

**RESTORATION ECOLOGY**  
(E 534, Spring 2005)

TIME: Monday & Wednesday, 5:30-6:45 PM  
PLACE: Room 278, SPEA  
CREDITS: 3 hours  
INSTRUCTOR: Chris Craft

*Restoration Ecology* is the application of ecological principles to restore or re-create ecological structure and function of terrestrial, wetland and aquatic ecosystems. Restoration ecology combines a solid understanding of the fundamentals of ecosystem ecology with adaptive resource management to guide ecosystem development towards a specific, pre-determined endpoint.

The course will cover basic concepts of ecosystem restoration, including development of energy flow and nutrient cycles, soil formation, mechanisms of species dispersal & colonization and mutualistic relationships. Topics related to terrestrial restoration include restoration of old fields, fire adapted ecosystems and surface mined lands, including phytoremediation, and amendments to accelerate the restoration process. Restoration of wetlands, including urban and agricultural wetlands, rivers & floodplains, lakes and estuaries (seagrasses) also will be covered.

Case studies of representative terrestrial (longleaf pine-wiregrass forests), wetland (salt marshes) and aquatic ecosystems (seagrasses) will be used to integrate lecture materials. There will also be a guest lecture by Joy Zedler, Aldo Leopold Professor of Restoration Ecology, University of Wisconsin, on the challenges of invasive species control in wetland restoration.

Four trips tentatively are scheduled to visit various terrestrial and wetland restoration projects. **You must attend three of the four field trips to receive full credit.** There is no required text for the course. Readings (see Schedule) for the lectures will be placed on reserve in the library.

You will write a short (10-15 pages double spaced text) term paper covering some aspect of restoration ecology. **The term paper should be an original piece of work and not something that was submitted for credit in another course. The term papers are due Wednesday March 2.** You also will write a NSF style proposal on a topic related to restoration ecology and/or ecosystem development. It would be prudent to check with me beforehand concerning the subject matter for the term paper and proposal. The proposal should describe a realistic and achievable experiment to test one or more hypotheses relating to ecosystem restoration. **The proposals are due Wednesday April 20.**

Grading:	Homework:	10%	
	Term paper	25%	<b>(due March 2)</b>
	Class involvement & Group Discussion	20%	
	Field trips	20%	
	NSF proposal	25%	<b>(due April 20)</b>

Term paper format: double-spaced, 10-15 pages in length including references.

20+ references, at least 80% (16) are from the peer-reviewed literature.  
Use a scientific journal (e.g. *Ecology*) as a template for citing and listing references.

- Term paper critique:
1. FOCUS on a specific topic.
  2. Include some visual aides (e.g. tables and figures).
  3. Cite mostly scientific (ecological, environmental policy) literature.
  4. PROOFREAD your paper.

**NOTES:** Email submissions of seminar write-ups, term papers or position papers will not be accepted.

**As is the case in all classes, cheating, plagiarism and other forms of academic dishonesty are not acceptable behavior, are morally wrong and will be punished.**

## SCHEDULE

Date	Topic
Jan. 10	Introduction / Human Activities and the Need for Restoration Ecology <i>Reading: Hopes for the future: Restoration ecology...</i>
Jan. 12	Soils and Terrestrial Restoration
Jan. 17	<b>MLK holiday</b>
Jan. 19	Reconstruction of Terrestrial Ecosystems <i>Readings: The reconstruction of ecosystems</i> <i>Restoration of mined lands – using natural processes</i>
Jan. 24	Microorganisms, Mycorrhizae and Terrestrial Restoration <i>Readings: Enzyme activity and respiration in minesoils</i> <i>Relationship between soil organic carbon and...</i> <i>Management of indigenous plant-microbe symbiosis...</i>
Jan. 26	Accelerating Ecosystem Development with Amendments <i>Readings: Wood residue and fertilizer amendment of bentonite...</i> <i>Early stages of mine soil genesis as affected by...</i> <i>Responses of soil biota to organic amendments...</i> <i>Amendment of mine spoil to increase the number...</i> <i>Effects of soil nitrogen reduction on nonnative plants...</i>
Jan. 31	Phytoremediation <i>Readings: Lead and zinc in a contaminated pasture...</i> <i>The use of metal tolerant plant populations...</i> <i>A fern that hyperaccumulates arsenic</i>
Feb. 2	Mechanisms of Colonization and Species Persistence in Plant... <i>Readings: Mechanisms of succession in natural communities...</i> <i>Evidence for the existence of three primary strategies...</i> <i>Wind as a long distance dispersal vehicle...</i> <i>Old-field succession on a Minnesota sand plain</i>
Feb. 7	<b>No class</b>

