GEO/EVS 423 / EVS 523
Exercise 6: Automating Geoprocessing with ModelBuilder

It is one thing to be able to carry out a geoprocessing operation as a one-off. Sometimes, however, you need to do complex and/or multi-step operations on several inputs, or things for which it makes sense to automate the process using a model. ArcGIS contains a useful model builder that you can use for most, but not all, of the operations you might be interested in doing.

To open the model builder window, click on the icon that looks like some dots connected by lines; it should be the right-most icon on the main icon bar. To load a *layer* into the ModelBuilder window, you drag it from the catalog. To load a *tool* into the ModelBuilder window, you drag it from the toolbox.

In this exercise, we will use ModelBuilder to replicate two of the operations you have already done, one using vector layers, the other using raster.

The first task one might be interested in doing is to determine the acreage of each of several land-cover types in each of several watersheds in northeast Ohio. The second will be to take a classified satellite image and allocate the clusters generated in the classification to explicit land-cover types.

Acreage of Land Cover Classes

For the first part of this exercise, make the NorthEastOhio.gdb geodatabase your default geodatabase. Open the toolbox, the ModelBuilder window, and the catalog. Drag the northeast Ohio watersheds and the land-cover layers into the ModelBuilder window (you do remember which these are, don't you?). Your first step is to dissolve the boundaries between all of the subwatersheds contained in the watershed layer. When you did this in exercise 2, you clicked on the "geoprocessing" link on the menu bar. Now you have to do it using the toolkit. It is in Data Management -> Generalization. Drag the tool onto the ModelBuilder window to the right of the watershed layer. You will see that the tool object is loaded into the window along with an output object. Connect the watershed layer to the tool using the "connect" icon on the ModelBuilder window's icon bar (it's the third from the right, and looks like two squares connected by a line). Identify the layer as an Input Feature. Double-click on the tool object and choose HYUN as the dissolve icon. Remember that when you did this before, you chose to add the object ID as a statistics field and to count the objects dissolved. Do this as well. When you click OK, both the tool object and the output object should change color. This means that they have been completely defined. You can change the name of the output object if you wish.

The next step is to intersect the dissolved watershed layer with the land-cover layer. Drag the Intersect tool onto the ModelBuilder window (it's in Analysis Tools -> Overlay), and connect both the dissolved watershed layer and the LULC layer to the tool object, identifying both as input features. Double-click on the tool object, and complete the dialog box. The resulting output object is the intersected polygon.

In exercise 2, you then created a separate layer for the Cuyahoga and Grand Rivers. You can do that here too. Drag two "Select" tools onto the ModelBuilder window (they're in Analysis Tools -> Extract). For each, double-click on the tool object, and complete the dialog box. The first two fields should be filled in for you, although you may wish to change the name of the output layer to something more expressive. To choose an expression, right-click on the SQL icon to the right of the third field, and choose "HYUN" and "=" . Click the Get Unique Values button and choose 04110002 for the Cuyahoga and 04110004 for the Grand.

You are now ready to find the area within each watershed devoted to each land-cover type. In exercise 2, you right-clicked on the individual-watershed layer and chose "Summarize." You can't do that here, since you haven't generated the individual-watershed layers yet. Drag two Summary Statistics tools onto the ModelBuilder window (they're in Analysis Tools -> Statistics), and double-click on the tool objects to open the dialog. Bear in mind that you want the *sum* of all of the *areas* within each *grid-code* for the watersheds. The syntax for doing this is a bit convoluted, but makes sense when you think about it. Your "Statistics Field" is Shape_Area, and the "Statistic Type" is Sum (i.e, you want the sum of each appropriate shape_area). The "Case Field" is grid_code (i.e. you want the sum of each shape_area for each instance, or case, of grid_code).

You are now ready to run the model. Click on the check icon to validate it. If there's a syntax problem, you will be notified. Then check the run icon (the right-most icon; it looks like a triangle pointing to the right). As each tool is being evaluated, it will turn red. When it has run completely, you will be able to look at the various outputs. They won't be added to automatically to the layout, but they will have been added to the geodatabase – assuming you designated it your default geodatabase. Verify that the model has performed as you expect it to.

Classifying a Satellite Image

The second task will be to classify a satellite image and evaluate the resulting clusters. You will actually have to do this in two successive operations, as you can't evaluate the clusters until you've generated them, and you can't automate the evaluation totally.

Open a new ModelBuilder window, and drag the shakerheights.img raster file onto it. Then drag an Iso Cluster workflow tool on it as well, and connect the raster to the tool object. Notice that this tool has two outputs by default, a raster called "isocluster" and a signature file. Double-click on the tool object to open the dialog, and complete the dialog. You will have to add the number of clusters you want to produce. If you choose not to add a signature file, the tool and the output raster will change color when you click OK. If you do choose to add a signature file, you will get an error message. This error is occasioned by the fact that you tried to store the signature file *in* the geodatabase. Erase the name of the geodatabase in the output signature file path name, and it will work fine. Run this model. It will create the clusters (and the signature file if you so indicated).

Allocating the Clusters to Land-Cover Classes

The first step in this part of the exercise is to figure out which land-cover class each cluster belongs to. You may be able to use the dataset you created in exercise 5, but you should check. Iso Cluster sometimes leads to strange results.

Once you've decided what the allocation should be, you have two choices. You can use conditional logic as you did in exercise 5, or you can use reclassify logic. We will try both. To make the logic easier, continue with the same model you used to classify the image. Drag a Con tool (it's in Spatial Analyst -> Conditional) onto the ModelBuilder window for each land-cover class you wish to consider, and also drag a Reclassify tool (it's in Spatial Analyst -> Reclass). Connect the classified image to each of these tool objects, and identify the input as an input conditional raster (for the Con tool objects) or input raster (for the Reclassify tool object). Double-click each tool object, and complete the dialog as appropriate for the tool in question. The output of the Reclassify object will be a complete allocation from clusters to land-cover classes. The outputs from the Con objects will be layers showing the distribution of each individual land-cover class.

Now drag a Raster Calculator tool on to the ModelBuilder window (it's in Spatial Analyst -> Map Algebra) and double-click on the tool object. If you try to connect the individual-land-cover layers to the raster calculator tool, you won't be able to do it; you have to double-click on the tool object to make the connections. In the appropriate field, set up the algorithm to add the values of the individual-land-cover layers.

Run the model. This will result in two layers, one produced by the reclassification; the other produced by the conditional layer-formation followed by layer addition. They should be identical.

Portfolio

6-1 The land-cover-class map you created in the first part of the exercise

6-2 A screen-shot (use PMView to get this) of the model you used to generate this map.

6-3 The classified satellite image you created in the second part of this exercise

6-4 A screen-shot (use PMView to get this) of the model you used to generate this map.