

# ANIMAL ECOLOGY

The animal ecology curriculum provides its majors with an understanding of ecological principles and processes and their applications to natural resource management. It is oriented toward students desiring a general and flexible program in environmental biology and for those planning graduate study. Students may select from four options: Fisheries and Aquatic Sciences, Interpretation of Natural Resources, Preveterinary and Wildlife Care, or Wildlife. Graduates find employment as aquaculturists, aquatic ecologists, wildlife biologists, fisheries biologists, resource managers, and ecologists for industry, environmental consulting firms, natural resource and environmental agencies and organizations, zoos, and as educators.

Graduates of the Animal Ecology major understand the basic principles of animal biology, ecology and management, and relevant aspects of scientific communication, basic mathematics and sciences, computing applications, and personal and professional development. Four specific options prepare students for careers in interpretation of natural resources, fisheries and aquatic sciences, pre-veterinary and wildlife care, and wildlife. Each option has specific outcomes expectations that include (1) the scope of the specialization and its relationships to broader aspects of animal ecology, biotic resource management, and other allied scientific disciplines and professions, (2) career opportunities and requirements, and (3) knowledge and skills appropriate for employment at technical and practitioner levels in each discipline. Graduates are able to communicate and work effectively in the multidisciplinary arena of ecology and natural resource management.

All options require three months (400 hours) of relevant work experience or study at a biological station prior to graduation. The latter may be accomplished at the university's affiliate field stations: Rod and Connie French Conservation Camp in Montana, Iowa Lakeside Laboratory at West Lake Okoboji, and Gulf Coast Research Laboratory at Ocean Springs, Mississippi. Information on these laboratories is available from the department's Student Services Center.

Preveterinary medicine preparation may be achieved while satisfying degree requirements in animal ecology.

Additional education and training can lead to other opportunities in such areas as research and management, natural resources planning and administration, teaching, and environmental consulting, among others. Graduate training is necessary for many specialized positions within the fields of animal ecology. Students preparing for graduate study should consult with their academic advisor concerning appropriate coursework.

Students wishing to be certified by the American Fisheries Society or The Wildlife Society need to consult with their advisors in selecting required courses in their respective programs. The formal application then needs

to be completed and submitted for review by their professional societies. Certification in either society has many professional benefits and may be required or recommended for employment by federal and state agencies and private industry.

Students seeking certification to teach biology in secondary schools must meet requirements of the College of Human Sciences as well as those of the Animal Ecology curriculum. In addition, they must apply formally for admission to the teacher education program (see Teacher Education Program (<http://catalog.iastate.edu/previouscatalogs/2021-2022/collegeofhumansciences/schoolofeducation/#teachereducationtext>)). Students with an interest in careers in outdoor writing are encouraged to obtain a minor or a second major in journalism (see Journalism and Communication, Courses and Programs (<http://catalog.iastate.edu/previouscatalogs/2021-2022/collegeofliberalartsandsciences/greenleejournalcomm/>)). Students who wish to pursue a job as a conservation officer may wish to minor in criminal justice (see Criminal Justice (<http://catalog.iastate.edu/previouscatalogs/2021-2022/collegeofliberalartsandsciences/criminaljustice/>)).

## Curriculum in Animal Ecology

**Total Degree Requirement: 128 cr.**

Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

**International Perspective: 3 cr.**

**U.S. Diversity: 3 cr.**

**Communications Proficiency (with a C or better):**

6 cr. of English composition

3 cr. of speech fundamentals

**Communication/Library 16 cr.**

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
SP CM 212	Fundamentals of Public Speaking	3
LIB 160	Information Literacy	1
Plus 6 credits from the following:		6
ENGL 207	Introduction to Creative Writing	
ENGL 275	Analysis of Popular Culture Texts	
ENGL 302	Business Communication	
ENGL 303	Free-Lance Writing for Popular Magazines	
ENGL 304	Creative Writing: Fiction	
ENGL 305	Creative Writing: Nonfiction	
ENGL 306	Creative Writing: Poetry	
ENGL 309	Proposal and Report Writing	
ENGL 310	Rhetorical Analysis	
ENGL 312	Biological Communication	
ENGL 314	Technical Communication	

AGEDS 311	Presentation and Sales Strategies for Agricultural Audiences	
P R 305	Publicity Methods	
NREM 330	Principles of Interpretation	
SP CM 312	Business and Professional Speaking	
SP CM 313	Communication in Classrooms and Workshops	

**Humanities and Social Sciences: 6 cr.**

Humanities course list: <https://www.cals.iastate.edu/student-services/humanities>  
 Humanities (https://www.cals.iastate.edu/student-services/humanities/)  
 Social Science course list: <https://www.cals.iastate.edu/student-services/social-sciences>  
 Social Sciences (https://www.cals.iastate.edu/student-services/social-sciences/)

Approved humanities course		3
Approved social science course		3
<b>Total Credits</b>		<b>6</b>

**Ethics: 3 cr.**

3 cr. from approved ethics list: <https://www.cals.iastate.edu/student-services/ethics>  
 Ethics (https://www.cals.iastate.edu/student-services/ethics/)

