

# ENVIRONMENTAL STUDIES (ENVS)

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## **ENVS 101. Introduction to Environmental Studies I. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Enrollment is restricted to environmental studies majors. Study of contemporary issues related to environmental studies including sustainability, biological conservation, global change and an overview of the core earth systems.

## **ENVS 102. Introduction to Environmental Studies II. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Prerequisite: ENVS 101 or permission of instructor. Enrollment is restricted to environmental studies majors. Studies of contemporary issues related to government policy and environmental issues at local to international scales.

## **ENVS 105. Physical Geology. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. A descriptive approach to physical geology dealing with the history and structure of the earth, catastrophic events and geology as it relates to the contemporary environment. An optional laboratory, ENVZ 105, may be taken with this course.

## **ENVS 201. Earth System Science. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. An introduction to the processes of and linkages among the major systems that drive planet Earth. The biosphere, geosphere, hydrosphere, atmosphere and sociosphere are presented as dynamic and interdependent systems.

## **ENVS 222. Electronic Portfolios. 1 Hour.**

Semester course; 1 lecture hour (delivered online). 1 credit. This online course will guide individuals in developing an electronic portfolio consisting of student-curated collections of specific academic work, bibliographic information and a curriculum vitae used throughout their academic career. Graded as pass/fail.

## **ENVS 260. Outdoor Leadership. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. This course is designed to provide an introduction to the concepts and skills needed to work and lead teams in outdoor settings. Topics include the historical and philosophical foundations of outdoor leadership, outdoor teaching and facilitation, safety and risk management, and environmental stewardship. The course includes classroom and field application components.

## **ENVS 265. Paths to Environmental Leadership. 2 Hours.**

Semester course; 2 lecture hours. 2 credits. Prerequisites: ENVS 101 and ENVS 102, both with a minimum grade of B. This course focuses on personal leadership development, leadership in the field of environmental studies, grant writing and revision, and the peer-review process. Discussions with guest speakers who are leaders in various environmental fields, additional readings and self-directed exploration of leadership figures will broaden our understanding of environmental leadership. Students will then use the Udall Undergraduate Scholarship application as a tool to begin to develop their own vision of environmental leadership and develop experience in grant writing and peer review.

## **ENVS 291. Special Topics in Environmental Studies. 1-4 Hours.**

Semester course; 1-4 lecture hours. 1-4 credits. May be repeated with different topics for a maximum of 12 credits. An introductory investigation into a selected topic salient to environmental studies. See the Schedule of Classes for specific topics being offered each semester.

## **ENVS 300. Sustainable Societies: James River Basin. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. This course explores the 25 most critical social, economic and environmental issues in the region in a global context. It examines how people are tackling the issues of sustainably and turning them into opportunities.

## **ENVS 301. Introduction to Meteorology. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. An introductory course designed to provide the student with an overview of the structures and processes that cause weather. These include atmospheric circulations and the weather patterns that we observe. Emphasis will be placed upon the tracking and display of weather phenomena, as well as their forecast movement and impact.

## **ENVS 310. Introduction to Oceanography. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. An introductory course designed to provide the student with an overview of the structures and processes of the world's oceans. These include the systems that impact the oceans: the hydrosphere, the atmosphere, the geosphere, the biosphere and the sociosphere. Emphasis will be placed upon hands-on techniques for understanding these systems, including online simulations and in-class activities.

## **ENVS 311. Politics of the Environment. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. An exploration of the current controversy about environmental politics and the issues and crises it centers on. Special attention will be given to the constitutional, political and geographical factors in the development of environmental policy and the organized effort to deal with governmental actions and inaction and its impact on policy outcomes. Crosslisted as: POLI 311.

## **ENVS 314. Human-Environment Interactions: Foundations and Applications. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. A comparative study of the ecology and natural history of human populations, including the environments as determining factors in the evolution of human institutions and technology, resources management, and population crises; cultural traditions as mechanisms of population control; basic theory of population biology. Crosslisted as: INTL 314.

## **ENVS 315. Energy and the Environment. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to non-physics majors with junior or senior standing; not applicable to the physics major. A study of society's demands for energy, how it is currently being met, the environmental consequences thereof and some discussion of alternatives. Crosslisted as: PHYS 315.

