Environmental Conservation Graduate Program

Wildlife, Fish and Conservation Biology Concentration

A. Concentration Description

This concentration leads to both Master of Science (MS) and Doctor of Philosophy (PhD) degrees in Environmental Conservation (ECo) and is designed for students who want scientific training in the multi-disciplinary field of wildlife, fish and conservation biology. The focus of this concentration is broadly on animal ecology and conservation biology but encompasses specialized training in fields such as conservation genetics, population ecology and landscape ecology. The prime impetus for this concentration is the need for an adequate science base and professional training for decision-making regarding wildlife and fish resources.

Faculty affiliated with this concentration (see below) have expertise in vertebrate population ecology; endangered, threatened, and overabundant species; wetland and forest ecology; animal behavior and physiology; geographic information systems and remote sensing; aquatic toxicology; population dynamics and demographic modeling; and landscape and ecosystems ecology. A major strength of our program is the unique convergence of Universities, federal and state agencies in Amherst, unmatched in the Northeast. A series of cooperative agreements, memoranda of research understanding and sole-source vendor relationships with state and federal agencies provide a strong base of research funding. These agreements also provide important teaching and research relationships between our program and state and federal natural resource agencies. Wildlife research focuses on wetlands, biodiversity, animal habitat associations,
landscape and systems ecology, remote sensing, human-wildlife conflicts, forest-wildlife relationships, and international conservation. Fisheries research focuses on marine, estuarine, and inland resources and specifically on population dynamics, relationship of ecosystem structure and production, the effect of organic and inorganic contamination on aquatic ecosystem function, and anadromous fish behavior, ecology and physiology. There are approximately 70 graduate students in the Wildlife, Fish and Conservation Biology Concentration. Through their research projects, graduate students often employ or provide volunteer opportunities for interested undergraduates (about 150 in the Wildlife and Fisheries Conservation concentration within the Natural Resources Conservation major). Graduate students are encouraged to participate in projects and activities of their colleagues to broaden their experience and to provide and receive ideas and suggestions for improvements.

At the MS level, students have the option of pursuing either a professional degree or thesis degree. The thesis/dissertation degree leads to the MS or PhD degree and centers around the completion of a major independent research project in addition to a modest coursework requirement. The professional degree leads to the MS degree and centers around a professional paper based on an internship/practicum in addition to a more substantial coursework requirement. Both degree options provide students a strong foundation in three core topic areas: 1) environmental science (biology, ecology, conservation and environmental building systems), 2) quantitative science (statistics, GIS and modeling), and 3) human dimensions (environmental policies, economics, politics, administration, management and values). The MS thesis degree is intended to prepare students for the option of pursuing a PhD or a career in conservation science. The MS professional degree is meant to be a terminal degree for students seeking graduate-level training in a particular field of study and a career as a professional conservation scientist. Overall, the academic requirements of this concentration in combination with the research/practicum experience provide students the professional training for conservation science positions within academia, state and federal resource management agencies, non-governmental conservation organizations, and private industry (e.g., environmental consulting firms). In addition, MS thesis degree students completing this program are well prepared to meet the challenges of any PhD program.
B. The MS Professional Degree

Prerequisites

Candidates for an MS professional degree in this concentration will be admitted on the basis of their academic training, work experience, and letters of recommendation. At a minimum, candidates will be expected to possess:

1) a Bachelor's degree in:
   - a natural resources field or environmental sciences; or
   - the biological sciences with an emphasis in ecology; or
   - any field with strong background in mathematics and the biological and physical sciences, and professional experience working as a natural resources professional.

Note, prerequisites exist for many of the required courses. Students are expected to have satisfied these prerequisites prior to commencing the program or in addition to the curriculum requirements outlined below.

