BIOE - Biology-Ecological

BIOE 103CS. Environmental Science and Society. 3 Credits. (3 Lec)ES
Annually. The relationship between people and the environment as the earth as an ecosystem to show the effects of people's activities on natural ecosystems. Environmental issues such as wilderness, wolf reintroduction, global warming, fire ecology, whirling disease, and grizzlies are covered.

BIOE 290R. Undergraduate Research. 1-6 Credits. (1-3 Ind; max ) On Demand
PREREQUISITE: Consent of instructor and approval of department head. Directed research and study on an individual basis.

BIOE 291. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
Max credits PREREQUISITE: Consent of instructor and approval of department head. Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand.

BIOE 292. Independent Study. 1-3 Credits. (1-3 Ind; 6 cr max) On Demand
PREREQUISITE: Consent of instructor and approval of department head. Directed research and study on an individual basis.

BIOE 298. Internship. 1-4 Credits. (1-4 Ind. Study. Max 8 credits) ES,Su
PREREQUISITE: Approval of intern program by consent of instructor and approval of department head. An individualized assignment arranged with an agency, business, or other organization to provide guided experience. May be repeated.

BIOE 370. General Ecology. 3 Credits. (3 Lec) ES
PREREQUISITE: BIOB 170IN. Recommended: STAT 216Q or BIOB 318. Relation of organisms to their environment. The composition, structure, function and distribution of populations, communities, and ecosystems. Emphasis on population ecology, including demography, population dynamics and evolutionary ecology.

BIOE 375. Ecological Responses to Climate Change. 3 Credits. (3 Lec) S
PREREQUISITE: BIOE 160, and BIOB 170IN, and BIOE 370 or NRSM 240. Students explore how ecosystems are responding to climate changes at a range of spatial and temporal scales. Case studies include changes in vegetation and soils, plant and animal phenology, and disease outbreaks.

BIOE 405. Behavioral and Evolutionary Ecology. 3 Credits. (3 Lec) S
PREREQUISITE: Junior standing. Abundance and distribution of organisms in relation to their evolution, behavior, population biology and interactions with other organisms.

BIOE 408. Rocky Mountain Vegetation. 3 Credits. (2 Lec, 1 Lab)
PREREQUISITE: Senior Class Standing in Biological Sciences major, or consent of instructor. Rocky Mountain Vegetation is an integrative, place-based course in vegetation ecology. Topics include: Geographic distribution and geological characteristics of the component ranges of the Rockies, interaction of geology and soils with climate to produce the extreme environmental gradients typical of the Rockies, the basic autecology of dominant and widespread species that characterize the vegetation of the Rockies, the principles of disturbance and succession and how the vegetation of the Rockies exhibits those principles, the distribution and dynamics of the common plant communities of the Rockies in response to the variable environment.

BIOE 416. Alpine Ecology. 3 Credits. (1 Lec, 2 Lab) Su
PREREQUISITE: Junior standing, BIOB 170IN. The ecology characteristics of alpine areas. A three-day field trip will confirm and reinforce material presented in class and is a course requirement.

BIOE 420. Field Ornithology. 3 Credits. (2 Lec, 1 Lab) ES
PREREQUISITE: Junior standing, and either BIOE 100IN or BIOB 170IN. Field identification, habitat affinities and life histories of birds of the northern Rockies. Includes early morning field trips.

BIOE 421. Yellowstone Wildlife Ecology. 3 Credits. (2 Lec, 1 Lab) Su
PREREQUISITE: Junior standing, and BIOB 100IN or BIOB 170IN, and BIOE 370. Basic ecology of the major animal species of the Yellowstone area and the ecological controversies surrounding their management.

BIOE 422. Insect Ecology. 3 Credits. (3 Lec) S

BIOE 424. Ecology of Fungi. 3 Credits. (2 Lec, 1 Lab) F alternate years, to be offered odd years.
PREREQUISITE: BIOE 170IN, BIOE 256, a comparable course in introductory biology, or consent of instructor. COREQUISITE: None, but an upper division biology course is recommended. This course emphasizes the important and varied roles of the higher fleshy fungi in natural and managed systems, focusing on forest habitats. Fungi are the ecological backbone of many terrestrial systems, yet their ecological roles as saprophytes, symbions, and mycorrhizal mutualists are often minimized. Both traditional techniques and more recent molecular methods will be presented at the individual, population, community, landscape, and biome levels, along with topics on fungal conservation and global change. This course consists of twice weekly sessions of two hours each for lecture, discussions, and demonstrations. One or two afternoon or morning field trips to nearby forests are required to initiate a final project.

