

# **User's Manual for Thuban 1.0**

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# Chapter 1. Introduction

Thuban is an interactive geographic data viewer. It has been developed because there was no simple interactive viewer for geographic information available as Free Software. Thuban is written in Python and C++ and uses the wxWindows library allowing it to run on many different platforms, including GNU/Linux and Windows.

Geographic data viewers are a necessary tool as they allow one to get a visual impression of the positional relationship of the information that may not be apparent from simple inspection of the data values themselves. Thuban allows the user to create a session that displays geographic data and then explore that data through navigation and manipulation of how it is drawn. The results can then be saved or printed.

Thuban arranges a session in a hierarchy. A session contains a map which consists of layers. Each layer represents one kind of data set. For instance, there may be a layer for roads and another layer for buildings. These layers can either be vector shapes or images.

## 1.1. Installation

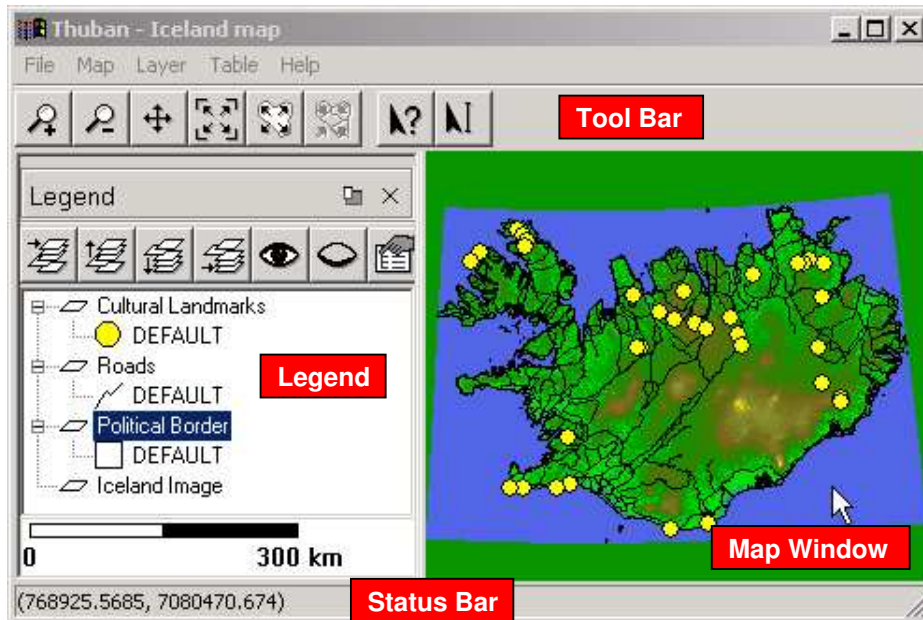
Thuban is actively supported under Debian Testing (sarge), RedHat 7.2, and Windows 2000. Thuban depends on the following packages. These packages can also be found on the Thuban Download site (<http://thuban.intevation.org/download.html>).

- Python 2.2.1 (<http://www.python.org>)
- wxWindows 2.4 (<http://www.wxwindows.org>)
- wxPython 2.4 (<http://www.wxpython.org>)
- proj 4.4.5 Projection Library (<http://www.remotesensing.org/proj/>)
- GDAL 1.1.8 (<http://www.remotesensing.org/gdal/>)
- SQLite 2.8.3 (<http://www.hwaci.com/sw/sqlite/>)
- PySQLite 0.4.3 (<http://pysqlite.sourceforge.net>)

Along with the source codes, the download page also offers full installation packages for Debian, Windows and RPM-based systems (Mandrake, RedHat, SuSE, etc).

## 1.2. The Main Window

Figure 1-1. The Main Window



The map window shows the current state of the map and is where the user can interact with the map using the tools.

The legend on the left displays a list of the current layers and any visible classification groups. In the example, each shape layer has a default classification which specifies how the shapes in each layer are drawn. Layers that are higher in the list appear “closer” to the user. The legend can be closed by clicking on the small X in the upper right-hand region of the legend. To open it again, use **Map**→**Legend**. The legend is also dockable, which means that it can be detached from the main window by clicking on the small button next to the close button. It can be attached by clicking the same button again.

The status bar displays different information depending on the current context. If the user is selecting an item from the menu then the status bar will display a short help message indicating what each menu item is for. If the user has a tool selected then the position of the cursor on the map is displayed.

The tool bar provides quick access to the commonly needed tools. By hovering over each button the user can see a short messages describing what the tool does. The tools provided are Zoom In, Zoom Out, Pan, Full Extent, Full Layer Extent, Full Shape Extent, Identify, and Label. Each of the tools will be explained in further detail later in the manual.

# Chapter 2. Session Management

## 2.1. Starting a New Session

A new session can be started from File→New Session. If a session is already loaded and has been modified without being saved a prompt will ask if the current session should be saved. A new session consists of an empty map with no layers and no tables.

