

# Presentation of results

Data presentation is the procedure by which information from a GIS is presented in a form suitable for the user. Remember that the results of a GIS analysis are used in planning and management. Normally, data analysis is not done by the decision

makers and planners, therefore, information should be presented to them in such a way that they are able to make sound decisions. If the information is presented to them in a vague, unclear way, wrong decisions may be taken.

A map contains information, presented in a graphical form, intended for the map user. A map is a means of communication, just as spoken text, video images, graphics and sounds. A map should be well designed, so that the user can retrieve the information quickly and easily.

Although ILWIS is not a cartographic package, it does provide the basic tools for the creation of annotation and to convert digital spatial data (maps) to a hard copy print.

In the first part of this chapter, an introduction is given to the use of color, both for display on the screen and for printing. The second part of the chapter explains how to produce an output map. The selection of colors, patterns and point symbols is demonstrated, and the Layout editor is used to create a complete land use map. The procedure for printing a map is shown after that, followed by the methods for converting your data to other (cartographic) packages. The last part of this chapter deals with the generation of demos in ILWIS.

Before you can start with the exercises, you should start ILWIS and change to the subdirectory C:\ILWIS 3.0 Data\Users Guide\Chapter13, where the data files for this chapter are stored.



- Double-click the ILWIS icon on the desktop.
- Use the Navigator to go to the directory: C:\ILWIS 3.0 Data\Users Guide\Chapter13.

### 13.1 Introduction

When you prepare a map, you should be aware of the requirements of the map users. A map intended for decision-makers, containing clear data without details, will be very different from one made for scientists, which should contain as much factual information as possible.

A map may be multi-purpose, such as a topographical map, which may be used by many different people, for different purposes. A map can also be a single-purpose map, displaying only one theme, for example, the annual rainfall distribution.

A map has a primary content (the main theme of the map), a secondary content (base map information, such as roads, contours, drainage), and a supportive content (legend, scale, north arrow, location map, etc.).

When you prepare a map for presentation you should decide on the scale of the map you want to produce on paper. The scale of the output map should be based upon considerations, such as: the purpose of the map (regional planning versus detailed design), the requirements of the map user, the contents of the map, the size of the area mapped, the size of the output map (paper format), and the required accuracy.

#### Displaying data to be used in the final map

In ILWIS, the map making-process starts with the visualization of the mapped area and the selection of the spatial and attribute data to be presented. You will first have to investigate which data you want to display on your map as primary content (main theme) and secondary content (base map information). Users should always be able to locate themselves on a map, so each map should contain sufficient base map information. On a large scale map, this base map information can be quite extensive including contour lines, drainage lines, roads and other infrastructure, and the location of villages and towns. On small scale maps, maybe only the main roads and main towns can be displayed as base information. Putting too much base information on a map is confusing.

It is possible to make use of one, or a combination of data layers (raster, segment, polygon or point maps) to compile a final output map. In the Display Options - dialog boxes, which appear just before a map is displayed in a map window, you can specify how each map should be displayed.

The objective of the exercises in this chapter is to produce a complete land use map. The first step of the preparation process for producing an output map in this exercise, is to display the map `Landuse`. Visualization of the map area is an important stage in the preparation of the map for final printing, since further planning of the layout can only be decided after viewing the map. For example, by visualization you are able to check whether enough space is available for annotation or whether the map area has to be extended and whether the contrast between colors representing different mapping units is satisfactory or not.

In this exercise, the following data layers will be combined into a single map:

The polygon map `Landuse`: Forming the primary content. The map is displayed as colored patterns.

- The point map `Labels`, containing text labels of the land use polygons.
- The raster map `Shadows`, containing the hillshading of the study area.
- The segment map `Contour`, containing the contour lines.
- The segment map `Drainage`, containing the drainage network.
- The segment map `Roads`, containing the road network.
- The point map `Places`, containing the location and names of the most important locations in the area.

The various steps required to display maps and adding data layers to a map window were explained in chapter 2.



- Display polygon map `Landuse`.

The map `Landuse` is displayed in the map window. You can add several data layers (polygon, segment and point maps) to this window, as long as they are using the same coordinate system.



- Add the other data layers mentioned above to this map window: the segment maps `Contour`, `Drainage` and `Roads`, the point maps `Labels` and `Places`, and the raster map `Shadows`. Always use the default parameters in the `Display Options` - dialog boxes.

It is clear that the complete map may become difficult to read because if you use all layers as they are the map will contain too much base map information. Especially the contour lines are too densely spaced. Later on, you will make a selection of the contour lines.



- Close the map window when you have finished the exercise.

## 13.2 Colors

One of the most important aspects in the design of presentable maps is the selection of the most appropriate colors.



In ILWIS, the colors of objects are defined in the *representation*. In chapter 2 several aspects of representations were already discussed.



- Click with the right mouse button on representation `Colors` and select `Open` from the context-sensitive menu. The Representation Class editor is opened.

You will see a display of 20 colors. Every color may be seen as a combination of different amounts of the primary colors: Red, Green and Blue (see Figure 13.1).

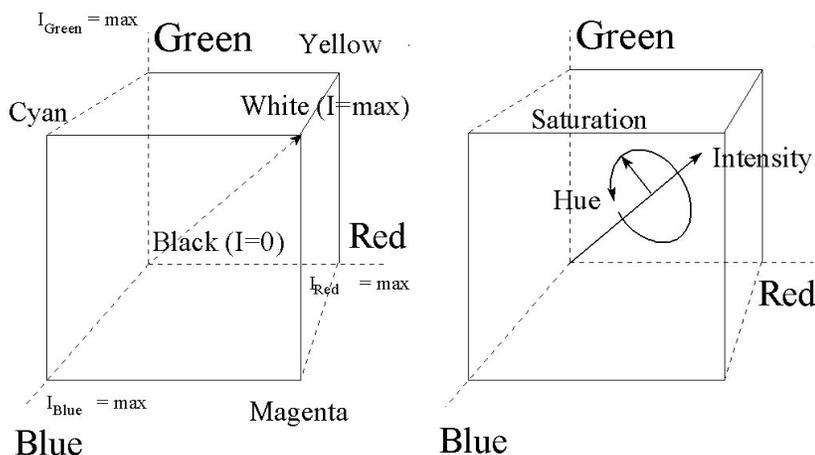


Figure 13.1: Color systems. Left: The RGB color system. Right: The HSI color system.

In ILWIS, you can work with three color systems (see Figure 13.1):

- The *RGB* (Red, Green, Blue) color system, which is used for display on most computer screens.
- The *YMC* (Yellow, Magenta, Cyan) color system, often used to describe the color of an image produced by several hard copy devices.
- The *HSI* (Hue, Saturation, Intensity) color system, used for image processing.

In theory there is an infinite number of colors possible. ILWIS uses contributions of each of the colors Red, Green and Blue in the range from 0 to 255. A value of 255 refers to the full intensity of a basic color.

The notation:

- |                 |                |               |                 |
|-----------------|----------------|---------------|-----------------|
| (0, 0, 0)       | returns black, | (0, 0, 255)   | returns blue,   |
| (255, 255, 255) | returns white, | (255, 255, 0) | returns yellow, |

(255, 0, 0)	returns red,	(255, 0, 255)	returns magenta,
(0, 255, 0)	returns green,	(0, 255, 255)	returns cyan.



- Click on the color Yellow. You can see that the three slide bars on the left-hand part of the window change. Red will be 255, Green will also be 255 and Blue will be 0.
- Check the Red/Green/Blue components of the other 19 colors and close the Representation Class editor afterwards.

Besides manipulation of colors in the representation of maps, ILWIS also has the possibility to retrieve and/or assign colors in calculations. Calculations on colors require maps or table columns with a color domain or a picture domain. You can also see the color assignments of the items represented in the representation `Colors` in a table.



- Click in the Catalog with the right mouse button on representation `Colors` and select `Open as Table` from the context-sensitive menu. The representation is now shown as a table.
- Double-click the column header `Color`. The Column Properties dialog box is opened. As you can see, column `Color` has domain `Color`.

Domain `Color` is a domain in which the colors are stored as Red, Green and Blue. You can convert the colors as stated in the `Color` domain to the values of separate Red, Green and Blue colors (or YMC or HSI as explained earlier) with a number of statements (see Table 13.1).

**Table 13.1:** Expressions to convert a color domain into the individual values of the color systems RGB, YMC and HSI.

<code>CLRR</code> ( <i>colorexpr</i> )	returns the red component
<code>CLRG</code> ( <i>colorexpr</i> )	returns the green component
<code>CLRB</code> ( <i>colorexpr</i> )	returns the blue component
<code>CLRY</code> ( <i>colorexpr</i> )	returns the yellow component
<code>CLRM</code> ( <i>colorexpr</i> )	returns the magenta component
<code>CLRC</code> ( <i>colorexpr</i> )	returns the cyan component
<code>CLRG</code> ( <i>colorexpr</i> )	returns the gray component
<code>CLR</code> ( <i>colorexpr</i> )	returns the hue component
<code>CLRS</code> ( <i>colorexpr</i> )	returns the saturation component
<code>CLR</code> ( <i>colorexpr</i> )	returns the intensity component

By using one of these statements you can either convert the colors in a representation, shown as a table, using map calculation formulas, or you can use them on a map with a color domain or picture domain.



