# MapCalc Tutorial

Overview

This tutorial introduces you to the basic *MapCalc* procedures for accessing and displaying maps. The tutorial contains six lessons, each designed to take approximately fifteen minutes to complete. Upon completion of the tutorial lessons you will be familiar with the basic operation of *MapCalc*.

The **MapCalc Applications** document provides numerous examples of applying the comprehensive set of map analysis tools. The application examples use the tutorial databases provided with the software and you are encouraged to review the material then perform the analysis on your own.

The **MapCalc User's Manual** contains additional information about features and capabilities not covered in the basic tutorial lessons. You can access the online version of the manual by clicking on the "Help" item on the main menu, then selecting "Contents and Index." Also, most dialog boxes have a question mark button in the upper right corner next to the window controls. This button provides information about specific objects in the dialog box. The "Help" button at the bottom of most dialog boxes provides more information by opening the help topic for the current operation.

Fundamental MapCalc Concepts
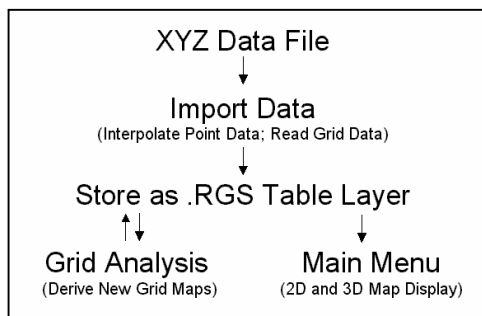
MapCalc is a grid-based map analysis system. Individual map layers are stored in a database table (.RGS file) as a series of map values. Each map value is geo-referenced to a cell in a rectangular grid that extends over a project area.

A *MapCalc* database consists of a set of maps having the same configuration and usually identified with a common application. Maps can be created by directly importing data in grid form, interpolating a set of discrete points or by performing map analysis on existing maps.
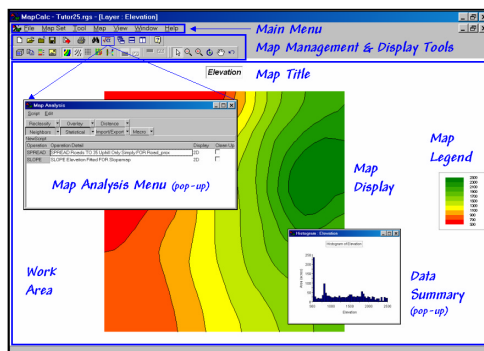
The number of columns/rows, cell size and the Longitude/Latitude coordinates of the extent define the **Grid Configuration**. The **Main Menu** provides extensive procedures for map management, display and data summary. The **Map Management and Display Tools** consists of buttons used to directly access map viewing and management operations.

The **Work Area** identifies the portion of the screen used for map display and reporting data summaries.

The **Map Analysis Menu** contains operations that use existing data to derive a new map, such as using an encoded "Road map" to create a map of "Proximity to roads." It is accessed through the Map Analysis button with the Management and Display Tools.
The

Starting MapCalc

To begin a **MapCalc** session:
1. Click on the Windows **Start** button.
2. Navigate to **Programs** à **Red Hen Systems** à **MapCalc** and click on the **MapCalc** icon.
3. Choose "Open existing map set" from the MapCalc Quick Start menu and open the "Tutor25.rgs" database. The .RGS table will be accessed, several of the base maps will be opened and a 2-D display of the Elevation map will be maximized.

Exiting MapCalc

To exit a *MapCalc* session, click on the word "File" in the main menu and select "Exit." When exiting the Tutorial lessons press the **No** button to <u>NOT</u> save the changes to the Tutor25.rgs database. It is recommended to exit with out saving after each lesson to insure that the initial form of the database is used when starting another lesson. The Tutor25_BU.rgs file is a backup copy of the tutorial database.

Lesson 1 – Displaying Maps

Access the Tutor25 database as described in "Starting *MapCalc*" at the beginning of this Tutorial.

Slowly move the cursor over the map and observe the map values associated with various locations. The color levels identified in the map legend aggregate the elevation values into ten 200-foot contour intervals ranging from 500 to 2500.

Click on the **Layer mesh** button on the main tool bar. The grid configuration for the Tutor25 database is 25 columns by 25 rows (25 x 25= 625 grid cells). Each cell is 100 x 100 meters (10,000 square meters; one hectare). Several of the maps in the database are hypothetical and the Latitude and Longitude coordinates for the project area were arbitrarily assigned. The contour lines and interactive data labels for the Elevation map are interpolated "on-the-fly" from the underlying grid data.

Click on the **Use cells** button. The display switches from "lattice" to "grid" display type with the contour color codes are assigned to entire cells. The important differences between lattice and grid display types are covered in more detail in the MapCalc Application example entitled "Display Type."

Click on the Toggle 3D view button. The display switches to a 3-D display in grid cell display. The color-coding at the top of each projected cell identifies its elevation.

