LESSON 1 – Starting TerraView

This lesson introduces TerraView software, presenting its main interface and usages. TerraView executable, this document and the data files required to follow the tutorial lessons can be downloaded from TerraView web site at http://www.dpi.inpe.br/terraview.

TerraView is a viewer of geographical data stored in a TerraLib database. In addition to visualization tools, TerraView provides a set of analysis tools. Figure 1.1 shows the different parts of TerraView main interface.
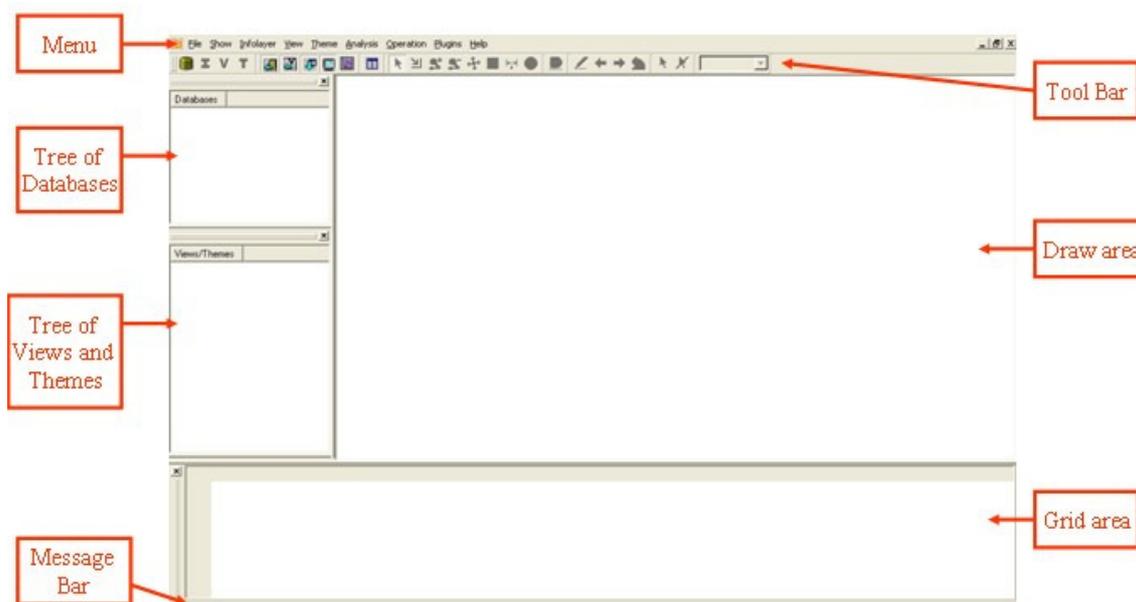

Figure 1.1 – Main Interface.

As can be seen in Figure 1.1, TerraView main interface consists of 7 components that will be described as the reader is guided through a set of examples and exercises. Theses examples and exercises are designed to provide to the user a comprehension of the main concepts of TerraView.

1.1 Database

TerraView creates and handles geographical databases in a DBMS – Database Management System, such as MySQL or PostgreSQL. Data is stored according to the data model proposed by TerraLib, a library of functions that supports TerraView. A TerraLib/TerraView database can store both vector and raster data.

Each session of TerraView allows the manipulation of one database. Therefore, the first operation when starting TerraView is to create a new database or to connect to an existing one.