- Close the Column Properties dialog box.
- Make the Command line appear in the table window by choosing the Command Line from the View menu.
- Type the following formulas on the Command line and click OK each time the Column Properties dialog box shows up:  
Red = CLRRED(color) ↵  
Green = CLRGREEN(color) ↵  
Blue = CLRBLUE(color) ↵  
Yellow = CLRYELLOW(color) ↵  
Magenta = CLRMAGENTA(color) ↵  
Cyan = CLRCYAN(color) ↵  
Grey = CLRGREY(color) ↵  
Hue = CLRHUE(color) ↵  
Sat = CLRSAT(color) ↵  
Intensity = CLRINTENS(color) ↵

Now you can see the 20 colors of the representation, expressed in the components of the three color systems explained earlier. The first three columns Red, Green and Blue, are simply the same values as in the appropriate part of the column color. The second group of three columns (Yellow, Magenta, and Cyan) show the colors in the YMC color system. Note that the calculation is made in the following way:

Yellow = 255 - Blue  
Magenta = 255 - Green  
Cyan = 255 - Red

Next, there is a column showing the gray tones of the colors. The gray component is useful when you want to produce a gray tone map out of a color map.

The last three columns (Hue, Sat, Intens) show the values according to the HSI color system:

- *Hue* is the direction of the color in a three-dimensional color cube;
- *Saturation* is the purity of the color;
- *Intensity* is the brightness of the color.

Note that the values for Hue, Saturation and Intensity range from 0 to 240, because that is the standard HSI color range in Windows. For the exact conversion formulas, see the ILWIS Help topic Color Separation.



- Compare the values in the columns you have just calculated with the color cubes in Figure 13.1 in order to get an idea of the three color systems.
- Close the table window.

**Hints for appropriate use of colors:**

- For large areas in a map, the saturation of a color seemingly increases for the eye. A color that looks okay in the legend may be too dominating in the map.
- Two rather similar colors can only be differentiated when they appear next to each other in the map.
- Hues in the red-yellow region are said to be “warm colors”. Blue colors are said to be “cold”.
- There are generally accepted color order scales. For example:
  - Evidently: blue for water, green for vegetation, yellow for sandy areas.
  - Some colors are more “powerful” and are used to indicate important features: red for high hazard areas.
  - To indicate increasing order scales, decreasing values are used: dark to light.
- It is not advisable to use more than 4 to 6 steps of the same hue.
- To indicate increasing positive and negative values use two base colors: red/yellow & blue.
- The same colors are perceived lighter on a computer screen than on a paper map, especially if you use high contrast and high brightness settings for your monitor.

## 13.3 Editing visual variables

### 13.3.1 Maps with a representation

A cartographer disposes of the following tools in the representation of information in a map:

- The basic types of spatial data, mentioned in chapter 2: points, lines and areas.
- Volumetrical shapes, for example an impression of the relief shown with hill shading.
- Text for legend information, topographical information and codes of mapping units.
- Symbols related to points but also to other symbols such as pie charts or bar graphs to display statistical information within mapping units.

To convey relevant information with these cartographic tools, a cartographer can use several *visual variables*. With visual variables, one can manipulate how these above mentioned items will be displayed. There are seven visual variables: position, form, orientation, texture (variation of density of graphical elements with the same overall gray expression), value (gray tones), size and color.

The visual variables that can be used in ILWIS depend on the map domain (class, ID, value, picture, color), and on the type of map (point, segment, polygon and raster).

When you make a division according to the type of maps, the following variables can be used:

- *Point maps*. Point can be displayed with different symbol types from different symbol fonts. The size, line color, line thickness and fill color can be specified.
- *Segment maps*. Segments can be displayed in different colors, line types (double, triple, etc. for e.g. a highway) and different line widths.
- *Polygon maps*. Polygons can be displayed in different colors, either solid, hatching or with a pattern, and the boundary lines around polygons can be shown in different colors and different line widths.
- *Raster maps*. Raster maps can be displayed using different colors.

From point, segment and polygon maps, you can extract text labels which can use a certain font type, size, color, etc. by creating an annotation text layer (see section 13.4).

For point (and raster) maps, you can also directly show texts via the map's Display Options - dialog box.

In chapter 2, the different types of representations that are available for different domains were discussed. To summarize, the Representation editor can be used to edit colors, patterns and point symbols of a map with:

- *Class domains*: Colors and patterns can be assigned to the classes of the map.
- *Value domains*: For maps with a value domain you can have two types of representations:
  - *Representation Gradual*, using percentage values as limits. This representation can be used to display maps with any value domain.
  - *Representation Value*, using actual values as limits. This representation can be used only for the user-defined value domain for which it was created.

- *Identifier domains*: Maps with domain type ID do not have a user-defined representation. They can be displayed:
  - in 1, 7, 15, or 31 system colors via the Display Options - dialog box;
  - by selecting a (class or value) column in the attribute table, e.g. in the Display Options - dialog box.
  - by calculating colors in a column with the color domain in the attribute table (see paragraph 13.3.2).

In this paragraph you will edit visual variables through a representation. Table 13.2 shows for which type of maps and domains a representation is available. Identifier domains and some system domains (Bit, Bool) do not have a stored representation on disk. Editing visual variables if no representation is available will be discussed in paragraph 13.3.2.

Table 13.2: Managing Colors for maps with different domains.

Type	Domain Class	Domain Identifier	Domain Value
Point map	Representation Class	Symbols, Symbols by Attribute, as Arrows, as Graphs	Stretched Symbols
Segment map	Representation Class	1, 7, 15, 31 Colors	Representation Value/Gradual
Polygon map	Representation Class	1, 7, 15, 31 Colors	Representation Value/Gradual
Raster map	Representation Class	1, 7, 15, 31 Colors	Representation Value/Gradual

- 
- ! For maps which use system domain `Value`, you can create a representation and
    - you can choose to work with either *percentages* (0-100%) or with *values* (-99999.99 to 99999.99).
- 

## Assigning colors to a class map

A map using a class or group domain always has a representation. Such a representation can be edited in the Representation Class editor. The colors, patterns, line types, etc. of all classes in the map's domain are shown and can be changed in the editor.

This exercise shows how to change colors in a class map by editing its representation class.



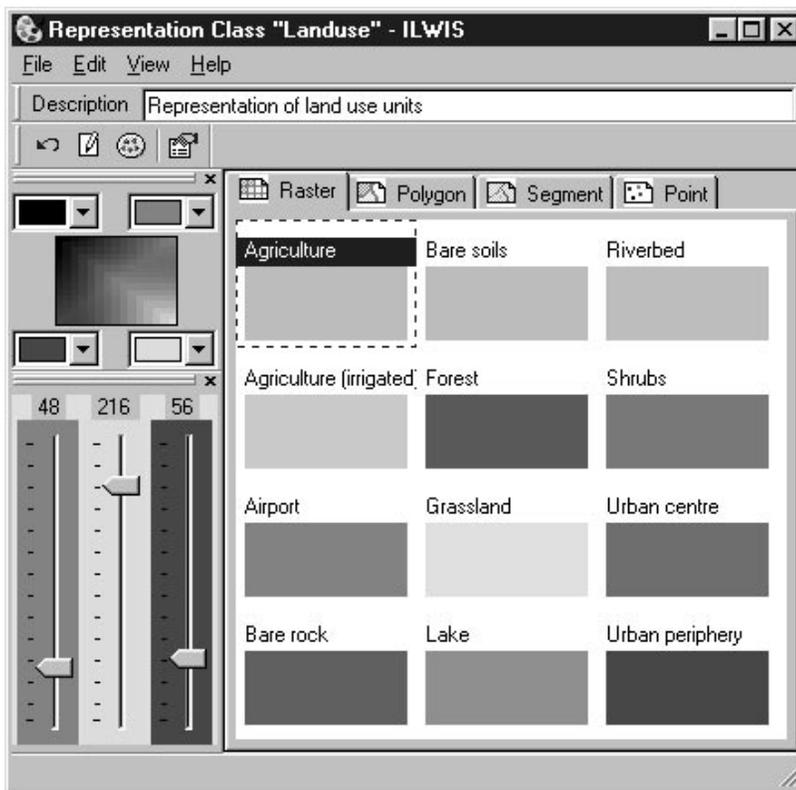
- Display raster map Landuse.

