GEO/EVS 425/525 Unit 2
The ERDAS Imagine Viewer: Query and Editing

In this exercise, you will use Imagine to get information from various images. In some cases, your operations will be quite simple; others will be more complex.

Getting and Recording Simple Information

Open the image, LANIER.IMG. Go to the intersection of the airport runways. It is at 34° 16' 25" N, 83° 49' 53" W. How do you find that point? Invoke the Inquire Cursor icon (the cross on the viewer). The window that tells you the location is editable. Enter the latitude and longitude as indicated above. What happens? Now use the Measurement tool (the ruler icon on the viewer). Find the length and azimuth of the runways. Remember (from Unit 1) that to measure a line you click on the wavy line (the Measure Lengths and Angles icon) on the measurement window. Single-click the beginning of the line; double-click the end of the line. Now measure the area of the airport using the polygon icon (the Measure Perimeters and Areas icon). Now move the cursor into the measurement window and annotate the information. Type a title for the information and annotate each line (e.g. “Length of Runway 5 in Gainesville, GA”). Skip enough lines that the file is easy to read. Also, be sure your name is on it. Click on the Save icon (the floppy disk icon) to save the file. Click on the printer icon to print the file. **This printout will go into your portfolio.**

In the same viewer, open LNHYDRO.IMG and LNSOILS.IMG. Be sure to uncheck “Clear Field” in the raster options so that all three images are in the viewer. Which of the images can you see? What is their order? Click on View-Arrange Layers to verify this. Move the layers around, clicking on “Apply” after each move. What happens? Now delete LNHYDRO.IMG from the viewer, but leave the other two there. If it isn’t obvious how to do this, you do it from within the Arrange Layers window. Now select Utility-Blend from the viewer menu bar. Move the slider bar back and forth to see what happens. Click on “Auto Mode” and change the rate number to change the speed of blending. Click on OK to dismiss the Utility-Blend window. Select the Close Top Layer icon from the viewer’s menu bar to remove the soils map and return to the satellite image.

Using the Attribute Editor to Query Thematic Information

Erase the contents of your viewer. Open the soils map, LNSOILS.IMG. Select Raster-Attributes from the viewer’s menu bar. The CellArray that appears has information about each soil type in the image.

Find out what sort of soil appears at any point in the image. Click on any soil area on the image in the viewer. What happens in the CellArray? Now click on a soil area and drag the mouse while you hold down the left mouse button. What happens in the CellArray?

Now go to the CellArray and choose the Madison Sandy Loam 15-25%. You do this by going to its record (line 23) and clicking on the row number. Do you see the areas of Madison Sandy Loam 15-25% on the soils map? Click on the color patch in the Madison Sandy Loam 15-25% record with your left mouse button. Choose a prominent color from the color palette that opens. Now can you see where the Madison Sandy Loam is? Choose two more soils of interest to you, and give them different prominent colors.

Print this image. Click on the printer icon on the viewer. Choose portrait or landscape mode (whichever makes more sense for this image), and click OK. A new window opens up. Select the MagiColor 6100 as the destination printer, and then click on OK when the button appears. **This printout will go into your portfolio.**

Can you change the colors back to their original state? Click on Edit-Undo Last Edit from the Raster Attributes editor menu bar. Do all of the colors change? How do you go back to the original state? Close the Raster Attribute editor and click “no” when asked if you want to save your changes. Open the image file again (clearing the display), and reopen the Raster Attribute editor. Is the file as it was originally?

Now you want to find the areas of the various soils. From the menu bar of the Raster Attribute editor, select Edit-Add Area Column. Note that you can add any number of columns, but "area" is a special column that, when you add it, will be filled automatically. Note also that you can choose the units in which area will be measured.

Imagine that you are interested in knowing the names and distribution of the significant sandy soils in this area. You can query the image and find this. Put your mouse cursor in the "row" column and press the right mouse button. This accesses the so-called "hidden functions." Select Criteria. The Criteria window opens. *When entering criteria statements, you should use the mouse* ***only*** *if you can. Do not type from the keyboard unless you absolutely have to.* Set up the following criteria statement:

$"Class_Names" contains sandy and $"Area" > 300

Note that you will have to type the word "sandy," but this word is the only thing you should type. Hit Select to view the results in the CellArray. Several rows should be highlighted in yellow. To see these on the image, click on the color patch of any highlighted row and choose a prominent color. What happens in the image?

