SmallMap Manual

1. General information

SmallMAP is a tool for creating vector maps based on raster backgrounds, and processing spatial information. The application is based on the Firebird 3.0 relational database. It allows you to collect and process raster data and vector layers. Currently, the program works with spatial data in WGS84 system and Web Mercator projection. It operates in two modes: viewing and editing of objects. The default unit of the program is one meter.

2. Raster data

The program does not create new rasters, but you can add/import them via the *Layers-> Add Raster Layer* menu or the button in the docked *Layers* window. So you can add an existing raster from the database, i. e. previously imported rasters (Fig. 1), combine existing rasters (*Merge rasters*) or import them from a (Geo)TIFF file, provided that it refers to the WGS84 ellipsoid.

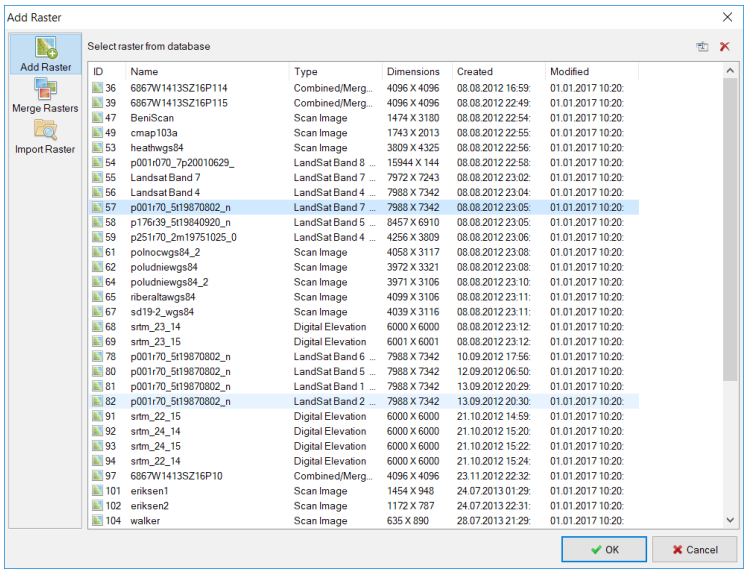


Fig. 1. *Add Raster* dialog window. Adding a raster layer from the database.

The *Add Raster* dialog window also allows you to remove rasters from the database (button) and change the name of a given raster layer (button). The *Merge Rasters* option has four filters defined: *Near Infrared, True-Color, Shortwave Infrared 1 and 2*, which are used to combine images from the respective LandSat image ranges. If the option of raster import has

been selected, the program will load the source file and then you need to specify the raster type by selecting it from the list of all defined types (Fig. 2). *Name* and *Description* fields have only informative significance to the user.

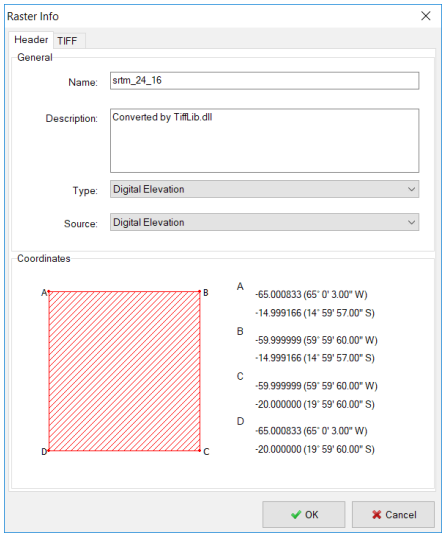


Fig. 2. *Raster Info* dialog window. Raster data import.

After loading into the program, raster files are positioned, and 8-bit and 16-bit rasters are displayed in gray scale, by default.

3. Vector data

Creating new vector layers and opening the existing ones is enabled by the *Layers-> Add Vector Layer* menu (or button), which launches the *Add Vectors* dialog with three tabs (buttons): *New Vectors*, *Add Vectors*, and *Import Vectors* (Fig. 3).

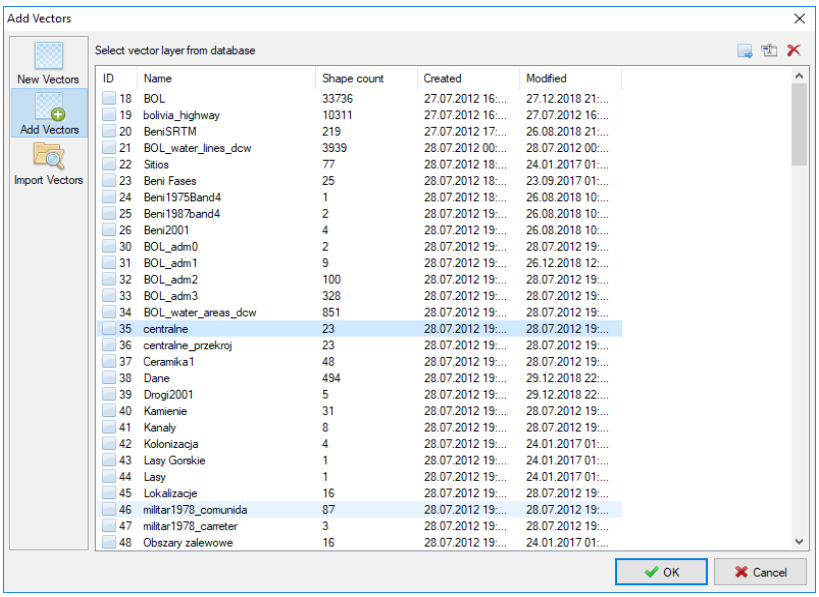


Fig. 3. *Add Vectors* dialog window. Adding a vector layer from the database.

The program allows you to import vector data from SHP files and GPX files (from GPS) - after pressing the *Import Vectors* button. Because SHP files do not contain information about colors and formatting shapes, when importing these files, the program displays a window with a selection of the necessary data (Fig. 4).

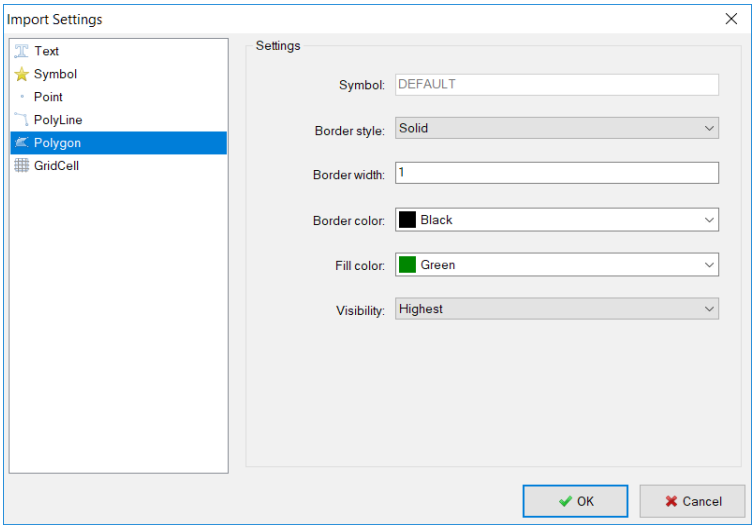


Fig. 4. Dialog window for formatting imported data from SHP files.

The program supports the following vector shapes: symbols, points, polylines, polygons, text labels and grid cells.