1.1.1 Creating a New Database

In order to create a new database, you activate the **Database** user interface through the shortcut icon [icon] in the toolbar or through the **File → Open Database...** menu (see Figure 1.2).
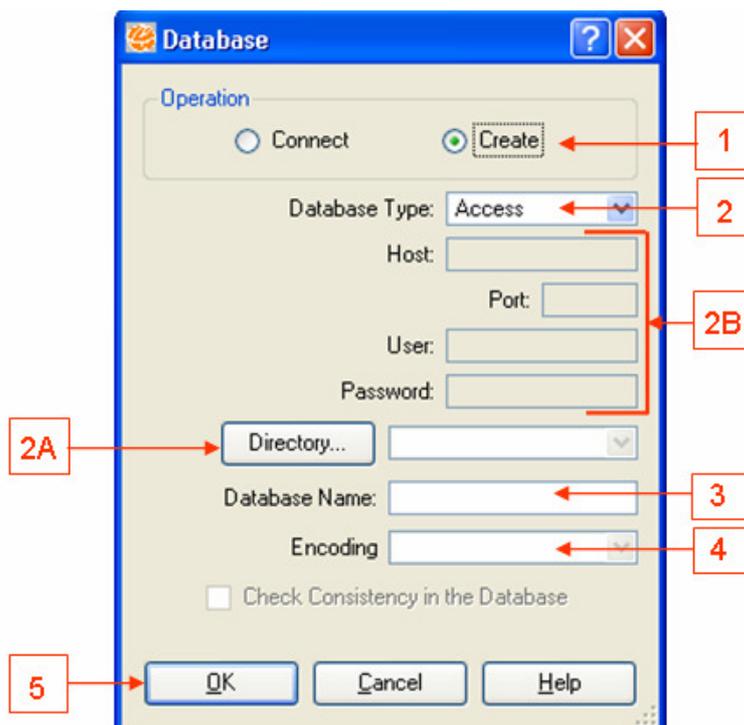

Figure 1.2 – Database User Interface (Create).

To create a new database, follow these steps:

1. Select **Create** option in **Operation** frame.

2. Select the DBMS in **Database Type** list. Observe that this interface changes based on the chosen DBMS:

   a. If you want to use Access DBMS, click on the **Directory...** button to indicate where the new database will be stored.

   b. If you want to use another DBMS with client-server architecture, it is necessary to inform where the server is located (**Host** and **Port**) and who the user is (**User** and **Password**).

3. Choose a name for the new database and type it in the **Database Name** field. In this tutorial, we will use ACCESS and will create a new database named *Tutorial*, but it can be replicated in any of the DBMS currently supported by TerraView.

4. **Encoding**: when this field is enabled, you may want to provide the new database character encoding (e.g. latin1, UTF8), if the default encoding is not desired. When you do not fill this field, the default encoding will be used. This field is enabled when creating the database and using a few database managers, e.g. PostgreSQL and PostGIS.

5. Click on **OK** button.

Creating a database means that a set of tables and their relationship are created. Those tables and relationships will be later used by TerraView. After creating a database, TerraView automatically connects to it.

1.1.2 Connecting to a Database

In order to connect to, or open, a database that has been already created, you should activate **Database** interface through the shortcut icon [icon] in the toolbar or through the **File → Open Database...** menu. The interface shown in Figure 1.3 will be displayed.
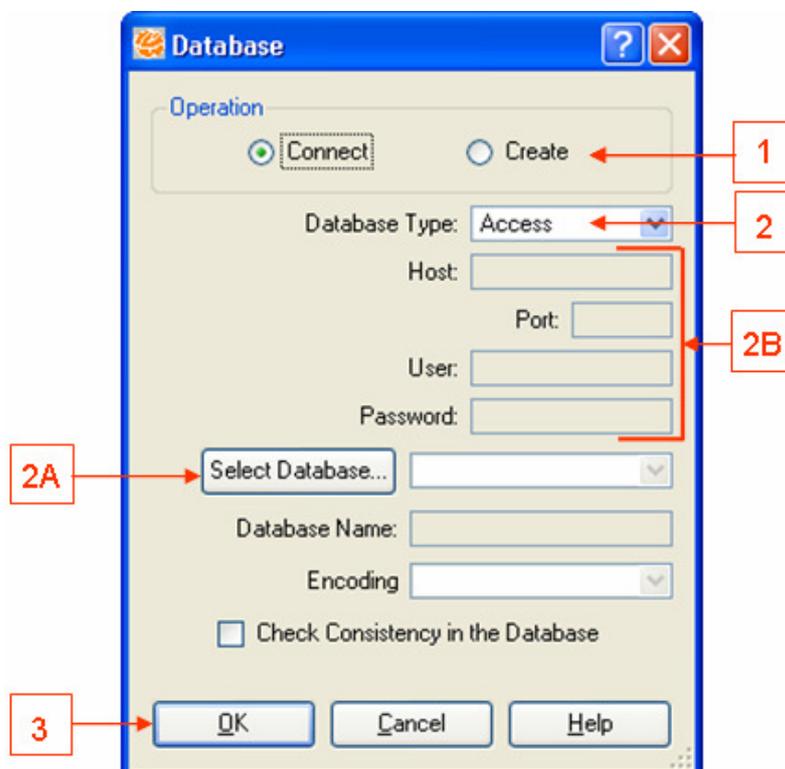

