Practical 3

Learning objectives:

- **To work with Vector Data in a GIS.**
- **To practise selecting data using a GIS.**
- **To learn how to use one layer to interact with another.**
- **To use a GIS to produce a proper printable map.**

Selecting data: Getting layers to interact.

We will create a map showing the location of a set of settlements in the UK. We will practise how to select the points based on certain criteria. We will then use the point layers attributes to create a choropleth map of the UK and use this map to produce a print quality PDF.

Part 1: Creating a shapefile for analysis

1. Open a "new map file" by clicking on the Icon in the top left corner of the interface.

You cannot have two map files open at the same time in ArcGIS so if you have still got Practical 2 open it will ask you to save changes and close it.

We will need to set the projection for the layer again using the same process as before.

2. Right click on the **Layers** icon at the top of the table of contents then click on the **Properties** item at the bottom.
3. In the data frame properties dialogue box, click on the **Coordinate System** tab and in the Select a Coordinate System part navigate to the **British National Grid** by clicking on the following folders:

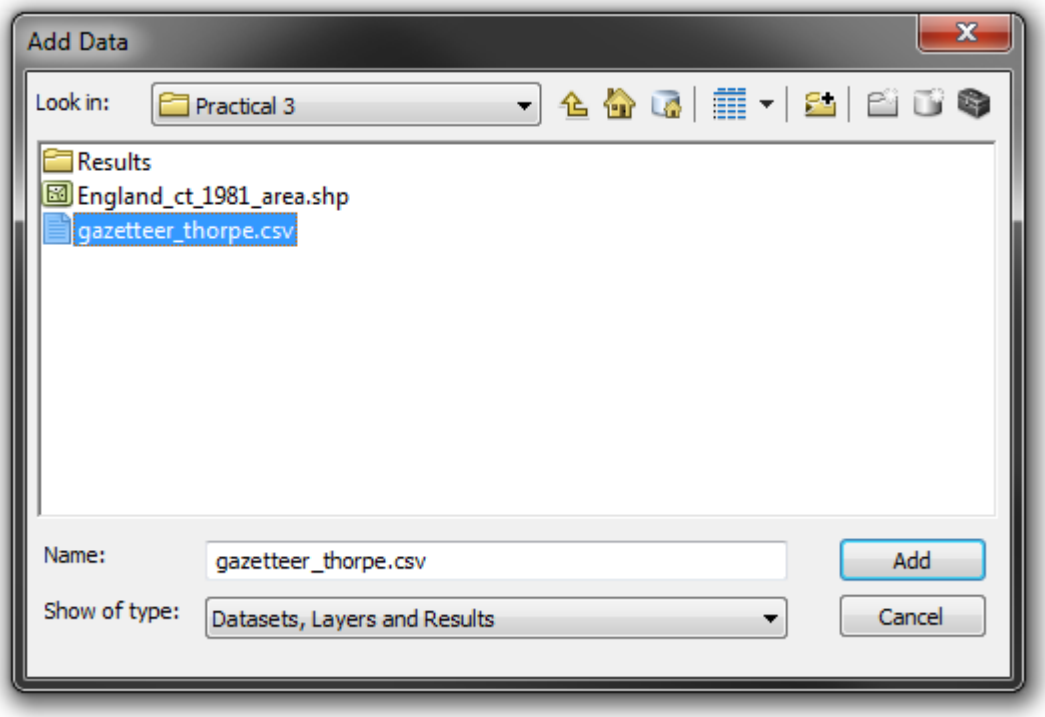
`Predefined → Projected Coordinate Systems → National Grids → Europe → British National Grid`

Now you can begin to bring in the vector data to ArcMap.

4. Click on the **Add Data button** on the tool bar:

You should already be connected to the **Intro to Visualising Data** directory so select it from the list.

5. Double click on **Practical 3** to open it.



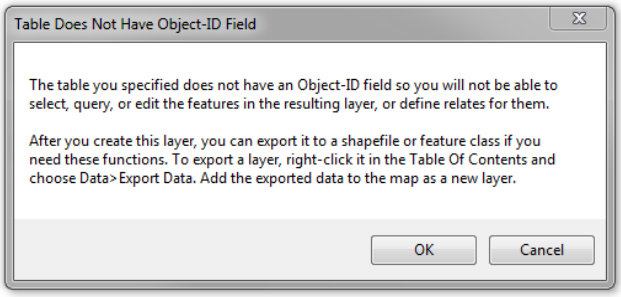
6. Add the **gazetteer_thorpe.csv** file.

NOTE: This file is a list of points that was downloaded from the Gazetteer Plus facility in Digimap. This facility allows you to select parts of the 1:50,000 scale gazetteer to download based on a list of search criteria. You can also specify which attributes each entry should include. This particular file was created by searching for all the features in England that's names end with …Thorpe. The attribute columns were limited to Easting, Northing, County Name and Feature Type.

To view the data on the map we will need to use the **Add X Y Data** function again:

7. Right-click on the gazetteer_thorpe.csv in the table of contents and select Display XY Data.
8. Set the **X field** to **Eastings** and the **Y field** to **Northings**.
9. Click **OK**.

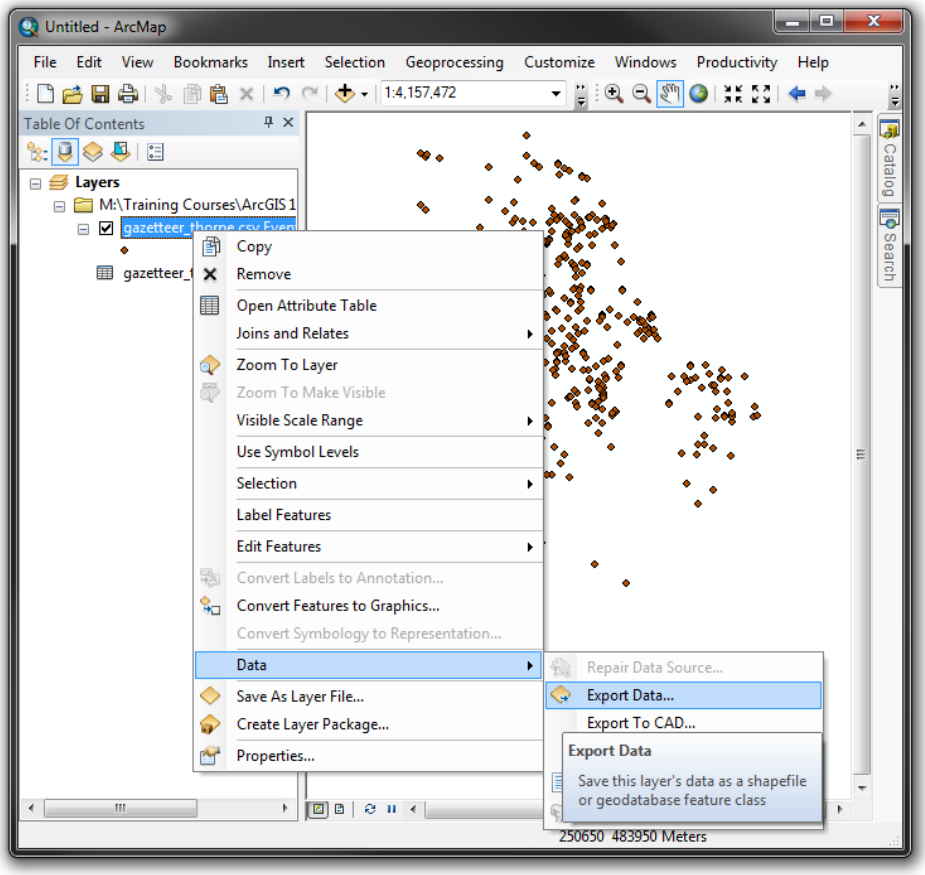
You will receive the warning message as in Practical 1:



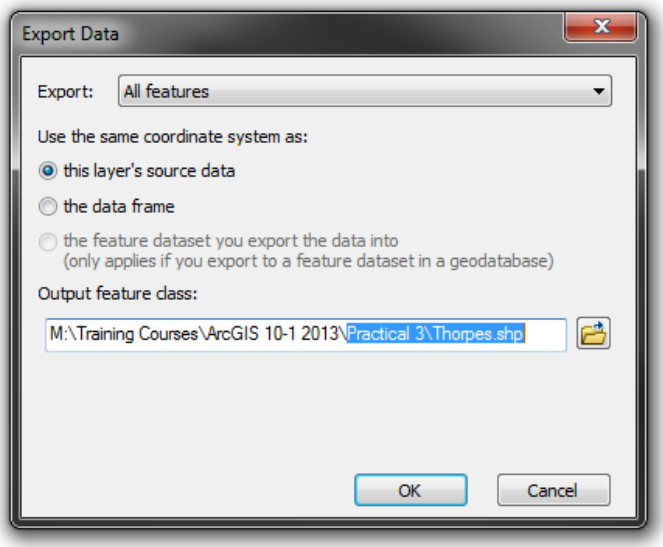
10. This time we will Export this file in the next step. **Click OK.**

11. A new layer should be added to the Table of Contents called **gazetteer_thorpe.csv Events.** As we won't be able to select from this Events layer we will need to export it to a new Shapefile.

