How To: Colour geographic feature locations and different types of attributes using ArcMap 9.3

This paper aims at giving a brief introduction to the diverse colour scheme and to the great amount of colouring methods/techniques available in ArcMap 9.3. Since an important part of making a good map is about giving the map some reasonable but at the same time appealing colours, making the map interesting for the spectator to look at, a great deal of attention has been given to the development of a comprehensive colour scheme in ArcMap 9.3. In the following sections this paper will introduce the two main ways of colouring your map, i.e. merely colouring on feature location or colouring on your features' attributes and in connection hereto go through the different colouring methods available when you want to colour on your feature's attributes (section 2). First, however, a practical example will be given in section 1 on how to find and apply the colours in ArcMap in the first place.

1) How to find and choose the right colours and colour symbols in ArcMap 9.3

Basically, there are two ways of getting to the colour palette (i.e. the "Symbol Selector") in ArcMap 9.3. One way is to use the "Table of Contents" located in the left side of your screen when having launched ArcMap. From here you can always double-click the default colour icon(s) positioned below each layer-file/shapefile and the "Symbol Selector"-window will automatically pop up. The "Symbol Selector"-window allows you to find colours that may be more suitable or preferable for your purpose(s) than might be the case with the default colour that ArcMap provides whenever you add a layer-file/shapefile to the "Table of Contents". Figure 1 below exemplifies this showing the shapefile of the polling districts at the November 2007 Danish Paliamentary Election displayed with the default colour. Another way is to right-click the name of your layer-file/shapefile and choose the "Properties"-option at the very bottom of the drop bar. Inside the "Properties"-window you should choose the "Symbology"-tab. From here you can also get to the "Symbol Selector" and thus change the colours of your icon(s), see figure 2 below.

Figure 1: Display of the "Symbol Selector"-window when double-clicking a colour icon in the "Table of Contents"
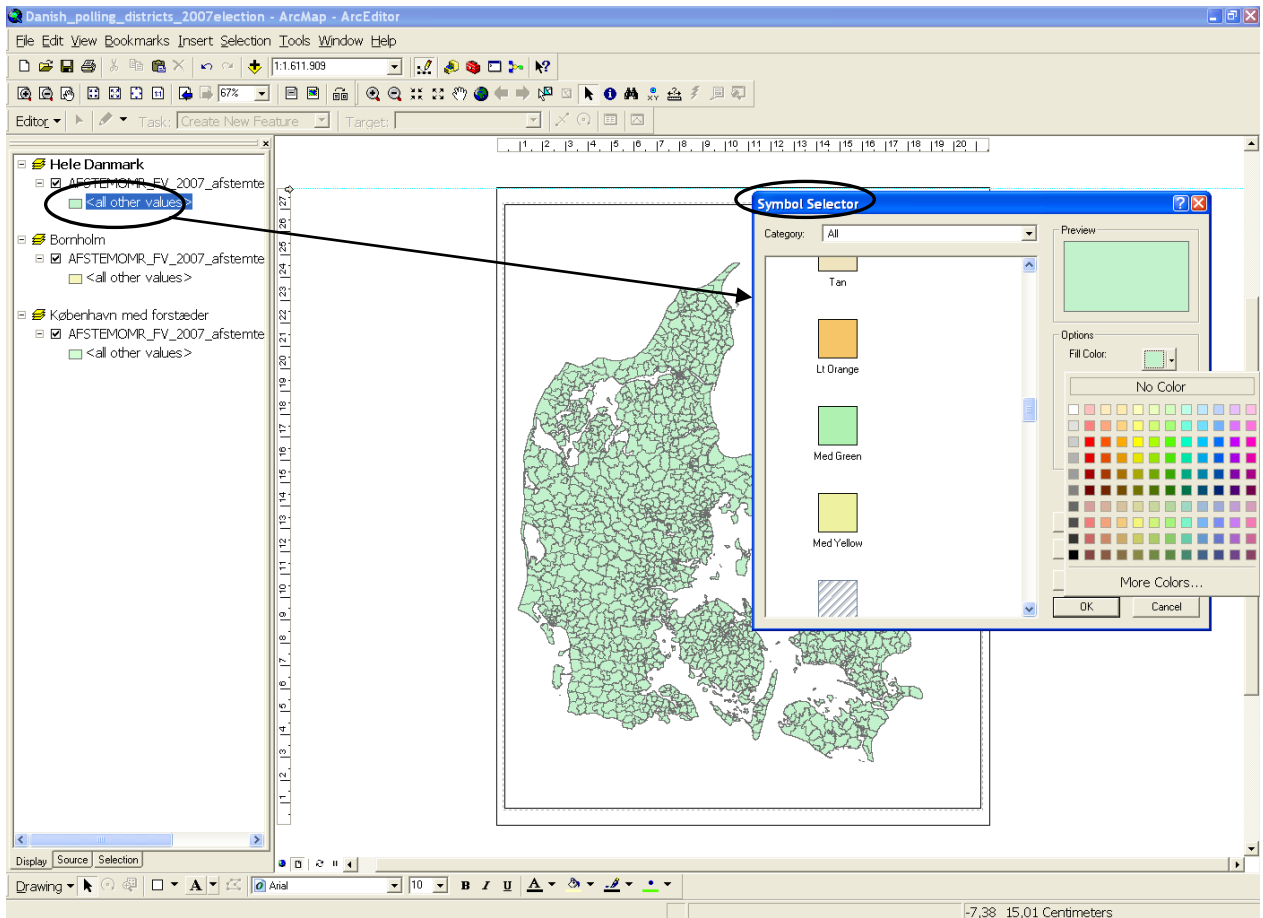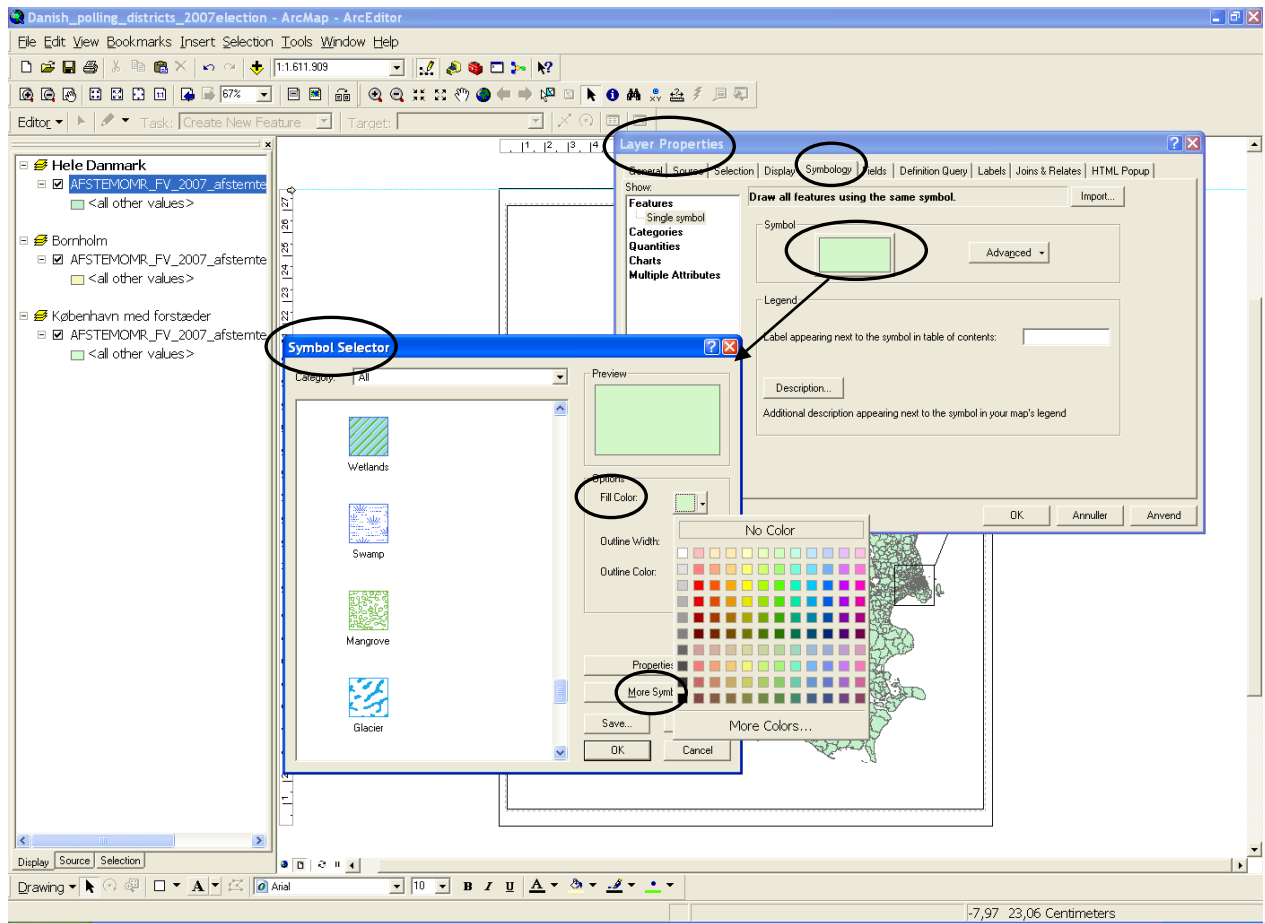
Figure 2: Display of the "Symbol Selector"-window when using the "Symbology"-tab within the "Layer properties"-option

