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Editing Raster Geodata

in

TNTmips®

and TNTedit™

Before Getting Started

This booklet introduces techniques for creating, altering, and updating raster geospatial objects in the Spatial Data Editor in TNTmips® and TNTedit™. A raster object contains a two-dimensional array of numeric cells of a common data type. Each cell value can represent a geospatial variable (such as elevation, soil type, crop type) or color information for display (numeric pixel color). This booklet introduces you to the basic raster editing tools. The Spatial Data Editor also has tools for editing your vector, CAD, database, TIN, and region geodata.

Prerequisite Skills This booklet assumes that you have completed the exercises in the tutorials *Displaying Geospatial Data* and *Navigating.* Those exercises introduce essential skills and basic techniques that are not covered again here. Please consult those booklets and the TNTmips Reference Manual for any review you need.

Sample Data The exercises presented in this booklet use sample data that is distributed with the TNT products. If you do not have access to a TNT products CD, you can download the data from MicroImages' web site. In particular, this booklet uses objects in the LANCSOIL and UNLPHOTO Project Files in the EDITRAST data collection. Make a read-write copy of these files on your hard drive; you may encounter problems if you work directly with the read-only sample data on the CD-ROM.

More Documentation This booklet is intended only as an introduction to raster editing in the Spatial Data Editor. Consult the TNT Reference Manual, which includes over 200 pages on the Spatial Data Editor, for more information.

TNTmips and TNTlite® TNTmips comes in two versions: the professional version and the free TNTlite version. This booklet refers to both versions as "TNTmips." If you did not purchase the professional version (which requires a software license key), TNTmips operates in TNTlite mode, which limits object size.

The Spatial Data Editor is not available in TNTview or TNTatlas. All the exercises can be completed in TNTlite using the sample geodata provided.

Keith Ghormley, 20 September 2004

It may be difficult to identify the important points in some illustrations without a color copy of this booklet. You can print or read this booklet in color from MicroImages' web site. The web site is also your source for the newest tutorial booklets on other topics. You can download an installation guide, sample data, and the latest version of TNTlite:

http://www.microimages.com

The Spatial Data Editor

The TNT Spatial Data Editor (Edit / Spatial Data) offers a flexible, editing environment that can be used for simple one-object tasks or complex multi-layer, multi-object manipulations. You can have an object in one layer, or a combination of read-only reference layers, with other editable layers. You can have multiple types of objects open at the same time, stacked in any front-to-back order.

Editing operations apply to the currently "active" layer. As you switch from layer to layer, the editing tools automatically change according to the data type of the active layer (raster, vector, CAD, or TIN).

Newly created objects may have independently defined map registration, or map registration derived from another layer in the editor.

A **layer** contains one geospatial object: raster, vector, CAD, TIN, database, or complex layout. TNT automatically reconciles the map registration and scale of all layers.
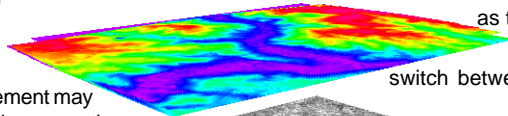
the ACTIVE layer has many ELEMENTS

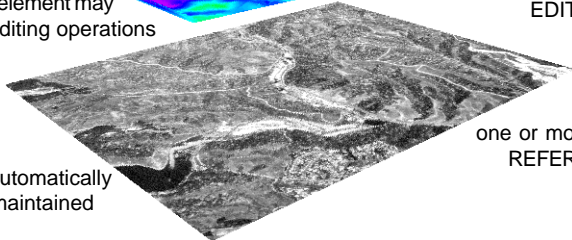one or more ELEMENTS may be SELECTED
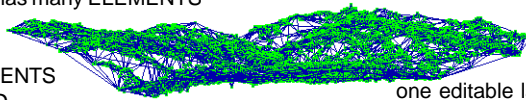
one editable layer is selected as the ACTIVE layer

switch between one or more EDITABLE layers

one SELECTED element may be ACTIVE for editing operations

one or more read-only REFERENCE layers

all map control automatically reconciled and maintained

You may see editing tools like those in TNTmips in other software products, but the important thing about the TNT Spatial Data Editor is the way you can edit *multiple geospatially related* objects easily and intuitively. You can concurrently edit project materials of all types while TNT automatically retains and reconciles their map registrations. This means that all the new objects you create can automatically derive their map registration from other layers, so all of your project materials have a correct geospatial relationship.

The exercises on pages 4-13 take you through the process of marking an airphoto for a walking tour of part of a university campus. Pages 14-19 introduce other raster editing tools.

Open a Raster Object

Open UNL by clicking the Open Object for Editing icon button.

In our first exercises, we will use a single layer and edit one raster object. In a later exercise, we will edit one raster object while using a second raster object in a reference layer.

Vocabulary:
A **Color Map** (also **"Color Table"**) assigns 8-bit data values (0-255) to discrete display colors. A **Color Palette** presents all or part of a color map in a graphic interface for color selection and editing.

STEPS
☑ click the Open Object for Editing icon button and select the LITEDATA / EDITRAST / UNLPHOTO / UNL raster object

The view window displays a temporary work raster, which you save into the UNL raster object from time to time.

