Ecology
Spring 2024

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Office hours: By prior email appointment on Mondays and Thursdays

Course overview

The course will cover a range of topics from individuals to ecosystems with an emphasis on theoretical foundations and recent developments in the field. We will begin with how ecological understanding is achieved, how conditions and resources influence individual species and then move to processes at higher levels of organization and end with rethinking some of the big questions in ecology. The topics covered will include physiological ecology, population ecology, species interactions, community ecology, succession and disturbance; ecosystem ecology, and biogeochemistry. Topics introduced in the lectures will be followed by in class-activities (and simulations) and discussions. For discussion sessions, I will suggest classic and recent research papers and students will lead discussions based on those. The course will allow to reflect on uncertainty and variation in natural processes from individual behavior to ecosystem services. It is recommended strongly to take evolutionary biology course prior to this, since this course will build on some of the modules covered in that course.

Towards the end of this course, students will be able to (a) understand how ecologists empirically study processes occurring at various scales and apply evolutionary thinking to these processes (b) integrate proximate and ultimate factors to understand natural processes (c) quantitatively synthesize ecological research (d) explore applications of ecological concepts such as conservation, landscape management.

Tentative schedule

Week	Lecture-1	Lecture-2
1	**Introduction to ecology and evolutionary backdrop:** Physical/Environmental conditions, geographic patterns (global, regional, local), biomes, natural selection, local adaptation	**Conditions and resources**: life at extreme conditions, adaptations, temperature-size rules
2	Resources: plant and animal resources, ecological niches, ecogeographical rules	**Lifecycles:** Birth, death and growth
3	**Lifecycles:** dispersal and migration	**Lifecycles**: intraspecific competition, reproduction
4	**Population dynamics:** Density-dependence, growth models, metapopulations and patch dynamics	**Individuals and behaviour:** Communication and signaling systems, problem of signal reliability
5	**Revisiting individuals and populations:** discussions and presentations	**Revisiting individuals and populations:** discussions and presentations
6	**Competition:** Interspecific competition: mechanisms, experiments and models	**Competition:** Exploitation, allelopathy, Functional traits
7	**Mid-semester break**	**Mid-semester break**
8	**Foraging and predator-prey interactions:** Predator-prey interactions, herbivory	**Foraging and predator-prey interactions:** Game theory, optimality, foraging, arms race
9	**Mutualisms and antagonisms**: Pollination, seed dispersal	**Mutualisms and antagonisms**: symbiosis, parasitism, decomposition
10	**Behavior ecology of species interactions:** Economics of decision making, resource defense and learning	**Testing hypotheses in behavioral ecology:** Comparative approaches, repeatability, multivariate statistics
11	**Revisiting interactions : discussions and presentations**	**Revisiting interactions : discussions and presentations**
12	**Community structure in time and space:** Successional mechanisms, patterns and gradients of species richness,	**Community structure in time and space:** Disturbance, spatial heterogeneity, Island Biogeography
13	**Community structure and stability:** Diversity-invasibility relationships; diversity-productivity relationships; niche-complementarity hypothesis; species-selection hypothesis	**Ecosystems ecology:** Primary productivity, decomposition, flow of energy and matter through ecosystems, biogeochemical cycles
14	**Revisiting community structure: discussions and presentations** **Big questions in ecology:**	**Revisiting community structure: discussions and presentations**

	Why sex? Why cooperate? Why are the tropics so diverse? Why Species? Is nature chaotic? Why is the world green?	**Big questions in ecology and** discussion on: 'Why mountain passes are higher in the tropics'; 'Homage to Santa Rosalia or Why are there so many kinds of animals'; Why fruits rot, seeds mold and meat spoils

Resources:

Begon, M., Harper, J. L., & Townsend, C. R. *Ecology. Individuals, populations and communities*. Blackwell scientific publications.

Scott, G. (2009). *Essential animal behavior*. John Wiley & Sons.

Davies, N. B., Krebs, J. R., & West, S. A. (2012). *An Introduction to behavioural ecology*. John Wiley & Sons.

Grading scheme for undergraduate students:

Absolute grading system will be followed for the course

Assignments - 30% (2 assignments of 15 marks each)

Paper discussions and presentations- 10%

Midterm (in class)- 25%

Final (in class)- 25%

Class participation and attendance- 10%

There will be two take-home assignments (15 marks each) and two examinations (midterm and final). A list of research papers will be circulated towards the second week of the course for discussions and presentations.

Letter Grade	Total percentage
A	90 -100
A-	85-89
B+	80-84
B	75-79
B-	70-74
C+	65-69
C	60-64
C-	55-59
D+	50-54
D	45-49

D-	40-44
F	0-39

For graduate students:

Paper discussions and presentations- 10%

Assignments - 20% (2 assignments of 20 marks each)

Reaction paper/critique paper- 30% (2 papers of 15 marks each)

Midterm- 20%

Final- 20%

Graduate students are required to submit two written papers: 1500-word critique papers briefly summarizing and critically evaluating published research work, presenting personal viewpoints along with evidence backed by constructive criticism on a specific concept or research article.

Course Policies:

- No more than three unexcused absences will be allowed.
- Special assistance/support: Please contact me directly if you require any special assistance or support for understanding course materials such as slides, research papers, etc.
- Strict no to plagiarism and cheating in exams