RELMA
REGIONAL LAND MANAGEMENT UNIT

GIS Data Mining on Internet

Requirements
This exercise requires a PC with Windows95/98 or Windows NT, a connection to the Internet and the freeware ArcExplorer 2.0. To install ArcExplorer from the Internet see appendix 1. The necessary data is mined from the Internet.

Objectives
The objective of the exercise is that the students should gain insight into using the www as a source of data and exploration tools for georeferenced data; to introduce some basic elements of digital cartography including scale, georeferencing, labelling and layout. After completing the exercise students should be able to create small scale (country) thematic maps from tools and data available over the www

Task
This exercise aims is to introduce freely available GIS software and georeferenced data over the world wide web (www). As we will use global data sets you could choose to work with any region of the globe. However, the idea is to work with some country/countries in Africa to illustrate typical data for developing regions. The instructions are written for Botswana – a land locked country in Southern Africa.

Disclaimer
This exercise was originally written in 1999 for ArcExplorer 1.1, and only briefly updated in May 2003. The interface of ArcExplorer2.0 hence differs a bit compared to the given instructions and also some webpages also differ, or have been moved.

Start the GIS Viewing program and add data from internet

In this exercise we will use ArcExplorer - a GIS freeware offered by ESRI – see appendix 1 for instructions on how to retrieve ArcExplorer from the internet. Start ArcExplorer. The main parts of the ArcExplorer interface are shown in the figure below. You will be presented with an empty project called untitled. The legend window contains two tabs (pages), one for local themes (themes that are stored on your local computer or local area network) and one for WWW themes (themes stored on Web sites). To get help on any topic just press F1, or search via help in the menu bar. You can also find the document Using ArcExplorer (**Arcexplorer.pdf)** in the same folder as the program file. This manual can be read by using Adobe Acrobat reader.

In the interface you will notice than some menu and tool items are gray (fuzzy) that means that they are not available at the moment. Many items require that you have some themes in the view, and some that you have at least one theme active (this will soon be clear to you).
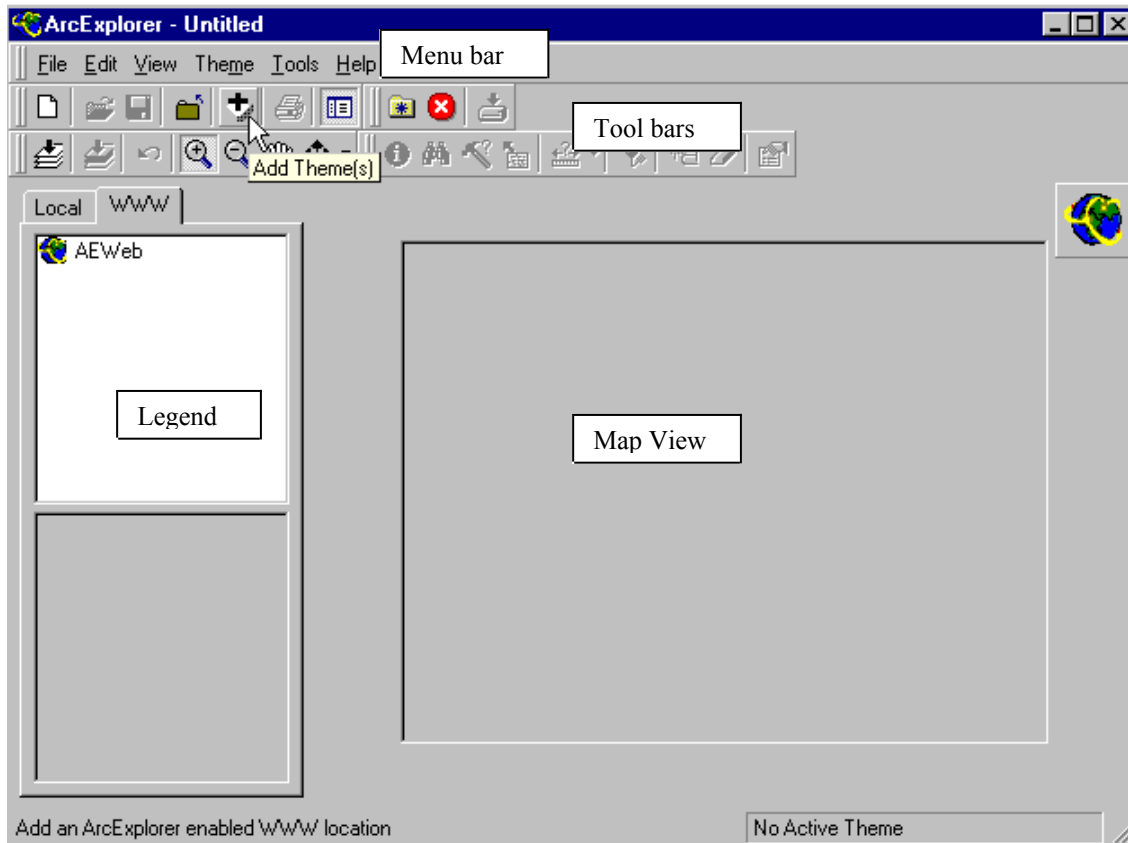
We will start by adding some maps directly from www. Choose the www tab from the top of the legend, where after the legend should look like the one in the figure above. Press the Add theme button, [+], and select ESRI ArcExplorer Web Site (default – as to the right). Press Add URL.


The legend window should now have some more items, as shown to the right. Click on "World BaseMap". The transfer might take a while but you will then get a view of the whole globe, with labels for the continents. Use the Zoom in tool, [magnifier], to zoom in on Africa. Click the left mouse button; drag to the window you want to zoom and then release the mouse button. If you just click in the view with the zoom in tool active the position you clicked will be the center of the new display area after the zoom. When you zoom in new themes will be displayed in the map view, as shown below. Try to zoom in further to see what other themes are displayed at increasingly larger scales.
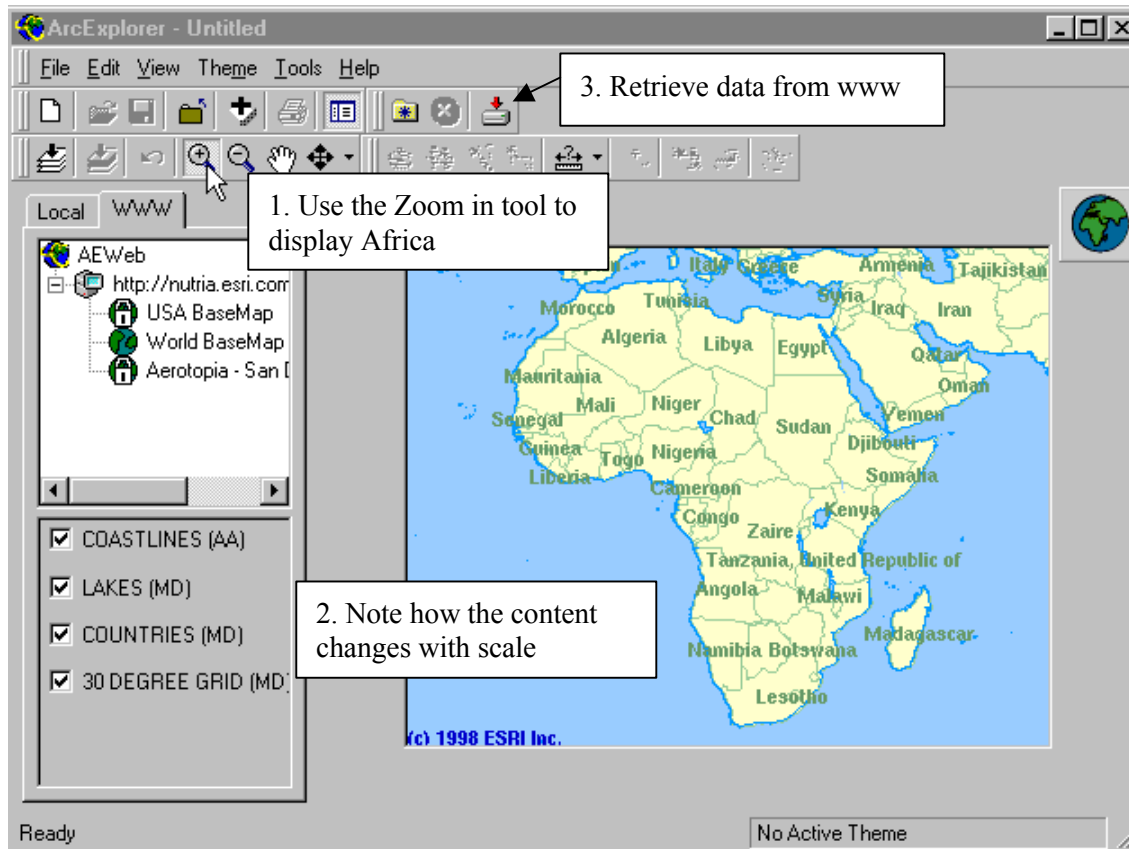
With the whole of the African continent displayed (as above) press the Retrieve data from www button, [icon]. Select the radio button for The current extent and press the Retrieve button (as to the right). Accept the license agreement and put the data in a separate folder (create a folder if necessary). Again press the Retrieve data from www button to start the process. The data is transferred from the www to your computer.
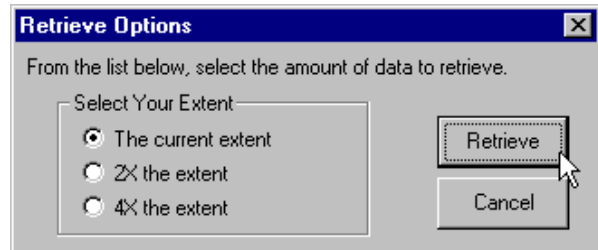
Answer Yes to the question "Would you like to add the data into your local view?" You will then be transferred to the local view. Notice that the retrieved map is exactly clipped as the area you had zoomed in, and that the labeling is lost in the view in the local mode.

