

COURSE SYLLABUS

- TIME:** LECTURES: Mondays & Wednesday, 2.30-4 pm
LABS: Wednesdays, 4–6 pm
- PLACE:** Mondays: 2218 School of Education
Wednesdays: Check the schedule. Most Wednesdays at Matthaei Botanical Garden; bus departs 2.30 pm at Rackham Building 915 E Washington St
- INSTRUCTOR:** Sara Adlerstein, School for Environment and Sustainability
Dana Building G524
adlerste@umich.edu
- OFFICE HOURS:** Mondays 4 – 5 pm and by appointment
- GSI:** Eva Roos School for Environment and Sustainability
Dana Building 4046 or 4573 (TBD)
evadroos@umich.edu
- OFFICE HOURS:** Tuesdays 5-6 pm and by appointment

**COURSE DESCRIPTION**

The course offers an introduction to the natural science, engineering, policy, and social issues around ecological restoration. Restoration ecology is a relatively new field that relies on fundamentals of ecology and draws from other disciplines including engineering, landscape architecture, social sciences, economics, environmental education and the arts to assist the recovery of ecosystems that have been degraded, damaged, or destroyed. Ecological restoration is a fundamental element of ecosystem management. It is an intentional activity that initiates or accelerates an ecological pathway—or trajectory through time—towards a reference or desired state. In this capstone course, you will draw on your foundation studies in the natural sciences, social sciences, and culture to help you assess real-world problems in local ecosystems.

At the heart of the course is the question: can we repair some of the damage done to ecosystems and biodiversity? Restoration ecologists generally embrace the notion that our environment can be repaired, but their goals and methods vary widely. We will cover basic principles of the field of ecological restoration, but we will also take a broader look at what restoration means in the

context of urban areas and agriculture, and briefly address the extent to which issues of environmental justice may be involved. Along the way, we will consider the following questions about restoring areas:

- What needs to be restored? What should we restore to, and how? Who decides?
- What to do about invasive species?
- What does restoration mean in a changing world? In natural vs. agricultural vs. urban areas?
- Why should we restore?
- Who will work on or restore a site, who will use it?
- How can restoration be sustainable?

We begin by focusing on how to use knowledge of ecosystem function to facilitate the recovery of disturbed and damaged ecosystems. We examine and discuss restoration projects through guest lectures from local practitioners of restoration ecology, use of case studies, and field work. We will discuss application of ecological principles to restoration design, implementation, and monitoring. Field exercises will be mostly at the Matthaei Botanical Gardens and Nichols Arboretum (MBGNA). Students will practice applying acquired skills through researching a restoration case study, and working in teams to develop a restoration and management plan for sites at Matthaei Botanical Gardens and Nichols Arboretum.

The course is structured as a theory & practice class that integrates concepts addressed in lecture with participation in related activities at MBGNA sites and projects as much as possible. Students do course-related activities each Wednesday that relates to MBGNA restoration work and does something useful for MBGNA (includes measuring/monitoring; burns/follow up and seed-collecting/cleaning). Activities will cover terrestrial, and aquatic system, has one module on First Nation's perspectives. Activities involve MBGNA personnel as guest lecturers and as “client” for the “Restoration Management Plan project (RMP)” to help lay the ground work for student teams to propose parts of restoration concepts/plans for specific areas. These potential projects will be presented to the students during Wednesday visits.

COURSE GOALS AND OBJECTIVES

- Understand ecological principles, philosophies, and sociopolitical aspects of restoration.
- Understand the importance of history of ecosystem use, reference conditions, and goals and objectives for ecological restoration planning.
- Become aware of difficulties associated with restoration.
- Develop common sense and a creative spirit.

The field activities will offer opportunities to

- Explore and assess local restoration projects at the MBGNA that demonstrate prairie, wetlands and riparian restoration, and agriculture and open space initiatives.
- Learn practical elements of restoration including planning, assessment, implementation, monitoring.
- Practice and learn techniques to implement restoration plans.

