

Environmental Conservation Graduate Program *Forest Resources and Arboriculture 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 fields of forestry and arboriculture. The focus of this concentration is broadly on forests and trees in urban, rural, and wildland ecosystems, and encompasses specialized training in fields such as forest ecology and management, urban forestry and arboriculture, and forest policy and land protection.

Students in this concentration work broadly on the management and ecology of forest ecosystems in a variety of settings. Faculty affiliated with this concentration (see below) have expertise in forest policy; managing forests for watershed protection, wildlife habitat, and the control of invasive species; landscape and ecosystem ecology; family forest owner &

ECo students often conduct studies on urban forestry issues, such as this study on the impacts of the Asian longhorn beetle outbreak in Worcester Massachusetts.



community engagement; development of urban

forestry programs; pest and disease management in urban trees; arboricultural biomechanics; tree worker safety; forest ecology related to climate change and invasive species; geographic information systems and remote sensing; and population and community 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 and other

ECo students often conduct field research on forest ecology and management issues, such as this study on old-growth forest in Massachusetts.



collaborations provide a strong base of research funding. These agreements also provide important teaching and research relationships between our program and governmental natural resource agencies. Much of the forest and tree research conducted in the Forestry and Arboriculture Concentration focuses on Massachusetts and the New England region, but graduate students also work in places such as Colorado, Peru, and Mexico. There are approximately 15 graduate students in the Forest Resources and Arboriculture Concentration. Through their research projects, graduate students often employ or provide volunteer opportunities for interested undergraduates (about 60 undergraduates are in the Forest Ecology and Conservation and Urban Forestry and Arboriculture concentrations 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

ECo students often conduct forest research in other regions of the country, such as this study on plant reestablishment following high severity wildfire in northern New Mexico.



ECo students learn how to manage individual trees and develop the technical skills needed to pursue a career in arboriculture.



internship/practicum in addition to a more substantial coursework requirement. Both degree options provide students with a strong foundation in three core topic areas: *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 conservation professional. 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 and tree care

companies). In addition, MS thesis degree students completing this program are well prepared to meet the challenges of a 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. The fields of Forestry and Arboriculture are so broad that graduate students come from a wide range of undergraduate programs and employment positions. Prospective students should contact a faculty member in this concentration to discuss their backgrounds and interests.

Candidates are expected to possess a Bachelor's degree in:

- a natural resources, environmental sciences, or biological sciences field; or
- any field with a strong background in mathematics and biological, physical, or social sciences, and experience working in natural resources. Or
- a field which provides complimentary knowledge and experience to the course of study and professional program.

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. To better understand specific requirements, it is very helpful to contact a prospective advisor before applying to the program.

Requirements

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

- 1) A minimum of 30 credits is required, 21 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;
- 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 exam conducted by the committee.

Curriculum

Please check the SPIRE online and department's course offering sheet (<https://tinyurl.com/y7pz3uu2>) for the current course number listing.

1. Required Core Courses (1 credit) (take the following)

ECO 691A Current research in environmental conservation (1cr)

2. Core Topic Areas (29 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; course numbers are subject to change)

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

NRC 521 Timber harvesting (spr even yrs, 2)
NRC 526 Silviculture (fall even yrs, 4)
NRC 528 Forest & wetland hydrology (fall, 3cr)
NRC 540 Forest resource management (spr 4 cr)
NRC 541 Urban forestry (fall 3 cr)
NRC 564 Wildlife habitat management (fall, 4cr)
NRC 571 Fisheries science & management (fall even yrs, 4cr)
NRC 597 Aquatic ecology (spr odd yrs, 3cr)
NRC 597 Conservation genetics (fall, 4 cr)
NRC 597C Case Studies in Conservation (fall, 3cr)
ECO 605 Urban Forest Management (spr 3 cr)
ECO 621 Landscape ecology (spr even yrs, 4cr)
ECO 697 Conservation biology (fall odd yrs, 3cr)
ECO 697 Urban ecology (fall, 4cr)
ECO 697 Applied conservation genetics (fall even yrs, 4cr)
ENTOMOL 572 Insects & diseases of forests & shade trees (spr odd yrs, 3cr)
PLSOIL 505 General plant pathology (fall, 4cr)
PLSOIL 510 Management & ecology of plant diseases (spr, 3cr)
PLSOIL 555 Urban plant biology (fall, 3cr)
PLSOIL 566 Soil formation, classification, & land use (spr odd yrs, 3 cr)
PLSOIL 590A Plant stress physiology (fall, 3cr)
LANDARCH 592A Plants in the Landscape (fall, 4 cr)

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

BCT 530 Mechanics of building materials (spr, 3 cr)
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 632 Multivariate statistics for environmental cons. (spr odd yrs, 4cr)
ECO 697AB Applied Biostatistics (spr, 4cr)
ECO 634 Analysis of environmental data - lab (fall, 2cr)
GEO-SCI 595A Advanced GIS (spr, 3 cr)
PLSOIL 661 Intermediate biometry (fall, 3 cr)

c. Human Dimensions (take one or more of the following courses)

NRC 576	Water resources management & policy (fall even yrs, 3 cr)
NRC 590A	Advanced Arboriculture (spr odd yrs, 3 cr)
ECO 697P	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)
POLSCI 784	Environmental policy (tbd, 3 cr)
ENVDES 574	City planning (fall, 3cr)
LANDARCH 691E	People & the environment (fall, 2-3cr)

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, together demonstrating a strong work ethic. The field of forestry and arboriculture is so broad that graduate students come from a wide range of undergraduate programs and employment positions. Prospective students should contact a faculty member in this concentration to discuss their backgrounds and interests.