Finding data

The legend should now look as the example to the right. With the check box to the left of the label you can include or exclude the theme from the view (try it). If you click once on the name label the theme will become active, it appears lifted. Activate the theme COUNTRIES (MD) as shown to the right. We will now locate Botswana (or another country) in our view by using the Find tool, 🔍. Click the find tool.
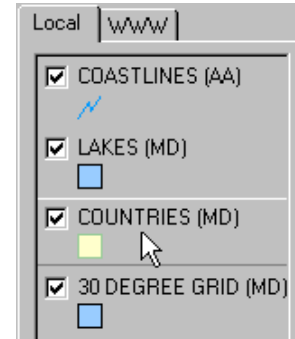
In the dialogue box that appears enter Botswana and select the theme Countries(MD) as shown to the right. Press the Find button. The lower part of the dialogue box will be changed as shown below. Select one of the two fields. Try all options, Highlight, Pan To and Zoom to – in that order.
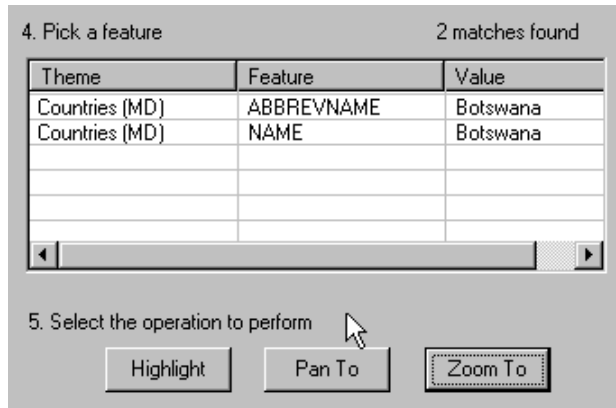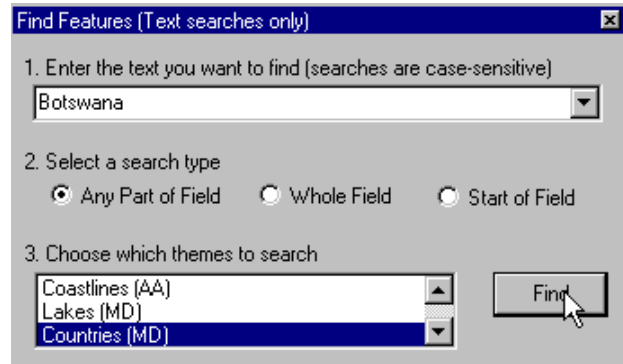
Close the find feature dialogue box.

Symbolizing data

Use the Zoom to full extent button, to get the view of the whole of Africa. As you can see the theme coastlines (AA) also contains the borders between countries, but that the lines do not coincide with the COUNTRIES theme. Turn of all themes except COUNTRIES (i.e. click the check boxes to empty them).

To set a background color and other map display properties press View in the menu bar and then Map display properties. You can add scrollbars make the map appear 3D and change the color of the background (the sea in our case) and Highlight (when you query the data the result is highlighted in this color – yellow is default).
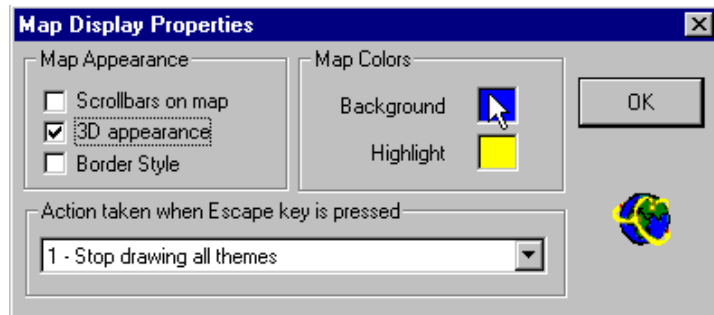
Make the theme COUNTRIES active. Open the theme properties dialogue box, either via the Theme properties button,

, under theme in the menu or clicking the right mouse button. Set Classification option to be Unique value and Field to NAME. Press Apply.
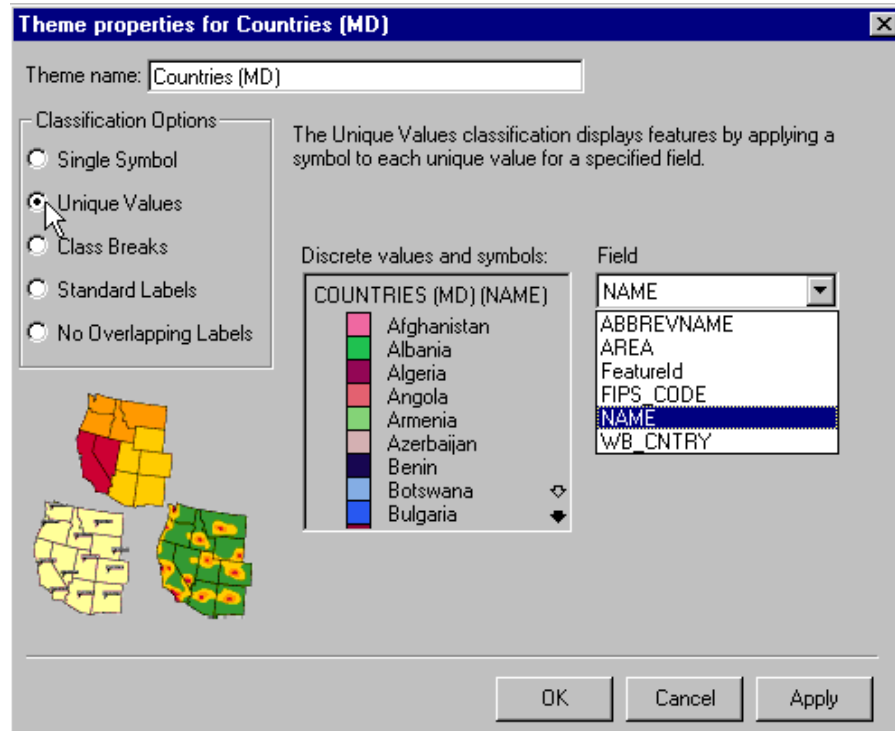
You can set individual colors, style and size (line width) of each attribute by clicking each country in the middle box (see figure to the right). In the second part of the exercise you must symbolize European cities using this dialog box. Cities are point themes and shape, size and color can all be changed via symbol properties.
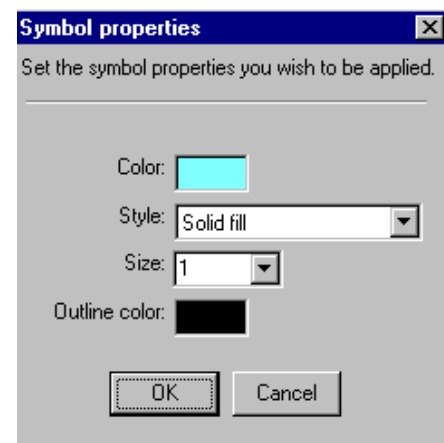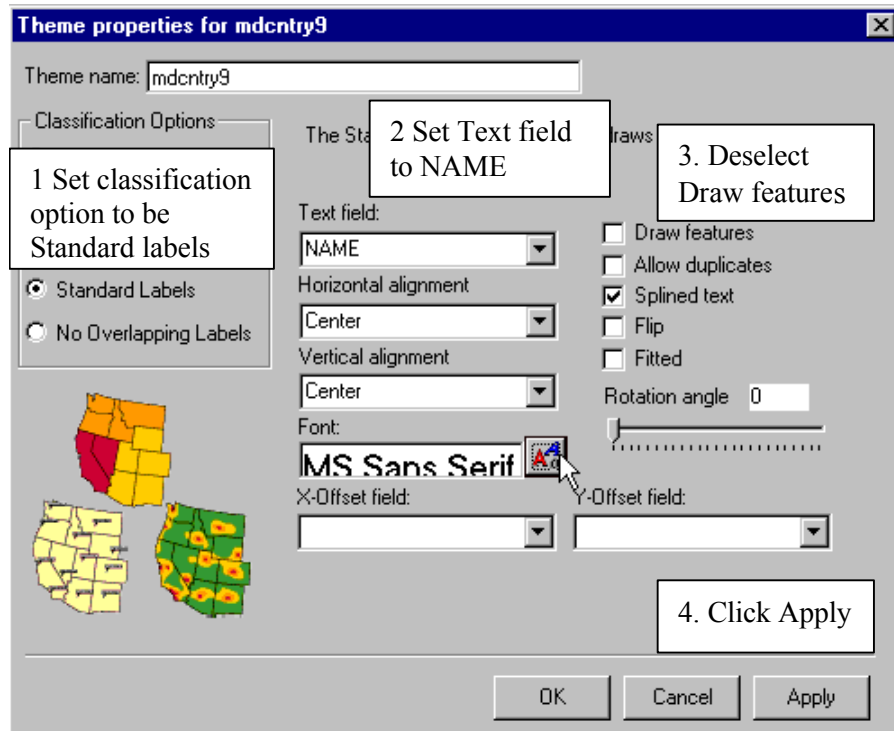
Labeling maps

