Full Name
Nichole Barger

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Sarah Seiter

Home Department
EBIO

Home Department(s) of Co-applicant(s)
EBIO

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nichole.barger@colorado.edu

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By submitting this application, I confirm that, if selected to receive a Chancellor’s Award for Excellence in STEM Education, I will:

✓ Attend and be recognized at the annual Symposium on STEM Education (fall 2014).
✓ Give a brief introduction (~10-15 min) to my project at DBER in fall 2014.
✓ Actively engage in the CU-Boulder STEM education community by attending weekly DBER seminars and Chancellor’s Fellow events when possible.
✓ Present my work to the STEM education community by giving at least one DBER seminar, OR, if that is an impossibility, I will give a talk that the CU-Boulder STEM education community is invited to attend.
✓ Submit a 1000 to 3000-word report detailing the outcomes of the project at the end of the funding period
Transforming Graduate Training in STEM Education

PI, Nichole Barger, Associate Professor (in AY 14), Ecology and Evolutionary Biology

Co-PI, Sarah Seiter, SEI Science Teaching Fellow, Ecology and Evolutionary Biology

1. PROBLEM STATEMENT

The need for improved instruction in college science, technology, engineering and math (STEM) courses is a prominent national policy issue (Brewer and Smith 2011, Olson and Riordan 2012). To address this need, instruction in many college STEM courses is being transformed through the adoption of student-centered, evidence-based teaching practices. A number of national programs address the need to train the next generation of educators in best practices in STEM education, but the majority of efforts are directed at faculty and post-docs while graduate student training in these practices has not kept pace (Tanner and Allen 2006). We propose that pre-service faculty (i.e. graduate students) receive structured, graduated training in pedagogy from the beginning of their education (Allen and Tanner 2005), just as K-12 science teachers receive professional development during the pre-service stage of their careers. Providing graduate students such training, including opportunities for significant classroom practice in student-centered, evidence-based practice, will benefit graduate students as they enter the workforce. Furthermore, collaborations between graduate students in training and faculty provides a sustainable model to further departmental transformations of instruction and curricula. This project strongly aligns with the Center for STEM Learning (CSL) mission to “promote K-20 faculty recruitment, preparation, and professional development.”

2. MAKING THE CASE FOR GRADUATE TRAINING IN STEM EDUCATION

STEM graduate students both want and need formal training and experience in education (Nyquist 1991). Despite the perception that STEM graduate students are primarily research-motivated, they are more likely than their peers in other disciplines to express an interest in teaching, but are less likely to be given increasing responsibility and freedom in the classroom as their graduate careers progress (Nyquist 1991, Gold and Dore 2001). Although a portion of curriculum design often falls to graduate student teaching assistants under current models, these opportunities could be more effective and meaningful with additional training, support, and mentorship in pedagogical best practices. Indeed, current training in pedagogy for TAs is often limited to seminars and workshops with few opportunities for practice (Nyquist 1991, Luft et al. 2004). The impact of such single-experience workshops is known to have very limited effect on actual classroom practices (Hanushek 2006). There have been a few notable national efforts to improve graduate training in teaching, such as the Preparing Future Faculty program and the now-defunded NSF GK-12 program. While these programs have made some progress in increasing opportunities for pedagogical training, they were not specifically designed to transform college level STEM instruction and they impact only a limited number of graduate students (DeNeef 2002, Trautmann and Krasny 2006). Therefore, models supporting structured, and progressively advancing graduate student pedagogical training need to be developed and disseminated. Ideally, for scalability, these models would deliver clear, immediate benefits to graduate student home departments and could be replicated by those departments while minimizing faculty time investment, logistical hurdles, and the need for ongoing external funding.
The consequences of a lack of pedagogical training are well documented: graduate students and new faculty frequently report being unprepared for the responsibilities of teaching in tenure-track positions (Golde and Dore 2001, Nyquist et al. 1999, Austin 2002). At the same time, teaching experience is rapidly becoming a decisive factor in faculty job searches of all levels (Meizlish and Kaplan 2008), and an increasing number of doctoral students in the sciences are pursuing non-tenure track careers (Snyder and Dillow 2013), all of whom would be served by more structured training and practice in pedagogy. Below we describe the benefits of increasing graduate student access to formal pedagogy training and mentorship. We then propose a model for pedagogical training in which mentorship and support for teaching begin early in a graduate career and students gain progressive responsibility for course design and teaching throughout their training.

Training and guided practice in evidence-based best teaching methods can benefit graduate students in their graduate and post-graduate careers in several tangible ways. First, graduate students will be better prepared for the demands placed on them as faculty and educators in STEM disciplines (Boice 1991, Adams 2002). Second, the skills students gain as they learn to be better educators, such as how to communicate information effectively to a range of audiences, manage time efficiently, and lead groups with diverse perspectives and abilities, will also make them better scientists (Trautmann and Krasny 2006). Third, in a climate of increased competitiveness for academic positions, evidence that an applicant is a proven educator and has the skills to design and implement courses with active learning components gives them a distinct advantage (Adams 2002). This advantage will be particularly evident as universities experience increasing pressure to improve undergraduate STEM education, and are looking for educators to help them meet their goals (Adams 2002). Overall, graduate student training in education, and opportunities for meaningful practice prior to entering the workforce, will make future scientists into more effective educators and more competitive in both the academic and non-academic job markets.

