

RESTORATION ECOLOGY
(E 555, Spring 2003)

TIME: Monday & Wednesday, 5:30-6:45 PM
PLACE: Room 273, SPEA
CREDITS: 3 hours
INSTRUCTOR: Chris Craft

Restoration Ecology is the development, testing and application of ecological principles to restore or re-create ecological structure and function of terrestrial 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 wetlands, rivers & floodplains and lakes also will be covered.

Case studies of representative terrestrial (longleaf pine-wiregrass forests), wetland (Florida Everglades) and aquatic ecosystems (Klamath Basin) will be used to integrate lecture materials. There will also be several guest lectures from practitioners of ecosystem restoration.

Four trips, three on Friday and one on Saturday, tentatively are scheduled to visit various terrestrial (surface mine reclamation, terrestrial ecosystem restoration with TNC) and wetland restoration projects (USFS wetland restoration project, urban wetland restoration along White River, Indianapolis). **You must attend three of the four field trips to receive full credit.**

There are two required textbooks for the class. *Restoration of Aquatic Ecosystems*, by the National Research Council, provides an excellent summary pertaining to restoration of lakes, rivers & streams and wetlands. *Restoration Ecology: A Synthetic Approach to Ecological Research* will cover restoration of terrestrial ecosystems. Additional readings (see Readings List) to supplement the texts 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 Friday February 28.**

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 Friday April 18.**

Grading:	Term paper	25%	(due February 28)
	Class involvement & Discussion	25%	
	Field trips	25%	
	NSF proposal	25%	(due April 18)

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.

SCHEDULE

Date	Topic
Jan. 13	Introduction
Jan. 15	Human Activities and the Need for Restoration Ecology <i>Reading: Hopes for the future: Restoration ecology...</i>
Jan. 20	MLK holiday
Jan. 22	Soils and Terrestrial Restoration
Jan. 27	Reconstruction of Terrestrial Ecosystems <i>Readings: The reconstruction of ecosystems Restoration of mined lands – using natural processes</i>
Jan. 29	Microorganisms, Mycorrhizae and Terrestrial Restoration <i>Readings: Enzyme activity and respiration in minesoils Relationship between soil organic carbon and... Management of indigenous plant-microbe symbiosis...</i>
Feb. 3	Accelerating Ecosystem Development with Amendments <i>Readings: Wood residue and fertilizer amendment of bentonite... Early stages of mine soil genesis as affected by... Responses of soil biota to organic amendments... Effects of soil nitrogen reduction on nonnative plants...</i>
Feb. 5	Phytoremediation <i>Readings: Lead and zinc in a contaminated pasture... The use of metal tolerant plant populations... A fern that hyperaccumulates arsenic</i>
Feb. 10	Mechanisms of Colonization and Species Persistence in Plant... <i>Readings: Mechanisms of succession in natural communities... Evidence for the existence of three primary strategies... Old-field succession on a Minnesota sand plain</i>
Feb. 12	Fire and Ecosystem Restoration <i>Readings: Fire and grazing in the tallgrass prairie... Succession and fire season in experimental prairie... Restoration of smoke-dependent species</i>
Feb. 17	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...
 Soil change and carbon storage in longleaf pine stands...
 Application of ecological principles...The red-cockaded
 woodpecker
- Feb. 19 Restoration of Wetlands
Readings: *Tidal salt marsh restoration*
- Feb. 24 Wetland Restoration and Ecosystem Structure & Function
Readings: *The strategy of ecosystem development*
 Twenty five years of ecosystem development...
- Feb. 26 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...
 Soil organic matter effects on infauna community...
- Feb. 28 Term papers due**
- Mar. 3 Wetland Restoration and Biodiversity
Readings: *The vegetation of restored and natural prairie wetlands*
 Declining biodiversity: Why species matter...
 Progress in wetland restoration ecology
- Mar. 5 Wetland Restoration in Urban Environments
Readings: *Soil organic C, N and P as indicators of recovery...*
- Mar. 10 Impacts of Human Activities on the Florida Everglades
- Mar. 12 Case Study: Hydrologic restoration of the Florida Everglades
Readings: *Experimental policies for water management...*
 Effects of nutrients and hydroperiod...
 Effects of four years of N and P additions...
 A comparison of wading bird nesting...
 Senate approves \$7.8 billion plan...
- Mar. 17 SPRING BREAK**
- Mar. 19 SPRING BREAK**
- Mar. 24 Restoration of Rivers and Streams

- Readings: The river continuum concept*
Questions and comments about the RCC
- Mar. 26 Restoration of Rivers and Streams (continued)
Readings: Disturbance and recovery of large floodplain rivers
Naturalization of the flood regime in regulated rivers
A general protocol for restoration of regulated rivers
- Mar. 31 Restoration of Floodplains and Riparian Zones
Readings: The ecology of interfaces: riparian zones
Flooding to restore connectivity of regulated large-river...
Colorado River paper
- April 2 Case Study: Klamath Basin: Restoration of river flows for
endangered fish species
Readings:
- April 5 Saturday Field Trip (Terrestrial restoration at Green's Bluff Nature
Preserve; Chad Bladow & Ellen Jacquart, The Nature Conservancy)**
- April 7 Restoration of Natural Resources Damaged by Oil Spills and
Hazardous Wastes
John Sacco, New Jersey Department of Environmental Protection
- April 9 Restoration of Lakes
Readings: Blue-green algae: Why they become dominant
Lake restoration by biomanipulation
- April 11 Friday Field Trip (USFS Rolland wetland restoration project;
Pat Merchant & Kelle Reynolds, USFS; Bruce Plowman, IN DNR)**
- April 14 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 16 Open Date
- April 17 Thursday Seminar: Ecosystem Restoration and Invasive Species**
Ellen Jacquart, The Nature Conservancy of Indiana
- April 18 Friday Field Trip (Restoration of surface mined lands;**
Don Mann, Kindill Mining Company)

(Proposals due)

- April 21 Ecosystem Restoration and Invasive Species (continued)
- April 23 Invasive Species (continued)
Readings: Biological invasions: lessons for ecology
Progress in invasion biology: predicting invaders
Ecological predictions and risk assessment for alien
fishes...
- April 28 Synthesis
- April 30 Open Date
- May 2 Friday Field Trip (Urban wetland restoration: White River,**
Indianapolis; Lenore Tedesco & Bob Barr, IUPUI)

* **Field visit to Jordan River ??? ***

* **Jim Bever seminar (Thursday Feb. 6) ???**