To label the map in ArcExplorer add a duplicate copy of the theme countries. Use the Add theme

button, [icon], and navigate to the directory where you did put the retrieved data. It is the theme called mdcntry9.shp (as shown to the right) that you should add. Put the new theme highest up in the legend (grab it by holding down the left mouse button and slide it to the top of the legend).

| Name	Type
aacountr.shp	Arc
mdcntry9.shp	Polygon
mdlakes.shp	Polygon
mdworld3.shp	Polygon

Open the theme properties dialogue box for this second countries theme – either by double clicking, through the right mouse button or under Theme in the menu bar.

In the theme properties menu set Classification Options to be Standard Labels. New labels and edit boxes will appear. Select NAME as Text field and deselect Draw features. You can also change the font if you feel like it. Press Apply and then OK. Your map should now have name labels for countries in Africa

Theme properties for mdcntry9

Theme name: mdcntry9

Classification Options

1 Set classification option to be Standard labels

○ Standard Labels
○ No Overlapping Labels

The Sta...   ...raws

2 Set Text field to NAME

Text field:
NAME

Horizontal alignment
Center

Vertical alignment
Center

Font:
MS Sans Serif

X-Offset field:

3. Deselect Draw features

□ Draw features
□ Allow duplicates
☑ Splined text
□ Flip
□ Fitted

Rotation angle 0

Y-Offset field:

4. Click Apply

OK   Cancel   Apply

As you will see when you display the whole African continent the name labels are too large; it is difficult to read the names as well as distinguish which name belongs to which country. To improve the layout of the map you can decide a scale above or below which the name labels will not be displayed. First zoom the map of Africa so that you can conveniently read the labels and associate them with a particular country. Then open the theme manipulator (activate the theme and press the right mouse button). Select the option Set Maximum Scale Factor. Zoom to full extent – and voila no name labels, if you zoom in they will reappear.

To display your view over the whole screen you can use the Toggle legend button, [icon]. Try it.
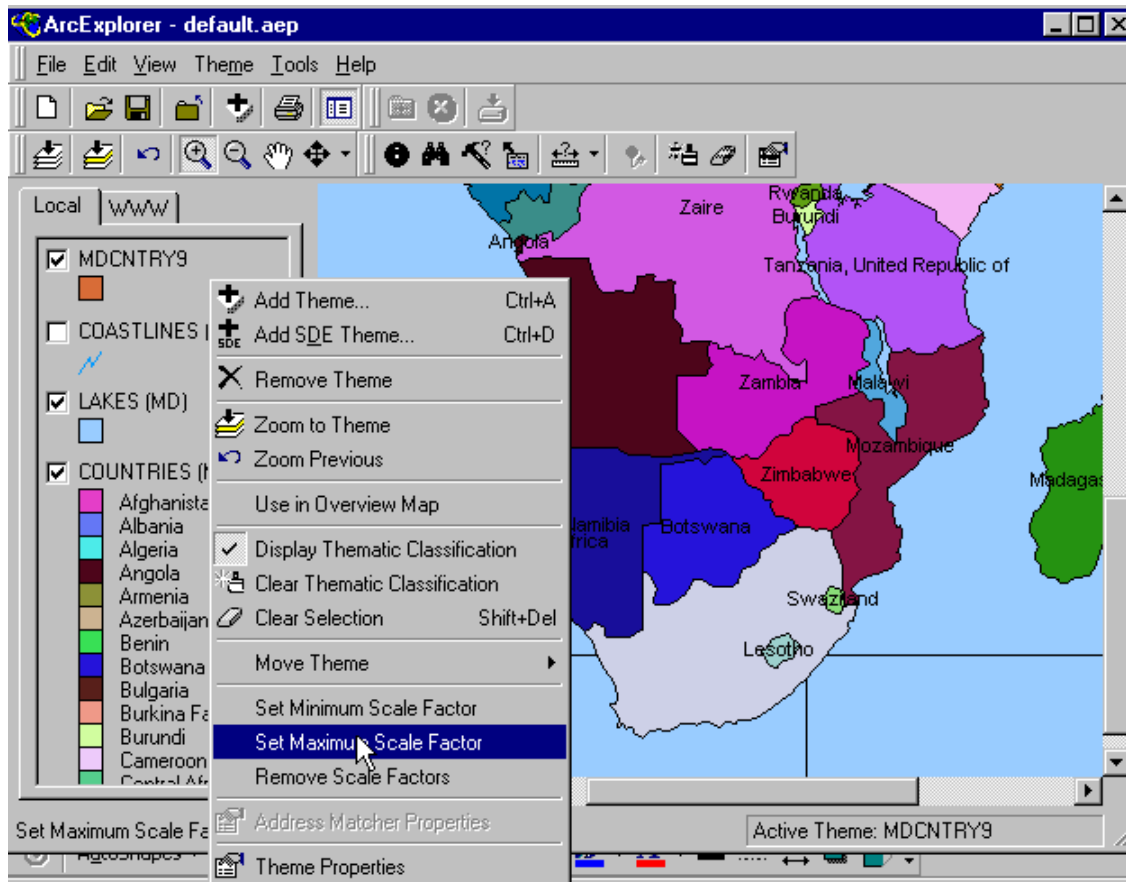
Zoom to full extent. If you followed the instructions no labeling should be seen. You should now add a tool that allows you to use the mouse for displaying selected properties of a theme. Make

sure the theme COUNTRIES is active. Click the Map tips tool, [icon] , to display the Map Tips dialog. Select NAME in the list and click OK. When you move the cursor in the view the name of the country where you slide the cursor will be shown in a little box. Hands on your heart - how many African countries do you really know?

Set the scale and scale units

A scale bar is obligatory for a map. Thus you must add one. This you do under View in the menu bar as shown to the right. To change the scale bar to display kilometers and be in centimeter units change the Scale Bar Properties (also found under View in the menu). Map units are decimal degree so you must not change them, set Scale Units to kilometers and Screen Units to centimeters You also need to set measure units to be able to interactively calculate distances in the map. This is done under Tools in the menu. Set the Measure units

[icon] to be kilometers and see how far the distance is between Egypt and South Africa (should be approximately 6 000 km).
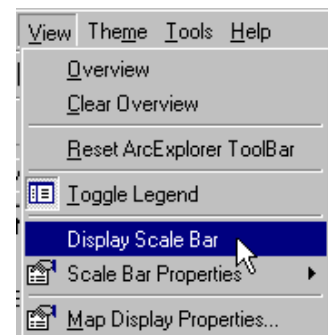
Querying data

Next we will try the Query builder, , to see which African nations are larger than Sweden. The area of each country is given in square miles in the theme COUNTRIES.

