# GIS OPERATION MANUAL

## 1. Computer System Description

| Hardware | Make | Compaq Presario 5004 |
|---|---|---|
| | CPU | AMD Athlon 1.1 Ghz |
| | Main Memory | 640MB |
| | CD-ROM | 52 X |
| | CD-RW | 8 X |
| | HD | 57GB |
| | Monitor | 19 inch |
| | Video Adapter | 16 Mb Nvidia |
| | Network Adapter | 10/100Mb PCI NIC |
| Software | GIS application | ArcView3.2 ® ESRI Inc (Keyed Version). |
| | OS | Windows ME Microsoft |
| Data | | All Data Volume ▲▲MB |

## 2. Operation

Main GIS functions used in the Study are explained in this Manual and shown in the table below. Also, a listing of additional extensions to enhance core ArcView that are necessary to perform the functions.

**Basic Functions used in the Study**

| Basic Functions | | | |
|---|---|---|---|
| General | | Function | ArcView Extension |
| 1.Start Quit | (1) | Starting GIS database system | Core Arcview |
| | (2) | Quitting GIS database system | Core Arcview |
| 2.Displaying Different Data Source | (3) | Displaying vector data | Core Arcview |
| | (4) | Displaying grid data | Spatial Analyst |
| | (5) | Display image data | Image Analyst |
| 3.Data Conversion | (6) | Converting vector data to grid data | Spatial Analyst |
| | (7) | Converting grid data to vector data | Spatial Analyst |
| 4.Overlaying and Querying Data Sources | (8) | Overlaying vector data | Geoprocessing Wizard |
| | (9) | Overlaying grid data | Spatial Analyst |
| | (10) | Queries: vector data | Core Arcview |
| | (11) | Queries: grid data | Spatial Analyst |
| 5. Reprojecting Image Files & CAD Drawing Files | (12) | Registering images to Map Coordinates | Core Arcview |
| | (13) | CAD Drawing Coordinate Transformations | Core Arcview |

**Complex Functions used in the Study**

| Complex Functions (Study Operations) | | |
|---|---|---|
| 6.Specific Analysis | A. Working with Digital Elevation Models<br>  &ndash; Making contours by using point height data<br>  &ndash; Calculating Slope and Aspect | 3D Analyst<br>Spatial Analyst |
| | B. Analyzing Flood Prevention Data<br>  &ndash; Generate the Flood Water Level Surface<br>  &ndash; Subtract the Actual Terrain Elevation from the Water Level Surface | Spatial Analyst |
| | C. Slope Failure Dangerous Area Analysis<br>  &ndash; Overlaying the Geology Map with the Slope Range<br>  &ndash; Arranging the output database into occurrence probability ranks<br>  &ndash; Reclassify the Combined Grid in a new Grid Containing only the Rank Value<br>  &ndash; Calculation of the Affected Areas | Spatial Analyst |
| | D. Watershed Management (Potential Erosion Analysis)<br>  &ndash; R value Interpolation Process<br>  &ndash; K value Interpolation Process<br>  &ndash; LS value Calculation Process<br>  &ndash; C value interpretation process<br>  &ndash; Calculation of E (Potential Erosion) Value | Spatial Analyst |
| Complex Functions (Study Operations) Cont⋯ | | |
| | E. Land Use (Existing & Future) Analysis<br>  &ndash; Target Area Present Land Use<br>  &ndash; Land Use Layers Combination<br>  &ndash; Target Area Future Land Use<br>  &ndash; Study Area Present Land Use<br>  &ndash; Study Area Future Land Use | Spatial Analyst |
| | F. Detailed Topo Field Survey (1:500)<br>  &ndash; Procedure for obtaining LIDAR elevation<br>  &ndash; Procedure for Merging the Original Field Work Points with the LIDAR chosen Points | Spatial Analyst<br>Geoprocessing Wizard<br>Grid Analyst |

**Operation**

**1. Start / Quit**

(1) Starting GIS database system
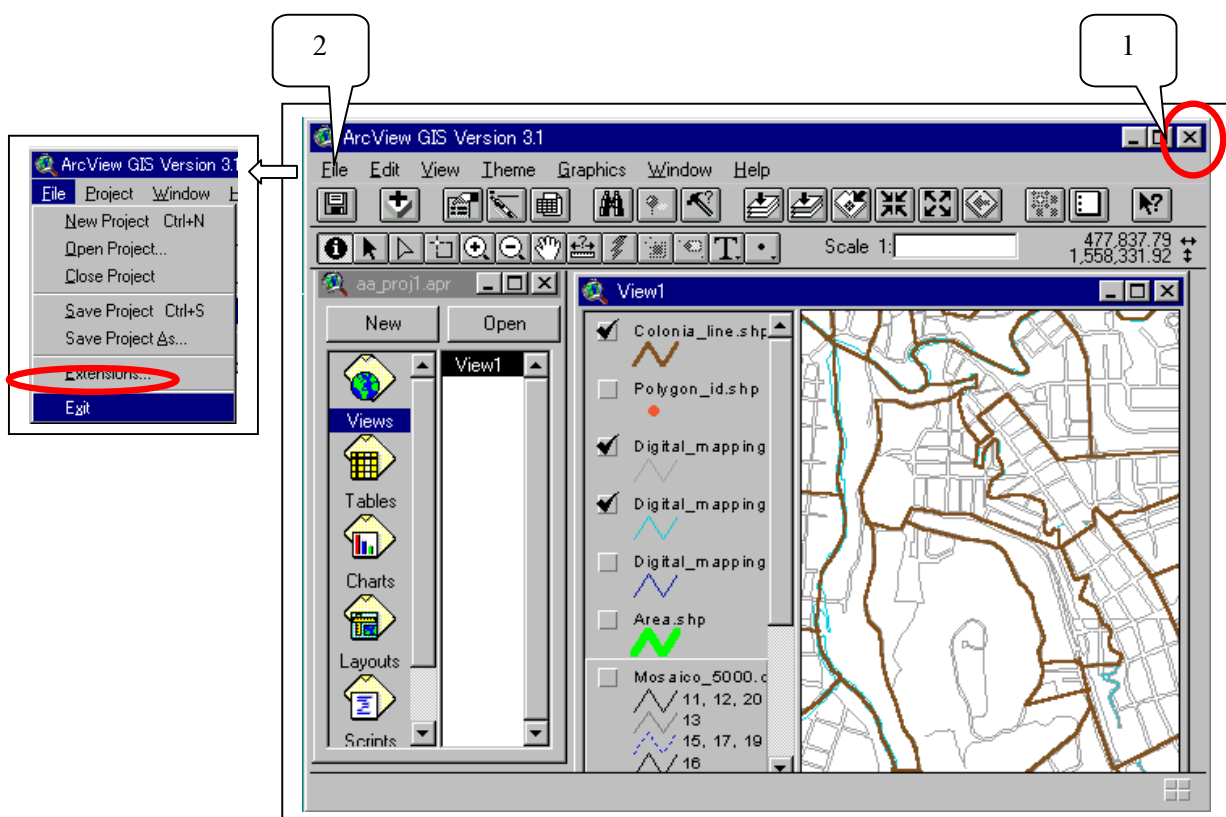
1) ArcView3 icon click

Double click right icon.


Arcview
ArcView3 icon
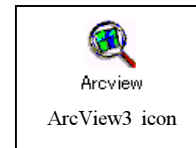
2) Project icon click

Double click right icon.
Previous saved project is shown.


