CEEN 114 Geomatics



# Lab 10- Geoprocessing

## Introduction

WARNING! Yellowstone Disaster is Eminent! Unprecedented climate change and natural disasters have destabilized much of Yellowstone National Park. The National Park Service has tasked you and a team of experts to use GIS skills to analyze areas most in need of attention as this disaster unfolds. Your team will evaluate 3 scenarios to find areas that most need attention. No data will be provided to you. Any data you need should come from the National Map website or occasionally created by you.

This lab will accomplish the following:

1) Become familiar with using the National Map service and the kinds of information available.
2) Review cartography skills and GIS fundamentals.
3) Introduce and practice these GIS tools:
    - Reclassification
    - Buffer
    - Intersect/clip/cut
    - Erase

## Some tips you shouldn't ignore

- Still use UTM Zone 12N for all of your GIS work in this lab. Although your datasets are not in Utah, they are within the boundaries of zone 12N and lie almost directly north of Provo
- Use the D:/ drive for ALL of your data. Not most of your data, not some of your data, ALL of your data. For best results, create a new folder for ALL of your data in this lab. Create a new geodatabase in that same folder and set it as the default geodatabase. Save ALL of your data to that folder. If you do not follow these steps, ArcMap will crash, take much longer than necessary to work, and/or lose your files that come out of geoprocessing to the default geodatabase.
- If this all overwhelms you, diagram what the outputs of the geoprocessing operations should look like to help yourself visualize what the operations mean. And remember, these are your first steps.

## Part 1: Floods

Yellowstone Lake is about to spill into the rest of the park! The Continental Divide is disappearing in a series of unexplainable earthquakes and landslides of biblical proportions. Find the areas of the park most at risk for flooding.

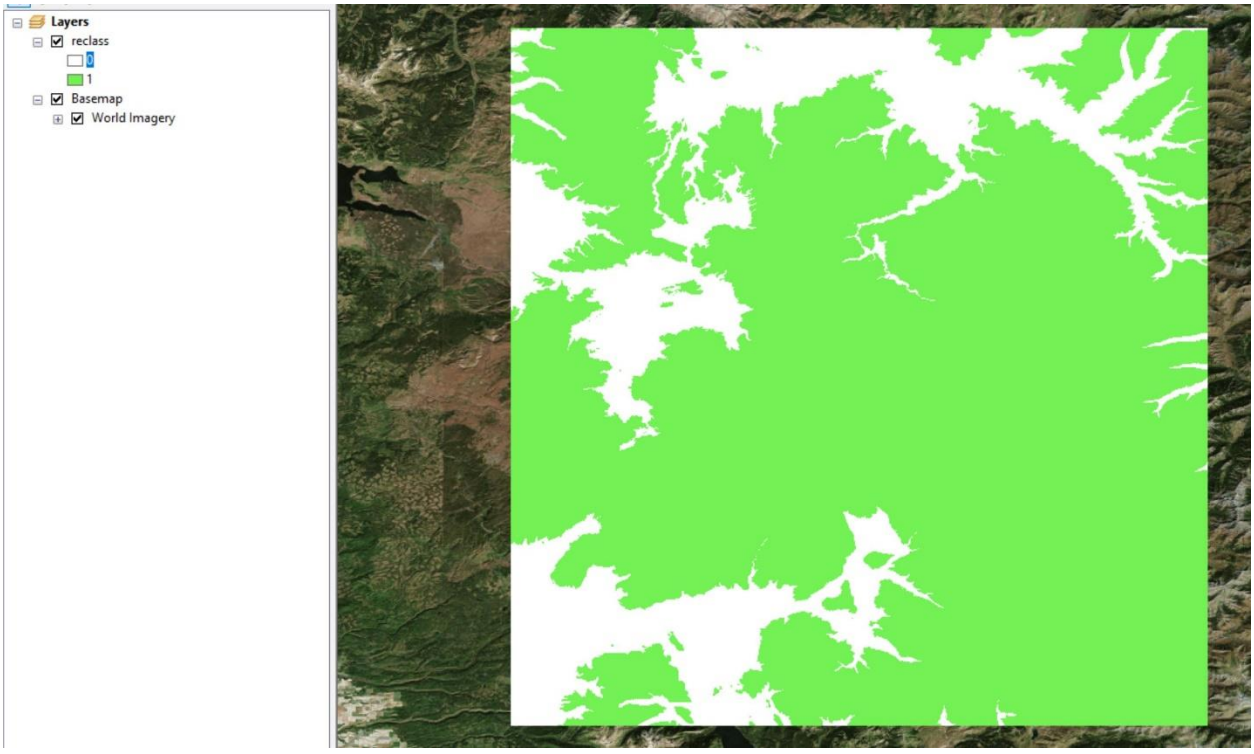
1) Find an elevation dataset for Yellowstone National Park
2) Use the identify tool to find the average elevation of Yellowstone Lake.
3) Reclassify the DEM to 1 and 0 where 1 is higher than the lake and 0 is lower than the lake.
4) Make a map showing your reclassified DEM

To get an elevation dataset, use the national map. Find the "3D elevation program" section. Find the "download elevation products" button. You will be taken to an interactive map downloading screen. Choose the 1/3 arc-second resolution. Use one of the search options (Box/Point, Current Extent,

Coordinates, etc) to search for datasets around Yellowstone. These datasets will be large, perhaps up to a GB each. Download 1 elevation set that covers the northwest section of Wyoming (most of the park, including the lake). When you add an elevation dataset for the first time, you will usually be asked if you want create pyramids. While not necessary, pyramids are an additional piece of data that helps the computer render the raster dataset more quickly as you navigate around the map and perform geoprocessing functions. It may take the computer a few moments at first, but it will save your time later; build the pyramids.

