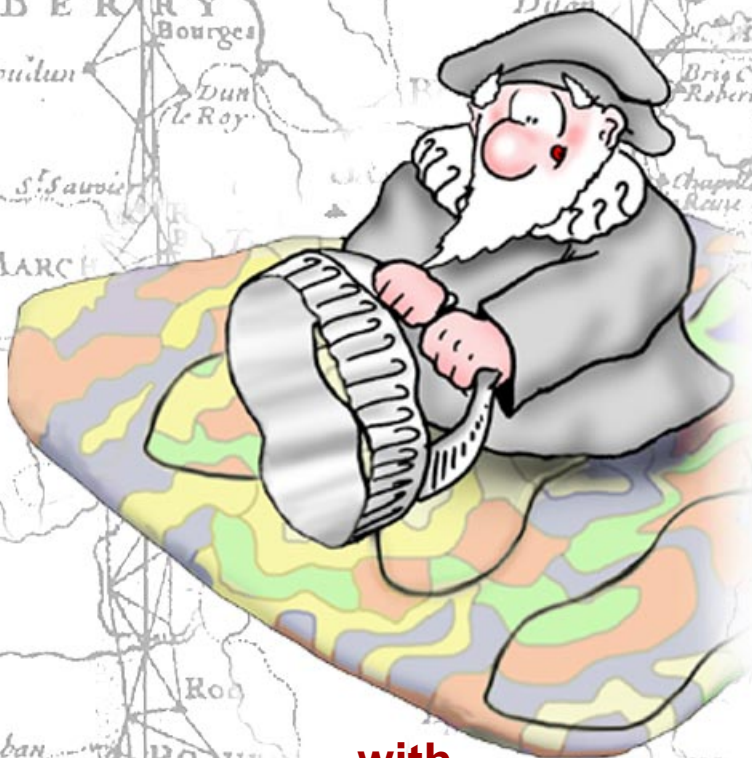


Getting Started



REGIONS

Interactive Region Analysis



with

TNTmips[®]

TNTedit[™]

TNTview[®]

Before Getting Started

A region is an area used for selection or extraction. “Region” seems to be a pretty vague term. Perhaps that’s because regions can be used for so much and generated in so many different ways. So rather than vague, think of regions as an all inclusive term. Through a series of exercises, this booklet familiarizes you with the powerful functions that generate regions and use them for selection and extraction. These functions are found throughout TNTmips® as well as in TNTedit™ and TNTview®.

Prerequisite Skills This booklet assumes you have completed the exercises in *Getting Started: Displaying Geospatial Data* and *Getting Started: Navigating*. The exercises in those booklets provide basic knowledge on how to use the TNT products including how to select and view raster, vector, CAD, TIN, and database objects stored in Project Files. You should know how to zoom, pan, and enhance display objects. Please be sure you remember how to add and remove layers from a multilayer view, and how to use the reference manual. This booklet does not present these basic skills again.

Sample Data The exercises presented in this booklet use sample data 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. The first exercises use objects in the CB_DATA data collection in LITEDATA. Additional objects and Project Files are found in the REGIONS and BEREA data collections, also in LITEDATA.

More Documentation This booklet is intended only as an introduction to the functions associated with creating and using regions. For more information, consult the TNT reference manual, which includes discussion of these topics in conjunction with Spatial Data Display and the Spatial Data Editor.

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 the size of your project materials and enables data sharing only with other copies of TNTlite. All exercises in this booklet can be completed in TNTlite using the sample geodata provided.

Merri P. Skrdla, Ph.D., 21 July 2000

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 of the newest Getting Started booklets on other topics. You can download an installation guide, sample data, and the latest version of TNTlite.

<http://www.microimages.com>

Introducing Regions

A region is a simple object used to define a complex geographic area of interest. There are no separate element types in a region object. Nor do regions have associated databases with attached attributes. Regions have rudimentary topology in that alternating nested polygons are inside then outside the region. For all their simplicity, however, regions provide very sophisticated and powerful selection capabilities for analytical tasks that use the attributes of one object to determine the elements selected in another object. For example, if you have a contour map of the distance from the surface to the ground water, a soil map with attributes such as permeability attached to soil type polygons, and point locations for hazardous materials storage, you can identify areas most in need of monitoring for ground water contamination. You can identify target marketing areas from demographic point data and political boundaries, such as counties or ZIP codes. You can identify areas in greatest need of public health information for a variety of diseases. In short, regions let you relate the previously disjoint information you have available in a number of new and innovative ways.

A region is a geographic area, which means that regions are made up of one or more polygons. In order to create regions from point or line elements, another process must act on the selected elements to generate areas. Region generation is embedded in TNTmips' powerful element selection operations found in processes throughout TNTmips.

TNTmips provides additional means for interactive GIS by providing methods for region combination to generate new regions. Intersection, union, exclusive union, and subtract operations are supported for region combinations. Thus you can generate a region that is more than 200 but less than 400 meters from a stream or that has a specified soil type and is within 100 feet of a road.



Vocabulary: A **region** is a scalable mask generated from selected vector points, lines, or polygons; TIN nodes, or raster cell values. The elements for region generation can also be drawn directly.






STEPS

- launch TNT
- copy the files in the REGIONS data collection, as well as CB_DLG and CB_ELEV in the CB_DATA data collection, to your local drive

Pages 4–7 introduce the element selection tools that are an integral part of region generation. Pages 8–12 introduce region generation techniques that work directly on selected elements. Pages 13–17 describe region generation methods that require a reference raster. Pages 18–19 introduce the Extract Via Region operation and associated database features that can be applied to vector layers. Pages 20–23 describe the advanced options, region combinations, and adding regions to vector objects.

Before Regions: Element Selection

STEPS

- ☑ select Display / Spatial Data from the main menu
- ☑ click on Setup, choose View Options, and set the Startup Mode to New 2D Group (General panel) 
- ☑ in the View panel, turn on Redraw after any change
- ☑ click on the New 2D Group icon if one is not already open 
- ☑ click on the Add Vector icon and choose Quick-Add Vector 
- ☑ first select CBSOILS_LITE from the REGIONS Project File, then select HYDROLOGY from the CB_DLG Project File
- ☑ click on the Show Details icon for the HYDROLOGY layer 
- ☑ click on the Select tool icon in the View window 
- ☑ click on one of the lines in the HYDROLOGY object
- ☑ note that the Select icons for lines and polygons are now turned on and the Create Region icon is active

The TNT products offer two means of element selection: simple selection using the Select tool and more complex selection using the GeoToolbox. The Select tool lets you select just one element at a time. You can, however, create a selection set with multiple elements by using the Select tool in the Select (add) selection mode or by starting with selection by query (or select all) and modifying that selection set.

In order to create regions from selected vector elements or from rasters, you need to show the details for the layer. You cannot use selected elements in CAD or TIN objects to generate regions, however, you can use regions to select elements in these object types.

When you click on the Show Details icon for a layer, the information for that layer is exposed. Vector and TIN layers have a row of icons for each element type. Raster layers have a row of icons for each component of the layer (one for single, three for RGB, four for RGBI, and so on). CAD layers have a single row of icons. These rows of icons are referred to as table/selection icon rows since their functions are associated with creating and showing tables and selecting elements. The Create Region icon is also in this row if regions can be created from the element or layer type and is active when elements are selected.