There are numerous colours to choose from within the "Symbol Selector"-window. In addition to the plain colours that appear if you click the "Fill Color"-drop bar and the plain and patterned colour symbols which you can find in the left hand side of the window (see figure 2 above), it is also possible, by clicking the "More Symbols"-drop bar, to find so-called "agreed upon" colour symbols relating to various administrative and natural concepts. These can be very fruitful to apply in certain situations e.g. when making a map relating to a specific topic of public interest as for example a map showing occurrences of different types of crimes in a city. To take a few examples of these, in the "More Symbols"-drop bar you can find:

- Conservation symbols (a few of which are shown below in figure 3)
- Crime Analysis symbols (a few of which are shown below in figure 4)
- Civic symbols (a few of which are shown below in figure 5)

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Figure 3: Examples from the "Conservation symbols"-category using the "More Symbols"-option
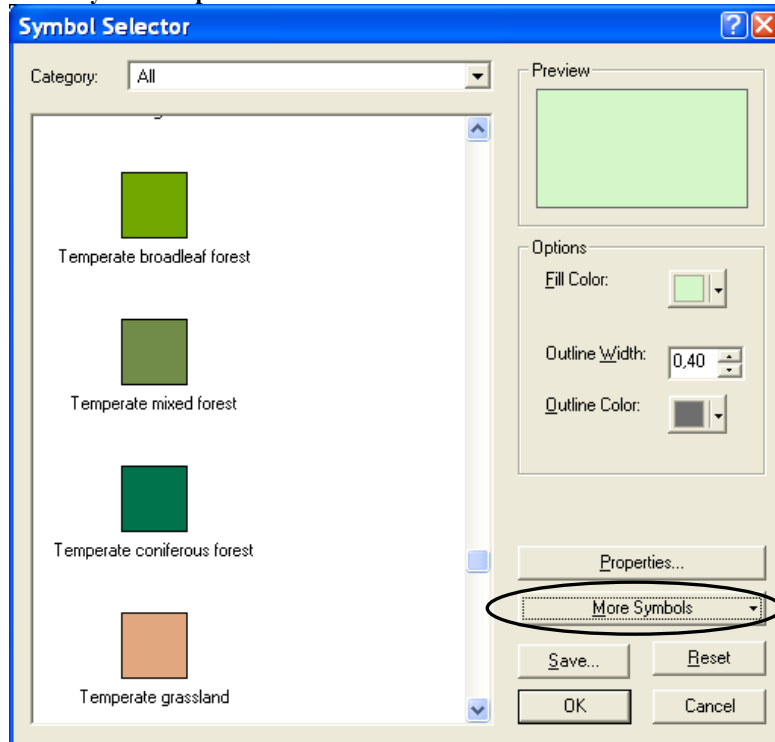