Figure 1.3 – Database User Interface (Connect).

To connect to an existing database, follow these steps:

1. Select **Connect** option in **Operation** frame**.**

2. Select a DBMS in **Database Type** list. Observe that this interface changes based on the chosen DBMS:

   a. If you use Access DBMS, search and select the database through the **Select Database** button. In this case, the selected database is a file with ".mdb" extension, and its name will be written in the **Database Name** field.

   b. If you use another DBMS with client-server architecture, it is necessary to inform where the server is (**Host** and **Port**) and who the user is (**User** and **Password**). After that, click **Select Database** button, and the list of available TerraLib databases in the server is displayed. Select a database in that list, and its name will be written in the **Database Name** field.

3. Click on **OK** button.

Once a database is connected, it is ready to be populated and/or manipulated by TerraView.

1.2 Importing Vector Data

This section describes TerraView importing procedures for vector data files in different formats. Usually an importing operation will create a new information layer (or simply layer) in a TerraLib database.

1.2.1 MID/MIF Format

The Districts.mif and Districts.mid files contain the data related to the districts of São Paulo city, including their boundaries and descriptive attributes. The ".mif" and ".mid" files are MAPInfo software interchange format.

To import this data you activate **Import** interface through the shortcut icon ![I] in the toolbar or through **File→Import Data** menu (see Figure 1.4).
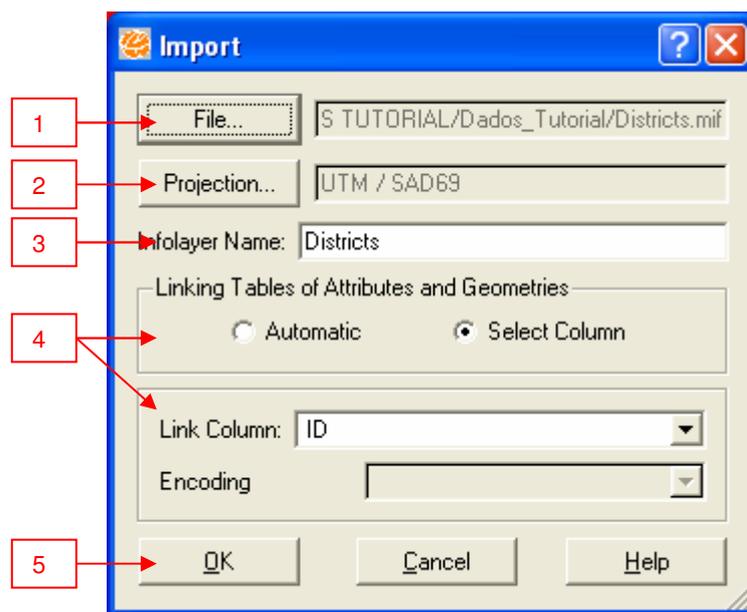
Figure 1.4 – Import Interface.

In this interface, follow these steps:

1. Click **File** button to select the file. Change file type filter to MID/MIF files (see Figure 1.5), select <u>Districts.mif</u> file, and click **Open**.
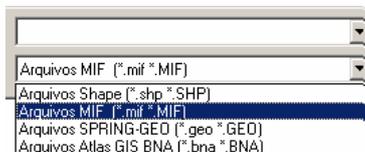

Figure 1.5 – File Types Filter.