The Show Details icon in the layer row reveals table and selection icons for the layer.

Select

GeoToolbox

Create Region icon

mode for modifying the selected set

global deselect and unselectability

table / selection icon row for Hydrology lines

table / selection icon row for Hydrology polygons

icons that don't currently apply (element not selected for display) are dimmed

Element Selection Tools and Modes

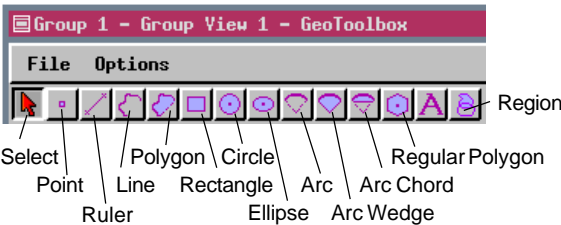
There are selection related icons in both the Controls and View windows. The selection mode and global selection action icons are found in the Controls window. The mode icons determine whether the elements identified are added to or subtracted from the selection set. The global action buttons provide shortcuts for multiple elements, layers, and groups. The View window has icons for the Select and GeoToolbox tools. The GeoToolbox icon opens another window that contains the selection and region drawing tools.

The tool icon selected determines which drawing tool is active for identifying elements for selection. Elements clicked on are immediately highlighted when the single select tool is active. The other tools require a right mouse click (perhaps accompanied by a menu choice) or a click on the Perform Selection button on the Select panel in the GeoToolbox window to select elements. A right mouse click and menu choice is also necessary to generate a region from the current tool.

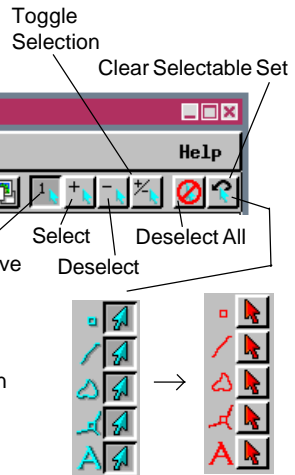
Vocabulary: The **selectable set** is the set of element types chosen for display that also have their Select icon turned on in the table / selection icon row. When an element type is not part of the selectable set, none are selected even though they fall within the area defined by a selection tool. If none of the Select icons are on when you use the Select tool, the Select icons for all drawn element types in the active layer are turned on. (The first table for each of these element types is also opened.) The **selected set** is those elements that have been selected with the mouse, by query, or using a region.



The selection related icons in Group or Layout Controls and GeoToolbox windows are labeled.



In the GeoToolbox, the Select tool or an area drawing tool is required for selection to be active (point, line, segment, and arc tools cannot be used for element selection). Any of the drawing tools can be used for region generation. The type of regions that can be generated depends on the drawing tool selected.



Selection is turned off for all element types in all layers (they are removed from the selectable set) when you click on the Clear Selectable Set icon.

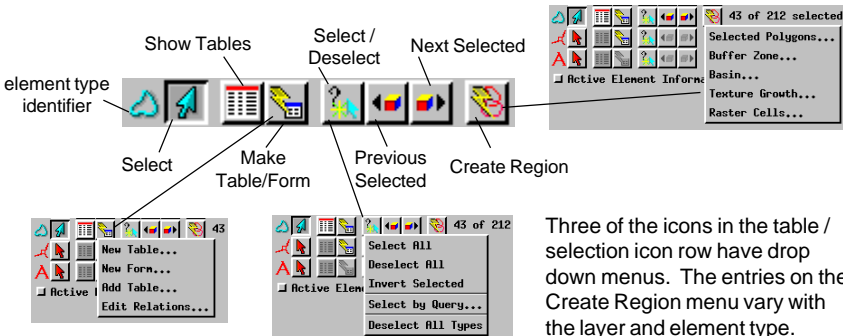
Table / Selection Icon Row

Vocabulary: A **form** is an alternative layout for a database table in single record view. It draws its fields from an existing table, but need not include all fields and can incorporate headings or other labels not associated with an individual field. You can also rearrange fields and provide alternative names not constrained by field naming conventions, such as the 15 character limit and the absence of spaces.

The table / selection icon row lets you set which object (CAD, raster, pinmap) or element types (vector, TIN) are selectable, set which tables or forms to list, create new tables and forms, enter and apply selection queries, select or deselect all elements, step through internal information about the elements in the selected set, and create regions from selected elements.

The first icon in this row is the element or object type identifier and the next determines whether elements are part of the selectable set. The Select icon and the element type identifier for vector and TIN elements are light blue when an element type is part of the selectable set and red when it is not. The object type identifiers for raster and CAD layers do not change when the ability to select is turned on/off.

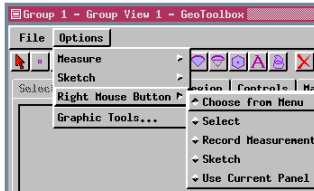
The second group of icons shows / hides database tables and forms and lets you create new ones. The third group of icons lets you enter and apply a query for element selection. This group also lets you globally select / deselect from that element type or layer and step through raw data information about selected elements. The last icon lets you create regions appropriate for the layer or element type. You cannot create regions from CAD or database layers, from TIN elements, or from non-geospatial layers, such as legends and text.



Three of the icons in the table / selection icon row have drop down menus. The entries on the Create Region menu vary with the layer and element type.

GeoToolbox Options and Features

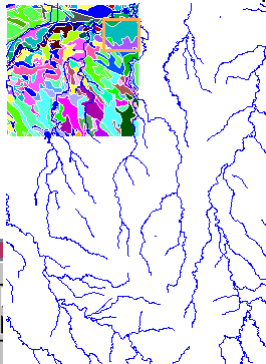
Selecting elements and generating regions are only two of the GeoToolbox's functions, which also include sketching and measuring. The right mouse button function can be set to decrease the effort needed when the GeoToolbox is used repeatedly for only one of its tasks.



For example, if the tools are in repeated use for selection only, you can elect to make a right mouse click select elements by applying the region test chosen (partially inside, completely inside, partially outside, or completely outside). Generating regions from graphic tools requires that the Right Mouse Button option be set to Choose from Menu.






Including region management in the GeoToolbox means that measurements are immediately available for any region created. You can also know the ground dimensions of the graphic tools before using them for selection.

Measurements are for the current graphic tool, which in this case is the rectangle. When the Region tool is active, the measurements apply to the region selected on the Regions panel.