As an initial exercise, we will edit a raster object that contains an airphoto image of a portion of a university campus. We will mark sidewalks and buildings to provide a color image map for a campus tour. Of course the edits we make could alternatively be done with the Spatial Data Editor in a CAD or vector overlay, but for these exercises we will edit the sample raster object itself.

Open the TNT Spatial Data Editor (Edit / Spatial Data). Click the Open Object for Editing icon button and select the LITEDATA / EDITRAST / UNLPHOTO / UNL raster object. UNL is an 8-bit 512 x 512 raster object that displays with a default color map. The display colors are all shades of gray, but the color map also contains a selection of bright colors that we will use for editing operations.

The UNL raster object contains part of an airphoto of a university campus.
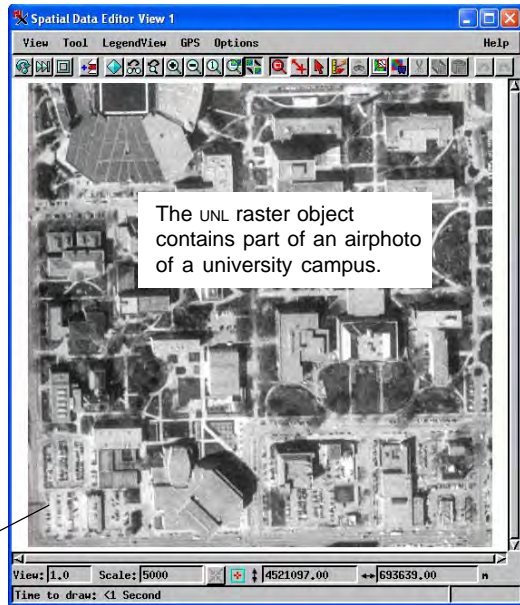
Select the Line Tool

When you open a raster object for editing, the Editor opens the Raster Tools window. The Raster Tools window presents a selection of tools for editing cells in a raster object. Since you want to draw lines first, click the Line tool in the top row.
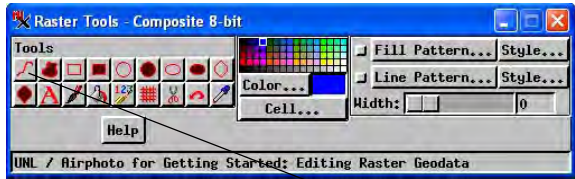
The Line tool opens the Line / Polygon Edit Controls window.

The Editor opens a Line / Polygon Edit Controls dialog. The Add End operation is the default selection. In the Add End operation, each time you click the mouse, the Editor extends the prototype line by adding a new segment at the end. By contrast, the Add Start operation is used to extend a prototype line by adding segments to its initial point.

STEPS
- ☑ click the Line button
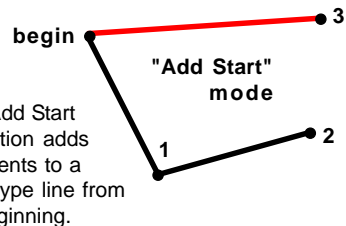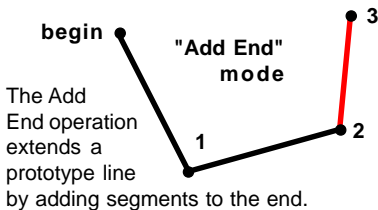- ☑ change from Draw mode to Stretch mode

Change the drawing mode from Draw to Stretch. The Stretch mode lets you see your new line segment and drag the position of its endpoint before you place it. For tracing operations, this ability to move a segment to see the surrounding photo image is very helpful. The Stretch mode also lets you hold down the Shift key to force vertical and horizontal segments.

Remember, the Editor adds a line into a raster object by replacing existing cell values with new values that are mapped by the current color table to a selected color. Once a line is drawn into the raster, it can no longer be selected and edited as a line.

Vocabulary:
A **prototype** line is one that you are creating and have not yet added. You can modify a prototype line, but once you draw it into the raster object, it can no longer be selected and edited as a line.

The default operation is Add End.

"Add End" mode

begin

3

1

2

The Add End operation extends a prototype line by adding segments to the end.

"Add Start" mode

begin

3

1

2

The Add Start operation adds segments to a prototype line from its beginning.

Choose Line Color and Width

Click on a tile in the color palette to choose a drawing color.

In a color mapped display of an 8-bit raster object, each raster cell value is mapped to a discrete display color. Since 8-bit data ranges from 0 to 255, an 8-bit color palette has 256 colors.

STEPS
- ☑ click on a red tile in the color palette
- ☑ click the [Cell...] push button and examine the Get Raster Cell Value dialog
- ☑ click [Cancel] to close the Get Raster Cell Value dialog
- ☑ click [Color...] to open the Color Editor dialog
- ☑ click [OK] to close the Color Editor dialog
- ☑ adjust the Width slider to set your line width to 4 cells

change line width by adjusting the slider ...   ... or typing in a width value

As you draw into a raster object, the cell values change to the numeric value that you are currently using to draw. In the current exercise, we don't care much how the cell values correspond to display colors, but in some applications, you may have reason to want very specific values in the raster cells. The Editor lets you select a drawing color from the color palette by clicking on a color, or you may specify an editing value numerically.

Change the line Width value to 4 cells so the sidewalk lines will be thick enough to see easily.