**Mathematical Sciences: 6 cr.**

MATH 140	College Algebra	3
STAT 101	Principles of Statistics	3-4
or STAT 104	Introduction to Statistics	
<b>Total Credits</b>		<b>6-7</b>

**Physical Sciences: 14 cr.**

CHEM 163	College Chemistry	5
& 163L	and Laboratory in College Chemistry	
or CHEM 177	General Chemistry I	
& 177L	and Laboratory in General Chemistry I	
CHEM 231	Elementary Organic Chemistry	4
& 231L	and Laboratory in Elementary Organic Chemistry	
or CHEM 331	Organic Chemistry I	
& 331L	and Laboratory in Organic Chemistry I	
PHYS 115	Physics for the Life Sciences	5
& 115L	and Laboratory in Physics for the Life Sciences	
or PHYS 111	General Physics	
<b>Total Credits</b>		<b>14</b>

**Biological Sciences: 24 cr.**

NREM 110	Orientation in Natural Resource Ecology and Management	1
NREM 120	Introduction to Renewable Resources	3
NREM 211	Careers in Natural Resources	1
A ECL 231	Principles of Wildlife & Fisheries Conservation	3
A ECL 312	Ecology	4

A ECL 365	Vertebrate Biology	4
BIOL 211	Principles of Biology I	3
BIOL 211L	Principles of Biology Laboratory I	1
BIOL 212	Principles of Biology II	3
BIOL 212L	Principles of Biology Laboratory II	1
<b>Total Credits</b>		<b>24</b>

**Practical Experience:****Fisheries and Aquatic Sciences option**

A ECL 321	Fish Biology	3
A ECL 486	Aquatic Ecology	3
A ECL 486L	Aquatic Ecology Laboratory	1
Choose one of two Mathematics sequences:		7-8

## Sequence 1 (Calculus)

MATH 143	Preparation for Calculus	
One of the following:		
MATH 160	Survey of Calculus	
MATH 165	Calculus I	

## Sequence 2 (Statistics)

NREM 240	Quantitative Problem Solving in Natural Resources	
or MATH 143	Preparation for Calculus	
STAT 301	Intermediate Statistical Concepts and Methods	
Plus 20 credits from approved list		20

**Total Credits** **34-35**

**Interpretation of Natural Resources option**

A ECL 366	Natural History of Iowa Vertebrates	3
BIOL 366	Plant Systematics	4
ENT 370	Insect Biology	3
NREM 303	Internship	1-3
NREM 330	Principles of Interpretation	3
BIOL 474	Plant Ecology	3
or FOR 356	Dendrology	
One of the following:		3

AGRON 182	Introduction to Soil Science	
AGRON 206	Introduction to Weather and Climate	
ASTRO 120	The Sky and the Solar System	
GEOL 100	How the Earth Works	
GEOL 101	Environmental Geology: Earth in Crisis	
GEOL 108	Introduction to Oceanography	

Plus additional credits from approved list to total 33 credit hours. 10-13

Total credits = 33

**Preveterinary & Wildlife care option**

AN S 214	Domestic Animal Physiology	3
or B M S 329	Anatomy and Physiology of Domestic Animals	
One of the following:		3
A ECL 551	Behavioral Ecology	
AN S 336	Domestic Animal Behavior and Well-Being	
ANTHR 250	Primate Behavior	
BIOL 354	Animal Behavior	
Three credits from the following:		3
A ECL 321	Fish Biology	
A ECL 366	Natural History of Iowa Vertebrates	
A ECL 457	Herpetology	
A ECL 457L	Herpetology Laboratory	
A ECL 458	Ornithology	
A ECL 458L	Ornithology Laboratory	
A ECL 459	Mammalogy	
A ECL 459L	Mammalogy Laboratory	
One of the following:		3-5
AN S 214	Domestic Animal Physiology	
B M S 329	Anatomy and Physiology of Domestic Animals	
BIOL 335	Principles of Human and Other Animal Physiology	
BIOL 351	Comparative Chordate Anatomy	
BIOL 352	Vertebrate Histology	
BIOL 434	Endocrinology	
One of the following:		3
AN S 331	Domestic Animal Reproduction	
BIOL 313	Principles of Genetics	
BIOL 423	Developmental Biology	
GEN 320	Genetics, Agriculture and Biotechnology	
NREM 315	Genetics for Natural Resource Managers.	
At least three credits from the following list:		3-4
A ECL 401	Intro to Aquatic Animal Medicine	
A ECL 442	Aquaculture	
A ECL 454	Principles of Wildlife Disease	
AN S 319	Animal Nutrition	
AN S 493	Workshop in Animal Science	
BIOL 353	Introductory Parasitology	
MICRO 201	Introduction to Microbiology	
MICRO 201L	Introductory Microbiology Laboratory	
3 cr from course level 300-500 from A ECL or NREM		3
Plus additional credits from approved list to total 33 credit hours.		9-12
Total credits = 33		

