

PROBLEM 1

? As you saw in the last assignment, the ozone concentration in California becomes more and more one of the most important environmental problems. At approximately 200 spots, spread over the whole state, the concentration was measured and is now available to you. A common threshold, which should not be exceeded to avoid serious risk to the human body, is 0.12 ppm. Compute a probability map to reveal areas of dangerous ozone concentrations.

The *Ordinary Kriging* algorithm, part of the *Geostatistical Wizard*, is able to compute such a probability map.

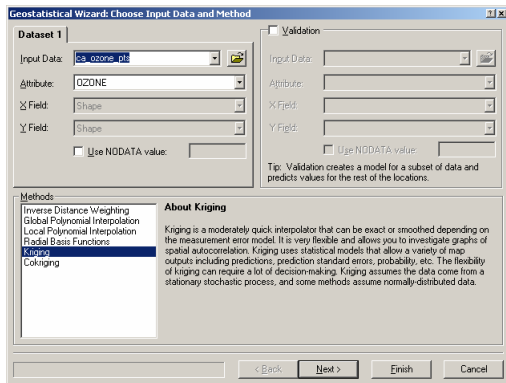


Figure 1 Choose Kriging

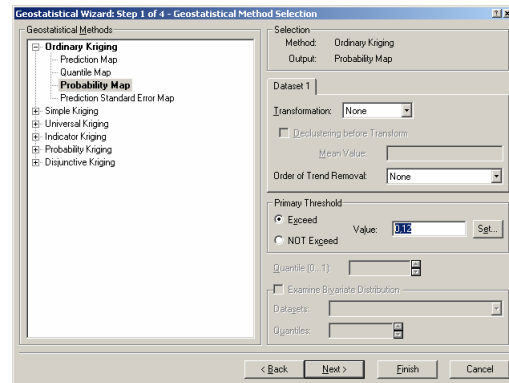


Figure 2 Set threshold to 0.12

Rotating the map by 345° (equals -15°) seems to yield better results since California will be more like a rectangle, which simplifies the computation. Anisotropy should be enabled, too.

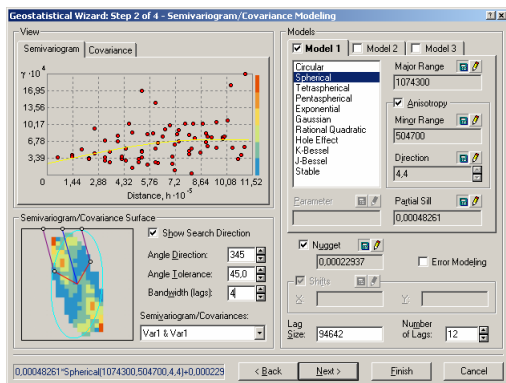


Figure 3 Modify search direction, enable anisotropy

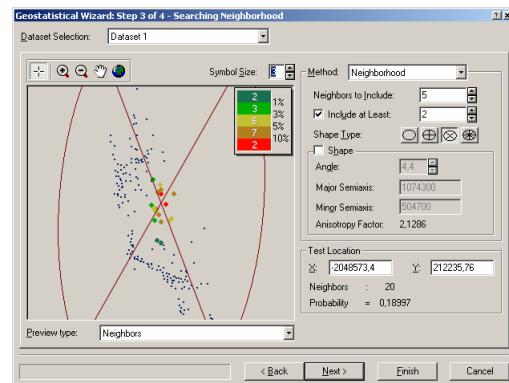


Figure 4 No further changes

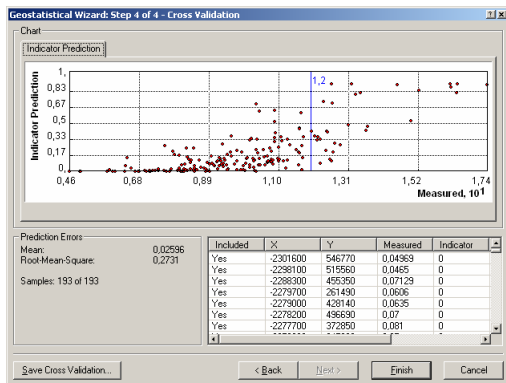


Figure 5 No further changes

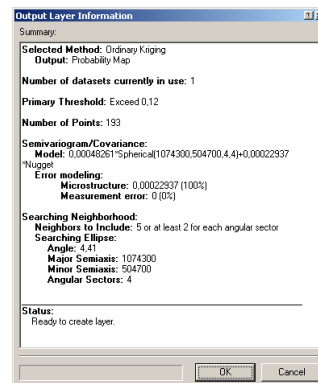


Figure 6 Generated status report

The resulting map shows that some areas reach a probability of up to 80% while the main parts of California are below 30%. I would not dare to live close to Los Angeles now that I know about the ozone concentration down there ...

