Biology 3151 WA **Biogeography** **Course Outline 2019**

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Lectures: 5:30 – 7:00 pm M & W in BB 1021 **Office hours**: 1:30 – 2:30 pm W & TH

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Course Description: A study of the distribution and dispersal of organisms. [An examination of how biotic and abiotic factors interact and species distributions respond to dynamic environmental processes such as climate and glaciation. Topics covered include: history of biogeography, distributions of species, communities, and biomes; speciation and extinction, endemism, dispersal, history of lineages and biotas, patterns of continental and oceanic diversity, island biogeography, and human impacts on species distribution. Lecture concepts are complemented by quantitative assignments in a workbook and journal article critiques.]

Required Textbook: Lomolino, M.V., B.R. Riddle, and R.J. Whittaker. 2017. *Biogeography: Biological Diversity Across Space and Time. fifth edition*. Sinauer. ISBN: 978-1-60535-472-9

Optional Materials: Lectures can be downloaded gratis from the Desire2Learn (D2L) website for the course. These slides can provide a good basis for notes but are **not** a substitute for attending class. Those that rely only on downloaded lectures will miss out on material that is covered verbally and ultimately used for exam questions.

Marking Scheme: Midterm 35%, Problem Work Book 15%, Final Exam 50%

Examination Dates: Midterm **Monday Feb 25th**, Final Exam T.B.A.

General Information: The short course description belies the complexity of biogeography. Consequently, we will cover a lot of material. Although there are not specific prerequisites, I assume that students understand basic ecological principles and are familiar with general geography of the world. Maintaining good attendance is for your own benefit. Examination questions often come from poorly attended lectures. Missed examinations will be graded zero unless you have an acceptable excuse and supporting documentation (see official university regulations). If you have a contagious illness, please refrain from attending class and check with the instructor after you recover to ensure that you are up to date. If you do miss, or expect to miss an exam, contact the instructor as soon as possible. Noise or distractions during lectures or exams will not be tolerated. Cell phones must be turned off during lecture. Laptop or notebook computers are allowed in class for following lecture slides and note taking only.

Assignments: There are two assignments, a problem workbook and a journal assignment, both are **due at the end of the lecture on Wednesday March 27 2019**. The problem work book (pdf file) can be downloaded gratis from the Desire2Learn (D2L) website. This work book contains quantitative sample problems related to concepts covered in lecture. **Marks for workbooks submitted late will be reduced by 1 of 15 grade points per day.** Students are also required to read two papers on biogeographical topics from the primary literature (journals). A two page report summarizing and critiquing each paper, one paper for each paper (which must be fully cited) must be handed in with the completed workbook. The

papers will be checked for accuracy and assessed on a pass/fail basis and will be considered when calculating final marks. Reports submitted must be in your own words. Plagiarism will result in a grade of '0' (zero) being assigned. **If the reading assignments are not received by the time of the final exam, an incomplete grade for the course will be assigned.**

Further Reading for Interested Students: The Paterson Library has a considerable, albeit somewhat dated, number of volumes in biogeography. However, electronic subscription packages allow access to pdf versions of papers in several biogeographical journals. You can also access numerous pdfs of published papers by doing keyword searches on Google Scholar. If you are interested in a particular subtopic, seek out references cited in your text or see the instructor for advice.

Journals:
Journal of Biogeography - the primary journal of the discipline. QH 84 J86. (Paper 1974-1984, 1987-1995, electronic 1996-).
Biodiversity and Conservation - basic and applied issues in biogeography. (Electronic 1997-)
Check List - an online journal of data on biodiversity featuring species lists and notes on distribution (http://www.biotaxa.org/cl/index)
Diversity and Distributions - applied biogeography with a conservation focus. (Electronic 1998-)
Ecography - a journal publishing many papers in biogeography. QH 540 H64. (Paper 1992-1996, electronic 2000-).
Global Ecology and Biogeography - papers focusing on the emerging field of macroecology (Electronic 1998-)
Global Ecology and Biogeography Letters - short fast track publications in biogeography. QH 84 J86L. (Paper 1991-1995, electronic 1998-)
Oikos - an ecology journal that often publishes papers in biogeography. QH 540 O39. (Paper 1949, 1951-2004, electronic 2000-).
American Naturalist - an ecological journal that often publishes papers in biogeography. QH 1 A512. Current subscription (hardcopy 1968-, electronic 1997-).
Other ecological journals such as Ecology, Ecology Letters, Oecologia, Journal of Animal Ecology, and taxon specific journals such as Journal of Mammalogy, Journal of Herpetology also publish papers on biogeographical topics. Occasionally, papers on biogeography are also published scientific news journals such Science and Nature.