Requirements

Students in this concentration are expected to meet all of the requirements for an MS degree in ECo, as outlined in the student handbook, including the following:

1) A minimum of 35 credits is required, 21 of which must be in the major (defined broadly), 8 of which must be at the 600 level or above, and 6 of which must be an internship/practicum specific to this concentration and approved by the student's advisory committee; up to 6 graduate credits can be transferred from previous course work from UMass or another university;

2) Successful completion of a comprehensive exam based upon the student's academic training in environmental conservation, encompassing three “core” topic areas (environmental science, quantitative science, and human dimensions) in addition to the required ECo core courses; and

3) Successful final defense of a publishable-quality professional paper resulting from the internship/practicum.

Curriculum

Note, all courses ending in 97 have an additional letter designation (e.g., 697A) not specified below because it is subject to change; check SPIRE online for the current course number listing.

1. Required Core Courses (8 credits) (take all of the following)

   ECO 601  Research concepts (fall, 3cr)
   ECO 697  Analysis of environmental data - lecture (fall, 3cr)
2. Core Topic Areas (21 credits) (including a minimum of one 500-level or above 3-4 credit course in each core topic area below, plus a minimum of three additional courses, as approved by student's committee; note, students may take courses other than those listed here to fulfill the core topic area requirements if they are approved by the students advisory committee and the Graduate Concentration Coordinator; course numbers are subject to change)

a. Environmental Science (take one or more of the following)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>BIO 542</td>
<td>Ichthyology (fall, 4 cr)</td>
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<tr>
<td>NRC 564</td>
<td>Wildlife habitat management (fall, 4cr)</td>
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<tr>
<td>NRC 565</td>
<td>Wildlife population dynamics &amp; management (fall, 4cr)</td>
<td></td>
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<tr>
<td>NRC 571</td>
<td>Fisheries science &amp; management (fall even yrs, 4cr)</td>
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<tr>
<td>NRC 597</td>
<td>Aquatic ecology (spr odd yrs, 3cr)</td>
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<tr>
<td>NRC 597</td>
<td>Ecology of fish (spr even yrs, 4cr)</td>
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<tr>
<td>NRC 597</td>
<td>Global change ecology (fall, 3cr)</td>
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<tr>
<td>NRC 597</td>
<td>Conservation genetics (fall, 4 cr)</td>
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<tr>
<td>NRC 597</td>
<td>Watershed science &amp; mgt (spr, 3cr)</td>
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<tr>
<td>ECO 621</td>
<td>Landscape ecology (spr even yrs, 4cr)</td>
<td></td>
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<tr>
<td>ECO 697</td>
<td>Conservation biology (fall odd yrs, 3cr)</td>
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<tr>
<td>ECO 697</td>
<td>Diadromous fisheries ecology &amp; conserv. (fall even yrs, 3cr)</td>
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<tr>
<td>ECO 697</td>
<td>Predator-prey interactions (spr odd yrs, 3cr)</td>
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<tr>
<td>ECO 697</td>
<td>Urban ecology (fall, 4cr)</td>
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<tr>
<td>ECO 697</td>
<td>Applied conservation genetics (fall even yrs, 4cr)</td>
<td></td>
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<tr>
<td>ECO 697</td>
<td>Conservation of aquatic ecosystems (spr odd yrs, 3 cr)</td>
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<tr>
<td>ECO 720</td>
<td>Ecological interactions of fishes (spr odd yrs, 3cr)</td>
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<tr>
<td>ECO 757</td>
<td>Advanced fisheries management (tbd, 3cr)</td>
<td></td>
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<tr>
<td>ECO 768</td>
<td>Wetland ecology &amp; conserv. (fall even yrs, 3cr)</td>
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b. Quantitative Science (take one or more of the following)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>NRC 577</td>
<td>Ecosystem modeling &amp; simulation (fall odd yrs, 3cr)</td>
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<tr>
<td>NRC 587</td>
<td>Digital remote sensing (spr odd yrs, 3cr)</td>
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<tr>
<td>NRC 592</td>
<td>GIS for natural resource management (both, 3cr)</td>
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<tr>
<td>ECO 697</td>
<td>Multivariate statistics for environmental cons. (spr odd yrs, 4cr)</td>
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<tr>
<td>ECO 697</td>
<td>Advanced topics in GIS (fall odd yrs, 3cr)</td>
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<tr>
<td>ECO 697</td>
<td>Info. technology in the public &amp; nonprofit sectors (spr, 3 cr)</td>
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<tr>
<td>ECO 697</td>
<td>Intermediate statistics for environmental cons. (spr, 4cr)</td>
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<tr>
<td>ECO 697</td>
<td>Advanced statistics for environmental cons. (fall even yrs, 4cr)</td>
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<tr>
<td>ECO 697</td>
<td>Analysis of environmental data - lab (fall, 2cr)</td>
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<tr>
<td>ECO 777</td>
<td>Advanced systems ecology (spr even yrs, 3cr)</td>
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<tr>
<td>GEO-SCI 595A</td>
<td>Advanced GIS (spr, 3 cr)</td>
<td></td>
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<tr>
<td>PLSOIL 661</td>
<td>Intermediate biometry (fall, 3 cr)</td>
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c. Human Dimensions (take one or more of the following courses)