## 2.2. Opening a Session

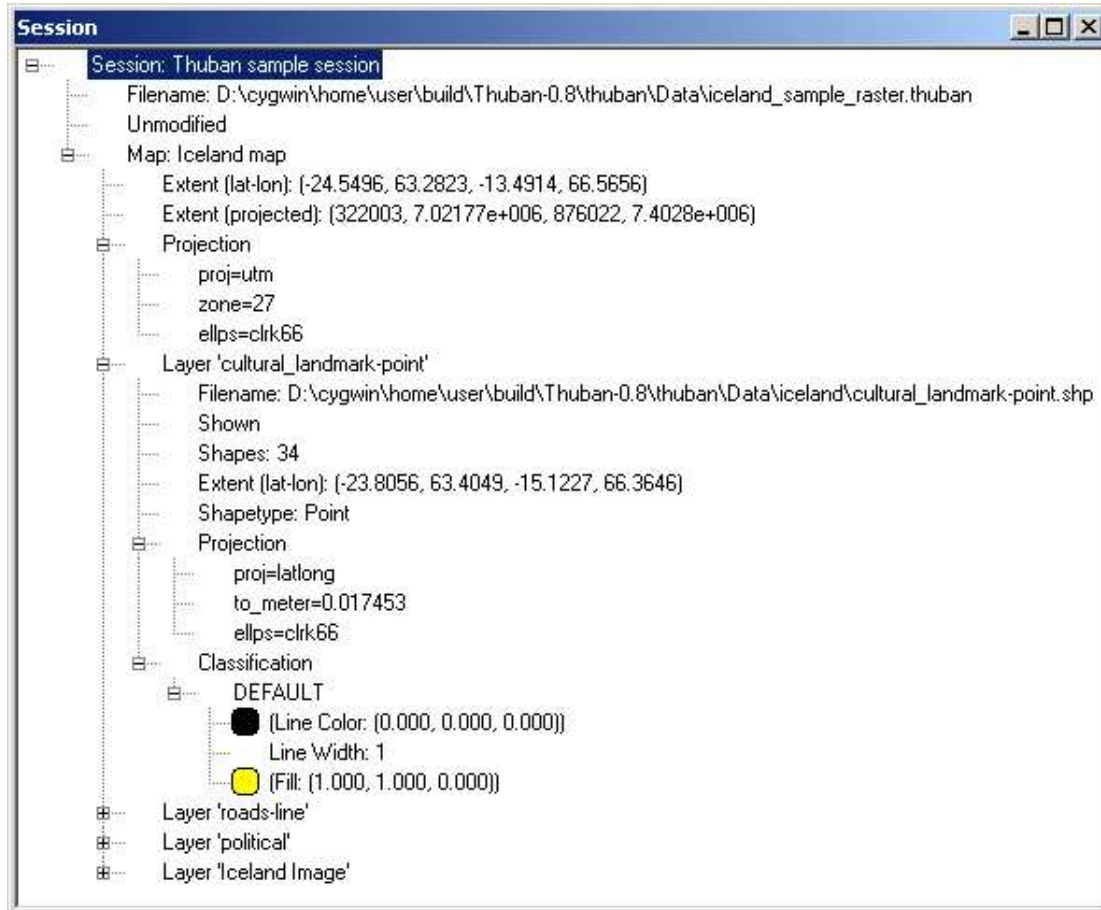
A session can be opened from File→Open Session. A dialog box will open allowing the user to browse for a Thuban Session file. Thuban session files end with `.thuban`. Selecting a file a clicking OK will load the session into Thuban. If a session is already loaded and has been modified without being saved a prompt will ask if the current session should be saved.

## 2.3. Saving a Session

A session can be saved from File→Save Session. A dialog box will open allowing the user to browse the file system and select a place to save the session. Thuban sessions should be saved under a name ending in `.thuban`. If the file already exists the user will be prompted to save under a different name or overwrite the existing file.

## 2.4. The Session Info-Tree

Figure 2-1. Session Info Tree



The session info-tree is primarily intended for developers working with Thuban. It displays many of the internal values for the session, map, and layers. It can be opened from File → Session Tree.



# Chapter 3. Map Management

The map consists of a number of layers where each layer represents a different type of data set. By interacting with the map the user can visually explore the data.

The map can have a name that will appear in the Thuban title bar. The map name can be changed using Map→Rename.



## 3.1. Adding and Removing Layers



There are two types of layers that can be added to a map: shape layers and image layers. Shape layers are stored in Shapefile format, a standard file format for storing geographic objects. These files have the extension “.shp”. Associated with the shape file is a database file which stores attributes for each shape in the shape file. This file, in dBase format, has the extension “.dbf”. Both files must have the same base name. For example, if there is a shape file named roads.shp there must also be a file roads.dbf.





Shape layers can be added to the map with Map→Add Layer. Thuban will load all files with the same base name, so it doesn't matter if the shape file or database file is selected.

Image layers can be added to the map with Map→Add Image Layer. It is important to select a valid image file that has geographic data associated with it. The data can be embedded in the file itself, or in another file. If geographic information cannot be found, Thuban will report an error.


## 3.2. Navigation

The map can be explored by using the navigation tools available on the tool bar or from the Map menu.


- The ZoomIn tool  enlarges a region of the map. Clicking once on the map will double the magnification and center the map on the point that was clicked. Clicking and dragging selects a region that will be enlarged to fit the window.
- The ZoomOut tool  shrinks the map so that a larger region is visible. A single click reduces the magnification by a factor of two. Clicking and dragging selects a box such that the current contents of the window will be scaled to fit into that box.

- The Pan tool  allows the user to move the map around by clicking and dragging.
- The Full Extent tool  rescales the viewable region so that the entire map is visible.
- The Full Layer Extent tool  rescales the viewable region so that the currently selected layer fits within the window. If no layer is selected this button will be disabled.
- The Full Shape Extent tool  rescales the viewable region so that the currently selected shape fits within the window. If the shape is a point, it is centered and the map is zoomed all the way in. If no shape is selected this button will be disabled. This feature is especially helpful when identifying an object related to a selected record in a tableview (see below).

