College of the Environment, Forestry, and Natural Sciences 2020-2021

Department of Biological Sciences

Biology, Doctor of Philosophy

- **Available Emphasis Areas:**
- Ecology, Evolution and Conservation Biology - Emphasis

This doctoral degree allows advanced students to pursue their content and research skills while studying under faculty specialists in microbiology, botany, genetics, bioinformatics, human biology, ecology, and zoology. The program is enhanced by advanced research facilities that include the Deaver Herbarium, the Electron Microscope Facility, and the nationally prominent Microbial Genetic and Genomics Center, home to powerful research into anthrax, plague, and other bacterial-disease-causing infections.

Careers

What Can I Do with a Doctor of Philosophy in Biology?

The Doctor of Philosophy program provides advanced training in research through focused coursework and extensive research experience, using an integrative, interdisciplinary, and evolutionary approach. Students will develop expertise in collecting, analyzing, interpreting, and presenting data at a level appropriate to the profession.

University Requirements

- To receive a Doctor of Philosophy Degree (Ph.D.) at Northern Arizona University, you must complete a planned group of courses, from one or more disciplines, ranging from at least 60-109 units of graduate-level courses. Most plans require research, a dissertation, and comprehensive exams. All plans have residency requirements regarding time spent on the Flagstaff campus engaged in full-time study.

  The full policy can be viewed here.

Overview

In addition to University Requirements:

- Complete individual plan requirements.

Minimum Units for Completion	60
Additional Admission Requirements	Required
Emphasis, Minor, Certificate	Optional
Dissertation	Dissertation is required.
Comprehensive Exam	Comprehensive Exam is required.
Oral Defense	Oral Defense is required.
Foreign Language	Optional
Research	Individualized research is required.

Purpose Statement

The Biology Ph.D. program prepares students for research-focused professions in the biological sciences, developing students' expertise in the empirical foundations of their dissertation area, and collecting, analyzing, interpreting, and presenting data to push forward the forefront of knowledge in their biological field of study. Our faculty members conduct research in the many fields of biology, from the level of single molecules to whole ecosystems. From the first day of entry into our program, students work closely with their faculty mentor, selecting a course of study suited to their future goals and professional interests. The program enables graduates to contribute to the forefront of knowledge in the scientific community, share their knowledge through teaching, or apply it in public service or industry.

Students pursuing the emphasis in Ecology, Evolution & Conservation Biology will integrate theoretical and empirical concepts in ecology and evolutionary biology to understand ecological patterns and the mediating processes that drive populations, communities and ecosystems. Students will become familiar with ecological sampling techniques and statistical methodologies necessary to characterize populations, communities and ecosystems over broad geographic regions, and will apply current approaches for identifying and mitigating the effects of invasive species and anthropogenic impacts on threatened and endangered species within the natural ecosystems they inhabit.

Student Learning Outcomes

Upon completion of the Biology PhD degree, students will be able to:

- Elucidate the major theories, research methods, approaches to inquiry and schools of practice in their biological discipline (genetics, physiology, anatomy, ecology, evolution, cell- or biochemistry, and microbiology), illustrating both the applications and relationships to other biological disciplines.
- Integrate applied, empirical or experimental work into a broader context, incorporating and considering perspectives and methods of other fields of study.
- Apply logical, mathematical or statistical methods most important or appropriate to the exploration of their field of study.
- Identify, select and defend the choice of mathematical or statistical methods or models appropriate to research questions.

- Design and perform empirical or experimental work independently, as well as describing, analyzing, and critically evaluating experimental data.
- Communicate biological knowledge, including results of research undertakings, and the rationale underpinning their conclusions, to specialist and non-specialist audiences clearly and unambiguously.
- Synthesize principal ideas, techniques or methods at the forefront of the field of study.
- Create sustained, coherent arguments or explanations summarizing his/ her work for both general and specialized audiences.
- Provide evidence contributing to, expanding, evaluating or refining the information base within the field of study.
- Articulate and defend the significance and implications of the work in terms of the challenges and trends of their primary field of study.
- Conceive, design, and implement an original scientific project with the purpose of generating new knowledge.

