# ESSM 660-600

# LANDSCAPE ANALYSIS AND MODELING

## – Spatial Methods and Ecological Inquiry

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 frame and answer spatial questions 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 relevant software;
- formulate research hypotheses for spatial issues in related fields, select appropriate quantitative methods to test the hypotheses, and interpret the findings; and
- develop a research report in the form of a journal manuscript, conduct peer reviews of manuscripts, and revise the manuscript based on review feedback and write response to reviewer comments.

**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.

We'll use *Blackboard Collaborate Ultra* (links in eCampus under "Information & materials" tab) if you need to meet with us online during office hours or appointments.

**Class meeting:**

Thursdays 3:50-5:00 pm, in 348 WFES.

**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 discussions in class meeting 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 of students will conduct a research project and develop a manuscript in the style for a relevant journal, participate in a simulated journal peer review process, and revise the manuscript based on the reviews and develop response to reviewer comments.

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

   The project summary should include the objectives of the study, the research questions/hypotheses, description of data, proposed methods of spatial analyses, and expected outcome. The proposed research project should be in a student's own area of research and has sufficient spatial data ready for analysis.
2. Manuscript and submittal letter (due April 17)
3. Oral presentations of group projects on April 18
4. Peer review of the manuscripts (due April 24)

   Each group member will submit a review of another group's manuscript. Each group will then develop a summary of the individual reviews.
5. Revised manuscripts and response to (summary and individual) reviewer 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).
- Group Project, 50% (manuscript-40%, response to review comments-5%, oral presentation-5%).

**Notes:**

- Each student please schedule an individual meeting (15'-20') with me at the beginning of the semester (first two weeks), during office hours or by appointment. I would like to get to know you a little and discuss the possibilities for the group projects.
- We will form the groups during the first two weeks. Each group needs to have sufficiently strong expertise in ecology and GIS and is ideally composed of students from diverse academic backgrounds. Please make sure to provide opportunities for each group member to contribute and build a collaborative and productive group. There will be an end-of-term peer evaluation of individual group members based on their preparedness for tasks, their contribution to group project, and how well they collaborate with group members.
- Unless specified otherwise, assignments and assessments are due Wednesday night (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 17) | | | | |
| 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 at least 2 summaries posted by others | Wu 2013 |
| Feb 4 | Diversity and Contagion | McGarigal 2015 (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 group project; individual groups meet with instructor (on Apr 2, 4 or by appointment); Synthesis assignment (due on April 3). | | | | |
| Apr 8 | Work on group project; discussion of student syntheses on April 11 | | | | |
| Apr 15 | Work on group project (manuscript due Apr 17); oral presentations of group projects on Apr 18 | | | | |
| Apr 22 | Conduct peer review of manuscripts (due Apr 24); course review and feedback on Apr 25 | | | | |
| Apr 29 | Complete revised manuscript, response to review comments, and peer evaluations (due May 1) | | | | |