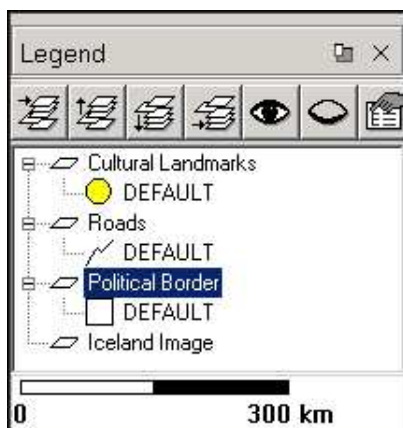
### 3.3. Object Identification

Objects on the map can be identified using the Identify tool . Clicking on an object selects that object and opens a dialog which shows all the table attributes for that object. Any current selection is lost. Objects on the map are typically shapes and this document will often refer to objects as shapes.

### 3.4. Object Labeling








Objects can be labeled using the Label tool . Clicking on an object selects that object and opens a dialog which displays the table attributes for that object. An attribute can be selected to be the label on the map. The label will be placed at the center of the shape. Clicking on an object that already has a label will remove the label.

### 3.5. The Legend



The Legend provides an overview of the layers in the map. Layers that appear higher in the legend will appear “closer” to the user. If a layer supports classification (currently, only shape layers have this feature) then the classification groups will be shown below each layer. The properties for each group are also displayed with a small graphic. Polygon layers appear as rectangles, lines appear as curved lines, and points appear as circles.

Along the top of the legend is a toolbar which allows quick access to some of the layer manipulation options under **Map**.

- The Move Layer to Top tool  raises the selected layer to the top of the map.
- The Move Layer Up tool  raises the selected layer one level.
- The Move Layer Down tool  lowers the selected layer one level.
- The Move Layer to Bottom tool  lowers the selected layer to the bottom of the map.
- The Visible tool  shows the selected layer in the map if it was hidden.
- The Invisible tool  hides the selected layer in the map.
- The Properties tool  opens the layer’s properties dialog box. Double-clicking on a layer or a group of a layer will open the properties dialog for that layer.

Along the bottom of the legend is the scalebar. The scalebar will be available if there are any layers and the map has a projection set.

## 3.6. Exporting

Under **Windows**, maps can be exported in Enhanced Metafile format (.wmf) from **Map**→**Export** for use in reports, presentations, or further modification. The current map view, legend, and, if available, scalebar are exported. Under other platforms this option is not available. Clicking this menu item open a file selection dialog that lets the user select a location to export the map.

## 3.7. Printing

The map can be printed using **Map**→**Print**. The current map view, legend, and, if available, scalebar are printed. A standard printing dialog will open allowing the user to configure the printer. This dialog will differ depending on which platform Thuban is running.

# Chapter 4. Layer Management

## 4.1. Types of Layers

There are two types of layers supported by Thuban: shape layers and image layers. Shape layers consist of vector based shapes with geo-referenced coordinates. There are three types of supported shapes: polygons, lines (arc), and points. Image layers can be any image file format supported by the Geo-spatial Data Abstraction Library (GDAL). The images must have geographic coordinate data either embedded within the file or in a separate file that is in the same directory as the image file. GeoTIFF files work very well with Thuban and were designed specifically to be image layers in GIS programs.

All actions in the **Layer** menu act on the currently selected layer in the legend.

## 4.2. Properties

To view the properties for a layer it must first be selected in the legend. The menu option **Layer**→**Properties** opens a dialog that displays a layer's properties. All layers have a title which can be modified in the text field provided. The type of layer is also shown. If the type is a type of shape (polygon, arc, point) the classification table will be shown. Image layers have no other properties other than title and type.

