

SIE 509 – Principles of GIS

Exercise 5 – An Introduction to Spatial Analysis

Due: Oct. 31, 2017

Total Points: 50

Introduction:

The Governor of Maine is asking communities to look at regionalization for major projects. Towns in the greater Bangor area (Bangor, Brewer, Orono, Old Town and Veazie) have banded together to locate a new Trash to Energy facility. Your job is to advise the building committee on the best location for this site. Because the siting of such a plant can be controversial they want to identify highly suitable land based on specific criteria. The possible sites will be discussed at a public meeting. The map you create for the meeting should make clear which parcels meet these criteria.

The committee has provided you with the following criteria:

- Elevation must be less than or equal to 60 meters.
- Outside of the floodplain to avoid spillage during storms.
- More than 30 meters from any body of water.
- Within 500 m of an existing road to minimize construction costs
- A minimum of 100 acres.

Procedures:

1. Open an MS Word Document add an appropriate title, your name and the due date. This is your Report Sheet. You will be pasting screen shots into this document.
2. Download and extract the Ex_05 Data to your Workspace.
 - a. This file contains a 30 meter DEM called *elevation*. This file was created from four DEM's downloaded from USGS website and mosaiced using ArcToolbox.
 - b. It also contains two shapefiles: *hydro24p.shp* (hydrology) and *firm.shp* (floodplain data).
3. Go to the Maine Office of GIS website (<http://www.maine.gov/megis/catalog/>) and download the following files and unzip/extract them into your Ex_05 folder¹:
 - a. MCDCCD10 (Minor Civil Divisions)
 - b. Roads - NG911
 - c. Parcels - organized towns

Setting up the Personal Geodatabase

4. Create a personal Geodatabase called GBA.mdb.
5. Within GBA create a feature dataset called Site and set the projection to NAD83, UTM zone 19.
6. Click Next to accept the defaults, then Finish.

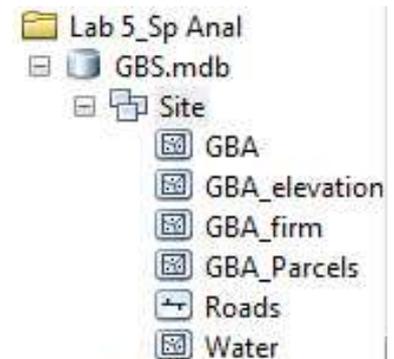
¹ Use the help in "My Computer" to learn how to extract these files if you have not done so before.

7. Close ArcCatalog and open ArcMap.
8. From the Geoprocessing menu, set your Current and Scratch Workspaces to your Geodatabase
9. From the Customize menu, add the Spatial Analyst extension, by selecting the box next to Spatial Analyst.
10. Add the mosaiced DEM (*elevation*) to ArcMap.
11. Open ArcToolbox, and expand Spatial Analyst Tools->Map Algebra->Raster Calculator.
12. Double click to open the Raster Calculator and set up the following expression "elevation" <= 60, and save it in your Folder (not your geodatabase) as *elev*. Click OK. When the process completes, it will produce a calculation raster where 1 represents all of the areas meeting your criteria of less than or equal to 60 meters, and 0 for everything else.
13. From ArcToolbox, select Conversion Tools->From Raster->to Polygon.
 - a. The Input raster is *elev*
 - b. The Field is Value.
14. The output polygon should be saved in your feature data set as *elevation*.
15. When the process is complete, and the *elevation* feature class has been added, remove the DEM and *elev* from your project.
16. Open the elevation attribute table, and notice the gridcode values, then remove it from your project.

Creating the Base Map

17. Add the *mcddcd10* shapefile. This is a map of all of the minor civil divisions in the state. You re only interested in the five towns in the greater Bangor area.
18. Create a query that will select the following cities/towns from the mcddcc00 coverage using the attribute "NAME10": Bangor, Brewer, Veazie, Orono and Old Town.
19. Right-click on mcddcd10 in the TOC, select Data ->Export Data as GBA (Greater Bangor Area) as a Feature Class (Greater Bangor Area) to your feature data set Site.
20. Add it to your map and make it a light green. This will act as a "cookie cutter" for clip operations.
21. Right-click on mcddcd10 and choose Remove.
22. From the Geoprocessing menu, choose Clip
 - i. Your input is the *hyd24p* (browse to it in your folder).
 - ii. Clip feature is GBA
 - iii. Output feature is hydro, be sure to save it in your **folder**.
 - b. Using the attribute Type, select the all waterbodies (everything but islands) and export the selected feature as Water to your feature data set, and add it to your map.
 - c. Set the color to blue.
23. Clip each of the following and save them in your feature data set
 - a. *NG911rds* – save as Roads - dark grey
 - b. *firm*. - save it as GBA_firm

- c. *Parcels* – save as GBA_parcel
 - d. *elevation* save as GBA_elevation
24. Remove *elevation* from your project.
 25. You should now have the following files in your feature data set and in ArcMap.
 26. You may need to reorder the themes in your TOC so that all of the polygon themes are below the line themes



Beginning the Analysis

You will now begin looking at each of the criteria for a suitable site. It may be necessary to draw themes on and off as you go through this process, and to remove themes that are no longer needed. From this point on, all files should be stored in your **feature data set**.