Not only are there clear benefits for graduate students in receiving training in best practices in teaching and learning but placing highly trained graduate student instructors into the classroom to implement these practices will improve the undergraduate educational experience. Graduate students in the STEM disciplines at the University of Colorado Boulder (UCB) contribute substantial student contact hours as graduate teaching assistants (TAs) in lab courses, recitations, and lecture courses in addition to serving as instructors of record as graduate part-time instructors (GPTIs). A broad survey of undergraduate perceptions of graduate TAs relative to tenure track faculty suggests that TAs relate better to undergraduates on a personal level and create a classroom atmosphere which is more personalized, engaging, and interactive (Kendall and Shussler 2012). In this same survey, however, undergraduates report that TAs were more hesitant, nervous, and uncertain in their approach to teaching. Providing structured training and opportunities for implementing best practices in teaching is likely to increase graduate student confidence in their instructional abilities. Combining the positive classroom atmosphere created by graduate students with additional and focused pedagogical training is a pathway by which STEM education may be greatly improved across campus.

Finally, pairing highly trained graduate student instructors in STEM education with faculty members provides an opportunity to accelerate the pace at which these STEM educational reforms are occurring. Many faculty members identify time constraints as the primary barrier to adopting active learning practices, despite recognizing the benefits of such evidence-based practices (Brownell and Tanner 2012). Significant fractions of faculty members who attempt to adopt active learning report reverting to traditional practices due to a lack of support in overcoming a variety of barriers to change (Henderson and Dancy 2007, Henderson et al. 2012). By implementing teaching collaborations between faculty and graduate students,
graduate students can practice evidence-based teaching with the support of a seasoned educator (Adams 2002), while that educator can observe and be supported in learning about evidence-based teaching. Thus, co-teaching with a graduate student will reduce the teaching time-commitment on faculty, allow graduate students to gain valuable teaching experience, and ultimately increase the quality of college STEM education.

Our overarching goal is to create a home department-based STEM graduate teaching program that builds from and compliments the graduate teaching opportunities provided to STEM graduate students at UCB (e.g. TAships; GPTiships; the Graduate Teacher Program/GTP; the Center for Integrated Research Teaching and Learning/CIRTL). Our objective is to provide structured, graduated opportunities to implement evidence-based best practices for graduate students in STEM disciplines. We will achieve our objective by organizing a multi-day summer workshop in which graduate students will design, critique, and practice developing and delivering evidence-based teachable STEM units. These units designed during the summer workshop will then be taught with cooperating faculty from their home department during the fall semester. Graduate students will enroll concurrently in the fall semester in a STEM graduate teaching seminar, either one led by PIs Barger and Seiter in EBIO or an approved alternate offered in MCDB or the School of Education. Barger and Seiter will mentor and assess graduate student teaching throughout the fall semester, through standard teacher evaluation tools and personalized coaching. Funding from this proposal will allow summer workshops and a fall graduate teaching seminar to be offerred twice, in AY 2014 and 2015, and we plan to use pilot data from this project to develop a full NSF proposal.

3. METHODOLOGY

**Graduate Teaching Framework** –
We propose a model for pedagogical training in which graduate students progress from early study in foundational topics in education (Fig.1, Study) while gaining active learning and classroom management experience as a graduate teaching assistants (Fig. 1, Assist). The study and assist phase of graduate training is the existing graduate teaching model for most STEM graduate students at CU and nationally. We propose to expand on this model by providing opportunities to design and practice teachable units (Fig. 1, Design) in an intensive summer workshop. Crucial to the impact of this model is the implementation of these teachable units by partnering with departmental faculty (Fig. 1, Collaborate). In some cases, participants will parlay their workshop experience, with mentoring, into full course design as the instructor of record or as a co-instructor (Instruct). Through this proposed model, we expand and integrate existing graduate training programs with opportunities to implement best practices within STEM graduate students’ home departments. Our model emphasizes the importance of providing

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Fig. 1. Proposed framework for STEM graduate teaching training. Light blue denotes programs on campus. Light pink denotes components which extend existing programs into a structured, graduated training model.
graduate students with collaborative teaching and lead instructor opportunities so the learning curve for best practices in STEM education can occur prior to entering the workforce.

**Design and practice teachable units—Summer Graduate Teaching Workshop** - Graduate students will learn about and practice methods of ‘scientific teaching’ (Handelsman et al. 2006) and other evidence-based practices in STEM education, in a Summer Graduate Teaching Workshop (Handelsman et al. 2004). The objective in this workshop is for graduate student participants to produce teachable units based on principles in scientific teaching (Table 1, draft workshop agenda). The workshop will be modeled off of and use curricula developed by the highly effective and popular Howard Hughes Medical Institute and National Academies Summer Institutes on Higher Education (see http://www.academiessummerinstitute.org). The 5-day workshop will be convened for a week in July from 9 am – 2 pm and enroll up to 20 graduate students across STEM disciplines. Recruitment and enrollment for a late July workshop will begin in May. At this time, graduate students who enroll in the workshop will be asked to identify a collaborating faculty member, who will provide a letter of support. Barger is currently teaching a graduate teaching seminar, and the 10 graduate students involved (from EBIO and Geology) have had great success partnering with STEM faculty to develop teachable units. Many STEM faculty have travel during a semester thus providing a natural opportunity for graduate students to fill in for faculty.