Change the display color for the currently selected editing value by clicking on a tile in the Palette tab of the Color Editor, or by adjusting component sliders in the other tabbed panels.

Specify a drawing "color" numerically in the Get Raster Cell Value dialog.
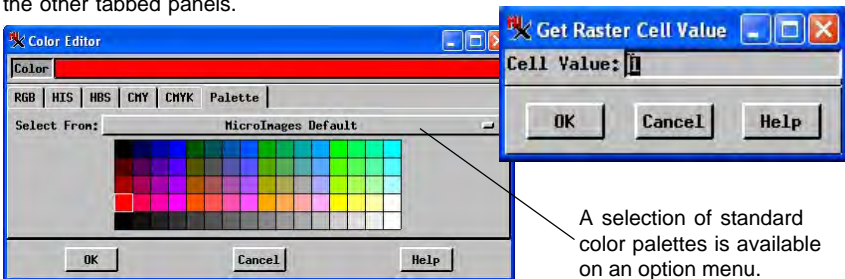
A selection of standard color palettes is available on an option menu.

Draw a Prototype Line

You are now ready to begin drawing red sidewalks for the campus tour. Draw over the sidewalk from the library to the parking lot in the east central portion of the photo as illustrated. With the Line tool active, each time you click the mouse, the Editor adds a **prototype line** segment. Your first click defines the starting point of the line, so choose the point where the sidewalk emerges from the east side of the library. Then move the cursor and click on the corner where the sidewalk turns south.

STEPS
- ☑ locate the sidewalk that joins the Library and parking lot
- ☑ click the right mouse button to add prototype line segments
- ☑ drag each new point to adjust the position of the new line segment
- ☑ click the right mouse button to add the line

The Editor draws a prototype segment that joins your first two click points. Click again,

first click

second click

third click
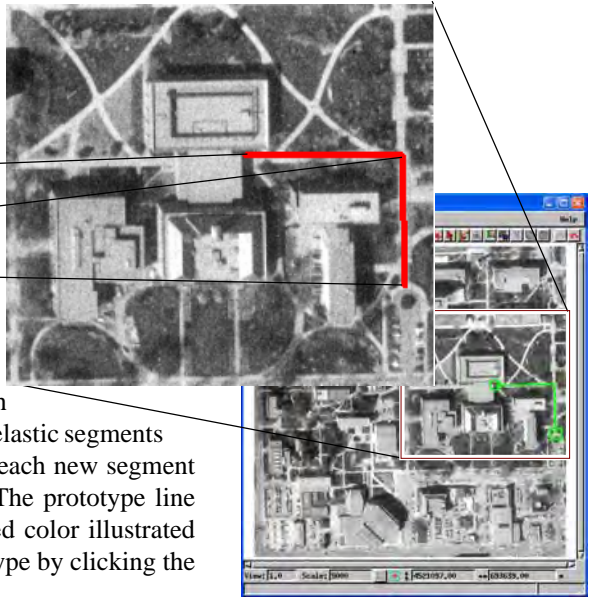
where the sidewalk meets the parking lot. Since you are in stretch mode, you can drag out elastic segments by dragging the end of each new segment to just the right spot. The prototype line does not show in the red color illustrated until you add the prototype by clicking the right mouse button.

The last segment ends with a circle graphic. You can drag the end by holding down the left mouse button until the segment is where you want it.

When you finish a prototype line, draw it by clicking the right mouse button.

The Editor shows the starting point of a **prototype line** with a box graphic.

Each click adds a new prototype **segment** to the line.

Cancel a prototype line that you don't want by pressing the Clear button in the Edit Controls window.

Draw Lines into Raster

STEPS
- ☑ add lines for the sidewalk route illustrated
- ☑ select File / Save to write your edits into the UNL raster object
- ☑ select Setup / Preferences and choose an Autosave interval in the Save panel of the Preferences dialog

Draw the sidewalk route as shown. Click the right mouse button when you finish a prototype line to draw it into the raster object. The Editor draws the line in the selected color and width. (A later exercise describes techniques for deleting and correcting what you have drawn.)

At any time, you can zoom in to work at a higher magnification, and use the scroll bars to continue working on a line that goes off the edge of the window. All of the standard display tools are available in the View window.

The red sidewalk route that you have drawn has changed the cell values in the photo image to 13, which is mapped to red display values by the current color table.

The Editor keeps the changes you make in a temporary work raster. When you finish drawing the red sidewalk route as illustrated, select File / Save to update the UNL raster object.

- ☑ zoom and pan until you have added lines across the entire photo

The Editor opens a Verify dialog to ask if you want to change the UNL raster object, and again for each autosave operation.

The Spatial Data Editor also offers an autosave feature. Select Preferences / Save from the Setup menu and specify how frequently you want your work saved. Thereafter the Editor reminds you each time the autosave interval elapses.

Verify
Saving over the original object will permanently remove the original object. Do you wish to save over the original object?

| Yes | No | Cancel | Help |

Verify
Save timer interval has elapsed for:
"UNL / Airphoto for Getting Started: Editing Raster Geodata"
Do you wish to save the latest modifications?

| Save... | Save As... | Skip | Cancel | Help |

Insert, Delete, and Drag

Three main editing operations are available for prototype lines. Select the Insert, Drag, and Delete tools in turn and practice changing the shape of a prototype line. Each operation has particular usefulness as you create a prototype line that follows a reference feature in the image. As you click along a curvilinear path placing new segments, you may miss the feature by clicking to one side (delete that vertex) or by cutting a corner (insert a new vertex). Experiment with a prototype line until you have the feel for each editing operation. You may practice on a prototype line and then cancel it if you wish.