## **ENVS 321. Cartography. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Prerequisite: MATH 131, STAT 208, or higher level MATH or STAT course. This course provides an introduction to the art and science behind the presentation of spatial information using maps and charts. Students will develop visual thinking and communication skills while applying cartographic theory to address contemporary practical problems. Students must have a laptop able to run ArcGIS Online.

## **ENVS 330. Environmental Pollution. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Prerequisites: BIOL 151 and BIOL 152. The study of pollution in the environment with emphasis on the procedures for detection and abatement.

**ENVS 332. Environmental Management. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Prerequisite: URSP 204. An interdisciplinary review of domestic and international environmental problems and their underlying causes, current management frameworks, alternative management approaches and strategies, and barriers to their implementation. Other topics include: environmental history and economics, population growth, natural resources use, biodiversity, pollution. Crosslisted as: URSP 332.

**ENVS 335. Environmental Geology. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Prerequisite: ENVS 105 or URSP 204. The relationship between humankind and the physical environment, earth materials and processes, geological hazards, water, mineral and energy resources, land use, and environmental health and law.

**ENVS 343. Data Literacy. 4 Hours.**

Semester course; 4 lecture hours. 4 credits. Prerequisites: ENVS 102 and STAT 210. This course takes a hands-on, collaborative approach for students to develop proficiency in the application of data management skills, static and dynamic data visualization, and quantitative analyses of environmental and geospatial datasets. Students will be required to bring their own laptop and analyses and visualization will be performed using the R statistical programming language.

**ENVS 355. Water. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Prerequisite: BIOL 317 or ENVS 330 or permission of instructor. The course takes an ecosystem approach to understanding the functioning of streams, rivers, lakes, estuaries and oceans. The course complements curricula in biology and environmental studies and is specifically geared toward students with an interest in the water resources profession.

**ENVS 360. Outdoor Programming and Event Management. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. This course is designed to provide students with information and practical experience required to successfully design, promote, implement and evaluate outdoor experiential programming across a range of contexts.

**ENVS 361. Outdoor Team Building and Group Facilitation. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. This course is designed to provide students with the theory and practice of developing and deploying a successful outdoor recreational, educational, interpretive or adventure experience. In doing so, students will learn about group dynamics, team building, risk management and inquiry-based learning techniques.

**ENVS 368. Nature Writing. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Prerequisite: ENGL 201, ENGL 202, ENGL 203, ENGL 204, ENGL 205, ENGL 206, ENGL 211, ENGL 215, ENGL 217, ENGL 236, ENGL 250, ENGL 291, ENGL 295 or NEXT 240. A study of the literary genre of nature writing in English. Crosslisted as: ENGL 368.

**ENVS 370. Applications of Conservation Science. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Prerequisite: ENVS 343. The field of conservation science is focused on protecting biodiversity through the promotion of both social and ecological processes. This course will provide a foundation in the real-world applications of conservation science and demonstrate how data are essential to effective conservation of natural resources.

**ENVS 391. Special Topics in Environmental Studies. 1-4 Hours.**

Semester course; 1-4 lecture hours. 1-4 credits. May be repeated with different topics for a maximum of 12 credits. A detailed investigation into a selected topic salient to environmental studies. See the Schedule of Classes for specific topics being offered each semester.

**ENVS 401. Meteorology and Climatology. 3 Hours.**

Semester course; 3 lecture hours. Prerequisite: PHYS 201 or PHYS 207. A basic, semiquantitative course in the elements of weather and climate, their driving forces and their spatial and temporal distribution and variability. Atmospheric motions and circulation, weather forecasting, human impact on weather and climate.

**ENVS 411. Oceanography. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Prerequisites: BIOL 151, BIOL 152 and CHEM 102. A basic course in the physical, chemical and geological properties of oceans and ocean basins. Origin and character of ocean basins, properties of oceanic waters, oceanic circulation, land-sea interactions, marine environments and ecology.