2. Observe that the interface recognizes the data projection since MID/MIF format contains this information.

3. If you want, change the recommended name of the layer that will be created in **Infolayer Name** text field.

4. Choose how descriptive attributes of the districts (in MID file) and their geometries (in MIF file) should be linked. **Linking Attributes Table and Geometries** frame presents two linking options:

   a. **Automatic** option indicates that TerraView will automatically create a unique identity number for each district. This will be done considering the district order within MID/MIF file. For instance, the first object will receive the identity 1, the second, identity 2, and so on. This identity will be shown in TerraView as a new attribute of the districts.

b. **Link Column** option allows you to choose one of the existing attributes (or columns) in the MID file to be used to identify a district. If you choose this option, you must be sure that the chosen column does not contain repeated values. In this case, choose the second option and the column ID.

5. Click **OK**. The interface asks you to confirm the choice of step 4.

NOTE: The **Encoding** option may be used when import data use a character encoding which is incompatible with the database character encoding. This occurs, for example, with Latin1 and UTF-8 encodings. In general, it may be ignored. See more information in the corresponding interface help.

Now a new layer appears in the **Layers Tree**, as shown in Figure 1.6.

Figure 1.6 – Layers Tree.

In order to display or manipulate a layer in TerraView, you must have a Theme built from the layer in a View (Theme and View concepts will be explained further later). The importing procedures can create Theme and View automatically by answering **Yes** to the question shown in Figure 1.7.
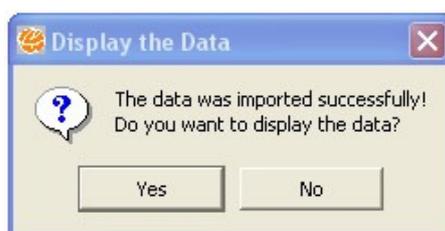

Figure 1.7 – Confirm Automatic Display Interface.

Check **Views Tree** and **Themes Tree** and observe that a View and a Theme have been created. Districts boundaries are displayed in **Draw Area** and their attributes are shown in **Grid Area** (see Figure 1.8).
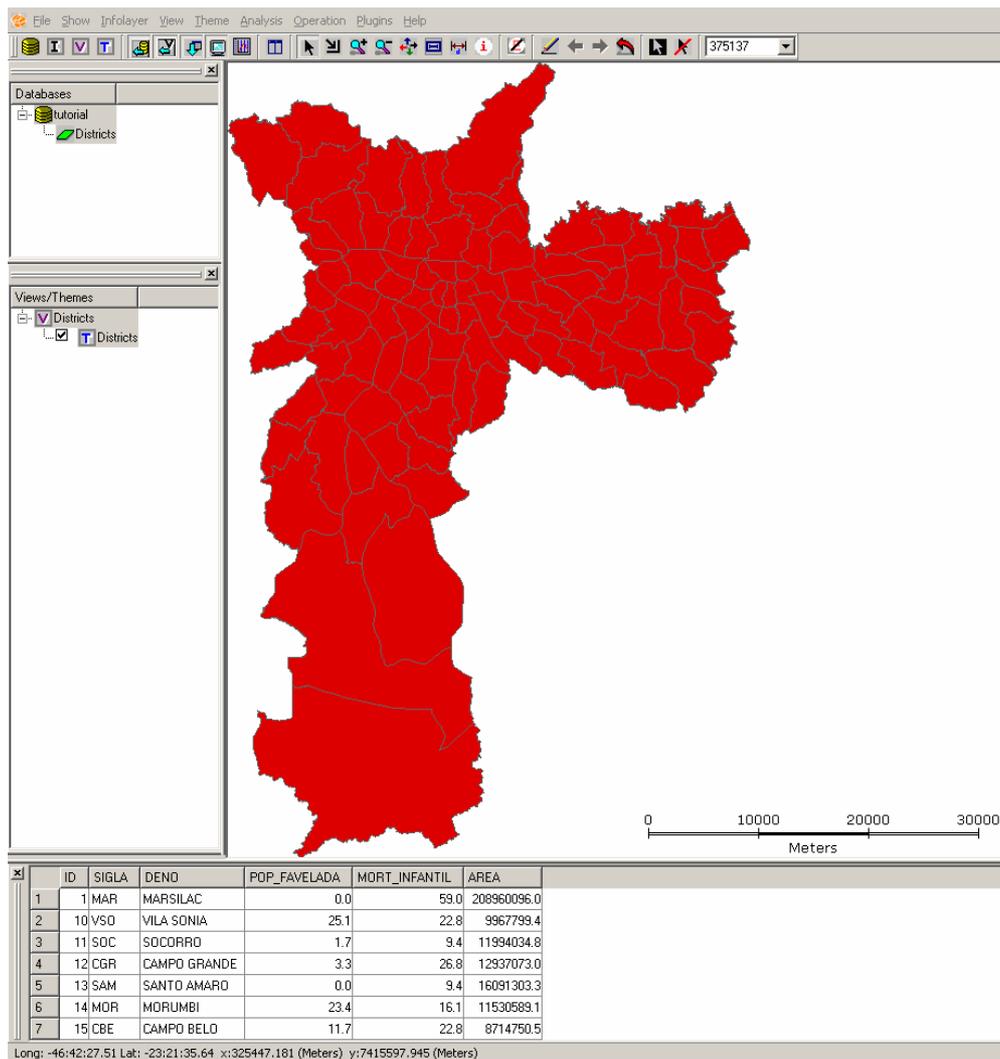
Figure 1.8 – Result of Importing a MID/MIF File.

