

Instructors

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General information

Credit hours: 3
Delivery format: In-person lecture and computer lab*
Hardin Hall 142
Tuesdays & Thursdays 9:30–10:45am
*To accommodate remote students and those unable to attend for various reasons, all lecture and lab sessions will be available via Zoom and recorded.
Zoom meeting ID: <https://unl.zoom.us/j/96474379082>

Course prerequisites

None.

Course description and goals

This course is about recognizing and understanding causes and effects of landscape heterogeneity, quantifying landscape pattern, relating landscape patterns to ecological processes, and ultimately, addressing grand challenges in landscape systems through contributions to the science of landscape ecology.

During this course, we will focus on investigation of heterogeneity and pattern–process relationships in landscapes, including how to identify, characterize, and track spatial patterns and relate them to populations, communities, and ecosystem processes at multiple scales. Both theoretical and applied aspects of landscape ecology are explored through lectures, computer labs, and a final group project (preparation and submission of a peer-reviewed manuscript). Students will leave this course with an applicable knowledge of prominent aspects of landscape ecology. This course may be most valuable to graduate students in agriculture, natural resource science, remote sensing, spatial science, and related fields.

Course objectives

- Identify sources of landscape heterogeneity.
- Recognize the centrality of scale in landscape ecology.
- Quantify landscape pattern with landscape metrics and spatial statistics.
- Relate landscape patterns and ecological processes.

Required texts

Gergel, S.E. and M.G. Turner, eds. 2017. *Learning landscape ecology: A practical guide to concepts and techniques. Second edition.* Springer-Verlag, New York, NY, U.S.A. 347 pp. Available for free download from SpringerLink through UNL libraries: libraries.unl.edu

Turner, M.G. and R.H. Gardner. 2015. *Landscape ecology in theory and practice: Pattern and process. Second edition.* Springer-Verlag, New York, NY, U.S.A. 482 pp. Available for download from SpringerLink through UNL libraries: libraries.unl.edu

Fletcher, R., and M.-J, Fortin. 2018. *Spatial Ecology and Conservation Modeling: Applications with R.* Springer International Publishing, Cham. 523 pp. Available for download from SpringerLink through UNL libraries: libraries.unl.edu

Additional readings from the primary literature may be assigned periodically.

Suggested (optional) text

Liu, J. 2002. *Integrating Landscape Ecology into Natural Resource Management.* Cambridge University Press, Cambridge, U.K. 518 pp.

Grading policy

Assessment type and count	Total points	(% final grade)*
Labs (9)	225	50
Exams (2)	200	30
Group Publication Progress Reports (3)	150	20
Self-assessments (3)	6 (bonus)**	
Total	575	100

*Assessment groups weighted independently of points (final percentages may not equal proportion of total points).

**Bonus points for completion of self-assessments added to lowest exam score.

Grading scale

Grade	Weighted % of available points
A+	97.0 – 100
A	90.0 – 96.9
B+	87.0 – 89.9
B	80.0 – 86.9
C+	77.0 – 79.9
C	70.0 – 76.9
D+	67.0 – 69.9
D	60.0 – 66.9
F	< 59.9

Lab exercises

This course contains 9 lab exercises meant to equip students to put knowledge of critical landscape ecology into practice. Ideally, the knowledge and skills acquired through completion

of lab exercises will be applicable to the group publication project (details below), and more importantly, your own research. Collectively, labs will account for 50% of your final grade.

Most labs will be conducted in a geographic information system (GIS). There are a number of different GIS software products and platforms available (ArcPro, ArcMap, R, Google Earth Engine, etc.). While we support students in becoming more proficient in the software they use in their own research, the majority of GIS labs in this course will be geared toward completion in ArcGIS Pro (<https://www.esri.com/en-us/arcgis/products/arcgis-pro/overview>). It may be possible to successfully complete lab exercises in different programs, or to complete different portions of labs in different programs. For that reason, students are free to complete labs in whichever software they prefer, and in doing so, to maximize the applicability of labs in their own research. However, we cannot simultaneously provide technical support and advice on all things GIS, although we will do our best to help. The bottom line is that although you have freedom to choose the software/platform, it is ultimately your responsibility to ensure your submission satisfies the requirements outlined in the lab instructions.

Because there are not GIS prerequisites for this course, we will spend the first several weeks getting acquainted with GIS and spatial analysis. If you already have experience in GIS, you may find these exercises elementary. If you prefer, you may use this as an opportunity to challenge yourself and add to your skillset, you may consider completing these labs in a different program. For example, if you are already familiar with ArcPro, you may wish to try out R.