Teguci_Proj
project icon
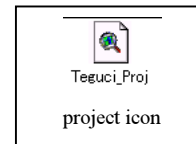
(2) Quitting GIS database system

1) ArcView3 Window X

Click X mark of right-upper ArcView Window.

2) ToolbarMenu File/Exit

Select Exit of ToolBarMenu File.



**Arcview Main Window(View)**

## 2. Displaying Different Data Sources

It is necessary to check specific extensions to display different types of data source, such as grid (spatial analyst) and image (IMAGINE image support) data.

### 1) ToolbarMenu File

Function 'Extensions' to display grid data needs Spatial Analyst.
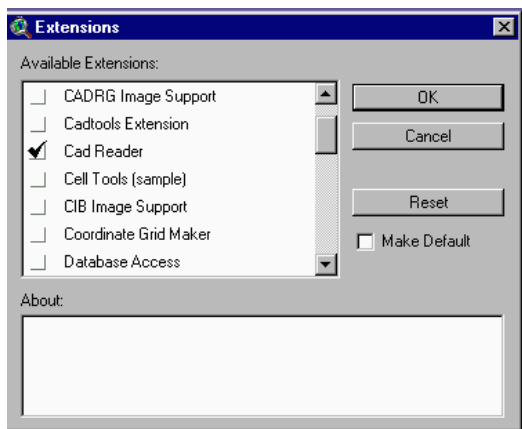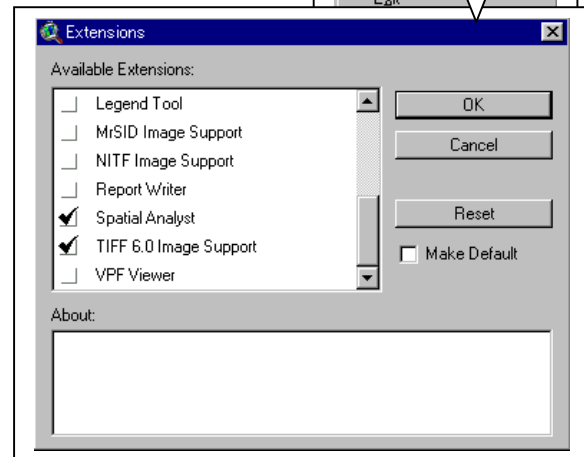Function 'Extensions' to display image data needs Image Analyst.
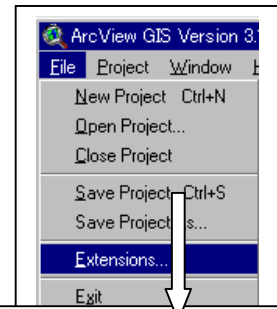
### 2) Set Extensions

Check 'CAD Reader' to display CAD data, such as AutoCAD
Check 'SpatialAnalyst' to display grid data.
Check 'TIFF6.0 Image Suport' to display image data.

**Arcview is composed of 5 different types of documents:**

1. **Views**
2. **Tables**
3. **Charts**
4. **Layouts**
5. **Scripts**

Select:
View→ if you want to display different information data sources

Tables→ if you want to create or modify databases (dbf, txt, etc)

Charts→ if you want to create bar or pie charts from the tables

Layouts→ When you have finished arranging your data in the view to create fine cartography

Scripts→ To load or write programs used to customize Arcview.
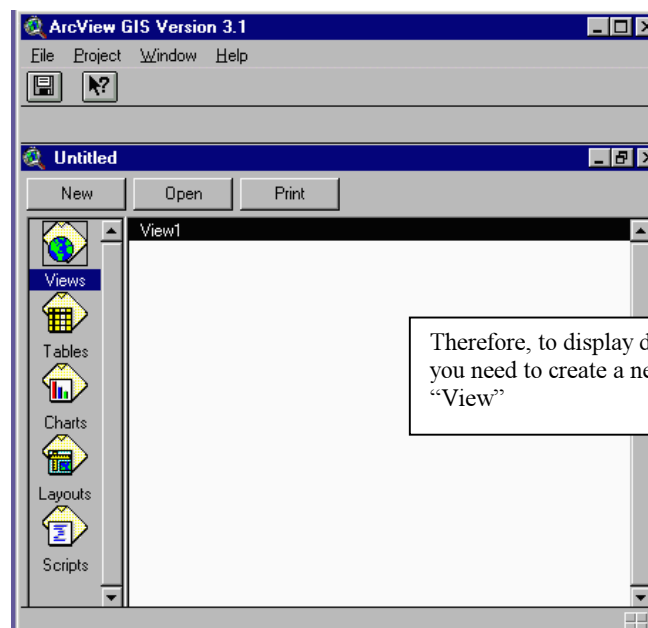
Therefore, to display data you need to create a new "View"

3) Adding Themes. Remember: to display vector data source information (shapefiles, Arc/info coverages) there is no need to check any additional extension.
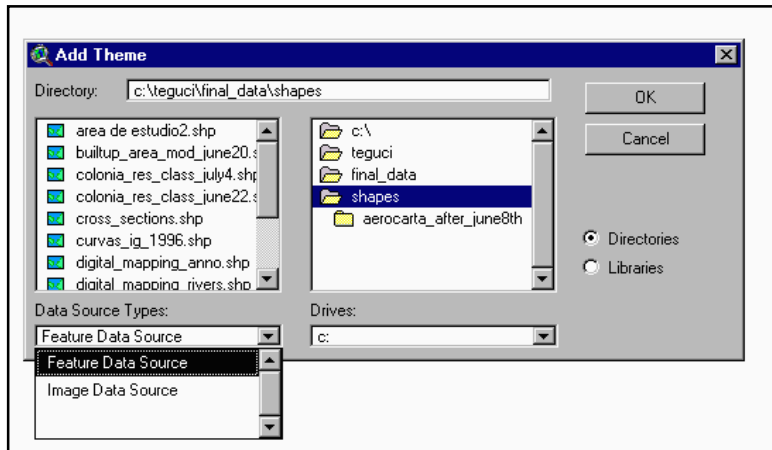


Add Theme to View Button
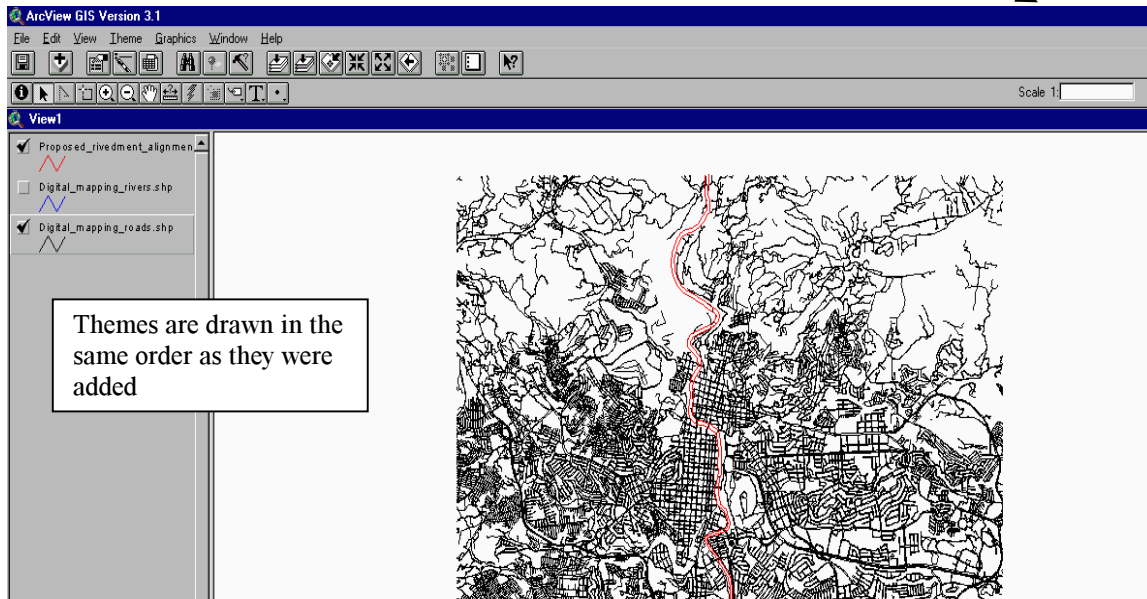
(3) Displaying vector data