- NRC 697  Water resources management & policy (fall even yrs, 3 cr)
- ECO 697  Federal environmental law & regulation (spr even yrs, 3cr)
- ECO 697  Human dimensions of natural res. cons. (tbd, 3cr)
- ECO 697  Natural resources policy & administration (tbd, 3cr)
- REGIONPL 553  Resource policy & planning (spr even yrs, 3 cr)
- REGIONPL 575  Environmental law & resource management (tbd, 3 cr)
- RES-ECON 720  Environmental & resource economics (fall even yrs, 3 cr)
- RES-ECON 721  Advanced natural resource economics (fall, 3 cr)
- GEO-SCI 666  Water resource policy (tbd, 3 cr)
- POLSCI 784  Environmental policy (tbd, 3 cr)

3. Practicum (6 credits)

- ECO 698  Practicum

All students in the MS professional degree option are required to complete at least a 3-month long professional internship or equivalent. There are numerous internship opportunities with state and federal resource management agencies (e.g., MA Division of Fisheries and Wildlife, MA Department of Environmental Protection, U.S. Fish and Wildlife Service), nonprofit organizations (e.g. The Nature Conservancy), and many other organizations. The advisory committee and the concentration coordinator may exempt some students with prior professional experience from this internship requirement. Each student will develop a publishable professional paper (based on the practicum) and defend it to their examination committee.

C. The MS Thesis Degree

Prerequisites

Candidates for an MS thesis degree in this concentration will be admitted on the basis of their academic training, work experience, and letters of recommendation. At a minimum, candidates will be expected to possess:

1) a Bachelor’s degree in:
   • a natural resources field or environmental sciences; or
   • the biological sciences with an emphasis in ecology; or
   • any field with strong background in mathematics and the biological and physical sciences, and professional experience working as a natural resources professional.

Note, prerequisites exist for many of the required courses. Students are expected to have satisfied these prerequisites prior to commencing the program or in addition to the curriculum.
requirements outlined below.

Requirements

Students in this concentration are expected to meet all of the requirements for an MS degree in ECo, as outlined in the student handbook, including the following:

1) A minimum of 35 credits is required, 21 of which must be in the major (defined broadly), 8 of which must be at the 600 level or above, and 12 of which must be a thesis specific to this concentration and approved by the student's advisory committee; up to 6 graduate credits can be transferred from previous course work from UMass or another university;
2) Successful completion of a comprehensive exam based upon the student's academic training in environmental conservation, encompassing three “core” topic areas (core science, quantitative science, and human dimensions) in addition to the required ECo core courses;
3) Successful final defense of the thesis; and
4) A minimum of one publishable-quality scientific paper resulting from the thesis research project.

