

ECOLOGICAL RESTORATION

Macalester College – Spring 2018

Ecosystem restoration requires extensive decision-making in response to existing site conditions (biotic and abiotic), anticipated effects from the surrounding landscape, predictions about future events, logistical realities, and, of course, desired conditions and outcomes. In this course, you will learn how people intervene to reverse ecosystem degradation and population decline and about the numerous factors that affect ecosystem and population recovery. This course includes examples from ecosystems around the world, with greater emphasis on those found in the Upper Midwest. Through lectures, activities, field trips to local restoration sites, and discussion of relevant ecological literature, you will gain broad knowledge and critical thinking skills that will prepare you for sound restoration decision-making and practice. **Welcome!**

LEARNING OBJECTIVES:

Upon completion of this course, you will be able to:

- Assess site conditions and identify effective restoration actions to reverse degradation;
- Develop general restoration plans, including establishing clear goals, evaluating the feasibility of alternative restoration options, and determining resources required for implementation (e.g., funding, partnerships, and organizational capacity);
- Develop detailed revegetation plans and be able to acquire appropriate seeds and plants;
- Develop post-construction and installation management plans;
- Develop monitoring programs to evaluate restoration progress;
- Critically review ecological literature relevant to restoration practice and clearly communicate about the science and practice of restoration.

INSTRUCTOR:

Professor Laura Phillips-Mao Office Hours: M/W 2:00-3:00 pm, or by appointment
Office: Olin-Rice 220 Phone: 651-696-6846
Email: lphillip@macalester.edu

LECTURE & LAB SCHEDULE:

Lecture: MWF 10:50 – 11:50 Olin-Rice 284

Lab: T 1:20 – 4:30 pm Olin-Rice 284 or field trip meeting location (to be announced)

Please be on time for lecture. Late arrivals are disruptive to me and to your classmates, and you may miss important announcements.

Lab attendance is required! We will use lab periods primarily for field trips to local restoration sites, where you will have an opportunity to learn about real restoration projects directly from experts and practitioners in the field. These opportunities are critical to your learning experience (and building a professional network!), and there is no “make-up” opportunity. **We will leave PROMPTLY at 1:20 pm** on field trip days to maximize our time in the field. If you are late, you will be left behind! In addition to field trips, we will use lab periods for in-depth skill-building activities and exercises.

TEXTS & RESOURCES:

The textbook, *Ecological Restoration* by Susan Galatowitsch (Sinauer Associates) is required for this course. It is available in the Highlander bookstore. You should bring your textbook with you to class, as there will often be activities or small-group discussions based on the text book case studies.

Two additional recommended books (The Tallgrass Prairie Center Guide to Prairie Restoration in the Upper Midwest - Smith et al. 2010 and The Tallgrass Restoration Handbook – Packard and Mutel 1997) are available at the Highlander bookstore as well. These are not required, but they are good resources for restoration in the Upper Midwest, and you may want to add them to your personal library. We may have some readings assigned from these books as well, but I will make copies of the readings available to you, so purchasing these books is optional.

A field notebook, such as a small, spiral-bound Rite-in-the-Rain notebook, is also recommended for field trips. Making notes and quick sketches in the field will help you retain important information, and it's good practice for ecological fieldwork. Field notebooks are available at the Highlander bookstore.

COURSE MOODLE SITE:

The course Moodle site will be updated throughout the semester with announcements, readings and other assignments, helpful resources, and schedule changes (as needed). Please check the Moodle page frequently for the most current course information. Note – both lecture and lab content are housed on a single Moodle site for this course.

EXAMS, ASSIGNMENTS, & GRADING:

There will be **two “midterm” exams** plus a comprehensive **final exam** in this class. The exams will cover lecture and lab material as well as assigned readings. Active engagement and discussion with guest speakers and each other are highly prioritized in this class, and many of the graded “assignments” are designed to encourage participation, discussion, and reflection. Specifically:

- For each field trip that features a guest speaker (see course calendar), you will preview relevant site/project information and prepare **questions for the guest speakers** prior to our departure. Each student is expected to ask at least one question of our guest speaker while on the field trip (something more thoughtful than “where’s the bathroom?”). Following the field trip, you will submit a **brief (1-2 page) reflection** about the field trip experience (DUE Fridays at 5pm).
- Each student is required to participate in **ONE restoration-related volunteer activity** on their own time (outside of formal class time) and submit a **brief (1-2 page) reflection**. I may also ask you to share a few thoughts about your experiences in class. This can be done at any time during the semester (prior to the last day of class), and you are welcome to coordinate with other classmates to carpool, etc. Suggestions for volunteer events will be provided on Moodle.
- Over the semester, we will have **8 in-class discussions** in which we review and discuss scientific journal articles relevant to current issues in ecological restoration. Attendance on discussion days is required and you will receive credit for active participation in these discussions. Additionally, you will each collaborate with 1-2 other classmates to **lead 2 class discussions**. You will have an opportunity to sign up for discussion-leader dates/topics and receive more information about this assignment in class.

