PROBLEM 1

> **?** *Activate the extension "Spatial Analyst". It is responsible for processing large raster data sets efficiently.*
> *You will find a raster data set in your directory which assigns a height value to each (x,y) coordinate. Create an according raster image by applying an interpolation scheme well suiting the raster data, i.e. with a visual error as low as possible.*

The Spatial Analyst seems to be a bit hidden in ArcView's menu hierarchy. I finally found the extension itself in *Tools → Extensions* and added it to the toolbar band under *View → Toolbars → Spatial Analyst*:
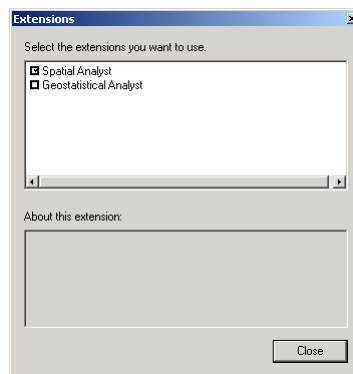

Figure 1   *Loading the Spatial Analyst Extension*

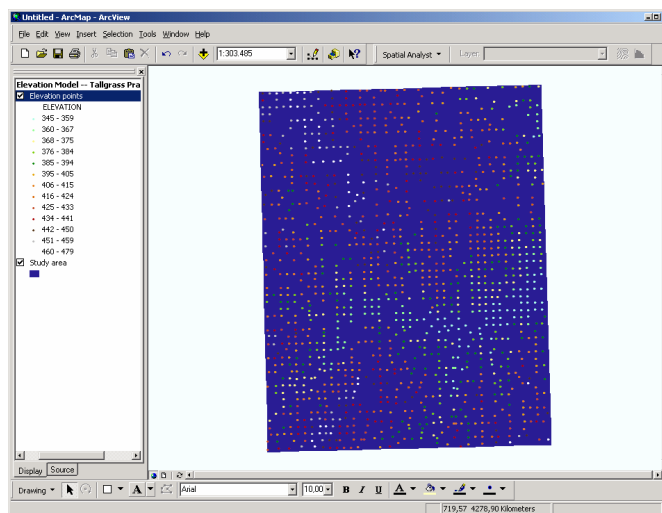Once I managed to import the data set, a confusing image built up on the screen:

Figure 2   *Unprocessed raster data*

Now the Spatial Analyst comes into play. It offers functionality called *Interpolate to Raster* which is further subdivided, too. Most appealing is *Inverse Distance Weighted*, the default parameter produce Figure 4.
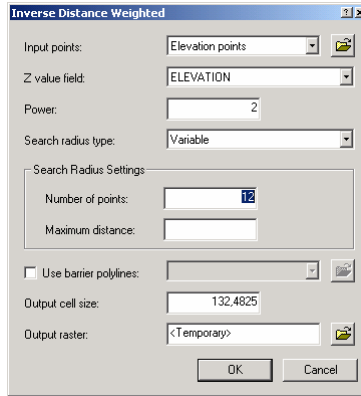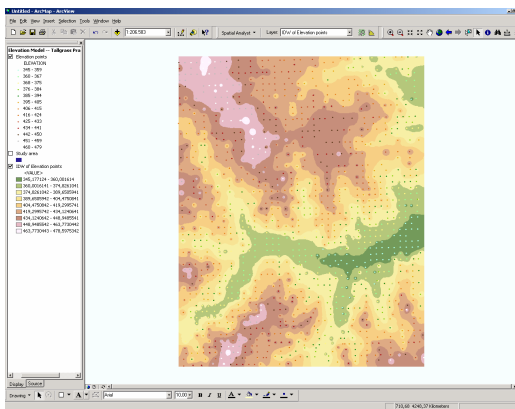
Figure 3 *Default parameters*
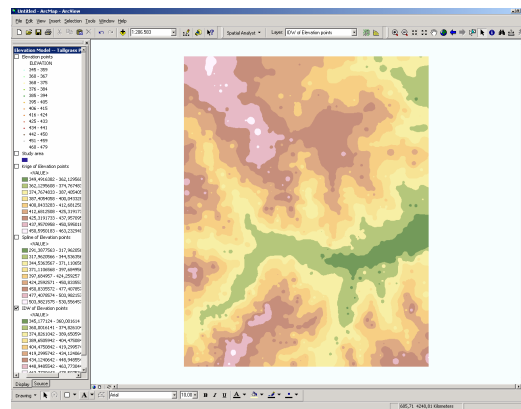

