Restoration Ecology
EBIO 4460-40
Fall Semester 2018

This course emphasizes practical in-the-field experience necessary for a career in restoration, conservation and land management. The format is varied, involving lectures of the necessary conceptual background, discussions of literature, and time dealing with the messy reality in the field.

Instructor: Katharine Suding. Katie is a plant community ecologist that has worked on issues in restoration ecology for the past decade. She focuses on how invasion, species feedbacks and environmental change influence ecosystem recovery. Office: SEEC 254a (primary), Ramaley C296 (Secondary). Email: suding@colorado.edu.

Teaching Assistant: Julie Larson. Julie is a PhD candidate in the EBIO department. She studies drought and grazing in nearby grasslands, and is interested in adaptive management strategies, seedling traits, and soil. Office: SEEC S247 (primary), Ramaley N125 (secondary) Email: Julie.E.Larson@colorado.edu

Objectives and Learning Outcomes

This course focuses on the ecological theories that must be successfully incorporated into restoration practice. Specific objectives include:

1. To explore theories that inform the practice of ecological restoration and management;
2. To consider the application of these theories in the context of practical attempts to remake, improve, or design damaged ecosystems;
3. To gain real-world experience in the practice of ecological restoration;
4. To gain professional skills necessary for conservation land management careers.

Learning Outcomes. By completing this course students will be able to:

1. Identify and discuss the relevance of scientific ideas for use in a practical framework;

2. Adapt ideas from theory and provide arguments for how they pertain to practical applications;
3. Evaluate restoration case studies for success or failure in part by assessing their adherence to ecological principles as they are currently understood.
4. Understand the steps in adequate data collection and monitoring, and how to use this information as a basis for management recommendations.

Pedagogy: The course is an advanced, upper year exploration of the ecological theory and application of science that informs the practice of ecological restoration. As an advanced course, the curriculum requires that students integrate knowledge rather than just memorizing and

repeating ideas presented in lecture. As such, assignments are designed to help students push their boundaries and think both broadly and deeply about the material covered in class, knowledge gained from other coursework, and relevant field experiences. Independent work, including field-based data collection, is essential for successful completion of the restoration management plan. A commitment to coming to class prepared and eager to discuss ideas, dilemmas and solutions is necessary for success in this course.

Course Components and Grading

There are five main components required for successful completion of the class.

1. Minute papers (~10, 2 pts each). There will be several minute papers throughout the course for you to consider key issues in restoration ecology and read current research. Short, 200-300 word responses in the discussion page of Canvas, need to be turned in prior to the start of the class when the paper is due. You will be able to read others minute papers once you turn in your own. You will be given a 2 pts credit for submission of your response, they will not be otherwise graded and there will be no ways to make up a missed submission (there will, however, be ways to receive extra credit as the course progresses).
2. Professional skill sets (5, 10 pts each). There will be several exercises required throughout the class that focus on particular skills needed in the field. These typically will proceed or follow a specific lab exercise, and include plant identification, mapping, data analysis and visualization, and presentation of results to your client. In addition, we require a restoration field experience where you volunteer on an actual restoration project. Five skill sets in total, each 10 pts.
3. Restoration Management Project. The focal experience of the class will be to develop a restoration management plan in conjunction with a client. Each student will be assigned to be part of given project team. The project will be divided into different stages, which will allow you to develop the plan step-by-step, and get feedback from your teacher and peers before the final compilation is due. The project has been designed this way to reflect the actual restoration planning and design process. At the end of the semester, students will give oral presentations on their plans to a review board comprised of your instructors, peers, and collaborators. *While you will work as a team for the data collection and plan presentation, each student is responsible for their own written assignments.* There are three parts of the RMP, each with staggered due dates.
    1. Part I: Project background and justification, literature review (10 pts). View this as a brief background of the restoration challenge and what is currently known about the species, conservation targets, and issues. Aim for 5 double-spaced pages, edited and written for a professional audience with proper citations.
    2. Part II: Assessment (20 pts). This section should show the results of your baseline measures and investigations (i.e. field work). Include specific methodology. Data should be presented graphically and statistically analyzed. Three double-spaced pages, plus figures, maps and tables as appropriate.
    3. Part III: Final RMP (40 pts). I will provide a template that follows standards of formatting and structure common to professional reports; you will be expected to include revised

versions of RMP I and II in this final plan. Based on the literature review and these results, this the RMP report will outline the key goals relevant to your project plan, discuss a few different restoration options, and outline uncertainties and next steps that need to be undertaken, providing rationale in why your client should invest in taking next steps.

