Syllabus

WILD 4700, Ecological Foundations of Restoration

Spring 2009

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Class: TR, 12:00-1:15+, BNR 314

Office Hours: MWF, 10:30-11:30; TR, 11:00-11:50 (except for occasional emergency absences)

If you can not come at this time, make an appointment after class, by phone, or by e-mail. *Please note that my e-mail is for notifying me in emergencies and for making appointments, not as a substitute for office visits.*

Format: Two 75-min "lectures" per week. Although most of these will indeed be lectures, some periods may be devoted to other activities such as working on collaborative projects, etc.

Objectives: This course is designed to build on basic ecological knowledge developed in "*General Ecology*" (NR/Biol 2220) and to complement the more applied knowledge obtained in "*Vegetation and Habitat Management*" (WILD 3850). Specific objectives are:

1) To develop an advanced understanding of principles of basic plant ecology relevant to the restoration of healthy and functioning natural ecosystems, with an emphasis on issues relevant to establishment, survival, growth, and reproduction of plants.

2) To develop an ability to integrate information across levels of ecological organization (e.g., links between ecosystem function and plant establishment) and across temporal and spatial scales (e.g., effects of short-term climatic changes on long-lived species).

3) To gain an understanding of how ecological information can improve restoration decisions and explain restoration failures.

See "Specific Learning Objectives" below.

Readings:
Text: Lectures will not come directly from the textbook, but the book will be a core component of this class and must be read.

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

Supplemental Printed Materials: Readings from journals and book chapters will be assigned at times throughout the semester to supplement lecture material and to provide "case studies." These publications will be available as pdfs on electronic reserve. To access electronic reserve:

1) Go to <http://eres.usu.edu/courseindex.asp>
2) Search by either Insturctor Name, Course Name, or Course Number
3) Click on this class (WILD 4700)
4) Type in the password (**sch4700**)
5) Click on the material wanted
6) Then you can read it or, preferably, print it out

Required Electronic Resource:
"*The SER Primer on Ecological Restoration*" (15 pp), found at http://www.ser.org/, the web site of the Society for Ecological Restoration (click on "reading" and you'll find a link to the pdf). Print it, read it, and keep it in mind throughout the course.

Electronic Resources To Be Aware Of:
"Clewell, A., J. Rieger, and J. Munro. December 2005. Society for Ecological Restoration International: Guidelines for Developing and Managing Ecological Restoration Projects, 2nd Edition." Find the same way as the *Primer*.

"Monsen, Stephen B.; Stevens, Richard; Shaw, Nancy L., compilers. 2004. Restoring western ranges and wildlands. Gen. Tech. Rep. RMRS-GTR-136, 3 volumes. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. Pages 1–294 (Vol I), Pages 295–698 (Vol II), Pages 699–884 (Vol III)." Available as a pdf file at http://www.fs.fed.us/rm/pubs/rmrs_gtr136.html or a hard copy can be ordered from the Rocky Mountain Research Station site.

Student Evaluation: Assessment of student performance will be based on two exams and on a final group presentation. There will also *probably* be one or more opportunistic short writing assignments.

Exams will be in class and will emphasize short essay questions that focus on integration of material rather than regurgitation; in particular, there will be a focus on the application of ecological principles to restoration problems, goals, etc. There will not be a final – presentations of the final group projects will be in lieu of a written final.

Writing assignments, if we have them, will be based on Ecology Center and/or Departmental seminars, extra readings, etc.

Group presentations will be by PowerPoint and will be presented at the end of the semester – I will assign groups and a topic *fairly* early in the semester, although most of the work will be later in the course after more material has been covered.

Exams will be worth 100 points each. The final presentation will be worth 100 points. Any writing assignments we might have will be worth 30 points each.

Grading will be based on a 90–100% = A, 80–89% = B, etc. scale. Depending on scores, these cutoffs may be shifted slightly up or down, but not by much.

Academic (Dis)honesty: This course will have zero tolerance of cheating and plagiarism. Read and believe the statement on "Academic Integrity – The Honor System" (http://www.usu.edu/policies/PDF/Acad-Integrity.pdf). If you have any question about what constitutes academic dishonesty, or what the consequences of dishonesty may be, see Article V, Section V-3, and Article VI, Section VI-5 of the USU Student Code (http://www.usu.edu/studentservices/studentcode/). In brief, academic dishonesty is not only grounds for failing the course, but potentially for being expelled from the University.

Students With Disabilities: If you have any disability that requires accommodation, such as the use of a reader, scribe, interpreter, alternatives to print media (e.g., Braille, large print, or audio format), or extra time for exams, the University and I are more than happy to accommodate you to the fullest extent possible. You must, however, document your disability and needs at the Disability Resource Center in University Inn 101 and talk to me as soon as possible.