1) Select Theme

Select 'Feature Data Source' in 'Data Source Type'
Select Shape type Theme.



Drawing scale can be set after defining the view properties to meters or feet in the
**View → Properties menu**

2) Sample Screen



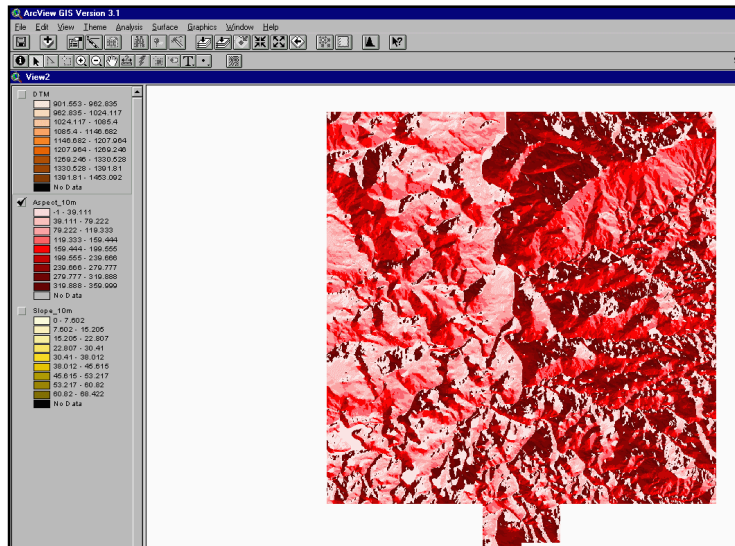Themes are drawn in the same order as they were added

## (4) Displaying Grid data

1) Select Theme

Select 'grid Data Source' in 'Data Source Type'
Select grid Theme .

2) Sample Screen



## (5) How to display Image data

1) Select Theme

Select 'Image Data Source' in 'Data Source Type'
Select image type Theme .

2) Sample Screen

## 3. Data Conversion

(6) Converting vector data to grid data

1) Explain
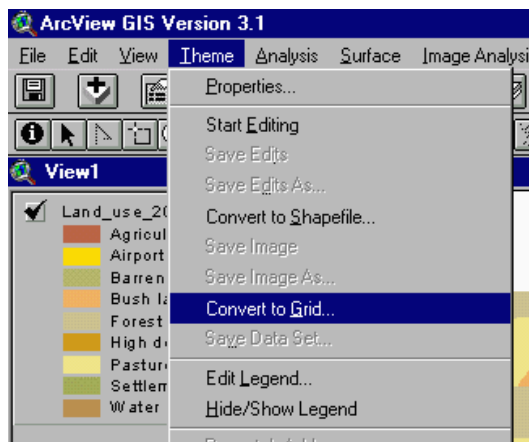
This function is that tranfers vector data to grid data.



2) Operate

Select menu :
Theme : Convert to Grid
Name the output Grid File



Output Grid Extent : The spatial extent for the output theme.
Output Grid Cell Size: Sets the resolution that will be used to create the output grid.
Cell Size: The cell size to be used for output grid theme.
Number of Rows: The number of rows that the output grid will created with.
Number of Columns: The number of columns that the output grid be created with.
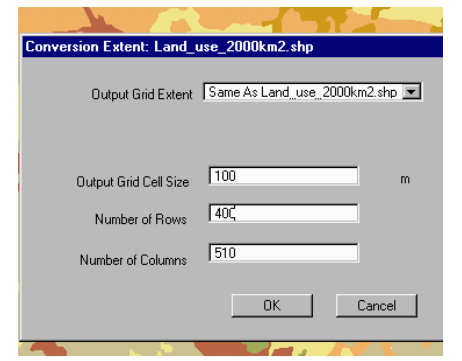


Set parameters (shown right Window)
Pick field database for New Grid Cell Values
(Must be the values to be preserved in the cell values)
Grid data Complete
Display Grid data

3) Sample: Geology Vector Data Conversion to 10m x 10 m Grid.
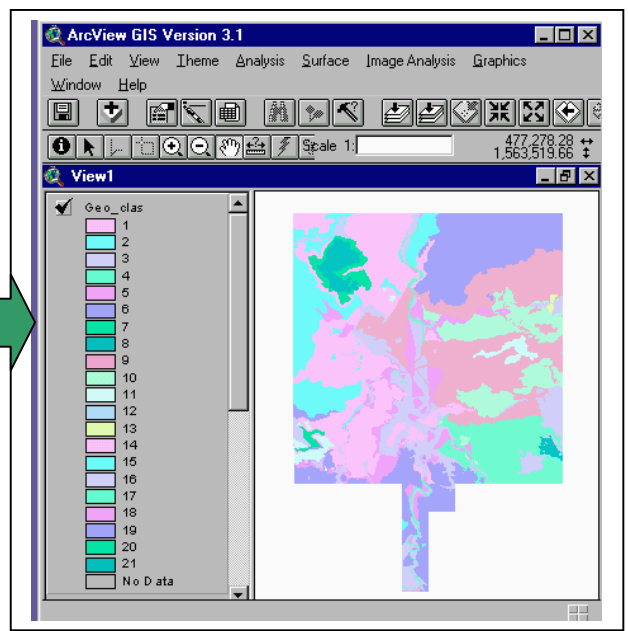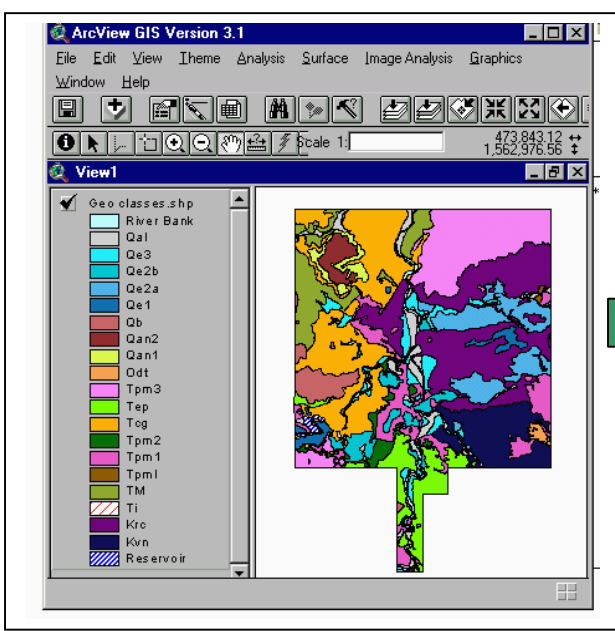
Spatial Analyst is necessary
to commit this Function