In addition, you will complete a variety of smaller **skill-building activities/assignments**, most of which will be completed at least partly in class or lab, as well as one **short (~8-10 page) term paper** synthesizing and applying concepts from class to a real-world location.

Your overall course grade will be based on your performance on **exams (45%)**, field trip questions/reflections and other **assignments (28%)**, the **final paper (15%)** and **class discussions (12%)**.

Attendance at lab/field trips is required; any missed labs/field trips will result in a 20-point deduction (per session missed) from the semester's point total. Regular attendance in lectures is expected (and required for class discussion days). The final exam is scheduled for Thursday, May 3 (10:30 – 12:30). You must arrange your end-of-semester travel plans so that you can take the exam at the scheduled time.

FIELD TRIP NOTES:

We will visit a variety of parks and other natural areas in order to highlight local restoration projects and learn directly from the practitioners and managers who oversee this restoration work. Please dress appropriately for the weather and come prepared to walk through snow, ice, mud, tall grass, and semi-rugged terrain. Note that there may not be public restrooms available at some of our field trip sites.

Remember that we will depart Olin-Rice promptly at 1:20 on field trip days (unless otherwise specified). We will be using Biology Department vehicles to travel to our destinations. Personal transportation is generally not feasible due to logistics and parking limitations at some sites.

You are encouraged to bring the following with you on field trips:

- Water bottle
- Sturdy shoes/boots, long pants, long-sleeved shirt (protective clothes that can get dirty)
- Field notebook and pen/pencil
- Digital camera/phone for taking photos
- Mosquito & tick repellent (as needed, later in the semester)
- Sunglasses & sunscreen (again, as needed)
- Work gloves and boots (as needed)

ACCOMODATIONS & POLICIES:

I am strongly committed to supporting the learning of all students in my class. If you are experiencing any barriers to your learning that I can mitigate, please bring them to my attention as soon as possible. I am happy to work with you to find reasonable accommodations that can facilitate your learning and enjoyment of the class. If you need disability related accommodations please contact the Disability Services Office at your earliest convenience. The Director of Disability Services, Allie Quinn, coordinates services for any student in need of accommodations. You may schedule an appointment by calling the Disability Services Office, 651-696-6874.

I expect all students to perform their work with honesty, academic integrity, and respect for everyone in the classroom. Violations of Macalester's policies on academic integrity will be taken seriously, as described on the Academic Programs website:

<https://www.macalester.edu/academicprograms/academicpolicies/academicintegrity/>

Lecture & Lab Schedule <i>(Subject to change - please check Moodle!)</i>						
Week	Day	Date		Unit	Topic	Readings* & Deadlines
1	F	Jan.	19	Restoration Planning	Course Intro / What is restoration?	
2	M	Jan.	22		What is restoration? (continued) and Why restore? Values, motivations & history of ecological restoration	Ch. 1; SER Primer; Allison 2004
	T	Jan.	23		*** NO LAB TODAY ***	
	W	Jan.	24		Environmental "damage": Natural & anthropogenic drivers of ecological change	Ch. 2 (2.1 - 2.2)
	F	Jan.	26		Environmental "damage" (continued) and Conceptual Ecological Models	Ch. 2 (2.1 - 2.2)
3	M	Jan.	29	Assessing current conditions and ecological resilience	Ch. 2 (2.3 - 2.5); Suding et al. 2004	
	T	Jan.	30	<i>Lab (Library & OR): Tools of restoration planning</i>		
	W	Jan.	31	Establishing "SMART" restoration goals	Ch. 2 (2.6)	
	F	Feb.	2	Discussion 1: Restoration goals & outcomes	Disc. 1 Readings TBD	
4	M	Feb.	5	Defining and assessing restoration "success"	Wortley et al. 2013; also review SER Primer	
	T	Feb.	6	<i>FT: Arden Park, Edina - Restoration Planning & Partnerships</i>	DUE: FT Questions	
	W	Feb.	7	Restoration Planning 1: alternative futures & scenario planning	Ch. 3	
	F	Feb.	9	Restoration Planning 2: Writing a restoration plan - logisitcs, budgets, personnel	Ch. 3 (continued); DUE: FT Reflection	
5	M	Feb.	12	Developing social & institutional support for restorations	Ch. 4	
	T	Feb.	13	<i>Lab (OR): Restoration Planning & Logistics Exercise; Guest Speaker: Dan Shaw</i>		
	W	Feb.	14	Discussion 2: Scenario planning/Institutional support	Disc 2 Readings TBD	
	F	Feb.	16	** EXAM 1 **	EXAM 1	
6	M	Feb.	19	Adaptive Management & Monitoring	Ch. 5	
	T	Feb.	20	<i>FT: Flint Hills Resources - Winter seeding and Discussion of conservation-industry partnerships</i>	DUE: FT Questions	
	W	Feb.	21	Monitoring, continued: parameters & protocols	Ch. 5 (continued)	
	F	Feb.	23	Discussion 3: Adaptive management & monitoring	Disc. 3 Readings TBD; DUE: FT Reflection	
7	M	Feb.	26	Restoring Abiotic Conditions	Wind & water erosion / Intro to soil & water quality	Ch. 6 (6.1 - 6.2)
	T	Feb.	27		<i>FT: Savanna restoration at Murphy-Hanrehan Regional Park</i>	DUE: FT Questions
	W	Feb.	28		Groundwater, wetlands, & lakes	Ch. 6 (6.3 - 6.4)
	F	Mar.	2		Riparian and marine systems	Ch. 6 (6.5 - 6.6); DUE: FT Reflection
8	M	Mar.	5	Guest Speaker: Minnehaha Creek Watershed District - Preview of Minnehaha Creek Greenway Restoration		
	T	Mar.	6	<i>FT: Minnehaha Creek Greenway - Stream and wetland restoration; stormwater management</i>	DUE: FT Questions	
	W	Mar.	7	Soil & water quality 1: biogeochemical cycles	Ch. 7 (7.1)	
	F	Mar.	9	Soil & water quality 2: Restoration approaches	Ch. 7 (7.2 - 7.8); DUE: FT Reflection	
x	M	Mar.	12	***** SPRING BREAK - NO CLASS *****		
	T	Mar.	13	***** SPRING BREAK - NO CLASS *****		
	W	Mar.	14	***** SPRING BREAK - NO CLASS *****		
	F	Mar.	16	***** SPRING BREAK - NO CLASS *****		