Figure 4-1. Properties Window

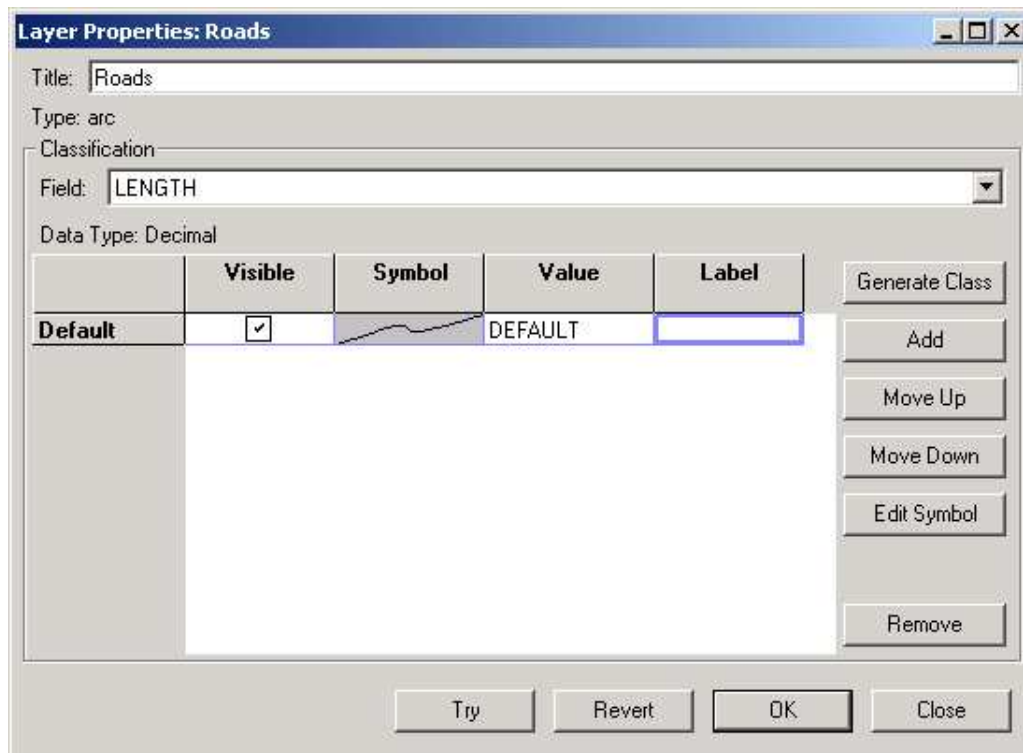


Figure 4-2. Properties Window



### 4.3. Visibility

Sometimes it is not desirable to view all layers at the same time. Some layers may take a long time to draw and so while navigating around the map the user may not want to wait for the map to redraw all the layers each time the map is changed. Each layer can be independently turned on or off using the Layer→Show or Layer→Hide options respectively.

## 4.4. Duplication

Layers and all their properties, including classifications, can be duplicated using **Layer** → **Duplicate**.

Duplicating a layer is useful if the user wishes to model a layer in several different ways. Even though the layers overlap, by carefully selecting the shape properties it is possible to display several pieces of information at once. For example, one copy of a roads layer may be classified on a length property and another copy may be classified on a type property. If the length property was expressed with color and the type property expressed with line thickness then it would be possible to view both classifications by placing the type property copy over the length property copy.

# Chapter 5. Layer Classifications

A layer classification is a way of assigning drawing properties to groups of shapes based on attributes stored in the layer's table. Only layer's with shapes can have a classification; image layers cannot be classified.

A classification consists of a number of groups, each group having a value or range of values to match against, and symbol properties which control how a shape is drawn on the map. The user selects which field in the table is used by the classification and when the map is drawn the value for that field for each shape is compared with each group's value. The properties of the first group to match are used to draw the shape. This allows the user to get a visual impression of not only how the data is laid out but also what kind of data lies where.

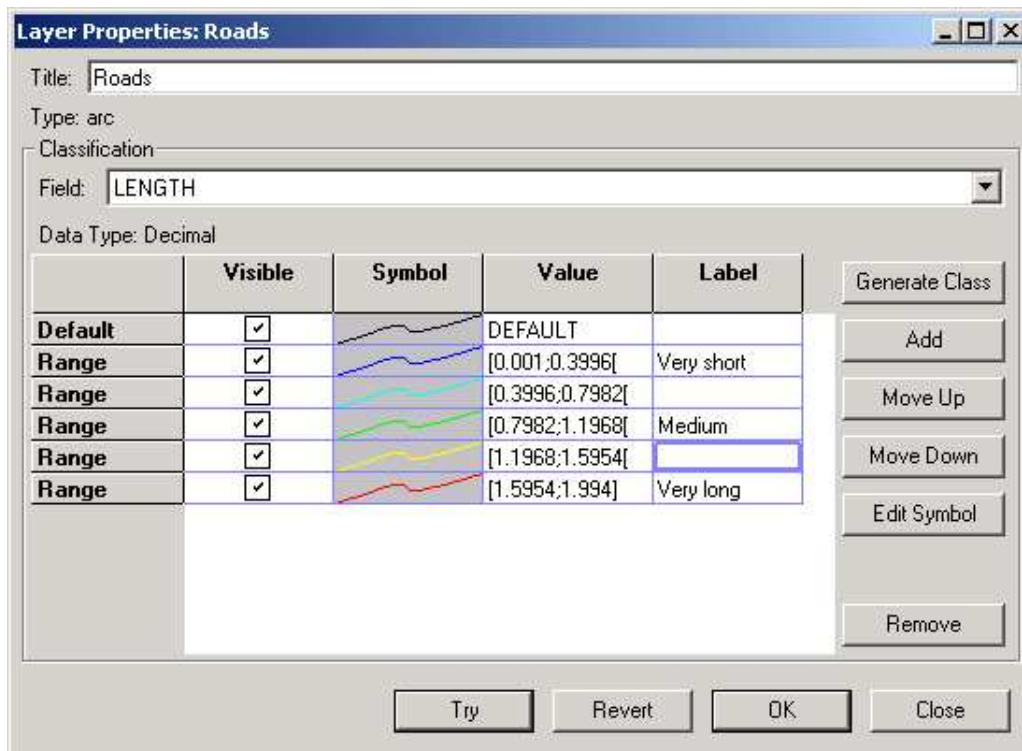
A layer always has a classification. When a new layer is added to the map, a default classification is created with the DEFAULT group. This group cannot be removed but can be hidden (see below). Every shape in the layer, regardless of its attributes, will match this group if no other group matches.

## 5.1. Editing Classifications

A layer's classification can be modified under the properties dialog (**Layer** → **Properties**). The layer's classification field can be set to None, which simply assigns a DEFAULT group to the classification. No new groups can be added to the classification if the field is None. The user must first select a field to classify on. New groups can be added to the classification with the **Add** button.