BIOE 427RN. Research in Freshwater Ecology. 3 Credits. (1 Lec, 2 Lab) F
PREREQUISITE: Junior standing. BIOE 370: Prior or concurrent registration in BIOE 428. This course is designed to expose students to the fullness of designing and conducting research in freshwater ecosystems. Students will develop a research question, propose a study design, conduct field and laboratory research, and present their research in oral and written format. This course will also include a stream invertebrate collection and identification assignment.

BIOE 428. Freshwater Ecology. 3 Credits. (3 Lec) F
PREREQUISITE: BIOE 370 and Junior standing; or consent of instructor. This course examines relationships between freshwater organisms and their environment. Students learn about the ecology of rivers, lakes, reservoirs, and wetlands, with exposure to a wide diversity of organisms and processes. Emphasis is placed on linking basic concepts and real-world applications.

BIOE 435. A Study of Local Ecosystems for Teachers. 1 Credit. (1 Lec) F
PREREQUISITE: The course is designed for practicing or pre-service teachers. A Study of Local Ecosystems for Teachers investigates ecological principles as students perform field studies of their local ecosystem. Students will also create lesson plans based on their findings for the respective K-12 teaching assignments or future assignments if not currently in the classroom.

BIOE 436. Symbiosis for Teachers: Eat, Prey, Love. 3 Credits. (3 Lec) S
PREREQUISITE: Graduate standing and 2 years successful classroom teaching experience. This course is intended for pre-service (BIOE 436) and in-service (BIOE 526) teachers. Graduate standing and teaching experience will be waived for pre-service teachers. This course is designed for elementary, middle school, high school, and pre-service teachers. Students will participate in the process of science and develop creative and critical reasoning skills. The course provides an effective way to integrate instructional scientific strategies for teachers. Students will share cross-level instruction and constructive ideas. The goal of this course is to promote the study of symbiosis and applications of symbiotic relationships.

BIOE 439. Streams Ecology. 3 Credits. (2 Lec, 1 Lab) F
PREREQUISITE: BIOB 170IN, CHMY 121IN or CHMY 141, and PHYS 205. Examination of the structure and function of stream ecosystems emphasizing connections among stream organisms, the aquatic chemical and physical environment, and the surrounding terrestrial landscape.

BIOE 440R. Conservation Biology. 3 Credits. (3 Lec) F
PREREQUISITE: BIOE 370 and STAT 216Q and STAT 217Q, or equivalents, and Junior standing. RECOMMENDED: STAT 411. Examines issues relevant to conservation of wild populations, focusing primarily on animals. Emphasis is on approaches that use demography, population biology and genetics to address conservation questions. Approaches include empirical field studies, mathematical models, and the use of R programming for modeling and empirical analysis. Readings are from the primary literature and a textbook, including case studies. Co-convened with BIOE 521.

BIOE 445. Macrosystems Ecology: Linking Plants, Animals, and Ecosystems Across Scales. 3 Credits. (3 Lec) S
PREREQUISITE: BIOE 370 and Junior standing. Advanced ecology designed to help students "put the pieces together" and understand how plants, animals, and ecosystems interact. These interactions are examined across biomes of the world to better understand general principles and to derive effective local management strategies.

BIOE 455. Plant Ecology. 3 Credits. (3 Lec) S
PREREQUISITE: BIOB 170IN, and BIOE 370 or NRSM 240, and Junior standing. Principles of plant ecology, covering plant-environment relations, plant life histories, plant species interactions, plant community concepts, succession, and the role of plants in ecosystem processes.
BIOE 490R. Undergraduate Research. 1-6 Credits. (1-6 Lec; 12 cr max) 
PREREQUISITE: Junior standing, consent of instructor and approval of department head. Directed undergraduate research which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. Maximum of 6 credits as electives in Organismal Biology Option. 202050.

BIOE 491. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand 
Max 12 credits PREREQUISITE: Course prerequisites as determined for each offering. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand.

BIOE 492. Independent Study. 1-3 Credits. (1-3 Ind; 3 cr max) On Demand 
PREREQUISITE: Junior standing, consent of instructor and approval of department head. Maximum of 6 as electives in Organismal Biology Option. Directed research and study on an individual basis.

