

# Applied Ecology (AEC)

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## **AEC 114 Wicked Problems, Wolfpack Solutions: Global Change** (2 credit hours)

Wicked Problems, Wolfpack Solutions is a shared academic experience designed for all students new to NC State. Each year, this course focuses on a current wicked problem, defined as a highly complex problem that can only be addressed through collaborative, multidisciplinary efforts. This course explores a wicked problem and possible solutions through the perspectives of NC State scholars representing many different areas of study and reflects NC State's commitment to inclusion of individuals and ideas from a broad diversity of backgrounds and experiences. AEC 114 focuses on the wicked problem of Global Change.

R: New First-Year Students and New Transfer Students  
*GEP Interdisciplinary Perspectives*  
*Typically offered in Fall and Summer*

## **AEC 203 An Introduction to the Honey Bee and Beekeeping** (3 credit hours)

Introduction to honey bee biology and a fundamental understanding of beekeeping management including crop pollination by bees. Examination of the relationships between honey bees and humans from prehistoric through modern times and the behavior and social system of one of the animal world's most complex and highly organized non-human societies.

*GEP Natural Sciences*  
*Typically offered in Fall only*

## **AEC 245 Global Conservation Ecology** (3 credit hours)

This course provides an introduction to the scientific principles and concepts that are the foundation of conservation biology. A diversity of topics will be covered, including 1) causes of extinction, 2) the impacts of habitat fragmentation, small population sizes, and exotic species, 3) evidence based nature preserve and corridor design, and strategies for protecting and restoring endangered species and ecosystems. Students will build on their conceptual and analytical skills and gain real-world decision making through collaborative research projects, in which they will gather data and apply their findings to develop climate-smart conservation approaches.

*GEP Global Knowledge, GEP Interdisciplinary Perspectives*  
*Typically offered in Spring only*

## **AEC 295 Special Topics in Applied Ecology** (1-3 credit hours)

Special topics and experimental offerings in Applied Ecology including developmental courses offered on a trial basis. Intended for students at an intermediate level of training in Biological Sciences.

Prerequisite: BIO 181  
*Typically offered in Fall, Spring, and Summer*

## **AEC 360/PB 360 Ecology** (4 credit hours)

The science of ecology, including factors which control distribution and population dynamics of organisms, structure and function of biological communities, and energy flow and nutrient cycling in ecosystems; contrasts among the major biomes; and principles governing ecological responses to global climatic and other environmental changes.

Prerequisite: C- or better in BIO 181  
*Typically offered in Spring only*

## **AEC 380 Water Resources: Global Issues in Ecology, Policy, Management, and Advocacy** (3 credit hours)

This course will take a broad look at global issues associated with water resources, including the ways that people interact with water (how we use, degrade, conserve, and advocate for water and water rights). And how these interactions shape our lives. Woven throughout the course is the fact that science (ecology), policy (resource management), and cultural perspectives interact (sometimes in cooperation and sometimes in conflict) on many topics related to water. Students will explore water resource issues from the perspectives of ecology, natural resource management, and different cultures. The course is appropriate for students with interests in the life and social sciences.

Prerequisite: BIO 181  
*GEP Global Knowledge, GEP Interdisciplinary Perspectives*  
*Typically offered in Summer only*

## **AEC 384 Tropical Ecology in a Changing World** (3 credit hours)

The tropics have attracted the attention of scientist for a long time and tropical studies have help advance our understanding of ecology and ecological theories. This course will focus on understanding tropical ecosystems, their biodiversity, and complexity. Students will learn about major ecosystem types and their characteristics. We will discuss major tropical contributions to ecology and ecological theories. In addition, we will study how global change is affecting the tropics and the potential consequences. Students will gain a general understanding of tropical ecology in a changing world.

P: AEC 360 / PB 360 or equivalent  
*Typically offered in Spring only*

## **AEC 390 Community Ecology** (3 credit hours)

This course explores the various mechanisms structuring ecological communities. The course builds on community ecology topics introduced in other courses, by providing an advanced understanding of the theoretical and quantitative nature of community ecology. Topics covered include two-species interactions (e.g. predation, competition, parasitism, mutualisms), multispecies interactions, food webs and ecological networks, biodiversity and ecosystem functioning, estimation of and regulation of species diversity at ecological and evolutionary time scales, higher order interactions, community succession, and biogeography. Emphasis will be on concepts and theory, quantitative and mathematical models, experimental and other empirical approaches, and hands-on use of data and computer software to address basic and applied questions in community ecology.