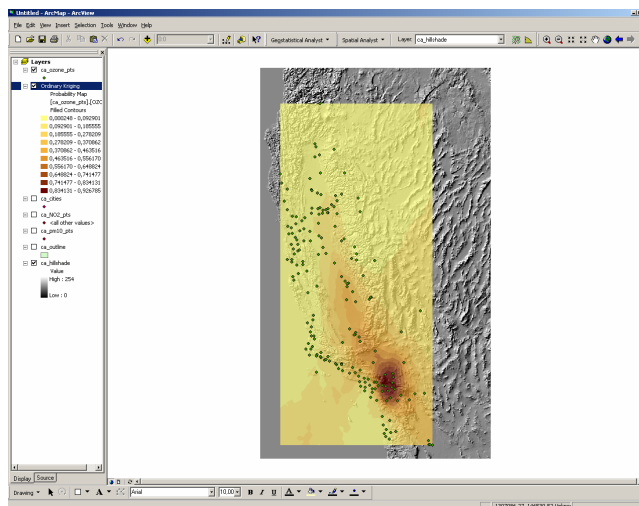


Figure 7 Probability map

PROBLEM 2

? *A farmer likes to seed a new costly plant, which grows only under certain circumstances. Give him a map indicating areas belonging to the so-called “zone 2” that are closer than 200 meters to the next river. Use vector operations to generate the desired map. Now try to solve the same problem with raster operations. Compare the results.*

Vector based buffers can be easily computed via the Buffer Wizard. When the 200 m area buffer has been extracted, a clipping based on zone 2 returns all suitable regions.

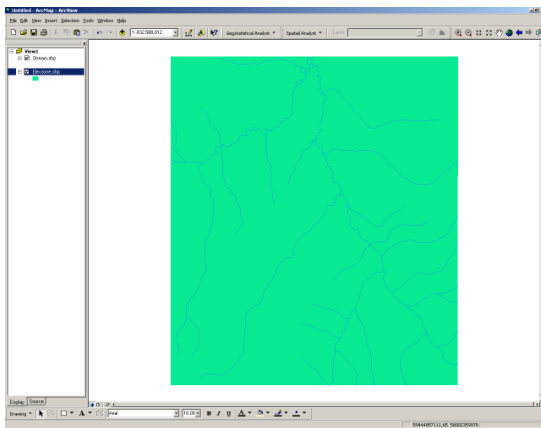


Figure 8 *Input layers*

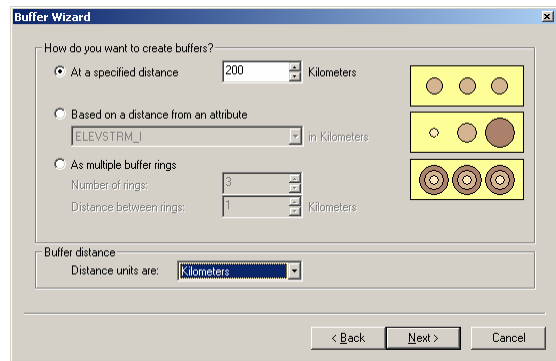


Figure 9 *200 m area*

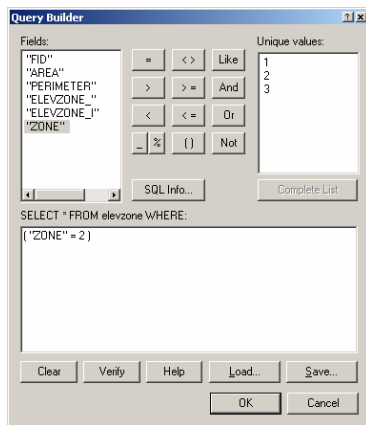


Figure 10 *Query: “zone” = 2*

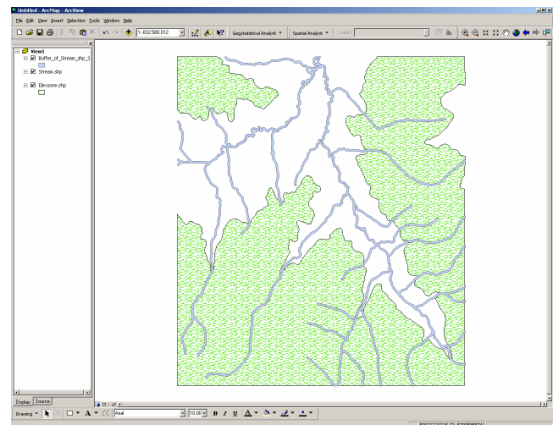


Figure 11 *Zone 2*

Zone 2 has been coloured bright green, the rivers are blue. All suitable regions are dark green. Mr Schwarz admitted a slight error in the original data set causing a weird scaling. In consequence, the suitable area is a bit to slim, it should be about 10 times larger.