12. **Right-click** on the **Events** layer and select **Data → Export Data.**



13. A new pop-up will open called **Export Data**.

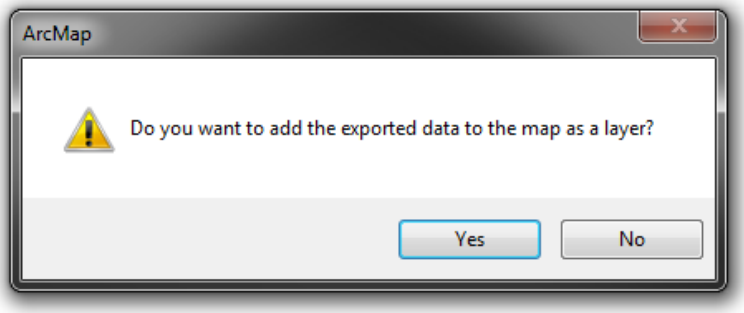


14. Export: **All features**.

15. Use the same coordinate system as **this layer's source data**.

16. Browse to the **Practical 3** folder and call the file **Thorpes.shp**

17. Click **OK.**

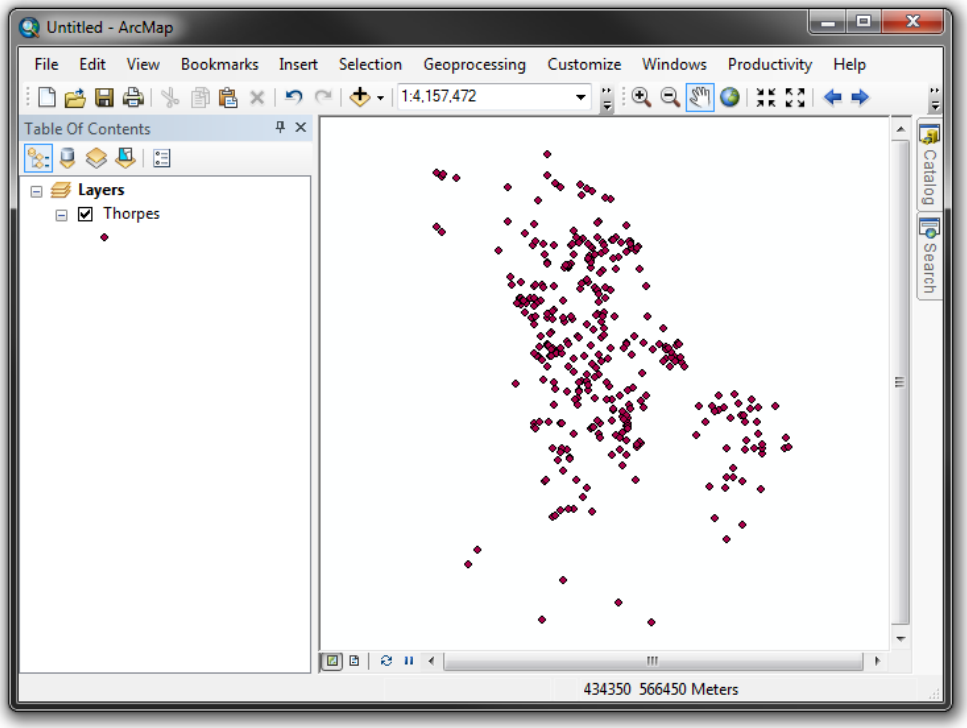


18. Once the file has finished processing click **Yes** to add it as a layer on the map.

You have now created an entirely new shapefile containing all the information from the CSV file along with geometry information to draw the points. You need to carry out this export process if you want to do any kind of analysis with the data, though it isn't necessary to just symbolise the points.

You can remove the **.csv Events** file without affecting the map or the new shapefile you have created.

19. Right-click on the **gazetteer_thorpe.csv Events** file in the table of contents and select **Remove**.



At this point it is also a good idea to save our map again; do this in the same way as before:

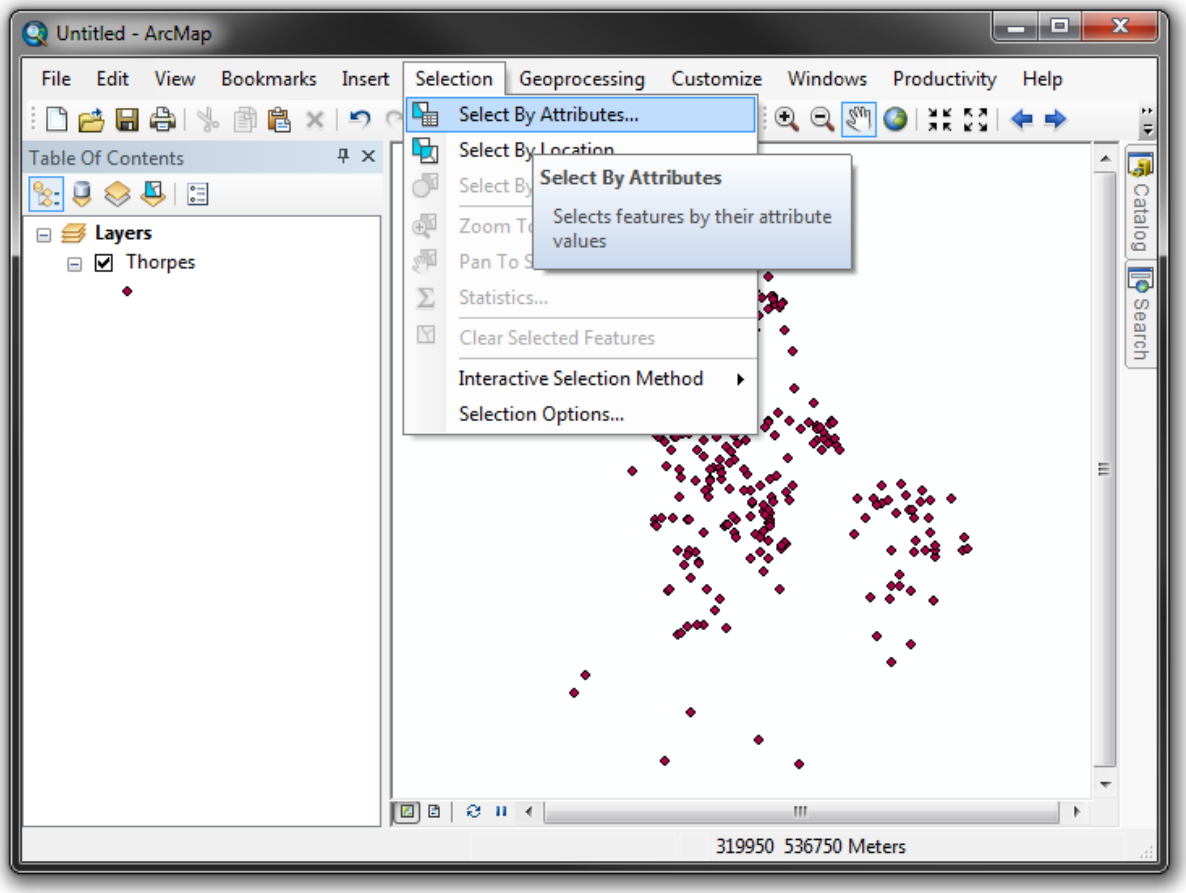
20. Click **File** then **Save as.**
21. Save the file in the same folder as the data: **Intro to Visualising Data.**
22. Replace untitled with a suitable name such as **Practical 3.**

Part 2: Selecting features based on their attributes

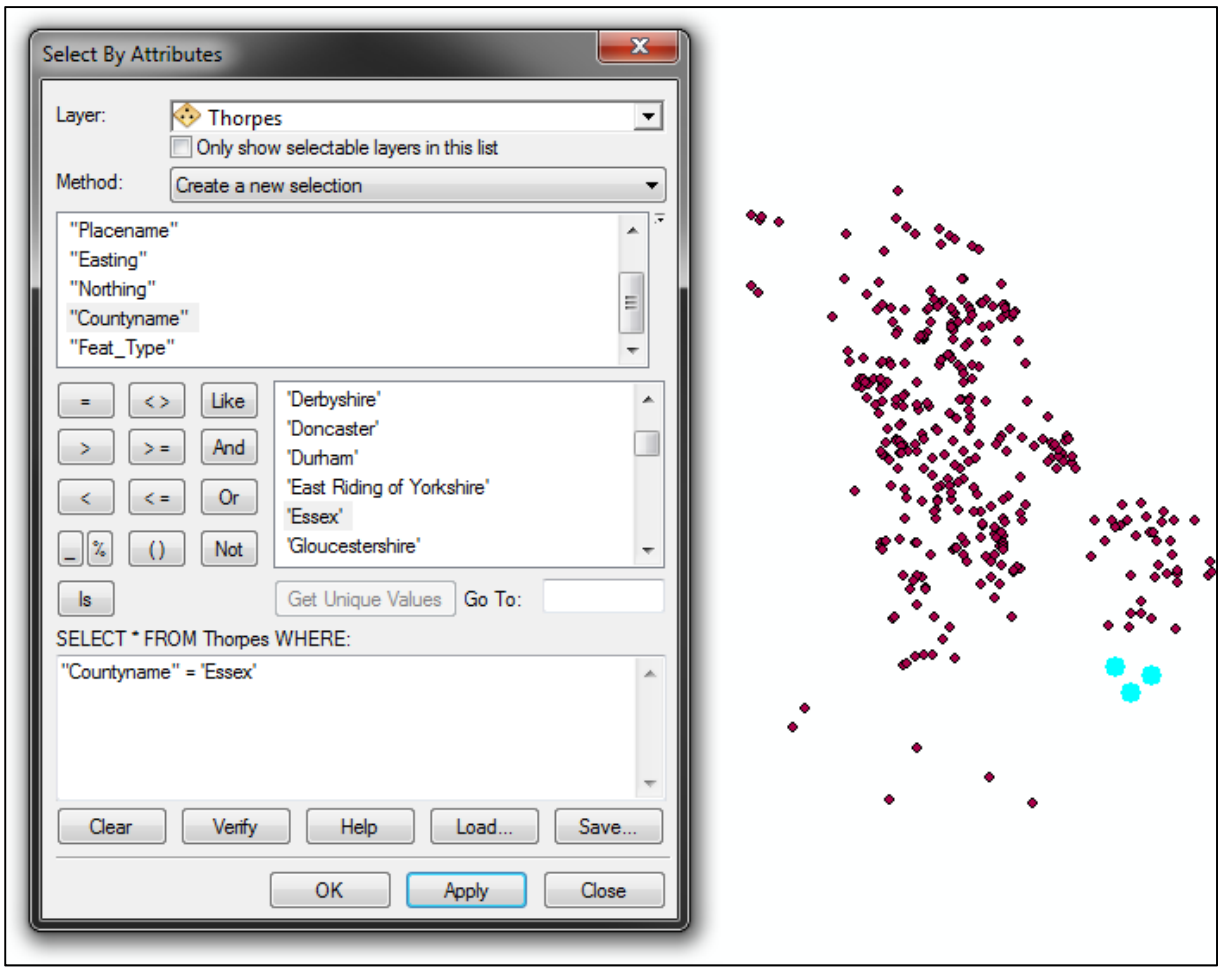
Once you have created a Shapefile you can then use the GIS software to select features. Selected features can be manipulated separately from the rest of the features in the layer. They can be used in further analysis or have their attributes updated independently from the rest of the layer.

The first way we are going to select features is by their attributes. This is done in exactly the same way as database software.

1. Click on the **Selection** menu in the top bar and click on the first option, **Select by Attributes.**



2. A new window will open allowing you to:
    a. choose the layer you want to select from,
    b. what you want to do with the features you select,
    c. and then there are a few lists that will help you build your selection query.



3. The **Thorpes** shapefile is the only available layer to select from so this choice is made for you.

4. The **method** we want to use is **Create a new selection**, this should be the default though the other options are often very useful.

Above the bottom box is the start of your database query:

SELECT * FROM Thorpes WHERE:

If you are confident in the database language SQL you can continue the query yourself in this box. However, it is much easier to use the predefined field names, operators and attributes.

A simple query to try is **Select ***(all attributes) from **Thorpes** (data table name) where **"Countyname"** (a column heading) **=** (or any Boolean operator from the buttons in the interface) **'Essex'** (one of the Attributes found in the column you have chosen).

You can get a list of all the Attributes in a column once you have selected it for the query, just click on **Get Unique Values.** This is not a good idea on a large table where all the values in the column you have selected are different.