Make sure COUNTRIES is the active theme and click the query builder. In the query dialogue box select AREA as field then press the ">" sign and fill in 167400 (the area of Sweden in square miles) by hand in the query below (as to the right). Press Execute, and then Highlight. Most African countries are larger than Sweden - Africa is not a small continent. In the query builder you can also calculate summary statistics for numerical fields. Try it out for the area of countries.
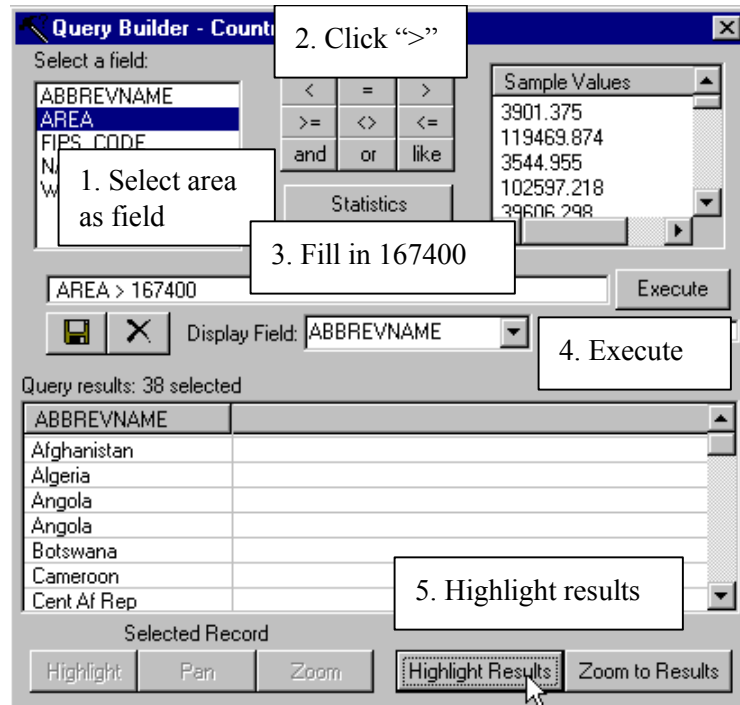
Your map of Africa should now be classified in colors representing individual countries, and also selected according to relative size versus Sweden. To clear the classification you can use the Clear Thematic classification tool, , and to clear selected areas you can press the Clear selection tool, . In both cases you can also open the theme manipulator to clear thematic classification and selection.

Save the ArcView project, , that you have created, preferably in your working directory. Change the name into something logical.

Add cities over your selected country

We also want to get a theme with cities from the ESRI site with Arc data on the www. To do this we will use another route.

In the menu select Help and then ESRI on the Web and finally ArcData Online as shown to the right. You will automatically come to http://www.esri.com/data/download/Index.htmlFurther down on that web page open the pop up menu for Select by Geographic Area and find GLOBAL.
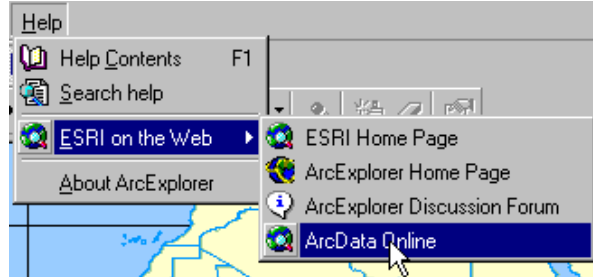
There are several alternative data sources to choose from. Browse around among the data and have a look of some of it. The data that we retrieved earlier were from ESRI World Reference Data Sets, and from this set we will now retrieve global cities. Thus select ESRI World basemap Data and "your country" (Botswana) and press the button "Make the map". When the map is prepared press Download data. Accept the license agreement and choose PC Compatible Zip as format and Proceed to download. Save the data to the directory where you did put the other data. Unzip the file that you transferred.
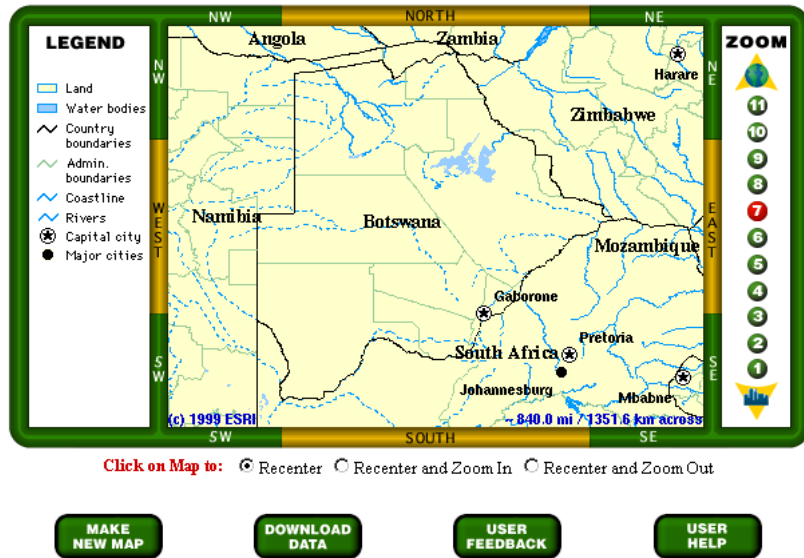
Add the themes over your country (Botswana) that you just retrieved to your view. Press the Add theme button, . Navigate to the directory where you put the data. Add all the data you

retrieved (highlight them in the Add theme menu and press the Add theme in the menu, you can also simply double click all layers).
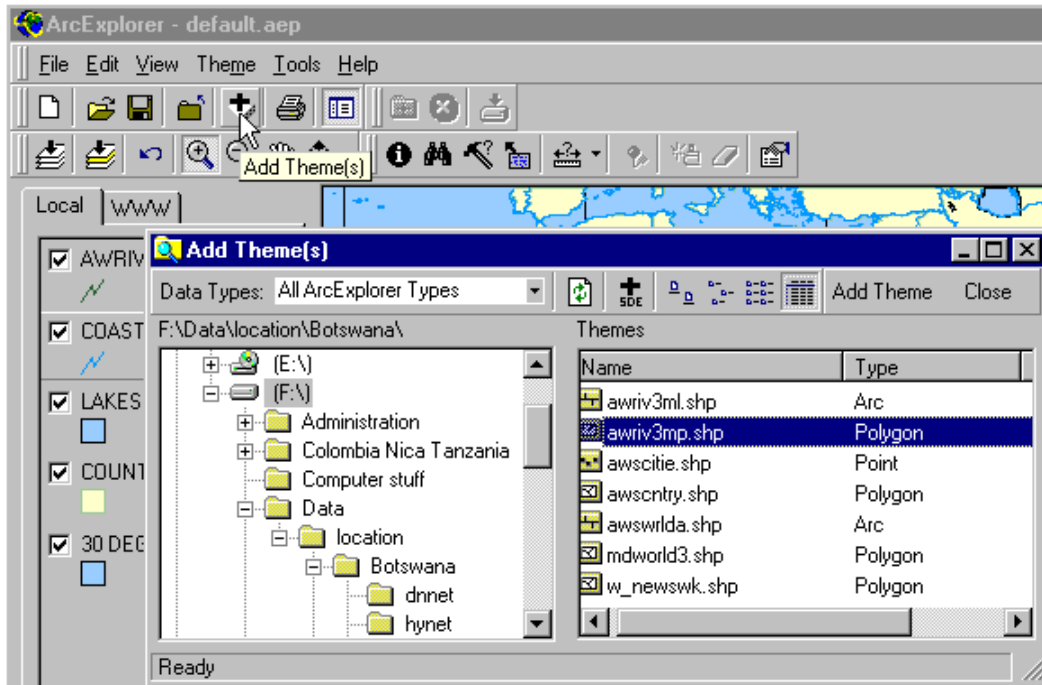

Have a look at all the data you just retrieved. Remember: to view a theme click the check box to the left of the theme label. To activate a theme click on the name label and the theme will appear lifted.

