Biogeography
GEOG380/BIOL351/ENVR300

"… that grand subject, that almost keystone of the laws of creation – Geographical Distribution." – Charles Darwin

Instructor:
Todd Lookingbill (he/him/his)
Office hours: Mon. 1:00-2:00 at https://urichmond.zoom.us/my/lookingbill
or Thurs. in person from 1:30-2:30 (email me and we will find a place to meet)

Email: tlooking@richmond.edu

Course schedule:
Lecture: Wed/Frid, noon-1:15, GOTW A100

Prerequisite:
GEOG 250 or ENVR 201 or BIOL 202

Why is this course important?
The Earth is in the midst of its sixth mass extinction event. Why is this happening? What can we expect the future to look like? What can be done? Biogeography is the study of the Earth's biological diversity, the spatial distribution of species, and how these distributions change over time. The science combines basic concepts in ecology and geography. This course provides a foundational understanding of biogeography and assesses the relevance of biogeography during a time of increasing human impact, globalization, and climate change. The varying influences on species distributions in different ecosystems and different regions of the world will be critically examined to assess future opportunities for conservation.

Biogeography draws from a broad range of basic science (macroecology, evolutionary biology, ecosystem science, climatology, geology, ecoinformatics) and applied disciplines (global change biology, invasion ecology, environmental health, conservation). Topics considered range from evolutionary mechanisms, earth history, and plate tectonics to concepts of ecological niche theory and basic taxonomy. This course examines both historical and contemporary patterns of

species distributions. It includes the study of current and future threats to species and the evaluation of potential conservation actions to mitigate threats. Through homework assignments and a final project, special emphasis will be placed on comparing the influences on biological distributions in an urban environment (Richmond, Virginia) vs an old-growth forest (Blue River, Oregon).

Attendance:
We continue to face a challenging situation in which all of us are called on to make a good faith effort to be flexible and to make decisions in the best interest of the community, including staying home when sick. If you are sick, you should not attend class. You will not be required to provide formal documentation from a health care provider, and will not be penalized for absences.

However, you should:

- Notify me in advance of the absence if possible.
- Contact the Student Health Center if sick.
- Keep up with classwork and attend class online if you are able to do so
- Submit assignments digitally on time whenever possible
- Work with me to try to reschedule any missed assignments
- Most importantly, stay in close communication with me through Slack

This attendance policy puts everyone on their honor. It requires me to trust your word when you say you are ill, and it requires you to report the reason for your absence truthfully. Falsely reporting a reason for an absence is an honor code violation.

Course materials:
The required text for this course will be available via Skyepack. Instructions to set up your account and purchase the course pack are provided below:

1. Go to www.skyepack.com
2. Click on "Create Account." Make sure you are using your university address (EX: "student@richmond.edu")
3. Skyepack will send you an automated verification email to the address used to create your account. Please check this email to Verify Your Account. This will take you to the "My Pack Collection" homescreen.
4. Click on "Channel Guide", find your university, then your pack, and click, "ADD to MY COLLECTION".
7. Pay the access fee using a debit or credit card ($35.00)
8. Your course pack will now be available for you whenever you log into your account.
9. For further assistance, please contact, SUPPORT@SKYEPACK.COM.

Additional materials can be found on the web site for the class, which can be found on Blackboard: http://blackboard.richmond.edu/

What will you be learning?
The goal of the course is to study the interplay between species biology, geographic ranges, environment, evolution, and extinction. Learning objectives of the course include:

- To develop an appreciation for the historical and ecological factors that influence the pattern of life on earth.
- To survey through readings, lectures, and discussions the scientific revolutions of evolution, geography, and ecology that shaped the path to modern biogeography.
- To understand through homework assignments the scientific method and how to test hypotheses using inferential statistics.
- To analyze the processes that affect how biotas respond to a changing climate and other challenges we face today and in years to come.
- To critically examine examples of conservation biogeography and apply these approaches in a final project of local or international interest.

In general, lectures will focus on teaching key biogeographic principles and the relevance of biogeography in forecasting global change. Discussion sections will focus more on case studies and controversies.