Figure 4: Examples from the "Crime Analysis symbols"-category using the "More Symbols"-option
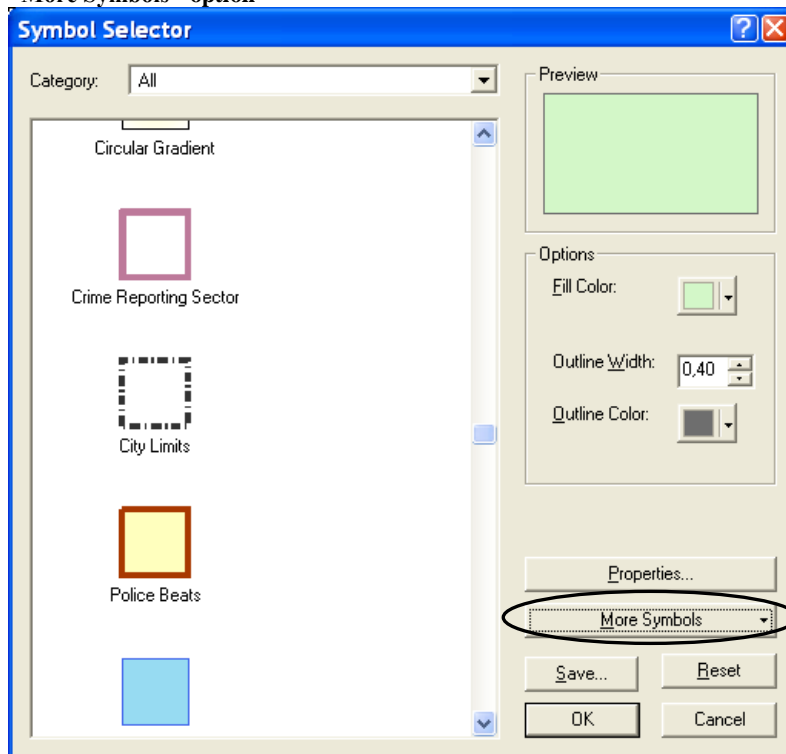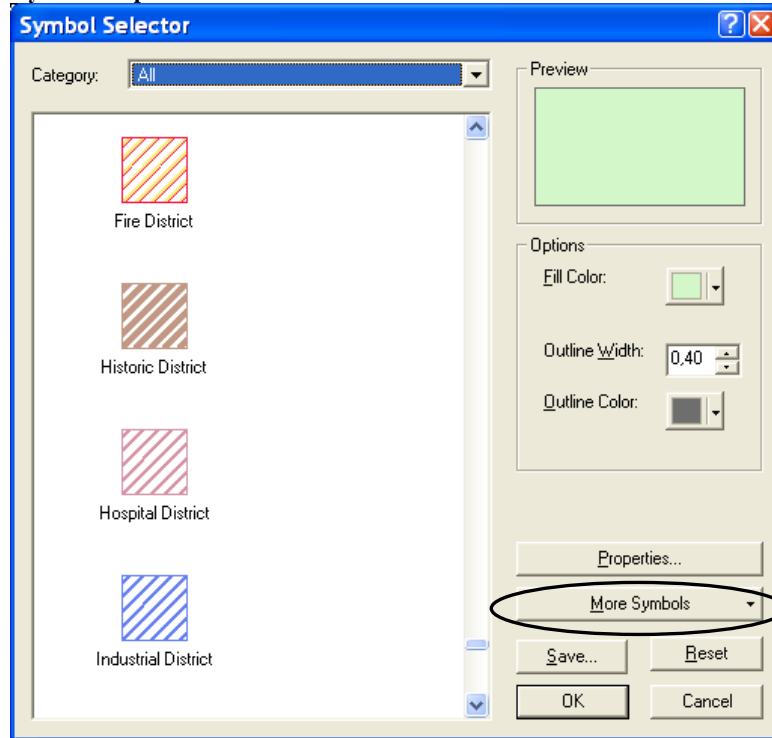
Figure 5: Examples from the "Civic symbols"-category using the "More Symbols"-option

In addition to these several options for colouring your map, you can also create your own colours and colour symbols by pressing the "Properties"-button which is positioned just above the "More Symbols"-button in the "Symbol Selector"-window. Pressing that button takes you to the "Symbol Property Editor". For instance, if you wish, you can choose to make a gradient fill symbol in a circular style, see figure 6 below. You should really try to experiment with these many possibilities yourself! Finally, it is possible to save your new colours and perhaps even assign them to a certain category of colour symbols, if you like, by clicking the "Save"-button in the "Symbol Selector"-window.

Figure 6 The "Symbol Property Editor" from where you can create your own colours and colour symbols
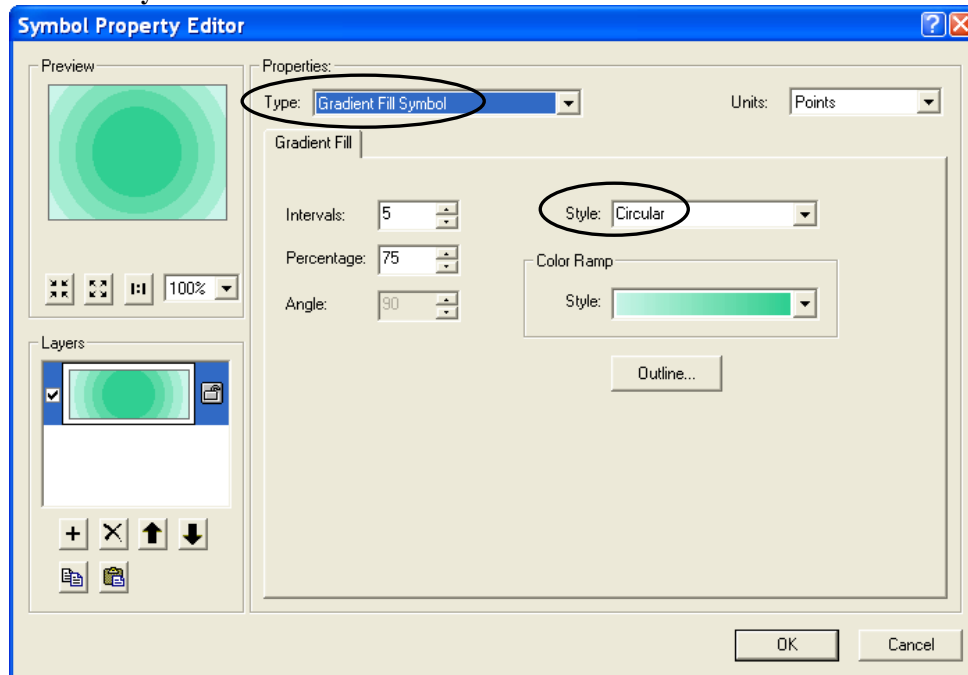
2) How to display your geographic feature locations or feature attributes using the various colours, colour symbols and colouring methods available in ArcMap 9.3

Having learned how to find the palette of colours and colour symbols in ArcMap 9.3 and learned how to make your own colours as well, the next step will be to learn how to display your features or feature attributes in the best possible way using the colours and colour symbols together with the different colouring methods available in ArcMap.