To change the colors of the mapping units:



- From the Edit menu, select the Representation command and select raster map Landuse.

The Representation Class editor (Figure 13.2) is opened. The tabs in this representation editor can be used to see the colors for raster, polygon, segment or point maps using this class domain. In the central part of this window, the class names and their colors can be viewed. In the upper left part just below the Toolbar of the window you will see the Color Selector and in the lower left part the Red, Green and Blue Color Sliders are visible.



**Figure 13.2:** The Representation Class editor showing the Raster, Polygon, Segment and Point tabs, the Color Selector (upper left part) and the Color Sliders (lower left part).

Colors can be edited in various ways:

- double-clicking classes;
- selecting a class and using the Color Selector;
- selecting a class and using the Color Sliders;
- selecting multiple classes and edit multiple items;
- assigning custom colors to a class.

In this exercise you will produce a simplified land use map based on the main land use classes of Cochabamba.

- 
- ! When you change the color of a class in a representation class, the color of this class will also be changed in all other maps that use the same domain and thus the same representation.
-



- Select the class `Bare rock`.
- Use the Red, Green and Blue Color Sliders to compose the correct color for this class.
- Move the Red (color) scroll bar to value 84.
- Move the Green (color) scroll bar to value 84.
- Move the Blue (color) scroll bar to value 84.
- Select the class `Agriculture( irrigated)`.
- Change the colors to: Red = 0, Green = 176 and Blue = 20.
- Double-click the class `Forest`. The Edit Repr. Item dialog box is opened.

! Any changes are directly saved to disk.

The selected class is shown as text at the top of the dialog box. The color list box displays a number of pre-defined colors. If you want to select your own color, you can click the Custom Color button; then the custom Colors dialog box appears. You can also double-click Custom at the bottom of the list of colors.



- Select the color `ForestGreen` and click OK.
- Double-click the class `Urban centre`. The Edit Repr. Item dialog box is opened again.
- Click the Custom Color button. The Color dialog box is opened.

The standard Windows Color dialog box (see Figure 13.3) provides another way to create an appropriate color for a class. The pre-defined colors are shown in the group Basic colors. You can make a new color by clicking the Define Custom Colors >> button, dragging the cursor in the Color Refiner box, and adjust the brightness in the bar next to it. You can also enter the color as values of Hue/Saturation/Luminosity (=Intensity), or as Red/Green/Blue. When you are satisfied with a certain color, you can press the Add to Custom Colors button: the new color will be added to the selected box in the Custom colors palette.



- Press the Define Custum Colors >> button.
- In the Color Refiner box, select a reddish color along the left-hand side (Red = 195, Green = 35 and Blue = 35). Click the button Add to Custom Colors and click OK in the Color dialog box.
- Now you are back in the Edit Repr. Item dialog box. Click OK. This will bring you back to the Representation Class editor.

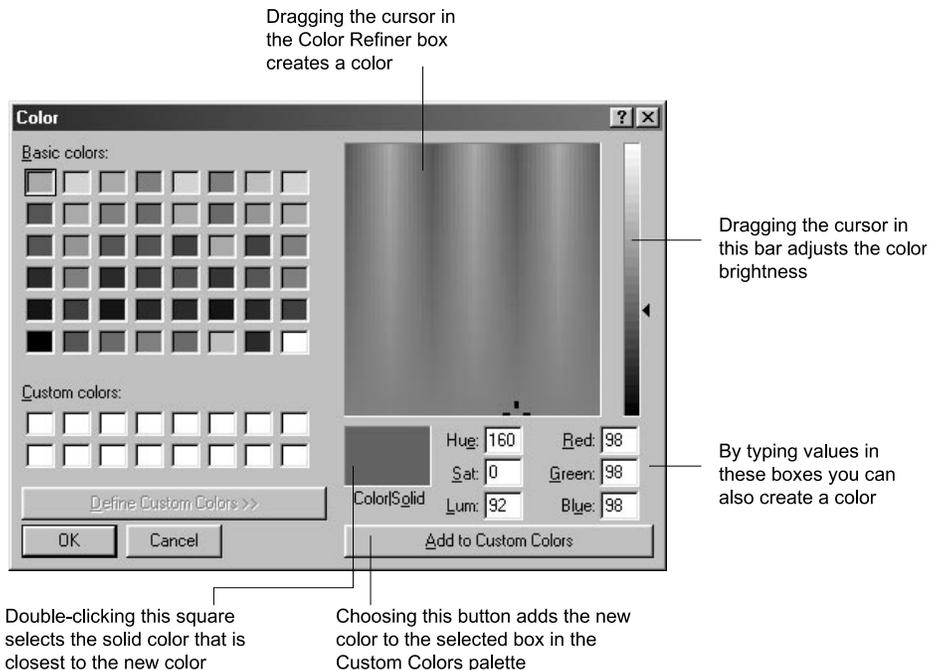


Figure 13.3: The standard Windows Color dialog box.

Now, you will edit the colors for the various mapping units.



- Edit the Red, Green, and Blue colors of each class according to the colors in Table 13.3.
- Click the Redraw button in the map window to see the result.

Table 13.3: Colors of the land use units.

Class	Color Name	Red	Green	Blue	Hatching polygons
Agriculture	Green	0	255	0	Horizontal
Agriculture (irrigated)	LimeGreen	0	176	20	Vertical
Airport	Red	255	0	0	Upwards
Bare rock	DimGray	84	84	84	Solid
Bare soils	LightGray	68	168	168	Solid
Forest	ForestGreen	48	128	76	Solid
Grassland	Custom	159	255	0	Solid
Lake	Custom	0	146	255	Solid
Riverbed	Custom	182	182	255	Solid
Shrubs	Custom	106	126	0	Solid
Urban centre	Custom	195	35	35	Diagonal
Urban periphery	Custom	129	40	0	Crossing

## Unit hatching

Besides colors, the Representation Class editor contains a number of hatching types which can be used to represent units in a polygon map.



- Add polygon map Landuse to the map window and switch off the raster layer in the map window.
- In the Representation Class editor, click the Polygon tab.
- On the Polygon tab, double-click class Urban centre. The Edit Repr. Item dialog box is opened.

Note that there is now an extra option Hatching in the lower part of the dialog box. With this option, you are able to select a hatching type and/or a background color for a selected class.



- Select the Hatching type Diagonal and click the OK button.
- Set the hatching of the other classes as indicated in Table 13.3.
- Press the Redraw button in the map window to see the result.
- Close the Representation Class editor and the map window when you have finished the exercise.

Note that hatching is only possible for polygon maps.

## Visual variables for segments: color, line type and line width

The visual variables for segment maps are color, line type and line width. For the production of the final map you will need three segment maps: Contour, Drainage, and Roads. The first map is a value map and the other two are class maps.



- Open segment map Drainage.
- Double-click the word 'Legend' in the Layer Management tree of the map window to open the Representation Class editor.
- Double-click the item Main river. The Edit Repr. Item dialog box is opened. Change the Line width to 0.2 and the Color to Blue.
- Change the Color of the item Drainage to Blue, and the one of the item Lake to Cyan. Leave the Line width 0 for these two.
- Click the Redraw button in the map window, look at the result and close the Representation Class editor.
- Add segment map Roads to the map window.





- Similarly, change the representation of the segment map `Roads`. Change the Color of item `Main roads` to `Red`, Line Type to `Double` and the Line width to `0.2`. Change the Color of `Secondary road` to `Red`.
- Click the `Redraw` button in the map window and close the `Representation Class` editor after you have seen the result.

The segment map `Contour` has a value domain `Height`, which also has a value representation `Height`. However, we do not want to display the contour lines in different colors. They should be shown in gray, and we want to display only the main contour lines (those every 100 meters).



- Drag-and-drop the segment map `Contour` to the map window. The `Display Options – Segment Map` dialog box is opened.
- Select the check box `Mask` and type the following mask: `??00`. This will result in the display of the 100 meter contour lines only.
- Click the option `Single Color` and select the color `Gray`. Click `OK`.
- Close the map window after you have seen the result.

### Visual variables for point maps

Data such as the location of villages and towns or data that are aggregated to points, such as total population per province, can be symbolized as points. Points are visualized as symbols, but they may vary in size according to the quantity they represent. Different simple point symbols are supported (circle, square, diamond, plus, etc.); you can also choose another symbol font.

Point data presented in a point map with a domain type class can be symbolized by editing the representation linked to the map. Point maps with the domain type identifier or value are linked to a system representation; the process of symbolizing the point data has to be done using the `Display Options – Point Map` dialog box.

In this part of the exercise, the point map `Places` with class domain is used. By editing the representation used by this map, you are able to select symbol type, symbol, size, fill color, line width and line color for the individual points in the map.