With the theme active you can access the theme manipulator (shown to the right) by simply clicking the right mouse button. Remove all themes that you have added except the three themes shown in the above legend - AWSCITIE, AWRIV3ML1, COUNTRIES (MD).

Select the COUNTRIES theme to be used as overview map: activate COUNTRIES, click the right mouse button and select "Use in Overview Map". This map should now be seen in a small window in the lower part of the legend as shown in the figure below.
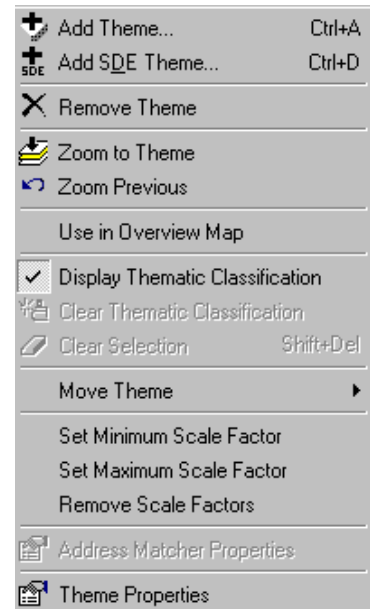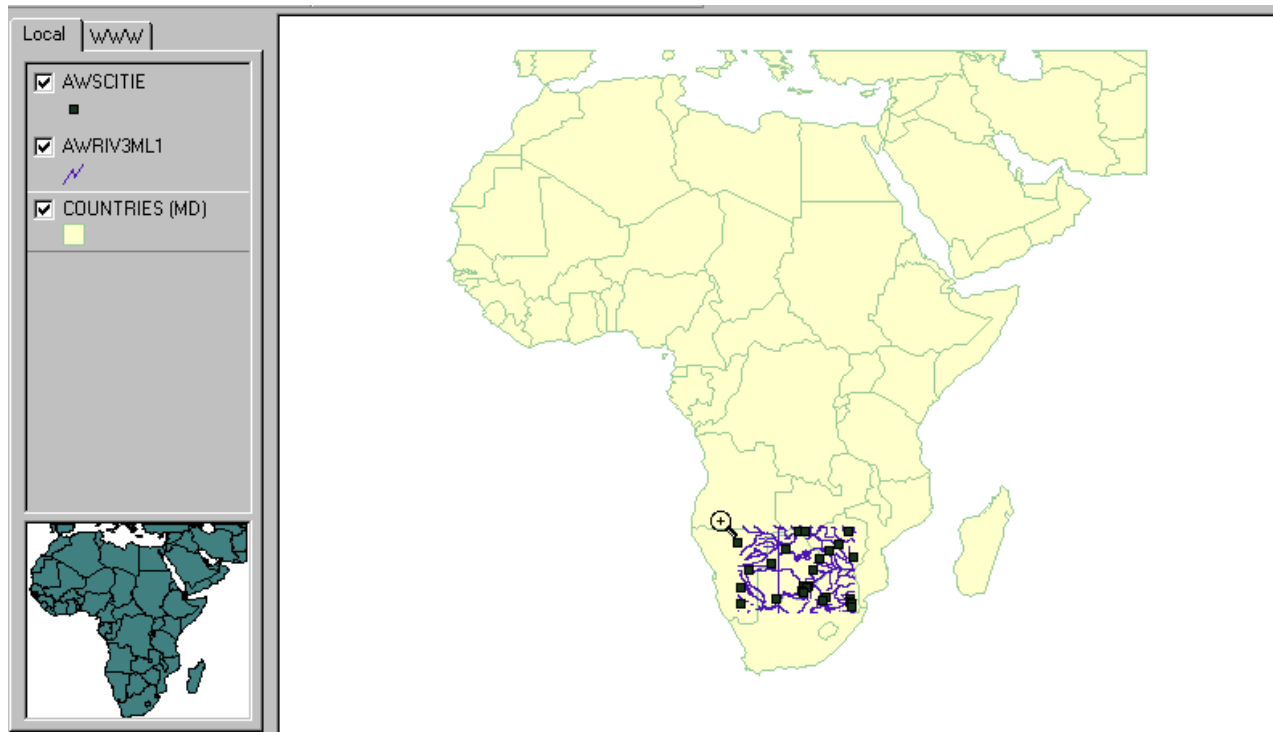
Zoom in to your selected country – a red frame in the overview map shows the area that is displayed in the view. An alternative to manual zooming is to activate one of the themes that only covers "your country" and press the zoom to active themes button .

Digital Chart of the World (DCW)

There is another www site that holds free data but with some more details at a country level. We will use this site for mining data over land cover, roads, hypsography (elevation), towns, lakes and rivers. DCW is a set of maps with global coverage, and is originally actually also a product from ESRI. DCW exists in many versions, and we will use the one available at Penn State University (PSU). Their version exist as the ArcInfo export format *.e00 that can be used by ArcExplorer and ArcView as well. However there are many steps before we get a useful map. To learn more about DCW look at www.maproom.psu.edu/dcw/

When you have learnt about DCW, download the maps of your selected study area (Botswana).

Use Internet Explorer or Netscape navigator to go to www.maproom.psu.edu/dcw from the world map that appears select the Africa tile to work with and then "your country" from the list that appears to the right.
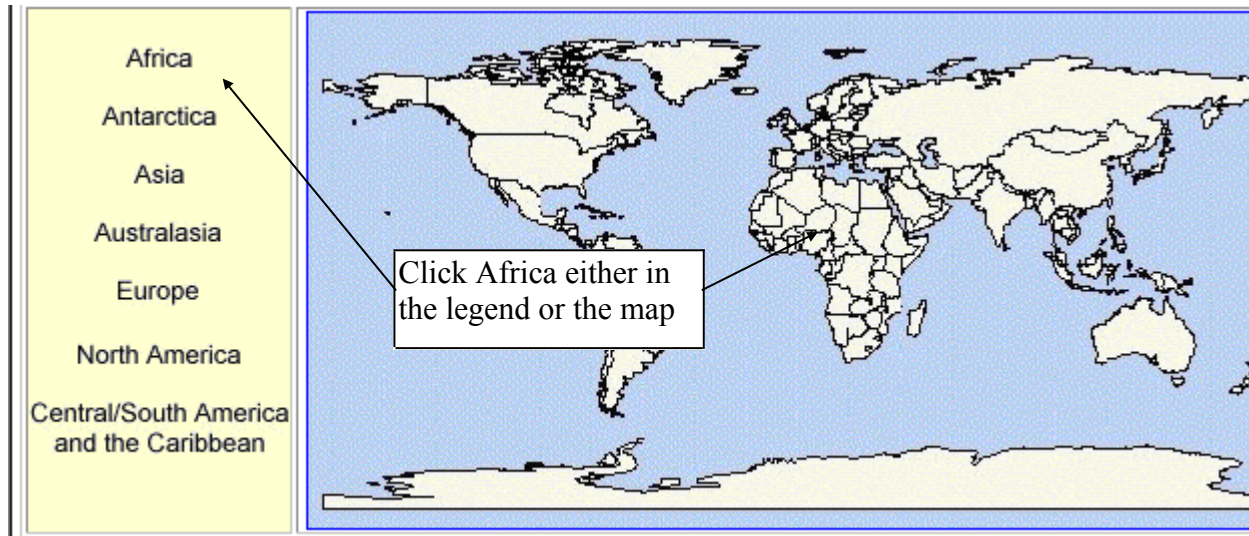
Digital Chart of the World
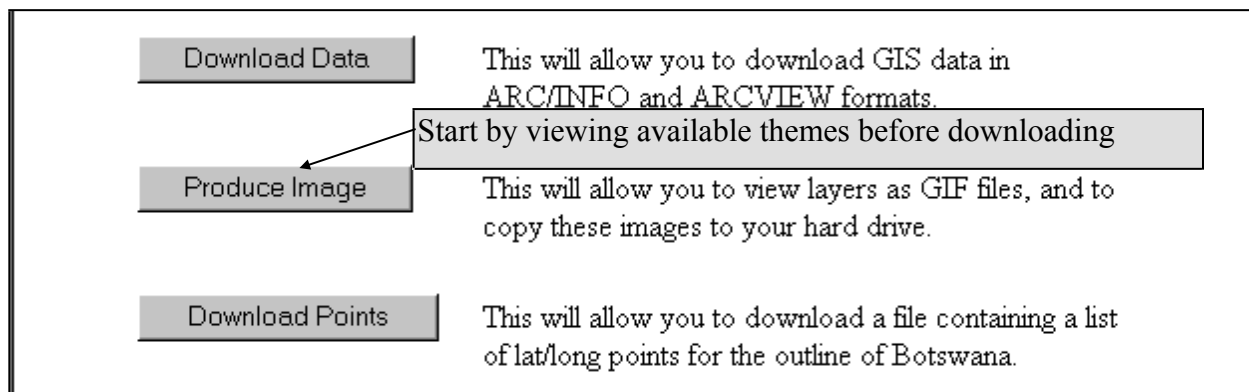
DCW download manager

Download the following themes:

Populated places (points)
Roads (lines)
Drainage (network)
Hypsography (network)
Land cover (polygon)

Select the layers you want to download and continue. In the DCW download manager do select [Data Compression Type] to be PC/NT and [Optional Arc View Projects] to be NONE. Then press [Compute Data]. Then just [Download Coverages]. If the downloading does not work (not uncommon) you must use a manual FTP program to download. It is important that you note the name and directory of the file that the Download Manager created for you.