5. Double Click **"Countyname"** in the top list, it will be added into the query.
6. Click the **=** button.
7. Click on the **Get Unique Values** button to populate the lower list with attributes for **Countyname** column.
8. Double-click **'Essex'**
9. Click **Apply;** notice that the three points in Essex are highlighted in turquoise on the map.
10. Click **OK** to close the **Selection By Attributes** window.

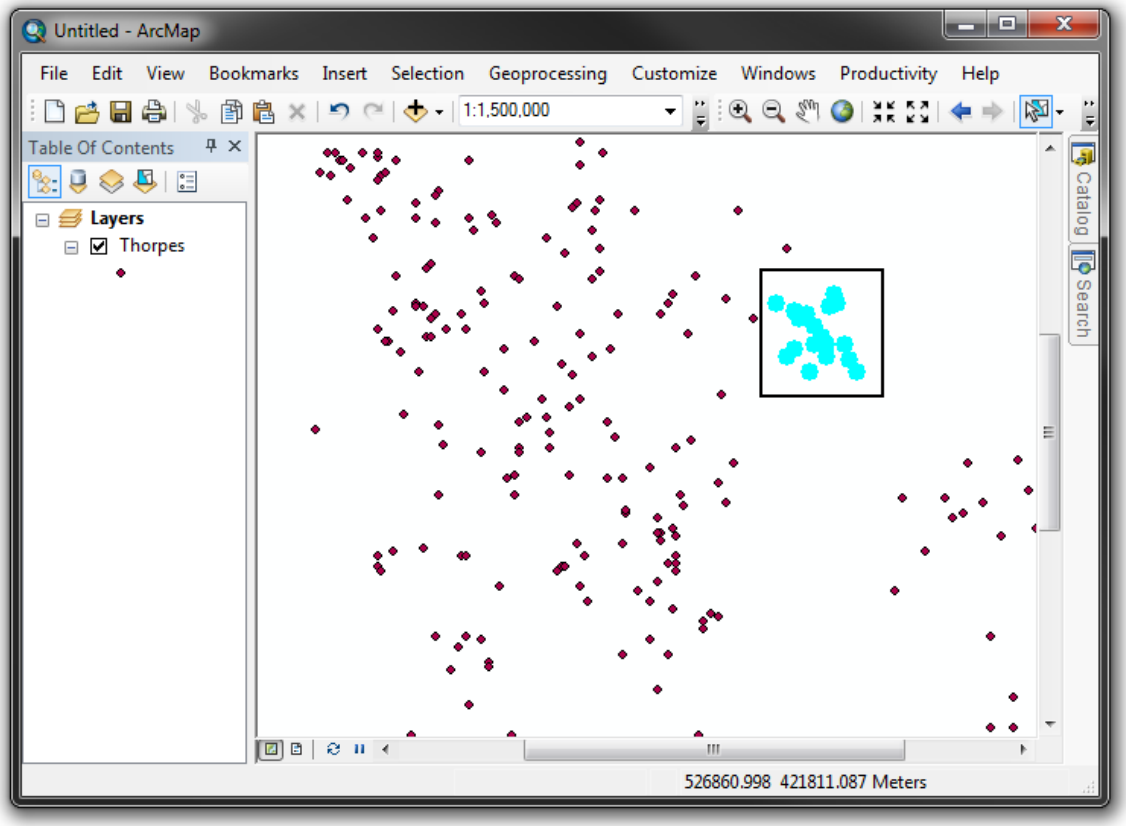
You have now selected all the towns with names ending in Thorpe in Essex based on their attributes. However it isn't always possible to do this as the attributes may not contain the information you want to select by. The next section will show you how to make some selections using location.

11. Save your work and we can then move on to the next section.

Part 3: Selecting features based on their location

The easiest way to select features by their location is to use the Select Features Tool to drag a box around the ones you want.

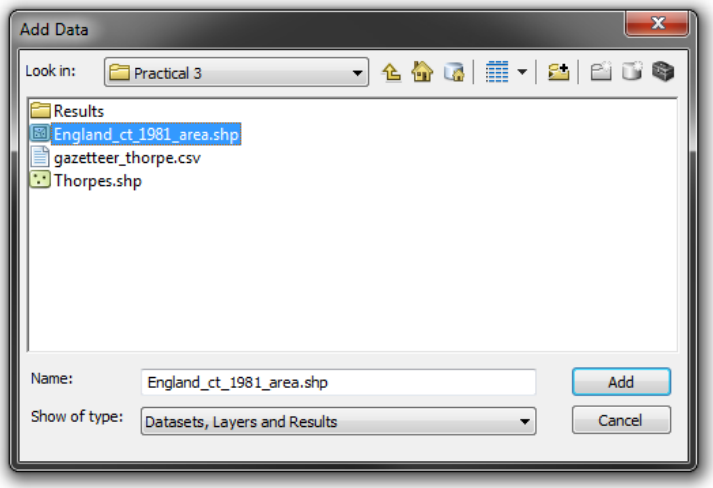
1. Click on the **Select Features** icon above the map:
2. Drag a box around a set of points



3. These features will now be selected in the data table.

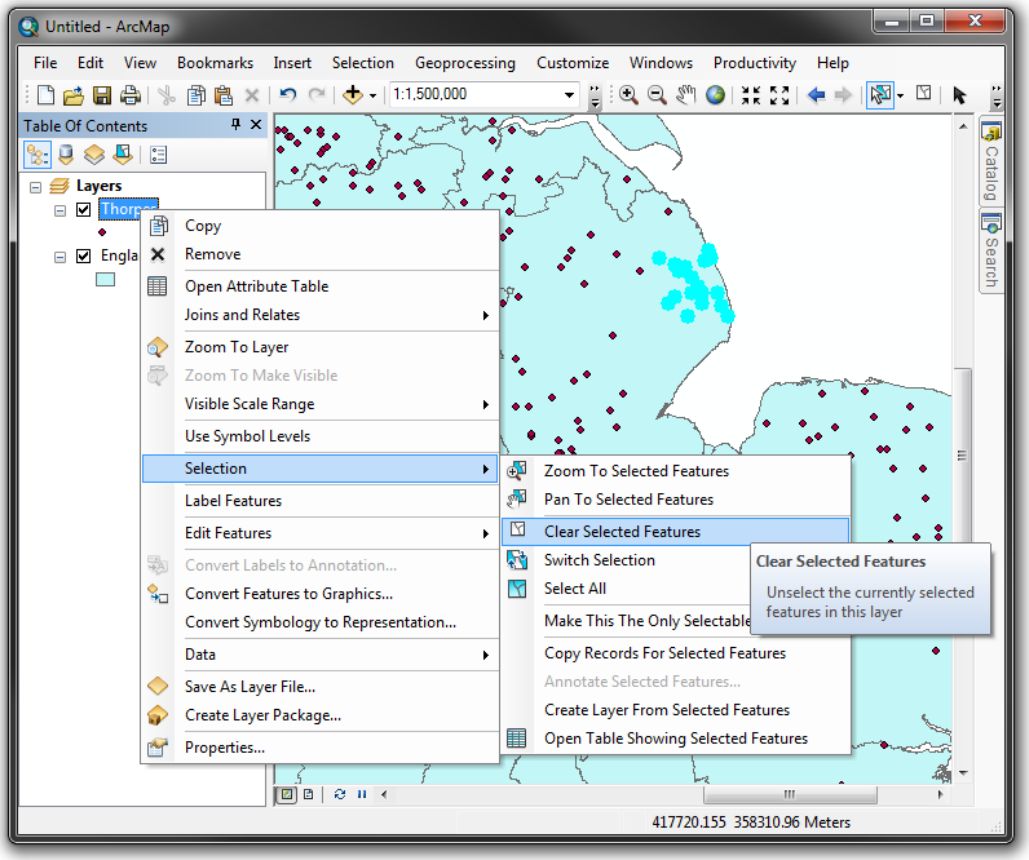
This is a very quick way to select a group of points but it isn't always possible to get the ones you want if they are densely grouped or you have a complex boundary to select them by. We are now going to add in a set of county boundaries and use them to select the points.

4. Click on the **Add Data** icon on the tool bar:
5. Add the **England_ct_1981_area.shp** file from the **Practical 3** subfolder.



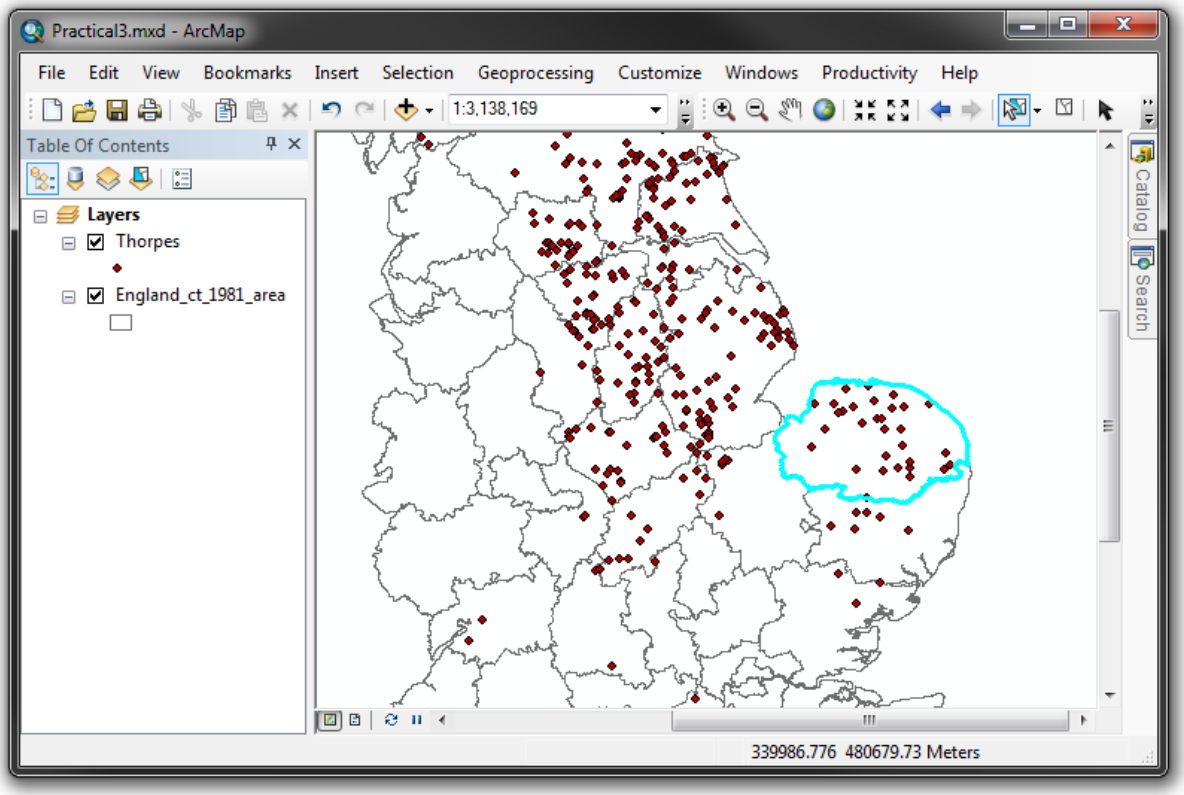
NOTE: This is a set of County boundaries from 1981 before the introduction of Unitary Authorities. These were chosen as they are large simple polygons. They are probably not appropriate for current research unless your other data is from this time period. We can now use these polygons to select the settlement points but first we need to clear the selection we have made already.