First, however, let us start with making a distinction between colouring on geographic feature locations alone and colouring on their attributes (i.e. the aspatial characteristics) of these features. For example, there is a world of difference between making a map showing the result of a cluster analysis based on geographic location alone (e.g. a cluster analysis which focuses on *where* people are located in light of the fact that people tend to cluster together in certain areas of Denmark e.g. in the Mideastern part of Jutland and Eastern part of Sealand. In this kind of analysis the features consist of dots and each dot represents a certain number of people), or to the contrary making a map based on a cluster analysis of one of the aspatial characteristics of your geographic features (e.g. *what* percentage of the total vote a party has been given in each polling district). In the latter case, a great example could be to look at the distribution of votes for the former Danish Parliamen-

tary party Kristendemokraterne (see figure 6 below) which tended to cluster heavily in the Western part of Jutland - an otherwise sparsely populated, i.e. non-clustered, area of Denmark if looking at the location of people alone!

It should furthermore be noted that a cluster analysis based on the location of features alone only makes sense as long as your geographic features are not contiguous (as is for instance the Danish polling districts), that is, if using contiguous geographic features as the basis of your map, it would only be possible to do a sound cluster analysis based on the *attributes* of the polling districts, and not on the location of these districts themselves! For an example of a cluster analysis based on an attribute of the old Danish nomination districts, consult the paper: "How To: Prepare for, carry out and display a cluster analysis in ArcMap 9.3".

Figure 6: Percentage voting for the former Danish Parliamentary party, Kristendemokraterne in every polling district at the 2007 Danish National Parliamentary Election. A clustering effect in the Western part of Denmark is clearly evident.
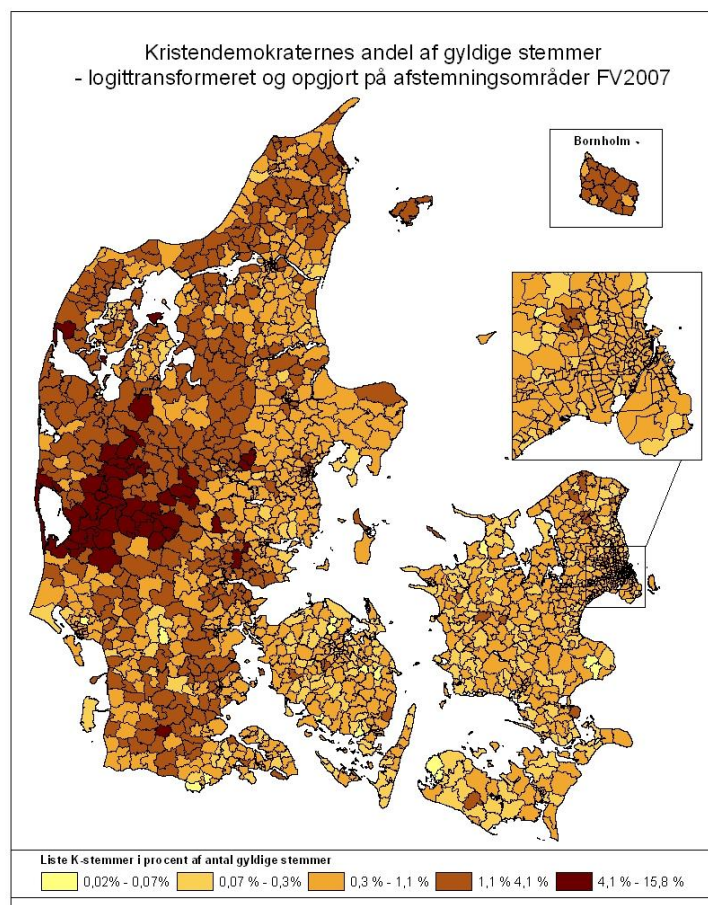
As such, it seems instructive to look at these two colouring options in turn. We will begin with the choice of colouring on geographic feature location alone since this alternative is actually quite trivial because of its very limited use.

2.1) Colouring on geographic feature location alone

Let us once more take as an example the map of polling districts at the 2007 Danish National Parliamentary Election, see figure 7 below.

Figure 7: The 1645 polling districts at the 2007 Danish National Parliamentary Election with default colours
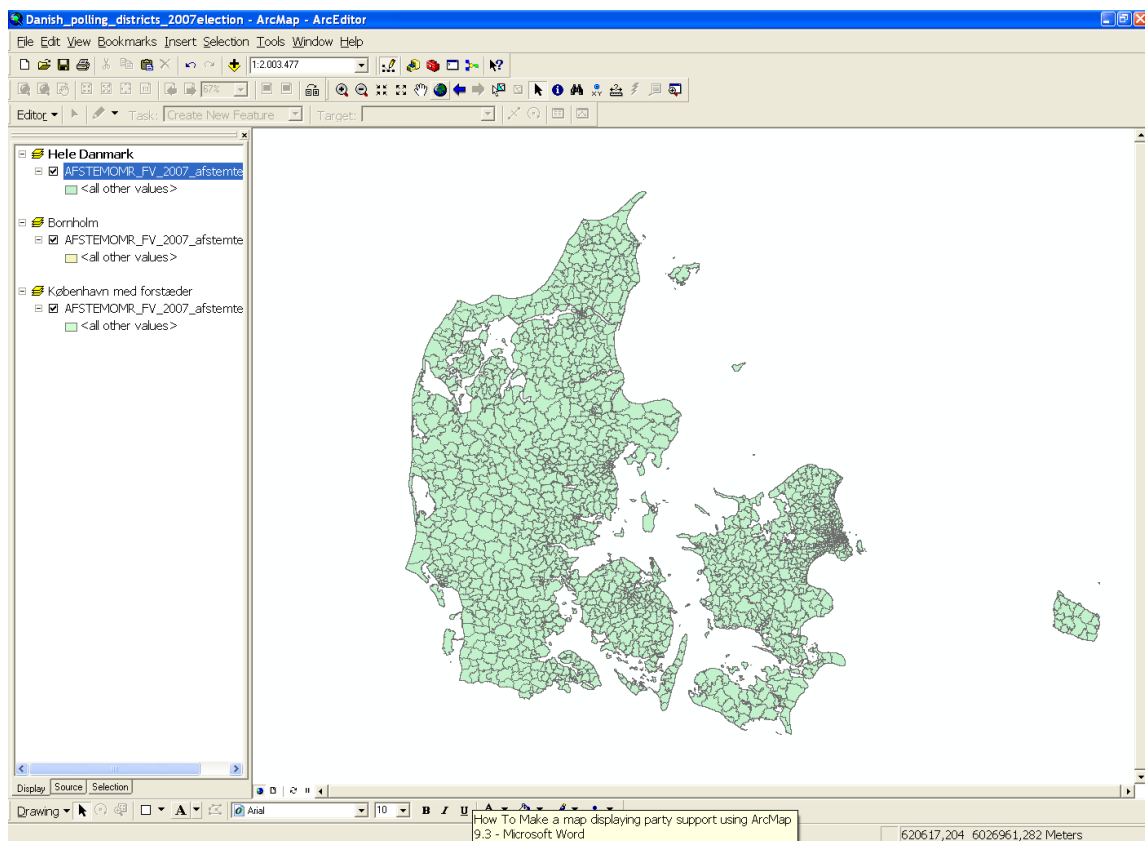
Because every polling district has a unique location and these locations are contiguous, i.e. no districts overlap each other, if colouring on these (e.g. using the unique feature ID-attribute in the "Attribute Table") in theory we would get a map displaying 1645 unique colours. Such a map would only lead to confusion and even though ArcMap 9.3 can display several different colours in one map, 1645 might be too many after all! Figure 8 below shows the result of such an operation. The same problem, however, relates to a shapefile containing many non-contiguous feature locations too. It might make a bit more sense to colour on geographic fea-

