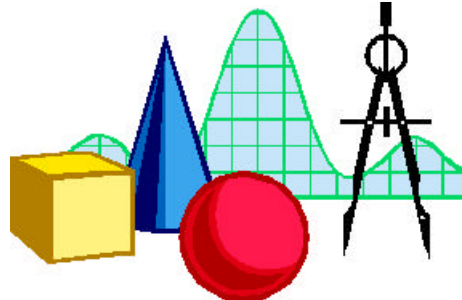




# SPATIAL TOOLS



**SPATIAL TOOLS ARCVIEW EXTENSION**  
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[Introduction](#)
[Data Format](#)
[Views](#)
[Bibliography](#)

**Loading this Extension:** *Spatial Tools is an ArcView program extension which must be run simultaneously with Spatial Analyst. After downloading, unzip the .avx file directly (or unzip to a temp directory, then copy) to the ArcView EXT32 folder. Start the ArcView program, click on "file" and go to "extensions". From the list of available extensions, select Spatial Analyst, then Spatial Tools and click "ok". The collection of new functions will now be available through menu choices, tools, and buttons described below.*

**Using this documentation:** *Click on the menu bar above to go to the major headings and then click on either the subheading list or the image map of menu choices or buttons. Click on the return button to get back to the subheading list.*

*For any questions or problems regarding this documentation, contact [elizabeth\\_solomon@nps.gov](mailto:elizabeth_solomon@nps.gov).*



Spatial tools is an ArcView extension which provides a collection of grid tools made available through the program's GUI (Graphical User Interface). Menus, Tools, and buttons provide access to various spatial modeling and analysis capabilities such as geometric transformations, mosaicking, resolution alteration, data clean-up and spatial analysis. Spatial Analyst must be loaded simultaneously.

Requirements: ArcView and Spatial Analyst. This program will work in versions of ArcView on PC, UNIX and Macintosh hardware. On the PC platform it is recommended that a Pentium or Pentium Pro 200 or faster be used with this program and at least 32 megabytes of memory, since Spatial Analyst must be running simultaneously.

Other grid operations and functions not currently available through Spatial Analyst or Spatial Tools menus can be accessed through the use of the additional extensions and Avenue Requests. Help for these requests and extensions can be found in the ArcView On-Line Help Documentation and/or at <http://www.esri.com/>.

**Hydrologic Modeling Extension (v1.1)**

Flow Accumulation  
 Flow Direction  
 Flow Length  
 Delineate Watershed  
 Area/Perimeter/Length of watersheds  
 Focal Flow  
 Snap Pour Point  
 Stream Order  
 Identify/Fill Sinks  
 Flow Length by Watershed  
 Shape Factor by Watershed  
 Centroid as Point Shape  
 Pour Points as Point Shape  
 Mean Watershed  
 Elevation/Slope/CurveNumber/Precipitation

**Avenue Requests**

Flip  
 Mirror  
 Shrink  
 Expand  
 CostDistance  
 CostPath  
 ReturnCostPath  
 Curvature  
 Lookup  
 BlockStats  
 Focal Stats  
 Slice  
 ZonalFill

**Visibility Extension**

Line of Sight  
 Visibility



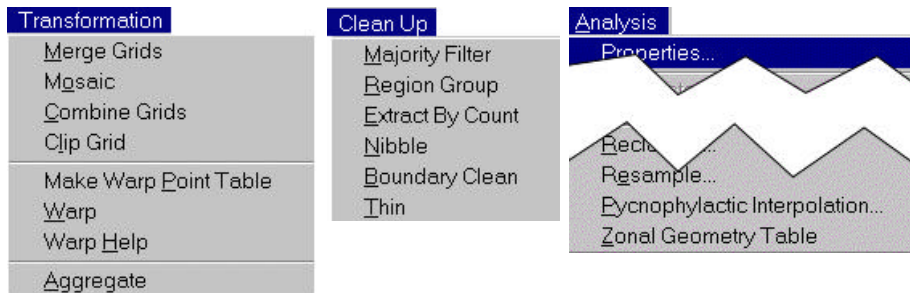
The majority of functions in Spatial Tools operate primarily on grid theme data (ARC GRID format). The exceptions are the [Profile](#) and [Profile with Feature Points](#) operations which require a combination of active grid, line and point feature themes, and [Clip Grid](#), which requires a selected graphic object as well as an active grid theme to perform the analysis. The menu choices [Set to View](#) and [Set from View](#) each require a separate existing view in the project and the [Type in to Link](#) and [Type in from Link](#) work with an existing table (which can be created using the [Create Link Table](#) option).