4. Preview mode

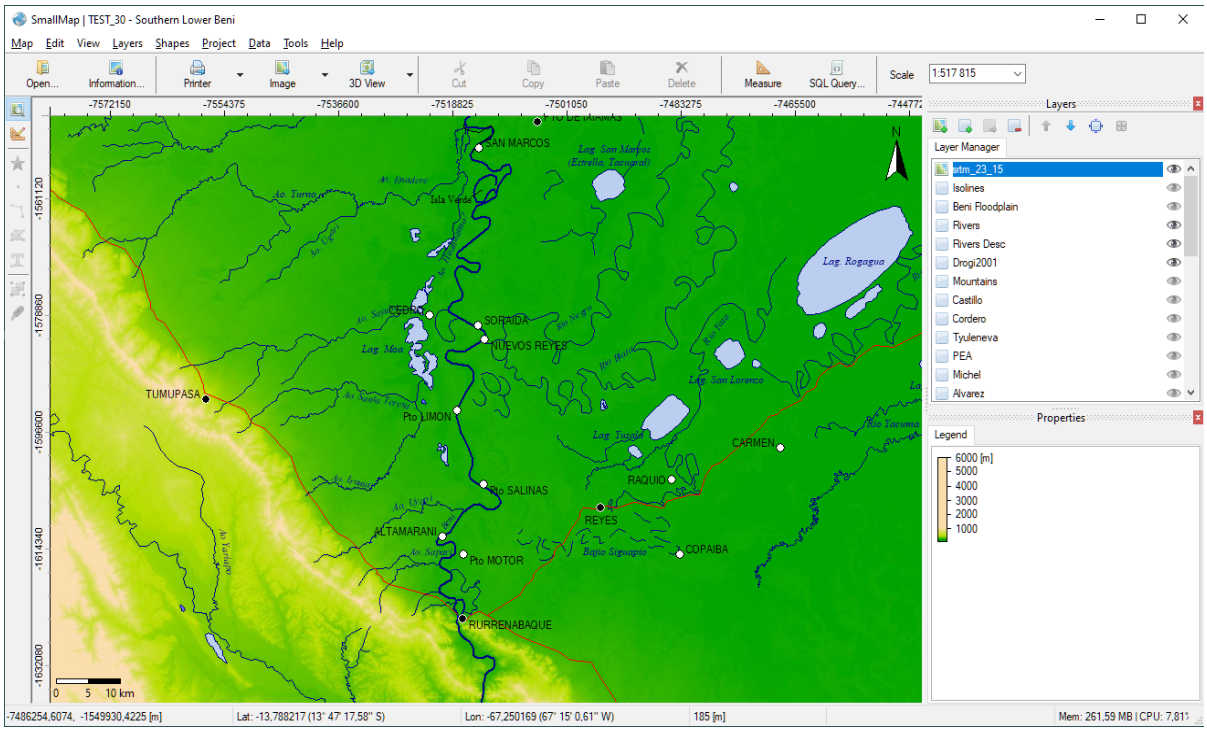


Fig. 5. Program in the preview mode. Loaded raster layer and vector layers.

Preview mode is activated through the *View-> Preview Mode* menu or by pressing the button on the left bar. In the preview mode the loaded layers are visible in the order they were added, while the raster layers are always "at the bottom", i. e. visible in the background (Fig. 5). You can change the order of displaying layers (*Layers-> Move Up/Down*, or buttons and in the *Layer Manager* tab), and hide them (icon). The loaded layer can also be centered (button) or removed from the list (button)[1]. These options are also available in the edit mode.

In the preview mode, the image visible in the main program window can be moved by pressing the left mouse button (the cursor changes to), and change its scale with the mouse wheel or in the drop-down list on the top bar. At the same time, the current cursor position is displayed in the status bar: in meters and degrees, and if a raster image containing elevation data has been loaded, the height in m a.s.l. is also displayed. Moreover, in the preview mode you can find the scale in [km] or [m] in the bottom left corner of the image (map), and a wind rose in the upper right corner. After hovering over a given vector shape on the map, a hint window with the name of the object will appear just below the mouse cursor. Also you can measure a distance in straight line from any point using mouse (*Tools->Measure*, icon). The result will appear at the status bar.

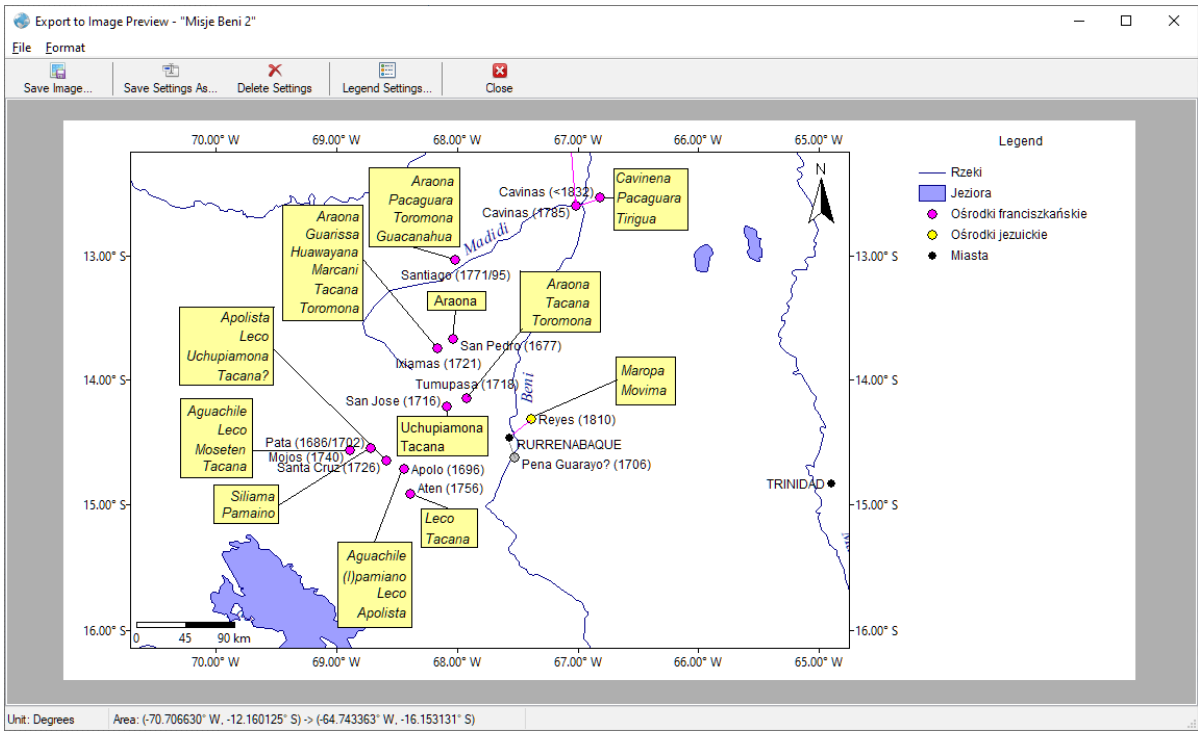


Fig. 6. Preview for image export to EMF/WMF file.

In the preview mode, you can export your work result to vector Windows metafiles (EMF, WMF) by choosing an option *Map->Export to Image* or pressing the button on the top bar, and then selecting the area to be exported with the mouse (the cursor will change to "cross"). The export preview window will appear (Fig. 6). The image in the export preview (i. e. the map) contains automatically matched meridians and parallels, and legend elements defined in the layer attributes. Meridians, parallels, and map borders (axes) can be turned off in the *Format-> Grid* and *Format-> Axes* menu, respectively.

[1] This does not remove the layer physically from the database.

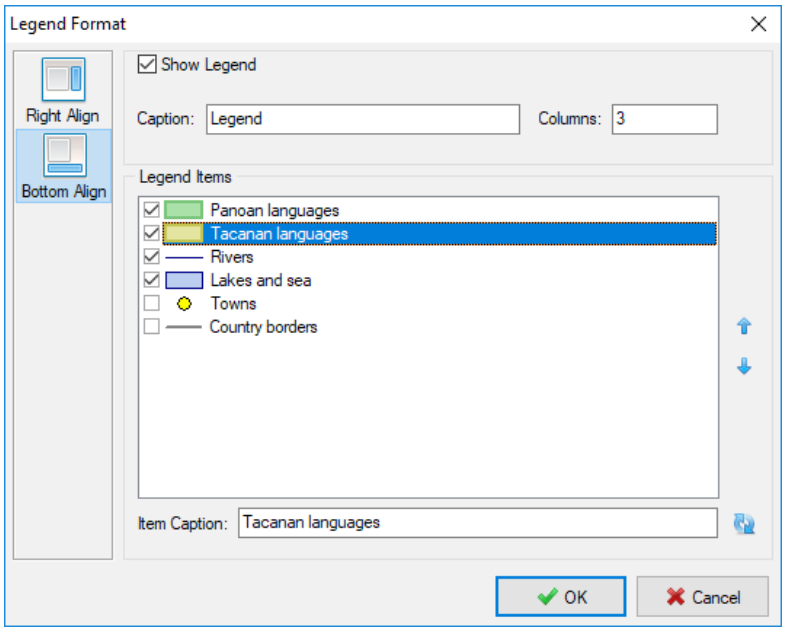


Fig. 7. Legend properties dialog window.

The program also enables a detailed formatting of the legend area by the option available in the *Format-> Legend...* menu. This option allows you to change the position of the legend, set the number of columns in which the legend elements are arranged, and change the visibility of these elements, as well as edit the caption (Fig. 7). After closing the export preview window, the program restores the previous view of the preview mode. The visible map image can be saved to a file by choosing *File-> Save* or the button .

