

# FISH, WILDLIFE AND CONSERVATION ECOLOGY

## Undergraduate Program Information

Through lecture courses, labs, hands-on field experience and internships, the Department of Fish, Wildlife and Conservation Ecology will prepare you for a career in a variety of natural resource fields related to the conservation and management of wild animal populations and the natural systems they perpetuate. Award-winning professors will guide students in the study of how to manage fish and wildlife populations, their habitats, how their populations grow and contract, how different species influence the biotic community in which they live and how natural systems are affected by human activities.

### Bachelor of Science in Fish, Wildlife and Conservation Ecology.

With the continuous growth of human populations and the ever dwindling of natural resources, natural resource professionals are needed now more than ever. Learn how to sustainably manage fish and wildlife populations and the habitats they utilize to ensure their long-term successful conservation. We offer two options within this degree. The Wildlife Ecology and Management option focuses on the ecology, conservation and management of wildlife (including mammals, birds, amphibians, and reptiles) in their natural habitats. The Aquatic Ecology and Management option focuses on the ecology, conservation and management of aquatic resources and the animals and plants found in them.

The department offers a minor in Wildlife Science for students majoring in other disciplines. The minor includes a minimum of 18 credit hours.

### Bachelor of Science in Conservation Ecology

New Mexico State University offers an interdisciplinary, undergraduate program in Conservation Ecology. The goal of this program is to train biologists for the current and future challenges that we face in the conservation and wise use of natural resources. An overriding principle of the program is to provide a solid foundation in basic science coupled with a practical approach towards sustainability and stewardship. The curriculum encompasses several disciplines and includes a wide variety of courses from Fish, Wildlife and Conservation Ecology, Biology, and Geography.

This educational experience will provide students with an overview of global biodiversity and an understanding of the ecological and evolutionary processes that have created and sustained it. Courses in population and community ecology coupled with population viability analysis and risk assessment will give students the necessary background to understand the theory and development of these fields as well as the tools to tackle real-world problems. Courses in basic genetics, evolution, and conservation genetics will expose students to the importance of conserving genetic variation in order to maintain adaptive potential within populations, thereby sustaining the evolutionary process. Students will also receive background on wildlife law and environmental policy, information vital for assisting governing bodies in making decisions regarding the protection and wise use of our natural resources. Skills obtained in the application of geographic information systems, molecular genetics, and professional communication can also be acquired through various electives. If biochemistry is taken as an elective, this curriculum provides the necessary educational background for pre-vet requirements, thus preparing students for veterinary school

and future jobs such as wildlife or zoo veterinarian, or conservation medicine practitioner. In sum, we seek to provide undergraduate students with an education that will allow them the opportunity to contribute to the conservation of all life on Earth.

The department offers a minor in Conservation Ecology for students majoring in other disciplines. The minor includes 20 credits.

To graduate from the Department of Fish, Wildlife and Conservation Ecology, an overall grade point average of 2.0 is required in courses taken in the major field and in all courses taken at NMSU.

## Graduate Program Information

### Master of Science in Fish, Wildlife and Conservation Ecology.

The Department of Fish, Wildlife and Conservation Ecology (FWCE) offers graduate work leading to the Master of Science degree with a major in Fish, Wildlife and Conservation Ecology. Faculty members in the department also may advise Ph.D. candidates through the graduate program in the Department of Biology, Department of Animal and Range Sciences, Department of Plant and Environmental Sciences, as well as other Ph.D. granting departments. For additional information please see the graduate catalog entries for the respective departments.

Minimum qualifications for admission to the graduate program include the following:

- 3.0 grade-point average in the last two years of undergraduate work
- Students who are most competitive for admission are those with a combined average GRE score greater than 70th percentile on the verbal and quantitative parts of the GRE.
- Course work in zoology, botany and animal ecology and a basic appreciation of sustainable use of natural resources, with supporting courses in mathematics, chemistry, physics and written and oral communication.