Group 1 - Group View 1 - GeoToolbox		
File Options		
Select	Measure	Sketch
Perimeter	5123.88778 n	
Major Axis	1358.60661 n	
Minor Axis	1203.33729 n	
Area	1.63486 km ²	
X Extent	1361.83203 n	
Y Extent	1206.98008 n	
Angle	0.00000 deg	
Center X	N 103 19 14.207	
Center Y	N 42 44 20.878	
CBSOILS_Lite		
Type	Vector	HYDROLOGY
Minimum X	917.11897	-2207.79836
Centroid X	1053.55673	-1090.06199
Maximum X	1189.99449	27.48234
X Extent	272.87552	2235.20971
Minimum Y	2782.38036	8415.80289
Centroid Y	2902.66090	9403.51066
Maximum Y	3022.94144	10331.32831
Y Extent	240.56108	1975.52542

STEPS

- click on the Geo-Toolbox icon 
- select Options / Right Mouse Button / Choose from Menu in the GeoToolbox window
- click on the Rectangle icon 
- use the mouse to draw a box near the upper right of CBSOILS_LITE
- click on the Measure tab and note the measurement details you have about the rectangle
- check that the Test option on the Select tabbed panel is set to Partially Inside
- click on the Clear Selectable Set icon in the Group Controls window 
- click on the Show Details icon for the CBSOILS_LITE layer 
- turn on the polygon Select icon 
- right-click over the canvas area of the View window and choose Select Elements from the menu

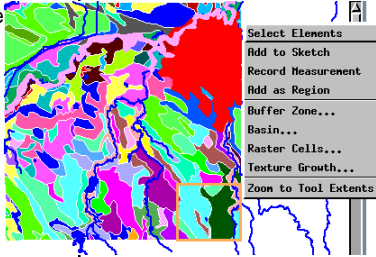
The exercise on the following page starts where this one leaves off.

The measurements provided at the top of the Measure panel are in the units selected from the Options menu. The object specific measurements below are in object coordinates. For more information on other aspects of the GeoToolbox, refer to *Getting Started: Sketching and Measuring*.

Selected Polygon Regions

STEPS

- ☑ click on the Select mode icon in the Group Controls window
- ☑ drag the Rectangle tool to the lower right of CBSOILS_LITE
- ☑ right-click over the canvas area of the View window and choose Select Elements from the menu
- ☑ choose Selected Polygons from the Create Region drop down menu



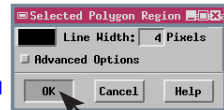
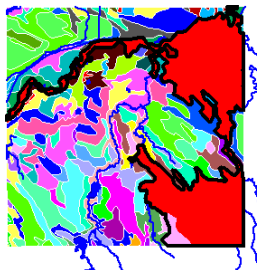
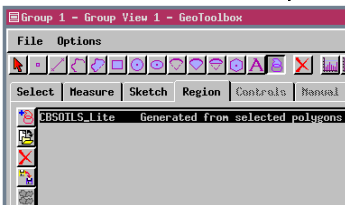
The point of dwelling on element selection is that elements must be selected to create regions. The region drawing tools let you directly draw the selected elements (a feature that will be described later), but for the most part regions are generated from selected elements in existing objects. Because regions are areas, polygons are the only element type that can be converted directly to a region.



- ☑ click [OK] in the Selected Polygons Region Generation window that opens
- ☑ click on the Region icon in the GeoToolbox to see the newly created region outline and view the list of available regions and the icons for region management

You can select polygons to define a region using any selection method, such as the mouse, a query, or with another region. Lines between adjacent selected polygons are dissolved when a region is created. A region generated from selected polygons can include spatially separated polygons, each referred to as a subregion. They can also contain islands. The Selected Polygons region option is active as soon as at least one polygon is selected.

A region is added to the list on the Region panel of the GeoToolbox window as soon as you click on [OK] in any Region Generation window. We will use this region to select line elements for buffering in the next exercise.



Keep this region open for use in the next exercise.

All region manipulations are handled from the Region panel.








Using a Region to Select

You can use an existing region to select elements in any displayed object whenever the Region selection tool is active and a region is selected in the Region panel. Let's use the region we created on the previous page to select elements from another object, specifically the HYDROLOGY object already chosen for display.

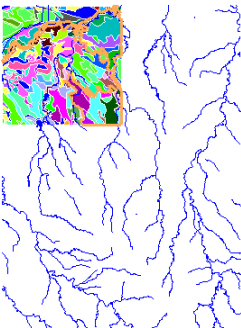
The polygons used to create the region in the previous exercise remain selected after the region is created. It is not necessary to deselect these elements to proceed, especially since we are switching the selection mode to exclusive, but deselection makes the results of each step clearer to the novice. Use the Clear Selectable Set icon to turn off selection of lines and polygons in the CBSOILS_LITE object, then turn line selection on again in the HYDROLOGY object. It wouldn't hurt to leave the CBSOILS_LITE object active for selection, but the selected hydrology lines are much easier to see when selection of soil map elements is disabled.

Once you have created a region or opened a saved region, using that region to select is as simple as clicking on the Region icon then right-clicking over the View window and choosing Select Elements.

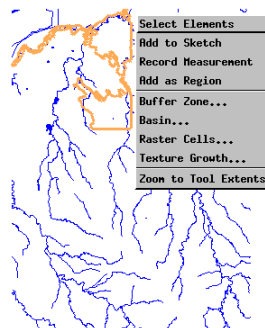
STEPS

- click on the Deselect All icon 
- click on the Clear Selectable Set icon 
- turn on the line Select icon for the HYDROLOGY layer   
- change the selection Mode from Add to Exclusive 
- click on the Select tab and check that the Test option is set to Partially Inside
- click on the Region icon 
- right-click in the View window and choose Select Elements

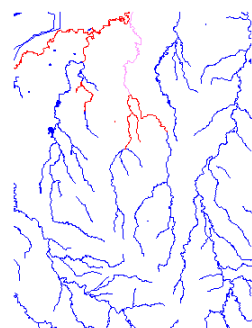
CBSOILS_LITE and CB_DLG /
HYDROLOGY in overlay with
selected polygon region



selected polygon region with
CBSOILS_LITE layer hidden




elements selected



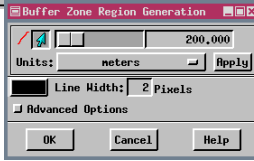
Buffer Zone Regions

STEPS

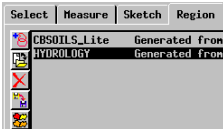
- click on the Create Region icon for the HYDROLOGY lines and select Buffer Zones from the drop down menu
 




- set the buffer (line setback) distance to 200 meters and the Line Width to 2 pixels



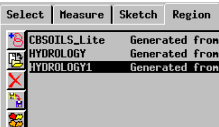
- click on [Apply]
- click on [OK]





- click on the Create Region icon again, and select Buffer Zones from the drop down menu
 

- set the buffer distance to 400 meters then click on [Apply]

- click on [OK]

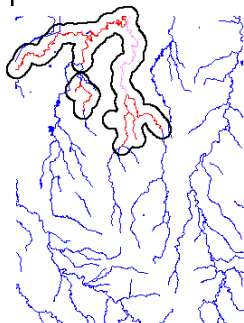
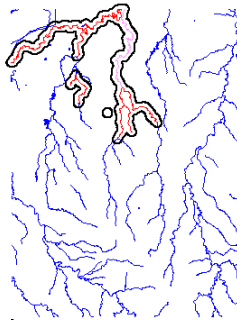


- click on the Save As icon in the Region panel
 

- save HYDROLOGY400 then highlight HYDROLOGY, click on Save As and name it HYDROLOGY200
 

Now that you have selected lines, you can use them to generate a region (in this case, a buffer zone region). Buffer zone regions can also be generated from selected points and polygons. Generating buffer zones around polygons results in setback lines around the outside of the polygons only. Generating buffer zones around lines that form polygons results in setbacks on both the interior and exterior of the polygons if the polygon dimensions are more than twice the buffer distance.