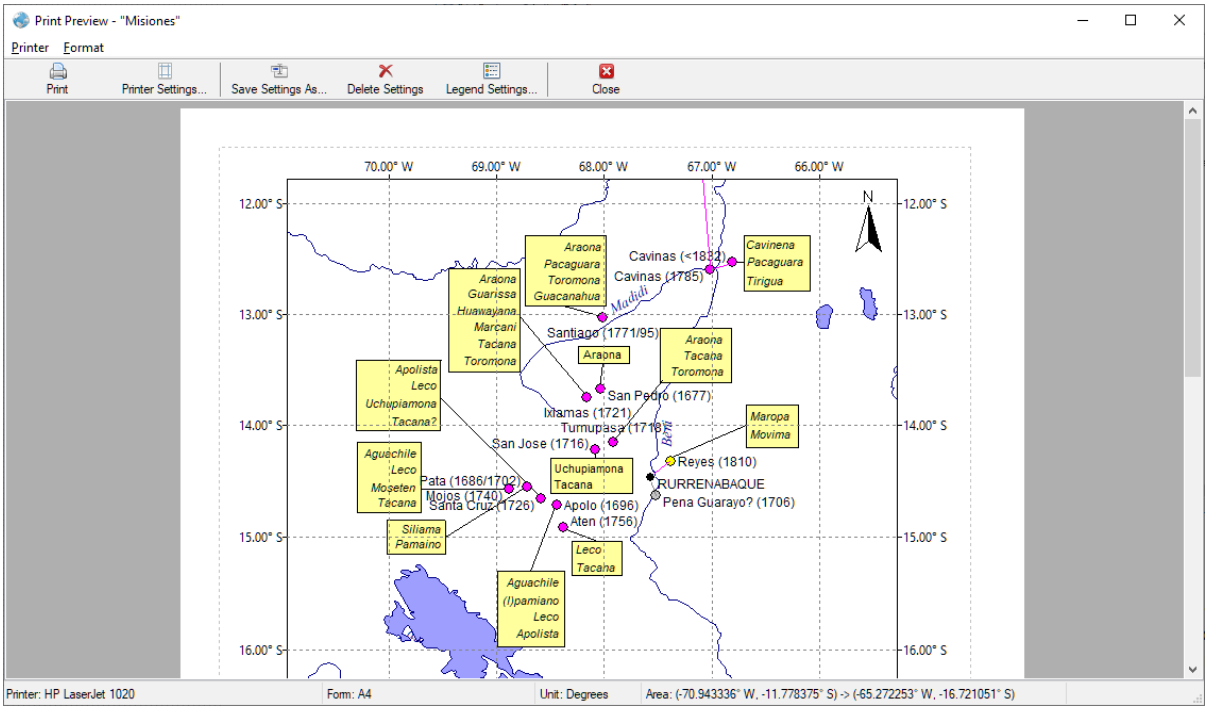


Fig. 8. Print preview window.

Similarly, the option of exporting the selected area to a printer works by calling the *Map-> Export to Printer* menu or by pressing the button . The print preview window (Fig. 8)

allows you to change the printer as well as the page format and orientation (button). Moreover, the edges of the image (map) can be snapped to the width of the page (menu *Format-> Fit to Page*) or centered on the page (*Format-> Center in Page*). The printing process is started by pressing the button .

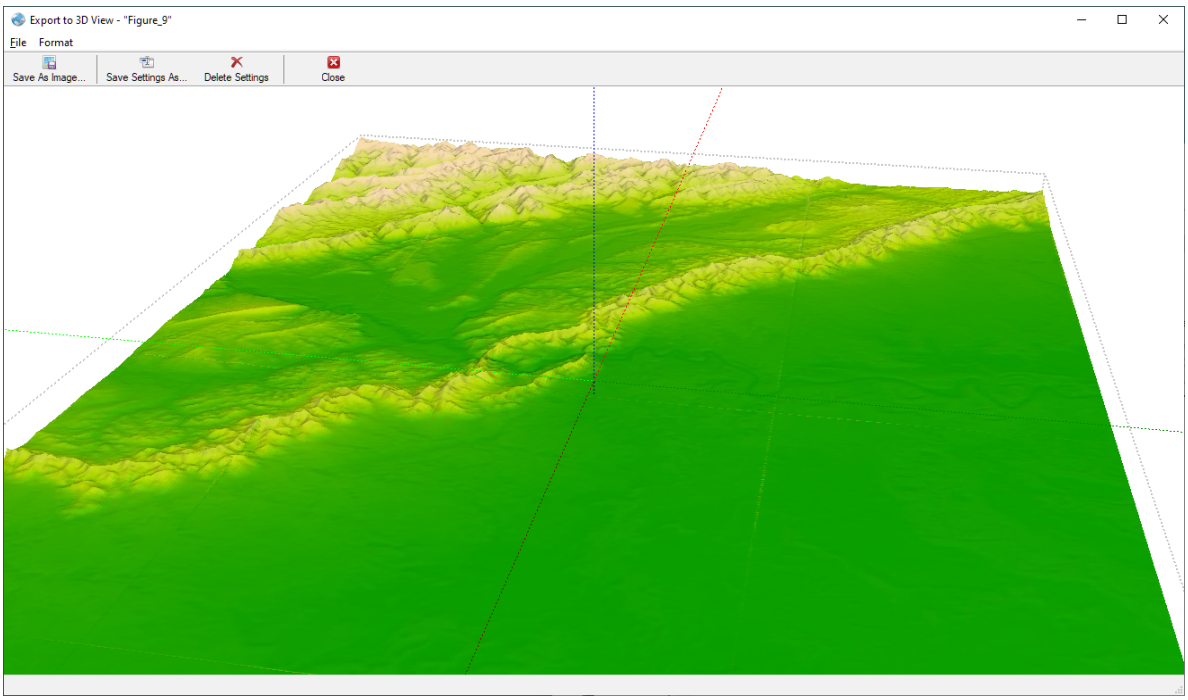


Fig. 9. 3D view window.

Raster data and some of vector data, in particular objects of varied elevation, can be exported to a 3D view. Choose the menu option *Map-> Export to 3D View* or press the button on the top bar and select the area (object) to be exported with the mouse cursor. The export preview (Fig. 9) works like a typical 3D object viewer, with options to rotate and zoom in/out.

5. Edit mode

Edit mode is activated through the *View-> Edit Mode* menu or by pressing the button on the left bar. You can edit such objects as raster and vector layers, and vector shapes. Modified layers in the layer list are marked with '*', and they are automatically saved in the database.

Raster layers can be selected by clicking the left mouse button on the workspace (unless they are covered by other layers) or by selecting them from the list of layers (*Layer Manager* tab). Then the list of layer properties will appear in the *Inspector* tab showing the name, description, type, palette and range of the palette of the layer. The name and description of the layer can be edited in all types of raster layers, while in case of rasters containing 8-bit and 16-bit data also the color palette and its range can be modified (Fig. 10). Predefined palettes are: in gray scale or inverted gray scale, spectral and hypsometric.

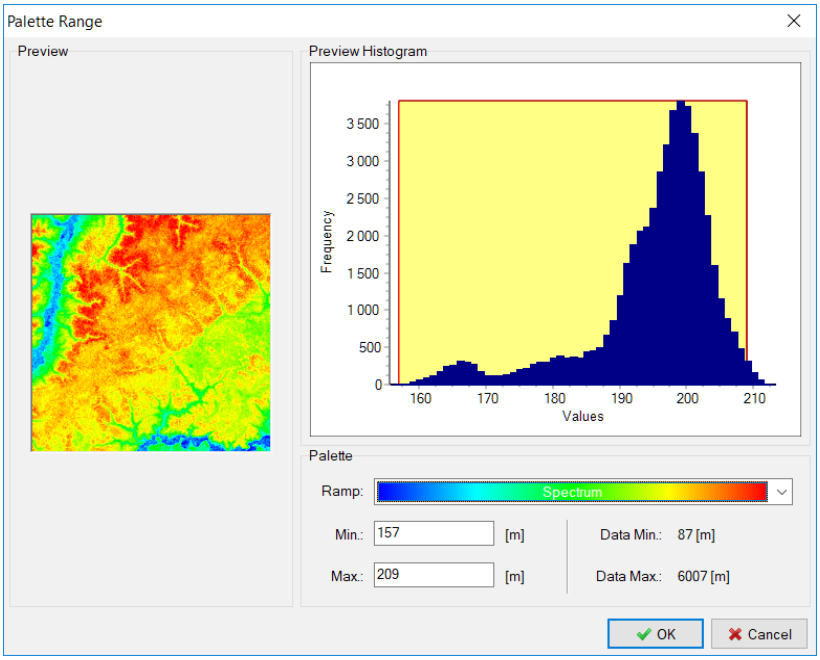


Fig. 10. Window for choosing the color scale and palette range of the raster layer.

