



## UPPSALA UNIVERSITET

Institutionen för geovetenskaper  
Geoinformatiklaboratoriet

### **INTRODUCTION TO AVENUE FINDING SUITABLE AREAS FOR SEISMIC STATIONS**

#### **Introduction**

The aim of this exercise is to introduce application development and customisation in GIS. Specifically the interface of ArcView will be customised; scripts and extensions will be added. The exercise deals with a problem of identifying areas suitable for seismic measuring stations in Uppsala County. It is estimated that the exercise should take approximately 4 hours. To pass the exercise you must hand in a map as specified in the exercise.

#### **Background**

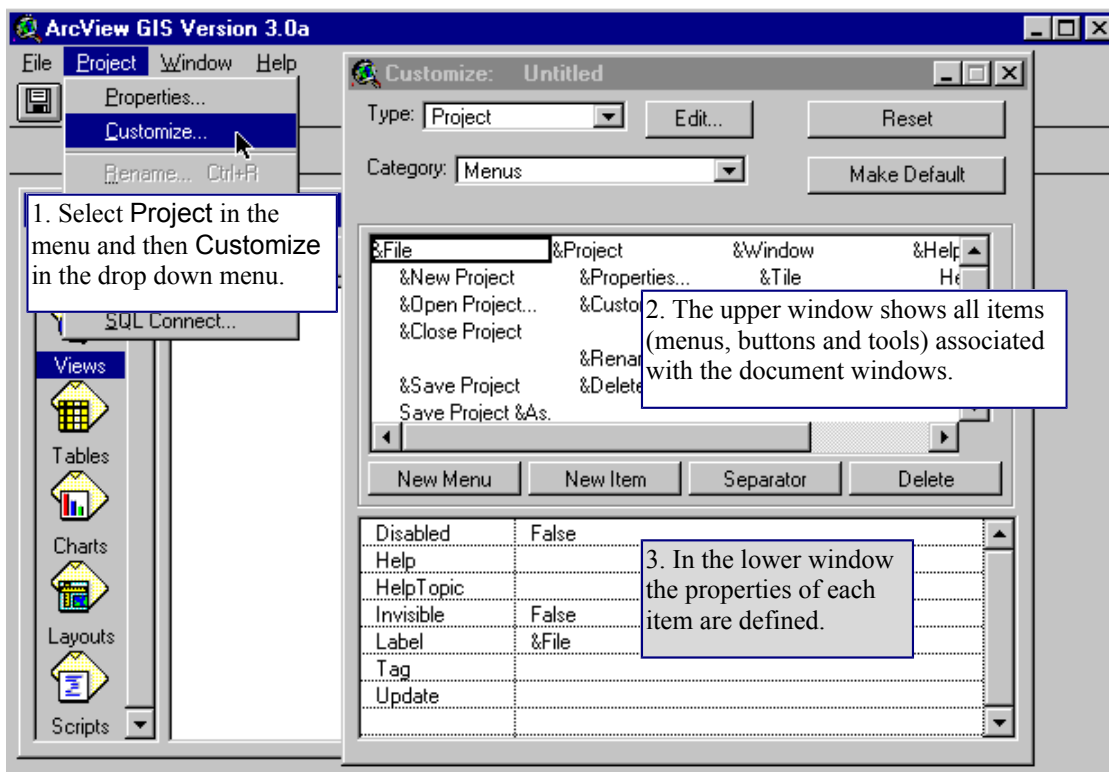
The mid Atlantic ridge is continuously pushing North America and Europe apart. Science can fairly well depict the large scale forces that operate, however still predictions about specific earth quakes and volcanic activities can not be done with any significant accuracy. In order to improve the understanding of the forces generating earth-quakes and volcanic activity several countries have joined forces. A new net of measuring stations for seismic activity is thus going to be set up. In Sweden 8 to 10 stations are to be set up along the Baltic coast from Uppsala to Haparanda. The localisation of a seismic measuring station is sensitive - no sources giving rise to vibration in the bedrock are allowed in the neighbourhood. The internal geometry of the stations is also important - the perfect geometry is to have a station at each intersection of a set of regular triangles. Sources of disturbance include lakes and the sea, traffic and communications systems, power stations and power lines, military shooting and training fields, and built up areas (see below). All major source factors can be found in Röda Kartan - the 1:250 000 scale map produced by the Swedish Survey, normally published per county. Apart from identifying disturbance sources, the seismic stations must of course be placed in solid rock. Thus only areas with barren rock or thin soil are suitable. The Swedish Geological Survey has published a national soil map of Sweden in the scale 1: 1 million that shows such areas. In this exercise you shall add modules and customise ArcView so that it can solve the problem of localising potential areas suitable for seismic measuring stations. Uppsala County will be used as an example.