Once a region is generated, it is a temporary object for use only in the current display session unless you explicitly save it. You can save a region in the same Project File with the same name as the object it was generated from because it is a different object type (two objects of the same type cannot have the same name, but different object types, for example a vector and region, can have the same name in a single Project File). The default description provides the region generation method used, but you may want to add more information to the name or description, such as the setback distance when saving buffer zone regions.



You can make a set of buffer zones with different setback distances around the same selected lines by clicking on the Create Regions icon again, selecting Buffer Zones, changing the setback distance, and accepting the new prototype region.

The Region Panel


When you click on the OK button in any of the Region Generation windows, the Region is automatically added to the list in the Region panel and highlighted. A region is created as a temporary object with a default name that is the same as the object from which region generation was initiated. If you create other regions based on the same object, the new region names will be appended with a 1, then a 2, and so on. Click on the Rename icon if you want to change the default name without creating a permanent region object. Click on the Save As icon if you want to save the region as a permanent object for use in later display sessions or other processes. The current region name is offered as the default in the New Object window when you save. You can change the name and edit the description if desired.

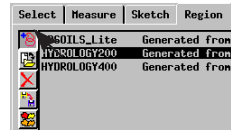
You can also open previously saved region objects or any vector object to serve as a region by clicking on the Add icon. When you open a vector object as a region, all polygon boundaries are dissolved and you are left with the object outline.

You can use the Region tool without first generating any regions in the current display session by clicking on the Add button to select an existing region or vector object, which will then be drawn in position if it falls within the area currently shown in the View window. The drawn region changes as you change the region selected in the list.

There is also a Delete icon so that you can remove regions you no longer need from the list. Remember that a newly generated region is a temporary object; if you haven't used the Save As button, you cannot select this region in a subsequent display session. The last icon at the left of the region list is the Combine icon, which is active when there are two or more regions in the list. Region combinations are discussed at the end of this booklet.

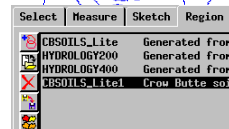
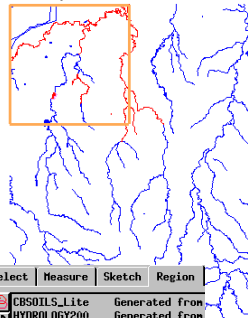
STEPS

- click on the Add icon  in the Region panel



- select the CBSOILS_LITE vector object and click [OK] in the Select Objects window

- click on the Hide icon for the CBSOILS_LITE vector layer in the Group Control window













Note: The CBSOILS_LITE vector object you added as a region was renamed CBSOILS_LITE1 to distinguish it from the region generated from selected soil polygons in the exercise on page 8.

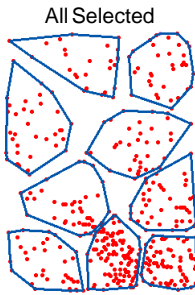
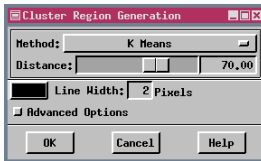
- highlight each entry in the region list in turn and note the changes in the objects drawn
- when done with this exercise, choose Group / Close in the Group Controls window

Cluster and Polygon Fitting Regions

STEPS

- ☑ click on the New 2D Group icon on the Display Spatial Data toolbar 
- ☑ click on the Add Vector icon, choose Quick-Add Vector and select the POINTS object in the REGIONS Project File 
- ☑ click on the Show Details icon 
- ☑ click on the Select / Deselect icon and choose Select All 
- ☑ click on the Create Region icon and choose Cluster 
- ☑ set the Method to K Means and Distance to 70.00, then click [OK] in the Region Generation window
- ☑ click on the Select / Deselect icon, choose Select By Query, and enter the query at the right 
- ☑ click on [Apply]
- ☑ click on the Create Region icon and choose Cluster, then click [OK] in the Region Generation window 
- ☑ click on the Create Region icon and choose Polygon Fitting, then select Tessellation and set the Percentage to 95, then click [OK] 
- ☑ click on the Create Region icon and choose Voronoi Regions, then click [OK] 
- ☑ click on the GeoToolbox icon and highlight each of the Cluster and Polygon Fitting regions 

Region generation methods that use points as input without also requiring a reference raster include Buffer Zones, Polygon Fitting, Clustering, and Voronoi Regions. Buffer Zones for points work just as they do for lines; you specify a setback distance, and any overlap of the buffers around

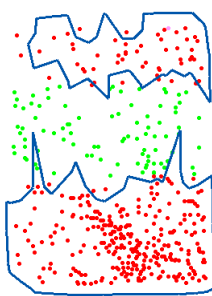


Internal.ElemNum <= 54 or
Internal.ElemNum >= 144

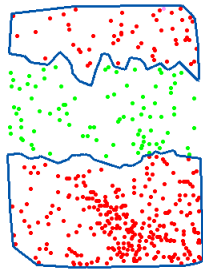


Query Selected

Polygon Fitting (Tessellation)



Voronoi

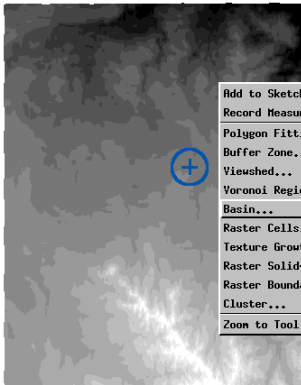


individual points is resolved to form a single polygon. The polygon fitting algorithms were derived originally to define an animal's home range based on swarms of observation points. The Minimum Polygon, Harmonic Mean, Fourier, Tessellation, Minimum Convex, and Kernel algorithms for Polygon Fitting are available for regions. The Clustering algorithms for points are adaptations of those used for automatic raster classification. K Means, Fuzzy C Means, Minimum Distribution Angle, Self Organization, Adaptive Resonance, and ISODATA Classification methods are available.

Changes in parameters while generating these regions are immediately applied to the displayed regions.

Basin Region Generation and Histogram

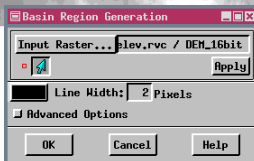
A basin region identifies the watershed basin for one or more selected points using an elevation raster to determine the cells that contribute to water flow through the selected points. Points can be selected from any existing vector object or drawn directly over a reference object. When elements are drawn for region generation rather than selected, you choose the region generation method from the right mouse button menu rather than the Create Region icon. You can update the histogram for any raster that has an open Histogram Display to include only those cells that fall within the selected region when the Region tool is active.



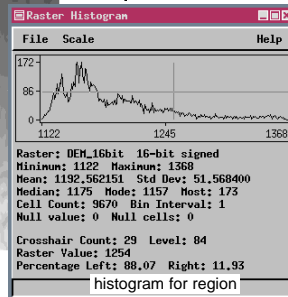
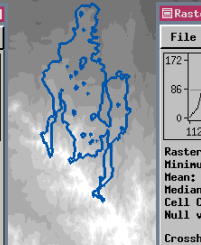
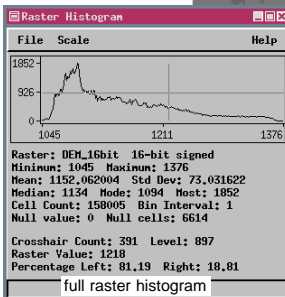
Your display will appear with a rainbow color map instead of in gray-scale as shown here.

