

# *SURFACE WATER MODELING SYSTEM*

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## ***GIS***

GIS data can be useful for building models with SMS. This is particularly true for land use or other data that would be time consuming to digitize by hand. GIS data can also be viewed in the background of your SMS data.

This tutorial demonstrates how you can read in GIS data, visualize it, and convert it into SMS coverage data that could be used to build a numeric model. We will read in water related land use information acquired from Utah's GIS Portal, found online. However, the concepts can be useful to work with any GIS data in SMS.

SMS contains two implementations for working with GIS data:

1. Generic SMS implementation – Reads ArcGIS shapefiles as well as MapInfo mif/mid formats. Includes tools for selecting, viewing table data, and converting data to coverages and scattersets.
2. ArcGIS Implementation (ArcObjects) – Uses ESRI code to read in, manage, and display GIS data. To use ArcObjects you must have a license of ArcGIS on your computer. ArcObjects implementation has more options for displaying ArcGIS data (it uses the same layer settings functionalities that exist in ArcGIS).

This tutorial can be done with the generic SMS implementation or the ArcObjects implementation but there will be some differences pointed out along the way.

By default SMS starts up in the generic implementation. To switch to the ArcObjects implementation (optional):

1. Switch to the GIS module.
2. Choose Data | Enable Arc Objects from the menu.

## **1 Opening an Existing GIS Data File and Viewing Attributes**

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We will begin by opening the shape file both in generic SMS implemented mode and the ArcGIS supported mode. We will also view the general attributes assigned to each shape using

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both methods. Note that each method is different. In order to view the shape file in ArcGIS mode, you will need to go to the GIS module and choose *Data | Enable Arc Objects* and jump to section 1.2. If you are using the generic SMS implementation then proceed to section 1.1.

## 1.1 Generic Method

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1. Select *File / Open*. Find the file *SGID\_U024\_WaterRelatedLanduse.shp* in the data files folder for this tutorial. Select *Open*. \*There are two of files with this name. One is a shape file, and the other is an XML Document. The Shape file is the one that should be read in.
2. Click the GIS *Get Attributes* tool. Select inside the lake polygon located in the middle of the display.
3. The *Info* dialog should appear showing the attributes for the lake including a description of the land use, the land cover designation, the year the GIS data was acquired, the total polygonal area in acres, and its length in feet.
4. Close the *Info* dialog.
5. Select *Data | Attribute Table* from the menu. Click *OK* to use the *SGID\_U024\_WaterRelatedLanduse.shp* file to compile the attributes table.
6. The *Attributes* dialog should show the same information as the *Info* dialog, but with information listed for each and every polygon in the domain of the shapefile. Note the total number of records as found in the bottom-left corner of the dialog.
7. Click *OK* to close the *Attributes* dialog.

## 1.2 ArcGIS Mode

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### Viewing Attributes

1. Select *File / Open*. Find the file *SGID\_U024\_WaterRelatedLanduse.shp* in the data files folder for this tutorial. Select *Open*.
2. Select *Data | Attribute Table* from the menu. Click *OK* to use the *SGID\_U024\_WaterRelatedLanduse.shp* file to compile the attributes table.
3. The *Attributes* shows the data for each polygon in the domain of the shapefile. Note the total number of records as found in the bottom-left corner of the dialog.
4. Close the *Attributes* dialog.

### Layer Properties

1. Right click on the 'SGID\_U024\_WaterRelatedLanduse' GIS layer and select *Properties* from the menu. This brings up the layer properties dialog found within the ArcGIS software.
2. Select the *Symbology* tab and choose Unique values under categories.

3. Select LANDCOV in the value field.
4. Click on the *Add All Values* button and notice how each section is assigned a heading, I.D and color.
5. Click OK in the Layer Properties dialog and zoom into the city located north-east of the lake. Your screen should look similar to Figure 1.

