

# CURRICULUM FOR THE ENVIRONMENT AND ECOLOGY

## Contact Information

### Curriculum for the Environment and Ecology

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## Introduction

The Curriculum for the Environment and Ecology offers diverse and multidisciplinary undergraduate degree programs in environmental science (B.S.) and environmental studies (B.A.). Faculty throughout the University, including the College of Arts and Sciences and the schools of business, government, law, and public health, mentor students through courses, internships, and research opportunities. This unique approach provides students an opportunity to explore the knowledge base needed to understand the environment and its relationship to society, as well as the applications of that knowledge in areas such as environmental modeling; aquatic systems; environmental behavior and decisions; environmental change and human health; ecology, conservation, and biodiversity; and population and the environment. The degrees combine traditional classroom teaching with extensive use of interdisciplinary, team-based projects, internships, study abroad opportunities, and research.

## Advising

The Curriculum for the Environment and Ecology maintains an advising system for students with an environmental interest. Students are encouraged to contact the director of undergraduate studies as early as they wish in their academic plan to discuss options and be assigned to a faculty advisor. Students may use the advising system from the time they enter UNC–Chapel Hill, obtaining advice from specialists in the various environmental fields. This advising system includes opportunities to meet with professionals from government, industry, and consulting to learn about the skills needed to work effectively in those fields if students are interested. In addition we routinely schedule seminars and host visitors who showcase career opportunities by their example in their respective fields.

## Facilities

Curriculum faculty members and staff occupy offices and laboratories in Venable/Murray Halls (third floor) and the facilities in Manteo, Morehead City, and Highlands, NC.

## Graduate School and Career Opportunities

A major in environmental science or studies prepares students for a variety of career options, including marine scientist, ecologist, environmental modeler, environmental policy maker, conservation

advocate, land use planner, and environmental educator. Combining either major with other studies at the undergraduate or graduate level can lead to careers as an environmental lawyer, epidemiologist, or environmental geneticist, to cite a few examples.

### Majors

- Environmental Studies, B.A. (<http://catalog.unc.edu/undergraduate/programs-study/environmental-studies-major-ba>)
- Environmental Science, B.S. (<http://catalog.unc.edu/undergraduate/programs-study/environmental-science-bs>)
- Dual Bachelor's-Master's Degree Programs (<http://catalog.unc.edu/undergraduate/programs-study/environmental-studies-major-ba/#opportunities>)

### Minors

- Environmental Science and Studies Minor (<http://catalog.unc.edu/undergraduate/programs-study/environmental-science-studies-minor>)
- Sustainability Studies Minor (<http://catalog.unc.edu/undergraduate/programs-study/sustainability-studies-minor>)

### Graduate Programs

- Doctor of Philosophy (<http://catalog.unc.edu/graduate/schools-departments/environment-ecology/#programstext>)
- Master of Science (<http://catalog.unc.edu/graduate/schools-departments/environment-ecology/#programstext>)
- Master of Arts (<http://catalog.unc.edu/graduate/schools-departments/environment-ecology/#programstext>)

## Affiliated Professors

Carol Arnosti (Marine Sciences), Larry Band (Geography), Larry Benninger (Geological Sciences), John Bruno (Biology), Jaye Cable (Marine Sciences), Joe Carter (Geological Sciences), Jim Costa (Western Carolina University), Barbara Entwisle (Sociology), Pat Gensel (Biology), Donald Hornstein (School of Law), Rich Kamens (Environmental Sciences and Engineering), Andrew Keeler (East Carolina University), Joel Kingsolver (Biology), Jonathan Lees (Geological Sciences), Paul Leslie (Anthropology), Richard Luettich (Institute for Marine Sciences), Doug MacLean (Philosophy), Christopher Martens (Marine Sciences), Brent McKee (Marine Sciences), Timothy McKeown (Political Science), Charles Mitchell (Biology), Rachel Noble (Institute for Marine Sciences), Hans Paerl (Institute for Marine Sciences), Robert Peet (Biology), Charles Peterson (Institute for Marine Sciences), David Pfennig (Biology), Jose Rial (Geological Sciences), Al Segars (Kenan–Flagler Business School), Maria Servedio (Biology), Conghe Song (Geography), Andreas Teske (Marine Sciences), Stephen Walsh (Geography), Peter White (Biology), Dale Whittington (City and Regional Planning), Haven Wiley (Biology).

## Affiliated Associate Professors

Marc Alperin (Marine Sciences), Todd Bendor (City and Regional Planning), Allen Hurlbert (Biology), Pamela Jagger (Public Policy), Nikhil Kaza (City and Regional Planning), Chip Konrad (Geography), Aaron Moody (Geography), Laura J. Moore (Geological Sciences), Tamlin Pavelsky (Geological Sciences), Karin Pfennig (Biology), Michael Piehler (Institute for Marine Sciences), Keith Sockman (Biology), Jill Stewart (Environmental Sciences and Engineering), Donna Surge (Geological Sciences), Jason Surratt (Environmental Sciences and Engineering), Colin West (Anthropology), Jason West (Environmental Sciences and

Engineering), Stephen Whalen (Environmental Sciences and Engineering), Erika Wise (Geography), Andrew Yates (Economics).

## Affiliated Assistant Professors

Karl Castillo (Marine Sciences), Xiaodong Chen (Geography), Clark Gray (Geography), Adrian Marchetti (Marine Sciences), Diego Riveros-Iregui (Geography), Caroline Tucker (Biology).

## Research Faculty

Richard Andrews (emeritus, Public Policy), Dick Bilsborrow (Biostatistics), Elizabeth Dickinson (Kenan–Flagler Business School), Lindsay Dubbs (Coastal Studies Institute), David McNelis (Institute for the Environment), Johnny Randall (NC Botanical Gardens), Elizabeth Shay (Appalachian State University), James Umbanhower (Biology/CEE), Alan Weakley (NC Botanical Gardens); Gary Wein (Highlands Trust).

