W&FCON 577, FOREST 577 ECOSYSTEM MODELING AND SIMULATION

Fall 2007: M, W 11:15-1:15 (Holdsworth Rm 302 or 305)

Course Teacher: Dr. Timothy Randhir, Department of Natural Resources Conservation
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Office Hours: M, W 1:15 -2:15 @ Holdsworth Rms. 320 or 312B.

Course website: TBA

Required Texts:

1. **Textbook** (Available at the Textbook Annex)**:**
   a. Grant, Pederson, and Marin. 1997. "Ecology and Natural Resources Management: Systems Analysis and Simulation." John Wiley & Sons.
2. **The Course Reader (On Reserve at the library).**

Course Help: Students needing special help are encouraged to contact the instructor.

Course Objectives: a) to learn methods to gain insights into complex natural resources and ecosystems using a systems approach; b) to develop skills in systems modeling and optimization; b) to quantify and evaluate dynamic inter-linkages between and within biotic, abiotic, and socio economic components of an ecosystem; and c) to develop an inter/trans disciplinary perspective in natural resources conservation through 'systems thinking'.

Day	Lecture Topic	References
Sept 5	Course plan and orientation	
	1. Systems perspective	
	1.1 The systems approach to problem solving	Grant, et al. Chapter 1
Sept 10	1.2 Basic concepts of systems analysis and simulation	Grant, et al. Chapter 2
	2. Theoretical Framework:	
Sept 12	2.1. Conceptual Modeling	Grant, et al. Chapter 3
Sept 17	2.2. Empirical Modeling	Grant, et al. Chapter 4
Sept 19	2.3 Model Evaluation	Grant, et al. Chapter 5
Sept 24	2.4. Model Use	Grant, et al. Chapter 6
	3. Simulation Modeling in Practice	
Sept 26	3.1 Modular Representation of System Structure and Dynamics	Grant, et al. Chapter 7
Oct 1	3.2 Modeling in Practice: Iteration of Phases	Grant, et al. Chapter 8
Oct 3	3.3 Model Development and Use: Aquaculture Pond Model	Grant, et al. Chapter 9
Oct 9	3.4 Reporting development and Use of Simulation Models	Grant, et al. Chapter 10
	4.0 Applications in Ecology	
Oct 10	4.1. Modeling Density Factors in Ecosystems	Grant, et al. Chapter 11

Oct 15	4.2. Modeling Natality and Mortality	Grant, et al. Chapter 12
Oct 17	4.3 Modeling Interspecific Competition	Grant, et al. Chapter 13
Oct 22	4.4 Modeling Community Structure	Grant, et al. Chapter 14
Oct 24	4.5. Predator-Prey Systems	Grant, et al. Chapter 15
Oct 29	4.6. Energy Balance of Homeotherms	Grant, et al. Chapter 16
	5.0. Applications in Natural Resources Management	
Oct 31	5.1. Modeling Wildlife Management: Habitat Fragmentation and Endangered Species	Grant, et al. Chapter 17
Nov 5	5.2. Modeling Fisheries Management: Harvest regulations and Biomass Yield	Grant, et al. Chapter 18
Nov 7	5.3. Modeling Rangeland Management: Stocking density and Brush Control	Grant, et al. Chapter 19
Nov 14	5.4. Modeling Forest Management: Timber Harvest and Species Abundance	Grant, et al. Chapter 20
Nov 19	5.5. Modeling Open Access Resources: Tragedy of Commons	Ruth and Hannon: Chapter 25
	6.0 Spatial Modeling	
Nov 26	6.1. Spatial Fishery Model	Ruth and Hannon: Chapter 28
Nov 28	6.2. GIS Modeling	Chang: Chapter 14
	7.0. Optimization	
Dec 3	7.1. Dynamic Forestry Management	Brooke et al: Chapter 2 Bergendorff: Antalya Model
Dec 5	7.2. Global Warming: Carbon trade	Perroni and Rutherford: Carbon Model
	8.0. New Frontiers	
Dec 10	8.1 Decision Support Systems, Expert Systems and Neural networks.	Discussion
Dec 12	8.2 Evolutionary Modeling and Operations Research	Discussion

Evaluation:

The final grades will be calculated based on completion of class exercises (32%), in-class participation (10%), class presentation (10%), lab exercises (10%), and a class project (30%). Innovation and creativity (new ideas on problem-solving or new approaches to solutions) demonstrated in the course will also be considered in grading (8%).

1. **Class Assignment:** 32%

There will be eight assignments (evaluated as 8*4) in the course (one per topic). Assignments will be distributed on completion of each topic. Assignments are due the following week.

2. **Class Project:** 30%
   (Students will identify an issue of interest in systems modeling. Evaluation will be based on a report and scientific methods used)

3. **Class Presentation** 10%
   (Presenting and leading a discussion on a major topic or class project)

4. **Lab Exercises** 10%
   (Performance in lab exercises that are done inclass)

5. **Class Participation:** 10%
   (Student is evaluated based on the leadership exhibited, new ideas discussed, frequency and quality of interaction)

6. **Innovation, creativity, promptness, and attentiveness:** 8%
   (New ideas and solutions in using systems approach to problems shared by the student. Students are encouraged to discuss these ideas with me. Late submissions of class exercises and report and lack of attention in class may result in loss of these points).

Class Project Report is due at Prof. Randhir's office one week before the finals week.
We will follow university rules regarding academic honesty and grievance as detailed in http://www.umass.edu/dean_students/code_conduct/acad_honest.htm)

References:

Bergendorff , H, P. Glenshaw, and A. Meeraus, The Planning of Investment Programs in the Paper Industry, The World Bank, Washington DC, 1980.

Brooke, A. D. Kendrick, A. Meeraus. And R. Raman. GAMS: A User Guide. GAMS Development Corporation, Washington, DC.

Chang, K. Introduction to Geographic Information Systems. McGraw-Hill, Boston.

Grant, Pederson, and Marin. 1997. "Ecology and Natural Resources Management: Systems Analysis and Simulation." John Wiley & Sons

Perroni, C.and T. Rutherford (1993) "International Trade in Carbon Emission Rights and Basic Materials: General Equilibrium Calculations for 2020", Scandinavian Journal of Economics.

Ruth, M. and B. Hannon. 1997. Modeling Dynamic Economic Systems. Springer Verlag, New York.