

## **Syllabus: Biogeography, BI/GE307 Spring 2010**

<http://people.bu.edu/nathan/ge307.htm>

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Tuesdays/Thursdays 9:30-11:00, STH 113

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Office Hours: Tue 11-12:30, Wed.12:30-2:00

### **Required Texts:**

The Song of the Dodo, by David Quammen

The Future Eaters, by Tim Flannery

The Voyage of the Beagle, by Charles Darwin

Additional Readings (excerpted handouts, with texts on reserve):

Guns, Germs and Steel, by Jared Diamond

The Eternal Frontier, by Tim Flannery

Foundations of Biogeography: Classic Papers with Commentaries, edited by Mark V. Lomolino, Dov F. Sax and James H. Brown

Biogeography, by James H. Brown and Mark V. Lomolino

### **Course description:**

The objective of this course is to study the spatial and temporal distributions of organisms, populations, and species, in an era of global climate change, habitat fragmentation, and globalization of human activity. The central processes in the study of biogeography are evolution, extinction, and dispersal, which span many scales of time and space. Thus we will cover both historical and contemporary biogeographical patterns and processes on local, regional and global spatial scales. Critical current issues related to the study of biogeography, including anthropogenic caused species invasions, extinction or loss of biodiversity, and climate change impacts on biogeographic patterns will be highlighted.

The course will focus on three general topic areas:

I. Foundations of Biogeography: (Darwin, Brown and Lomolino, Lomolino et al.)

II. Biogeography of Natural and Fragmented Ecosystems (Quammen)

III. Biogeography of Humanity (Flannery)

Additionally, as time and schedules allow, we may take up to three field trips to illustrate principles and concepts of Biogeography. These are (1) a trip to the Arnold Arboretum in Boston to investigate phylogenetic relationships between temperate Asian and North American flora, (2) a trip to the Boston Harbor islands to investigate principles of Island Biogeography, and (3) a trip to Boston University's Sargent Center and Mount Monadnock, to investigate topics including species diversity, endemism and rarity, and invasions, and altitudinal gradients in tree and shrub species diversity.

Below is a detailed lecture schedule and other important dates. The format of the course consists of lectures and discussions. Questions and class discussion during lecture are encouraged. I will lecture for approximately 60 minutes during each class period, with open discussion, led by a student, to follow for the remainder of the class period. Students will take turns each class meeting to provide a synopsis of that week's reading material, and leading discussion on two or three talking points.

**Grading:**

Class participation 5%

Midterm I 25%

Midterm II 25%

Course Project 20%

Final Exam 25% Wednesday, May 5<sup>th</sup>, 9:00-11:00

**Academic Honesty Policy:** The College of Arts and Sciences policies on incomplete grades and academic conduct will be followed. For details refer to the BU undergraduate or graduate bulletins and the CAS Academic Conduct Code.

## Lecture Schedule

Week	Dates	Topic	Reading	Discussion Leader
1	Jan 14	Course Introduction, Introduction to Texts	Quammen pp 11-21, Flannery pp. 13-29	None
2	Jan 19, 21	Deepest Space and Time of Biogeography: Continental Drift and Climate Change	Flannery pp. 30-84 Darwin, chapters 1,2	
3	Jan 26, 28	Australasia: A Case Study for Understanding Core Biogeographical Processes	Flannery pp. 85-134 Darwin, chapters 3,4	
4	Feb 2, 4 ( <b>Field Trip to Harvard NHM Feb 4</b> )	Biogeography of Humanity: Humans as Future Eaters <i>*Project Proposal Due</i>	Flannery pp. 136-207 Darwin, chapter 5	
5	Feb 9, 11 ( <b>Film: First Contact Feb 11</b> )	Co-adaptation of Humans with Environment: Lesson from the Aboriginals	Flannery pp. 208-298 Darwin, chapter 6	
6	Feb 16	<b>NO CLASS</b>		
6	Feb 18	The Newest Future Eaters	Flannery pp. 300-406 Darwin, chapter 7	
7	Feb 23, 25	The Key Role of Islands in Biogeography <i>*EXAM 1</i>	Quammen pp. 21-114 Darwin, chapter 8	
8	Mar 2, 4 ( <b>Field Trip to Arnold Arboretum Mar 4</b> )	Evolution and the Oddity of Islands	Quammen pp. 115-259 Darwin, chapter 9	
9	Mar 6-14	<b>SPRING BREAK</b>		
10	Mar 16, 18	Extinction: a Litany of Cases and Causes	Quammen pp. 259-383 Darwin, chapters 10,11	
11	Mar 23, 25 ( <b>Field Trip to Urban Lot Mar. 25</b> )	The Species-Area Relationship and the Distribution of Rarity and Commonness	Quammen pp. 383-407 Darwin, chapter 12	
12	Mar 30, Apr 1	The Equilibrium Theory of Insular Biogeography <i>*EXAM 2</i>	Quammen pp. 407-449 Darwin, chapter 13	
13	Apr 6, 8	Fragmentation: Carving up Amazonia, and the Debate over Reserve Design <b>PROJECT PRESENTATIONS</b>	Quammen pp. 449-499 Darwin, chapters 14,15	