Lecture & Lab Schedule (Continued)						
9	M	Mar.	19		Discussion 4: Toxic soil remediation - Decision Case	Disc. 4 Readings TBD
	T	Mar.	20		<i>FT: Ordway - Site overview and assessment of restoration needs/potential</i>	
	W	Mar.	21		** EXAM 2 **	EXAM 2
	F	Mar.	23	Restoring Plants & Animals	Revegetation: To plant or not to plant? (natural vs. active recolonization)	Ch. 8 (8.1)
10	M	Mar.	26		Controlling invasive plants	Ch. 8 (8.2)
	T	Mar.	27		<i>FT: Ordway - Vegetation control tutorial & equipment overview</i>	
	W	Mar.	28		Seeding vs. planting	Ch. 8 (8.3)
	F	Mar.	30		Discussion 5: Plant invasions	Disc. 5
11	M	Apr.	2		Designing seed mixes; seed collection & storage	Ch. 8 (8.4 & 8.6)
	T	Apr.	3		<i>Lab (OR): Seedling Identification & Seed Mix Design</i>	
	W	Apr.	4		Seeding methods & site preparation	Ch. 8 (8.4, continued)
	F	Apr.	6		Discussion 6: Seed sources	Disc. 6 Readings TBD
12	M	Apr.	9		Revegetation with plants: materials/methods	Ch. 8 (8.5)
	T	Apr.	10		<i>FT: Roseville City Parks & Stantec - Restoration Initiatives & Public-Private Partnerships</i>	DUE: FT Questions
	W	Apr.	11		Managing/monitoring plantings	Ch. 8 (8.7 - 8.8)
	F	Apr.	13		Intro to animal restoration - animal control & monitoring	Ch. 9 (9.1 - 9.2; 9.5; 9.8) Ch. 10 (10.1; 10.6; 10.8) DUE: FT Reflection
13	M	Apr.	16		Animal restoration - restoring habitat	Ch. 9 (9.3-9.4; 9.7) Ch. 10 (10.2 - 10.3)
	T	Apr.	17		<i>FT: MN Zoo - Wildlife Reintroductions & Conservation</i>	DUE: FT Questions
	W	Apr.	18		Animal restoration - reintroductions	Ch. 9 (9.6) Ch. 10 (10.7)
	F	Apr.	20		Discussion 7: Animal restorations	Disc. 7 Readings TBD DUE: FT Reflection
14	M	Apr.	23		Restoring rare species	Readings TBD
	T	Apr.	24		<i>FT: MN Landscape Arboretum - Orchid & Rare Plant Reintroductions & Conservation</i>	FT Questions
	W	Apr.	25		Landscape scale restoration	Readings TBD
	F	Apr.	27		Discussion 8: Restoration in an era of climate change	Disc. 8 Readings TBD; DUE: FT Reflection
15	M	Apr.	30		Restoration & climate change; Course synthesis	Readings TBD Due: Volunteer Summary & Reflection
	Th	May	3		** FINAL EXAM ** (10:30 - 12:30)	DUE (5/5): Final Paper

*Chapter readings refer to Ecological Restoration (Galatowitsch) unless otherwise indicated. Additional readings to be assigned (check Moodle).

FT = Field Trip

OR = Olin-Rice 284

TBA = To be announced (check Moodle)