NRE 589 Ecological Restoration
Winter Term 2015 • 3 Credits
Lectures: Tu/Th 10-11:30am, 2024 Dana
Labs: Th 2:30-5:30pm, 2024 Dana

Ecological restoration, allied with the creation of ecosystem-scale wilderness reserves, represents the main hope that the organic quality of wilderness may someday be resurrected in human souls and in all life-places on planet Earth. -- Stephanie Mills, In Service of the Wild

Description. Restoration ecology is a relatively new discipline that integrates principles from ecology, engineering, economics, landscape architecture, and select social sciences to repair ecosystems that have been degraded, damaged, or destroyed. The goal is to restore the structure of biological communities and the ecological functions and ecosystems services they provide. This course will cover advanced topics in ecological restoration for graduate students (M.L.A., M.S. and Ph.D.) who see themselves practicing or participating in restoration projects during their careers. Using a combination of lectures, readings, field trips, and project work, we will cover the conceptual and theoretical foundations that underlie restoration efforts, and link these to the real-world applications in past and ongoing restoration projects. We will take advantage of projects ongoing in Michigan and the upper Midwest to reinforce principles discussed in class.

Objectives
- Understand the philosophies and ecological principles of restoration efforts.
- Evaluate current management practices and technique that are used in restoration projects.
- Learn the practical elements of restoration planning, include site assessment, implementation, monitoring and adaptive management.
- Become aware of the current uncertainties and ongoing controversies in restoration ecology.

Instructors
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Prerequisites. Students must have taken (a) NRE 509 (Ecology) … or … (b) NRE 436 (woody plants) with either NRE 430 (soil ecology) or NRE 547 (forest ecology) … or … (c) an equivalent course sequence in ecology. We will assume that students in this class are proficient with all topics covered in the
introductory ecology text Stiling, Peter. 2014. *Ecology: Global Insights and Investigations*, 2nd edition. McGraw Hill. In addition, we will assume students have an equivalent of college-level algebra, and are familiar with basic statistics (distributions, probabilities, how to calculate means/variances, t-tests, least squares regression, etc.). For those who need to brush up, we would be happy to recommend refresher tutorials upon request.

**Course readings.** Pdfs of required readings for each lecture discussion will be posted on CTools ([https://ctools.umich.edu](https://ctools.umich.edu)) in advance of class. Students will need to read these materials prior to class to prepare for discussion, and students will be tested on these readings on the final exam. There is no required textbook for this course; however, we do recommend several texts for students who need extra help with the concepts covered in this class:


**Course expectations**

*Attendance.** Attendance in lecture is strongly encouraged, as we will cover material in class that students will not be able to get from any other source. **Attendance in labs is mandatory.** Any student who misses two or more labs will be given a failing grade for the course.

*Class etiquette.*** Please turn cell phones off at the beginning of each class. Put away all computers during lectures and do not web surf or email during class.

*Academic integrity.*** We will adhere to the University of Michigan’s Policy Statement on Academic Integrity, which students are responsible for reading and understanding [https://ctools.umich.edu](https://ctools.umich.edu).

*Late & make-up policy.*** Deadlines will be strictly enforced, and late work will have grades penalized at 10% per day. Extensions to deadlines will only be granted for those who provide documentation of a valid, university approved excuse.

**Grading.** The grading scale will be A = 90-100%, B = 80-89.9%, C = 70-79.9%, D = 60-69.9%. We reserve the right to curve grades upward at the end of the semester; however, this grading scale gives the minimum percentages required for students to assure themselves of a particular grade. Grades will be assigned based on student performance in the four categories outlined below.

1. **Class discussions** (100 pts): The goal of discussion is reinforce points made in lecture with real-life examples, and help students develop an understanding of contemporary issues and controversies in restoration. Discussions are student led, with points divided into two parts:
Lead a discussion (50 pts). Students will be assigned to a discussion and lecture date. Each student/team will be responsible for ...

- Thoroughly reading and understanding the paper associated with lecture.
- Posting 3-5 discussion questions on the course website 3-days before discussion.
- Providing a concise (5 min) summary at the beginning of discussion.
- Leading a lively and engaging class discussion.

Participation (50 pts). Each student is responsible for coming to class having read the assigned paper or material, with answers to the discussion questions ready, and with additional questions or comments. Participation will be monitored and graded.

2. Design a restoration project (150 pts). Working in groups of 2-4, students will choose a degraded local habitat in need of restoration, visit the site, and then design a restoration plan.

Written report (100 pts). Each group will write a 10-page report with the following components: (1) assessment of the problem, (2) statement of restoration goals/targets, (3) restoration plan describing what should be done, (4) a description of the monitoring plan. Grades will be assigned based on the completeness and detail of the project design, and ability to integrate principles discussed in lecture and lab to the restoration proposal. Proposals are due on Tuesday, 14-Apr by 5:00pm EST. Proposals must be uploaded to the CTools DropBox using the name of one team member (preferably the first author). More details about expectations for the project will be provided in class.

Class presentations (50 pts). Groups will present their restoration proposal in a 15-min talk at the end of the semester. Grades will be assigned based on the clarity and professionalism of the presentation, and the ability to convincingly justify the restoration proposal. A copy of your PowerPoint presentation must be uploaded to the CTools DropBox using the name of one team member (preferably the first author).

3. Final Exam (100 pts). The final exam will cover all content of lectures and reading assignments. Format will include multiple-choice, true/false, short answer, calculations, and essay questions.

