BIOS 454/854 Ecological Interactions
Syllabus and Course Information

Instructor: Dr. Sabrina E. Russo
208 Manter Hall, 472-8387, srusso2@unl.edu

Course website: Canvas

Lectures: Tu/Th 11:00am-12:15pm, 401 Manter Hall

Office Hours: Tu 12:30-1:45pm, 208 Manter Hall or appointment by email

Required texts: None – Course reserves in Love Library and Canvas; PDFs on Canvas

What are Ecological Interactions?

The phrase, "ecological interactions" describes how individuals of populations and populations of species interact with each other and their environment and includes the fields of population and community ecology. Population ecology addresses the dynamics of populations of one species and how individuals within those populations interact. Community ecology addresses the properties of and patterns in assemblages of species, such as in diversity or function, and what processes or mechanisms give rise to those patterns, such as predation or dispersal. Studying ecological interactions not only can give us insight into how natural communities are "assembled", but also how humanity's modifications to the earth may impact them.

The study of ecological interactions is at an exciting frontier largely because of advances in the tools uses to study populations and communities: Computational and analytical advances allow us to build complex models, allowing stronger linkages between empirical and theoretical approaches. Genomic techniques allow us to investigate ecological interactions and responses on scales that were heretofore intractable. The future holds much promise and opportunity for groundbreaking work by creative thinkers and motivated students! Perhaps for these reasons, there is no modern, definitive textbook in this area. Morin (2011) provides concepts foundational to much of what will be covered in greater depth or from a different angle in lectures and discussions. The "useful texts" listed below serve as supplemental information. Much of what you learn will be from readings in primary literature, which we will cover in detail in student-led discussions.

Goals of this course:

(1) To introduce students to some of the main ideas, concepts, and approaches in the study of ecological interactions and to demonstrate the integrative, multidisciplinary nature of this field.
(2) To practice reading, evaluating, interpreting, and discussing primary literature in population and community ecology and reflect on the scientific impact and conceptual advances that published research provides.
(3) To gain exposure to and experience with quantitative tools commonly used in Community Ecology.
(4) To practice scientific writing and inference both to justify and solidify your ideas and to learn to write and publish scientific papers.
(5) To investigate in detail, demonstrate technical proficiency, and reflect upon a particular topic of the students' choice within population or community ecology by reviewing the primary literature, writing a synthetic review paper, and making a lecture presentation to the class on this topic.
(6) To practice evaluating and reflecting upon the impact of scientific papers by conducting a peer-review of class-mates' review paper.

Prerequisites and requirements of this course:

Prerequisites for undergraduate students are LIFE 120, 121, and either BIOS 207 or BIOS 220, or equivalent courses. I expect that you will attend all course meetings, complete assignments, prepare for and participate in discussions, and ask questions in lecture. The material in this course assumes knowledge of general biology and ecology, with some familiarity with basic calculus, algebra, and statistics. Class attendance and participation are part of your grade. If you anticipate that you must be absent from a class meeting for a legitimate reason, speak to me about it before your absence.

ACE 10 Student Learning Outcome

This course satisfies the ACE 10 student learning outcome to generate a creative or scholarly product that requires broad knowledge, appropriate technical proficiency, information collection, synthesis, interpretation, presentation, and reflection. This will be achieved by (1) discussions of primary literature and debates of controversial issues in population and community ecology during class, (2) writing one synthetic review paper on a topic within population and community ecology, and (3) conducting peer-reviews of fellow classmates review papers, which involves reflection on and synthesis of scientific information. See the sections below for details.

Course Details

The schedule of activities and readings for course meetings will be updated on Canvas. Course meetings will be divided between lectures, discussions, and in-class quantitative assignments on selected topics. PDFs of the assigned readings will be available on Canvas or on reserve in Love library. See the Course Schedule for reading assignments.

Most course material will be covered through lectures and the required readings. I welcome students to interrupt me (politely!) at any time to ask a question. I take an active-learning approach in this course, and provide a diversity of activities for students to engage in the learning process. Students are encouraged to take responsibility for their own learning and so are expected to actively participate in course activities, which include preparing for lectures and discussions by doing the required readings, in-class activities, including impromptu thought questions during lecture that may sometimes require small-group discussion, and planned small-group activities, and discussions. Students should consult with me in advance when they anticipate an absence from class to make sure the absence is excusable.