1) Explain

This function is that tranfers grid data to vector data.
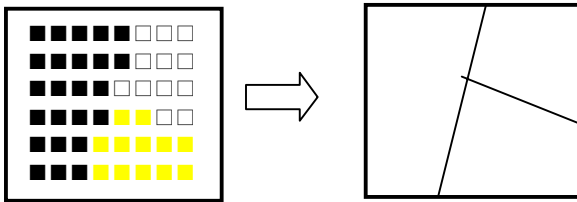


2) Select menu :

Theme : Convert to Shapefile
Name the output Shapefile
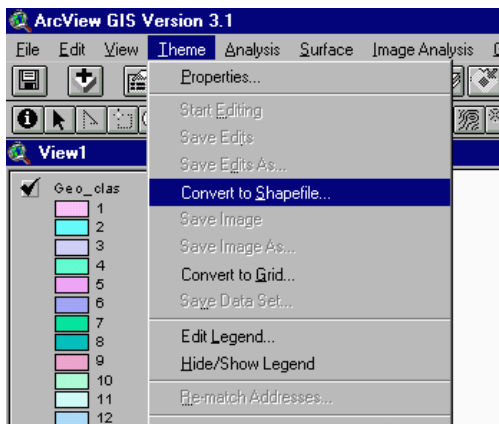


The new shapefile will contain a numerical field in its database named "Gridcode", depending on the numerical value found in the "Value" grid database field.

3) Sample: Landslides grid data 10 m x 10 m conversion to vector file.
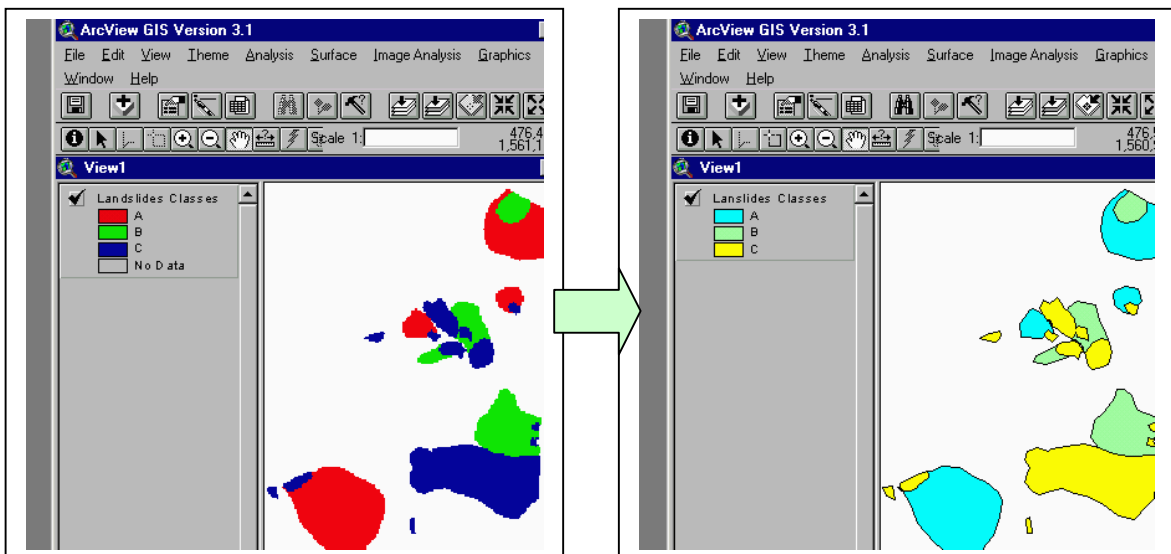
## 4. Overlaying and Querying Data Sources

Two or more themes can be overlayed to make a new theme containing spatial and database information from the input themes.

Themes

New Theme
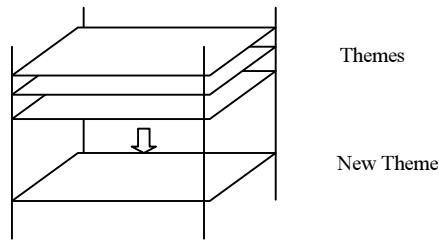
Geoprocessing Wizard is necessary to commit this Function

(8) Overlaying vector data

1) Explain

Two shape files are overlayed to make new shape file.
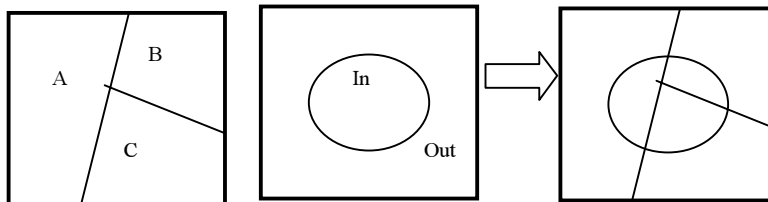
Database containing field information from the input shapes

| ID | Thema1 | Thema2 | House |
|----|--------|--------|-------|
| 1 | A | In | |
| 2 | A | Out | |
| 3 | B | In | |
| 4 | B | Out | |
| 5 | C | In | |
| 6 | C | Out | |

2) Operate (Several operations can be performed with overlay. Depending on the analysis needs. Here an example on the "union" process is shown.
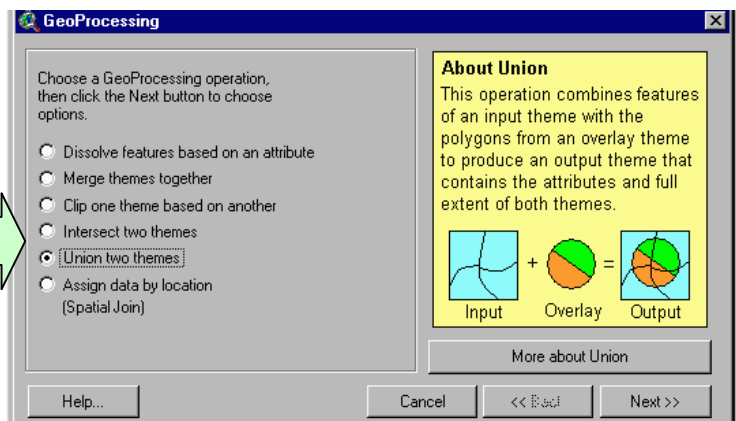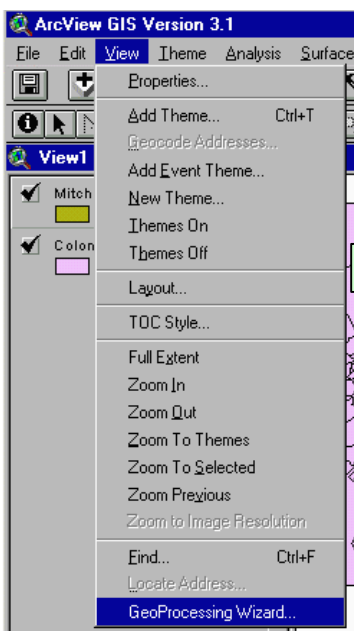
The Union process creates a new theme by overlaying two polygon themes. The output theme contains the combined polygons and attributes of both themes. The polygons of the input theme are split at their intersection with polygons of the overlay theme. The feature attribute table for the output theme contains attributes from the input and overlay themes' attribute tables.
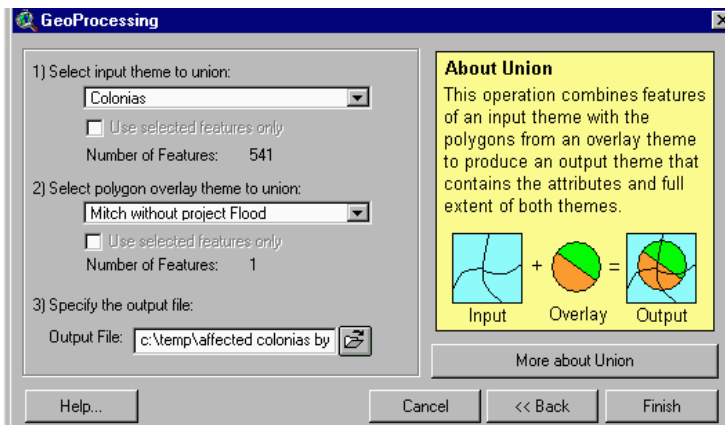
3) Sample: Overlay of the Colonia Theme with the Flood Prevention Scenario. The output theme contains information from both and can be seen clearly in the database.



