

September 4, 2014

Ecological Modeling (BIOE 591, in F15, BIOE 514)

(T 14:00-16:00, 307 Lewis Hall, Th lab 14:00-15:00, 307 Lewis Hall)

Instructor: Dr. Ben Poulter

Office Hours: 9-11 am Thursday, or by appointment, 111 AJM Johnson Hall

Contact: benjamin.poulter@montana.edu

Course D2L Website: Log in at: <https://ecat.montana.edu/>

Course Objectives: During the course, we will investigate the various components and modules of ecosystem models and critically evaluate underlying model structure, parameters and scaling assumptions, to fully understand how they work. Students will be introduced to computer science concepts related to ecosystem modeling and survey various analytical approaches required to run and evaluate ecosystem models. By the end of the course, students should feel confident in reading modeling literature and also in thinking about how to develop and apply ecosystem models to their own research interests.

Textbook: Ecological Climatology (Second Edition), by Gordan Bonan, and Consider a Spherical Cow by John Harte. We may also read primary literature from scientific journals.

Course Format: This course includes both lectures (Tuesday) and labs (Thursday). A windows/mac/linux laptop computer is required for the lab with a Unix terminal installed. We will each have teaching accounts on the National Science Foundation XSEDE high performance computer.

Attendance: Your attendance is mandatory – please see me if you will be absent or miss a class to discuss on how to catch up on the topic.

What to expect: This will be a relatively fast paced course that will take students through multiple interdisciplinary concepts related to ecosystem modeling. Students should be motivated to stay engaged and think critically about the work and especially how it relates to their research interests.

Academic Misconduct (from Dr. Hu's course description): MSU Policy - academic honesty and integrity are fundamental to the mission of higher education. The University has a responsibility to promote academic honesty and integrity and to assure the highest ethical and professional standards and behavior in the classroom. MSU has developed procedures that address instances of academic dishonesty, and students who violate these standards are subject to academic and/or disciplinary sanctions. Sanctions range from a simple verbal reprimand (disrupting class) to separation from the University, and/or withdrawal of an academic degree (cheating/plagiarism).

Special needs (from Dr. Hu's course description): If you have a documented disability for which you are or may be requesting an accommodation(s), you are encouraged to contact me and the Disabled Student Services as soon as possible. I wish to fully include persons with disabilities in this course. It is in your best interest if you inform me as soon as possible regarding any special accommodations in the curriculum, instruction, or assessments of this course that may be necessary to enable you to fully participate in this course.

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Grading: There will be weekly problem solving sets, due in Thursday's class, that student teams will be asked to present (10% of grade), in addition, an end of semester presentation on your research and what you have learned from the course (20%). A take-home midterm (25%) and final exam (30%) will address topics covered in class and be designed to evaluate critical thinking skills. Participation, for example, coming to class, staying awake, expressing interest, will be another 15% of your grade.

CLASS SCHEDULE

| Week | Date | Day of Week | Topic | Assignments (Harte's solutions due Thursdays) |
|------|----------|-------------|--|---|
| 1 | 8/26/14 | Tues | Introduction to Ecosystem Modeling | Watch Dynamic Earth movie |
| | 8/28/14 | Thurs | Introduction to Unix | |
| 2 | 9/2/14 | Tues | Model Drivers and Parameters | Practice Unix commands Chapter 4, 5 (Bonan) |
| | 9/4/14 | Thurs | No Class | |
| 3 | 9/9/14 | Tues | Data/File Types / Variables Plant Functional Types | <i>Chapter 16, Ex. 2 (Harte)</i> Chapter 6 (Bonan) |
| | 9/11/14 | Thurs | Unix Shell Scripting | |
| 4 | 9/16/14 | Tues | Bioclimates and Establishment | <i>Chapter II-3, Ex. 1 (Harte)</i> Chapter 24 (Bonan) |
| | 9/18/14 | Thurs | Species distribution modeling | |
| 5 | 9/23/14 | Tues | Canopy Phenology | <i>Chapter II-7, Ex. 2 (Harte)</i> Chapter 26 (Bonan) |
| | 9/25/14 | Thurs | CDO and the Netcdf (+course reviews) | |
| 6 | 9/30/14 | Tues | Soil-Plant-Atmosphere Continuum | <i>Chapter II-9, Ex. 5 (Harte)</i> Chapter 11, 13 (Bonan) |
| | 10/2/14 | Thurs | Soil Datasets and the Netcdf | |
| 7 | 10/7/14 | Tues | Introduction to HPC / File Systems (Llovet) | <i>Chapter II-13, Ex. 3 (Harte)</i> Chapter 16, 17, 18 (Bonan) |
| | 10/9/14 | Thurs | Photosynthesis and the Big Leaf | |
| 8 | 10/14/14 | Tues | Photosynthesis and the Big Leaf | <i>Chapter II-22, Ex. 1 (Harte)</i> Chapter 19 (Bonan) |
| | 10/16/14 | Thurs | Plant Respiration and Reproduction | |
| 9 | 10/21/14 | Tues | Plant Growth, Allocation, and Allometry | <i>Chapter III-3, Ex. 5 (Harte)</i> Chapter 20, 21 (Bonan) |
| | 10/23/14 | Thurs | Mid-term | |
| 10 | 10/28/14 | Tues | Mid-term | Chapter 22 (Bonan) |
| | 10/30/14 | Thurs | Plant Mortality | |
| 11 | 11/4/14 | Tues | Election Day, NO CLASS | <i>Chapter III-6, Ex. 4 (Harte)</i> Chapter 25 (Bonan) |
| | 11/6/14 | Thurs | Soil Carbon Cycle | |
| 12 | 11/11/14 | Tues | Veterans Day, NO CLASS | Chapter 9, 10 (Bonan) |
| | 11/13/14 | Thurs | Interactive Nutrient Cycling / Trace Gases | |
| 13 | 11/18/14 | Tues | Zhen Zhang – TOPMODEL Model Analysis and Uncertainty | <i>Chapter III-7, Ex. 4 (Harte)</i> |
| | 11/20/14 | Thurs | Rob Payne Model Benchmarking | |
| 14 | 11/25/14 | Tues | Disturbance Modeling | Chapter 23 (Bonan) |
| | 11/27/14 | Thurs | Thanksgiving, NO CLASS | |
| 15 | 12/2/14 | Tues | Student Presentations | <i>Chapter III-8, Ex. 2 (Harte)</i> Chapter 28, 29 (Bonan) |
| | 12/4/14 | Thurs | Next Generation DGVMs | |