BIOL 465 Syllabus
Global Biodiversity and Macroecology

INSTRUCTOR

Dr. Allen Hurlbert
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Meeting Time:
T Th 9:30 – 10:45
1378 Genome Sciences Bldg

Office Hrs:
By appt
331 Wilson Hall

In this course you will learn about the distribution of biodiversity on planet Earth, but more importantly, you will learn to think about these and other patterns in the context of statistics. Macroecology is a way of studying the relationships between organisms and their environment that involves characterizing and explaining statistical patterns of abundance, distribution, phenotypes, and diversity. As we explore these patterns, we will also focus on statistical tools that can help us to understand them.

TEXT

There is no required text for this course. Required readings will be posted to Sakai as PDFs.

SOFTWARE

Throughout the course we will use the statistical programming language ***R*** for data analysis and visualization. This software is freely available for download from http://cran.r-project.org/ for Mac, Windows, and Linux operating systems. We will interact with ***R*** using *RStudio*, which can be downloaded for free from https://www.rstudio.com/. Students do not need any prior knowledge of R to take this class. We will spend approximately one class per week programming and doing data analysis. Students should always bring a laptop to class unless the instructor specifies otherwise.

EVALUATION

Course grades will be based on a combination of assignments, a research paper, an oral presentation, and participation as outlined below.

***ASSIGNMENTS** (50%)

You will have in-class and take-home assignments almost every week throughout the semester. Collectively, they will account for 50% of your grade. Assignments turned in late will not be graded and there will be no make-up assignments. However, I will drop your lowest assignment score in the calculation of your final Assignment grade.

***RESEARCH PAPER** (40%)

Students will complete a research paper at the end of the semester that introduces a macroecological research question, and involves the novel analysis of an ecological dataset including R code, figures, and discussion. More information on these options will be provided later in the semester.

***RESEARCH PAPER PRESENTATION** (5%)

You will present a short presentation summarizing your research findings to the class.

***CLASS PARTICIPATION** (5%)
Class meetings will involve discussion of the reading and of the new material presented. Participation in these discussions is a critical component of this course. *As part of their participation grade, students are expected to post on Sakai questions or issues for discussion based on the reading by midnight prior to each class.*

TOPICS AND READINGS
The next page has the tentative schedule of topics and assigned readings. Readings may change from what is listed here, but will be posted on Sakai no later than one week before each class. Students are responsible for conducting the reading prior to coming to class.

COURSE GOALS
By the end of the course, students will

- be able to describe basic global patterns of biodiversity and summarize the major hypotheses for such patterns.
- be able to provide evidence in support of each of the major hypotheses for richness patterns.
- be able to describe and interpret the first four moments of a distribution.
- be able to perform and interpret linear regression multiple regression, ANCOVA, variance partitioning, and t-tests.
- know the assumptions behind the above statistical methods and how to evaluate them.
- understand the theoretical and empirical relationships linking abundance, distribution, body size and niche breadth.
- be able to define the concept of allometry and provide examples.
- be able to describe the consequences of a sublinear scaling of organismal metabolism and body size.
- be able to describe the ways in which humans are similar and different from other organisms with respect to macroecological patterns.
- be able to characterize the constraints on and impacts of human societies within the Earth's ecosystem.
- be able to synthesize diverse sources of information statistically, and interpret results in the context of general macroecological research questions.

Graduate Research Consultant

In this course, you will be working with a Graduate Research Consultant (Grace Di Cecco, gdicecco@live.unc.edu) who will assist you in the research project. The GRC Program is sponsored by the Office for Undergraduate Research (www.unc.edu/depts/our). I encourage you to visit this website to see other ways that you might engage in research, scholarship and creative performance while you are at Carolina.

Disability Services Information

If you have a medical condition/disability that may require reasonable accommodation to ensure equal access to this course, please contact the Department of Disability Services at 919.962.8300, on the internet at http://disabilityservices.unc.edu/eligibility or via email at disabilityservices@unc.edu

Honor Code Information

The University of North Carolina at Chapel Hill has had a student-administered honor system and judicial system for over 100 years. The system is the responsibility of students and is regulated and governed by them, but faculty share the responsibility. If you have questions about your responsibility under the honor code, please bring them to your instructor or consult with the office of the Dean of Students or the Instrument of Student Judicial Governance. This document, adopted by the Chancellor, the Faculty Council, and the Student Congress, contains all policies and procedures pertaining to the student honor system. Your full participation and observance of the honor code is expected. If you require further information on the definition of plagiarism, authorized vs. unauthorized collaboration, unauthorized materials, consequences of violations, or additional information on the Honor Code at UNC, please visit http://honor.unc.edu*.*

BIOL 465 Schedule of topics

Date	Topic	Assigned reading	HW
*Biodiversity			
8/20/2019	Course goals; A brief history of life on Earth	Simpson & Kiessling 2016	
8/22/2019	Richness Patterns, Spatial Analysis in Macroecology	Lomolino et al 2016	MoL.org
8/27/2019	Intro to R		Install R; HW 1 due
8/29/2019	Equilibrium and limits to species richness	2 Papers: Ecological Limits vs No Limits	
9/3/2019	Phylogenies, speciation, and extinction	Morlon 2014	
9/5/2019	Phylogenies in R		HW 2 due
9/10/2019	The species-area relationship, linear models	Rosenzweig 1995	
9/12/2019	ANCOVA, multiple regression		HW 3 due
9/17/2019	Island biogeography	Simberloff 1976	
9/19/2019	Variance partitioning, local vs regional determinants of diversity	White & Hurlbert 2010	HW 4 due
9/24/2019	Species invasions and global biodiversity	Sax et al 2002	
9/26/2019	Visualizing distributions, *t*-tests	Matejka & Fitzmaurice 2017	HW 5 due
10/1/2019	Tropical niche conservatism	Wiens & Donoh 2004; Wiens et al 2009	
10/3/2019	Debate prep	Cornell 2013	HW 6 due
10/8/2019	Debate		
10/10/2019	UNIVERSITY DAY		
*Macroecology			
10/15/2019	Intro to macroecology: patterns and constraints	Brown 1996, Ch 1-2	HW 7 due
10/17/2019	FALL BREAK		
10/22/2019	Finding macroecological datasets		
10/24/2019	Patterns in abundance: across space and species	Brown 1996, Ch 4	HW 8 due
10/29/2019	Data manipulation in R	Wickham dplyr tutorial, YouTube	Proposal due
10/31/2019	Allometry: metabolism, body size & temperature	Brown et al. 2004	
11/5/2019	Patterns in body size	White et al. 2007	HW 9 due
11/7/2019*	Research project: working on your analysis		Revised proposal
11/12/2019	Macroecology of humans	Burnside et al. 2012	
11/14/2019	Research project: working on your analysis		
11/19/2019*	Writing peer review: Introduction draft		Intro due
11/21/2019	Research project: working on your analysis		
11/26/2019	Human energy budget	Haberl et al. 2007	
11/28/2019	HOLIDAY		
12/3/2019	The future of biodiversity	Dornelas et al. 2015; Dirzo et al. 2015	HW 10 due; PAPER DUE 12/6
12/10/2019	FINAL EXAM, 8:00 AM		Presentation