BIOE 494. Seminar/Workshop. 1 Credit. (1 Sem; 4 cr max) 
PREREQUISITE: Junior standing and as determined for each offering. Topics offered at the upper division level which are not covered in regular courses. Students attend and discuss seminar presentations by professional biologists.

BIOE 498. Internship. 1-4 Credits. (1-4 Internship; 8 cr max) On Demand 
PREREQUISITE: Junior standing, approval of intern program by consent of instructor and approval of department head. An individualized assignment arranged with an agency, business, or other organization to provide guided experience. May be repeated.

BIOE 499. Senior Thesis/Capstone. 2 Credits. (2 Sem) ES 
PREREQUISITE: Senior standing in Ecology Department. Senior capstone course. Discussion of topics that integrate evolutionary theory with ecology, genetics, medicine, behavior, or other subjects that are part of the biology curriculum.

BIOE 513. Terrestrial Ecology of Plains and Prairies. 1 Credit. (1 Rct) Su
PREREQUISITE: Either BIOE 408 or BIOL 516, graduate standing, secondary teacher certification, two years teaching experience, and computer access.
COREQUISITE: Suggested: ESCI 513. Students will develop plant keys for classroom use, quantitatively analyze two grassland communities, and develop classroom activities on ecology of grasslands. Distance learning, class offered by internet connection. This course is designed for secondary school teachers enrolled in MSSE program and cannot be used in graduate programs in Biological Sciences.

BIOE 514. Ecological Modeling. 3 Credits. (3 Lec) F
alternate even years PREREQUISITE: BIOE 370. Interactions and feedbacks between vegetation, disturbance, and climate will be explored using biogeography and biogeochemical models. Theory and computational techniques in ecological modeling.

BIOE 515. Landscape Ecole & Mgmt. 4 Credits. (2 Lec, 2 Lab) F alternate years, to be offered odd years.
PREREQUISITE: Graduate standing or consent of instructor. Principles on landscape pattern, change, and function. Application of theory to conservation including population viability, reserve design, multiple-use landscapes. Lab introduces GIS, GPS, and simulation models. For graduate students and motivated undergraduates.

BIOE 517. Advances in Ecological Modeling. 3 Credits. (3 Lec) S
PREREQUISITE: BIOE 370. Advances in numerical modelling of disturbance, demography, and ecosystem biology will be introduced with lectures and applied computational examples.

BIOE 519. Riparian Zones/Wetlands. 2 Credits. (2 Rct) Su 
PREREQUISITE: Either BIOL 516 or BIOE 408, secondary teacher certification, two years teaching experience, and computer access.
COREQUISITE: Suggested: ESCI 512. ESCI 515. Students will develop plant keys for classroom use, quantitatively analyze two riparian and two wetland areas, and develop classroom activities about ecology of those areas. Distance learning class offered by internet connection. This course is designed for secondary school teachers enrolled in the MSSE program and cannot be used in graduate programs in Biological Sciences.

BIOE 520. Animal Biodiversity in GYE. 2 Credits. (1 Lec, 1 Lab) Su
PREREQUISITE: BIOE 370, WILD 301, BIOE 405, or equivalent and (a) 2 years science technology experience or (b) enrolled in MSSE. Exploration of biodiversity’s meaning, importance & determinants; key ecological features of the Greater Yellowstone Ecosystem and patterns of change in those features; & possible strategies for maintaining biodiversity in the Greater Yellowstone Ecosystem.

BIOE 521. Conservation Biology. 3 Credits. (3 Lec) F 
PREREQUISITE: BIOE 370, BIOL 420, STAT 21602 and STAT 2170Q, or equivalents. RECOMMENDED: STAT 411 A broad survey of conservation biology, emphasizing approaches related to demography/population dynamics and evolution. Less extensively considers approaches related to community/ecosystem/landscape ecology. Approaches include empirical field studies, mathematical models, using R for modeling and empirical analysis, reading primary literature, writing a research paper and presenting a research talk. Co-ordinated with BIOE 440.