Menu choices are performed on selected (active) feature themes, after which the user is prompted to enter or select from a list of variables. Tool buttons are utilized by clicking the tool and then clicking in the view to perform the function.






## VIEW MENU CHOICES

### Select a Menu Item



### Changes to Version 3.0 menus include the following:

- Make Warp Point Table, Warp Help, and Warp choices have been removed from the Transformation menu.
- New warp functions have been added to the Transformation menu, which include [Set From view](#), [Set To View](#), [Set Link Table](#), [Create Link Table](#), [Type in From Link](#), [Type in To Link](#), and [Warp](#).
- [Random Grid](#) has been added to the Analysis menu.
- [Profile](#) and [Profile with Feature Points](#) have been added to the Analysis menu.
- A Delete Link Button  has been added to the view.
- A Rotate Grid Button  has been added to the view.
- The Grid Shift Tool Icon  has been changed.

### Select a [Button](#)



### Select a [Tool](#)




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## TRANSFORMATION MENU

### Merge Grids

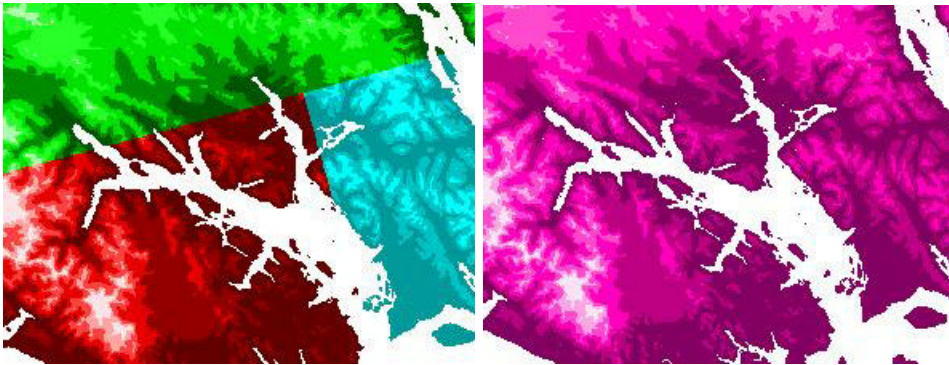
Runs the MergeGrid request based on user input; Merges two or more adjacent grids into one grid. Cells in common or overlapping areas are assigned values based on the sequence of grids entered (highest priority goes to the grids entered first).



### Mosaic

Runs Mosaic request based on user input. Creates one grid from two or more adjacent grids, Overlapping or common areas between grids are "smoothed" using a calculated weighted average. The maximum number of grids that can be combined is 50.

In the following example, 3 grids were mosaiced to create a new grid with smooth boundaries.



### Combine Grids

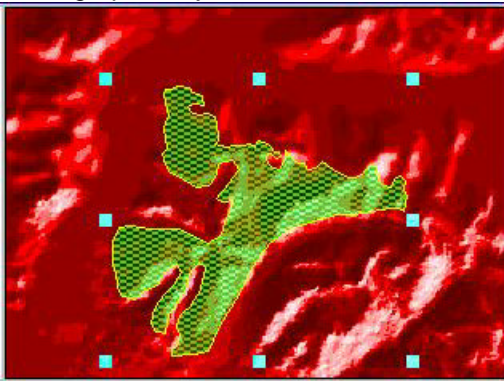
Combines the first selected grid with grids selected from the file dialog to create a grid of unique values.