To get to the reclassify tool. Go to geoprocessing, click on the search button, and search for reclassify. There are two reclassify options, one is 3D analysis and the other spatial analysis. Either will work for this lab. If you click on the tool and it tells you that you don't have the proper licenses, then you will need to enable them. Go to Customize -> extensions then check the boxes for 3D analyst and Spatial Analyst. The reclassify tool lets you change values that are equal to a certain range or value, in a certain quartile, etc and assign them to another value. In this case, you're interested in higher than the lake and lower than the lake. Use a binary system, 0 for below and 1 for above, to make this easy for yourself. The tool will prompt you on the proper formatting for typing intervals. Explore the different ways ArcMap will let you reclassify data.

If you did these operations correctly, it should look something like this:




## Part 2: Noxious Gas

What if the 4 of the largest geysers in Yellowstone National Park were all contaminated and all erupted with a noxious gas at the same time? Are there any hotels or lodges or other buildings within 1 km of any of these geysers that would need to be evacuated?

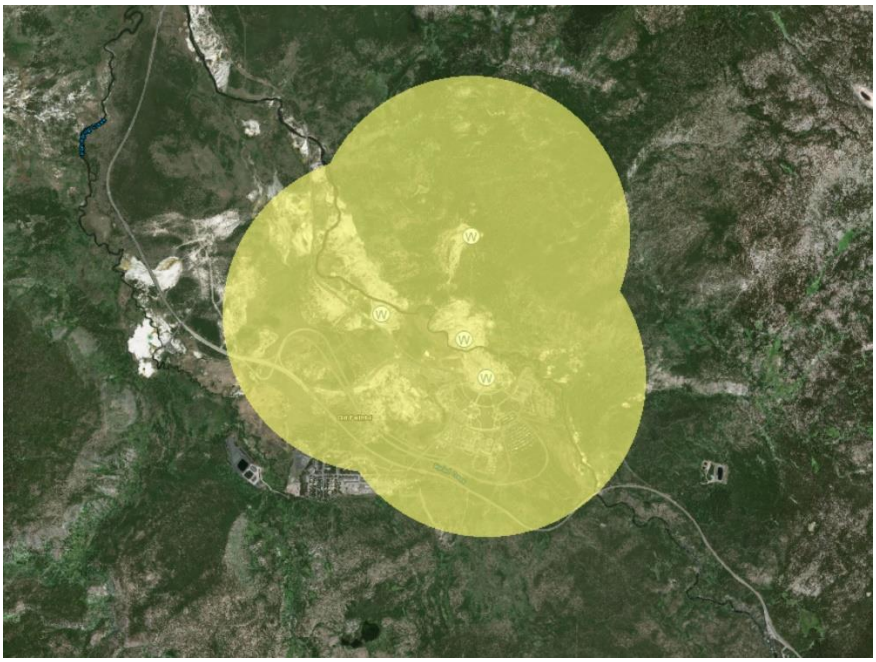
1) Use Wikipedia to find 4 geysers in the Upper Geyser Basin.
2) Locate them on a basemap in ArcMap and create a new point shapefile and digitize these five points
3) Use the buffer tool to create a 1 km buffer around all the geysers.
4) Visually explore the basemap to see if you can find any buildings that need to be evacuated.
5) Make a map showing your basemap and the buffer polygons with a semitransparent yellow fill.
6) If you find any buildings that need to be evacuated, make an inset map showing the buildings and use a text box on your map to list the buildings that need to be evacuated.

When locating the geysers, find the wiki page for Yellowstone and use the 4 geysers listed in the first paragraph of the "Geysers and hydrothermal systems" section. To help you locate them exactly on ArcMap, you might consider using a webservice such as google maps to locate them so you have a reference. You might also consider using their GPS coordinates and converting those to UTM coordinates.

You can find the buffer tool in 2 places. 1- under the geoprocessing tab on the top menu, there is an option called buffer. Select that. 2- use the search menu to find the Buffer tool. The input layer is the one you want to put a buffer around. The output layer section gives you the ability to choose where to save the output, what to name it, and what file format to use when applicable. Specify the appropriate unit and length to buffer. Choose "dissolve all," and leave the rest of the options the same.

The option to use transparent fill is found under properties -> symbology -> advanced. If you need additional assistance, review the cartography lab and/or use google.

