

## **Environmental Conservation Graduate Program**

### ***Wildlife, Fish and Conservation Biology Concentration***

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### **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.

### *Curriculum*

## **B. Course Offerings**

The following courses are offered for partial fulfillment of the degree requirements (see below). Note, all courses ending in 90 and 97 have an additional letter designation (e.g., 697A) not specified below because it is subject to change; Please check the SPIRE online and department's course offering sheet (<https://tinyurl.com/y7pz3uu2>) for the current course number listing.

### **1. Core Courses for the MS Thesis degree**

ECO 601	Research concepts (fall, 3cr)
ECO 697	Analysis of environmental data - lecture (fall, 3cr)
ECO 691A*	Current research in env. conservation seminar (1cr)

### **2. Core Topic Areas for the MS degree**

#### **a. Environmental Science**

NRC 564	Wildlife habitat management (fall, 4cr)
NRC 565	Wildlife population dynamics & management (fall, 4cr)
NRC 570	Fish ecology (fall odd yrs, 4cr)
NRC 571	Fisheries science & management (spr odd yrs, 4cr)
NRC 581	Wetlands Assessment (spr odd yrs, 3cr)
NRC 590AE	Aquatic ecology (fall even yrs, 4 cr)

NRC 590	Global change ecology (fall odd yrs, 3cr)
NRC 590	Invasion ecology (fall even yrs, 3 cr)
NRC 590	Restoration ecology (spring, 3cr)
ECO 621	Landscape ecology (spr even yrs, 4cr)
ECO 622	Conservation biology (spr odd yrs, 3cr)
ECO 624	Diadromous fisheries ecology & conservation (fall, 3cr)
ECO 697	Recreational fisheries science and management (fall odd yrs, 2cr)
ECO 697	Urban wildlife ecology and management (spr even yrs, 4cr)
ECO 757	Advanced fisheries management (spr odd yrs, 3cr)
ECO 758	Advanced wildlife conservation (fall even yrs, 3 cr)
ECO 768	Wetland ecology & conserv. (fall even yrs, 3cr)
ECO 777	Advanced systems ecology (spr odd yrs, 3cr)

### **b. Quantitative Science**

NRC 577	Ecosystem modeling & simulation (fall even yrs, 3cr)
NRC 585	Introduction to GIS (both, 4cr)
NRC 587	Digital remote sensing (spr even yrs, 3cr)
NRC 597	WebGIS (spr, 3 cr)
ECO 632	Multivariate statistics for environmental cons. (spr odd yrs, 4cr)
ECO 634	Analysis of environmental data - lab (fall, 2cr)
ECO 697	Advanced topics in GIS (fall even yrs, 3cr)
ECO 697	Applied biostatistics (spr, 4cr)
ECO 697	Advanced statistics for env conservation (fall even yrs, 4cr)
GEOG 668	GIS and Spatial Analysis (spr, 3 cr)
PLSOIL 661	Intermediate biometry (fall, 3 cr)

### **c. Human Dimensions**

NRC 576	Water resources management & policy (fall, 3 cr)
NRC 579	Cree culture, natural resources and sustainability (spr, 3 cr)
NRC 590	Adapt. to climate change: theories, policy ... (spr even yrs, 3cr)
ECO 690	Environmental conflict & collaborative policy (spr even yrs, 3cr)
ECO 690	Public engagement and communication (spr even, 3cr)
ECO 697	Federal environmental law & regulation (fall, 3 cr)
ECO 697SV	Design, Implementation, Analysis of Surveys of People (spr 3cr)
REGIONPL 553	Resource policy & planning (spr even yrs, 3 cr)
REGIONPL 575	Environmental law & resource management (spr, 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 (spr, 4 cr)
POLSCI 784	Environmental policy (tbd, 3 cr)

## C. 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 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.

### *Requirements*

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

- 1) Complete one semester of ECO 691A Current research in env. conservation seminar (1cr)
- 2) A minimum of 30 credits is required, 29 of which must be in the major (defined broadly), 12 of which must be at the 600 level or above; up to 6 graduate credits can be transferred from previous course work from UMass or another university;
- 3) 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
- 4) Successful final exam conducted by the 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 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.

### *Requirements*

MS thesis degree 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 30 credits is required, distributed as follows:
  - a) Core courses (see above): 7 credits.
  - b) Core topic area courses: 17 credits in the major field (defined broadly), 8 of which must be at the 600 level or above, including a minimum of one 500-level or above 3-4 credit course in each core topic area (see above). Note, students may take courses other than those listed above to fulfill the core topic area requirements, such as special topics courses that are offered irregularly, if they are approved by the students advisory committee. Note, up to 6 graduate credits can be transferred from previous course work from UMass or another university to fulfill these requirements.
- 2) Thesis: 6 credits. All students in the MS thesis degree option are required to complete a thesis based on independent research as approved by the student's advisory committee.
- 3) 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.
- 4) Successful final defense of the thesis.
- 5) A minimum of one publishable-quality scientific paper resulting from the thesis research project.

## **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 as evaluated by the faculty sponsor. 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
  - mathematics, statistics, or policy with some coursework in biological and physical sciences, or experience working as a natural resource professional.

\*Note, students wishing to pursue a PhD with only a BS degree can choose to obtain a MS degree on the way to completion of Ph.D. degree requirements. MS is not a requirement.

### *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 10 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) Complete two consecutive, full time semester residency
- 3) Successful completion of a comprehensive exam based on the three "core" topic areas (environmental science, quantitative science, and human dimensions).
- 4) Successful final defense of the dissertation.
- 5) A minimum of three publication-quality dissertation chapters.

### **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 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 2-4 semesters to complete, a full-time MS thesis degree student 3-5 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 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 and Departmental

fellowships are awarded by the Graduate School or ECo Graduate Program in open competition.

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:*

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### *Principal Faculty/ Staff Affiliates:*

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