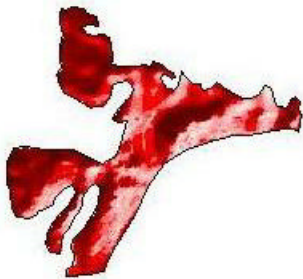
### Clip Grid

Extracts a new grid by clipping to the inside or outside of an overlaying graphic object.

Select graphic object



Choose "clip inside" or "clip outside"





**The following set of tools are used in the georeferencing/warp operation for grid data sets:**

Note...Online help for the warp procedure is available from ArcView's Help Menu.

**Set From View**

Specifies the view to be used as the From View in the Warp operation.

**Set To View**

Specifies the View to be used as the To View in the warp operation.

**Set Link Table**

Specifies the Table to be used as the Link Table (a table containing "from" and "to" link coordinates) in the warp operation.

**Create Link Table**

Creates (and sets) an empty Link Table to be used in the warp operation. Prompts user to select file destination.

**Type in From Link**

Allows the user the option to manually type in a "from" link coordinate in to the Link Table instead of clicking in the "From View".

**Type in To Link**

Allows the user the option to manually type in a "to" link coordinate into the Link Table instead of clicking in the "To View".

**Warp**

Starts the warp calculation on an active grid theme. After creating/setting the "From" and "To" views, creating/setting the link table, and building a list of coordinates in the table, the user must select the "From View", and is prompted to enter the polynomial order to be used, as well as the desired resampling method (Nearest Neighbor, Bilinear, or Cubic Convolution). The new dataset will be added to the "to" view and named "Warp of (original grid theme)".

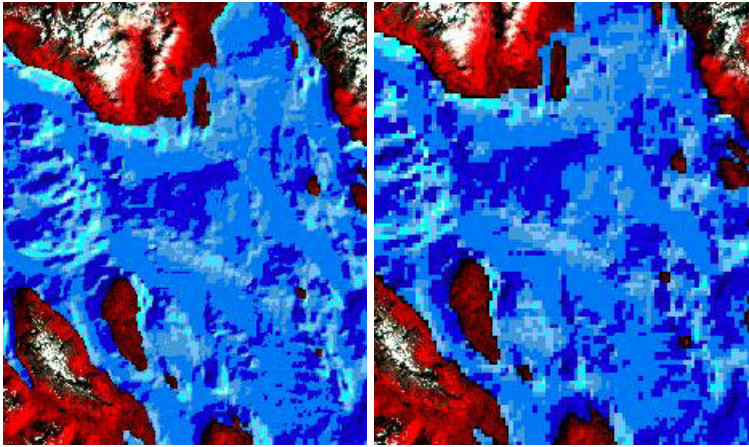


**Aggregate**

Aggregates a grid using the selected method. Using a user-prompted statistical method (**maximum, mean, medium, minimum or sum**), this function alters the resolution of a grid by performing aggregation calculations on groups of cells with the same value. The result is a new grid resampled to a coarser resolution.



The following bathymetry grid was aggregated using maximum values for depth and a cell factor of 3. The resulting grid been resampled to a coarser resolution.