Vector layers and shapes can be selected by clicking the left mouse button on the workspace (unless they are covered by other layers/shapes) or by selecting them from the list of layers and shapes: their properties appear in the *Inspector* tab showing the name, description, legend and number of shapes (the last is read-only mode). With regard to vector shapes you can edit the name, visibility level[2] and, depending on the type of shape, its properties such as style and color of the edge/fill, etc. The latter features appear in the bottom bar below the workspace in a form of drop-down lists, edit fields or buttons.

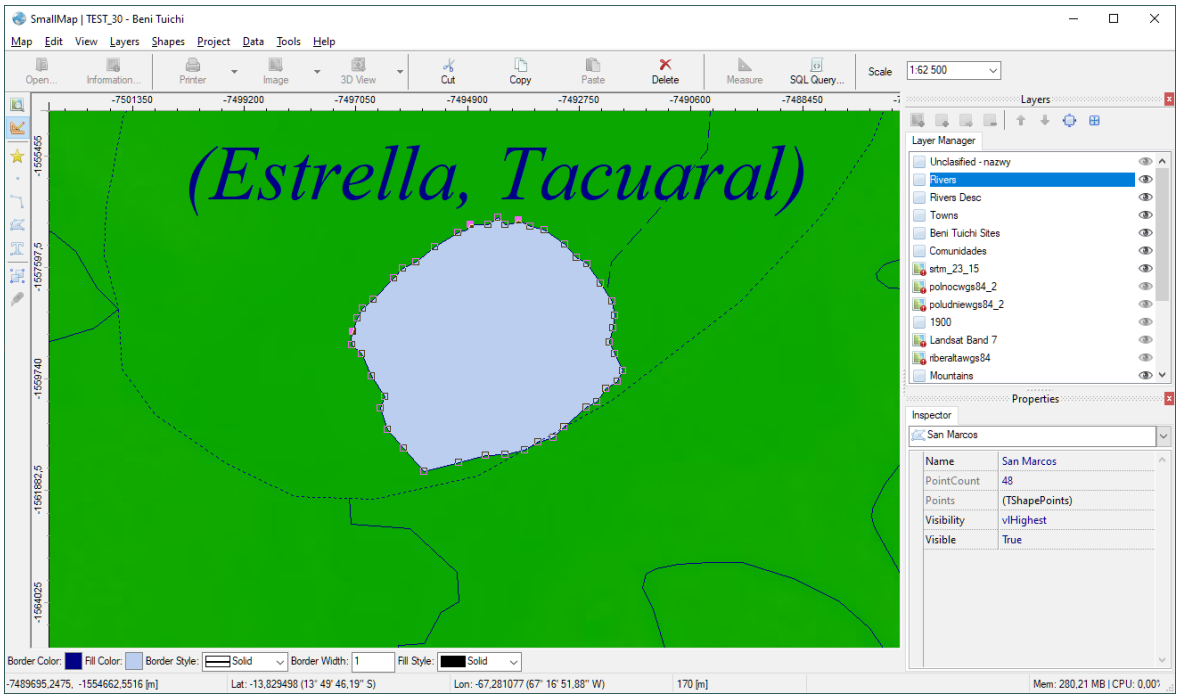


Fig. 11. Selected vector shape (polygon) with handles.

[2] Visibility level is useful when a given object is to be visible only on a specific map scale.

After selecting the vector shape, node handles appear around its edges (Fig. 11). Each node can be moved with the mouse; you can also add or remove the existing nodes by holding the CTRL button. Moreover, selected shapes can be moved (see the respective cursors in the table 1).

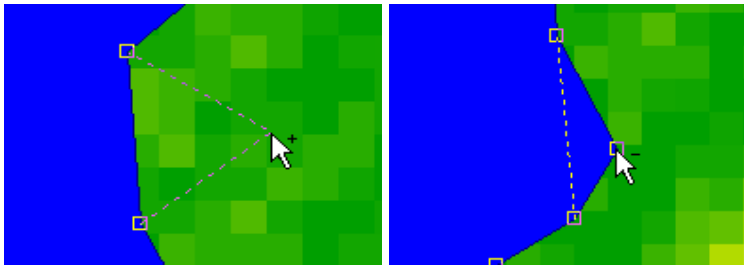


Fig. 12. Adding and removing polygon nodes using mouse.

Mouse cursor	Action
	Moving node points
	Adding node points
	Removing node points
	Moving selected shapes

Table 1. Mouse cursors during edition of a vector shape.

You can also edit manually the location of node points of the selected shape. After selecting the list of elements, a window with a list of points and their location will appear in the shape properties window (Fig. 13). The point order number corresponds to the node number. For comparison, you can activate the *Shapes->Show Handle Labels* option, then the order numbers of nodes will appear next to the handles.

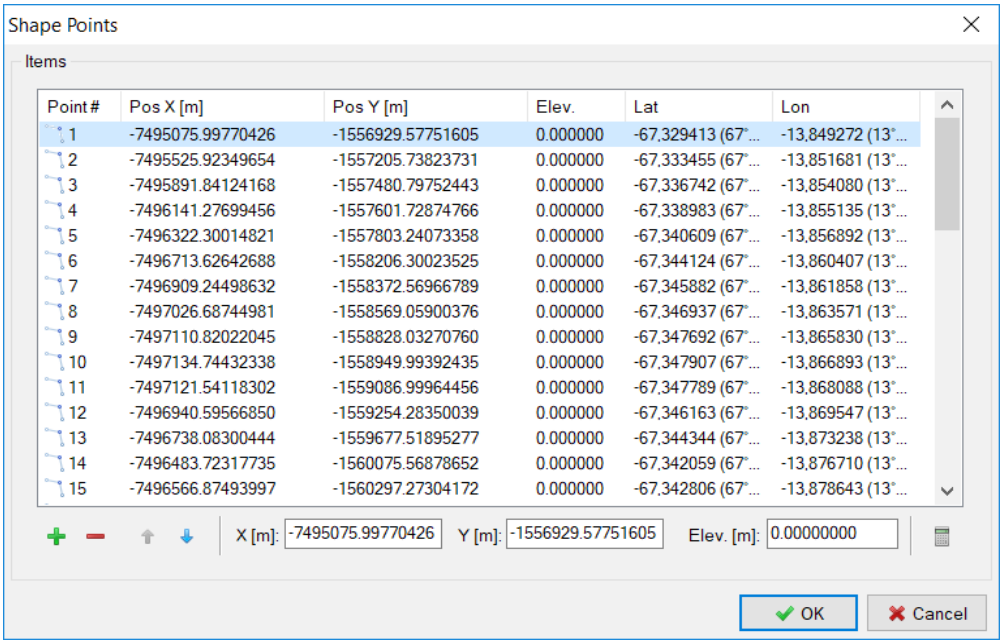


Fig. 13. Editable list of node points of the selected shape.

Colors and edge styles as well as fill colors of the shape can be defined on the bottom toolbar (Fig. 11). To change the color of the border or fill of a given shape, click the appropriate box (*Border/Line Color*, *Fill Color*) on the bar. Then a dialog box will appear that allows you to select a color from one of the predefined color palettes, either in RGB/HSV modes, or choose a color according to Albert Munsell's classification (Fig. 14).

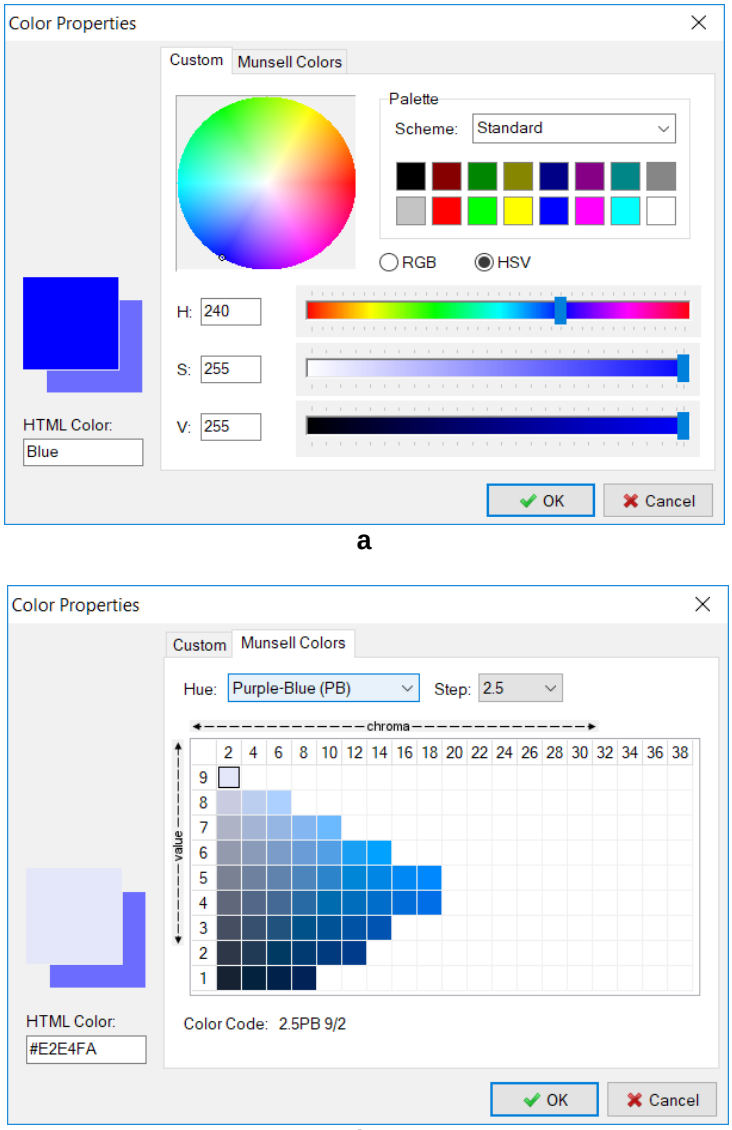


Fig. 14. Color selection dialog window: a) manual mode; b) Munsell's scale.

