

**WELCOME TO GEOGRAPHY/BOTANY 338: ENVIRONMENTAL BIOGEOGRAPHY
Fall 2017**

Schedule: Monday & Wednesday 2:30-3:45 pm, Science Hall 360

Credits: 3

Instructor: Professor Erika Marin-Spiotta

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Office: Science Hall 223

Office Hours: Tuesdays and Wednesdays 12:00-1:00 pm and by appointment.

Note: This course fulfills the Biological Science breadth requirement.

COURSE DESCRIPTION: This course takes an ecosystems approach to understand how physical -- climate, geologic history, soils -- and biological -- physiology, evolution, extinction, dispersal, competition, predation -- factors interact to affect the past, present and future distribution of terrestrial biomes and all levels of biodiversity: ecosystems, species and genes. A particular focus will be placed on the role of disturbance and to recent human-driven climatic and land-cover changes and biological invasions on differences in historical and current distributions of global biodiversity.

COURSE GOALS:

- To learn patterns and mechanisms of local to global gene, species, ecosystem and biome distributions
- To learn how past, current and future environmental change affect biogeography
- To learn how humans affect geographic patterns of biodiversity
- To learn how to apply concepts from biogeography to current environmental problems
- To learn how to read and interpret the primary literature, that is, scientific articles in peer-reviewed journals.

COURSE POLICY: I expect you to attend all lectures and come prepared to participate in discussion. I will take attendance. Please let me know if you need to miss three or more lectures. Please respect your fellow students, professor, and guest speakers and turn off the ringers on your cell phones and refrain from texting during class time. Non-class-related internet or computer use is not allowed during the class period. It is distracting to your fellow students and to the instructor.

REQUIRED READING: All readings will be posted as PDFs on Learn@UW (Desire2Learn)

- Quammen, D. 1996. The Song of the Dodo: Island Biogeography in an Age of Extinction. Touchstone Simon & Schuster, NY. (Selections).
- Selected research articles and book chapters as posted online

Supplementary texts (on reserve in the Helen C. White Hall Library):

- Biogeography - An Ecological and Evolutionary Approach by Cox and Moore (Blackwell Publishing)
- Biogeography 3rd Edition by Lomolino, Riddle and Brown (Sinauer)

- Biogeography - Space, Time and Life by MacDonald (2003) Wiley
- Foundations of Biogeography ed. by Lomolino, Sax and Brown (Chicago Press)
- Principles of Terrestrial Ecosystem Ecology by F.S. Chapin III, P.A. Matson, and H.A. Mooney (Springer)

EVALUATION:

Final letter grade is based on a percentage of points you earn out of a possible 200.

Exam 1: 40 points (20% of your grade)

Exam 2: 40 points (20%)

Exam 3: 40 points (20%)

Paper Outline: 5 points (2.5%)

Term Paper: 40 points (20%)

Peer-Review: 5 points (2.5%)

Reading Reflections: 10 points (5%)

Group presentations and participation during in-class discussions: 20 points (10%)

There will be no extra credit.

EXAMS: Exams will cover material from lectures, assigned readings, and in-class discussion and will consist of multiple choice, definition, short answer, and essay questions designed to gauge the extent students have acquired a basic literacy in biogeographical concepts. The third exam will predominantly focus on the last third of the course material, but students should be aware that the topics in biogeography build upon each other and so links to materials in previous lectures will be expected. There is no exam during finals week.

TERM PAPER: All paper topics should be approved by the instructor. Papers will be peer-reviewed by one of your classmates before final submission. Instructions will be provided when paper topics are due. All submissions are to be word-processed in 12-point font, double-spaced, left-justified and uploaded into the Dropbox on the Learn@UW (Desire2Learn) website. Provide citations for all data and arguments that are not your own. In scientific articles, it is usual practice to paraphrase results or conclusions from other articles as long as the exact wording is not copied and the original authors are given proper credit. The use of direct quotations is very uncommon unless the exact wording is necessary to prove a point. Please see separate paper instructions document.