- Assess and present methods, results, and interpretation of restoration activities.

In addition, you will gain practical skills in ecological restoration and sustainable ecosystems through guest speaker presentations. You will...

- Interact with restoration experts from local organizations.
 - Volunteer for local restoration projects.
 - Develop a restoration and management plan for a local site
- Finally, this class will encourage you to reflect on how the interdisciplinary knowledge and skills nurtured throughout your PitE studies can be combined and focused to address the complex ecological, sociopolitical, and cultural aspects of ecological restoration.

COURSE MATERIALS

There are **no required texts** for the class. Pdfs of **course readings** (typically peer-reviewed articles and book chapters) will be posted on the Canvas course website. To facilitate class discussions, please read and come prepared to discuss materials on the day the reading is listed (that is, **do the reading before class**). A summary of the readings will be due electronically through Canvas before the start of class. Additionally several books are recommended for students who need to review concepts covered in class. The following books were placed on course reserve at the Shapiro Undergraduate Library.

- Apfelbaum, Steven I., and Alan Haney. 2010 *Restoring Ecological Health to Your Land*. Washington, DC: Island Press. ISBN 978-1-59726-571-3.
<http://islandpress.org/ip/books/book/islandpress/R/bo8041031.html>.
- Cole, David N. and Laurie Yung. 2010. *Beyond Naturalness: Rethinking Park and Wilderness Stewardship in an Era of Rapid Change*. Washington, DC: Island Press.
- Gobster, Paul H., and R. Bruce Hull. 2000. *Restoring Nature: Perspectives from the Social Sciences and Humanities*. Washington, DC: Island Press.
- Greipsson, Sigurdur. 2011. *Restoration Ecology*. Sudbury, MA: Jones & Bartlett Learning. ISBN-13: 9780763742195. <http://www.jblearning.com/catalog/9780763742195/>
- Howell, Evelyn A., John A. Harrington, and Stephen B. Glass. 2012. *Introduction to Restoration Ecology*. Washington, D.C.: Island Press.
- Izaak Walton League of America. 2006. *A handbook for stream enhancement & stewardship*. McDonald & Woodward Publishing Co. 2nd ed.
- Morrison, Michael L. 2009. *Restoring wildlife: ecological concepts and practical applications*. Washington, DC: Island Press. 2nd ed.
- Packard, Stephen, and Cornelia F. Mutel. 2005. *The Tallgrass Restoration Handbook for Prairies, Savannas, and Woodlands*. Washington, DC: Island Press. 2nd ed.

Links to useful documents

- Pesticide Applicators study materials and exam registration.
 Core Manual: <http://www.nasda.org/9381/Foundation/11379/11383/30485.aspx>
 Michigan Addendum to Core Manual: <http://www.scmac.org/PDF/MichiganAddendum.pdf>
 Right-Of-Way Manual: <http://www.nasda.org/File.aspx?id=3941>
 Exam Registration: <https://secure1.state.mi.us/opes/>
 Link to Tallgrass Prairie Restoration Handbook

<http://www.amazon.com/The-Tallgrass-Restoration-Handbook-Ecological/dp/1597260347>

For the Management Plan Project

MBGAN maps of cover-type and natural communities, plant lists, etc. as well as raw GIS data.