## Senior Lecturers

Geoffrey Bell, Amy Cooke, Greg Gangi.

## Lecturers

Lama BouFajreldin, Leda Gerber, Brian Naess.

## ENEC–Environment and Ecology Undergraduate-level Courses

**ENEC 51. First-Year Seminar: Balancing the Environment: Science, Human Values, and Policy in North Carolina. 3 Credits.**

This course examines the ways in which scientific information, human values, and the policy process interact to produce environmental change, economic growth, and social justice in North Carolina.

**Gen Ed:** SS.

**Grading status:** Letter grade.

**ENEC 89. First Year Seminar: Special Topics. 3 Credits.**

Special topics course. Content will vary each semester.

**Repeat rules:** May be repeated for credit; may be repeated in the same term for different topics; 6 total credits. 2 total completions.

**Grading status:** Letter grade.

**ENEC 108. Our Energy and Climate Crises: Challenges and Opportunities. 4 Credits.**

Students quantify global depletion of energy resources and accompanying environmental degradation, hence discovering the profound changes in attitudes and behavior required to adjust to diminished fossil fuels and modified climate.

**Gen Ed:** PL, GL.

**Grading status:** Letter grade

**Same as:** PWAD 108.

**ENEC 191. Peoples of Siberia. 3 Credits.**

Comparative study of the cultural and biological diversity of peoples of Siberia from prehistoric through contemporary times. Course topics include the biological diversity, culture, behavior, and history of Siberian populations.

**Grading status:** Letter grade

**Same as:** ANTH 191.

**ENEC 201. Introduction to Environment and Society. 4 Credits.**

Human-environment interactions are examined through analytical methods from the social sciences, humanities, and sciences. The focus is on the role of social, political, and economic factors in controlling interactions between society and the environment in historical and cultural contexts. Three lecture hours and one recitation hour a week.

**Gen Ed:** SS, GL.

**Grading status:** Letter grade.

**ENEC 201H. Introduction to Environment and Society Honors. 4 Credits.**

Human-environment interactions are examined through analytical methods from the social sciences, humanities, and sciences. The focus is on the role of social, political, and economic factors in controlling interactions between society and the environment in historical and cultural contexts. Three lecture hours and one recitation hour a week.

**Gen Ed:** SS, GL.

**Grading status:** Letter grade.

**ENEC 202. Introduction to the Environmental Sciences. 4 Credits.**

Examines fundamental processes governing the movement and transformation of material and energy in environmental systems. Focuses on the role of these processes in environmental phenomena and how society perturbs these processes. Integrates methods from a range of scientific disciplines. Three lecture hours and three computer laboratory hours a week.

**Gen Ed:** PX.

**Grading status:** Letter grade.

**ENEC 203. Introduction to Environmental Science Problem Solving. 3 Credits.**

A quantitative introduction to selected topics in environmental sciences with an emphasis on developing and solidifying problem-solving skills.

**Requisites:** Prerequisite, MATH 231; corequisite, MATH 232.

**Grading status:** Letter grade.

**ENEC 204. Environmental Seminar. 1-3 Credits.**

This course will provide an intellectual focus on the interface between environment and society by examining the relationship among science, policy, and actual management practices on a chosen topic.

**Grading status:** Letter grade.

**ENEC 208. New Frontiers: Environment and Society in the United States. 3-4 Credits.**

By employing a multidisciplinary approach, this class will give students a sense of the role that the environment has played in shaping United States society and the role that our society plays in producing environmental change at the national and global level.

**Grading status:** Letter grade.

**ENEC 208H. New Frontiers: Environment and Society in the United States. 3-4 Credits.**

By employing a multidisciplinary approach, this class will give students a sense of the role that the environment has played in shaping United States society and the role that our society plays in producing environmental change at the national and global level.

**Grading status:** Letter grade.

**ENEC 210. Energy in a Sustainable Environment Seminar. 1 Credit.**

This seminar series will provide a general introduction to energy sources, resources, technologies, and societal use from a sustainability perspective.

**Grading status:** Letter grade.

**ENEC 220. North Carolina Estuaries: Environmental Processes and Problems. 3 Credits.**

Natural processes and human impacts on estuarine systems using the Neuse River estuary as a case study. Course includes one week of intensive field work based at the Institute of Marine Sciences. A student may not receive credit for this course after receiving credit for ENEC 222.

**Gen Ed:** PX, EE-Field Work.

**Grading status:** Letter grade

**Same as:** MASC 220.

**ENEC 222. Estuarine and Coastal Marine Science. 4 Credits.**

Introduction to the estuarine and coastal environment: geomorphology, physical circulation, nutrient loading, primary and secondary production, carbon and nitrogen cycling, benthic processes, and sedimentation.

Consideration given to human impact on coastal systems with emphasis on North Carolina estuaries and sounds. Includes a mandatory weekend field trip and laboratory.

**Requisites:** Prerequisites, MATH 231 and either CHEM 101 or PHYS 114.

**Gen Ed:** PL, QI.

**Grading status:** Letter grade.

**ENEC 237. Food, Environment, and Sustainability. 3 Credits.**

Explores the nexus of agricultural, ecological, and food systems as they dynamically interact. The class examines case studies from North Carolina and other parts of the world. Themes include nutrition, food security, agroecology, and sustainable livelihoods. Students engage in readings, class projects, and hands-on activities in a laboratory setting.

**Grading status:** Letter grade

**Same as:** ANTH 237.

**ENEC 238. Human Ecology of Africa. 3 Credits.**

Course examines human adaptations to environments across Africa. Focuses on livelihood systems such as farming, herding and hunting/gathering.