**Wildlife option**

A ECL 371	Ecological Methods	3
A ECL 451	Wildlife Ecology and Management	3
BIOL 313	Principles of Genetics	3
or GEN 320	Genetics, Agriculture and Biotechnology	
or NREM 315	Genetics for Natural Resource Managers.	
BIOL 366	Plant Systematics	4
Choose one of two Mathematics sequences		7-8
Sequence 1 (Calculus)		
MATH 143	Preparation for Calculus	
One of the following:		
MATH 160	Survey of Calculus	
MATH 165	Calculus I	
Sequence 2 (Statistics)		
NREM 240	Quantitative Problem Solving in Natural Resources	
or MATH 143	Preparation for Calculus	
STAT 301	Intermediate Statistical Concepts and Methods	
Six credits from the following list:		6
A ECL 457	Herpetology	
A ECL 457L	Herpetology Laboratory	
A ECL 458	Ornithology	
A ECL 458L	Ornithology Laboratory	
A ECL 459	Mammalogy	
A ECL 459L	Mammalogy Laboratory	
Six credits from the following list:		6
A ECL 455	International Wildlife Issues	
ENV S 293	Environmental Planning	
ENV S 383	Environmental Politics and Policies	
NREM 270	Foundations in Natural Resource Policy and History	
NREM 385	Natural Resource Policy	
NREM 452	Ecosystem Management	
NREM 460	Controversies in Natural Resource Management	
At least three credits from the following list:		3-4
A ECL 415	Ecology of Freshwater Invertebrates, Plants, and Algae	
A ECL 454	Principles of Wildlife Disease	
A ECL 516	Avian Ecology	
A ECL 551	Behavioral Ecology	
ANTHR 250	Primate Behavior	
BIOL 315	Biological Evolution	
BIOL 336	Ecological and Evolutionary Animal Physiology	
BIOL 354	Animal Behavior	

BIOL 354L	Laboratory in Animal Behavior	
BIOL 471	Introductory Conservation Biology	
EEOB 507	Advanced Animal Behavior	
ENT 370	Insect Biology	
At least five credits from the following list:		5
A ECL 415	Ecology of Freshwater Invertebrates, Plants, and Algae	
AGRON 317	Principles of Weed Science	
BIOL 355	Plants and People	
BIOL 454	Plant Anatomy	
BIOL 456	Principles of Mycology	
BIOL 474	Plant Ecology	
EEOB 564	Wetland Ecology	
FOR 356	Dendrology	
NREM 357	Midwestern Prairie Plants	
NREM 358	Forest Herbaceous Layer: Ecology and Identification.	
Plus additional credits from approved list to total 45 credit hours.		0-5
Total credits = 45		

## Minor - Animal Ecology

The department offers a minor in animal ecology that may be earned by taking 15 credits in the department including:

A ECL 312	Ecology	4
A ECL 365	Vertebrate Biology	4
NREM 120	Introduction to Renewable Resources	3

Plus four additional credits of Animal Ecology or NREM courses at the 300 level or above.

The minor must include at least 9 credits that are not used to meet any other department, college, or university requirement.

### Animal Ecology, B.S. - fisheries and aquatic sciences

#### Freshman

Fall	Credits Spring	Credits
BIOL 211	3 BIOL 212	3
BIOL 211L	1 BIOL 212L	1
NREM 110	1 NREM 120	3
MATH 140	3 ENGL 150	3
CHEM 163	4 LIB 160	1
CHEM 163L	1 MATH 145	3
Required Elective	3 STAT 101 or 104	3-4
<b>16</b>		<b>17-18</b>

#### Sophomore

Fall	Credits Spring	Credits
A ECL 365	4 A ECL 231	3
NREM 211	1 CHEM 231	3
A ECL 312	4 CHEM 231L	1
MATH Calculus Elective	4 SP CM 212	3
ENGL 250	3 Free Elective / Restricted Elective	3
Required Elective		3
<b>16</b>		<b>16</b>

#### Junior

Fall	Credits Spring	Credits
PHYS 115	4 A ECL 321	3
PHYS 115L	1 Communications Elective	3
A ECL 486	3 Restricted Elective	3
A ECL 486L	1 Required Elective	3
Restricted Elective	6 Free Elective	3
Required Elective	3	
<b>18</b>		<b>15</b>

#### Senior

Fall	Credits Spring	Credits
Required Elective	3 Restricted Electives	7
Restricted Elective	6 Communications Elective	3
Free Electives	8 Free Electives	6
<b>17</b>		<b>16</b>

\* To complete degree program in 4 years students must maintain an average of 16 credits per semester.

\*\* Initial math course is determined on the basis of high school math and placement test scores. A non-credit course (Math 10) maybe be required at additional costs.

\*\*\* In scheduling coursework, students should pay particular attention to courses with limited offerings (e.g., offered only on alternate years) and to course sequences (i.e., where a course serves as a prerequisite for another course).

