# Course Syllabus: BIOL 1475 – Biogeography – Spring 2011

Biogeography, the study of the geography of life, has a long and distinguished history, and one interwoven with that of ecology and evolutionary biology. Traditionally viewed as the study of geographic distributions, modern biogeography now explores a great diversity of patterns in the geographic variation of nature — from physiological, morphological and genetic variation among individuals and populations to differences in the diversity and composition of biotas along geographic gradients. Given its interdisciplinary and integrative nature, biogeography is now broadly recognized as a unifying field that provides a holistic understanding of the relationships between the earth and its biota. Our abilities to develop more general theories of the diversity of life, and to conserve biological diversity may well rest on insights from the field of biogeography.

**Objectives:** To introduce students to the foundations, current state-of-the-art, and future of the field of Biogeography.

**Lectures:** Tuesdays and Thursdays (1-2:20), J. Walter Wilson 202

**Instructor:** Dov F. Sax, 401-863-9676. **Office Hours**: Friday, 10AM-Noon, 302 Walter Hall

**Required Texts:**

1. Biogeography, Fourth Edition – by Lomolino, Riddle, Whittaker and Brown
2. Various readings outlined for discussion sections

**Recommended Texts:**

1. Foundations of Biogeography – by Lomolino, Sax and Brown
2. Song of the Dodo – by David Quammen

## Curriculum Schedule:

Week 1:
January 26 – Course Introduction

Week 2:
January 31 – Discussion I: History of Biogeography
February 2 – Discussion II: Niche concepts

Week 3:
February 7 – Lecture: Species distributions and niche concepts (Chapters 1-4)
February 9 – Lecture: Biogeographic dynamics of the Pleistocene (Chapters 8-9)

Week 4:
February 14 – Discussion III: Geography of Communities
February 16 – Discussion IV: Dispersal and Immigration

Week 5:
February 21 – *No class – University holiday*
February 22 (Wednesday) – **Outline of Term Paper Due**
February 23 – Lecture: Dispersal and Immigration (Chapters 5-6)

Week 6:
February 28 – Discussion V: Biogeography of human infectious disease
March 1 – **Exam I**

Week 7:
March 6 – Discussion VI: Speciation and Extinction
March 8 – Lecture: Speciation and Extinction (Chapter 7)

Week 8:
March 13 – Discussion VII: Geography of Diversification and Invasion
March 15 – Lecture: Geography of Invasion (Chapters 10-12)

Week 9:
March 20 – Discussion VIII: Island Biogeography
March 22 – Discussion IX: Assembly and Evolution of Insular Biotas

Week 10:
March 27 – *No class – Spring Recess*
March 29 – *No class – Spring Recess*

Week 11:
April 3 – Lecture: Assembly and Evolution of Insular Biotas (Chapters 13-14)
April 5 – Discussion X: Ecogeographic Rules and Diversity Gradients

Week 12:
April 10 – Lecture: Ecogeographic Rules and Diversity Gradients (Chapter 15)
April 12 – Discussion XI: Conservation Biogeography

Week 13:
April 17 – Lecture: Conservation Biogeography (Chapters 16-17)
April 19 – **Exam II**

Week 14:
April 23 (Monday) – **Draft Term paper due**
April 24 – Lecture: structuring a scientific presentation
April 26 – Class Presentations of Term Papers

Week 15:
May 1 – Class Presentations of Term Papers
May 3 – No Class – Reading Period

May 16 – 2PM - **Final Draft of Term Paper Due**

## Discussion Readings:

Discussion I: History of Biogeography

Lomolino, M.V. et al. 2004. Foundations of Biogeography. (pages 14-48)

Quammen, D. 1996. Song of the Dodo. Simon and Schuster. (pages 1-115)

Discussion II: Distribution of single species

Grinnell, J. 1917. The niche-relationships of the California Thrasher. Auk 34: 427-433.

Root, T. 1988. Energy constraints on avian distributions and abundances. Ecology 69: 330-339.

Parmesan, C. and Yohe, G. 2003. A globally coherent fingerprint of climate change impacts across natural systems. Nature 421: 37-42.

Wiens, J.A. et al. 2009. Niches, models and climate change: Assessing the assumptions and uncertainties. PNAS 106: 19729-19736.

Discussion III: Geography of communities

Clements, F.E. 1936. Nature and structure of the climax. Journal of Ecology 24: 252-284.

Gleason, H.A. 1926. The individualistic concept of the plant association. Bulletin of the Torrey Botanical Club 53: 7-26.

Janzen, D. 1985. On ecological fitting. Oikos 45: 308-310.

Wilkinson, D.M. 2004. The parable of Green Mountain: Ascension Island, ecosystem construction and ecological fitting. Journal of Biogeography 31: 1-4.

Williams, J.W. and Jackson, S.T. 2007. Novel climates, no-analog communities, and ecological surprises. Frontiers in Ecology and the Environment 5: 475-482.

Discussion IV: Dispersal and Immigration

Grinnell, J. 1922. The role of the "accdiental". Auk 39: 373-380.

Simpson, G.G. 1940. Mammals and land bridges. Journal of the Washington Academy of Sciences 30: 137-163.

Nathan, R. et al. 2008. Mechanisms of long-distance seed dispersal. Trends in Ecology and Evolution 23: 638-647.

Vermeij, G.J. and Roopnarine, P.D. 2008. The coming Arctic invasion. Science 321: 780-781.

Early, R. and Sax, D.F. 2011. Analysis of climate paths reveals potential limitations on species range shifts. Ecology Letters 14: 1125-1133.

