

# Agroecology

## Applied Plant Population and Community Ecology

LRES 543, Spring 2010

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Class: Tu & Th 11:00 am 1115 Wilson Lab: 208 LJH

### Course Goals:

1. Examine the ecological basis for developing land management that simultaneously sustains ecosystems and supplies human needs.
2. Develop a sound background in population and community plant ecology that can be applied to agriculture and invasive species management decisions.
3. To become familiar with approaches to assess plant interactions.
4. To understand approaches for modeling plant population dynamics for description, prediction and knowledge.
5. To introduce the use of simulation modeling for refining and testing ecological hypotheses associated with plant populations and communities.

### Useful Text Books (not required):

Crawley, M.J. ed. 1997. **Plant Ecology**, 2<sup>nd</sup> Edition. Blackwell Science Pub.

Silvertown, J.W. and J.L. Doust. 1993. **Introduction To Plant Population Biology**. Blackwell Science Pub.

Hilborn, R. and M. Mangel. 1997. **The Ecological Detective**. Princeton University Press.

### Course Format:

Lec Tu & Th, 11:00 to 11:50 am 1115 Wilson Hall

Lab Th, 3:00 to 5:00 pm Roberts 209 Computer Room

Lecture/Discussion based on reading. Lecture will usually be limited to 40 min. with discussion following. Students must read the assigned material before class! Students will lead paper and chapter discussions by first describing the theme of the paper or chapter including how it fits into the discipline of ecology. If it is a paper describing some research then identify the problem that was addressed with the research, the specific objectives, the methods used, the results and the conclusions. The student that leads the discussion must be an advocate for the paper.

Lab will consist of conducting an experiment, discussions and exercises. The lab is designed to familiarize you with ecological, mathematical, statistical and computer techniques that facilitate integration of ecology into management.

### LRES 543: Short Outline

- A. Ecology Terminology

- i. Making sense of nature (Experimentalists vs Naturalists)
    - ii. Hierarchy of organization
- B. Individual Plants
  - a. Genets vs ramets (*What is an individual?*)
  - b. Plant growth (Compound interest principle)
  - c. Growth analysis
    - i. Inherent problem with destructive sampling
    - ii. RGR, LAR, NAR
- C. Plant Population Structure
  - a. Size
  - b. Age
  - c. Genetic
  - d. Spatial
- D. Plant Population Growth and Dynamics
  - a. Fundamental theory
  - b. Demographics
  - c. Models
- E. Plant Interactions
  - a. Empirical Assessments
    - i. Niche theory
    - ii. Density
      - 1. Constant final yield law
      - 2. Reciprocal yield law
      - 3. Self-thinning law
    - iii. Experimental designs
      - 1. Additive
      - 2. Replacement series
      - 3. Full factorial (addition series)
      - 4. Neighborhood
  - b. Hybrid Assessments
    - i. Neighborhood (WITH Model)
    - ii. Resource Ratio Hypothesis (R\*)
  - c. Mechanistic Assessments
    - i. Resource use and partitioning models
- F. Plant Communities
  - a. Composition
    - i. Assembly rules
    - ii. Species diversity ( $\alpha, \beta, \delta$ ) and scale
  - b. Dynamics
    - i. Succession (*Clements vs Gleason*)
    - ii. Diversity  $\rightarrow$  Stability  $\rightarrow$  Productivity
  - c. Keystone and nexus species
  - d. Models
    - i. Temporal dynamics
    - ii. Spatial dynamics
  - e. Trophic interactions
    - i. Herbivores
    - ii. Predators
    - iii. Pathogens
    - iv. Symbionts

**Agroecology, LRES 543**

Spring Semester, 2010

**Class Schedule, Lectures, Assignments, Readings**

<u>January</u>	<u>Subject</u>	<u>Assignment Due</u>	<u>Readings</u>
Th, 14	Introduction and Lect. Ecology Terminology		After Description, Harper, 1982 ; Levin 2010; Twombly, Bull. Ecol. 2009
Lab 1	Describe Experiment	Take data	
Tu, 19	Discuss Readings	Submit a one page comparison contrasting and/or identifying similarities between Harper and Levin papers.	
Th, 21	Individual Plants: Growth Analysis	Discuss Papers	Reich et al, 2003 Poorter and Garnier, 1996 Hunt, 1982
Lab 1		Take data	
Tu, 26	Discuss readings on individual based plant growth		Crawley: Chpt. 19 (Crawley) pp. 616-624
Th, 28	Plant Population structure		
Lab 1	Analyze plant growth data	Take data	
<u>February</u>			
Tu, 2	Discuss Reading		Nowak et al. 2010;
Th, 4	The structure of plant populations.		Hutchings: Chpt. 11 (Crawley) pp. 325-358
Lab 2	Analyze plant growth data. Meet in 208 LJH	Lab 1 Assignment Due: Growth Analysis	
Tu, 9			
Th, 11			Life History and Environment Chpt. 4 (Crawley) pp. 73-131;
Lab 3		Take data	
Tu, 16	Discuss Chpt. 11 & 4: The Structure of Plant Pops and Life History and Env.		
Th, 18	Discuss Chpt 12: Plant Population Dynamics		Watkinson: Chpt. 12 (Crawley) pp. 359-400
Lab 3	Plant life history model lab Meet in 208 LJH		
Tu, 23	Plant Population Dynamics		
Th, 25	Plant Population Dynamics		
Lab 5		Take data	
<u>March</u>			
Tu, 2	Models: discuss Hilborn & Mengel 1997		Hilborn and Mangel. 1997 Chpt 1
Th, 4	Pop. Spatial Dynamics		Tilman and Kareiva, 1997
Lab 6	Plant life history model lab (Sens. Anal.)		
Tu, 9	Interspecific Interference: R* (Discussion)		Cpt 8 in Crawley (Tilman)
Th, 11	Interspecific Interference		Cousens 1991
Lab 7	Presentation of model structure and question to class		LJH 208
Tu, 16	<u>Spring Break: no class</u>		
Th, 18	<u>Spring Break: no class</u>		

Tu, 23	Interspecific Interference R*		Tilman cont.
Th, 25	Interspecific Interference		Lecture notes
Lab 8	Take data	Growth chamber	
Tu, 30	Interspecific Interference		Lecture notes
<u>April</u>			
Th, 1	Calculating Thresholds		Maxwell and O'Donovan 2007
Lab 9	Analyze flat data		
Tu, 6	Plant Community Structure: Intensity vs importance of comp.		Weldon and Slauson 1986; Freckelton et al 2009; Damgaard and Fayolle 2010.
Th, 8	Plant Community Structure	Discuss Crawley	Crawley Chpt 14
Lab 10	Presentations of models		
Tu, 13	Guest Lecture: Jack Brookshire		
Th, 15	Read & Disc. Papers on Plant Com. Dynamics		Collins et al 2008; Kadmon and Allouche 2007
Lab 11	Presentations of models		
Tu, 20	Plant Community Structure and Function Lecture		
Th, 22	Plant Invasion Ecology		reading
Lab	Analyze flat data		
Tu, 27	Restoration Ecology	Read: Lockwood 1997	
Th, 29			
Lab 13	Open for finishing Com. Dynamics or Final Exam problem		
<u>May</u>			
Fri., ? pm	Field Trip: Meet in LJH Pit	Red Bluff	
Mon. 3, 12-1:50	<u>Final Exam</u>	<b>Due at 1:50 pm</b>	