208 Outdoor Preparedness for Natural Resources Professionals  
Spring. 3(3-0)  

211 Introduction to Gender and Environmental Issues  
Spring. 3(3-0)  
Interdepartmental with Criminal Justice and Environmental Economics and Policy and Environmental Studies and Agriscience and Forestry and Women's Studies. Administered by Fisheries and Wildlife.  
R: Not open to freshmen.  

224 Introduction to Probability and Statistics for Ecologists  
Spring. 3(2-2)  
P: MTH 103 or MTH 116 or (MTH 124 or concurrently) or (MTH 132 or concurrently) or (MTH 152H or concurrently) or (LB 115 or concurrently) or (LB 116 or concurrently) or (LB 117 or concurrently) or (BS 162 or BS 182H or LB 144)  
A: FW 324  
Not open to students with credit in STT 231.  
Probability and statistics with computer applications for the analysis, interpretation and presentation of ecological data. Data analysis, probability models, random variables, estimation, confidence intervals, test of hypotheses, and simple linear regression with applications to ecology.

238 Introductory Fisheries and Wildlife Field Experience  
Summer. 3(1-4)  
Introductory Biology, Botany, Zoology, Forestry, Natural Resources, Plant Biology, Fisheries and Wildlife course  
R: Approval of department; application required.  
Terrestrial and aquatic field research techniques and their application to current issues. Interaction with professionals. Field trips required.

293 Undergraduate Seminar in Fisheries and Wildlife  
Fall. 1(0-2)  
Open to undergraduate students in the Fisheries and Wildlife major or in the Lyman Briggs Fisheries and Wildlife Coordinator major.  
R: Open to students with credit in STT 231.  
Case studies highlighting the integrative nature of fisheries and wildlife management.

341 Nature, Environmental, and Travel Writing  
Fall of even years. 3(3-0)  
Interdepartmental with Writing, Rhetoric and American Cultures. Administered by Writing, Rhetoric and American Cultures.  
P: Completion of Tier I Writing Requirement  
R: Open to undergraduate students in the Department of Community, Agriculture, Recreation and Resource Studies or in the Professional Writing major or in the Fisheries and Wildlife major or approval of department.  
A: AL 341  
Writing and reading-intensive course focusing on nature writing, place-based writing, and travel writing which engage the environmental imagination, shaped by the variety of human relationships with place.
Fisheries and Wildlife—FW

419 Applications of Geographic Information Systems to Natural Resources Management
Spring. 4(2-4) Interdepartmental with Community, Agriculture, Recreation and Resource Studies and Biosystems Engineering and Forestry and Geography. Administered by Fisheries and Wildlife. P: GEO 221. Application of geographic information systems, remote sensing, and global positioning systems to integrated planning and management for fish, wildlife, and related resources.

420 Stream Ecology
Fall. 3(3-0) Interdepartmental with Zoology. Administered by Fisheries and Wildlife. P: ZOL 355 or approval of department RB: CEM 141. Biological and environmental factors determining structure and function of stream ecosystems.

422 Aquatic Entomology
Fall of odd years. 3(2-3) Interdepartmental with Entomology and Zoology. Administered by Entomology. P: BS 162 SA: ENT 420. Biology, ecology and systematics of aquatic insects in streams, rivers and lakes. Field trips and aquatic insect collection required.

423 Principles of Fish and Wildlife Disease
Fall. 3(3-0) Interdepartmental with Large Animal Clinical Sciences. Administered by Fisheries and Wildlife. P: (BS 162 and BS 172) or (BS 182H and BS 192H) or LB 144 RB: Additional course work in ecology, zoology, microbiology or environmental science. R: Open to juniors or seniors or graduate students. Role and practical application of communications for fisheries and wildlife professionals, which integrates public and media relations, community relations, social marketing, and courtroom testimony using a variety of communication tools including news releases, direct mail, storyboards, and business writing.

423L Principles of Fish and Wildlife Disease Laboratory
Fall of odd years. 1(0-3) Interdepartmental with Large Animal Clinical Sciences. Administered by Fisheries and Wildlife. RB: Additional laboratory course work in ecology, zoology, microbiology or environmental sciences. C: FW 423 concurrently. Tools for diagnosis and assessment of disease in fish and wildlife populations.

424 Population Analysis and Management
Fall. 4(3-2) P: ZOL 355 and (STT 224 or STT 231 or STT 421) and (MTH 124 or MTH 132 or LB 118). Statistical, ecological and management concepts and methods needed to analyze and interpret demographic data and manage fish and wildlife populations.