It is especially important to edit prototype lines carefully as you edit a raster object. Once you draw a line into a raster object, you cannot select it *as a line* and reshape it the way you can reselect line elements in vector or CAD objects. As a later lesson shows (page 11), you can undo edits that you have made since the last File / Save operation, but the undo operation completely erases your edits.

Practice on a prototype line. If you want to draw the result into the UNL raster object, click the right mouse button or [Add]. To discard the prototype line, click the [Clear] button or just select a different tool.

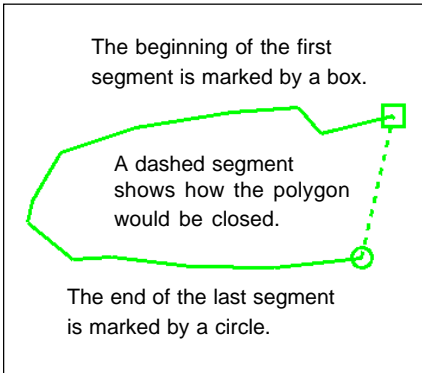**Delete** vertices where too many errant mouse clicks wandered off the feature.

Insert vertices where too few mouse clicks did not conform to the complex shape of the feature.

Drag vertices where the mouse clicks missed the feature.

INSERT VERTEX
- single mouse click
- adds a new vertex at click point
- one segment becomes two

DELETE VERTEX
- single mouse click
- removes vertex nearest to click point
- two segments become one

DRAG VERTEX
- drag with mouse
- moves a vertex
- number of segments does not change

Draw Polygons

The Polygon tool is slightly more complex than the Line tool, which you have been using. As with the line tool, a polygon's initial point is indicated with a box, and the end of the last segment is indicated with a circle. The new thing you see in the polygon tool is a dashed line segment (between the initial vertex and the last vertex), which indicates how the polygon would be closed were you to complete it by clicking the right mouse button. All other aspects of the polygon tool are the same as the line tool.

The beginning of the first segment is marked by a box.

A dashed segment shows how the polygon would be closed.

The end of the last segment is marked by a circle.

When you close a polygon, the Editor fills it with the selected drawing color or fill pattern.

For this exercise, you will outline campus buildings. Select the Add Polygon tool and choose a yellow fill color from the palette. Place a series of vertices on the corners of a building by clicking the left mouse button, and finish the polygon by clicking the right mouse button. The Editor automatically fills the polygon with the drawing color.

You can edit a prototype polygon element the same way you edit a prototype line. Use the insert, delete, and drag operations to reshape a prototype polygon before you draw it into the raster object.
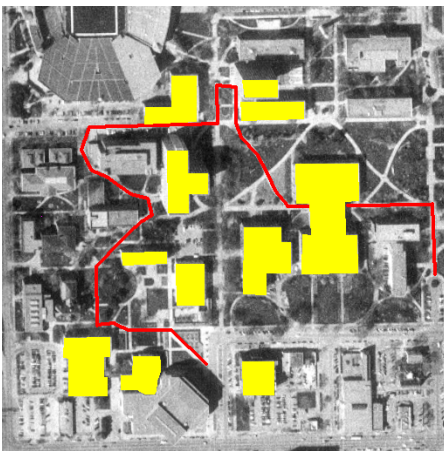
STEPS
- ☑ select the Add Polygon tool
- ☑ select a yellow drawing color
- ☑ click the left mouse button to place a sequence of vertices
- ☑ click the right mouse button to add the polygon
- ☑ practice tracing several campus buildings as illustrated

Do not save these edits into the UNL raster object.

Restore, Undo/Redo

The Spatial Data Editor keeps the changes you make in a temporary work raster. You may undo drawing changes you have made by restoring the work raster from the UNL source raster object. Thus, as long as you have not saved your editing changes into

The Restore From Source tool lets you undo edits made since the last time you saved your work.

the UNL raster object (as on page 8), you can undo your edits. However, once you save your edits into the UNL raster object,

the restore operation has no effect.

The Restore from Source tool lets you draw a polygon on the image to define the area that contains edits that you want to undo. For this exercise, draw a polygon to enclose the buildings in the west and north portions of the photo as illustrated. An edit is removed if it meets two conditions: (1) if you made it since the last save and (2) if the edit falls inside the restore polygon.

☑ Draw a polygon with the Restore from Source tool around an area you want to restore and click the right mouse button. The Editor copies cell values from the UNL raster object back into the temporary work raster.

☑ Observe that the View window also has a pair of Undo/Redo buttons in the top corner. The Undo/Redo buttons let you step back through a series of edits.

In the illustration, several yellow buildings were included in the restore polygon (illustrated in white), and the image was restored from the UNL source raster object. Observe that since the red sidewalks had previously been saved into the UNL raster object (page 8), the Restore From Source operation did not remove them.

The building polygons are good candidates for re-doing. You probably noticed that it is difficult to trace a regular-looking building shape from this airphoto because of the perspective effect on the tall buildings. For best results, draw the roof outline and then switch to the Move Line operation and drag the prototype polygon to the building's footprint position.