6. Right-click on the **Thorpes** file in the table of contents.
7. Select the **Selection** option and then **Clear Selected Features**, as shown in the picture below.

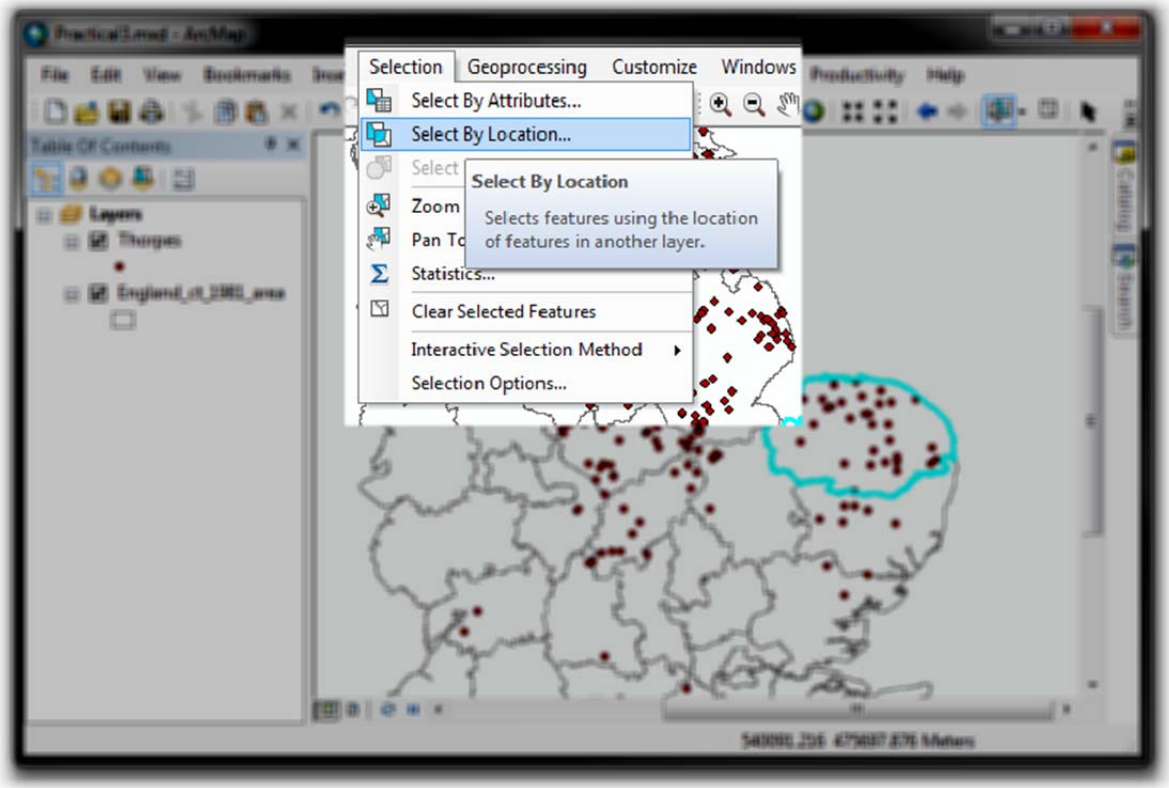


We can now use pick a county and select the points within it:

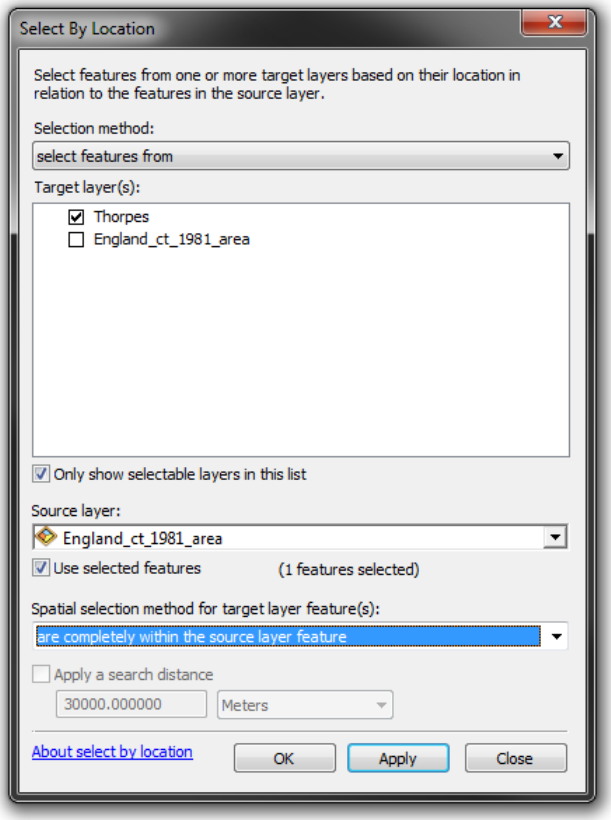
8. With the Select Features tool point and **click in the county of Norfolk**.



9. Go back to the **Selection** menu above the map and click on **Select By Location.**



10. The **Select By Location** window will now open.



11. You want to **select features from** the following layer(s):**Thorpes**.

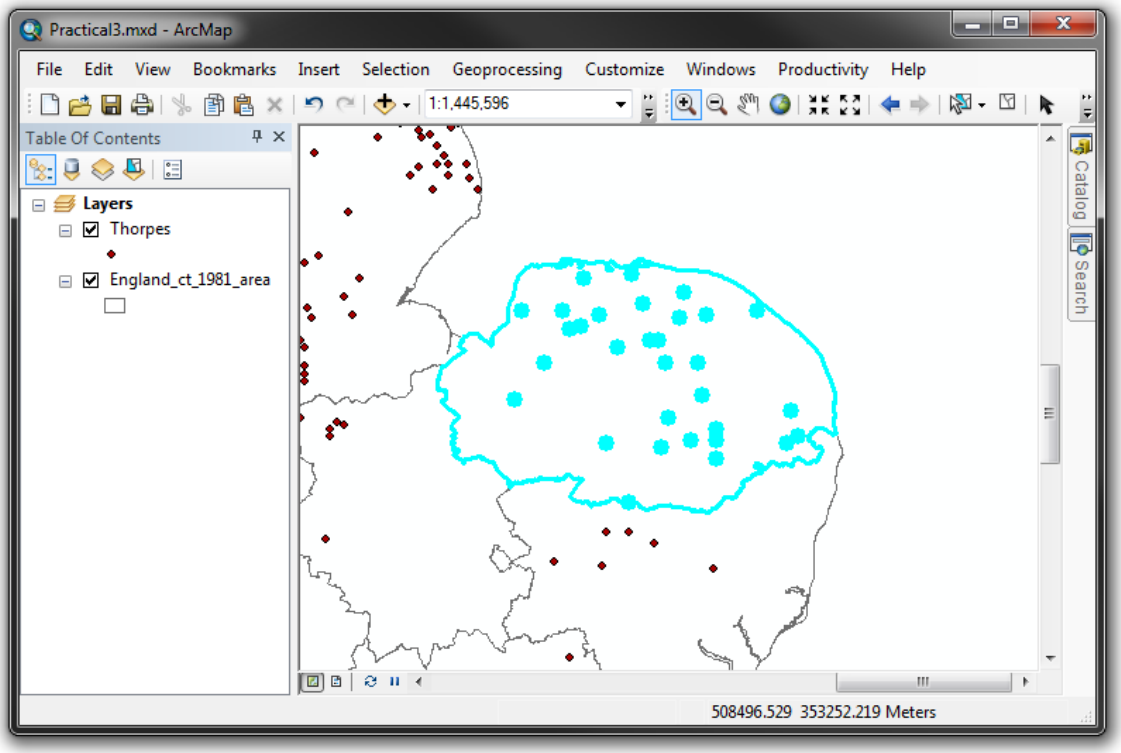
12. Using the Source Layer: **England_ct_1981_area**

13. Make sure you check the box for **Use selected Features**.

14. The **Spatial selection method for target layer feature(s)** to pick from the drop down menu is: **are completely within the source layer feature.**

15. Click **Apply** and **OK.**

You have now selected all the settlements with place names that end with thorpe in the county of Norfolk. You could now export these to a new shapefile or add or change their attributes for example.