To apply the changes to the map the user can click either **Try** or **OK**. **Try** will not close the dialog box, allowing the user to see how the classification changes the map. **Revert** will undo the last classification applied to the map. **OK** will commit the changes and close the dialog. The user will be unable to undo the changes. **Close** simply closes the dialog box. If any changes have not been applied with **Try** the changes will not be applied to the map.

Figure 5-1. Properties Window



The order of the groups in the classification is significant except for the DEFAULT group, which remains at the top. When shapes are matched against groups the matching begins at the first group after the DEFAULT group so that groups higher in the list will be checked first. Matching for a given shape will stop at the first group that matches. The user can use Move Up and Move Down to change the order of the groups. The DEFAULT group will always match a shape that hasn't matched another group.

### 5.1.1. Visible

The Visible column has check-boxes that determine whether a classification group will be displayed in the legend. This is useful if the user knows that the groups completely cover the data set and don't want the DEFAULT group to be displayed in the legend and on a printout.

### 5.1.2. Symbols

Each type of shape has its own type of symbol. Thuban supports three types of shapes: polygons, lines, and points. Polygons and points have outline and fill color, while lines have only line color. Each group has associated symbol properties. To edit the symbol properties for a group the user can double click on the Symbol column or select a group and click the Edit Symbol button.



### 5.1.3. Value

The Value column of the classification table is the value that will be matched when the map is being drawn. The type of data that can be entered into this field depends on the type of data of the classification field.

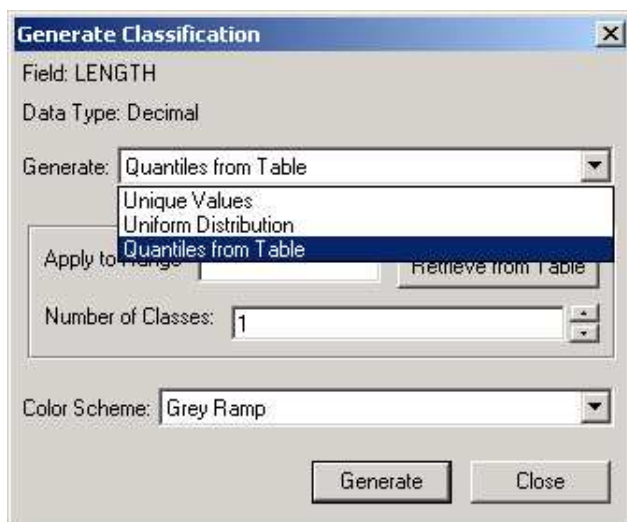
If the field is of type Text, anything entered into the field is valid. The text will be compared literally to the value of the shape attribute, including case sensitivity. If the type is Integer, then any valid integer may be entered. In addition, with special syntax, a range of values can be entered. A range from *start* to *end* inclusive is specified like this: [*start*;*end*]. The exclusive range is specified like this: ]*start*;*end*[. Ranges can include infinity like this: [-∞;∞]. Field types can also be of type Decimal. They represent any rational number and can be used in ranges as well.

### 5.1.4. Label

By default, the text that is displayed for a group in the legend is the value for that group. The label can substitute a more descriptive term in the legend.

## 5.2. Generating Classes

Figure 5-2. Generate Class

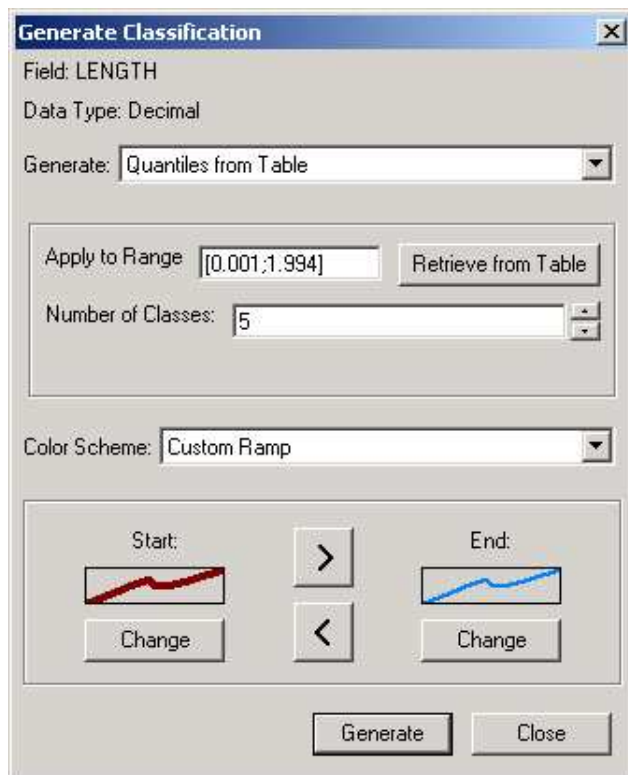


Creating a classification by hand can be tedious. Thuban, therefore, provides a means of generating an entire classification at once while still giving the user control over how it appears. Clicking **Generate Class** opens the `Generate Classification` dialog. Under the `Generate` pull down there are at most three different ways to generate classifications: Unique Values, Uniform Distribution, and Quantiles. Some options may not be available

if the data type for the field does not support them. For instance, `Uniform Distribution` doesn't make sense for a `Text` field.

