

LANDSCAPE ECOLOGY

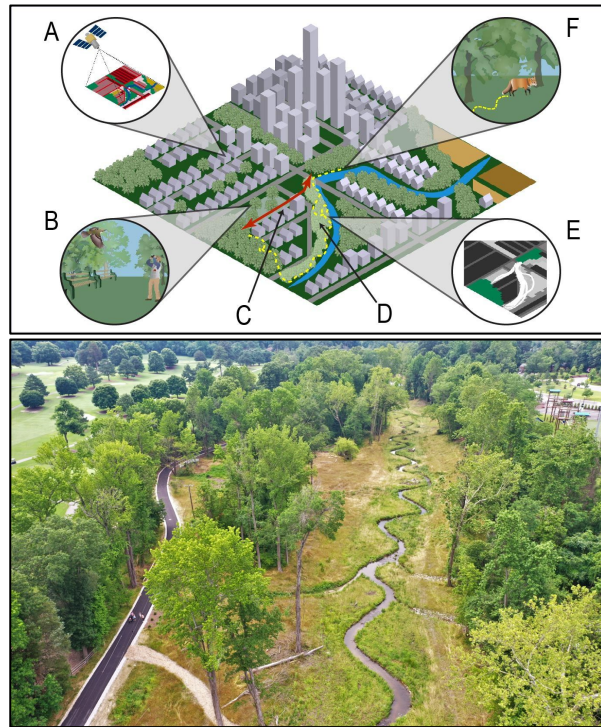
GEOG/BIOL 315

Course Description and Syllabus (Spring 2025)

COURSE OBJECTIVES:

Upon completion of the course, students will:

- understand the scientific principles that govern the reciprocal relationship between spatial patterns and ecological processes;
- understanding how landscape pattern is generated and why it matters to populations, communities, and ecosystem processes.
- relate landscape ecology to grand challenges in ecology such as urbanization, fragmentation, climate change, and species invasions;
- access and critically interpret primary sources of scientific literature;
- identify and use analytic tools for specific applications of landscape ecology theory; and
- develop skills in natural resource assessment and scientific communication.



Landscape ecology is an applied science and this class is an applied, project-based course. In addition to the regular lab assignments, each student will participate in a semester-long project group to apply landscape ecology in collaboration with a community partner.

LOGISTICS

Instructor:

Dr. Todd Lookingbill (he/him/his)
Office: 311 Carole Weinstein International Center
phone: (804) 289-8265
e-mail: tlooking@richmond.edu

How to Reach Me:

Office hours: Wednesdays 2:30-3:30 pm or grab me after class
Pop in or if you know ahead of time you'd like to chat at a specific time, email me first
I make a point of trying to respond to all correspondents within 24 hours (48 hrs on weekends). So if you do not hear back from me in that time, feel free to ping me again.

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Course Material:

The website for the class can be found on Blackboard. The daily schedule maintained there will be updated throughout the semester:

<http://blackboard.richmond.edu/>

Textbook: *Agents and implications of landscape pattern: Working models for landscape ecology.*

Urban, DL. 2023. Springer Nature Switzerland AG. <https://doi.org/10.1007/978-3-031-40254-8>.

We will use this book as a guide for the class. There is an eBook available online at the link above. It will be supplemented liberally with readings from other texts and from the primary literature. These additional readings will be posted on Blackboard.

Prerequisites:

GEOG/ENVR 250, ENVR 201, BIOL 202 or 207, or permission of instructor

Attendance:

Class meets Tues in GOTW A201 and Wed in GOTW A100 or Thurs in GOTW A201 (depending on what section you are in) from 12:00-1:15. Classes will be highly interactive, so attendance is critical. If you are sick, you should not attend class. You will not be required to provide formal documentation from a healthcare provider.

However, you should:

- Stay in close communication with me, including notifying me in advance of the absence if possible.
- Contact the Student Health Center if sick.
- Keep up with classwork.
- Submit assignments digitally on time whenever possible.

This attendance policy puts everyone on their honor. Falsely reporting a reason for an absence is an honor code violation.

NOW, WHAT IS THIS COURSE ALL ABOUT?

