 - 6 units)

Description: This workshop-based course is designed to enable UA undergraduate and graduate students to work in Tucson-area schools and community sites helping stakeholders to plant, harvest and prepare foods from their garden as well as use the garden as a learning space. As a member of a school or community garden team, students are likely to cover a wide range of activities from maintaining a compost pile to administering lesson plans for teaching in the garden to weeding, planting, and organizing work crews. In addition to attending one 3-hour weekend workshop, students are required to attend weekly class meetings on the UA campus. Most of the course, however, revolves around independent and sustained involvement with a Tucson school or community garden. No teaching or gardening experience is required.

Grading basis: Regular Grades

Career: Graduate

Course Components: Workshop Required

Repeatable: Course can be repeated for a maximum of 9 units.

Also offered as: AIS 597F, GEOG 597F, LAS 597F, NSC 597F, PLS 597F, STCH 597F, TLS 597F

Co-convened with: ENVS 497F

Course typically offered:

Main Campus: Fall, Spring

Home department: School of Geography and Development

ENVS 599: Independent Study (1 - 4 units)

Description: Qualified students working on an individual basis with professors who have agreed to supervise such work. Graduate students doing independent work which cannot be classified as actual research will register for credit under course number 599, 699, or 799.

Grading basis: Alternative Grading: S, P, F

Career: Graduate

Course Components: Independent Study Required

Repeatable: Course can be repeated a maximum of 99 times.

Course typically offered:

Main Campus: Fall, Spring, Summer

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 616: Arizona Cropping Systems (1 unit)

Description: Students will learn various crop production systems and understand challenges, production practices, technologies, pests and diseases in Arizona agriculture. Students will be able to associate impact of plant and microbial sciences in arid land agriculture. This course consists of 7 field trips scheduled on selected Fridays during fall semester. The last trip will be a Friday/Saturday trip to the Yuma area.

Grading basis: Regular Grades

Career: Graduate

Course Components: Laboratory Required

Also offered as: PLP 616, PLS 616

Course typically offered:

Main Campus: Fall

Home department: Plant Pathology

ENVS 619: Ecology of Savannas, Shrublands, and Woodlands (3 units)

Description: [Taught Spring semester in even-numbered years] The functional ecology and dynamics of biogeographically diverse savanna, shrubland and woodland ecosystems will be examined. Interactions among co-occurring life forms and growth forms will be emphasized with in the context of climate, soils and disturbance.

Grading basis: Regular Grades

Career: Graduate

Course Components: Lecture Required

Equivalent to: ARL 619, ECOL 619, GEOG 619, SWES 619

Also offered as: ARL 619, ECOL 619, GEOG 619, RAM 619

Course typically offered:

Main Campus: Spring (even years only)

Home department: Range Management

ENVS 641: Water Law (3 units)

Description: The course in Water Law traditionally emphasizes state law rules that govern rights to use surface water and groundwater throughout the country. Although we will give ample attention to the prior appropriation doctrine, riparian water rights, and various systems for regulating groundwater use, this course will also emphasize how federal law may impact water rights. Increasingly, environmentalists and others claim that there are public rights to water that may take precedence over rights under the prior appropriation system.

Grading basis: Alternative Grading: ABCDE/SP

Career: Graduate

Course Components: Lecture Required

Also offered as: GEOG 641, HWRS 641, LAW 641, MNE 641

Course typically offered:

Main Campus: Spring

Home department: Law

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 691: Preceptorship (1 - 6 units)

Description: Qualified students working on an individual basis with professors who have agreed to supervise such preceptor work.

Grading basis: Alternative Grading: S, P, F

Career: Graduate

Course Components: Independent Study Required

Course typically offered:

Main Campus: Fall, Spring

ENVS 693: Internship (1 - 3 units)

Description: Specialized work on an individual basis, consisting of training and practice in actual service in a technical, business, or governmental establishment.

Grading basis: Alternative Grading: S, P, F

Career: Graduate

Course Components: Independent Study Required

Repeatable: Course can be repeated a maximum of 99 times.

Course typically offered:

Main Campus: Fall, Spring, Summer

ENVS 696A: Soils ,Water, and Environmental Science (1 unit)

Description: The development and exchange of scholarly information, usually in a small group setting. The scope of work shall consist of research by course registrants, with the exchange of the results of such research through discussion, reports, and/or papers.

Grading basis: Regular Grades

Career: Graduate

Course Components: Seminar Required

Repeatable: Course can be repeated a maximum of 5 times.

Course typically offered:

Main Campus: Fall, Spring

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 696C: Topics in Mine Environment Management (1 - 2 units)

Description: Topics in state of the art and practice for mine reclamation and environmental management of mine sites will be discussed from current literature. Students will gain an understanding of mining operations and the environmental impacts of the mine that need to be managed. Students will integrate readings in soil science, geology, hydrology, chemistry, biology, and engineering to formulate research topics.

Grading basis: Regular Grades

Career: Graduate

Course Components: Seminar Required

Also offered as: CHEE 696C, MNE 696C, RNR 696C

Course typically offered:

Main Campus: Fall, Spring

Online Campus: Fall, Spring

Home department: Mining & Geological Engineering

ENVS 696E: Seminar Environ Microbiology & Microbial Ecology (1 unit)

Description: Graduate Seminar in Environmental Microbiology and Microbial Ecology

Grading basis: Regular Grades

Career: Graduate

Course Components: Seminar Required

Repeatable: Course can be repeated a maximum of 3 times.

