

## Create Regions from Points (Voronoi)

While the major strength of *Vertical Mapper* lies in its ability to create a continuous grid from non-continuous data points, not all types of data are best represented as a continuously varying surface. Some types of point data should be mapped as discrete regions within which the values assigned to each point are constant. Point data such as this is referred to as having a natural neighbourhood. Examples include: store locations having natural areas of influence (trade area) as do point observations that record a classified values (i.e. soil type and land use).

In *Vertical Mapper*, natural neighbourhoods are built around data points using Delaunay triangulation. A network of Thiessen polygons is generated from the point locations, creating what is called a Voronoi diagram. As shown below, a Voronoi diagram produced by *Vertical Mapper* is a network of MapInfo regions. Note that any location within a region will always be closer to the enclosed point in that region than to the enclosed point of any other region. The points may represent sites as varied as soil sampling locations or fast food outlets. The common denominator in both lies in the fact that each site exerts a natural area of influence in relation to adjoining sites.

A feature that is unique to *Vertical Mapper* is the passing of all attribute fields from the original point data base to the new region file. Once the natural neighbourhoods have been mapped, it is possible to visually analyze and compare any column of information attached to the region table using the MapInfo thematic mapping tools.

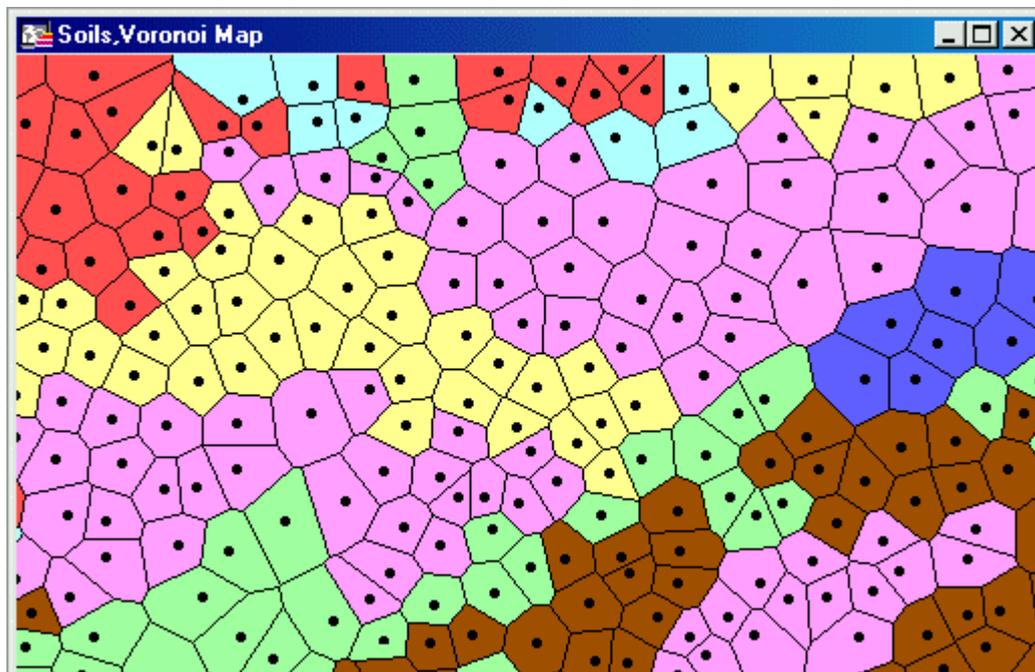


Figure 13.1. Voronoi diagram showing the natural neighbourhoods of a series of point observations. One of the columns of data passed to the region table has been thematically mapped.

The same natural neighbourhood relationships that are used to examine the distribution and proximity of point occurrences over space can also be applied to quantify point density. Of common concern through a wide range of disciplines is the examination of the spatial occurrence of certain phenomena. Examples which reflect the extensive range of studies covering such phenomena include the location of

artifacts over a site (archaeology), nest sites of bird species in a habitat (ecology), towns in a state (geography), or seismic events over a continent (geology). Point distribution over space can be observed qualitatively simply by plotting the data on a map. However, producing a quantitative map of the distribution requires some analysis of the relative proximity of the points in relation to one another.

Computing a natural neighbourhood (Voronoi) diagram for all points yields an excellent measure of point density. By calculating the area of the Thiessen polygon encompassing each point, attaching that area as an attribute to the point, and generating a grid of the new point file through interpolation, a representative density surface grid can be produced. This routine has been automated in *Vertical Mapper* and represents a powerful tool using natural neighbourhood analysis.