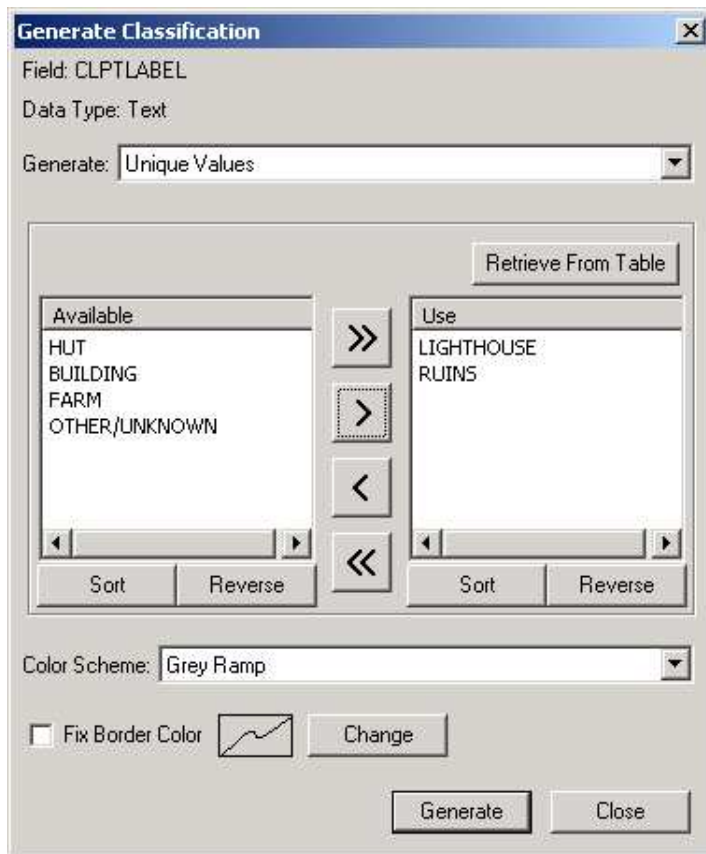
For every way of generating a classification, a color scheme must be selected. Thuban provides several different color schemes that affect how the group properties change over the classification. It may be desirable that only certain properties change over the classification. If the shape type is a polygon or a point then the `Fix Border Color` option will be available. This allows the user to select a border color for all classification groups. It is also possible to create a custom color scheme. Selecting this option will display two symbols: the one on the left has the properties of the first group and the one on the right has the properties of the last group. Thuban will interpolate between these two properties to generate the other groups.

**Figure 5-3. Custom Color Scheme**



The `Unique Values` option lets the user select specific values that appear in the table. Clicking `Retrieve From Table` searches the table for all unique values and displays them in the list on the left. Items can be selected and moved to the list on the right. Each list can be sorted or reversed for easier searching. The classification that is generated will be in the same order as the list on the right.

Figure 5-4. Unique Values



The Uniform Distribution option creates a user specified number of groups of ranges such that each range covers equal intervals. The minimum and maximum values can automatically be retrieved from the table by clicking Retrieve From Table. The stepping is how large each interval is. Adjusting this value will automatically recalculate how many groups is appropriate.

Figure 5-5. Uniform Distribution

The screenshot shows the 'Generate Classification' dialog box with the following settings:

- Field: LENGTH
- Data Type: Decimal
- Generate: Uniform Distribution
- Min: 0.001
- Max: 1.994
- Retrieve From Table: (button)
- Number of Groups: 5
- Stepping: 0.3986
- Color Scheme: Grey Ramp
- Buttons: Generate, Close

The Quantiles option generates ranges based on the number of items in the table. For example, by specifying five groups Thuban will generate five groups with appropriate ranges such that 20% of the table data is in each group. If it is impossible to generate exact groupings, Thuban will issue a warning but allow the user to continue.

Figure 5-6. Quantiles

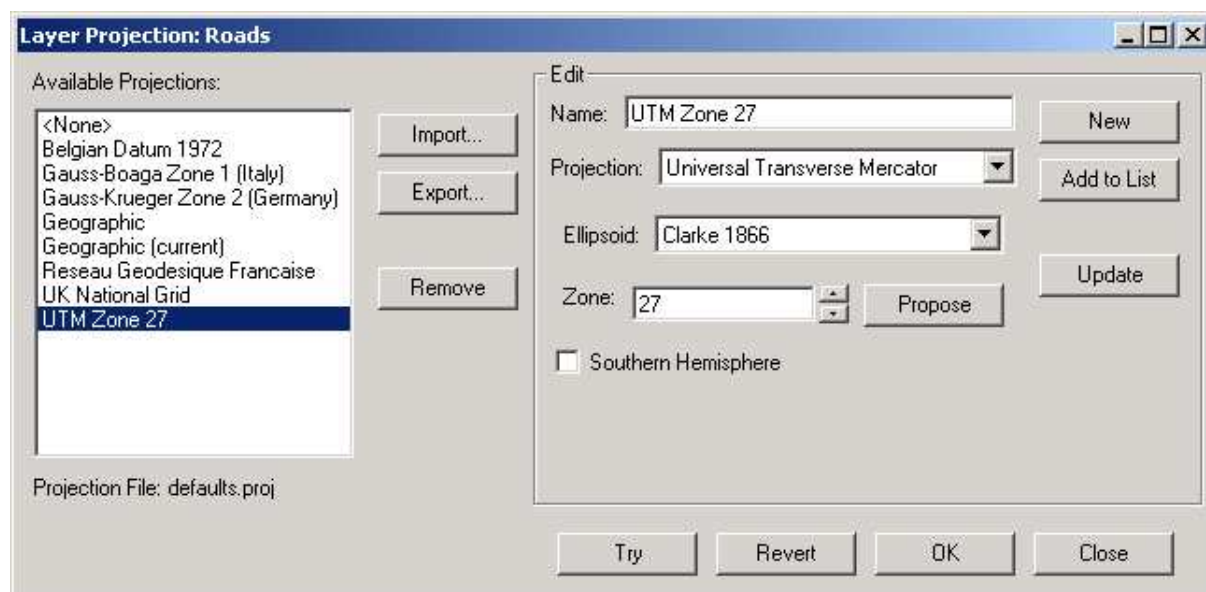
The screenshot shows the 'Generate Classification' dialog box with the following settings:

- Field: LENGTH
- Data Type: Decimal
- Generate: Quantiles from Table
- Apply to Range: [0.001;1.994]
- Retrieve from Table: (button)
- Number of Classes: 5
- Color Scheme: Grey Ramp
- Buttons: Generate, Close

# Chapter 6. Projection Management

Projections control how the geographic data is displayed on the screen. If multiple layers are loaded into Thuban where the geographic data is in a different projection system, then the user must specify a projection for each layer. The user must also tell Thuban which projection the map is in. This can be the same as the layers or a different projection in which case the layers are reprojected into that space. The map projection can be set using Map→Projection and the layer projection can be set using Layer→Projection.

Figure 6-1. Projection Window



Thuban is distributed with a sample collection of projections. The user can create new projections and make them available to all future Thuban sessions. They may also be exported and imported so that custom projections can be distributed.

## 6.1. Selecting a Projection

The available projections are listed on the left. If the layer or map already has a projection it will initially be highlighted and will end with (current). Selecting <None> will cause Thuban to use the data as it appears in the source file and will not use a projection.

## 6.2. Editing a Projection

Whenever a projection is selected from the list its properties are displayed on the right. These properties can be changed and the changes saved to the selected projection using Update. Only a projection that comes from a file can be updated, so if the current layer's projection is selected, Update will be disabled. Add to List adds the

projection to the list of available projections as a new entry, and thus makes it available to future Thuban sessions. Clicking **New** will create an entirely new, empty projection. The **Remove** button will permanently remove a projection from the list of available projections.

To apply the selected projection to the map the user can click either **Try** or **OK**. **Try** will not close the dialog box, allowing the user to see how the projection changes the map. **Revert** will undo the last projection applied to the map. **OK** will commit the changes and close the dialog. The user will be unable to undo the changes. **Close** simply closes the dialog box. If no selection has been applied with **Try** the selection will not be applied to the map.

### 6.3. Importing/Exporting Projections

The projections that appear in the list of available projections can be exported to another file that the user chooses. By selecting one or more projections and clicking **Export** the user will be able to select a file in which to store those projections. The file can then be distributed to other Thuban users. To import a projection file the user can click **Import**. The imported projections are added to the list and are then available to the current session and any future Thuban sessions.

# Chapter 7. Table Management

Thuban distinguishes two different types of tables: Attribute tables (which belong to a layer) and normal data tables. Both provide the same general functionality with the difference that actions on an attribute table might also effect the map display.

## 7.1. Table View

Figure 7-1. Table View

	FNODE_	TNODE_	LPOLY_	RPOLY_	LENGTH	RDLINE_
1	3	1	146	146	0.156000	1
2	4	1	146	146	0.031000	2
3	4	3	146	146	0.161000	3
4	3	5	146	146	0.039000	4
5	6	8	146	146	0.121000	5
6	8	2	146	146	0.040000	6
7	1	9	146	146	0.187000	7
8	9	4	146	146	0.110000	8
9	10	11	146	146	0.001000	9

Thuban provides a standard dialog to display table contents, the Table View. The view has five sections: The title, selections, the table grid, export functions, and the status bar.

The title bar identifies the table with its name.

The selections box let the user perform simple analysis on the data based on comparisons: The first choice must be a field identifier of the table, the second choice determines the type of comparison. The third choice can be either a specific value (interpreted as numerical or string depending on the type of the first field) or a second field identifier. Thus you can perform analysis like selecting all records where `population > 10000` or `cars_per_inhabitant < bikes_per_inhabitant` (note that the field names are only explanatory, the dBase files allow only 11 character field names). Selections can be combined either by applying a selection only on a previously selected set of records or by adding the results of a selection to a previous set. The default is that a selection replaces earlier results.

The table grid shows the contents of the table (one record per row), with highlighted selection results. Columns and rows can be resized.

The contents of a table can be exported into a file, either dBase format (DBF) or comma separated values (CSV). The **Export** button raises a file dialog to specify a path and file name, the export type is determined by the file extension (either .dbf or .csv). The **Export Selection** button works similarly but exports only the selected records. The **Close** button closes the table view window. This is different from the menu item **Table→Close** which unloads the table from Thuban.

The status bar displays some statistics about the table and optional selection results.

## 7.2. General Functionality (Menu Table)

The general functions affect all tables open in Thuban. Attribute tables are considered here as normal data tables (with the exception that they cannot be closed).

### 7.2.1. Open

The **Table→Open** item raises a file dialog to let you select a dBase file from the file system to be loaded into Thuban read-only. On OK the selected file is loaded and a table view is opened.