Students graduating with an emphasis in Ecology, Evolution, and Conservation will be able to:

- Articulate the theoretical and empirical foundations of ecology and integrate their application into thesis area
- Provide coherent summaries and insights regarding current and emerging topics in ecology, evolution and conservation biology for both general and scientific audiences.
- Apply quantitative methods to examine patterns, processes and anthropogenic impacts on terrestrial and aquatic environments.
- Examine the major theories, research methods, and inquiry approaches that scale from physiology to ecosystems.

Details

Additional Admission Requirements

- Admission requirements over and above admission to NAU are required.
    - NAU Graduate Online application is required for all programs. Details on admission requirements are included in the online application.
    - Undergraduate degree from a regionally accredited institution
    - Grade Point Average (GPA) of 3.00 (scale is 4.00 = "A"), or the equivalent.
    - Admission to many graduate programs is on a competitive basis, and programs may have higher standards than those established by the Graduate College.
    - Transcripts
    - For details on graduate admission policies, please visit the Graduate Admissions Policy
    - International applicants have additional admission requirements. Please see the International Graduate Admissions Policy

Individual program admission requirements include:

- GRE® revised General Test

- 3 letters of recommendation
- Personal statement or essay

- All applicants are expected to make email contact with potential faculty members in the department BEFORE APPLYING. Applicants should only apply if a mentor agrees to support the applicant.
- Knowledge of biology at the baccalaureate level

- One of the following:
  - An earned thesis-based MS degree in a biological or related science
  - Demonstrated research ability by being a responsible author on a scientific, peer-reviewed publication (journal article)
  - Have equivalent credentials to above, which may include considerable relevant research experience, average GRE scores above the 70th national percentile in Verbal, Quantitative and Writing Ability, experience presenting scientific papers as an author at regional, national or international scientific meetings, with reference letters attesting to the student's performance and responsibility for the science reported at such venues.

Doctoral Requirements

- **Take the following 60 units:**
  - BIO 503, BIO 504 (6 units)
  - Coursework*, beyond the bachelor's degree, covering the major principles of biology (39 units)

*Coursework may include the Ecology, Evolution & Conservation Biology Emphasis - see below (13 units)

Ecology, Evolution & Conservation Biology Emphasis

- (BIO 577 or ENV 577 or FOR 577) (3 units)
- Select one seminar course from FOR 505 or BIO 698 (1 unit)
- Breadth Courses - select one course from each of two of the following groups: (6 units)

  - Quantitative:
    - BIO 523, BIO 567, BIO 580, BIO 682, FOR 606, (EES 529 or GSP 529) or other graduate-level coursework in quantitative ecology at NAU, with your advisor's approval.
  - Physiological/Population/Community
    - BIO 568, BIO 570, BIO 571, BIO 573, BIO 663, BIO 673, ENV 540, FOR 504, FOR 517, FOR 520, FOR 543, FOR 545, FOR 550, FOR 551, FOR 552, FOR 553, FOR 560, FOR 580, FOR 582, FOR 604, or other

graduate-level coursework in physiological, population, or community ecology at NAU, with your advisor's approval.
        - Ecosystem/Global
            - (BIO 507 or FOR 507), BIO 578, ENV 571, FOR 515, FOR 521, FOR 544, or other graduate-level coursework in ecosystem/global ecology at NAU, with your advisor's approval.

    - BIO 799, for the research, writing, and oral defense of an approved dissertation. (15 units)

- Please note that you may count only 15 units of dissertation credit toward your degree. However, experience tells us that our doctoral students in Biology end up taking an average of 36 units. This is due to the requirement that you register for BIO 799 for each semester during which you work on your dissertation.

  In addition, we require that you:
    - Have a reading knowledge of one foreign language or skill in statistics
    - Perform satisfactorily on a comprehensive exam in your fifth semester
    - Fulfill Northern Arizona University's residency requirements. (For more information about residency and other requirements that pertain to this degree, see Doctoral Requirements Policy.)
    - Pass the oral exam on your dissertation (Dissertation Defense)

- Be aware that some courses may have prerequisites that you must also take. For prerequisite information click on the course or see your advisor.

Campus Availability

- Flagstaff