Before the workshop convenes in July, Barger and Seiter will work on reviewing or creating assessment tools for graduate student professional development in the summer workshop and the following graduate teaching seminar in the fall semester. She will reach out to campus leaders in STEM education to identify and evaluate the most appropriate tools to assess graduate student experience and professional development. The biology department is currently developing a tool to measure student centered practices and student engagement for faculty (SITAR), which could be applied to graduate student teaching in during the “instruct” phase of the program. Other stages of the program may require different assessment tools.

**Table 1. Proposed topics for the Summer Graduate Teaching Workshop.** The workshop will be held in July for 5 days from 9 am – 2pm on the UCB campus. We will use Handelsman et al. 2006 and the central text for the workshop.

<table>
<thead>
<tr>
<th>Date</th>
<th>Activities</th>
<th>Readings</th>
</tr>
</thead>
</table>
| Day 1 | Topic: STEM education in the 21st century and scientific teaching  
Afternoon panel discussion with campus leaders in STEM education | *Scientific Teaching* Ch. 1 |
| Day 2 | Topic: Creating learning goals | *Scientific Teaching* Ch. 3 |
| Day 3 | Topic: Designing assessments | *Scientific Teaching* Ch. 3 |
| Day 4 | Topic: Interactive learning strategies | *Scientific Teaching* Ch. 2 |
| Day 5 | Topic: Teaching diverse populations  
Afternoon panel discussion on diversity - Convene a panel of 5-6 undergraduates representing diverse populations at UCB | *Scientific Teaching* Ch. 4 |

The workshop will utilize active and project-based learning, and formative assessment techniques to train graduate students in pedagogy, modeling the same techniques they will later implement in the instruction phase of their training. When the workshop convenes in July, each day we will assign a reading (Fig. 2, 1) and students will provide a short 200-300 word summary.
of the reading with discussion questions before arriving at the workshop (Fig. 2, 2). At the start of each workshop we will discuss the reading in small groups of 4-5 students (Fig. 2, 3). Following the discussion, we will apply the reading to the teachable unit each student will be working on during that week, while integrating practice of evidence-based instructional techniques (Fig. 2, 4). We expect these teachable units to represent a diverse cross-section of topics across the STEM disciplines. To boost student metacognition around their experiences, at the end of each day, students will report back to the larger group on the successes and challenges of applying the topic for that day to their teachable unit (Fig. 2, 5). That evening before the next workshop students will write a short reflection on their learning for that day, for discussion the next day (Fig. 2, 6). Two of the five workshop days, we will hold a panel discussion. The first panel discussion topic will examine scientific teaching and we will invite UCB campus leaders in STEM education to discuss their experiences in this arena. The second panel discussion will be devoted to teaching to diverse populations. We will convene a panel of undergraduates that represent a diverse cross section of the UCB campus to discuss diversity and learning. At the end of the workshop, all graduate students will have a draft teachable unit, ready for critique and practice during the fall seminar.

**Daily Summer Workshop Schedule**

1. Read
2. Summarize
3. Discuss & Practice
4. Construct teachable unit
5. Report to group
6. Reflect

Fig. 2. Proposed summer workshop schedule. Each day will consist of activities both in and out of the workshop.

Collaborate and Instruct - Fall Semester Graduate Teaching Seminar, EBIO 6100- Graduate students who participated in the summer workshop will bring the teachable unit developed during the summer workshop to the fall teaching seminar. A condition of the summer workshop will be the fall teaching seminar, and this will be made clear to students during recruitment. We are confident that we can fill all the positions in the summer workshop and fall graduate teaching seminar, based on the current enrollment in Barger’s seminar, which was only advertised to EBIO graduate students (9 students enrolled, and 1 more who attends without receiving credit). During the seminar, graduate students will peer review teachable units, then practice their units on a rotating basis. We anticipate approximately 12-15 graduate students will enroll in the seminar coming from a wide range of STEM disciplines. This presentation will be the ‘dress rehearsal’ before the teachable unit is taken into the undergraduate classroom. When the graduate student is scheduled to present the teachable unit either Barger or Seiter will attend the class and provide assessments of teaching effectiveness and student engagement. Immediate feedback will be provided to the graduate student and the teachable unit will be modified accordingly. If the teachable unit is a case study, the graduate student will be encouraged to write up and submit their work to a peer-reviewed online case study repository (see the National Center for Case Studies in Teaching http://sciencecases.lib.buffalo.edu/cs/ Teaching Issues and Experiments in Ecology, http://tiee.ecoed.net).
4. EVALUATION

We will collect the following data to evaluate the impact of this project and to develop subsequent proposals:

a. **Graduate participant reflections and survey.** Summer workshop and fall course reflection assignments as well as comments made during class discussions and informal conversation will be compiled by PIs. All participants will complete an evaluative survey at the completion of both the summer workshop and fall seminar. These data will be analyzed for qualitative themes related to perceptions of project impact and any evidence of transformation from traditional to student-oriented, evidence-based teaching philosophy and practices.

b. **Quantitative and Qualitative Observational Data.** The SITAR observational tool will be used by PIs and/or course participants to track graduate participant teaching practices and student interactivity, as they implement their practice and final teachable units. This tool was developed by EBIO-SEI STFs and is “descended with modification” from published observational tools including the RTOP, COPUS and TDOP. Each participant will be observed at least 3 times, by the same observer. This data will be analyzed for evidence of the use of evidence-based practices and any change in such practices over time.

c. **Undergraduate Survey.** The PIs will develop a standard survey, to which participants can append additional questions, which will be administered shortly following each participant’s implementation of their teachable unit. Standard survey questions will be drawn from the widely-used Student Assessment of Learning Gains (SALG) tool as well as UCB’s standard FCQ tool. Student responses will be analyzed with respect to the impact of the teachable unit curricula on perceived student attitudes, motivation, and learning. FCQ responses will be compared to the cooperating faculty’s FCQ overall course ratings to investigate differential student responses to the teachable unit curricula.

d. **Faculty survey.** The PIs will develop a survey of cooperating faculty in which free responses will allow faculty to describe any impacts their collaboration with the graduate student had upon their teaching philosophy and practice.

