

## EVS 427 / 527

### Exercise 8: Zonal Analysis

Zonal analysis is one of the most useful tools for analysis. Essentially, it evaluates the statistical aspects of an object, based on one or more larger information-containing images. The object in question is set by one or more polygon vectors; the statistical information is typically derived from raster images. Even when doing zonal analysis in ArcGIS, the zonal tools are part of the Spatial Analysis toolbox.

In order to carry out a zonal analysis, you first have to have a meaningful zone. You also need to have one or more raster images from which meaningful statistics can be derived. "Meaningful statistics" in this case covers a rather large range. Some, like Maximum value, Minimum value, Mean value, Median value, Range, Standard Deviation, Sum, etc. imply that the raster comprises interval or ratio numbers, although some of them don't have to. Others, like Majority value, Diversity, Majority count, or Majority fraction could involve nominal and ordinal, as well as interval and ratio numbers.

In this exercise, you will consider how to create a meaningful zone or set of zones, and you will analyze different kinds of imagery for their zonal statistics.

#### West Creek Reservation

Our first look at zonal analysis will be to look at the West Creek Reservation, one of the newest reservations in the Cleveland Metroparks system, located in Parma. The files you need are in the WestCreek directory on the S: drive. These include a DEM and an NSDM for the area of the West Creek watershed, as well as a shapefile of the boundary of the West Creek Reservation. Load all of the files in the WestCreek directory into the view you have active in Imagine. The shapefile should be on top.

First determine the details of the elevation of land in the Reservation. To do that, go to Thematic -> Zonal Attributes on the Raster tab. The DEM is the raster layer; the WestCreek shapefile is the vector layer. What attributes are meaningful? Click the ones that seem most appropriate and click OK. This won't seem to do very much, but it does. It changes the WestCreek.dbf to include the attributes you have chosen. You should go to a command-prompt window and copy the dbf file to a new name (e.g. type **copy WestCreek.dbf WestCreekDEM.dbf** to copy the base dbf file to reflect that the attributes are those of the DEM). Next, determine the meaningful attributes of the NDSM image. This works the same way, except that since the shapefile extends beyond the NDSM, you will need to click the "ignore zero" checkbox.

It might be of interest to see what the distribution of slopes is within the Reservation. Use Terrain -> Slope to develop a slope map from the DEM, and analyze the slope statistics. You might consider both the aggregate slope statistics for the Reservation and the statistics of seriously steep slopes.

#### Coyote Habitat

It is no secret that there are coyotes in northeast Ohio. Several years ago, one of our graduate students did a study of their habitats; you will be duplicating some of her results – but without having to collect the data in the first place. What Beth did was to go to known points in the Cleveland Metroparks and generate sounds to which the coyotes responded. She was able to evaluate two parameters: distance between her and the coyotes (0 - ½ mile, ½ - 1 mile, 1 - 1½ mile) and direction (degrees azimuth). Because she knew the easting and northing of the spots from which she was generating the sounds, she was able to define a polygon that encompassed both the range of distance and the azimuth  $\pm 10^\circ$ . She used a spreadsheet to calculate the eastings and northings of all of the bounding corners to these polygons, and she used a package called ShapeFile Library to generate shapefiles for every coyote response she received.

The resulting file to generate the shapefiles for the North Chagrin Reservation are in a batch file called NCBeth.bat in the NChagrin folder on the S: drive. The programs you will need to use from the ShapeFile Library are also there. First copy the NChagrin directory onto your X: drive. You should look at to see if you can figure out what NCBeth.bat does – the logic is reasonably important, and it is highly likely that you

will have the opportunity (or requirement) to do something similar in your careers. You should then execute the batch file to generate a shapefile called 'beth.shp.' It will also create a DBase file so that you can provide attribute information for each polygon, should you choose to do so.

Load the NCRClass image into a view in Imagine. It is a classified image of the northeast part of Cuyahoga County and surroundings. Then add the beth shapefile. As you can see, most of the coyotes' responses showed that they were in wooded areas of the North Chagrin Reservation, but some of them were in more developed areas of Mayfield Heights. Your job now is to characterize the habitat of the coyotes resident in the North Chagrin Reservation. The polygons created by the ShapeFile library give you an estimate of the zones in which each of the coyotes' responses are found. The classified image provides the information about the predominant land cover for each pixel in the area.

You can use zonal analysis to determine the nature of the land cover in each zone – either separately or in the aggregate. That is, what are the percentages of each of the 8 land-cover types in the classified image found in the coyote-response zone(s)? Can you do it directly from the image you have? What do you have to do in order to make the analysis? [In case there's a question, the answer to the first question is 'no,' and the easiest thing to do is to make a graphic model to decompose the land-cover image and then do the zonal analysis.]

### **Portfolio**

You should prepare the following for your portfolio:

1. A table showing the statistics for the elevation of the land, the height of trees and other objects, and the slopes of interest in the West Creek Reservation.
2. A table showing the statistics for the habitat of the areas of coyote responses in the North Chagrin Reservation. This table should show the aggregate habitat and details of at least a couple of individual response areas.