- Display point map `Places`.
- In the `Layer Management` pane, double-click the name `Cerveceria Taquina` (the local beer brewery). The `Edit Repr. Item` dialog box is opened.
- Specify Symbol `Square`, Size `4`, Fill Color `Yellow`, Line Width `1` and Color `Red` for this point and click `OK` to see the result.





- Specify the symbol representation for the other points according to Table 13.4.
- Close the map window when you have finished the exercise.

**Table 13.4:** Symbol representation for the point map places.

	Symbol Type	Symbol	Size	Fill Color	Line Width	Color
Cerveceria Taquina	Simple	Square	4	Yellow	1	Red
Cochabamba	Simple	Circle	6	Red	2	Black
Laguna Largon Mayu	Simple	Diamond	4	White	2	Blue
Airport	Wingdings	→	8			Red

- ! You can also create an annotation text object (see section 13.4) which can be based on a map. In this way you obtain all class names, IDs, or values of the points in your map, while you can edit the exact positions, fonts, font sizes, etc. of the texts later on in the Annotation Text editor.

### 13.3.2 Maps without a representation

In the previous paragraph, you have seen how to edit visual variables through a representation. The visual variables that can be changed are subject to the type of map and to the map's domain. In this paragraph, you will see how to change visual variables of maps without a user-defined representation.

#### Point map with a value domain: temporary stretching

For point maps with a value domain, you can specify symbol type, color, line width and line color for all points. For interpretation purposes, a point map with a value domain can be displayed using a stretch option for the symbol size. There are two stretch methods available: Linear and Logarithmic. If this is applicable to the type of symbol, you can either stretch the Radius or Area of a symbol. A stretch range can be specified as lower and upper boundaries.

Point map `Rainfall` has an identifier (ID) domain. The map is linked to an attribute table which contains rainfall data per year (`Total`), per quarter and per month. In this exercise you will display an attribute point map `Rainfall` with the point radius stretched according to the total annual rainfall.



- In the Catalog, double-click point map `Rainfall`.
- In the Display Options – Point Map dialog box, select the Attribute check box, and select column `Total`.
- Click the Symbol button. The Symbol dialog box is opened.





- Accept the defaults for Symbol Type, Symbol, Fill Color, Line Width and Color.
- Select the Stretch check box and accept the default stretch range.
- Accept Linear and Radius for the stretch method and click OK in the Symbol dialog box.
- Click OK in the Display Options - Point Map dialog box. Point map Rainfall is now displayed with a point radius proportionally to the total annual rainfall.

### Point map with an ID domain: points as graphs

When the attribute table of an ID point map contains comparable value columns of various *categories*, you can display the points as graphs. In the Symbols as Graphs dialog box, you can specify the type of graph:

- Pie Chart
- Bar Graph
- Line Graph
- Composed Bar
- Volume Cubes

The values of the selected columns will be represented by the size, length, volume, etc. of the selected graph type. For pie charts, you can also specify a stretch and stretch range of the total size of the pie charts. This is a useful option when the total size of the pie charts should represent the total amount of all variables depicted in the pie charts. As an alternative, you can also specify a fixed, user-defined size for all pie charts.

For more information on this subject, see the ILWIS Help topic Symbols as graphs: Point maps with ID domain and attribute table.

In this exercise, you will use a pie chart to display rainfall data of one year for the Cochabamba area. To reduce the number of wedges in the pie chart, you will represent the total rainfall per quarter. The stretch option will be selected to display the size of the pie charts according to the total annual rainfall. The raster map Shadows will be used as a background map.



- In the Catalog, double-click raster map Shadows. In the Display Options - Raster Map dialog box, select the option Light and click OK. The raster map Shadows is displayed.
- Drag and drop point map Rainfall into this raster map window. The Display Options - dialog box of point map Rainfall is opened.
- In the Display Options - Point Map dialog box, select Symbols as Graphs and click the Details button. The Symbols as Graphs dialog box appears.





- Make sure that the option Pie Chart is selected.
- From the left hand list box, select the columns Quarter1, Quarter2, Quarter3 and Quarter4. Use the Ctrl or Shift key to select multiple columns and press the > button. The right hand list box now lists the selected columns from which the graphs will be constructed.
- Select the Stretch check box and select column Total.
- Type 6 for the minimum and 14 for the maximum piechart Size.
- Accept the Radius option as stretching method and click OK. You are back in the Display Options – Point Map dialog box.
- Click OK. The point map Rainfall is now displayed on top of the raster map Shadows.

The points are displayed as pie charts, showing the rainfall values per quarter. The total size of each pie chart is proportional to the total annual rainfall at that location. If you like, repeat the exercise and try other possibilities like Compose Bar and/or Line Graphs.

### User-defined coloring of maps with an ID domain

In general, maps with an ID domain are displayed with a system representation. Units are represented in a fixed number of system colors (1, 7, 15 or 31 colors) that cannot be assigned to specific map elements (domain items). However, in most cases, you will wish to show an attribute value of the ID map.

In case, you really wish to show the mapping units as IDs themselves, you can use in the attribute table of the ID map some table calculations: for each ID a different color will be generated. The colors will be stored in an attribute column with the color domain.

Every color may be seen as a combination of different amounts of the primary colors Red, Green and Blue. The easiest way to create distinct colors for all domain items is to use a formula that will assign random colors to the domain items. Another option is to enter values for Red, Green and Blue manually. For more information, see ILWIS Help, topic Table calculation, Calculations on colors.

In this exercise, you will create a user-defined representation for polygon map Cityblock, which has an ID domain. You will create a new column with a color domain in the attribute table, and calculate random colors for all city blocks. To display the polygon map Cityblock with the new distinct colors, you need to select the option Attribute Column in the Display Options – Polygon Map dialog box.



- Open the table `Cityblock`.
- Type the following formula on the Command line of the table window:  
`Random:= COLOR(RND(255),RND(255),RND(255)) ↵`
- In the Column Properties dialog box accept Domain `Color` and click OK.

In column `Random`, you will see the newly calculated values Red, Green and Blue. The formula returns a color composed by the random `RND` function, resulting in random values for Red, Green and Blue (each ranging from 0 to 255).

You can now display polygon map `Cityblock` by its attribute column `Random`.



- In the Catalog, double-click polygon map `Cityblock`.
- In the Display Options – Polygon Map dialog box, select the Attribute check box, select column `Random` and click OK.

Polygon map `Cityblock` is now displayed with random colors for all map units. If necessary, you can change individual colors manually. This map could be saved as a map view and used to create a layout.



- Close the table and the map window.

### Summary: Editing visual variables

- The visual variables that can be used in ILWIS depend on the one hand on the domain of the map (class, ID, value, picture, color) and on the other hand on the type of map (point, segment, polygon and raster).
- When you make a division according to the type of maps, the following variables can be used:
  - *Point maps*. Point can be displayed with different symbol types from different symbol fonts. The size, line color, line thickness and fill color can be specified.
  - *Segment maps*. Segments can be displayed in different colors, line types (double, triple, etc. for e.g. a highway) and different line widths.
  - *Polygon maps*. Polygons can be displayed in different colors, either solid, hatching or with a pattern, and the boundary lines around polygons can be shown in different colors and different line widths.
  - *Raster maps*. Raster maps can be displayed using different colors.
- From point, segment and polygon maps, you can extract text labels which can use a certain font type, size, color, etc. by creating an annotation text layer. For point (and raster) maps, you can also directly show texts via the map's Display Options - dialog box.
- The ILWIS Representation editor can be used to edit colors, patterns and point

symbols of a map with:

- *Class domains*: Colors and patterns can be assigned to the classes of the map.
- *Value domains*: For maps with a value domain you can have two types of representations:
  - *Representation Gradual*, using percentage values as limits. This representation can be used to display maps with any value domain.
  - *Representation Value*, using actual values as limits. This representation can be used only for the user-defined value domain for which it was created.
- *Identifier domains*: Maps with domain type ID do not have a user-defined representation. They can be displayed:
  - in 1, 7, 15, or 31 system colors via the Display Options - dialog box;
  - by selecting a (class or value) column in the attribute table, e.g. in the Display Options - dialog box.
  - by calculating colors in a column with the color domain in the attribute table (see paragraph 13.3.2).
  
- Editing visual variables of maps without a user-defined representation:
  - *Point maps with a value domain*. For interpretation purposes, a point map with a value domain can be displayed using a stretch option for the symbol size.
  - *Point maps with an ID domain*. When the attribute table of an ID point map contains comparable value columns of various categories, you can display the points as:
    - Single Symbol;
    - Symbols by Attribute;
    - Symbols as Arrows, or
    - Symbols as Graphs.
  - *User-defined coloring of maps with an ID domain*. If you prefer to display an ID map in a user-defined way, instead of using system colors, you can calculate for instance random colors in a column in the map's attribute table. The column should use the color domain.