Now let's take a look at the soils that *don't* fit the criteria. Again access the hidden functions. The Criteria selection has identified the soils that *do* fit the criteria; to select those that don't, select "Invert Selection" from the hidden functions. Again, several rows should be highlighted in color, including all of those that weren't highlighted the first time. We could click on the color patch for one of the newly highlighted soils and choose a color. But let's do something else. You should click on the color patch in one of the newly highlighted soils, but choose "Other" instead of a color. A color wheel pops up. You can make a color from this wheel, or you can change the opacity. Deselect the "Use Color" checkbox (i.e. you will not be changing the color from its original level), and Select the "Use Opacity" checkbox. Then drag the slider bar to a very small number to make the selected soils nearly (or, if you drag it all the way to 0, completely) transparent. Save this file on your X: drive. You will need it again.

To see what you have done, open up LANIER.IMG in the same viewer (remember, don't Clear Display), and use Arrange Layers to put the soils layer on top. What do you see? Now save the image as you have it in the viewer as a VUE file. From the viewer's menu bar, select File-Save-View. Give the image a suitable name, and click OK.

Using More Complex Query Capability

Imagine that you wish to find areas suitable for a new housing development. "Suitable" in this context might mean many things. For this exercise, it implies that the parcel to be chosen has [1] sufficient size, [2] suitable current land use, and [3] more or less compact in shape (as opposed to long and narrow). Let us assume that criterion [1] requires a minimum size of 3 hectares, criterion [2] requires that current land use be forest, and criterion [3] requires a minimum value of a suitable measure of circularity.

In the viewer, open GERMCLASS.IMG. This is a land use image from the general area of Germantown, Maryland. Using the Raster Attribute editor, ascertain the significance of each class in the image. How are the various classes distributed? Look especially at forests. Where are they? How big are they? Try adding an Area column to the CellArray in the Raster Attribute editor. Does this give you answers?

What do you have to do in order to turn GERMCLASS.IMG into an information base that will enable you to find tracts that meet criterion [1]? From the main Imagine Control Panel, click on "Interpreter", then choose "GIS Analysis-Clump." The Clump dialog box appears. The clump operation will create a series of clumps from contiguous zones of pixels with the same attribute (i.e. land use) value, and it will give each clump a unique identifier. The input file for the clumping operation is GERMCLASS.IMG. Give your output file a suitable name. Check "Ignore Zeros in output statistics." You now need to specify 4 or 8 as the option for "Connected Neighbors." This is significant. Imagine a pixel surrounded by its neighbors. There are 9 in all, so that if *all* neighbors are included, each pixel will have 8 connected neighbors. Pixels will be included in the same clump if they have the same attribute value and are located adjacent to the reference pixel in *any* of the 8 directions (both orthogonal and diagonal) around it. This may result in clumps whose pixels are connected very tenuously to each other. We often do not wish to include diagonal connections. If the diagonal connections are ignored, each pixel has only the 4 orthogonal connected neighbors. The choice is the user's, and it must depend on the nature of the analysis being carried out. In the present example, where compactness of the clump is important, it is more meaningful to consider only clumps that are built up only of orthogonal connections. Therefore, you should choose 4 as the "connected neighbors" option. Click OK. Now Click on Interpreter-GIS Analysis-Perimeter and run it on the image you have just created. Select Island Perimeter and Island Count checkboxes. This module will calculate both the perimeter of each clump produced in the clumping routine and the number and perimeter of each island included in each clump and add these values to the Raster Attribute table.

Open a *second* viewer (or a second window in the GLT viewer) and open the file you created with the clumping operation in it. Then open the Raster Attribute editor and stretch it wide enough that you can see all of the attributes. Add a column for the area of each clump. Use the default unit of Hectares. Click OK. You can, if you choose to, determine at this time which of the clumps are sufficiently large (i.e. > 3 ha), but let's do the more fun stuff first.

Let's calculate the index of circularity for each clump. From the Raster Attribute Editor Tool Bar, select the Column Properties icon (it looks like a Greek column). Select the "New" button. Insert "Circularity" as the title for the new column, and change its Type to "Real." Remember that numbers can be integers or real numbers (i.e. numbers with decimal points), and you typically have to specify which sort of numbers you are using in computer programs, since computers store integers and real numbers differently.

Within the "Formula" section, select the "More" button. Enter the following circularity formula, which uses existing attributes to generate a new attribute of polygon circularity. Since *all* of the attributes currently exist in the raster, ***do not*** use the keyboard to write the formula. *Enter the entire formula using the mouse.*

(4*pi*$"Area"*10000)/($"Perimeter,exterior" * $"Perimeter,exterior)

This formula will generate numbers which range from 1 (for a perfect circle) to 0 (for a line). When the formula is complete, click on OK in the formula dialog box, then click on the "Apply on OK" radio button within the Formula section, and click on OK within the Column Properties dialog. The formula will be applied to all of the clumps in the image. It make a couple of seconds, since there are almost 14,000 clumps. But the circularity index will soon appear as an attribute. Save the edits within the Raster Attribute Editor.