Assessments:

(1) Discussion Participation:	15%
(2) Discussion Thought Questions:	5%
(3) Midterm and Final Exams:	20%
(4) Review Paper Proposal:	10%
(5) Peer-reviews of class-mates' Review Papers:	20%
(6) Final Review Paper:	30%

Turning in Assignments: The Review Paper Proposal, Draft Paper, Peer Reviews, and Final Paper should be turned in by email to me. **DO NOT use the email function in Canvas to contact me or send me assignments** – this does not always work. Instead, email me directly at srusso2@unl.edu. Please send me your assignments as **Microsoft Word files**, because I use the review and comment features to send you comments on your assignments. I generally reply to each student to acknowledge receipt of his/her assignment, so if you do not receive a reply from me, please check to make sure that I have receive it. Thus, you can turn in most assignments in this course via the internet.

Rules for Late Assessments: If you know that an excusable absence will affect your ability to turn in an assignment (or take an exam) on time, then **you must speak with me ahead of time** to make sure that your absence is indeed excusable. Otherwise, your assignment will be considered late, and there are **stiff penalties for late assignments** in this course. For assignments on Canvas, there will be no credit given for late assignments. For other assignments, if an assignment is turned in late by three hours or less, then 1/3 of a letter grade will be deducted from the final grade. After that, one letter grade will be deducted for every day (24-hour period) that the paper is late. In other words, if you turn in your paper 25 hours late, then if the paper grade was an A, then you will receive a C.

(1, 2) Discussion Participation and Discussion Thought Questions: Primary literature will be discussed in class (see the Course Schedule). What are the important research questions in population and community ecology? Which researchers have influenced thinking and development of ecological knowledge and what have they contributed? The discussions will help you learn how to answer these questions and train you how to read primary research literature in ecology.

The goal of discussions is to provide you the opportunity to develop your skills to critically read and evaluate scientific literature, interpret and synthesize data and fundamental concepts in ecology, and understand how these research papers fit within the broader context of the course. Discussions will be student-led, and students will be assigned, likely in teams of 2 or 3 depending on enrollment, to be Facilitators and Recorders for each the discussion of each paper. By being Facilitators and Recorders of the discussion, you will have the opportunity to think more deeply about topics that are currently being discussed in the lectures. For each paper discussion, there will be a set of Discussion Thought Questions that all students must answer prior to the scheduled in-class discussion. Discussion Thought Questions can be downloaded as a Word document from Canvas. Type your answers into the Word document and email the file to me at srusso2@unl.edu by 5pm on the day BEFORE the discussion of that paper in class. The Discussion Thought Questions should help guide your thinking and understanding about the paper and will be available through Canvas. Although your answers will not be graded in detail for correctness, students not giving thoughtful answers will not receive credit. See **Discussion Instructions** and **Leading the Discussion of a Scientific Journal Article** documents on Canvas for more information.

Some questions to consider for preparing for discussions are: What are the fundamental contributions of researchers who made the foundational observations for these conflicting views of the community? What ideas or syntheses have helped resolve (or fuel) the controversy? How might remaining disagreement be resolved through additional observations or experiments or methods? Participation and leadership will be assessed based on the level of preparation of the student and the productiveness of the ensuing discussion, including knowledge of the assigned reading, integration of

the assigned reading with lecture material covered thus far, and clarity, creativity, and logic of the arguments. The Discussion Participation grade will consist of (1) Being Discussion Facilitator or Recorder, (2) Quality of the Discussion summary produced as Facilitator and Recorder, and (3) Participation in discussion when not being Facilitator or Recorder.

In-class Lectures:

(2) Midterm and final exams: Midterm and final exams will be given in class (see Course Schedule) and consist of short-essay answers based on any material covered in lecture, discussions, or readings. The goal of exam questions will be to challenge your critical and analytical thinking skills and may involve quantitative reasoning, such as interpretation of data, although most questions will also require recall of information covered in the course. Exam questions will be similar in style to those in Discussion Thought Questions and learning activities in class, and some practice exam questions with an answer key will be provided. The final exam will not be comprehensive and will only cover material after the midterm exam.

(3, 4, and 5) Final Project: Review Paper Proposal, Peer Reviews, and Draft and Final Review Papers: The discussions will allow students to develop skills in articulating and synthesize research topics. These skills are essential for them to produce a Final Review Paper, which is the scholarly product produced in this course. The purpose of the Final Review Paper assignment is for the student to investigate a topic in population or community ecology and its body of research in the primary literature and write a comprehensive review that reflects the scientific information that the student gained about the topic.

The scholarly Final Review Paper will demonstrate that students can collect information on a topic, review and interpret the information, and synthesize the information in written and oral formats. Students will also be expected to evaluate different scientific views and demonstrate that they have a broad knowledge of the research topic that allows synthesis and interpretation of scientific information. Assessment will be based on the thoroughness of the literature review and synthesis, critical evaluation of the literature and of the direction of the research in that topic area, integration with lecture material covered thus far, and clarity of presentation.