## 13.4 Map views

### Combining data layers



In the previous section you have learned how the individual data layers, that will form part of the final map, can be best displayed. A data layer is a raster, polygon, segment or point map, for which the user has specified display options such as color, width, size, etc., for the display in a map window. In this exercise you will combine various data layers into a single ‘map’. The combination of data layers will be stored as a *map view*.

A map view may contain data layers, annotation text layers, grid lines and/or graticules. The display settings (colors, widths, etc.) of each layer is stored. By opening a map view, all layers that were stored in the map view will be displayed exactly as they were stored, i.e. same colors, same zoom factor, same area. The title that you give to a map view, is later visible in the Title bar of the map window.

In this exercise, the following data layers will be combined into a single map:

- Polygon map *Landuse*: Forming the primary content. The map is displayed as colored patterns.
- Raster map *Shadows*, containing the hillshading of the study area.
- Segment map *Contour*, containing the contour lines.
- Segment map *Drainage*, containing the drainage network.
- Segment map *Roads*, containing the road network.
- Point map *Places*, containing the location and names of the most important locations in the area.



- Double-click raster map *Shadows* in the Catalog. The Display Options dialog box is opened.
- Select the *Light* option and click OK in the Display Options – Raster Map dialog box. The map is displayed.
- On the Toolbar of the map window, click the button *Add Layer*. The Add Data Layer dialog box is opened.
- Select the polygon map *Landuse* and click OK. The Display Options - Polygon Map dialog box is opened.
- Accept the defaults and click OK. The polygon map *Landuse* is added to the list of data layers.
- Click the *Add Layer* button again and select segment map *Contour* in the Add Data Layer dialog box.
- Click OK. The Display Options – Segment Map dialog box is opened.
- Select the *Mask* check box and type the following mask: `??00`.
- Select the *Single Color* option and select the color *Brown*.
- Click OK in the Display Options – dialog box. The map *Contour* is now displayed and added to the list of data layers.





- Add segment maps `Drainage` and `Roads` and point map `Places` to the same map window; use default Display Options.

Now all added layers are displayed in the map window. Furthermore, all layers appear in the Layer Management pane (left hand side of the map window).

## Adding an Annotation Text layer

You can also add text layers by creating a new object called *annotation text*. An annotation text layer is designed to display and store multiple texts at multiple positions. An annotation text object can be based on an existing point, segment, or polygon maps. If you do so, the text object will contain a text (class name, ID or value) for each point, segment or polygon in the selected map. In the next exercise you will create text labels for point map `Places`.



- From the File menu in the map window, select Create and select Annotation Text. The Create Annotation Text dialog box is opened.
- Enter the AnnText Name: `Place_labels`.
- Make sure the check box Based on Map is selected and choose point map `Places` from the drop-down list box.
- Accept all other defaults and click OK. The Annotation Text editor is opened.

The Annotation Text editor allows you to edit text items stored in an annotation text object. With the Annotation Text editor, you can:

- insert new texts and delete selected existing texts,
- move one or more selected texts to another position,
- make text duplicates, and
- specify fonts, sizes, colors, etc. for (multiple) selected texts.

In this case, we will only change the font and the font size of all text labels.



- From the Edit menu, choose Select All. In the map window, you will see that all the text labels are selected.
- Click the right mouse button in the map window and select Edit from the context-sensitive menu. The Edit Texts dialog box appears.
- Select the Font Name `Arial` and type 8 for the Font Size.
- Select Text COLOR `Blue`, deselect the Transparent check box, accept all other defaults and click OK. The annotation text labels appear in blue on top of the point symbols.
- Move the text labels one by one to a position you like and click the Exit Editor button  in the Toolbar after you are satisfied with the result.

The text labels are displayed with the new font and font size. For more information of using the Annotation Text editor, refer to the ILWIS Help.

- 
- ! Advanced users may prefer to edit an annotation text object in table form. This
- may provide quicker, easier or more precise possibilities to edit texts, positions and other settings like font, font sizes, colors, etc. To open an annotation text object as a table, you can double-click the object in the Catalog or open the File menu in the Main window, choose Open As Table and select an annotation text object.
- 

### Adding grid lines

Grid lines are regularly spaced, horizontal and vertical on a map area, according to the coordinate system linked to the map. In this exercise, grid lines are added to the data layers in the map window.



- From the Layers menu, select the Add Grid Lines command. The Display Options - Grid dialog box is opened.
- Type 5000 in the Grid Distance text box, accept Line Type Single and select Yellow from the COLOR list box.
- Click OK in the Display Options Grid – dialog box. The grid lines are added to the map window.

### Saving as map view

Now you can save the map window with all data layers, the annotation text layer and the grid lines in a map view.



- From the File menu in the map window, select the Save View As command. The Save View AS dialog box is opened.
- Enter the Map View Name: Landview.
- Enter the Title: Landuse map of the Cochabamba area.
- Click OK. The view is now saved.
- Close the map window.
- Open the map view Landview. As you can see, all layers that you combined earlier are now appearing in the same way as you displayed them before.
- Close the map view afterwards.

### Summary: Map views

- A map view contains the names of all layers to be displayed in one map window including the display settings (the colors, widths, etc.) of these layers.
- Besides data layers (maps), you can also add annotation text objects, grid lines or graticules to a map window. These layers can also be saved in the map view.
- The title that you give to a map view, is later visible in the Title bar of the map window. If you save a map view when zoomed in on a map, the zoomed area will be displayed when opening the map view.

## 13.5 Layout and Annotation

A map has a primary content (the main theme of the map), a secondary content (base map information, such as roads, contours, drainage), and a supportive content (legend, scale, north arrow, location map etc.). In the previous exercise you have generated a map view (`Landview`) containing the primary content (`Landuse` polygon map), the secondary content (raster map `Shadows`, segment maps `Contour`, `Drainage` and `Roads`, and point map `Places`) and a supportive content (annotation text labels (`Place_labels`), grid lines). In this exercise you will see how you can add other supportive content (annotation) by creating a *layout*.

A layout is required to print maps with annotation. A layout is a virtual sheet of paper on which you can make a composition of one or more map views into which you can insert annotation. For each map view, you can specify the *scale* on which the map view has to be displayed and printed later on.

A layout may contain:

- One or more map views, each of which may include a raster map, and multiple polygon, segment or point maps, annotation text layers, grid lines and/or a graticule;
- Texts;
- Boxes;
- Pictures and/or bitmaps.

For each map view, you can add in the layout:

- A legend for each layer in a map view;
- A scale bar and scale bar text;
- A north arrow;
- A map border, including coordinates and ticks for grid lines and or a graticule.

Pictures or bitmaps can be inserted from the clipboard or from harddisk. Annotation can be edited by double-clicking the object in the Layer Management pane. The total composition of the map view(s) added annotation should be saved in the layout. This layout can be printed later on.

In this exercise you will create a layout for the land use map of the Cochabamba area. The final map that will be made is shown in Figure 13.4.

### Creating a Layout



- From the File menu of the Main window, select Create, Layout. The Layout editor is opened.

The Layout editor contains a Layout Management pane and a Layout pane. The Layout Management pane lists the inserted layout items, showing their icon, name,

position, size and scale. In the Layout pane itself, the paper and its margins are visible.

- ! You can also start to create a layout by choosing the Create Layout command from the File menu in the map view window or by clicking the right mouse button on a map view in the Catalog and choosing Create Layout from the context-sensitive menu.

In this stage of creating a layout, you can change the Page Setup and choose Paper Size, Orientation (Portrait or Landscape) and Margins. The page setup can still be changed later, if needed. You will alter the Orientation of the paper into Landscape now.



- From the File menu of the Layout editor, select Page Setup. The Page Setup dialog box is opened.
- Make sure the Paper Size is A4, change the Orientation to Landscape and click OK. The orientation of the layout is now changed into landscape.

Layout elements, such as map views, legend, scale bar, north arrow, etc., can be added to the virtual paper using the Insert menu or by using the following buttons in the Layout toolbar of the Layout editor:



to add a Map View



to add simple Text e.g. a title



to add a Box



to add a Picture or bitmap from disk



to add a Legend



to add a Map Border



to add a North Arrow



to add a Scale Bar



to add a Scale Text



to add a layer to a map view



to remove a layer from a map view



to add Grid Lines to a map view



to add a Graticule to a map view

## Inserting a map view

Map views are the primary contents of a layout (see section 13.4 for how to make a map view). You can insert multiple map views in a single layout. In this exercise you will only use one map view `Landview`.



- From the Insert menu, select Map View. You can also click the Map View button  in the Layout toolbar. The Insert Map View dialog box is opened.
- Select `Landview` and click OK. The Set Scale dialog box appears.
- Change the scale into 1:150000 and click OK. The map view `Landview` is now listed in the Layout Management pane and displayed in the Layout pane.

In the Layout pane, you can position the map view by dragging it, size the map view by dragging one of its size handles or zoom in into a specific area and/or pan to the desired area.



