

Biology and Natural Resources

Gregory L. Bruland, Professor

Scott A. Eckert, Professor

John T. Lovseth, Associate Professor

Christine A. McAllister, Professor

We offer a biology curriculum that emphasizes ecological and organismal science, that exposes students to concepts, methods and skills in field biology, environmental studies, and natural resource management or conservation. With more than 2500 acres of forests, grasslands, wetlands, streams, and rivers that constitute the Principia lands, you'll not only learn fundamental concepts in biology and ecology but also conduct original research and conservation activities, including the ecology of prairies and prairie restoration, wetland and stream ecology and management, forest and forest resource management, as well as biological and ecological studies of local wildlife. We stress the preparation of our students for careers in the biological, ecological and environmental sciences, and particularly emphasize the skills that will enable them to become successful immediately upon graduation. Because the Biology and Natural Resources Department has a low faculty to student ratio combined with a highly accomplished faculty it is in a unique position to invest in each individual student and to develop within them professional level abilities that match their individual interests.

B.S. in Biology

The B.S. in biology emphasizes ecology, ecological research and organismal biology. The biology degree has added coursework in math and science thus making the program especially appropriate for students interested in graduate study or work in biological and ecological research or management.

B.A. in Environmental Studies

The B.A. in environmental studies provides a high level of customization to support a student's academic and professional interests. The academic structure of the Environmental Studies degree program allows students to customize their course of study to their own goals by enabling them to choose from a wide variety of courses and departments within four categories (Foundational Knowledge courses, Skills courses, Environmental and Economic Policy courses, Ecosystem Function courses). It is anticipated that environmental studies students will focus on a number of career areas including wildlife management, forest or forest resource management, environmental policy and law or environmental education. There is also a minor in environmental studies for those students seeking to enhance their major degree in another discipline.

There is a growing recognition of the importance that marine environments play in global ecological processes. To provide Principia students with the opportunity to study at a world-class marine laboratory, Principia has joined the Marine Science Education Consortium (MSEC), based at Duke University's Marine Laboratory (DUML). Over 34 schools (mostly four-year liberal arts colleges like Principia) in the consortium send students to DUML to take classes in a wide variety of marine science fields. Principia students wishing to attend a semester at DUML may apply through Principia's Biology and Natural Resources Department to take courses that

will then be accepted for credit at Principia College through the normal processes in the Registrar's Office.

Departmental Learning Outcomes

The study of Biological and Environmental Sciences cultivates understanding of and care for the environment; it motivates ethical decisions, and integrates critical and scientific thinking into every educational experience. Students majoring in Biology or Environmental Studies will be able to:

1. *Demonstrate foundational knowledge in the Biological and Environmental Sciences*
2. *Practice scientific skills such as sampling, measuring, estimating, calculating, and analysis of data*
3. *Demonstrate the ability to communicate science and scientific findings to society*

Majors

- B.S. in Biology (<http://catalog.principiacollege.edu/majors-minors/biology-natural-resources/bs/>)
- B.A. in Environmental Studies (<http://catalog.principiacollege.edu/majors-minors/biology-natural-resources/ba-environmental-studies/>)

Minor

- Minor in Environmental Studies (<http://catalog.principiacollege.edu/majors-minors/biology-natural-resources/minor-environmental-studies/>)

BNR 042 Internship - No Credit **0.0 SH** []

An opportunity to gain practical experience in biology, natural resource conservation, environmental policy, consulting, and many other related environmental fields. Internships are selected based on student interest and are designed to extend classroom learning, explore career interests, and put into practice content, theories, and skills in the major. May be taken more than once if topics differ.

BNR 050 BNR Service Learning **0.0 SH** []

Students volunteer in positions as naturalists, outdoor teachers, land managers, research technicians, and community recyclers. Projects may serve Principia or other communities or outside agencies such as the Two Rivers National Wildlife Refuge.

BNR 105 Introduction to Forestry **4.0 SH** [GESL]

An introduction to humanity's connection to trees and how we care for them. This course is designed to impart technical skills in forest inventory, data analysis, writing forest management plans and harvest prescriptions, tree planting, timber marking and grading, milling, firewood, and operating equipment. Topics on global forest issues, wildlife, recreation, and forest products are covered.

