

## Geol588: GIS for Geoscientists II – Spring 2011

Instructor: Chris Harding ([charding@iastate.edu](mailto:charding@iastate.edu))

3 credits, in Durham 248 (GIS computer lab)

Lecture/Lab: Tuesday 2-4, Thursday 2-4

Prerequisites: foundation in ArcGIS (Geol 552 or equivalent)

Counts as a “Tools & Techniques” course for the GIS certificate, will be (is?) cross listed with Agron and EnSci

### Course description

This advanced GIS course will focus on spatial analysis and modeling using raster data (grids, images) and TIN (Triangular-Irregular-Networks). This hands-on course uses ESRI’s ArcGIS 10 and various add-on modules (extensions) related to grids (Spatial Analyst, 3D Analyst and ArcScene). Students will learn about theoretical background, work on a raster/TIN-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 (paper printout of slides are provided). Practical exercises are performed together in class (lab), some larger exercises will require additional time outside of class to complete.

### Topics (may change depending on student interest and time):

- Getting familiar with ArcGIS 10
- 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), Python interface
- 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,
- ((( Geostatistics, kriging)))
- Terrain (surface) analysis:
  - DEM, TINs (3D analyst), slope, azimuth, contour, cut-fill, viewshed, hillshade
  - hydrological analysis: flow direction, accumulation, watershed delineation
  - ArcScene/ArcGlobe for 3D visualization
- Suitability analysis
- Volume/thickness analysis
- Data sources for rasters (Iowa DNR, USGS seamless, Lidar)
- Geo-referencing
- Image classification

**Required text:** None

### WebCT:

We’ll be using WebCT ([webct.its.iastate.edu/webct/](http://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](http://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 than 10 files to attach, you need to zip them into single file first). Test dates and assignment due dates 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](mailto: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.

**Graded exercises (“Homework assignments”) (40%):**

Your main work will consist graded exercises (roughly every 2 weeks) about material presented in the lectures. You will be required solve the tasks and questions and to describe the exercise (its GIS methods and results) via text and via adding screenshots. The grade given will depend on correctness of the solution and 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. You may use Word 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.

**Midterm (20%):**

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 parts will test the entire material presented to this point!

**Class (final) project (30%):**

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).

**Participation (10%):**

Show up on time, ask questions, give me feedback via WebCT

**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\. Each student has a personal folder under \\delphi.gis.iastate.edu\GEOL588\students to put exercises, project data, etc. Data is provided in the GEOL588\data folder, you will first need to copy this data to you 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)! ArcGIS 10 uses a Default.gdb Geodatabase and a Toolbox.tbx in My Documents\ArcGIS which you may want to check before you log out.

Some GIS journals:

- International Journal of Geographical Information Science (academically the most prestigious)
- 2.Computer, Environment and Urban Systems (academically a good journal, focusing on urban applications of GIS)
- Transactions in GIS
- Journal of Geographical Systems

**Legal Matter**

**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/2007-09/geninfo/dishonesty.html>)

(Last modified: Jan. 11, 2011)