GEOL 5315/6315
Advanced Spatial Analysis & Modeling
Fall 2014
CRN 17439/17598

Lecture: W 9-10:50 GEO 302
Lab: F 9-10:50 GEO 409

Instructor
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Department of Geological Sciences
GEO 305C
dpennington@utep.edu
Office Hours: Wed/Fri 11:00-12:00, during lab, or by appointment

General Information
This course focuses on advanced topics in geographic information systems applicable to the environmental, geological, and hydrological sciences. The course is intended for graduate students who wish to further develop GIS analytical skills. Advanced GIS will cover a wide range of analysis and modeling applications using vector and raster data. Students will also be introduced to analytical tools such as spatial data interpolation techniques, point pattern and density analysis. Hands-on experience will be provided through weekly labs and final project.
Prerequisite: An introductory GIS course.

Course Objectives
• Expand breadth and depth of GIS concepts and skills
• Expand knowledge of tools, techniques, theory, and methods used in spatial modeling
• Foster ability to efficiently solve complex geospatial problems by clearly defining a project objective, determining the tools and parameters needed to achieve the objective, and automating the final workflow
• Enable students to complete a GIS project using best practices
• Introduce students to principles and practice of model design and development using model building and scripting languages

Academic dishonesty
A student’s submission of work for academic credit indicates that the work is the student’s own. Any outside assistance should be acknowledged. While cooperation during the lab is encouraged, the lab reports must be constructed and written by each individual student.

Makeup policy
Due dates are firm. 10% will be deducted for each day a lab, the project proposal, or the final project is late. No late summaries of the reading will be accepted.

Students with Disabilities
Students with disabilities are encouraged to meet with the instructor in order that course materials can be updated and adapted appropriately to better foster a positive teaching and learning experience.
Course Textbooks

Scally (2006), GIS for Environmental Management

A reading list of journal articles will be compiled the second week of the semester. These readings will be made available to you in one of the following ways (depending on logistics and copyright issues):

• on the Internet (e.g., certain open-access journal articles and websites);
• at UTEP library hardcopy reserve at the Circulation Desk;
• on UTEP library electronic reserve via library homepage (choose: Services => course reserves => type “Geol5315” => Pennington => Readings);
• from a UTEP library database (go to the UTEP library home page, and type the exact name of the journal’s title into the search window on the left side under E-Journals. This usually results in your being able to access the journal from one or more sources. Be aware that sometimes the listing suggests that fewer years are available than actually are, so always click as far as you can); or
• sent by email to the email address that UTEP has on file for you.

Grading
Class participation 20%
GIS article 5%
Lab questions 15%
Lab reports 25%
Project proposal 5%
Poster presentation 10%
Final project 20%

Class participation
VERY IMPORTANT: Reading assignments must be completed before class. This will be largely a seminar style class with discussion and in-class exercises based on the reading. Participation in these class activities is a significant portion of your grade and depends on your prior preparation. Therefore, at the beginning of each class you must turn in a summary about the reading (1/2 page) along with two questions about the reading that you can potentially raise in class. Your participation grade will be based half on these summaries and half on participating in discussion. PhD students will be assigned to lead one or more of these discussions.

GIS Article
Select a peer-reviewed GIS article (or book chapter) of interest to you. The article must describe some sort of GIS analytical methodology. Provide a citation for the article. Write a paragraph about what you found interesting in the article and how it may be pertinent to your own GIS pursuits (project, work, etc.). These will be used to compile a reading list for the class.
Lab
Lab will be comprised of a set of exercises and accompanying questions to be answered. In addition, a technical report will be written based on the lab. These (the questions and the report) will be graded separately. The report will require you to reflect on the different steps in the lab and synthesize what you learned from it. It should be a comprehensive report that includes one or more maps and the results from your analyses, and must be written in a professional manner. The final section of every lab report must include a paragraph describing ideas for how the lab could be extended with additional analyses to answer remaining questions about the spatial relationships in the data.

Map Guidelines
A good map should be technically correct, aesthetically pleasing, communicative, and thought-provoking. Every map that you turn in will be reviewed using the following six guidelines:

1. Is the purpose clear? Is there a succinct and descriptive title?
2. Are all of the data selected relevant to the purpose? Are there one or more reference layers to provide context?
3. Is the selected level of detail appropriate for the purpose?
4. Are symbols distinctive, intuitive, and easy to interpret?
5. Are the categories appropriate for the purpose, and are there few enough to be cognitively manageable (seven or less)? Are the boundaries of the categories logical?
6. Are explanatory aids present? This includes title, date, author, legend, north arrow, scale bar, and data sources.

Preliminary project proposal
The project will extend one of the guided exercises with new analyses developed by the student. The choice of which exercise to extend will be made by the student with feedback from the instructor. Each lab report will require the student to brainstorm about ways it could be extended. One or more of these ideas should be selected for the final project. The purpose of the project proposal is to verify that the work is appropriate in scope, that the methods proposed are appropriate, that any new data required in fact exist, and that it is possible to complete the project in the time allocated. This description should be 1-2 pages in length. Make sure to include the following:

- Which lab will be extended and why it is of interest to you.
- Goal: What is the big picture goal of this work?
- Objectives: What subset of objectives do you wish to accomplish in this project?
- What data are required and if new data are needed, where do you intend to obtain these data?
- What methods do you intend to use?
- What concerns do you have or what problems do you anticipate encountering?
**Final Project**
The project must involve a major GIS component. Simply adding data is not sufficient; additional analysis must be conducted. Results will be presented during a poster session November 26, and in a project report due December 3.