- In the Layout pane, click the map view `Landview`, hold down the mouse button and drag the map view to the left side of the paper (see Figure 13.4).
- Before you can size or pan you must deselect the Keep Scale option by opening the View menu and deselecting Keep Scale or by clicking the Keep Scale button  in the Standard toolbar (the button should appear up). Try to size and/or pan the map view, but in the end make sure to display the entire map.

The same operation can be carried out in the Layout Management pane. Select a field in the Layer Management pane and edit the value of the field: position, size, scale, etc.



- In the Layout Management pane, click the Scale field of the map view `Landview`.
- Change the scale into 1:125000.
- If necessary, position the map view again.

The map is now displayed on scale 1:125000. For A4 paper size, this is a reasonable scale to print the map later on. You can fix this scale.



- Make sure the map view `Landview` is selected in the Layout pane.
- From the View menu, select the Keep Scale command or click the Keep Scale button  in the Standard toolbar (the button should appear down).

In principle, the scale of the map view is now fixed to 1:125000. When the size handles of a map view are dragged by accident, nothing will happen. When you make the map view smaller by dragging its size handles to the inside the map view will become smaller, but the scale on which the map view is displayed remains the same. Only part of the map view will be shown.

You can still change the scale of the map view manually by typing a scale in the Layout Management pane.

## Creating a map border

With the Map Border option, you can add border information to a map, optionally displaying: neat line graduation, grid and/or graticule ticks, grid coordinates, graticule and/or corner coordinates, map outline.

Here, you will add a neat line, grid ticks and grid coordinates to the map view.



- Make sure the map view Landview is selected in the Layout pane.
- From the Insert menu, select Map Border or click the Map Border button  in the Layout toolbar. The Edit Map Border dialog box is opened.
- On the Grid tab, select the Grid Ticks check box and type 5000 for the Interval and type 1.0 for the Tick Length.
- Select the Grid Coordinates check box and type 5000 for the Interval.
- Select Full Coordinates and Text Offset 2.0 mm.
- Select the Font Name: Times New Roman and Font Size: 10.
- Click OK. The map border is displayed in the layout window.
- Position the map view in such a way that the map view and coordinates are displayed within the page margins.

## Creating a legend

A legend is created based on information available in the domain of a map in a map view and the representation used by the domain. In this exercise, a legend is created for the map Landuse and this legend is added to the map view Landview that is displayed in the layout.



- Make sure the map view Landview is selected in the Layout pane.
- From the Insert menu, select Legend. You can also click the Legend button  in the Layout toolbar.

The Map Layer Selection dialog box is opened. It enables you to select a layer for which the legend will be created.



- Select polygon map Landuse and click OK. The Display Options – Legend dialog box is opened.
- Select Font Name: Times New Roman, and Font Size: 10.
- Accept the defaults for other display options by clicking the OK button. The legend will be displayed in the Layout pane.
- Select the legend box.
- Drag the box to the right hand side of the layout (see Figure 13.4). Leave some open space below the legend, so that the scale bar can be placed there.
- Repeat the previous steps to insert a legend for the Drainage and Road data layers.

- ! You can align the separate legend items by typing identical values for Left and/or Top position in the Layer Management pane.

Save the layout before proceeding.



- From the File menu, select Save As. The Save As dialog box appears.
- Type Landview for the File name and click Save.

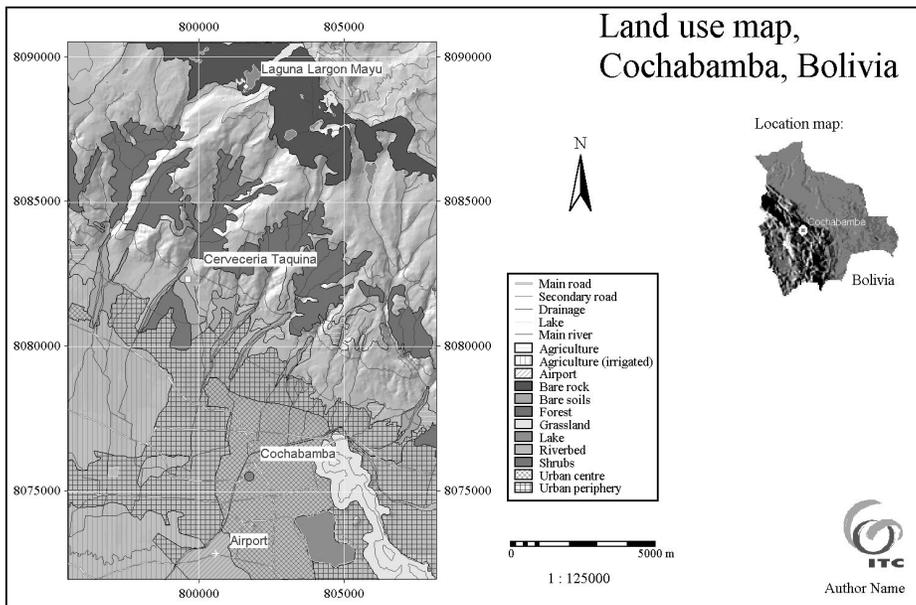


Figure 13.4: The land use map that will be made in this exercise.

### Adding an inset map or picture

Graphics may be inserted into the layout. You can add pictures and/or bitmaps, which have been copied to the Clipboard before and paste them in the layout (copy and paste one by one). You can also insert picture and/or bitmap files. Pictures, also called Windows Meta Files, have extension WMF; bitmaps have extension BMP.

First, a bitmap of Bolivia will be added to the map window.



- From the Insert menu, select Bitmap/Picture or click the Bitmap/Picture button  in the Layout toolbar. The Insert Bitmap or Picture dialog box is opened.
- Select the bitmap Bolivia and click OK. The Bolivia map is displayed in the layout.





- Drag the Bolivia map and position it somewhere at the right hand side of the layout (see Figure 13.4).
- Size the inset map by dragging its corner handles.
- Save the layout.

It is also possible to paste a picture from the Clipboard into the layout.



- Open the file `ITClogo.bmp` in a drawing program (e.g. Microsoft Paint).
- In Microsoft Paint, open the Edit menu and choose Select All.
- Open again the Edit menu and choose the Copy command. The bitmap is now copied to the Clipboard.
- Close the Microsoft Paint program.

To paste the bitmap into the layout:



- Activate the Layout editor and select the Paste command from the Edit menu or use the Paste button  in the Standard toolbar. The `ITClogo` is now pasted into the layout.
- Click the `ITClogo` and drag it to the position as in Figure 13.4.
- Save the layout.

## Adding text

In general, a map has a title, which gives a description of its contents. This exercise shows how to create a title and how to position it in the layout.



- From the Insert menu, select the Text command or click the Text button  in the Layout toolbar of the Layout editor. The Edit Text dialog box is opened.
- Type the following in the text box:  
Land use map,  
Cochabamba, Bolivia
- Choose the Font Name: `Arial` and use Font Size: 28.
- Select the Bold check box and click OK. The text appears in the layout.

If you select in the Edit Text dialog box the option Transparent, the background color of the text area (white) will not be shown. This is important when the text has to be placed on mapping units.

The position of the text and the size of the text can be changed. The text box size can be changed by dragging one of its size handles. You can size the text in both directions by dragging the corner size handles of the text box. To change the position of the text:



- Select the text box.
- Drag the box and place it at the top, right of the map view (see Figure 13.4).
- Save the layout before proceeding.

You can now add other texts: for the inset map of Bolivia, and to display the author name.



- Click the Text button  in the Layout toolbar of the Layout editor. The Edit Text dialog box is opened.
- Type the following in the text box:  
Location map:
- Choose the Font Name: Times New Roman use Font Size: 12.
- Select the Bold check box and click OK.
- In the Layout pane select the text box and position it at the top of the inset map of Bolivia (see Figure 13.4).
- Repeat these steps to add the text Cochabamba to the inset map of Bolivia. Select Font Color white, Font Name Arial and Font Size 8 and select the Transparent check box.
- Insert also the word Bolivia and the Author Name and drag them to the correct position.

### Adding a north arrow

A north arrow points to the north of a map, based on the coordinate system or georeference that is used by the maps in the map view. In the next step, a north arrow is added to the layout.



- Make sure the map view Landview is selected in the Layout pane.
- From the Insert menu, select North Arrow or click the North Arrow button  in the Layout toolbar. The Edit North Arrow dialog box is opened.
- Select Arrow Type wing.
- Select Font Name: Times New Roman, Font Size: 14 and click OK. The north arrow is displayed in the layout.
- Position the arrow below the title of the map (see Figure 13.4).
- Resize the north arrow and make it smaller.
- Save the layout.