Add Text

STEPS
- ☑ select the Text tool
- ☑ use the left mouse button to place the text tool crosshairs on a yellow building
- ☑ select a black drawing color in *both* color palettes
- ☑ type text in the Text panel of the Text Label Edit Controls dialog
- ☑ choose a font in the Style panel
- ☑ resize the text tool for the label size you want
- ☑ click [Add] to draw the text at the text tool position on the raster

The buildings on your campus tour map must be numbered so that visitors will be able to associate them with a printed list that accompanies the map. In this exercise you will use the text tool to type a number on each building.

When you click on the Text tool, the Editor opens a Text Label Edit Controls dialog. Type the text you want in the Text panel. Select a font and style in the Style panel.

A text tool in the view shows where the text will be drawn. Drag the baseline of the tool to position your label anywhere on the image. Drag the tool's "+" handle to resize the text. Drag the "box" handles on the baseline to change the angle of the text. When the text is the right size in the right place, click the Add push button or the right mouse button to draw it.
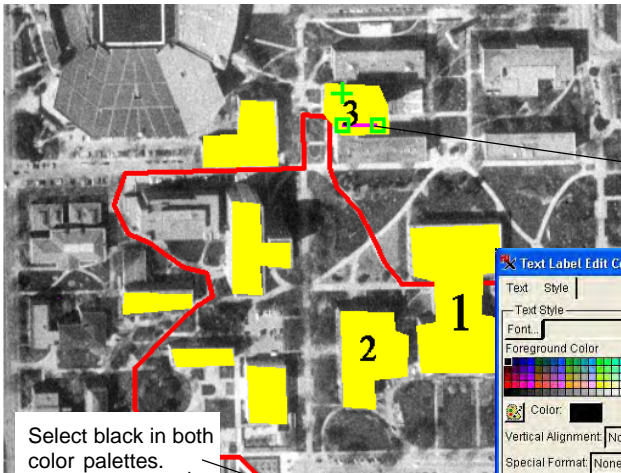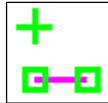
The text you enter in the Text Label Edit Controls dialog is added to the UNL raster object with the text tool.

Select black in both color palettes.
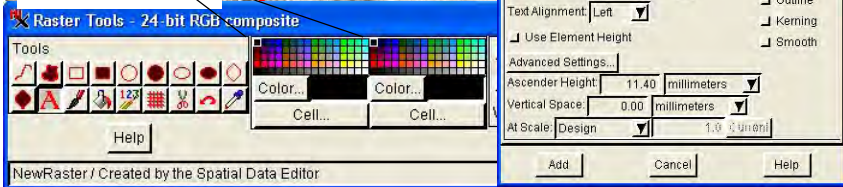
Draw Shapes

Finish numbering the buildings as illustrated. In this exercise you will add the final touches on your campus tour map: Start and End boxes.

Choose a green drawing color from the color palette and select the solid rectangle drawing tool. Draw a box at the beginning and ending points of the tour as illustrated. Then choose the Text tool and a black drawing color for the "start" and "end" text. Use the Text tool and label the start and end boxes.

Experiment with the other shape drawing tools. The Editor provides tools for outline or filled rectangles, circles, and ellipses. Create a prototype rectangle by dragging it out from its corner point. Prototype circles and ellipses drag out from their centers; then you can resize them by dragging their edges.

As with lines and polygons, once you draw a rectangle, circle, or ellipse shape into the image by clicking the right mouse button, you cannot select and edit it as a shape. (Of course, you can erase it with Undo/Redo or the Restore from Source operation, as described on page 11.)

STEPS
- ☑ click on a green tile in the color palette
- ☑ select the solid rectangle tool
- ☑ draw a rectangle at the start and end of the tour route
- ☑ click on a black tile in the color palette
- ☑ click on the Text tool
- ☑ position the text tool and type in start and end labels as illustrated
- ☑ save (or discard) your work and remove the Airphoto layer from the View

Start and End boxes complete your campus map image.
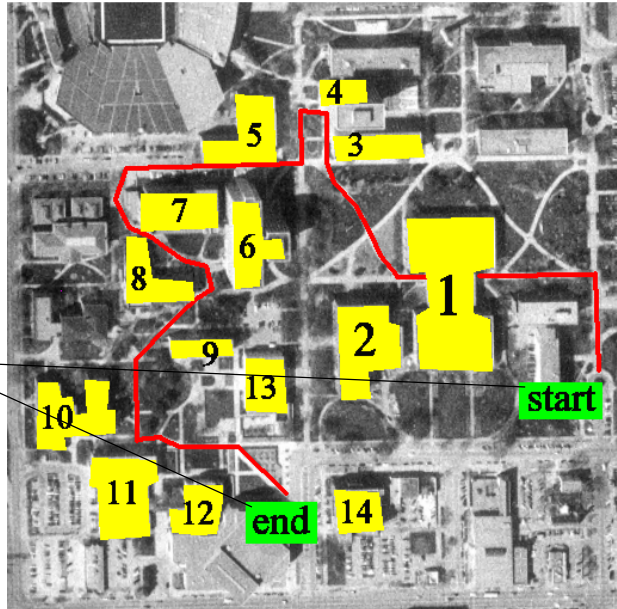
Flood Fill