Figure 4 *Resulting image*

Figure 5 *Removed source points*

The considerate reader has to note that Figure 4 as well as Figure 5 cover a rectangular area enclosed by the right-most, top-most, left-most and bottom-most raster data points, plus all borders axis aligned, and therefore slightly differs from the blue object formerly object or layer called *study area*.

An increased quality can be achieved by switching from *Inverse Distance Weighted* to *Spline*. as done in Figure 6 and Figure 7.
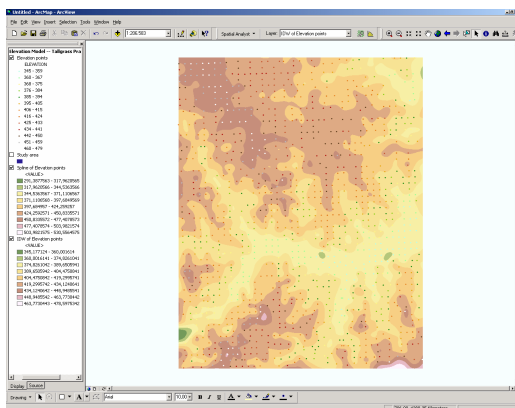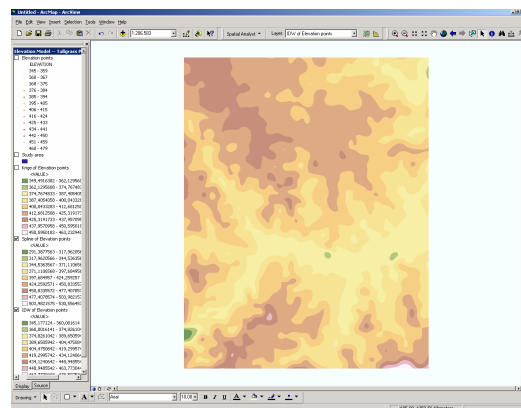

Figure 6 *Spline*

Figure 7 *Without source points*

ArcMap is able of processing the raster data set with the *Krige* algorithm, too. The high randomness does look more natural, though, but cannot convince me as *Spline* does. Nevertheless, here are the results:
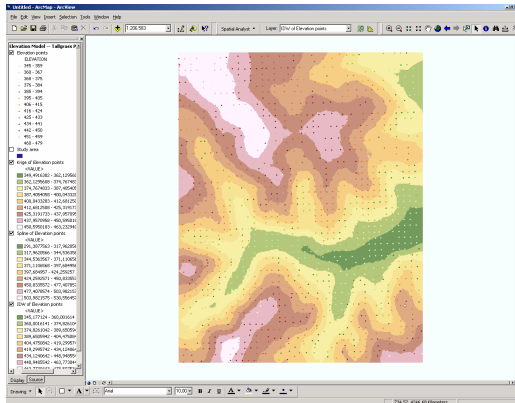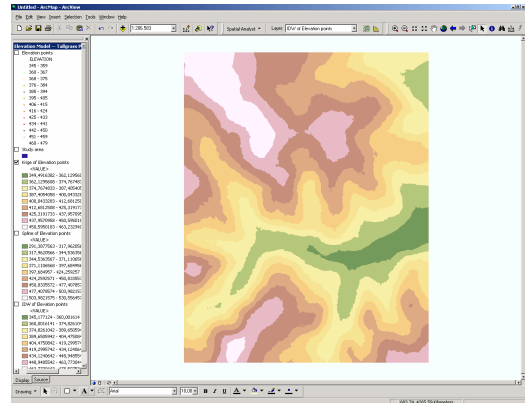