431 Ecophysiology and Toxology of Fishes
Spring of odd years. 3(3-0) P: (BS 161 or LB 145 or BS 181H) and (BS 162 or LB 144 or BS 182H) and completion of Tier I writing requirement R: Not open to freshmen or sophomores. Physiological processes and the effect of anthropogenic stresses on fishes. Fate of contaminants in the environment and biota. Individual, population and community effects. Temporal, spatial and scaling issues. Modeling tools and environmental risk assessment.

434 Human Dimensions of Fisheries and Wildlife Management (W)
Spring. 3(2-2) P: (ZOL 355) and completion of Tier I writing requirement R: Open to juniors or seniors or approval of department. Sociological implications of public policy and planning processes in fisheries and wildlife management.

435 Integrated Communications for the Fisheries and Wildlife Professional
Fall. 3(3-0) P: Completion of Tier I writing requirement R: Open to juniors or seniors or graduate students. Communication skills necessary to manage fish and wildlife resource management. Field trips required.

438 Philosophy of Ecology (W)
Spring of even years. 3(3-0) Interdepartmental with Lyman Briggs. Administered by Fisheries and Wildlife. P: Completion of Tier I Writing Requirement RB: Additional coursework in ecology, natural resources, philosophy, or environmental sciences. R: Open to juniors or seniors or graduate students. Conceptual issues in the science of ecology, including connections between ecology and environmental philosophy. Western and non-western perspectives.

439 Conservation Ethics
Spring of odd years. 3(3-0) P: Completion of Tier I Writing Requirement RB: Additional coursework in ecology, natural resources, philosophy, or environmental sciences. R: Open to juniors or seniors or graduate students. Ethical concepts and arguments underlying natural resources.

443 Restoration Ecology
Spring. 3(2-2) Interdepartmental with Bio-systems Engineering and Zoology. Administered by Fisheries and Wildlife. RB: (CSC 210 or BE 230) and (FOR 404 or FW 354 or ZOL 355). Principles of ecological restoration of disturbed or damaged ecosystems. Design, implementation, and presentation of restoration plans. Field trips required.

444 Conservation Biology
Spring. 3(3-0) Interdepartmental with Zoology. Administered by Fisheries and Wildlife. P: (ZOL 355 or FOR 404) and completion of Tier I writing requirement. Ecological theories and methodologies to manage species, communities and genetic diversity on a local and global scale.

445 Biodiversity Conservation Policy and Practice
Spring of even years. 3(3-0) Interdepartmental with James Madison College. Administered by Fisheries and Wildlife. P: ((EC 201 or concurrent RB: (EC 202 or concurrently) or (EC 251H or concurrently) or (EC 252H or concurrently)) or approval of department) and completion of Tier I writing requirement RB: Interest in Conservation Biology Social, economic, and policy considerations. Approaches to conserve biodiversity.

450 International Environmental Law and Policy

452 Watershed Concepts
Fall, Spring, Summer. 3(3-0) Interdepartmental with Biosystems Engineering and Crop and Soil Sciences and Environmental Studies and Agronomy and Forestry. Administered by Environmental Studies and Agriscience. P: ESA 324 and ZOL 355 RB: organic chemistry SA: RD 452. Watershed hydrology and management. The hydrologic cycle, water quality, aquatic ecosystems, and social systems. Laws and institutions for managing water resources.

454 Environmental Hydrology for Watershed Management
Spring of odd years. 3(3-0) P: (MTH 124 or MTH 132 or LB 118) and (PHY 183 or concurrently) or (PHY 231 or concurrently)) RB: ZOL 355 or concurrently. Effect of climate, topography, geology, soil, vegetation, and anthropogenic land uses on the amount, timing, and quality of water yield. Implications for fish and wildlife resource management. Field trips required.

463 Wildlife Disease Ecology
Spring of even years. 3(3-0) Interdepartmental with Large Animal Clinical Sciences. Administered by Fisheries and Wildlife. P: FW 423 or approval of department RB: Additional course work in ecology, zoology, microbiology and environmental sciences. Role of wildlife disease in ecological interactions. Factors underlying pathogen emergence. Disease modeling. Conservation medicine.

466 Natural Resource Policy
Spring. 3(3-0) Interdepartmental with Forestry and Park, Recreation and Tourism Resources and Resource Development. Administered by Forestry. R: Not open to freshmen or sophomores. Natural resources policy-making in the context of scientific, environmental, social, and legal-institutional factors. Historical evolution of policies and case studies of contemporary policy issues.