UNDERGRADUATE STUDENTS:

Write a 6-page paper on the biogeography of a particular species, genus or family, and provide its current and historical patterns and mechanisms of distribution, conservation status, and life history (including important biological interactions and environmental requirements).

GRADUATE STUDENTS:

Write a 12-page paper on a controversy in Biogeography and state the problem, trace its origins in the literature, provide arguments on opposing sides from the peer-reviewed

literature, and what implications it has on current thinking and practice in conservation or sustainable use.

Suggested Journals with Biogeographic Content:

Ecography; Journal of Biogeography; Diversity and Distributions; Global Ecology and Biogeography; Progress in Physical Geography; Global Change Biology; Proceedings of the National Academy of Sciences; Nature; Science; Trends in Ecology & Evolution; Conservation Biology; American Naturalist; Annual Reviews in Ecology and Systematics; Biodiversity and Conservation; Biological Journal of the Linnean Society; Ecology; Ecological Applications; Molecular Ecology

Tips on How to Read a Scientific Paper

www.biochem.arizona.edu/classes/bioc568/papers.htm

www.bio.unc.edu/faculty/Khogan/HowToReadAScientificPaper.ppt

SHORT ASSIGNMENTS: During the semester, you will be asked to submit a brief summary or reading reflection of a research or news article to complement lecture material.

PARTICIPATION: I encourage in-class discussions of the lecture material and readings. Most class periods will consist of a 50 minute lecture and 25 minute discussion. In order to make this as productive and enjoyable as possible, I expect everybody to participate. Thus, you need to have read the papers ahead of time, bring questions, and complete assignments as given. On those days that we discuss a reading, each student must come prepared to share an opening discussion statement about the reading.

QUESTIONS: Students who ask questions tend to be able to build connections between course topics and fare better on exams. I am happy to entertain questions during lectures. At the beginning of each class period I will devote time for questions on any material from previous lectures. I will also answer questions submitted by email and on the Learn@UW course discussion board. I expect you to let me know if any of the material is confusing either in person before or after class, by email, or in my office hours. Feedback is welcome at any time.

ACADEMIC INTEGRITY: Academic honesty requires that the course work (drafts, reports, exams, papers) a student presents to an instructor honestly and accurately indicates the student's own academic efforts. Please review the university's guidelines on proper conduct: <http://students.wisc.edu/saja/misconduct/UWS14.html>

Some examples of academic misconduct (from the website) include: cutting and pasting text from articles or from the web without quotation marks or proper citation and paraphrasing from the web without crediting the source. When in doubt about how to properly cite something, come talk to me.

ADDITIONAL RESOURCES FOR STUDENTS:

- McBurney Disability Resource Center. We are happy to work with students who need additional accommodations. Please talk to one of the professors early on in the semester so we can best accommodate you. <http://www.mcburney.wisc.edu/>

- Multicultural Student Center. The MSC exists to make sure students of all backgrounds are successful at UW. <https://msc.wisc.edu>
- GUTS (Greater University Tutoring Service) tutoring. See their homepage to inquire about individual tutors/general tutoring sessions. <http://guts.studentorg.wisc.edu/>
- UW Writing Center. See their website for information about drop-in or scheduled appointments with expert writers. They will help with just about any type of writing assignments/needs. <http://www.writing.wisc.edu/>
- L&S Student and Academic Affairs. See their website for issues regarding medical absences and other emergencies that may affect your ability to attend courses and complete coursework. <http://saa.ls.wisc.edu>
- Any student facing food and/or housing insecurity and who believes this may affect their performance in the course, is urged to contact the Dean of Students for support: <https://doso.students.wisc.edu/student-assistance/>. Please notify one of the professors if you don't feel comfortable doing so, so they can help you access resources. As a student at the University of Wisconsin – Madison there are numerous resources available to you, including your Deans. Each student has two Deans, an **Academic Dean**, whose role is to assist students with academic matters pertaining to his/her/their respective School or College, and the **Dean of Students**, whose role is to assist students with personal matters.