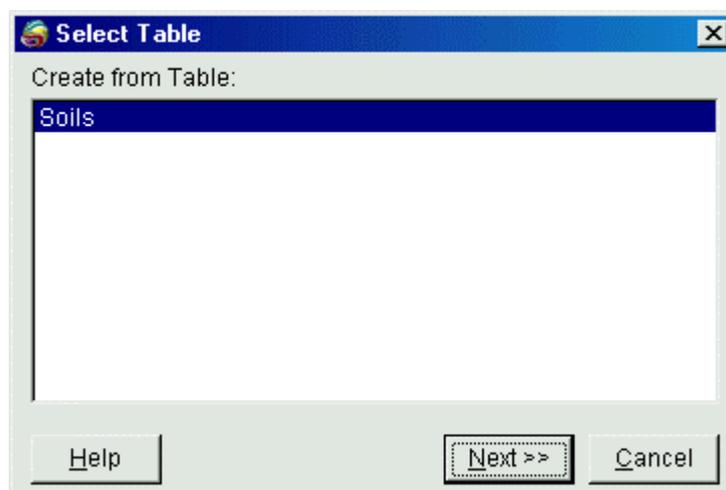
The following sections describe the two main procedures in *Vertical Mapper* that make use of Natural Neighbourhood relationships: building Voronoi diagrams from point tables and calculating point density.

For an instructional lesson on *Natural Neighbourhood Analysis* refer to Lesson 10 of the *Installation and Tutorials* manual.

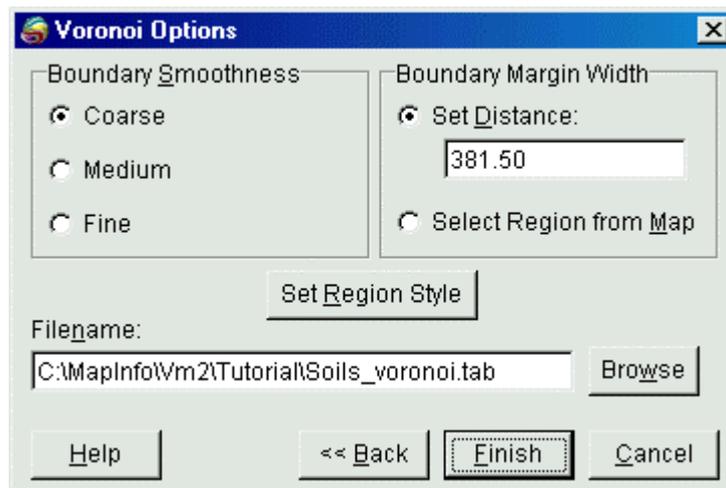
Using this technique, one region is generated around each individual data point. The resulting network of regions is often referred to as a Voronoi diagram.

**Note:** Points must first be created in the table using the MapInfo command *Table > Create Points*.

- From the *Vertical Mapper* pull-down menu, select the command *Natural Neighbour Analysis > Create Regions From Points (Voronoi)*.



- From the **Select Table** dialogue box, select a table of points from the list provided. Note that the procedure will pass all data fields present in the point table to the new Voronoi region table.
- The **Voronoi Options** dialogue box provides settings that control the manner in which the Voronoi diagram is created. The most critical area of the Voronoi diagram is the outer margin where no points are present to control the formation of the outermost polygons.



- 1 The **Boundary Margin Width** setting (in map units) controls the distance of the outermost polygon edge from the outer points. Since no points are present beyond the margin to control polygon creation, this setting restricts the construction of polygon sides to a fixed distance from each outermost point (refer to the diagram below). A pre-defined MapInfo region can also be used as the Voronoi boundary by checking the **Select Region From Map** check box. When checked, the user will be prompted to pick a region from a Map window.
- 2 The **Boundary Smoothness** setting determines the number of line segments that are used to construct the corners of the outer hull of the diagram. The finer the setting, the smoother the corners.
- 3 **Set Region Style** is used to customize the fill and line style pattern of the Voronoi diagram.

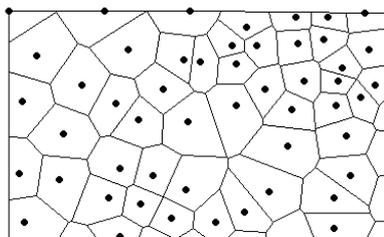


Figure 13.2. In this Voronoi diagram, the **Boundary Margin Width** setting is very small (1). Therefore polygons are effectively cut off at the outermost limit of the point file.

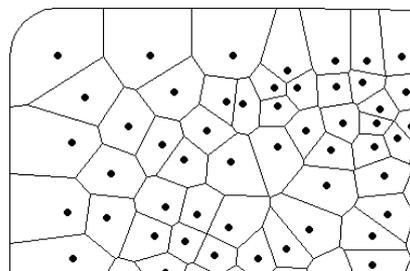


Figure 13.3. For the same data, the **Boundary Margin Width** has been set to 1000 resulting in the construction of outer polygon edges 1000 metres away from the outermost points. Note that the rounded corners of the outer boundary are controlled by the smoothness setting.

- Once this dialogue has been completed, choose the ***Finish*** button. The Voronoi regions table will be opened into a new MapInfo Map window.

**Note:** Before running to completion, the point table is checked to ensure that no coincident points are present. If coincident points are found, an error message will appear warning you that the input table contains coincident points. The you may either edit the table or use data aggregation tools to fix this problem. The extended error code contains the row ID of the first coincident point found.