

LANDSCAPE ECOLOGY

GEOG/ENVR/BIOL 315

Course Description and Syllabus
(Fall 2014)



INSTRUCTOR:

Dr. Todd Lookingbill	311 Carole Weinstein International Center
University of Richmond	phone: (804) 289-8265
Department of Geography & Environment	e-mail: tlooking@richmond.edu
Office hours: Mon 2:00-3:00; Thur 10:30-11:30	

The web site for the class can be found on Blackboard

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

COURSE SCHEDULE: Class meets Tues/Thurs, 9:00-10:15 in 229 Carole Weinstein International Center. There also will be one field trip on Saturday, September 27 from 9:00 to 1:00.

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

Text Book: *Basic Landscape Ecology*, Robert N. Coulson and Maria D. Tchakerian. 2010. Knowledge Engineering Laboratory Partners, Inc (available at <http://www.kelabpartnersinc.com/>).

Homework Assignments: Adapted from the forthcoming second edition of *Learning Landscape Ecology: A Practical Guide to Concepts and Techniques*. S. E. Gergel and M. G. Turner, eds. Springer-Verlag.

Supplemental Readings: To gain some exposure to the primary literature of landscape ecologists, one to two journal articles will be read and discussed each week. These will be available on the class website.

COURSE DESCRIPTION: *Landscape ecology is the study of how the spatial patterning of the environment influences ecological processes and how ecological process, in turn, shape the patterns that we observe on the landscape.* It is an applied science that focuses on the development, consequences, and management of environmental patterns. These patterns include the spatial distributions of species and the environment resources upon which they depend. Although the focus is typically on relatively large landscape units, careful attention is paid to the importance 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 of 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, homework assignments, and special projects to study topics including: fragmentation and land-use change; characteristic spatial and temporal scales of ecological processes; methods for describing spatial variability in the physical and biological environment; the role of disturbance in shaping environmental patterns; and the application of landscape ecology to monitoring, conservation, and restoration (with special emphasis on urban environments).

COURSE OBJECTIVES: Upon completion of the course, students will:

- understand the evolution of landscape ecology as a field of study and practice;
- understand the scientific principles that govern the reciprocal relationship between spatial pattern and ecological processes;
- relate landscape ecology to grand challenges in ecology such as land use change and 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.

COURSE STRUCTURE: The course will meet Tuesdays and Thursdays from 9:00 to 10:15. Each week will cover a new topic. The first class of the week will be a more formal lecture. The second class will continue lecture followed by a 30-45 minute student-led discussion of assigned readings. The course will also involve a series of homework exercises. A portion of each week will be dedicated to discussing these homework exercises. The semester will conclude with a special project conducted in partnership with a management agency that ties together many of the themes studied in the course.

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 (textbook readings should be completed by the Tuesday class period and primary literature reading should be completed by the Thursday class period). Responsibility for leading discussion will be rotated sequentially among all students. 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 the end of the day on Tuesday of that week to help facilitate the discussions. I encourage all discussion leaders to meet with me during office hours prior to the discussion of their papers.

HOMEWORK ASSIGNMENTS: A series of three homework exercises require familiarity and access to a PC running Windows operating system. Written reports will be submitted for each of the exercises. Electronic copies must be submitted on Blackboard by the due date or one point will be subtracted per day late. No advanced computer skills are required, but the homeworks may be challenging for the technophobic. See me early on if you are having problems.

EXAMS: There will be two exams. The first will cover all content in the textbook and will focus on understanding the basic concepts of landscape ecology. This exam will be given in class and will be closed-book. The final exam will be take-home and open-book. It will be cumulative covering all material in the course and will focus on the practice of landscape ecology to address natural resource management challenges in the real world.

SPECIAL PROJECTS: We will incorporate concepts developed during the semester to conduct one of three projects: 1) an assessment of state of invasive species in the Commonwealth of Virginia for Virginia's Invasive Species Advisory Committee, 2) an assessment of GIS-based river corridor indicators for the Envision the James Wildlife Habitat and Landscape Conservation Working Group, or 3) a highly cross-disciplinary Cary Street Mural Project. All assessments will be conducted in small groups. They will require the direct application of concepts learned in class such as spatial variability of the physical environment; human-environment interactions; and species dispersal and spread modeling. Final write-ups will include significant graphical elements for distribution to a wide audience following principles of environmental reporting (<http://ian.umces.edu/ecocheck/report-cards/>). In addition to the written reports, short 15-minute group presentations will be in the style of a scientific conference.

CLASS ATTENDANCE AND PARTICIPATION: Class participation will be evaluated on your leading and actively participating in discussion of the readings and on active, engaged participation in the 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. Participation will be quantified using the following guidelines (adapted from JA Schatzel, Stonehill College):

<u>Points</u>	<u>Behavior</u>
9-10	Always well prepared for class; facilitates productive peer discussions; offers reasoned responses of high quality and asks thoughtful questions on an ongoing basis.
7-8	Contributes regularly; generally prepared; asks questions and provides occasional responses of moderate quality; handles direct questions satisfactorily.
5-6	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.