Please let me know if you need any additional accommodations, I am happy to work with you.

Environmental Biogeography - Fall 2017

Week	Date	Lecture	Topic	Reading list (see details in footnotes) and <i>Term Paper Deadline</i>
1	Wed 6-Sep	1	Welcome and introduction to biogeography	
2	Mon 11-Sep	2	Requirements for life: Biological context	Ch. 6 Terrestrial Proc. (1)
	Wed 13-Sep	3	Requirements for life: Biological context	Ehleringer 2002 (2)
3	Mon 18-Sep	4	Requirements for life: Physical environments	Higgins et al. 2011 (3)
	Wed 20-Sep	5	Requirements for life: Physical environments	The Global Climate System (4)
4	Mon 25-Sep	6	Geographic distributions: Biomes	Ch. 6 Biomes MacDonald 2003 (5)
	Wed 27-Sep	7	Biological interactions & Trophic dynamics	Predator-mediated coexist (6); Why is the world green? (7); <i>Paper Topic due</i>
5	Mon 2-Oct	8	Biological interactions & Disturbance	<u>Group presentation readings</u> (8)
	Wed 4-Oct		Species ranges	So Huge a Bignes-Dispersal (9); Pearson 2003 (10)
6	Mon 9-Oct	9	EXAM 1	
	Wed 11-Oct	10	Species ranges and dispersal	
7	Mon 16-Oct	11	Evolution and speciation	So Huge a Bignes-Evolution (11) & Radiation (12);
	Wed 18-Oct	12	Speciation and extinction	The Man Who Knew Islands (13) <i>Paper Outline Due</i>
8	Mon 23-Oct	13	Changing earth geography	Bartlein & Prentice 1989 (14); Jackson 2000 (15)
	Wed 25-Oct	14	Quaternary climate change	
9	Mon 30-Oct	15	Biogeographic realms	Mercer 2003 (16)
	Wed 1-Nov	16	Phylogeography & biodiversity	<u>Group presentation readings</u> (17)
10	Mon 6-Nov	17	Phylogeography & biodiversity	
	Wed 8-Nov		EXAM 2	

11	Mon	13-Nov	18	Island biogeography	Island Theory (18); Walter 2004 (19)
	Wed	15-Nov	19	Conservation biogeography	Prugh et al. 2008 (20); Mendenhall et al. 2014 (21)
				<i>Draft to Peer Due</i>	
12	Mon	20-Nov	20	Humans as a biogeographic force: Domestication	Larson et al. 2014 (22)
	Wed	22-Nov		No class - Happy Thanksgiving	
13	Mon	27-Nov	21	Humans as a biogeographic force: Agriculture	
	Wed	29-Nov	22	Climate change & disease biogeography	Smith 2010 (23)
				<i>Peer Review Due</i>	
14	Mon	4-Dec	23	Biogeography in a changing world	Davis 2011 (24); Response to Davis (25)
	Wed	6-Dec	24	New topics in biogeography	
15	Mon	11-Dec	EXAM 3		
	Wed	13-Dec		No class	<i>Final Paper Due</i>

Reading details: (All available on course website Learn at UW)

1. Chapin, F.S., Matson, P.A., Mooney, H.A. (2002). Principles of Terrestrial Ecosystem Ecology. Chapter 6 - Terrestrial Production Processes
2. Ehleringer, J.R. & Cerling, T.E. (2002). C₃ and C₄ Photosynthesis, Encyclopedia of Global Environmental Change. Editor-in-Chief Ted Munn. John Wiley & Sons, Ltd, Chichester
3. Higgins MA, Ruokolainen K, Tuomisto H, Llerena N, Cardenas G, Phillips OL, Vasquez R, Rasanen M (2011) Geological control of floristic composition in Amazonian forests. Journal of Biogeography 38:2136-2149
4. The Global Climate System - <http://www.nature.com/scitable/knowledge/library/the-global-climate-system-74649049>
5. MacDonald GM (2003) Chapter 6 - Communities, Formations, and Biomes. Biogeography: Space, Time, and Life