4. **Problem sets and Comprehensive Final Exam.** The problem sets (2, 20 pts each) and final exam (50 pts) will be a mixture of short answer and essay questions that will test your understanding of the course objectives. You will be expected to synthesize across lectures, discussions, case studies and your experiences in the field. You will be able to use all class materials and notes. The final will be similar to a problem set, although will be comprehensive, covering the entire class.
5. **Participation.** Participation is a key component in this class. It includes attendance, preparation and active participation in class and labs, working as a constructive team member in the independent project.

Overall Point Allocation. This course is not graded on a curve. I may lower (but will never increase) the classwide point cut-offs for a given grade (e.g., 88% for the cut-off for a A-) to better reflect accomplishment. These final point cut-offs will be determined at the end of the class, and will be based on 250 points.

Minute Papers (2 pts each x ~10)	20 pts
Skill Sets (10 pts each x 5)	50 pts
RMP I-III (10 pt, 20 pts, 40 pts)	70 pts
Problem sets, Final exam (20 pts x 2, 50pt)	90 pts
Participation	20 pts
Total points: 250 pts	

Class Policies

1) Assignments are almost always due electronically; due dates are listed in the assignment section. If an assignment is late, I will deduct 10% of the total points allocated to that assignment each day it is late.

2) Let me know if you will be missing a class, and Julie if you will need to miss a lab. All missed classes and labs need to be approved prior to the start of class. Unexcused absences will result in the deduction of participation points.

3) This class requires group work and cooperation. I expect all students to actively participate in class discussions, field exercises, and independent projects. Part of your participation score will reflect an evaluation by other group members as to your contribution in the independent project.

4) This course requires independent work in the field. The tall oatgrass project location is approximately 3 miles south of campus in Boulder Open Space lands, and will require the use of car, bike or bus transportation. The urban tree project will be located on or near campus. Please follow the permit guidelines, prioritize field safety, record when and where you will be in the field, and always work as a group (not alone).

5) I will follow the school policy of plagiarism and academic dishonesty. Please be familiar with the Student Honor Code (http://www.colorado.edu/academics/honorcode/). In particular, the course will be writing intensive -- you have any questions about plagiarism and what constitutes your own work, please ask me and I will be happy to clarify guidelines.

6) If you qualify for accommodations because of a disability, please submit a letter from Disability Services in a timely manner so that I can address your needs.

7) If course work interferes with your religious observances, please let me know as soon as possible. I will make reasonable accommodation without penalty.

8) It is my priority to provide a supportive, inclusive, and positive learning environment. Harassment is never tolerated. If there is anything I can do to make the environment more conducive to your learning, please let me know.

Schedule (as of the start of the semester, please see Canvas site for any updates)

Date	Details (Section 041 is T lab, 042 is TH lab)
Tue Aug 28, 2018	WK1: Welcome
	Lab: WK1 Introduction (EBIO 4460-041)
Thu Aug 30, 2018	WK1: Restoration Ecology, Ecological Restoration
	Minute Paper: WK 1
	Lab: WK1 Introduction (EBIO 4460-042)
Tue Sep 4, 2018	T Lab: Field Trip (EBIO 4460-041)
	WK 2: Thinking local (lecture for TH lab section only, T section go directly to the field) (EBIO
Thu Sep 6, 2018	TH Lab: Field Trip (EBIO 4460-042)
	WK 2: Thinking Local (Tues lab section only) (EBIO 4460-041)
Tue Sep 11, 2018	WK 3: Dynamics over time
	Plant ID Set (EBIO 4460-041)

