

Michigan Technological University
School of Forest Resources and Environmental Science
FW3540

Introduction to Geographic Information Systems and Remote Sensing for
Natural Resource Management
Spring Semester 2009

Laboratory Exercise 4: Delineation of Land Cover Types, Part I

Getting Started

This week's lab will introduce cover type mapping and give you a chance to practice digitizing (outlining) land use/cover polygons from remotely sensed images and developing a land use/cover map. You will be delineating land use/cover boundaries that define different land use/cover classes based on the MRLC classification scheme for the Indiantown quadrangle. An outline of the scheme is available at: http://www.mrlc.gov/nlcd_definitions.php. The document is also available on the class website. It is suggested you print it.

Make a "lab4cover" directory in your H: drive and copy the contents of p:\fw3540\lab4 to your lab4cover folder. Use ArcCatalog and copy the orthophotoquads and the MRLC land use/cover map. The images are color digital orthophotograph quadrangle (DOQQ) maps and will serve as your information base. There are 4 photo quads for each 7.5 minute quadrangle. They are designated with SW, NW, NE, and SE. You will also need to access the DLG thematic layers which you worked with in Lab 2.

Orthophoto Quads

The orthophotoquads were downloaded from the Michigan Center for Geographic Information. This is the site for the state's GIS system (<http://www.michigan.gov/cgi/>). Go to the site and click on "The Michigan Geographic Data Library. In the next window, click "geographic extent", next click "county", followed by clicking on "Alger". You will now see a listing of all the currently available data for Alger County. Note the listing of the 2005 Digital Orthophoto Quads. As you can see, there are several orthophotos sets available.

Base Map Features and National Wetlands Inventory

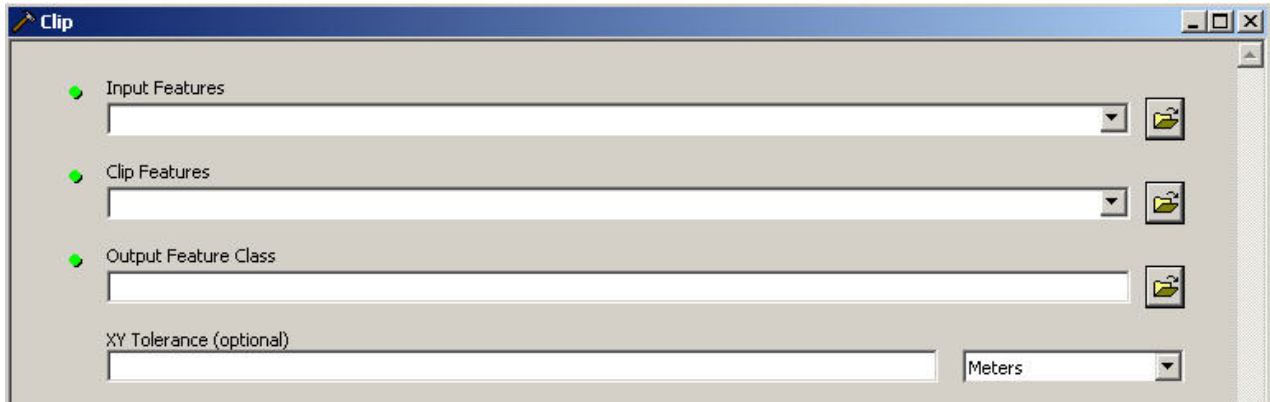
Base Map Features for Alger Co. are located under the listing directly below the Aerial Imagery listing and are called the **MI Geographic Framework Base**. Download this file to your lab 4 folder, decompress and display in ArcMap. Next download the **National Wetlands Inventory (NWI)** file, found under the Hydrography listing using the shapefile format, decompress and display in ArcMap. Refer to lab handouts 1 and 2 for downloading guidance if needed.

What error message appears when you display the NWI wetlands for Alger? _____

How will you correct this problem (refer to lab handout 1 for guidance)?

When the framework thematic layers and the NWI file are displayed, spatial coverage is for the entire country. You only need the data for the Indiantown Quadrangle.