Colonia +
FloodArea
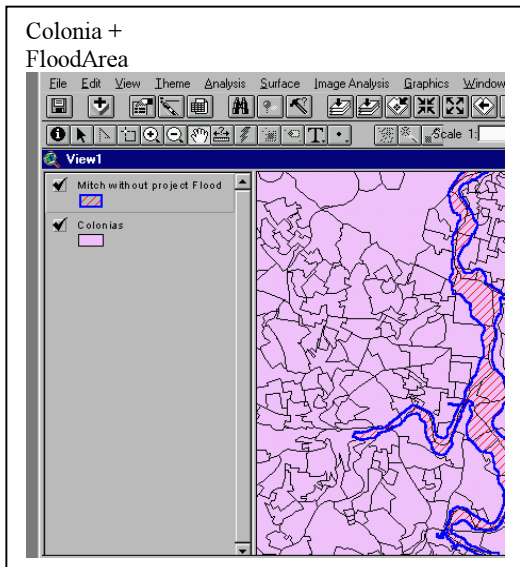
Calculate Population and Houses in Flood Area

| Code | Neigh | Pop_est | Newhn | Area |
|------|-------|---------|-------|------|
| 5128 | Col. Monseñor Fiallos | 2688 | 543 | 8.103071 |
| 5115 | Bo. El Lempira | 2559 | 517 | 17.053964 |
| 4080 | Col. Lomas del Guijarro Sur | 2153 | 435 | 40.239083 |
| 4037 | Col. Santa Ana | 762 | 154 | 2.514515 |
| 5059 | Col. Nueva Providencia | 505 | 102 | 3.453473 |
| 5099 | Col. Cooperativa Las Mercedes | 183 | 37 | 13.248162 |
| 5085 | Col. Villa San Antonio o Boquerón | 639 | 129 | 15.859653 |
| 5105 | Col. Bella Vista Norte | 757 | 153 | 1.562420 |
| 5081 | Col. El Rosario | 2470 | 499 | 2.099042 |
| 4116 | Centro Cívico Gubernamental | | 0 | 0.003945 |
| 4116 | Centro Cívico Gubernamental | | 0 | 0.425983 |
| 10 | Open Space | | | 0.226311 |
| 2004 | Col. La Primavera | 1277 | 258 | 0.248081 |
| 5097 | Col. La Haya | 2089 | 422 | 11.507791 |
| 4062 | Col. Res. Loma Alta | 84 | 275 | 27.081708 |
| 5127 | Bo. Belén | 5064 | 1023 | 17.772035 |
| 5092 | Col. Iberia | 2822 | 570 | 14.926242 |
| 4033 | Col. Nueva Edén | 579 | 117 | 4.029926 |
| 4034 | Col. Santa Anita | 332 | 67 | 1.863849 |
| 5095 | Col. Granada | 1401 | 283 | 5.062750 |
| 4032 | Col. Res. Maya | 1035 | 209 | 7.936580 |
| 5078 | Col. Centro América Oeste | 12291 | 2483 | 47.600068 |
| 5116 | Bo. Perpetuo Socorro | 4341 | 877 | 12.945475 |
| 4064 | Col. Res. Villa Universitaria I, II Etapa | 856 | 173 | 8.404688 |
| 5087 | Col. 1 de Diciembre | 4376 | 884 | 35.122949 |
| 4045 | Bo. Las Palomas | 347 | 70 | 6.023903 |
| 4036 | Col. La Esperanza | 3614 | 730 | 4.594868 |

Spatial Analyst and Grid Transformation Tools are necessary to use this Function

(9) Overlaying grid data

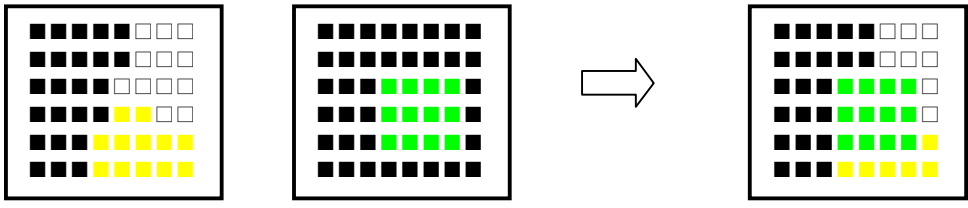1) Explain

Two grid files are overlaid to make new grid file.



2) Operate

Add the grid themes to be overlaid
Make sure the "value" field in all of them is the output value that needs to be preserved.
In the Parameter settings box select the grids that are to be combined



M - 10
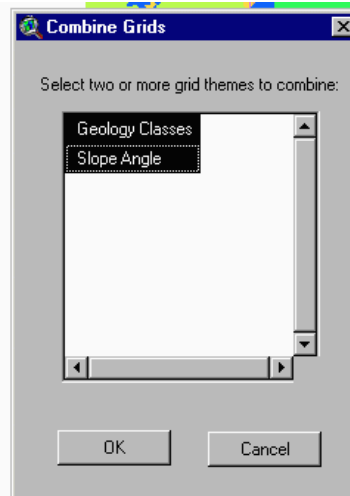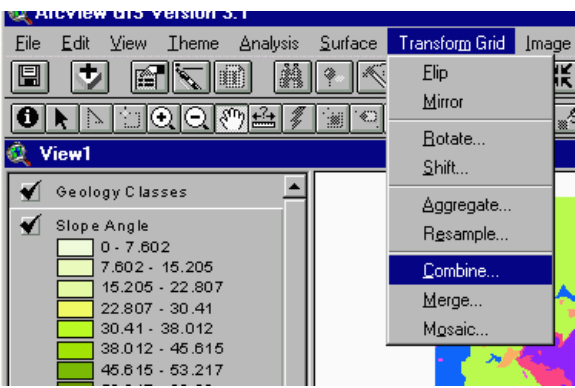
3) Sample: The Combined grid spatial extent of the Geology map and the Slope Map, covers the area common to both grids and its database is formed of the "value" numerical field from the input grids.