### Animal Ecology, B.S. - interpretation of natural resources option

#### Freshman

Fall	Credits Spring	Credits
BIOL 211	3 BIOL 212	3
BIOL 211L	1 BIOL 212L	1
NREM 110	1 NREM 120	3
Required Elective	3 ENGL 150	3

MATH 140**	3 MATH 145	3	<b>Freshman</b>
CHEM 163	4 STAT 101 or 104	3-4	<b>Fall</b>
CHEM 163L	1 LIB 160	1	
<b>16</b>		<b>17-18</b>	
<b>Sophomore</b>			
<b>Fall</b>	<b>Credits Spring</b>	<b>Credits</b>	
A ECL 365	4 CHEM 231	3	
NREM 211	1 CHEM 231L	1	
A ECL 312	4 SP CM 212	3	
Earth Science Elective	3 Free Elective/ Restricted Elective	6	
ENGL 250	3 Required Elective	3	
<b>15</b>		<b>16</b>	
<b>Junior</b>			
<b>Fall</b>	<b>Credits Spring</b>	<b>Credits</b>	
PHYS 115	4 NREM 330	3	
PHYS 115L	1 Communications Elective	3	
Botany or Restricted Elective	3-4 A ECL 366	3	
ENT 370	3 Required Elective	3	
Required Elective	3 BIOL 366	4	
Free Elective	3		
<b>17-18</b>		<b>16</b>	
<b>Senior</b>			
<b>Fall</b>	<b>Credits Spring</b>	<b>Credits</b>	
Restricted Elective	6-7 Botany or Restricted Elective	3	
Required Elective	3 Restricted Elective	3	
Free Electives	7 Communications Elective	3	
	NREM 303	1-3	
	Free Electives (if needed)	8	
<b>16-17</b>		<b>18-20</b>	

\* To complete degree program in 4 years students must maintain an average of 16 credits per semester.

\*\* Initial math course is determined on the basis of high school math and placement test scores. A non-credit course (Math 10) maybe be required at additional costs.

\*\*\* In scheduling coursework, students should pay particular attention to courses with limited offerings (e.g., offered only on alternate years) and to course sequences (i.e., where a course serves as a prerequisite for another course).

**Animal Ecology, B.S. - Pre-vet & wildlife care option**

BIOL 211	3 BIOL 212	3	
BIOL 211L	1 BIOL 212L	1	
NREM 110	1 NREM 120	3	
Required Elective	3 ENGL 150	3	
MATH 140	3 MATH 145	3	
CHEM 163	4 STAT 101 or 104	3-4	
CHEM 163L	1 LIB 160	1	
<b>16</b>		<b>17-18</b>	
<b>Sophomore</b>			
<b>Fall</b>	<b>Credits Spring</b>	<b>Credits</b>	
A ECL 365	4 CHEM 231	3	
NREM 211	1 CHEM 231L	1	
A ECL 312	4 SP CM 212	3	
Restricted Elective	3 Free Elective/ Restricted Elective	6	
ENGL 250	3 Required Elective	3	
<b>15</b>		<b>16</b>	
<b>Junior</b>			
<b>Fall</b>	<b>Credits Spring</b>	<b>Credits</b>	
PHYS 115	4 NREM 330	3	
PHYS 115L	1 AN S 214 or B M S 329	3	
Restricted Elective	3 Natural History Elective	3	
Required Elective	3 Required Elective	3	
Free Elective	6 Free Elective	6	
<b>17</b>		<b>18</b>	
<b>Senior</b>			
<b>Fall</b>	<b>Credits Spring</b>	<b>Credits</b>	
Restricted Elective	6 Restricted Elective	3	
Genetics/Development Elective	3 Communications Elective	3	
Required Elective	3 Free Elective	9	
Communications Elective	3		
Free Elective	2		
<b>17</b>		<b>15</b>	

\* To complete degree program in 4 years students must maintain an average of 16 credits per semester.

\*\* In scheduling coursework, students should pay attention to courses with limited offerings, (e.g., offered only on alternate years) and to course sequences (i.e., where a course serves as a prerequisite for another course).

# Admission to the ISU College of Veterinary Medicine requires a different set of Chemistry and Physics courses. Students should plan to enroll in Chemistry 177, 177L, 178, 331, 331L and 332. The Physics requirement is PHYS 111.

\*\* Initial math course is determined on the basis of high school math and placement test scores. A non-credit course (Math 10) maybe be required at additional costs.

\*\*\* In scheduling coursework, students should pay attention to courses with limited offerings, (e.g., offered only on alternate years) and to course sequences (i.e., where a course serves as a prerequisite for another course). It is critical that students take A ECL 371 fall semester of the junior year and A ECL 451 fall semester of the senior year.

### Animal Ecology, B.S. - wildlife option

#### Freshman

Fall	Credits Spring	Credits
BIOL 211	3 BIOL 212	3
BIOL 211L	1 BIOL 212L	1
NREM 110	1 NREM 120	3
MATH 140	3 ENGL 150	3
CHEM 163 <sup>#</sup>	4 MATH 145	3
CHEM 163L <sup>#</sup>	1 LIB 160	1
Required Elective	3 STAT 101 or 104	3-4
<b>16</b>		<b>17-18</b>

#### Sophomore

Fall	Credits Spring	Credits
A ECL 365	4 CHEM 231 <sup>#</sup>	3
NREM 211	1 CHEM 231L <sup>#</sup>	1
A ECL 312	4 SP CM 212	3
MATH Calculus Elective	4 Free Elective / Restricted Elective	6
ENGL 250	3 Required Elective	3
<b>16</b>		<b>16</b>

#### Junior

Fall	Credits Spring	Credits
PHYS 115	4 BIOL 366	4
PHYS 115L	1 Communications Elective	3
A ECL 371	3 Restricted Electives	6
Restricted Electives	6 Required Elective	3
Required Elective	3	
<b>17</b>		<b>16</b>

#### Senior

Fall	Credits Spring	Credits
A ECL 451	3 Restricted Electives	9
Restricted Electives	6 Communications Elective	3
Required Elective	3 Free Elective	3
Free Electives	6	
<b>18</b>		<b>15</b>

\* To complete degree program in four years students must maintain an average of 16 credits per semester.