If you do not have a FTP program there is a shareware called **ws ftp** that you can download from www.shareware.com. In that web page search for ftp (as below), in the list of ftp shareware you will find ws ftp – download this program to your hard disk. Then use WinZip to unzip ws ftp.

To ftp your file with DCW from PSU use the following declarations for connecting:

URL	ftp://maproom.psu.edu/dcw_data/xx (where xx is a number given to your file by the DCW download manager)
Host name	Ortelius.maproom.psu.edu
Host type	Automatic detection
User-ID	Anonymous
Password	Anonymous or your own e-mail

In ws ftp the declarations looks like this (where you can enter your own e-mail as password).
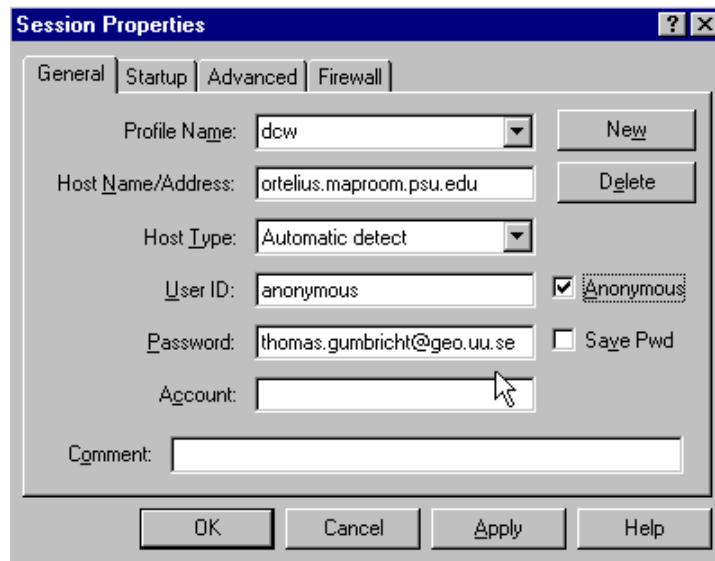
Once connected to ortelius.maproom.psu.edu change remote directory to dcw_data and then xx (where xx is the name given to you by the ftp server – see above). Change your local directory and press transfer button, (between the two windows).
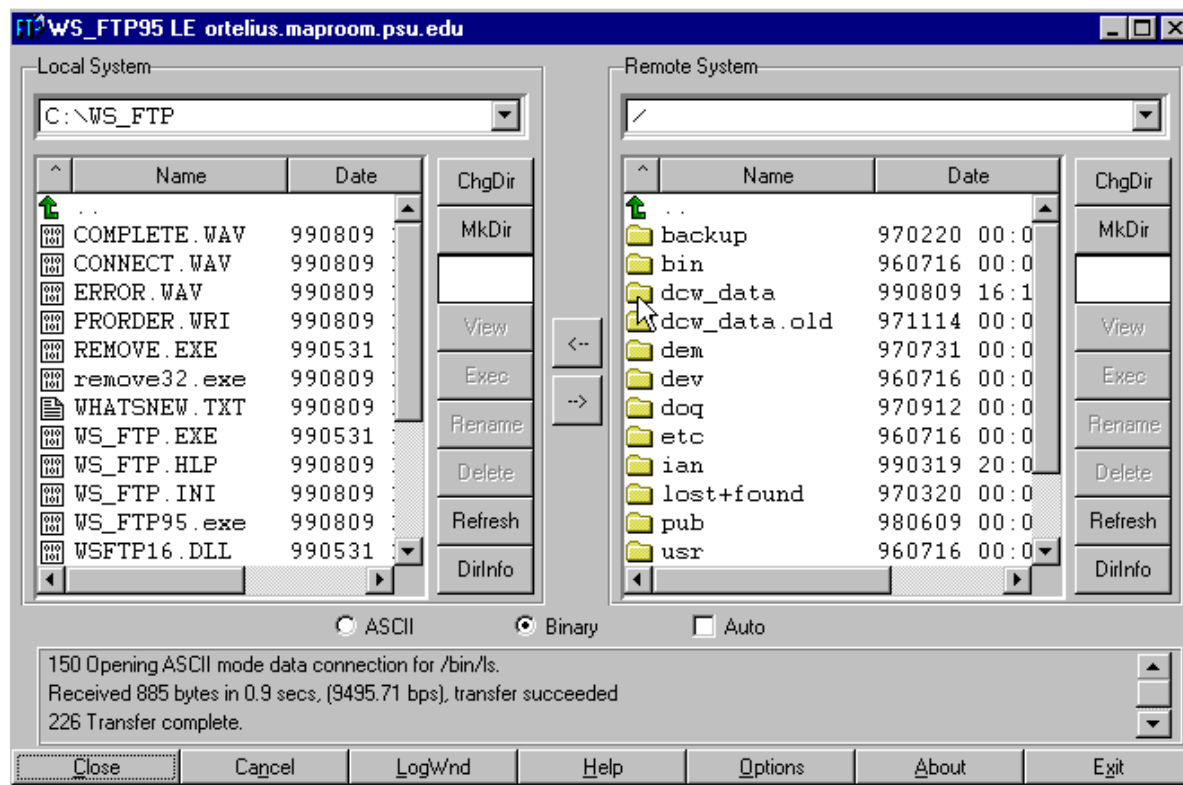
Import DCW to ArcExplorer

The DCW files that you got from PSU are zipped, so you need to unzip them. After unzipping you should have the following files in your directory

| Name	Content	Type
dnnet	Drainage	Coverage (arcs and polygons)
hynet	Hypsography (digital elevation model)	Coverage (arcs and polygons)
lcpoly	Land cover	Polygon
ponet	Political/ocean boundary (comes automatically)	Coverage (arcs and polygons)
pppoint	Populated places (i.e. cities)	Points
rdline	Roads	Arcs