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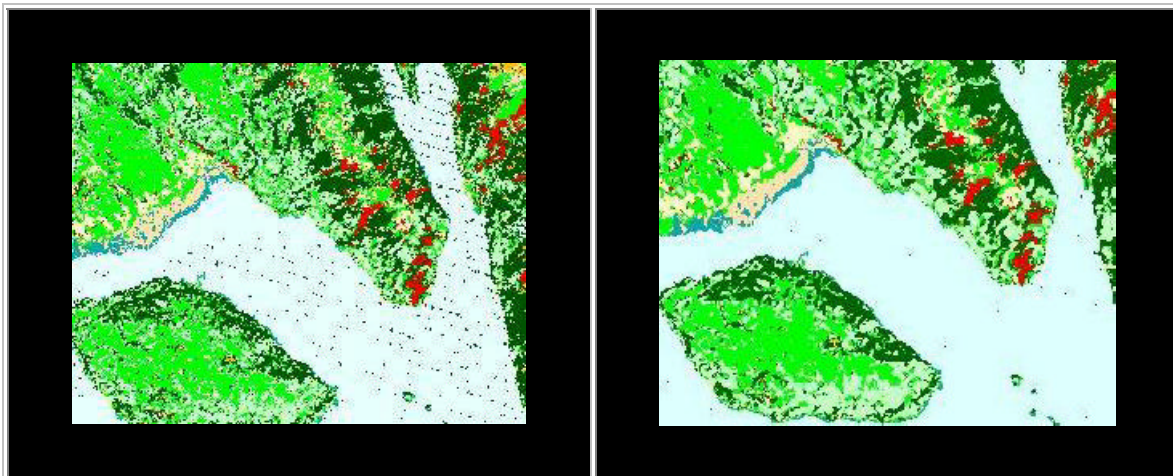
## CLEAN UP MENU

### Majority Filter

Runs MajorityFilter request on active grid theme.

Smooths data by replacing cell values in the active grid with the majority (most frequent) value of neighboring cells. Select diagonal neighbors (true/false) and halfok (majority or half) options to decide which and how many of the neighboring cells will be used to determine majority values.

In the following example, the majority filter function has smoothed out the data by replacing misclassified cells (dark green areas of vegetation occurring in water) with new values using the most frequently occurring values of neighboring cells.





### Region Group

Runs RegionGroup request on active theme.

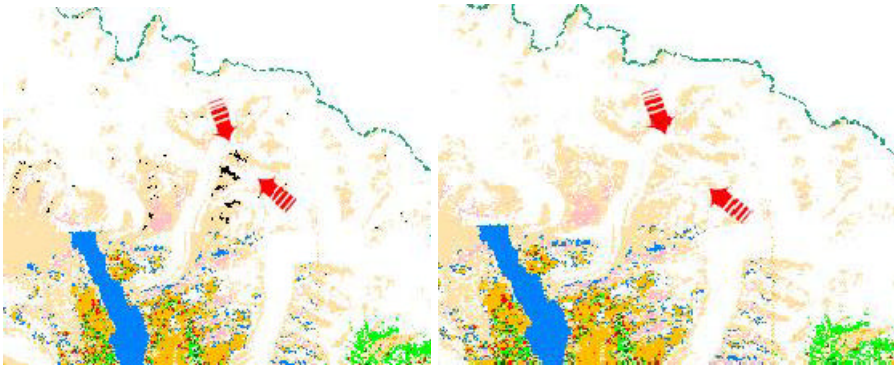
Creates a region for every contiguous group of cells with the same value.



### Extract by Count

Runs grid ExtractByAttribute request on active grid theme; Prompts to enter TheCount (Cells < TheCount are set to NoData in the new theme, otherwise cells retain their original values).

In the following landcover grid, the original values which represent "shadows" (displayed in black) were set to No Data by entering a count of 1500. The new grid represents the original values for all data with a count greater than 1500.