Geology map Grid 10*10m

Slope map Grid 10*10m

Geology hazard map grid 10*10m

| Value | Count | Geo_clas | Slope_10m |
|---|---|---|---|
| 5 | 6086 | 1 | 10 |
| 50 | 3330 | 3 | 4 |
| 51 | 4292 | 3 | 3 |
| 52 | 6039 | 3 | 2 |
| 53 | 6905 | 3 | 1 |
| 31 | 2970 | 2 | 13 |
| 32 | 2932 | 2 | 11 |
| 33 | 2948 | 2 | 12 |
| 34 | 3030 | 2 | 7 |
| 1 | 6721 | 1 | 9 |
| 2 | 5396 | 1 | 12 |
| 3 | 7047 | 1 | 8 |
| 4 | 7359 | 1 | 7 |
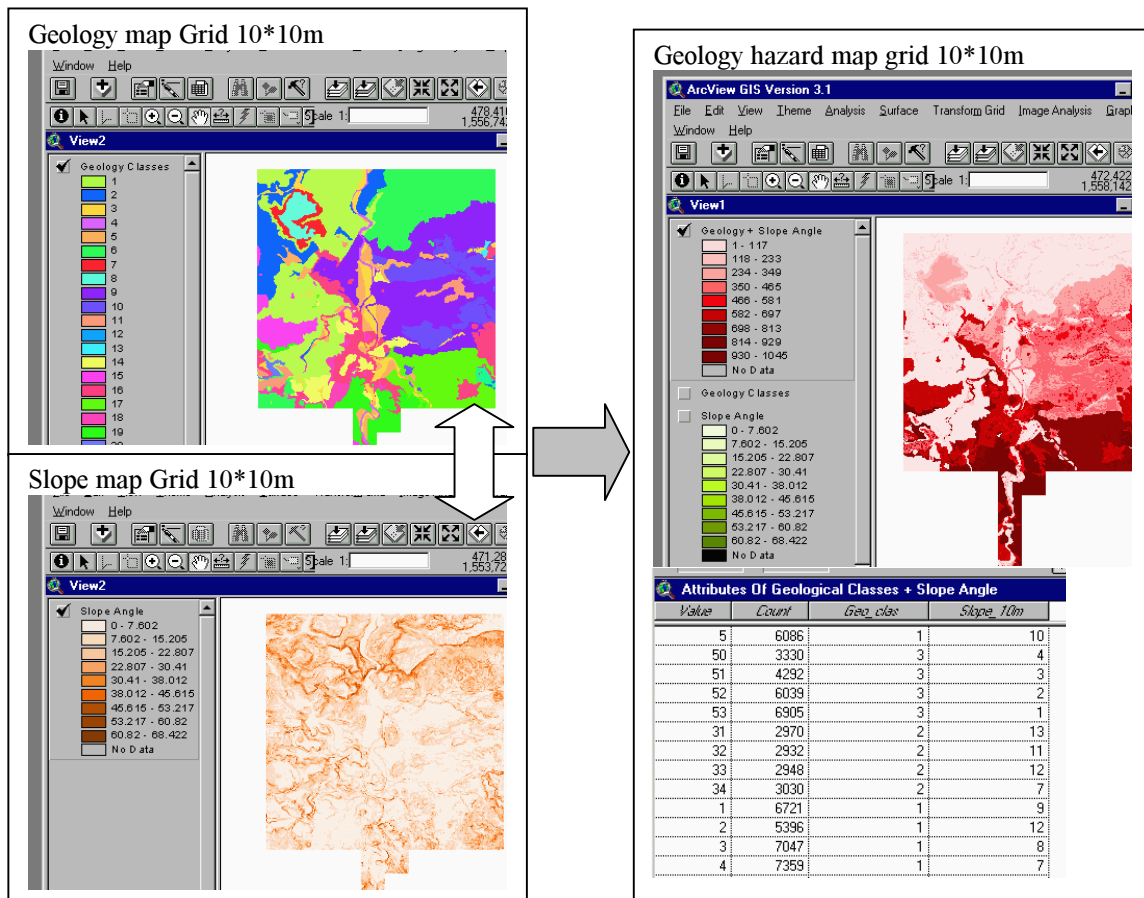
All the output grids being calculated from these processes are temporary files which will be deleted if the project is not saved. To save the final data and store it safely, press the "Save Data Set" under the "Theme" menu.
Name the output grid file and specify the directory.
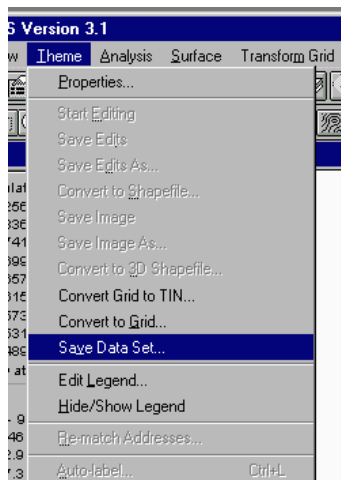
(10) Queries: vector data

1) Explain

Vector type objects are selected by query conditions.



2) Operate

Executing the Query Builder and Writing the Query Conditions



Parameter Setting Box Explanation:

Fields    This lists the fields in the theme or table you are querying.Fields that have been hidden do not appear in the Field list.
Operators    Use these operators to specify relationships between Fields and Values in a query. Either click or double-click an operator to place it into the query text box.

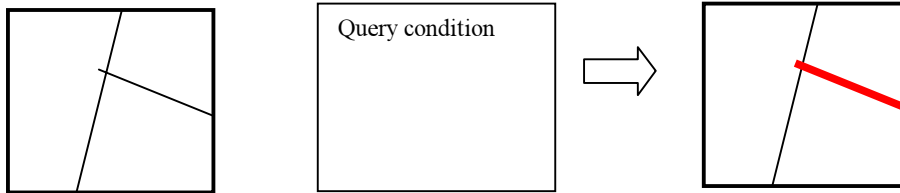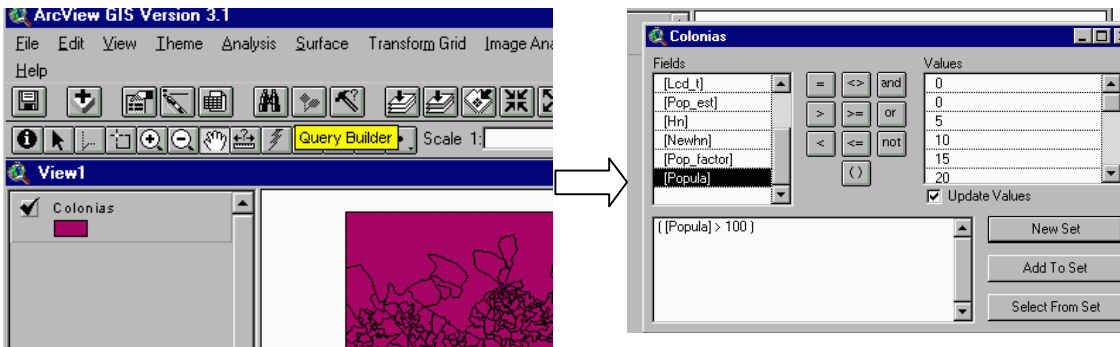| | |
|---|---|
| = | equals |
| > | greater than |
| < | less than |
| <> | not equal to |
| >= | greater than or equal to |
| <= | less than or equal to |
| ( ) | expressions enclosed in parentheses are evaluated first. |
| and | both expressions are true, e.g. [area] >= 100 and [area] <= 200 |
| or | at least one expression is true, e.g. [rainfall] < 20 or [slope] > 35 |
| not | excludes, e.g. not [name] <= "california" |

Values    This lists the values for the chosen Field. Only unique values are listed. So for example if 5 features or records in the theme or table you are querying have the same value for the chosen field, this value is only listed once in the Values list.

