Plant Population Biology

PBIO 435/535, Winter 2006
Call number: 05277/05283

Instructor
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Meeting times
Lectures: Mon/Fri 1:10 – 2:30
Labs: Weds 1:10 – 5:00
Office hours by appointment

Teaching assistant
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1. Rationale and goals

Population biology of plants is a fairly straightforward exercise in counting organisms. Counting should not be dismissed on the basis of simplicity, however. When conducted with statistical rigor, it allows close comparison of growth forms, environmental circumstances, phenology, and reproduction of individual plants. The individual phenotype is the unit of natural selection, and changes in plant populations are the clearest indication of natural selection at work. Through a population-level approach, we can understand the evolutionary consequences of any plant trait or behavior and, thereby, obtain an intimate view of the life of a plant as it relates to its environment. From an applied standpoint, demographic analysis allows us to project the population-level consequences of many forms of human intervention.

The goals of this course are to: 1) acquaint students with basic demographic processes as experienced by plants, 2) to explore the demographic implications of modular growth forms and sedentary life histories, and 3) present the material in the context of a variety of models. The course will take an evolutionary/behavioral approach to plant populations (sensu Harper 1968), seeking reproductive interpretations of autotroph function and life history. Labs will focus on population modeling, especially matrix representations and models of sedentary population and community structure.

2. Academic policy

All course policy is consistent with Ohio University policy. Please consult the Student Handbook. In addition, please note:

Academic honesty

Academic dishonesty of any form will result in immediate dismissal from the course without credit. This includes all the varied and subtle forms of plagiarism. If you are not sure when or how to assign credit, ask me beforehand.

Attendance

There is no attendance requirement. However, exams are drawn directly from lectures so it is strongly to the student's advantage to attend all lectures. As attendance is not required, no "make-ups" will be scheduled.

3. Syllabus

Jan 3-6	Course introduction and administration. Structure of plant populations. Plant reproduction and population growth. Patterns of natality. **Lab 1**: Plant greenhouse competition experiment. Descriptive statistics and computing.
Jan 9-13	Seedlings to flowering: Patterns of survivorship. Population flux. Life table construction and interpretation. Introduction to matrix algebra. **Lab 2**: Matrix models in plant populations; **Essay topics**
Jan 16	Martin Luther King day – **no class**
Jan 18-20	Transition matrix models. Sensitivity and elasticity analyses. Age and stage classified models. Stochastic models. **Lab 3**: Elasticity and sensitivity analyses
Jan 23-37	Plant life histories. Reproductive schedules and longevity. Application of matrix models to life history variation. **Lab 4**: **Exam** on weeks 1-3.
Jan 30 – Feb 3	Genetic structure of plant populations. Formation of local ecotypes. Selection, gene flow, and drift. Developmental plasticity. **Lab 5**: Genetic drift
Feb 6-10	Plant form. Plants as populations of meristems. Vegetative propagation. Clonal integration. Bud demography. Guerrillas and phalanxes. **Lab 6**: Modularity: Modeling plant growth from meristems to organisms.
Feb 13-17	Competition and coexistence. Seedling interactions. Resource partitioning. Density and yield in agricultural settings. Thinning. **Lab 7:** Harvest competition experiment
Feb 20-24	Neighborhood models. Interspecific interactions. Design of competition experiments. Environmental determinants of competitive success. **Lab 8**: **Exam** on weeks 4-7; weigh competition experiment
Feb 27 – Mar 3	Heterogeneous environments. Seed dispersal. Dormancy and germination. Disturbance. Patchiness of vegetation. Invasive weeds. **Graduate essay due** **Lab 9:** Plants in disturbed environments I (Landscape model)
Mar 6-10	Metapopulations: theory and application to plants. Course summary. **Lab 10:** Plants in disturbed environments II. **Seedling lab due**
March 16	**Exam** on weeks 6-10: 12:20pm in Porter 417.

3. Assignments

Labs will require either written reports or completion of a quiz at the beginning of the next lecture. Credit will be deducted for late assignments.

Expectations of graduate students

In addition to the above requirements, graduate students will prepare a short review based on a topic currently debated in the plant population literature. The review should include at least 12 citations published in the primary literature in the last 5 years. Topics must be approved beforehand in the form of a one-page description (the essay will not be accepted without prior approval). Graduate students will receive different versions of the exams than undergraduates requiring a more abstract conceptual mastery of the material.

Assessment

	Undergraduates	Graduate students
Exams	3 @ 20%	3 @ 20%
Lab reports	3 @ 10%	3 @ 8%
Quizzes	10%	8%
Literature review		8%

4. Texts

Readings: Students are also expected to read selectively from the list of works referred to in lecture (accessible at my website: http//www.plantbio.ohiou.edu/epb/faculty/faculty/grm.htm listed under "Sources"). The following texts may be helpful but are not required, nor followed closely in the course.

A clear exposition of the transition matrix method:

Caswell, H. 2001. Matrix Population Models. Sinauer, Sunderland, Ma.

A recent textbook which covers the topic somewhat superficially:

Silvertown, J. and D. Charlesworth. 2001. Introduction to Plant Population Biology. Blackwell, Oxford.

A survey of research methods in plant ecology:

Gibson, D.J. 2002. Methods in Comparative Plant Population Ecology. Oxford University Press, Oxford, UK.

Two recent textbooks with good sections on Population Biology:

Crawley, M. 1997. Plant Ecology. Blackwell, Oxford, UK.

Gurevtich, J., S.M. Scheiner, and G. Fox. 2003. The Ecology of Plants. Sinauer Associates, Sunderland, Ma.