1.2.2 Shapefile Format

Now, you are going to import a second set of files that represent the subway system in São Paulo city. This set is known as Shapefile, an interchange format for ESRI products. The format consists of three separated files: "subway_stations.shp", "subway_stations.dbf" and "subway_stations.shx". In order to import these files, follow the steps described in the previous section (do not forget to change the files type filter in step 1). After that, the **Import** interface should be presented as shown in Figure 1.9.
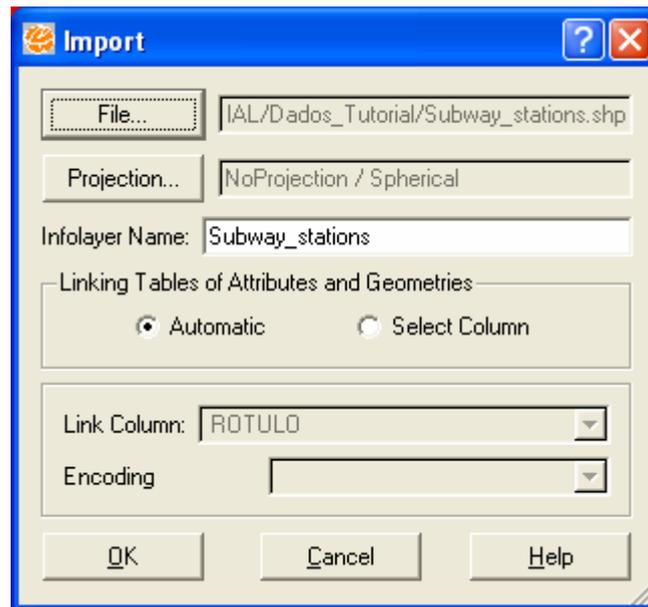
Figure 1.9 –Import Interface for the Subway system.

Optionally, shapefile format can also have a .prj file that describes data projection. When this file exists, TerraView reads it and attempts to decode the projection description. In cases when TerraView does not succeed the interface will indicate that the projection wasn't recognized.