After completing the steps for each criterion, turn off all but the immediate result, screen print that result and paste it into a MS Word Document with an appropriate caption.

The first criterion is based on elevation.

27. Draw off all files EXCEPT GBA_elevation
28. Do an Attribute Selection from GBA_elevation, based on Gridcode = 1 and export the file to your feature data set as Lowland .
29. Remove GBA_elevation.
30. Screen Print Lowland and paste it into your Word Document, crop it and size it appropriately and add an appropriate caption. (You will not be reminded of this step again, but remember to do it after completion of each criterion.)

The second criterion is that the site had to be outside the floodplain.

Firm data classifies land according to its potential for flooding. Zones A and AE are within the 100 year flood line.

31. Draw off Lowland and draw on GBA_firm.
32. Select the land that is **NOT** within the 100 year flood line and export it as DryLand. Add DryLand to your Data Frame and delete GBA_firm.

The third criterion is that the site must more than 30 meters from source of water.

33. Draw off DryLand.
34. From the Geoprocessing menu select Buffer. You will buffer the water features at a distance is 100 meters.
35. Dissolve barriers between buffers (Choose Dissolve Type ALL). Save the output in a new layer called Water_Buffer and click OK (don't forget to screen print).

36. Next you will do an Erase between DryLand and the Water_Buffer, as we don't want to include this in our Site.
 - a. Open ArcToolBox to Anaysis Tools ->Overlay->Erase.
 - b. The Input Feature is DryLand.
 - c. The Erase Feature is Water_Buffer
 - d. Save the output file in your feature data set as DryLand2

The fourth criterion is that the site must within 500 meters of an existing road.

37. Draw off all themes.
38. Create a 300 meter buffer (Choose Dissolve Type ALL) around the road theme and save it as Road_Buffer.

The fifth criterion is to look for parcels with acreage greater than 100 meters

39. Open the GBA_parcel attribute table and add a new field called Acres (type Float).
40. Use the field calculator to convert Shape_Area, which is in square meters to acres using the following:

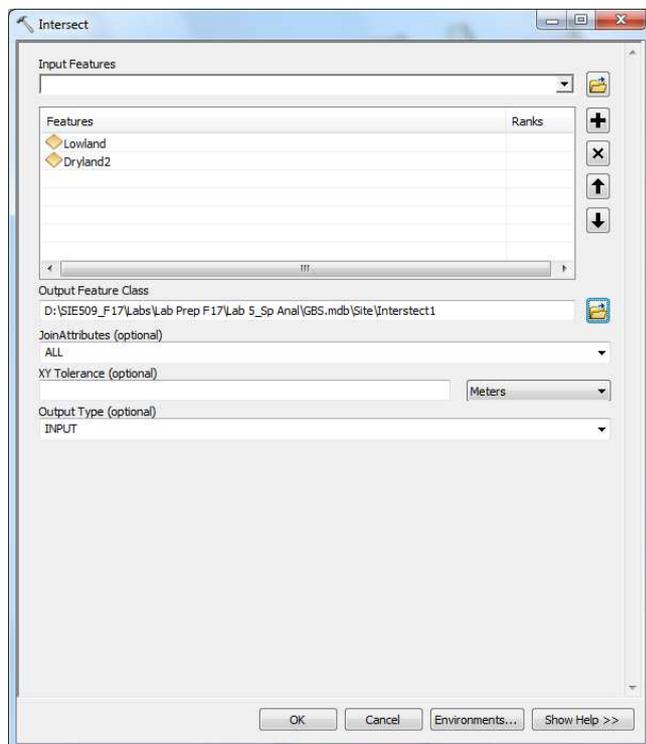
$$\text{Shape_Area} \cdot 0.000247$$

41. Select parcels greater than or equal to 400 acres.
42. Export the selected parcels as potential parcels.
43. **Save your project before going on to the next step.**

Identifying the Sites That Meet All of the Criteria

What you are looking for is the land where all of the criteria overlap. To do this, we will perform several Overlay operations. After each operation, screen print the result and paste it into your Word document.

44. From the Geoprocessing menu select Intersect to intersect LowLand and **DryLand2** to create Intersect1. Be sure to add the layers in the order stated.



45. Then intersect Intersect1 with Road_Buffer to create Intersect2.
46. Do a spatial selection to identify the potential parcels that are completely contained within Intersect2. Save the output as Potential Sites

Creating the Layout

47. Right-click on Layers and choose Properties. Name the Data Frame “Greater Bangor Area”.
48. Set the Display units to Miles.
49. Display the potential sites on the base map: Greater Bangor Area, roads and River
50. Create an attractive layout that clearly shows the potential sites.

Deliverables:

Submit your layout and your Word document with your (10) criterion and analysis screen prints.