<http://www.lsa.umich.edu/mbg/see/gis/>

<http://www.lsa.umich.edu/mbg/see/Resources.asp>

Jeffrey Plakke thesis <http://deepblue.lib.umich.edu/handle/2027.42/61367>

COURSE REQUIREMENTS AND GRADING

- **Labs /Field work.** Wednesday work will be conducted at the Matthaei Botanical Gardens with participation of their faculty and staff and will include hands on restoration practice, some data gathering and analysis exercises. A later lab at Dana will include basic GIS and finding, compiling, and interpreting online data and maps.
- **Readings.** You will submit a summary of the assigned reading on Canvas before class on the day it is due. The length can be one to several paragraphs emphasizing the important take away lessons which can include thoughts you might have and find valuable to the class.
- **Case study project.** You will group in **pairs** and choose a restoration case study. You will research project background, goals, implementation and accomplishments. Final student groups and topic should be communicated to the instructors by **September 21st**. Your research outcome will be presented orally in class on Monday **November 4th** and should include images, diagrams, and visuals you find helpful for your talk. The team presentation should be kept to 5 minutes. There will be 2 minutes for questions.
- **Volunteer field work** (service learning). You will volunteer for local restoration projects (three hours) and write a 2 page report describing what you did and how it relates to concepts you learned in class. Students interested in aquatic ecosystems should join one of the Huron River Watershed Council HRWC programs (your contact is Jason Frenzel jfrenzel@hrwc.org) and students interested in terrestrial ecosystem should join one of the Natural Areas Preservation NAP programs (your contact is Tina Stephens tstephens@a2gov.org). The best option for the students to volunteer with HRWC would be at the River Roundup on Saturday, October 12. The work involves doing field work for Benthic Macro Invertebrate collection. Details will be given at the presentation in class on September 30th and you can also reach out to Jason for further information. Your report will have standard 1" margins, double-spaced, 11pt legible font submitted electronically on Canvas.
- **Outreach creative project.** You will work in pairs to write and illustrate a children's book to communicate in simple terms some aspect of the course content that particularly interests you and that you consider is a valuable lesson towards restoration ecology. The text should be just a short paragraph per page. Illustrations can be hand drawings, collage, computer generated, photographs etc. Think about how you might explain complex topics discussed in class in simple terms. How might your book help inspire the next generation of environmental stewards? Your children's book may be produced as a hard copy or as a digital file (power point, animation, etc.). Think beyond the box! Students will submit an electronic copy in Canvas and present the book to the class.
- **Design of a restoration management plan project.** You will work in teams of three students to develop a restoration plan for a site at the Matthaei Botanical Gardens and Nichols Arboretum. This offers some great opportunities for explorations of properties, data gathering and presentation. Data on the Natural Areas Data Resources page provide background. Cover type, natural communities and

FQI maps form a good framework for these management plans, but the plans are not completely developed yet. There is a need to refine maps, prioritization of areas and develop prescriptions and timelines for management. Jeffrey Plakke will serve as the “client”. Once students have selected the project topic and team, they will submit a short proposal description and schedule. Groups will write a report of 10 pages (double space with figures and references). The report includes a description of project background with an assessment of the issues, goals of envisioned restoration, monitoring plan needed, a description of how results will be evaluated in relationship to goals, literature review, and a reflection on skills each student brings to the project. A report draft will be distributed to another group for review so that suggestions can be incorporated into the final report. The draft report should be marked in track changes and general comments of maximum one page added at the end. Final reports are to be uploaded to Canvas by one team member. Groups will present their projects in class. The presentation will be of 15 min and there will be 5 min for questions. Students should choose how to divide the collective effort and acknowledge their respective roles.

- **Participation.** Taking part in class discussions and activities is vital to your learning.

Grading

ASSIGNMENT OVERVIEW	% of Grade
Field and lab exercises*	20
One page summary / entry in note book	
Paired Restoration Case Study	15
Oral Presentation	
Individual volunteer field work (service learning)	10
Volunteer service at restoration activities (min 3 hours) 2 page paper reflecting on service work	
Team project: restoration & management plan	30
Team contract Literature Review Project draft (10 pages) Presentation (15 minutes) Final project paper Response to comments Self and team evaluation	
Paired outreach & education project	10
Children picture book. Text and illustrations Presentation to the class.	
Class participation and readings	15
	100

Grading scale will be: A= >90% , B= 80–89%, C= 70–79%, D= 60–69% E <60%

Pluses and minuses are also used to recognize unusual class performance, including outstanding participation and continuous improvement throughout the semester.

COURSE POLICIES

Attendance and Participation: Attendance in class counts toward your participation grade. If you have more than two unexcused absences, your participation score will be reduced to zero. Attendance to labs is mandatory – students who miss more than two labs will be given a failing grade. For an absence to be “excused,” you must contact me and the GSI by email **before class**.