- Feb. 9                      Fire and Ecosystem Restoration  
*Readings:*     *Fire and grazing in the tallgrass prairie...*  
                                  *Succession and fire season in experimental prairie...*  
                                  ***Community and ecosystem-level changes in a prairie...***  
                                  *A compound from smoke that promotes seed germination*  
                                  *Restoration of smoke-dependent species*
- Feb. 12                      **Field trip to TNC Green's Bluff Nature Preserve (10-3)**
- Feb. 14                      Case Study: Restoration of longleaf pine-wiregrass ecosystems  
*Readings:*     *The longleaf pine forests of the southeast*  
                                  *Natural history of wiregrass (Aristida stricta)*  
                                  *Effects of long-term fire exclusion on tree species...*
- Feb. 16                      Restoration of longleaf pine...(continued)  
*Readings:*     *Soil change and carbon storage in longleaf pine stands...*  
                                  *Application of ecological principles...The red-cockaded*  
                                  *woodpecker*
- Feb. 21                      Restoration of Wetlands /  
 Case Study: Restoration of Tidal Marshes  
*Readings:*     *Tidal salt marsh restoration*  
                                  *The strategy of ecosystem development*  
                                  *Pace of ecosystem development of constructed Spartina...*  
                                  *Long-term succession of benthic infauna communities...*
- Feb. 23                      Wetland Restoration and Biodiversity  
*Readings:*     *The vegetation of restored and natural prairie wetlands*  
                                  *Declining biodiversity: Why species matter...*  
                                  *Species rich plantings increase biomass and nitrogen...*  
                                  *Progress in wetland restoration ecology*
- Feb. 28                      Accelerating Wetland Ecosystem Development with Amendments  
*Readings:*     *Canopy architecture of planted and natural cordgrass...*  
                                  *Limited response of cordgrass to soil amendments...*  
                                  *Effects of nitrogen additions on vertical structure...*  
                                  *Hydrologic gradients and topsoil additions affect soil...*  
                                  *Soil organic matter effects on infauna community...*
- Mar. 2                      Wetland Restoration in Urban Environments  
*Readings:*     *Ecological functions of an impounded marsh...*  
                                  *Soil organic C, N and P as indicators of recovery...*  
**Term papers due**

- Mar. 7 Restoring wetlands in Agricultural Landscapes, Klamath Basin, Oregon.  
*Reading: Wetlands at your service: reducing impacts of agriculture...*
- Mar. 9 “Open Date”
- Mar. 14 **SPRING BREAK**
- Mar. 16 **SPRING BREAK**
- Mar. 21 **No class**
- Mar. 23 **No class**
- Mar. 28 Restoration of Rivers and Streams  
*Readings: The river continuum concept  
Questions and comments about the RCC*
- Mar. 30 Restoration of Rivers and Streams (continued)  
*Readings: Disturbance and recovery of large floodplain rivers  
The Grand (Canyon) Experiment  
Naturalization of the flood regime in regulated rivers  
A general protocol for restoration of regulated rivers*
- Mar. 31 **Special Seminar:** The Challenge of Restoring Wetlands that are Dominated by Invasive Monotypes – Joy Zedler, Aldo Leopold Professor of Restoration Ecology, University of Wisconsin, Madison.
- April 1 **Field trip USFS Roland Constructed Wetlands**
- April 4 Restoration of Floodplains and Riparian Zones  
*Readings: The ecology of interfaces: riparian zones  
Flooding to restore connectivity of regulated large-river...  
Flows for floodplain forests...*  
**Site visit to Jordan River**
- April 6 Restoration of Lakes  
*Readings: On the different nature of top-down and bottom-up effects..  
Biomanipulation as an application of food-chain theory...  
Lake restoration by biomanipulation*
- April 9 **Field trip to TNC Cedar Bluffs (10-2)**
- April 11 Acid Rain and Lake Restoration  
*Readings: Effects of acid rain...  
Effects of calcite treatment on primary producers...*

*Survival, growth, reproduction and diet of brook trout...*

- April 13 Case Study: Restoration of Seagrasses
- April 16 **Field trip to Big Walnut Natural Area (10-3)**
- April 18 “Open Date”
- April 20 Ecosystem Restoration and Invasive Species  
**(Proposals due)**
- April 25 Invasive Species (continued)  
*Readings: Biological invasions: lessons for ecology*  
*Progress in invasion biology: predicting invaders*  
*Biological invasion by Myrica faya in Hawai’i*  
*Making allelopathy respectable*  
*Allelopathy and exotic plant invasion...*
- April 27 Case Study: Restoration of Natural Resources Damaged by Oil Spills  
and Hazardous Wastes