#### Courses primarily for undergraduates:

##### A ECL 231: Principles of Wildlife & Fisheries Conservation

Cr. 3. S.

*Prereq: BIOL 211, BIOL 212, NREM 120*

Introduction to the principles of wildlife and fisheries management. Case studies will be explored along with assessment methods used to understand management including conservation of populations, species and communities, as well as habitat preservation and restoration.

##### A ECL 312: Ecology

(Cross-listed with BIOL, ENSCI). (3-3) Cr. 4. F.SS.

*Prereq: BIOL 211, BIOL 211L, BIOL 212, and BIOL 212L*

Fundamental concepts and principles of ecology dealing with organisms, populations, communities, and ecosystems. Laboratory and field exercises examine ecological principles and methods as well as illustrate habitats.

##### A ECL 312I: Ecology

(Cross-listed with ENSCI, IA LL). Cr. 4. SS.

An introduction to the principles of ecology at the population, community and ecosystem level. Field studies of local lakes, wetlands and prairies are used to examine factors controlling distributions, interactions, and roles of plants and animals in native ecosystems.

##### A ECL 321: Fish Biology

(2-3) Cr. 3. S.

*Prereq: A ECL 365*

Biology, ecology, and evolution of fishes. Emphasis on structure, physiology, and behavior, including a focus on the conservation and management of fishes and their habitats. Laboratory focus on fish morphology, survey methods, identification, distribution, habits, and habitats of fishes.

##### A ECL 326I: Ornithology

(Cross-listed with IA LL). Cr. 2. SS.

The biology, ecology, and behavior of birds with emphasis on field studies of local avifauna. Group projects stress techniques of population analysis and methodology for population studies.

**A ECL 333: Fisheries Techniques**

(Cross-listed with NREM). (1-3) Cr. 2. F.

*Prereq: BIOL 212*

Introduction to techniques used in the collection and interpretation of fish population data in the field and in the lab. Course objectives include an understanding of population survey methodology and improving student critical thinking and teamwork skills. Laboratory focuses on field trips and hands-on sampling experience.

**A ECL 365: Vertebrate Biology**

(Cross-listed with BIOL). (3-2) Cr. 4. F.

*Prereq: BIOL 211, BIOL 211L, BIOL 212, BIOL 212L*

Evolution, biology, and classification of fish, amphibians, reptiles, birds, and mammals. Emphasis on a comparative analysis of the structure and function of organ systems. Laboratory exercises concentrate on morphology and identification of orders of vertebrates.

**A ECL 366: Natural History of Iowa Vertebrates**

(2-3) Cr. 3. S.

*Prereq: BIOL 211, BIOL 211L, BIOL 212, BIOL 212L*

Vertebrate fauna of Iowa, including fishes, amphibians, reptiles, birds, and mammals. Species identification, habitat requirements, community structure and assessment, conservation issues that include historical population changes and value of wild animals to the region's ecological and economic health.

**A ECL 371: Ecological Methods**

(Cross-listed with BIOL). (2-3) Cr. 3. F.

*Prereq: A ECL 312; STAT 101 or STAT 104*

Quantitative techniques used in management of natural resources with emphasis on inventory and manipulation of habitat and animal populations.

**A ECL 401: Intro to Aquatic Animal Medicine**

(Cross-listed with B M S). (1-2) Cr. 1. S.

8-week course. Introductory course with focus on fin fish production, health and medicine. Course content will help define future roles for veterinarians, producers, and service providers. Emphasis will be placed on water-evaluation, anatomy, pathology, infectious diseases, nutrition, regulatory constraints in production, food safety, biosecurity and current research. Field trip to aquaculture facility.

**A ECL 404I: Behavioral Ecology**

(Cross-listed with IA LL). Cr. 4. Alt. SS., offered even-numbered years.

*Prereq: Two semesters of biology*

Animal coloniality, courtship, territoriality, predator defense, habitat selection, foraging, mating systems, and parental care will be examined in the field in order to evaluate various ecological and evolutionary theories of animal behavior.

**A ECL 406: Wildlife Camp**

Cr. 3. F.

*Prereq: BIOL 211 and permission of instructor; restricted to Animal Ecology majors*

Introduction to methods and career options in wildlife research and management through field work. Two-week field work experience followed by on-campus reflection, analysis and presentation of field data.

**A ECL 415: Ecology of Freshwater Invertebrates, Plants, and Algae**

(Dual-listed with A ECL 515). (2-3) Cr. 3. Alt. F., offered odd-numbered years.

*Prereq: A ECL 312*

Identification, biology, and ecological requirements of freshwater invertebrates, plants and algae. Additional emphases on community sampling methods and analysis, and use of organisms as tools for aquatic ecosystem health assessment.