Draft and Final Review Papers should be **10-12 pages (double-spaced in 12-point Times Roman font) in length**, written as a manuscript for publication in the style of the professional scientific journal, *Trends In Ecology and Evolution* (*TREE: http://www.trends.com/tree/about.htm#authors*). This manuscript will be submitted to me (the mock "editor" for *TREE*). A Proposal for your Review Paper, in the form of a provisional title and a 750-1000 word summary outlining the specific topics that your review will cover and justifying why it is of interest to the readers of *TREE*, is required (see Course Schedule for the due date). **You are required to meet with me to discuss your proposed topic before the proposal is due**. As the mock-subject editor, I will return comments on your proposal, along with a grade.

A Draft Review Paper must be turned in (see Course Schedule), and each student will be assigned two fellow class-mates' Draft Review Papers (anonymously) to conduct a peer-review of them. Peer-review is the process whereby scientific research is evaluated by fellow scientists before the research results can be published, since publishing represents a permanent, authoritative archive of scientific

findings and ideas. Students will evaluate the Draft Review Papers' contributions to the discipline of ecology. The Peer-review Assignment will provide students with the opportunity to reflect on ecological concepts that they have learned and to evaluate how well those concepts are explained and interpreted in a peer's Review Paper, as well as learn to articulate their assessment of a peer's work in a constructive manner, as in the formal process of professional scientific peer-review. The Peer-review Assignment will be graded based on those learning criteria. Guidance on how to conduct peer reviews is posted on Canvas. I will write to each of you again as mock-subject editor, sending you the anonymous peer reviews of your manuscript. You should take these comments into consideration in revising your paper for your Final Review Paper.

A Writing Fellow from the UNL Writing Center (http://www.unl.edu/writing/home) will be working with ***undergraduate students*** on the Proposal and Draft Review Paper. Writing is a critical part of professional development in every field, whether it is a scientific or liberal arts field, and my goal is to give you opportunities to perfect and reflect upon your writing skills and be a more confident and capable writer. Undergraduate students are required to meet with the Writing Fellow before the Proposal and before the Draft Review Papers are due. Be sure to read the **Requirements for Undergraduates for Working with the Writing Fellow** for details about what is required for this aspect of the Final Project.

Here are some **guidelines and ideas to help you choose a topic for your Final Review Paper**:
You can (1) trace the development of research ecological interactions in population or community ecology that we are not able to cover (or cover sufficiently) in class or (2) provide synthetic reviews of conceptually-driven empirical research on particular groups of organisms or from particular study sites, biomes, or ecosystems.

You should focus on the conceptually interesting aspects of your topic, especially the fundamental natural patterns, and hypotheses about the biological mechanisms or processes that might explain those patterns, and how researchers have tested among alternative hypotheses. Your topic should interest you – feel free to address a topic directly related to your thesis research. In fact, this assignment could form the basis for the introduction to your thesis or a review paper you later submit for publication. Your Review Paper should be information-rich and demonstrate the depth of your understanding. You may also consider designing a conceptual figure regarding your topic for your paper. Your topic should be interesting to the ecological community (specifically the readers of *TREE*). You may copy figures from papers in the primary literature and use them in your paper, **provided** that they are **adequately discussed** in your review paper and are **appropriately cited**. Plagiarism of any sort will result in a student receiving a failing grade on the assignment and disciplinary action.

For example, you could highlight some of the most important patterns and processes that have been identified from work on a selected group of organisms in a selected location (e.g., Galapagos finches). In this case it would be useful to include both details of the key studies and a synthetic overview. Or, you could choose a type of ecological interaction and examine its effects on populations or communities, or ecosystems, building on what was presented in lectures or choosing an interaction that was not discussed in lectures, such as topics in these areas: Plant-pathogen interactions, plant-herbivore interactions, indirect interactions, plant-microorganism interactions (mycorrhizae, fungi,

bacteria), food webs, predator-prey interactions, mutualisms, plant-pollinator interactions, plant-frugivore/seed-disperser interactions.

Some examples of research questions that could be used for the review paper are:
How do ecological interactions control ecosystem services, such as nutrient retention, in natural systems?
Do ecological interactions producing top-down or bottom-up control regulate primary production?
Are there any general rules that can be used to predict the success of invasive species?
How do ecological interactions affect the stability of populations and communities?
What is the distribution of interaction types in communities and are there any general patterns?
What theory explains why mycorrhizal networks may or may not be adaptive for fungi or plants?
How might interactions between the soil microbiota control the distribution and abundance of plant species or nutrient and biogeochemical cycling in natural systems?
Do the responses of tree species to neighborhood competition depend on phylogeny, life history, ecological strategy, or successional stage?
What are the relative importance of physical versus chemical defenses of plants against herbivory and are there any general patterns with respect to biomes?

