

Digitizing and Editing Polygons in the STS Gypsy Moth Project

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Overview of Digitizing in STS

On-screen digitizing in a GIS is performed in the STS Gypsy Moth Project to capture areas scheduled for treatment applications and to define areas to be trapped at selected densities. This document is designed to familiarize the user with:

- the digitizing tools and interfaces supplied by the STS Information Systems Group;
- the processes to follow to get desired results while digitizing; and
- editing tools provided by ESRI in the ArcView environment.

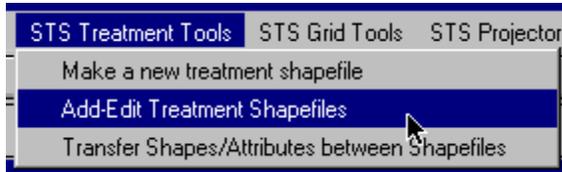
Both *STS Treatment Tools* and *STS Grid Tools* provide a digitizing interface to facilitate making changes to the geometry of blocks and grids. **The Digitizing Window** section lists the buttons and their accompanying actions associated with this interface. A GIS handles the geometry of shapes in particular ways. Knowing how a shape reacts to certain processes is necessary to achieve correctly digitized polygons. The section titled **Digitizing Using STS Specific Tools in ArcView** demonstrates how edited shapes react to actions applied using STS tools. ESRI provides tools in ArcView for digitizing new shapes as well; these tools are listed and explained in the **Digitizing in ArcView with ESRI-provided Tools** and **Snapping Options while Digitizing** sections. The final section, **The ArcView Edit Menu**, discusses the shape-to-shape interactions associated with the options in the Edit Menu and points out similarities and differences between these options and those provided by the STS Information Systems Group.

If there are any questions about the information provided in this document, contact me at hdodd@vt.edu or (540)231-9119.

The Digitizing Window

Both *STS Treatment Tools* and *STS Grid Tools* provide a digitizing interface to facilitate making changes to the geometry of blocks and grids.

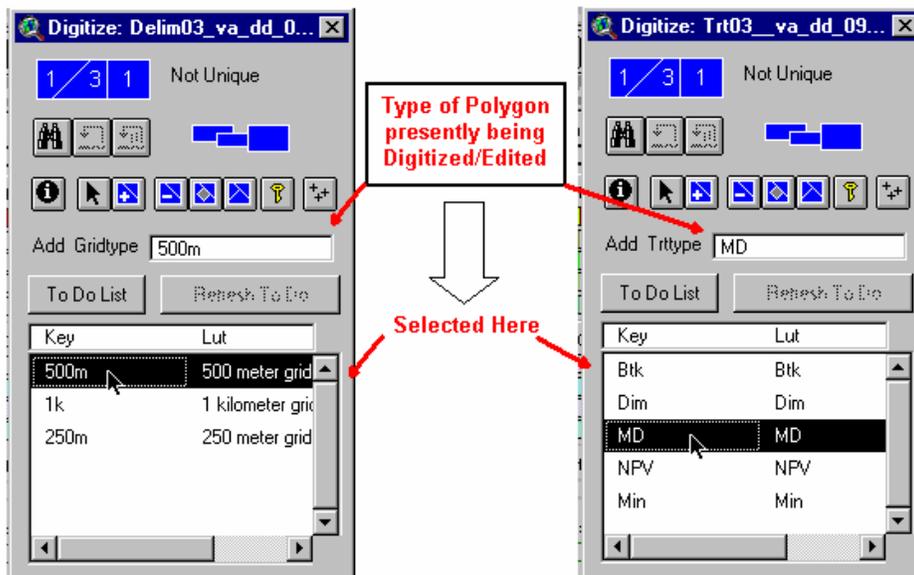
For treatments:



For grids:



Both of these options bring up the digitizing interface:



Select the type of polygon you want to edit/digitize in the large window at the bottom. Then select one of the following buttons to interact with the polygon:

 **Add Polygon** (Inactive when a polygon type is not chosen from list below)

 **Delete Polygon**

 **Cut Out from Polygon** – create a hole in an existing polygon

 **Split Polygon** (e.g., for splitting one polygon into two)

 **Select to Protect** – Used to select a polygon. The selected polygon then will not be altered even when points are digitized within its borders.