**Grading status:** Letter grade

**Same as:** ANTH 238.

**ENEC 241. Energy and Culture Seminar for the Thailand Field Site. 1 Credit.**

This one credit hour course meets the semester before UNC students go to study abroad at the Institute for the Environment Thailand Field Site.

The course will prepare students for the research portion of the program. Student should be applying to the field site when taking this course.

**Grading status:** Letter grade.

**ENEC 242. Ecology and Culture Seminar for Ecuador Field Site. 1 Credit.**

This one credit hour seminar is only open to students who are planning to participate in the spring research semester in Ecuador. The main purpose of this seminar is to prepare students for this six-month experience in Ecuador by discussing both research methods and Ecuadorian society.

**Grading status:** Letter grade.

**ENEC 253. Introduction to Atmospheric Processes. 4 Credits.**

Includes one-hour laboratory. Atmospheric processes including radiation, dynamics, and thermodynamics are emphasized. Circulations across a range of temporal and spatial scales are described. Links between environmental problems and the atmosphere are explored.

**Requisites:** Prerequisites, MATH 231 and either CHEM 102 or PHYS 114.

**Grading status:** Letter grade

**Same as:** GEOG 253.

**ENEC 254. International Environmental Politics. 3 Credits.**

Covers the politics of environmental issues, with a focus on issues that have become internationalized. It focuses on the special problems that arise in creating rules for environmental management and regulation when no single government has authority to enforce those rules.

**Gen Ed:** SS, GL.

**Grading status:** Letter grade

**Same as:** POLI 254.

**ENEC 256. Mountain Biodiversity. 4 Credits.**

Introduction to the new field of biodiversity studies, which integrates approaches from systematics, ecology, evolution, and conservation.

**Grading status:** Letter grade

**Same as:** BIOL 256.

**ENEC 259. Coral Reef Ecology and Management. 1 Credit.**

The course familiarizes students with the natural history, ecology, and physical and chemical characteristics of the coral reef environment. Policy and management issues are also examined.

**Gen Ed:** EE-Field Work.

**Grading status:** Letter grade.

**ENEC 263. Environmental Field Studies in Siberia. 4 Credits.**

This course explores the biogeography of Siberia and gives students practical training on how to do field work in field ecology and physical geography.

**Grading status:** Letter grade

**Same as:** GEOG 263.

**ENEC 264. Conservation of Biodiversity in Theory and Practice. 3 Credits.**

This course will give students a multidisciplinary introduction to growing field of biodiversity preservation.

**Requisites:** Prerequisite, ENEC 201; permission of the instructor for students lacking the prerequisite.

**Grading status:** Letter grade

**Same as:** GEOG 264.

**ENEC 266. Contemporary Africa: Issues in Health, Population, and the Environment. 3 Credits.**

A seminar that introduces students to non-Western perspectives and comparative study of ecological, social, and economic factors that influence the welfare of contemporary African communities. Examination of famine, population growth, and health issues within the context of African cultural and social systems.

**Gen Ed:** SS, BN.

**Grading status:** Letter grade.

**ENEC 304. Restoration Ecology. 4 Credits.**

Explores ecological theory and its application to the restoration of terrestrial, aquatic, and marine ecosystems. Requires 30 hours of service to a local restoration project in which students will collect ecological data for a final case study project.

**Requisites:** Prerequisite, BIOL 201 or ENEC 202.

**Gen Ed:** EE-Service Learning.

**Grading status:** Letter grade.

**ENEC 305. Data Analysis and Visualization of Social and Environmental Interactions. 4 Credits.**

Principles of spatial and temporal data analysis are applied to issues of the role of society in producing environmental change. Methods include statistical analysis, model development, and computer visualization. Three lecture hours and one laboratory hour a week.

**Requisites:** Prerequisite, ECON 400, ENEC 201, MATH 231, or STOR 155.

**Grading status:** Letter grade.

**ENEC 307. Energy and Material Flows in the Environment and Society. 3 Credits.**

Examines regional to global scale flow of materials and energy through materials extractions, processing, manufacturing, product use, recycling, and disposal, including relevance to policy development. Reviews natural cycles, basic physics, and technology of energy production.

**Requisites:** Prerequisites, ENEC 201 and MATH 231 or MATH 152; permission of the instructor for students lacking the prerequisite.

**Grading status:** Letter grade.

**ENEC 308. Environmental History. 3 Credits.**

Historical development of the system of beliefs, values, institutions, etc, underlying societal response to the environment in different cultures is analyzed. The approach is interdisciplinary, drawing on methods from history, philosophy, psychology, etc. Three lecture hours a week.

**Grading status:** Letter grade.

**ENEC 309. Environmental Values and Valuation. 3 Credits.**

Introduction to the methods for assigning value to aspects of the environment and to interhuman and human-environment interactions.

The approach is interdisciplinary, drawing on methods from philosophy, ecology, psychology, aesthetics, economics, religion, etc.

**Gen Ed:** SS.

**Grading status:** Letter grade.

**ENEC 310. Coastal Environmental Change. 3 Credits.**

An exploration of the large-scale evolution of coastal environments, including relevance of geologic setting, wave and sediment transport processes, the evolution of beach and barrier island morphology, and issues of coastal environmental management.

**Requisites:** Prerequisite, GEOL 101 or MASC 101 or MASC 401; permission of the instructor for students lacking the prerequisite.

**Grading status:** Letter grade

**Same as:** GEOL 310, MASC 316.

**ENEC 312. Risk-Based International Environmental Decisions. 3 Credits.**

A Web-based course on the methods and roles of risk assessment in the international setting, with a primary focus on United States-European Union applications in environmental policy decisions.

**Grading status:** Letter grade.

**ENEC 320. The Future of Energy. 3 Credits.**

This course takes a deep dive into the global energy transition, studying the rapidly-evolving renewable energy and energy-efficiency technologies, prices for new energy sources like solar and wind, and competition with fossil and nuclear fuels.

