FORS 595

Introduction to Landscape Ecology (3 credits)
Monday, Wednesday 9:30-11:00; Stone Hall 107
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Course Description:

"Landscape ecology is not a distinct discipline or simply a branch of ecology, but rather is the synthetic intersection of many related disciplines that focus on the spatial-temporal patterns of the landscape" Risser et al. (1984)

Landscape ecology focuses on the causes and consequences of spatial patterning across a range of scales, and originated from the recognition by ecologists that spatio-temporal heterogeneity in landscapes has strong influences on ecological and ecosystem processes. Landscape ecology examines concepts, theory, and methods for characterizing spatial heterogeneity, its effects on the dynamics of ecological systems, and how these may vary through time. The fundamental concepts of landscape ecology are the basis for decision-making in many contemporary problems in conservation science and resource management.

Objectives:

The purpose of this course is to provide students with an introduction to the discipline of landscape ecology with a focus on applications within ecology and natural resource management. In addition to studying the fundamentals of landscape ecology through reading primary literature, students will gain exposure to a range of applied tools including raster analysis, environmental remote sensing, state transition models (Markov models), FRAGSTATS, and species distribution models. Another stated objective is to engage students in student-directed learning within an inter-disciplinary environment to improve and refine student's oral and written communication skills.

Course Format:

This course will be principally focused on student directed learning in various formats. The course will entail generally short lectures by me, student led presentations, student directed discussions on assigned reading, and computer based labs. Students will be assessed on three criteria: 1. A term project and oral presentation on a focal topic (see description below). 2) A student led discussion of primary literature, and 3) Participation in labs.

Lecture schedule:

The following lecture schedule is subject to change and modification as the course progresses.

Week	Topic	Readings
	Part 1. Introduction to landscape ecology	
1. 1/25	Landscapes defined	Pickett & Cadenasso 1995; Turner (2005)
2. 2/1	Concepts of scale Hierarchical Scaling	Wiens (1989), Levin (1992), Urban (1987)
	Part 2. Agents of pattern formation	
3. 2/8	**The physical template:** Climate; terrain; hydrology; water balance	Swanson et al. (1988); Dobrowski (2011), Stephenson (1990), Bunn et al. (2005)
4. 2/15	**Biotic Processes:** Niche concept and species distributions	Elith and Leathwick (2009), Araujo and Guisan (2006)
5. 2/22	Succession, and time **Disturbance** People = Land use change	Watt (1947), Jackson (2006), Sandel and Svenning (2013, Sanderson et al. (2002)
6. 2/29	Disturbance regimes, scale, interactions, non-linearity	Turner et al. (1993), Peters et al. (2007),
	Part 3. Implications of Landscape Structure	
7. 3/7	Fragmentation/ dispersal/connectivity Landscape Genetics	Fahrig (2003), Damschen et al. (2008), Gilbert-Norton et al. (2010) Manel et al. (2003)
8. 3/14	**Population dynamics:** Island biogeography, metapopulations Invasive organisms	McArthur and Wilson (1963), Hanski (1994, 1998) With (2002), Melbourne et al. (2007)
	Part 4. Characterizing Landscapes	
9. 3/21	Neutral Models, models of landscape structure	Gardner 1987, Gardner and Urban 2007, With and King (1997)
10. 3/28	Landscape Metrics Graph models and network theory	Gustafson (1998), Li and Wu (2004) Grant et al. (2007), Urban et al. (2009)
11. 4/4	**Spring Break**	
12. 4/11	Landscape dynamics; equilibrium and non equilibrium concepts	Perry (2002), Delcourt and Delcourt (1988), Svenning and Sandel (2013)
	Part 5. Conserving and Managing Landscapes	
13. 4/18	Historical range of variability	Keane et al. (2009), Landres et al. (1999)

Week	Topic	Readings
	Landscape management	Wiens (2009), Lindenmayer et al. (2008)
14. 4/25	Conservation Biogeography	Lawler et al. (2015) Ackerly et al. (2010)
15. 5/2	Final Presentations	

Labs:

The following set of lab topics is subject to change and modification and is not listed in order per se.

Number	Topic	Readings
1	Defining the landscape – gradient analysis	Lookingbill and Urban (2005)
2	Species distribution modeling	Guisan et al. (2002)
3	Vegetation – environmental remote sensing	TBD
4	Patch characteristics – Patch Metrics	TBD
5	Spatial data, point pattern analysis, spatial auto-correlation, semivariance	Legendre and Fortin (1989)
6	Change detection- transition probability matrices, 1st order Markov models	Baker (1989)
7	Connectivity Modeling	TBD

Texts and readings:

This course will emphasize readings from the primary literature. I will typically assign 3-4 papers to read each week. **Student are expected to have read the assignments before class and be prepared to discuss the papers.** Each week, a student will be assigned to lead discussion on a paper or set of papers. Discussion leaders should be prepared to summarize the significant contributions of the paper; posit relevant questions to facilitate discussion, and direct the discussion among the group (see notes below).