5. BROADER IMPACTS OF THE PROPOSED WORK

*Professional Development* — Over the past several years, Barger has committed significant time and energy to adopting teaching strategies to enhance student learning in all of her courses. Her current approach to teaching and learning that evolved during this time can be best described as a student-centered *evidence-based approach*. To adopt this new approach to teaching required a complete restructuring of her courses. This graduate teaching program not only gives Barger the professional opportunity to share what she has learned over the past seven years with graduate students as they develop into educators, but also provides an opportunity to be trained in the use and analysis of the wide range of assessment tools laid out in the evaluation section.
Supporting STEM Reform in EBIO and UCB — Our proposed graduate teaching model will address the need for STEM education reform in EBIO and UCB in several ways. Providing graduate students with formal pedagogical training and mentored teaching practice will directly benefit undergraduate STEM students, increasing the quality of the instruction they receive. Further, increased classroom time and support for graduate students will reduce the teaching requirements of current faculty, serve as pre-service training for future faculty, and help prepare graduate students for success in a variety of future careers, including non-academic positions. Our model builds on existing graduate training programs at UCB by increasing graduate student teaching responsibilities, supplementing current training structures with increased opportunities for practicing evidence-based education techniques, and enhancing training and mentorship through courses and faculty partnerships. By directing these efforts towards graduate students, who often lack this type of guidance and support, we believe our model will address a critical area of need in training the next generation of STEM educators.

This framework for graduate teaching training is currently supported by the EBIO department and also the UCB Arts and Sciences Deans Office. EBIO released Barger from her primary teaching responsibilities in the fall semester of AY 2014 and 2015 to lead the proposed graduate teaching program. Thus Barger has been awarded the time to invest in this program during the academic year. The A&S Deans Office recently awarded two GPTI positions for AY 2014 and 2015 in EBIO for graduate student participation in this program.

6. ACKNOWLEDGEMENTS

Although not traditionally included in proposals, we feel it’s important to acknowledge the EBIO and Geology graduate students who motivated and inspired our proposed graduate teaching program. The training framework in this document strongly reflects the ideas and needs presented to Barger and Seiter by the group of graduate students who participated in the EBIO Science Education Reading Group during the Fall 2013 semester. These graduate students played an important and critical role in developing this proposal: Amy Churchill, Chelsea Cook, Amanda Hund, Kathy Kelsey, Sierra Love-Stowell, Miranda Redmond, and Katie Richgels. Their collective enthusiasm, passion, and commitment for teaching is both humbling and inspiring.

7. REFERENCES CITED


8. BUDGET

<table>
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<tr>
<th>Expenditure</th>
<th>Year 1</th>
<th>Year 2</th>
<th>All Years</th>
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<tr>
<td></td>
<td>2014</td>
<td>2015</td>
<td>Total</td>
</tr>
<tr>
<td>Barger Summer Salary</td>
<td>$4,476</td>
<td>$2,238</td>
<td>$6,714</td>
</tr>
<tr>
<td>(Year 1 = 2 weeks, Year 2 = 1 week)</td>
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<td></td>
<td></td>
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<td>Faculty Fringe Benefits (28.2%)</td>
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<td>$631</td>
<td>$1,893</td>
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<td>Honorarium for panel participants</td>
<td>$500</td>
<td>$500</td>
<td>$1,000</td>
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<td>$50</td>
<td>$100</td>
</tr>
<tr>
<td>Photocopying for Summer Workshop</td>
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<td>$40</td>
<td>$80</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td>$9,707</td>
</tr>
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</table>

Budget Justification:

**Barger Summary Salary** – $8607 of the CFA funds will be used for summer salary for Barger to organize and run the graduate summer teaching workshops and to review assessment tools (see Timeline). In year 1, Barger will design summer workshop activities, create new assessment tools or refine existing tools of graduate student professional development, evaluate existing teaching and student behavior tools, lead the summer workshop, analyze workshop assessment data, and write up a workshop report. We estimate that this will require 11 work days for Barger. Following this, we are requesting two weeks of time for Barger in year 1. Barger does not have any support to develop the graduate training summer workshop, which is a critical component to our proposed framework. Thus the summer support for Barger to develop the workshop activities is important to it’s success. In year two, only one week of time is requested to support Barger in organizing and leading the summer workshop. All of Seiter’s time will be covered by EBIO Science Education Initiative funds. Sarah Wise, an SEI STF in EBIO will also contribute time to the project as an advisor.

**Honorarium for panel participants** – In the summer workshop we will convene two panel discussions comprised of 5 participants. We will provide a modest honorarium ($50) to each participant in year 1 and 2 of the workshop. This honorarium recognizes that faculty are not often paid during the summer and is a gesture of our appreciation to participate.