### 7.2.2. Close

The **Table→Close** item raises a dialog listing the currently open data tables (loaded via **Table→Open**). Selected tables are dereferenced on confirmation. Since tables are opened read-only the contents of the tables are not affected. Any open views of the tables are closed as well. Tables used in a join cannot be closed.

### 7.2.3. Rename

**Table→Rename** changes the table title.

### 7.2.4. Show

The **Table→Show** item raises a list of available tables (explicitly loaded, attribute tables, results of a join). Selected tables are show in tables views on OK.



## 7.2.5. Join

Figure 7-2. Join Tables



The **Table**→**Join** item raises a dialog to specify the two tables to be joined. The join results in a new table named 'Join of "left table" and "right table"'. The dialog lets you select the two tables to be joined and the two fields the join has to be performed on. By default, the new table contains only those records which are matched by the join. If you want to preserve the records of the left table you can perform an outer join. The fields from the right table for records not matched by the join are filled with `None` in this case.

## 7.3. Attribute Tables

To clearly separate between both types of tables (data and attribute), Thuban provides functionality regarding the attribute tables under the **Layer** menu.

### 7.3.1. Show Table

**Layer**→**Show Table** opens the attribute table of the currently active layer in a table view. In addition to the functionality described above selections affect also the map display: objects related to selected records are highlighted.

### 7.3.2. Join Table

Unlike the join described above, the join does not result in a new table. The attribute table of the currently active layer is the left table and other tables are joined to this table. The results of the join are available for classification. As a consequence, the join cannot result in fewer records than the source attribute table. The user is warned if the right table does not fulfill this constraint. An outer join must be used in such cases.

### 7.3.3. Unjoin Table

As said above, a normal table cannot be closed while it is still used in a join. While the joined table resulting from a join of normal tables can be simply closed (and thereby dereferencing the source tables), this is not possible for attribute tables. Hence joins on attribute tables must be solved explicitly. This is what the Layer→Unjoin Table item is used for: The last join for the currently active layer is solved.

# Chapter 8. Trouble Shooting

Here are a few problems that users have encountered when first using Thuban.

- After adding two or more layers nothing is drawn in the map window.

This is probably because the layers have different projections. Projections must be set on all layers and on the map itself if the layers' projections are different.

- Thuban crashes on startup with the error `NameError: global name 'False' is not defined`.

`True` and `False` were only introduced in Python 2.2.1. Thuban depends on at least Python 2.2.1.

- After compiling Thuban, Thuban crashes with an error similar to `ImportError: /usr/local/lib/thuban/Thuban/./Lib/wxproj.so: undefined symbol: __gxx_personality_v0`

Thuban depends on the wxWindows library. If Thuban is compiled with an incompatible version of the compiler than wxWindows was compiled with this error may occur. Try compiling with a different version of the compiler.

If an error occurs Thuban will display a dialog indicating the error before closing. The text should be copied and reported to the Intevation bugtracker (<http://thuban.intevation.org/bugtracker.html>). More information about the system is available from **Help**→**About** box. This should also be included in the bug report.

**Figure 8-1. Error Dialog**





# Appendix A. Supported Data Sources

## Shapefile

The Shapefile format has become a standard format for saving geographic vector information. It supports polygons, lines, and points. Technical Specification.  
(<http://www.esri.com/library/whitepapers/pdfs/shapefile.pdf>)

## dBase file

dBase files are used to store the attributes for each layer. This is closely associated with the Shapefile format. For detailed specifications on the correct format of a dBase file used with Thuban please see the Technical Specification for the Shapefile format above.

## Raster files

Binding the GDAL library Thuban supports numerous raster file formats, see GDAL format list ([http://www.remotesensing.org/gdal/formats\\_list.html](http://www.remotesensing.org/gdal/formats_list.html)) for details.

Most commonly used is the *TIFF/GeoTIFF* format: Raster maps are provided as TIFF images, with an additional "world file" storing the geographic reference (usually with an extension ".tfw").

# Appendix B. Supported Projections

The following types of projections are directly support by Thuban. The specific values for each are provided by the user to create custom projections. Thuban comes with predefined projections which are available through the Projections dialog.

- Geographic
  - Ellipsoid
  - Source Data: either Degrees or Radians
  
- Lambert Conic Conformal
  - Ellipsoid
  - Latitude of 1st standard parallel
  - Latitude of 2nd standard parallel
  - Central Meridian
  - Latitude of Origin
  - False Easting (meters)
  - False Northing (meters)
  
- Transverse Mercator
  - Ellipsoid
  - Latitudeof origin
  - Longitudeat central meridian
  - Scale Factorat central meridian
  - False Easting (meters)
  - False Northing (meters)
  
- Universal Transverse Mercator
  - Ellipsoid
  - Zone (can be guessed applying the Propose button)
  - Southern Hemisphere flag

Thuban comes with a sample set of map projections for various European countries. Apart from the basic projection they differ especially in their parameterization:

- Belgium Datum 1972 (Lambert Conic Conformal)
- Gauss-Boaga Zone 1 (Italy, Transverse Mercator)
- Gauss-Krueger Zone 2 (Germany, Transverse Mercator)
- Reseau Geodesique Francaise (France, Lambert Conic Conformal)

- UK National Grid (United Kingdom, Transverse Mercator)

Thuban uses the comprehensive PROJ library for projections. PROJ provides more than the four commonly used projections described above. If needed Thuban can be easily extended to a new projection covered by PROJ.