469 Biomonitoring of Streams and Rivers
Summer of odd years. 3(2-3) Interdepartmental with Entomology. Administered by Entomology. P: BS 162 or LB 144 RB: Additional course work in aquatic ecology and sampling and identification of fish, macroinvertebrates and other biota.
471 Ichthyology
Spring, 4(3-3) Interdepartmental with Zoology. Administered by Fisheries and Wildlife. P: (BS 162 and BS 172) or (BS 182H and BS 192H) or LB 144 and Completion of Tier I Writing Requirement. Fish morphology and physiology. Development, behavior, evolution, and ecology. World fishes with emphasis on freshwater fishes. Field trips required.

472 Limnology
Spring, 3(3-0) Interdepartmental with Zoology. Administered by Fisheries and Wildlife. P: (CEM 141 or LB 171) and ZOL 355. Ecology of lakes with emphasis on interacting physical, chemical, and biological factors affecting their structure and function.

474 Field and Laboratory Techniques for Aquatic Studies
Fall. 3(2-3) Interdepartmental with Zoology. Administered by Fisheries and Wildlife. P: (FW 414 or concurrently) or (FW 420 or concurrently) or (FW 417 or concurrently) or (FW 416 or concurrently) or (FW 472 or concurrently) or (FW 479 or concurrently) SA: FW 470. Field and laboratory techniques for the investigation and analysis of lake and stream ecosystems and their biota. Field trips required.

475 Aquaculture
Spring, 3(3-0) Interdepartmental with Animal Science. Administered by Fisheries and Wildlife. P: ANS 313 or ZOL 355. Propagation and rearing of aquatic organisms used for food, bait and recreational fisheries management. Culture principles and techniques for important aquatic species. Commercial potential.

479 Fisheries Management
Spring, 3(2-2) P: ZOL 355. Quantitative analysis of fish populations. Case study of ecological interactions linking fish to aquatic ecosystems and the challenge of balancing multiple human values in managing fisheries resources. Field trips required.

480 International Studies in Fisheries and Wildlife
Fall, Spring, Summer. 1 to 6 credits. A student may earn a maximum of 12 credits in all enrollments for this course. RB: ZOL 355 R: Approval of department; application required. Fisheries and wildlife ecology and management study in regions beyond the United States. Ecological, economic, social, and cultural influences on fisheries and wildlife resources.

481 Global Issues in Fisheries and Wildlife
Spring, 3(3-0) Interdepartmental with James Madison College. Administered by Fisheries and Wildlife. P: EC 201 or EC 202 R: Open to juniors or seniors or graduate students. Global issues and their impacts on implications for the management of fisheries and wildlife resources.

485 Environmental Science Senior Seminar
Spring, 1(2-0) P: ESA 435 or concurrently R: Open to seniors. Ecological principles, population growth, resource utilization and lifestyle choices.

489 Seminar in Zoo and Aquarium Science
Fall, Spring. 1(1-0) A student may earn a maximum of 3 credits in all enrollments for this course. Interdepartmental with Landscape Architecture and Park, Recreation and Tourism Resources and Zoology. Administered by Zoology. R: Approval of department. Scientific writing and oral presentations related to zoo and aquarium studies.

490 Independent Study in Fisheries and Wildlife
Fall, Spring, Summer. 1 to 5 credits. A student may earn a maximum of 5 credits in all enrollments for this course. RB: BS 162 R: Not open to sophomores or freshmen. Approval of department; application required. Supervised individual research and study in fisheries and wildlife.

491 Special Topics in Fisheries and Wildlife
Fall, Spring, Summer. 1 to 5 credits. A student may earn a maximum of 5 credits in all enrollments for this course. R: Not open to freshmen or sophomores. Approval of department; application required. Selected topics of current interest and importance in fisheries and wildlife.

493 Professional Internship in Fisheries and Wildlife
Fall, Spring, Summer. 1 to 3 credits. A student may earn a maximum of 6 credits in all enrollments for this course. A student may earn a maximum of 6 credits in all enrollments for this course. R: Open to juniors or seniors. Approval of department. Supervised professional experiences in agencies and businesses related to fisheries and wildlife professions.