Update Values    By default, the Values list updates each time you choose a field. If there are a lot of values, it may take a moment for the values to be updated. Click this choice off if you don't want to update the values.

Performing a query on a view or a table
If you are using the Query Builder to select features on a view or records in a table, the following options are available for performing your query:

New Set   Makes a new selected set containing the features or records selected in your query. Features or records not in this set are deselected.
Add To Set    Adds the features or records selected in your query to the existing selected set. If there is no existing selected set, the features or records specified in the query become a new set. Use this option to widen your selection.

Select From Set    Selects the features or records in your query from the existing selected set. Only those features or records in this existing set that are selected in your query will remain in the selected set. Use this option to narrow down your selection.

3) Sample: By Querying the colonia vector theme, we can easily see and check the distribution of all the colonias having a population greater than 100 inhabitants.



Colonia

Calculate Population over Pop 100
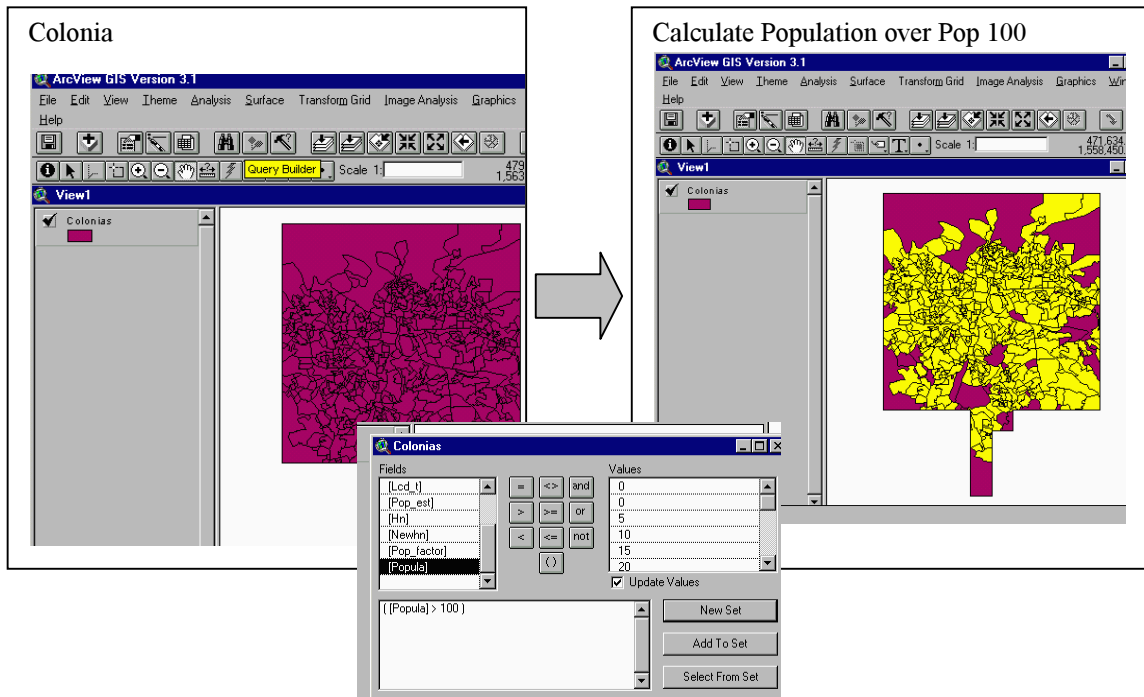
(11) Queries: grid data

1) Explain

Grid type objects are selected by query conditions.



Query condition

2) Operate

Executing the Map Query Function and Building the Query Conditions (A new Grid File will be Created)

3) Sample: Querying of the slope angle grid theme to identify the steep slope zones (over 30 degrees).



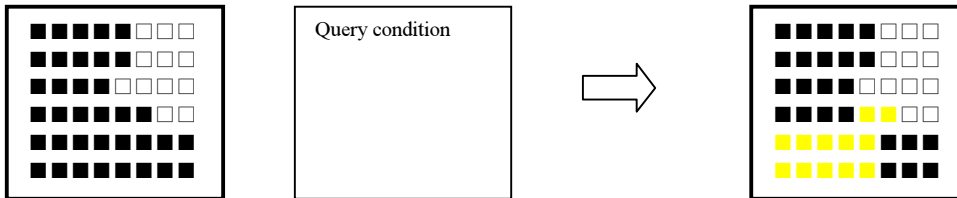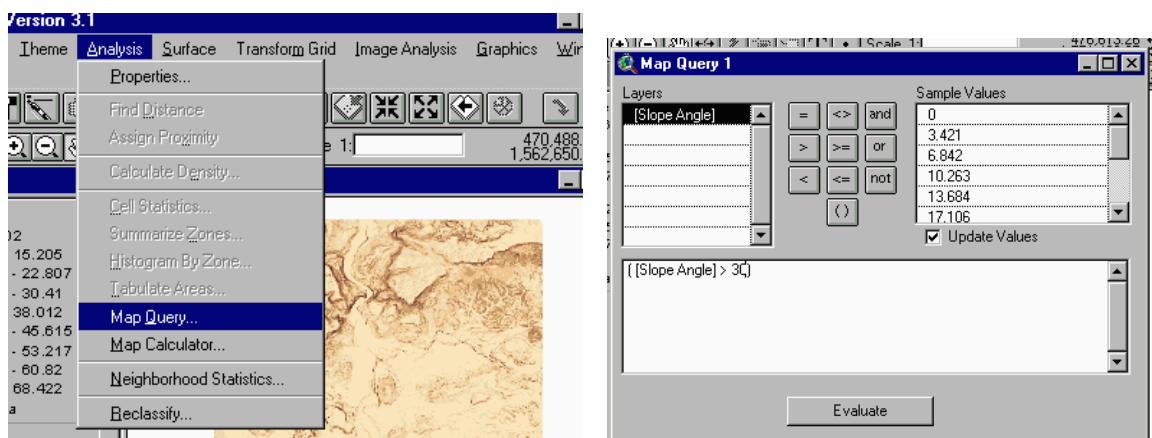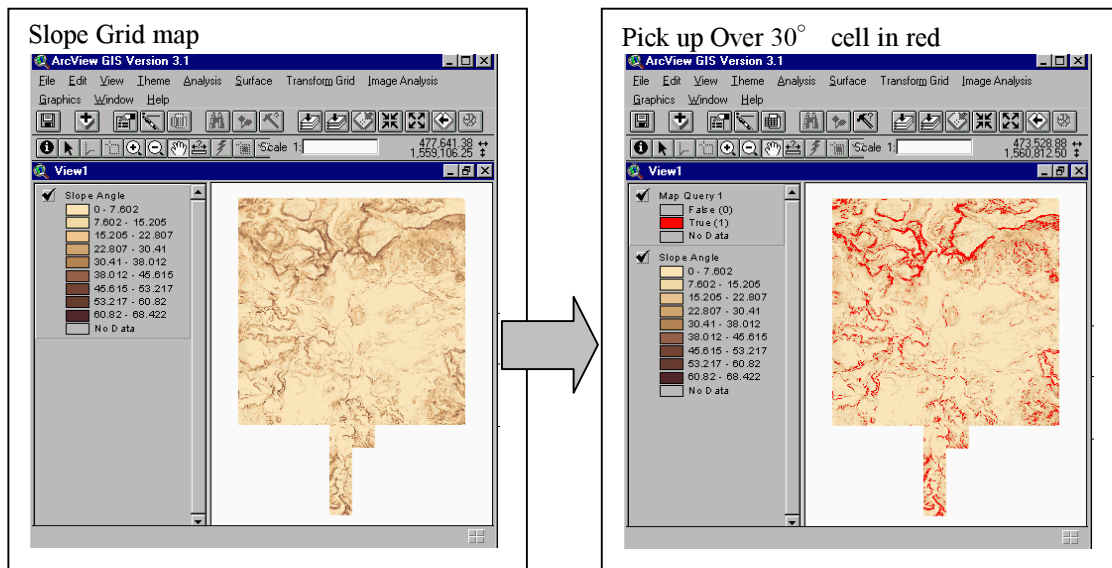Slope Grid map

