

There are three questions on this exam. Do all three. For each of the first two questions, prepare a 2-page typed essay (2 pages x 2 essays = 4 pages total). For the third question use ArcGIS (and Excel/Word) to prepare the map and answers requested. Combine solutions together in the order of the questions in a single PDF or Word document, and submit through the class Sakai website, by 11:55 PM on Friday, December 12.

This is a take-home exam. You are honor bound not to discuss this exam with your colleagues in the class. Your answers should be the result of your work and thought alone. Be assured that if essentially the same idea appears in answers from more than one person, it is fairly easy to recognize that when the grading is being done. If that happens, it is not clear from whom the idea originated and who is just using somebody else's knowledge. So, keep your ideas to yourself!

Questions 1 and 2 require you to read and synthesize information from term projects by other students in the class. The term papers that you choose to describe in answering Questions 1 and 2 should be mutually exclusive, that is, if you focus on particular term papers in answering one of the questions, don't focus on the same papers when answering the other question. The term projects can be found at:

Texas: <http://www.caee.utexas.edu/prof/maidment/giswr2014/TermProject/TermProjList.htm>
UNC & Utah: <http://www.neng.usu.edu/cee/faculty/dtarb/giswr/2014/students.html>

You are encouraged to look at term projects from all locations in preparing your answers since this will give you a greater body of information to speak from. At least one of the projects reviewed in one of the questions should be from an institution other than yours.

What we are looking for in grading your answers to this question is:

- **Knowledge of the facts.** Make sure you lay out the facts of what has actually been done before you start offering opinions about what could have or should have been done. Make sure you discuss what was actually done in the term papers not just about the general subject itself.
- **Thoughtful evaluation.** How do you evaluate the advantages and limitations of the principles, methods and data that have been used? How does the knowledge you've learned in this class relate to the world around us? I am looking for a sense of reflection here, of seeing you set individual situations and facts in a larger context in an intelligent way.
- **Effective use of Maps.** Identify specific maps from these projects that you think are effective and explain why they are effective.

In your answers, you must refer specifically to work presented in term papers prepared in this course this year. In other words, I am not looking here just for a general statement about your opinions in the field but rather a deduction based on the term papers presented in this class of what has been done and how you judge the effectiveness of that.

Questions

1. Compare and contrast two papers dealing with the same theme

Choose two term papers that deal with the same or similar themes or topics. Neither of these papers should be your own term paper. The papers that you choose may be from any of the participating universities. Briefly summarize the contents of the papers (the problem examined, the method of analysis, the results achieved). Compare and contrast the approaches to the problem that the two papers took. Which technical approach do you think was more effective? Why? Which paper does a more effective job of communicating its results? Why? Suppose you were undertaking a study of this same subject. Having studied these two papers, what have you learned about how to go about your investigation effectively? What would you do differently from what the authors of these papers did?

2. Write an assessment of the utility of GIS in a particular subject area

Student term papers on a range of topics have been presented. Select four papers that fall within a similar subject area and present a critique of how effective GIS is in its application in this subject area. What is the scope of the subject area? How has GIS been used? What types of problems have been solved effectively? What limitations exist that have yet to be overcome in the application of GIS in this area? The papers that you select for this question may be from any of the participating universities. You are encouraged to look at and use papers from Utah, North Carolina and Texas, where they address similar subject areas.

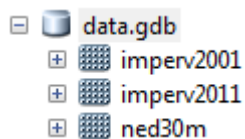
3. Hydrologic Assessment of Onion Creek

The information that you'll need to complete this question is contained in the zip file:

<http://www.neng.usu.edu/dtarb/giswr/2014/Final.zip>

This includes the following datasets:

- Digital elevation model
- 2001 and 2011 impervious surface raster datasets



Part 1: Introduction to the Watershed.