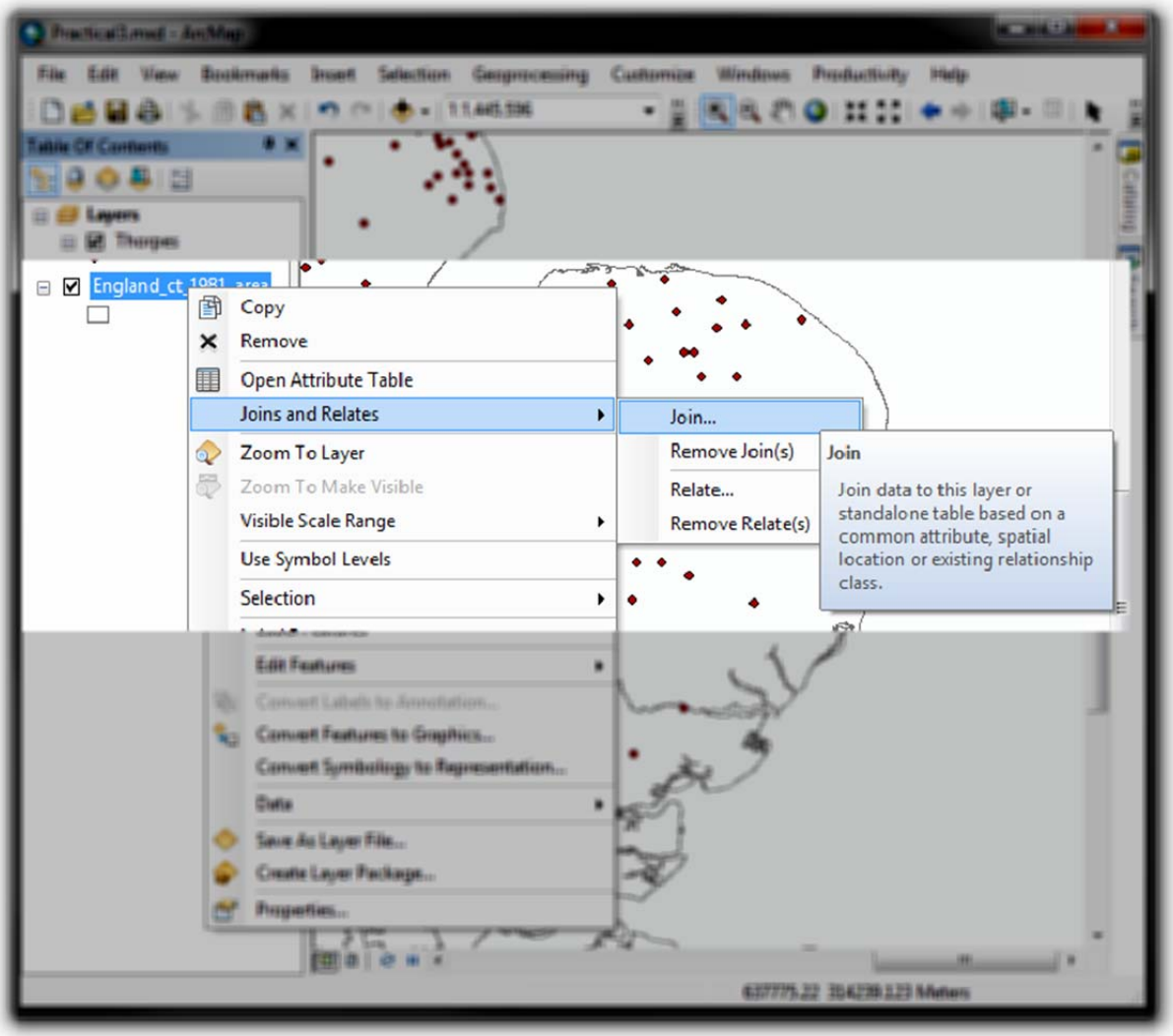


Part 4: Joining layers based on their location

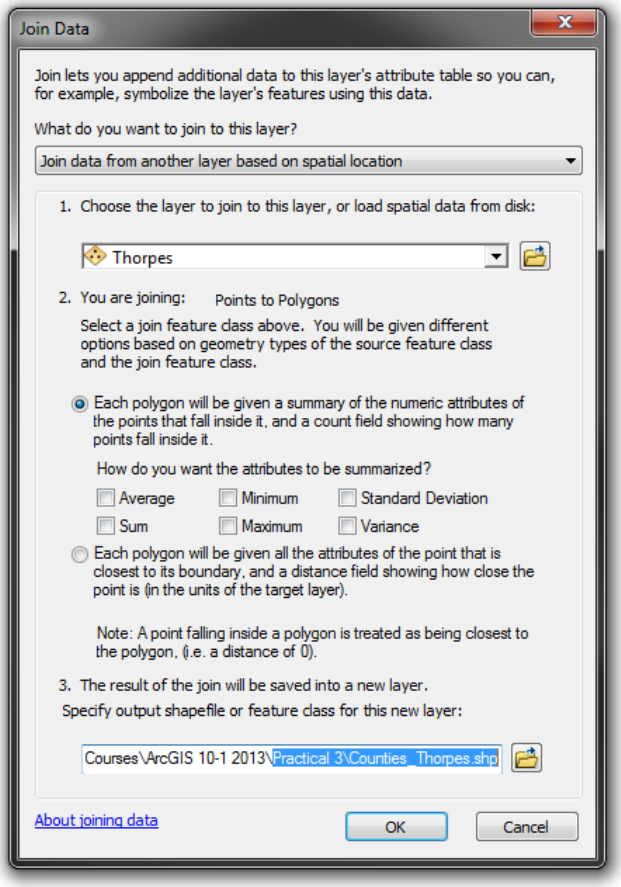
In the next part of the exercise we are going to perform a spatial join between the settlement points to the Counties. This operation will join the attributes of one layer to features in the other layer based on their location. You can also automatically add summary attributes where multiple features in one layer join to a single feature in the other.

In this instance we are looking to create a field in the **Counties** dataset that has a count of the number of **Thorpe** points. This means we will be able symbolise the Counties by the number of Thorpe settlements they contain.

1. Right-click on the **Thorpes** file in the table of contents.
2. Select the **Selection** option and then **Clear Selected Features**
3. Repeat this for the **England_ct_1981_area** file.
4. Right-click on the **England_ct_1981_area** and select **Joins and Relates** and then **Join…**



5. The **Join Data** window will open as shown below:



6. We want to **Join data from another layer based on spatial location.**

7. Select the **Thorpes** layer if it isn't already**.**

8. We want to use the first option in part two as it is the count field we are interested in.

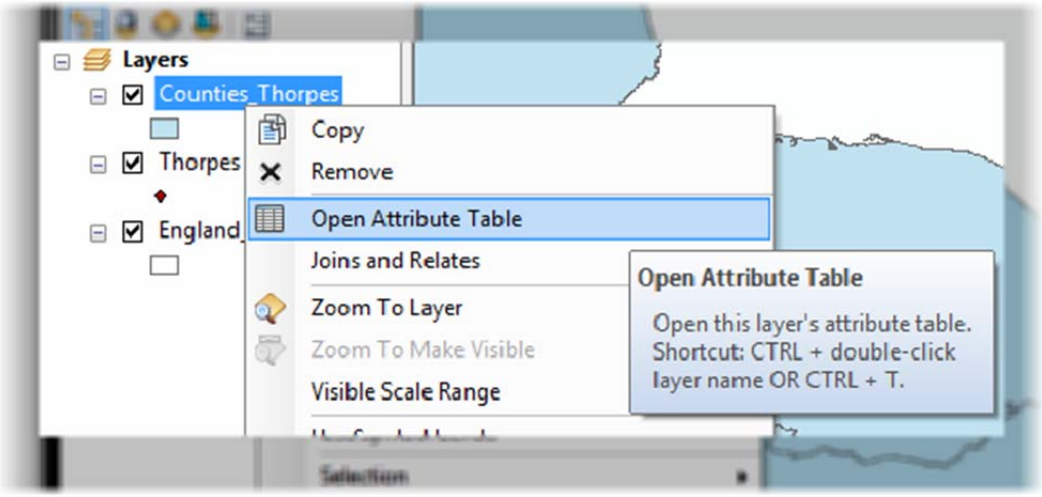
9. We don't need a summary of any of the other attributes of the points though these may be important for your own research so have a look. Leave all the boxes unchecked.

10. In part three browse to the **Practical 3** folder and save the new output file as **Counties_Thorpes.shp.**

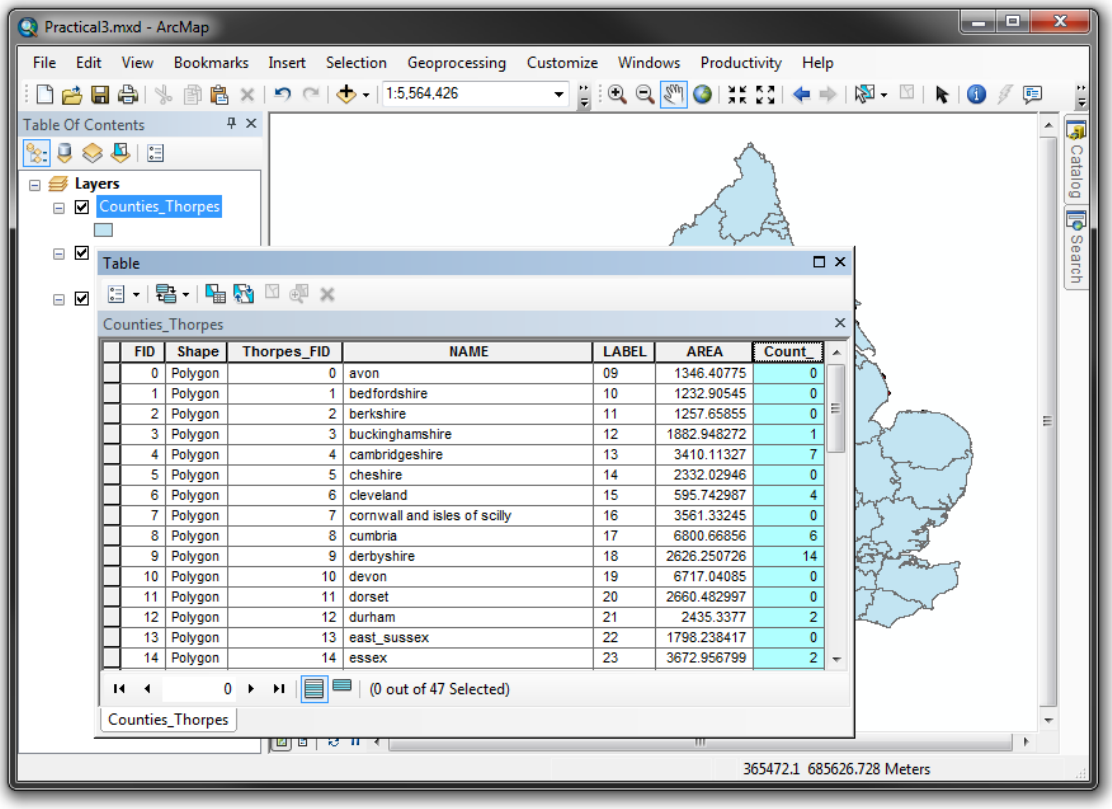
11. There will be a brief message showing the progress of the join then the new shapefile will be added to the map.

The new data will look exactly the same as the counties data set but if we look in the attribute table we can see new columns.

12. Right –click on the **Counties_Thorpes** file in the Table of Contents and select **Open Attribute Table.**



13. The Attribute Table will open and you should be able to see the count field at the end.



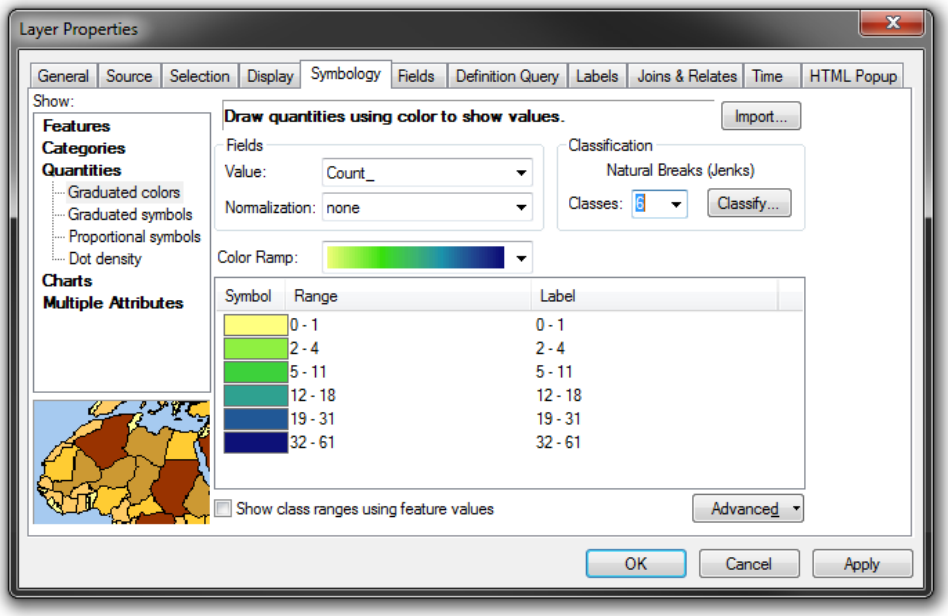
We can use the Count field to colour the map like we did with the deprivation scores earlier.