## Adding a scale bar

Map scale is a ratio indicating the relationship between the distance on the map and the distance on the ground. In ILWIS, the map scale can be expressed in the following ways:

- Graphically in the form of a scale bar
- As scale indication (e.g. 1:50000)



- Make sure the map view Landview is selected in the Layout pane.
- From the Insert menu, select Scale Bar or click the Scale Bar button  in the Layout toolbar. The Edit Scale Bar dialog box is opened.
- Select the Unit Indication check box.
- Select Font Name: Times New Roman, Font Size: 10 and click OK. The scale bar is displayed in the map window.
- Position the scale box below the land use legend (see Figure 13.4).
- Save the layout.

## Adding scale text

The Scale Text option can be used to obtain a scale indication as text, e.g. below a scale bar. For each map view in your layout, you can add a distinct scale indication.



- Make sure the map view Landview is selected in the Layout pane.
- From the Insert menu, select Scale Text or click the Scale Text button  in the Layout toolbar. The Edit Scale Text dialog box appears.
- Select Font Name: Times New Roman, Font Size: 12 and click OK. The scale text is displayed in the layout.
- Position the scale box below the map view or below the scale bar and save the layout.

## Creating a box

Finally, you will add a box to the map window that encloses the entire map. Boxes can be used to emphasize certain annotation (e.g. text, legend, etc.), highlight certain areas, emphasize features, etc.



- From the Insert menu, select Box or click the Box button  in the Layout toolbar. The Edit Box dialog box is opened.
- Accept the defaults by clicking the OK button. A box is added to the map.
- Position the box close to the legend and resize it so that it encloses the whole legend (see Figure 13.4).





- Repeat the steps to create a box for the entire layout. Make sure the box is within the page margins.
- Save the layout.

### Editing map annotation

Existing annotation (map border, legend, picture, text, north arrow, scale bar, scale text, box) can be edited by double-clicking an item. Grid lines or a graticule can not be edited in the layout, but solely in a map window (see section 13.4).



- Double-click the north arrow in the Layout pane. The Edit North Arrow dialog box is opened.
- Select the Half check box and click OK.

Existing annotation can be removed from the layout using the mouse together with the Del key of the keyboard or the Remove command on the Edit menu. You can also click on the Remove button  in the Standard toolbar. To remove an annotation layer:



- Select an Annotation layer and click on the Remove button  in the Standard toolbar.

### Summary: Layout and Annotation

A map has a primary content (the main theme of the map), a secondary content (base map information, such as roads, contours, drainage), and a supportive content (annotation like a legend, scale, north arrow, location map, etc.).

A *Layout* is required to print maps with annotation. The layout may contain:

- Map views: one or more map views, each of which may include a raster map, and multiple polygon, segment or point maps, annotation text layers, grid lines and/or a graticule. For each map view, you need to specify the scale on which it should be displayed and printed later on.
- Map border: border information for a map, optionally displaying: neat line graduation, grid and/or graticule ticks, grid, graticule and/or corner coordinates and a map outline.
- Legends: a legend from the domain of any map in a map view and the representation used by that domain.
- An inset map, pictures or bitmaps: an inset map can be added as map view and pictures or bitmaps can be pasted from Clipboard or inserted from file.

- Text: multiple lines of text (e.g. a title); select a font type and color for the created text.
- North-arrow: showing the north orientation of a map from the georeference or coordinate system that is used by a map view.
- Scale bar: adds a graphic scale (scale bar) to the layout. The type of scale bar, intervals, font and colors are user-defined.
- Scale text: to obtain a scale indication as text in the layout. For each map view in your layout, you can add a distinct scale indication.
- Box: can be placed around an annotation item.

The total composition of map views and annotation on a certain paper size is stored as a layout and can be printed.

## 13.6 Printing a map

ILWIS enables you to produce paper copies of a layout, which contain one or more map views and annotation. Paper copies can be created in black and white or color, depending on the printer connected to your computer.

It is also possible to print only attribute data of a table. To this purpose, you can select the Print command in the table window. In the Print Options dialog box, you can select whether you want to see a header and leftmost column on all pages, and you can set the font specifications.

Before you can print, you should make sure that the printer is correctly installed under Windows. In this exercise, you will print the layout `Landview` that was created in 13.5.



- Open the layout `Landview`.
- From the File menu, select the Page Setup command. The Page Setup dialog box is opened.
- Check whether the Paper Size A4 is selected.
- Still in the Page Setup dialog box, click the Printer button. The Page Setup dialog box is opened. Make sure the correct printer is selected and click OK.
- Click OK in the Page Setup dialog box.
- From the File menu, select the Print command. You can also use the Print button  in the Standard toolbar. The layout is now printed.

- 
- ! If you change the paper size or orientation of the paper, you may have to
- rearrange all items in the layout.
- 

### Summary: Printing maps

- ILWIS enables you to produce paper copies of a layout which contain map views and annotation.
- Paper copies can be created in black and white or color, depending on the printer you use.
- It is also possible to print only attribute data of a table.

## 13.7 Exporting maps to cartographic software

In order to be able to use data generated in ILWIS in specialized cartographic software, you might need to export your maps to an interchangeable file format. In that case, you need to export all required data layers and create a final map composition in the cartographic software package you are using.

Exporting your data is not needed if you use the cartographic software package ACE, but it is recommended to transform your data to a *georeference corners*.

For raster maps, the easiest way is to convert to either *Windows Bitmap* format, or *TIFF* format. Nearly all software packages dealing with maps and images are able to read these file formats. These formats have the major disadvantage, however, that the coordinate information is not converted. The imported files will thus lose their coordinates. This will lead to problems when you want to combine a converted raster map with vector information in the cartographic software. To make sure that the exported file from ILWIS doesn't lose its coordinates, the conversion to *GeoTiff* is often used.

For vector data the most common file format is DXF, which is defined by AutoCad.

For more information on how to export data, see the ILWIS Help topics Export and How to export data.

In this exercise you will practice the conversion of raster and vector data. For raster maps, conversion is fairly simple.



- From the File menu of the Main window, select the Export command. The Export dialog box is opened.
- Select the raster map *Shadows* from the list box.
- Select the Export Format: *Tiff (Geotiff).TIF*
- Type the Output Filename: *Shadows* and click OK. The raster map *Shadows* is exported to TIF format.

Exporting point maps and segment maps is also quite simple.



- From the File menu of the Main window, select the Export command. The Export dialog box is opened.
- Select the point map *Places* from the list box.
- Select the Export Format: *AutoCad.DXF*, type the Output Filename: *Places* and click OK. The point map *Places* is exported to DXF format.
- Repeat the operation for the segment map *Drainage*. Export it to *Drainage.DXF*

For polygon maps the situation is more complex, due to topological differences between a GIS and a cartographic system. In ILWIS there is only one segment as boundary line between two polygons, while in most cartographic packages it is assumed that each polygon is enclosed by boundary lines, so there are in fact two lines forming the boundary of two polygons. During the conversion of a polygon map to DXF format, each polygon will be made so that it is enclosed by boundary lines.



- From the File menu of the Main window, select the Export command. The Export dialog box is opened.
- Select the polygon map Landuse from the list box.
- Select the Export Format: AutoCad.DXF, type the Output Filename: Landuse and click OK. The polygon map Landuse is exported to DXF format.

If you want to show any ILWIS information e.g. as a picture, or even the data (tables) in any other Windows application, you can always try to use the Copy in ILWIS and Paste in the other package. In this way a map, table, etc. can be easily pasted into for instance Microsoft Word or Power Point. To copy a whole window including borders, Layer Management pane, etc., use Alt + PrintScrn in ILWIS.

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- ! Use the Export to Bitmap option in the File menu of a Layout window to export the layout to a Windows bitmap.
- 

### Summary: Exporting maps to cartographic software

- To use data generated in ILWIS in specialized cartographic software, you need to export all required data layers to an interchangeable file format.
- Raster maps can be converted to Windows bitmap or TIFF format or to GeoTiff format when coordinate information should be preserved.
- Vector files are mostly converted to AutoCad DXF format.

## 13.8 Creating demos with ILWIS

'Professional' users will use a specialized program to give demonstrations, but to some extent, you can also do some automatic display in ILWIS. Two possibilities are described:

- *Double-click Action* in a map window,
- *Slide Show* in a map window.

You can show ILWIS maps, a GIF image, a bitmap, play a sound or a video, etc., when a mapping unit in a domain class map or an element in a domain ID map is double-clicked. In an attribute table linked to the map, there should be a column called `Action`, which should have the *string* domain. In this `Action` column, you specify a file name of a map or table and its extension (.MPR, .MPA, .MPS, .MPP, .TBT), or a GIF image, picture, sound or video, that you want to see/hear when double-clicking a mapping unit.

In Windows Explorer you should make sure that a default Open action is defined for the file types which you would like to be opened when such a file type is double-clicked. These are so-called registered file types. Native ILWIS extensions are already associated with ILWIS during the setup of ILWIS. Most other file types will also have a default program already, which will be used to open the files.