Other Texts:
Brown, J.H., and A.C. Gibson. 1983. *Biogeography*. Mosby. QH 84 B76
Carlquist, S. 1974. *Island Biology.* A detailed account of the evolution of island forms of organisms. QH 541.5 I8C37.
Cox, C.B., and P.D. Moore. 2000. *Biogeography: an ecological and evolutionary approach.* 6th edition. Blackwell. ISBN 0-86542-778-X. This is the most widely used biogeography text and a good alternative text (although less detailed) to Brown and Lomolino. QH 84 C65 (older edition).
Darwin, C. 1859. *The origin of species.* Many printings available. All biology students, if not everyone, should read this scientific classic which had tremendous impact on how the world is viewed. QH 365 O2 or PN 6013 H33 v.11 or online <http://www.literature.org/authors/darwin-charles/>
Hengeveld, R. 1990. *Dynamic biogeography*. A perspective on biogeography that emphasizes the dynamics of distribution. Cambridge. QH 84 H46
Hubbell, S.P. 2001. *The unified neutral theory of biodiversity and biogeography*. Princeton ISBN 0 691

02128 7. A new mathematical theory building on MacArthur and Wilson's model of island biogeography that attempts to merge major concepts in ecology and biogeography. QH 541.15 B56H83

Kolbert, E. 2014. *The Sixth Mass Extinction: An Unnatural History.* Henry Holt and Company, New York. A current popular science best seller describing the current extinction crisis. ISBN: 978-0-8050-9299-8.

Lomolino, M.V., and J.H. Brown. 1998. *Biogeography*, 2nd ed. Sinauer ISBN 0 87893 073 6. A previous edition of our textbook .

Lomolino, M.V., B.R. Riddle, and J.H. Brown. 2006. *Biogeography*, 3rd ed. Sinauer ISBN 0-87893-062-0. A previous edition of our textbook.

Lomolino, M.V., B.R. Riddle, and J.H. Brown. 2010. *Biogeography*, 4th ed. Sinauer ISBN 0-87893-062-0. The penultimate edition of our textbook .

Lomolino, M.V. and L.R. Heaney 2004. *Frontiers of Biogeography: New directions in the Geography of Nature*, Sinauer. An edited volume on emerging concepts in the field of biogeography.

MacArthur, R.H., and E.O. Wilson. 1967. *The theory of island biogeography*. Monographs in Population Biology No. 1. Princeton. A detailed description of the equilibrium model of island biogeography which created a revolution in the field of biogeography. QH 85 M12

Pielou, E.C. 1979. *Biogeography*. John Wiley. An older and more mathematical treatment of topics in biogeography. QH 84 P53

Spellerberg, I.F., and J.W.D. Sawyer. 1999. *An introduction to applied biogeography*. A concise treatment of biogeography from an applied perspective. QH 84 S7

Wallace, A.R. 1880. *Island life*. The summary of a life's work studying the distribution of island forms by the 'father of biogeography.' QH 85 .W18

Whittaker, R.J. 1998. *Island biogeography: ecology, evolution, and conservation*. Oxford. A detailed treatment of the topic of island biogeography. QH 541.5 I8W48

General books: *Each of the following books are great popular reads I recommend should you be interested in more in-depth knowledge on topics covered in our course...*

Crosby, A.W. 1986. *Ecological imperialism: the biological expansion of Europe, 900 - 1900*. Cambridge. An informative account of how Europeans facilitated species invasions. GF 50 C76

Dale, V.H., F.J. Swanson, and C.M. Crisafulli. 2005. *Ecological responses to the 1980 eruption of Mount St. Helens.* Springer. ISBN 0 387 23850 6. An edited volume that examines the return of life after the volcanic eruption.