Discussion V: Biogeography of Human Infectious Diseases

Guernier, V. et al. 2004. Ecology drives the worldwide distribution of human diseases. Plos Biology 2: 740-746.

Smith, K.F. et al. 2007. Globalization of human infectious disease. Ecology 88: 1903-1910.

Wolfe, ND et al. 2007. Origins of major human infectious diseases. Nature 447: 279-283.

Jones, K.E. et al. 2008. Global trends in emerging infectious diseases. Nature 990-993.

Discussion VI: Speciation and extinction

Mayr, E. 1942. *Excerpt on "Geographic Speciation"* in Systematics and the Origin of Species. Columbia University Press. (pages 154-184)

Bush, G.L. 1969. Sympatric host race formation and speciation in frugivorous flies of the genus Rhagoletis (Diptera, Tephritidae). Evolution 23: 237-251.

Olson, S.L. and James, H.F. 1982. Fossil birds from the Hawaiian Islands: Evidence for wholesale extinction by man before Western contact. Science 217: 633-635.

Jackson, S.T. and Sax, D.F. 2010. Balancing biodiversity in a changing environment: extinction debt, immigration credit and species turnover. Trends in Ecology and Evolution 25:153-160.

Loehle, C. and Eschenbach, W. 2012. Historical bird and terrestrial mammal extinction rates and causes. Diversity and Distributions 18: 84-91.

Discussion VII: Geography of diversification and invasion

Dobzhansky, T. 1950. Evolution in the tropics. American Scientist 38: 209-221.

Marshall, L.G. et al. 1982. Mammalian evolution and the great American interchange. Science 215: 1351-1357.

Gillespie, R. 2004. Community assembly through adaptive radiation of Hawaiian spiders. Science 303: 356-359.

Jablonski, D. et al. 2006. Out of the tropics: evolutionary dynamics of the latitudinal diversity gradient. Science 314: 102-106.

Fridley and Sax – in prep

Discussion VIII: Island Biogeography

MacArthur, R.H. and Wilson, E.O. 1963. An equilibrium theory of insular zoogeography. Evolution 17: 373-387.

Simberloff, D.S. and Wilson, E.O. 1969. Experimental zoogeography of islands. The colonization of empty islands. Ecology 50: 278-296.

Heaney, L.R. 2007. Is a new paradigm emerging for oceanic island biogeography? Journal of Biogeography 34: 753-757.

Whittaker, R.J. et al. 2008. A general dynamic theory of oceanic island biogeography. Journal of Biogeography 35: 977-994.

Discussion IX: Assembly and evolution of insular biotas

Wilson, E.O. 1959. Adaptive shifts and dispersal in a tropical ant fauna. Evolution 13: 122-144.

Carlquist, S. 1966. The biota of long-distance dispersal. I. Principles of dispersal and evolution. The Quarterly Review of Biology 41: 247-270.

Diamond, J.M. (1975) Assembly of species communities, in M.L. Cody and J.M. Diamond's, Ecology and Evolution of Communities, Harvard University Press. (pages 342-349)

Connor, E.F. and Simberloff, D. 1979. The assembly of species communities: chance or competition? Ecology 60: 1132-1140.

Emerson, B.C. and Gillespie, R.G. 2008. Phylogenetic analysis of community assembly and structure over space and time. Trends in Ecology and Evolution 23: 619-630.

Discussion IX: Ecogeographic rules and Diversity Gradients

Pianka, E.R. 1966. Latitudinal gradients in species diversity: a review of concepts. American Naturalist 100: 33-46.

Stevens, G.C. 1989. The latitudinal gradient in geographical range – how so many species coexist in the tropics. American Naturalist 133: 240-256.

Lomolino, M.V. et al. 2012. Of mice and mammoths: Evaluations of causal explanations for body size evolution in insular mammals. Journal of Biogeography: in press.

Discussion X: Conservation Biogeography

Diamond, J.M. 1975. The island dilemma: Lessons of modern biogeographic studies for the design of natural reserves. Biological Conservation 7: 129-146.

Whittaker, R.J. et al. 2005. Conservation biogeography: assessment and prospect. Diversity and Distributions 11: 3-23.

*2-3 more articles TBD*

## **Grading Policy**:

Exam I – 15% of final grade
Exam II – 20% of final grade
Discussions – 25% of final grade (quizzes and participation)
Term Paper – 30% of final grade
Term Paper Presentation – 10% of final grade

## **Attendance at Discussions:**

Attendance and active participation in discussions is mandatory; each missed discussion will result in 0 points for participation and the quiz of the day. Quizzes will be held at the beginning of discussion sections; if you are late you will miss the opportunity to take the quiz and receive 0 points on the quiz.

## **Make-up Examinations:**

There will be no make up examinations with the following exceptions: 1) an agreement reached between the student and instructor prior to the examination, and 2) an unplanned event, such as a medical condition, traffic accident, et cetera, together with appropriate evidence of the event.

## **Term Paper:**

Each student will prepare an individual term paper. Term papers will focus on an original biogeographic analysis performed by the student over the course of the semester. The goal is for each student to provide a novel analysis and description of some empirical pattern of relevance to the field of biogeography. Ample data to address thousands of potential analyses now exists in online databases, in printed literature and from other sources. Each student will pick one such analysis to perform. For example, a student might test whether a particular taxonomic group (such as sharks, whales or pine trees) shows typical biogeographical trends, such as geographic clines in body size, range size, diversity or some other metric. The paper will be written as if it were a manuscript being submitted to the *Journal of Biogeography*; consequently the paper will follow all instructions on formatting and style provided by that journal. The maximum length of text will be 3000 words, with a maximum of 50 references and 4 illustrations (i.e., figures or tables).