The navigation tools enable you to zoom, pan and rotate a display.
- Ü Click on the **Zoom in** button then click-and-drag a rectangular portion of the displayed map to enlarge that area.
- Ü Click on the **Zoom out** button then click-and-hold while sliding up and down to continuously rescale the display when you release the mouse button.
- Ü Click on the **Move** button and click-and-hold to move the display to another part of the screen.
- Ü Click on the **Rotate** button and click-and-hold as you rotate the plot cube.
- Ü Click on the **Reset view** button to return to the default display settings.

Click off the **Use cells** button to switch to a 3-D lattice display type, commonly called a "wireframe" display. Note that the navigation tools operate in the same manner for both the grid and lattice display types.

Click off and on the **Layer contoured** and **Layer contour lines** buttons to turn off and on the contour-fill colors and lines.

Click off and on the **Floor contours/lines** and **Ceiling contours/lines** buttons and note the changes in the 2-D projected planes in the plot cube.

Click on the word "**Map**" in the main menu, then select "**Overlay**" and choose the "**Slope**" map. The result is a graphical overlay of the Slope map on the 3-D display of the Elevation map. Note that the areas classified as steep (green tones) align with the steepest portions of the terrain surface.

Click on the **Arrange windows** buttons to view all of the open map windows in different arrangements. Click on the **Maximize** button in the Slope map's window to enlarge the display to fit the entire work area. For review, repeat the display tools exercises you just completed using the elevation map on the Slope map.

Clicking on the word "**Window**" on the main menu produces a listing of open windows and window management tools. Clicking on any of the open map windows listed will cause that map to be maximized in the work area.

Click on the **View, Rename and Delete layers** button to pop-up a listing of the current maps in the Tutor25 database. You can Rename and Delete existing maps. As new maps are created they are added to the list. The View function opens a map in a new window. It is important to note that you can have multiple windows open of the same map. While this can cause some initial confusion, experienced *MapCalc* users find it useful for positioning side-by-side views of the same data, such as a 2-D display and a 3-D plot.

Exit the Tutor25 database as described in "Exiting MapCalc" at the beginning of this Tutorial… *do not save your changes.*

Lesson 2 – Understanding Data Types

Access the Tutor25 database as described in "Starting *MapCalc*" at the beginning of this Tutorial.

The Elevation map contains **Continuous** mapped data—the map values form a gradient that changes throughout the map area. The display tools described in Lesson 1 form appropriate plots of this data type. In generating the displays a numerical relationship is assumed to exist between the map values. For example, a the elevation of location that is 2000 feet is twice as high as one that is 1000 feet. Similarly, a slope of 10 percent is much more gentle than one of 30 percent.

However, not all maps contain values that are numerically related. **Discrete** mapped data uses map values simply to identify separate categories. For example, a map of Roads might use the value 1 to denote backcountry roads and the value 4 to identify highways. Similarly, maps for administrative Districts might simply number different districts or assign a numerical code.
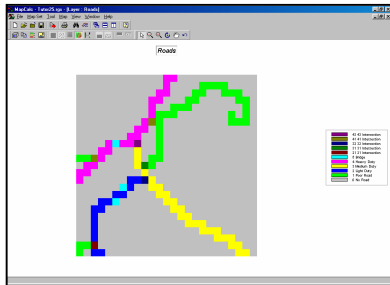
Click on the word "**Window**" on the main menu and select the Roads map.

A grid representation of a road map identifies the cells that contain a road. In this example, the value zero is assigned to all locations without a road. Numbers are assigned to areas with roads in a manner that identifies the type of road. Note that values 1-4 are used for roads with increasingly greater traffic, value 5 is used for bridges, and two-digit values form a code of the road types at each intersection. Clearly the map values do not represent Continuous data and cannot be interpreted in the normal way—a road type 4 isn't four times bigger or better than a road type 1 (just different).

The display of the Road map is as a **Discrete Data t**ype and provides the most appropriate view of this kind of information.

Click on the **Layer mesh** button on the main tool bar. Move the cursor throughout out the map and note the map categories corresponding to the color-coding within the grid cells.

Click on the **Toggle 3D view** button to generate a 3-D view of the data. While this view isn't wrong, per se, it is inappropriate. In this view, the map values are considered related and the two-digit codes for the intersections tower over the smaller map values representing road type.

Click off the **Use cells** button to switch to a 3-D lattice format. The effect is similar to the 3-D grid type display and is just as inappropriate.

Click off the **Toggle 3D view** button to generate a 2-D view of the data. This view of the data is as confusing as it is inappropriate because the display attempts to establish color intervals between adjacent cells with different values.

Click on the **Data type** button to switch from Discrete data to Continuous data representation. Note, for the first time, the map values appearing in the legend have changed. This view treats the data range (minimum= 1 to maximum= 43) as number gradient and divides the range into contour intervals. As depicted in the legend, red is assigned to map values within the range 0 to 6.1—from no road to all road types and bridges. The "bull's-eye" looking locations correspond to the two-digit intersections. This view is inappropriate and confusing as well.