Curriculum

Note, all courses ending in 97 have an additional letter designation (e.g., 697A) not specified below because it is subject to change; check SPIRE online for the current course number listing.

1. Required Core Courses (8 credits) (take all of the following)

   - ECO 601 Research concepts (fall, 3cr)
   - ECO 697 Analysis of environmental data - lecture (fall, 3cr)
   - ECO 791A Communicating science (spr, 1cr)
   - ECO 691A Current research in environmental conservation (both, 1cr)

2. Core Topic Areas (15 credits) (including a minimum of one 500-level or above 3-4 credit course in each core topic area below, as approved by the students advisory committee; note, students may take courses other than those listed here to fulfill the core topic area requirements if they are approved by the students advisory committee and the Graduate Concentration Coordinator; course numbers are subject to change)

   a. Environmental Science (take one or more of the following)

      - BIO 542 Ichthyology (fall, 4 cr)
      - NRC 564 Wildlife habitat management (fall, 4cr)
      - NRC 565 Wildlife population dynamics & management (fall, 4cr)
      - NRC 571 Fisheries science & management (fall even yrs, 4cr)
      - NRC 597 Aquatic ecology (spr odd yrs, 3cr)
NRC 597  Ecology of fish (spr even yrs, 4cr)
NRC 597  Global change ecology (fall, 3cr)
NRC 597  Conservation genetics (fall, 4 cr)
NRC 597  Watershed science & mgt (spr, 3cr)
ECO 621  Landscape ecology (spr even yrs, 4cr)
ECO 697  Conservation biology (fall odd yrs, 3cr)
ECO 697  Diadromous fisheries ecology & conserv. (fall even yrs, 3cr)
ECO 697  Predator-prey interactions (spr odd yrs, 3cr)
ECO 697  Urban ecology (fall, 4cr)
ECO 697  Applied conservation genetics (fall even yrs, 4cr)
ECO 697  Conservation of aquatic ecosystems (spr odd yrs, 3 cr)
ECO 720  Ecological interactions of fishes (spr odd yrs, 3cr)
ECO 757  Advanced fisheries management (tbd, 3cr)
ECO 768  Wetland ecology & conserv. (fall even yrs, 3cr)

b. Quantitative Science (take one or more of the following)

NRC 577  Ecosystem modeling & simulation (fall odd yrs, 3cr)
NRC 587  Digital remote sensing (spr odd yrs, 3cr)
NRC 592  GIS for natural resource management (both, 3cr)
ECO 697  Multivariate statistics for environmental cons. (spr odd yrs, 4cr)
ECO 697  Advanced topics in GIS (fall odd yrs, 3cr)
ECO 697  Info. technology in the public & nonprofit sectors (spr, 3 cr)
ECO 697  Intermediate statistics for environmental cons. (spr, 4cr)
ECO 697  Advanced statistics for environmental cons. (fall even yrs, 4cr)
ECO 697  Analysis of environmental data - lab (fall, 2cr)
ECO 777  Advanced systems ecology (spr even yrs, 3cr)
GEO-SCI 595A  Advanced GIS (spr, 3 cr)
PLSOIL 661  Intermediate biometry (fall, 3 cr)

ECO 699  Thesis

3. Thesis (12 credits)

ECO 699  Thesis
D. The PhD Degree

Prerequisites

Candidates for a PhD degree in this concentration will be admitted on the basis of their academic training, work experience, and letters of recommendation. At a minimum, candidates will be expected to possess:

1) a Master’s degree in:
   • a natural resources field or environmental sciences; or
   • the biological sciences with an emphasis in ecology; or
   • any field with strong background in mathematics and the biological and physical sciences, and professional experience working as a natural resources professional.

*Note, students wishing to pursue a PhD with only a BS degree must enroll in the MS degree program and successfully complete the requirements of the MS degree before being admitted into the PhD program.