FRWS 4700 Specific Learning Objectives

Students will learn:

1. The philosophical and empirical foundations of the field of restoration ecology and differences with conservation biology

2. The concept of reference ecosystems and how we select a reference ecosystem as a model for restoration

3. The basics of soil science and other abiotic components from the perspective of plant establishment and growth and the restoration of functioning ecosystems

4. Plant genetic concepts relevant to restoration, including genetic variability, natural selection, genetic drift, genetic bottlenecks, inbreeding and outbreeding depression, site adaptation, and the selection of restoration materials

5. Relevant knowledge of photosynthesis and energy flow in ecosystems, with an emphasis on environmental factors influencing photosynthetic rates and the importance of local adaptation of photosynthesis to the environment

6. The basics of decomposition and nutrient cycling, especially aspects of the soil carbon cycle and the nitrogen cycle relevant to the ecology of plant establishment and success

7. Fundamental changes in ecosystem processes caused by vegetation change, especially how ecosystem-level changes induced by weed invasions may influence the success of desirable plant establishment and restoration

8. The ecology of seeds and seedlings relevant to restoration of degraded ecosystems, including seed dormancy, seed banks, the influence of seed bed conditions on seedling establishment, and evolution of germination strategies in response to environmental variation

9. The ecological effects of plant-plant interactions on the establishment, initial development and long term succession of restored ecosystems, including intraspecific competition, interspecific competition, allelopathy, and facilitation

10. The ecological effects of plant-animal interactions on the establishment, initial development and long term succession of restored ecosystems, including seed dispersal, seed predation, and herbivory

11. The relationships among species richness, ecosystem stability, and invasion by exotic weeds

TENTATIVE **Course Outline**

Week(s)	Topic
5 Jan 12 Jan	**Foundations** definitions; what is "natural?"; what are we trying to restore?; "reference communities" as restoration models; historic and future climate change *Chapter 1, Ecological theory and restoration ecology* *Chapter 15, Climate change and paleoecology: new contexts for restoration ecology*
19 Jan	**Soils and landscapes from a restoration perspective** topographic effects/topographic heterogeneity; review of soil structure and chemistry relevant to plant establishment; nutrient availability and redistribution; water infiltration/soil erosion *Chapter 7, Topographic heterogeneity theory and ecological restoration*
26 Jan	**Genetic considerations for restoration** genetic variation, plasticity, and adaptation; seed source considerations; natural selection and evolution *Chapter 2, Population and ecological genetics in restoration ecology* *Chapter 6, Evolutionary restoration ecology*
2 Feb	**Plant physiological ecology and restoration** resource capture and use; adaptations to stress *Chapter 3, Ecophysiological constraints on plant responses in a restoration setting*
9 Feb, 16 Feb	**Seed banks, germination, and establishment ecology** seed dormancy and germination; safe sites; seed bed conditions; limits to recruitment: seed availability vs. environmental conditions **Note:** *USU has declared Tuesday 17 February to NOT be a Tuesday. Attend Monday classes*
23 Feb	**Population ecology** populations and metapopulations; minimum viable population size; implications for restoration *Chapter 4, Implications of population dynamic and metapopulation theory for restoration* **Exam 1:** *<u>Tentatively</u> Thursday 26 February*
2 Mar, 16 Mar	**Plant competition** intraspecific competition; law of constant final yield; self-thinning; density dependence; competitive response vs. competitive effect; traits associated with competitive ability; resource capture and resource use in relation to competition
9 Mar	*Spring Break! Go to southern Utah and live it up!*
23 Mar, 30 Mar	**Community ecology** regional processes; environmental filters; biotic interactions; multiple states and restoration trajectories; diversity effects *Chapter 5, Ecological communities: from theory to practice* *Chapter 9, The dynamic nature of ecological systems: multiple states and restoration strategies* *Chapter 10, Biodiversity and ecosystem functioning in restored ecosystems: extracting principles for a synthetic perspective*

6 Apr, 13 Apr — **Ecosystem processes from a restoration perspective**

food web dynamics; nutrient cycling; disruption and repair of ecosystem processes; feedbacks

Chapter 8, Food-web approaches in restoration ecology

Exam 2: *Tentatively Thursday 16 April*

20 Apr — **Issue: restoration and invasive species**

integrating a variety of issues in the context of weed invasion

Chapter 12, Using ecological theory to manage or restore ecosystems affected by invasive plant species

Final project presentations

23 April in class – one group randomly selected will give their presentation

28 April, 11:30-1:20, during scheduled final exam period the other two groups will present