## Retrieve the data needed

All the files that you need for the exercise are found under ???

## Introduction to customisation and programming in ArcView

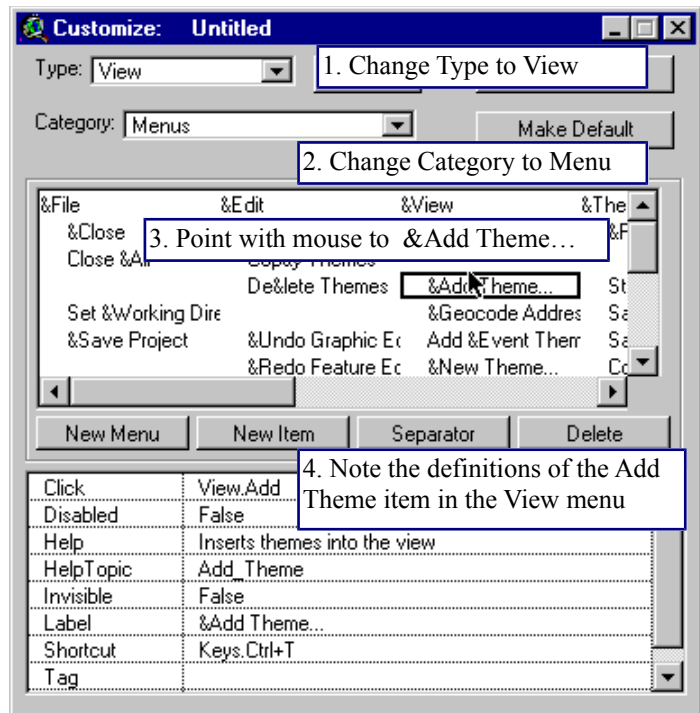
Start ArcView and open an empty view. Under Project in the menu select Customize, the following menu appears.



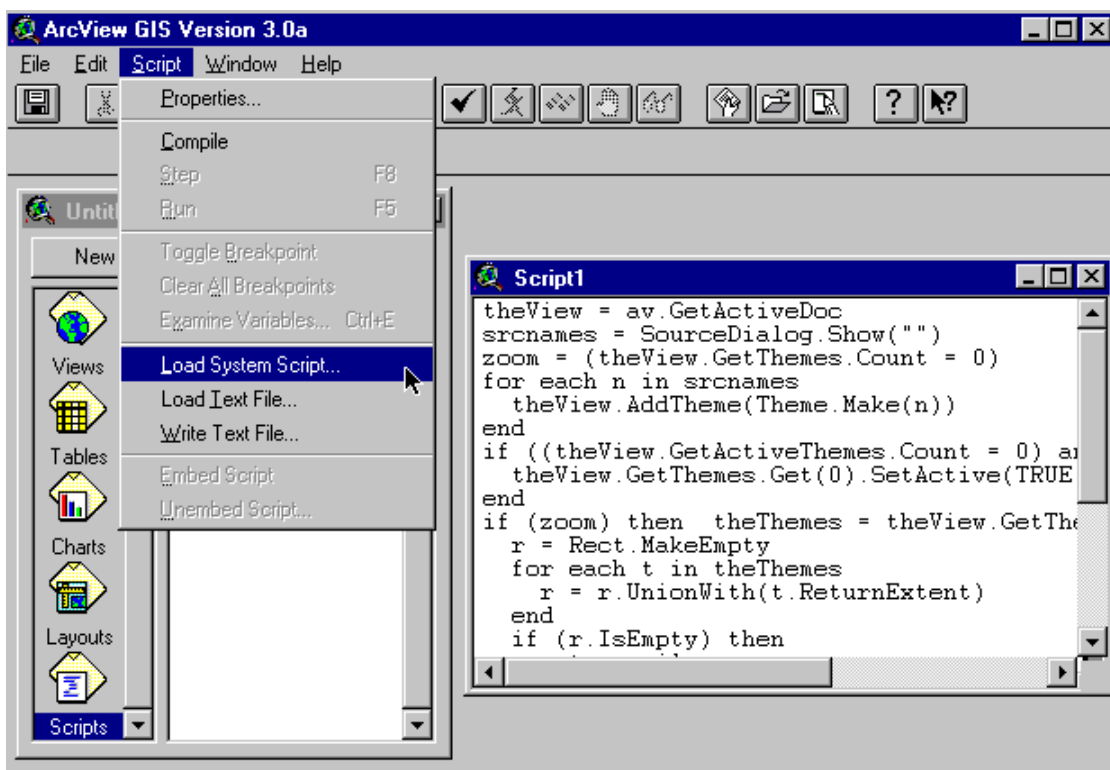
With the Customize dialogue box you can change the menu bar, buttons and tools of ArcView. You can also add new buttons or tools.