6. Life of every color and kind (Paine 1966). ECOMotion Studios -
<https://www.youtube.com/watch?v=FsEOBZbxBr0&feature=youtu.be>
7. The World is Green (Hairston, Smith and Slobodkin 1960). ECOMotion Studios -
<https://uwmad.courses.wisconsin.edu/d2l/le/content/3356237/viewContent/20654781/View>
8. Group presentation readings:
 - A. Trophic downgrading
 - i. Ripple WJ, Estes JA, Beschta RL, Wilmers CC, Ritchie EG, Hebblewhite M, Berger J, Elmhagen B, Letnic M, Nelson MP and others (2014) Status and ecological effects of the world's largest carnivores. *Science* 343:151-+.
 - ii. Terborgh J, Lopez L, Nunez P, Rao M, Shahabuddin G, Orihuela G, Riveros M, Ascanio R, Adler GH, Lambert TD and others (2001) Ecological meltdown in predator-free forest fragments. *Science* 294:1923-1926
 - B. Nutrient subsidies
 - i. Bump JK, Peterson RO, Vucetich JA (2009) Wolves modulate soil nutrient heterogeneity and foliar nitrogen by configuring the distribution of ungulate carcasses. *Ecology* 90:3159-3167
 - ii. Menge BA, Lubchenco J, Bracken MES, Chan F, Foley MM, Freidenburg TL, Gaines SD, Hudson G, Krenz C, Leslie H and others (2003) Coastal oceanography sets the pace of rocky intertidal community dynamics. *Proc Natl Acad Sci U S A* 100:12229-12234
 - C. Trophic cascades
 - i. Hughes BB, Eby R, Van Dyke E, Tinker MT, Marks CI, Johnson KS, Wasson K (2013) Recovery of a top predator mediates negative eutrophic effects on seagrass. *Proc Natl Acad Sci U S A* 110:15313-15318
 - ii. Holdo RM, Sinclair ARE, Dobson AP, Metzger KL, Bolker BM, Ritchie ME, Holt RD (2009) A disease-mediated trophic cascade in the Serengeti and its implications for ecosystem C. *Plos Biology* 7:12
 - D. Disturbance tradeoffs
 - i. Collins SL, Knapp AK, Briggs JM, Blair JM, Steinauer EM (1998) Modulation of diversity by grazing and mowing in native tallgrass prairie. *Science* 280:745-747

- ii. Martin KL, Hurteau MD, Hungate BA, Koch GW, North MP (2015) Carbon tradeoffs of restoration and provision of endangered species habitat in a fire-maintained forest. *Ecosystems* 18:76-88

E. Density dependence hypothesis

- i. Bagchi R, Gallery RE, Gripenberg S, Gurr SJ, Narayan L, Addis CE, Freckleton RP, Lewis OT (2014) Pathogens and insect herbivores drive rainforest plant diversity and composition. *Nature* 506:85-+
- ii. Comita LS, Queenborough SA, Murphy SJ, Eck JL, Xu KY, Krishnadas M, Beckman N, Zhu Y (2014) Testing predictions of the Janzen-Connell hypothesis: a meta-analysis of experimental evidence for distance- and density-dependent seed and seedling survival. *J Ecol* 102:845-856

9. The Song of the Dodo, pages 141-149

10. Pearson RG, Dawson TP (2003) Predicting the impacts of climate change on the distribution of species: are bioclimate envelope models useful? *Global Ecology & Biogeography* 12:361-371

11. The Song of the Dodo, So Huge a Bignes, pages 128-137

12. The Song of the Dodo, So Huge a Bignes, pages 217-234

13. The Song of the Dodo, The Man Who Knew Islands, pages 15-114

14. Bartlein PJ, Prentice IC (1989) Orbital variations, climate and paleoecology. *Trends Ecol Evol* 4:195-199

15. Jackson ST, Overpeck JT (2000) Responses of plant populations and communities to environmental changes of the late Quaternary. *Paleobiology* 26:194-220