Reading assignments and discussions:
Selected readings from the course pack and the primary literature will be assigned with each weekly unit. Every student is expected to have read the assignments before class (course pack readings should be completed by the Wednesday class period and primary literature reading should be completed by the Friday class period).

Responsibility for leading discussion will be rotated sequentially from week to week. Discussion leaders should become familiar with background materials, be prepared with an evaluation of the significant contributions of the readings, and facilitate discussion among the group. Leaders should post discussion questions on Blackboard by 8:00 pm on Tuesday of that week to help facilitate the discussions. Everyone else should respond to at least one of the discussion prompts on the Blackboard Discussion Board by 8:00 pm on Thursday.

A good written response will be free of grammatical and spelling errors, have a clear thesis statement articulating an original idea or claim stimulated by the prompt. Your argument should be supported by evidence from the reading or other sources. The writing style should be formal. The purpose of these exercises is to provide an opportunity to critically examine the latest examples of cutting-edge research in biogeography. A secondary goal is to practice generating and articulating new ideas in writing using what is probably new terminology to you from biogeography. These exercises will help develop higher level analytical, critical thinking, and communication skills. These skills will be required for your final project. By reading your classmates posts, it will also help you to get to know each other and hear multiple perspectives on our readings.

Facilitators should review all responses and use them to actively engage the class during the Friday discussion period. I encourage discussion leaders to meet with me during office hours prior to the discussion of their papers.

Homework assignments:
A series of three homework exercises will relate the theory of biogeography to practical applications in two focal ecosystems in Richmond, Virginia and Blue River, Oregon. Homework assignments will include the collection of primary data, analysis of online resources, and interpretation of spatial patterns and trends of the Earth's biota on campus, in the City of Richmond and around the world. Specific exercises will investigate the specific biogeographic processes on campus, within Richmond parks, within the mountains of the Pacific Northwest. Written reports will be submitted for each of the exercises. Electronic copies must be submitted on Box by the due date or one point will be subtracted per day late. See me early on if you are having problems. Each assignment will be worth 5% of the course grade.

Exams:
The course grade will be based in part on a mid-term exam and a final exam. The mid-term exam will combine short answer, fill-in, multiple choice, and three to four half-page essay questions. The mid-term will be closed-book and worth 25% of the final grade. The final exam will be cumulative and worth 25% of your grade. It will focus on the applications of conservation biogeography to address real-world, environmental challenges.

If you must miss the mid-term exam for a legitimate, documented reason you must inform me ahead of time to schedule a make-up. Anyone missing a mid-term exam for a non-legitimate reason will be assigned a zero. No make-up final exams will be given.

Special projects:
As a final project, students will incorporate concepts developed during the semester to propose some new conservation action related to a biogeographic challenge of interest. Proposals may be constructed individually or in small groups. They will require the direct application of concepts learned in class such as predicting the shift in the distribution of a species due to warming temperatures or changes in precipitation. Final projects will include an in-class oral presentation of your idea and a written proposal. The assignment is worth 25% of the overall grade.

Class participation:
Class participation will be worth 10% of your grade and will be evaluated on your leading and actively participating in discussion of the readings and on active, engaged participation in lectures. If you are unable to attend a class, please advise by email beforehand, as participation is clearly dependent on attendance. One undocumented (no note from a dean or physician) absence is permitted per semester. One point will be deducted for each additional absence. Attendance on the field trip is mandatory. Participation will be quantified using the following guidelines (adapted from JA Schatzel, Stonehill College):

Points	Behavior
9-10	Creative and well-rehearsed discussion leader; always well prepared for class; offers reasoned responses of high quality and asks thoughtful questions on an ongoing basis.

7-8	Facilitates productive discussion; contributes regularly; generally prepared; asks questions and provides occasional responses of moderate quality; handles direct questions satisfactorily.
5-6	Discussion session poorly organized; participates infrequently; needs to be prodded; weak preparation; allows other to carry the ball in class discussions.
3-4	Often inadequately prepared; little involvement in class discussions; repeatedly late or leaves during class.
< 2	Unprepared; disruptive in class; unauthorized use of computers during class – e.g. e-mail or instant messaging; repeated talking with other students about topics not related to class.