**Book** – We are requesting 4 copies of Scientific Teaching to have as reference books and to loan to students during the summer workshop.

**Photocopies** – We are requesting $40 to support photocopying during the summer workshop or of final reports.
9. TIMELINE

The STEM graduate teaching program will operate over a 2-year period beginning late spring of 2014. Initial efforts to meet with campus leaders in STEM education will be led by Barger. In developing this proposal Barger met with Laura Border (Director, GTP) and communicated our goals to CSL. Our framework for the summer teaching workshop was also discussed with Jenny Knight. Barger will continue to engage campus leaders in graduate student teaching in April and May 2014. In these meetings Barger will work to further align the STEM graduate teaching program with other efforts across the UCB campus. Beginning in the summer session, Barger and Seiter will work closely to identify and perform any modification of evaluation tools. Following this Barger and Seiter will design and lead the summer workshop. Beginning in the fall semester Barger and Seiter will lead the fall semester graduate teaching training seminar. During this time they will schedule class evaluations of graduate student teaching and individual and group coaching of graduate student teaching. Spring semester tasks will focus on analyzing the evaluation data and drafting our first reports. We will perform these same duties in the second year of our project.

<table>
<thead>
<tr>
<th>Yr/Sem</th>
<th>Task</th>
<th>Time</th>
</tr>
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<tbody>
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<td>2014</td>
<td>- Arrange meetings with campus leaders in graduate education to align activities</td>
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</tr>
<tr>
<td>2014</td>
<td>- Design summer workshop activities</td>
<td>2 days</td>
</tr>
<tr>
<td></td>
<td>- Create assessment of graduate student learning for summer workshop</td>
<td>2 days</td>
</tr>
<tr>
<td></td>
<td>- Lead summer workshop</td>
<td>5 days</td>
</tr>
<tr>
<td></td>
<td>- Analyze workshop assessment data</td>
<td>1 day</td>
</tr>
<tr>
<td></td>
<td>- Write up summer workshop</td>
<td>1 day</td>
</tr>
<tr>
<td>2014</td>
<td>- Lead graduate teaching training seminar (EBIO 6100)</td>
<td>5 days</td>
</tr>
<tr>
<td></td>
<td>- Create assessments for graduate student development in teaching</td>
<td>3 days</td>
</tr>
<tr>
<td></td>
<td>- Choose appropriate assessment tool (e.g. RTOP, TDOP, SITAR) for student behaviors</td>
<td>2 days</td>
</tr>
<tr>
<td></td>
<td>- Conduct in-class assessments of graduate student teaching</td>
<td>5 days</td>
</tr>
<tr>
<td>2015</td>
<td>- Analyze data from in-class assessments</td>
<td>2 days</td>
</tr>
<tr>
<td></td>
<td>- Write report from Year 1</td>
<td>2 days</td>
</tr>
<tr>
<td>2015</td>
<td>- Lead summer workshop</td>
<td>5 days</td>
</tr>
<tr>
<td></td>
<td>- Analyze workshop assessment data</td>
<td>1 day</td>
</tr>
<tr>
<td></td>
<td>- Write up summer workshop</td>
<td>1 day</td>
</tr>
<tr>
<td>2015</td>
<td>- Lead graduate teaching training seminar (EBIO 6100)</td>
<td>5 days</td>
</tr>
<tr>
<td></td>
<td>- Conduct in-class assessments of graduate student teaching</td>
<td>5 days</td>
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<td>2016</td>
<td>- Analyze data from in-class assessments</td>
<td>2 days</td>
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<tr>
<td></td>
<td>- Write report from Year 2</td>
<td>2 days</td>
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</tbody>
</table>

Fig. 3. Tasks to be accomplished by semester within our project beginning at the end of the spring 2014 semester through spring 2016 semester. Green = spring semester, red = summer semester, blue = fall semester. The ‘time’ column represents Barger’s commitment. Bolded time commitments for Barger denote the request for summer salary.
10. CURRENT CV FOR APPLICANTS

NICHOLE N. BARGER
Dept. of Ecology and Evolutionary Biology, University of Colorado at Boulder
UCB 334, Boulder CO 80309-0334
Phone: 303.492.8239 nichole.barger@colorado.edu Fax: 303.492.8699

PROFESSIONAL PREPARATION

2003    Ph.D., Graduate Degree Program in Ecology, Colorado State University

1998    M.S., The Graduate Group in Range Science, Department of Environmental Science Policy and Management, University of California, Berkeley.

1995    B.A., The Evergreen State College, Olympia, WA.

PROFESSIONAL EXPERIENCE

2007-Present    Assistant Professor. Department of Ecology and Evolutionary Biology.

Spring 2007    Instructor. University of Colorado, Environmental Studies Program.


1997-98    Masters student. The Graduate Group in Range Science, Department of Environmental Science Policy and Management, University of California-Berkeley.