**A ECL 418: Stream Ecology**

(Dual-listed with A ECL 518). (Cross-listed with ENSCI). (2-3) Cr. 3. Alt. F., offered odd-numbered years.

*Prereq: A ECL 486*

Biological, chemical, physical, and geological processes that determine the structure and function of flowing water ecosystems. Current ecological theories as well as applications to stream management for water quality and fisheries.

**A ECL 419I: Vertebrate Ecology and Evolution**

(Cross-listed with IA LL). Cr. 4. SS.

Field and laboratory study of representative vertebrates of northwestern Iowa. Observations and experimentation emphasize ecological histories by integrating concepts of functional morphology, behavioral ecology, and evolutionary biology.

**A ECL 420I: Amphibians and Reptiles**

(Cross-listed with IA LL). Cr. 2. Alt. SS., offered even-numbered years.

*Prereq: Two semesters of biology*

Ecology, behavior, and conservation biology of amphibians and reptiles with emphasis on their anatomy and morphology; temperature and water regulation; locomotion; life history; reproduction; population and community ecology; and conservation.

**A ECL 425: Aquatic Insects**

(Dual-listed with A ECL 525). (Cross-listed with ENT). (2-3) Cr. 3. Alt. S., offered odd-numbered years.

*Prereq: BIOL 312 or equivalent*

Morphology, ecology, diversity, and significance of aquatic insects, with emphasis on the collection, curation and identification of taxa in local streams and lakes.

**A ECL 440: Fishery Management**

(Dual-listed with A ECL 540). (2-3) Cr. 3. F.

*Prereq: A ECL 312, A ECL 321, A ECL 333; STAT 101 or STAT 104; credit or enrollment in A ECL 486*

Biological basis of fishery management, fishery problems, and management practices for freshwater, anadromous, and marine fisheries.

**A ECL 442: Aquaculture**

(Dual-listed with A ECL 542). (3-0) Cr. 3. S.

*Prereq: BIOL 211 and BIOL 212.*

Concepts related to the culture of aquatic organisms including culture systems, water quality, nutrition, genetics, diseases, and marketing.

**A ECL 451: Wildlife Ecology and Management**

(2-3) Cr. 3. S.

*Prereq: A ECL 371*

Ecological theory and practice of wildlife management, including, population ecology, habitat management, and current issues in the field. Course involves a series of case studies addressing actual wildlife issues using field and quantitative methods.

**A ECL 454: Principles of Wildlife Disease**

(Dual-listed with A ECL 554). (3-0) Cr. 3. S.

*Prereq: Junior standing and at least 10 credits in biological sciences at the 300+ level*

Ecological and epidemiological aspects of diseases as they relate to wildlife populations. Topics to be covered include: major classes of disease; detection, description, monitoring, and management of disease; characteristics and interactions between disease agents and wildlife hosts; relationships among wildlife, domestic animal, and human health.

**A ECL 455: International Wildlife Issues**

(3-0) Cr. 3. Alt. F., offered even-numbered years.

*Prereq: A ECL 365, A ECL 312 or graduate standing; NREM 120*

Biological, political, social, and economic factors affecting the management of international wildlife resources. Meets International Perspectives Requirement.

**A ECL 457: Herpetology**

(Cross-listed with BIOL). (2-0) Cr. 2. F.

*Prereq: BIOL 351 or BIOL 365*

Biology, ecology, and evolution of amphibians (salamanders, frogs, caecilians) and reptiles (lizards, snakes, tuatara, turtles, crocodilians). Emphasis on structure, physiological adaptation to different environments, behavior, reproduction, roles of amphibians and reptiles in ecosystems, and conservation. Laboratory focus on survey methods, identification, relationships, distribution, habits, and habitats of amphibians and reptiles.

**A ECL 457L: Herpetology Laboratory**

(Cross-listed with BIOL). (0-3) Cr. 1. F.

*Prereq: BIOL 351 or BIOL/A ECL 365; concurrent registration in BIOL 457 or A ECL 457*

Laboratory to accompany Biology/Animal Ecology 457. Focus on survey methods, identification, relationships, distribution, habits, and habitats of amphibians and reptiles.

**A ECL 458: Ornithology**

(Cross-listed with BIOL). (2-0) Cr. 2. S.

*Prereq: A ECL 365 or BIOL 351*

Biology, evolution, ecology and taxonomy of birds. Emphasis on structure, physiology, behavior, communication, navigation, reproduction, and conservation.

**A ECL 458L: Ornithology Laboratory**

(Cross-listed with BIOL). (0-3) Cr. 1. S.

*Prereq: BIOL 351 or AECL/BIOL 365. Concurrent enrollment in AECL/BIOL 458 is required.*

Laboratory complements lecture topics with emphasis on external anatomy, identification and distribution of Midwest birds, and field trips.

**A ECL 459: Mammalogy**

(Cross-listed with BIOL). (2-0) Cr. 2. S.

*Prereq: BIOL 351 or A ECL 365*

Biology, ecology, and evolution of mammals. Emphasis on structure, physiological adaptation to different environments, behavior, reproduction, roles of mammals in ecosystems, and conservation.

**A ECL 459L: Mammalogy Laboratory**

(Cross-listed with BIOL). (0-3) Cr. 1. S.