Class Level Restriction: Freshman and Sophomore only.

BNR 111 Introductory Botany **4.0 SH** []

Introduction to basic plant structure and function, with emphasis on the processes of photosynthesis, growth, respiration, and reproduction. Includes a survey of the plant kingdom, from algae to flowering plants, focusing on life cycles and ecology of representative plants. Designed primarily for students intending to major in biology or environmental studies.

Corequisite: BNR 112, BNR 191, BNR 201.

Class Level Restriction: Freshman and Sophomore only.

BNR 112 Introductory Zoology 4.0 SH []

Survey of animal kingdom and the animal-like protists, including basic structure, life history, ecology, and classification of major groups. Emphasis is given to invertebrates, although vertebrate groups are covered near the end of the course. Introduction to laboratory techniques and scientific writing are stressed.

Corequisite: BNR 111, BNR 191, BNR 201.

Class Level Restriction: Freshman and Sophomore only.

BNR 115 Intro to Restoration Ecology 4.0 SH [GESL]

This course presents students with an introduction to the field of restoration ecology. Students will learn how to apply basic ecological principles to the restoration of various ecosystems as well as the social, economic, and political forces that impact restoration success. Students will become familiar with field techniques, scientific writing skills, and participate in a local ecosystem restoration project.

BNR 120 Plants and Society 4.0 SH [GESL]

Explores basic plant biology, plant culture, from house plant care to home gardening to large-scale agriculture. Topics include introductory plant physiology, the impacts of light, temperature, soil, and fertilizer on plant growth, and pest control. Special emphasis is placed on the development and environmental impacts of large-scale agriculture (including the development and use of genetically modified organisms in agriculture).

Class Level Restriction: Freshman and Sophomore only.

Fee=\$25.00.

BNR 141 Intro to Marine Fisheries 4.0 SH [GESL]

Students examine the broad diversity of life on earth by studying the major plant and marine animal taxa involved in making sushi: rice, kelp, corals and jellies, marine worms, echinoderms, crustaceans, mollusks, and cartilaginous and bony fish. Students unpack the theory of natural selection and consider how forces long ago shape present ecological dynamics of these organisms. They also examine modern day fishing/harvesting practices and consider sustainability as a function of species' evolutionary traits.

BNR 161 Field & Natural History 4.0 SH [GESL]

Studies of local plants and animals in their natural environment and in their relation to humankind. Emphasis on conservation, nature interpretation, and observation and field research skills.

Class Level Restriction: Freshman and Sophomore only.

Fee=\$50.00.

BNR 190 Global Environmental Issues 3.0 SH [GESN]

Exploration of major environmental issues that are global in scale. By examining topics such as deforestation, agriculture, climate change, and the worldwide decline of biological diversity, students will learn to think critically about environmental issues. They will also learn to recognize and sort through the many conflicting perspectives that surround most of these issues. Special emphasis is placed on the role of science in helping to identify and solve global environmental problems. Designed primarily for students intending to major in biology or environmental studies.

Class Level Restriction: Freshman and Sophomore only.

BNR 191 Introduction to Ecology 4.0 SH [GESL]

Exploration of fundamental concepts relating to ecosystem structure and function, including the interactions of plant and animal populations within biological communities, and the role of abiotic factors in shaping those populations and communities. Emphasizes basic methods of field research, data analysis, and scientific writing. Designed primarily for students intending to major in biology or environmental studies.

Corequisite: BNR 111, BNR 112, BNR 201.

Class Level Restriction: Freshman and Sophomore only.

BNR 201 Methods in Research & Writing 4.0 SH []

Course emphasizes a broad range of skills essential to successful work in biology or environmental studies. Skills include reading and analyzing scientific literature, designing and conducting lab and field research projects, data management and analysis, scientific writing, and presentation techniques. Designed primarily for students intending to major in biology or environmental studies.

Corequisite: BNR 111, BNR 112, BNR 191.

Class Level Restriction: Freshman and Sophomore only.