Applicants should submit a written composition of approximately 350 words that indicates the applicant's reasons for pursuing advanced study, explains personal and educational goals, and any additional experiences (e.g., military or career) or skills that might provide a foundation for graduate study. Applicants should submit three letters of recommendation (it is preferred that at least two letters come from university instructors) along with official GRE scores (use NMSU code 4531). Applicants should also contact a faculty member in the department that they would like to work with as an advisor, and that faculty member needs to agree to serve as the student's advisor. Application forms, application fee and transcripts, GRE scores, letters of recommendation and letter of application should be submitted online to the Graduate School. Successful applicants will be selected from those who meet the criteria of grade-point average, GRE scores, and educational background described above and who appear to have professional promise as indicated by personal history and written references.

For the Master of Science degree, a minimum of 30 semester credits of graduate work in the major and related subjects is required, together with a thesis for most students. Of these credits, at least 15 must be in courses numbered 500 or above, and at least 15 must be for courses with the FWCE prefix. Those programs involving a thesis or research project include 4 to 6 credits of research (FWCE 598 Special Research Programs or FWCE 599 Master's Thesis). Students electing a minor in FWCE are required to take at least 9 credits in the minor field. A nonthesis option is

available to some students, depending on prior training and experience, and subject to approval by the advisor and department head.

All students in the program must complete the following requirements:

- A ST 505 Statistical Inference I or equivalent
- One semester of Graduate Seminar (FWCE 515 Graduate Seminar - may be repeated for credit)
- A minimum of 3 additional credits from the Quantitative Methods category in addition to A ST 505 Statistical Inference I (eligible courses listed below)
- One course each from the Ecological Concepts, Organismal Biology and Ecological Techniques categories (eligible courses listed below)
- 4 to 9 credits from the Independent Study category (eligible courses listed below)

In addition, a student may petition to have up to 3 credits of special topics courses (FWCE 548 Graduate Problems) to apply to one of the three areas. Courses other than those listed may be acceptable, given permission by the student's supervisory committee

## Degrees for the Department

### Bachelor Degree(s)

- Conservation Ecology - Bachelor of Science in Conservation Ecology (<https://catalogs.nmsu.edu/nmsu/agricultural-consumer-environmental-sciences/fish-wildlife-conservation-ecology/conservation-ecology-bachelor-conservation-ecology/>)
- Fisheries and Wildlife Science (Aquatic Ecology and Management) - Bachelor of Science in Fish, Wildlife and Conservation Ecology (<https://catalogs.nmsu.edu/nmsu/agricultural-consumer-environmental-sciences/fish-wildlife-conservation-ecology/fisheries-wildlife-science-aquatic-ecology-mgt-bachelor-science-fwce/>)
- Fisheries and Wildlife Science (Wildlife Ecology and Management) - Bachelor of Science in Fish, Wildlife and Conservation Ecology (<https://catalogs.nmsu.edu/nmsu/agricultural-consumer-environmental-sciences/fish-wildlife-conservation-ecology/fisheries-wildlife-science-wildlife-ecology-mgt-bachelor-science-fwce/>)

### Master Degree(s)

- Fish, Wildlife and Conservation Ecology - Master of Science (<https://catalogs.nmsu.edu/nmsu/graduate-school/fish-wildlife-conservation-ecology-master-science-fwce/>)

## Minors for the Department

- Conservation Ecology - Undergraduate Minor (<https://catalogs.nmsu.edu/nmsu/agricultural-consumer-environmental-sciences/fish-wildlife-conservation-ecology/conservation-ecology-undergraduate-minor/>)
- Fish, Wildlife and Conservation Ecology - Graduate Minor (<https://catalogs.nmsu.edu/nmsu/graduate-school/fish-wildlife-conservation-ecology-graduate-minor/>)
- Wildlife Science - Undergraduate Minor (<https://catalogs.nmsu.edu/nmsu/agricultural-consumer-environmental-sciences/fish-wildlife-conservation-ecology/wildlife-science-undergraduate-minor/>)

Regents Professor, Martha Desmond, Department Head

**Professors** Boeing, Cain, Desmond, Frey, Jones; **Associate Professor** Gebreselassie; **Assistant Professors** Hernandez-Gomez, Klein, Lawson, Laverty, Pregler

