Natural Resources 760 Ecosystem Modeling
Call # 14953-8
Winter Term 2007

INSTRUCTORS:

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TEACHING ASSISTANTS:

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CLASS TIME: **lecture/discussion:** Mondays 6:00 - 8:30 P.M.
laboratory: Wednesdays 6:00 - 9:00 P.M.

CREDIT HOURS: 5 quarter hours

CLASS LOCATION (Lecture and Lab): 101 Heffner Wetland Research Building
352 W. Dodridge Street

PREREQUISITE: Math 151 (calculus) or equivalent and EEOB 413 Principles of Ecology or equivalent. Computer experience is assumed.

COURSE DESCRIPTION: Introduction to the principles, history, and methodologies of systems ecology, emphasizing the development and simulation of ecological models for natural resource/ecosystem management; conceptual and symbolic models, simulation techniques on microcomputers.

TEXT: Odum, H.T. and E.C. Odum. 2000. Modeling for all Scales: An Introduction to Systems Simulation. Academic Press, San Diego (includes CD used in first 2 labs)

SUPPLEMENTAL TEXT: Jørgensen, S.E. and G. Bendoricchio. 2001. Fundamentals of Ecological Modelling. Elsevier, Amsterdam, 530 pp. (paperback)

SOFTWARE (highly recommended):

STELLA 9.0. We will send a list of students in the class to IEES Systems and you will have the option of purchasing a 6 month lease or a permanent copy of the software at student prices. Available from ISEE Systems (formerly High Performance Systems, Inc.) at: http://www.iseesystems.com

THIS IS NOT A REQUIRED PURCHASE AS SOFTWARE IS AVAILABLE IN THE LAB. LIKEWISE IT IS NOT REQUIRED THAT YOU USE STELLA FOR YOUR CLASS PROJECT BUT IT IS UNLIKELY YOU WILL FIND ANY SOFTWARE THAT IS EASIER. WE HAVE 2 LABS THAT TEACH YOU THE BASICS OF STELLA.

SUPPLIED AT LABORATORY AT APPROPRIATE TIMES:

- appropriate simulation models
- STELLA™ 9.0 Simulation Software
- EXTEND™ 1.1b Simulation Software
- other software as needed

COURSE OBJECTIVES:

The course introduces graduate students (and highly motivated, upper level undergraduates) to a systems approach to the understanding and management of ecosystems such as lakes, reservoirs, forests, and human-dominated systems such as agriculture and cities. With the aid of energy system language (energese) and microcomputers, the course introduces concepts of model development, modeling mathematics, parameter estimations, hierarchy of systems, computer simulations, model calibration and verification, and ecosystem management. Emphasis is on developing skills to appreciate systems approaches for the study and management of the environment. Ecological engineering and ecological economics, as allied fields of ecological modelling, will also be presented.

GRADING:	% of Grade
Labs (attendance/participation)	10
Modeling Project (presentation and paper)	50
Midterm Exam	30
Literature Review Presentations	10
	100

LABS:

Students are required to participate in 4 formal computer labs during the class period. Laboratories are scheduled for 6:00 - 9:00 P.M. No lab reports are required. However, students will demonstrate to the teaching assistant that they have completed the assignments in the laboratory. This can be accomplished in two ways:

1. Show the TA during the laboratory that you have completed the exercises; you can use the computer screen, a saved file, or a printout.
2. Bring proof (hard copy) that you have completed the exercises to the TA in his office at a time convenient to you and the TA.

MODELLING PROJECT:
Students will develop from scratch an ecological model of a system in which they are interested. In the past we have assigned models based on any ecological system. In recent years, almost all students have chosen to do their models with STELLA although that is not required if you are familiar with other simulation languages.

In any case, the models are to be developed from scratch. That means that no previously constructed models can be used in this exercise, e.g. water quality models, ecosystem models, etc. Severe loss of points will result; if in doubt, check with instructors.

You will quantify and simulate the model with techniques learned in class. The simulations will be dynamic, that is, they will include time as an independent variable.

Students will be required to complete the following on their project:

1. an oral presentation of their models to class on **Monday March 5**
2. a written report due on **Monday March 5**

Project topics are due **Monday January 22** to Dr. Zhang. This should be submitted in the form of a conceptual model in energese or STELLA, with a title and one page write-up (typed) about what you hope to simulate.

Do not put this modeling project off until the last moment as it is a very time consuming and grade-important part of this class.

STUDENT PAPER PRESENTATIONS:
One of the most important experiences in a graduate course is to explore the published literature. Each student will be required to give a short (5-10 minute) synopsis of a modeling paper, perhaps related to their modeling project. It can be a modeling paper that is published in a journal or a symposium volume. Use recent literature. Use a maximum of 3 - 5 overheads/pp slides to show the model being presented and its general findings. Good sources for information are:

- modeling books
- the journal *Ecological Modelling* almost complete collection in 130 Heffner
- other ecological literature, e.g. *Ecological Applications*, *Water Research*, *Ecological Engineering*, etc.

Your short presentations will be on **Monday February 13 or February 20**. Grade for presentation will be based on quality of presentation, how well you understand the paper, and the appropriateness of the paper to ecological modeling.

SCHEDULE:

Date		Topic	Reference
Jan 3	Wed	Introduction to Course Objectives; Systems Ecology and Systems Thinking	
Jan 8	Mon	Energy Systems Diagramming Modeling Methodology	Odum - Chaps. 1, 2, 3
Jan 10	Wed	**LAB No.1 Simple Ecological Minimodels** **Ecological/Economic Models**	CD from Odum book
Jan 15	Mon	UNIVERSITY HOLIDAY - NO CLASS	
Jan 17	Wed	**LAB No. 2 Intro. to STELLA Simulation**	handouts
Jan 22	Mon	Modeling Methodology (continued) **DEADLINE: PROJECT TOPIC DUE**	Odum – Chaps, 6, 7
Jan 24	Wed	**LAB No. 3 STELLA Ecosystem Models**	handouts
Jan 29	Mon	Ecological process	Odum Chaps 4, 5
Feb 2	Wed	Optional Lab--Assistance for Student Projects	
Feb 5	Mon	**LAB No. 4 Introduction to EXTEND**	
Feb 7	Wed	**MIDTERM EXAMINATION**	
Feb 12	Mon	ecosystem models **STUDENT LIT REVIEW PRESENTATIONS**	
Feb 14	Wed	Optional Lab--Assistance for Student Projects	
Feb 19	Mon	spatial modeling **STUDENT LIT REVIEW PRESENTATIONS**	
Feb 21	Wed	Optional Lab--Assistance for Student Projects	
Feb 26	Mon	ecological engineering; ecological economics	Chap 11; handouts
Mar 5	Mon	**STUDENT MODEL PRESENTATIONS; WRITTEN REPORTS DUE**	