Notice that the projection description for this data indicates "NoProjection/Spherical", which means that no Projection and Datum information could be retrieved from the data file. Therefore, no geographical location can be associated to this data. If you know the data projection you can inform it before starting the import by clicking the **Projection…** button and setting the **Projection** parameters shown in Figure 1.10.
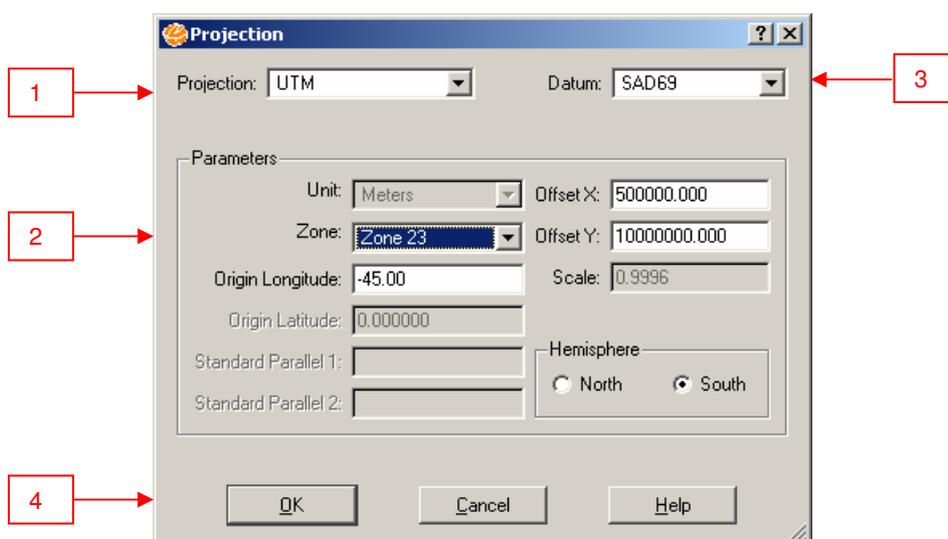

Figure 1.10 – Interface to define projections.

In this interface, set the parameters following the steps:

1. Select one of the available projections in the **Projection** list. In this case choose UTM projection.

2. Observe that only the fields that describe the parameters that should be informed for the chosen projection are enabled in the interface. In this case, choose **Zone** 23 and observe that the origin longitude is automatically displayed. **Offset X** and **Offset Y** fields are automatically filled with values associated to this default south hemisphere, which are 500000 and 10000000, respectively.

3. Select one of the available Datum in the **Datum** list. In this case, datum is SAD69 (South American 1969)

4. Click **OK**.

Finish the import as in the previous example using the column *ROTULO* to identify the objects. Now, answer **No** to the automatic display question (see Figure 1.7), and notice that a new layer was created in **Layers Tree** (Figure 1.11), but data about the subway system was not automatically displayed.
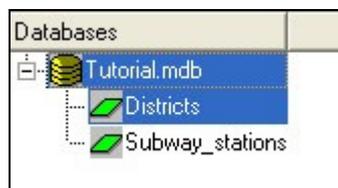

Figure 1.11 – Layers Tree with new layer.

Note: For a shapefile, it is possible to import more than one file in one operation. In order to execute it, just choose the files to import in the file selection interface (activated through **File...** button in Figure 1.9) using **Ctrl** key while pointing files with the mouse. In this case, the **automatic** option (detailed in step 4 of item 1.2.1) will be used to link attributes table and geometries for all resulting layers.

1.2.3 Tab/Geo Format

Now you are going to import a third set of files that represents some of the railway system of São Paulo city. This file is in Geo/Tab format, an interchange file format of SPRING software. This format is composed by two files: "railways_stations.geo" and "railways_stations.tab". Follow the steps described in the section 1.2.1 and do not

forget to change the filter of file types to show extensions ".geo". This format also does not contain information about the data projection, but you can manually inform it as shown in section 1.2.2. In this case, inform the projection for this data: projection UTM Zone 23, and Datum SAD69.