1994    Research assistant. NSF Arthropods of La Selva (ALAS) project. La Selva Biological Research Station, Costa Rica.

RESEARCH GRANTS

2013-2018    Lead PI, Strategic Environmental Research and Development Program (SERDP), Achieving Dryland Restoration Through the Deployment of Enhanced Biocrusts to Improve Soil Stability, Fertility and Native Plant Recruitment, $2,300,000

2011-2016    Co-PI, Science Education Initiative, University of Colorado, Increasing Teaching Effectiveness in Ecology and Evolutionary Biology, $499,942 total to support innovative teaching within department
2011-2013  Co-PI, NASA North American Carbon Program (NACP) Grant, Carbon Management on Public Land in the Intermountain West: Multi-Scale Analysis of Carbon Stock Responses to Human and Natural Disturbance, $570,000

2008-2012  Co-PI, Mellon Foundation, Nitrogen Inputs and Cycling in Ecosystems of the Western Cape Province of South Africa, $293,000

2008-2012  Lead PI, USDA NRI-Managed Ecosystem Program, Development of a Science-Based Decision Making Model for Restoration of Pinyon-Juniper Ecosystems, $499,590

2005-2008  Co-PI, NASA North American Carbon Program (NACP) Grant, Regional Carbon Storage Responses to Woody Encroachment in Western Pinyon-Juniper Systems, $812,000

PENDING GRANT PROPOSALS

2013  Lead PI, National Geographic Committee for Research and Exploration, Are fairy circles the product of self-organizing vegetation patterning? $19,600

RESEARCH PUBLICATIONS

◆ denotes graduate student authorship
■ denotes undergraduate authorship
○ denotes post-doctoral research associate authorship

Published or in press


EDUCATION PUBLICATIONS


programs. Bulletin of the Ecological Society of America 94:245–246. DOI: 10.1890/0012-9623-94.3.245. (Non-peer reviewed commentary. This article was a product from EBI 6100 Science Writing taught in the Spring 2013 semester)


**CONFERENCE PROCEEDINGS**


**PRESENTATIONS (Since August 2011)**

* = outreach presentations


15) **Barger, N.N.,** J.E. Herrick, J. Belnap, J. Van Zee. Hydrologic response of biologically crusted soils to disturbance and extreme climatic events: implications for ecosystem


6) Belnap, J., B. Wilcox, N.N Barger, J. Herrick, and M. van Soyoc. Biological soil crusts influence hydrologic function differently in various deserts and future climate and land use will affect these relationships, European Geophysical Union, Vienna, Austria. March 2012.


RECOGNITION AND AWARDS

2003-2006 National Parks Ecological Research Fellowship, $120,000
2002 Best Graduate Student Poster, Front Range Student Ecology Symposium
2000-2003 Canon National Parks Science Scholars Fellowship, $60,000
1999-2000 Francis Clark Soil Biology Scholarship, Colorado State University, $1500

WORKING GROUP COLLABORATIONS


TEACHING ACTIVITIES

Classroom Teaching (since 2011)

<table>
<thead>
<tr>
<th>Semester</th>
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<th>Course title</th>
<th>Course number</th>
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<th>Instructor Rating 1= lowest 6= highest</th>
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<td>15</td>
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<td>In progress</td>
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<td>Spring</td>
<td>2014</td>
<td>Ecosystem Management</td>
<td>4800</td>
<td>39</td>
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<td>Fall</td>
<td>2013</td>
<td>Plant Ecology</td>
<td>4140</td>
<td>39</td>
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<td>5.5</td>
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<td>2013</td>
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<td>4140</td>
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<td>5.8</td>
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<tr>
<td>Spring</td>
<td>2012</td>
<td>Ecosystem Management</td>
<td>4800</td>
<td>30</td>
<td>5.6</td>
<td>6.0</td>
</tr>
<tr>
<td>Fall</td>
<td>2011</td>
<td>Plant Ecology</td>
<td>4140</td>
<td>47</td>
<td>5.2</td>
<td>5.6</td>
</tr>
</tbody>
</table>

Guest Lectures
Spring 2013  GEOG 1001, Climate and Vegetation, 200 students

Fall 2009  EBIO 2040, Two guest lectures in Principles of Ecology, > 100 students

Fall 2008  EBIO 4140, Plant Ecology guest lecture, 40 students

Science Education Activities

Fall 2013  Organizer, Graduate Student Science Education Reading Group. Reading group on the most recent literature on teaching and learning in biology education.

Fall 2013  University of Colorado Graduate Teaching Program (GTP) Fall Intensive Workshop, The Flipped Classroom. Workshop for graduate students on creating a student centered, active learning environment in their courses.

Spring 2013  Consulting work with Simbio (company that produces interactive software to teach inquiry-based biology courses) on the ‘flipped’ classroom. The product of the consulting work was a one-hour webinar for faculty in higher education.

2011-2014  Co-PI, EBIO Science Education Initiative, University of Colorado.


Principal Advising Activities

2013-present  Scott Clingan, Honors expected May 2014, ENVS
2011-present  Miranda Redmond, Ph.D. expected May 2015
2010-2012  Tamara Jane Zelikova, USGS Mendenhall Post-doctoral Research Associate
2009-2012  Heidi Guenther, EBIO, M.A. awarded December 2012
2010-2012  Matt Peoples, EBIO Honors Program, Magna Cum Laude, May 2012
2009-2012  Rhonda Hoenigman, co-advised Ph.D. in Computer Science, Ph.D. August 2012
2009-present  Taryn Morris, EBIO, Ph.D. expected May 2014
2008-2010  Matt Ross, EBIO Honors Program, Graduated Summa Cum Laude, May 2010