Each menu item, button and tool in ArcView is associated with a *script*. A script is a program written in ArcView's development language *Avenue*. Everything you do in ArcView is run by scripts. The set of scripts that ArcView uses as default are called *system scripts*. ArcView is however delivered with several more scripts that you can load to the system yourself - these are found under C:\ESRI\AV\_GIS30\ARCVIEW\Samples\scripts. Another important source for scripts is ESRI's www site ([www.esri.com](http://www.esri.com)). And then it is also possible to write your own script in Avenue.

In the Customise dialogue menu change Type to View and Category to Menus as shown to the right. Use the mouse to point at the "&Add Theme..." text item in the upper window (as to the right). Note how the definitions of the menu item Add Theme are shown in the lower window. The first line defines the script to be executed when the menu item is clicked. The logic in calling this script **View.add** is that *View* is the object that is affected by it and the argument (or request) passed to the object View is *add*. This kind of *object oriented* reasoning lays behind all Avenue semantics. It is not necessary to deal with the other rows of the lower window for now.



Do not make any changes in the customize dialogue menu - instead just close it and return to your project window. In the project window select **Script** and press **New**. From the menu do select **Script** and **Load System Script** as shown below. In the Script manager box that appears go down to the script **View.add** and add it. You can now read the Avenue program text of the script **View.add**. If you are familiar with programming you will recognise some features, like conditional statements (if .. then) and loops (for each ....).



Close the script.

## Finding suitable areas for seismic measurement stations

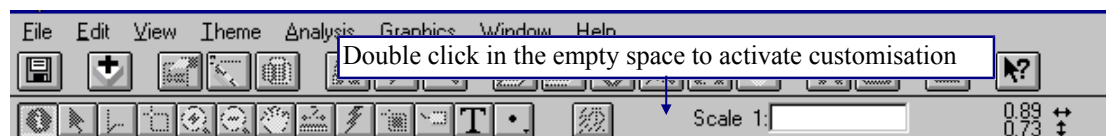
Let us turn to the task of creating a customisation that can be used to seek out areas suitable for seismic measuring stations along the Swedish Baltic coast north of Stockholm. The first part in creating the customisation is to define what needs to be done.

Operation that will be needed	Arc View equivalent
Add necessary themes over the county	Add Theme
Delete themes (not obligatory, but might be useful)	Delete theme
Query features of a theme to be used separately	Query builder
Clip the theme "Soil map of Sweden" to fit the county	Clip theme
Evaluate proximity from different themes and features	Proximity analysis
Zoom tools	Zoom in, Zoom out, pan, Zoom to full, Zoom to selected
Definition of view properties (map and distance units)	View properties

