

Syllabus for Agron 525X: Crop and Soil Modeling

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October 12, 2011

1 Basics

- Location: Agronomy Hall 1022
- Time: Tue and Thurs 2:10-3:30pm
- Instructor: Fernando E. Miguez (femiguez@iastate.edu)
- Web: I will use blackboard learn <http://bb.its.iastate.edu>
- Phone: 515-294-5980
- Office: 1206
- Office hours: TBD.

2 Course Description

Understanding basic crop physiology and soil processes through the use of mathematical and statistical approaches. Structure of crop models, dynamics and relationship among components such as leaf-level photosynthesis, canopy architecture, root dynamics and soil carbon and nitrogen pools.

3 Software

I will be using mainly R (www.r-project.org) to illustrate examples. I recommend that you study R on your own. I will only provide a short introduction to using the software during the first two lab sessions.

In this special topics class other tools might be more appropriate and I will consider these as needed for each student. No background in programming is needed.

3.1 Computers

Thursday classes will consist of computer work. I will need to know whether we will provide laptops or you will bring your own. For the first scheduled Lab (8/25/2011) you are expected to have R installed if bringing your own computer. Nothing else is required although it would be beneficial to start getting familiar with R.

4 Grading

This is a graded course. The grade will have four components.

- bi-weekly quizzes (25% grade)
- Problem sets (25% of the grade).
- Special project (40% of the grade).
- Oral presentation (10% of the grade).

4.1 Problem sets

The problem sets will be based on the material presented in lecture and will have as their main objective to reinforce the skill needed to approach problems using quantitative skills. Each student (at random) will be required to present the answers to the rest of the class.

You can work in groups to solve them, but at least make sure you understand the answer in case you need to present.

4.2 Special Project (Final Exam)

Your final exam will be your special project.

The special project will have a format similar to a scientific publication, but with more emphasis on clearly defining the problems and the challenges. It will be shorter in length than a typical scientific publication and will need to have an appendix with the equations and code relevant to the methods used. More details about this will be given later in the semester.

4.3 Oral Presentation

The oral presentation will be based on the Special Project and will be your opportunity to share with the rest of the class your work. More details about this will be given later in the semester.

4.4 Quizzes

The main in-class mechanism for evaluation will be through bi-weekly quizzes. The quiz will be taken during the first 15 minutes of the Thursday class and it will cover the material from the previous two weeks. However, questions can refer to any topic previously covered as this type of course builds on previous concepts. You will be able to drop two quizzes toward the final grade.

4.5 Important Dates

- First class Aug 23rd
- First part of special project due Oct 4th

- Second portion of the project Nov 5th
- Final project deadline Dec 10th. (The week of final exams is 13-17)

5 Schedule and class topics

The schedule is in Table 1.

Additional topics that I can cover

- Modeling phenology
- Modeling spatial processes
- Modeling in 3D
- Stochastic simulation
- Bayesian methods

Table 1: Schedule and Class topics

Date	Day	Topic	Quiz
08-23-2011	Tue	Introduction to modeling	
08-25-2011	Thurs	Lab 1: Intro to R	
08-30-2011	Tue	Simple Crop Models	
09-01-2011	Thurs	Lab 2: Basic Programming	Yes 1
09-06-2011	Tue	Modeling Development	
09-08-2011	Thurs	Lab 3: Data and Graphics	
09-13-2011	Tue	Light Capture	
09-15-2011	Thurs	Lab 4: Light geometries	Yes 2
09-20-2011	Tue	Photosynthesis	
09-22-2011	Thurs	Lab 5: Leaf-level photosynthesis	
09-27-2011	Tue	Growth models	
09-29-2011	Thurs	Lab 6: Growth models in R	Yes 3
10-04-2011	Tue	Optimization	
10-06-2011	Thurs	Lab 7: Optimization in R	
10-11-2011	Tue	Model Agreement	
10-13-2011	Thurs	Lab 8: Model Agreement in R	Yes 4
10-18-2011	Tue	ASA-CSSA-SSSA Meetings – no class	
10-20-2011	Thurs	Lab 9: Review of topics	
10-26-2011	Tue	Sensitivity analysis	
10-28-2011	Thurs	Sensitivity analysis in R	
11-01-2011	Tue	Applied Quantitative Pedology	
11-03-2011	Thurs	AQP in R	Yes 5
11-08-2011	Tue	Chicago Meeting – no class?	
11-10-2011	Thurs	Chicago Meeting – no class?	
11-15-2011	Tue	Water retention curves	
11-17-2011	Thurs	Water retention curves in R	Yes 6
11-22-2011	Tue	Thanksgiving – no class	
11-24-2011	Thurs	Thanksgiving – no class	
11-29-2011	Tue	Soil Carbon Pools	
12-01-2011	Thurs	Soil Carbon Pools in R	Yes 7
12-06-2011	Tue	Student presentations I	
12-08-2011	Thurs	Student presentations II	

6 Books

There is no text book for this class. I will be borrowing material from the following books:

- Working with Dynamic Crop Models. Evaluation, Analysis, Parameterization and Applications. D. Wallach, D. Makowski and J. W. Jones. 2006. Elsevier. 447 pages.
- Plant and Crop Modeling. A Mathematical Approach to Plant and Crop Physiology. Thornley, J. H. M and Johnson, I. R. 2000. The Blackburn Press. 669 pages.
- The Physiology of Crop Yield. Second Edition. 2006. Hay, R. and Porter, J. Blackwell Publishing. 314 pages.
- Introduction to Scientific Programming and Simulation Using R. Owen Jones, Robert Maillardet and Andrew Robinson. Chapman & Hall. 2009. 453 pages.
- Modern Applied Statistics with S. Venables and Ripley. Fourth Edition. Springer.