Ecosystem Restoration

GEOL453

Fall 2011, 3 Credits

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Lecture and Discussion: Tuesdays, 3:30 – 6:30 pm

Required texts: Selected readings from the primary literature will be on ELMS.

Recommended texts: *Ecological Engineering and Ecosystem Restoration*, Mitsch and Jorgensen; *Principles of Terrestrial Ecosystem Ecology*, Chapin, Matson, and Mooney

Course Description:
Overview of critical ecosystem functions across biomes, and general considerations and tradeoffs in restoration designs for enhancing function and biotic communities. Specific cases studies and discussions will be aimed at understanding how structure can influence biophysical and biogeochemical processes supporting ecosystems, and then describes how rates, timing, and location of physical, chemical, and ecosystem processes can be altered by different restoration strategies to enhance ecosystem services and improve habitat quality. Through quantitative examination of current "real world" applications and evaluation of alternatives, this course will examine both how and when structure and function can be considered in the principles and practices of ecosystem restoration.

Topics covered:
The initial overview lectures will illustrate how key processes across terrestrial, freshwater, and marine environments can present challenges to restoration across these biomes. Later, we will discuss specific case studies regarding restoration strategies across ecosystem such as forests, streams, wetlands, coastal ecosystems, etc. in addition to fundamental principles and tradeoffs in optimizing various ecosystem functions (e.g. sequestration of organic contaminants and heavy metals, nitrogen and phosphorus removal, buffering acidity, strategies to increase habitat extent and quality and food web structure for protecting target species, etc.). All topics will be discussed with an emphasis on how basic underlying principles in ecosystem ecology can be used in restoration science to solve contemporary and emerging problems in the environment.

Course Structure and Objectives:

Lecture (3:30 pm – 5:00 pm) – A primary goal of the initial lectures are to provide a general overview of important ecosystem considerations in restoration across biomes and then further explore the use of ecosystem concepts in restoration related to a select group of current and emerging environmental problems. The basic format of lectures regarding more specific topic areas will cover a brief review of how key processes and reactions of cycles (e.g. hydrologic, material, energy and/or habitat extent and foodweb structure) have been altered by human activities to understand the nature and scope of the environmental problem. The lectures on specific topics will then describe the broad spectrum of ecosystem level approaches/methods used in restoration with examples from case studies.

Break (5:00 pm – 5:15 pm)

Question and Answer Session (5:15 pm – 5:30 pm)

Discussion (5:30 pm – 6:30 pm) – The objective of the following discussion after lecture is to discuss general themes and cases studies from the primary literature and stimulate critical thinking regarding *how much, when, where, and why* restoration applications of ecosystem ecology can work in problem solving in a particular ecosystem and identify potential application and limitations in application across different biomes. The discussion can also propose and critique alternative strategies and designs. A student will be assigned to summarize 2 papers, and then provide questions for analysis and discussion. Other students are expected to participate in discussion and share viewpoints and ideas.

Group Projects and Paper – Group projects will be coordinated outside of lecture and discussion sessions. A team of 3 students will pick a specific ecosystem service (e.g. water quality, biodiversity, erosion and protection of infrastructure, etc) and synthesize a review of studies in the literature describing the efficacy of restoration applications of ecosystem ecology to improving this ecosystem service. The project will quantify and review our state of knowledge on restoration science in this area and discuss new developing technologies and/or strategies across 3 different ecosystems of their choice.

Grading:

Midterm exam (covering both lecture and discussion material)……30%

Final exam (covering both lecture and discussion material)……..30%

Group research project/paper (w/ brief proposal)…..……30%

Individual participation (in discussion and group project)……10%