Prerequisites: (ENV 101 or AEC 360 or PB 360 or FOR 260) and (MA 121 or MA 131 or MA 141 or ST 311)  
*Typically offered in Spring only*

## **AEC 400 Applied Ecology** (3 credit hours)

Global climate change, over-fishing, habitat loss, altered nutrient cycles, and the spread of invasive species are among the world's pressing global environmental issues. Solutions to these problems are complex, but firmly rooted in the fundamental tenets of ecological theory. The field of applied ecology is premised on using these fundamental ecological principles to help solve the environmental challenges we face. This course will provide an overview of the field of applied ecology, based on a series of case studies. Working from the individual to global level, the course will provide a broad perspective on the field of applied ecology.

Prerequisite: AEC/PB 360  
*Typically offered in Fall only*

**AEC 409/AEC 509 Ecology and Conservation of Freshwater Invertebrates** (3 credit hours)

This course will introduce the student to the identification and ecology of freshwater invertebrates, with an emphasis on their life histories and adaptation to diverse freshwater habitats, significance to higher trophic levels, such as fish, ecosystem functioning, as a major source of freshwater animal diversity, conservation of threatened species, and application to bioassessment of water quality.

*Typically offered in Spring only*

**AEC 419/AEC 519 Freshwater Ecology** (4 credit hours)

The course explores the structure and function of streams, lakes, and wetlands, including physical, chemical and biological controls of productivity and species composition of aquatic plants and animals and effects of pollution on organisms and water quality. The laboratory emphasizes modern, hands-on techniques for answering fundamental and applied questions. One local weekend field trip required. Credit in both AEC 419 and AEC 519 is not allowed.

Prerequisite: C- or better in BIO/PB 360

*Typically offered in Fall only*

**AEC 420 Introduction to Fisheries Science** (3 credit hours)

Role of fish in aquatic ecosystems, fish biology, fish ecology, fisheries management and conservation. Emphasis on aquatic ecosystems and food webs, life history and ecology of important sport and commercial fishes, population and community dynamics, and theory and practice of fisheries management and conservation. Case studies from freshwater, estuarine and marine systems.

Prerequisite: C- or better in BIO/PB 360

*Typically offered in Spring only*

**AEC 423 Introduction to Fisheries Sciences Laboratory** (1 credit hours)

General anatomy and identification of common freshwater, estuarine and marine fish, functional morphology, age and growth analyses, fish health and diets. Computer analyses of bioenergetic and population dynamics.

Corequisite: FW/BIO 420

*Typically offered in Spring only*

**AEC 424 Marine Fisheries Ecology** (3 credit hours)

This course covers the life history, stock concept, fishing gears, stock assessment approaches, fish-habitat relationships, socio-economics, and management of marine fishes. Several field trips to state and federal agency laboratories and fish houses/docks are used to emphasize fish sampling, biological sample processing, and gear design. This course is part of the semester at CMAST program and requires students to be on site in Morehead City, NC.

Prerequisite: BIO 181

*Typically offered in Spring only*

**AEC 441 Biology of Fishes** (3 credit hours)

Behavior, evolution, physiology and ecology of fishes, emphasizing their adaptations for life in streams, lakes, and oceans.

Prerequisite: C- or better in BIO/PB 360 Corequisite: AEC 442 Biology of Fishes Laboratory

*Typically offered in Fall only*

**AEC 442 Biology of Fishes Laboratory** (1 credit hours)

Field and laboratory exercises with the common fish species and communities of North Carolina. Field trips to local streams and lakes plus weekend trips to coastal, estuarine, and mountain habitats.

Corequisite: AEC 441

*Typically offered in Fall only*

**AEC 460 Field Ecology and Methods** (4 credit hours)

Field Ecology and Methods will expose senior students with interests in Ecology and Evolution to the diverse field approaches used to address ecological questions. The course considers and implements a variety of field approaches ranging from microcosm experiments to global studies of patterns and diversity. Course is restricted to seniors.

Prerequisite: C- or better in ST 311 and BIO 360

*Typically offered in Fall only*

**AEC 470/AEC 570 Urban Ecology** (3 credit hours)

Developing design, conservation, and management strategies to serve humans and biodiversity in urban areas is an ongoing challenge. This course examines cities as unique physical environments and as social-ecological systems: How urban factors drive physiology, abundance and distribution of plants and animals, with consequences for biodiversity, ecosystem function, and human well-being. We will discuss the role of ecology in urban design and management, and emphasize the question of whether urban systems, and the role of humans therein, are adequately described by existing ecological principles.