### Nibble

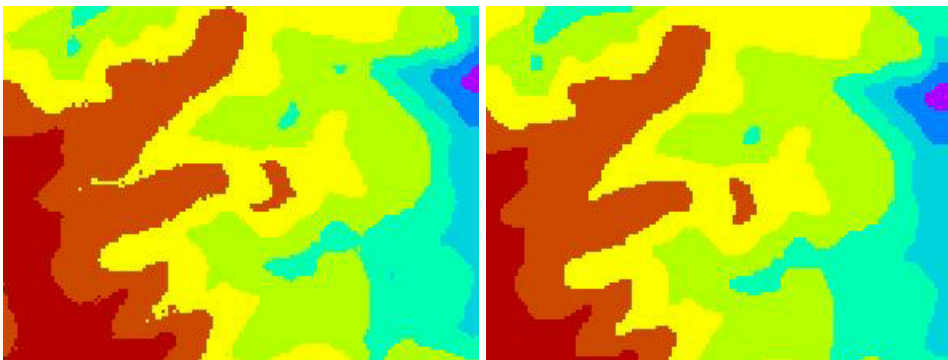
Prompts for mask grid, analysis grid, and request variables; runs the Nibble request, ignores active themes. Uses a mask grid to replace NoData cell values of the active grid (input grid) with the values of the nearest neighboring cell.



### Boundary Clean

Runs BoundaryClean request on active grid theme.

Cleans (smoothes) transition areas between grid zones using expand and shrink methods.





### Thin

Runs Thin request on active grid theme.

Shrinks linear features in the active grid to one pixel width. Prompts for the following variables:

notBinary (TRUE = all values other than No Data are thinned. FALSE = only values greater than 0 are thinned).

doFilter (TRUE = the Grid is filtered to smooth the boundaries between values. FALSE = no filter is used).

sharpenCorners (TRUE = rectangular corners and junctions are preserved. FALSE = all corners and junctions are smoothed).

maxThickness (can be a Number or Nil, that defines the maximum thickness, in map units, of linear features in the Grid. If maxThickness is set to Nil a value 10 times the cell size of aGrid is used).



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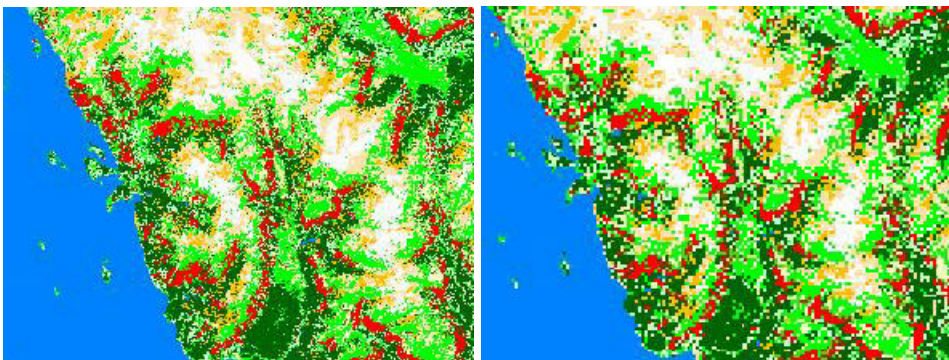
## ANALYSIS MENU

### Resample

Changes the resolution of the active grid by interpolating values using a chosen resampling method (nearest-neighbor, bilinear, or cubic).

- **NEAREST NEIGHBOR:** Fastest of the 3 interpolation methods. It is mainly used for categorical data, as it will not change cell values. The maximum spatial error will be one half the cell size.
- **BILINEAR:** Determines the new value of a cell based upon a weighted distance average of the four nearest input cell centers. It can be used for continuous data, and will cause some smoothing of the data.
- **CUBIC CONVOLUTION:** Determines the new value of a cell based upon a weighted distance average of the sixteen nearest input cell centers. It is used for continuous data and is geometrically less distorting than the Grid achieved by running the nearest neighbor method. This method require the most processing time.

In the following example, the grid was resampled to a larger cell size using the nearest-neighbor method.