If you would rather view the raster in grayscale, set the Color Palette option to None. You select the color map again for

the exercise on page 15.



Keep this elevation raster open in the View window for the next two exercises.








STEPS

- in a new 2D Group, click on the Add Raster icon, choose Quick-Add Single and select the DEM_16BIT object in the CB_ELEV Project File
- click on the Geo-Toolbox icon in the View window
- click on the Point drawing tool
- position the cursor approximately as shown (60% of the way across and 40% of the way down) and click the left mouse button to position the tool
- click the right mouse button and select Basin from the dropdown menu
- click on [Input Raster] and select DEM_16BIT
- click on [Apply]
- click on [OK] (results will vary with point position)
- click on the Tools icon for the DEM_16BIT layer and select Raster Histogram from the menu
- view the Histogram Display then click on the Update Histogram

icon in the GeoToolbox window and note the difference

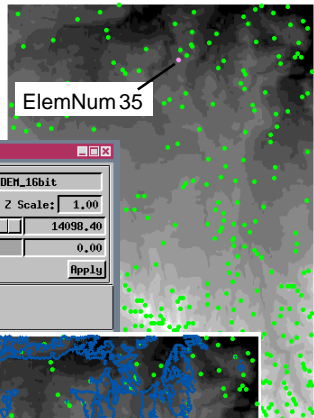
Viewshed Region Generation

STEPS

- ☑ click on the Add Vector icon, choose Quick-Add Vector, and select the POINTS object in the REGIONS Project File 
- ☑ click on the Show Details icon for the POINTS layer 
- ☑ click on the Select / Deselect icon for the POINTS layer, choose Select By Query, select Insert / Field in the Select By Query window, and click on Internal in the Table column then ElemNum in the Field column 
- ☑ click on [Insert] then append the statement with "=="35" (without the quotation marks)
- ☑ click [Apply] in the Select By Query window
- ☑ click on the Create Region icon and Select Viewshed from the menu 
- ☑ click on [Input Raster] and select DEM_16BIT from the CB_ELEV Project File
- ☑ set the Height of View to 1.5 (meters), then click on [Apply]
- ☑ click on [OK]
- ☑ click on the Rename icon in the region manager panel and change the name to Viewshed 

A viewshed is the area that can be seen from one or more selected points, and thus requires elevation information (both terrain information and the height of the viewer above the surface at the selected point). Because of the ups and downs in elevation surfaces, a viewshed is generally made up of many discrete polygons some of which may be very small.

The viewshed functions allow you to pick multiple viewpoints and designate the percentage of the selected points that must be able to see a particular location for it to be included in the viewshed. A percentage of 0.00 means that the location must be visible from at least one of the selected points. A maximum distance to search for components of the viewshed can also be entered. The default value is somewhat larger than the largest dimension of the elevation raster.



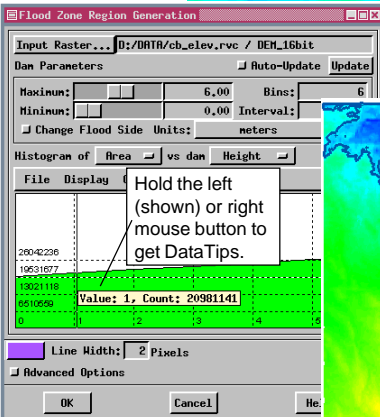
This region outline indicates which areas can be seen from 1.5 meters above the surface at point 35.

Note that the regions on these two pages are drawn in the same color even though the color shown for the prototype region differs. The final regions are drawn with the Graphic Tools color set from the Options menu in the GeoToolbox window.

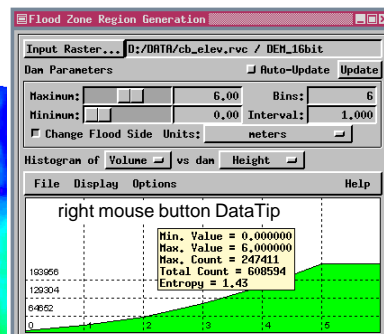
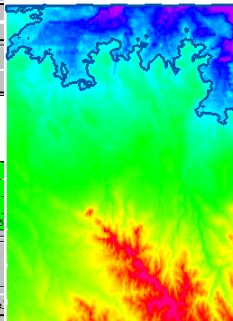
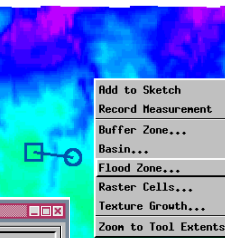
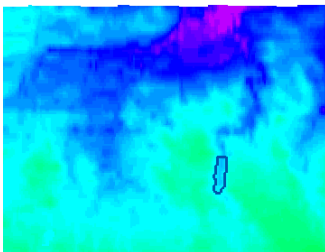
Flood Zone Region Generation

Flood zone regions enable you to determine the area that would be flooded if a dam represented by a selected location and a specified height happened to break and, alternatively, to determine the area that would be covered by the lake behind the dam. You may have a vector object with designated potential sites or you may be looking for a suitable site. The “dam” line you draw or select must cross a valley or you will receive the message that the element is improperly positioned.






Use the Line tool to evaluate a potential dam site.



The histogram shows either the area covered by or the volume of water with increasing dam height.







STEPS

- click on the Remove Layer icon for the POINTS layer 
- click on the Raster icon for the DEM_16BIT layer and choose ColorMap on the Color Palette option menu 
- click on the Zoom 1X icon and check that the Show Scale / Position on the Options menu (View window) is toggled on with the Projection set to Lat / Lon 
- position the cursor near N 42° 44' W 103° 19' and press the + key 
- click on the GeoTool-box icon then on the Line tool 
- draw a line across the narrow, darker blue “finger” near the center of the view, then right-click and select Flood Zone
- click on [Input Raster] and select the DEM_16BIT object from the CB_ELEV Project File
- enter 6.0 meters for the Maximum height and click [Update]
- after observing the region

that would flood if the dam broke, change the Histogram option menu to Volume, click on the Change Flood Side toggle, and [Update]

Raster Solid-Trace Regions

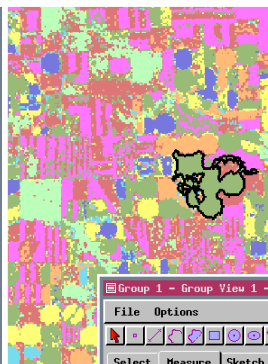
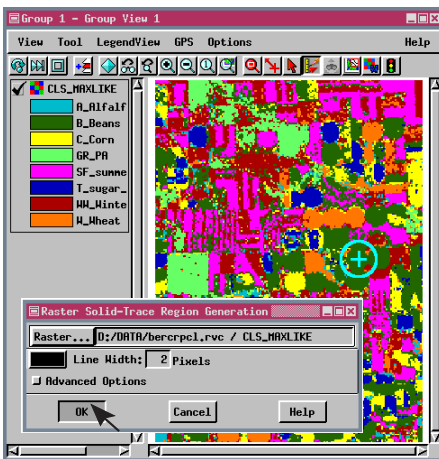
STEPS