Diamond, J.M. 1997. *Guns, germs and steel: the fates of human societies*. A Pulitzer prize winning book explaining the distribution of humans, development of civilization, and the disparate success of human societies from a geographical perspective. Norton. ISBN: 0-393-31755-2. HM 206 D48.

Diamond, J.M. 2005. *Collapse: how societies choose to fail or succeed*. An examination of the environmental causes of collapse of civilizations. Penguin, New York. ISBN:0-670-03337-5. HN 13 D5 2005.

Erwin, D.H. 2006. *Extinction: how life on earth nearly ended 250 million years ago*. A book analyzing the evidence for the causes of the greatest mass extinction (Permian) in Earth's history. Princeton University Press, Princeton. ISBN: 978-0-691-13628-8. QE 721.2 E97E965 2006.

Fagan, B. 2000. *The Little Ice Age: How Climate Made History 1300 – 1850*. Basic Books, New York. ISBN: 978-0-4675-02272-4. This book explains how a fast cooling of climate affected human history.

Fagan, B. 2004. *The Long Summer: How Climate Changed Civilization*. This book chronicles how

human history and the rise and fall of civilizations, is a result of our adaptation to the warm climates that have predominated the planet since the ice age ended 15,000 years ago. ISBN: 978-0-465-02282-3.

Fagan, B. (Ed.). 2009. *The Complete Ice Age: How Climate Change Shaped The World*. Thames & Hudson, London. A very thorough guide to all aspects of the ice age. ISBN: 978-0-500-05161-0.

Flannery, T. 2001. *The eternal frontier: an ecological history of North America and its peoples*. Grove Press, NY. ISBN 0 8021 3888 8. An interesting account of the physical development of North America and the evolution and history of its biota with emphasis on mammals.

Flannery, T. 2010. *Here on Earth: A Natural History of the Planet*. Atlantic Monthly Press, New York. ISBN: 978-0-8021-1976-6. A highly readable concise summary that interweaves many of the major concepts of ecologogy, evolution, biogeography and human history.

Homer-Dixon, T. 2006. *The Upside of Down: Catastrophe, Creativity and the Renewal of Civilization*. Vintage Canada ISBN: 978-0676977233

Huxley, R. (Ed). 2007. *The Great Naturalists*. Thames & Hudson. London. ISBN: 978-0-500-251-39-3. This book covers how our understanding of natural history developed by examining the lives and contibutions of 39 naturalists from ancient times to the 19th century.

Jackson, M.H. 1993. *Galápagos: a natural history.* Univ. of Calgary Press. A highly readable book on the patterns of nature on the islands that inspired Darwin to develop his theory of natural selection. ISBN 1 895176 40 9

Kolbert, E. 2014. *The Sixth Mass Extinction: an unnatural history*. Henry Holt. ISBN: 978-0-8050-9299-8. A popular account of how human actions are leading to the sixth mass extinction.

Mayr, E., and J.M. Diamond. 2001. *The birds of northern Melanesia: speciation, ecology, and biogeography*. Oxford. ISBN 019 514170. QL 691 B52M38 2001.

McCalman, I. 2009. *Darwin's armada: four voyages and the battle for the theory of evolution*. Norton, New York. ISBN: 978-0-393-06814-6. An account of how Darwin, Wallace, Hooker, and Huxley came to understand variation in nature, natural selection, and the defence and acceptance of the theory of evolution.

Quammen, D. 1996. *The song of the dodo: island biogeography in an age of extinctions.* Touchstone. ISBN 0-684-82712-3. This popular book provides an entertaining read covering the development of the field and its contemporary importance.

Ponting, C. 2007. *A new green history of the world: the environment and the collapse of great civilizations*. Penguin Books, London. ISBN: 978-0-14-303898-6. An environmentally based explanation of human history. GF 75 P66 2007 Orillia

Raup, D.M. 1991. *Extinction*: *bad genes or bad luck*. Norton. ISBN 0-393-30927-4. An interesting book on mass extinctions.