If you've done the previous steps correctly, you should have an output that looks like the following figure. Be sure to add all the appropriate cartographic elements, including labels, titles, scale bar, etc.



## Part 3: Search and Rescue

Experts from the state of Idaho have requested assistance. Since only a small portion of Yellowstone is within the boundaries of Idaho, they only responsibility for a very small part of the disaster zone that is Yellowstone National Park. You need to fly a helicopter to the remote parts of your area (10 km away from the highway) to look for survivors. Find this search area.

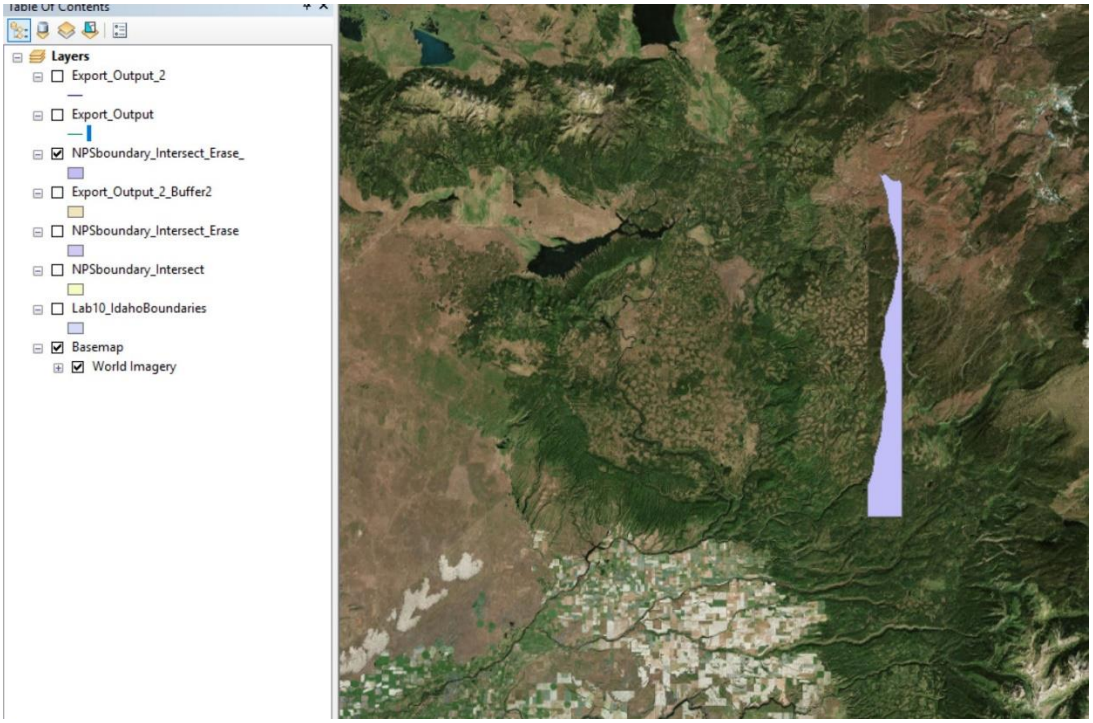
1) Download a shapefile of the state of Idaho and a shapefile of the park boundaries
1) Intersect these two shapefiles to find the sliver of land within Idaho
2) Download a transportation file and select only the I-20 and State Route 082
3) Buffer the US-20 and State Route 082 with a 6 km buffer
4) Use the Erase tool to remove the 6 km buffer from your Idaho-Yellowstone sliver of land.
5) Make a map showing this critical search and rescue area!

To find the national park boundary polygons, search the internet to find a file called NPS_Boundaries. The national park service has GIS data that is not available on the national map. The state boundaries of Idaho are available on the National Map and a variety of other websites.

Road datasets are available on the national map and many other places online. You will either need to select the section of I-20/State 82 that you want with a Select By Attributes query or with the select tool. You may either export that as a shapefile or use the selected portion in your GIS operations. The fastest way to select these with the Select by Attribute feature is to use the Interstate attribute and the Full Road Name attribute.

You can solve this portion of the lab in several ways. You might end up using the intersect, clip, buffer, erase, or select by attributes function as part of your solution. It will be helpful for you to diagram the steps you will need to take in order to stay organized and begin to understand the process. This diagraming portion is called a workflow.

If you did the previous steps correctly, you should get an output shapefile that looks like the following:




## Deliverables

The end goal of GIS operations is, generally, to produce datasets that represent areas that meet your criteria. Typically, GIS data is presented by way of maps. Your team will present the findings of your GIS analysis as maps as described in each of the 3 sections of the lab. Those maps should be professional and presentable. Use all your cartography (map design) skills and knowledge of GIS such that each map meets those criteria.

You should submit 3 maps combined into a single file. Each map should be in the pdf format that comes from ArcMap. Each map needs to be well labeled and obviously answer the question/solve the problem.

## Rubric

10 pts/map

- Points for cartographic elements
- Points for properly processed output layer visible
- Points for your maps being clear enough to be useful solving the problem statement