*Prereq: BIOL 351 or BIOL/AECL 365; concurrent enrollment in AECL 459 or BIOL 459 required.*

Laboratory focus on identification, survey methods, distribution, habits, and habitats of mammals. Several field trips.

**A ECL 471: Introductory Conservation Biology**

(Cross-listed with BIOL). Cr. 3. S.

*Prereq: BIOL 312*

Examination of conservation issues from a population and community perspective. The role of genetics, demography, and environment in determining population viability, habitat fragmentation, reserve design, biodiversity assessment, and restoration ecology.

**A ECL 480: Studies in Marine Biology**

Cr. 1-8. Repeatable. SS.

Courses taken at Gulf Coast Research Laboratory and other marine biological stations are transferred to Iowa State University under this number.



**A ECL 486: Aquatic Ecology**

(Dual-listed with A ECL 586). (Cross-listed with BIOL, ENSCI). (3-0) Cr. 3. F.

*Prereq: Biol 312 or EnSci 381 or EnSci 402 or NREM 301*

Structure and function of aquatic ecosystems with application to fishery and pollution problems. Emphasis on lacustrine, riverine, and wetland ecology.

**A ECL 486L: Aquatic Ecology Laboratory**

(Dual-listed with A ECL 586L). (Cross-listed with BIOL, ENSCI). (0-3) Cr. 1. F.

*Prereq: Concurrent enrollment in BIOL 486*

Field trips and laboratory exercises to accompany 486. Hands-on experience with aquatic research and monitoring techniques and concepts.

**A ECL 489: Population Ecology**

(Dual-listed with A ECL 589). (Cross-listed with BIOL). (2-2) Cr. 3. Alt. F., offered even-numbered years.

*Prereq: BIOL 312, STAT 101 or STAT 104, a course in calculus, or graduate standing*

Concepts and theories of population dynamics with emphasis on models of growth, predation, competition, and regulation.

**Courses primarily for graduate students, open to qualified undergraduates:****A ECL 515: Ecology of Freshwater Invertebrates, Plants, and Algae**

(Dual-listed with A ECL 415). (2-3) Cr. 3. Alt. F., offered odd-numbered years.

*Prereq: A ECL 312*

Identification, biology, and ecological requirements of freshwater invertebrates, plants and algae. Additional emphases on community sampling methods and analysis, and use of organisms as tools for aquatic ecosystem health assessment.

**A ECL 516: Avian Ecology**

(3-0) Cr. 3. Alt. S., offered even-numbered years.

*Prereq: A ECL 365, A ECL 312, or graduate standing*

Current topics and theories including avian breeding and foraging ecology, population biology, community structure, habitat selection, field methodologies, and data interpretation.

**A ECL 518: Stream Ecology**

(Dual-listed with A ECL 418). (Cross-listed with ENSCI). (2-3) Cr. 3. Alt. F., offered odd-numbered years.

*Prereq: A ECL 486*

Biological, chemical, physical, and geological processes that determine the structure and function of flowing water ecosystems. Current ecological theories as well as applications to stream management for water quality and fisheries.

**A ECL 520: Fisheries Science**

(3-0) Cr. 3. Alt. S., offered odd-numbered years.

*Prereq: A ECL 312, A ECL 321*

Concepts, approaches, and techniques for assessment of recreational and commercial fisheries. Scope will range from individual fish to entire ecosystems, both freshwater and marine.

**A ECL 523I: Fish Ecology**

(Cross-listed with IA LL). Cr. 2. Alt. SS., offered even-numbered years.

Basic principles of fish interaction with the biotic and abiotic environment. Field methods, taxonomy, and biology of fish with emphasis on the fish fauna of northwestern Iowa.

**A ECL 525: Aquatic Insects**

(Dual-listed with A ECL 425). (Cross-listed with ENT). (2-3) Cr. 3. Alt. S., offered odd-numbered years.

*Prereq: BIOL 312 or equivalent*

Morphology, ecology, diversity, and significance of aquatic insects, with emphasis on the collection, curation and identification of taxa in local streams and lakes.

**A ECL 526I: Advanced Field Ornithology**

(Cross-listed with IA LL). Cr. 2. SS.

*Prereq: Concurrent registration in IA LL 326I*

Field study of birds of the upper Midwest; extended field trip to Minnesota and Wisconsin; individual or group project.

**A ECL 531: Conservation Biology**

(Cross-listed with EEOB). (3-0) Cr. 3. Alt. S., offered even-numbered years.

*Prereq: BIOL 312; BIOL 313 or graduate standing*

Examination of conservation issues from a population and a community perspective. Population-level analysis will focus on the role of genetics, demography, and environment in determining population viability. Community perspectives will focus on topics such as habitat fragmentation, reserve design, biodiversity assessment, and restoration ecology.

**A ECL 531I: Conservation Biology**

(Cross-listed with EEOB, IA LL). Cr. 4. Alt. SS., offered even-numbered years.

*Prereq: IA LL 312I*

Population-and community-level examination of factors influencing the viability of plant and animal populations from both demographic and genetic perspectives; assessment of biodiversity; design and management of preserves.