ENVS 696M: Using MATLAB® for Environmental Data Processing (3 units)

Description: The processing and analysis of some scientific data sets often require the use of technical tools capable of handling large volumes of information and the possibility of programming routines to analyze and model processes associated with the data. For the past couple of years, University of Arizona has offered a free license to the MATLAB® programming language which has these capabilities. This course is designed to help students make better use of this great resource. While not a requirement, students are encouraged to bring their own data sets to the course, so that they can make progress with their own data over the semester. Topics will be largely based on the needs of the students, but are anticipated to include: the MATLAB® environment, types of data sets and their processing, matrix operations, image analysis, statistics, differential equations and graphical presentation, all in MATLAB®.

Grading basis: Regular Grades

Career: Graduate

Flat Fee: \$50

Course Components: Seminar Required

Equivalent to: SWES 696M

Also offered as: WSM 696M

Home department: Watershed Management

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 696N: Indigenous Food Energy Water Security and Sovereignty Seminar (1 unit)

Description: MS and PhD trainees will participate in a weekly cross-cutting seminar each year wherein one or more of the following will take place: -UA faculty and trainees present on FEWS research. Guest lectures will be provided by UA Udall Native Nations Institute to discuss tribal governance and nation building, UA Law College Faculty and Indigenous Peoples Law and Policy program to discuss Indian water rights, land tenure and indigenous rights, UA Indian Cooperative Extension to discuss research and extension on tribal lands. Additional faculty working on tribal natural resources challenges will be invited as needed. This seminar will be live-streamed to Diné College and NTU. -First year PhD trainees will discuss preparation strategies for internships. Topics include career paths, Indige-FEWSS internship opportunities, written and oral mechanisms of scientific communication to reach disciplinary, cross-disciplinary and lay audiences, and work place expectations. -Second year PhD trainees will prepare to work with Diné College and NTU faculty and teach FEWS modules. Topics include: inquiry based

Grading basis: Alternative Grading: S, P, F

Career: Graduate

Course Components: Seminar Required

Repeatable: Course can be repeated a maximum of 2 times.

Course typically offered:

Main Campus: Fall, Spring

ENVS 696P: Hazardous Waste Risk and Remediation in the US Southwest (1 unit)

Description: Interdisciplinary trainees who participate in a colloquium, professional development activities and research translation/community engagement activities.

Grading basis: Alternative Grading: S, P, F

Career: Graduate

Course Components: Seminar Required

Course typically offered:

Main Campus: Fall, Spring

ENVS 697: Graduate Workshop for Professional Development (1 unit)

Description: SWES graduate students will develop practice oral and poster presentation in front of an audience (and camera), practice chairing a session, and develop a relevant resume/CV appropriate for a professional career in their field. Students will also practice a simulated job interview, based on the CV they developed.

Grading basis: Regular Grades

Career: Graduate

Course Components: Workshop Required

Course typically offered:

Main Campus: Spring

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 697S: Economics, Law and Environment (1 unit)

Description: The Economics, Law and Environment workshop (ELE Workshop) is intended to expose students and participating faculty members to a broad range of original research in the area of overlap between law, economics and environmental issues. The workshop will consist of six meetings during which leading scholars in the field will present their research for discussion and critique by the enrolled students and participating faculty. The workshop is part of the broader Program on Economics, Law and the Environment, a research and educational collaboration between the College of Law and the College of Agriculture and Life Sciences.

Grading basis: Pass/Fail

Career: Graduate

Course Components: Workshop Required

Equivalent to: AREC 697S

Also offered as: AREC 697S, LAW 697S

Home department: Law

ENVS 699: Independent Study (1 - 6 units)

Description: Qualified students working on an individual basis with professors who have agreed to supervise such work. Graduate students doing independent work which cannot be classified as actual research will register for credit under course number 599, 699, or 799.

Grading basis: Alternative Grading: S, P, F

Career: Graduate

Course Components: Independent Study Required

Repeatable: Course can be repeated a maximum of 99 times.

Course typically offered:

Main Campus: Fall, Spring, Summer

ENVS 900: Research (1 - 6 units)

Description: Individual research, not related to thesis or dissertation preparation, by graduate students.

Grading basis: Alternative Grading: S, P, F

Career: Graduate

Course Components: Independent Study Required

Repeatable: Course can be repeated a maximum of 99 times.

Course typically offered:

Main Campus: Fall, Spring, Summer

ENVS 909: Master's Report (1 - 9 units)

Grading basis: Alternative Grading: S, P, F

Career: Graduate

Course Components: Independent Study Required

Repeatable: Course can be repeated a maximum of 99 times.

Course typically offered:

Main Campus: Fall, Spring, Summer

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.

ENVS 910: Thesis (1 - 9 units)

Description: Research for the master's thesis (whether library research, laboratory or field observation or research, artistic creation, or thesis writing). Maximum total credit permitted varies with the major department.

Grading basis: Alternative Grading: S, P, F

Career: Graduate

Course Components: Independent Study Required

Repeatable: Course can be repeated a maximum of 99 times.

Course typically offered:

Main Campus: Fall, Spring, Summer

ENVS 920: Dissertation (1 - 9 units)

Description: Research for the doctoral dissertation (whether library research, laboratory or field observation or research, artistic creation, or dissertation writing).

Grading basis: Alternative Grading: S, P, F

Career: Graduate

Course Components: Independent Study Required

Repeatable: Course can be repeated a maximum of 99 times.

Course typically offered:

Main Campus: Fall, Spring, Summer

-SA represents a Student Abroad & Student Exchange offering

-CC represents a Correspondence Course offering

May Be Offered Departments may offer this component in some semesters. See the Schedule of Classes for term-specific offerings.