**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/](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/](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/](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.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ANTH 559</td>
<td>Human Ecology</td>
<td></td>
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<tr>
<td>BIOL 428</td>
<td>Population Genetics</td>
<td></td>
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<tr>
<td>GEOG 414</td>
<td>Principles and Applications in Landscape Ecology</td>
<td></td>
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<tr>
<td>WFS 430</td>
<td>Conservation Biology</td>
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</tbody>
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In addition, two courses (at least 6 credits) are required from this list of Conservation Biology courses:

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<tr>
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<tbody>
<tr>
<td>ANTH 560</td>
<td>Ecology, Evolution, and Human Behavior</td>
<td></td>
</tr>
<tr>
<td>BIOL 414</td>
<td>Taxonomy of Seed Plants</td>
<td></td>
</tr>
<tr>
<td>BIOL 422</td>
<td>Advanced Genetics</td>
<td></td>
</tr>
<tr>
<td>BIOL 427</td>
<td>Evolution</td>
<td></td>
</tr>
<tr>
<td>BIOL 448</td>
<td>Ecology of Plant Reproduction</td>
<td></td>
</tr>
<tr>
<td>ENT 432</td>
<td>Insect Biodiversity and Evolution</td>
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<tr>
<td>ENT 457</td>
<td>Principles of Integrated Pest Management</td>
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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).

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<tbody>
<tr>
<td>MICRB 401</td>
<td>Microbial Physiology and Structure</td>
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</tr>
<tr>
<td>MICRB 416</td>
<td>Microbial Biotechnology</td>
<td></td>
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<tr>
<td>SOILS 512</td>
<td>Environmental Soil Microbiology</td>
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<tr>
<td>PPEM 440</td>
<td>Introduction to Microbiome Analysis</td>
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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 537 Topics in Biogeochemistry

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

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<tbody>
<tr>
<td>BIOL 406</td>
<td>Symbiosis</td>
<td></td>
</tr>
<tr>
<td>BIOL 446</td>
<td>Physiological Ecology</td>
<td></td>
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<tr>
<td>HORT 445</td>
<td>Plant Ecology</td>
<td></td>
</tr>
<tr>
<td>PLBIO 514</td>
<td>Modern Techniques and Concepts in Plant Ecophysiology</td>
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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

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

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