Lecture slides will be posted on CTools when guest speakers provide them. If you miss class, please review slides and speak with classmates about the material. If you are still unclear about what was covered in class, come to office hours to discuss it.

Deadlines: In case of extenuating circumstances, you must contact me **before** the due date to discuss whether accommodation will be possible.

Academic: If you have questions about proper citation and allowable use, bring up your questions in class so that we can review these issues together, or check with us for clarification. If you have questions about plagiarism, there are many sources that show proper use of citations and what constitutes plagiarism vs. allowable use. Please refer to these:

[Proper citation methods \(http://www.lib.umich.edu/shapiro-undergraduate-library/academic-integrity-resources-students\)](http://www.lib.umich.edu/shapiro-undergraduate-library/academic-integrity-resources-students)

[Types of plagiarism \(http://www.lib.umich.edu/shapiro-undergraduate-library/types-plagiarism\)](http://www.lib.umich.edu/shapiro-undergraduate-library/types-plagiarism)

[Examples of plagiarism \(http://www-personal.umich.edu/~mmanty/teaching/integrity2.html\)](http://www-personal.umich.edu/~mmanty/teaching/integrity2.html)

[LSA academic integrity \(http://www.lsa.umich.edu/academicintegrity/\)](http://www.lsa.umich.edu/academicintegrity/)

Written assignments should exhibit college-level quality writing: legible and proofread. If there are significant number of errors or if the paper is difficult to read, it will be returned to you for changes, with a recommendation that you consult the Sweetland Writing Center or work closely with teammates to improve writing. Alternatively, if you are concerned about the quality of your writing, you may submit a draft to us in advance for comments and suggestions.

RESOURCES

- **Be ready to interact with guest speakers as well as other students.**
- **Check Canvas for announcements, assignments, and additional resources.** Explore all resources for the class, as well as other printed or internet sources available through the library.
- **Course texts and supplemental readings will be available through Course Reserves.** Check with the Media Library on the 2nd floor of Shapiro. While we make many materials available on Canvas, we cannot provide lengthy sections of books.
- **Attend office hours** for more individualized attention about course issues.
- **Consult Sweetland Writing Center.** Remember that free, professional assistance with writing and revision is available Monday through Friday at the Sweetland Writing Center (764-0429; <http://www.lsa.umich.edu/swc/>). The Center offers various online writing guides (<http://www.lsa.umich.edu/sweetland/undergraduate/writingguides>) and in-person consultation (<http://www.lsa.umich.edu/sweetland/undergraduate/inpersonwritingsupport>).

Proposed Schedule—Lectures, Labs, Readings, Assignments

The proposed schedule may be modified according to weather or to reflect the need for more work in certain areas, or as other opportunities arise.

Labs are an integral part of this class, allowing you to gain on-the-ground experience in restoration.

Week	Date	Topic	Readings & Assignments in Canvas
1	Wed Sep 4 Lab	Introduction: What are we going to do this semester? Course Logistics, assignments. Visit Nichols Arboretum: restoration history, stream and terrestrial restoration with Eva Roos .	
2	Mon Sep 9	What is Ecological Restoration? An Overview	1. Apfelbaum & Hanley Chp1: Connecting with the Land. 2. Gobster & Hull Introduction: Restoring Nature: Human actions, interactions and reactions.
	Wed Sep 11 Lab	Introduction to Matthaei Botanical Gardens Guided tour and talk with Jeff Plakke . Description of areas for the Management Plan Project	1. Plakke, 2008. Thesis: Natural Areas Stewardship at the University of Michigan Matthaei Botanical Gardens and Nichols Arboretum - Read Introduction Submit lab report
3	Mon Sep 16	Terrestrial Restoration – Invasive Plants Presentation by Wes Bickford UM EEB/USGS Phragmites	1. Apfelbaum & Hanley Chp 2: Ecological Restoration: An overview 2. Apfelbaum & Hanley Pg. 99-103: Implementing Restoration 3. Cole & Yung Chp 10: Invasive Species Management Due: Case Study Team and Topic Proposal
	Wed Sep 18 Lab	Terrestrial Restoration- Native Plants Introduction by Michael Kost, Curator of Native Plants MBGNA - Seed Collection, cleaning, stratification Greenhouse operations, seed germination, plant propagation with Steve Parrish MBGNA/ Eva Roos	1. Howell et al. 2012 Chapter 6: The Master Plan 2. Check http://plantwiserestoration.com/ Sign up Management Plan Proposal topic Submit lab report.