Again, answer **No** to automatic display question (see Figure 1.6) and observe the new layer in **Layers Tree** (Figure 1.12).
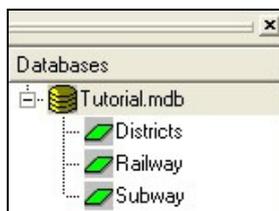

Figure 1.12 – Layers Tree.

Import of geographical data represented as raster data will be explained in Lesson 5. The next section presents some visualization operations and tools using the data imported in previous sections.

1.3 ToolBar Icons

The main functionalities related to data visualization can be accessed through the icons in the **ToolBar** shown in Figure 1.13. When the mouse moves over an icon, TerraView shows a tooltip for the operation it executes. The operations are executed on the active View and its themes, and some are related to the concepts of Active Theme and Visible Themes which are explained later.

Figure 1.13 – TerraView ToolBar.

Some of the functionalities available through the toolbar are:

- ✍: **Draws** the visible themes of the active View. This icon is only enabled when there is an active View and, at least a visible Theme in this View. Click on a View name to turn it into an active one. Click on the box next to a Theme name to turn it into a visible one.

- ▶: Activates cursor mode **Pointer** (its usage will be explained later).

- ↘: Activates cursor mode **Zoom**. This cursor allows you to select a region of the draw area to be zoomed. Click a point on the draw area, keep the button

pressed down, and move the mouse to select the region to be zoomed. Release the button and the area will be redrawn.

- Executes **Zoom In** operation. It magnifies the drawing based on a clicked point (that will be centralized) and an increase factor defined by the user. A default increase factor is provided, but if you want to change it, right click on **Draw Area** and choose one of the available values, as shown in Figure 1.14.

Figure 1.14 – Increase or Decrease Zoom Factor.

- : Executes **Zoom Out** operation. This operation is the opposite of **Zoom In** and reduces the draw area.

- : Activates cursor mode **Pan**. With this cursor you can move the data on the **Draw Area**. Click on a point on the Draw Area, keep the button pressed down, move the drawing to a new position, and release the button.

- and : Execute **Previous Visualization** and **Next Visualization operations**, respectively.

- : Executes **Reset** operation. This operation adjusts the draw area to show the visible data in its entire extension.

- : Activates cursor mode **Distance**. This cursor is responsible for calculating the distance between two points on the **Draw Area**. Click on an initial point P1, keep the button pressed down, and drag it to another point P2. This cursor draws a circle in the **Draw Area** and shows the distance between P1 and P2 in the Message Bar. This distance is calculated considering the current view projection unit.

- : Hides/shows **Database Tree** box.

- : Hides/shows **Views and Tree Themes** box.

- : Hides/shows **Grid Area**.

- : Hides/shows **Draw Area**.

- : Hides/shows **Graphic Display Area**.

1.4 Selecting Objects

Each geographical object of a Theme is composed by geometries and descriptive attributes. The geometries are shown in the **Draw Area** and the attributes are shown in the **Grid Area**. In order to examine the link between geometries and attributes of objects, follow the steps below:

1. Activate **Pointer Cursor** and click on an object on the Draw Area. Notice that the geometry of the selected object is highlighted by changing its color in the Draw Area and its attributes are highlighted in the Grid Area with the same color. By default, TerraView moves the geometry of the pointed object to the center of the Draw Area. To change this behavior, unselect the option **Centralize the Drawing of the Select Objects** on the menu displayed when right-clicking on the Draw Area.

2. Clicking on a row of the Grid Area highlights the geometries associated to this object in the Draw Area.

3. Activate **Information Cursor** and click on an object on the Draw Area. The descriptive attributes of this object are presented in another interface, as shown in Figure 1.15.
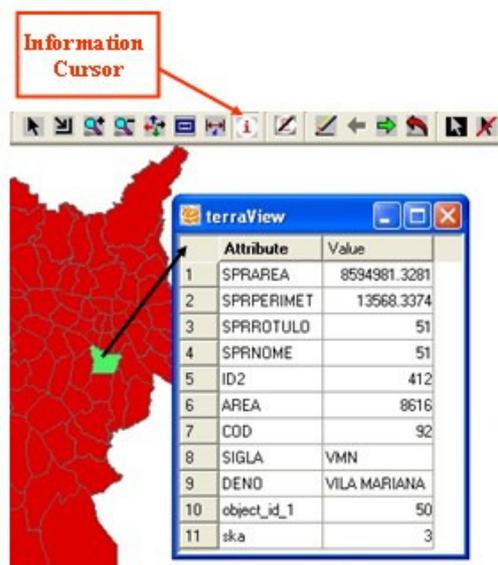

Figure 1.15 – Information Cursor.