- in a new 2D Group, click on the Add Raster icon, choose Quick-Add Single and select the object in the BERCRPCL Project File in the BEREA data collection
 
- click on the GeoToolbox icon, then on the Point tool
 

- position the cursor over one of the several connected bean fields (dark green, cell value = 5) at the center right of the raster and left-click
- right-click and choose Raster Solid-Trace from the menu
- click on [Raster] and select and again select CLS_MAXLIKE, then click [OK]
- click on the Region tool and the Measure tab to see both the region outline and the measurements for the rather rambling bean field
 

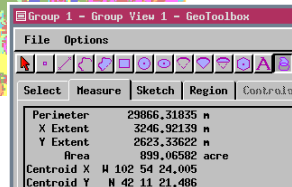
Raster Solid-Trace region generation creates a region that encloses an area of uniform cell value defined by the position of the point tool. This type of region is best generated from categorical data, such as automatic classification or feature map rasters. The position of the point tool defines both the origin and the cell value for the region. The region is generated by searching from the origin in all directions until any different cell value is found, which defines the region boundary.

You can use the Multi-Point tool on the Controls panel of the GeoToolbox to define multiple origin and cell value pairs. The region polygons generated from multiple points still enclose just one cell value (unless you happen to place points so that region polygons would share a common boundary, which is dissolved).

Another region generation method, Raster Boundary-Trace, uses the point tool to define an origin and one or more boundary cell values. Such regions include the origin and extend until the boundary values are encountered.



raster set to 50% transparency to make region visible (black outline)



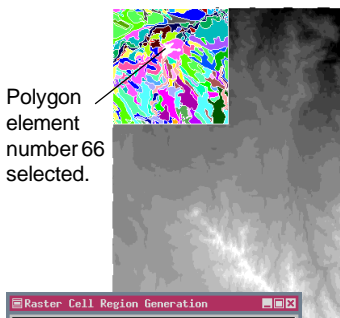
Raster Cells Region Generation

A Raster Cells region is generated by first selecting one or more points, lines, or polygons. The cell values that fall within the selected polygons, along the selected lines, or at the selected points define the cell values to find throughout the raster. (You can also use the GeoToolbox to draw the points, lines, or areas for cell value identification.) The resulting region outlines the cells that match those initially identified by selected elements.

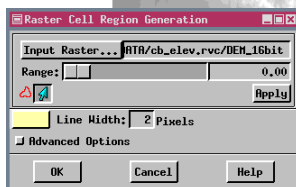
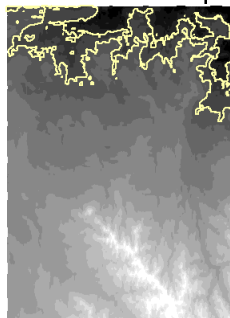
You can set a range around the identified cell values to expand the raster values matched when generating the region. We leave the range at zero in this exercise so that only the values within the polygon are matched throughout the raster.

We use an elevation raster as input so the resulting region is the cells with the same elevations as those enclosed by a specific polygon. `Internal.ElemNum==66`








A more sophisticated usage might involve a classification raster, say clustering of a multitemperal, multispectral image, and a vegetation map or surface geology vector object. Then the raster cells region would represent the image classes that were associated with a particular vegetation type or surface geology.



You will use this region in the exercises on the next two pages.



STEPS

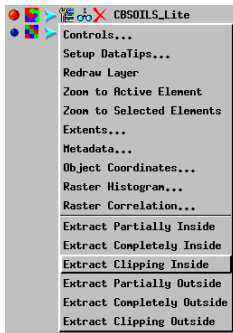
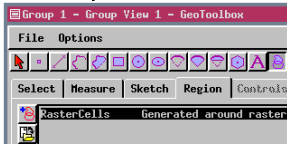
- in a new 2D Group, click on the Add Raster icon, choose Add Single Raster, select DEM_16BIT from the CB_ELEV Project File, and set the Color Palette option menu to None 
- click on the Add Vector icon, choose Quick-Add Vector, and select CBSOILS_LITE from the REGIONS Project File 
- click on the Show Details icon for the CBSOILS_LITE layer 
- click on the Select / Deselect icon in the polygon row, choose Select By Query, and enter the query at the left 
- click [Apply] in the Select By Query window
- click on the Create Region icon in the polygons row and choose Raster Cells 
- click [Input Raster] and select DEM_16BIT
- click [Apply]
- click [OK]
- click on the GeoToolbox icon, the Region tab, then the Save As icon, and save the region to your REGIONS Project File naming it RasterCells  

A Raster Cells region identifies those cells with the same elevation values as enclosed by the selected polygon(s).

Extract via Region

STEPS

- ☑ check that the Region tool is active and the RasterCells region is selected on the Region panel
- ☑ click on the Tools icon for the CBSOILS_LITE layer in the Group Controls window and select Extract Clipping Inside from the lower panel of the menu
- ☑ change to some tool in the GeoToolbox or in the View window so the drawn region doesn't obscure your view of the extracted elements



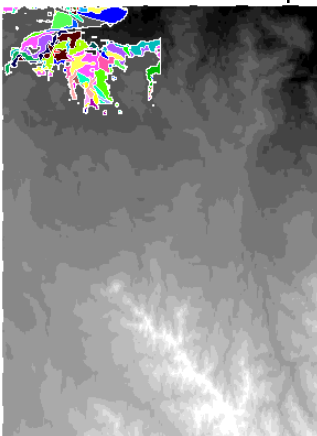
When you start this exercise, the Region tool and Region tab are selected if you have just completed the previous exercise. This tool may be automatically selected after generating a region, but it depends on the options used to generate the region. Making the Region tool active does not necessarily activate the

Region panel, which lets you open, save, delete, and rename regions, as well as initiate region combinations.

Note that the vector object you are extracting from becomes a hidden layer and the extracted layer is drawn when the extract function is completed. If the original layer was not hidden, you wouldn't be able to tell the extracted layer was also there.

This extracted layer is only a temporary object; when you exit the display process, it is gone (so be sure not to exit the display process before completing the next exercise). If the extraction is done in the Spatial Data Editor, you can paste the extracted elements into a new or existing vector object. You can also use the Copy function in the Editor to extract only selected elements within a region. The extract functions in display extract all elements within the region whether or not they are selected. A later exercise in this booklet tells you how to add regions to vector objects using the Spatial Data Editor.

Although temporary, the extracted layer has all the element selection features and database viewing capabilities of any permanent object. The database information is adjusted when you extract so that only the records attached to the extracted elements remain in the tables.

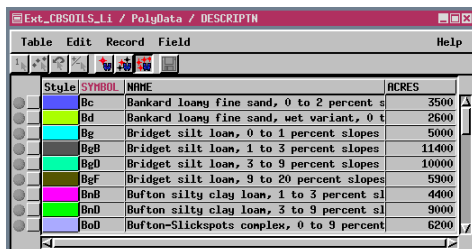


New Tables from Extracted Elements

The extracted layer is identified by DataTip and in the Display Controls window as located in a file named TEMP0001.TMP (or a higher number if you have other temporary files on your machine) with an object name like the original except beginning with EXT_. You will note that all the display controls are available for this temporary layer. You can click on the Vector icon and change the display parameters. You can click on the Show Tables icon and view all the associated database information, which is the same as for the original object except only those records related to the elements in the extracted object are present. You can use the Save As feature found in tabular database viewing to create a new and permanent table that will continue to identify the attributes of the elements that were part of this extraction. The elements themselves can also be identified using either the selection tools or by selecting from database records.