Week	Date	Topic	Readings & Assignments
4	Mon 23 Sep	Terrestrial Restoration -Invasive Plants Controlled fire presentation by David Borneman , Natural Area Preservation City of Ann Arbor (NAP)	1. Howell et al. 2012 Chp 8: The Implementation Plan 2. http://restoringnaturewithfire.com/
	Wed Sep 25 Lab	Terrestrial Restoration -Monitoring Progress Field Work with Michael Kost, MBGNA Site evaluation, data collection and assessment	1. Apfelbaum & Hanley Chp. 6 Grassland Restoration 2. Apfelbaum & Hanley Chp. 7 Forest Restoration 3. Howell et al. Chapter 7: The Site Plan Due: Submit proposal Management Plan. Submit lab report.
5	Mon Sep 30	Restoration and People Role of NGOs & volunteers/ opportunities Jason Frenzel Huron River Stewardship Council (HRWC); Tina Stephens Natural Area Preservation City of Ann Arbor (NAP)	1. Bowles & Jones 2013. Repeated burning 2. Howell et al. 2012 Ch. 9: The Monitoring Plan 3. Pauly 1997. Handbook
	Wed Oct 2 Lab	Terrestrial Restoration – Native / Invasive Plants Nurseries and restoration presentation by Bill Schneider , Wildtype Nursery. Woody species removal, herbicides, regulations with Eva Roos	1. Herman et al. 2014 Native Plant Resources 2. Invasive Species Control Techniques.pdf 4. https://garlicmustardchallenge.wordpress.com/ Submit Lab report
6	Mon Oct 7	Aquatic Ecosystem Restoration Huron River Watershed Council (HRWC) Programs by Paul Steen, Watershed ecologist HRWC	1. Apfelbaum & Hanley Ch. 8:Wetland Restoration
	Wed Oct 9 Lab	Stream restoration Evaluation of dam effects by Paul Steen. Benthic Macro Invertebrates sampling bellow and above the dam in Fleming Creek.	1. Greipsson Chp 13 Restoration Ecology- Aquatic Ecosystems Submit lab report
7	Mon 14-Oct	STUDY BREAK: NO CLASS	
	Wed Oct 16 Lab	Aquatic Ecosystem Restoration Stream bank restoration and soft engineering Presentation by Marty Boote, Environmental Consulting & Technology (ECT) . Small, scaled-down demonstration, techniques used in Miller Creek to restore fish passage and control bank erosion, hydraulic and sediment transport.	1. Apfelbaum & Hanley Ch. 9: Stream Restoration 2. Palmer et al. River Restoration http://link.springer.com/chapter/10.1007/978-1-4614-7996-3_2/fulltext.html . Fleming Creek restoration project Due: Volunteer Work Report in Canvas Submit Oct lab report