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14	Apr 14, 16	Minimum Viable Populations <b>PROJECT PRESENTATIONS</b>	Quammen pp. 499-547 Darwin, chapters 16,17
15	Apr 20	Saving Species: Conservation Case Studies <b>PROJECT PRESENTATIONS</b>	Quammen pp. 547-603 Darwin, chapters 18,19
15	Apr 22	<b>NO CLASS</b>	
16	Apr 29	The Sixth Extinction: Fate versus Hope <b>PROJECT PRESENTATIONS *Project Due</b>	Quammen pp. 603-625 Darwin, chapters 20, 21
17	May 5	<b>FINAL EXAM, Wednesday, May 5, 9:00am – 11:00am</b>	

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### **Discussion Leader Presentations:**

You will be assigned one chapter from Darwin's Voyage of the Beagle to present and discuss in class. Each class period a different student or students will present. Please include the following in your discussion powerpoint (or other format) presentations:

- Find or reconstruct a map of the starting and ending points of your chapter of Darwin's book, with place marks for each location stopped at, and dates associated with locations. You should be able to use google earth or google maps to do this.

- For each location that Darwin describes as visiting in your chapter, do the following:

- Visit the location and surroundings using google earth
- Note the latitude, longitude, climatic and topographical features of the area, plus any special geological or geographic features of the area.

- For each species, lifeform, or physical feature of the ecosystem or place that Darwin describes, do the following:

- Look up the species, ecosystem, or other feature using web and other sources
- Obtain and show pictures or photos of species, ecosystems, features..
- Provide a short description of the evolutionary history and phylogeny of species, or the geologic history of a place. Note the status of each species (endangered, extinct, threatened, etc.)

### **Course Term Project:**

You will be required to complete a semester project on a topic related to Biogeographical concepts discussed in class. The major purpose of this project is to stimulate your interest in an aspect of the field of Biogeography. My own experience with college lab courses or other semester assignments was often disappointment that the answers to the questions being studied were already known. My belief is that it is much more fulfilling for students to address questions that no one yet knows the answer to, and in doing so to produce new knowledge and insights. The field of Biogeography is highly integrative, intersecting with subjects such as Evolution, Ecology, Paleontology, Biodiversity and Conservation Science, Natural History, and the History of Exploration. Students are encouraged to pursue topics with foci in any of these

areas of Biogeography, but the essential aspect of Biogeography that must be central to all projects is the *Spatial Context* of the particular subject area studied. This is the defining feature of Biogeography and is important to keep in mind at all times.

I encourage students to ‘think outside of the box’, and use their creativity to formulate unique projects of personal interest. Additionally, several possible topics are described below. Projects must address a novel question or thesis, and cannot simply review existing studies or publications. Students will be required to submit a 2-3 page proposal by early February detailing the question to be addressed, the methods to be used in addressing the question or topic, and a unique format in which results and discussion will be presented. This could be, for example, a video presentation using a camcorder, a poster, or other multi-media format. In addition, a bibliography of research papers and sources used for your research is required and a 10-15 minute oral presentation, and a 10-15 page write up of your study will be required.

*Possible Project Topics:* Below are listed just a few possible ideas to get you started thinking about a project. Students are encouraged to choose one of the following, or to develop their own topic in consultation with me.