P: AEC360 / PB360 or equivalent

*Typically offered in Fall only*

**AEC 492 External Learning Experience in Applied Ecology** (1-3 credit hours)

Learning experience in applied ecology within an academic framework with facilities and resources on or off campus. Contact and arrangements with prospective supervisors must be done by the student. Prior approval by faculty advisor and minor coordinator in department of applied ecology is required. Students are responsible for risk and safety assessment at off campus locations. Students are responsible for transportation. Individualized/Independent Study and Research courses require a Course Agreement for Students Enrolled in Non-Standard Courses be completed by the student and faculty member prior to registration by the department.

Prerequisite: BIO 181 (Variable, depending on instructor)

*Typically offered in Fall, Spring, and Summer*

**AEC 493 Internal Learning Experience in Applied Ecology** (1-3 credit hours)

Internal learning experience in applied ecology within an academic framework with facilities and resources on campus. Contact and arrangements with prospective supervisors must be done by the student. Prior approval by faculty advisor and minor coordinator in department of applied ecology is required. Students are responsible for risk and safety assessment at off campus locations. Individualized/Independent Study and Research courses require a Course Agreement for Students Enrolled in Non-Standard Courses be completed by the student and faculty member prior to registration by the department.

Prerequisite: BIO 181 (Variable, depending on instructor)

*Typically offered in Fall and Spring*

**AEC 495 Advanced Special Topics in Applied Ecology** (1-4 credit hours)

Special topics and experimental offerings in Applied Ecology including developmental courses offered on a trial basis. Intended for students at an advanced level of training in Biological Sciences.

*Typically offered in Fall, Spring, and Summer*

**AEC 501 Ornithology** (4 credit hours)

The biology of birds. Lecture topics include evolution, functional morphology, physiology, ecology and behavior. Field and museum laboratories emphasize particular aspects of morphology, ecology and behavior, as well as taxonomy and identification. One coastal weekend field trip required.

Prerequisite: BIO 181, BIO 183, and (BIO 250 or BIO/PB 360)

*Typically offered in Fall only*

**AEC 502 Introduction to Biological Research** (2 credit hours)

The main objectives of this course are to introduce and develop the tools and skills useful for excelling in graduate programs in Biology. Topics range from practical skills, such as selecting a committee, communication, data management, generating a thesis topic, and formulating hypotheses, to those that are more philosophical. There is a focus on scientific writing, especially grant proposals, and other professional skills, such as oral discussions of topics related to diversity and inclusivity, collaboration, publishing and reviewing, and developing professional skills and relationships that will be important throughout the graduate tenure of the students.

*Typically offered in Fall only*

**AEC 503 Foundations of Ecology** (2 credit hours)

This course covers major concepts, themes, and theories in ecology, including population, community and ecosystem ecology, and evolutionary ecology. Students are introduced to the core skill of critically evaluating scientific papers. The format of the course is readings from the primary literature and student-lead discussions. This course is focused toward first- and second-year graduate students, especially those in preparation for their preliminary exam.

Prerequisite: Graduate standing

*Typically offered in Spring only*

**AEC 509/AEC 409 Ecology and Conservation of Freshwater Invertebrates** (3 credit hours)

This course will introduce the student to the identification and ecology of freshwater invertebrates, with an emphasis on their life histories and adaptation to diverse freshwater habitats, significance to higher trophic levels, such as fish, ecosystem functioning, as a major source of freshwater animal diversity, conservation of threatened species, and application to bioassessment of water quality.

*Typically offered in Spring only*

**AEC 510 Machine Learning Approaches in Biological Sciences** (2 credit hours)

A wide range of high-throughput technologies are now being used to generate data to answer an ever-increasingly diverse set of questions about biological systems. The next great challenge is integrating data analysis in a systems biology approach that utilizes novel supervised machine learning methods, which accommodate heterogeneity of data, are robust to biological variation, and provide mechanistic insight. The course will not focus on detailed mathematical models, but instead on how these machine learning tools may be used to analyze biological data, in particular gene and protein expression.

Restriction: Graduate standing; Senior Undergraduates with permission from instructor

*Typically offered in Fall only*

**AEC 515/FW 515 Fish Physiology** (3 credit hours)

The biology of fishes: physiology, anatomy, endocrinology, behavior and genetics. Designed especially for graduate students in fisheries. Several trips to research laboratories taken.