Final grades will be Calculated as Follows:
25% Mid-term exam
25% Final exam
25% Project
15% Homework assignments
10% Class participation

- The grading scheme will follow standard University of Richmond guidelines (http://registrar.richmond.edu/services/policies/grading.html).

A > 93 pts	**B 87-83**	**C 77-73**	**D 67-63**
A- 93-90	**B- 83-80**	**C- 73-70**	**D- 63-60**
B+ 90-87	**C+ 80-77**	**D+ 70-67**	**F < 60 pts**

Academic honesty:
The strength of the university depends on academic and personal integrity. In this course, you must be honest and truthful. Ethical violations include cheating on exams, plagiarism, reuse of assignments, improper use of the Internet and electronic devices, unauthorized collaboration, alteration of graded assignments, forgery and falsification, lying, facilitating academic dishonesty, and unfair competition. Report any violations you witness to the instructor. https://studentdevelopment.richmond.edu/student-handbook/honor/guide.pdf

Time-on-Task Expectations:
To be successful in this course, you should expect to devote an average of 10-14 hours each week reading for class (3-4 hours), participating in class session (3 hours), completing exercises at home (2-3 hours), and studying for exams and working on the final project (2-3 hours).

Spring 2022 Class Schedule

This schedule will be followed approximately. Some changes may be made as the class proceeds. Time permitting, we will conclude each major section with an in-class review. Readings in Skyepack course packet are listed on the right.

Week	Topic	Readings
	Introduction and Foundations	
1 – Jan 12	*Biodiversity Crisis. What is Biogeography and Why Should We Care? Place within Biology and Geography. Core Concepts, Definitions, and Motivation*	Module 1
2 – Jan 19	*Who is Represented in the Historical Foundations of Biogeography? What Did They Say? Whose Voice is Absent? What are We Missing as a Result?*	Module 2
The Geographic and Ecological Foundations of Biogeography		
3 – Jan 26	*An Overview Model for Biogeography. The Geographic Template: Climate, Soils, and Variation in Aquatic Environments. What Causes the Variability in the Physical Environment at Different Spatial Scales?*	Module 3
4 – Feb 2	*Visualizing Biogeographic Pattern using GIS and Remote Sensing. Ecological Niche. Species Distributions Models: What are They and Why are They Useful? Biotic Processes and How Species Respond to the Environment. How Does the Geographic Template Limit Species' Distributions?*	Module 4
5 – Feb 9	*Species Interactions. Ecological Communities in Biogeography. Ecological Succession. Global Comparison of Biomes and Hotspots*	Module 5
Fri, Feb 11	**Homework 1 Due at 5:00 pm**	
Biogeographic Processes		
6 – Feb 16	*Dispersal and Range Expansion. Mechanisms and Barriers. Biological Invasions.*	Module 6

7 – Feb 23	*Pattern, Process and Geographic Modes of Speciation and Extinction. What Are Species, How Do They Arise, and What Causes Them to Go Extinct?*	Module 7
Fri, Feb 25	**Homework 2 Due at 5:00 pm**	
Mon, Feb 28	**Huguenot Flatwater Field Trip**	
8 – Mar 2	**Mid-term Exam**	
Ecological Biogeography		
9 – Mar 16	*Temporal Dynamics of the Geographic Template. Geological Timescale. Geological Evidence of Earth's Historical Changes. Continental Drift and Plate Tectonics. Other Change Processes.*	Module 8
10 – Mar 23	*Processes of Island Formation. Island Syndrome. Species-Area Relationships. Island Biogeography. Perils of Island Life*	Module 9
Fri, Mar 25	**Homework 3 Due at 5:00 pm**	
11 – Mar 30	*Fundamental Geographic Patterns of Biological Diversity. Areography, Ecogeography, and Macroecology. Latitudinal Gradients*	Module 10
12 – Apr 6	*Conservation Biogeography. Recent Extinctions and Endangerments. Expansions across the Palearctic. Invasions of the New World*	Module 11
13 – Apr 13	**Project Presentations**	
14 – Apr 20	*Frontiers and Future of Biogeography*	Module 12
	Take-home Final Exam Due Apr 27 at Noon	

Supplemental Readings (examples):