BIOE 522. Birds of Prey. 2 Credits. (1 Lec, 1 Lab) Su 
PREREQUISITE: BIOE 370, WILD 301, BIOE 405, or equivalent and 2 years science technology experience or enrolled in MSSE. Exploration of the ecology and habitat of avian raptors in the Greater Yellowstone Ecosystem (GYE). Application of the scientific method to the study of raptors. Field identification of raptors, investigation of species life histories, and inquiry methods of species-specific habitat needs. Students will develop methods and skills for classroom based research on wildlife. This course is designed for secondary school teachers enrolled in the MSSE program and cannot be used in graduate programs in Biological Sciences.

BIOE 523. Wildlife Ecology. 2 Credits. (2 Lec) Su 
PREREQUISITE: BIOE 370, WILD 301, BIOE 405, or equivalent and 2 years science technology experience or enrolled in MSSE. Introduction to wildlife species and the range of habitats present in the Northern Rocky Mountain ecosystems. Emphasis on large carnivores and ungulates within montane terrestrial systems. Application of the scientific method to study interactions between predators, prey, and human impacts. This course is designed for middle and high school teachers and cannot be used in graduate programs in Biological Sciences.

BIOE 524. Frontiers in Landscape Ecology. 3 Credits. (2 Lec, 1 Lab) F 
Alternate Even Years. PREREQUISITE: BIOE 370 or the equivalent. Students and instructor will write a scientific paper for publication that synthesizes an important question in landscape ecology. Students will select the topic, review and synthesize current knowledge on the topic, and write a scientific manuscript.

BIOE 526. Symbiosis for Teachers: Eat, Prey, Love. 3 Credits. (3 Lec) S 
PREREQUISITE: Graduate standing and 2 years successful classroom teaching experience. This course is intended for pre-service (BIOE 436) and in-service (BIOE 526) teachers. Graduate standing and teaching experience will be waived for pre-service teachers taking BIOE 436. “Symbiosis for Teachers: Eat, Prey, and Love” is a thought provoking course designed for elementary, middle school, high school, and pre-service teachers. Students will participate in the process of science and develop creative and critical reasoning skills. The course provides an effective way to integrate instructional scientific strategies for teachers. Students will share cross-level instruction and constructive ideas. The goal of this course is to promote the study of symbiosis and applications of symbiotic relationships.

BIOE 527. Teaching Evolution. 3 Credits. (3 Lec) F 
PREREQUISITE: Graduate standing; science educator; interest in science. The primary goal of this course is to change how evolution is taught. This course is designed to provide students with the knowledge, skills, and resources they need to teach evolution effectively. Students will learn why evolution is the fundamental concept that underlies all life sciences. Students will acquire tools for making evolution relevant to the science classroom and students’ lives and the background knowledge for addressing student misconceptions.

BIOE 532. Physiological Plant Ecol. 3 Credits. (2 Lec, 1 Lab) F 
Alternate Even Years. PREREQUISITE: BIOE 370. The goal of this course is to expose students to the fundamental theories of plant physiological ecology, ranging from bioenergetics to organizational feedback. In this course, we explore the various ways that the diversity of living organisms influences ecosystem structure, productivity, geomorphological and hydrological regimes, and nutrient cycling. Using a variety of research approaches, from primary literature to podcasts, we investigate the foundations of the biodiversity ecosystem function and services field as well as the current state of knowledge across terrestrial, marine, and freshwater ecosystems.

BIOE 536. A Study of Local Ecosystems for Teachers. 1 Credit. (3 Lec) S 
PREREQUISITE: Junior standing and as determined for each offering. Topics offered alternate even years. Multivariate statistical analysis of data from terrestrial or aquatic, plant or animal communities. Classification, ordination, and predictive modeling of alternate even years. Distance learning class offered by internet connection. This course is designed for middle and high school teachers and cannot be used in graduate programs in Biological Sciences.

BIOE 537. Restoration Ecology. 4 Credits. (2 Lec, 1 Lab) F 
PREREQUISITE: Junior standing, science technology experience or enrolled in MSSE. Exploration of the ecology and habitat of avian raptors in the Greater Yellowstone Ecosystem (GYE). Application of the scientific method to the study of raptors. Field identification of raptors, investigation of species life histories, and inquiry methods of species-specific habitat needs. Students will develop methods and skills for classroom based research on wildlife. This course is designed for secondary school teachers enrolled in the MSSE program and cannot be used in graduate programs in Biological Sciences.

