

NREM 682 - RESTORATION ECOLOGY (CRN 79302)

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Course website: www.ctahr.hawaii.edu/LittonC/teaching.html
CLASS HOURS: T 1:30 – 4:00 p.m. (Sherman 111)
OFFICE HOURS: M 11:00 – 12:00 noon (or by appointment)

COURSE OVERVIEW

This is a 3-credit graduate-level course that explores the foundations of restoration ecology, and how ecological theory is used to inform ecological restoration. Restoration ecology is the scientific discipline of developing and/or applying theory to guide ecological restoration. It requires *a priori* knowledge of ecological theory, and provides the basis for the application of this theory to “design” or modify ecological systems that have been degraded, damaged or destroyed. In this class, the application of ecological principles for restoring Hawaiian and other island and continental ecosystems will be considered.

PREREQUISITES

Graduate standing. Completion of an upper-division undergraduate or graduate-level Ecology course highly recommended.

READINGS

Required Textbook: Falk, D.A., Palmer, M.A. and Zedler, J.B., eds. 2006.
Foundations of Restoration Ecology. Island Press, Washington, DC, USA.

Supplemental Reading: (1) The Society for Ecological Restoration website (http://www.ser.org/reading_resources.asp), including *SER International Primer on Ecological Restoration*, and *Guidelines for Developing and Managing Ecological Restoration Projects*, (2) individual journal articles or book chapters available as PDFs on the course website, via email, or as electronic resources thru the library.

STUDENT LEARNING OBJECTIVES

Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed (SER, 2004). Restoration ecology, in turn, provides the theoretical principles underpinning ecological restoration. Through completion of NREM 682 students will: (**i**) understand the basic theoretical underpinnings of restoration ecology; (**ii**) understand how ecological principles are applied to restore ecological systems; and (**iii**) demonstrate understanding and competency in:

1. The historical development & empirical foundations of restoration ecology
2. The role & value of science in restoration ecology/ecological restoration
3. Use of reference ecosystems as endpoints for ecological restoration
4. How ecological principles from population biology, community ecology, soil science, ecosystem ecology, and landscape ecology are used to inform ecological restoration
5. Current & future research foci & needs in restoration ecology/ecological restoration

COURSE STRUCTURE

Class attendance is mandatory. All students are expected to read required materials prior to class, and be prepared to critically analyze, ask questions, and discuss the assigned topics and literature for that day. Students are responsible for obtaining readings, notes, & handouts from the instructor, their classmates and/or the course website, and for keeping track of all assignments and due dates.

A typical week will include the first ½ of class devoted to the discussion of assigned readings and a “lecture” (i.e., online slides viewed by students before class) that is based on the assigned readings and supplemented with additional information from the primary and secondary literature. This format is often referred to as a “flipped classroom”, and in this class the lecture material is meant to provide a basis for understanding the foundations and principles of restoration ecology. The second ½ of class will consist of a discussion of peer-reviewed literature on the week’s topic, where students will read one article assigned by the instructor and one article of their choosing on the overall topic. Expectations of the various components of a typical week’s class include (also see *Guidelines* on p. 6-8):

- (i) “Lecture” Preparation:** read assigned readings, study online lecture slides, prepare a bullet list of the 5 most important highlights/take-home points (*to be emailed to the instructor prior to each class*), and come prepared to discuss, analyze, and ask questions.
- (ii) Article Discussion Preparation:** read article assigned by instructor, choose and read additional article on overall topic, prepare an article summary on the article you select (*to be emailed to the instructor prior to each class*), and come prepared to discuss, analyze, and ask questions, including incorporating information and ideas into the discussion from the article you select.

STUDENT EVALUATION

Grading will be assessed based on 5 categories: (i) weekly “lecture” discussion participation, (ii) weekly “lecture” highlights write-up, (iii) weekly “article” discussion participation, (iv) weekly “article” summary, and (v) a comprehensive final exam.

Activity	Frequency	% of Grade
“Lecture” Discussion Participation*	~Weekly	25
“Lecture” Highlights Write-Ups	~Weekly	10
Article Discussion Participation*	~Weekly	25
Article Summary	~Weekly	20
Final Exam	1x	20

*Participation will be based on attendance, attitude, and, in particular, active engagement in lecture and article-based discussions throughout the semester. Receiving a good grade in this class should not be very difficult if you do the work outside of class, come prepared, and participate actively.