ture location alone if the number of features is somewhat low and if the purpose of your presentation simply is to highlight the location of these few features, e.g. if you wanted to make a quick display of the five new regions of Denmark giving each a distinct colour[1].

Figure 8: The 1645 polling districts at the 2007 Danish National Parliamentary Election have been coloured on their geographic location alone.
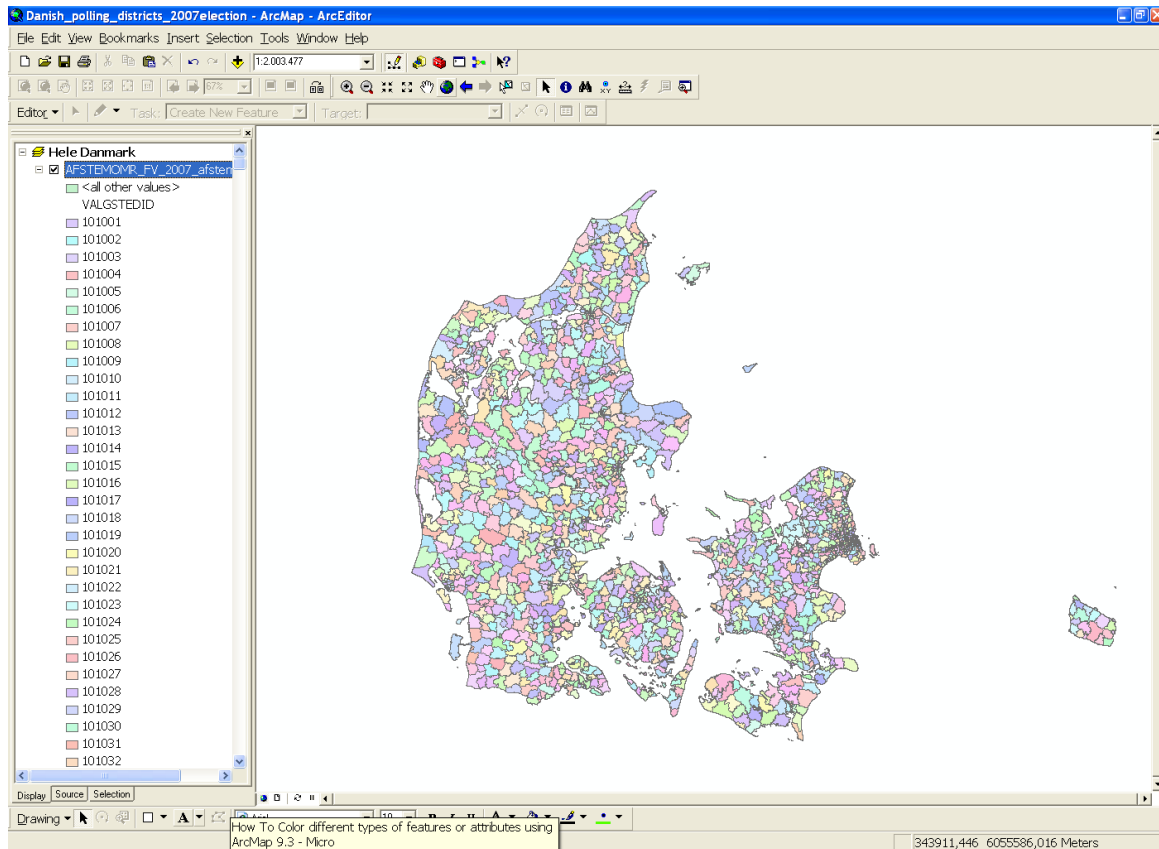
The following section will go through (some of) the methods of displaying the aspatial attributes of geographic features by exploiting the numerous colouring methods to be found under the "Symbology"-tab within the "Properties"-window.

2.2) Colouring on the attributes of your geographic features

Whether it makes sense to colour on geographic feature location alone or not, in any case it is much more common to colour a map on one or more of its feature attributes, for instance, as mentioned above, to colour a map of the Danish polling districts on the vote share of a given

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[1] However, you can also colour on region by using one of the colouring options available when colouring on the attributes of you geographic features, as will be noted below.

party in each district. The following subsection thus takes as its point of reference the various colouring methods available when colouring on feature's attributes.

2.2.1) Choosing the best method when colouring on your geographic feature's attributes

As you learned previously in this paper, the "Symbology"-tab within the "Layer Properties"-window provides you with several possibilities for choosing or making your own colours and colour symbols. Another, but related, element is the question of which colouring *method* will best represent the intentions behind your map making. In other words, it is not enough to know *what* colours you want to have displayed on your map e.g. when making a map of the vote percentage for a given party in each polling district at a given election. You also need to consider *how* these colours should be displayed. To get a sense of the possibilities available, first you need to know if the attribute you are dealing with is a categorical or a continuous variable since this has consequences for the subsequent colouring opportunities.