**Gen Ed:** SS, GL.

**Grading status:** Letter grade.

**ENEC 324. Water in Our World: Introduction to Hydrologic Science and Environmental Problems. 3 Credits.**

This introductory course will cover two broad themes: the physical processes of the hydrologic cycle and how human use (and abuse) of freshwater resources can lead to major environmental problems. PX credit for ENEC/GEOL 324 + 324L. PL credit for ENEC/GEOL 324.

**Gen Ed:** PX.

**Grading status:** Letter grade

**Same as:** GEOL 324.

**ENEC 324L. Water in Our World Laboratory. 1 Credit.**

Students will conduct laboratory and field experiments to reinforce the topics covered in ENEC/GEOL 324. PX credit for ENEC/GEOL 324 + 324L.

**Requisites:** Pre- or corequisite, ENEC/GEOL 324.

**Grading status:** Letter grade

**Same as:** GEOL 324L.

**ENEC 325. Water Resource Management and Human Rights. 3-4 Credits.**

This course explores logistical, political, social, and economic challenges in supplying every human with adequate access to clean water, the most basic human right.

**Gen Ed:** PH, GL.

**Grading status:** Letter grade.

**ENEC 325H. Water Resource Management and Human Rights. 3-4 Credits.**

This course explores logistical, political, social, and economic challenges in supplying every human with adequate access to clean water, the most basic human right.

**Gen Ed:** PH, GL.

**Grading status:** Letter grade.

**ENEC 330. Principles of Sustainability. 3 Credits.**

This course introduces students to theories, principles, and measurement of sustainability. It also provides an overview of sustainability in national and international contexts.

**Gen Ed:** SS, GL.

**Grading status:** Letter grade

**Same as:** PLAN 330.

**ENEC 350. Environmental Law and Policy. 3 Credits.**

This course gives students an overview of environmental law and some practical experience in environmental policy making.

**Grading status:** Letter grade.

**ENEC 351. Coastal Law and Policy. 3 Credits.**

The utilization of common coastal resources, the management of fisheries, and coastal zone management guide an examination of coastal laws, policies, and regulations at the federal, state, and local levels.

**Grading status:** Letter grade.

**ENEC 352. Marine Fisheries Ecology. 3 Credits.**

Gives students a foundation in population biology and the ecological processes that influence populations of economically important fish and shellfish. Students will gain practical quantitative skills including statistical analyses, model development, and data visualization.

Familiarity with introductory statistics concepts is preferred but not necessary.

**Requisites:** Prerequisite, MASC 101, 401, or ENEC 202.

**Grading status:** Letter grade

**Same as:** MASC 352.

**ENEC 368. Environmental Ethics. 3 Credits.**

The meaning of environmental values and their relation to other values; the ethical status of animals, species, wilderness, and ecosystems; the built environment; environmental justice; ecofeminism; obligations to future generations.

**Gen Ed:** PH, GL.

**Grading status:** Letter grade

**Same as:** PHIL 368.

**ENEC 370. Agriculture and the Environment. 3 Credits.**

Introduction to the ecology of agricultural practices and the impact of food production on the environment. Particular attention will be paid to the constraints on agriculture which must be overcome to feed the planet's growing population.

**Grading status:** Letter grade.

**ENEC 370H. Agriculture and the Environment. 3 Credits.**

Introduction to the ecology of agricultural practices and the impact of food production on the environment. Particular attention will be paid to the constraints on agriculture which must be overcome to feed the planet's growing population.

**Grading status:** Letter grade.

**ENEC 372. Global Environment: Policy Analysis and Solutions. 3 Credits.**

Explores linkages among nations, global environmental institutions, and the environmental problems they cause and seek to rectify. Introduces pressing challenges of the global environment such as China and India's energy and climate policies, the environmental impacts of coal, nuclear energy, shale gas and fracking, and marine pollution. Discusses perspectives of nations, the role of financial markets and NGOs, and the international community involved in crafting policy solutions.

**Gen Ed:** SS.

**Grading status:** Letter grade

**Same as:** PLCY 372.

**ENEC 375. Environmental Advocacy. 3 Credits.**

Explores rhetorical means of citizen influence of practices affecting our natural and human environment; also, study of communication processes and dilemmas of redress of environmental grievances in communities and workplace.

**Gen Ed:** PH, CI.

**Grading status:** Letter grade

**Same as:** COMM 375.

**ENEC 380. Environmental Economics. 3 Credits.**

This course develops a set of core principles that are essential to understand and evaluate environmental policy and renewable resource use. These principles are primarily economic, but our discussion will also include insights from politics and ethics.

**Requisites:** Prerequisite, ECON 101.

**Gen Ed:** SS.

**Grading status:** Letter grade.

**ENEC 393. Internship in Sustainability. 3 Credits.**

Permission of the instructor. This course provides an internship with an organization on sustainability topics and public engagement. Pass/Fail only.

**Gen Ed:** EE-Academic Internship.

**Repeat rules:** May be repeated for credit. 6 total credits. 2 total completions.

**Grading status:** Pass/Fail.

**ENEC 395. Research in Environmental Sciences and Studies for Undergraduates. 1-3 Credits.**

Permission of the instructor. Research in an area of environmental science or environmental studies.

**Gen Ed:** EE-Mentored Research.

**Repeat rules:** May be repeated for credit. 6 total credits. 2 total completions.

**Grading status:** Letter grade.

**ENEC 396. Directed Readings. 1-4 Credits.**

Permission of the instructor. A specialized selection of readings from the literature of a particular environmental field supervised by a member of the Carolina Environmental Faculty group. Written reports on the readings or a literature review paper will be required. Cannot be used as a course toward the major.