Click on the **Use cells** button to switch from lattice back to grid format. The color-coding of this legend is still inappropriate as it treats the data as continuous.

Click on the **Data type** button to switch back to discrete data representation. This display (**2-D grid** display type in **Discrete** data format) is the only appropriate display for this type of data.

Click on the **Shading Manager** button to access the color pallet and labels for the Roads map. Click in the **Category** column next to the value "0" and enter "No Road" as the label for that value. Change the color for that value by clicking on the color and selecting another one from the basic color panels or by clicking anywhere in the color gradient and pressing the **OK** button. Repeat labeling and color selection for other map values. In the Shading manager dialog box click the **Apply** button to store your label and color assignments.

For review, click on the word "**Window**" on the main menu and select the Districts map to display another example of a map containing discrete data. Use the display tools to view the map under different views as you did for the Roads map. Use the shading manager to recolor and label the map.

Exit the Tutor25 database as described in "Exiting *MapCalc*" at the beginning of this Tutorial… *do not save your changes.*

Lesson 3 – Using the Shading Manager

Access the Tutor25 database as described in "Starting *MapCalc*" at the beginning of this Tutorial.

Click on the **Shading Manager** button to access the color pallet and labels for the Elevation map. Another way to access the shading manager is by right clicking anywhere within the map and selecting the Shading Manager option.

The shading manager for continuous data contains two sections. The left side interacts with the contour intervals and colors assigned. The right side provides map summaries and procedures for setting the display intervals.

The button at the bottom toggles on ("More") and off ("Less") the right side of shading manager dialog box.

Color assignments are changed by clicking on the color and selecting another from the basic color panels or by clicking anywhere in the color gradient and pressing the **OK** button. Change the color assignments of the Elevation map by clicking on red (bottom), changing it to blue and pressing OK. Repeat the process to change green (top) to red. Note the automatic assignment of other colors to the new color gradient. Press the **Apply** button to submit the changes and generate a new display.

You can set "Inflection points" within the color gradient. In this example, yellow is locked "On" and effectively breaks the blue to red gradient into two gradients—blue to yellow and yellow to red. Remove the yellow inflection point by clicking on the word "On" (switches to "Off"). Press the **Apply** button to view the change in the map. On your own, set the yellow inflection point as the forth position from the top.

Click on the **Statistics** tab to get a statistical summary of the map values.
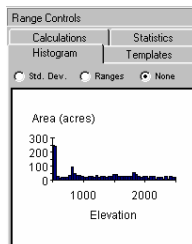
Click on the **Histogram** tab to get a plot of the distribution of the map values.
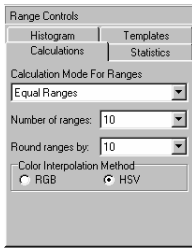
Click on the Calculations tab to activate the interface for changing the display intervals. There are two primary specifications needed to set the ranges used in defining the intervals— 1) Number of Ranges and 2) Calculation Mode for Ranges.

Change the number of intervals from 10 to 5. Note the change in the upper and lower values defining each of the five intervals and the number of grid cells they contain. Press the **Apply** button to view the map with the new interval assignments.
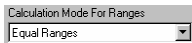
Use the drop down scroll list (down arrow next to the "Calculation…" input field). Change the "Equal Ranges" mode to **Equal Count**. Note the change in the upper and lower values defining the intervals (right side) and the number of grid cells assigned to each. Press the **Apply** button to view the change in the map.
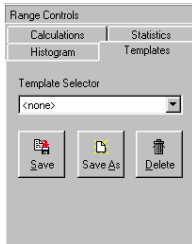
Click on the **Template** tab to store the new display settings. Press the **Save As** button and enter "Tutorial" as the name for the new display template. Press the drop down scroll list and retrieve any of the other current templates to apply to the map. Repeat to retrieve and reapply your "Tutorial" template.

See the **MapCalc User Manual** for more information on the considerations and effects of interval calculations.

Exit the Tutor25 database as described in "Exiting *MapCalc*" at the beginning of this Tutorial… *do not save your changes.*

Lesson 4 – Setting Map Properties

Access the Tutor25 database as described in "Starting *MapCalc*" at the beginning of this Tutorial.