Make sure that:

- An attribute table is linked to the map.
- This attribute table has a column `Action` (column of domain string type).
- You have typed in this column file names inclusive of path and extension of the map, table, GIF image, picture, sound or video, that should be opened when you double-click a certain mapping unit or element.
- Windows knows which program should be used to open the map, table, sound video, etc. This can be set in the File Types section in Windows Explorer. The default Open action will be used to open the particular file type.

When you have set the Double-click Action to Execute Action in a map window which displays a class or ID map, and double-click a unit in the map, then if an attribute table is found with a column `Action`, in which a filename is found that has a registered extension, then that file is opened (map or table is shown, audio or video is played, etc.).

### Demo example: Display of field-photos

In this exercise, you will learn how you can make a demo, using a number of scanned photographs from the Cochabamba area, and a point map showing the locations where the photos were taken, represented as red dots. When you double-click on a red dot, the appropriate photo is shown. The photos were obtained through the scanning of snapshots and slides, using a simple scanner. These files are available in TIF format (`Photo1.tif` to `Photo9.tif`). The locations where the photos were approximately taken are stored in a point map.

If you want to show the photos in ILWIS map windows then the first thing that should be done is to import the TIF Files. If you just leave the TIFF files as they are and use them straight away in an attribute table probably a program like PhotoShop, PaintShop, Windows Paint or even Internet Explorer may be used to open the pictures.



- From the File menu of the Main window, select the Import, General Raster command. The Import dialog box is opened.
- Select the Import Format: Tagged Image File Format .TIF. The list of TIF files appears in the list box.
- Select the File: Photo1.tif. The Output Filename is set to Photo1.
- Click OK. The file is converted.
- Repeat this procedure for the other photos or create a script.
- Display the various photos and close all map windows after you have finished.

As you can see the last photo (Photo9) is rotated. To rotate it into the normal position you can use the operation Mirror Rotate.



- Click the map Photo9 with the right mouse button and select the commands Raster Operations and Mirror Rotate from the context-sensitive menu. The Mirror Rotate dialog box is opened.
- Select the option Rotate 90 degrees clockwise. Type as Output Raster Map name: Photo9r and click Show. The Display Options – Raster Map dialog box is opened.
- Click OK. The map is rotated and the result is displayed. Close the map window.

The next step is to create a map view for each photo. The advantage of a map view is that it will be displayed without showing first a Display Options - dialog box, since the display options are already stored in the map view. Another advantage of using map views is that you can give each map view a descriptive title, which will be shown on the Title bar. You can also switch off Display Options - dialog boxes in the Preferences (available via the File menu in the Main window).



- Open the map Photo1. Select from the File menu the Save View command. The Save View As dialog box is opened.
- Type the Map View Name: Photo1, and the Title: Country school in the mountains.
- Close the map window.
- Repeat this for the other photos (Photo2 to Photo8, and Photo9r), and create views with the same names. Type the descriptions as given in Table 13.5.

Table 13.5: Description of photos used in the demo.

View	Title
Photo1	Country school in the mountains
Photo2	Cochabamba seen from the Colina de San Sebastian
Photo3	Indian village in the mountains
Photo4	Llamas grazing in the mountains
Photo5	Cochabamba by night
Photo6	Transporting Chicha and Coca
Photo7	Geologic fault
Photo8	Central park of Cochabamba
Photo9r	Cochabamba beats Rio de Janeiro with 33cm

Now the photos are finished. The next step is to adapt the file with the location of the photos. This is a point map, with the name `Photos`.



- Double-click point map `Photos`. The Display Options – Point Map dialog box is opened.
- Press the Symbol button. The Symbol dialog box is opened.
- In the Symbol dialog box, select the Symbol Type: `Simple`, the Symbol: `Circle`, the Size: `4`, the Fill Color: `Red`, Line Width: `1` and the Color: `Red`.
- Click OK. You are back in the Display Options - dialog box.
- Select the Text check box and press the Font button. The Font dialog box appears.
- Select the Font: `Times New Roman`, the Font style: `Bold`, and the Size: `12`.
- Click OK. You are back in the Display Options – Point Map dialog box.
- Select the Text Color: `Red` and click OK in the Display Options - dialog box. The point map is displayed.
- Drag-and-drop raster map `Shadows` to the map window. The Display Options dialog box is opened. Select the option `Light` and click OK. The hillshading map is now also displayed in the map window.
- From the File menu select the Save View As command. The Save View As dialog box is opened.
- Type the Map View Name: `Photos`, the Title: `Photos from the Cochabamba area` and click OK.
- Close the map window.

The next step is to create a table that is linked to the point map `Photos` and which contains a column `Action`, in which the names of the map views of the photos are written.



- In the Operation-tree of the Main window, expand the Create option and double-click New Table. The Create Table dialog box is opened.
- Enter the Table Name: `Photos`, select the Domain `Photos` and click OK. The table is opened.
- From the Columns menu in the table window, select the command Add Column. The Add Column dialog box is opened.
- Type the Column Name: `Action`, select the Domain `String` and click OK.
- Type the names of the map views in the column `Action`, including the extension. So for the first record, with the domain item `Photo1`, you type `Photo1.mpv` in the column `Action`. Make sure that the name of the last field in column `Action` reads: `Photo9r.mpv`. The extension `.mpv` stands for map view.
- Close the table window.
- Click the point map `Photos` with the right mouse button and select Properties. The Properties sheet is opened.
- Make sure that the Attribute Table check box is selected, select the table `Photos` and click OK.

Now all input data is ready, so you can do the actual demo.



- Open map view `Photos`.
- From the Layers menu, select Double-Click Action and select the option: Execute Action.
- Double-click on any of the red dots, to see the map view of the photos. The explanation of each photo is shown in the Title bar.
- Make sure to close all map windows when you have finished the exercise.

You can use this method also for segment, polygon or raster maps (domain type class or ID) which have an attribute table where the files are listed that should be opened with a double-click in the class or ID unit.

## Creating a slide show

The second example of the preparation of a demo with ILWIS is the creation of a slide show that can be used to display multi-temporal maps, in order to evaluate changes through time. The operation Slide Show is meant for this purpose.

In a slide show, a map window shows multiple raster maps like a slide show. It is in fact the same as repeatedly replacing the raster map in a map window, e.g. by dragging the raster maps into the map window. The raster maps to be displayed must all be stored in a *map list*.



A map list is a container object and stores the names of a set of raster maps, for example of the multi-spectral bands of a satellite image that you want to classify. A map list may also store the names of several raster maps of a time series, which you can display as a slide show.

In the slide show only one set of display options will be used. The defaults are based on the first map in the map list. The parameters set for this map in the map list, also define the display options for the other maps in the map list. So, a ‘constraint’ of using a slide show is that all maps in the map list must use the same domain and the same georeference.

The Slide Show operation is useful for multi-temporal monitoring, where data regarding a site is collected on more than one occasion. It can, for example, be used for observing a series of satellite images of the same area in time, derived products such as NDVI, or classified maps, such as land use maps. In this way you get a clear view of the general changes in time.

In this example, you will work with multi-temporal maps showing the growth of the city of Manizales, located in central Colombia, with a set of 7 maps from 1851 till 1989. In order to show these maps as a slide show, you should first create a map list, containing the names of these maps.



- From the File menu of the Main window, select the Create and the Map List commands. The Create Map List dialog box is opened.
- Enter the Map List Name: `Manizales`.
- Enter the Description: `Growth of the city of Manizales (Colombia)`.
- Select the raster maps `M1851`, `M1930`, `M1949`, `M1960`, `M1970`, `M1977`, and `M1989` (hold the Ctrl key down to select multiple maps at a time), press the > button and click OK.

Now you can run the slide show.



- Double-click map list `Manizales` in the Catalog.
- In the map list, click the Open As Slide Show button . The Display Options - Raster Map dialog box is opened, with the display options for the first map (`M1851`).
- Accept the defaults and click OK. The Display Options - Map List dialog box is opened. In this dialog box you can change the Refresh Rate, indicating how many times per minute the display will be changed.
- Change the Refresh Rate to 30 and click OK.
- Maximize the window, open the Options menu and select the option No Zoom.

Now the maps are displayed in the map window one by one, so that you can evaluate the changes quite easily. You can change the refresh rate, to make the display slower or more rapid.



- When you have finished watching the slide show, close the map window.

### Summary: Creating demos in ILWIS

- You can show ILWIS maps, a GIF image, a bitmap, play a sound or a video, etc., when a mapping unit is double-clicked in a map which has a domain class or a domain ID.
- Another way of demonstration in ILWIS is the creation of a slide show that can be used to display multi-temporal maps in order to evaluate changes through time. The Slide Show operation is meant for this purpose.