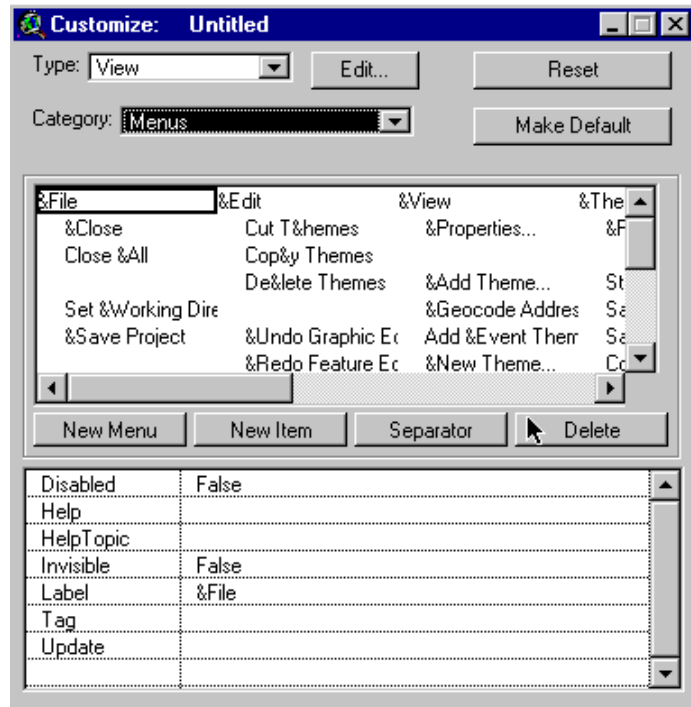
Even though the task of identifying undisturbed areas with rock outcrops is rather difficult it only involves a few generic steps. Most steps can be done by ArcView system scripts. Clipping themes must, however, be done by a script supplied with the ArcView license that you must add yourself, whereas the script that evaluates proximity can only be found at ESRI's www site.

## Customisation of the interface of the View document

In this exercise we will primarily be concerned with customising the view document. Thus again return to the project window and open a new empty view. To activate the customisation dialogue box from the view document you can double click on the empty area to the right of the tools.

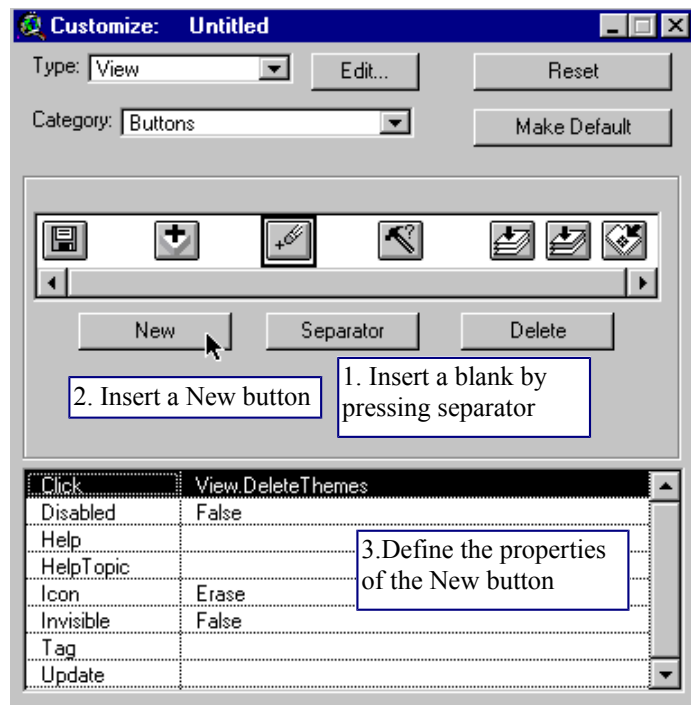


You will again get the Customize dialogue menu - this time defaulted to Type being View (as shown to the right). **Do not** press the button Make default (if you do we will have to reinstall ArcView on that computer later). The first thing to do is to delete the menu item, buttons and tools that are superfluous. To delete an item just press the Delete button between the two windows of the dialogue box. The item inside the box in the upper window will be deleted. As you delete something the corresponding menu item, button or tool disappears. Be careful not to delete too much. Here is a suggestion on what to keep.



In the example above three menus, seven buttons, and six tools have been kept. We also want to have possibilities to delete files. In the original interface that is a menu option, however we will put it as a button in our customisation.