498 Internship in Zoo and Aquarium Science
Fall, Spring, Summer. 4 credits. A student may earn a maximum of 8 credits in all enrollments for this course. Interdepartmental with Landscape Architecture and Zoology. Administered by Zoology. R: Open to juniors or seniors. Approval of department. Application of zoological experience in a zoo or aquarium setting outside the university.

499 Senior Thesis in Fisheries and Wildlife
Fall, Spring, Summer. 2(2-0) A student may earn a maximum of 4 credits in all enrollments for this course. R: Open to seniors in the Fisheries and Wildlife major. Approval of department. Faculty-guided undergraduate research in Fisheries and Wildlife. Thesis required.

821 Conservation Medicine
Fall of even years. 3(3-0) Interdepartmental with Large Animal Clinical Sciences. Administered by Fisheries and Wildlife. R: Prior course work in vertebrate ecology, epidemiology and/or animal disease management. R: Open to graduate students or approval of department. SA: FW 823. Ecological and epidemiological principles of wildlife disease impacts and management. Critical review of selected case studies.

824 Analysis of Wildlife Populations
Spring of even years. 3(2-3) Statistical and ecological concepts, methods and computer techniques needed to analyze and interpret demographic data from fish and wildlife studies.

828 Conservation and Genetics
Fall of even years. 3(2-2) Interdepartmental with Plant Biology and Zoology. Administered by Fisheries and Wildlife. R: ZOL 341 or CSS 350 or ANS 314. Population and evolutionary genetic principles applied to ecology, conservation, and management of fish and wildlife at the individual, population, and species level.

829 The Economics of Environmental Resources
Spring, 3(3-0) Interdepartmental with Community, Agriculture, Recreation and Resource Studies and Agricultural Economics and Economics and Forestry. Administered by Agricultural Economics. Economic principles related to environmental conflicts and public policy alternatives. Applications to water quality, land use, fish and wildlife, conservation, development, and global environmental issues.

840 Landscape Ecology
Fall of even years. 3(2-2) R: Knowledge or course work in the natural sciences, particularly ecological concepts, as well as exposure to GIS and data analysis. Ecological patterns and processes. Spatial variation in landscapes at multiple scales as affected by natural causes and human activity. Landscape ecology in natural resource decision-making and management.

842 Population Genetics, Genealogy and Genomics
Fall or seniors. 3(3-0) Interdepartmental with Animal Science and Crop and Soil Sciences and Forestry and Genetics and Horticulture. Administered by Forestry. R: Pre-calculus, basic genetics. Population genetic processes underlying patterns of molecular genetic variation. Genealogical approaches to the study of genomic diversity, phylogenetic reconstruction, and molecular ecology.

845 Environmental Risk Perception and Decision-Making
Spring, 3(3-0) Interdepartmental with Criminal Justice and Environmental Science and Policy. Administered by Criminal Justice. R: Open to graduate students or approval of school. Theoretical underpinnings of individual decision-making and risk perception processes. Case studies of the interplay of risk perception and decision-making in an environmental and or criminological context.
846 Corporate Environmental Crime and Risk
Spring, 3(3-0) Interdepartmental with Crimi-
nal Justice and Environmental Science and
Policy. Administered by Criminal Justice. R: Open
to graduate students or approval of school.
Theoretical accounts and multiple interventions
relevant to corporate environmental crime and risk.
Use of "Smart Regulation" principles to design inter-
ventions to match specific problems.

847 Global Risks, Conservation, and
Criminology
Fall. 3(3-0) Interdepartmental with Criminal
Justice and Environmental Science and Pol-
cy. Administered by Criminal Justice. R: Open
to graduate students or approval of school.
Theories, actors, characteristics and legal instru-
ments associated with risk, conservation, and crimi-
нологies related to globalization. Current case studies
in criminological conservation.

850 Applied Multivariate Statistical Methods
Spring of even years. 4(3-2) Interdepart-
mental with Statistics and Probability. Ad-
ministered by Fisheries and Wildlife. RB: (STT 422 or concurrently) and MTH 314 SA:
FOR 976
Application of multivariate methods to research
problems. Hotelling's T-test, profile analysis, discrimi-
ant analysis, canonical correlation, principal
components, principal coordinates, correspondence
analysis, and cluster analysis.

851 Modeling Natural Resource Systems
Spring, 3(3-0) Interdepartmental with Com-
munity, Agriculture, Recreation and Re-
source Studies and Environmental Science
and Policy. Administered by Community,
Agriculture, Recreation and Resource Stud-
ies. RB: ecology, statistics, and calculus'
introductory quantitative modeling of environmental
systems.