GRADING: Grades will be assigned based on the following formula:

<u>Point values</u>	
Written homeworks (3 total)	20
Exam 1	25
Final comprehensive exam	25
Special project	20
Class participation	10
100	

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

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 (<http://asc.richmond.edu> or 289-8626) helps students assess their academic strengths and weaknesses; hone their academic skills through teaching effective test preparation, critical reading and thinking, information processing, concentration, and related techniques; work on specific subject areas (e.g., calculus, chemistry, accounting, etc.); and encourage campus and community involvement.

Career Development Center (<http://cdc.richmond.edu/> or 289-8547) can assist you in exploring your interests and abilities, choosing a major, connecting with internships and learning experiences, investigating graduate and professional school options, and landing your first job. We encourage you to schedule an appointment with a career advisor during your first year.

Counseling and Psychological Services (<http://caps.richmond.edu> or 289-8119) assists students in meeting academic, personal, or emotional challenges. Services include assessment, short-term counseling and psychotherapy, crisis intervention and related services.

Speech Center (<http://speech.richmond.edu> or 289-6409): 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.

Writing Center 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: <http://writing.richmond.edu>

Boatwright Library Research Librarians assist students with identifying and locating the best resources for class assignments, research papers and other course projects. Librarians also assist students with questions about citing sources correctly. Students can schedule a personal research appointment, meet with librarians at the library's main service desk, email, text or IM. Link to <http://library.richmond.edu/help/ask.html> or call 289-8669.

Note: Students having special needs that require an accommodation or an academic adjustment, please arrange a meeting with me within the first two weeks of the semester.

Week	Topic	Readings
	Introduction and Foundations	
1 – Aug 26	<i>Landscape Ecology; What is it? A History, Some Definitions and a Prospectus</i>	Chapter 1 and 6
2 – Sept 2	<i>Hierarchical Levels of Organization: Populations, Communities, Ecosystems, Landscapes</i>	Chapter 2 and 4
3 – Sept 9	<i>Why is Scale Important? Cartographic vs. Ecological Scale; Grain and Extent; Scaling; Characteristic Spatial and Temporal Scales of Ecological Events</i>	Chapter 3
Fri, Sept 12	Homework 1 Due at 5:00 pm	
	Landscape Structure, Function and Change	
4 – Sept 16	<i>Introduction to the Agents of Pattern Formation: Landscape Structure, Function, and Change</i>	Chapter 5
5 – Sept 23	<i>Landscape Structure Landscape Geometry: Patches, Corridors, Matrix, Ecotones The Physical Setting: Gradient Analysis, Climate, Landforms, Soils</i>	Chapter 7
Set 27	Visit to Richmond National Battlefield Park 9:00 am – 1:00 pm	
6 – Sept 30 7 – Oct 7	<i>Landscape Function Biotic Processes: Percolation, Connectivity, Dispersal, and Species Invasions 10/2: <u>Kevin Heffernan</u>, Stewardship Biologist, Virginia DCR</i>	Chapter 8
Oct 9	Homework 2 Due at 5:00 pm	
8 – Oct 16 9 – Oct 21	<i>Landscape Change Disturbance Regimes: Patch Dynamics, What is 'Natural', Land-use Change and Other Human Disturbances 10/20: <u>Matt Coolidge</u>, Founder and Director, Center for Land Use Interpretation (<u>Ukrop's Auditorium, Robins School of Business, 6:00-7:00 pm</u>)</i>	Chapter 9
10 – Oct 30	Exam 1	

	Landscape Analysis and Synthesis	
11 – Nov 4	<i>Landscape Analysis and Quantification; Habitat Loss and Fragmentation; Quantifying Pattern and Change; Fragstats</i> 11/3 <u>Greg Garman</u> , Director, VCU Center for Environmental Studies, 400 Years of Chesapeake Bay Fish and Fisheries: A Study in Environmental Change (Gottwald Auditorium, 4:30-5:30 pm)	Chapter 10
12 – Nov 11	<i>Landscape Ecology for Resource Management; Conservation by Design; Guidos</i>	
Nov 13	Homework 3 Due at 5:00 pm	
13 – Nov 18	<i>Landscape Modeling: Simulating Spatial Movement on Heterogeneous Landscapes; Conefor</i> 11/17, <u>Baird Callicott</u> , Philosophy of Conservation, Thinking Like a Planet: The Land of Ethic and the Earth of Ethic (Brown Alley Room, Weinstein Hall 4:45-6:00 pm)	
14 – Nov 25	<i>Thanksgiving – Work on Special Projects</i>	
15 – Dec 2	<i>Special Project Presentations; Semester Review</i>	
Fri, Dec 5	Special Project Reports Due 5:00pm	
Mon, Dec 8	Take-home Final Exam Due 5:00pm	

TEXT: Robert N. Coulson and Maria D. Tchakerian. 2010. *Basic Landscape Ecology*.