BIOE 540. Analysis of Ecological Communities. 3 Credits. (1 Lec, 2 Lab) S 
alternate even years. Multivariate statistical analysis of data from terrestrial or aquatic, plant or animal communities. Classification, ordination, and predictive modeling of species and communities, emphasizing a hands-on approach and practical problem solving in community ecology.
BIOE 542. Community Ecology. 3 Credits. (3 Lec/S)
Alternate Odd Years. PREREQUISITE: At least one upper division or graduate course in each of the following: ecology and statistics, or consent of instructor. Focuses on the origin, maintenance, and consequences of biological diversity within local communities by examining studies of natural patterns, explorations of mathematical models and direct experimentation. The complexities of species interactions are explored in multi species assemblages.

BIOE 548. Conservation Genetics. 3 Credits. (3 Lec) F
PREREQUISITES: BIOB 375 or BIOB 377 or BIOL 320 and BIOB 420, and STAT 216Q. Introduction to the application of genetics for the conservation of plant and animal populations. Emphasis will be placed on case studies from the primary literature and analyzing genetic data using mathematical models developed in class. Co-convened with BIOB 480.

BIOE 554. Foundations of Ecology & Mgmt. 1 Credit. (1 Rct) F
This course explores the origin, maturation, and application of core principles in ecology. Students gain an appreciation for the scope of ecology, how theory and application are linked, and how big ideas in ecology have matured (or not) over time.

BIOE 555. Communication in Ecol Sciences. 1 Credit. (1 Sem) S
PREREQUISITES: Graduate standing, consent of instructor. This course will require students to gain experience presenting scientific information in a variety of communication methods.

BIOE 590. Master’s Thesis. 1-10 Credits. (1-10 Ind; max unlimited) FS,Su
PREREQUISITE: Master’s standing.

BIOE 591. Special Topics. 1-4 Credits. (1-4 Lec; 12 cr max) On Demand
PREREQUISITE: Upper division courses and others as determined for each offering. Courses not required in any curriculum for which there is a particular one time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number.

BIOE 592. Independent Study. 1-3 Credits. (1 Ind; 6 cr max) On Demand
PREREQUISITE: Graduate standing, consent of instructor, approval of department head and Dean of Graduate Studies. Directed research and study on an individual basis.

BIOE 593. Alpine Ecology for Teachers. 2 Credits. (1 Lec. 1 Lab) Su
PREREQUISITES: A minimum of two years science teaching experience. The primary goals in this course will be to understand how altitude affects the structure, function and evolution of alpine and sub-alpine plants and animals, and to create ways to bring this understanding into the grade 6-12 classroom. We will explore and gather data describing the biotic (living) and abiotic (non-living) constraints of sub-alpine and alpine environments to infer how these factors affect the form, abundance and niches of a variety of plants and animals.

BIOE 594. Seminar. 1 Credit. (1 Sem; 4 cr max) On Demand
PREREQUISITE: Graduate standing or seniors by petition and course prerequisites as determined for each offering. Topics offered at the graduate level which are not covered in regular courses. Students participate in preparing and presenting discussion material.

BIOE 595. Ecology and Conservation of the World’s Marine Ecosystems for Teachers. 3 Credits. (1 Lec. 1 Lab. 1 Rec) F
PREREQUISITES: A minimum of two years science teaching experience. This course will lay the groundwork for an understanding the legal and political basis for scientific management of natural resources. Readings, field visits and skill-building exercises will equip science educators with the social context of complex ecological issues.

BIOE 596. Land Use Issues in GYE for Teachers. 2 Credits. (1 Lec. 1 Rec) Su
PREREQUISITES: Teacher of science with two years minimum teaching experience. This course will lay the groundwork for an understanding the legal and political basis for scientific management of natural resources. Readings, field visits and skill-building exercises will equip science educators with the social context of complex ecological issues.

BIOE 597. Ecology of Trout Streams for Teachers. 2 Credits. (1 Lec. 1 Lab) Su
PREREQUISITES: A minimum of 2 years science teaching experience. Montana is home to world-renowned trout streams, and this course is designed to delve into how trout and trout streams function and some of the current issues surrounding their management. The course content will include principles and techniques for studying trout and trout streams in the laboratory and the field. This course will combine laboratory lectures and exercises with day-long field visits to area streams to collect aquatic insects, conduct habitat analyses, and view various types of stream management practices. On one field trip, students will don wet suits and directly observe trout behavior.