The Flood Fill tool works in three different modes and fills an area with either a solid color or a selected pattern.
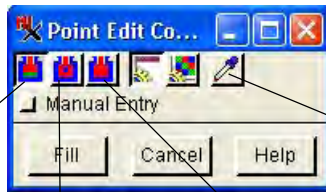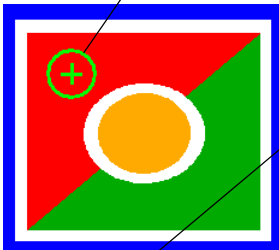
The Flood Fill tool fills an area with either a solid color or selected pattern. You can use it to replace a contiguous area of one solid color with another, or to fill an area that is enclosed with a continuous boundary of a solid color. The Flood fill tool was developed to help clean up scanned maps, removing unwanted labels and notations as a preliminary to automatic vectorization.
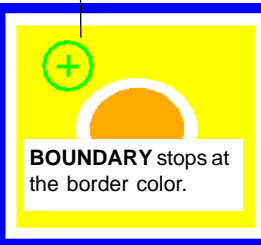
To select the fill tool, click the Flood Fill icon button. The tool appears as a crosshair in a circle, which marks the point of the fill's origin. Place the crosshair with the left mouse button, and apply the flood operation with the right mouse button.

Three fill operations can be applied: Flood, Boundary, and Smart. Select the operation you want from the Point Edit Controls window, which opens when you select the tool. The illustrations below show the results of each operation. NOTE: the Boundary and Smart operations look for a contiguous boundary of a single solid color. You will not get satisfactory results if you apply the tool in an area that is not so enclosed.

STEPS
- ☑ create a new 16-bit RGB composite raster object for practice
- ☑ use the shape tools to draw a figure like the one illustrated
- ☑ practice with the Flood, Boundary, and Smart fill operations

The fill tool works from the color at the point of origin.

Place the tool, then click Grab Border Color to register your border color.

FLOOD stops where the color of origin stops.

BOUNDARY stops at the border color.

**SMART** removes islands and stops at the border color.
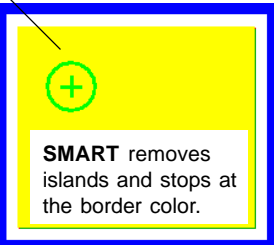
Fill Patterns

Fill patterns let you draw shapes that are filled with transparent patterns in order to identify features in a background image. For example, you

Turn on the Fill Pattern toggle and click [Fill Pattern] to select a pattern.

might draw a polygon around a wooded area in an airphoto and fill the polygon with a fill pattern of tree symbols. In the same way, a geologist might draw around a rock formation and assign a certain type of rock symbol to an area according to the geologic survey data.

Fill patterns may be solid or they may be partially transparent. Choose a transparent pattern when you want features in the image to show through. You can apply fill patterns with the shape drawing tools and with the Smart Fill tool.

You can design any number of custom fill patterns for special applications. Refer to the TNT Reference Manual for instructions on using the pattern editor.
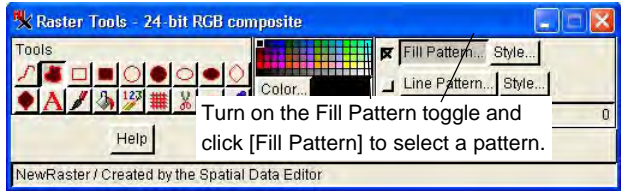
STEPS
- ☑ open the LITEDATA / EDITRAST / LANCSOIL / SHEET_45LITE raster object for practice
- ☑ select the polygon tool
- ☑ Click [Fill Pattern] and select the STYLE subobject under SHEET_45LITE
- ☑ turn on the Fill Pattern toggle and click [Fill Pattern]
- ☑ select a transparent pattern
- ☑ practice drawing filled polygons, outlining soil polygons

Select or create a fill pattern and practice filling soil polygons.
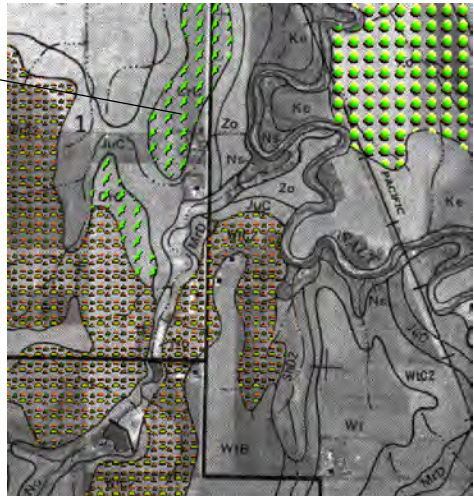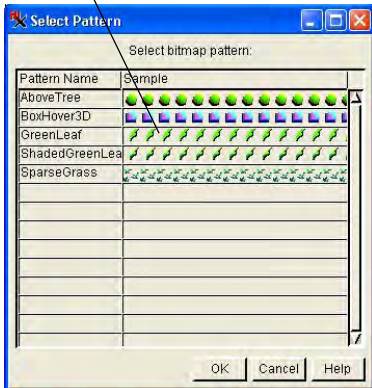
Cut, Copy, and Paste

The Cut, Copy, Paste tool opens the Box Edit Controls window so you can duplicate part of an image.