I don't require a textbook but Turner's is a good general resource:

Turner, M. G., R. H. Gardner, and R. V. O'Neill. 2001. Landscape ecology in theory and practice. Springer-Verlag, New York.

As for the primary literature, I will post pdfs of the articles on Moodle.

Term project:

Students are required to write a relatively short (<12 page) term paper on a landscape ecology related topic of interest to them. Students will also gain experience with the primary phases of conducting a research project including preparation of a proposal, conducting the study; writing a manuscript; and presenting the results in an oral format. Ideally, this project will provide an opportunity for students to augment their current research. It also can be a general review of a topic taken from the list in the lecture schedule or similarly focus on management applications of the theories and concepts presented in the course. If neither of these are attractive to students, I can provide spatial datasets and ideas for novel analysis (keeping in mind that the risks and rewards here are greater). As there are lots of interests represented in this class, my intention is to

not restrict the scope of topics that could be covered. That said, it is critical for students to begin thinking about this early in the course and to discuss ideas with me. I want to informally sign off on projects prior to the proposal being due.

Format for proposals: Proposals should include an introduction/background/justification; a clear and concise statement of objectives/questions/hypothesis, methods, and expected results. The proposal has a 3-page maximum length excluding references (less length is *encouraged* if well presented). Proposals are due the 5th week of class (tentative).

Format for Project Reports: First drafts of manuscripts must be typed, double spaced with one-inch margins, and will be due the 12th week of class (tentative). Manuscripts should not exceed 12 pages of text excluding references, figures, and tables. The format should follow that used for the journal ECOLOGY.

In addition to writing your own paper, students will be required to read and write constructive peer reviews of first complete drafts of 2 other student's manuscripts. These reviews will be graded by the instructor based on specific criteria, namely their thoroughness, attention to detail, and utility to the writer. The final draft of the manuscript will be graded both on its merit and based on the improvement made from the 1st draft given peer review comments.

Guidelines for Oral Presentations: Presentations should be 10-15 minutes in length, followed by a 5-minute question period. Powerpoint is recommended (but not abused). The intent here is to provide students with practice giving talks at scientific meetings. Your presentation should provide general context, it should clearly state the question or objective of your study, briefly describe your methods, clearly present results, and formulate take home messages. Presentations will be done in the lab sections during the final two weeks of the semester.

Grading:

Written Report– 40%
Peer reviews – 10%
Oral Presentation – 20%
Student led discussion – 20%
Participation in labs – 10%

Leading discussion

Each student will be required to lead the class discussion of assigned weekly readings. All students will have read the papers prior to class, so the discussion leader should **not** provide a detailed review of the paper. The discussion leader should provide a brief summary of the main points of a given paper, and how multiple papers are related to the larger topic of interest. **The discussions are intended to provide students an opportunity to think critically about important papers, develop questions related to this work, and provide a forum to explore answers/explanations of these questions and communicate these clearly with others in the class.**

Here is what is expected from the discussion moderator:

i. Take 10 minutes and provide a brief synopsis of the paper(s) and the topic addressed by the papers. I often provide multiple readings so it will be up to the moderator to decide

which of the multiple papers to focus on or spend energy summarizing. Additionally, it may be helpful for the moderator to explore other related literature in order to place the assigned reading and the discussion in a larger context. The moderator may also want to summarize important research methods related to the readings if they anticipate a lack of clarity for these among the group. Moderators can use powerpoint (a few slides) or handouts if needed for visual aids.

ii. Summarize for yourself some of the important points about the paper. It's useful to have a set of questions that you develop while planning discussion. For example, what is the main conceptual contribution of the paper? Why is it important or influential? Does it propose a new direction or idea? How does this paper relate to other research/concepts with which you are familiar? Are there any new methodologies presented? Are there any problems with the study? How does this reflect the current state of the science?

iii. Prepare in advance open-ended questions that you can pose to the group to get the ball rolling. "Yes" or "no" questions or answers do not facilitate a discussion. Feel free to call on people if there is silence. Silence is OK but it is the moderators job to keep the discussion moving by including all members of the group (including those that hide in the corners) and by redirecting discussion that goes off into non-productive tangents.

iv. Try to summarize and synthesize as you go. It's often helpful to synthesize the discussion: "So far, we've summarized the following main contributions of this paper: …. "