Figure 9: Using the "Categories – Unique values"-option available in the "Symbology"-tab
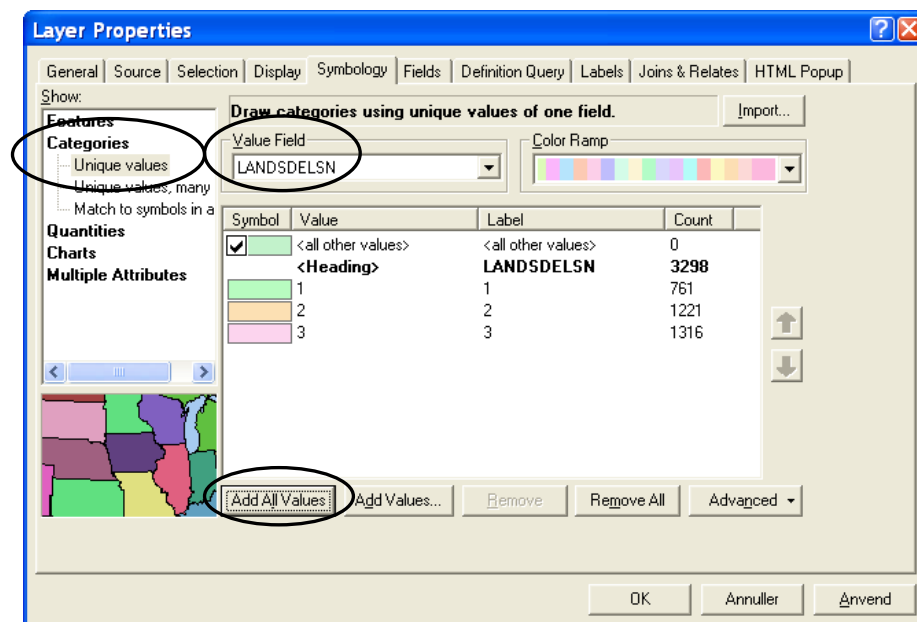
For instance, if you want to colour your map on the different regions of Denmark you should use the "Categories"-option found in the left side of the "Symbology"-tab (see figure 9 above) and choose "LANDSDELSN" in the "Value Field"-drop bar. By clicking the "Add All Values"-button you will end up getting three different colours (which of course you can

always change) belonging to the three regions of Denmark. On the other hand, if you want to display the logit-transformed vote percentages for Socialdemokraterne (LN_A) in every polling district of Denmark, you should choose the "Quantities"-option instead. Within the "Quantities"-option there are four interesting sub-options to choose from. If you go for the "Graduated colours"-option your attribute of interest LN_A (remember to choose LN_A in the "Value Field"-drop bar[2]) will be divided into a number of different intervals and each interval will get assigned a graduated colour from one of the various colour bars, see figure 10 and 12 below. However, using the "Quantities"-option will naturally restrict the number of colours that will eventually be displayed on your map since you will need to classify your attribute including indicating how many classes (i.e. intervals) up to 32 you want, as well as indicating the specific method you want these classes to be classified on. Clicking the "Classify"-button thus gives you the "Classification"-window (see figure 11 below) from where you can choose a number of different classification methods, e.g. the "Natural Breaks" (Jenks) or the "Equal Interval"-method. In this case we will have our data divided into five intervals using the "Equal Interval"-method, see figure 10 and 11.

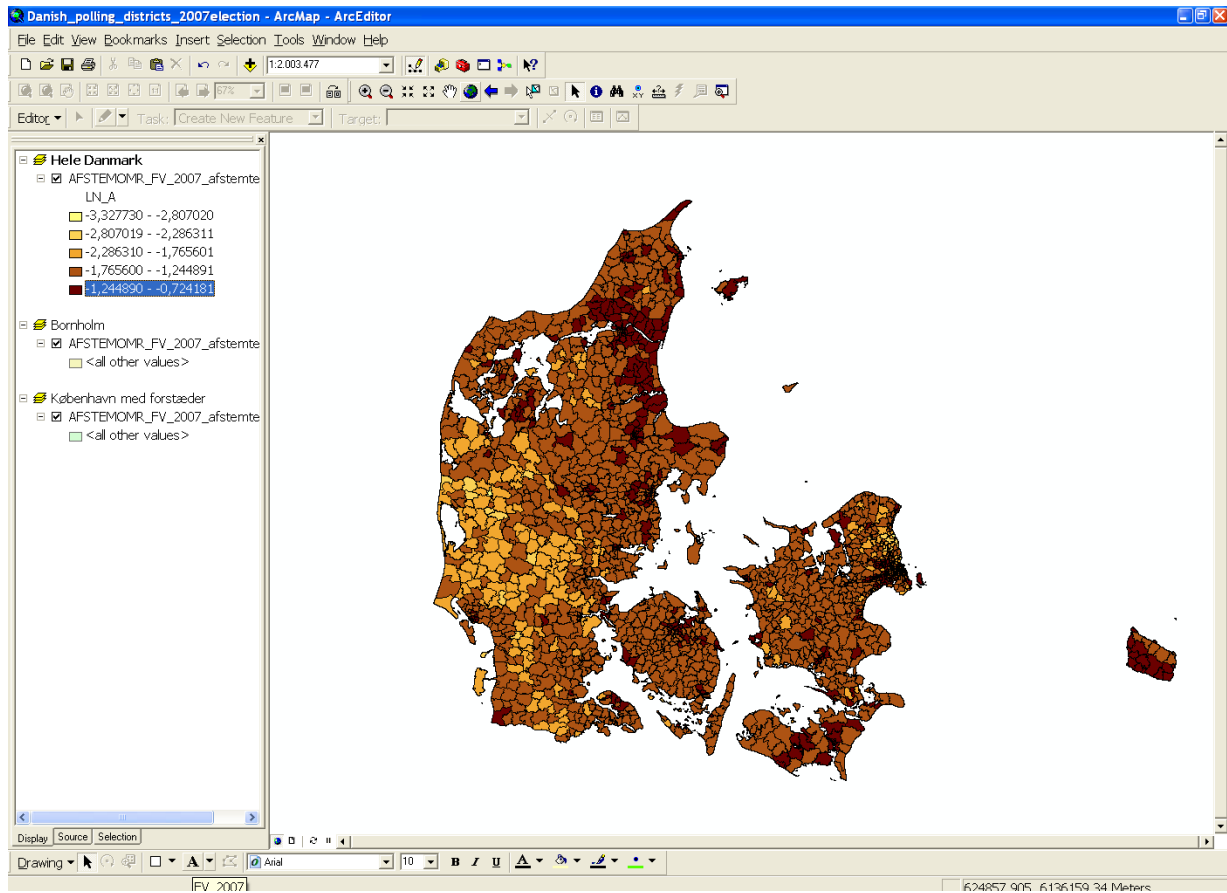**Figure 10: Using the "Quantities – Graduated colors"-option available in the "Symbology"-tab**