Course Description:

Landscape ecology is the study of how spatial patterns are created on landscapes and the implications of these patterns on ecological processes (see simplified definition that we derived together as a class during the first week). It is an applied science that focuses on the understanding and management of environmental patterns. These patterns include the spatial distributions of species and the environmental resources upon which they depend. Although the focus is typically on relatively large landscapes like cities or national parks, careful attention is paid to the influence of scale in natural resource management. Because nearly all of the earth's landscapes have been altered by human activities for some time, landscape ecology also emphasizes the role of humans in the environment. The goal of this course is to provide a firm grasp of the concepts of landscape ecology and how these concepts can be used to enhance the effectiveness of environmental policy, assessment, and management.

The course will use a combination of lectures, discussions, and hands-on activities to study topics including: habitat loss and fragmentation; methods for describing spatial variability and characteristic scale of environmental variables; the role of disturbance in ecosystems; the distribution of species; the impacts of a changing climate; and, broadly, the application of landscape ecology to monitoring, conservation, and restoration. We will place special emphasis this semester on landscape challenges within the city of Richmond. Special projects will focus on working with community partners to apply your learning towards a just and equitable management of environmental resources in the city.

Course Schedule:

A more detailed schedule will be updated continuously throughout the semester on Blackboard:

Week	Topic	Text
	Introduction and Foundations	
1 – Jan 14	<i>An Introduction to Landscape Ecology – What is It? A History, Some Definitions and a Prospectus</i> <i>Introduction to the Agents of Pattern: Landscape Structure, Function, and Change</i>	
	Agents of Landscape Pattern Creation	
2 – Jan 21	<i>Landscape Structure – Physical Template, How is it Organized? (Patches vs. Gradients), What are the Elements? (Temperature, Radiation, Precipitation, Soils), and How are They Estimated for Landscapes? (Proxy Variables)</i>	Chapter 1
3 – Jan 28	<i>Landscape Function – Biotic Processes such as Demography (birth, growth, and death), Competition and Dispersal; Pattern Process Paradigm and the Unit Pattern revisited</i>	Chapter 2
4 – Feb 4	<i>Landscape Change – Disturbance Definitions and Types, Are</i>	Chapter 3

	<i>Disturbances 'Natural' Parts of the System? Humans and Landscape Change, Legacies, Disturbance Regimes</i>	
	Interpreting Landscape Pattern	
5 – Feb 11	<i>Scale and Scaling – Why is Scale Important? Characteristic Ecological Scale, Grain and Extent, How can Characteristic Scale be Quantified? Scaling Techniques</i>	Chapter 4
6 – Feb 18	<i>Landscape Pattern Metrics – Why and How do We Use Them? Patch Concept Revisited; Measures of Composition, Configuration, and Connectivity; Neutral Landscape Models</i> Quiz	Chapter 5
	Implications of Landscape Pattern	
7 – Feb 25	<i>For Populations – How do Populations Respond to Landscape Pattern? Metapopulations, Structural and Functional Connectivity, Network Analysis/Graph Theory</i>	Chapter 6
8 – Mar 4	<i>For Communities – How do Communities Respond to Landscape Pattern? Theory of Island Biogeography, Diversity Measures, Gradient Analysis and Ordination</i>	Chapter 7
9 – Mar 11	Spring Break	
10 – Mar 18	<i>For Ecosystems – How do Ecosystems Respond to Landscape Pattern? Lateral Fluxes of Carbon and Nutrients, Primary Production, Edge Effects Revisited</i>	Chapter 8
11 – Mar 25	Review and Exam	
	Landscape Ecology in a Changing World	
12 – Apr 1	<i>Urban Landscapes – What are Approaches to Studying Cities? Socio-Environmental Systems, Urban Heat Islands, Urban Stream Syndrome</i>	Chapter 9
13 – Apr 8	<i>Landscape Ecology in Practice – How are Real-Life Practitioners Applying this Science in the Field?</i>	
14 – Apr 15	<i>Climate Resilient Landscapes – How Can Landscapes Adapt to Climate Change? Components of Climate Change, Species Range Shifts, Resiliency Assessment and Planning</i>	Chapter 10
15 – Apr 22	<i>The Future of Landscape Ecology</i>	

Final Exam – Take Home

WHAT WILL WE BE DOING?