Week	Date	Topic	Readings & Assignments
8	Mon Oct 21	Aquatic Ecosystem Restoration Watershed restoration – Case Study Great Lakes Crane Creek Lake Erie Presentation by Kurt Kowalsky, USGS.	1. Mitsch & Wilson 1996. Improving success
	Wed Oct 23 Lab	Wetland Restoration - Wildlife /Habitat. Eastern Massasauga rattlesnake, presentation by Steve Parrish, MBGNA , survey methods and ecological management practices. Consultation of Management Plan Project (if time allows)	1. Hallock_thesis_1990 for general information 2. MBG 2015 Massasauga Report.docx Due: Restoration Management Plan: Team Contract and Topic Submit lab report.
9	Mon Oct 28	Terrestrial Restoration Agriculture and restoration Presentation by Ivette Perfecto, SEAS – and Jeremy Moghtader Campus Farm	http://www.meetup.com/Washtenaw-Permaculture/events/222841043/ https://www.facebook.com/UMpermaculture
	Wed Oct 30 Lab	Agriculture and Restoration at Campus Farm Jeremy Moghtader MBGNA	Due: Restoration Management Plan: Literature Review Submit lab report.
10	Mon Nov 4	Student presentations Case Study	Due: Children’s Book Team Partner & Topic Proposal in Canvas
	Wed Nov 6 Lab	Alternative date: Prescribed burns- Steve Parrish, MBGNA Alternative Field Activity Stakeholders & Restoration at Botanical Gardens and Arboreta. Stakeholder Activity based on The Beholding Eye TBC	1. Meinig, The Beholding Eye Submit lab report.

Week	Date	Topic	Readings Assignments
11	Mon Nov 11	Urban Restoration – Huron River Dam Removal presentation by Julia Wondolleck, SNRE , and potentially walk to site	1. HRIMP_Plan_Final.pdf
	Wed Nov 13 Lab	Alternative date: Prescribed burns- Steve Parrish, MBGNA	1. Oldfield & Newton 2012: Tree Species Conservation 2. Hardwick et al. 2010: Botanical Gardens and Conservation Submit lab report.
12	Mon Nov 18	Urban Restoration – Community Engagement The Stewardship Network presentation by executive director Lisa Brush .	1. http://www.stewardshipnetwork.org/ 2. Grese et al. 2000. Volunteering 3. Monroe 2005. Tools to reach & educate
	Wed Nov 20	Alternative date: Prescribed burns- Alternative Field Activity Public Gardens and Restoration Botanical Gardens Conservation International, Presentation by Michael Kost and Mike Palmer MBGNA - Conservatory Observations	Due: Restoration Management Plan Draft, print out and bring to class
13	Mon Nov 25	Traditional Knowledge. Skype presentation by Scott Herron , Ferris Univ.	1.Hunt & Berkes 2003: Anishinaabe Perceptions 2.Fache & Moizo: Burning Practices and Indigenous Australia 1. Baer et al. 2005. Soil heterogeneity. Due: Restoration Management Plans Peer Edits
	Wed Nov 27	Thanksgiving day NO LAB	Thanksgiving day
14	Mon Dec 2	Wildlife Restoration Endangered Species - Great Lakes case study Cisco. Hacienda Chacabuco, Patagonia, Chile. Grassland to National Park. International case study	1.Greipsson 2011. Chp12 Endangered Animals. 2.Coblentz 1978.pdf Due: Children Book Project on Canvas, Electronic Version
	Wed Dec 4 On campus	Restoration and the Humanities. Presentation by David Choberka , UMMA Outreach and Teaching. Meet at UMMA entrance by UMMA Store. GIS Lab: aerial photos, soil and vegetation maps. Presentation by Shannon Brines SEAS and Maricela Avalos MBGA . Central Campus Computer Lab School of Education (Win, RM 2302)	Due: Final Restoration Management Plan Report in Canvas

Week	Date	Topic	Readings Assignments
15	Mon Dec 9	Children Book Project Student presentations Environmental grief & moving on	Children Book Project Student presentations
	Wed Dec 11	Management Plan Project Student Presentations	Management Plan Project Student Presentations
		Farewell Party	

List of suggested topics for Student Case Study project:¹

Local/Regional

- Black ash and the emerald ash borer
- Monarch butterflies/ milkweeds
- Bees
- Wolves in Yellowstone

International

- Coral reefs
- Deforestation Red Cross Program, Palm oil

Aspects to consider for the project are the origin and background of the issue, consequences, restoration actions, results, social implications.

¹