4. Activate **Graphic Cursor**. Observe that this cursor is a rectangle, allowing you to select all objects that intersect this rectangle (Figure 1.16).
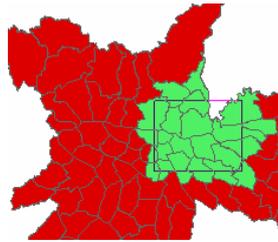
Figure 1.16 – Selecting Objects using the Graphic Cursor.

In order to change the cursor size, keep **Alt** key pressed down and move the mouse until the desired size is created.

To change the cursor shape from rectangle to ellipse, right click on the Draw Area and choose in **Spatial Cursor Type → Ellipse**. To change the spatial operation of this cursor, right click on the Draw Area and choose one of the spatial operations in **Spatial Operation**.

To remove the highlight or selection of an object, click on one of its geometries or attributes. To remove the selection of all objects, click on **Unselect Objects** icon . **Invert Selection** icon reverses pointed objects and non pointed objects, as shown Figure 1.17.
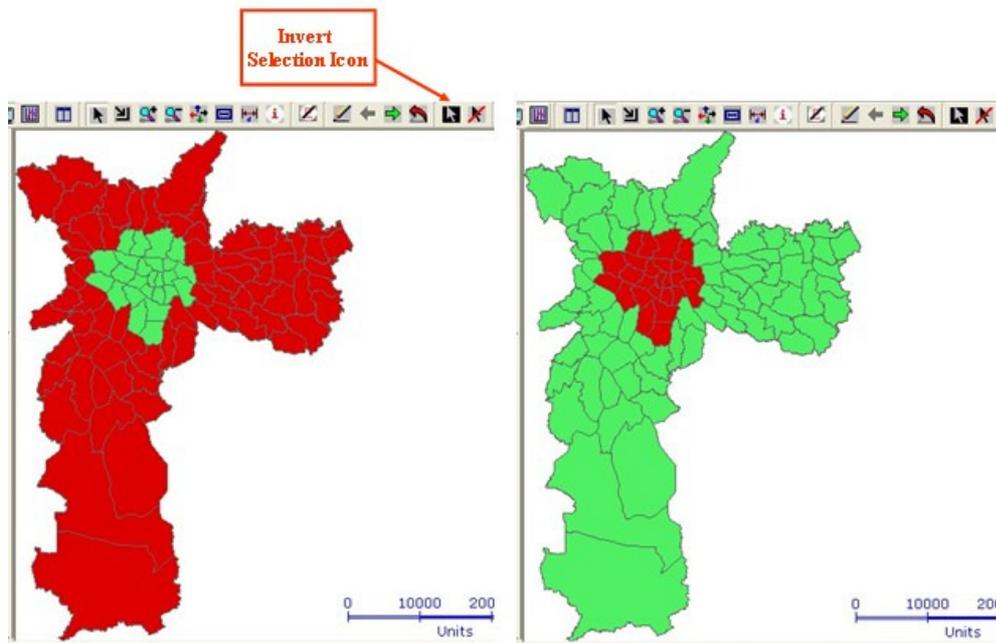

Figure 1.17 – Invert Selection Icon.

1.5 Exiting from TerraView

In order to exit from TerraView, select **File → Exit** menu. Everything that you have created (Layers, Views and Themes) and done (Selection) is saved in the database. It is not necessary to save explicitly before exiting from TerraView.