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### Program Overview

The Ecology, Evolution and Behavior (EEB) Graduate Program is dedicated to training graduate students to conduct question-oriented research to make empirical and theoretical discoveries of the nature, causes, and consequences of Earth’s biodiversity and the response of Earth’s ecosystems to human-caused global environmental changes. The Graduate Program is focused on enabling our students to achieve excellence in original research and scholarship, and to think critically about their own work and that of others, within the fields of ecology, evolution, behavior, and organismal biology, as well as their intersections with other disciplines. Our program is primarily focused on training PhD students, and also offers options for both thesis and non-thesis master’s programs.

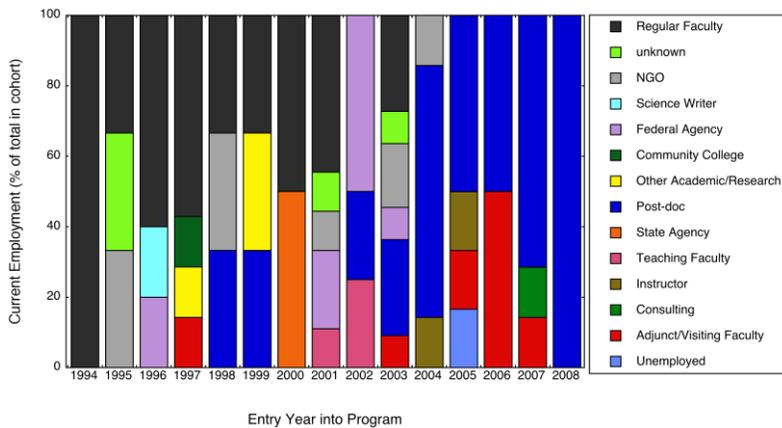


Fig. 1 Employment in 2013 (as % of total students awarded degrees) for all EEB students awarded degrees who entered program between 1994-2008, by year of entry into program.

Our students leave our program to pursue a wide range of careers (Figs. 1 and 2). Data obtained in 2013 show that most EEB graduate students take a post-doctoral position or a position as a Visiting or Adjunct Faculty member (e.g., as a “sabbatical replacement” at a liberal arts college) immediately after earning their PhD degree (Fig. 1). After a post-doc, EEB PhDs most commonly obtain regular faculty positions; research positions in federal agencies such as USGS, EPA, and the USDA Forest Service; research positions for NGOs, such as The Nature

Conservancy and the Jane Goodall Institute; and other research or academic positions (e.g., natural history museums or research institutes) (Figs. 1 and 2). Less commonly, EEB PhDs obtain positions as consultants, instructors, state agency employees, and science writers (Fig. 2). Recognizing the diversity of careers pursued, we provide training that can be tailored to the specific goals of our students.

To attain the goals of our program and our students, the graduate program provides training through formal coursework, informal tutorials, research seminars, and guidance during laboratory and field investigations through to thesis preparation and manuscript publication. This document describes our approach to core training and opportunities provided to support pursuit of the diversity of careers chosen by our graduate students, inclusive of both our Master’s and PhD programs. With input from the EEB Graduate faculty and students, this

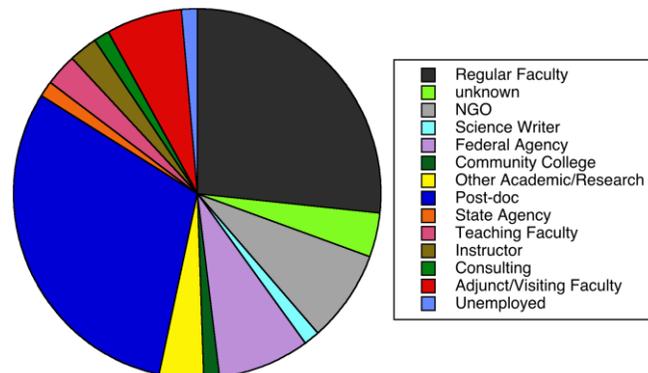


Fig. 2 Current employment (as of 2013) of all EEB students awarded degrees who entered the program between 1994-2008.

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document addresses five areas, as identified by the University of Minnesota Graduate School<sup>i</sup>, that encompass the most important outcomes of successful training in our Graduate Program: (1) Scholarly Formation, (2) Communication, (3) Leadership and Collaborative Skills, (4) Professional Responsibility, and (5) Personal and Professional Management Skills. Descriptions of outcome assessment activities are integrated within each section, with a summary of assessments described in a final section.

