

# ECOLOGY

## Degree Requirements

### Master of Science (M.S.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

A minimum of 30 credits at the 400, 500, 600, or 800 level is required, with at least 18 credits at the 500 and 600 level, combined. A minimum of six (6) thesis research credits (ECLGY 600 or ECLGY 610) must be taken in Ecology.

In addition to Graduate Council requirements, the instructional program includes:

- ECLGY 515 Advances in Ecology (3 cr.),
- two graduate courses in ecology selected from the following subdisciplines: Molecular, Physiological, Behavioral, and Evolutionary Ecology; Population and Community Ecology; Ecosystem, Landscape and Global Ecology. A list of courses that will satisfy this requirement is maintained by the graduate program office,
- a graduate (500 or 800 level) statistics course,
- two credits of colloquium (ECLGY 590),
- a minimum of six thesis credits (ECLGY 600 or ECLGY 610),
- breadth courses selected by the student in consultation with the research adviser and research committee,
- and a thesis research project directed by the student's adviser. The thesis must be accepted by the advisers and/or committee members, the head of the graduate program, and the Graduate School, and the student must pass a thesis defense.

### Doctor of Philosophy (Ph.D.)

Requirements listed here are in addition to Graduate Council policies listed under GCAC-600 Research Degree Policies. (<https://gradschool.psu.edu/graduate-education-policies/>)

In addition to Graduate Council requirements, the instructional program includes:

- ECLGY 515 Advances in Ecology (3 cr.),
- ECLGY 510 Classical Ecology (2 cr.)
- two graduate courses in ecology selected from the following subdisciplines: Molecular, Physiological, Behavioral, and Evolutionary Ecology; Population and Community Ecology; Ecosystem, Landscape and Global Ecology. A list of courses that will satisfy this requirement is maintained by the graduate program office,
- two graduate (500 or 800 level) statistics courses,
- two graded credits plus two audit credits (4 credits total) of colloquium (ECLGY 590),
- breadth courses selected by the student in consultation with the research adviser and Ph.D. committee,
- one credit of Supervised Experience in College Teaching (ECLGY 602),
- a minimum of 15 thesis credits (ECLGY 600 or ECLGY 610),
- and a dissertation research project directed by the student's adviser.

English competence will be assessed and reported at the time of the qualifying examination and formally attested before the comprehensive

examination is scheduled. The qualifying examination includes written and oral portions.

The Ph.D. committee is selected by the student and adviser and approved by the Program Chair and the Graduate School. The Ph.D. Committee must meet all Graduate Council Requirements (<https://gradschool.psu.edu/graduate-education-policies/gcac/gcac-600/gcac-602-phd-committee-formation/>). In addition, members of the Ecology faculty must comprise at least half of the committee. The committee has the responsibility for determining the course program and research acceptable in satisfying degree requirements. The committee will administer the comprehensive examination and final oral examination.

Doctoral students must pass a qualifying examination, a comprehensive examination, and a final oral examination (the dissertation defense). To earn the Ph.D. degree, doctoral students must also write a dissertation that is accepted by the Ph.D. committee, the head of the graduate program, and the Graduate School.

### Options

Four options for specialization are offered, for both the M.S. and the Ph.D.:

1. Conservation Biology
2. Microbial Ecology
3. Quantitative Ecology
4. Physiological Ecology

Students are not required to select an option. Each option entails extra course requirements plus a thesis directed by an ecology faculty member in the option.

When courses that fulfill option requirements appear on the list of approved subdiscipline courses, these courses may also be counted towards the subdiscipline graduate courses required for the Ecology major.

### Conservation Biology

The Conservation Biology option is concerned with problems of maintaining the rapidly disappearing diversity of organisms and their habitats, and the global reservoir of genetic diversity that these organisms represent.