Other buttons on the digitizing interface:

 **Finds** and zooms to all polygons of a given type

 **Undo Last Edit**

 **Undo All Edits Since Last Save Edits**

 **Identify button** – lists all fields and values for the selected polygon

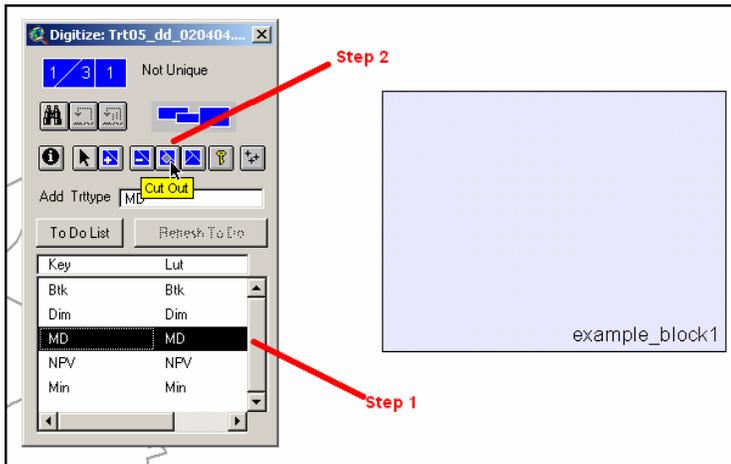
 **Change Key Field Value** – used to quickly change the treatment type or grid type (the Key Field) for a selected polygon.

NOTE: Once you have changed the shape of a grid or a treatment you MUST update all attributes associated with the altered polygon.

Digitizing Using STS Specific Tools in ArcView

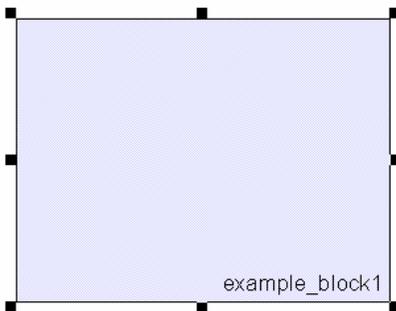
Creating Holes in Polygons

1. Select the grid or treatment type of the polygon you wish to edit from the Digitizing Window.
2. Click the **Cut Out** button on the Digitizing Window.



3. Make sure that the polygon is NOT selected for protection.

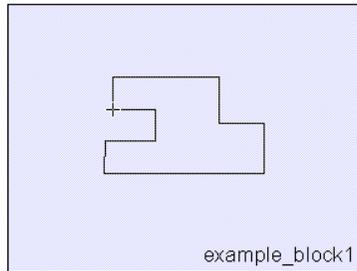
Unprotected Polygon



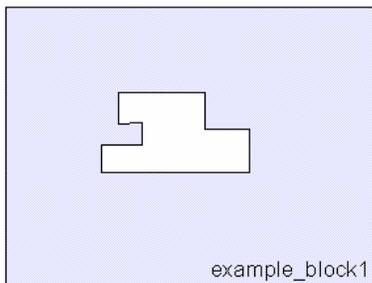
Protected Polygon

***If the block is protected, click the **Select to Protect** button from the Digitizing Window and click in the View outside of any polygons, to unselect the polygon. Then, select the **Cut Out** tool again to start editing.

4. Digitize the area that you want to be removed from the polygon. Double click the mouse button to finish digitizing.



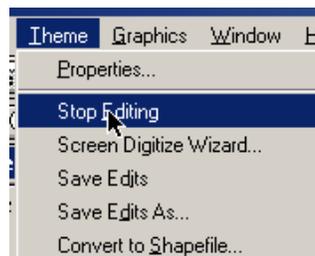
5. Examine the removed area to ensure that the extent of the excluded area is what you intended.



6. If you make a mistake, click the **Undo Last Edit** button. 

This will restore the polygon to its original form before you started creating the hole. If you want to undo only the last digitized point of the hole, right-click and select Delete Last Point while still in digitize mode.