The program allows you to use text labels. In edit mode you can change their attributes such as: size[3], font color and style, rotation angle and text alignment (options available on the bottom toolbar). The text is aligned with the insertion point (node), with possible values such as: centering, right alignment and left alignment. The program also allows you to manually rotate the text label with the mouse (Fig. 15).

[3] The text size is a value that corresponds to the font size, but calculated relatively to the default map scale (see *Map-> Information...* menu). This means that if the font size is 12 and the default map scale is e.g. 1:10,000,000, then on this scale the text label will have the size of 12.

Fig. 15. Rotating the text label of the center alignment using the mouse.

Selected shapes can be cut, copied to the clipboard, pasted and deleted. These options are available in the *Edit* menu, on the upper bar of the program window (buttons , , , and , respectively) and through standard keyboard shortcuts. Selected shapes can also be moved to the top of the layer or to the bottom of other shapes of a given layer - menu *Shapes-> Bring to Front/Send to Back*.

The program also allows you to add new shapes on the selected layer - through the *Shapes-> Add Shape* menu or by pressing an appropriate button on the left bar. Currently, you can add: symbols (icon), points (icon), polylines (icon), polygons (icon), and text labels (icon), by clicking on the point where a new node should appear; the operation of adding node points can be terminated by pressing ESC. With regard to polylines and polygons, they can be converted to each other. Moreover, selected polyline can be divided into shorter ones cutting it by line at any angle, using knife tool (*Shapes->Knife*, icon).

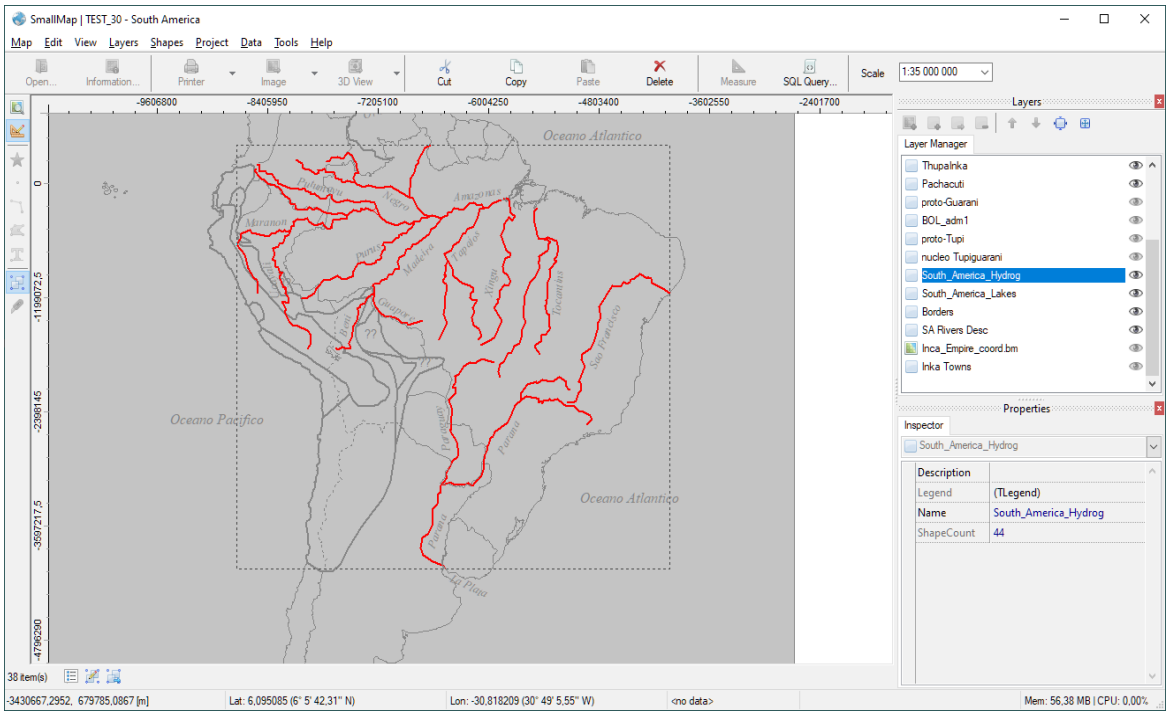


Fig. 16. Group of highlighted polylines (rivers) within the selected area.

You can also highlight a group of shapes. After selecting the *Shapes-> group Shapes* menu (icon on the left bar), use the mouse to select the area containing shapes of the current layer to be highlighted. The entire shapes within this area will be marked in red against the gray background of the other layers (Fig. 16).

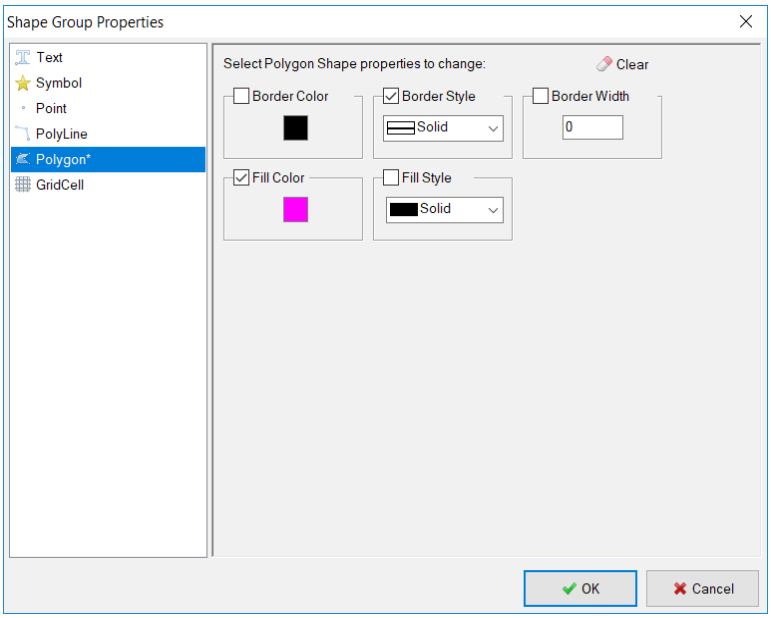


Fig. 17. Editing visual attributes of the group. The color and style of the polygon edges have changed.

The group thus marked can be cloned into a new layer (icon on the bottom bar), and the visual features of these shapes can be edited collectively (icon) by changing the characteristics of the selected shapes (Fig. 17). It is possible to undo the last stage of editing the visual features of the group.

For vector layers, you can edit the legend associated with the layer. In the list of layers, select the desired layer, and then call the *Legend* item from the *Inspector* tab. The legend item editor window will appear, allowing you to add, remove and move the order of selected items (Fig. 18). The editor allows you to insert symbols, shapes (linear and rectangular) and texts into the legend.

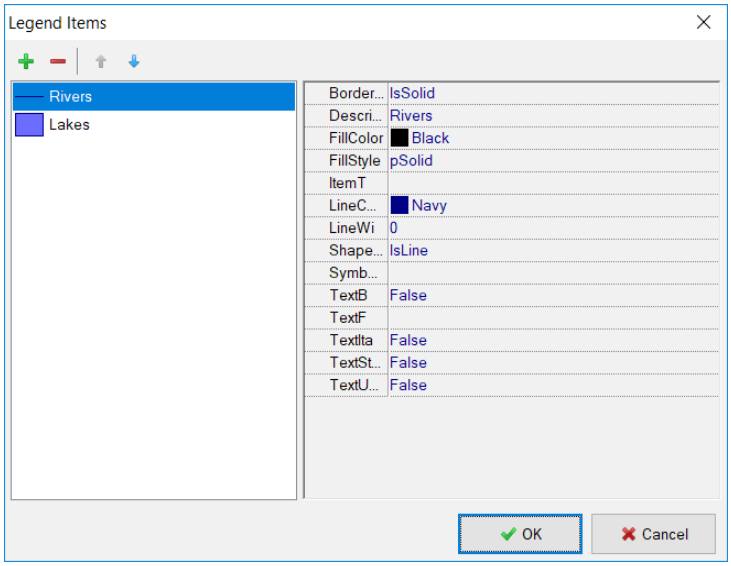


Fig. 18. Legend items editor.