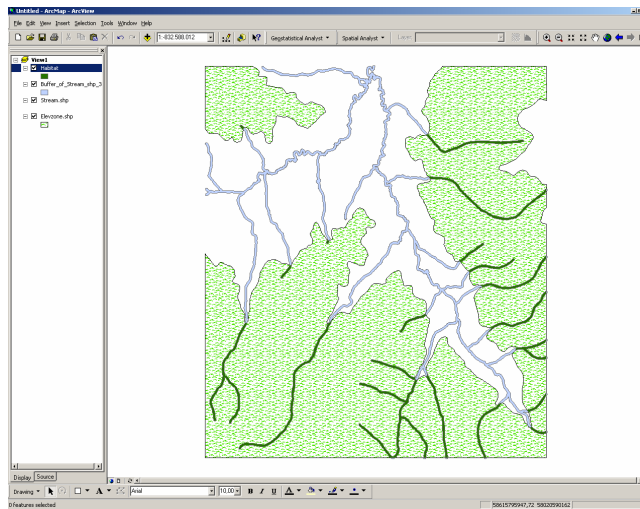


Figure 12 Suitable areas

There are no explicit operations required to prepare the input layers. They can be directly used in the *Raster Calculator*:

$$[\text{Distance to Stream_gd}] < 200 \ \& \ [\text{elevzone_gd}] == 2$$

The Boolean result maps to two colors. I decided to indicate *false* by fully transparent pixels showing the underlying layers and *true* by dark green occluding other layers.

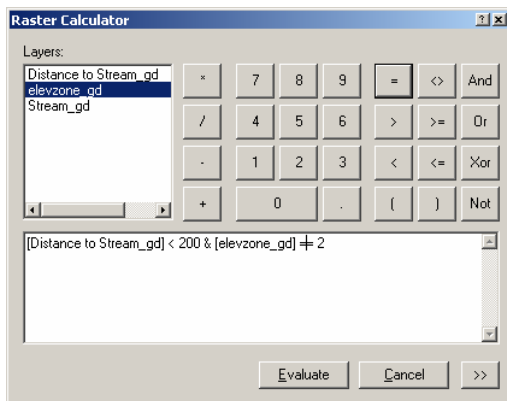


Figure 13 Raster calculator

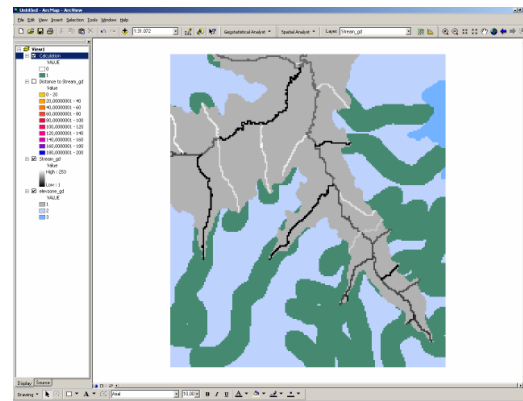


Figure 14 Same as figure 12 (more or less ...)

The main difference between vector and raster calculations is the easiness: raster calculations could be done within a few seconds without expensively preparing the input layers. However, the resulting map was of a bad quality not suitable for print media.

PROBLEM 3

? *Ground-water is the most valuable resource on earth. Humans as well as animals and plants are every day in need of clean water. However, intensive land use influences the quality in a negative way. Scientists developed a “quality index” depending on the land use, the soil and the depth of ground-water. Apply that formula to all non-urban areas of the given scenarios using vector operations and raster operations. When finished, classify all areas into five categories. Compare your results.*

The formula has been kept quite simple:

$$\text{Quality Index} = 3 * \text{Soil Index} + \text{Land Use} + \text{Depth Of Water}$$

I am not sure how these values were measured and what they actually mean (except for the depth of water).

The procedure is very much the same as is problem 2. I will begin with vector operations.

First of all, the three layers have to be combined. I choose the intersect operation, which has to be repeated: ((soil intersect land use) intersect depth of water). Now all needed information is available within a single layer and can be forwarded to the *Field Calculator*.