The tables associated with extracted elements, or any tables, can be saved in TNTmips' internal format, in dBASE III/IV format, in a predefined ODBC format, or as comma separated values if you are running TNTmips (internal format is the only option in TNTedit, TNTview, and TNTlite). You need not save all records in a table; you can save only those records attached to selected elements or only selected records. You also have the option of whether or not to save any fields hidden at the time.

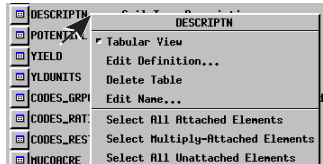
The number of records in the extracted and saved database table is fewer than in the original.





Style	SYMBOL	NAME	ACRES
Bc		Bankard loamy fine sand, 0 to 2 percent s	3500
Bd		Bankard loamy fine sand, wet variant, 0 t	2600
Bg		Bridget silt loam, 0 to 1 percent slopes	5000
BgB		Bridget silt loam, 1 to 3 percent slopes	11400
BgD		Bridget silt loam, 3 to 9 percent slopes	10000
BgF		Bridget silt loam, 9 to 20 percent slopes	5900
BnB		Bufton silty clay loam, 1 to 3 percent sl	4400
BnD		Bufton silty clay loam, 3 to 9 percent sl	9000
BoD		Bufton-Slickspots complex, 0 to 9 percent	6200

STEPS

- click on the Show Details icon for the extracted vector 
- click on the Show Tables icon for polygons for the extracted layer 
- right-click on the DESCRIPN table in the list and turn on the Tabular View toggle if it is not already on



- click on the View Table icon for the DESCRIPN table 
- choose Save As from the Table menu
- check that Format is set to Internal, Records to All Records, and Values is set to Data, then click [OK]
- select CBSOILS_LITE as the destination vector object, set the element type to Polygon, click [OK] in both the Select Object window and the Name and Description window
- note the new table at the end of the CBSOILS_LITE (not the extracted version) polygon list

 DESCRIPN1 Soil Type Descriptions

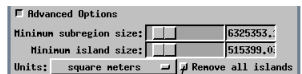
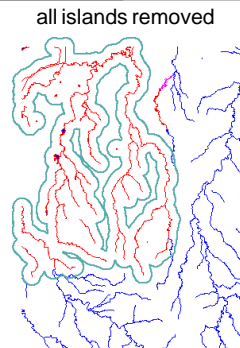
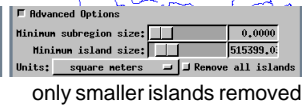
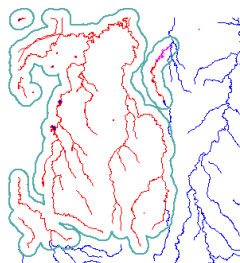
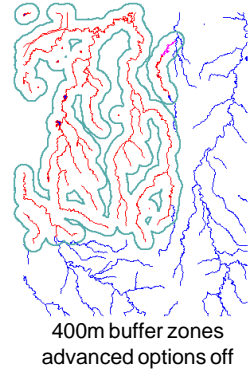
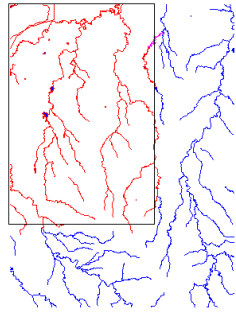


Advanced Options

STEPS

- in a new 2D Group, click on the Add Vector icon, choose Quick-Add Vector, and select the HYDROLOGY object in the CB_DLG Project File
- click on the Show Details icon for the HYDROLOGY layer, and turn on the Select icon for lines
- click on the GeoToolbox icon in the View window
- click on the Rectangle icon, draw a box that inscribes the upper left of the vector, right-click, and choose Select Elements
- click on the Create Region icon for lines and select Buffer Zone
- set the line buffer distance to 400 m
- click on [Apply] then on the Advanced Options button
- toggle on the Remove All Islands button and note how the region changes
- toggle off the Remove All Islands button, click once in the trough to the right of the Minimum Island Size slider, and note the changes
- click once in the trough to the right of the Minimum Subregion Size slider, and note the changes
- click [OK] in the Region Generation window
- click on Save As and save this region as ADVANCEDOPTIONS

The advanced options, which are available for all region types, let you remove islands and subregions less than a specified size from a prototype region. The advanced options are only active while this drop down panel is active, so you must click on [OK] with the panel open for the settings to become part of the actual region.



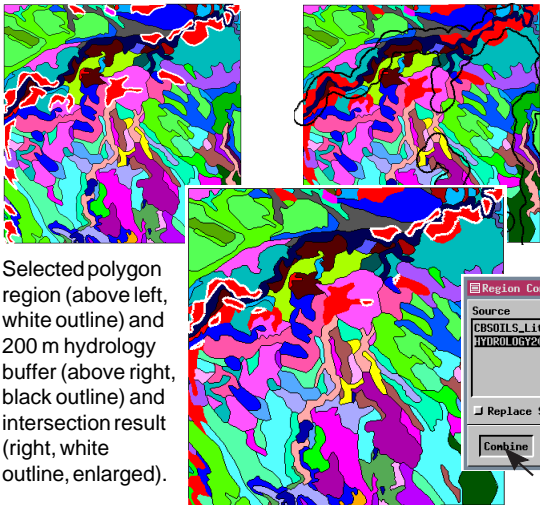
Be sure you've turned this toggle off when you want to remove only some of the islands.

Region Combinations: Intersect

The Combine icon on the Region panel of the GeoToolbox becomes active as soon as two regions are listed. These regions can be newly created or added from a previous display session.






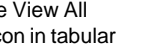






The four combination choices are Intersect (AND), Union (OR), Exclusive Union (XOR), and Subtract. Intersect results include areas found in both regions. Union results include areas found in either region. Exclusive Union results include the areas present in one or the other, but not both, regions. Subtract results remove all areas in the operator region from the source. For more information on these operations see *Getting Started: Vector Analysis Operations*.

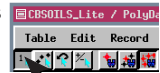
Many questions can be answered using region combinations. You can identify areas that are more than one mile but less than five miles from features of interest, areas that have a slope > 5% and face north, areas of specified soil types within potential development sites, and so on. In this exercise, you identify areas within 200 meters of water features that also have one of two specified soil types.



Selected polygon region (above left, white outline) and 200 m hydrology buffer (above right, black outline) and intersection result (right, white outline, enlarged).