**ENVS 421. Environmental Data Visualization. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Prerequisite: STAT 314. This is an introductory course in using databases and geospatial technology. The course will introduce students to computer technology, project development and management skills, database management skills, and geospatial technology. Students will use in-class applied environmental analyses to guide skill-set development. The course will introduce the students to working with data in various formats and using the ArcGIS software suite to visualize the data. Students will be introduced to Microsoft Excel, Microsoft Access, ESRI ArcGIS software suite and ESRI ArcGIS Online.

**ENVS 430. Invasive Species Management. 3 Hours.**

Semester course; 1 lecture and 2 field experience hours. 3 credits. Prerequisite: BIOL 317. This course explores the ecological, political and regulatory issues surrounding invasive species in the city of Richmond and the commonwealth of Virginia. Students will be introduced to the James River Park System habitat restoration plan, a long-term strategy to manage non-native invasive species. Individuals will work directly with environmental professionals, park personnel and community partners to restore natural areas.

**ENVS 460. Wilderness First Responder. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. This course is intended for anyone working in a position of leadership in an outdoor setting or for individuals who want a high level of wilderness medical training for working in remote field settings, extended personal backcountry trips or expeditions. The course is a comprehensive and in-depth look at the standards and skills of dealing with response and assessment, musculoskeletal injuries, environmental emergencies and survival skills, soft tissue injuries, and medical emergencies. Additional topics, such as CPR, are also included. Wilderness First Responder training is the industry standard for those who work as government and nongovernment field technicians, backcountry trip leaders, camp counselors, mountain guides, river guides and ski patrollers.

**ENVS 461. Wilderness Policy and Practice. 3 Hours.**

Semester course; 2 lecture and 1 field experience hours. 3 credits. This course takes a multidisciplinary and experiential look at the concept of wilderness. Learning spans from the classroom to a first-hand wilderness experience, and materials include environmental law, natural resources management, environmental philosophy and ethics, regional and local history, and conservation science. Throughout students will focus on the intersection between society, biodiversity and the wilderness concept in principle and practice.

**ENVS 490. Research Seminar in Environmental Studies. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Prerequisites: senior standing and at least 12 hours of approved environmental studies course work. An interdisciplinary examination of problems and issues central to environmental studies. Environmental research of VCU faculty will be reviewed, and selected local environmental problems will be studied. Each student will complete a research project focusing on a specific environmental question.

**ENVS 491. Topics in Environmental Studies. 1-4 Hours.**

Semester course; 1-4 lecture hours. 1-4 credits. May be repeated with different topics for a maximum of 12 credits. An in-depth study of a selected environmental topic. See the Schedule of Classes for specific topics to be offered each semester and prerequisites.

**ENVS 492. Independent Study. 1-3 Hours.**

Semester course; variable hours. Variable credit. Maximum of 3 credits per semester; maximum total of 6 credits for all topics courses. Prerequisite: junior or senior standing, and permission of instructor.

**ENVS 493. Environmental Studies Internship. 1-3 Hours.**

Semester course; variable hours. 1-3 credits per semester. Maximum total of 6 credits. Prerequisite: junior or senior standing, and permission of instructor. Graded as pass/fail.

**ENVS 499. Environmental Studies Capstone Experience. 0 Hours.**

Semester course; variable hours. 0 credits. Corequisite: ENVS 490, ENVS 491 (when topics implement core competencies required for a capstone experience and are approved by the director of the Center for Environmental Studies), ENVS 492 or ENVS 493. Enrollment restricted to students who have completed 90 hours of undergraduate course work. Any of the corequisite courses qualify as a capstone experience if taken with this course. Graded as pass/fail.

**ENVS 510. Stream Surveys. 3 Hours.**

Semester course; 2 lecture and 3 laboratory hours. 3 credits. Prerequisite: BIOL 317 or permission of the instructor. This course will cover basic and advanced methods used to study fishes and benthic macroinvertebrates in small, wadeable streams. Topics covered will include qualitative and quantitative field surveying methods, fish and invertebrate specimen identification, and data analysis of original field data.