Lab exercise instructions and data will be posted on Canvas. For full credit, upload your completed lab exercise to Canvas by the assigned due date.

Exams

This course contains two exams: a one midterm exam and one cumulative final exam. Exams may cover topics from all course materials (readings, lectures, labs, projects). Together, these exams will account for 30% of your final grade.

Exams will be administered through Canvas and will be taken during the assigned class session (see detailed course schedule). Make-up exams are not allowed unless exceptional circumstances occur. You must make arrangements for a make-up exam prior to the scheduled exam. Any exceptions to the policy in this class must be formally appealed in writing based on the guidelines set forth by the university (<https://registrar.unl.edu/academic-standards/policies/class-attendance/>). Otherwise, a make-up exam will not be granted. It is unfair to the rest of the class.

Group publication project

A substantial portion of this course will be devoted to the preparation and submission of a manuscript for publication in a peer-reviewed journal. What better way to demonstrate your mastery of course material than to directly contribute to the science of landscape ecology?! This also provides each of us with an opportunity to build our CVs. Whether it is applying for a PhD assistantship, a postdoc, a faculty position, tenure, etc., publishing a paper stands to benefit us all. At the same time, it will require hard work and persistence to see it through to completion over the 16-week semester. To document your individual contributions to the publication project and the group's achievement of milestones in the publication process over the semester, you will complete a series of progress reports documenting your contributions to reaching group milestones, which will collectively account for 20% of your final grade.

Both group-level progress in reaching milestones (10% final grade) and individual-level contributions to group efforts (10% final grade) will be assessed. To receive full credit at the group level, the group must reach each of a set of pre-determined milestones in the publication process (e.g., listing a set of candidate topics, selecting a final topic, outlining the manuscript, conducting a literature review, gathering data, planning analyses, reporting methods and results, developing a discussion/conclusion section, assembling tables/figures, compiling a references section). Staying on track with group-level milestones should put us in a good position to submit the paper by the end of the semester. To receive full credit at the individual level, you must demonstrate meaningful contributions to at least one major group milestone. To be successful, you will need to balance individual-level and group-level priorities. Ensuring the success of the group may mean you need to go above and beyond the minimum individual-level requirements (e.g., contribute to achievement of multiple milestones). For details, please see the publication project report grading rubric below. Report-specific instructions (e.g., milestone descriptions) will also be provided on Canvas.

Rubric: Publication project reports					
Criteria	Ratings				Points
Group milestones	25 points (Exceeds expectations) All assigned milestones reached; minor revisions necessary for inclusion in/contribute to peer-reviewed journal submission.	20 points (Meets expectations) Most assigned milestones reached; moderate revisions necessary for inclusion in/contribution to peer-reviewed journal submission.	15 points (Below expectations) Some assigned milestones reached; major revisions necessary for inclusion in/contribution to peer-reviewed journal submission.	0 (Element absent) No milestones reached; unsuitable for inclusion in/contribution to peer-reviewed journal submission.	
Individual contributions	25 points (Exceeds expectations) Active participation and leadership in one or more group milestones; individual instrumental in group progress.	20 points (Meets expectations) Moderate participation in one group milestone; sufficient contribution to group progress.	15 points (Below expectations) Limited participation in reaching group milestones; contributions to group progress minimal	0 (Element absent) Little-to-no participation in reaching group milestones	
Total points =					

To encourage progress on the publication project, the first 15 minutes of each class session (excluding the 8/24 session) will be devoted to discussion/planning of the publication project. This is a time for brainstorming about topics and analyses, volunteering for tasks, providing

updates, outlining sections of the paper, etc. Please come to class ready to discuss and share your ideas, feedback, etc.

There is no pre-determined topic for the paper; therefore, one of our first objectives as a group will be to develop a set of candidate topics that we might address through the lens of landscape ecology. A good place to start thinking broadly is UNL's Grand Challenges Framework (<https://research.unl.edu/grandchallenges/>). It may also be helpful to develop a list of the most important landscape challenges in Nebraska and beyond. For example, what are the greatest challenges for Nebraska landscape dominated by cropland, grassland, wetlands, forests, etc.? The Nebraska Natural Legacy Plan may also be a good place to start in thinking about this, as it provides an overview of conservation challenges and opportunities across 39 Nebraska landscapes: <https://outdoornebraska.gov/wp-content/uploads/2015/09/NebraskaNaturalLegacyProject2ndEdition.pdf> Assembling a list of landscape challenges early on in the course will provide opportunities to address them with tools and skills we acquire along the way.