Elements of the legend associated with a given layer are visible in the preview mode on the *Legend* tab.

6. Symbol library

In the *Tools-> Symbol library* menu, you can find a tool designed for editing the existing and creating new symbols used in *symbol* shapes (Fig. 19). There are three basic shapes: circle, square and triangle, whose visual features, namely the color of the fill and the border, can be changed, giving the names to the symbols created in this way. The default symbol is a yellow circle with a black border - this is the shape for undefined symbols on the map.

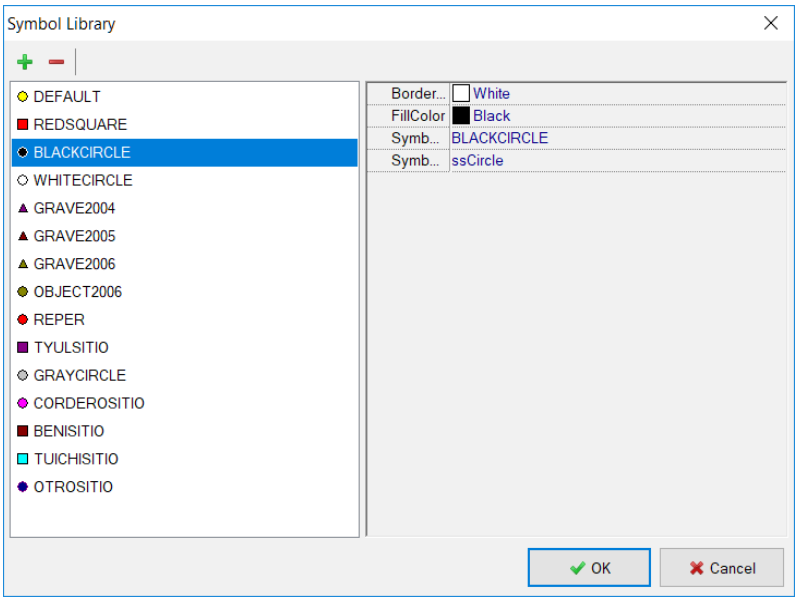


Fig. 19. Symbol editor.

7. SQL queries

The program provides you with an access, in read-only mode, to database structures used to define maps, layers, shapes and others, using SQL queries. This option is available in the *Tools-> SQL query* menu or the toolbar button . In the left panel of the window (Fig. 20), a list of tables (map layers; icon), columns of individual tables (icon), including columns with a master key (icon) and a list of available functions (icon) are visible in a form of a tree structure.

Using the SQL query language, the user can create a report using data from any table contained in the database (see Figure 20), but it is not possible to modify, add or delete any data.

Queries are stored in the default "SQLs/" directory. They are edited in the window with the highlighted SQL syntax. The queries are launched by *File-> Execute (F8)* command or the button on the toolbar. If the query generates results, they are displayed in a form of a list that appears below the editing window; otherwise, the user is notified about the result of the query via a pop-up window with an appropriate message. If a query error occurs, relevant information appears in the status bar or in the information pop-up.

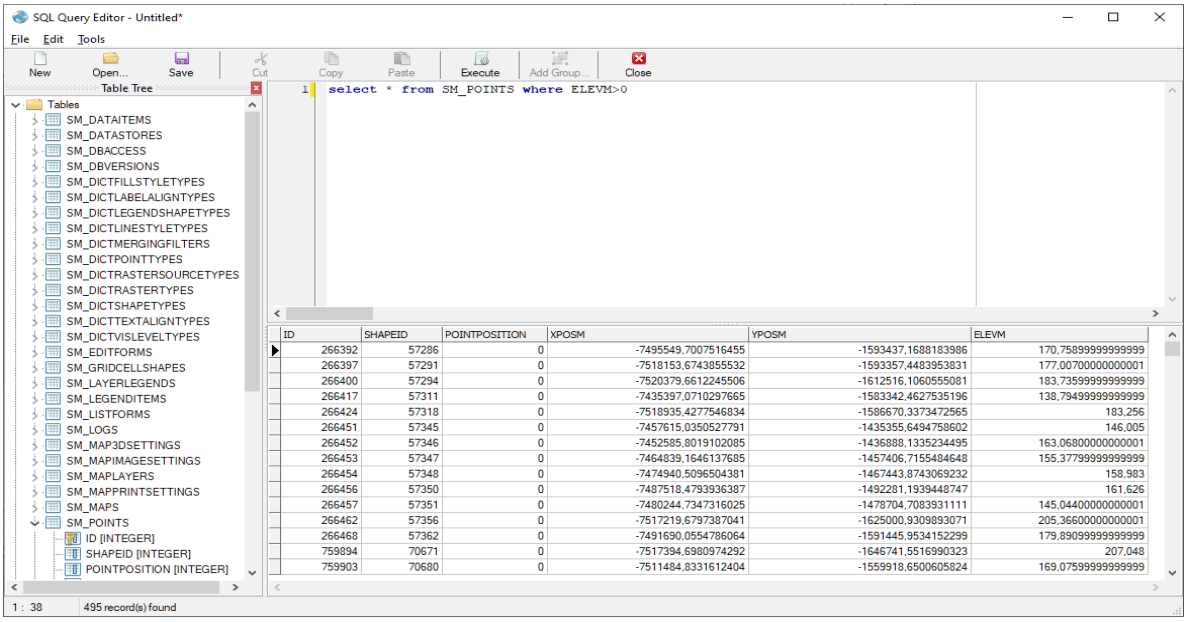


Fig. 20. SQL Query editor window.

If the results of the SQL query include shape identifiers of the current layer, it is possible to highlight them on the map (see Fig. 16). To do this, select *Tools-> Add Group from Result* (icon) and specify the map layer and the field (name) of the shape identifier (Fig. 21). This option is available if the edit mode is checked.

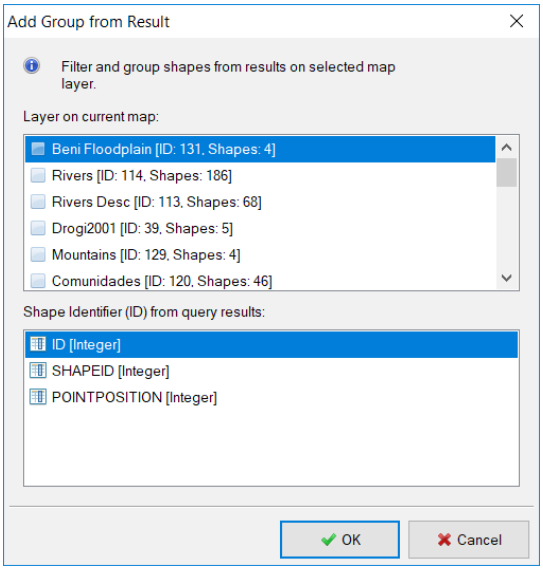


Fig. 21. Window for selecting layer and shape identifier from the results of the SQL query.

8. Context menu

The program provides you with a quick access to the most-used main menu options via the context menu. In the workspace, the pop-up menu allows you to change the working mode (preview/edit) and provides options for cutting, copying, pasting and removing shapes, as well as adding new and conversions of existing ones (Fig. 22). The program also provides a

context menu in the layer list area (*Layer Manager*), allowing you to add, delete and save edited layers.

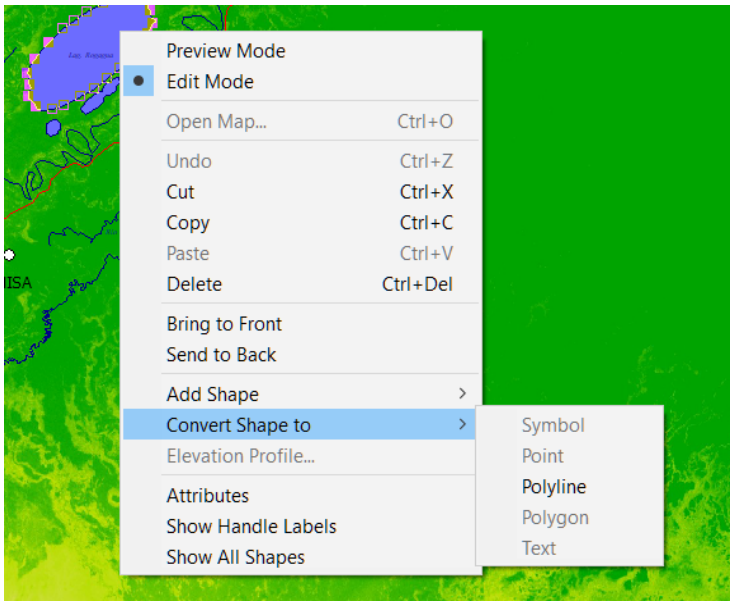


Fig. 22. Context menu in the workspace.