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- BNR 215 Biometry** **3.0 SH** []
This course provides an introduction to statistics emphasizing applications to biology and natural resource management. Topics include descriptive statistics, distributions, confidence intervals, T-tests, correlation, linear regression, analysis of variance (ANOVA), multiple and nonlinear regression, multiple ANOVA, and nonparametric statistics. The course emphasizes application of statistical methodology. (A student may receive credit for only one of the courses BNR 215 or MATH 164.)
Prerequisite: BNR 201 or permission of instructor.
Field of Study Restrictions: Biology, Environmental Studies Majors only.
- BNR 220 Marine Biology** **3.0 SH** []
This survey course covers a broad range of subject areas in marine biology including basic oceanography, biology of life in the seas, and management/conservation of oceanic biological resources. Also focuses on learning about marine ecosystems (types, locations, and biological structure).
Prerequisite: BNR 112.
- BNR 225 Indigenous Ecol Knowledge** **3.0 SH** []
The course provides an introduction to the ways in which indigenous people understand the world and the land. Special attention will be paid to interactions between indigenous knowledge and Western science. Students will explore aspects of indigenous ecological knowledge and the role it plays in contemporary ecology. The relevance of indigenous knowledge to contemporary resource management will also be explored.
- BNR 230 Ornithology** **4.0 SH** [GESL]
Study of birds: their structure, identification, classification, habits, life history, distribution, migration, methods of attraction, economic importance. Field identification and behavioral study of local species.
Fee=\$25.00.
- BNR 231 Herpetology** **4.0 SH** [GESL]
A survey of the biology of reptiles and amphibians. Topics covered include evolutionary origins, morphology, life history, ecology, and identification, emphasizing Principia College campus species. Field work, collecting, and identifying the Principia herpetofauna constitute a significant portion of the course. Students undertake a research project on the amphibian or reptile of their choice.
Fee=\$25.00.
- BNR 232 Wildlife Conservation** **3.0 SH** []
This course explores major local and global wildlife issues focusing on the impacts of population growth, land use, tourism, development, and other human activities. This course also examines a range of conservation and planning strategies to protect wildlife species.
- BNR 236 Sea Turtle Biology** **3.0 SH** []
This course teaches the biology of sea turtles (evolution, anatomy, physiology, behavior, life history, and population dynamics) and their conservation needs. Basic ecological concepts are integrated with related topics of conservation and management of endangered species, the contributions of technology to the management of migratory marine species, and the role of research in national and international law and policy.
- BNR 237 Sea Turtle Biology: Trinidad** **4.0 SH** [GESL]
This course teaches the biology of sea turtles (see description for BNR 236) and their conservation needs. During spring break students travel to Trinidad in the Caribbean to study marine turtles. They assist in ongoing research, as well as interact with local resource managers in a "real world" context where the complexities of biodiversity conservation can be learned. (A student may receive credit for only one of the courses BNR 236 or BNR 237.)
Fee=\$900.00.
- BNR 245 Natural History** **2.0-4.0 SH** [GESL]
This course focuses on the study of the natural history of flora and fauna in a specific country or region. Ecosystems studied may include: marine, alpine, forest, grasslands, riverine. Offered on Principia abroads only, with a star (*) grade until following midterm. May be offered for variable credit from two to four semester hours. The title will be extended to describe the current topic. May be taken more than once provided the topics differ.