Code	Title	Credits
<b>Required Courses</b>		
Select two required courses from the following list:		
ANTH 559	Human Ecology	
BIOL 428	Population Genetics	
GEOG 414	Principles and Applications in Landscape Ecology	
WFS 430	Conservation Biology	
In addition, two courses (at least 6 credits) are required from this list of Conservation Biology courses:		
ANTH 560	Ecology, Evolution, and Human Behavior	
BIOL 414	Taxonomy of Seed Plants	
BIOL 422	Advanced Genetics	
BIOL 427	Evolution	
BIOL 448	Ecology of Plant Reproduction	
ENT 432	Insect Biodiversity and Evolution	
ENT 457	Principles of Integrated Pest Management	

FOR 508	Forest Ecology
FOR 530	Conservation Genetics
GEOG 411	Forest Geography
GEOG 587	Conservation GIS
WFS 462	Amphibians and Reptiles

### Microbial Ecology

The Microbial Ecology option addresses the structure, function, and interactions of microbial populations and communities, both within plants and animal hosts and in diverse environmental samples (soils, sediments, water).

Code	Title	Credits
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#### Required Courses

Select two required courses from the following list:

MICRB 401	Microbial Physiology and Structure
MICRB 416	Microbial Biotechnology
SOILS 512	Environmental Soil Microbiology
PPEM 440	Introduction to Microbiome Analysis

In addition, two courses (at least 6 credits) are required from this list of Microbial Ecology courses:

BIOL/PPEM 425	Biology of Fungi
BMB/MICRB 450	Microbial/Molecular Genetics
CE 479	Environmental Microbiology for Engineers
FDSC 526	Microbial Physiology of Foodborne Organisms
GEOSC 409W	Geomicrobiology
GEOSC 502	Evolution of the Biosphere
MCIBS 593	Molecular Biology Laboratory
PPATH 533	Molecular Genetics of Plant-Pathogen Interactions
PPEM 454	Virus Ecology
PPEM 456	Applied Microbial Ecology
SOILS/CE 536	Topics in Biogeochemistry or GEOSC 53 Topics in Biogeochemistry

### Quantitative Ecology

The Quantitative Ecology option includes mathematical and statistical modeling and applications of statistics to experimental design and data analysis.

Code	Title	Credits
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#### Required Courses

Select two required courses from the following list:

BIOL 465	Network analysis of biological systems
BIOL 519	Ecological and Environmental Problem Solving
WFS 560	Population Estimation and Modeling
WFS 585	Applied Spatial Ecology

In addition, two courses (at least 6 credits) are required from this list of Quantitative Ecology courses:

BIOL/STAT 555	Statistical Analysis of Genomics Data
FOR 455	Remote Sensing and Spatial Data Handling
GEOG 464	Advanced Spatial Analysis
GEOG 465	Advanced Geographic Information Systems Modeling

GEOSC 450	Risk Analysis in the Earth Sciences
MATH 450	Mathematical Modeling
STAT 416	Stochastic Modeling
STAT 464	Applied Nonparametric Statistics
STAT 505	Applied Multivariate Statistical Analysis
STAT 508	Applied Data Mining & Statistical Learning
STAT 510	Applied Time Series Analysis
STAT 511	Regression Analysis and Modeling
STAT 512	Design and Analysis of Experiments
STAT 513	Theory of Statistics I
STAT 514	Theory of Statistics II
STAT 515	Stochastic Processes and Monte Carlo Methods
STAT 517	Probability Theory
STAT 551	Linear Models I
STAT 565	Multivariate Analysis

### Physiological Ecology

The Physiological Ecology option is concerned primarily with the function and performance of organisms in their environment.

Code	Title	Credits
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#### Required Courses

Select two required courses from the following list:

BIOL 406	Symbiosis
BIOL 446	Physiological Ecology
HORT 445	Plant Ecology
PLBIO 514	Modern Techniques and Concepts in Plant Ecophysiology

In addition, two courses (at least 6 credits) are required from this list of Physiological Ecology courses:

AGRO 410W	Physiology of Agricultural Crops
AGRO 518	Responses of Crop Plants to Environmental Stress
BIOL 415	Ecotoxicology
BIOL 441	Plant Physiology
ENT 539	Chemical Ecology of Insects
PLBIO 512	Plant Resource Acquisition and Utilization
PLBIO 513	Integrative Plant Communication and Growth
PLBIO 515	Modern Techniques and Concepts in Plant Cell Biology
PLBIO 516	Modern Techniques and Concepts in Plant Molecular Biology