Figure 8   *Kriging*

Figure 9   *Without source points*

When looking at Figure 4, Figure 6 and Figure 8, the source points are visible even at the first glance. It seems I failed to minimize the visual error. The main reason is a difference in the total number of separate intervals assigned to a colour. Furthermore, the colour ramps used do not match exactly; hence, I changed that, too. Last but least, a non-equally distant subdivision better fits the raster's nature (*Classify→Natural breaks*), see

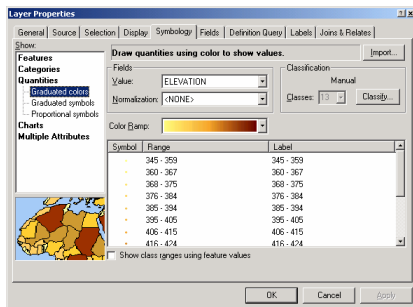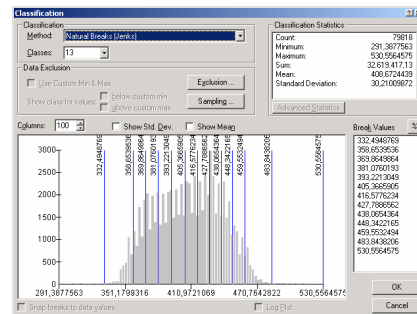**Figure 10**   *New colour ramp*

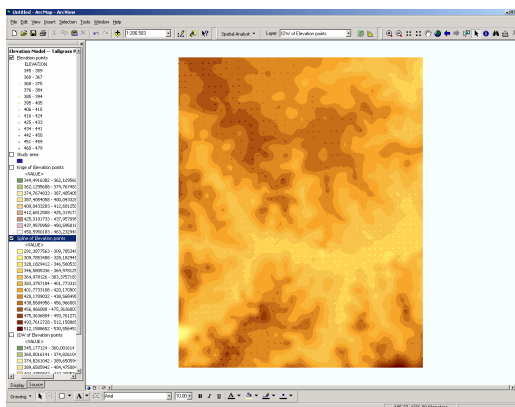**Figure 11**   *Adapting the interval's lengths*

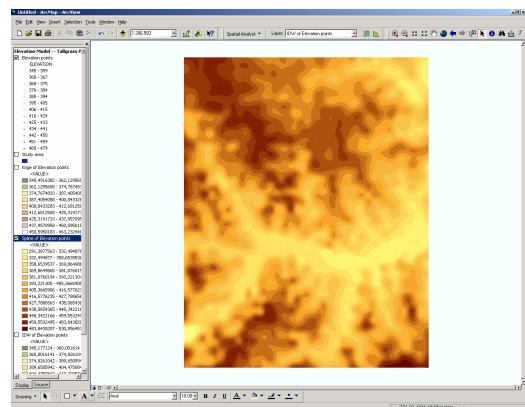

Figure 12   *Colour ramp*

Figure 13   *Natural breaks*

In Figure 13, I can hardly detect the source points. They differ from the generated raster only in small areas, mainly in the upper left and lower right corner.

PROBLEM 2

> **?** *A major American city, Minneapolis, likes to visualize its urban parks and their correlation to the most densely populated areas. There is a huge interest in an image highlighting all regions closer than 1500 meters to a park and populated by more than 2000 p/km². Note: An image resolution of 100m per pixel is requested.*

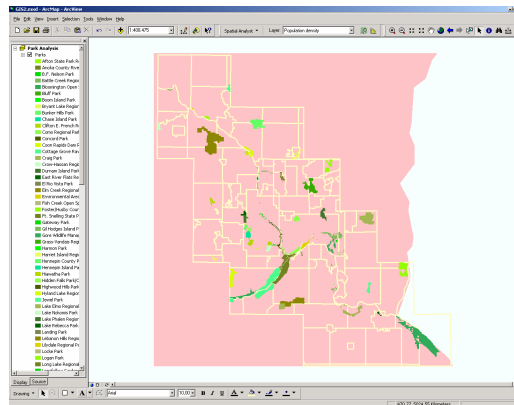After importing the raster, several parks incl. their full names are drawn (Figure 14).