*M.J. Desmond, Ph.D. (University of Nebraska)– avian ecology and conservation; W.J. Boeing, Ph.D. (Louisiana State University)– aquatic ecology; J. W. Cain, Ph.D. (University of Arizona)– large mammal ecology, conservation and management; J.K. Frey, Ph.D. (University of New Mexico)– ecology and conservation of mammals; F.A. Gebreselassie, Ph.D. (University of Bern Switzerland)- Capture-recapture models, Integrated population models; O. Hernandez-Gomez, Ph.D. (Purdue University)- disease ecology, herpetology, conservation genetics; K. Jones, Ph.D. (University of Wisconsin-Madison)- human dimensions of conservation, environmental economics, evidence-based conservation; Z. Klein, Ph.D. (University of Idaho)-fish ecology, fisheries management, fish conservation, population ecology; A. Lawson, Ph.D. (Clemson University)- vertebrate population ecology, analytical tool development; T. Laverty, Ph.D. (Colorado State University)- applied population, community and conservation ecology; K.C. Pregler, Ph.D. (Colorado State University)- population and evolutionary ecology, conservation biology*

## Fish, Wildlife and Conservation Ecology Courses

### FWCE 1110G. Introduction to Natural Resources Management 4 Credits (3+2P)

This class covers historical and current issues affecting the management of renewable natural resources with an emphasis on water, soil, rangeland, forest, fish, and wildlife resources. An emphasis is placed on the scientific method and critical thinking. In the laboratory students collect and analyze field data on topics covered above and write up each unit as a laboratory report.

#### Learning Outcomes

1. Students should be able to recall, describe and explain the laws, treaties and acts that have led to our current management of natural resources in the United States.
2. Students should recognize or explain what ecological processes are, the importance of ecological processes in maintaining ecosystem function and how human activities change ecological processes and the ecosystems dependent on those processes.
3. In each of the six course and lab modules (water quality, soils, forestry, rangelands, wildlife and fisheries) students should be able to recall, describe and explain basic terminology, fundamental ecological principles and management techniques and challenges.
4. Students should be able to interpret data presented graphically and in tables from class exercises and lectures.
5. Students should be able to solve problems scientifically through field data collection, laboratory analyses and the use of quantitative methods (basic statistics, tables and graphs).
6. Students should be able to communicate results from laboratory exercises (6 lab modules) orally and in writing.
7. Students will learn to apply scientific thinking to real world problems through in class discussion and short essays based on material from case studies presented in class and guest speakers.

### FWCE 1120. Contemporary Issues in Wildlife and Natural Resources Management 3 Credits (3)

Ecological, socioeconomic, and political issues surrounding the management of our natural resources with an emphasis on fish and wildlife resources.

**FWCE 2110. Principles of Fish and Wildlife Management****3 Credits (3)**

Basic principles of fish and wildlife management including history, ecology, economics, and policy. Emphasis on wildlife and fisheries. Uses an ecosystem approach integrating living and nonliving resources.

**Prerequisite(s):** FWCE 1110G.

**Learning Outcomes**

1. The goal of this course is to provide a firm foundation in the principles of wildlife and fisheries management.
2. Material will include a background in biological principles geared towards animal populations, characteristics and management of the habitats utilized by fish and wildlife, techniques used to study and manage animals and their habitats, and aspects of the human dimension involved in wildlife and fisheries issues.
3. This course serves as a core requirement for degrees offered in the Department of Fish, Wildlife and Conservation Ecology and as a required course for degrees in other departments such as Rangeland Resources.

**FWCE 301. Wildlife Ecology****3 Credits (3)**

General ecological theory with emphasis on concepts including biogeography, species interactions, population dynamics and disease ecology as they relate to the management and conservation of vertebrates. **Prerequisite(s):** BIOL 2610G

**FWCE 325. Human Dimensions of Fish and Wildlife****3 Credits (3)**

This course provides a foundational understanding of multiple perspectives in human dimensions of fish and wildlife. The course provides the information needed to identify stakeholders, engage them, understand their concerns, and communicate management plans effectively. Specific topics include the social, psychological, and economic underpinnings of human interactions with wildlife; qualitative and quantitative methods to gather information from people; and ethical considerations. Students will be challenged to approach human dimensions of wildlife issues from multiple perspectives. While this course is focused on fish and wildlife, the concepts covered about human dimensions will be relevant to a broader audience interested in environmental and natural resource conservation, management, or stewardship.