Remember that you could have determined which clumps were large enough for the housing development before calculating the circularity index, but we decided not to do it. The reason is that we can use a single criteria statement to determine both sufficient size and circularity. Access the hidden functions from the Row column and select Criteria. Again using the mouse (rather than the keyboard), create the following criteria statement.

$"Area" >= 3 and $"Circularity" >= 0.45

This will extract all clumps whose area is greater than or equal to 3 ha and whose circularity index is greater than or equal to 0.45. Change the color of each selected clump to a prominent color, invert the selection, and change the opacity of the non-selected clumps to 0.

The result of these operations is to find all areas that meet criteria [1] and [3]. Let's see how these relate to the original image. You should currently have two open viewers, one with your clumped image highlighting the clumps which meet the two criteria and the original viewer containing GERMCLASS.IMG. Click on View-Link/Unlink Viewers on the menu bar of one of the viewers and choose "Geographic" as the basis of the linkage. A window opens inviting you to click on a viewer to link it. Click anywhere on the other viewer. The two viewers are now linked. To see what this means, click on the Inquire Cursor icon in either viewer, and the inquire cursor opens for both. As you move the crosshair around either of the images, it moves simultaneously in the second. Move the crosshair to each of the selected clumps (in your clump image). What is the current land use (from GERMCLASS.IMG) for that clump? Open the Raster Attribute editor for GERMCLASS.IMG. What is the index value for forested land?

Do you have information as to the current land use? Look again at the Raster Attribute editor for your clumped image. Is there a column that preserves the land use information present in GERMCLASS.IMG?

There is. It is “Original Value.” To find the tracts that meet all three criteria, revise the criteria statement above as follows:

$”Area” >= 3 and $”Circularity” >= 0.45 and $”Original Value” == 3

There is another, better way to do it. Select Interpreter-Utilities-Mask from the main Imagine Control Panel. The Mask window opens. For the Input File, choose GERMCLASS.IMG. Choose your clumped file for the input mask. Choose a suitable name for the output mask. Click the “Ignore Zeros in Stats” checkbox. When all this is done, click the “Setup Recode” button under the Input Mask File section. The window that opens should contain all of the attribute columns you placed in the input mask file. The next step is to create a criteria statement to select the optimum polygons. From the “Values” column, access the hidden functions (just as you did earlier in the “Row” column in the Raster Attribute editor), and select Criteria. Insert the following criteria statement:

$”Area” >= 3 and $”Circularity” >= 0.45 and $”Original Value” == 3

Again, the “original value” is set to 3, because that is the value that corresponds to forests. Click “Select” within the Selection Criteria dialog. Your selections are highlighted in the Thematic Recode dialog. Now close the Selection Criteria dialog. Within the Thematic Recode dialog box see that the New Value is 1, and click “Change Selected Rows.” The values of the desired polygons will change. Again access hidden functions from the “Values” column and choose “Invert Selection.” Change the New Value to 0 and click “Change Selected Rows.” These are the polygons not suitable for development as housing. Click OK. Click OK in the Mask dialog box.

Open GERMTN.IMG in a viewer. This is a satellite image of the Germantown, Maryland area. Open the mask file as an overlay to GERMTN.IMG. You do this by opening the second raster in the viewer, unchecking the “Clear Display” checkbox. The tracts suitable for development are highlighted in a color overlay. To see this more dramatically, select Utility-Flicker from the viewer’s menu bar.

Questions to Consider

Why is LNSOILS.IMG displayed in one layer while LANIER.IMG is displayed in three layers?

What sorts of images automatically display in pseudo color? In gray scale? In true color?

Where in the Raster Attributes Editor can you find hidden functions? Is the “Row” column the only place?

How would the results of your criteria selection of soils would change if you replaced “and” with “or” in the criteria statement?

Can you figure out a way to create a “Percentage” column that will tell you what percentage of the image contains Louisburg Sandy Loam?

What are the units of the Perimeter Values calculated by the GIS Analysis-Perimeter routine?

Looking at your clump scene as a whole, what would be your selection as the best plots for housing development without carrying out the Mask step?

How many different class values does a mask image have?

How could you have produced a mask layer that preserved both forest and agricultural areas as individual pixel values?

Portfolio

The only things you will print in hard copy in this unit are the table and the image of the Madison Sandy Loam. Be sure to save the files you generate in this exercise, however, since you will print most of them in next week’s unit.