STEPS

- in a new 2D Group, click on the Add Vector icon, choose Quick-Add Vector, and select the CBSOILS_LITE object from the REGIONS Project File 
- click on the Show Details icon, and turn on the Select icon for polygons  
- click on the Show Tables icon, then the View Table icon for the CLASS table  
- click on the View All Records icon in tabular view, scroll and click in the Select Record box for GoB and JmC polygons 
- click on the Exclusive icon in tabular view 
- click on the Create Region icon for polygons and choose Selected Polygons (click C 
- click on the GeoToolbox icon, then on the Region tab, and on the Add Region icon  
- select the hydrology200 region you made on p 
- click on the Combine icon on the Region panel 
- with the operation set to Intersect and HYDROLOGY200 as the Source and CBSOILS_LITE (selected polygons) as the Operator, click on [Combine]



Region Combinations: Subtract

STEPS

- in a new 2D Group, click on the Add Vector icon, choose Quick-Add Vector and select the CACOUNTIES and CALIFICITIES objects in the REGIONS Project File
 
- click on the Show Details icon for CALIFICITIES,* then click on the Select / Deselect icon, choose Select By Query, enter the query at the right, and click on [Apply] in the Select By Query window
 

- click on the Create Region icon and select Buffer Zone
 
- set the distance to 10 miles, click [Apply], then [OK]
 
- click on the Select / Deselect icon for CALIFICITIES, choose Select By Query, enter the query at the right, and click on [Apply]
 
- click on the Create Region icon, select Buffer Zones, set the distance to 100 miles, click [Apply], then [OK]
 
- click on the GeoToolbox icon, on the Region tab, then on the Combine icon
 

- choose CalifCities as the Source and CalifCities1 as the Operator, click on the Subtract icon, then on [Combine]
 
- click on the Region icon to see the results
 

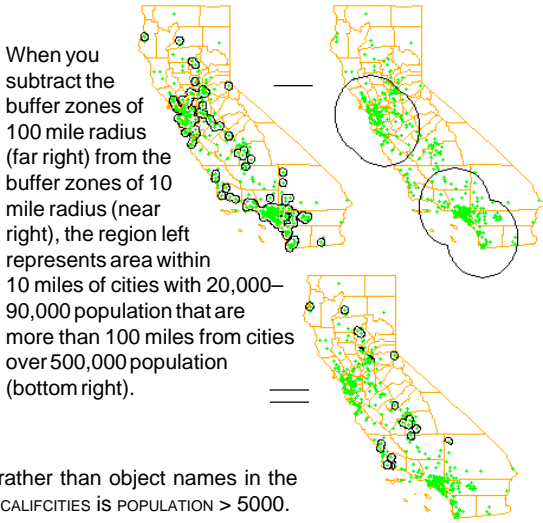
Population.POP > 20000 and
Population.POP < 90000

Population.POP > 500000

Subtract is the only region combination in which it matters which region is the source and which is the operator. (The source / operator assignment in vector combinations does matter for vector combinations for the other operations because of element selection and attribute transfer considerations.) The purpose of this exercise is to locate areas to live in California within 10 miles of a city with a population between 20,000 and 90,000 but at least 100 miles from a city with a population > 500,000.

Such areas can be identified by subtraction of two

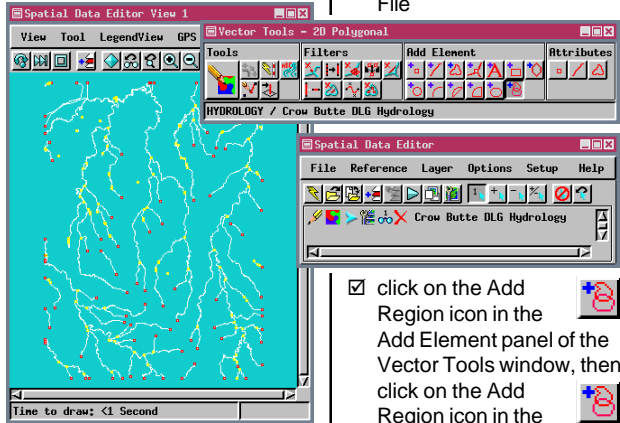
buffer zones (intersection would find areas within 10 miles of moderately sized cities that were also within 100 miles of large cities). The importance of which region is the source and which the operator is apparent in this example. If the 100 mile buffer zone is the source, the result identifies areas that are within 100 miles of a large city but not within 10 miles of a city with population between 20,000 and 90,000. For this example, the 10 mile buffer zone is the source and the 100 mile buffer zone is the operator.



* If showing descriptions rather than object names in the Group Controls window, CALIFICITIES IS POPULATION > 5000.

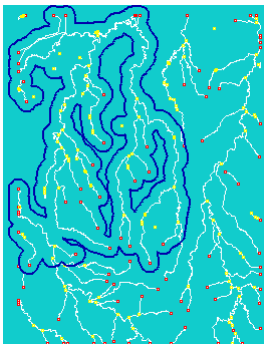
Adding Regions to Vector Objects

This is the only exercise in this booklet that cannot be completed in TNTview, as well as in TNTmips and TNTedit. The features of TNTmips' Spatial Data Editor are required. Most illustrations in this booklet use a white background in the View window, which is the default color for lines in the Spatial Data Editor. It appears as though nothing has been drawn if you open an object for editing over a white background. Also note that after you add the region, you need to change to some tool other than the Add Region tool in order to see the changed appearance of the vector object.

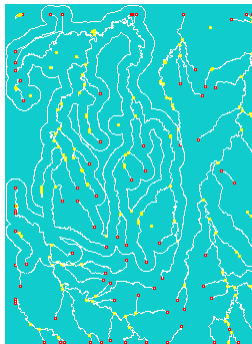


In this example we add the region without assigning any attributes. Attribute assignment is the topic of another Getting Started booklet (*Managing Geoattributes*). It is up to you whether you save or discard this object when exiting the Editor (the original is not effected in any way).


region and vector
before adding




vector after
adding region



STEPS

- choose Edit / Spatial Data from the main TNTmips menu
- click on the Open Object for Editing  icon and select HYDROLOGY from the CB_DLG Project File

- click on the Add Region icon in the Add Element panel of the Vector Tools window, then click on the Add Region icon in the Region Edit Controls window that opens 
- select the ADVANCEDOPTIONS object you saved on page 20



- click on [Add] in the Region Edit Controls window
- change the tool selected in the Add Element panel

Advanced Software for Geospatial Analysis

REGIONS

MicroImages, Inc. publishes a complete line of professional software for advanced geospatial data visualization, analysis, and publishing. Contact us or visit our web site for detailed product information.

TNTmips TNTmips is a professional system for fully integrated GIS, image analysis, CAD, TIN, desktop cartography, and geospatial database management.

TNTedit TNTedit provides interactive tools to create, georeference, and edit vector, image, CAD, TIN, and relational database project materials in a wide variety of formats.

TNTview TNTview has the same powerful display features as TNTmips and is perfect for those who do not need the technical processing and preparation features of TNTmips.

TNTatlas TNTatlas lets you publish and distribute your spatial project materials on CD-ROM at low cost. TNTatlas CDs can be used on any popular computing platform.

TNTserver TNTserver lets you publish TNTatlases on the Internet or on your intranet. Navigate through geodata atlases with your web browser and the TNTclient Java applet.

TNTlite TNTlite is a free version of TNTmips for students and professionals with small projects. You can download TNTlite from MicroImages' web site, or you can order TNTlite on CD-ROM with the current set of *Getting Started* booklets.

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