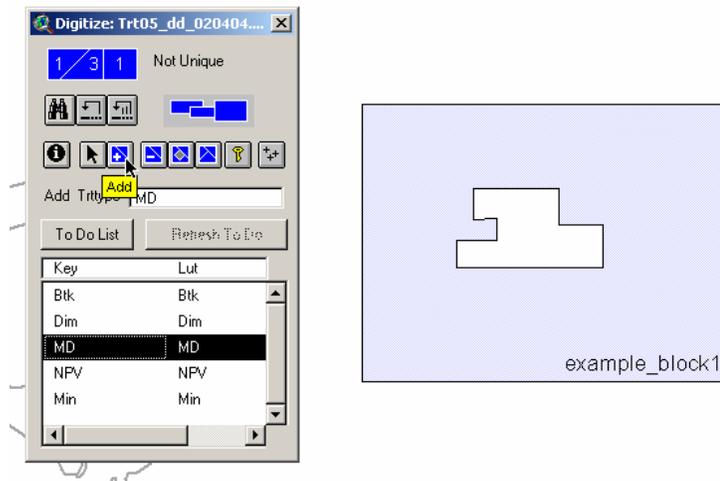
7. Stop Editing and Save by going to the Theme Menu and selecting Stop Editing.



8. Update the acreage/area of the edited polygon using *STS Treatment* or *STS Grid Tools*.
9. **Once you have changed the shape of a grid or a treatment you MUST update all attributes associated with the altered polygon.**

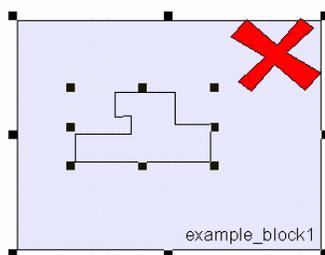
Filling Holes in Polygons

1. Select the grid or treatment type of the polygon you wish to edit from the Digitizing Window.
2. Click the **Add** button on the Digitizing Window.



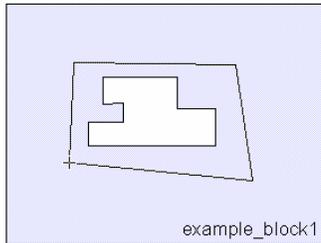
3. Make sure that the polygon is NOT selected for protection (see **Creating Holes in Polygons** for images of protected and unprotected polygons).

*****If the block is protected, the hole will get filled, but will be a separate polygon from the surrounding polygon. This is how to create embedded polygons, discussed later.**

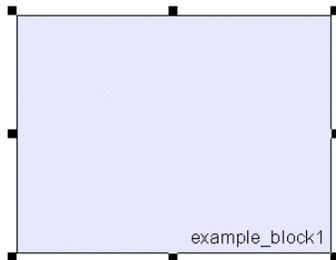


- a. To unselect a polygon, click the **Select to Protect** button from the Digitizing Window.
- b. Click in the View outside of any polygons, to unselect the polygon.
- c. Then, select the **Add** tool again to start editing.

4. Digitize around the area that you want filled. Double-click the mouse to end digitizing.



5. When you finish digitizing the block becomes whole and is selected.

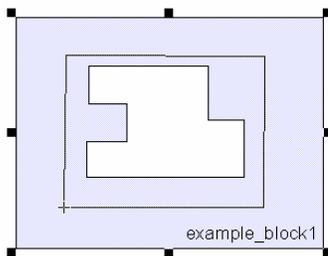


6. If you make a mistake, click the **Undo Last Edit** button.
This will restore the polygon to its original form before you started creating the hole. If you want to undo only the last digitized point, right-click and select Delete Last Point while still in digitize mode.
7. Update the acreage/area of the edited polygon using *STS Treatment* or *STS Grid Tools*.
8. **Once you have changed the shape of a grid or a treatment you MUST update all attributes associated with the altered polygon.**

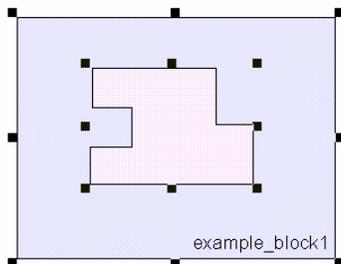
Creating Embedded Polygons

This is a two part process combining steps to create holes in polygons and steps to fill in the hole.