## Scholarly Formation

Development of scholarly excellence in research is a central goal of the EEB Graduate Program. Our students receive common training in our disciplinary core areas in addition to the intensive research training they receive in their specific areas of inquiry. Both types of training are focused on but not restricted to five core outcomes related to scholarly excellence:

- Identify and address novel research questions to move beyond the frontier of existing knowledge
- Build broad competency in research and scholarly methods
- Acquire expertise in research approaches, quantitative analyses, and critical thinking skills within specific disciplinary areas
- Conduct novel research and pursue scholarship in their chosen field of study
- Think critically about research results including their connections to other fields and society, and their historical and philosophical underpinnings

The EEB Graduate Program includes *communication* (#2 above) and *collaboration* (#3) as essential aspects for Scholarly Formation; these are discussed in subsequent sections. The five outcomes identified in this section are pursued with a combination of formal coursework, program requirements and individual training with faculty as described in detail below.

### Core Courses

EEB graduate students come from diverse backgrounds, and leave our program to enter diverse careers. The EEB Graduate Program provides students with a common core of knowledge and skills that provides a foundation for their pursuit of original research in a specialized area. An important mechanism for this is the recently developed “Foundations” course in ecology, evolution and behavior required for all first-year students in the PhD program. The course provides our incoming student cohort with foundational knowledge in ecology, evolution, and behavior, with emphasis on the cross-disciplinary connections among them. The course provides content that is broader than what they can learn in more specialized graduate courses. It also provides students with historical and fundamental knowledge while introducing them to the pressing current questions and grand challenges in core areas. Instructors help guide students towards articulating the current “big questions” in the field and help students draw connections between current questions and their historical foundations. The course was first taught in 2012-2013 and the program assessed its effectiveness (using SRTs and interviews with students and instructors) at the end of 2013-2014. Instructors responded to the assessment by adjusting the format and content to address student concerns.

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Complementing the *Foundations* course, all students participate in a two-year series of seminars focused on proposal writing. The seminars provide instruction, guidance, and support for students to develop novel research questions, and present them to diverse audiences. The first of these also includes discussions of a variety of professional development topics. This sequence leads up to submission of their written preliminary examination, in the form of a NSF-style proposal that is evaluated by three faculty reviewers. These reviewers provide extensive feedback to the students, along with a consensus statement prepared following discussion by a panel of faculty reviewers. This process has been an effective way to guide students toward identification of novel research questions and development of testable hypotheses to address them. Students often submit products of their written examination for fellowship or grant competitions. A robust indicator of the effectiveness of this process is the high success rates our students in these competitions, such as the NSF Doctoral Dissertation Improvement Grant.

In addition to the Foundations and Proposal Writing courses, weekly departmental seminars, lab tours, individual lab meetings, and weekly research meetings of special-interest groups all promote the scholarly goals of the EEB Graduate Program.

#### *Program milestones and resources*

The EEB Graduate Program has formal mechanisms to foster and assess scholarly development of our students that complement course requirements. The written exam process (described previously) is followed by a two-part oral exam. The oral exam requires a public presentation in which students articulate and defend their research questions and a closed oral examination by the student's committee. Both exams provide extensive opportunities for input and feedback on development of research questions, and approaches and expression of ideas and concepts via written and verbal communication. After completing preliminary exams, EEB PhD (and Master's) students prepare their dissertations/theses in consultation with their faculty mentors and graduate committees, and present their work at a public seminar followed by a closed defense. EEB students are strongly encouraged to submit their work for publication during or soon after completion of their dissertations and theses.

The EEB graduate program provides resources and support to help students establish themselves as independent scholars. Direct support from small grants and travel funds is provided when available from Program resources. In addition, the Program strongly supports pursuit of external fellowship and grants funding via individual mentorship and the two-year proposal writing seminar series.

#### *Lab specific training*

EEB Graduate students conduct novel research in a specific area under the guidance of their primary faculty advisor(s). About 10% of our students are coadvised by two faculty. Faculty advising complements coursework and program requirements to train our students in identification of novel research questions, building competency in research and scholarly methods, and in conducting research and pursuing scholarship in their chosen field of study. To achieve these goals, the faculty provides training through formal coursework, informal tutorials, research seminars, and guidance during laboratory and field investigations through to manuscript preparation and submission.

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## Communication

Effective communication and leadership are essential to pursue and succeed in careers typically chosen by EEB students. The EEB Graduate Program develops skills to *communicate effectively to a diversity of audiences through written, oral, and visual means* through activities sponsored by our PhD program, and more flexible training provided by specialized programs and individual faculty mentors. All students participate in the sequence of courses, seminars and exams (as described earlier) which all have substantial foci on oral and written communication and collaborative skill development.