- BNR 255 Natural Resources Management** **4.0 SH** **[GESL]**
 This course focuses on the biological and physical science aspects of natural resource management at local, national, and global scales. Topics covered include management of soil, water, forest, coastal, and wildlife resources. In the laboratory exercises, students learn field measurement techniques and computer skills commonly used in managing natural resources as well as learn how to write scientific lab reports.
- BNR 256 Genetics** **4.0 SH** **[]**
 Classical and modern genetic theory and technique, with an emphasis on the role of genetic variability in the development of species, and in the conservation of biodiversity.
Prerequisite: BNR 111 or BNR 112.
- BNR 264 Sugarbush Management** **4.0 SH** **[GESL]**
 Course exposes students to historical, scientific, business, and conservation aspects of managing a maple-dominated woodland for syrup production. Central to this course is the planning and implementation of a small-scale "sugarbush" on the college campus, complete with tapping, evaporating, and marketing the final product.
Fee=\$50.00.
- BNR 280 Plant Taxonomy** **4.0 SH** **[]**
 Study of plant families illustrated by their morphology and reproductive structures. Emphasis is on the development of skills used to identify and classify plants in the field.
Prerequisite: BNR 111.
- BNR 290 Environmental Policy** **3.0 SH** **[]**
 This course includes the formulation and implementation of environmental policy, with special reference to the impact of political and economic factors. Specific consideration will be given to major environmental regulations.
- BNR 293 Soil and Water Conservation** **3.0 SH** **[]**
 Past and present issues in soil and water conservation will be examined. Principles of erosion, conservation tillage, irrigation, and drainage will be discussed. Agencies and programs responsible for soil and water conservation will be studied. Current issues such as integrated watershed management, water conflicts and cooperation, organic agriculture, urban agriculture, and green roofs will also be investigated.
Prerequisite: BNR 191 or EARTH 111.
Class Level Restriction: Sophomore and Junior and Senior only.
- BNR 301 Environmental Mapping & GIS** **4.0 SH** **[]**
 Introduction to the concepts, techniques, and applications of mapping and monitoring the environment. Students become familiar with the uses of topographic maps, aerial photography, satellite imagery, Global Positioning Systems (GPS), and Geographic Information Systems (GIS). Students design and implement an ecosystem mapping project. Also listed as EARTH 301.
Class Level Restriction: Junior and Senior only.
- BNR 312 Grassland Ecology** **4.0 SH** **[]**
 Exploration of the structure and function of grassland ecosystems. Topics include the evolutionary history of the grassland biome, interactions between plants and animals in grasslands, and the effects of fire, grazing, and climate on grasslands. Introduces students to key papers on grassland ecology, as well as current field research methods.
Prerequisite: BNR 111 and BNR 191.
Class Level Restriction: Junior and Senior only.
- BNR 313 Forest Ecology** **4.0 SH** **[]**
 An exploration of the structure and function of forested ecosystems, with an emphasis on field research and scientific writing. Topics include succession, disturbance, landscape variation, nutrient cycling, tree identification, and ecosystem stability. This course builds on the fundamentals learned in Introduction to Ecology and introduces students to contemporary ecological thinking.
Prerequisite: BNR 111 and BNR 191.
Class Level Restriction: Junior and Senior only.

- BNR 315 Freshwater Ecology** 4.0 SH []
 A survey course in the ecological functioning of lakes, rivers, streams, and wetlands. The course has a special focus on the great rivers of the Midwest, including their ecological and environmental problems. Students learn field skills needed to conduct ecological research and write scientific lab reports and a final research paper on freshwater ecosystem topics.
Prerequisite: BNR 111 and BNR 191.
Class Level Restriction: Junior and Senior only.
- BNR 317 Wetland Ecology** 4.0 SH []
 The study of bogs, fens, swamps, bottomland hardwood forests, salt marshes and mangroves with an emphasis on the formation, hydrology, biogeochemistry, and community dynamics of these systems. Management, policy, and restoration strategies will also be discussed. Students will learn field skills needed to conduct wetland research and write lab reports and a final research paper on wetland ecosystem topics.
Prerequisite: BNR 111 and BNR 191.
Class Level Restriction: Junior and Senior only.
- BNR 325 Wildlife Management** 4.0 SH []
 This course is designed to give students an understanding of wildlife and conservation management methods. Covers techniques in population estimation, radio and satellite telemetry and other electronic data gathering methods as well as studying when and how to apply such methods. The course combines lecture and field work, with a heavy emphasis on the field work.
Prerequisite: BNR 112.
Class Level Restriction: Junior and Senior only.
- BNR 340 Adv Natural History** 2.0-4.0 SH []
 An advanced course that focuses on natural history of flora and fauna in a specific country or region. It also focuses on the ecological dynamics of populations, communities, and ecosystems in the region. Case studies are drawn from a variety of systems including marine, freshwater, forest, grassland, alpine and other ecosystems. May be offered for variable credit from two to four semester hours. The title will be extended to describe the current country or region. May be taken more than once provided the regions differ.
- BNR 360 Vertebrate Zoology** 4.0 SH []
 Studies include the evolutionary development of vertebrates, from their origins to the divergence of groups. It focuses on comparative anatomy to understand common ancestral linkages. Students study the broad diversity of modern vertebrates, including life histories, physiology, and ecological adaptations. Laboratory work focuses on anatomy as well as key features of the major vertebrate groups.
Prerequisite: BNR 112.
Class Level Restriction: Junior and Senior only.
- BNR 362 Conservation** 2.0-4.0 SH [GESN]
 This course focuses on how natural resources of a given country are managed. Students study conservation management strategies of representative ecosystems as well as species management and the interface of native culture and resource conservation. Offered on Principia abroad only, with a star (*) grade until following midterm. The title will be extended to describe the current country. May be offered for variable credit from two to four semester hours.
Class Level Restriction: Junior and Senior only.
- BNR 380 Advanced Ecology Seminar** 1.0-3.0 SH []
 Offered when regular or visiting faculty are available to work with students on selected topics in ecology. Recent topics have included ecological modeling and soils ecology. The title will be extended to describe the current topic. May be offered for variable credit from one to three semester hours. May be taken more than once provided the topics differ.
Class Level Restriction: Junior and Senior only.