Course Structure:

The course will meet Tuesdays and Wednesdays or Thursdays (depending on your section). Each week will cover a new topic. The first class of the week will be a more formal lecture. The second class will focus more on discussion of articles from the primary literature and hands-on exercises. These exercises will be introduced in class and continued as a series of homework assignments. You must complete all of the in-class work, but you can choose any three of the homeworks to complete. Each of you will take turns leading one of the exercises. We will have a short quiz in class after we complete Chapter 5 to help prepare you for the in-class exam. The exam will cover the content of the first eight chapters of the book. The final exam will be take-home and more application-based; you will be provided a set of applied challenges in landscape ecology that will tie together many of the themes studied in the course. *You will choose a special project at the beginning of the semester. Although there will be time in class for project teams to meet, you should expect to meet outside of regular class hours to meet with your team and community partners.*

Reading Assignments:

Selected readings from the text and the primary literature will be assigned with each weekly unit. Every student is expected to have read the assignments before class (background readings should be completed by the Tuesday class period and primary literature or exercise readings should be completed by the Wednesday/Thursday class periods). Reading reflections, when required, should be posted to Blackboard by **10:00 am before class on Wednesday/Thursday**.

A good written reflection will be approximately 200 words, free of grammatical and spelling errors, and have a clear thesis statement articulating an original idea or claim stimulated by the reading. Your argument should be supported by evidence from the reading, your experiences, and/or other sources. The writing style should be formal. The purpose of these exercises is to provide an opportunity to critically examine what you have learned in class. A secondary goal is to practice generating and articulating new ideas in writing. These exercises will help develop higher-level analytical, critical thinking, and communication skills. I encourage you to read over your classmates' posts before writing your own. By reading your classmates' posts, it will also help you to get to know each other and hear multiple points of view on our readings.

Some ideas to help stimulate your reflections include: (1) if multiple papers provided on a similar theme, identify which paper was your favorite (or least favorite) of the group and explain why, (2) describe something unclear or confusing about the readings, (3) identify something in the readings that was new to you and/or that changed the way you think about things, (4) identify a topic from the readings that you would like to know more about, (5) describe a connection between the readings and something you know about outside of class (e.g., from other classes, news stories, your own personal experiences, etc.).

Class Exercises and Homework Assignments:

At the beginning of the semester, I will lead the class through a first in-class exercise. Later in the semester you and a partner(s) will have the opportunity to lead one of the exercises yourself. These exercises will include practice in using remote sensing, tools for citizen science, landscape pattern metrics, connectivity tools, and landscape change models. Exercise leaders should become familiar with background materials, administer a short five-question pop quiz on the background material at the beginning of class, run the exercises themselves ahead of time, and select parts of the exercises to be done in class and as homework assignments. Leaders should submit their assignments to me by **10:00 pm on Monday** of that week (pre-lab reading, in-class quiz with answer key, in-class exercise, and homework assignment for those choosing to do this lab as one of their written reports). I encourage all exercise leaders to also meet with me during office hours on Wednesday to finalize plans.

Written reports should be submitted for two of the exercises (you will be leading one and you need not hand in a written report for others, though you must do the pre-lab reading and in-class quiz for all exercises). Electronic copies of your reports must be submitted to Blackboard by the due date (**10:00 pm on Wednesday of the following week**) or one point will be subtracted per day late. No advanced computer skills are required, but the homeworks may be challenging for the technophobic. *Start them early and come see me* if you are having problems. Additional homework will also be assigned from time-to-time and is mandatory.

Exams:

There will be two exams and one quiz. The quiz and first exam will cover all content in the lectures and readings and will focus on understanding the basic concepts of landscape ecology. This exam will be given in class and will be closed-book. The quiz preceding the exam is meant to help prepare you for the exam. The final exam will be take-home and open-book. It will be cumulative covering all material in the course. Unlike the first exam, which is primarily a test of course content, this exam will focus on the practice of landscape ecology to address natural resource management challenges in the real world. Here, you will be asked to apply your knowledge to realistic problems.

