

Geography 323: Biogeography

Fall, 2016

Lecture: Tue & Thu 10:00-11:20 in 229 McKenzie

Weekly lab sections: Tuesdays 2:00 and 3:00 in 206 Condon, and Wednesdays 12:00 and 1:00 in 206 Condon. Many will be held outdoors on campus.

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Biogeography, once a secret delicacy enjoyed only by geniuses, must now be elevated from its current obscurity and placed alongside literature and history as an indispensable component of a truly enlightened education. —Dennis McCarthy, Here Be Dragons.

Course Overview: The spatial patterns of species distributions are widely recognized, but few appreciate the complex causes of these patterns. Biogeography is the study of the spatial patterns of biological diversity, and its causes, both in the present and in the past. Biogeographers synthesize information from a very broad range of fields, including ecology, evolution, paleontology, and climatology. This course will provide the ecological and historical foundations for understanding the distribution and abundance of species, and the changes in distribution and abundance over time. We will also explore the relevance of biogeography during a time of increasing human impact and climate change.

Prerequisite: GEOG 141 or GEOL 103 or GEOL 203 or BI 370.

The course begins with an overview of important concepts, including evolutionary mechanisms, earth history, and plate tectonics, as well as concepts of the ecological niche and patterns of distribution at various taxonomic levels. We also study basic ecological concepts, how species are patterned and disperse on the landscape, and how these patterns have changed over the relatively recent ice ages. In the second part of the course, we delve into historical biogeography and study why continents and islands have unique assemblages of species, and the effects of mega-extinctions and biotic interchanges between continents. We also return to ecological concepts in a detailed examination of the equilibrium theory of island biogeography. The following diagram illustrates the organization of topics to be covered, with the emphasis on how this information is used to understand current biodiversity and what threatens it.

Part 1. Ecological biogeography

- Species characteristics and the ecological niche
- Dispersal
- Island biogeography and species diversity in fragmented landscapes
- Recent climate changes of the past 20,000 years

Part 2. Historical biogeography

- The changing template of the Earth
- Speciation
- Patterns of endemism
- Past extinctions and biotic interchanges



Current and future patterns of biodiversity
Impacts of humans and climate change on biodiversity

Goals of the course:

- To develop an appreciation for the historical and ecological factors that influence the pattern of life on earth.
- To survey the scientific revolutions of evolution, plate tectonics, and molecular ecology that shaped the path to modern biogeography.
- Using the lab assignments, to understand the scientific method and how to test hypotheses using inferential statistics.
- To understand the processes that affect how biotas respond to a changing climate, and the challenges we face today and in years to come.

Course grading:

- Two exams, each covering about 1/2 of the course and each worth 25% of your total grade.
- Five lab reports for a total of 50% of your grade, weighting of the grades will increase with expectations and complexity of the lab:
 - Lab 1: Trees adaptations across the continents: 5%
 - Lab 2: Virtual Megatransect: 10%
 - Lab 3: Spatial patterns of individuals: 15%
 - Lab 4: Island biogeography: 15%
 - Lab 5: Invasive species: 5%. Lab 5 will be graded as credit/no credit: ALL questions must be answered to get credit!

Required readings:

- All readings will be supplied online through Canvas. You may wish to purchase the following book (no longer in print) if you can get a copy through Amazon or another seller:
 - Here Be Dragons, by Dennis McCarthy. Oxford University Press.
- Content of the lab sections will be on exams.
- Lab manuals and additional materials will be posted on canvas.uoregon.edu.

The "small print": During lecture please be respectful of everyone's learning experience. This includes:

1. No talking amongst each other. Please leave your social conversations for outside the classroom. However, questions during lectures are encouraged. If you have a question, raise your hand or catch me after class.
2. Please don't leave in the middle of lecture. It is distracting for many people, including me. If you need to leave, then let me know before the lecture starts, then sit near an exit.
3. Do not have your laptop open to surf the web. Note-taking on laptops is OK. Second and additional infringements will lead to 10 point reductions on an exam.
4. Cheating. Cheating, such as copying material from other students on tests, will result in failing the test at a minimum and I will pass the information on to the Dean of Students. In serious cases, you will flunk the class or be expelled from the university.
5. Plagiarizing. Plagiarizing occurs when you copy materials from other sources without citing the source (i.e., taking credit for someone else's work), or copy someone else's lab. All students should be familiar with the material in this [guide on avoiding plagiarism](#).

See Canvas Modules (one per week) for the full listings. **Bold** indicates required readings. *Italic* indicates optional readings.