9. Data stores

The raster data, including their thumbnails created for different levels of the map scale (raster mosaic), is stored by default in the database. This solution may, however, be uncomfortable, therefore you can specify additional places (*Data stores*) to store this data, e. g. in a selected folder on the hard drive. To do this, select *Tools-> Data Stores* menu and specify the location of additional data stores (Fig. 23).

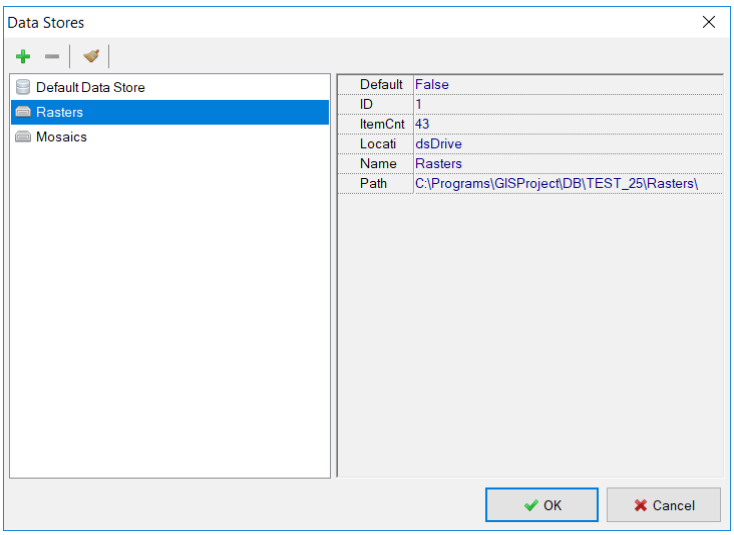


Fig. 23. Data Stores editing window.

You can also move the data from one place to another. The *Tools-> Move Data* option is used for this purpose.

10. Plug-ins

All imports of external files (i. e. raster and vector layers) into the program are possible thanks to the mechanism of plug-ins, the number of which is gradually increased. Currently, the program supports the following external data formats[4]:

Plug-in	Notes
TiffLib	TIFF rasters converter
GELib	GoogleEarth cache data converter
ShpLib	SHP vectors converter
GpxLib	GPX vectors converter (from GPS devices)
GMLib	MAP vectors converter
DBFLib	DBF vectors converter (points and labels)

Moreover, through the plug-in mechanism, LandSat imagery channel mixing (bands) is performed, enabling e. g. visualization of near-infrared satellite images (Fig. 24).

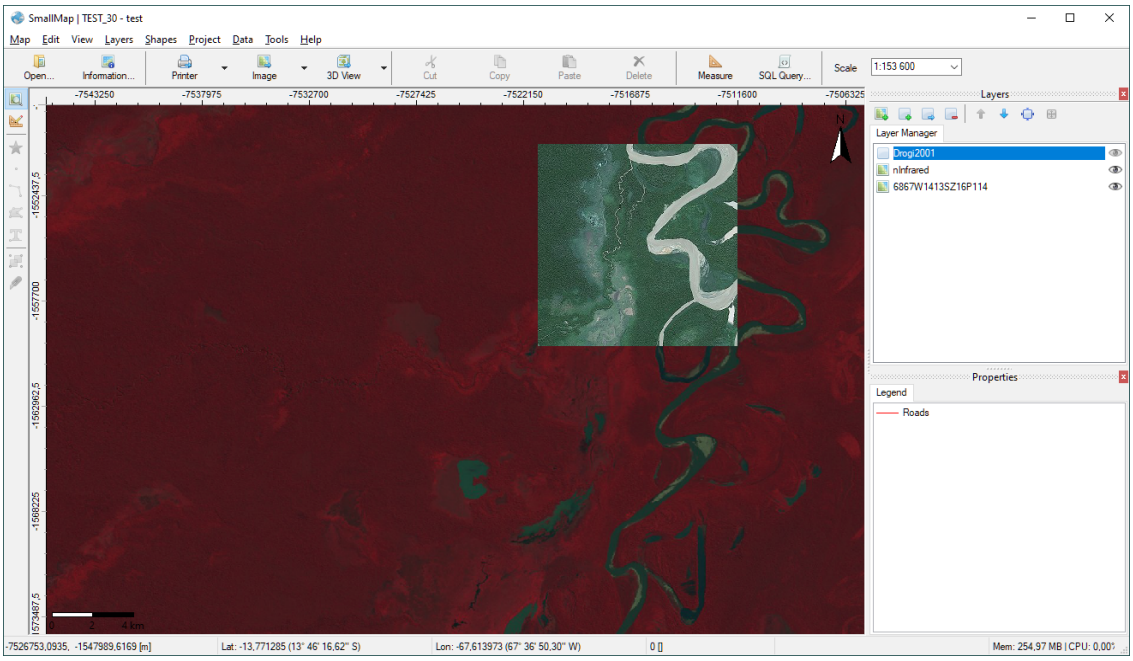


Fig. 24. Raster layer in true-color mode on the background of infrared image.

11. Generators

The program enable the generation of vector layers based on existing data or information delivered by the user, through the mechanism of generators (menu *Layers-> Generate)*. Currently the following generators are available in the program:

Generator	Notes
GridGen	Generator of are grid
IsoGen	Generator of isolines based on a height map

[4] Some features of the external formats are not yet supported.

The number of available generators is increasing gradually. So far, it is possible to generate the Are grid in relation to the reference point, useful e. g. in archaeology to determine the examined area of the site (Fig. 25).

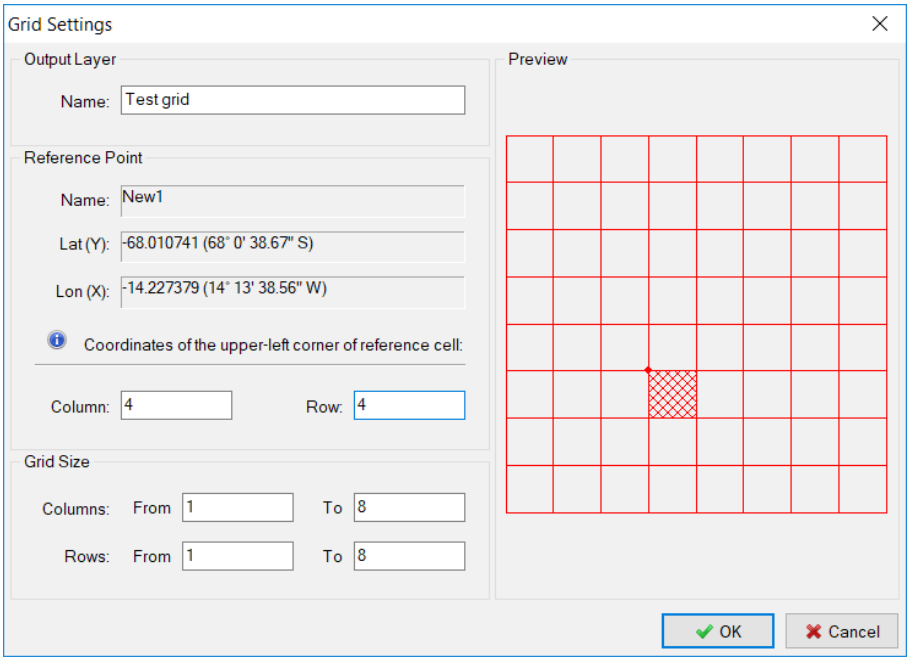


Fig. 25. Are grid generator window.

Another application is generating of isolines based on the heighmap of given area. To do this, select the SRTM raster layer in preview mode and, after starting the generator window (Fig. 26), specify parameters such as height range, step between isolines and size of the interpolated image cell (they affect the detail of the result).