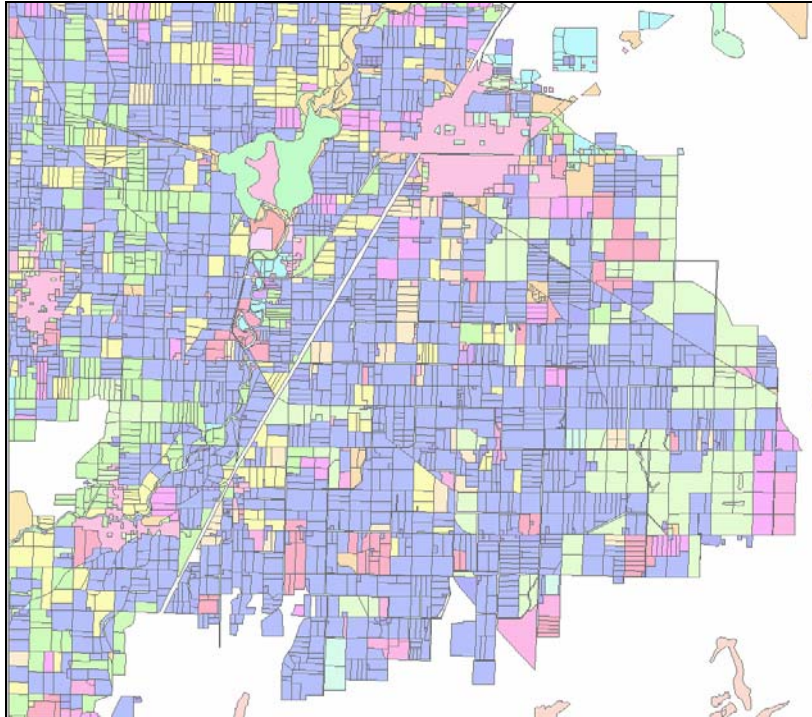


Figure 1 GIS shape file showing Land cover layer.

## 2 Mapping the Shape File to an Active Coverage

In order to incorporate data into models, the GIS data needs to be converted into native SMS data. Generally, GIS data is converted into Map coverages which are similar to GIS layers.

Data converted from GIS layers into Map coverages are put into the active coverage. Therefore, it is important that you create the type of coverage you want and make it active before the conversion process.

We will convert the landuse data into an area property coverage with designated materials. These steps are the same for the Generic and ArcObject implementations.

1. Right-click on the default coverage and select *Rename*.
2. Rename the coverage “Landuse”.
3. Right-click on the “Landuse” coverage and make sure that the type is “Generic->Area Property.”

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4. In the GIS module and with the Landuse coverage active, select *Mapping | Shapes -> Feature Objects* (or *Mapping | ArcObjects -> Feature Objects* if using the ArcObject implementation). Click *Yes* to use all the shapes in the visible shapefiles for mapping.

\*\*\*Note: If you have selected any number of shapes in the shapefile, SMS will not prompt you to use all shapes in visible shapefiles. Instead, it will only convert those selected shapes into feature objects. This is useful if you only plan on using a few selected shapes from a large shapefile.

5. Click *Next* to bring up the *GIS Feature Objects Wizard* table. In the *Description* column select *Material* from the *Mapping* drop-down box. SMS will assign the polygon description to each polygon mapped to the active coverage.
6. Click *Next* then *Finish*.
7. Turn off the GIS coverage by clicking the checkbox next to it.

### 3 Map Module Display Options

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The landuse data has now been copied to an area property coverage in SMS. Area property coverages can be used to define materials for numeric models. Each polygon is assigned a material based upon the description column that was mapped early.

We will change the visualization settings so we can see the landuse information in the SMS map module.

1. Open the *Display Options* dialog by selecting *Display | Display Options*.
2. Select *Map* in the tree menu to the left of the dialog.
3. Deselect *Arc* and *Node* and select the *Polygon: Fill* option. Also turn on the *Legend*. Click OK.
4. Zoom into the city located north-east of the lake. This area is farmland and residential as can be seen by observing the color of the polygon and matching it to the legend. Most fields are used for Alfalfa according to the color associated with it. The display should look similar to Figure 2.

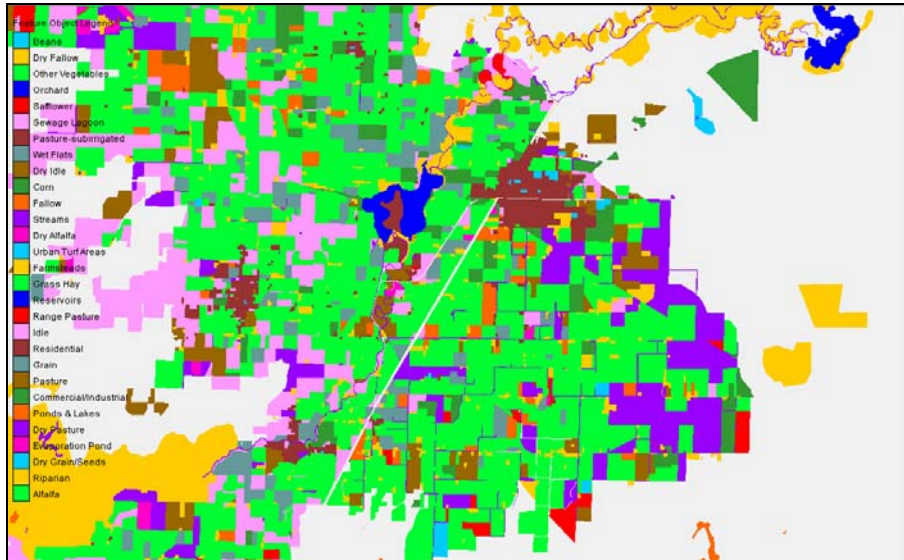


Figure 2 Display of the land use coverage

## 4 Downloading Aerial Photo

Sometimes it is useful to download an aerial photo in order to supplement the display and for better observations. The “Import from Web” tutorial gives instructions for one method for finding image data online. SMS can also grab image data from Terraserver for a specific geographic area. To grab an image from Terraserver for this area:

1. Return to *Display Options* and turn off the *Polygon: Fill* and turn on the *Arc* options. Turn off the *Vertex* options. Click OK. This will make the display a little easier to read.
2. Click on the *Get Data* tool and select a region within the city. Zoom in until you can distinguish the individual parcels of land clearly. Be sure to select a region by clicking the area and then dragging out a box around it.
3. In the *Data Service Options* dialog, select “TerraServer aerial photo.” Click OK. In the Save As box, name the file “aerial” and click OK.
4. Choose to generate the photo with tiles of the recommended size and click OK. The photo will take a moment to update and display. If you in the generic SMS implementation mode, the image should look similar to Figure 3.

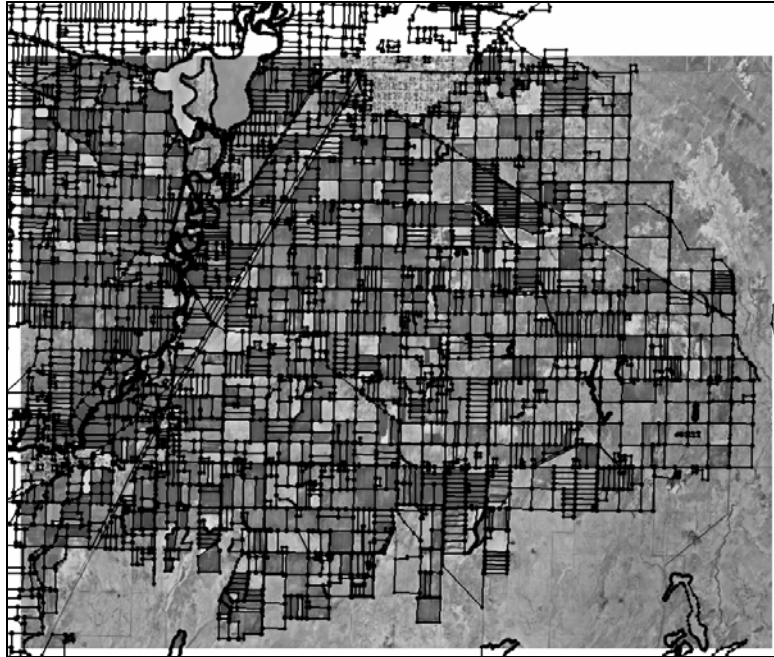


Figure 3 Viewing the aerial photo

5. If you desire, go to *Display Options* and turn off the *Arcs* display.

If you are using the ArcGIS mode, the previous steps should be the same. The following figure shows the aerial photo when viewed with GIS Layers properties showing.

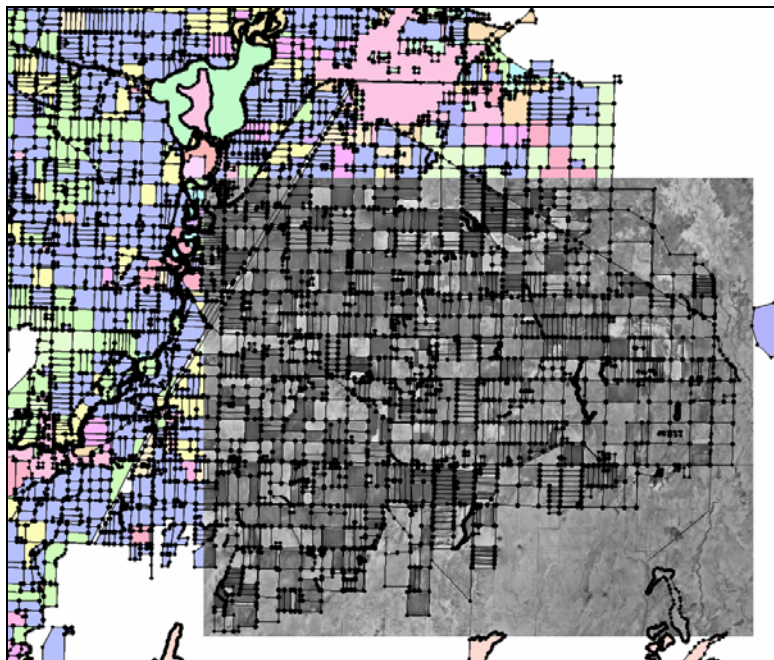


Figure 4 Viewing aerial photo with GIS Layer properties in background.

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## 5 Conclusion

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This concludes the *GIS* tutorial. You may continue to experiment with shapefiles in SMS by downloading other pertinent GIS data from websites.

Our wiki (<http://xmswiki.com/xms/GSDA:GSDA>) has a page that includes some ideas for places you may be able to acquire useful GIS and other spatial data.