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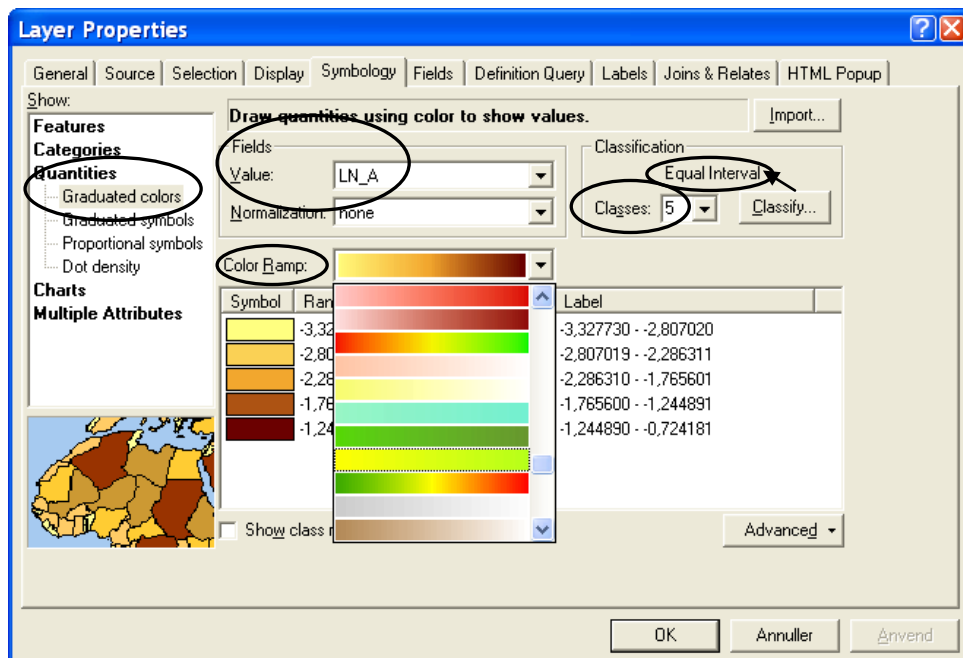
[2] In conjunction hereto you have the possibility of using the "Normalization Field" positioned below the "Value Field" in which for instance you can choose to normalize the logit-transformed party support into percentages

Figure 11: Choosing a classification-method inside the "Classification"-window
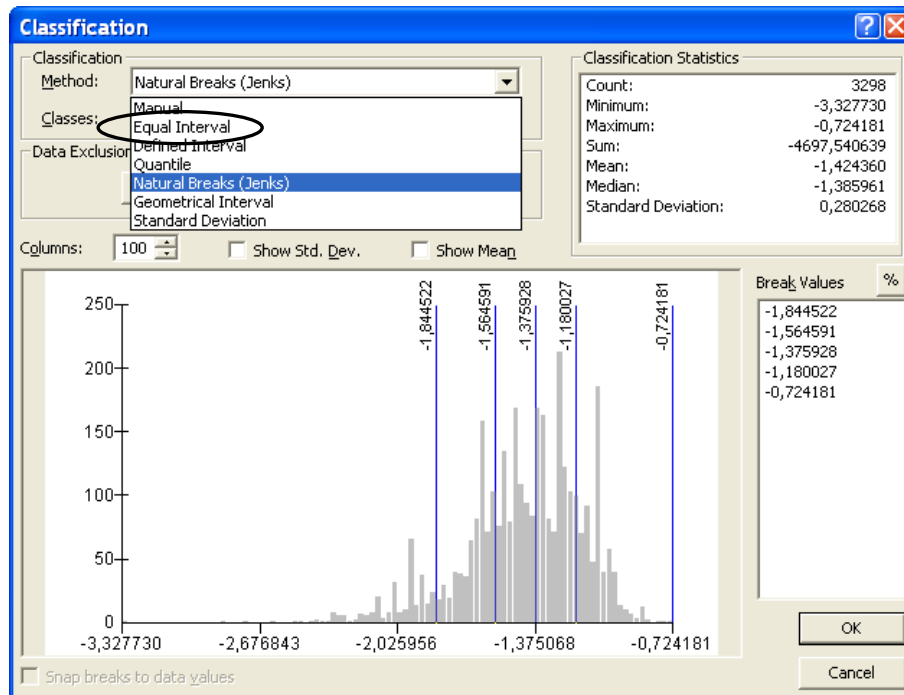
NB: The look of you map depends to a large extent on which options you choose during the classification process. It therefore is highly important to be aware of this before you read too much into the look of you final map.

Figure 12: Display of party support for the Danish Parliamentary party Socialdemokraterne using the "Graduated colors"-sub-option with the settings of figure 10

As previously mentioned there are other sub-options within the "Quantities"-option besides the "Graduated colors"-option. The "Graduated symbols"-option lets you do more or less the same things as the "Graduated colours"-option, e.g. defining the number of intervals you want to have displayed as well as the classification method etc., see figure 13 below. However, now your attribute of interest will be displayed as symbols with a single colour, e.g. as green dots of different sizes, and be placed in the centroid of the geographic unit of reference, i.e. the Danish polling districts (see figure 14 below and compare it, if you like, to figure 12 above). The "Graduated symbols"-sub-option, though, does not seem to work as well as the "Graduated colors"-sub-option in our case. The map in figure 14 is somewhat more confusing to look at with all the green dots of different sizes many of them even overlapping each other. In our case, therefore, it seems instructive to go for the "Graduated colors"-sub-option when making our final map.

