BIOL 465 Syllabus
Global Biodiversity and Macroecology

INSTRUCTOR

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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

The required text is James Brown's *Macroecology* (1995). Additional required readings will be posted to Blackboard 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. Students do not need any prior knowledge of R to take this class. Students should always bring a laptop to class unless the instructor specifies otherwise.

EVALUATION

Course grades will be based on a combination of exams, assignments, oral presentations, and participation as outlined below.

***EXAMS** (Midterm 30% + Final 30%)

Both the midterm and final are in class essay exams with 5-6 questions each. The final is not cumulative, but will cover only the second half of the course material.

***ASSIGNMENTS** (20%)

Assignment 1. Regression analysis and Analysis of Co-Variance(4%)
Assignment 2. Variance partitioning and Quantile Regression (4%)
Assignment 3. Visualizing a complex dataset (4%)
Assignment 4. Regression Trees (4%)
Assignment 5. Human macroecology and GapMinder.org (4%)

***CLASS PARTICIPATION** (10%)

Each class meeting 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 Blackboard questions or issues for discussion based on the reading by midnight prior to each class.*

***ORAL PRESENTATIONS** (10%, undergraduates only)
Undergraduate students will participate in two oral presentations. For the first (4%), small groups of 3-4 students will be assigned a biogeographic realm, and then present to the class the unique facets of biodiversity and geological history for that realm. For the second (6%), each student will choose a published macroecology research paper and present a 10-minute summary of the paper's methodology and findings.

***RESEARCH PAPER** (10%, graduate students only)
Graduate students will complete a research paper at the end of the semester rather than participating in oral presentations. Two types of research paper are possible: 1) A literature review of some topic in macroecology, or 2) The novel analysis of a macroecological dataset including R code, figures, and discussion. More information on these options will be provided later in the semester.

TOPICS AND READINGS
The next page has the tentative schedule of topics and assigned readings. Any chapter designations (e.g., "Ch. 9") refers to the book *Macroecology*. Readings may change from what is listed here, but will be posted on Blackboard 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 identify unique features of biodiversity on each continent.
- 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, quantile regression, multiple regression, ANCOVA, variance partitioning, and regression tree analysis.
- 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.
- understand how various plant traits are related to and tradeoff against one another along geographic gradients.
- 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.

Date	Topic	Reading & Assignments
*Biodiversity		
8/24/2010	Course goals and intro to biodiversity and macroecology	
8/26/2010	A brief history of life on Earth and extant biodiversity	Sepkoski et al 1981; Alroy et al 2008
8/31/2010	Phylogenies, speciation, and extinction	Raup 1986; Sahney & Benton 2007
9/2/2010	Palearctic, Nearctic, Neotropics	**presentations**
9/7/2010	Afrotropics, Australasia, Indo-Malaya	**presentations**
9/9/2010	The species-area relationship and island biogeography	Rosenzweig 1995
9/14/2010	Spatial patterns of species richness	Pianka 1966; Gaston 2000
9/16/2010	Determinants of richness - equilibrial processes	Ch. 9; Brown et al 2001; **Assmt 1 due**
9/21/2010	Determinants of richness - time and niche conservatism	Wiens & Graham 2005
9/23/2010	Determinants of richness - local vs regional processes	White & Hurlbert 2010
9/28/2010	Sub-continental patterns - elevation, depth, peninsulas	Smith & Brown 2004; McCain 2007
9/30/2010	Beta diversity: patterns in species turnover	McKnight et al 2007
10/5/2010	Species invasions and global biodiversity	Sax & Gaines 2008; **Assmt 2 due**
10/7/2010	Microbes versus macrobes	Martiny et al 2006; Costello et al 2009
10/12/2010	HOLIDAY	
10/14/2010	MIDTERM	
*Macroecology		
10/19/2010	Statistics and data visualization	TBA
10/21/2010	Introduction to macroecology: patterns and constraints	Ch 1-2
10/26/2010	Geographic ranges	Ch 6; Gaston 2007; **Assmt 3 due**
10/28/2010	Patterns in abundance: across space and species	Ch 4; McGill & Collins 2003
11/2/2010	Body size distributions	Ch 5; White et al 2007
11/4/2010	Allometry: an introduction	Peters 1983; **Assmt 4 due**
11/9/2010	Allometry: metabolism and its ecological consequences	Ch 10; Brown et al 2004
11/11/2010	Macroecology of plant traits	Moles et al 2007; Swenson & Enquist 2007
11/16/2010	Paper presentations	**presentations**
11/18/2010	Paper presentations	**presentations**
11/23/2010	Paper presentations	**presentations**
11/25/2010	HOLIDAY	
11/30/2010	Macroecology of humans: human ecology	Moses & Brown 2003; Maffi 2005
12/2/2010	Macroecology of humans: human impacts	Ch 12; TBA
12/7/2010	The future of biodiversity	TBA **; Assmt 5 due**