- Ackerly, D.D., Loarie, S.R., Cornwell, W.K., Weiss, S.B., Hamilton, H., Branciforte, R. and Kraft, N.J.B., 2010. The geography of climate change: implications for conservation biogeography. Diversity and Distributions, 16(3): 476-487.
- Hoffmann, S., Irl, S.D.H. and Beierkuhnlein, C. 2019. Predicted climate shifts within terrestrial protected areas worldwide. Nature Communications 10: 4787
- Richardson, D.M. and Whittaker, R.J., 2010. Conservation biogeography–foundations, concepts and challenges. Diversity and Distributions, 16(3): 313-320

- Rominger, A.J., Goodman, K.R., Lim, J.Y., Armstrong, E.E., Becking, L.E., Bennett, G.M., Brewer, M.S., Cotoras, D.D., Ewing, C.P., Harte, J. and Martinez, N.D., 2016. Community assembly on isolated islands: macroecology meets evolution. Global Ecology and Biogeography, 25(7): 769-780
- Sax, D.F., Stachowicz, J.J., Brown, J.H., Bruno, J.F., Dawson, M.N., Gaines, S.D., Grosberg, R.K., Hastings, A., Holt, R.D., Mayfield, M.M. and O'Connor, M.I., 2007. Ecological and evolutionary insights from species invasions. Trends in ecology & evolution, 22(9): 465-471
- Wiens, J.J., 2011. The niche, biogeography and species interactions. Philosophical Transactions of the Royal Society of London B, 366(1576): 2336-2350.

If you experience difficulties in this course, do not hesitate to consult with me. There are also other resources that can support you in your efforts to meet course requirements.

Academic Skills Center (asc.richmond.edu): Academic coaches assist students in assessing and developing their academic and life-skills (e.g., critical reading and thinking, information conceptualization, concentration, test preparation, time management, stress management, etc.). Peer tutors offer assistance in specific subject areas (e.g., calculus, chemistry, accounting, etc.) and will be available for appointments in-person and virtually. Peer tutors are listed on the ASC website**. Email** Roger Mancastroppa (rmancast@richmond.edu) **and** Hope Walton (hwalton@richmond.edu) **for coaching appointments in academic and life skills.**

Boatwright Library Research Librarians: (library.richmond.edu/help/ask/ or 289-8876): Research librarians help students with all steps of their research, from identifying or narrowing a topic, to locating, accessing, evaluating, and citing information resources. Librarians support students in their classes across the curriculum and provide individual appointments, class library instruction, tutorials, and research guides (libguides.richmond.edu). Students can contact an individual librarian (library.richmond.edu/help/liaison-librarians.html) or ASK a librarian for help via email (library@richmond.edu), text (804-277-9ASK), or chat (library.richmond.edu/chat.html).

Career Services: (careerservices.richmond.edu or 289-8547): Can assist you in exploring your interests and abilities, choosing a major or course of study, connecting with internships and jobs, and investigating graduate and professional school options. We encourage you to schedule an appointment with a career advisor early in your time at UR.

Counseling and Psychological Services (caps.richmond.edu or 289-8119): Assists currently enrolled, full-time, degree-seeking students in improving their mental health and well-being, and in handling challenges that may impede their growth and development. Services include brief consultations, short-term counseling and psychotherapy, skills-building classes, crisis intervention, psychiatric consultation, and related services.

Disability Services (disability.richmond.edu) The Office of Disability Services works to ensure that qualified students with a disability (whether incoming or current) are provided with reasonable accommodations that enable students to participate fully in activities, programs, services and benefits provided to all students. Please let your professors know as soon as possible if you have an accommodation that requires academic coordination and planning.

Speech Center (speech.richmond.edu or 287-6409): Assists with preparation and practice in the pursuit of excellence in public expression. Recording, playback, coaching and critique sessions offered by teams of student consultants trained to assist in developing ideas, arranging key points for more effective organization, improving style and delivery, and handling multimedia aids for individual and group presentations. Remote practice sessions can be arranged; we look forward to meeting your public speaking needs.

Writing Center (writing.richmond.edu or 289-8263): Assists writers at all levels of experience, across all majors. Students can schedule appointments with trained writing consultants who offer friendly critiques of written work.