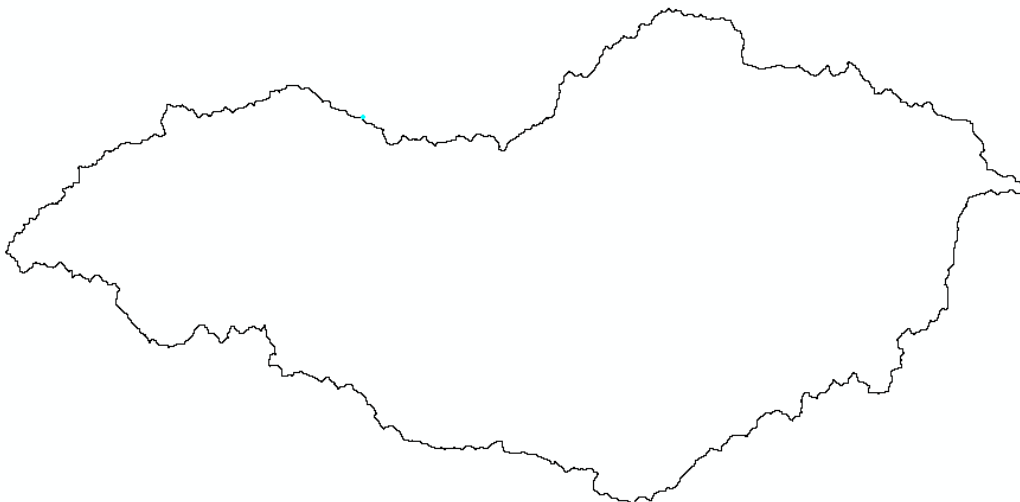
The Onion Creek watershed has been the focus of several lectures throughout the semester. It is of particular interest because of recent flood conditions, notably October 30/31, 2013. Your goal is to investigate the hydrology of the Onion Creek watershed using the skills you have learned throughout the semester. The outlet of the Onion Creek watershed is described in Table below.

Property	Value
Name	Onion Creek at 183
Latitude	30.17732
Longitude	-97.68896
Coordinate System	NAD 1983

To be done: Use the information in the table above to:

- Construct a point Shapefile representing the watershed outlet.
- Use this Shapefile and the provided DEM to delineate the watershed boundary. Note that due to imprecision in the mapping of gage locations this point may not lie exactly on a stream so you will need to make the appropriate adjustments.
- Prepare a nice map that displays the Onion Creek watershed overlaying the ArcGIS Topographic basemap. On your map, include any necessary symbols (e.g. north arrow, scale bar, etc), labels (e.g. watershed and outlet names), as well as an annotation on the map indicating the area of the watershed in square kilometers.
- List (giving one sentence detail for each step) the steps taken to delineate the watershed and determine its area.

Following shows the approximate shape of the watershed you should produce



Part 2: Investigate Land Use Change

The Multi-Resolution Land Characteristics Consortium's National Land Cover Database (NLCD) provides many data products that help us understand land use changes. The development and urbanization of land greatly impacts watershed hydrology, specifically in flood prone areas such as Onion Creek. The NLCD Percent Developed Impervious surface area provides estimates of man-made impervious surfaces. These raster datasets are derived from Landsat imagery and consist of values from 0 to 100 percent impervious. This part of the exam requires the `imperv2001` and `imperv2011` raster datasets.

To be done:

Load the `imperv2001` and `imperv2012` rasters into ArcMap. Clip these datasets to the extent of the Onion Creek watershed. (Hint. Extract by Mask).

- a) Determine the number of cells and area (in km²) within the watershed in which the amount of impervious area has increased from 2001 to 2011. Describe the steps taken to do this.
- b) Create three maps: (1) showing areas in 2001 that had impervious values greater than 0, (2) areas in 2011 that had impervious values greater than 0, and (3) pixels in where the percent impervious has increased from 2001 to 2011 overlaying the percent impervious for 2001. When creating these maps, make sure to choose symbology that clearly conveys your message (e.g. values of 0 should have no color).
- c) Create a table (in the format below) that shows the percent impervious values for the 2001 and 2011 of datasets classified into 25% ranges (Hint. Use the reclassify tool) and the watershed area that they represent. For example:

Percent Impervious	2001 Area (km ²)	2011 Area (km ²)
0-25		
25-50		
50-75		
75-100		

- d) In one paragraph, discuss what these maps tell us about the urbanization of the Onion Creek watershed. What impact will this have on watershed hydrology in the future?