**Repeat rules:** May be repeated for credit. 8 total credits. 2 total completions.

**Grading status:** Letter grade.

**Advanced Undergraduate and Graduate-level Courses****ENEC 403. Environmental Chemistry Processes. 3 Credits.**

Required preparation, a background in chemistry and mathematics, including ordinary differential equations. Chemical processes occurring in natural and engineered systems: chemical cycles; transport and transformation processes of chemicals in air, water, and multimedia environments; chemical dynamics; thermodynamics; structure/activity relationships.

**Grading status:** Letter grade

**Same as:** ENVR 403.

**ENEC 405. Mountain Preservation. 4 Credits.**

Introduces students to approaches used to preserve the natural and cultural heritage of the Southern Appalachians.

**Grading status:** Letter grade.

**ENEC 406. Atmospheric Processes II. 4 Credits.**

Principles of analysis of the atmosphere are applied to the analysis of environmental phenomena. The link between the atmosphere and other environmental compartments is explored through environmental case studies.

**Grading status:** Letter grade

**Same as:** GEOG 406.

**ENEC 410. Earth Processes in Environmental Systems. 4 Credits.**

Principles of geological and related Earth systems sciences are applied to analyses of environmental phenomena. The link between the lithosphere and other environmental compartments is explored through case studies of environmental issues. Three lecture hours and one laboratory hour a week.

**Requisites:** Prerequisites, CHEM 102, GEOL 200, MATH 231, and PHYS 115 or 119; permission of the instructor for students lacking the prerequisites.

**Grading status:** Letter grade

**Same as:** GEOL 410, MASC 410.

**ENEC 411. Oceanic Processes in Environmental Systems. 4 Credits.**

Principles of analysis of the ocean, coast, and estuarine environments and the processes that control these environments are applied to the analysis of environmental phenomena. Case studies of environmental issues. Three lecture hours and one laboratory hour a week.

**Requisites:** Prerequisites, BIOL 101, CHEM 102, ENEC 222, MATH 231, PHYS 115 or 119; permission of the instructor for students lacking the prerequisites.

**Grading status:** Letter grade

**Same as:** GEOL 411, MASC 411.

**ENEC 415. Environmental Systems Modeling. 3 Credits.**

This course explores principles and strategies for studying environmental phenomena, and presents methods for developing explanatory and predictive models of environmental systems, e.g., predator-prey, estuaries, greenhouse gases, and ecosystem material cycles.

**Requisites:** Prerequisite, MATH 383; pre- or corequisite, PHYS 115 or 118, and COMP 116.

**Grading status:** Letter grade

**Same as:** GEOL 415, MASC 415.

**ENEC 416. Environmental Meteorology. 3 Credits.**

This course explores atmospheric processes most important to environmental problems such as the transport and transformation of air pollutants and weather systems involved in intercontinental transport of gases and particles.

**Grading status:** Letter grade.

**ENEC 417. Geomorphology. 3 Credits.**

Introduction to process geomorphology with emphasis on quantitative interpretation of weathering, hill slope, fluvial, glacial, and eolian processes from topography and landscapes.

**Requisites:** Prerequisites, GEOL 101, 200, or 201; and MATH 231; permission of the instructor for students lacking the prerequisites.

**Grading status:** Letter grade

**Same as:** GEOL 417.

**ENEC 420. Community Design and Green Architecture. 3 Credits.**

The impact of building on the environment and health will be examined by looking at the major areas of: land use planning, water resource use, energy, materials and indoor environment.

**Grading status:** Letter grade

**Same as:** PLAN 420.

**ENEC 431. Sustainable Cities: Exploring Ways of Making Cities More Sustainable. 3 Credits.**

Recommended preparation, ENEC 330. For the first time in history, a majority of the world's people live in cities with huge implications for sustainability. Students will examine the factors driving the trend toward urbanization worldwide, the challenges posed by this trend, and the efforts by cities to become more sustainable.

**Grading status:** Letter grade.

**ENEC 433. Wetland Hydrology. 3 Credits.**

Study of wetland ecosystems with particular emphasis on hydrological functioning, the transition from terrestrial to aquatic systems, wetlands as filtration systems, and exchange between wetlands and other environments.

**Grading status:** Letter grade

**Same as:** MASC 433.

**ENEC 441. Marine Physiological Ecology. 3 Credits.**

This course introduces students to the physiological, morphological, and behavioral factors employed by marine organisms to cope with their physical environment. Emphasis will be placed on the response of marine organisms to environmental factors such as seawater temperature, light, water salinity, ocean acidification, etc.

**Grading status:** Letter grade

**Same as:** MASC 441.

**ENEC 444. Marine Phytoplankton. 3 Credits.**

Permission of the instructor. For junior and senior science majors or graduate students. Biology of marine photosynthetic protists and cyanobacteria. Phytoplankton evolution, biodiversity, structure, function, biogeochemical cycles and genomics. Harmful algal blooms, commercial products, and climate change. Three lecture/practical session hours per week.

**Grading status:** Letter grade

**Same as:** MASC 444, BIOL 456.

**ENEC 448. Coastal and Estuarine Ecology. 4 Credits.**

A field-intensive study of the ecology of marine organisms and their interactions with their environment, including commercially important organisms. Laboratory/recitation/field work is included and contributes two credit hours to the course.

**Requisites:** Prerequisites, CHEM 102 and MATH 231.

**Grading status:** Letter grade

**Same as:** MASC 448.

**ENEC 450. Biogeochemical Processes. 4 Credits.**

Principles of chemistry, biology, and geology are applied to analysis of the fate and transport of materials in environmental systems, with an emphasis on those materials that form the most significant cycles. Three lecture hours and one laboratory hour a week.

**Requisites:** Prerequisites, MATH 231, and PHYS 114 or 118; permission of the instructor for students lacking the prerequisites.

**Gen Ed:** PL.

**Grading status:** Letter grade

**Same as:** GEOL 450, MASC 450.

**ENEC 451. Population, Development, and the Environment. 3 Credits.**

Introduction to contemporary and historical changes in human population, international development, and the global environment and how these processes interact, drawing on population geography as an organizing framework. Previously offered as GEOG 450.

