ESSM 660-700

LANDSCAPE ANALYSIS AND MODELING

– Spatial Methods, Software and Ecological Applications

3 Credit Hours

Spring 2019

Instructor:

X. Ben Wu, Department of Ecosystem Science and Management

Office: 320 WFES; Phone: 979-845-7334; E-mail: xbw@tamu.edu

Office hours: Tue and Thur 2:30-3:30 pm, or by appointment

Teaching Assistant:

Zheng (Jenny) Li, Department of Ecosystem Science and Management

Office: 333 WFES; E-mail: bnulizheng1991@tamu.edu

Office hours: Tue 1:30-2:30 pm, Wed 4:00-5:00 pm, or by appointment

Learning Goals and Outcomes:

The goal of this course is to help students enhance their spatial perspectives and abilities to define and solve spatial problems in relevant disciplines. Through this course, students will be able to:

- explain the concepts and methods of the spatial analyses studied;

- perform spatial analyses using associated software;

- formulate problem statements for applied spatial issues and select appropriate quantitative methods and software to solve problems; and

- develop an exercise for one of the methods studied using R, with directions and a video tutorial.

Prerequisites:

Course work in ecology/landscape ecology, introductory statistics, and introductory GIS (ArcGIS); or approval of instructor.

eCampus:

An eCampus (http://eCampus.tamu.edu/) course is available that includes syllabus, lectures, readings, assignments, quizzes, discussion forum, grades, and project reports and presentations.

Class meetings:

Thursdays 7:00-8:00 pm, online

We'll use *Blackboard Collaborate Ultra* (links in eCampus under "Information & materials" tab) for class meetings and the office hours/appointments.

Course description:

Introduction to concepts and quantitative methods of spatial analysis and their applications, with an emphasis on ecological studies.

Concepts and Methodology

Readings and lectures on quantification of spatial pattern and spatial statistics (landscape metrics, quadrat variance methods, spatial autocorrelation, Mantel tests, geostatistics, and point pattern analysis, etc.), supported by asynchronized online discussions, synchronized online class meetings, and office hours.

Online quizzes

Open-book timed quizzes in eCampus over lecture and reading materials. Up to 5 attempts are allowed for each quiz, with some alternative questions. The highest of the scores will be recorded.

Paper Discussions

Discussions of articles focused on applications of the methods studied. Each student will make a posting following the prompts, *at least 24 hours before the deadline*, and then respond to at least 2 postings of other students.

Assignments

Hands-on exercises on spatial analysis using Excel, ArcGIS, specialty software, and R. Students will be assigned to review the submissions and provide summary feedback for each exercise during class meeting.

Assignments for peer evaluation, synthesis, and reflection.

Group Project

Each group will develop an exercise for one of the methods studied using R, with directions and a video tutorial.

1. Project summary (1-2 pages, due February 6)

   The project summary should include (1) the spatial analysis method and potential R scripts(s) and (2) a brief description of the case(s) to be used and associated data.

2. Exercise package (directions, video tutorial, and data set) (due April 17)

3. Oral presentations of exercise package and Q&A on April 18

4. Peer review of the exercise package developed by another group (due April 24)

5. Revised exercise package and response to review comments (due May 1)

Reference materials:

Readings are available in eCampus.

Grading (A: 90-100%, B: 80-89%, C: 70-79%, D: 60-69%, F: <60%):

- Quizzes over lecture and reading materials, 15%.
- Assignments, 15%.
- Paper discussions, 10% (participation and quality of contributions).

- Peer evaluation, 10% (performance as group member, quality of peer review).

- Project, 50% (exercise package - 40%, response to review comments-5%, oral presentation-5%).

Notes:

- Each student please schedule an individual meeting (15'-20') with me via Google Hangouts at the beginning of the semester, during office hours or other times by appointment. I would like to get to know you a little and discuss the possibilities for the project.

- Unless specified otherwise, assignments and assessments are due Wednesday nights (midnight plus a 5-hour grace period). The due dates will be specified in individual assessments/assignments. The eCampus calendar will show Thursday (5:00 AM) as the due date, but it's really Wednesday night.

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call 979-845-1637. For additional information visit http://disability.tamu.edu/.

"An Aggie does not lie, cheat or steal, or tolerate those who do." (www.tamu.edu/aggiehonor)

TENTATIVE SCHEDULE

Week of	Topic (lecture)	Reference Materials	Quiz due	Assignment due	Paper discussion
Jan 14	Organizational meeting (Jan 18)				
Jan 21	Landscape Ecology	McGarigal 2015 (Background section)		Post a summary of a landscape ecological paper	
Jan 28	Patch-based metrics	McGarigal 2015 (Fragstats Metrics: area and edge, shape, core area, and contrast); Wu *et al.* 2000	Q-Landscape metrics	E-Metrics; respond to 3 summaries posted by others	Wu 2013
Feb 4	Diversity and Contagion	McGarigal 2013 (Fragstats Metrics: aggregation and diversity); Li & Reynalds 1993	Q-Contagion	E-Contagion	Perotto-Baldivieso *et al.* 2011
Feb 11	Lacunarity analysis	Plotnick *et al.* 1993; Wu *et al.* 2000	Q-Lacunarity	E-Lacunarity	Roces-Diaz *et al* 2014
Feb 18	Autocorrelation, Mantel tests	Fortin & Gurevitch 1993; Wu & Mitsch 1998; Middleton & Wu 2008; Crabot et al. 2019	Q-Autocor, Mantel tests	E-Mantel tests-PASSAGE	Parks *et al.* 2015
Feb 25	Point pattern analysis	Haase *et al.* 1996; Feagin & Wu 2007; Velázquez *et al* 2016	Q-Point pattern	E-Point pattern	Rossi *et al* 2009
Mar 4	EDA & variography	Rossi *et al.* 1992; Isaaks & Srivastava 1989 (Chpt 2, 3, 4, 7)	Q-EDA & variography	E-Fragstats	McGarigal *et al.* 2009
Mar 11	**Spring Break (no class)**				
Mar 18	Kriging	Isaaks & Srivastava 1989 (Chpt 11, 12, 13, 15)	Q-Estimation	E-Geostatistical Analyst	Bai *et al.* 2009
Mar 25	Quadrat variance methods	Dale 2000 (Chpt 3)	Q-Quadrat variance	E-Quadrat variance-PASSAGE	Liu *et al.* 2010
Apr 1	Work on projects; each group meets with instructor (on Apr 2, 4 or by appointment); Synthesis assignment (due on April 3).				
Apr 8	Work on projects; discussion of student syntheses on Apr 11				
Apr 15	Work on projects (exercise package due Apr 17); oral presentations of group projects on Apr 18				
Apr 22	Conduct peer reviews of exercise packages (due Apr 24); course review and feedback on Apr 25				
Apr 29	Complete revised exercise package, responses to review comments, and peer performance evaluations (due May 1)				