**ENVS 515. Tropical Field Ecology. 4 Hours.**

Semester course; 3 lecture and 3 laboratory hours. 4 credits. Study abroad at a tropical location. This course provides students with an immersive study of tropical ecology and conservation through a unique blend of rigorous science and community engagement. While studying abroad, students learn about tropical ecosystems by collecting data on both organisms and their habitats and by reading and discussing scientific papers. Students also engage with local conservation organizations leading efforts to protect habitats. Progress and research findings are intended to be presented in a symposium format. See the Schedule of Classes for specific regions and topics.

**ENVS 521. Introduction to Geographic Information Systems. 3 Hours.**

Semester course; 2 lecture and 2 laboratory hours. 3 credits. An introduction to creating and using geographically referenced databases for urban and environmental analysis and planning. Includes geographic and remote sensing data structures, global positioning systems, spatial analysis, geographic data standards, public domain software and data resources, and principles of cartography design. Lab exercises in the use of geographic information systems software tools. Crosslisted as: URSP 521.

**ENVS 531. Landscape Ecology. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Prerequisites: ENVS 421 or ENVS 521; and ENVS 343 or ENVS 543. This class provides a foundation in the major concepts and applications of landscape ecology as a framework for research, analysis and management. Topics covered will include the causes of landscape pattern, quantifying landscape pattern, spatial statistics, the effects of landscape pattern on organisms and ecological processes, and using landscape ecology to inform conservation.

**ENVS 541. Principles of Waste Management. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Design and operation of waste treatment, storage, disposal and control processes will be covered. Design tanks, landfills and incinerators will be discussed in detail. Data acquisition and interpretation methods needed for process control and monitoring will be examined.

**ENVS 543. Environmental Data Literacy. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Enrollment restricted to students with graduate standing, or those with one course in statistics and permission of instructor. Develop quantitative skills for the visualization, manipulation, analysis and communication of environmental "big data." This course focuses on spatial environmental data analysis, interpretation and communication, using real-time data from the Rice Rivers Center and the R statistical analysis environment.

**ENVS 550. Ecological Risk Assessment. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Prerequisites: course work in ecology, or permission of instructor. Ecological risk assessment provides an introduction to the concepts and practice of risk assessment as applied to ecological applications, focusing on the United States. The course will examine the history of risk assessment in U.S. environmental regulation and policy, development and practice of ecological risk assessment and application to regional issues. All students will conduct a risk assessment for a regional case study.

**ENVS 556. Historical and Cultural Landscapes. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Open only to seniors who have completed ANTH 302 or 303 and graduate students with permission of instructor. Students will study historical and contemporary landscapes as the products of the producers of human culture, with particular attention to riverine landscapes. Focus will be on the ways in which humans shape and respond to their ecosystems. Students will participate in an active field research program, including the archaeological recovery and analysis of historical landscapes. Crosslisted as: ANTH 556.

**ENVS 590. Research Seminar in Environmental Studies. 1 Hour.**

An interdisciplinary examination of problems and issues related to environmental studies.

**ENVS 591. Topics in Environmental Studies. 1-4 Hours.**

Semester course; 1-4 lecture hours. 1-4 credits. May be repeated with different topics for a maximum of 12 credits. An in-depth study of a selected environmental topic. See the Schedule of Classes for specific topics to be offered each semester and prerequisites.

**ENVS 601. Survey in Environmental Studies. 3 Hours.**

Provides a foundational understanding of issues central to environmental studies. Lectures will address the theoretical and scientific basis for a variety of pertinent issues, including: and water quality and quantity, pollution prevention, environmental law and policy, population growth, global climate change, conservation, and human and ecological health.

**ENVS 602. Environmental Technology. 1-3 Hours.**

This course gives students the opportunity to develop skills not available in the traditional academic setting. Students take two to four workshops offered by the Center for Environmental Studies in its Environmental Technology Training Workshop series. Students will complete an additional project related to each workshop or series of workshops for evaluation purposes.

**ENVS 603. Environmental Research Methods. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Prerequisite: ENVS 543, STAT 543 or permission of instructor. Provides students with an understanding of statistical and research methods as they apply to environmental research. This course emphasizes the application of current data analysis methodologies, including the graphical display of summary data, statistical modeling and prediction, and geographic information systems.