If the Customize dialogue box is not active open it. Choose **Type** to be **View** and **Category** to be **Buttons**. You can insert a separator (blank) if you want to. Position the box to the left of where you want the New button for deleting themes. Then press New. In the lower window of the customisation dialogue box you can now assign various properties to the new button. Start by adding a suitable icon (click on the field that says icon and scroll and point at a suitable illustration). The most important is of course to associate the button with a script. Double click on the field "Click". You will get a Script Manager that by default shows a list of all system scripts. The system script we want to use is called **View.DeleteThemes**.



The name is again a logical outcome of object orientation. The object we want to change is the view, the request we send to that object is to delete a theme. Obviously no other object

have the possibility of deleting a theme. In object oriented programming requests and objects go hand in hand.

Before continuing it is time to add the themes that we need in order to complete our task. As said above all the features we want to analyse proximity from can be found in the themes of Röda Kartan.

Disturbance feature	Röda Kartan layer	kkod	Disturbance distance (m)
Railroad (various types)	rc_jv95	5611 - 5632	5000
Military exercise field	rc_mo95	432	5000
Military shooting field	rc_ms95	4310	5000
Military protected area	rc_my95	433	5000
Nuclear power plant	rc_sp95	362	5000
Mine	rc_sp95	321	5000
Coast line (mainland)	rc_hv95 (rc_ku95)	9000, 9009	3000
Built up areas	rc_to95	302, 303	3000
Major roads	rc_av95	5011 - 5321	2000
Airport, > 1200 meters	rc_sl95	5710	2000
Airport, other	rc_sp95	571	1000
Helicopter landing place	rc_sp95	572	1000
Wind power	rc_sp95	361	1000
Chimney	rc_sp95	326	800
Tower	rc_sp95	322	800
Radio mast	rc_sp95	323	800
Church	rc_sp95	351, 352	800
Power line (various types)	rc_kr95	4510, 4520	300
Lakes (> 1 km <sup>2</sup> )	rc_sj95	901	200

Apart from the layers of Röda kartan in the list above there are two more themes you must add - the soil map covering Uppsala county - **jordclan**; and the theme showing the county itself - **rc\_ln97**.

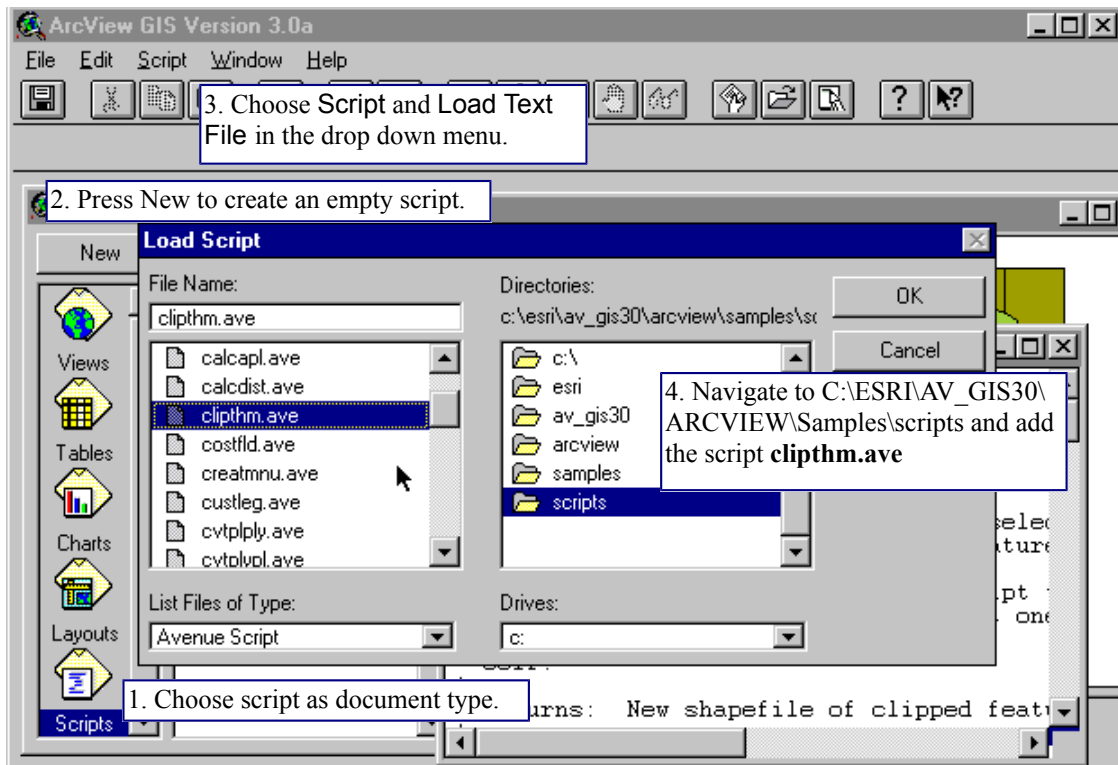
Once the Themes are loaded set the map and distance units in the View properties (or else no distances can be calculated).


