

**GEOG 521 F2F
General Spatial Analysis
Lab Exam
November 26, 2012**

Time: 2 Hours
Total Marks: 20

Background

You have been hired to develop a map showing deer winter range for a portion of Vancouver Island. Previous studies have shown that deer winter range is confined to:

1. Areas that have a south facing aspect (135-225 degrees) (SouthSlope)
2. Areas that are less than 300m in elevation (ElevRange)
3. Areas that are forested (ForestedRast)
4. Areas within an ecotone (a transition zone) between forested areas and cleared areas (Ecotone)


In this exam, we are going to set up 4 layers that represent these conditions, and these will be overlaid to create a final map showing deer winter range. All of the final layers will contain only values of 0 and 1, to make the analysis easier.

Setup

Go into the C:\Data\Geog_521\Lab_Exam folder, and double-click on 092B091.zip to extract the files. Place the 092B091 directory into C:\Data\Geog_521\Lab_Exam\ to create C:\Data\Geog_521\Lab_Exam\092B091.

Unless specified explicitly, do not change any default values in the commands that you use.

As you go through this exercise, there will be a number of questions to answer. As with any other lab assignment, these can be answered in Moodle. The only difference is that you will have a clock displayed to show you the elapsed time, since this is a timed exam.

This exam is designed so that a problem early in the analysis does not cascade through the rest of the exam, affecting all of your results. If you get into trouble on a particular step, you may be able to jump to the next part of the lab, marked with the symbol , to continue. Remember, your time is limited, so don't obsess on getting a particular question answered if the answer is not coming to you.

Procedures

Create the DEM

- ➡ 1. Open Lab_Exam.mxd from the 092B091 directory in ArcMap. Note that you must use this file because cell sizes have been set up in Environments in this file, so that you do not need to adjust any of your environment settings.
2. Load the layer DEM from the C:\Data\Geog_521\Lab_Exam\092B091\ directory.

Question 1: Examine the Layer Properties for DEM. What is the mean elevation value, to the nearest metre? (1 mark)

Answer: 633m

Question 2: How wide is each pixel in the DEM? (1 mark)

Answer: 50m

3. Load the Lakes.shp layer from the C:\Data\Geog_521\Lab_Exam\092B091\ directory.
4. Convert Lakes into a raster mask layer by using the Polygon to Raster command using the Value field LakeLand. LakeLand is set up so that all lake and land polygons are given a value of 1, and all ocean polygons are given a value of 0 (if ocean is present in your data set). Call the output raster C:\Data\Geog_521\Lab_Exam\LakeMask

STOP. Ensure that LakeMask is smaller in extent than DEM, and that it only contains values of 0 and 1.

Question 2: How many pixels in LakeMask have a value of 0? (1 mark)

Answer: 572

- ➡ 5. Use the Times command to multiply LakeMask by DEM to create C:\Data\Geog_521\Lab_Exam\DEMFinal.

Question 3: What is the purpose for multiplying the areas in LakeMask that have 0 by the values in DEM? (1 mark)

Answer: To flatten the areas of ocean, giving them a uniform elevation of exactly 0.

Question 4: Why did the area on DEM that was outside LakeMask disappear on DEMFinal? (1 mark)

Answer: Either because we were multiplying NoData on LakeMask by a value on DEM, or because the area was outside the raster grid definition. In either case, no values from the multiplication are returned.

Question 5: What is the highest elevation in DEMFinal, rounded to the nearest metre? (1 mark)

Answer: 1316m (no part marks – if they truncate they’ve been warned)

Create SouthSlope

6. Calculate the aspect for DEMFinal to create C:\Data\Geog_521\Lab_Exam\Aspect

Question 6: What value does the Aspect command assign to pixels to indicate that areas are flat? (1 mark)

Answer: -1

7. Start the Reclassify command, and reclassify Aspect to differentiate between south slopes (135-225 degrees), which deer prefer, and other slopes. Call the output file C:\Data\Geog_521\Lab_Exam\SouthSlope. Set up your reclassify table as follows:

Old values	New values
-1 - 135	0
135 - 225	1
225 - 360	0
NoData	NoData

Note: Ensure that your classes together encompass all values from -1 to 360 degrees, as shown above. If you use the classify button, some of the extreme high and low values may be missed.

Question 7: What is the number of pixels that are classified as facing south (135-225 degrees) in SouthSlope? (1 mark)

Answer: 9769

Create ElevRange

➡ 8. Again, use the Reclassify command to identify the elevation ranges that deer prefer. Set all values in DEMFinal that are 300m and below to 1, and all values above 300m to 0. Call the output file C:\Data\Geog_521\Lab_Exam\ElevRange.