*Typically offered in Fall only*

**AEC 519/AEC 419 Freshwater Ecology** (4 credit hours)

The course explores the structure and function of streams, lakes, and wetlands, including physical, chemical and biological controls of productivity and species composition of aquatic plants and animals and effects of pollution on organisms and water quality. The laboratory emphasizes modern, hands-on techniques for answering fundamental and applied questions. One local weekend field trip required. Credit in both AEC 419 and AEC 519 is not allowed.

Prerequisite: C- or better in BIO/PB 360

*Typically offered in Fall only*

**AEC 570/AEC 470 Urban Ecology** (3 credit hours)

Developing design, conservation, and management strategies to serve humans and biodiversity in urban areas is an ongoing challenge. This course examines cities as unique physical environments and as social-ecological systems: How urban factors drive physiology, abundance and distribution of plants and animals, with consequences for biodiversity, ecosystem function, and human well-being. We will discuss the role of ecology in urban design and management, and emphasize the question of whether urban systems, and the role of humans therein, are adequately described by existing ecological principles.

P: AEC360 / PB360 or equivalent

*Typically offered in Fall only*

**AEC 586/FW 586 Aquaculture** (3 credit hours)

Biological and general principles of aquaculture. Emphasis on the present status of aquaculture, species involved, techniques employed, and problems encountered. Discussion of recent advances in research and development and identification of areas of future research and development.

Prerequisite: BO 360 or ZO 260 or Graduate standing or Senior standing

*Typically offered in Spring only*

**AEC 587/FW 587 Aquaculture Laboratory** (1 credit hours)

Methods and techniques of cultivating aquatic organisms. Field trips and reports on local hatcheries and facilities required. (Three to four overnight field trips taken on week days to coastal areas, state hatcheries, and private hatcheries; students responsible for shared room costs and their meals. Four field trips also taken on laboratory day within driving range of Raleigh.)

Prerequisite: BO 360 or ZO 260 or Graduate standing or Senior standing, Corequisite: ZO 586

*Typically offered in Spring only*

**AEC 592 Special Topics in Applied Ecology** (1-6 credit hours)

Special Topics in Applied Ecology. Topics will vary.

*Typically offered in Fall, Spring, and Summer*

**AEC 624 Advanced Fisheries Science** (2 credit hours)

This is a seminar style course where students and faculty discuss readings in advanced fisheries science. The course is offered to students at CMAST (live) and on main campus (using Zoom or related online meeting software). Transportation is not required.

*Typically offered in Fall only*

**AEC 630 Special Topics in AEC** (1-6 credit hours)

Special Topics in AEC

*Typically offered in Fall, Spring, and Summer*

**AEC 710 Sampling Animal Populations** (3 credit hours)

Statistical methods applicable to sampling of wildlife populations, including capture-recapture, removal, change in ratio, quadrant and line transect sampling. Emphasis on model assumptions and study design.

Prerequisite: ST 512

*Typically offered in Fall only*

**AEC 718 Community Ecology** (3 credit hours)

Animal community structure and function. Effects of competition, predation, coevolution and disturbance on community composition. Emphasis on ecological and evolutionary controversies from empirical and theoretical approaches.

Prerequisite: BO 360 or ZO 260, BO(ZO) 760; BO(ZO) 365

*Typically offered in Spring only*

**AEC 726/FW 726 Quantitative Fisheries Management** (3 credit hours)

Current methods for assessment and management of exploited fish populations, including sampling methods, data analysis and modeling. A required research paper or project.

*Typically offered in Fall only*

**AEC 756 Ecology Of Fishes** (3 credit hours)

Physiological ecology of fishes emphasizing energetics, production and adaptations to aquatic mediums. Ecological classification of fishes and theory of resource partitioning in freshwater, estuarine and marine realms.

*Typically offered in Fall only*

**AEC 761 Conservation and Climate Science** (3 credit hours)

Conservation Science applies principles from ecology, genetics, and other biological disciplines and social sciences to the conservation of biological diversity. This course will train students in techniques in population ecology such as population viability analysis; community ecology and theories of biodiversity; and reserve selection algorithms. The course will also expose and trains students to understand climate science and using climate data for ecological studies. The class will examine threats to biodiversity such as habitat fragmentation and loss, climate change, and invasion by exotic species. These issues will be considered within the context of economic, social, and legal constraints. Graduate status or permission of instructor.

*Typically offered in Fall only*

**AEC 770 Advanced Topics In Ecology I** (3 credit hours)

Development of subject matter in major fields of ecology through seminars and lectures and principles illustrated by laboratory exercises and field trips. Microenvironment, population biology, community ecology, ecosystems and nutrient cycling.

*Typically offered in Spring only*