854 Adaptive Management of Natural
Resource Systems
Fall of odd years. 3(2-2) RB: ZOL 355
Principles and practices of adaptive environmental
assessment and management. Applications to eco-
system and natural resource management.

858 Gender, Justice and Environmental
Change: Issues and Concepts
Fall. 3(3-0) Interdepartmental with Anthro-
pology and Criminal Justice and Forestry
and Geography and Sociology. Adminis-
tered by Fisheries and Wildlife. RB: Back-
ground in social science, environmental sci-
ence, or natural resources.
Issues and concepts related to gender, ecology, and
environmental studies. Key debates and theoretical
approaches to addressing environmental issues
from a gender and social justice perspective. Gen-
der and environment issues and processes from a
global perspective.

859 Gender, Justice, and Environmental
Change: Methods and Application
Spring of even years. 3(3-0) Interdepart-
mental with Anthropology and Forestry and
Geography and Resource Development and
Sociology. Administered by Anthropology. RB: Background in social science, environ-
mental science, or natural resources.
Methods and case studies related to gender, ecology,
and environmental studies. Methodological and
fieldwork issues from a feminist perspective in inter-
national and intercultural contexts. Qualitative and
quantitative methods for integrating social and envi-
ronmental data.

860 Wildlife Nutrition
Fall of even years. 3(2-2) R: Open to gradu-
ate students in the College of Agriculture
and Natural Resources or in the College of
Natural Science.
Nutritional ecology of wild species. Techniques for
analyzing and improving nutritional qualities.

866 Water Policy and Management
Fall of odd years. 3(3-0) RB: Familiarity with
biological and ecological science and envi-
ronmental policy issues. SA: FW 468
Environmental policy issues associated with the use,
management, and protection of water resources and
aquatic ecosystems. Case studies in water science
and management.

869 Community and Conservation
Fall of even years. Summer of even years. 3
credits. Interdepartmental with Resource
Development and Sociology. Administered
by Sociology. RB: Social Science methods,
social science theory and environmental
 coursework.
Use of experiential, participatory, field-based mode
of inquiry to develop understanding of social and
cultural issues associated with conservation. Under-
standing of different social positions and perspec-
tives.

877 Fish Population Dynamics
Fall of even years. 3(2-2) R: Open only to
graduate students in the College of Agricult-
ure and Natural Resources or College of
Natural Science.
Quantitative analysis of fish populations. Evaluation,
causes, and impacts of the rates of change in sur-
vival, growth, reproduction, and recruitment for fish
populations and their yield.

879 Advanced Limnology
Spring of even years. 3(3-0) RB: FW 472 or
ZOL 431
Theory and management of streams, rivers, lakes,
reservoirs, and other deepwater habitats from eco-
system and landscape perspectives.

885 Leadership in Natural Resources and
Environmental Management
Fall of even years. 3(3-0) Interdepartmental
with Agricultural Economics and Forestry.
Administered by Fisheries and Wildlife.
Theory and practice of leadership in natural re-
source and environmental management. Integration
across disciplinary and jurisdictional divisions.

891 Advanced Topics
Fall, Spring, Summer. 1 to 4 credits. A stu-
dent may earn a maximum of 10 credits in all enrollments for this course.
In-depth study of advanced topics in fisheries and
wildlife.

893 Seminar in Fisheries and Wildlife
Fall, Spring. 1(1-0) A student may earn a
maximum of 15 credits in all enrollments for this course.
Study and research in advanced problems and
current developments in fisheries and wildlife.

897 Ecosystem Ecology and Global Change
Spring of odd years. 4(4-0) Interdepart-
mental with Plant Biology and Zoology. Ad-
ministered by Zoology.
Structure and function of natural ecosystems and
their responses to global environmental change.
Biogeochemical cycles, food webs, energy flow,
nutrient cycling, and ecosystem management and
restoration.

898 Master's Research
Fall, Spring, Summer. 1 to 6 credits. A stu-
dent may earn a maximum of 10 credits in all enrollments for this course. R: Open only
to graduate students in the Fisheries and
Wildlife major.
Master's degree Plan B research paper.

899 Doctoral Dissertation Research
Fall, Spring, Summer. 1 to 24 credits. A stu-
dent may earn a maximum of 99 credits in all enrollments for this course. R: Open only
to doctoral students in the Department of Fisheries and Wildlife.
Doctoral dissertation research.