Question 8: What is the number of pixels that lie above 300m elevation? (1 mark)

Answer: 56104

Question 9: Determine the area of each pixel in ElevRange, and use this to calculate the area that lie above 300m elevation, in Ha. (1 mark)

Answer: $50 \times 50\text{m} = 2500 \text{ m}^2$ $56104 * 2500 / 10000 = 14,026 \text{ Ha}$.

Create ForestedRast

➡ 9. Load the layer Cover.shp from the C:\Data\Geog_521\Lab_Exam\092B091\ directory into your Table of Contents.

10. Use the Union command to combine Cover.shp with Lakes.shp to create a new vector layer called C:\Data\Geog_521\Lab_Exam\ForestWater.shp.

Question 10: How many polygons are there in ForestWater.shp? (1 mark)

Answer: 133

11. Recalculate the area of the F_AREA column in ForestWater.shp, using the coordinate system of the data source (PCS: UTM10-83), in Hectares.

Question 11: How many hectares in size is the largest block of forest on map sheet 092B091, to the nearest hectare? (1 mark)

Answer: 15563

12. Some areas shown in Cover as Forest are actually lakes or parts of the ocean. We need to remove these non-forest areas from ForestWater before creating an output raster. On ForestWater, use Select by Attributes to select areas that are forested ("Forested" = 1) but which are not Lakes ("WaterType" = 'Lake') or Ocean ("WaterType" = 'Ocean')

Question 12: How many polygons meet these criteria? (2 marks)

Answer: 5

13. Export the selected **polygons** and their attributes from ForestWater to create a new shapefile called C:\Data\Geog_521\Lab_Exam\Forested.shp. Load this new layer into your Table of Contents when prompted.

14. Use the Polygon to Raster command to convert Forested.shp into a raster called C:\Data\Geog_521\Lab_Exam\ForestRaw. Use the Forested column for the value that is assigned to each pixel

Question 13: How many pixels have a value of 1 in ForestRaw? (1 mark)

Answer: 62255

15. Reclassify ForestRaw so that the forested areas (value = 1) remain unchanged, but all NoData values are converted to 0. Call the output C:\Data\Geog_521\Lab_Exam\ForestedRast.

Create Ecotone

➡ 16. Use the Polygon to Line command (Data Management Tools > Features > Polygon to Line) to convert Cover into C:\Data\Geog_521\Lab_Exam\ForestLines.shp.

17. Open the attribute table for ForestLines.shp and select all lines except the outside boundary by selecting for:

"LEFT_FID" <> -1 and "RIGHT_FID" <> -1

Question 14: How many of the lines are selected? (1 mark)

Answer: 214

18. Run the Euclidean Distance command on the selected ForestLines to generate C:\Data\Geog_521\Lab_Exam\EucDist, a raster showing the distance from the nearest forest boundary line.

Question 15: Examine EucDist. What is the maximum distance, in metres, from any of the selected boundaries? (2 marks)

Answer: 3021m

19. Reclassify EucDist so that areas that are less or equal to 200m from one of the forest boundaries are given a value of 1, and those areas greater than 200m from the boundaries are given a value of 0. Call the output raster C:\Data\Geog_521\Lab_Exam\Ecotone.

Create Deer Winter Range

20. Using Raster Calculator multiply SouthSlope, ElevRange, ForestedRast, and Ecotone together. (If Raster Calculator gives you problems, you can simply use the Times command three times). Call the output C:\Data\Geog_521\Lab_Exam\DWR

Question 16: What is the total area of deer winter range within map sheet 092B091 in Hectares, to two decimal places? (1 mark)

Answer: $135 * 2500 / 10000 = 33.75$ Ha

21. Let's try an alternative approach. Rather than multiplying the four input layers, use Raster Calculator to add SouthSlope, ElevRange, ForestedRast, and Ecotone together. (If Raster Calculator gives you problems, you can simply use the Plus command three times). Call the output C:\Data\Geog_521\Lab_Exam\DWRSum. In this interpretation perfect habitat conditions are given a value of 4, less perfect conditions are given a 3, and so on down to non-habitat, which is given a value of 0.

Question 17: How many pixels in total are there of “less than perfect” habitat (values 1, 2, and 3)? (1 mark)

Answer: $40233 + 20575 + 4117 = 64925$

Question 18: Can you identify any problems with handling the data using this alternative approach? (1 mark)

Answer: Yes, in the first approach, lakes were not included because they had a value of 0 in the ForestedRast layer. In the second approach, lakes are included as “less than perfect” habitat, when they should be non-habitat areas.

Completion

Answer all of the questions posed in this exam directly in Moodle. When complete, keep a copy of your Lab_Exam directory, just in case there are any questions about the answers that you gave or issues with the answer submission in Moodle.

And you are done!