Right-click anywhere within the map and select the **Properties** option.   Another way to access the dialog box is to click on the word "Map" on the main menu and select "Properties."
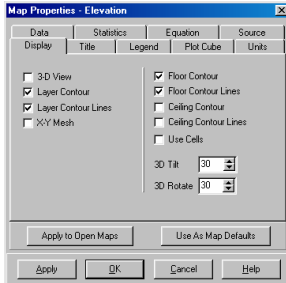
 Click on the **Display** tab to show the basic settings for the current map display. The buttons at the bottom enable you to apply the settings to all of the other maps and/or store them as the default settings (global settings)—rarely done. If you make changes in the settings you can apply the changes to the current map by pressing the Apply button at the bottom (individual map settings).
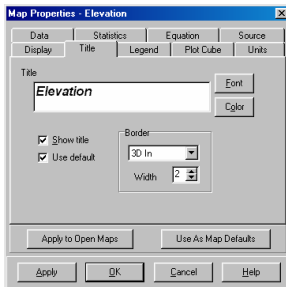
 Click on the **Title** tab. This dialog box allows you to change the title of the map and its appearance to include font type, font color, and border characteristics. Use the **Show title** checkbox to turn on and off the title in the map display. The **Use default** checkbox uses the map name as the default title. If you want to change the title click off the "Use default" checkbox, highlight the current title and enter a new one.
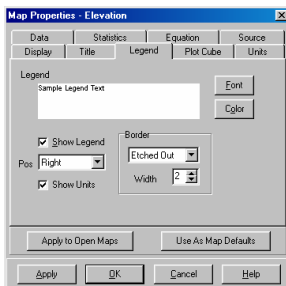
 Click on the **Legend** tab to change the map legend, its font and/or its appearance. The **Pos** input filed enables you to position the legend at the right, left, top or bottom of the work area.
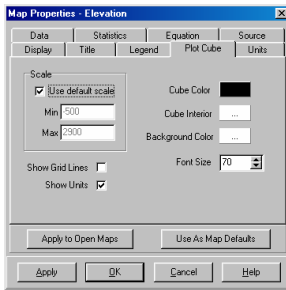
The **Plot Cube** tab enables you to customize the appearance of the reference plot that appears in 3-D displays. By far the most important option involves the setting the **Scale** of the three-dimensional plot. The **Use default scale** checkbox automatically sets the minimum and maximum values for the Z-axis that produces a pleasing vertical sizing of the map. To manually set the min/max, click off the check box and enter –2000 as the min and 4000 as the max then click the Apply button. Note that the plot has considerably less vertical exaggeration. To eliminate the plot cube click on Cube Color and change the color to white (background color).
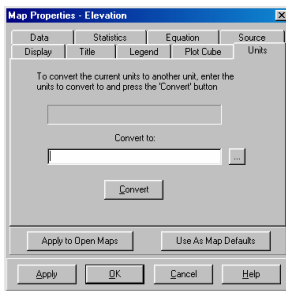
Click on the **Units** tab. Currently there are no units associated with the Elevation map. To set map units enter "feet", press the **Convert** button (respond "yes" to use a conversion factor of 1) and press the Apply button. Note that the units "feet" are now associated with the map and are included in the map legend.
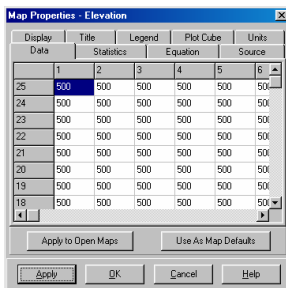
Click on the **Data** tab to view the map values in table form. Use the slider bars to scroll the columns (1 to 25 from left to right—X-axis with east at right) and rows (1 to 25 from bottom to top—Y-axis with North at top). The next lesson will describe several other procedures for data inspection and charting.
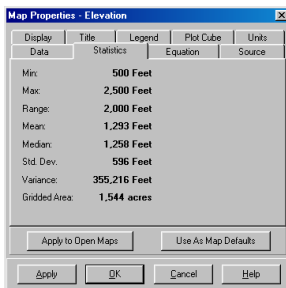
Click on the **Statistics** tab for a listing of statistics summarizing the map values.
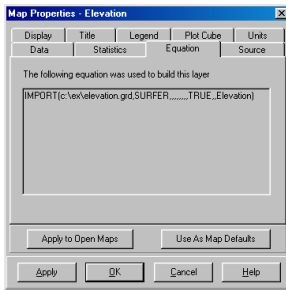
Click on the **Equation** tab for information about how the map was created. In
this example, the Elevation map was imported form a data file in Surfer format. Each map created by a
MapCalc operation contains the complete specification that derived it—metadata tracking.
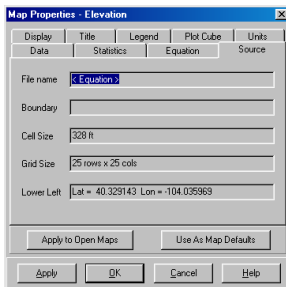
Click on the **Source** tab for information about the database configuration.
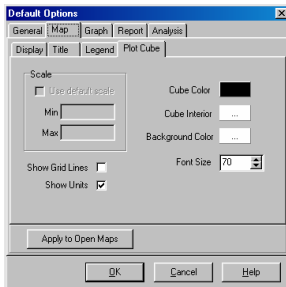
Click on the word **View** on the main menu then select "Options" to access the
global default dialog box that allows you to customize the "look-and-feel" of the software. Refer to the
MapCalc User Manual for the procedures and settings available in the Options dialog box.