The unzipped files all have the extension *.e00, this is the export format of Arc Info, and it can be imported to ArcExplorer or ArcView (see appendix 1). Use the program Import71 which you should have downloaded from ESRI's homepage. As Import71 will produce ArcInfo coverages you must put each imported theme in a separate directory. Thus for each e00 file that you import create a directory with the same name (as in the example below). You have to import all the maps individually.
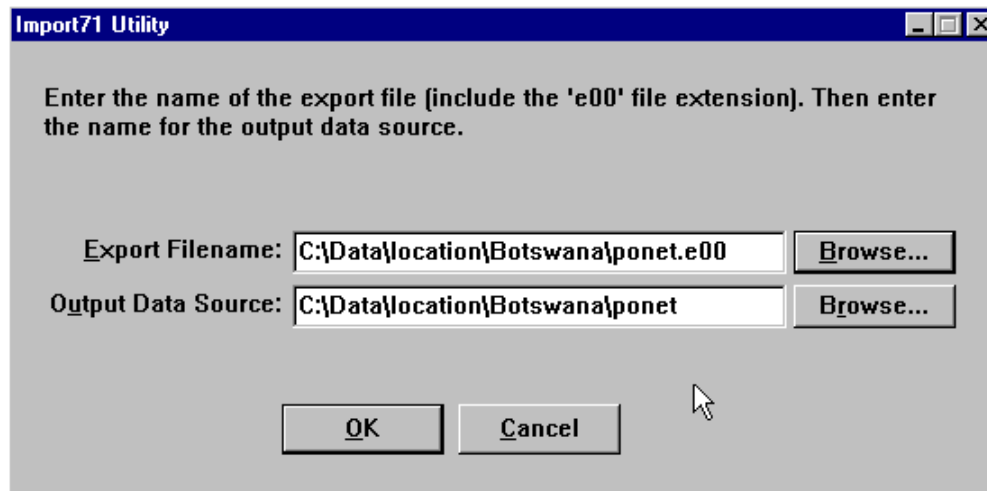
Use the Add theme tool to pick up the DCW data layers that you imported. The DCW data that you imported from www are now stored on your local hard disk so they should be added as local themes. In the Add theme dialogue box navigate to the directory where you saved the files you created with Import71. Make sure data types is eiter "All ArcExplorer Types" or "Arc/Info Coverages", . As the files you got from DCW were ArcInfo coverages they usually contain more than one theme. For example ponet (political ocean boundary) contains one theme as polygon (a closed area showing the borders), one theme as line (a line showing the borders) and a theme with annotations (text labels to put on the map). Other themes might contain other types.
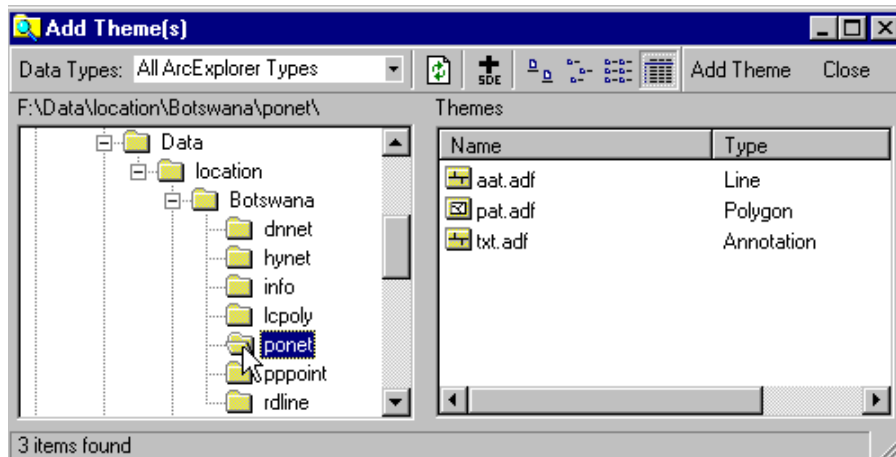
Here is a suggestion on what DCW themes to add

Content	Add as
Political/ocean boundary	Polygon
Land Cover	Polygon
Land Cover	Annotation
Drainage	Polygon
Drainage	Line
Drainage	Annotation
Hypsography	Line
Roads	Line
Population (cities)	Point
Population (cities)	Annotation

The colours of the themes that you have added were set in a random manner. Thus the next step is to set colours and classify your data.. Before you can do that you must find out what is actually shown in the different themes. This you can do via the www site of DCW. Thus navigate to http://www.maproom.psu.edu/dcw/ and choose ABOUT DCW.

Try to find out information about the coding of land cover, drainage and roads. If you do not find the information here is the URL to write for these themes:

Theme	URL
Land cover	http://www.maproom.psu.edu/dcw/dcw_about.shtml#LANDDESC
Drainage	http://www.maproom.psu.edu/dcw/dcw_about.shtml#DRAINDESC
Road	http://www.maproom.psu.edu/dcw/dcw_about.shtml#ROADDESC

Once you have noted which field hold which information you can classify and set colour to your data. This is done in the Theme properties dialogue box which you can open by either double click the name label in the legend, or under theme in the menu bar.

Save the ArcView project, 🖬, that you have created, preferably in your working directory. Change the name into something logical.

<u>Your turn</u>

Having added all the data over your country it is time to create a thematic map of land cover and drainage network. An example for Botswana is shown below. The map was specifically made for illustrating the Okavango delta. Okavango is one of Africa´s most pristine inland wetland areas, with a lot of interesting wild life and escalating tourism. Water is a scarce resource since the Okavango is really in the Kalahari dessert. The upstream countries Angola and Namibia are interesting in utilising the water resources feeding Okavango river.

The maps shown below are made from the data that you have already retrieved. The first one is a map of the whole of Botswana showing the hydrology, the road network and larger towns. Several more themes have their check boxes filled, but Maximum scale is set in order not to display them at this small scale. The second view is a more large scale map of Okavango. Here also smaller towns and their names are displayed. You can also see labels for major rivers and some of the land cover. All colours for land coverage and drainage are set according to cartographic principles. Try to create a similar map. It is not easy and you may need to consult the manual.

When using an Arc/Info coverage for annotation you should specify X and Y Offset fields as shown to the right. Also remember to deselect Draw features and. Splined text means that the text follows the form of the shape of an associated feature (useful for e.g. rivers).
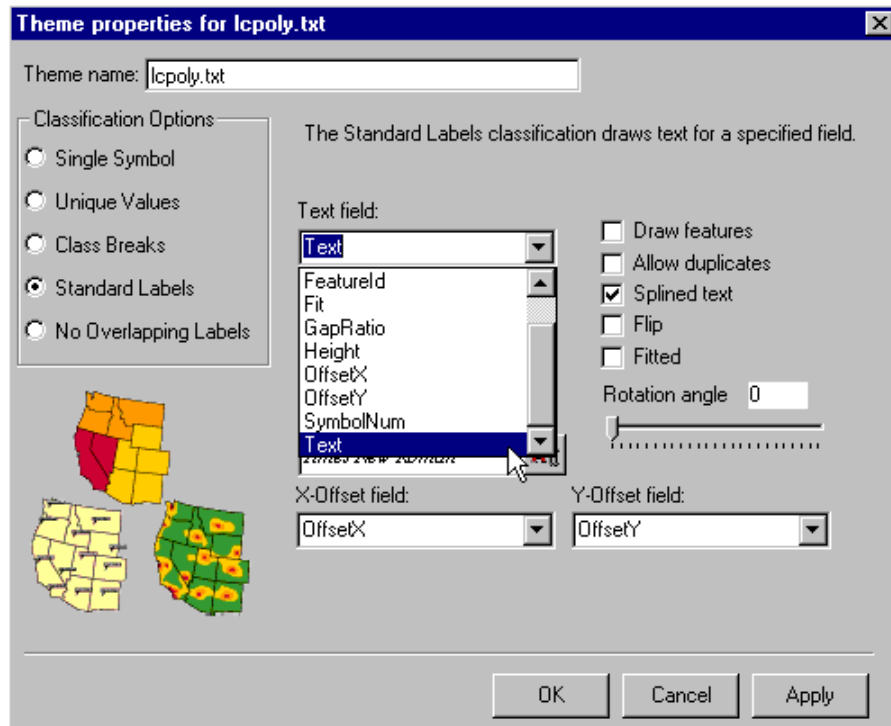
Here are the thematic maps that you can use as guidance. The first map displays the whole of Botswana. By clicking an item in a classified theme you can highlight this theme in the map. In the example below the annually flooded area is highlighted (indicated by the cursor – with the flooded area shown in yellow).
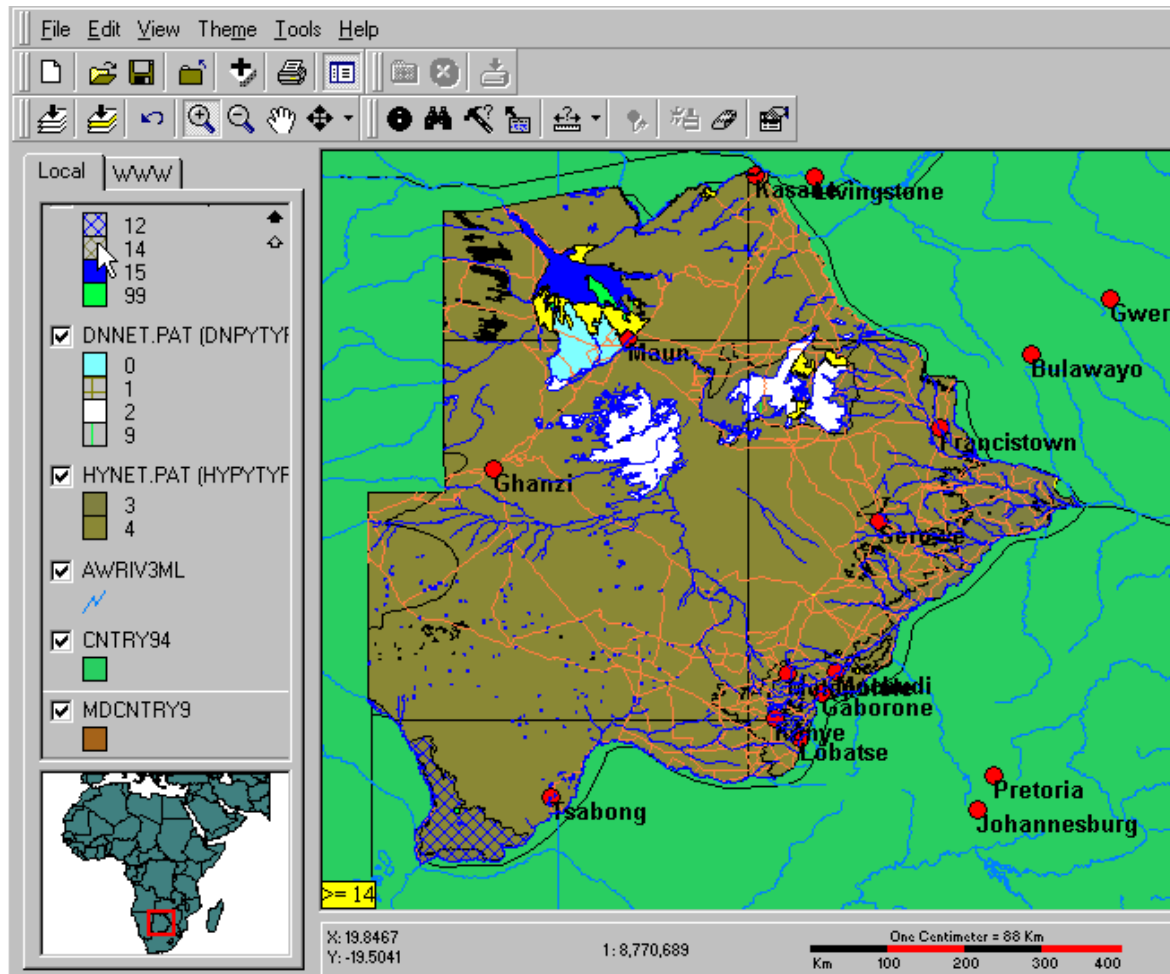