**Prerequisite:** (FWCE 1110 or BIOL 2110 or BIOL 2610 or EPWS 1110 or ENVS 1110 or GEOG 1110 or ANTH 1115 or ECON 1100 or ECON 2120 or GEOG 1130 or PSYC 1110 or PSYC 1110 or SOCI 1110) AND (ENGL 1110 or COMM 1115 or ACOM 1130).

**Learning Outcomes**

1. Identify the role and importance of human dimensions in fish and wildlife management.
2. Explain specific social science concepts and theories commonly applied in human dimensions.
3. Discuss factors important to recognize in conducting human dimensions research and describe common methodologies.
4. Summarize current and historical trends in human dimensions inquiry.
5. Assess the application of human dimensions concepts and research in current fish and wildlife topics.

**FWCE 330. Natural History of the Vertebrates****4 Credits (3+3P)**

Evolution, ecology, and diversity of vertebrates. Topics include comparative anatomy and physiology, biogeography, community ecology,

behavior, and conservation. Laboratory emphasizes identification of local taxa. Field trips may be required.

**Prerequisite(s)/Corequisite(s):** BIOL 322. **Prerequisite(s):** BIOL 2610G and BIOL 2610L.

**FWCE 355. Wildlife Techniques and Analysis****4 Credits (3+2P)**

FWCE 355 will provide a broad overview of basic skills and techniques that are commonly used by biologists in performing management, research, and reporting functions in natural resource fields with an emphasis on wildlife techniques, data processing and analysis.

**Prerequisite(s):** FWCE 301, A ST 311.

**FWCE 357. Fisheries Management and Analysis****4 Credits (3+2P)**

Lectures and laboratory exercises provide a broad overview of basic skills and techniques used for assessing and managing fish populations.

**Prerequisite(s):** FWCE 301 and A ST 311.

**FWCE 391. Internship****1-3 Credits (1-3)**

Professional work experience under the joint supervision of the employer and a faculty member. A written report is required. No more than 3 credits toward a degree. Consent of Instructor required. Graded: S/U Grading (S/ U, Audit).

**Prerequisite(s):** Consent of instructor.

**FWCE 393. Professional Experience and Communication****3 Credits (3)**

Professional work experience under the supervision of employer and/or a faculty member. Written report and presentation is required.

**Prerequisite(s)/Corequisite(s):** FWCE 2110.

**FWCE 402. Seminar in Natural Resource Management****1 Credit (1)**

Review and discussion of current topics in natural resource management.

**Prerequisite(s):** Senior standing or above.

**FWCE 409. Introduction to Population Ecology****3 Credits (3)**

Quantitative analysis of vital statistics and mechanisms affecting dynamics of wild populations. Patterns of growth, age structure, survival, and natality. Population theories and life tables.

**Prerequisite(s):** MATH 1430G and FWCE 2110.

**FWCE 430. Avian Field Ecology****4 Credits (3+3P)**

Principles of avian ecology and management with an emphasis on taxonomy, physiology, behavior and field studies. Includes weekly field trips focusing on identification and behavior of Southwest birds.

**Prerequisite(s)/Corequisite(s):** FWCE 330.

**FWCE 431. Mammalogy****4 Credits (3+2P)**

Classification, identification, anatomy, physiology, life history, and ecology of mammals. Field trips required.

**Prerequisite(s):** FWCE 2110 and FWCE 330.

**FWCE 432. Environmental Biology of Fishes****4 Credits (3+3P)**

What makes a fish, a fish? Mechanisms of circulation, gas exchange, osmotic and ionic regulation, swimming, migration, reproduction, and chemoreception will be covered in this class. Taught with FWCE 532.

**Prerequisite(s):** CHEM 1215G and senior standing.

**FWCE 434. Aquatic Contaminants and Toxicology****4 Credits (3+3P)**

Basic principles and methodologies of aquatic toxicity testing; routes of exposure and modes of action; environmental legislation and ecological risk assessment. Taught with FWCE 534. Crosslisted with: ENVS 434.