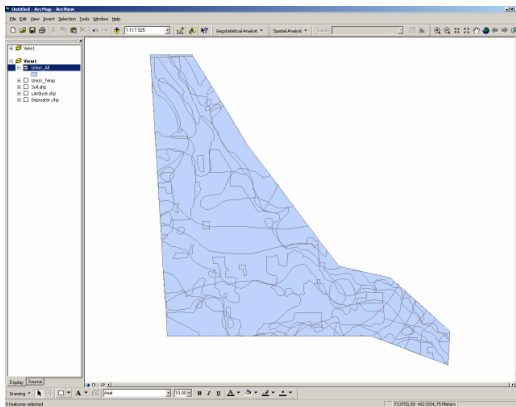


Figure 15 *Input layers*

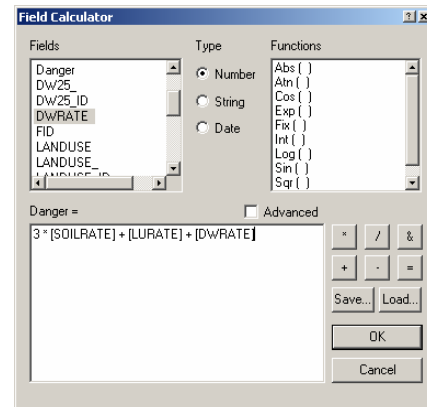


Figure 16 *Field Calculator*

My categories are (chosen arbitrarily):

Category	Quality Index
1	< 150
2	150 – 175
3	175 – 200
4	200 – 225
5	> 225

I moved the layer containing the land use information on top of the Field Calculator’s output and made all regions transparent except for the urban ones. They are responsible for the white “holes” in figure 17 on the next page.

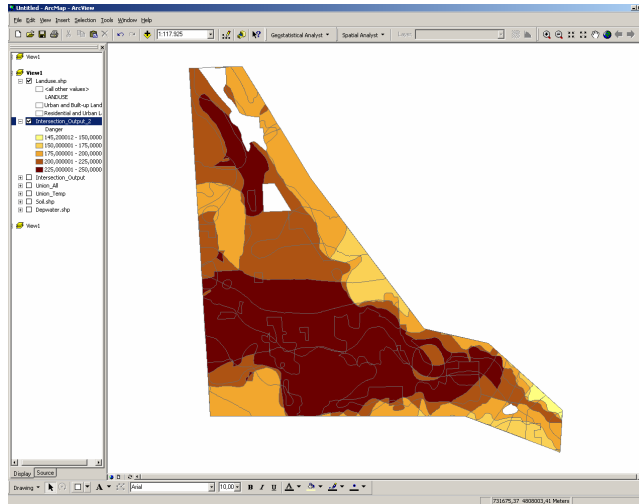


Figure 17 Vector based result

Applying the Raster Calculator does not directly give the raster based result since we have to care for the urban areas as well. Fortunately, the land use index 99 stands for “urban” and this formula works as needed:

$$\text{Quality Index} = (3 * \text{Soil Index} + \text{Land Use} + \text{Depth of Water}) * (\text{Land Use} \neq 99)$$

The right part always evaluates to true or false, i.e. 1 or 0. If Land Use is 99 then false, i.e. 0, gives 0 for the whole equation, too. Hence, an overall Quality Index of 0 should be discarded or drawn white since it stands for urban areas indeed.

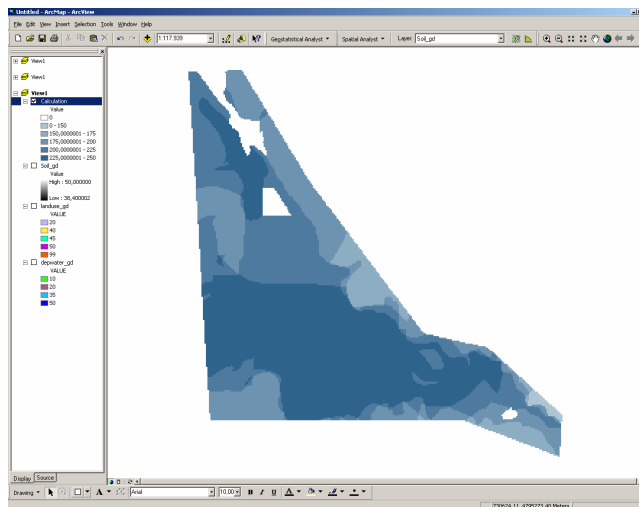


Figure 18 Raster based result

This time, raster operations were not so painless to apply. The quality of the resulting map is still too bad to be used in print media.