Grading Scale

A+	$x \geq 97\%$	B+	$90 > x \geq 87$	C+	$80 > x \geq 77$	D+	$70 > x \geq 67$
A	$97 > x \geq 94$	B	$87 > x \geq 84$	C	$77 > x \geq 74$	D	$67 > x \geq 64$
A-	$94 > x \geq 90$	B-	$84 > x \geq 80$	C-	$74 > x \geq 70$	F	$x < 64\%$

COURSE EXPECTATIONS

Students: Students are expected to: **(i)** come to class each week on time; **(ii)** complete assignments (i.e., review lecture slides and read assignments) prior to each class and come prepared to participate; **(iii)** be respectful of fellow students and the instructor during class activities; and **(iv)** be an active participant in all class activities.

Instructor: The primary responsibility of the instructor is to make the course useful and, ideally, enjoyable. The instructor will: **(i)** be punctual, prepared, and enthusiastic; **(ii)** communicate clearly the course objectives, policies, and assignments; **(iii)** listen carefully to questions and concerns; **(iv)** grade assignments fairly and return them in a timely manner; and **(v)** be available to provide assistance during office hours (or by appointment).

ACADEMIC INTEGRITY

Students are expected to conduct themselves with the utmost integrity. The *University of Hawai'i at Mānoa Student Conduct Code* defines cheating and plagiarism as follows:

CHEATING includes, but is not limited to: (1) use of any unauthorized assistance in taking quizzes, tests, or examinations; (2) use of sources beyond those authorized by the instructor in writing papers, preparing reports, solving problems, or carrying out other assignments; (3) the acquisition, without permission, of tests or other academic material belonging to a member of the UH faculty, staff or student; (4) engaging in any behavior specifically prohibited by a faculty member in the course syllabus or class discussion.

PLAGIARISM includes, but is not limited to, the use, by paraphrase or direct quotation, of the published or unpublished work of another person without full and clear acknowledgement. It also includes the unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic materials.

If you ever have any questions about what constitutes fair academic play, please come and talk to the instructor. *Cheating or plagiarism will result in an F for your final grade in the course.* It may also lead to other serious academic repercussions (see *UH Mānoa Student Conduct Code*; http://studentaffairs.manoa.hawaii.edu/policies/conduct_code/).

ACCOMMODATIONS FOR DISABILITIES

If you feel you need reasonable accommodations because of the impact of a disability, please: **(1)** contact the KOKUA Program at 956-7511 or 956-7612 in room 013 of the Queen Lili'uokalani Center for Student Services; and **(2)** if possible, speak with the instructor privately to discuss your specific needs. I will be happy to work with you and/or the KOKUA Program to meet access needs related to any disability.

FINAL CAVEAT

All material on this syllabus is subject to change at the discretion of the instructor to suit the needs of the course.