### Clip the Soil map theme to fit the county

The soil map (**jordclan**) that you loaded is part of the national soil map produced by SGU (Swedish Geological Survey) in the scale 1: 1 million. As you can see, however, its extensions do not match that of the other maps of Uppsala county that you have loaded. In order to save storage space and improve the cartographic layout you should now clip the soil map to fit the county. There is no system script doing this. There is however a script doing exactly what we want supplied with the ArcView program. It is called **ClipThm.ave** (all scripts have the default extension .ave). You can find it together with all other scripts supplied with the program package under C:\ESRI\AV\_GIS30\ARCVIEW\Samples\scripts.

The script **ClipThm.ave** is only needed once and we will run it as a script document instead of associated with a menu, button or tool item. Go to the project window, select script as document type and press New. You will get an empty script. Choose **Script** in the menu and

then **Load Text File** in the drop down menu. In the dialogue box that appears navigate to C:\ESRI\AV\_GIS30\ARCVIEW\Samples\scripts and select the script **ClipThm** (see below).



As with all computer programs before executing it you must compile it. You compile a script with the compile button . Note that the run button, , to the right of the compile button became enabled when you compiled the program. Run the program. Most likely you will encounter an error. That is because the script does not recognise the view document. Thus activate the view with your themes, then activate the script (activate by clicking on the bar above the document - the bar that turns blue when active). If you go directly from the View to the Script, the latter will interpret the former as active. Again run the program and set "intersect" theme to be the soil map and "clipping" theme to be the map that shows the extension of your county. Save the county soil map in your working directory and add it to your View. If it worked out OK you can delete the original soil map.

### Creating buffers around the disturbance sources

There is neither a system script nor another supplied script that does calculate proximity and saves the results. However, as said above on ESRI's internet site several more scripts donated by ArcView users can be found and downloaded. Use your internet browser and navigate to <http://www.esri.com/>. On the main ESRI page you can find your way to the scripts in the left margin, or use the address <http://andes.esri.com/arcscripts/scripts.cfm>.

As you will see from the script page (cf. below) there are quite a lot of scripts to download (however the list also include all the sample scripts delivered with ArcView). Use the search function as indicated below to find scripts that create buffers.



# ArcScripts

Useful Tools from GIS Users and ESRI

Welcome to ArcScripts

Share or download scripts developed by ESRI and users like you. Find scripts by category or use the search tool to find scripts in your area of interests.

## ADD NEW SCRIPTS

[New Author](#)

[Existing Author](#)

[Update/Delete Existing Script](#)

[Edit Your Contact Info](#)

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## TOP 10 DOWNLOADS

## NEW SCRIPTS THIS MONTH

### LANGUAGE

[AML](#) (90)  
[Autolisp](#) (32)  
[Avenue](#) (426)  
[C](#) (3)  
[C++](#) (6)  
[Delphi](#) (2)  
[Java](#) (1)  
[PowerBuilder](#) (4)  
[SML](#) (7)  
[Visual Basic](#) (15)

### PRIMARY SOFTWARE

[ARC/INFO](#) (91)  
[ArcCAD](#) (31)  
[ArcView 3.0a/b](#) (19)  
[ArcView 3.1](#) (63)  
[ArcView 3.x](#) (361)  
[Atlas GIS](#) (3)  
[MapObjects](#) (9)  
[PC ARC/INFO](#) (8)  
[Spatial Database Engine](#) (1)