The data can be subset to a specific area by using the **Clip** command found in the **Arc Toolbox** under **Analysis Tools/Extract**. See illustration of the command window below

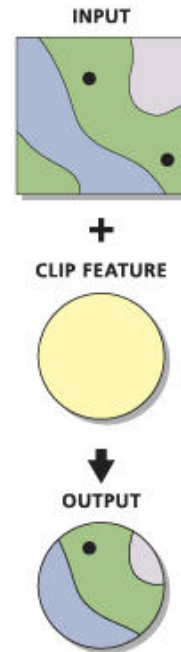


The Clip command is essentially a “cookie cutter”. See illustration to the left. It subsets a specific geographic area from a larger area file. In this case we only want the data for the Indian Town quad, not all of Alger Co.

Clip

Extracts input features that overlay the clip features.

What layer would you use for the clip feature (i.e. the cookie cutter)? Hint: it is a DLG layer and fairly simplistic in its data content. _____



What coordinate system is the DLG data projected to? _____

Is this the same coordinate system as the information you downloaded from the Michigan Geographic Library? _____

Review on-the-fly projection in chapter 2 of your text. Based on Chang’s discussion, what should you do with the DLG data before using the Clip function? _____

DO IT!

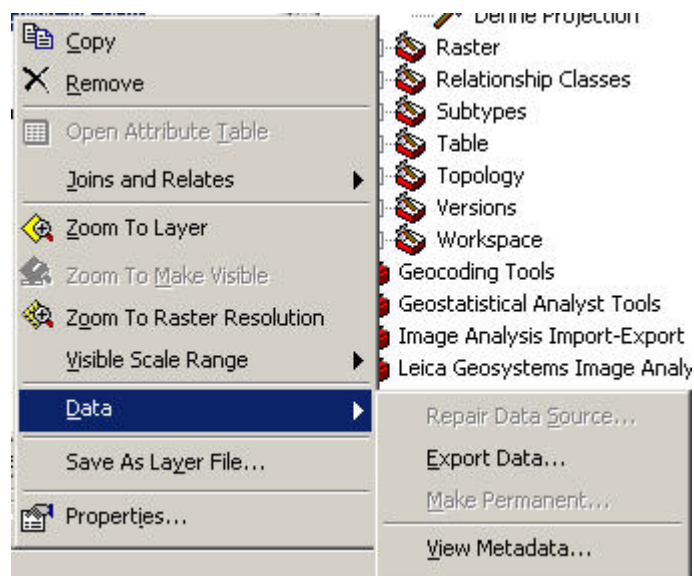
Use the Clip function to subset all of the framework thematic layers and the NWI thematic layer. You will be working with these in next week’s lab.