14. Right-click on **Counties_Thorpes** in the table of contents and click on **Properties.**

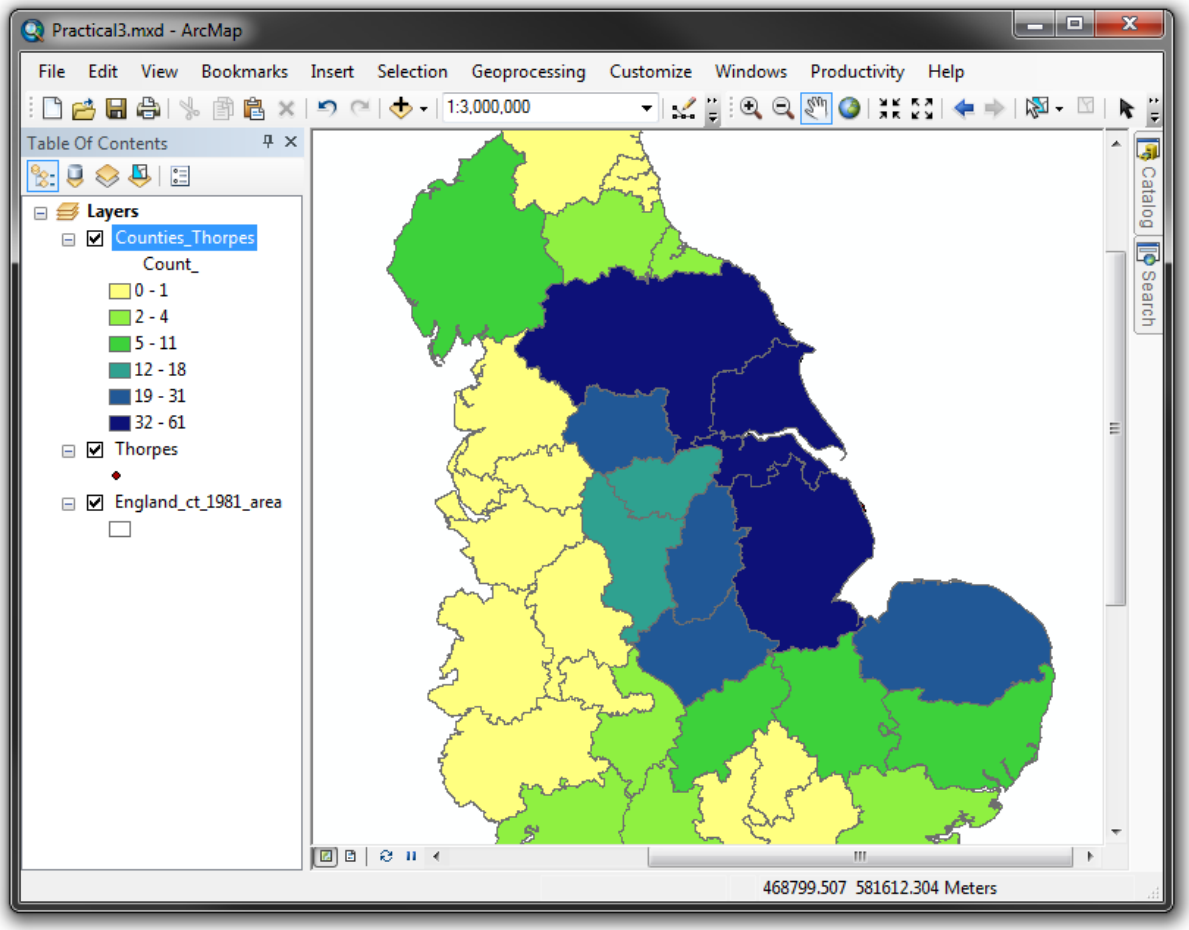
15. Select the **Symbology** tab.

16. Click **Quantities** on the left and select **Graduated colors**.

17. Change the **Fields Value:** to be **Count_** and the number of **Classes** to be **6**.



18. Change the **Color Ramp:** to one that you like the best.
19. Click **Apply** and **OK**.



The resulting map gives a great indication of the distribution of the Thorpe settlements across England and could allow you to make inferences as to where the Vikings might have settled first and where they then spread to.

20. Save your work and then move on to the next section

This is the end of the basic exercises,

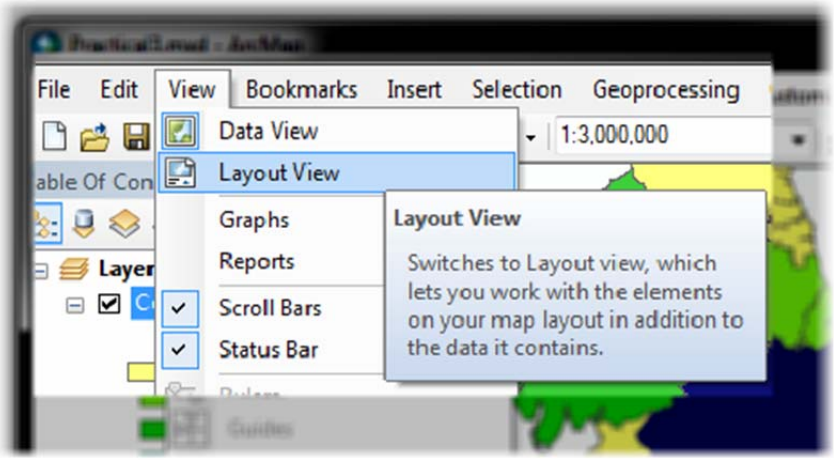
there is one further part if you have time.

The following exercise can be done if you have time:

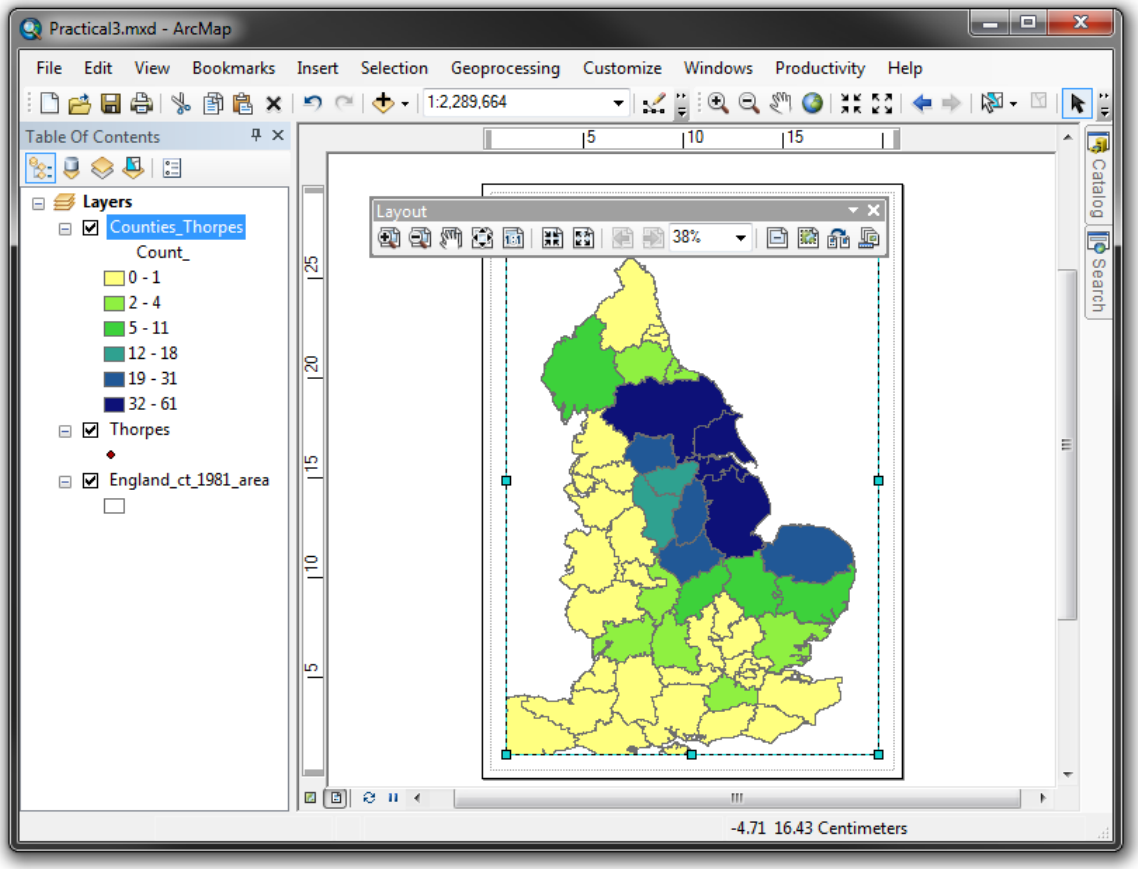
Part 5: Working with Layouts in ArcMap

The following instructions show you how to get your map ready for printing. You can also use these instructions to export a map image to use in a presentation or website.

The default “view” within ArcMap is the data view. Click on **View** in the Menu bar and change to **Layout View**.



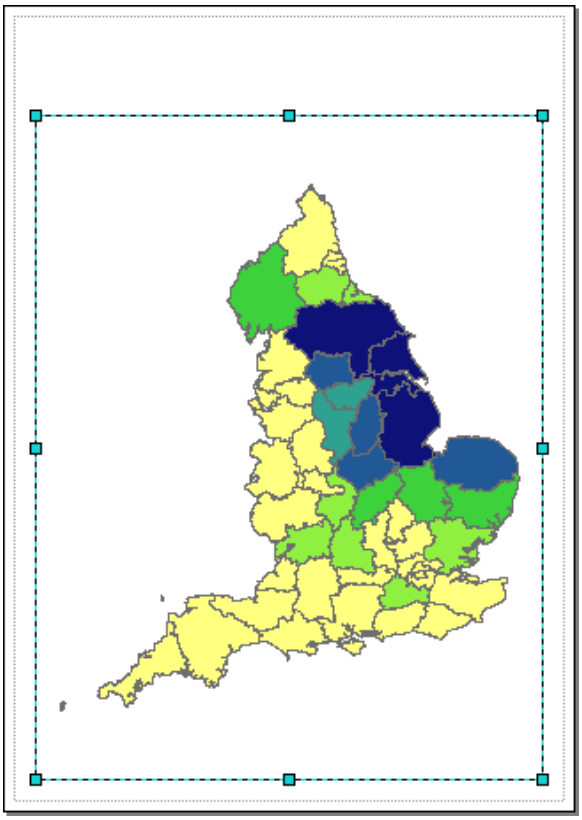
You are now working in the layout environment, a new tool bar will appear and your map will be shown within a box inside of another box that looks like a page.