COURSE SCHEDULE

Week (Date)	Topic / Reading Assignment*
1 (8/25)	Course Introduction (quiz; introduction to course content and format; discussion of expectations; course guidelines; etc.)
2 (9/1)	Foundations of restoration ecology (definitions; historical context; what is “natural”?; what are we trying to restore?; “reference ecosystems”; restoration ecology vs. ecological restoration) <u>Lecture:</u> (i) <i>Ch. 1: Ecological theory and restoration ecology</i> ; (ii) <i>SER International Primer on Ecological Restoration</i> (http://www.ser.org/docs/default-document-library/english.pdf); and (iii) <i>SER Guidelines for Developing and Managing Ecological Restoration Projects</i> (http://www.ser.org/docs/default-document-library/ser_international_guidelines.pdf)
3 (9/8)	What is the role of science in ecological restoration? <u>In-class Debate;</u> Readings: (i) Cabin 2007. Science-driven restoration: A square grid on a round earth? <i>Restoration Ecology</i> 15:1-7; (ii) Giardina <i>et al.</i> 2007. Science driven restoration: A candle in a demon-haunted world - Response to Cabin (2007). <i>Restoration Ecology</i> 15:171-176; (iii) Cabin, R.J., 2007. Science and restoration under a big, demon haunted tent: Reply to Giardina <i>et al.</i> (2007). <i>Restoration Ecology</i> 15: 377-381; and (iv) an article addressing this general topic that you find.
4 (9/15)	Population biology in a restoration context (populations and metapopulations; minimum viable population size; population genetics) <u>Lecture Discussion:</u> (i) <i>Ch. 4: Implications of population dynamic and metapopulation theory for restoration</i> ; and (ii) <i>Ch. 2: Population and ecological genetics in restoration ecology</i> <u>Article Discussion:</u> TBA + an article addressing this general topic that you find
5 (9/22)	Community ecology in a restoration context (environmental filters; competition and biotic interactions; diversity effects) <u>Lecture Discussion:</u> <i>Ch. 5: Restoring ecological communities: from theory to practice</i> <u>Article Discussion:</u> TBA + an article addressing this general topic that you find
6 (9/29)	Succession in a restoration context (primary and secondary succession; multiple states and alternative trajectories; natural disturbance regimes) <u>Lecture:</u> <i>Ch. 9: The dynamic nature of ecological systems: Multiple states and restoration trajectories</i> <u>Article Discussion:</u> TBA + an article addressing this general topic that you find
7 (10/6)	Plant physiological ecology in a restoration context (resource capture and use; adaptations to stress) <u>Lecture:</u> <i>Ch. 3: Ecophysiological constraints on plant responses in a restoration setting</i> <u>Article Discussion:</u> TBA + an article addressing this general topic that you find

*All assigned Chapter readings from Falk *et al.* (2006) unless otherwise noted

- 8 (10/13) Soils and belowground ecology from a restoration perspective** (topography; soil physical, chemical and biological properties)
Lecture: *Ch. 7: Topographic heterogeneity theory and ecological restoration*
Article Discussion: TBA + an article addressing this general topic that you find
- 9 (10/20) Ecosystem ecology in a restoration context** (nutrient cycling; productivity; ecosystem services; measuring success in restoration)
Lecture: *Ch. 10: Biodiversity and ecosystem functioning in restored ecosystems: extracting principles for a synthetic perspective*
Article Discussion: TBA + an article addressing this general topic that you find
- 10 (10/27) No Class**
- 11 (11/3) Invasive species in a restoration context** (integration of a variety of issues in the context of nonnative invasions and restoration)
Lecture: *Ch. 12: Using ecological theory to manage or restore ecosystems affected by invasive plant species*
Article Discussion: TBA + an article addressing this general topic that you find
- 12 (11/10) Global change biology in a restoration context** (integration of a variety of issues in the context of global climate change, N deposition, & increased atmospheric CO₂)
Lecture: *Ch. 15: Climate change and paleoecology: New contexts for restoration ecology*
Article Discussion: TBA + an article addressing this general topic that you find
- 13 (11/17) Restoration from a landscape perspective** (integration of a variety of issues at landscape and regional scales)
Lecture: *Ch. 14: Ecological restoration from a macroscopic perspective*
Article Discussion: TBA + an article addressing this general topic that you find
- 14 (11/24) No Class**
- 15 (12/1) Restoration from an Entomology &/or Wildlife Perspective** (explicit consideration of insects &/or animals in an otherwise plant-centric restoration ecology course)
Lecture: TBA
Article Discussion: TBA + an article addressing this general topic that you find
- 16 (12/8) Final Exam Review**
- 17 (12/15) Final Exam** (12:00-2:00 p.m. in Sherman 111)

GUIDELINES

“Lecture” Discussion Participation (25%)

For each week of lecture, come prepared to discuss the assigned lecture slides/readings. Most important point here is to not be shy. Participation simple means that you actively engage in discussion. It does not mean that you have to make the most profound statement of the day, or that you have to be an expert on the topic. Asking questions is a perfectly acceptable way to participate in discussions. So is answering questions, be they from me or your fellow classmates. But you have to speak up to participate, which means you need to come prepared to discuss that week’s topic (i.e., you need to have viewed and thought about the slides, and done the assigned readings). And whatever you have to say should be directly related to the overall topic for the week (i.e., telling us what incredibly cute thing your cat did the night before won’t cut it). Speaking up during the “highlights/take-home points” portion of the “lecture” discussion (see next point) is part of this assignment.