Converting the Orthophotos to Image (.img) Files

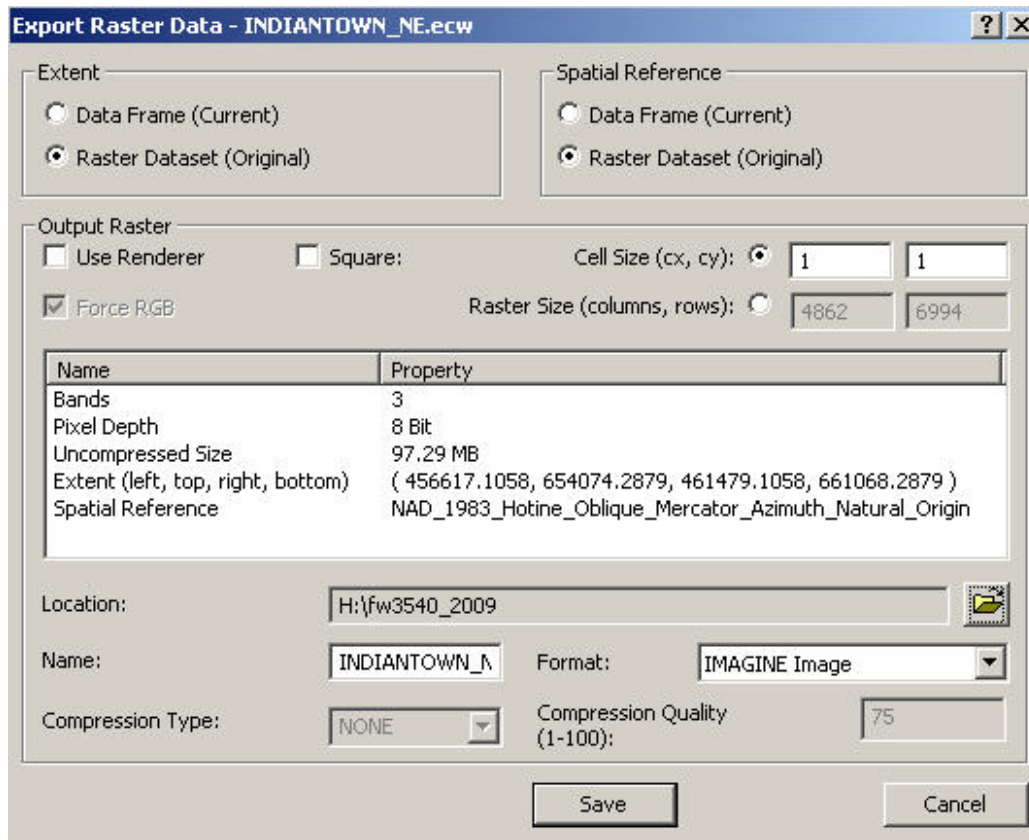
Display the orthophotos in ArcMap. What does the .ecw extension stand for? _____

If you are not familiar with this extension, click on **Help** in the main menu bar of ArcMap and choose **ArcGIS Desktop Help**. Under the **Index** tab type in ecw. Choose description of ecw format and click the **Display** button. It is very important to note that this format is a Read-Only format which severely limits what can be done with the file.

Therefore, convert the 4 orthophotos to .img (Image files). Right click on the file name in the Table of Contents for the dropdown menu. Chose **Data, Export Data** (see below).

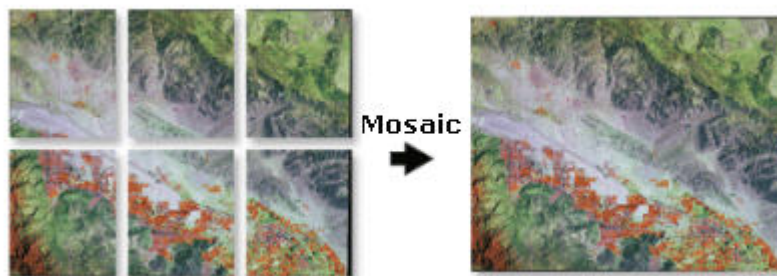


The **Export Raster Data** window will open (see illustration on next page). By default an image (.img) file format is chosen. Export the 4 orthophotos and be sure to place the .img files in your lab 4 folder. You can now delete the .ecw files from your H: drive and the Table of Contents in ArcMap. They will remain on the P: drive should you need to access them in the future.