Figure 14 *Initial raster*

I am not interested in such a depth of information. Primarily, all parks ought to be visually generalized to be just "parks". In their *Properties→Symbology* dialog, I switched to *Single Symbol* and selected an appropriate Green.
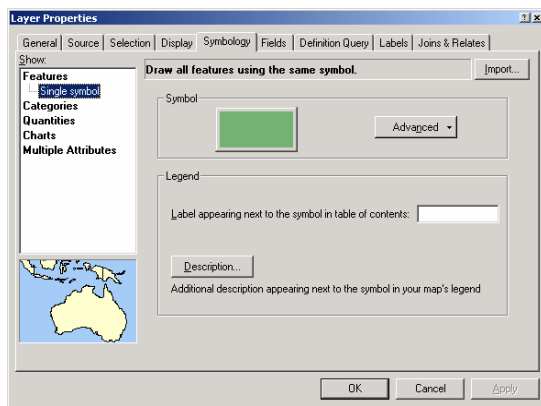

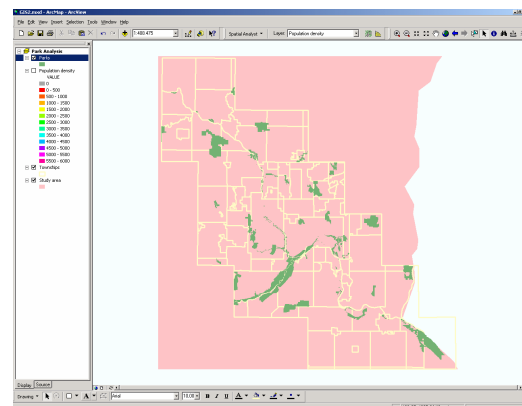**Figure 15** *Reduced dimensionality*

Figure 16 *Just one kind of Green*

In Assignment 1, I set up a buffer to approximate the surrounding area of an object. Unfortunately, the *Buffer Wizard* is not available whilst processing raster data. On the other hand, the Spatial Analyst acts as a proper substitution; its neat *Distance→Straight Line* feature (Figure 17) does just output the desired raster in Figure 18 on the next page:
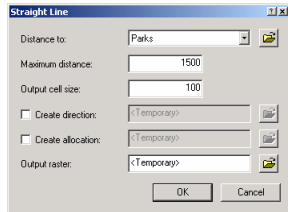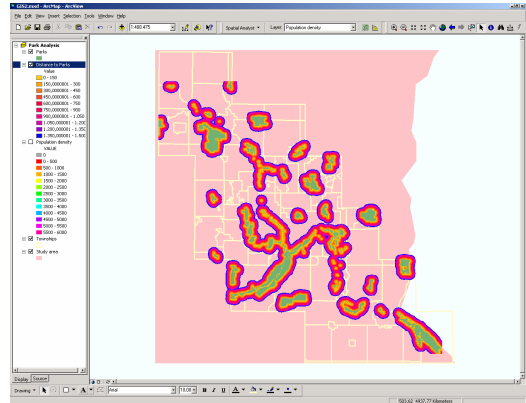
Figure 17 *Parameters*

Figure 18 *A "raster buffer"*

The joint condition "closer than 1500 meters to park" and "at least 2000 people per square kilometre" can be described by a short and obvious equation in the *Raster Calculator* of the Spatial Analyst:

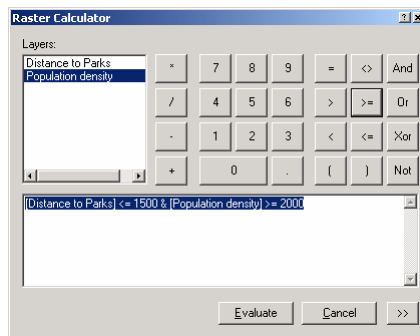**[Distance to Parks] <= 1500 & [Population density] >= 2000**

Figure 19 *Joint condition*

The *Raster Calculator* emits bunches of zeros or ones where zero stands for "condition is not satisfied" coloured Green in Figure 20:
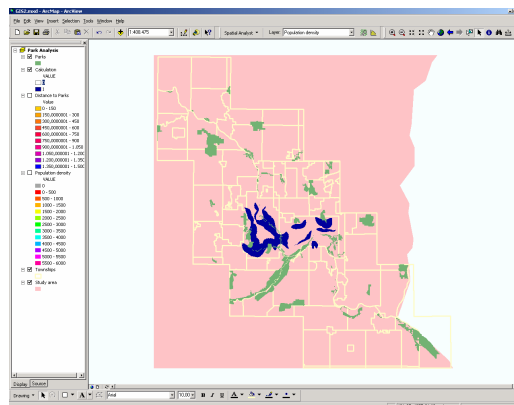

Figure 20 *Result of the Raster Calculator*

I am not satisfied by the visual complexity of Figure 20 – playing around with ArcMap I discovered that a colour may be set to null, i.e. being fully transparent. A double click on the

looked-for colour in the pane on ArcMap's left side of the window lets pop up a window that allows to tick the *Color is Null* check box.
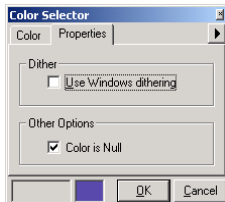

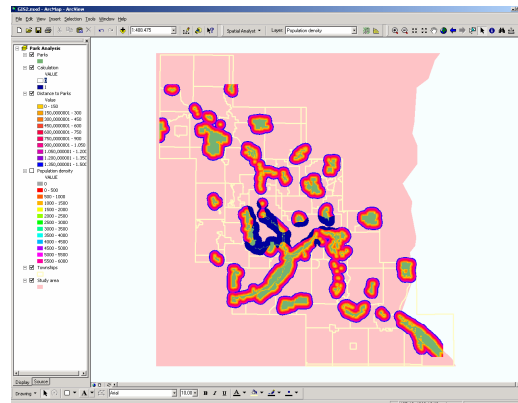**Figure 21** *Properties of a colour*

Figure 22 *Blending park proximity and population density*

Finally, assigning each raster point to its closed park is very easy indeed. The mathematical term "Voronoi diagram" describes what one should expect.

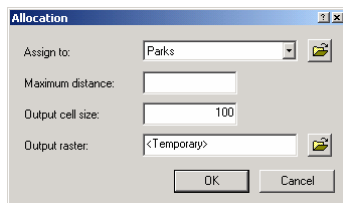The Spatial Analyst's *Distance→Allocation* menu entry is responsible for the dialog in Figure 23:

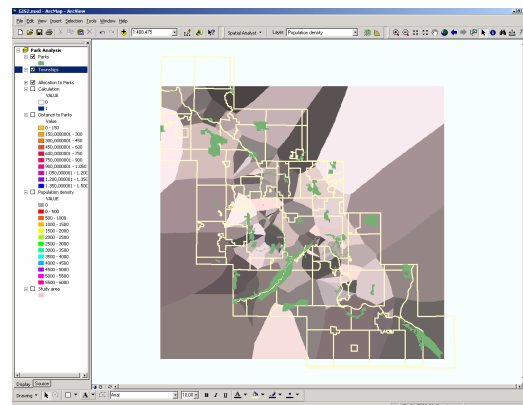

Figure 23 *Assigning parks*

Figure 24 *All Voronoi cells*

Figure 24 is a good example for automatically generated bad visualizations. Although there are not technically reasoned hurdles, Figure 24 does not uncover much of new information to the viewer because it is too complex.