1. Follow Steps 1-5 of **Creating Holes in Polygons**.
 - a. Note that when you are creating the hole in the polygon you are actually defining the boundaries of the embedded block, so digitize accordingly.
2. **SELECT** the block for protection using the **Select to Protect** button on the Digitizing Window.
3. Select the type of polygon you want to embed in the newly created hole in the list in the Digitizing Window.
4. Digitize around the area that you want filled. Double-click the mouse to end digitizing.



5. When digitizing is finished, the hole will get filled, but will be a separate polygon from the surrounding polygon, but the borders and vertices will be shared between the two polygons, meaning no gaps or overlaps.



6. When a new treatment block is created in this manner, *STS Treatment Tools* provides a new Unique ID value for the new polygon.
7. If you make a mistake, click the **Undo Last Edit** button. If you want to undo only the last digitized point of the hole, right-click and select Delete Last Point while still in digitize mode.

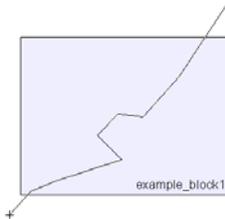
8. Update the acreage/area of the edited polygons using *STS Treatment* or *STS Grid Tools*
9. **Once you have changed the shape of a grid or a treatment you MUST update all attributes associated with the altered polygon.**

Splitting Polygons

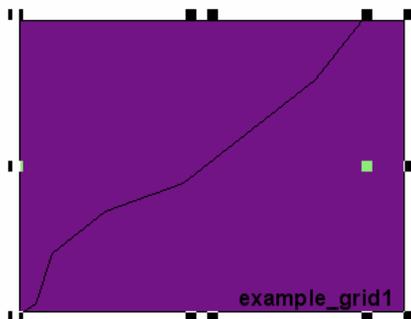
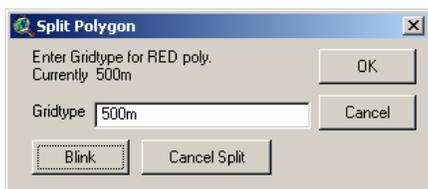
1. Zoom to the polygon you want to split.
2. Open the Digitizing Window with *STS Treatment Tools* or *STS Grid Tools*.
3. Make sure that the block is **not** protected (see **Creating Holes in Polygons** for images of a selected and an unselected polygon).
4. Select the **Split Polygon** tool from the Digitizing Window.



5. Digitize the line where you want the polygon to be split. Double click to end the line.



6. When you finish digitizing the split line a new window is displayed, asking for the treatment type or grid type of the highlighted polygon.



7. Depending on your legend, the highlighted polygon may or may not be red. To see which polygon's attributes you are editing click the **Blink** button.
8. Enter the grid or treatment type for the highlighted polygon. Valid grid types are listed in the gridtype.dbf table, valid treatment types are listed in the trttype.dbf table (both tables are located in \GM_STS\Programs\Extensions\Support\)
9. Enter the grid or treatment type for the next highlighted polygon.
10. Recalculate the area and/or acreage for the new shapes.
11. **Once you have changed the shape of a grid or a treatment you MUST update all attributes associated with the altered polygons.**
12. **NOTE: When you split a polygon you are creating a NEW shape. If this is a new treatment block the UNIQUE-ID field must be updated so that the two blocks that used to be one do not share the same ID value. Change this by altering the last 2 characters in the Unique-ID field.**
13. If you read this, call Mannin. He will buy you a beer.

Digitizing in ArcView with ESRI-provided Tools

NOTE: The following is excerpted from ESRI's ArcView GIS 3.3 Help Topic

Creating polygon features

Before you start creating polygons, decide whether they should be perfectly aligned. If it's important not to have gaps or overlap, you should set the snapping environment. If you create a polygon near another polygon that's within the snap tolerance, this new polygon will get snapped to the other polygon, eliminating gaps and overlap.

To create an irregularly shaped polygon feature

1. If the theme is not already in edit mode, make the theme active and from the Theme Menu, choose Start Editing.
2. Click the **Drawing tool palette**  and in the list of tools that pops down, click the **Polygon** tool .
3. In the view, click the left mouse button where you want the polygon to start, click each vertex around the polygon's boundary, and then double-click the final vertex.

If you have set the interactive snap environment, then while you are adding your polygon, you can hold down the right mouse button to display the popup menu, and choose one of the snapping options from this menu to control how the next vertex you add to the boundary will be snapped to existing polygons in the theme.