	Lab: Plant ID (EBIO 4460-041)
Thu Sep 13, 2018	WK 3: Dynamics over time
	MinutePaper: WK 3
	Plant ID Set (EBIO 4460-042)
	Lab: Plant ID (EBIO 4460-042)
Tue Sep 18, 2018	WK 4: Biodiversity
	Minute Paper: WK 4
	Lab: Mapping (EBIO 4460-041)
Thu Sep 20, 2018	WK 4: Biodiversity
	Lab: Mapping (EBIO 4460-042)
Fri Sep 21, 2018	Problem Set #1
Tue Sep 25, 2018	WK 5: Landscape Ecology
	Mapping skill set (EBIO 4460-041)
Thu Sep 27, 2018	WK 5: Landscape Ecology
	Mapping skill set (EBIO 4460-042)
	Minute Paper: WK 5
Tue Oct 2, 2018	Lab: Independent Projects (EBIO 4460-041)
	Wk 6: independent project time (no class) (EBIO 4460-042)
Thu Oct 4, 2018	Lab: Independent Projects (EBIO 4460-042)
	Wk 6: independent project time (no class) (EBIO 4460-041)
Tue Oct 9, 2018	WK 7: Ecological Genetics
	Minute Paper: WK 7
	Lab: Experimental Design (EBIO 4460-041)
Thu Oct 11, 2018	Wk 7: S. Serrod (guest presentation)
	Lab: Experimental Design (EBIO 4460-042)

Fri Oct 12, 2018	Due at 5 pm: RMP I (Part 1, literature review)
Tue Oct 16, 2018	WK 8: Invasive Species
	Lab: Independent Projects (EBIO 4460-041)
Thu Oct 18, 2018	Wk 8: J. Olson (guest presentation)
	Minute Paper Wk 8
	Lab: Independent Projects (EBIO 4460-042)
Tue Oct 23, 2018	WK 9: Trophic dynamics
	Minute Paper Wk 9
	LAB: Data Analysis and Visualization (EBIO 4460-041)
Thu Oct 25, 2018	Wk 9: Guest Presentation (J. Roberts)
	LAB: Data Analysis and Visualization (EBIO 4460-042)
Fri Oct 26, 2018	Due at 5pm: Problem Set #2
Tue Oct 30, 2018	WK 10: Ecosystem Processes
	Analysis Skill Set (EBIO 4460-041)
	Lab: Independent Projects (EBIO 4460-041)
Thu Nov 1, 2018	Wk 10: Ecosystem Services
	Analysis Skill Set (EBIO 4460-042)
	Minute Paper: WK 10
	Lab: Independent Projects (EBIO 4460-042)
Tue Nov 6, 2018	Lab: Independent Projects (EBIO 4460-041)
	Lab: Independent Projects (EBIO 4460-042)
Thu Nov 8, 2018	Lab: Independent Projects (EBIO 4460-042)
	Lab: Independent Projects (EBIO 4460-041)
	Restoration Volunteer
Tue Nov 13, 2018	WK 12: Assembly Theory and Functional Traits

	Minute Paper: Wk 12
	Lab: Independent Projects (EBIO 4460-041)
Thu Nov 15, 2018	WK 12:
	Lab: Independent Projects (EBIO 4460-042)
Fri Nov 16, 2018	Due at 5pm: RMP II (analysis and visualization)
Tue Nov 20, 2018	Fall Break (no class or lab)
Thu Nov 22, 2018	Thanksgiving (no class or lab)
Tue Nov 27, 2018	WK 14: Scaling up, global restoration initiatives
	LAB: Individual Meetings, RMP I and II Revision (EBIO 4460-041)
Thu Nov 29, 2018	WK 14: Standards and principles
	LAB: Individual Meetings, RMP I and II Revision (EBIO 4460-042)
Tue Dec 4, 2018	WK 15: Climate variability and change
	Lab: Effective presentations (EBIO 4460-041)
Thu Dec 6, 2018	WK 15: Resilience and Adaptation
	Lab: Effective presentations (EBIO 4460-042)
Fri Dec 7, 2018	Due at 5pm: Final RMP (Parts I-III)
Tue Dec 11, 2018	Presentations
	Lab: Presentation debrief, final RMP (EBIO 4460-041)
Thu Dec 13, 2018	Presentations
	Lab: Presentation debrief, final RMP (EBIO 4460-042)
Wed Dec 19, 2018	Take Home Final