Geol588: GIS for Geoscientists II – Spring 2009 (preliminary)

3 credits, in Durham 248 (GIS computer lab)
Lecture: Tuesday 2-4, Lab: Thursday 2-4
Prerequisites: foundation in ArcGIS (Geol 552 or equivalent)
Instructor: Chris Harding (charding@iastate.edu)
Counts as a “Tools & Techniques” course for the GIS certificate and can be taken as part of the 12 EnSci credits

Course description
This advanced GIS course will focus on spatial analysis and modeling using raster data (grids, images). This hands-on course uses ESRI’s ArcGIS and various add-on modules (extensions) related to grids (such as 3D Analyst and ArcScene). Students will learn about theoretical background, work on a raster-based exercises and complete a class project, possible with data from their thesis work.

Class Format:
Although geared towards the practical use of ArcGIS, class meetings will contain both a lecture and an exercise (lab) component. Lectures will focus on the conceptual basis of GIS raster analysis, students should take notes during the lecture component of the class. Although the exercises are typically performed together in class, some larger exercises will require additional time outside of class to complete.

List of potential topics:
- raster data concepts (general)
  - types of rasters: ERSI Info grid, images, DEMs, satellite images, int vs. float vs. categories
  - images: color-indexed vs RGB vs greyscale (luminance), statistics, histograms,
- raster analysis setup (temp./perm. rasters, mask, environment, raster information)
- using the ModelBuilder interface (ArcToolbox)
- raster symbolization (color-ramp, stretching, classified, histogram)
- raster projection issues
- raster import/export/conversion: vector data, TIN, raster file types (geotiff, grid, ASCII)
- map algebra/Raster Calculator (boolean overlay, mask, NoData)
- cell statistics (map stack math)
- neighborhood stats (moving kernels)
- zonal (summary) statistics
- distance analysis (straight line, least-cost-path)
- Interpolation (IDW, natural neighbors, Spline, (((kriging)))
- Terrain (surface) analysis:
  - DEM, TINs (3D analyst), slope, azimuth, contour, cut-fill, viewed, hillshade
  - (hydrological analysis: flow direction, accumulation, watershed delineation)
- Suitability analysis
- Volume/thickness analysis
- Data sources for rasters (Iowa DNR, USGS seamless)
- Geo-referencing

Required text: None
Supplemental texts: ArcGIS 9.2 – Using Spatial Analyst, ArcGIS 9.2 – Using 3D Analyst (available as pdfs in GIS lab)

Expectations of students and course preparation:
I expect you to participate in class and take responsibility for your learning. I assume your attendance in class, which provides you with the very important opportunity to ask questions! Ordinarily, no
“make-ups” will be provided for in-class quizzes, discussions, or activities missed due to absence from class. I expect you to treat the instructor and other students with respect (be on time, turn off cell phones, don't talk with classmates during lectures, don't read the newspaper during class, etc.). If you are going to miss a class, I’d appreciate letting me know in advance.

Graded exercises:
There are no regular homework assignments. However, there will a series of graded exercises:

1. **Documentation exercise**: After performing an exercise together in class, you will only be required to describe the exercise (its GIS methods and results) and to add screenshots. The grade given will depend on the effectiveness of your description – the clearer you can explain the gist of the exercise to me the more I will assume you have understood the material. (Time: 1 week)

2. **Variation exercise**: After going over an exercise in class together I will ask you to, on your own, repeat parts of the exercise (with the same data) but now use one or more variations of the methods used in class. Deliverables are: well documented results (incl. screen shots), comparisons of their differences and an explanation/speculation about the reason for these differences. (Time: 1 week)

3. **Mini-projects**: You are given a data set and a series tasks which require the use of several (previously learned) methods together. Deliverables: list of methods used, well documented results (text and screen shots). Time: 1-2 weeks

For all these graded exercises, you may use Word or Powerpoint to combine your text and screenshots. Adding your own thoughts about the methods and results (good/bad aspects of the methods, caveats, alternatives, real-world connections, etc.) may earn additional points.