When you create a new polygon feature in the theme, a corresponding new record is automatically added to the theme's feature attribute table. While you are editing a theme, its table is also in edit mode. You can add data for this record at anytime by entering new values in the table.

NOTE: While you are creating a line, you can choose the Delete Last Point option from the popup menu to delete the last vertex you added. Choosing this

option repeatedly enables you to successively delete all the vertices back to the start point of the line.

To create a circular polygon feature

1. Click the **Drawing** tool palette  and in the list of tools that pops down, click the **Circle** tool .
2. In the view, position the cursor where you want the center of the circle to be, hold down the left mouse button and drag the mouse until the circle is the size you want, then release the mouse button.

To create a rectangular polygon feature

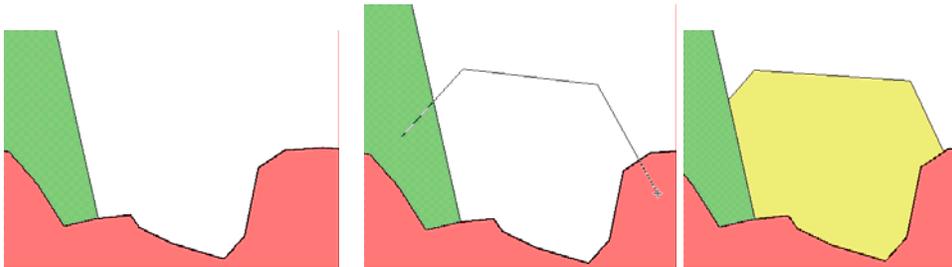
1. Click the **Drawing** tool palette  and in the list of tools that pops down, click the **Rectangle** tool .
2. In the view, position the cursor where you want the corner of the rectangle to be, hold down the left mouse button and drag the mouse until the rectangle is the size you want, then release the mouse button.

To create a polygon that shares its boundary with existing polygons

You can use the **AutoComplete** tool  to create a new polygon if it shares part of its boundary with an existing polygon(s) in your theme. In this way, it's not necessary to redraw the portion of the polygon's boundary that is already represented in your theme.

1. Click the **Drawing** tool palette  and in the list of tools that pops down, click the **AutoComplete** tool .
2. Draw a line that starts and stops at any of the existing polygon boundaries to enclose the area of the new polygon you are creating. To draw the line, click where you want the line to start, click each vertex along the line, then double-click the final vertex. When you draw the line, you can overshoot the existing polygon boundaries.

When you have finished drawing the line, ArcView automatically completes the new polygon, and removes any overshoots from the line you drew.



NOTE: A shapefile can only contain one feature type so polygon features can only be added to themes based on polygon shapefiles.

Snapping Options while Digitizing

NOTE: The following is excerpted from ESRI's ArcView GIS 3.3 Help Topic

Setting a theme's snapping properties

Setting a theme's snapping properties

With the use of the snapping environment in ArcView, you can improve how new features meet and align as you create them. When the snapping environment is set, ArcView moves the vertices or line segments of the new features you add to align with the vertices or line segments of other features that are within a specified distance, the snap tolerance. This way, for line themes, all line features coming together at an intersection will share the same endpoint, and there will be no overshoots or undershoots, and for polygon themes, there will be no gaps or overlap between adjacent polygon features. There are two types of snapping, general and interactive.

General snapping

If you want your features to be automatically snapped to other features within the specified tolerance, set ArcView's general snapping environment. General snapping is feature-to-feature snapping that gets applied as soon as you have added a new feature.

To set the general snapping environment by typing in a tolerance

1. Click on the name of the theme you are editing in the view's Table of Contents to make it active.
2. Click the **Theme Properties** button .
3. In the dialog that appears, click the **Editing** icon to display the theme's editing properties. In the **Snapping** panel, click the **General** check box to turn this snapping on. Type a tolerance value into the tolerance field that appears. Press OK.

To set the general snapping environment with the mouse

1. In the view, hold down the right mouse button to display the popup menu, and choose Enable General Snapping from this menu.
2. Click the **Snap** tool palette  and in the list of tools that pops down, click the **General Snap** tool . In the view, click and drag out a circle to represent the tolerance distance. The radius of the circle is displayed in the status bar. This radius value becomes the general snap tolerance.