COPY

PASTE

PASTE RESAMPLED
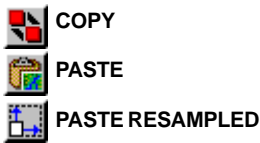
The Editor supports Cut, Copy, and Paste operations so that you can duplicate part of an image. Selecting the Cut, Copy, Paste tool opens the Box Edit Controls window. The basic procedure is:

☑ Press the Copy icon button in the Box Edit Controls window

☑ Use the left mouse button to draw an elastic box around the part of the image you want to copy

☑ Click the right mouse button to register the copy

☑ Press the Paste icon button in the Box Edit Controls window

☑ Use the left mouse button to drag the paste box to its target location

☑ Apply the paste operation by clicking the right mouse button

You can rotate and resample the copy by selecting Paste Resampled instead of Paste. When Paste Resampled is selected, you can resize the target elastic box by dragging its edges, and rotate it by holding down the Shift key as you drag a corner.
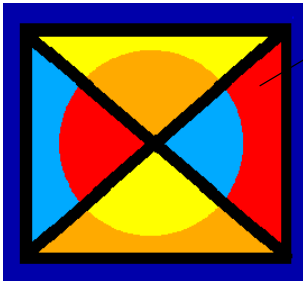
Part of the image is selected with the Copy box.

The Paste box and Paste Resampled box is used to make copies of different sizes and aspects. The rotation effect can be used to rotate labels for map features such as rivers. (Although many labeling tasks are more suited to vector and CAD objects.)
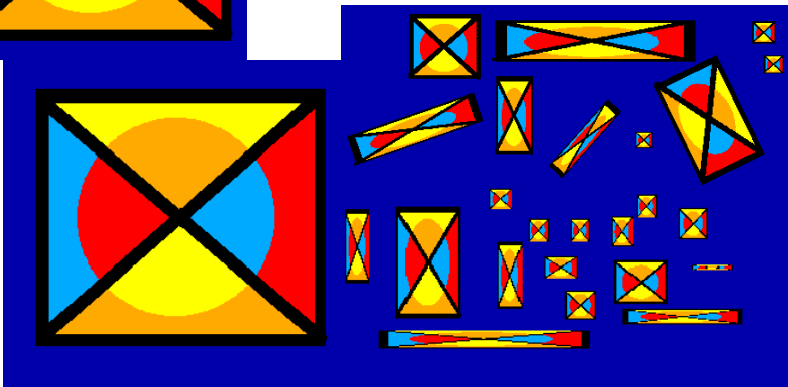
Using a Reference Layer

One of the most powerful features of the Spatial Data Editor is its ability to let you work with multiple layers. Often, your multi-layer editing will use a raster object as the backdrop and you will edit CAD or vector objects as overlays. (Refer to the tutorial booklet *Editing Vector Geodata*) But multi-layer editing has its uses with raster objects, too. You can edit a raster object over a raster object if the raster object in the editing layer has null values defined. Turn on the Null Cells Transparent toggle in the Display Controls dialog, and then the reference raster below will show through the null cells.

The Null Cells Transparent toggle lets a reference raster object be seen behind the raster object you are editing.
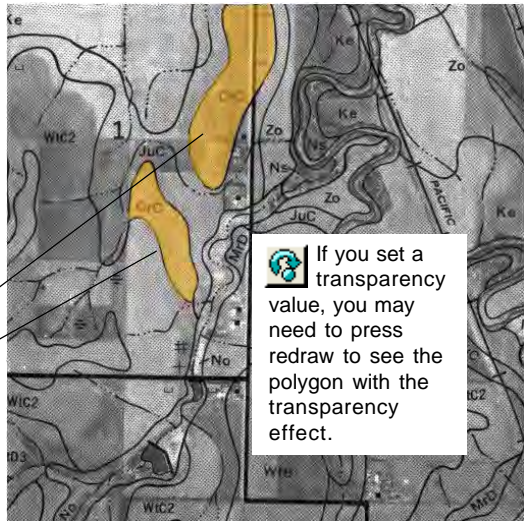

Setting a transparency value lets you see the reference image behind the features you draw.
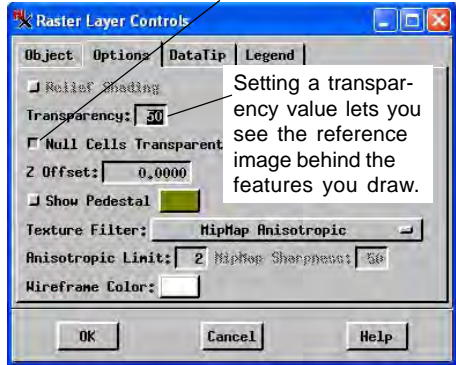
As an exercise, edit a soil polygon mask raster object:

☑ add LITEDATA / EDITRAST / LANCSOIL / SHEET_45LITE as a reference layer

☑ open LITEDATA / EDITRAST / LANCSOIL / SOILMASK as the raster object to edit

☑ set Null Cells Transparent in the Options tab of the Raster Layer Controls dialog for SOILMASK

☑ use the paintbrush or the polygon tool to paint over the CrC soil polygons

You can edit one raster using another raster as a reference layer.