BROWSE

BY CATEGORY:

SCRIPTS IN THE LAST  DAYS

BY KEYWORDS:

Type "buffer" and then search by pressing "Go"

SEARCH

The script you must use is Buffer Theme Manager (1a) by Kevin O'Malley. Follow the instructions and download the zip file which contains the script to your working directory. Unzip the file that you downloaded. The zip file contain four files:

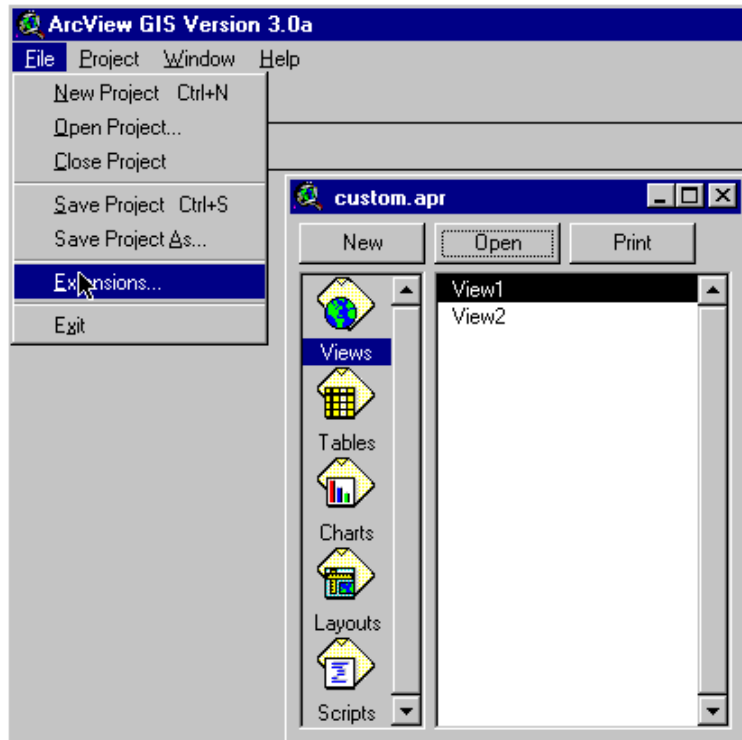
- avdlog.dat
- avdlog.dll
- buffread.txt
- buffthme.avx


Before continuing read the instructions in the file **buffread.txt**. From the instructions it should be clear that you need to copy the files as follows:

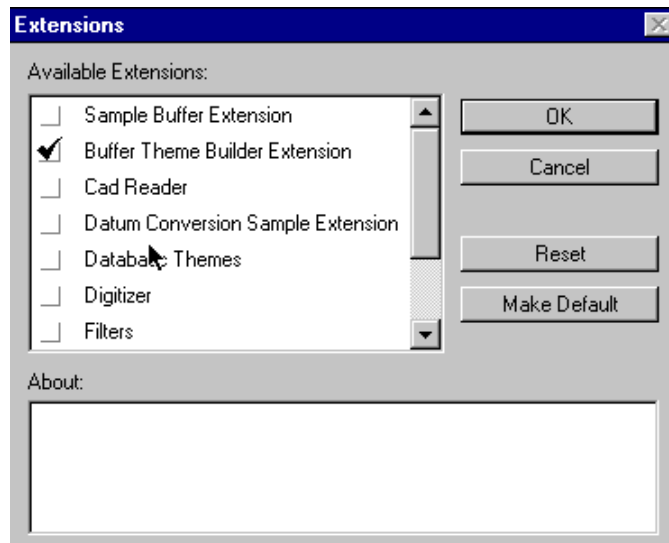
File	Copy to
avdlog.dat	C:\ESRI\AV_GIS30\ARCVIEW\BIN32
avdlog.dll	C:\ESRI\AV_GIS30\ARCVIEW\LIB32
buffthme.avx	C:\ESRI\AV_GIS30\ARCVIEW\EXT32



**Buffthme.avx** was created as an avenue script, however, it was saved as an extension instead of a script - hence the .avx instead of .ave. Extensions are modules that can be loaded to ArcView. When an extension is loaded the interface of one or several documents (views, tables, charts, layouts and scripts) are affected - menu items, buttons and tools are added. All extensions must be located in the directory C:\ESRI\AV\_GIS30\ARCVIEW\EXT32, where you just did put the buffer extension. To load the extension go to the project window, choose File and Extensions.