**A ECL 535I: Restoration Ecology**

(Cross-listed with EEOB, ENSCI, IA LL). Cr. 2. Alt. SS., offered even-numbered years.

*Prereq:* A course in ecology

Ecological principles for the restoration of native ecosystems; establishment (site preparation, selection of seed mixes, planting techniques) and management (fire, mowing, weed control) of native vegetation; evaluation of restorations. Emphasis on the restoration of prairie and wetland vegetation.

**A ECL 540: Fishery Management**

(Dual-listed with A ECL 440). (2-3) Cr. 3. F.

*Prereq:* A ECL 312, A ECL 321, A ECL 333; STAT 101 or STAT 104; credit or enrollment in A ECL 486

Biological basis of fishery management, fishery problems, and management practices for freshwater, anadromous, and marine fisheries.

**A ECL 542: Aquaculture**

(Dual-listed with A ECL 442). (3-0) Cr. 3. S.

*Prereq:* BIOL 211 and BIOL 212.

Concepts related to the culture of aquatic organisms including culture systems, water quality, nutrition, genetics, diseases, and marketing.

**A ECL 551: Behavioral Ecology**

(2-2) Cr. 3. Alt. F., offered odd-numbered years.

*Prereq:* a course in ecology or animal behavior

The study of how an animal's behavior affects its ability to survive and reproduce in its environment. Course topics, such as foraging behavior, sexual selection, parental care, etc., represent the interface of ecology, evolution, and behavior.

**A ECL 554: Principles of Wildlife Disease**

(Dual-listed with A ECL 454). (3-0) Cr. 3. S.

*Prereq:* Graduate classification

Ecological and epidemiological aspects of disease as they relate to wildlife populations. Topics to be covered include: major classes of disease; detection, description, monitoring, and management of disease; characteristics and interactions between disease agents and wildlife hosts; relationship among wildlife, domestic animal, and human health.

**A ECL 573: Techniques for Biology Teaching**

(Cross-listed with EEOB, IA LL). Cr. 1-2. Repeatable. SS.

The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

**A ECL 573A: Techniques for Biology Teaching : Animal Biology**

(Cross-listed with EEOB, IA LL). Cr. 1-2. Repeatable. SS.

The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

**A ECL 573G: Techniques for Biology Teaching: Limnology**

(Cross-listed with EEOB, IA LL). Cr. 1-2. Repeatable. SS.

The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

**A ECL 573I: Techniques for Biology Teaching: Insect Ecology**

(Cross-listed with EEOB, IA LL). Cr. 1-2. Repeatable. SS.

The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

**A ECL 573W: Techniques for Biology Teaching: Project WET**

(Cross-listed with EEOB, IA LL). Cr. 1-2. Repeatable. SS.

The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

**A ECL 586: Aquatic Ecology**

(Dual-listed with A ECL 486). (Cross-listed with EEOB, ENSCI). (3-0) Cr. 3. F.

*Prereq:* Biol 312 or EnSci 381 or EnSci 402 or NREM 301

Structure and function of aquatic ecosystems with application to fishery and pollution problems. Emphasis on lacustrine, riverine, and wetland ecology.

**A ECL 586L: Aquatic Ecology Laboratory**

(Dual-listed with A ECL 486L). (Cross-listed with EEOB, ENSCI). (0-3) Cr. 1. F.

*Prereq:* Concurrent enrollment in BIOL 486

Field trips and laboratory exercises to accompany 486. Hands-on experience with aquatic research and monitoring techniques and concepts.

**A ECL 589: Population Ecology**

(Dual-listed with A ECL 489). (Cross-listed with EEOB). (2-2) Cr. 3. Alt. F., offered even-numbered years.

*Prereq: BIOL 312, STAT 101 or STAT 104, a course in calculus, or graduate standing*

Concepts and theories of population dynamics with emphasis on models of growth, predation, competition, and regulation.

**A ECL 590: Graduate Independent Study**

(Cross-listed with ANTHR, EEOB, IA LL). Cr. 1-4. Repeatable. SS.

*Prereq: Graduate classification and permission of instructor*

**A ECL 590I: Special Topics: Graduate Independent Study**

(Cross-listed with ANTHR, EEOB, IA LL). Cr. 1-4. Repeatable. SS.

*Prereq: Graduate classification and permission of instructor*

**A ECL 599: Creative Component**

Cr. arr.

*Prereq: Nonthesis M.S. option only*

**Courses for graduate students:****A ECL 611: Analysis of Populations**

(2-2) Cr. 3. Alt. F., offered even-numbered years.

*Prereq: BIOL 312; STAT 401; a course in calculus*

Quantitative techniques for analyzing vertebrate population data to estimate parameters such as density and survival. Emphasis on statistical inference and computing.

**A ECL 698: Animal Ecology Teaching Practicum**

Cr. 1-3. Repeatable. F.S.SS.

*Prereq: Graduate classification in animal ecology and permission of instructor*

Graduate student experience in the animal ecology teaching program.

Offered on a satisfactory-fail basis only.

**A ECL 699: Research**

Cr. arr. Repeatable.

**A ECL 699I: Research**

(Cross-listed with ANTHR, EEOB, GDCB, IA LL). Cr. 1-4. Repeatable.