Mosaic the Orthophotos

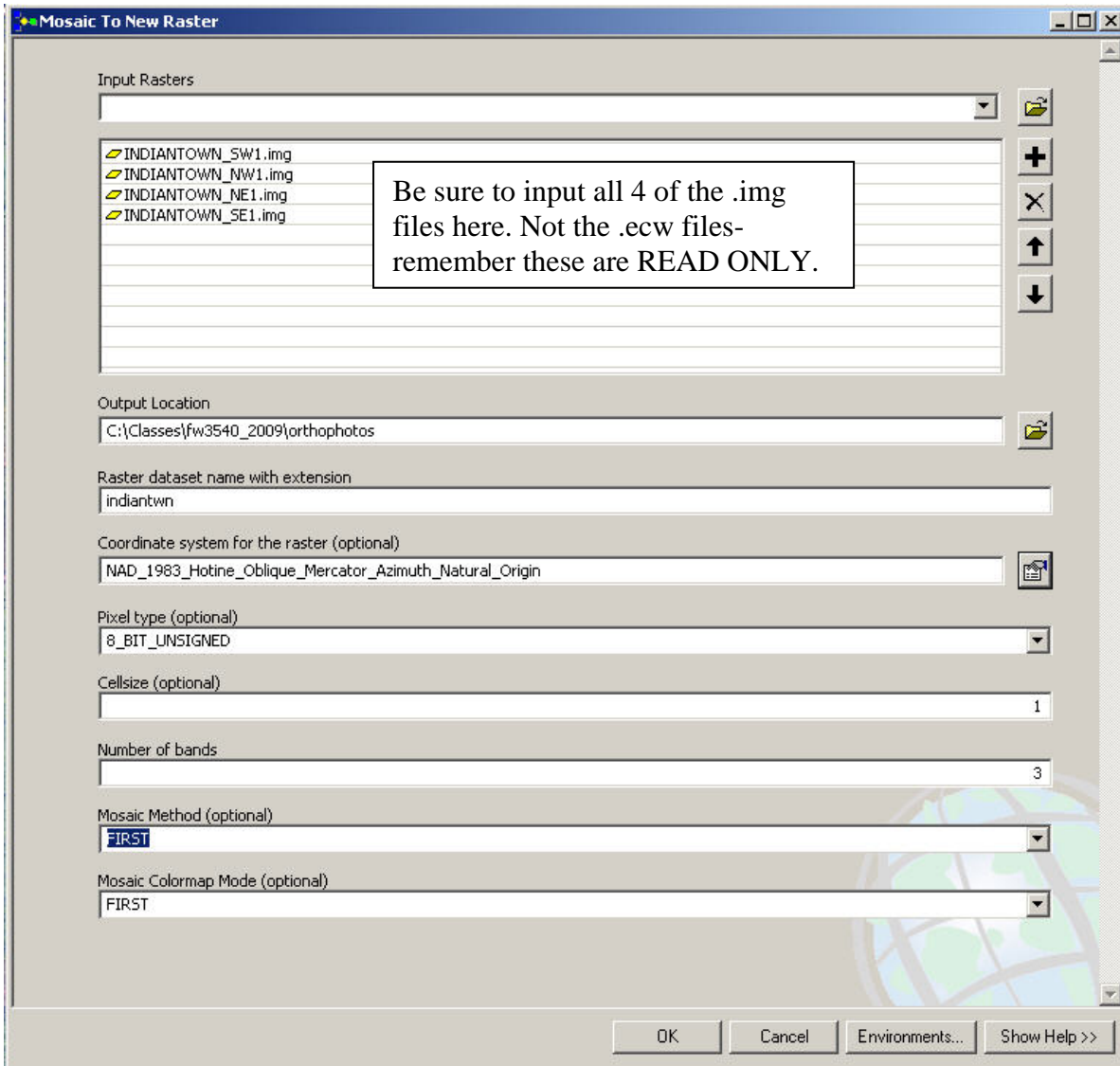
Mosaicking allows you to take two or more raster datasets and combine them into a single, seamless raster dataset. The illustration below shows how six adjacent raster datasets are mosaicked together into one raster dataset.



The input raster datasets are all the raster datasets you would like to mosaic together. The inputs must have the same number of bands; otherwise, the program will not run.

Mosaic the 4 orthophotos into one composite. This will allow you to work with just one orthophoto file instead of 4, and make digitizing much easier. In **Arc Toolbox**, click **Data Management Tools\ Raster\ Mosaic to New Raster**. See the illustration on the next page. **BE CAREFUL- DO NOT USE THE MOSAIC TOOL- IT DOESN'T WORK!**

Inputs into the **Mosaic to New Raster** program. Cellsize = 1 (this translates to 1 meter spatial resolution; Number of bands = 3; Mosaic method = FIRST and Mosaic Colormap Mode = FIRST.



The mosaic function will take a little time to run, so be patient. Once the program is completed display the image in ArcMap to be sure you like the output. Then delete the individual .img orthophotos from your lab 4 folder to save hard disk space.