Candidates are expected to possess a Bachelor's degree in:

- a natural resources, environmental sciences, or biological sciences field; or
- any field with strong background in mathematics and the biological and physical sciences, and experience working in natural resources.

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. To better understand specific requirements, it is very helpful to contact a prospective advisor before applying to the program.

Requirements

Students in this concentration are expected to meet all 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, 21 of which must be in the major (defined broadly), minimum of 6 of which must be at the 600 level or above, and at least 6 of which must be a thesis specific to this concentration and approved by the student's advisory

- committee;
- 2) Successful completion of a comprehensive assessment 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;
 - 3) Successful final defense of the thesis; and
 - 4) A minimum of one publishable-quality scientific paper resulting from the thesis research project.

Curriculum

Please check the SPIRE online and department's course offering sheet (<https://tinyurl.com/y7pz3uu2>) for the current course number listing.

1. Required Core Courses (7 credits) (take all of the following)

ECO 601	Research concepts (fall, 3cr)
ECO 602	Analysis of environmental data - lecture (fall, 3cr)
ECO 691A	Current research in environmental conservation (1cr)

2. Core Topic Areas (17 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)

NRC 521	Timber harvesting (spr even yrs, 2cr)
NRC 526	Silviculture (fall even yrs, 4)
NRC 528	Forest & wetland hydrology (fall, 3cr)
NRC 540	Forest resource management (spr, 4 cr)
NRC 541	Urban forestry (fall 3 cr)
NRC 564	Wildlife habitat management (fall, 4cr)
NRC 571	Fisheries science & management (fall even yrs, 4cr)
NRC 597	Aquatic ecology (spr odd yrs, 3cr)
NRC 597	Conservation genetics (fall, 4 cr)
NRC 597C	Cases of Conservation (fall odd yrs, 3cr)
ECO 605	Urban Forest Management (spr 3 cr)
ECO 621	Landscape ecology (spr even yrs, 4cr)
ECO 697	Conservation biology (fall odd yrs, 3cr)
ECO 697	Urban ecology (fall, 4cr)
ECO 697	Applied conservation genetics (fall even yrs, 4cr)
ENTOMOL 572	Insects & diseases of forests & shade trees (spr yrs, 3cr)
PLSOIL 505	General plant pathology (fall, 4cr)
PLSOIL 510	Management & ecology of plant diseases (spr, 3cr)

PLSOIL 555	Urban environment & plant growth (fall, 3cr)
PLSOIL 566	Soil formation, classification, & land use (spr odd yrs, 3 cr)
PLSOIL 590A	Plant stress physiology (fall, 3cr)
LANDARCH 592A	Plants in the landscape (fall, 4 cr)

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

BCT 530	Mechanics of building materials (spr, 3 cr)
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 632	Multivariate statistics for environmental cons. (spr odd yrs, 4cr)
ECO 697AB	Applied Biostatistics (spr, 4cr)
ECO 634	Analysis of environmental data - lab (fall, 2cr)
GEO-SCI 595A	Advanced GIS (spr, 3 cr)
PLSOIL 661	Intermediate biometry (fall, 3 cr)

c. Human Dimensions (take one or more of the following courses)

NRC 576	Water resources management & policy (fall even yrs, 3 cr)
NRC 590A	Advanced Arboriculture (spr odd yrs, 3 cr)
ECO 697P	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)
POLSCI 784	Environmental policy (tbd, 3 cr)
ENVDES 574	City planning (fall, 3cr)
LANDARCH 691E	People & the environment (fall, 2-3cr)

3. Thesis (minimum 6 credits)

ECO 699	Thesis
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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
 - any field with strong background in mathematics, applied statistics, and policy with

some coursework in 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 can choose to obtain a MS degree along the way toward 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 upon the student's academic training in environmental conservation, encompassing three "core" topic areas (environmental science, quantitative science, and human dimensions);
- 4) Successful final defense of the dissertation; and
- 5) A minimum of three publishable-quality scientific papers resulting from the dissertation research project.

Mount Toby State Forest including one of the University research forests is located just a few miles from campus.



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. A research group of the U.S. Forest Service (the Center for Research on Ecosystem Change) is located in Holdsworth Hall and is actively involved in this concentration. In addition, the departmental facilities include research laboratories with state-of-the-art equipment for testing wood performance. 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 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; students are responsible for nominal fees. Research assistantships are available through faculty members who have grant-supported research; please contact individual faculty to inquire about a research assistantship. 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 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 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:

Kristina Stinson

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Dept. of Environmental Conservation

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UMass Amherst research labs include state-of-the-art equipment for testing wood performance.



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