Interactive snapping

For better control over how your features get snapped, use interactive snapping. With interactive snapping, you can apply different snapping rules on a per vertex basis while you are adding a new line or polygon feature. In this way, you will be able to control how each vertex along the line or polygon boundary you are adding is snapped to existing lines or polygons in the theme. You can choose one of the following snap rules from the popup menu while you are adding the feature:

Snap to Vertex: snaps the next vertex to the nearest vertex in an existing line or polygon.

Snap to Boundary: snaps the next vertex to the nearest line segment in an existing line or polygon boundary.

Snap to Intersection: snaps the next vertex to the nearest node common to two or more lines or polygons.

Snap to Endpoint: snaps the next vertex to the nearest endpoint of an existing line.(Available for line themes only).

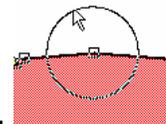
To set the interactive snapping environment by typing in a tolerance

1. Make the theme you are editing active, if it isn't already.
2. Click the **Theme Properties** button .
3. In the dialog that appears, click the **Editing** icon to display the theme's editing properties. In the **Snapping** panel, click the Interactive check box to turn this

snapping on. Type a tolerance value into the tolerance field that appears. Press OK.

To set the interactive snapping environment with the mouse

1. In the view, hold down the right mouse button to display the popup menu, and choose Enable Interactive Snapping from this menu.
2. Click the **Snap** tool palette  and in the list of tools that pops down, click the **Interactive Snap** tool . In the view, click and drag out a circle to represent the tolerance distance. The radius of the circle is displayed in the status bar.



This radius value becomes the interactive snap tolerance.

Snap tolerance cursor

When either general or interactive snapping is turned on, you have the option of displaying a circle representing the snap tolerance with the cursor as you create polylines, polygons, or edit vertices. This is known as the snap tolerance cursor. If general snapping is turned on, the circle represents the general snap tolerance. If interactive snapping is also turned on, the circle will change to the interactive snap tolerance when you chose an interactive snap rule. By default, the snap tolerance cursor is turned on when snapping is turned on.

To turn the snap tolerance cursor off

1. Click on the name of the theme you are editing in the view's Table of Contents to make it active.
2. Click the **Theme Properties** button .
3. In the dialog that appears, click the **Editing** icon to display the theme's editing properties. In the **Snapping** panel, click the **Show snap tolerance** cursor

check box to turn this off. **NOTE:** this checkbox is only visible when general and/or interactive snapping is turned on.

To turn the snap tolerance cursor off with the mouse

In the view, hold down the right mouse button to display the popup menu, and choose Hide Snap Tolerance Cursor.

The ArcView Edit Menu

Please **NOTE** that when you make edits using these tools, that **NO** attributes in associated tables will be updated as they are when using STS-provided editing tools.

The Edit menu in ArcView is available when a View is the active document in the project. When the active theme in the View is in edit mode (set in the Theme menu with the Start Editing option), there are different options available in the Edit menu than when the active theme is not editable. Here is the Edit menu when the active theme is editable:



The grayed out items work with features of the active theme. When the active theme is not editable the grayed out items work with graphics that are not associated with a shapefile and have Graphics in the option name instead of Features. In either instance the items become available for use when a feature (or graphic) is selected. The Combine, Union, Subtract, and Intersect options are designed to work with two selected features and will become available only when more than one feature is selected. Here are the Edit menu items and what they do:

Theme options in the Edit Menu

Cut Themes – Cuts (removes) the active theme(s) from the View and saves a copy that can be pasted into another View.

Copy Themes – Copies the active theme(s).

Delete Themes – Deletes the active theme(s) from the View.

Paste – Places the copied or cut theme(s) in the active View.

Error Handling options in the Edit Menu

Undo Feature Edit – Undoes the last change made to a shape.

Redo Feature Edit – Redoes the last undone edit.

Feature options in the Edit Menu

These options will work for one or more selected features.

Cut Features – Removes selected features from the active theme and saves a copy of the features to be pasted into a different theme.

Copy Features – Copies selected features to be pasted into a different theme.

Delete Features – Removes selected features from the active theme.