Pick up Over 30° cell in red

## 5. Reprojecting Image Files & CAD Drawing Files

(12) Registering Images to Map Coordinates

Some image files (untransformed orthophotos, scanned aerial photos, etc) do not have a coordinate system to be projected or visualized properly. In order to do so and capture new information from them (e.g. Screen Digitizing) an image-to-world-transformation must be performed.

The image-to-world transformation is accessed each time an image is displayed (e.g., when you pan or zoom). The transformation is calculated from one of the following sources, listed in order of priority:

· The world file
· The header file (if the image type supports one)
· From the row/column information of the image (an identity transformation)

Because a world file has higher priority, you can override the header file transformation information by creating your own world file.

The World file may be written in any text editor. The contents of the world file will look something like this:

0.40 ------------→ A
0.00--------------→ D
0.00--------------→ B
-0.40 ------------→ E
475000.00------→ C
1561000.00-----→ F

Sample parameters for one of the Orthophoto TIFF files

The Values Explanation is as follow:

A = x-scale; dimension of a pixel in map units in x (east) direction
B, D = rotation angle terms in degrees
C, F = translation terms; x, y map coordinates of the center of the upper-left pixel
E = negative of y-scale; dimension of a pixel in map units in y (north) direction
t's easy to identify the world file which should accompany an image file: world files use the same name as the image, with a "w" appended. For example, the world file for the image file orthophoto05.tif would be called orthophoto05.tifw and the world file for redlands.rlc would be redlands.rlcw.

After completing the world file, it must be saved in the same directory as the image file. Next time that Arcview is executed and the image file opened, Arcview will instantly load its coordinate system and display it properly. It also can be scaled after setting the Map Units Parameters in the View Properties Window.

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| (13) CAD Drawing Coordinate Transformations |
| --- |

Most of the CAD drawings are made using paper coordinates instead of real world coordinates. For printing or viewing purposes it may not represent a problem; but whenever area or distance or overlay analysis are required then having untransformed CAD themes becomes a serious headache. To solve this matter, a coordinate transformation must be applied.

To apply a coordinate transformation to a theme based on a CAD drawing

1   Click on the theme's name in the View's Table of Contents to make it active
2   Click the Theme Properties button or choose Theme→Properties Menu.
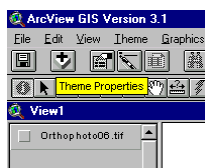


3   In the dialog that appears, choose Drawing from the list of categories
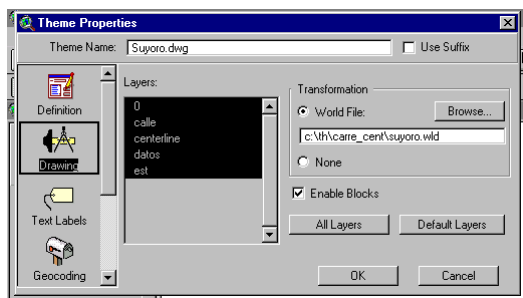


4   Click on the World File radio button and then click the Browse button
5   In the dialog that appears, navigate to the directory that contains the world file that you want to add, select it, and press OK. The name of the world file you choose appears in the Transformation section of the theme's drawing properties

6   Press OK

ArcView will immediately redraw the theme using the new coordinates.

The world file is a text file (with the extension .WLD) containing one or two pairs of X, Y coordinates. The first pair of X, Y coordinates is the actual X, Y location of any known control point in your drawing file or paper coordinates. The second pair of X, Y coordinates is a new location in geographic space where you would want the CAD drawing control point to be in ArcView or real world coordinates.
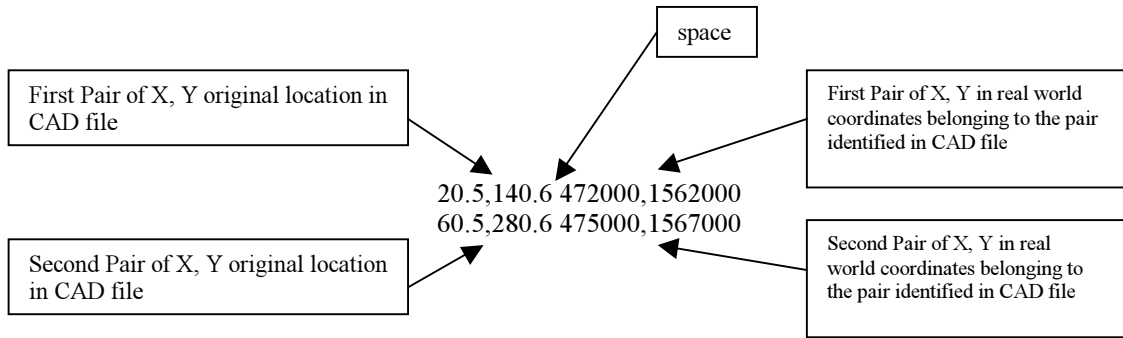
World File Format
The world file format is shown below:

<X, Y location in CAD drawing> <space> <X, Y location in geographic space>

(Example)

```
              ┌───────┐
              │ space │
              └───────┘
┌──────────────────────────────┐              ┌──────────────────────────────┐
│ First Pair of X, Y original   │              │ First Pair of X, Y in real   │
│ location in CAD file          │              │ world coordinates belonging  │
│                               │              │ to the pair identified in    │
└──────────────────────────────┘              │ CAD file                     │
                                              └──────────────────────────────┘
        20.5,140.6 472000,1562000
        60.5,280.6 475000,1567000
┌──────────────────────────────┐              ┌──────────────────────────────┐
│ Second Pair of X, Y original  │              │ Second Pair of X, Y in real  │
│ location in CAD file          │              │ world coordinates belonging  │
│                               │              │ to the pair identified in    │
└──────────────────────────────┘              │ CAD file                     │
                                              └──────────────────────────────┘
```

The world file must have the .WLD extension and cannot have more than two lines in the above format. ArcView automatically applies the world file when it finds a valid file name with the same prefix as the drawing file name in the same sub-directory. For example, suppose you've stored A1.dwg and A1.wld files in the same sub-directory. When you add themes from A1.dwg, ArcView automatically uses the A1.wld file for coordinate transformations.