- BNR 381 Adv Natural Resources Seminar** **1.0-3.0 SH** []
 Offered when regular or visiting faculty are available to work with students on selected topics in natural resources conservation. The title will be extended to describe the current topic. May be offered for variable credit from one to three semester hours. May be taken more than once provided the topics differ.
Class Level Restriction: Junior and Senior only.
- BNR 390 Forest Resource Management** **4.0 SH** []
 A course in the ways we manage forest lands to provide an array of goods and services to mankind. This course teaches the concepts of sustainable forestry and the field techniques that allow the manager to evaluate, plan, and implement forest management activities. Students learn specific skills in forest measurements, applied silviculture, and the use of management decision support tools.
Prerequisite: BNR 191.
Class Level Restriction: Junior and Senior only.
- BNR 400 Senior Thesis Seminar** **1.0 SH** []
 This course is designed to assist senior biology and environmental studies majors as they design, conduct, and plan for the presentation of a capstone project. Weekly class activities may include presentations from the research librarian, discussions with BNR faculty about project design and methodology, preparation of an annotated bibliography and coaching on presentation skills and technology. Students develop a formal research proposal and a plan for the project. Open only to biology or environmental studies majors.
Class Level Restriction: Junior and Senior only.
Field of Study Restrictions: Biology, Environmental Studies Majors only.
- BNR 401 Senior Thesis** **1.0-6.0 SH** []
 Project selected in accordance with student's qualifications, interests, and needs. May be taken for variable credit from one to six semester hours. May be taken more than once with BNR department chair approval. May be repeated up to a total of 12 semester hours.
Prerequisite: five or more BNR courses numbered above 150 including BNR 400.
Class Level Restriction: Senior only.
- BNR 402 Internship** **1.0-6.0 SH** []
 An opportunity to gain practical experience in biology, natural resource conservation, environmental policy, consulting, and many other related environmental fields. Recent student internships have included waterfowl research for the U.S. Fish and Wildlife Service, amphibian research in Puerto Rico, coyote behavior studies in Yellowstone, and aquarium management at the New England Aquarium. May be taken for variable credit from one to six semester hours. May be taken more than once if topics differ. Offered on an independent contract basis.
Class Level Restriction: Junior and Senior only.
- BNR 403 Biology Research Experience** **1.0-6.0 SH** []
 This course is designed to give students the opportunity to conduct guided research as research assistants in biology, natural resource conservation, or other environmental fields. Students will undertake original research while gaining practical experience as research biologists. Depending on the project, students may spend some of, or the whole semester, off campus. Open only to Biology Majors.
Prerequisite: BNR 111, BNR 191, and BNR 201, and at least one of the following: BNR 312, BNR 313, BNR 315.
Class Level Restriction: Junior and Senior only.
Field of Study Restrictions: Biology Majors only.
- BNR 410 Senior Readings** **3.0 SH** []
 This course introduces students to seminal pieces of environmental literature and to cutting edge thinking on environmental problems. Students are responsible for reading assigned materials and participating in seminar discussions. The course challenges students to define and defend their personal values regarding environment and to become active citizens in the environmental issues facing society.
Prerequisite: five BNR courses.
Class Level Restriction: Junior and Senior only.