The new tool bar has a new set of tools that allow you to zoom in and out on the page and move its elements around without changing the view on the data.

If you use the tools on the normal tool bar you will move the data and so not all of it may be present on the printed page. If you get into trouble then click on the **globe icon** in the **normal tool bar** to view the maximum extent of your data and the **whole page icon** in the **layout toolbar** to view all of your page layout. To resize and select different features on the map you must have the pointer selected in the normal tool bar.

We can now get started on producing a proper map for printing:



1. **Resize** the map area with the corner handles.
2. **Arrange** the map so there is room for a title above it.

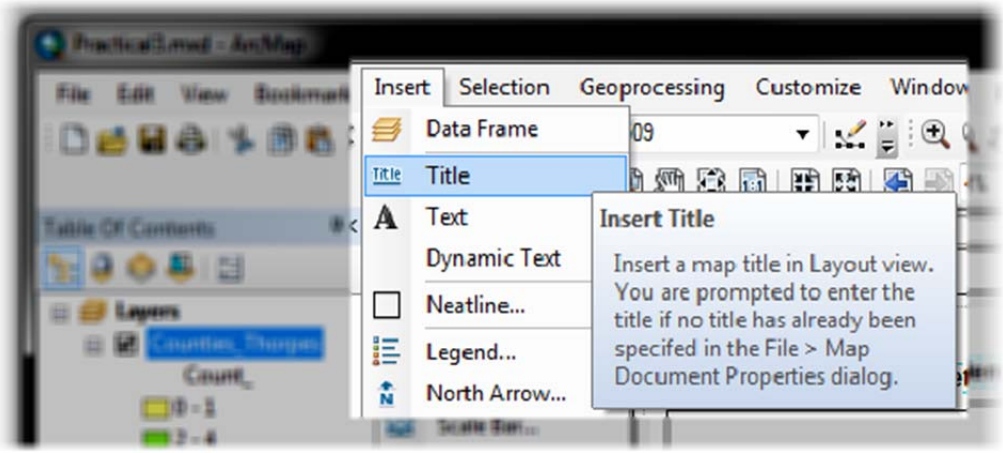
Warning: changes can be slow. Watch the spinning planet at the bottom of the window to see that the program is still working.

A map isn't really a map if it only consists of a picture. A number of cartographic entities are needed before we can really call our creation a map, namely: A Title, Scale bar, North Arrow and Legend.

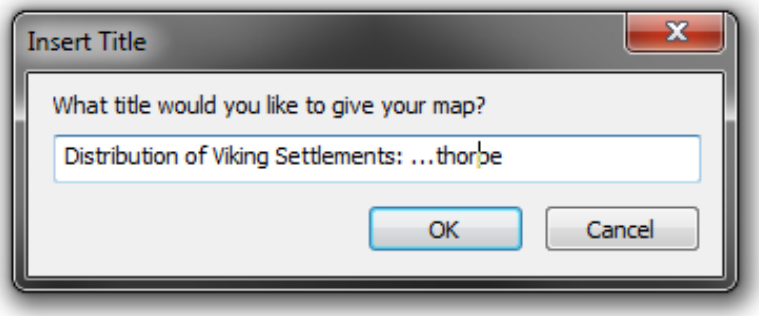
The following sections show how to add all these features to your map.

Part 5.1 Adding a Title

1. **Click Insert** on the Menu Bar and select **Title** which will open the Title box.

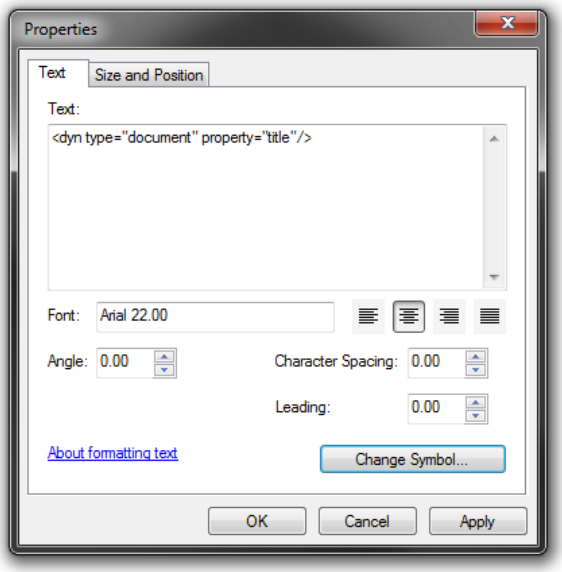


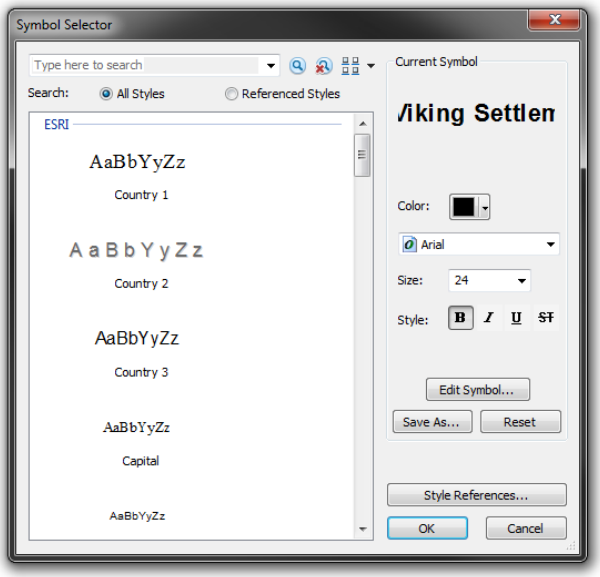
2. **Type** in an appropriate title, such as "*Distribution of Viking Settlements: …thorpe*".



3. **Click OK** and the title will be added to the map.

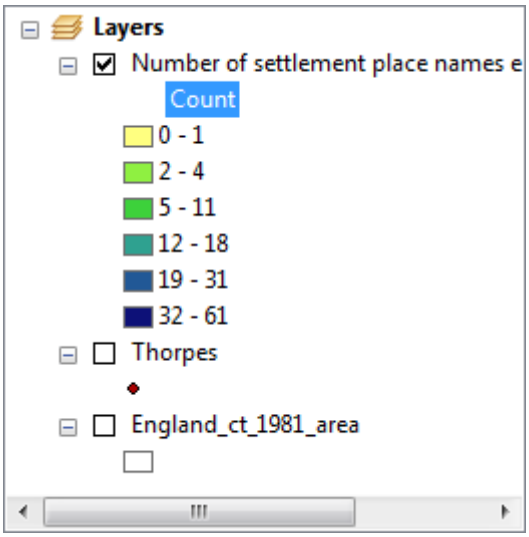
4. **Double click** on the title to open the properties box, here you can edit things like the font and size. Use the **Change Symbol…** button to do this in the simplest way.





Part 5.2 Adding a Legend

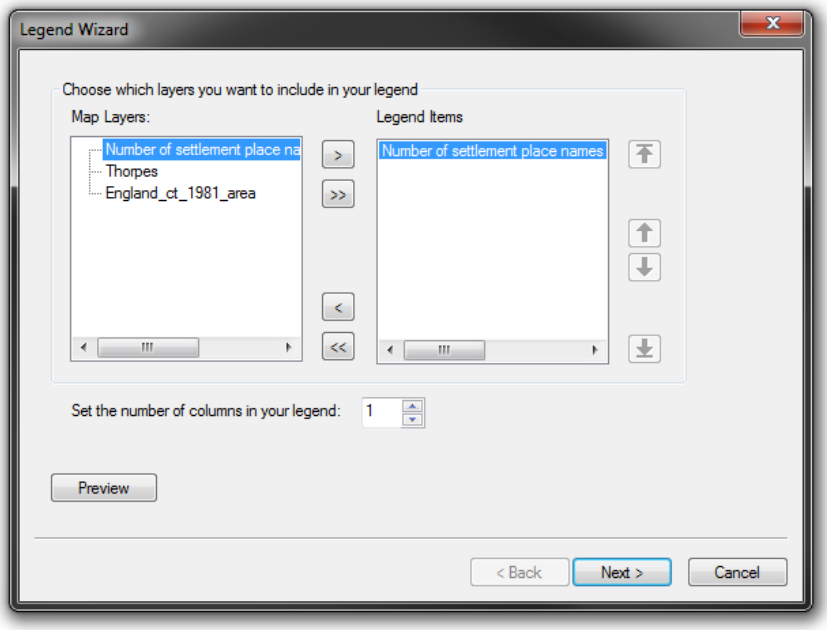
There is a wizard to take you through the creation of the legend; for this example there is no need to change any of the settings unless you want to. However, before you start it is good to make a few changes to the data layer names in the **Table of Contents**. The legend wizard uses these names to create titles so it is best to change them before you start.



1. Click on the names in the Table of contents and change them to something more sensible.

NOTE: The changes to the layer names are only saved in the MXD file, the names of the underlying Shapefiles will remain the same.

2. Click on the **Insert** Menu and then select **Legend**.



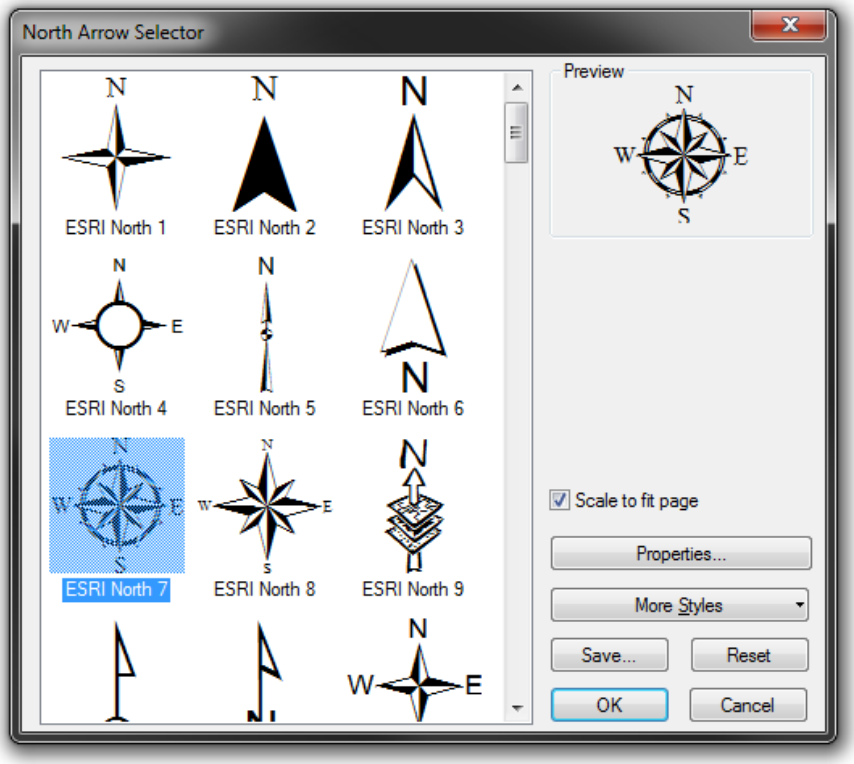
3. Make sure that only the layer you are displaying in the map is in the **Legend Items.**

