WELCOME TO GEOGRAPHY/BOTANY 338: ENVIRONMENTAL BIOGEOGRAPHY
Fall 2018

Schedule: Monday & Wednesday 2:30-3:45 pm, Humanities 1641
Credits: 3
Instructor: Professor Ken Keefover-Ring
Email: ken.keefoverring@wisc.edu
Office: Science Hall 115C
Office Hours: Tuesday 3:00-4:00 pm & Wednesday 12:00-1:00 pm or 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.

REQUIRED READING: All readings will be posted as PDFs on Canvas

- 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 on Canvas

EVALUATION:

Final letter grade is based on a percentage of points you earn out of a possible 200.
Exam 1: 40 points (~21% of your grade)
Exam 2: 40 points (~21%)

Exam 3: 40 points (~21%)
Paper Outline: 5 points (~2.6%)
Term Paper: 40 points (~21%)
Peer-Review: 5 points (~2.6%)
Group presentations and participation during in-class discussions: 20 points (~10.5%)
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 on the Canvas 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

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 Canvas 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.

RESOURCES FOR STUDENTS:

- McBurney Disability Resource Center. See their website regarding information for students with disabilities - 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 impact your ability to attend courses and complete coursework - http://saa.ls.wisc.edu

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

Environmental Biogeography Schedule - Fall 2018

Week	Date	(Lecture)	Topic	Reading list (see details in footnotes)	*Term Paper*
1	Mon	3-Sep	No class - Labor Day		
	Wed	5-Sep **1**	Welcome and introduction to biogeography		
2	Mon	10-Sep **2**	Requirements for life: Biological context	Ch. 6 Terrestrial Processes (1); Ehleringer 2002 (2)	
	Wed	12-Sep **3**	Requirements for life: Biological context		
3	Mon	17-Sep **4**	Requirements for life: Physical environments	Higgins et al. 2011 (3); The Global Climate System (4)	
	Wed	19-Sep **5**	Requirements for life: Physical environments		
4	Mon	24-Sep **6**	Geographic distributions: Biomes	Ch. 6 Biomes MacDonald 2003 (5)	
	Wed	26-Sep **7**	Biological interactions & Trophic dynamics	Predator-mediated coexist (6); Why is the world green? (7);	*Topic due*
5	Mon	1-Oct **8**	Biological interactions & Disturbance	Group presentation readings (8)	
	Wed	3-Oct **9**	Species ranges	Pearson 2003 (10)	
6	Mon	8-Oct	**EXAM 1**		
	Wed	10-Oct **10**	Dispersal	So Huge a Bignes-Dispersal (9)	
7	Mon	15-Oct **11**	Evolution and speciation	So Huge a Bignes-Evolution (11) & Radiation (12);	
	Wed	17-Oct **12**	Speciation and extinction	The Man Who Knew Islands (13)	*Outline Due*
8	Mon	22-Oct **13**	Changing earth geography	Bartlein & Prentice 1989 (14); Jackson 2000 (15)	
	Wed	24-Oct **14**	Quaternary climate change		
9	Mon	29-Oct **15**	Biogeographic realms	Mercer 2003 (16)	
	Wed	31-Oct **16**	Phylogeography & biodiversity	Group presentation readings (17)	
10	Mon	5-Nov **17**	Phylogeography & biodiversity		
	Wed	7-Nov **18**	Island biogeography	Island Theory (18); Walter 2004 (19)	
11	Mon	12-Nov	**EXAM 2**		
	Wed	14-Nov **19**	Conservation biogeography	Prugh et al. 2008 (20); Mendenhall et al. 2014 (21)	*Draft to Peer Due*
12	Mon	19-Nov **20**	Humans as biogeographic force: Domestication	Larson et al. 2014 (22)	
	Wed	21-Nov	No class - Happy Thanksgiving		
13	Mon	26-Nov **21**	Humans as biogeographic force: Agriculture	Smith 2007 (23)	

	Wed	28-Nov	**22**	Climate change & disease biogeography	Smith 2010 (24)	*Peer Review Due*
14	Mon	3-Dec	**23**	Biogeography in a changing world	Davis 2011 (25); Response to Davis (26)	
	Wed	5-Dec	**24**	New topics in biogeography		
15	Mon	10-Dec	**25**			
	Wed	12-Dec		**Exam 3**		*Final Paper Due*

Reading details:

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). C_3 and C_4 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 506:85-88

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) Palaearctic biogeography revisited: evidence for the existence of a North African refugium for Western Palaearctic 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. Mountains as barriers

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. Luebert, F. and M. Weigend. 2014. Phylogenetic insights into Andean plant diversification. Frontiers in Ecology and Evolution 2: doi.org/10.3389/fevo.2014.00027

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 BD (2007) Niche construction and the Behavioral context of plant and animal domestication. Evol Anthropol 16:188-199
24. 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
25. 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
26. Correspondence (2011; responses to Davis et al.). Nature 475:37