The finished SOILMASK raster object could be used as a processing raster in raster analysis combinations, or for reference and display.
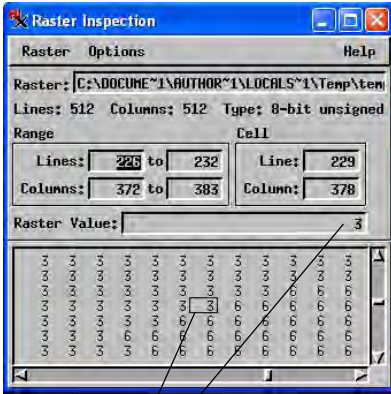
Create a soil mask in the SOILMASK raster object by painting over the CrC soil polygons in the SHEET_45LITE reference raster object.

If you set a transparency value, you may need to press redraw to see the polygon with the transparency effect.

Numeric Editing

 The Numeric Edit tool opens the Raster Inspection and Point Edit Controls windows.

The Raster Inspection window shows the cell values for the part of the image at the tool's crosshair and lets you type in a new cell value.

Recall that a raster object is logically a two-dimensional array of numbers. In 8-bit raster objects (which have a data range of 0 to 255), the number in each cell is mapped to a display color by the color map or contrast table.

When you use the raster editing tools, you are changing the numeric values of the raster cells, and thereby changing the color of the image. The Spatial Data Editor also lets you change cell values directly by entering numbers from the keyboard. Click the Numeric Edit tool button to open the Raster Inspection window. You can click the mouse cursor on the image to see the cell values for that location, or you can type line and column values into the Raster Inspection window to specify precisely which part of the raster you want to view.

Numeric editing would be slow and tedious for large extent features, but it gives you very precise control for specific locations and individual cells.
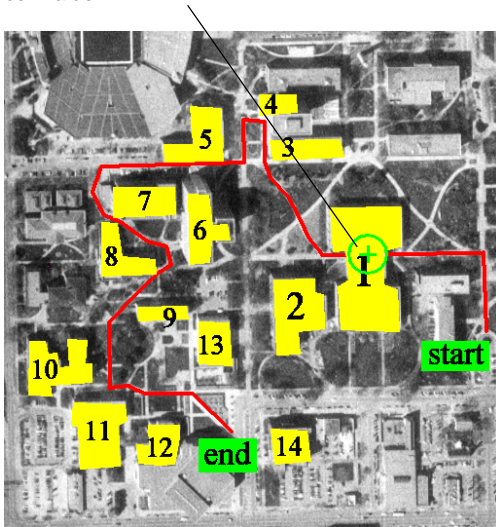

Use the Point Edit Controls dialog to specify precise map coordinates for the point you want to see in the Raster Inspection window. Type in the coordinates you want and click [Edit] to jump to that position in the image.
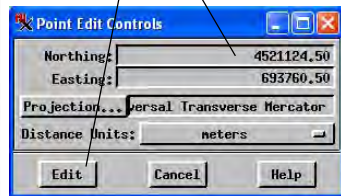
Other Tools

The **Paint** tool opens the Paint Brush window, which offers a selection of brush shapes and sizes. You can also create a custom brush shape (perhaps in the shape of a logo or special symbol) by clicking the Brush push button. Paint with the current brush shape and color by dragging the brush cursor over the image with the left mouse button.
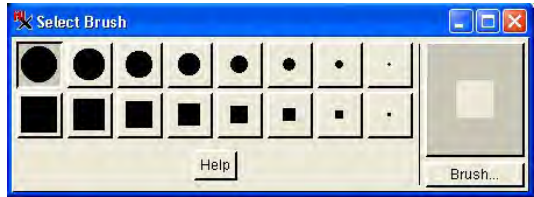
The **Grab Color** tool presents a crosshair that you place by clicking the left mouse button. Use the keyboard arrow keys for fine adjustment of the crosshair position, and then click [Grab Color] to make the cell color at the crosshair position the new drawing color. You can also enter map coordinates to position the crosshair.

The **Grid** tool lets you draw an elastic box that defines the region for a grid. A Box Edit Controls window lets you specify the number of grid divisions and whether the grid lines have a linear or logarithmic distribution.
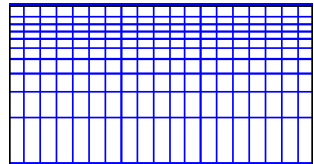
You can define and select custom **Line Patterns** in the same way that you define and select custom fill patterns (see page 15). Apply line patterns with the Line tool, any of the outline shape tools, and with the Grid tool.

The Spatial Data Editor offers many more features than this booklet has introduced. Be sure to look at the tutorials *Editing Vector Geodata, Editing CAD Geodata,* and *Editing TIN Geodata* for more information.
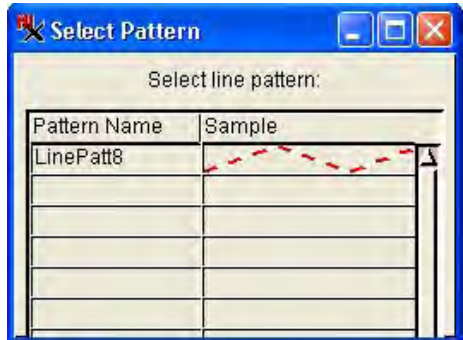
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