4. Laboratory (300 pts, 12 lab exercises x 25 pts. each). Students must read assigned materials prior to coming to lab. Although students should be able to complete most laboratory exercises within the allotted 3-hr time slot, lab write-ups are due by 2:00pm EST the week following each lab, and must be uploaded to the student’s CTools DropBox. For example, the write-up for the Scale Detection lab on 15-Jan must be uploaded to the CTools DropBox by 2pm EST on 22-Jan.
**Course Schedule**

<table>
<thead>
<tr>
<th>Date</th>
<th>Lecture Topic</th>
<th>Readings</th>
<th>Who</th>
<th>Lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>Th, Jan-8</td>
<td>Intro to ecological restoration</td>
<td>[1, 2][1], [3-5]</td>
<td>Cardinale/Grese</td>
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<tr>
<td>Tu, Jan-13</td>
<td>Assumptions, targets, &amp; goals</td>
<td>[6][2], [7-12]</td>
<td>Cardinale</td>
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<tr>
<td>Th, Jan-15</td>
<td>Matching appropriate scales</td>
<td>[13][3], [14, 15]</td>
<td>Cardinale</td>
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<tr>
<td>Tu, Jan-20</td>
<td>Mitigating habitat loss</td>
<td>[16][4], [17-19]</td>
<td>Cardinale</td>
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<tr>
<td>Th, Jan-22</td>
<td>Creating ecological heterogeneity</td>
<td>[20, 21][5], [22-24]</td>
<td>Cardinale</td>
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<tr>
<td>Tu, Jan-27</td>
<td>Managing invasive species</td>
<td>[25][6], [26-28]</td>
<td>Cardinale</td>
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<tr>
<td>Th, Jan-29</td>
<td>Re-establishing natural variation</td>
<td>[29, 30][7], [31-33]</td>
<td>Cardinale</td>
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<tr>
<td>Tu, Feb-3</td>
<td>Establishing suitable habitat</td>
<td>[34][8], [35-37]</td>
<td>Cardinale</td>
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<tr>
<td>Th, Feb-5</td>
<td>Project design and management</td>
<td>[38-40][9], [41]</td>
<td>Grese</td>
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<tr>
<td>Tu, Feb-10</td>
<td>Regulations and policy</td>
<td>[42, 43][10], [44, 45]</td>
<td>Grese</td>
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<tr>
<td>Th, Feb-12</td>
<td>Project evaluation</td>
<td>[46][11], [47]</td>
<td>Cardinale</td>
<td></td>
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<tr>
<td>Tu, Feb-17</td>
<td>Forest restoration</td>
<td>[48-50][12], [51]</td>
<td>Grese</td>
<td></td>
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<tr>
<td>Th, Feb-19</td>
<td>Grassland restoration</td>
<td>[52-55][13], [56]</td>
<td>Grese</td>
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<tr>
<td>Tu, Feb-24</td>
<td>Stream restoration</td>
<td>[57][14], [58-60]</td>
<td>Cardinale</td>
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<tr>
<td>Th, Feb-26</td>
<td>Lake &amp; wetland restoration</td>
<td>[61][15], [62, 63]</td>
<td>Cardinale</td>
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<tr>
<td><strong>Break</strong></td>
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<tr>
<td>Tu, Mar-10</td>
<td>Aesthetics and design</td>
<td>[64-66][16], [67-70]</td>
<td>Grese</td>
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<tr>
<td>Th, Mar-12</td>
<td>Horticulture for restoration</td>
<td>[71-73][17], [74]</td>
<td>Bill Schneider</td>
<td>Restoration site design</td>
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<tr>
<td>Tu, Mar-17</td>
<td>Botanical gardens &amp; arboreta</td>
<td>[75, 76][18], [77, 78]</td>
<td>Grese</td>
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<tr>
<td>Th, Mar-19</td>
<td>Captive breeding, stocking &amp; reintroductions</td>
<td>[79][19], [80-84]</td>
<td>Cardinale</td>
<td></td>
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<tr>
<td>Tu, Mar-24</td>
<td>Volunteers in restoration</td>
<td>[85-87][20]</td>
<td>Grese</td>
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<tr>
<td>Th, Mar-26</td>
<td>Prescribed burns</td>
<td>[88-90][21], [91]</td>
<td>Grese</td>
<td></td>
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<tr>
<td>Tu, Mar-31</td>
<td>Controlling invasive species</td>
<td>[92-94][22], [95, 96]</td>
<td>Grese</td>
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### Part 4. Case studies*

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Location</th>
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<tbody>
<tr>
<td>Th, Apr-2</td>
<td>Guest lecture 1</td>
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<tr>
<td>Tu, Apr-7</td>
<td>Guest lecture 2</td>
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<tr>
<td>Th, Apr-9</td>
<td>Guest lecture 3</td>
<td>Field trip: Prescribed burn</td>
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<tr>
<td>Tu, Apr-14</td>
<td>TBD</td>
<td>Field trip: Matthaei Botanical Gardens (alt. burn)</td>
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### Part 5. Student projects

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<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Location</th>
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<tbody>
<tr>
<td>Th, Apr-16</td>
<td>Project presentations</td>
<td>Field trip: Urban stream restoration</td>
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<tr>
<td>Tu, Apr-21</td>
<td>Project presentations</td>
<td></td>
</tr>
<tr>
<td>Tu, Apr-28</td>
<td>Exam</td>
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*required readings for lecture discussion
Reading list

†required readings for each lecture discussion are note on course schedule. Pdfs of the required readings will be posted on the class CTools website.