Create a New Empty Shapefile

Create a new empty shapefile which will become your land use/cover thematic layer. Open ArcCatalog, and **right-click on your lab4cover folder > New > Shapefile**. This window allows you to set up the parameters for a shapefile, including layer name, shape type and coordinate system information.

- Name the file: IN_landcover
- Feature Type: Polygon
- Go to Edit: Select Coordinate System > Import> Choose one of the files from your lab 1 folder. This will import the needed parameters for the Michigan GeoRef projected coordinate system.

Begin Digitizing in ArcMap

There should be a new shapefile created in your lab 4 folder. The actual digitizing takes place in ArcMap, so add IN_landcover to ArcMap and minimize ArcCatalog.

Before you can start digitizing the different land features visible on the orthophoto you need to add the Editor toolbar to ArcMap and open the shapefile for editing. To add the editor toolbar, click **View > Toolbars > Editor** or select the Editor button . To start the edit session, click the **Editor** button and on the drop-down menu select **Start Editing**.

A Primer on Editing

Once you have a thematic layer in edit mode, several items will become active on the editor toolbar:



Under the editor menu you may start and stop editing, save edits, set snapping options, and set other editing options, including Snapping tolerance (under the General tab).

The **edit tool** is used to change the geometry (shape) of *existing features*. Use it to select existing features, add vertices to lines and polygons, remove vertices, or move vertices. Clicking once selects features; double-clicking selects features and shown the vertices (points) that define the feature.

The **sketch tool** is used to add new features to a layer. You sketch a preview of the feature before it is added to the layer. Tools are available for drawing curves and for constraining distances and directions (useful for drawing land parcels).

The **edit task menu** is where you select the desired operation (add features, cut features, auto-complete polygon).

The **target layer list** is where you select the layer you are editing. ArcMap supports the editing of several layers at once, so *it is important to check this setting to verify you are editing the correct layer*.

The **attributes** button opens a window where you can view or edit the attributes of the feature you are editing. This is a quick way to add attributes to each polygon after you draw it.

The **sketch properties** button opens a window where you can view properties of the feature you are adding - it lists the number and location of vertices.

NOTE: It takes time and practice to get comfortable working with the Editor. The more you work it the easier it becomes.

Add Attribute Fields to IN_LandCover Shapefile

The IN_LandCover shapefile has only 3 fields in the attribute table (FID, Shape and ID). Additional fields are needed to store the land use/cover number and its associated description. . Open the attribute table for IN_LandCover. Click **Options/Add Field** and create a short integer field named **Code**. Repeat and add a text field named **Descrip**.

Begin Digitizing Land Use/Cover Polygons


Display the following thematic layers and imagery: the mosaiced orthophotos, the MRLC layer set at 60% transparency (you may want to edit the legend to appropriate colors for the land use/cover classes), the DLG hydrography polygons and the DLG hydrography arcs (this will provide information on streams (arcs) and lakes, plus major wetlands (polygons) and the IN_LandCover shapefile.

To start digitizing land use/cover features, ensure that the **Create New Feature** is selected under **Task** on the Editor Menu and **IN_LandCover** is selected under **Target**.

Select **Snapping** from the **Editor** menu and enable snapping for vertex, edge and end. Enabling snapping will help keep the line work clean and gap-free. Snapping allows drawn features to connect to the nearest existing features already in the shapefile. You should also select the checkboxes to the left of **Edit Sketch** and **Topology Elements**. Be sure to turn OFF **Perpendicular to sketch**. Close the snapping window. The snapping tolerance can be set in the **Options** window of the **Editor Menu**. You may need to change this as you work, depending on the feature you are delineating.

Select the **Sketch** tool and begin drawing polygons around obvious features as follows: click once at each location you want to place a vertex, which defines the boundary of your feature. When you are finished drawing points, you may hit F2, double-click the last vertex or right-click and choose **Finish Sketch**. A new polygon will be added to your land use/cover thematic layer.