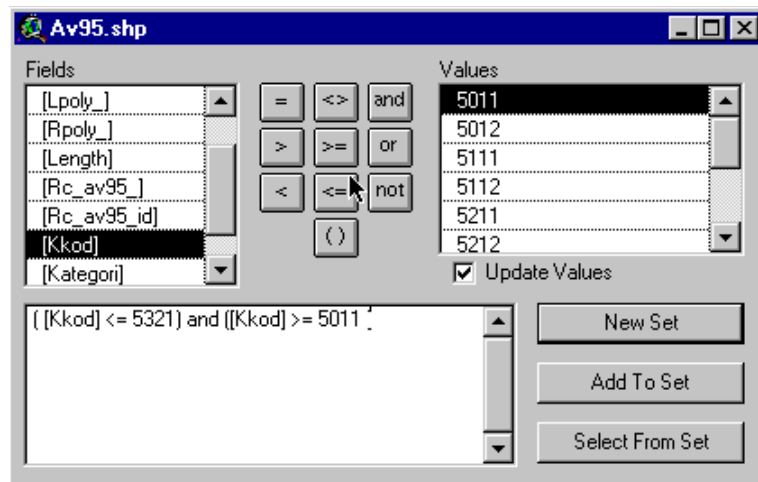


In the extensions dialogue box you will see the extensions available (i.e. files ending .avx in the directory ..\ext32). ArcView is delivered with several extensions (Cad Reader, Data Base Themes etc). You will also see the extension "Buffer Theme Builder Extension" which is the one you downloaded from the internet. Click in the box to the left of the extension to activate it. Return to your view. It should now have an extra button for creating buffer themes - .

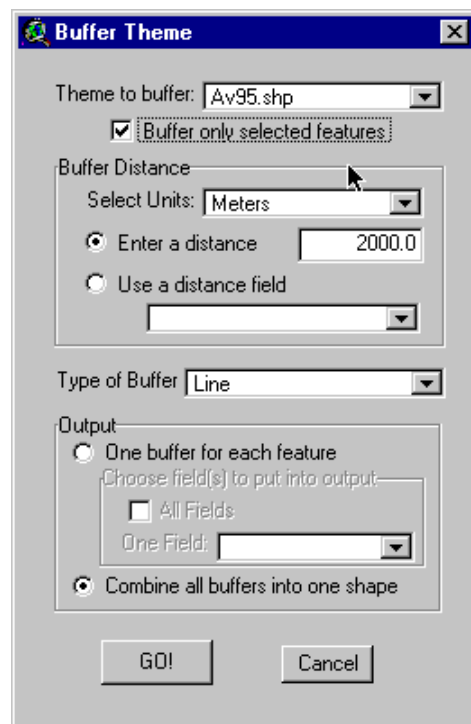


Obviously some of the themes as they are defined in Rödä Kartan do not match the definitions as we want to use them. So we must use query to select the various sets of features we want to use for doing our proximity analysis.

To the right you can see how the query function is used to select all the major roads (as defined above) from the theme containing all public roads. If you do not select any road the buffering will be around all public roads - meaning that most of the county will be constrained (or closed) for localising a seismic measuring station.



For each of the disturbance features identified above you have to run the Create Buffer Theme tool. Before running the tool you must select the features of the specific theme. To the right is an example of running the tool for the theme av (public roads) with selected features being "Major roads". The distance is calculated only from selected features; the distance is set to 2000 meters; no distance field is used; Type of Buffer is set to the same feature as the theme; and all buffers are combined into one shape. Use the same principles for deriving all buffers.



When you have calculated all the buffers it is time to create a layout. The map that you shall produce shall give information on where barren rock can be found in Uppsala County outside the disturbance buffer zones. This map must be handed in to the course staff to pass the exercise. You can send in the map in digital or paper format. Do not forget to write your full names on the map you hand in.