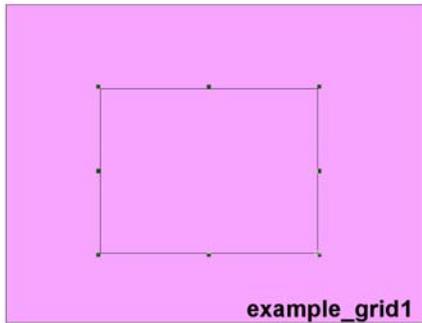
Paste – Places the copied or cut features into the selected, active theme. The destination theme must be editable.

Multiple Features options in the *Edit* Menu

These options will become available for use only when more than one feature is selected.

All of these options act differently depending on the spatial relationship of the selected features. Also, note what each of these options does to the records in the associated tables.

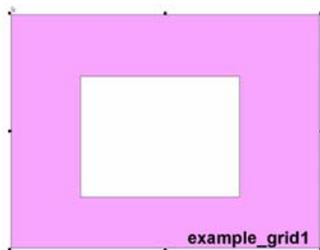
Here is the starting point for all of the following options:



These are two separate polygons in the same theme. The larger polygon on the bottom does not contain any holes. The smaller, upper polygon has just been digitized.

Combine Features – Combines the selected features together into a single feature.

The result for our example is:

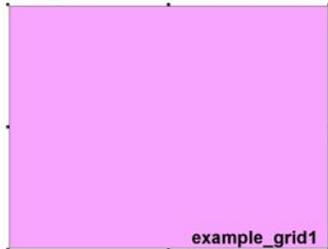


The result is similar to the result from using **Cut Out** tool in the STS Digitizing Window. However, this menu option works differently depending on how the selected shapes are located in relation to one another. Here is what ESRI's ArcView Help says:

If the selected polygons share a common boundary, the common boundary is removed to create one continuous polygon. If the selected polygons overlap, the area of overlap is removed from the resulting combined polygon, resulting in a hole. If the selected polygons are not adjacent or overlapping, the result is one feature with multiple parts. When a set of features is combined, the records of those features are removed from the feature attribute table and one new record is added to the table to represent the new feature.

Union Features – Returns the unions of the selected features to create a single feature.

The result for our example is:



This result is similar to the result of the Add tool in STS Digitizing Window.

Here is more from ArcView's Help:

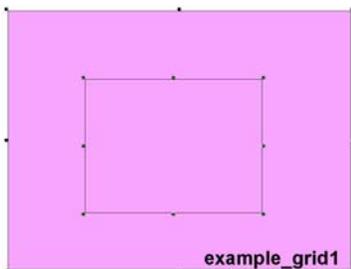
If the selected polygons share a common boundary, the common boundary is removed to create a single polygon. If the selected polygons overlap, the boundaries of the overlap are removed to create one polygon. If the polygons are not adjacent or overlapping, the result is one feature with multiple parts.

When a set of features is merged with Union Features option, the records of those features are erased from the feature attribute table and one new record is added to the table to represent the new feature.

Union Features only works on line and polygon shapefiles.

Subtract Features – Subtracts one overlapping feature from another feature. The feature on the top gets subtracted from the feature on the bottom. The portion of the bottom feature that is overlapped by the top feature is removed and the top feature remains unchanged. This option only works on polygon shapefiles.

The result of our example is:



This result is similar to the result of the **Create Embedded Polygon** progress.

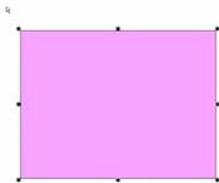
This shows the smaller polygon replacing the larger one where they overlap, so there is now a hole in the larger polygon that is filled with the smaller polygon.

NOTE: If you want to reverse the order of this operation, that is, subtract the bottom feature from the top feature, hold down the SHIFT key as you choose Subtract Features from the Edit menu.

The result for our example using this method is only the larger whole polygon.

Intersect Features - Creates a new polygon from the area that is shared between the selected overlapping polygons. When a set of features are intersected, the records of those features are removed from the feature attribute table and one new record is added to the table to represent the new feature. Intersect Features only works on polygon shapefiles. If you've read this far, call Mannin again. He'll buy you two beers.

The result for our example is:



example_grid1

This is just the smaller polygon.