**ENVS 627. Infographics: Visualization of Scientific Data. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. This course will introduce graduate students in the natural sciences to some of the modern tools used by designers for data visualization and digital communication. The course is a mix of traditional lecture and computer lab exercises, but also makes use of the sketchbook and reflective writing. Students will proceed through a series of projects that sequentially build their technical skills in Adobe Creative Suites (particularly Illustrator and Photoshop) as well as their knowledge of fundamental concepts in graphic design and the communication arts.

**ENVS 628. Environmental Policy and Administration. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. This course explores the relationship between environmental policy and its implementation within a democratic political system. It includes an investigation of basic concepts that underlie environmental policy and the difficulties encountered when attempting to apply them in a real-world setting. It also surveys a variety of tools and methodologies that may be useful in attempting to develop and implement environmental policy. Crosslisted as: PADM 628.

**ENVS 640. River Policy. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Examines public policy related to rivers and watersheds. Uses the James River for exploring and illustrating generic river policy issues. Crosslisted as: GVPA 640.

**ENVS 650. Pesticides, Health and the Environment. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Prerequisites: Course work in toxicology, chemistry or permission of instructor. This course is a balanced overview of the benefits and adverse effects of pesticides in the environment and as related to human health. The class provides an interdisciplinary study of pesticide use, fate, exposure, transport and effects.

**ENVS 654. Environmental Remote Sensing. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Prerequisite: ENVS 602, or permission of the instructor. This course provides a basic and applied understanding on the use of digital remote sensor data to detect, identify and characterize earth resources. Students are required to demonstrate an understanding of the spectral attributes of soils, vegetation and water resources through various labs involving both image- and non-image-based optical spectral data. Crosslisted as: URSP 654/BIOL 654.

**ENVS 655. Hydrogeology. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Focuses on the fundamental concepts of groundwater flow and contaminant transport with an emphasis toward environmental issues such as waste disposal, surface water hydrology, groundwater hydrology and wells, environmental impacts and hydrogeological systems. Allows students to understand and interpret the basic environmental hydrogeologic characteristics of a site and to use that knowledge to provide an informed opinion on protection and remediation.

**ENVS 660. Virginia Environmental Law. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. An overview of relevant Virginia environmental law and regulations in the fields of environmental planning, management and policy. Provides students with working knowledge of documentation necessary for compliance with state environmental programs.

**ENVS 670. Pollution Physiology. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Prerequisites: Course work in: ecology, toxicology or animal physiology; or permission of instructor. Course provides an in-depth presentation of the physiology of animals in polluted habitats and examines the responses of aquatic organisms exposed to pollutants and other environmental stressors, including: thermal and salinity changes, anoxia and hypoxia, hypercapnia, chemical contamination, sedimentation and microbial contamination. The course takes a comparative approach and focuses on non-human systems. Both laboratory and field experiences are provided.

**ENVS 675. Advanced Environmental Applications of GIS. 3 Hours.**

Semester course; 3 lecture hours. 3 credits. Prerequisite: ENVS 521 or ENVS 602. The objective of this course is to give students a greater understanding of advanced GIS topics using environmental data. Knowledge gained in this course will give students the tools required to address complex natural resources and environmental issues by providing experience in advanced spatial and geostatistical analysis and environmental modeling. Students will also be exposed to programming, open source tools and interfaces that are used to disseminate large environmental data sets.

**ENVS 691. Topics in Environmental Studies. 1-4 Hours.**

Semester course; 1-4 lecture hours. 1-4 credits. May be repeated with a different topic for a maximum of 12 credits. Provides an in-depth study of a selected environmental topic. See the Schedule of Classes for specific topics to be offered each semester and prerequisites.

**ENVS 692. Independent Study. 1-3 Hours.**

Variable hours. 1-3 credits per semester. May be repeated with different topics for a maximum of 6 credits. An in-depth study of a selected environmental topic.

**ENVS 693. Internship in Environmental Studies. 1-3 Hours.**

Each credit hour represents 60 clock hours of work. Provides students with a workplace experience in a public or private agency related to Environmental Studies.

**ENVS 697. Research. 1-3 Hours.**

Planning, preparation, completion, and presentation of research in environmental studies.

**ENVS 698. Thesis. 1-3 Hours.**

Planning, preparation, completion, and presentation of research in environmental studies.