Special Projects:

As a special project, you will explore the unequal distribution of heat in the city of Richmond. Studies by previous students have shown discrepancies in temperature to be as great as 14°F in different parts of the city. Our projects will consider what actions can be taken to address this inequality. You will choose to participate in one of the following project groups:

- 1) Fall Line Trail – This project will focus on stakeholder engagement and environmental impact analysis along the Fall Line trail corridor, guided by the Fall Line Vision Plan. By studying comparable trails, the study could explore, for example, how trail-adjacent projects—such as rain gardens, tree canopy expansion, shade structures, public art, and affordable housing initiatives—can enhance community outcomes and mitigate heat islands. The analysis will help partners and local governments make informed decisions on tradeoffs for trail development. Partner - Bike Walk RVA at Sports Backers
- 2) Cooling Center Access – This project will prioritize new cooling center locations in Richmond by using local datasets and methods adapted from Watkins et al. (2024) to

address heat-related vulnerabilities. The GIS-based analysis will consider factors such as the percentage of households without central air conditioning, emergency response data, and social vulnerability to identify high-need areas and optimize cooling center access. The findings will support local government and community partners in implementing heat mitigation strategies, including adding shade structures, green infrastructure, and transit-accessible cooling facilities. Partner – Richmond & Henrico Health Districts

- 3) Tree Inventory – This project will support the development of Richmond’s Urban Forest Master Plan by analyzing best practices in tree inventories and urban forestry planning from comparable cities. The collaborative effort between VCU and the City aims to create a long-term, data-driven strategy for enhancing Richmond’s green infrastructure and addressing climate resilience. The focus of the inventory is on existing species, age, general condition and location info, but could include a proposed study project for the future plantings in the city’s Right of Ways and Parks. Partner – City of Sustainability
- 4) Park Planning – This project will assess Richmond’s first-ever Parks and Recreation Master Plan, Richmond INSPIRE (Imagining Neighborhood-Shaping Parks and Inclusive Recreation Experiences), to be completed this spring. The focus will be on evaluating its goals, priorities, and strategies for equitable park improvements. Students will attend a workshop to learn about the draft plan and then create a response document to identify gaps in the plan, address the implementation framework, and recommend actionable steps for ensuring the city’s vision is effectively realized. Partner – Department of Parks & Rec

Each of these projects will require the direct application of concepts of landscape ecology learned in class. These projects will all require some work off-campus outside of classtime. Final write-ups will be in the form of a poster with short video describing and justifying the work. Examples of past video presentations can be found [here](#).

Class Participation:

Class participation will be evaluated on your active participation during in-class exercises and discussions and on active, engaged participation in the lectures. You will also have a chance for reflection on your participation and that of other group members in your leading of a lab exercise and group project work. If you are unable to attend a class, please advise by email beforehand, as participation is clearly dependent on attendance. Participation will be quantified using the following guidelines (adapted from JA Schatzel, Stonehill College):

<u>Grade</u>	<u>Behavior</u>
A	Always well prepared for class; facilitates productive peer discussions and helps others during exercises; offers reasoned responses of high quality and asks thoughtful questions on an ongoing basis; is a responsive and adaptable group member on project work that takes initiative and listens to others.
B	Contributes regularly; generally prepared; asks questions and provides occasional responses of moderate quality; handles direct questions and group tasks satisfactorily.
C	Participates infrequently; needs to be prodded; weak preparation; allows other to carry the ball in class discussions and exercises.
D	Often inadequately prepared; little involvement in class discussions or group projects; repeatedly late or leaves during class.

F	Unprepared; disruptive in class; unreliable in group projects; unauthorized use of computers during class – e.g. e-mail or instant messaging; repeated talking with other students about topics not related to class.
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Grading:

Grades will be assigned based on the following formula:

<u>Point values</u>	
Reading reflections	5 points
Class exercises and hmwks	20 points
Quiz	7 points
Exam	20 points
Final exam	20 points
Special project	20 points
Class participation	<u>8 points</u>
100 points	

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

CLASSROOM GROUND RULES

Regardless of age, ability, ethnicity, race, gender, gender identity, sexual orientation, socioeconomic status, geographic background, religion, political ideology, language, or culture, we expect all members of this class to contribute to a respectful, welcoming, and inclusive environment for every other member of our class. If there are aspects of the instruction or design of this course that result in barriers to your inclusion, engagement, accurate assessment or achievement, please notify me as soon as possible.