Week	Date	Topic	Readings
1	Sep 27	Introduction and history of biogeography	McCarthy : Chapter 1 MacDonald : Pages 1-16.
	Sep 29	Evolution and plate tectonics	McCarthy Chapter 2 MacDonald : Chapter 9 Evolution 101 web pages
	Lab 1	<i>Trees: adaptations across the continents I</i>	Meet at Condon east steps (facing quad)
2	Oct 4	Introduction to dispersal: Excerpt from Darwin's 'Origin of Species'	McCarthy : Chapter 3 Darwin : Ch. 12 ("means of dispersal")
	Oct 6	The ecological niche Distributions of species	Lomolino et al. pp. 83-114. Pielou Chapter 13 <i>Gavin</i>
	Lab 1	<i>Trees: adaptations across the continents II</i>	Meet at Condon east steps (facing quad)
3	Oct 11	Ecoregions and biomes	See Canvas (websites)
	Oct 13	Dispersal syndromes, barriers, and limits to distributions	Lomolino et al. pp. 167-204 Molles pp. 197-203
	Lab 2	<i>The Virtual MegaTransect</i> Tree lab due at lab time on week 3.	Meet in Condon
4	Oct 18	Patterns of biodiversity: local gradients to global biodiversity hotspots.	Perry Chapter 10
	Oct 20	Pleistocene climate, Pleistocene biogeography, and paleoecology	Jackson . Quaternary Biogeography
	Lab 2	<i>The Virtual MegaTransect –</i> Megatransect lab due Friday @ 4 pm.	Meet in Condon
5	Oct 25	Catch up, discussion & midterm review.	
	Oct 27	Midterm exam (covering lectures and readings for weeks 1–4 and labs 1 & 2)	
	Lab 3	<i>Spatial patterns of individuals – data collection</i>	Meet at Autzen footbridge
6	Nov 1	Vicariance biogeography, mammals, and paleontology.	Zimmer and Emian
	Nov 3	Life, death, and evolution on islands	Cox et al : Chapter 7
	Lab 3	<i>Spatial patterns of individuals – data analysis</i>	Meet in Condon
7	Nov 8	The Theory of Island Biogeography	MacDonald pages 428-444 Website: I.B. explained <small>Watch and read what you can; don't register at website</small> Cox et al. excerpt Chapter 7
	Nov 10	Island Biogeography: General Dynamic Model, Nestedness, SLOSS	Cox et al. Chapter 7 Website: Olivia Judson (NY Times)
	Lab 4	<i>Island biogeography I – data collection</i> Spatial patterns lab due at lab time on week 7	meet in Condon, then outside
8	Nov 15	Phylogenetics, vicariance biogeography, and Nothofagus	Cox et al. Chapter 8
	Nov 17	Case studies in historical biogeography	To be determined
	Lab 4	<i>Island biogeography – data analysis</i>	Meet in Condon
9	Nov 22	The Great American Interchange and Amazonian biodiversity	McCarthy Chapter 5 More readings to-be-determined.
	Nov 24	Thanksgiving - No class	–
	Lab 5	No meeting at lab time--watch film on your own time: The Silent Invasion Island Biogeography lab due Tuesday at 4 pm (for Tuesday lab sections) or Wednesday at 4 pm (for Wednesday lab sections).	

10	Nov 29	Advent of Humanity & Pleistocene megafauna extinctions	Flannery. <i>Eternal Frontier</i> . Barnosky <i>McCarthy</i> Chapter 7
	Dec 1	Conservation Biogeography: Mega-extinctions and Climate Change	Cox et al. Chapter 14 Website: Jablonski <i>McCarthy</i> Chapter 8
	Lab 5	<i>Invasive species in-class reports</i>	Meet in Condon
	Dec 8 (Thursday) 8:30 AM (!)	Final exam (covering lectures, readings, and labs: weeks 5 - 10) (Note: it is listed as 8:00 AM in the course schedules...we will start at 8:30, as 90 minutes is sufficient time.)	

References for Readings

- Cox, C. B., R. Ladle, and P. D. Moore. 2016. *Biogeography: An Ecological and Evolutionary Approach*. John Wiley & Sons.
- Darwin, C. 1859. [The Origin of Species](#). P. F. Collier & Son.
- Flannery, T. 2015. *The Eternal Frontier: An Ecological History of North America and Its Peoples*. Grove/Atlantic, Inc.
- Gavin, D. G. 2012. *Biogeography*. Pages 77-89 in J. P. Stoltman, editor. *21st Century Geography: A Reference Handbook*. SAGE Publications, Thousand Oaks, CA.
- Jackson, S. T. 2004. Quaternary biogeography: Linking biotic responses to environmental variability across timescales. Pages 47-65 in M. V. Lomolino and L. R. Heaney, editors. *Frontiers of Biogeography: New Directions in the Geography of Nature*. Sinauer, Sunderland, MA.
- Lomolino, M. V., B. R. Riddle, J. H. Brown, and R. J. Whittaker. 2010. *Biogeography*. Fourth Edition. Sinauer Associates, Sunderland, MA.
- MacDonald, G. M. 2003. *Biogeography: Space, Time and Life*. Wiley, New York.
- McCarthy, D. 2011. *Here Be Dragons: How the study of animal and plant distributions revolutionized our views of life and Earth*. OUP Oxford.
- Molles, M. C. 1999. *Ecology: Concepts and Applications*. WCB/McGraw-Hill.
- Perry, D. A., R. Oren, and S. C. Hart. 2013. *Forest Ecosystems*. JHU Press.
- [Pielou, E. C.](#) 1974. *Population and Community Ecology: Principles and Methods*. Gordon and Breach.

Laboratories:

The five laboratory topics roughly correspond with current lecture topics. Most labs involve two meetings and involve the collection and interpretation of data.

The *tree adaptations* lab involves two walks around campus to observe traits of several tree species from throughout the world. You are to create inventive hypotheses regarding the adaptive role of differences in related tree species.

The *virtual mega-transect* lab meets during only one week and involves more independent work. This involves comparing vegetation structure with climate variables across continental transects (using online resources).

The *spatial patterns* lab addresses the distribution of individuals of a population, and is meant to demonstrate how certain processes leads to spatial patterns. It also involves use of a statistical test to test hypotheses.

The *island biogeography* lab uses a simulation of the processes that lead to species richness on an island. Data collected during the first week are analyzed during the second week.

The *invasive species* lab will consist of a film from Oregon Public Television. Meeting on week 10 involves short presentations of a particular invasive species. The assignment will involve extra reading and thinking about invasive species.

Each lab will culminate in a lab report in which you are to answer specific questions. While it is helpful to discuss the labs amongst each other, and many labs are performed in groups, the lab reports are to be completed individually. Note the due dates for lab reports on the syllabus: lab reports are due at the lab meeting time. For each day late, grades will decrease by 20% of the total possible lab grade.

Read the lab before each lab meeting.

- [Interesting and potentially useful web links](#)

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