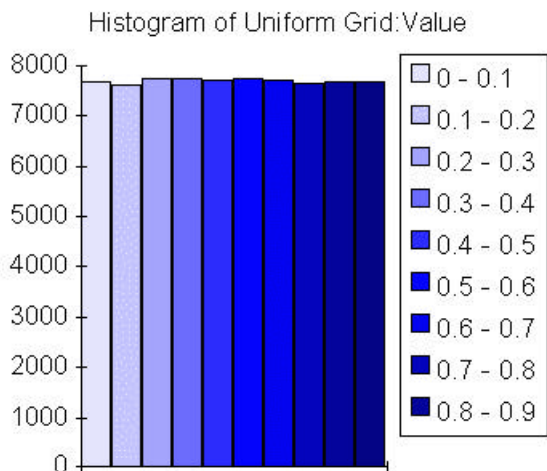




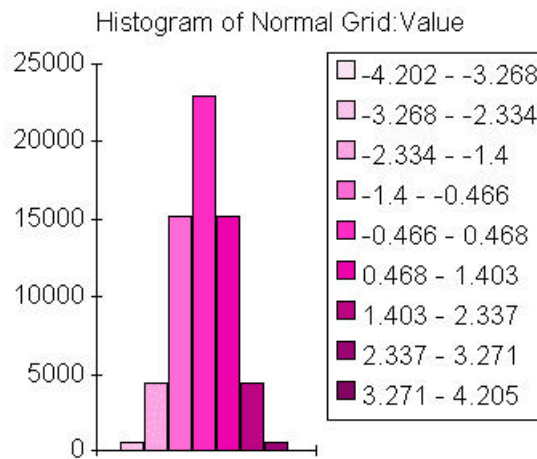
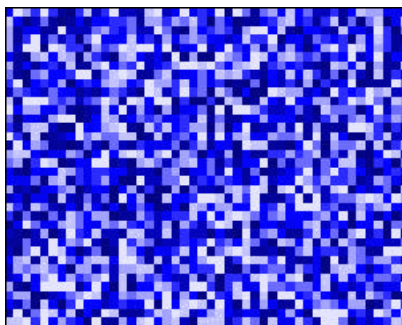
**Random Grid**

This function creates a random grid. The user selects either a uniform or a normal grid, and is prompted as to whether or not the values are to be adjusted.

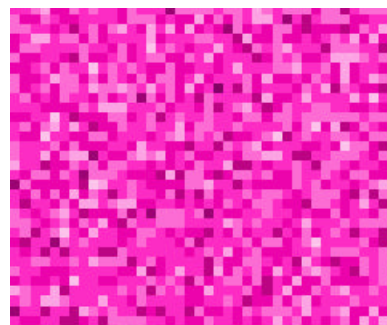
The following histograms illustrate the distribution of values for a uniformly and a normally distributed random grid:



**Uniform: Default values are between 1 and 0**



**Normal: Default Mean = 0, Standard Deviation = 1**



**Pycnophylactic Interpolation**

The program performs pycnophylactic interpolation on a categorical grid. The analysis variable in the VTAB of the grid should represent a phenomenon that changes continuously over space.



**Zonal Geometry Table**

Creates a table containing various geometric calculations for each zone in the active grid.