**Prerequisite(s):** CHEM 1215G and senior standing.

**FWCE 437. Wildlife Damage Management**

**3 Credits (3)**

Introduction to basic need and appropriate methods for resolving human-wildlife conflicts and management of animal damage. Socioeconomic, ecological, and political factors. Field trips required. Taught with FWCE 537.

**Prerequisite(s):** BIOL 2610G, FWCE 2110, FWCE 301, FWCE 409.

**FWCE 447. Wildlife Law and Policy**

**3 Credits (3)**

Introduction to state and federal laws and policies for wildlife and the historical context for their development. Taught with FWCE 547.

**Prerequisite(s):** Junior or Senior level standing.

**FWCE 448. Problems**

**1-3 Credits (1-3)**

Individual investigations in fishery or wildlife science. Maximum 3 credits per semester and a grand total of 6 credits. May be repeated up to 6 credits. Consent of Instructor required.

**Prerequisite(s):** 18 credits in WLSC.

**FWCE 450. Special Topics**

**1-4 Credits (1-4)**

Specific subjects and credits as announced in the Schedule of Classes. Maximum of 4 credits per semester. May be repeated up to 9 credits. Consent of Instructor required.

**FWCE 457. Ecological Biometry**

**3 Credits (3)**

Use of ecological data to test scientific hypotheses, stochastic and statistical models for environmental data, data visualization, likelihood-based and information-based model selection. Emphasis on open-source software tools.

**Prerequisite(s):** MATH 1430G or MATH 1511G, A ST 311, FWCE 301.

**FWCE 459. Aquatic Ecology**

**4 Credits (4)**

Ecological functions of plant and animal communities in aquatic ecosystems with emphasis on chemical and physical properties, productivity, species interactions, population dynamics, and concepts for diagnosing problems and restoring aquatic ecosystems. Taught with FWCE 559.

**Prerequisite(s):** FWCE 301 or BIOL 301, CHEM 1225G, MATH 1430G.

**FWCE 464. Management of Aquatic and Terrestrial Ecosystems**

**3 Credits (3)**

Principles and methods for managing aquatic and terrestrial ecosystems and their fish and wildlife resources. Emphasis on quantitative techniques, data collection and analysis for management of systems at a landscape spatial scale.

**Prerequisite:** (BIOL 301 or FWCE 301) FWCE 330, A ST 311.

**Learning Outcomes**

1. Demonstrate an understanding of The North American Model and the Public Trust Doctrine.
2. Demonstrate an understanding of the funding mechanisms underlying fish and wildlife management.
3. Demonstrate an understanding of the policies and laws germane to fish and wildlife management.

4. Demonstrate an understanding of the constraints facing modern fish and wildlife management.

5. Exhibit effective written and verbal communication skills.

**FWCE 467. Herpetology**

**4 Credits (4)**

Systematics, taxonomy, ecology, behavior, and conservation of amphibians and reptiles. Field trips required. Taught with FWCE 567.

**Prerequisite(s):** FWCE 330.

**FWCE 471. GIS for Natural Resource Scientists**

**4 Credits (4)**

Practical GIS class for students with little or no GIS experience. Class focuses on learning to use industry-standard software and applications in natural resource management. Taught with FWCE 571.

**FWCE 472. Wildlife Museum Internship**

**1-4 Credits (1-4)**

Substantial directed work experience in various functions of the wildlife natural history museum developed by the student in consultation with the faculty curator. Internships may involve aspects of collection development and management, public education programs, or other related museum activities. Internship must be approved by the faculty curator. May be repeated up to 9 credits. Consent of Instructor required.

**Prerequisite(s):** BIOL 2610G and BIOL 2610L.

**FWCE 482. Ichthyology**

**4 Credits (3+2P)**

Classification, morphology, identification, life history, and ecology of fishes.

**Prerequisite(s):** FWCE 330 or consent of instructor.

**FWCE 509. Population Ecology (s)**

**3 Credits (2+2P)**

Quantitative analysis of vital statistics and mechanisms promoting stability in wild populations. Theory and application of life tables and population models.

**FWCE 515. Graduate Seminar**

**1 Credit (1)**

Current topics.

**FWCE 530. Large Mammal Ecology, Conservation and Management**

**3 Credits (3)**

This course will cover aspects of large mammal ecology, management and conservation. Will include aspects of foraging ecology, resource and habitat selection, competition and resource partitioning, predation and population dynamics. Taught with FWCE 436.