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Figure 13: Using the "Quantities – Graduated symbols"-method available in the "Symbology"-tab
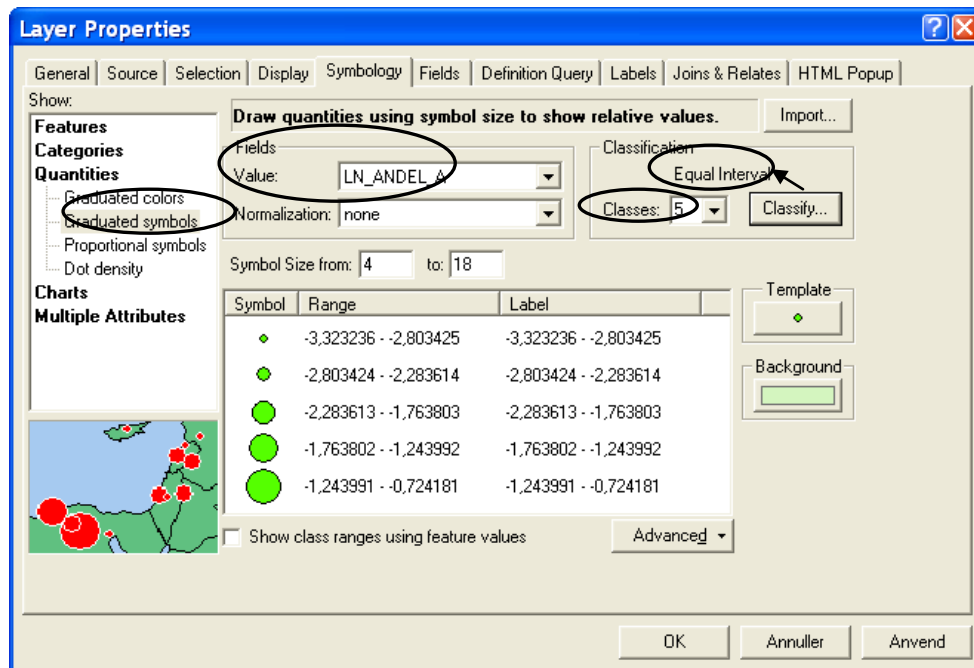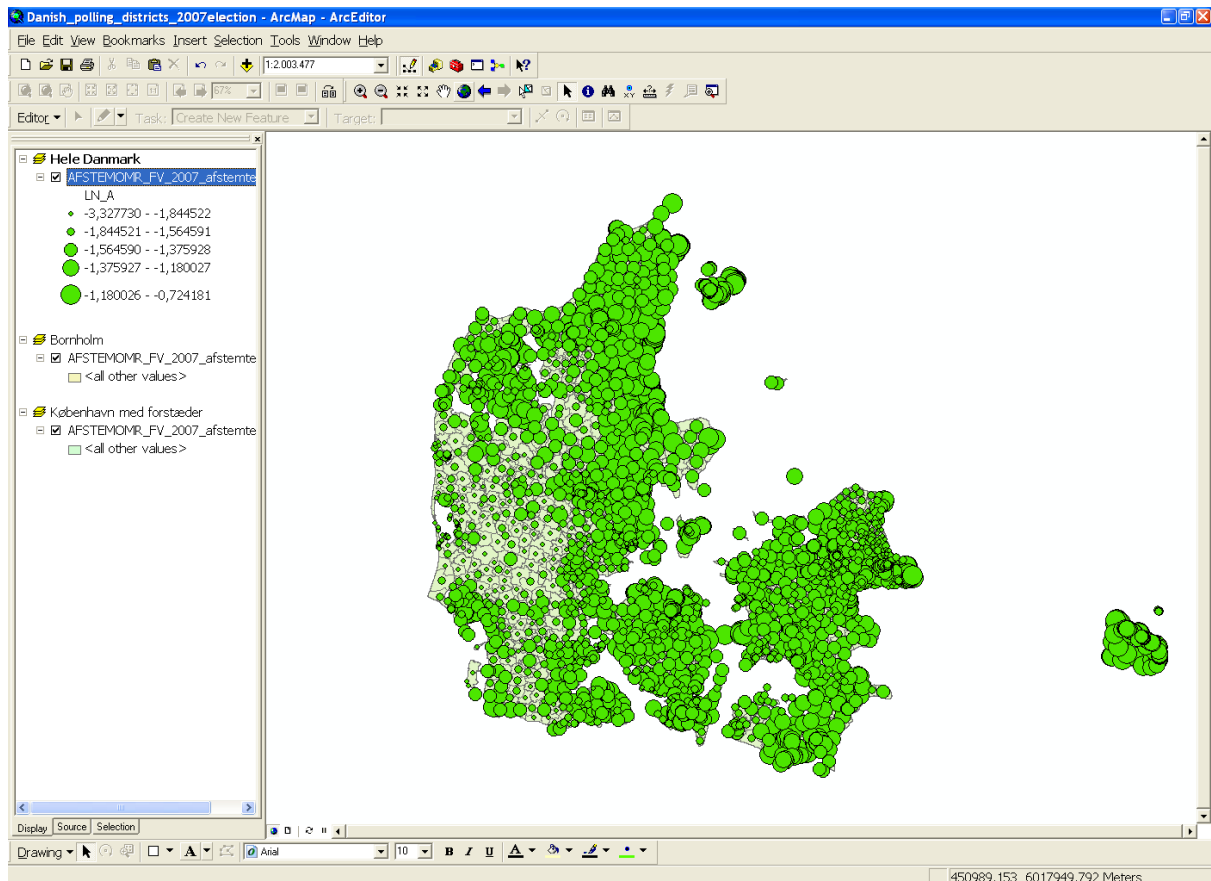

Figure 14: Display of party support for the Danish Parliamentary party Socialdemokraterne using the "Graduated symbols"-sub-option

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The "Proportional symbols"-sub-option is slightly different from the "Graduated symbols"-option since it lets you display your attribute of interest in symbols of different size (be they dots, triangles, squares etc.), but here the size of these symbols are not randomly chosen. The symbol sizes are proportional in that the size of one specific instance of the feature attribute of interest relates to the magnitude of this instance relative to magnitude of the other instances of that attribute. We cannot use the LN_A variable in this case, though, since logit-transformed vote percentages contain negative numbers and for this sub-option to work the attribute must contain all positive numbers. Finally, the "Dot density"-sub-option lets you display your attribute of interest with a small dot inside your geographic units of reference every time a given instance of your attribute reaches a certain preset magnitude. The number of dots inside one specific geographic unit thus equals the number of times this certain preset magnitude divides into the magnitude of the instance relating to this geographic unit.

Moreover, you can display your geographic feature attributes using the "Charts"- and "Multiple attributes"-options positioned right below the "Quantities"-option inside the "Symbology"-tab. These options will not be given any further attention in this paper, however, it is definitely worthwhile to try them out for yourself on occasion.

Malene Rode Larsen, January 2010

References:

- Larsen, Malene Rode: "How To: Prepare for, carry out and display a cluster analysis in ArcMap using the Ward's cluster analysis technique" (O:\PEDA\GIS\ Introductory papers to ArcMap 9.3)