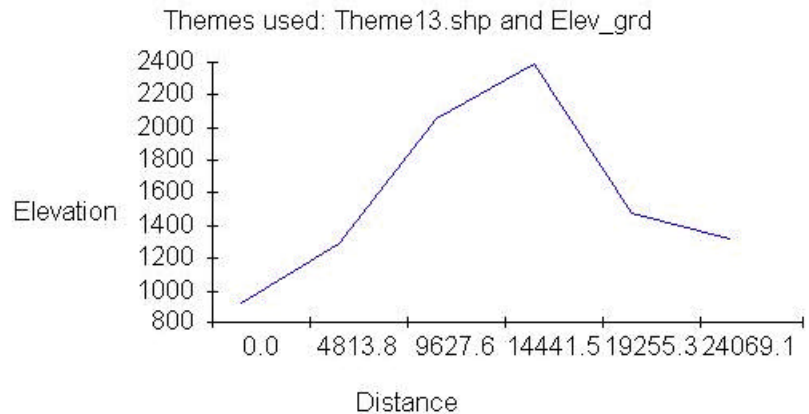
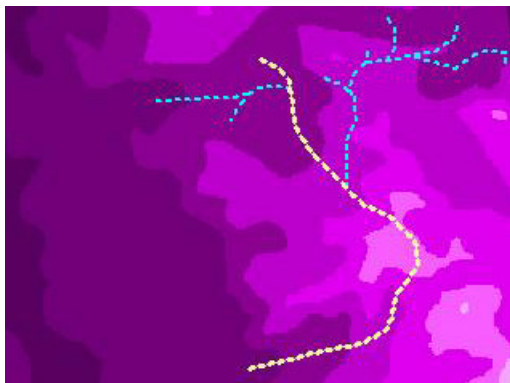
Value	Area	Perimeter	Thickness	Xcentroid	Ycentroid	Majoraxis	Minoraxis	Orientatio
1	1994032.875	59984.367	132.291	450456.000	6534330.500	1108.795	572.442	53.950
4	2222265.500	71144.250	116.249	451105.125	6534630.500	1331.456	531.275	48.000
5	24024.492	1239.987	38.750	449359.094	6545161.500	219.549	34.832	162.246
6	3795869.750	86954.078	164.376	449758.875	6537932.000	1420.841	850.386	20.118
13	5543651.500	151278.406	193.748	451149.000	6535779.000	1863.865	946.742	41.074
14	17333672.00	295426.875	273.960	451714.469	6539975.000	2688.891	2051.954	10.836
17	21754178.00	248462.375	396.873	452924.594	6540742.500	3380.037	2048.667	0.147
18	38838.688	8634.833	54.388	449188.188	6545588.888	353.548	86.588	134.888



**Profile**

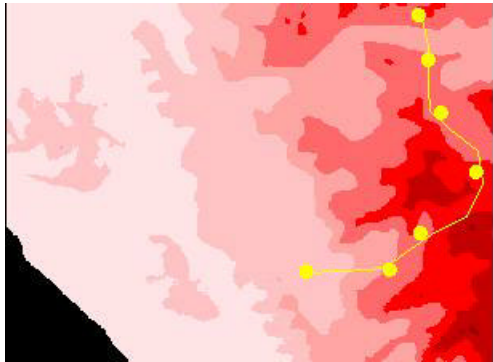
Used to create chart profiles of line features (streams, roads, trails, etc.) using a line theme and an elevation grid theme. Requires two active themes, the first a line theme (with records selected) and the second an elevation grid theme. Merges selected lines, then finds interval points along the merged line at equal intervals. User is queried for how many divisions of merged line. Outputs a dbf file of distances starting at the lowest interval point and including all interval points and corresponding z values. Outputs a line graph (profile) of distance from origin vs. z values if no more than about 100 interval points are produced.

In this example, the selected trail (shown highlighted in yellow) was profiled, using 5 equal divisions. The chart below shows distance and corresponding elevation values.