Weekly Lecture Highlights/Take-home Points (10%)

This should be an easy 10% of your final grade. Alternatively, you can blow this off and set yourself back one letter grade. This weekly assignment should be based on the online lecture slides and assigned lecture readings. Email the instructor, prior to the beginning of each class, a bullet (or numbered) list of the 5 most important highlights or take-home points from that week’s lecture material. When completing this assignment, determine what you feel are the five most critical ideas that should be taken away from the week’s topic. We will discuss these highlights as a class each week. There is no “right answer” for this assignment, and I fully expect people’s lists to differ.

Each highlight/take-home point should be no less than 1 complete sentence and no more than 3 complete sentences. Here is an example for week #2 (which is the longest any of these should be):

- *A reference ecosystem is the baseline used for designing ecological restoration projects, and monitoring their success over time. Because ecological systems are not static over time, a reference endpoint is seldom a single point in space or time, but rather should be considered as a range of desirable conditions or outcomes. One way to approach this is to establish a reference endpoint that is actually a range of possible outcomes based on the concept of historic range of variability (HRV).*

Article Discussion Participation (25%)

See text above under “Lecture” Discussion Participation. Same goes for the Article Discussion participation. Remember that you will read two articles, one that the instructor assigns and an additional article that you select on the overall topic. Since you are likely the only person to have read the article that you selected, you should be prepared to bring that into the discussion where appropriate. This does not mean having a prepared 15 minute presentation on the article, as there is not enough time for everyone to do that. Rather you will need to determine the proper time to bring information from that article into the discussion. It is perfectly fine if the opportunity never arises to bring your additional article into the conversation as long as you are participating actively in the discussion. But you will have read it and written a summary on it (see next point), so try to talk about it.

Article Summary (20%)

Each week that we have an article discussion, you will provide a summary of the additional article that you select on the overall topic. You are NOT required to do a summary of the article that the instructor selects. Email the instructor, prior to the beginning of each class: (i) your summary of the discussion article that you select for that week as a PDF, and (ii) the selected article as a PDF.

The purpose of this assignment is for you to summarize your selected reading to help prepare you to be an active participant in discussion. **Your summary should be typed in 12-point Times New Roman font, with 1 inch margins, double spacing, and should be at least 1 page but should not exceed 2 pages in length.** Address all 6 of the questions in your summary in chronological order. Do not restate the questions. You will have to be concise to fit all of this into no more than 2 pages.

1) Supply the following information at the top of the first page:

Name:

Date:

Author(s) & Date: (e.g., Vitousek, P.M., H.A. Mooney, J. Lubchenco, and J.M. Melillo, 1997)

Paper Title: (e.g., Human domination of earth's ecosystems)

Journal Information: (e.g., Science 277:494-499)

2) Address the following questions in the 1st paragraph (~1/2 of the 1st page) (25%):

- | |
|--|
| <ol style="list-style-type: none">1. What was the main objective(s) of the paper?2. What were the key methods/approaches taken to address the objective(s)?3. What were the most important results and conclusions of the study? |
|--|

3) Address the following questions in the following paragraph(s) (75%):

- | |
|---|
| <ol style="list-style-type: none">4. Did the paper meet the stated objective(s)? Why/why not?5. How well does the paper align with the week's overall topic? What other topics, if any, does it address?6. Was information presented that is novel and of interest to the field of restoration ecology (i.e., how useful is the information presented to restoration ecology as a whole)? |
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Article Summary Grading Rubric

10/10 = An outstanding summary that follows all instructions correctly, is well crafted and free of grammatical errors, succinctly addresses all questions, and provides a thoughtful and appropriate summary of the paper.

9/10 = A very good summary that follows all instructions correctly, is well crafted and mostly free of grammatical errors, succinctly answers all questions, and provides a reasonable and appropriate summary of the paper.

8/10 = A good summary that follows most instructions correctly, has some writing and grammatical errors, answers most questions clearly, and provides a decent summary of the paper.

7/10 = An average summary that follows most instructions correctly, has writing and grammatical errors, does not answer all questions clearly, and provides a mediocre summary of the paper.

6/10 = A below average summary that does not follow most instructions, has writing and grammatical errors throughout, does not answer all questions clearly, and provides a poor summary of the paper.

≤5/10 = A really poor overall summary.