**Gen Ed:** GL.

**Grading status:** Letter grade

**Same as:** GEOG 451.

**ENEC 459. Ecological Anthropology. 3 Credits.**

Examines how human-environmental adaptations shape the economic, social, and cultural lives of hunter-gatherers, pastoralists and agriculturalists. Approaches include optimal foraging theory, political ecology and subsistence risk.

**Gen Ed:** SS.

**Grading status:** Letter grade

**Same as:** ANTH 459.

**ENEC 460. Historical Ecology. 3 Credits.**

Historical ecology is a framework for integrating physical, biological, and social science data with insights from the humanities to understand the reciprocal relationship between human activity and the Earth system.

**Gen Ed:** HS, GL.

**Grading status:** Letter grade

**Same as:** ANTH 460.

**ENEC 461. Fundamentals of Ecology. 4 Credits.**

Students will develop a comprehensive understanding of the field of ecology, including modern and emerging trends in ecology. They will develop literacy in the fundamental theories and models that capture ecological processes; emphasis will also be placed on the relevance of ecology and ecological research for human society.

**Requisites:** Prerequisite, BIOL 201.

**Grading status:** Letter grade

**Same as:** BIOL 461.

**ENEC 462. Ecosystem Management. 3 Credits.**

Explores the ecological concepts underlying ecosystem management (e.g., genetic and species diversity, stability, resilience, landscape ecology, etc.), the tools used in the approach, and case studies of how communities are implementing ecosystem management.

**Requisites:** Prerequisite, BIOL 101.

**Grading status:** Letter grade.

**ENEC 463. Business and the Environment. 3 Credits.**

This course explores the intersection of business/economic growth and the major sustainability issues affecting the environment and societal well-being and raises questions about business ethics and the moral responsibility of business leaders, consumers, and citizens. Previously offered as ENEC 306.

**Gen Ed:** PH, CI.

**Grading status:** Letter grade

**Same as:** BUSI 463.

**ENEC 463H. Business and the Environment. 3 Credits.**

This course explores the intersection of business/economic growth and the major sustainability issues affecting the environment and societal well-being and raises questions about business ethics and the moral responsibility of business leaders, consumers, and citizens. Previously offered as ENEC 306.

**Gen Ed:** PH, CI.

**Grading status:** Letter grade

**Same as:** BUSI 463H.

**ENEC 468. Advanced Functions of Temporal GIS. 3 Credits.**

Required preparation, a multivariate calculus course like MATH 233. Overview of geographical information systems (GIS) using the Arc GIS software, and introduction to advanced geostatistical functions for temporal GIS describing environmental and health phenomena distributed across space and time. Application to the spatiotemporal mapping of environmental water quality.

**Grading status:** Letter grade

**Same as:** ENVR 468.

**ENEC 470. Environmental Risk Assessment. 3 Credits.**

Required preparation, one course in probability and statistics. Use of mathematical models and computer simulation tools to estimate the human health impacts of exposure to environmental pollutants. Three lecture hours per week.

**Grading status:** Letter grade

**Same as:** ENVR 470.

**ENEC 471. Human Impacts on Estuarine Ecosystems. 4 Credits.**

A cohesive examination of the human impacts on biological processes in estuarine ecosystems. Laboratory/recitation/field work is included and contributes two credit hours to the course.

**Requisites:** Prerequisites, CHEM 102 and MATH 231.

**Grading status:** Letter grade

**Same as:** MASC 471.

**ENEC 474. Sustainable Coastal Management. 3 Credits.**

This course explores the environmental history of the Albemarle estuary and its larger watershed and explores ways in which humans can utilize this region in a more sustainable manner.

**Grading status:** Letter grade.

**ENEC 475. The Political Economy of Food. 3 Credits.**

This course examines the political and economic dimensions of the food we eat, how it is produced, who eats what, and related social and environmental issues, both domestic and international, affecting the production, pricing, trade, distribution, and consumption of food.

**Gen Ed:** SS, GL.

**Grading status:** Letter grade

**Same as:** PLCY 475.

**ENEC 479. Landscape Analysis. 3 Credits.**

This course utilizes GIS, GPS, and remote sensing technologies to gather data on geology, watersheds, soils, integrated moisture indices. The class also develops habitat maps and derives species diversity indices.

**Gen Ed:** EE-Field Work.

**Grading status:** Letter grade.

**ENEC 480. Environmental Decision Making. 3 Credits.**

Introduces factors shaping environmental decision making by individuals, businesses, governments, advocacy groups, and international institutions. Explores public policy incentives and action strategies for influencing them.

**Gen Ed:** SS, NA.

**Grading status:** Letter grade

**Same as:** PLCY 480.

**ENEC 481. Energy Economics. 3 Credits.**

This course develops a core set of principles to understand and evaluate energy markets, policies, and regulations. Topics include oil markets, electric vehicles and CAFÉ standards, pollution permit markets and CO<sub>2</sub> regulations, and electricity markets.

**Requisites:** Prerequisite, ECON 101.

**Gen Ed:** SS.

**Grading status:** Letter grade.

**ENEC 482. Energy and the Environment: A Coastal Perspective. 3 Credits.**

Explores coastal and offshore energy issues, including energy demand, present-day and innovative sources of energy to meet that demand, economics, policy, and environmental and human health outcomes of different energy sources. Summer session only; online and field trip hybrid course, with a mandatory 8-day field site component on the Outer Banks. Housing and field activities arranged by the instructor, which will carry a fee.

**Gen Ed:** EE-Field Work.

**Grading status:** Letter grade.

**ENEC 485. Coastal Resource Economics and Policy. 3-4 Credits.**

This course develops and applies core principles essential to understanding and evaluating coastal environmental policy and renewable resource use. The principles include the economics of pollution, public choice, information and cost-benefit analysis, property rights, incentive-based regulation, and the economics of renewable resources. Includes insights from politics and ethics.