Quizzes:
There will be two written, open-book quizzes. You have 10 min. to answer 3 out of 4 questions on paper. These will be non multiple-choice questions that test your knowledge about the lecture material presented so far.

Midterm and Final:
Both tests will consist of a multiple-choice question part (answer 12 of 15 questions in 15 minutes, emphasizing theory) and a practical part (90 min., of which I expect you need only 60 min.) where you will use ArcGIS to analyze and process GIS data given to you and will answers questions about it. Both will test the entire material presented to this point!

Class (final) project:
The last 3 weeks of the course are reserved for a larger class project. The topic is up to the student and should, if possible, involve the graduate/thesis work. The final project will require a short proposal, stating the purpose of the project, the target audience as well as the data and GIS methods to be used. It is imperative that you start looking for suitable data well in advance (~ Midterm), otherwise the majority of your time could be spend hunting around for data! The actual project work will center on computational work with and analysis of the data and the presentation of your results. Deliverables are: a poster that could be used to present at a conference (electronic version only), plus a 10 min. / 10 slide power point presentation to the class (clarity of presentation and content will be graded equally).

Class participation:
Class participation will be based on attendance, participation and particularly the ability to ask intelligent questions. Half of your class participation grade will come from “participation points”(up to 20). I will give you a point every time you give me good feedback (via WebCT) about the material presented in class: something you did absolutely not understand and why this was a problem (today’s ‘muddiest point’) or the single most important point you learned today (the ‘clearest point’ you took away from today’s class) or for a valid, intelligent question about the material in general.
Grading:
All grading will be in percent (0%-100%), that I will convert to letter grades for the final grade according to this scale: A: >95%, A-: > 90%, B+: >85%, B: > 80%, B-: >75%, etc.
Quizzes: 10%, Midterm: 20%, Final: 20%, Graded exercises 20%, class project (includes oral presentation): 20%, Participation 10%

WebCT Gold:
We’ll be using WebCT Gold (webct.its.iastate.edu/webct/) for some aspects of the course, please familiarize yourself with WebCT if you’ve never used it before: www.celt.iastate.edu/webct/student_support.html. You can find an updated version of the syllabus on WebCT. You will hand-in your graded exercises via WebCTs “assignments” function (note: if you have more that 10 files to attach, you need to zip them into single file first). Test dates and assignment due dates for will show up on your WebCT calendar. We will use the journal-type discussion function (which is private between student and instructor) to give me direct feedback such as best-of-lecture, worst-of-lecture, questions, etc.
I don’t see a need for using the internal WebCT email (please use charding@iastate.edu to contact me). I will make the slides of past lectures available in WebCTs “Slides” folder (as pdfs) and also keep a collection of relevant Web links.

Course files on the Delphi server
We will use the GIS center’s Delphi server, which is administered by Robin McNeely (4-2087, mobes@iastate.edu). All course files are stored on \delphi.gis.iastate.edu\GEOL552\students to put exercises, project data, etc. Data is provided in the GEOL552\data folder, you will first need to copy this data to your student folder to work with it! The GIS-lab computer’s C: drive will be deleted every time you log out, do NOT use this drive to store permanent data (such as your project data)!

Non-Discrimination Policy: Iowa State University is “dedicated to fostering an environment in which differences in people such as nationality, race, gender, religion, cultural background, physical ability, and sexual orientation, are respected and mutual understanding is promoted.” (from the ISU Bulletin)

Disability Accommodation: Any student who feels s/he may need an accommodation based on the impact of a disability should contact me privately to discuss your specific needs. Please contact the Disability Resources Office at 515-294-6624 in room 1070 Student Services Building to coordinate reasonable accommodations for students with documented disabilities.

Academic Dishonesty
I expect students to follow the ISU rules regarding Academic Dishonesty (see http://www.public.iastate.edu/~catalog/2005-07/geninfo/dishonesty.html)

(Last modified: Nov. 19, 2008)