Exit the Tutor25 database as described in "Exiting *MapCalc*" at the beginning of this Tutorial… *do not
save your changes.*

Lesson 5 – Data Inspection and Charting

Access the Tutor25 database as described in "Starting *MapCalc*" at the beginning of this Tutorial.

Recall that the display type (**lattice** and **grid**) and data type (**continuous** and **discrete**) greatly affects map display (see Lesson 2). Keep in mind, however that while the display might change the underlying data stored in the map table is not changed.

By slowly moving the cursor over a map a tracking window continuously updates the value for each location. Maps containing Continuous data report "display values" interpolated from the surrounding "actual values" stored in the *MapCalc* table. Discrete data maps report the "category label" for the locations.

Click on the word **View** on the main menu then select **Data Inspection** option. A listing of all of the maps in the database pops-up and is continuously updated for the actual data values as the cursor is moved over the map. This "drill-down" feature works for both 2-D and 3-D displays.

Click on the words **Map Set** on the main menu, then select "New graph" and choose "Histogram" to generate a plot of the data distribution of a map. Select the Slope map for a plot of its data. Note that the scroll list only shows maps that contain Continuous data.

Click on the words **Map Set** on the main menu then select "New graph" and choose "Scatterplot" to generate a plot of the joint frequency for a pair of maps. Select the Slope map for the X-axis and the Elevation map for the Y-axis. The plot contains the regression line that graphically shows the relationship between the two sets of mapped data. The regression equation and its R-squared statistic indicating the strength of the relationship between the two maps appear at the bottom of the plot.

Click on the **Print** button to access the report printing dialog box. Select the Elevation map and press the button with a single arrow to move it to the selected list box. Press the **Preview** button for a mock-up of the printed page. See the MapCalc User Manual for more information on printing from *MapCalc*.

Click on the **Save** picture button to save a "screen grab" a basic image of the current map display. Any screen capture software, such as SnagIt by Techsmith, can be used for more control on the type, position and characteristics of the image.

Exit the Tutor25 database as described in "Exiting *MapCalc*" at the beginning of this Tutorial… *do not save your changes.*

Lesson 6 –Creating New Maps

Access the Tutor25 database as described in "Starting *MapCalc*" at the beginning of this Tutorial.

√α̅ Click on the **Map analysis** button to access the dialog box for creating new maps from existing mapped data by applying *MapCalc*'s comprehensive set of spatial statistics, analysis and modeling tools. This lesson covers the basic procedures for specifying individual analysis operations and creating map analysis macros. The online **MapCalc Applications** document provides numerous examples of applying the complete set of map analysis tools. In addition, the online **MapCalc User's Manual** contains more information about features and capabilities of each analysis operation.

Distance ▾ Click on the **Distance** button and select the "Spread" analysis operation. Press the Help button to get information about the function and specifications for Spread. Note that the operation is used to "create a map indicating the shortest effective distance from specified cells to all other locations." In this example, you will create a map that shows the distance from all map locations to the nearest road location—proximity to roads.
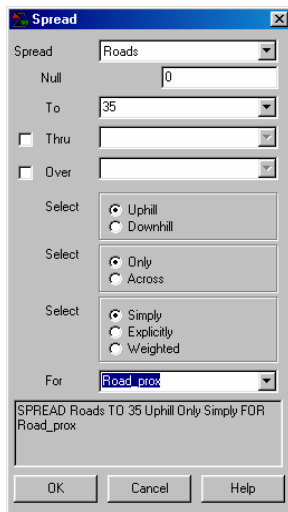
SPREAD Roads TO 35 Uphill Only Simply FOR Road_prox

Complete the specifications shown above by…
- Ü Spread <choose **Roads**> …as the map to measure distance from
- Ü To <specify **35**> …as the maximum number of grid cells away from the roads
- Ü For <enter **Road_prox**> …as the name of the new map created
- Ü …use the defaults for all of the other options

Press the OK button to create the proximity map. Close the Map Analysis dialog box to view the Road_prox map—increasing map values indicate areas farther away from roads. The farthest location is in the upper left corner and is 10.7 cells away (10.7 cells * 100 m/cell = 1070 meters).

Click on the word **Windows** on the main menu and select the Elevation map to redisplay the map. Click on the word **Map** then select "Overlay" and choose the "Road_prox" map you just created. In this display the information about proximity to roads is graphically overlaid on the 3-D plot of the Elevation surface.

√α̅ Click on the **Map analysis** button to resurrect the analysis dialog box. Note that your last entry is still there. Double-click on the command line and the Spread operation's dialog box reappears. You can edit any specification and rerun by clicking the OK button.

Neighbors ▾ Click on the **Neighbors** button and select the "Slope" analysis operation. Press the Help button to get information about the function and specifications for Slope. Note that the operation is used to "creates a map indicating the slope (1st derivative) along a continuous surface." In this example, you will create a map that shows the terrain inclination for each map location by fitting a plane to the nine elevation values surrounding the location—terrain slope.