Requirements

Students in this concentration are expected to meet all of the requirements for a PhD degree in ECo, as outlined in the student handbook, including the following:

1) A minimum of 18 dissertation credits is required, based on a research project specific to this concentration and approved by the student’s advisory committee; no other course credits are required other than those determined by the student’s advisory committee;
2) Successful completion of a comprehensive exam based upon the student’s academic training in environmental conservation, encompassing three “core” topic areas (environmental science, quantitative science, and human dimensions);
3) Successful final defense of the dissertation; and
4) A minimum of three publishable-quality scientific papers resulting from the dissertation research project.

E. Resources & Facilities

Two University forests (totaling 2,000 acres), the 800-acre Swift River Wildlife Management Area of the Massachusetts Division of Fisheries and Wildlife, and the 81,000-acre Quabbin Reservation of the Massachusetts Department of Conservation and Recreation offer unique field study areas close to campus. The University of Massachusetts also maintains the Nantucket Field Station and the Marine Station at Gloucester. The Conte Mount Toby State Forest including one of the University research forests is located just a few miles from campus.
The 81,000 acre Quabbin Reservation is located just a few miles from campus.

Anadromous Fish Research Center in Turners Falls offers excellent, modern facilities for both lab and field study of migratory fish behavior, ecology and physiology. Cooperation with the National Marine Fisheries Service allows graduate students to participate in research cruises in the Northwest Atlantic, as well as use facilities at the NMFS Woods Hole Laboratory. As members of the Five College School of Marine Science Program, students have access to research laboratories at Woods Hole and Waquoit Bay on Cape Cod. Further, concentration faculty conduct research in a variety of sites outside Massachusetts, including overseas.

F. Matriculation & Financial Aid

This program typically takes a full-time MS professional degree student 3-4 semesters to complete, a full-time MS thesis degree student 4-5 semesters to complete, and a full-time PhD student 8-10 semesters to complete, including the completion of a practicum/thesis/dissertation. However, some students may be able to complete the degree in less time and some take longer depending on their academic preparedness and the dictates of the practicum or thesis/dissertation research project.

Funding opportunities are limited, yet financial assistance is provided to virtually all of our MS thesis and PhD students through teaching or research assistantships (at Graduate Employee Organization bargained wage rates), University fellowships, or hourly wages. Tuition is waived during semesters in which at least a 10-hour assistantship or fellowship is awarded, but the student is responsible for most fees. Research assistantships are available through faculty members who have grant-supported research, and many faculty only accept students if they are able to provide grant-supported assistantships. Limited University fellowships are awarded by the Graduate School in open competition for those (including foreign applicants) who are endorsed by the Department.

Funding opportunities are more limited for students in the MS professional degree option. Some teaching assistantships and University fellowships may be available, or internship institutions may be able to provide some assistance, but most professional degree students are self-funded. Again, tuition is waived during semesters in which at least a 10-hour assistantship or fellowship is awarded (or the equivalent from an internship employer), but the student is responsible for most fees.

G. Concentration Coordinator & Faculty Affiliates

The following on-campus faculty (both regular and adjuncts) and professional staff, including the Graduate Concentration Coordinator, are principally affiliated with this concentration and
regularly serve in the role of the student’s advisory committee chair or member and instructor for core courses; other faculty and staff are occasionally involved in this concentration. See Departmental website for information about the faculty and staff (http://eco.umass.edu/index.php/people/).

Graduate Concentration Coordinator:
Kevin McGarigal
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Dept. of Environmental Conservation
160 Holdsworth Way
Amherst, MA 01003-4210
Tel: 413-577-0655
Fax: 413-545-4358
Email: mcgarigalk@eco.umass.edu

Principal Faculty/Staff Affiliates:
• Bethany Bradley (bbradley@eco.umass.edu)
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• Stephen DeStefano (sdestef@eco.umass.edu)
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