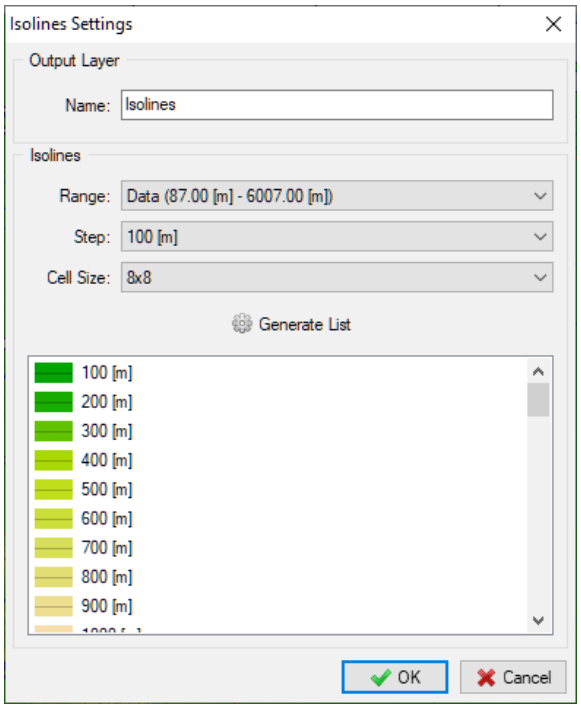


Fig. 26. Isolines generator window.

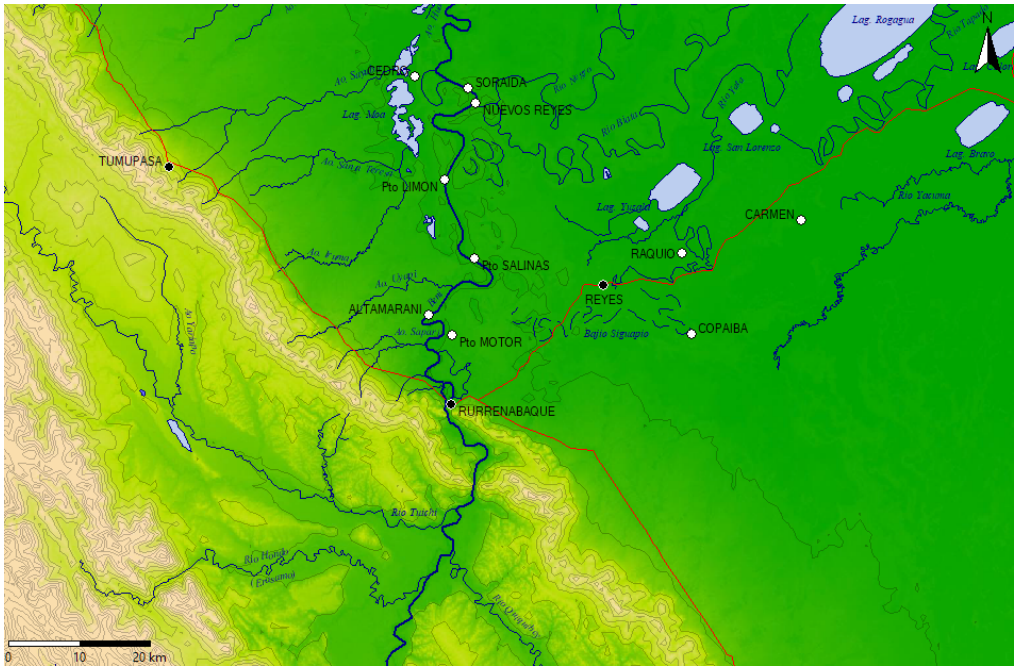


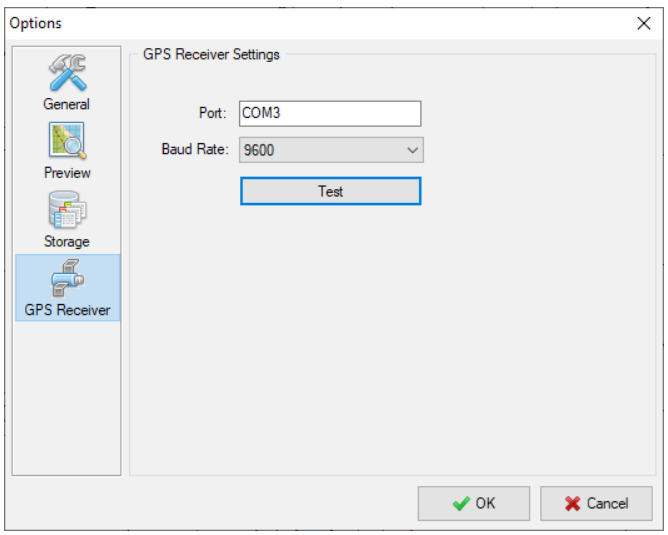
Fig. 27. Isolines generated each 100 m on raster background.

The colors of individual isolines are determined automatically on the basis of the color palette of the raster background, although their tone is slightly darker. The result is a set of polylines (Fig. 27), which can be edited in the program in a standard way (see Chapter 5).

12. Work with GPS receiver

The program allows you to receive data from a U-blox 7 GPS receiver (Fig. 28a) connected to a computer via USB and exposed as a serial COM/ACM port on desktop. To use the receiver, you must first configure the connection by selecting the *View->Options…* menu and then, in the dialog window, the GPS Receiver frame (Fig. 28b).

a



b

Fig. 28. GPS receiver: a) device; b) configuration of connection.

The default ports are: *COM3* (Windows) and */dev/ttyACM0* (Linux), but the port numbers are assigned by the operating system and may be different from the default ones. The recommended baud rate is 9600 bps. To test the selected configuration, you can use the *Test* button.[5].

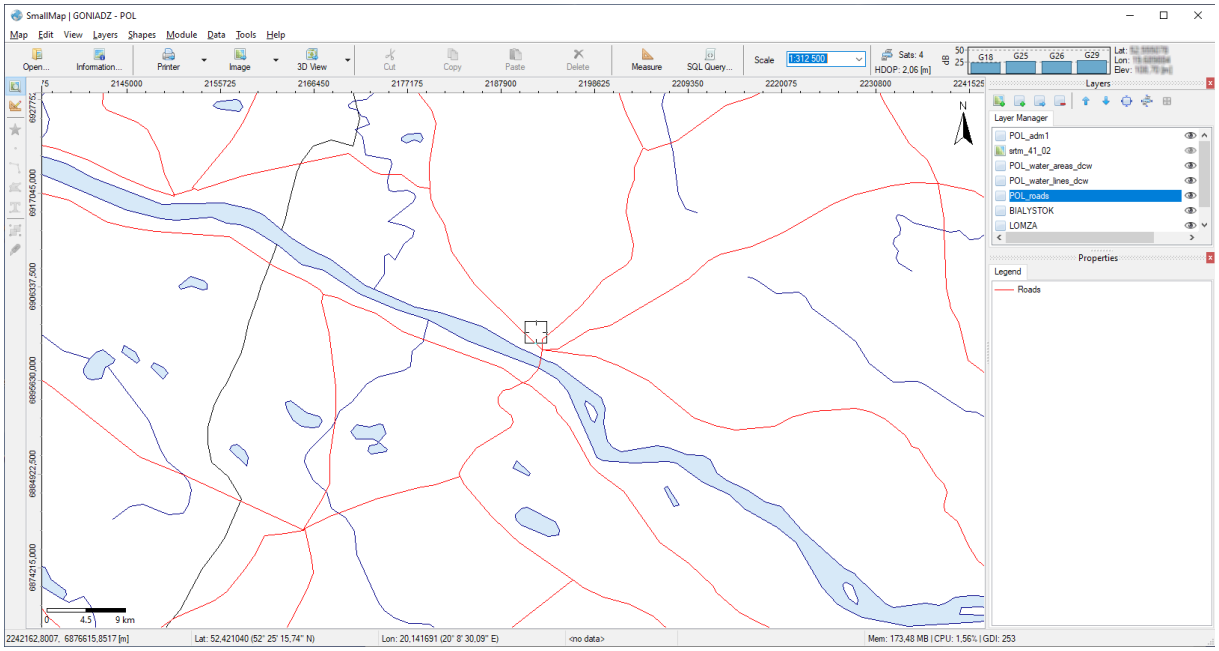


Fig. 29. Application in GPS receiver operation mode.

To enable and disable the transmission from the GPS receiver, select the *Tools-> GPS Receiver* menu item. Then, on the toolbar will appear a new section containing information about the currently visible satellites (diagram), the current position of the receiver (coordinates and level above sea level), the number of satellites used to calculate it and the horizontal error coefficient (Fig. 29). If the application is running in the preview mode, a mark ⌖ will appear on the map in place of the current coordinates of the receiver. Moreover, when you select *Layers-> Center GPS Position*, the current layer will be centered to the current GPS coordinates.

[5] On Linux systems, attempting to connect to the receiver may result in an error in accessing the port pseudo-file (*permission denied*). You should then make sure that the user belongs to the *dialout* group.