ArcMap allows you to “pause” while you are creating features if you need to change your view. You may select tools to zoom in, out, or pan while editing, so do not draw all your features while zoomed to the extent of the photograph. You can resume editing by selecting the sketch tool again. *This lab will be graded on correct identification of features, lack of gaps in your polygons, and detail, so you should correctly and carefully delineate as many features as possible.*

You may want to open the Attributes window  and jot a note about the feature in the land cover field you created above. Just click in the **Value** column to add the land use/cover code and in the **Describe** column, type your text (agriculture, conifer, open, retail, institutional, water, etc.) Use the same codes and names used by the MRLC.

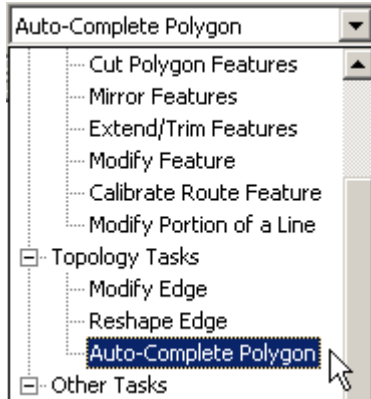
Continue adding features and adding attributes after you finish the sketch. For features that are at the edge of the photo, be sure to extend the boundary beyond the edge a fair distance (50-100 meters). You will be “clipping” this layer to create a straight edge next week.

Save your edits frequently! Every 5 minutes is suggested. The drawn polygons are NOT permanently written to the database until you click Save Edits.

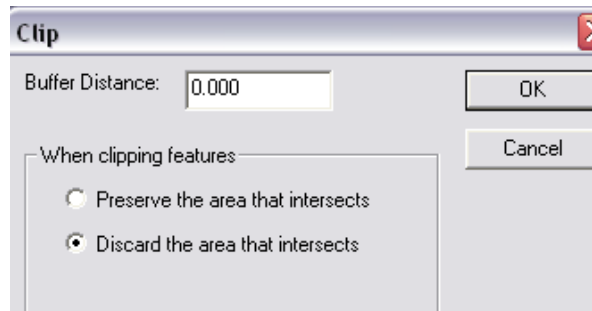
If you need to create a new feature adjacent to an existing one, be sure you follow the boundary of the existing polygon as you add your new one. With snapping enabled, ArcMap will “connect” the new vertices you add to the polygon already there.

Carefully following the existing feature’s boundary will ensure you have no gaps in your cover layer. If the cursor doesn’t “jump” to an existing adjacent vertex, you probably need to adjust the Snapping tolerance (**Editor Menu > Options > General Tab**).

Use the **Auto-Complete Polygon function** in the Task menu as much as possible! Auto-Complete Polygon will create a new polygon adjacent to an existing one and eliminates the need to trace the common border between two features and can save considerable time.



If you decide to further dissect an area you’ve already delineated, simply draw your new feature over the top of the existing polygon (be sure snapping is on and that you follow any existing boundaries if they will be shared in the resulting two features). After finishing your sketch, select **Clip** from the **Editor** menu (see illustration on next page). This will help ensure that areas you calculate for features (next week) will be correct by subtracting the area covered by the new polygon you just drew from the larger polygon underneath. Leave the Buffer Distance set to 0 and choose to **Discard** the area that intersects.



You can also use the **Merge Tool** to merge adjacent polygons of the same land use/cover type. Select all polygons you would like to merge using the **Edit Tool** and holding down the shift key, then go to **Editor Menu > Merge**, click **OK**.

By lab time next week you should have a land use/land cover map delineated for the Indian Town quad. If you are not sure on what to label a feature, delineate it and leave the classification for next week.

Due lab next week:

Have the entire quad delineated with polygons; there should be no gaps when your land cover layer is displayed over the DOQQs. At the beginning of next lab you will be graded on progress. The completed delineation is worth 20 points. A partial delineation is only worth 10 points. There is no flowchart due for this specific lab exercise. However, you will be constructing a flowchart and lab write up for labs 4 and 5 combined.