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.

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, participating in class sessions, studying course related materials, and completing course assignments.

SUPPLEMENTAL READINGS FOR DISCUSSION:

Week 1 (The Theory and the Practice)

Liu, J. and W.W. Taylor. 2002. Coupling landscape ecology with natural resource management: Paradigm shifts and new approaches. Pages 3-19 in Integrating Landscape Ecology into Natural Resource Management.

Colwell, R. et al. 2012. Revisiting Leopold: Resource Stewardship in the National Parks

Week 2 (From Past to Present)

Wiens, J.A., M.R. Moss, M.G. Turner, and D.J. Mladanoff. 2007. The early antecedents of landscape ecology. Pages 5-10 in Foundation Papers in Landscape Ecology.

Turner, M.G. 2005. Landscape ecology: What is the state of the science? Annual Review of Ecology Evolution and Systematics 36:319-344.

US-IALE Newsletter 29(2): August 2014.

Week 3 (Scale)

Levin, S.A. 1992. The problem of pattern and scale in ecology. Ecology 73:1943-1967.

Week 4 (Urban Gradients and Planning)

Luck, M., and J. G. Wu. 2002. A gradient analysis of urban landscape pattern: a case study from the Phoenix metropolitan region, Arizona, USA. Landscape Ecology 17:327-339.

Richmond Riverfront Plan. 2012. City of Richmond.

Richmond Green Infrastructure Assessment. 2010. Produced by the Green Infrastructure Center and E² Inc. for the City of Richmond.

Week 5 (Fragmentation and the Value of Small Parcels)

Fahrig, L. 2003. Effects of habitat fragmentation on biodiversity. Annual Review of Ecology, Evolution, and Systematics 34:487-515.

Lovell, S. T. and D. M. Johnston. 2009. Designing landscapes for performance based on emerging principles in landscape ecology. Ecology and Society 14(1): 44

Week 6 (Biological Invasions)

With, K. A. 2002. The landscape ecology of invasive spread. Conservation Biology 16:1192-1203.

Virginia Invasive Species Advisory Committee. 2012. Virginia Invasive Species Management Plan.

Week 7 (Corridors and Connectivity)

Gilbert-Norton, L., R. Wilson, J.R. Stevens, and K.H. Beard. 2010. A meta-analytic review of corridor effectiveness. *Conservation Biology*. 24:660-668.

Alpanidou et al. 2014. Providing insights on habitat connectivity for male brown bears: A combination of habitat suitability and landscape graph-based models. *Ecological Modelling*. 268: 37-44.

Week 8 (Patterns of U.S. Landscape Change)

Drummond, M. A., and T. R. Loveland. 2010. Land-use pressure and a transition to forest-cover loss in the eastern United States. *BioScience* 60:286-298.

Week 9 (Landscape Management using Fire and other Disturbance)

Cissel, J. H., F. J. Swanson, and P. J. Weisburg. 1999. Landscape management using historical fire regimes: Blue River, Oregon. *Ecological Applications* 9:1217-1231.

Putz, F.E. 2003. Are rednecks the unsung heroes of ecosystem management? *Wild Earth* 10-14.

Week 10

Exam

Week 11

Tanentzap A. J., B. W. Kielstra, M. T. Arts, N. D. Yan, and J. M. Gunn. 2014. Forests fuel fish growth in freshwater deltas, *Nature Communications*, 5

Week 12 (Conservation)

Cabeza, M., A. Arponen, L. Jaattela, H. Kujala, A. van Teeffelen, and I Hanski. 2010. Conservation planning with insects at three different spatial scales. *Ecography* 33:54-63.

Mackey et al. 2008. Applying landscape-ecological principles to regional conservation: The WildCountry Project in Australia. Pages 192-212 in *Key Topics in Landscape Ecology*. Cambridge University Press.

Week 13 (Landscape Models)

Lookingbill, T., R.H. Gardner, L.A. Wainger, C.L. Tague, and M. Suarez-Rubio. 2013. *Landscape Modeling, Reference Modules in Earth Systems and Environmental Sciences*, Elsevier.

van Manen, F. T., J. A. Young, C. A. Thatcher, W. B. Cass, and C. Ulrey. 2005. Habitat models to assist plant protection efforts in Shenandoah National Park, Virginia, USA. *Natural Areas Journal* 25:339-350

Week 15 (Review and Prospectus)

Kent, M. 2009. Biogeography and landscape ecology: the way forward - gradients and graph theory. *Progress in Physical Geography* 33:424-436.

Kupfer, J. A. 2012. Landscape ecology and biogeography: Rethinking landscape metrics in a post-FRAGSTATS landscape. *Progress in Physical Geography* 36:400-420.