After advancing to candidacy, our training in communications for PhD students is tailored to the specific goals and interests of individual students. For example, we encourage our students to participate in seminars or programs offered by individual faculty, CBS, Interdisciplinary Centers, and the Graduate School. Examples include the [Boreas Leadership Training Program](#) (offered through the Institute on the Environment), that provides students with training in leadership, communication, public engagement, and systems thinking; the campus wide [Preparing Future Faculty](#) (PFF) program; and the new [Emerge Bioscience Career Development Workshops](#) offered by the College of Biological Sciences, that provides students with training focused on networking and pursuit of careers outside of academia. Students also have opportunities to gain experience and skill in public outreach through collaborations with the Bell Museum of Natural History, Cedar Creek Ecosystem Science Reserve, the student-initiated [Teaching Smart](#) program, the Science Museum of Minnesota, and other venues.

## Leadership and Collaborative Skills

Collaborative research and networking are essential for success in all careers pursued by EEB Graduate Students; leadership skills are valuable for many, if not all, of our students. These skills were traditionally “taught by example” of individual faculty. In recognition of the growing importance of these skills to our students’ careers, the EEB Graduate Program strives to foster development of collaborations and leadership skills through our standard courses (e.g. *Foundations*) and by offering access to and support for participation in seminars with substantial focus on this area, such as the Boreas Leadership Training Program, described in the previous section.

## Professional Responsibility

The EEB program provides training and guidance in academic ethics through individual faculty mentorship, ad hoc workshops, and a required four part seminar with content tailored toward our program. Seminar content is divided into four sections: I. Relationships in the Academic and Research Community, II. Authorship and Scientific Misconduct, III. The Peer Review Process, IV. Research Conduct and is described in detail within the “Ethics requirement guide” on the [Program webpage](#). Seminar content is provided during workshops scheduled during a regular seminar slot over the course of the academic year with the goal of stimulating thought and discussion of ethical issues and cultural awareness. In addition, we have strong graduate student participation in ad hoc training opportunities offered by the EEB Department, College of Biological Sciences and University. For example, EEB students were involved in the CBS Equity and Diversity year-long collaboration with photographer

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WingYoung Huie. Finally, EEB graduate students are encouraged to participate in governance. For example, a student representative attends and contributes to faculty meetings; a student is always included on faculty search committees; and a student frequently participates in CBS Departments Heads meetings.

## Personal and Professional Management

The EEB Graduate program recognizes that becoming an effective scientist involves far more than being an excellent researcher. Many of the training programs described in other sections have substantial content designed to provide essential management skills and guidance to EEB graduate students. These include the Emerge Bioscience Career Development Workshops offered by CBS, a new graduate seminar on Professional Skills offered by EEB, PFF and a diverse array of ad hoc workshops.

## Formal Assessments of Program Outcomes

Assessments of student satisfaction with the educational and research experiences provided by the program and suggestions for program improvement have been obtained through formal external program reviews, surveys, annual closed-door meetings between the Director of Graduate Studies and the graduate students, and with exit interviews of graduating students. Formal program reviews by an external committee are conducted ca. every decade. The last program review was completed in 2011-2012, and its report provided the impetus to create the new *Foundations* core course. The graduate program collects information on graduate student progress and outcomes, and uses it to assess progress toward meeting program goals. The graduate program conducts annual reviews of student progress, where information on degree status, products of student work (i.e. publications, presentations, fellowships, and grants), and student and advisor input are considered during a meeting of the entire graduate faculty. The annual review process helps identify and address potential issues or obstacles impeding student progress. In addition, the DGS conducts candid annual meetings with the graduate students to get feedback on the effectiveness of core activities, and to allow students to make suggestions for activities to address areas of interest. These meetings are highly influential of programming and have informed changes to the *Foundations* core course, selection of Directors of Graduate Studies, and the formation of a new professional development course, among other activities.

High faculty and student engagement in the program, as shown by participation on departmental, college, and University-wide committees, Colloquium and Spring Retreat attendance, and willingness to contribute to teaching efforts, is another measure of success of the program. Our students are highly engaged in the operation of the graduate program, self-organizing and being selected to fill EEB, CBS, and University-wide committees such as the Council of Graduate Students. Students are integral to the recruitment of new graduate students and are very active participants in the annual recruiting weekend, hosting and providing transportation for prospective students. The broad engagement of our students in the graduate program provides additional opportunities for feedback to improve our program and integrate new ideas.

Post graduation, the EEB Graduate Program is planning to begin exit interviews of our PhD and Master's students to better assess how we are meeting the needs of our students. Exit interviews will begin in 2015. The EEB Graduate Program also surveys former students to track career outcomes

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of students who have gone through our program. These data are helping us better match training to the wide diversity of career outcomes realized by our students. The EEB Graduate Program will continue to seek input annually on career outcomes from our former students.

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<sup>i</sup> Graduate School Outcomes Initiative(<http://grad2.umn.edu/goals/>)