**Poster Guidelines**
- Place the title of your poster prominently at the top of the poster board
- Provide your name and contact information below the title
- Include the background of your work followed by results and conclusions. A successful poster presentation depends on how well you convey information to an interested audience
- Avoid cluttering your poster with too much text.
- Provide at least one professional map, including all relevant map elements (title, scale bar, legend, etc.)
- Provide at least one diagram (table, chart, or other visual) showing analytical results
- Prepare diagrams or maps legibly in a size sufficient to be read at a distance of 2 meters.
- Paragraph and figure captions should be at least in a 24-point font and headers at least in a 36-point font. Be creative by using different font sizes and styles, perhaps even color. A serif font (e.g., Times) is often easier for reading main text, and a non-serif font (e.g., Arial or Helvetica) is legible for headers and figure labels
- Organize the presentation so it is clear, orderly, and self-explanatory
- Use squares, rectangles, circles, etc., to group similar ideas. Label different elements as I, II, III; or 1, 2, 3; or A, B, C, making it easier for a viewer to follow your display

**Report Guidelines**
Report sections must include: background, goals and objectives, data used, methods including a logic model, and results including at least one map and one diagram (table, chart, or other visual) showing analytical results.
## EM = GIS for Environmental Management, Scally

<table>
<thead>
<tr>
<th>DATE</th>
<th>TOPIC</th>
<th>DUE</th>
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<tbody>
<tr>
<td>Aug 27</td>
<td>Introduction; Review of conceptual frameworks</td>
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<tr>
<td>Aug 29</td>
<td>Lab: GIS refresher</td>
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<tr>
<td>Sep 3</td>
<td>Spatial relationships Read: GA 2.1-2.2; EM Ch 1; Kuhn (2012)</td>
<td>GIS article</td>
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<td>Sep 5</td>
<td>Lab: GIS refresher</td>
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<td>Sep 10</td>
<td>Statistics and ESDA Read: GA 4.1.12; GA 5.1-5.2; EM Ch 2</td>
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<td>Sep 12</td>
<td>Lab: Earthquakes Read: GA 2.3; GA 5.4; EM Ch 4; Wagner &amp; Fortin (2005)</td>
<td>Refresher lab</td>
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<td>Sep 17</td>
<td>Grid-based statistics and metrics Read: GA 3.4; GA 4.6; GA 5.3; EM Ch 3; Weng (2002)</td>
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<td>Sep 19</td>
<td>Lab: Earthquakes (continued)</td>
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<td>Sep 24</td>
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<td>Sep 26</td>
<td>Lab: Landscape patterns Read: GA 5.5-5.6; EM Ch 5; Morris (1999)</td>
<td>Earthquakes lab</td>
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<td>Oct 1</td>
<td>Spatial autocorrelation Read: GA 5.5-5.6; EM Ch 5; Morris (1999)</td>
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<td>Oct 3</td>
<td>Lab: Landscape patterns (continued)</td>
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<td>Oct 8</td>
<td>Surface/field analysis: Modeling surfaces Read: GA 6.1; EM Ch 6; Laliberte et al. (2004)</td>
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<td>Oct 10</td>
<td>Lab: Prairie dog mounds – Point pattern analysis Read: GA 6.2-6.3; EM Ch 7; Haining et al. (2010)</td>
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<td>Oct 17</td>
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<td>Prairie dogs lab</td>
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<td>Oct 22</td>
<td>Surface/field analysis Read: GA 6.4; EM Ch 8; Tu (2011)</td>
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<td>Oct 24</td>
<td>Lab: Topography II</td>
<td>Topography I lab</td>
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<td>Interpolation Read: GA 6.5-6.7; EM Ch 9; Ayeni &amp; Kayode (2014)</td>
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<td>Oct 31</td>
<td>Lab: Rainfall interpolation Read: GA 8.1-8.4; EM Ch 10; Cheng et al. (2012)</td>
<td>Topography II lab</td>
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<td>Nov 5</td>
<td>Geocomputation Read: GA 3.3; EM Ch 11; Pachauri (2014)</td>
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<td>Nov 7</td>
<td>Lab: Work on project</td>
<td>Rainfall Lab</td>
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<td>Nov 12</td>
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<td>Nov 14</td>
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<td>Nov 19</td>
<td>GIScience Read: EM Ch 12; Brenman (2003); Goodchild</td>
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<td>Nov 21</td>
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<td>Nov 26</td>
<td>Presentations</td>
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<td>Nov 28</td>
<td>Thanksgiving holiday</td>
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<td>Dec 3</td>
<td>Debrief</td>
<td>Project report due</td>
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<td></td>
<td>Read: Howarth &amp; Sinton (2011)</td>
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**Journal References**