**Requisites:** Prerequisite, ECON 101.

**Grading status:** Letter grade.

**ENEC 489. Ecological Processes in Environmental Systems. 4 Credits.**

Principles of analysis of the structure and function of ecosystems are applied to environmental phenomena. The link between the biosphere and other environmental compartments is explored through case studies of environmental issues. Three lecture hours and one laboratory hour a week.

**Requisites:** Prerequisites, BIOL 101 or 201, CHEM 102, MATH 231, PHYS 115 or 119; permission of the instructor for students lacking the prerequisites.

**Grading status:** Letter grade.

**ENEC 490. Special Topics in Environmental Science and Studies. 1-12 Credits.**

Advanced topics from diverse areas of environmental science and/or environmental studies are explored.

**Repeat rules:** May be repeated for credit; may be repeated in the same term for different topics; 12 total credits. 4 total completions.

**Grading status:** Letter grade.

**ENEC 490H. Special Topics in Environmental Science and Studies. 1-12 Credits.**

Advanced topics from diverse areas of environmental science and/or environmental studies are explored.

**Repeat rules:** May be repeated for credit; may be repeated in the same term for different topics; 12 total credits. 4 total completions.

**Grading status:** Letter grade.

**ENEC 491. Effective Environmental Communication. 3 Credits.**

Combines theory and application to explore effective communication in various environmental contexts and professions. Offers students from diverse disciplines tools to effectively and credibly communicate about environmental topics using a spectrum of strategies, and offers methods for effective thinking, writing, and speaking.

**Gen Ed:** CI.

**Grading status:** Letter grade.

**ENEC 492. Social Science Research Methods. 3 Credits.**

Students learn quantitative, qualitative, and mixed methods research skills and their application to public policies and management of natural resources.

**Gen Ed:** SS, EE-Mentored Research.

**Grading status:** Letter grade.

**ENEC 493. Environmental Internship. 1-4 Credits.**

Permission of the instructor. This course provides an internship with an organization related to environmental sciences or studies. Pass/Fail only.

**Gen Ed:** EE-Academic Internship.

**Repeat rules:** May be repeated for credit. 6 total credits. 2 total completions.

**Grading status:** Pass/Fail.

**ENEC 510. Policy Analysis of Global Climate Change. 3 Credits.**

Provides a real-world and relevant case study in which to apply material from multiple disciplines including public policy, economics, environmental science, and international studies. Teaches techniques for building policy models not covered elsewhere.

**Gen Ed:** SS, GL.

**Grading status:** Letter grade.

**ENEC 511. Stable Isotopes in the Environment. 3 Credits.**

Introduction to the theory, methods, and applications of stable isotopes to environmental problems. Primary focus will be on the origin, natural abundance, and fractionation of carbon, hydrogen, oxygen, and nitrogen isotopes.

**Requisites:** Prerequisite, CHEM 102.

**Grading status:** Letter grade

**Same as:** GEOL 511.

**ENEC 520. Environment and Development. 3 Credits.**

Reviews environmental problems in developing countries. Analyzes proposed solutions, such as legal remedies, market instruments, corporate voluntary approaches, international agreements, and development policies. Discusses the link between trade and environment, environmental cases from the World Trade Organization, and sustainable development.

**Gen Ed:** SS, GL.

**Grading status:** Letter grade

**Same as:** PLCY 520.

**ENEC 522. Environmental Change and Human Health. 3 Credits.**

The course will provide students with a multidisciplinary perspective of environmental changes to encompass both human health and ecological health.

**Requisites:** Prerequisite, ENEC 201 or 202.

**Grading status:** Letter grade

**Same as:** ENVR 522.

**ENEC 530. Principles of Climate Modeling. 3 Credits.**

Recommended preparation, MATH 383. Develops explanatory and predictive models of the earth's climate. The level is introductory and the emphasis is on modeling past climate with the hope of understanding its future.

**Requisites:** Prerequisites, MATH 231, 232, and 233; PHYS 118 and 119.

**Grading status:** Letter grade.

**ENEC 547. Energy, Transportation, and Land Use. 3 Credits.**

This course explores the reciprocal connections between energy (production/conversion, distribution, and use), land use, environment, and transportation. Evaluation of federal, state, and local policies on energy conservation and alternative energy sources are emphasized. Students gain skills to analyze impacts, interdependencies, and uncertainties of various energy conservation measures and production technologies.

**Grading status:** Letter grade

**Same as:** PLAN 547.

**ENEC 562. Statistics for Environmental Scientists. 4 Credits.**

Introduction to the application of quantitative and statistical methods in environmental science, including environmental monitoring, assessment, threshold exceedance, risk assessment, and environmental decision making.

**Requisites:** Prerequisite, STOR 155.

**Grading status:** Letter grade

**Same as:** BIOL 562.

**ENEC 563. Statistical Analysis in Ecology and Evolution. 4 Credits.**

Application of modern statistical analysis and data modeling in ecological and evolutionary research. Emphasis is on computer-intensive methods and model-based approaches. Familiarity with standard parametric statistics is assumed.

**Requisites:** Prerequisites, MATH 231 and STOR 151; Permission of the instructor for students lacking the prerequisites.

**Grading status:** Letter grade

**Same as:** BIOL 563.

**ENEC 565. Environmental Storytelling. 3 Credits.**

An interdisciplinary course for students interested in environmental issues or journalism to produce stories about environmental issues that matter to North Carolinians. Students learn to identify credible sources, manage substantial amounts of information, and find story focus as they report on technical and often controversial subjects in a variety of media.