  SLOPE Elevation Fitted FOR Slopemap

Complete the specifications shown above by…
- ü   Slope <choose **Elevation**>   …as the map to measure terrain inclination
- ü   For <enter **Slopemap**>   …as the name of the new map created
- ü   …use the defaults for all of the other options

Press the OK button to create a map of slope. Close the Map Analysis dialog box to view the map—increasing map values indicate steeper areas.

Click on the word **Windows** on the main menu and select the "Elevation" map to redisplay it. Click on the word **Map** then select "Overlay" and choose the "Slopemap" you just created. In this display the information about terrain slope is graphically overlaid on the 3-D plot of the Elevation surface.

Importing and exporting grid data with other software packages is important.   If you have the Surfer system installed (bundled with *MapCalc* educational version), you can automatically export, launch, and view maps in Surfer software.

From the Main Menu, select File à Export à Wireframe then choose the Elevation map and any other maps you want to transfer. These specifications launch a series of actions: the map is exported as a temporary .GRD file; Surfer is activated; the .GRD file is imported; and a wireframe display is generated. At this point the Elevation map that originated in *MapCalc* is fully available for Surfer processing. Note that only the Elevation map was transferred without the graphic overlay map of slope.

Direct import/export in a variety of formats is supported provided the databases share the same grid configuration. In this example, you will import a map developed in Surfer software that shows the level of animal activity.

√α Import/Export ▾ Click on the **Map analysis** button, click on the **Import/Export** button and select "Import" to pop-up the import dialog box.
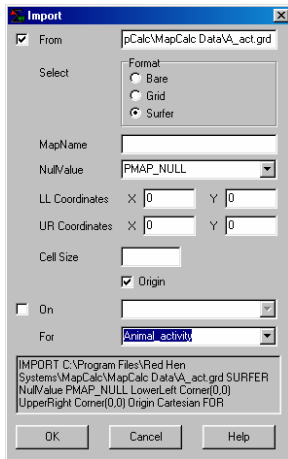
IMPORT C:\Program Files\Red Hen Systems*MapCalc\MapCalc* Data\A_act.grd SURFER NullValue PMAP_NULL LowerLeft Corner(0,0) UpperRight Corner(0,0) Origin Cartesian FOR Animal_activity

Complete the specifications shown above by…

- Ü   From <…**A_activity.grd**>   …navigate to …*MapCalc\MapCalc* Data\A_activity.grd
- Ü   Select <click **Surfer**>   …identifies a Surfer .GRD formatted file
- Ü   For <enter **Animal_activity**>   …as the name of the new map created
- Ü   …use the defaults for all of the other options

In addition to direct import of grid data, *MapCalc* creates map layers using columns of data you select from any *.tab (MapInfo table format) or *.shp (ArcView GIS format) files. Also it can interpolate maps from a set of point sample data (XYZ, where Z= measured value). See the MapCalc User Manual for a discussion of these procedures.

Exit the Tutor25 database as described in "Exiting *MapCalc*" at the beginning of this Tutorial… *do not save your changes.*

Taking the Next Step

The lessons in this tutorial were designed to get you started. Some of the basic procedures for accessing, displaying and creating maps were briefly introduced. Given this foundation you are ready for further investigation *MapCalc*'s capabilities.

Lesson 7 (below) is an example of a simple GIS model to locate the best areas for a proposed campground. The example demonstrates the logical structure of a GIS model and provides hands-on experience with command macro construction and operation. You are encouraged to complete the lesson and use some of map display techniques you learned in the previous lessons to enhance the default map displays created in evaluating the model. Also, you can change the calibration of the model and extend its criteria.

The **MapCalc User Manual** is another excellent place to continue your exposure to *MapCalc* and the analytical capabilities of grid-based processing. The first part of the manual extends the tutorial experience through a detailed yet concise discussion of setting program defaults, creating maps, working with maps and using the menus and toolbars. The remaining part provides description of the function and syntax for the map analysis operations.

Once you are comfortable with basic operation of *MapCalc* you are ready to consider using it in solving spatial problems and constructing GIS models. The **MapCalc Applications** document provides numerous examples of applying the broad set of Map Analysis tools. The application examples use the tutorial databases provided and you are encouraged to review the material then perform the analysis on your own.

As your familiarity with *MapCalc* increases, you can input your own data and begin developing your own spatial models—moving you beyond mapping toward spatial reasoning and better information for decision-making.