1. Develop a web-enhanced classic Biogeographical e-text, such as Alfred Wallace’s *The Malay Archipelago*, or Darwin’s *Origin of Species* or *Voyage of the Beagle*. This could include assimilating and linking background on species, locations, or other biogeographical information to topics discussed in the texts. Some major works of Biogeography are available on-line for free download from the Project Gutenberg website (<http://promo.net/pg/>).
2. Produce a Biogeography Guide or Handbook for travelers to a location or region of your choice. I encourage you to prepare this to submit for publication in a popular journal such as *Outside* magazine, *National Geographic*, or a more regional journal.
3. Revisit (both literally, and through library research) the journals of Henry David Thoreau, with a focus on his biogeographical observations, for example, his descriptions of flora and fauna on the Concord and Merrimack Rivers (located within driving distance). Address questions such as how land use change has altered biogeographical patterns from those of Thoreau’s day.
4. Develop a topic related to the Biogeography of plants or animals in an urban environment, such as Boston. Topics such as the survival or persistence of endemic and/or rare species, and invasive species, could be an angle. Field observation would be expected.
5. Test one of the principles of the Equilibrium Theory of Island Biogeography among the Boston Harbor Islands (<http://www.nps.gov/boha/>). Do species of one particular taxonomic group show patterns of lower diversity on farther islands? Plan a trip and protocol for field observation.
6. Study the Biogeography of a pair of related Northern Temperate Asian and North American tree species at the Arnold Arboretum in Boston (<http://www.arboretum.harvard.edu/>). For example, how closely is the Dawn Redwood (*Metasequoia*) related to the Coastal or Giant Redwoods of California? Explore the phylogenetic “tree” diagram of these species, and look back into the ancient past to find their most recent common ancestor.
7. Perform a survey of the endemic and invasive species of Boston University’s own ecological field station near Mount Monadnock, New Hampshire, Sargent Center for

Outdoor Education (<http://www.bu.edu/outdoor/>). Also, for example, test whether you can detect the biogeographical principle of decreasing species diversity with altitude as you go from the low elevation Sargent Center to the top of Mount Monadnock, about 7 miles away.

8. Study some aspect of the biogeography of the Tiputini Field Station in Ecuador, of which Boston University is closely affiliated. Students that have either completed the Tropical Ecology Semester in Ecuador, or plan to enroll, are especially encouraged to consider this topic for their project.

9. Plan your own personal Biogeographic expedition to a dream location in a remote part of the world. I encourage you to make this as realistic as possible, detailing everything from estimated flight expenses and visa regulations, to plant or animal collection permits, local research resources, and where you would stay and how you would survive. The ultimate goal should be to discover or produce biogeographical knowledge.

10. Rent the movie “Adaptation”, read the book on which this movie is based (The Orchid Thief), and delve into some aspect of the biogeography of Orchids.

11. Visit the Harvard University Herbarium or Museum of Comparative Zoology, and develop a topic based on some specimen that you find particularly intriguing (<http://www.hmn.harvard.edu/exhibitions/index.html>). Every single item in those collections has some fascinating biogeographic history associated with it. Do detective work to find out as much of the fascinating story of that piece as you can, and in doing so, develop a novel and creative thesis.

12. Scour popular sources that include anecdotal biogeographic information, such as National Geographic, Outside magazine, or other magazines to develop a project topic. For example, Susan Orleans, the author of “The Orchid Thief”, found her topic by perusing the newspapers and finding an obscure report about the arrest of a plant poacher in a remote swamp in Florida. From this small but intriguing beginning, a book with many biogeographical implications was produced.

13. Research the life or major expedition of one of the major figures in the development of the field of Biogeography. Strive to illuminate an aspect of the person’s life that has been overlooked or neglected. For such projects, one creative approach is to include the history of or major influences or events in the life of the person as a subtext to the more direct pursuit of a topic of direct biogeographical reference, such as a particular species or taxonomic group studied by that person.

14. Perform a personal human biogeography. Trace your paternal or maternal line back as far as possible. For example, my father’s (Phillips) paternal ancestors came to Pennsylvania from Wales, likely in 1796. But how far back does the Phillips name go in Wales, where did the Welsh come from, etc. Speculation is almost unavoidable, but it is recognized that in such a study more questions would likely be raised than answered.