Graduate and Honors Student Committee Membership

20) 2013-present  Cameron Naficy, Ph.D, Geography
19) 2013-present  Kathy Kelsey, Ph.D., Geosciences
18) 2013  Matt Olivier, Honors, ENVS
17) 2013  Alex Loomis, Honors, Geography
16) 2012-present  Chris Javornik, B.A./M.A., EBIO
15) 2012-present  Megan Caldwell, Ph.D. student, EBIO
14) 2012-present  Teal Potter, Ph.D. student, EBIO
13) 2012-present  Becky Poore, EBIO, Ph.D. student, EBIO
12) 2011-present  Amy Churchill, EBIO, Ph.D. student, EBIO
<table>
<thead>
<tr>
<th>Year</th>
<th>Name</th>
<th>Degree, School or University</th>
</tr>
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<tr>
<td>2011-present</td>
<td>Amy Steiker</td>
<td>EBIO, Ph.D. student, EBIO</td>
</tr>
<tr>
<td>2010-2011</td>
<td>Caitlyn Clark</td>
<td>Honors, Anthropology</td>
</tr>
<tr>
<td>2010-present</td>
<td>Akasha Faist</td>
<td>Ph.D., EBIO</td>
</tr>
<tr>
<td>2010</td>
<td>Simon Power</td>
<td>M.S., University of Cape Town (External examiner)</td>
</tr>
<tr>
<td>2010-present</td>
<td>Adam Markovits</td>
<td>M.S., EBIO</td>
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<tr>
<td>2010-present</td>
<td>Samantha Weintraub</td>
<td>Ph.D., EBIO</td>
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<tr>
<td>2009-present</td>
<td>Janet Prevey</td>
<td>Ph.D., EBIO, EBIO</td>
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<tr>
<td>2008-present</td>
<td>Chris Gray</td>
<td>Ph.D., EBIO, EBIO</td>
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<tr>
<td>2008-2010</td>
<td>Charlie Lawton</td>
<td>M.S. EBIO</td>
</tr>
<tr>
<td>2008</td>
<td>Blake Angelo</td>
<td>Honors, EBIO</td>
</tr>
<tr>
<td>2007-2008</td>
<td>Sarah Castle</td>
<td>M.S., Geology</td>
</tr>
</tbody>
</table>

**SERVICE ACTIVITIES**

**Service Within the University of Colorado**

- **2014-present** FTEP Early Career Faculty Program. Program co-lead spring 2014 for the natural sciences with plans to direct the program in fall 2014.
- **2014-present** School of Environment and Sustainability Implementation Committee
- **2013-present** University of Colorado Faculty-Student Mentoring Program
- **2013** EBIO Environment and Sustainability Visioning Committee (Spring semester)
- **2012-present** EBIO Science Education Initiative (SEI) Steering Committee
- **2011-2012** EBIO Botany Search Committee
- **2011-2012** EBIO Academic Review and Planning Advisory Committee (ARPAC)
- **2010-2011** EBIO Executive Committee
- **2010-present** EBIO Budget Committee
- **2009** EBIO Merit Evaluation Committee
- **2009** Film festival juror for film course (Atlas 3519), December
- **2008** LEAP Workshop on balancing career goals and family life, December
- **2008-2009** EBIO Graduate Committee
- **2007-2008** EBIO Undergraduate Curriculum Committee
- **2008** EBIO Gordon Alexander Fellowship selection committee

**Service Outside of the University of Colorado**

*Science and management advisory activities and meeting organization*

- **2012** Organizer, Canyon Country Science Symposium, Moab, UT. March 2012. A forum to exchange research information with state and federal agencies.
- **2009-present** Science and Management Advisory Council Member, Canyonlands Research Center, The Nature Conservancy, Moab, Utah

**OUTREACH ACTIVITIES**
<table>
<thead>
<tr>
<th>Year</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>Co-led two one-day field trips for state and federal land managers to highlight research on fuels reduction. Moab, Utah. March and May 2011.</td>
</tr>
<tr>
<td>2010</td>
<td>Dendrochronology workshop. Casey Middle School students attended a short dendrochronology workshop in my laboratory (45 students). The workshop was organized by Jeffery Morton a graduate student in my lab and an NSF GK12 Fellow at UCB. July.</td>
</tr>
</tbody>
</table>
EDUCATION

University of Colorado at Boulder
Science Teaching Fellow, Science Education Initiative 2013-2014
Using data on student demographics, attitudes, social network location and performance to measure the effects of in-class group discussion.

University of North Carolina at Chapel Hill, Chapel Hill NC
Ph.D. Student in Evolution, Ecology and Organismal Biology 2008-2012
Dissertation: “Latitude, Life History, and Immune Function in an Invasive Butterfly

University of Michigan, Ann Arbor, MI
M.S. in Conservation Biology 2008
Thesis: “Predators Suppress Immune Function in a Larval Amphibian”

University of Michigan, Ann Arbor, MI
B.A. in Biological Anthropology; Minor, Environmental Science 2006
Senior Project: “Squirrel Monkey Foraging Behavior in Fragmented Habitats

AWARDS
NESCent Evolution Blogging Contest, First Place NESCent 2011
NSF East Asia and the Pacific Institute Fellowship (Japan) 2011
Graduate Tuition Incentive Fellowship, UNC Chapel Hill 2010
National Evolutionary Synthesis Center Graduate Fellow 2010
North Carolina Science and Technology Fellow, UNC Chapel Hill 2008 – 2009
Karl Kidder Award, University of Michigan 2008
Rackham Graduate Research Award, University of Michigan 2007
School of Natural Resources Opus Grant, University of Michigan 2006
School of Natural Resources Incoming Student Fellowship, University of Michigan 2006- 2007

RESEARCH EXPERIENCE

University of Colorado at Boulder
Science Education Fellow 2013-2014
Science Education Fellow – I am combining demographic data, classroom assessments, attitude surveys and social network data to identify predictors of student learning during group work. I’m also developing a performance indicator dashboard
that visualizes teaching behaviors and student participation for new faculty. By providing minute-by-minute data to new professors, we hope to help them identify and set goals for their lessons, and track student engagement.