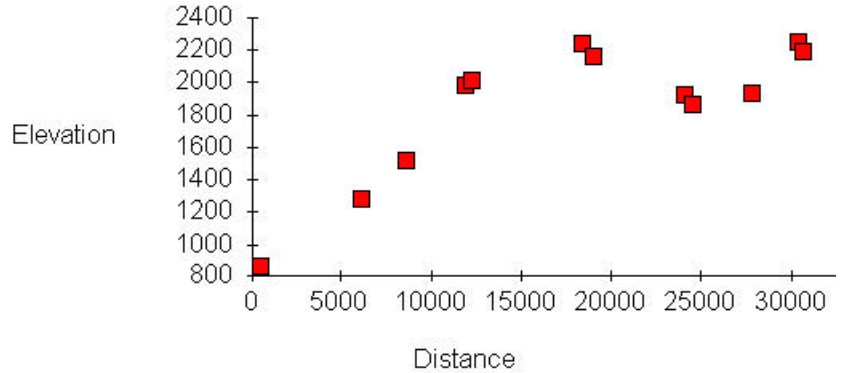


**Profile With Feature Points**

Used to create elevation profiles of selected lines and selected point features. Requires three active themes, the first a point theme (the feature points), the second a line theme and the third an elevation grid theme. User is queried for how many divisions of merged line. Outputs a dbf file of distances starting at the lowest interval point and including all interval points, feature points and corresponding z values. Dbf table contains a "Type" field indicating whether a distance is an interval point or a feature point. Outputs a scatter diagram graph (the line profile) of distance from origin vs. z values if no more than about 50 points are produced.



Themes used: Theme11.shp and Elev\_grd  
 Number of intervals: 5. Interval length: 6134.11 distance units.  
 Chart shows interval points and feature points.

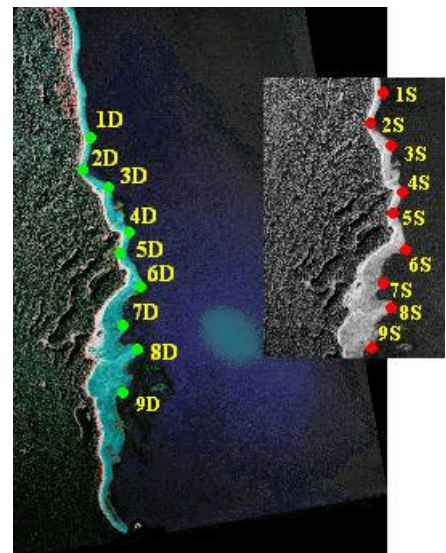


## VIEW TOOLS

**S** **Creates Warp start points (creates a "from link" in the "from" view).** Click on a location in the ungeoreferenced dataset to start building a list of "from links" (Points will automatically be labeled). Use the [delete links](#) button to remove incorrect links from the table.

**D** **Creates Warp desired points (creates a "to link" in the "to" view).** Click on the desired location in the georeferenced dataset to start building a list of "to links" (Points will automatically be labeled). Use the [delete links](#) button to remove incorrect links from the table.

**>>** **Shifts the active grid to a new location by clicking in the view to move its point of origin.** Click the tool, then click on the desired location to shift to in the view.





## VIEW BUTTONS



**Deletes one or many links from the current link table.** Click the button, then select one or many links to delete from the table.

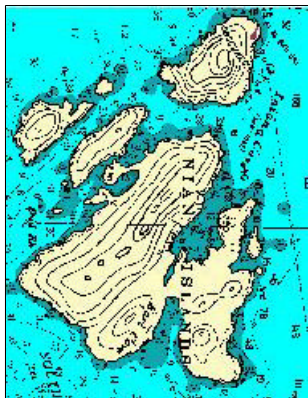
Link	From-X	From-Y
1	279836.329846	6589555.038236
2	365949.109399	6577483.153252
3	425503.741987	6568630.437597
4	461719.396939	6509880.597342
5	378020.994383	6467226.603732
6	308808.853808	6452740.341751
7	291103.422498	6505051.843348
8	296736.968824	6550120.213955



**Rotates the active grid in a clockwise motion around the lower left-hand corner.**



Click the button, then enter the number of degrees desired (and the resampling method to be used if multiples of 90 degrees are not used). (See previous section on [Resampling methods](#), for a description of the 3 types of interpolation).



In this example, a new grid was created, a rotation of 90 degrees around the original grid's lower left-hand corner.



**Bibliography**



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[\[Home](#) | [Research](#) | [Information](#) | [Announcements](#) | [Search](#) | [Publications\]](#)  
[http://www.absc.usgs.gov/glba/gistools/SpatialTools\\_doc.htm](http://www.absc.usgs.gov/glba/gistools/SpatialTools_doc.htm)

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