**FWCE 532. Environmental Biology of Fishes**

**4 Credits (3+3P)**

What makes a fish, a fish? Mechanisms of circulation, gas exchange, osmotic and ionic regulation, swimming, migration, reproduction, and chemoreception will be covered in this class. Taught with FWCE 432; however, students are responsible for all requirements in FWCE 432, plus additional assignments.

**FWCE 535. Special Topics**

**1-4 Credits (1-4)**

Specific subjects to be announced in the Schedule of Classes. Maximum of 4 credits per semester. No more than 9 credits toward a degree.

**FWCE 537. Wildlife Damage Management**

**3 Credits (3)**

Introduction to basic need and appropriate methods for resolving human-wildlife conflicts and management of animal damage. Socioeconomic, ecological, and political factors. Field trips required. Taught with

FWCE 437. Students are responsible for all requirements for FWCE 437 plus additional work. Prerequisite(s): BIOL 2610G, FWCE 2110, FWCE 301 and FWCE 409

**FWCE 540. Wildlife Habitat Relationships**  
**4 Credits (3+1P)**

The study of wildlife-habitat relationships primarily seeks to describe how the distribution and abundance of resources used for food, cover and security, and constraints on the use of these resources influence the distribution of animals. This course will cover aspects of animal behavior related to how animals select habitat, theoretical models of habitat selection, the influence of inter- and intra-specific interactions on habitat selection, habitat quality, study designs for wildlife-habitat studies, modeling habitat selection and data analyses.

**Learning Outcomes**

1. The addition of the laboratory component to the course will provide graduate students with hands on experience implementing current statistical approaches for modeling wildlife habitat relationships including selection ratios, resource selection functions, resource utilization functions, step-selection functions and other approaches.

**FWCE 547. Wildlife Law and Policy**  
**3 Credits (3)**

Introduction to state and federal laws and policies for wildlife and the historical context for their development. Taught with FWCE 447.

**FWCE 548. Graduate Problems**  
**1-3 Credits (1-3)**

Individual studies in fishery and wildlife sciences. Maximum of 3 credits per semester. No more than 6 credits of this course and FWCE 598, combined, toward a degree. May be repeated up to 6 credits.

**FWCE 558. Nonthesis Project**  
**1-6 Credits (1-6)**

Independent study to satisfy nonthesis project requirement. Maximum of 6 credits toward degree. Available only to nonthesis students. May be repeated up to 6 credits.

**FWCE 559. Aquatic Ecology**  
**4 Credits (4)**

Ecological functions of plant and animal communities in aquatic ecosystems with emphasis on chemical and physical properties, productivity, species interactions, population dynamics, and concepts for diagnosing problems and restoring aquatic ecosystems. Taught with FWCE 459.

**Prerequisite(s):** FWCE 301 or BIOL 301, CHEM 1225G, MATH 1430G.

**FWCE 567. Herpetology**  
**4 Credits (4)**

Systematics, taxonomy, ecology, behavior and conservation of amphibians and reptiles. Field trips required. Taught with FWCE 467.

**FWCE 571. GIS for Natural Resource Scientists**  
**4 Credits (4)**

Practical GIS class for students with little or no GIS experience. Class focuses on learning to use industry-standard software and applications in natural resource management. Taught with FWCE 471.

**FWCE 582. Ichthyology**  
**4 Credits (4)**

Classification, morphology, identification, life history, and ecology of fishes. Taught with FWCE 482.

**FWCE 598. Special Research Programs**  
**1-3 Credits (1-3)**

Individual investigations, either analytical or experimental. Maximum of 3 credits per semester. No more than 6 credits of this course and

FWCE 548, combined, toward a degree. Not available to students in the nonthesis program. May be repeated up to 6 credits.

**FWCE 599. Master's Thesis**  
**1-9 Credits (1-9)**

Thesis. May be repeated up to 30 credits. Thesis/Dissertation Grading.

**Office Location: Knox Hall 132**

**Phone: (575) 646-2245**

**Website:** <http://aces.nmsu.edu/academics/fws/>