Lesson 7 – GIS Modeling
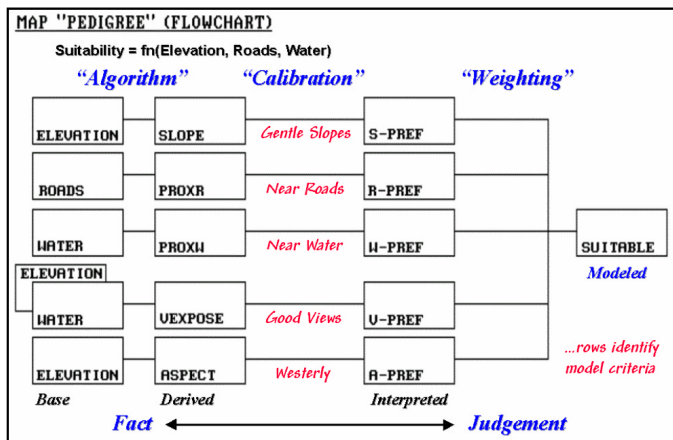
Situation
All GIS models can be expressed as a flowchart of processing steps. In this example, SLOPE is derived from a base map of ELEVATION. In turn, the SLOPE map is interpreted for areas of "relative goodness" in terms of terrain steepness and stored as the S_PREF map.

The each row in the flowchart is evaluated to reflect preferences for locating a campground—gentle slopes, near roads, near water, good views and westerly oriented. The final step combines the maps of the five criteria for a map of the overall suitability (SUITABLE).

Note that the columns in the flowchart reflect increasing abstraction from *Base* maps of physical features, to *Derived* maps of spatial context, to *Interpreted maps* of relative goodness, and finally to a *Modeled* map of suitability. The movement from maps of physical *Fact* to decision *Judgment* involves a logical sequencing of map analysis operations.

This lesson provides hands-on experience in accessing and executing a command macro that implements the campground location model described above.

Accessing a Stored Command Macro
Access the Tutor25 database as described in "Starting *MapCalc*" at the beginning of this Tutorial.

Open the command macro for the "Campground Suitability Model" by—
*…access the Grid Analysis module by pressing the **Grid Analysis** button on the Main Toolbar*
*…select **Script**à **Open** from the Map Analysis menu*
*…navigate to the **C:\Program Files\Red Hen Systems\MapCalc\MapCalc Data\Scripts** folder*
*…open the **Campground.scr** script*

Operation	Operation Detail	Display	Clean Up
SLOPE	SLOPE Elevation Fitted FOR Slopemap	2D	☐
SPREAD	SPREAD Roads TO 100 Uphill Only Simply FOR Proximity_roads	2D	☐
SPREAD	SPREAD Water TO 100 Uphill Only Simply FOR Proximity_water	2D	☐
RADIATE	RADIATE Water OVER Elevation TO 100 AT 1 NULLVALUE 0 Compl...	2D	☐
ORIENT	ORIENT Elevation Octants FOR Aspectmap	2D	☐
RENUM...	RENUMBER Slopemap ASSIGNING 9 TO 0 THRU 5 ASSIGNING 8 ...	2D	☐
RENUM...	RENUMBER Proximity_roads ASSIGNING 9 TO 0 THRU .9 ASSIGNI...	2D	☐
RENUM...	RENUMBER Proximity_water ASSIGNING 9 TO 0 THRU 2 ASSIGNI...	2D	☐
RENUM...	RENUMBER Exposure_water ASSIGNING 9 TO 80 THRU 150 ASSI...	2D	☐
RENUM...	RENUMBER Aspectmap ASSIGNING 9 TO 6 THRU 8 ASSIGNING 7...	2D	☐
RENUM...	RENUMBER Slopemap ASSIGNING 1 TO 0 THRU 50 ASSIGNING 0...	2D	☐
RENUM...	RENUMBER Proximity_water ASSIGNING 0 TO 0 THRU 1.4 ASSIGN...	2D	☐
COMPU...	COMPUTE NO_slope Times No_prox FOR Constraints	2D	☐
COMPU...	COMPUTE S_pref Plus R_pref Plus W_pref Plus V_pref Plus A_pref ...	2D	☐
CALCUL...	Potential_total / 5.0	2D	☐

Command Macro Procedures
Each line of the command macro contains an individual MapCalc command. The command lines are executed in their listed order (top to bottom). You can execute the entire command macro in "batch mode" by selecting **Script**à **Run Script**. You can view a command's specifications by double-clicking on a command line, then click "OK" to execute the command and display the derived map.

Annotated Listing of Commands
note ...DEVELOPMENT MODEL -- fn(Elevation, Roads, Water)

note   The best areas for development are those that are gently sloped, near roads, near water, good views of water, westerly oriented, and not legally 'constrained'.
note ...there are four submodels:
note   Section 1 -- Derived maps
note   Section 2 -- Interpreted maps
note   Section 3 -- Constraints map
note   Section 4 -- Suitability map

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note ...Section 1] Derived Maps
*note   ELEVATION --- slope ---> **SLOPEMAP***
*note   ROADS --- spread ---> **PROXIMITY_ROADS***
*note   WATER --- spread ---> **PROXIMITY_WATER***
*note   WATER | ELEVATION --- radiate **---> EXPOSURE_WATER***
*note   ELEVATION --- orient ---> **ASPECTMAP***

note ...1a] Generate map of slope
SLOPE ELEVATION FOR SLOPEMAP
note ...1b] Generate map of proximity to roads
SPREAD ROADS TO 100 FOR PROXIMITY_ROADS
note ...1c] Generate map of proximity to water
SPREAD WATER TO 100 FOR PROXIMITY_WATER
note ...1d] Generate map of visual exposure to water
RADIATE WATER OVER ELEVATION COMPLETELY TO 100 FOR EXPOSURE_WATER
note ...1e] Generate map of aspect
ORIENT ELEVATION FOR ASPECTMAP