The peer-review publication process can be lengthy, with many papers taking months or years to move through the publication process. Although we do not expect to have our paper published by the end of the semester, our aim is to have the paper submitted to a journal for consideration (or be close to that point). After the semester concludes, it will be difficult to maintain momentum; therefore, we should accomplish as much as possible before semester's end. To allow multiple individuals to contribute to the publication simultaneously, all publication materials (data, scripts, text, literature, etc.) will be maintained in a group OneDrive folder. For most or all of the semester, manuscript edits will be conducted in Microsoft 365.

Self-assessments

This course contains three self-assessments (pre-course, mid-term, and post-course), the purpose of which is gathering student feedback on their familiarity with course material, GIS software, spatial analysis techniques, etc. Self-assessments provide instructors with critical feedback for tailoring lectures and labs to the level of student knowledge and experience.

For completion of each self-assessment, students will receive two bonus points to add to their lowest exam score. Self-assessments will be completed on Canvas.

General Course Outline

Module 1: Foundations

Module 2: Landscape metrics

Module 3: Spatial statistics

Module 4: Landscape dynamics

Module 5: Project

Detailed course outline:

Date	Module	Lecture	Reading(s)	Lab	Assignment due*
24 Aug	1	Orientation; Intro to landscape ecology	Turner & Gardner (2015), pp. 1-15		
26 Aug	1			Intro to GIS and spatial data	Pre-course self-assess
31 Aug	1	Heterogeneity and scale; The scale of your research	Turner & Gardner (2015), pp. 15-32 Wiens (1989)		
2 Sep	1			Quantifying landscape heterogeneity	Aug 26 lab
7 Sep	1	Disturbance and succession	Turner & Gardner (2015), pp. 175-228		
9 Sep	1			Markov Models (Gergel & Turner, pp. 129-142)	Sep 2 lab
14 Sep	1	(More) sources of heterogeneity	Turner & Gardner (2015), pp. 33-62		
16 Sep	1			Landscape composition and configuration	Sep 9 lab
21 Sep	1	Spatial models	Turner & Gardner (2015), pp. 63-95		
23 Sep	1			Neutral landscape models	Sep 16 lab; Project report 1
28 Sep	2	Quantifying landscape pattern	Turner & Gardner (2015), pp. 97-116		
30 Sep	2		McConnel et al. (2019) Yeiser et al. (2021)	Marginal ag lands discussion	Sep 23 lab
5 Oct	2	Landscape metrics			
7 Oct	2		Turner & Gardner (2015), pp. 115-142	Functional connectivity (Circuitscape)	
12 Oct	3	Midterm exam review			
14 Oct	3			Midterm exam	
19 Oct	3	No class (Fall break)			
21 Oct	3			Project work day	Oct 5 lab
26 Oct	3	Introduction to spatial statistics	Turner & Gardner (2015) pp. 143-174		
28 Oct	3			Spatial dependence	Project report 2
2 Nov	4	Spatial statistical techniques			Mid-course self assess
4 Nov	4			Interpolation	Oct 28 lab
9 Nov	4	Animal movements and nutrient flows	Subsets of Turner & Gardner (2015), pp. 229-332; Fletcher & Fortin (2018), pp 271-312		
11 Nov	4			Animal movements—Space Use and Resource Selection	Nov 4 lab
16 Nov	5	Project work			
18 Nov	5			Project work	Nov 11 lab
23 Nov	5	Project work			
25 Nov	5			No class (Thanksgiving vacation)	
30 Nov	5	Project work			Project report 3

2 Dec	5			Final exam review	
7 Dec		Final exam review			
9 Dec				Final exam review	Post-course self assess
15 Dec		Final Exam			

* Upload all assignments to Canvas by 9:00am CST on the due date, unless otherwise specified in Canvas instructions.

Assignments

No class

Academic flexibility for COVID-19

Students who have medical documentation of a health risk that cannot be mitigated through vaccination should submit a COVID-19 Academic Flexibility Request. Those with a disability and/or chronic health condition that makes them high risk for the virus should seek support via Services for Students with Disabilities. International students should contact the International Student and Scholar Office to discuss their options.