Ground Rules for a Safe Space:

- Be mindful of one another's privacy -- do not invite outsiders into our class
- Be respectful
- Assume good will
- Challenge with care. Approach discussion as a "think out loud". Debate the concepts not the person.
- Speak from your own experiences, not assuming others have similar experiences
- Try not to make assumptions, seek to understand, not to judge
- Be open to challenges and different perspectives as an opportunity to learn something new

- Be flexible when things don't work
- Use preferred names and gender pronouns
- No side conversations
- Be willing to work together

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. I take the pledge to academic honesty very seriously, do not put yourself in jeopardy for a lazy plagiarism or other violation. It is not worth it. Report any violations you witness to the instructor.

<https://studentdevelopment.richmond.edu/student-handbook/honor/guide.pdf>

Use of AI Tools:

Our understanding of AI tools (like ChatGPT) is constantly evolving. While I encourage you to explore how these technologies can help you select appropriate analyses to conduct in your assignments (e.g., ordination or classification analysis), provide proper syntax for any coding that we do, or even provide additional explanations of difficult to understand concepts (e.g., learn more about edge effects) ... you are **prohibited** from using these tools to complete course assignments including any written assignments and online quizzes unless I have explicitly asked you to do so. Unauthorized use of these tools will be considered an Honor Code violation in this class.

Time-on-Task Expectations:

To be successful in this course, you should expect to devote an average of 10-14 hours each week to preparing for class (3-4 hours), participating in class lectures and exercises (3 hours), studying course related materials after class and for exams (1-2 hour), and completing course assignments and projects (3-5 hours). If you find you are spending significantly more than this amount of time averaged over the semester, please let me know. It is expected that you will have completed all reading assignments before class to participate actively in the classroom discussions and exercises.

If you experience difficulties in this course, do not hesitate to consult with me. Additional support services are available at:

Disability Services

The University of Richmond's office of Disability Services strives to ensure that students with disabilities and/or temporary conditions (i.e., concussions & injuries) are provided opportunity for full participation and equal access. Students who are experiencing a barrier to access due to a disability and/or temporary condition are encouraged to apply for accommodations by visiting: disability.richmond.edu. Disability Services can be reached at disability@richmond.edu or 804-662-5001.

Once accommodations have been approved, students must 1) Submit their Disability Accommodation Notice (DAN) to each of their professors via the Disability Services Student Portal available at this link: sl.richmond.edu/be, and 2) Request a meeting with each professor to create an accommodation implementation plan. It is important to complete these steps as soon as possible because accommodations are never retroactive, and professors are permitted a reasonable amount of time for implementation. Disability Services is available to assist, as needed.

Weinstein Learning Center

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 Mancastropa (rmancast@richmond.edu) for coaching appointments in academic and life skills.**

English Language Learning assists multi-lingual and international students in honing their language, academic, and/or intercultural skills. Among other available services for students are one-on-one tutoring, group workshops, and semester-long classes on writing and U.S. culture. **Please contact Leslie Bohon Leslie.Bohon@Richmond.edu for more information and appointments.**

Quantitative Resource Center: (qrc.richmond.edu): Provides services related to quantitative and computational learning across curriculum through tutoring, consultation and training. **Email Erica Modeste erica.modeste@richmond.edu for more info.**

Speech Center: (speech.richmond.edu): Assists with preparation and practice in the pursuit of excellence in public expression. Recording, playback, coaching and critique sessions are offered by teams of trained student consultants. During scheduled [appointments](#), consultants assist in developing ideas, arranging key points for more effective organization, improving style and delivery, and handling multimedia aids for individual and group presentations.

Technology Learning Center: (tlc.richmond.edu): The TLC is a staffed public lab dedicated to supporting digital media projects. Services include camera checkout, video/audio recording assistance, virtual reality, poster printing, 3D printing and modeling. The TLC is located on the second floor of Boatwright Library.

Writing Center (writing.richmond.edu): Assists writers at all levels of experience, across all majors. Students can attend [walk-in hours](#) at Boatwright Library (room 171A) with trained writing consultants who offer friendly critiques of written work.

Other Campus Services

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. Update your profile in [Handshake](#) and 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, skills-building classes, therapy groups, crisis intervention, psychiatric consultation, and related services.