Graduate vs. undergraduate student evaluation: Whether the student is an undergraduate or graduate student will be taken into consideration in the grading of all assignments. Although students will be graded on the same numerical scale, as described below, grading of graduate students will involve a higher level of expectation in terms of basic knowledge, understanding, ability to synthesize concepts, and writing, presentation, and discussion skills. Graduate students may also be asked to do extra reading for discussions and take more of a leadership role in discussions.

Grading Scale (% of available points)

A+	97.0 – 100
A	93.0 – 96.9
A-	90.0 – 92.9
B+	87.0 – 89.9
B	83.0 – 86.9
B-	80.0 – 82.9
C+	77.0 – 79.9
C	73.0 – 76.9
C-	70.0 – 72.9
D+	67.0 – 67.9
D	63.0 – 66.9
D-	60.0 – 62.9
F	<59.9%

Other important information:

Students with disabilities are encouraged to contact the instructor for a confidential discussion of their individual needs for academic accommodation. It is the policy of the University of Nebraska-Lincoln to provide flexible and individualized accommodation to students with documented disabilities that may affect their ability to fully participate in course activities or to meet course requirements. To receive accommodation services, students must be registered with the Services for Students with Disabilities (SSD) office, 132 Canfield Administration, 472-3787 voice or TTY.

Other useful texts:

Brown, James. H. and Geoffrey B. West. 2000. Scaling in Biology. Oxford University Press.
Case, Ted J. 2000. An illustrated guide to theoretical ecology. Oxford University Press.
Chase, Jonathan M. and Mathew A. Liebold. 2003. Ecological Niches: Linking classical and contemporary approaches. University of Chicago Press.
Cody, Martin L. and Jared M. Diamond. 1975. Ecology and evolution of communities. Belknap Press.
Diamond, Jared and Case, Ted J. 1986. Community ecology, Harper & Row.
Dodds, W. 2009. Laws, Theories, and Patterns in Ecology. University of California Press, Berkeley, CA
Gardener, M. 2010. Statistics for Ecologists Using R and Excel. Pelagic Publishing.
Gotelli, Nicholas J. 2001. A Primer of Ecology, 3rd ed, Sinauer Press.
Gotelli, Nicholas J. and Aaron M. Ellison. 2004. A Primer of Ecological Statistics. Sinauer Press.
Grace, James B. and David Tilman. 1990. Perspectives on plant competition. Academic Press.
Holyoak, Marcel, Mathew A. Leibold, and Robert D. Holt. 2005. Metacommunities : spatial dynamics and ecological communities, University of Chicago Press.
Hubbell, Stephen. 2001. The Unified Neutral Theory of Biodiversity and Biogeography. Princeton University Press.
Huston, Michael A. 1994. Biological Diversity. Cambridge University Press.
Kinzig, A. P., S. W. Pacala, and D. Tilman. 2001. The Functional Consequences of Biodiversity: Empirical Progress and Theoretical Extensions. Princeton University Press.
Levin, S.A. 2010 The Princeton Guide to Ecology. Princeton University Press.
Losos, J.B. 2011. Lizards in an Evolutionary Tree: Ecology and Adaptive Radiation of Anoles. University of California Press, Berkeley, CA
Losos, J.B., R.E. Ricklefs (eds) 2009. The Theory of Island Biogeography Revisited. Princeton University Press, Princeton, NJ
MacArthur, Robert H. and Edward O. Wilson. 1967. The theory of island biogeography, Princeton University Press.
Magurran, A. E. 2004. Measuring Biological Diversity. Blackwell Science, Inc.
Mittelbach, G. 2011. Community Ecology. Sinauer Press.
Real, Leslie A. and James H. Brown. 1991. Foundations of Ecology: Classic papers with commentaries. University of Chicago Press.
Resetarits, W. J., Jr. and Bernardo. 1998. Experimental Ecology: Issues and Perspectives. Oxford University Press.
Ricklefs, R.E. and Dolph Shluter. 1993. Species Diversity in Ecological Communities. University of Chicago Press.
Rosenzweig, Michael L. 1995. Species Diversity in Space and Time. Cambridge University Press.
Scheiner, S. M. and J. Gurevitch. 1993. Design and Analysis of Ecological Experiments. 1 edition. Chapman and Hall.
vanStraalen, N.M., D. Roelofs. 2006. An Introduction to Ecological Genomics. Oxford University Press, Oxford, England
Strong, Donald R. *et al.* 1984. Ecological communities: conceptual issues and the evidence. Princeton University Press.
Velland, M. 2017. The Theory of Ecological Communities. Princeton University Press.
Verhoef, H.A., P.J. Morin (eds). 2010. Community Ecology: Processes, Models, and Applications. Oxford University Press, Oxford, England