Rosenzweig, M.L. 1995. *Species diversity in space and time*. Cambridge. ISBN 0-521-499552-6. A very thorough treatment of the species-area effect and an argument that area is the primary cause of the latitudinal gradient in species richness.

Stott, R. 2012. *Darwin's Ghosts*. Spiegel & Grau. ISBN: 978-1400069378. A very readable account chronicling the stories of Darwin's predecessors who influenced him in developing the theory of evolution by natural selection.

Thompson, K. 2014. *Where Do Camels Belong?: Why Invasive Species Aren't All Bad.* Greystone, Vancouver. ISBN 978-1-77164-096-1. A book that questions native versus alien species and the importance of invasiveness as a fundamental concept.

Thornton, I. 1996. *Krakatau*: *the destruction and reassembly of an island ecosystem*. ISBN 0-674-50572-7. A fascinating account chronicling the recovery of life on perhaps the world's most watched island.

Ward, P.D. 1992. *On Methuselah's Trail: living fossils and the great extinctions*. W.H. Freeman, New York. 9780716722038. The author investigates the phenomenon of a number of 'living fossils' that provide glimpses into ancient times and past mass extinctions.

Wilson, E.O. 1992. *The diversity of life*. Belknap ISBN 0-674-21298-3. A popular account of biological diversity and a plea for its conservation by one of the most influential living ecologist/biogeographers

Winchester, S. 2001. *The map that changed the world: William Smith and the birth of modern geology*. Harper Perennial. ISBN 978-0-06-176790-6. A biography of William Smith whose work defining stratification of rocks and use of fossils for dating helped in establishing the age of the Earth. Also provides a good social history of science in the 18th and 19th century.

Wright, R. 2006. *An illustrated short history of progress*. Anansi, Toronto. An environmental interpretation of human history and assessment of the current sustainability of civilization. ISBN: 13-978-0-88784-206-1. CB 69 W75 2006, Audio of Massey Lectures CD 303.44 W75 2004 (Education Library).

Literature Searches:
The library subscribes to two databases, *Web of Science* and *Biological Abstracts* that cover journals carrying articles on biogeography. *Web of Science* provides information (including abstracts) on articles published since 1998 and is updated weekly. *Biological Abstracts* provides similar information but permits searching back a number of years. Information on how to access these databases can be obtained from the reference desk in the Paterson Library. Searching Google Scholar online will also retrieve similar information and often peovides links to available pdfs of papers. The Patterson library also has access to many primary journals where students can download journal papers for their own reading.

Reserve Materials: A folder containing course information and supplemental materials (*e.g.* practice problems, related readings) may be kept in the library at the circulation desk under the instructor's name and course number. The library may also have copies of some past final examinations which were provided by the university (not by the instructor). These can be helpful to some students as examples of the types of questions you may be asked in examinations. However, keep in mind that courses evolve and questions change. **The instructor will <u>not</u> provide answers to questions from previous examinations held in the library.**

Tentative Schedule of Lecture Topics

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1. Introduction to biogeography (Chap. 1 in the text)
2. Historical development (Chap. 2)
3. Physical setting (Chap. 3)
4. Distributions of species (Chap. 4)
5. Distributions of communities and biomes (Chap. 5)
6. Dispersal (Chap. 6)
7. Speciation and Extinction (Chap. 7)
8. Dynamic earth (Chap. 8)
9. Glaciation (Chap. 9)

Study week

Midterm – Monday February 25th

10. Geography of Diversification – Endemism, provincialism & disjunction (Chap. 10)

11. History of lineages (Chap. 11)
12. Reconstructing histories (Chap. 12)
13. Island biogeography - species richness (Chap. 13)
14. Island biogeography - assembly & evolution of communities (Chap. 13)
15. Areography, Ecogeography & Macroecology of Continents & Oceans (Chap. 14)
16. Human biogeography (Chap. 15)
17. The Future of Biodiversity (Chap. 15)
18. Species invasions (Chap. 16) (video, time permitting)

Workbook and journal article assignment due – Wednesday March 27, 2019