**Grading status:** Letter grade

**Same as:** MEJO 565.

**ENEC 567. Ecological Analyses and Application. 3 Credits.**

This course provides an overview of natural and social science approaches to addressing biodiversity conservation and resource management. Concepts and methods from population biology, evolutionary ecology, community ecology, and conservation biology will be complemented with approaches from common property theory, indigenous resource management, and human evolutionary ecology.

**Grading status:** Letter grade.

**ENEC 569. Current Issues in Ecology. 3 Credits.**

Required preparation, previous course work in ecology. Permission of the instructor. Topics vary but focus on interdisciplinary problems facing humans and/or the environment. May be repeated for credit.

**Repeat rules:** May be repeated for credit. 6 total credits. 2 total completions.

**Grading status:** Letter grade.

**ENEC 580. Environmental Markets: Science and Economics. 3 Credits.**

Examines the interplay of science and economics in the design of environmental markets. The first part introduces the principles of environmental economics. The second part considers several case studies that illustrate the critical role that scientific models of natural systems play in the design of environmental markets.

**Grading status:** Letter grade.



**ENEC 581. Water Resource Planning and Policy Analysis. 3 Credits.**

Water resources demand-supply relationships, United States water resource and related water quality policy, legal structure for water allocation, planning, project and program evaluation, and pricing. Strategies for coping with floods, droughts, and climate change will be explored. Extensive use of case studies.

**Grading status:** Letter grade.

**ENEC 585. American Environmental Policy. 3 Credits.**

Intensive introduction to environmental management and policy, including environmental and health risks; policy institutions, processes, and instruments; policy analysis; and major elements of American environmental policy. Lectures and case studies. Three lecture hours per week.

**Gen Ed:** HS, NA.

**Grading status:** Letter grade

**Same as:** ENVR 585, PLAN 585, PLCY 585.

**ENEC 586. Water Quality Policies and Planning. 3 Credits.**

Introduction to the management of water quality at the local and basinwide scales. Topics include theory and management frameworks; state and federal statutes and programs; water contaminants, their fate and transport; alternatives for improving and protecting water quality; and the technologies and management practices of selected basinwide comprehensive strategies.

**Requisites:** Prerequisites, BIOL 101 and MATH 231.

**Grading status:** Letter grade.

**ENEC 593. Environmental Practicum. 1-3 Credits.**

Permission of the instructor required. Students receive service-learning credit through active participation in a community, campus, or other approved group project.

**Gen Ed:** EE-Academic Internship.

**Repeat rules:** May be repeated for credit. 6 total credits. 2 total completions.

**Grading status:** Letter grade.

**ENEC 602. Professional Development Skills for Ecologists and Biologists. 3 Credits.**

The goal of this course is to help students who intend to become professional ecologists or biologists acquire critical skills and strategies needed for achieving their career goals.

**Grading status:** Letter grade

**Same as:** BIOL 602.

**ENEC 608. Continuum Mechanics in the Earth Sciences. 3 Credits.**

Required preparation, introductory geology course numbered below GEOL 202, except first-year seminar, or permission of the instructor. Applications of continuum mechanics in the earth sciences, including stress, strain, elasticity, and viscous flow. Numerical solutions to problems in heterogeneous finite strain including finite element analysis.

**Requisites:** Prerequisites, MATH 231; PHYS 114 or 118.

**Grading status:** Letter grade

**Same as:** GEOL 608.

**ENEC 641. Ecology and Land Use Planning. 3 Credits.**

Integration of the structure, function, and change of ecosystems with a land use planning framework. How land use planning accommodates human use and occupancy within ecological limits to sustain long-term natural system integrity.

**Grading status:** Letter grade

**Same as:** PLAN 641.

**ENEC 669. Seminar in Ecology. 1-3 Credits.**

May be repeated for credit.

**Requisites:** Prerequisite, BIOL 201; permission of the instructor for students lacking the prerequisite.

**Repeat rules:** May be repeated for credit; may be repeated in the same term for different topics; 12 total credits. 12 total completions.

**Grading status:** Letter grade

**Same as:** BIOL 669.

**ENEC 675. Environmental Communication and the Public Sphere. 3 Credits.**

Examines communication practices that accompany citizen participation in environmental decisions, including public education campaigns of nonprofit organizations, "risk communication," media representations, and mediation in environmental disputes.

**Grading status:** Letter grade.

**ENEC 685. Environmental and Resource Economics. 3 Credits.**

Theory and methods of environmental economics. Topics covered include cost-benefit analysis and environmental policy analysis, economic concept of sustainability, optimal use of natural resources, nonmarket valuation, and economic instruments.

**Requisites:** Prerequisite, ECON 310.

**Grading status:** Letter grade.

**ENEC 686. Policy Instruments for Environmental Management. 3 Credits.**

Design of public policy instruments as incentives for sustainable management of environmental resources and ecosystems, and comparison of the effects and effectiveness of alternative policies.

**Requisites:** Prerequisite, ECON 410 or PLAN 710.

**Gen Ed:** SS.

**Grading status:** Letter grade

**Same as:** PLCY 686, ENVR 686, PLAN 686.

**ENEC 693H. Honors Research in Environmental Sciences and Studies. 3 Credits.**

Permission of the director of undergraduate studies. First of two course sequence leading to the honors designation.

**Gen Ed:** EE-Mentored Research.

**Grading status:** Letter grade.

**ENEC 694H. Honors Project in Environmental Sciences and Studies. 3 Credits.**

Permission of the director of undergraduate studies. Independent project leading to the honors designation. Includes weekly research seminar.

**Gen Ed:** EE-Mentored Research.

**Grading status:** Letter grade.

**ENEC 698. Capstone: Analysis and Solution of Environmental Problems. 3 Credits.**

Interdisciplinary, team-based analyses of environmental phenomena are performed and applied to problems of the selection of effective environmental strategies. Students may select from a wide range of examples and venues.

**Gen Ed:** EE-Mentored Research.

**Grading status:** Letter grade.