Academic integrity

Academic integrity is defined in the Student Conduct and Community Standards (<https://studentconduct.unl.edu/student-code-conduct#sectionii>). Plagiarism and all other forms of cheating—as defined in Section II of the student code of conduct—are prohibited. Violations to this policy will be reported. A first offense will result in a warning and failure of the assignment. Additional violations may result in failure of the course. Information on policy and decision appeal processes can be found here:

<http://snr.unl.edu/undergrad/undergraduatehandbook.aspx>

Attendance policy

Attendance of lecture and lab sessions is strongly encouraged, but not mandatory. With that being said, it may be difficult to meet class requirements with sporadic or infrequent attendance. You can find the UNL Faculty Senate’s current Class Attendance Policy here:

<https://www.unl.edu/facultysenate/policies/Class-Attendance-Policy-081121.pdf>

Make-up exams are not allowed unless exceptional circumstances occur. You must make arrangements for a make-up exam prior to the scheduled exam. Any exceptions to the policy in this class must be formally appealed in writing based on the guidelines set forth by the university (<https://registrar.unl.edu/academic-standards/policies/class-attendance/>). Otherwise, a make-up exam will not be granted. It is unfair to the rest of the class.

Remote students, as well as those unable to attend in-person sessions for various reasons, may join live via Zoom at: <https://unl.zoom.us/j/96474379082>

Diversity and inclusion

This class is intended to be an inclusive and welcoming environment where all have the opportunity to learn and succeed. This means that in any form of class interaction (Canvas, in-class discussions, etc.), student should be respectful of one another, regardless of the circumstances, subject matter, or differences encountered.

Emergency resources

Consult UNL emergency planning site for current emergency procedures: <https://emergency.unl.edu/>

Instructor correspondence

We are committed to providing prompt feedback on all course assignments and responding to student emails in a timely manner. However, we will not be responsive to emails 24 hours a day, so please be flexible and patient in waiting for our responses. If you do not receive an initial response within 24 hours, please send a follow-up email.

Mental health and wellbeing resources

UNL offers a variety of options to students to aid them in dealing with stress and adversity. Counseling and Psychological & Services (CAPS) is a multidisciplinary team of psychologists and counselors that works collaboratively with Nebraska students to help them explore their feelings and thoughts and learn helpful ways to improve their mental, psychological and emotional well-being when issues arise. CAPS can be reached by calling [402-472-7450](tel:402-472-7450). Big Red Resilience & Well-Being (BRRWB) provides one-on-one well-being coaching to any student who wants to enhance their well-being. Trained well-being coaches help students create and be grateful for positive experiences, practice resilience and self-compassion, and find support as they need it. BRRWB can be reached by calling [402-472-8770](tel:402-472-8770).

Recording of class-related activity

I invite all of you to join me in actively creating and contributing to a positive, productive, and respectful classroom culture. Each student contributes to an environment that shapes the learning process. Any work and/or communication that you are privy to as a member of this course should be treated as the intellectual property of the speaker(s)/creator(s), and is not to be shared outside the context of this course.

Students may not make or distribute screen captures, audio/video recordings of, or livestream, any class-related activity, including lectures and presentations, without express prior written consent from me or an approved accommodation from Services for Students with Disabilities. If you have (or think you may have) a disability such that you need to record or tape class-related activities, you should contact Services for Students with Disabilities. If you have an accommodation to record class-related activities, those recordings may not be shared with any other student, whether in this course or not, or with any other person or on any other platform. Failure to follow this policy on recording or distributing class-related activities may subject you to discipline under the Student Code of Conduct.

Software requirements

Current versions of ArcGIS and R are available on Hardin Hall 142 computers. It is also fine to use versions of ArcGIS, R, and other programs/platforms to complete lab exercises and publication project analyses. To complete lab exercises with ArcPro, you will need an ArcGIS Online account. Please complete the pre-course self-assessment to let us know if you already have an ArcGIS Online account or provide us with needed information for getting your account set up through official university channels.

Student accommodation resources (ADA statement)

The University strives to make all learning experiences as accessible as possible. If you anticipate or experience barriers based on your disability (including mental health, chronic or

temporary medical conditions), please let us know immediately so that we can discuss options privately. To establish reasonable accommodations, we may request that you register with Services for Students with Disabilities (SSD). If you are eligible for services and register with their office, make arrangements with us as soon as possible to discuss your accommodations so they can be implemented in a timely manner.

SSD contact information: 117 Louise Pound Hall Bldg.; [402-472-3787](tel:402-472-3787)

Student concerns and feedback

Your experiences in this course are important to us. If you have questions, concerns, or positive feedback, please contact us via Canvas or email: duden2@unl.edu, alittle6@unl.edu. If neither of us is able to respond, or you feel we've not adequately addressed your concerns, you can contact Dr. Larkin Powell (email: lpowell3@unl.edu).

Technology and support

NU Information Technology Services (ITS) is available to help you create a functional and efficient work environment in your remote location. NU ITS has published a page, [Remote Work FAQ](#), with information on computer equipment, VPN networking, phones and voicemail, digital tools, and IT support.