Hint: An alternative way for panning in the image is to use the overivew map.

From the larger scale map you can see some of the annotations for rivers, smaller towns and also land cover. The white areas in the map are salt pans. The large green part inside the delta an island.
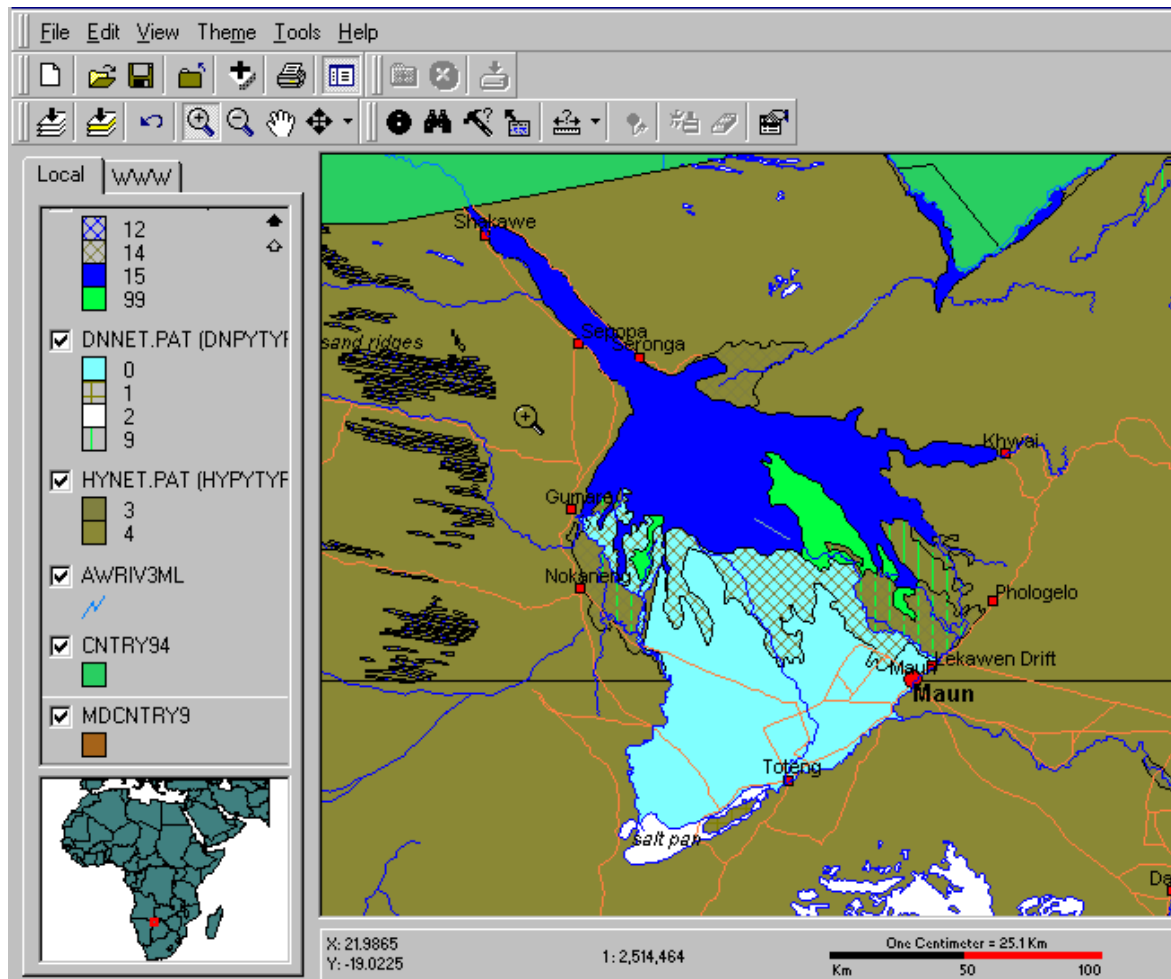
When you are satisfied with your cartographic product it is time to transfer it to another media. Either print it, [printer icon], if you are connected to a printer. Or export the map as a bitmap – found under Edit in the menu bar as shown to the right.
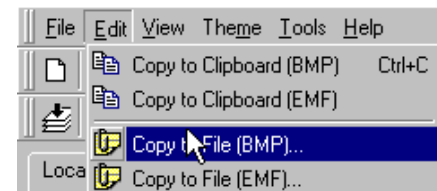
To pass this exercise you must hand this map in to the course staff – either as a paper copy or in electronic format – your choice. Remember to put your name on the map.

<u>Appendix 1: How to get ArcExplorer from the internet</u>

Use a web-browser (Netscape, Internet explorer) and navigate to ESRI´s homepage (http://www.esri.com/) and to the page with free resources (in the blue field to the left, you have to scroll down get to Free Resources), select ArcExplorer (you should then be transferred to the site http://www.esri.com/software/arcexplorer/index.html). Read about ArcExplorer and then press Download (version 2.0 is the latest at the time of writing this instruction). You should then be transferred to the page http://www.esri.com/software/arcexplorer/aedownload.html. Download the file **ae2seup.exe**, also download the User Guide, **arcexplorer.pdf**.

Close all windows applications that are running on your PC and install ArcExplorer by executing the program **ae2setup.exe** (the program that you downloaded). To be able to install ArcExplorer you must have administrative rights on the computer you are using – if you do not have that you must ask your system administrator to help you. To install and run ArcExplorer the user should have full access (read and write) to the archive C:\Esri\ (not only for installation – also for running). When you install the ArcExplorer the default path for installation is "**Program files\ ESRI\ArcExplorer**". It is recommended that you accept that.

If you get stuck or do not understand a command, please refer to the User Guide that you downloaded (**arcexplorer.pdf**). This document is in pdf format, which you can read using Adobe acrobate reader. If you do not have acrobat reader on your computer you can download it from **http://www.adobe.com/**. Installation is done in a similar manner as the ArcExplorer installation described above.

To import e00 files (ArcInfo export format) to ArcView or ArcExplorer you must have the program **Import71**, that can be downloaded from ESRIs homepage (http://gis.esri.com/download/index.cfm?fuseaction=download.all).