16. Mercer JM, Roth VL (2003) The effects of Cenozoic global change on squirrel phylogeny. *Science* 299:1568-1572

17. Group presentation readings:

A. Madagascar

- i. Ali JR, Huber M (2010) Mammalian biodiversity on Madagascar controlled by ocean currents. *Nature* 463:653-656
- ii. Krause DW (2010) BIOGEOGRAPHY Washed up in Madagascar. *Nature* 463:613-614
- iii. Wilme L, Goodman SM, Ganzhorn JU (2006) Biogeographic evolution of Madagascar's microendemic biota. *Science* 312:1063-1065

B. Glacial refugia

- i. Husemann M, Schmitt T, Zachos FE, Ulrich W, Habel JC (2014) Palaeartic biogeography revisited: evidence for the existence of a North African refugium for Western Palaeartic biota. *Journal of Biogeography* 41:81-94
- ii. Cheddadi R, Vendramin GG, Litt T, Francois L, Kageyama M, Lorentz S, Laurent JM, de Beaulieu JL, Sadori L, Jost A and others (2006) Imprints of glacial refugia in the modern genetic diversity of *Pinus sylvestris*. *Glob Ecol Biogeogr* 15:271-282

C. Beringia

- i. Haile J, Froese DG, MacPhee RDE, Roberts RG, Arnold LJ, Reyes AV, Rasmussen M, Nielsen R, Brook BW, Robinson S and others (2009) Ancient DNA reveals late survival of mammoth and horse in interior Alaska. *Proc Natl Acad Sci U S A* 106:22352-22357
- ii. Brubaker LB, Anderson PM, Edwards ME, Lozhkin AV (2005) Beringia as a glacial refugium for boreal trees and shrubs: new perspectives from mapped pollen data. *Journal of Biogeography* 32:833-848

D. Biotic ferries and dispersal

- i. Li JT, Li Y, Klaus S, Rao DQ, Hillis DM, Zhang YP (2013) Diversification of rhacophorid frogs provides evidence for accelerated faunal exchange between India and Eurasia during the Oligocene. *Proc Natl Acad Sci U S A* 110:3441-3446
- ii. Raxworthy CJ, Forstner MRJ, Nussbaum RA (2002) Chameleon radiation by oceanic dispersal. *Nature* 415:784-787

E. Sky islands

- i. Mastretta-Yanes A, Moreno-Letelier A, Pinero D, Jorgensen TH, Emerson BC (2015) Biodiversity in the Mexican highlands and the interaction of geology, geography and climate within the Trans-Mexican Volcanic Belt. *Journal of Biogeography* 42:1586-1600
- ii. McCormack JE, Huang H and Knowles L. "Sky Islands" *Encyclopedia of Islands* (2009)

18. The Song of the Dodo, Island theory, pages 409-415

19. Walter HS (2004) The mismeasure of islands: implications for biogeographical theory and the conservation of nature. *Journal of Biogeography* 31:177–197
20. Prugh LR, Hodges KE, Sinclair ARE and Brashare Justin S. Effect of habitat area and isolation on fragmented animal populations. *Proc Natl Acad Sci U S A* 105:20770-20775
21. Mendenhall CD, Karp DS, Meyer CFJ, Hadly EA and Daily GC. Predicting biodiversity change and averting collapse in agricultural landscapes. *Nature* 509:213-217
22. Larson G et al (2014) Current perspectives and the future of domestication studies. *PNAS* 111:6139-6146
23. Smith KF, Guegan JF. 2010. Changing geographic distributions of human pathogens. In: Futuyma DJ, Shafer HB, Simberloff D, editors. *Annual Review of Ecology, Evolution, and Systematics*, Vol 41. Palo Alto: Annual Reviews. p 231-250
24. Davis M, Chew MK, Hobbs RJ, Lugo AE, Ewel JJ, Vermeij GJ, Brown JH, Rosenzweig ML, Gardener MR, Carroll SP and others (2011) Don't judge species on their origins. *Nature* 474:153-154
25. Correspondence (2011; responses to Davis et al.). *Nature* 475:37