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note ...Section 2] Interpreted Maps (10-Best....1-Worst)
*note   SLOPEMAP --- renumber ---> **S_PREF***
*note   PROX-R --- renumber ---> **R_PREF***
*note   PROX-W --- renumber ---> **W_PREF***
*note   VIEWS --- renumber ---> **V_PREF***
*note   ASPECTMAP --- renumber ---> **A_PREF***
note ...a common preference scale is used for all of the interpreted maps—
note   0= Not Available , 1= Poor, …, 5= Marginal, 6= Acceptable, 7= Good, 8= Very Good, 9= Excellent

note ...2a] Slope preference (like it gently sloped)
RENUMBER SLOPEMAP ASSIGN 9 TO 0 THRU 5 ASSIGN 8 TO 5 THRU 15 ASSIGN 5 TO 15 THRU 25 ASSIGN 3 TO 25 THRU 40 ASSIGN 1 TO 40 THRU 100 FOR S_PREF

note ...2b] Proximity to road preference (like it near roads)

RENUMBER PROXIMITY_ROADS ASSIGN 9 TO 0 ASSIGN 8 TO .001 THRU 1.5 ASSIGN 7 TO 1.5 THRU 3 ASSIGN 3 TO 3 THRU 6 ASSIGN 1 TO 6 THRU 11 FOR R_PREF

note ...2c] Proximity to water preference (like it near water)

RENUMBER PROXIMITY_WATER ASSIGN 9 TO 0 THRU 2 ASSIGN 7 TO 2 THRU 4 ASSIGN 4 TO 4 THRU 6 ASSIGN 1 TO 6 THRU 100 FOR W_PREF

note ...2d] View of water preference (like good views of water)

RENUMBER EXPOSURE_WATER ASSIGN 9 TO 80 THRU 150 ASSIGN 8 TO 30 THRU 80 ASSIGN 5 TO 10 THRU 30 ASSIGN 3 TO 6 THRU 10 ASSIGN 1 TO 0 THRU 6 FOR V_PREF

note ...2e] Westerly oriented preference (like it westerly oriented)

RENUMBER ASPECTMAP ASSIGN 9 TO 6 THRU 8 ASSIGN 7 TO 1 THRU 2 ASSIGN 3 TO 4 THRU 5 ASSIGN 1 TO 3 FOR A_PREF

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note ...Section 3] Constraints 'Masking' Map
note   SLOPEMAP --- renumber ---> **NO_SLOPE**
note   PROXIMITY_WATER --- renumber ---> **NO_PROX**
note   NO_SLOPE | NO_PROX --- compute times ---> **CONSTRAINTS**
note ...a binary "masking map" is created where 0= Not Available and 1= OK to Develop

note ...3a] Not over 50% slope

RENUMBER SLOPEMAP ASSIGN 1 TO 0 THRU 50 ASSIGN 0 TO 50 THRU 1000 FOR NO_SLOPE

note ...3b] Not within 100 meters

RENUMBER PROX-W ASSIGN 0 TO 0 THRU 1.4 ASSIGN 1 TO 1.4 THRU 100 FOR NO_PROX

note ...3c] Combine individual constraints

COMPUTE NO-SLOPE TIMES NO-PROX FOR CONSTRAINTS

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note ...Section 4] Development Suitability Map
note   S_PREF --|
note   R_PREF --|
note   W_PREF --|-- average ---> **POTENTIAL**
note   V_PREF --|
note   A_PREF --|
note   POTENTIAL | CONSTRAINTS -- compute times ---> **POTENTIAL_MASKED**

note ...4a] Total individual preferences for overall campground suitability

COMPUTE S_PREF PLUS R_PREF PLUS W-PREF PLUS V-PREF PLUS A-PREF FOR POTENTIAL_TOTAL

note ...4a] Average individual preferences for overall campground suitability

CALCULATE POTENTIAL_TOTAL / 5.0 FOR POTENTIAL_AVERAGE

note ...4c] Eliminate constrained areas

COMPUTE CONSTRAINTS TIMES POTENTIAL_AVERAGE FOR POTENTIAL_MASKED

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note ... There are three types of modifications that can be made to GIS models—
note   WEIGHTING of interpreted maps (use the "times" option in the **Analyze** command)
note   PARAMETERIZATION of preference maps (change the "assign" phrases in **Renumber**)
note   STRUCTURAL additions to model logic (add new criteria such as being "**in or near Forests**")
note ... try expressing some of YOUR thoughts.