City College of New York / American Museum of Natural History, New York, NY 2013

Research Fellow – Designed and evaluated two inquiry based curricula on ecology and evolution. Extracted and visualized data from peer-reviewed publications for use in the curriculum. Designed surveys and focus group protocols, and analyzed qualitative and quantitative data to improve our product.

University of North Carolina at Chapel Hill, Chapel Hill, NC 2009-2012

Dissertation Research
Sampled populations of the invasive cabbage white butterfly for comparison with North American population, measured thermal tolerance, immune function and adaptation to diet quality. Conducted field experiments quantifying natural selection by parasites and predators.

Laboratory of Insect Ecology, Kyoto University, Kyoto Japan Summer 2011

NSF East Asia and the Pacific Fellowship, Kyoto Japan
Sampled Northern and Southern populations of the invasive cabbage white butterfly for comparison with North American population, measuring thermal tolerance, immune function and growth rate.

National Evolutionary Synthesis Center, Durham NC Fall 2010

National Evolutionary Synthesis Center Graduate Fellowship Program
Conducted a meta-analysis on methods for quantifying trait plasticity in different taxa and in different environments. Developed new statistical methods for quantifying and comparing variation of traits across environments and species.

National Evolutionary Synthesis Center, Durham NC 2010-2012

Costs of Plasticity and Adaptation to Novel Environments Working Group
Collaborated on a literature review on plastic and variable biological traits and their performance in changing environments (in press at the journal Evolution).

TEACHING & EDUCATION EXPERIENCE

Backyard Brains, Ann Arbor, MI 2013-2014
Freelance Curriculum Editor – Redesign curriculum for teachers and students to improve information uptake. Developed standards alignment guides for the Next Generation Science Standards and the Common Core Curriculum. Created new graphics to match branding while illustrating key science concepts.

North Carolina Museum of Natural Sciences, Raleigh, NC Fall 2012
Education Intern – Produced an inquiry based learning activity on climate change and insect behavior for the hands-on activity section of the museum.

University of North Carolina, Chapel Hill, NC 2011-2012
Laboratory Outreach – Developed hands on activities to teach students about insects and climate change using live tobacco hornworms. Presented the activity at Darwin Day, the NC Science Festival and in classrooms and scouting groups.

University of North Carolina, Chapel Hill 2012
Undergraduate Research Manager – Managed a staff of up to five undergraduate and high school researchers in our laboratory, coordinate student projects, taught laboratory protocols, lead field experiences, coached technical
writing skills and co-authored publications with students.

**University of North Carolina, Chapel Hill, NC**

**Co-instructor** – Science Communication and Outreach Seminar (BIOL659).

With my advisor Dr. Joel Kingsolver and labmate Jessica Higgins, I developed course activities and assignments on blogging, podcast production, and science writing for the public.

**University of North Carolina, Chapel Hill, NC**

**Course Development Assistant** – Developed curriculum for Evolution and Life a non-majors course with an emphasis on science writing (Biol 213) with Dr. Joel Kingsolver.

Coached students on translating scientific research for mainstream media publications used collaborative web tools to facilitate online editing and discussion of student work.

**University of North Carolina, Chapel Hill, NC**

**Teaching Assistant** – Environment and Society (ENST 201), Dr. Greg Gangi.

Developed class exercises in data visualization, taught science writing and composition.

**University of Michigan, Ann Arbor, MI**

**Scientific Illustrator and Exhibit Developer** – Produced custom illustrations and figures for the entomology laboratory, developed museum displays on insect based cuisines.

**SELECTED PUBLICATIONS AND PRESENTATIONS**


**SERVICE**

- Science Blog: https://butterfliesandscience.wordpress.com
- Volunteer Science Tutor for ESL students, Chapel Hill-Carrboro Public Schools
- Steward for Michigan Graduate Employees Union (Local 3550 American Federation of Teachers, AFL-CIO)
- Volunteer Data Analyst for Michigan United, analyzing foreclosure data
- TEDx Organizer (TEDxProspectHeights). Worked with speakers to hone talks on a variety of topics
11. CURRENT AND PENDING FUNDING

Barger Current Funding

2013-2018  Lead PI, Strategic Environmental Research and Development Program (SERDP), Achieving Dryland Restoration Through the Deployment of Enhanced Biocrusts to Improve Soil Stability, Fertility and Native Plant Recruitment, $2,300,000

2011-2016  Co-PI, Science Education Initiative, University of Colorado, Increasing Teaching Effectiveness in Ecology and Evolutionary Biology, $499,942 total to support innovative teaching within department

2011-2013  Co-PI, NASA North American Carbon Program (NACP) Grant, Carbon Management on Public Land in the Intermountain West: Multi-Scale Analysis of Carbon Stock Responses to Human and Natural Disturbance, $570,000

Barger Pending Funding

2013  Lead PI, National Geographic Committee for Research and Exploration, Are fairy circles the product of self-organizing vegetation patterning? $19,600

Seiter Current Funding

None

Seiter Pending Funding