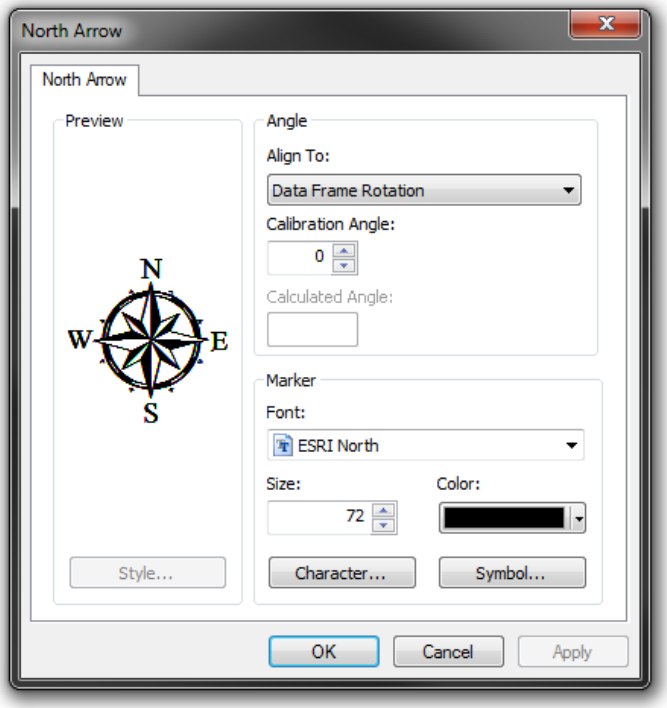
4. Use the **Next** button to advance through the wizard and click **OK** to finish. Once it is placed onto the map you can **drag** it somewhere suitable for display.

Part 5.3 Adding a North Arrow

A map should also have a **north arrow** so that users know which way it is orientated.

1. Click on the **Insert Menu** and select **North Arrow**.
2. Choose one that you like and click **OK**.
3. Drag the north arrow to position on the map, usually in one of the corners.

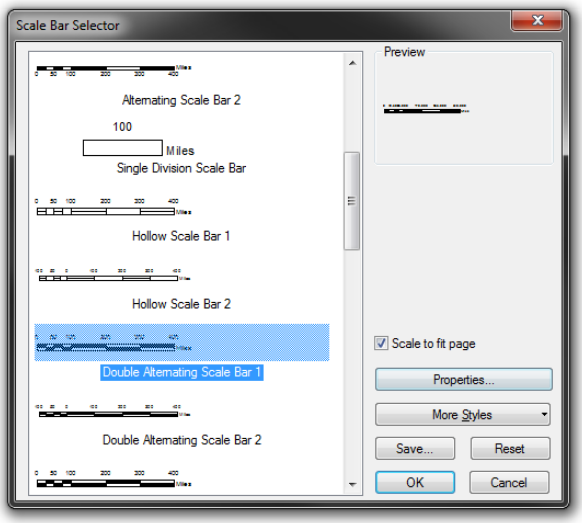




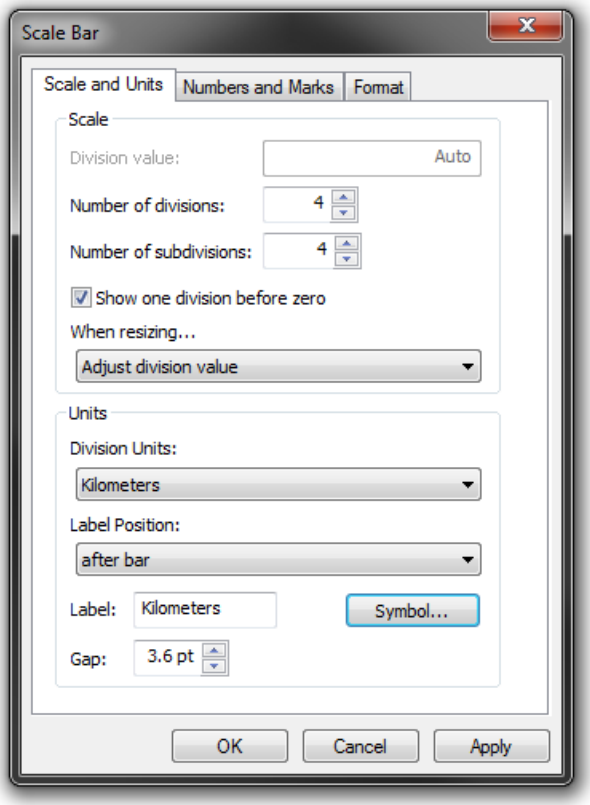
NOTE: If you click on Properties in the North Arrow Selector you can do additional things like rotate the arrow. This is useful if you know that the projection or grid you are using doesn't align exactly to true or magnetic north.

Part 5.4 Adding a Scale Bar

Scale bars are essential for your map as they allow users to measure distances and understand the sizes of the features shown.



1. Click on the **Insert Menu** and select **Scale Bar**.
2. Pick the one you like the look then Click on **Properties…**



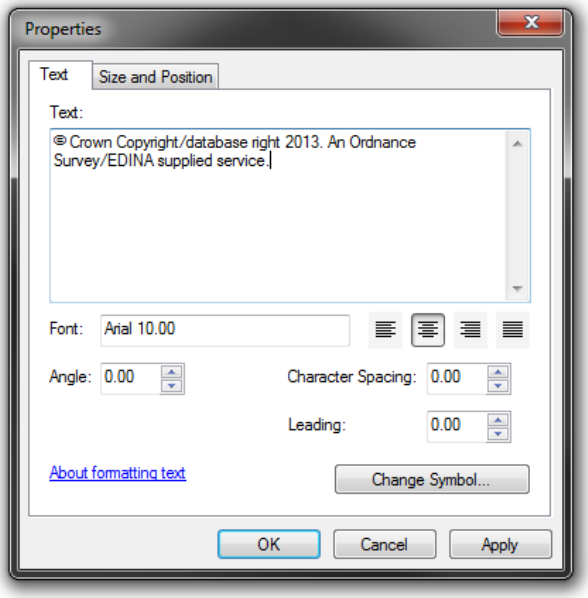
3. Change the **Division Units** to **kilometres**.
4. Optional: You can use the **Label Position** to move where the “Kilometres” is placed.
5. Optional: Switch to the **Numbers and Marks** tab to change the format and position of the numbers around the bar.
6. Optional: Switch to the **Format Tab** to change the colours and font and sizes of the text and bar.
7. Drag your scale bar into position, usually at the top or bottom of your map.

Part 5.5 Adding a Copyright Statement

There are times when you want to insert text to appear next to the map. A good example is source or copyright information.

1. Click on the **Insert Menu** and select **Text.** This will place a tiny text box in the centre of the map with a cursor for you to type in some text.

2. Zoom in using the icon on the layout tool bar then switch back to the pointer to move the text box.



3. You can type directly into the text box or **double click** on it with the pointer to open the **Properties** pop-up.

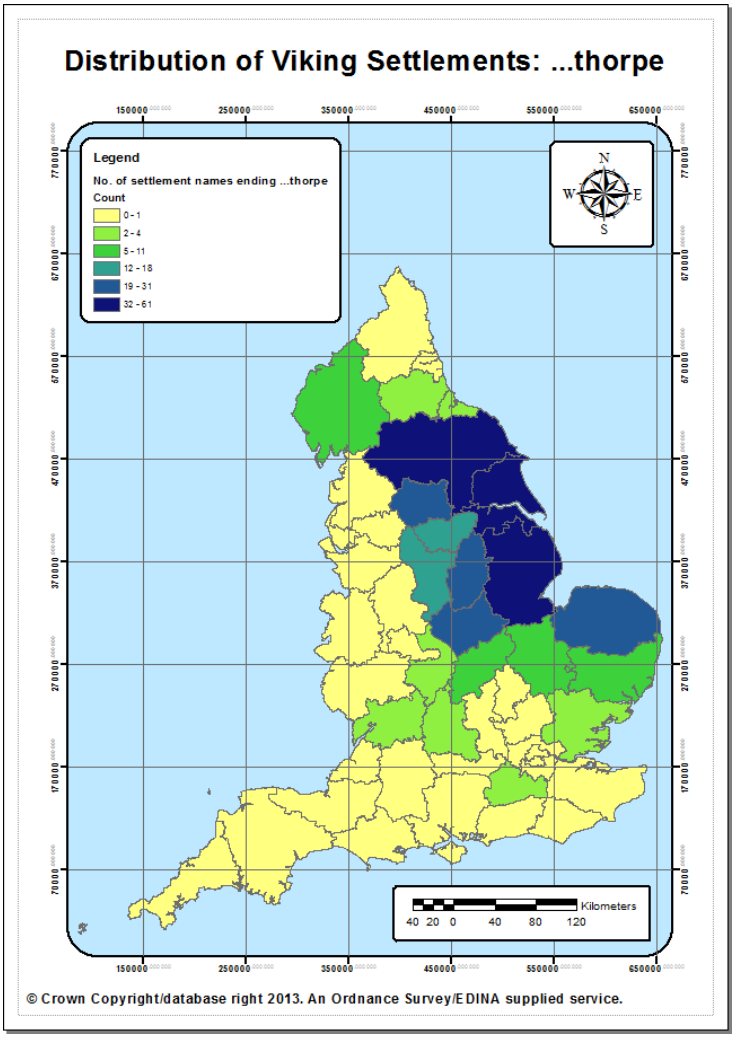
8. Enter the following text:

© Crown Copyright/database right 2014. An Ordnance Survey/EDINA supplied service.

9. Use **Change Symbol…** to change the font etc.

10. Click **Apply**. You may need to insert some new lines to get the text to fit.

The steps above are guidelines please feel free to explore all the options, and ask if there is something you can't see how to do. Some of the other things you might like to try can be found by right clicking on the map and looking at the Data Frame properties. Here you can change the background colour and add things like a grid.



Note that when you save your work, you are saving the entire map document. To export your map layout to an image file:

1. Click **File** then **Export Map** from the Menu.
2. Note the variety of image formats available, you can create a **PDF** to take away and print at a later date.

CONGRATULATIONS!

You have now completed the ArcGIS Course.

Please contact the Data Library or EDINA if you would like any more information about using GIS or Digimap data.

Thank you for attending!