

## CHAPTER 1

# Introduction to ILWIS 3.0

ILWIS is an acronym for the Integrated Land and Water Information System. It is a Geographic Information System (GIS) with Image Processing capabilities. ILWIS has been developed by the International Institute for Aerospace Survey and Earth Sciences (ITC), Enschede, The Netherlands.

As a GIS and Remote Sensing package, ILWIS allows you to input, manage, analyze and present geo-graphical data. From the data you can generate information on the spatial and temporal patterns and processes on the earth surface.

Geographic Information Systems are nowadays indispensable in many different fields of applications to assist in the decision making process. Most decisions are influenced by some facts of geography. What is at a certain location? Where are the most suitable sites? Where, when and which changes took place? Here are some examples.

- In land use planning, GIS is used to evaluate the consequences of different scenarios in the development of a region.
- In geology, GIS is used to find the most suitable places for mining, or to determine areas subject to natural hazards.
- Areas that may be affected by pollution are analyzed using GIS functions.
- Extensions of cities are planned, based on analysis of many spatial and temporal patterns, etc.

In order to be able to make the right decisions, access to different sorts of information is required. The data should be maintained and updated and should be used in the analysis to obtain useful information. In this process ILWIS can be an important tool.

This chapter is intended to introduce you to ILWIS, and specifically to the user interface. You will learn how to start ILWIS, the functions of the Main window and how to open maps and tables.

## 1.1 Starting ILWIS



To start ILWIS, double-click the ILWIS icon on the desktop. After the opening screen you see the ILWIS *Main window* (see Figure 1.1). From this window you can manage your data and start all operations.

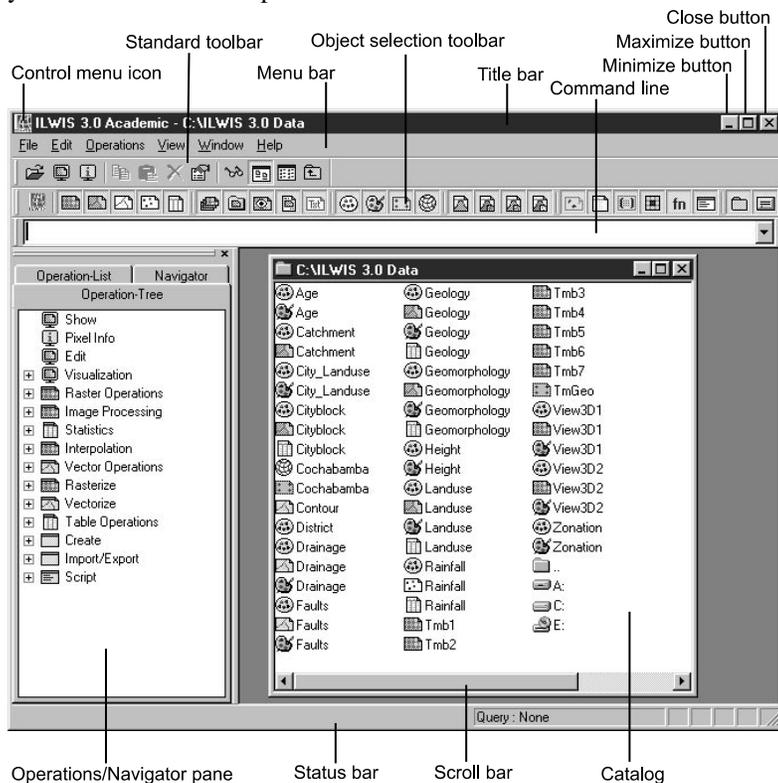


Figure 1.1: The ILWIS Main window.

The ILWIS Main window consists (by default) of a *Title bar*, a *Menu bar*, a *Standard toolbar*, an *Object selection toolbar*, a *Command line*, a *Catalog*, a *Status bar* and an *Operations/Navigator pane* with an *Operation-tree*, an *Operation-list* and a *Navigator*.

There is a possibility that the right-central part (i.e. the Catalog) of the Main window on your screen does not look exactly the same as shown in Figure 1.1. This may be due to the fact that you have another system configuration and/or that during the installation of ILWIS you decided to copy the data files to a different directory than the standard start-up directory C:\ILWIS 3.0 Data\.

### 1.1.1 The Navigator

Before continuing with the exercises you first need to change to the subdirectory C:\ILWIS 3.0 Data\Users Guide\Chapter01, where the data files for this chapter are stored.

You can use the *Navigator* (Figure 1.2) to change the current drive and working directory.

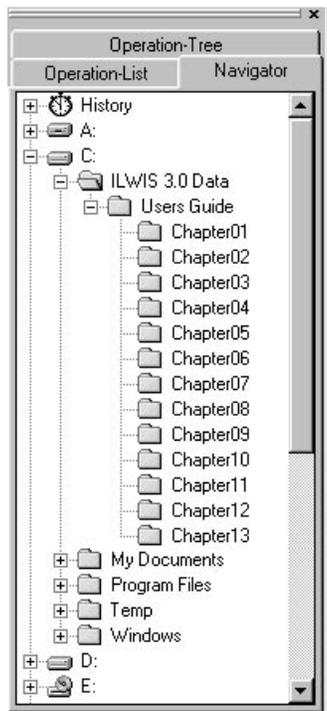


Figure 1.2: The ILWIS Navigator.



- Click the word Navigator in the Operations/Navigator pane.

The Navigator lists all drives and directories (i.e. folders) in a tree structure. The Navigator also has a History  to easily return to previously visited drives and directories.



- Click on the drives and folders in the Navigator until you are in the directory where the data for this chapter has been stored. By default the data is located in C:\ILWIS 3.0 Data\Users Guide\Chapter01.

### 1.1.2 Catalog(s)

If you are in the correct directory C:\ILWIS 3.0 Data\Users Guide\Chapter01 you will see, that the right hand side of the Main window, looks exactly the same as Figure 1.3. This part of the Main window, in which maps, tables and other ILWIS objects in the working directory are displayed each with its own type of icon, is called the *Catalog*. When you double-click an object in the Catalog, it will be displayed.

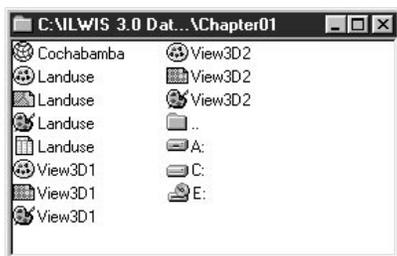


Figure 1.3: Example of a Catalog of the ILWIS Main window.

The following objects, related to the area surrounding the city of Cochabamba in Bolivia, can be seen:

 Cochabamba

A *coordinate system*, containing the definition of the coordinate system (the minimum and maximum coordinates of the study area and optionally the map projection) used for the maps of the Cochabamba area;

 Landuse

A *domain*, listing names of the mapping units in the Landuse map and the Landuse table;

 Landuse

A *polygon map* containing land use units in the study area (the city of Cochabamba and surroundings in Bolivia);

 Landuse

A *representation*, containing the color assignments of the mapping units in the Landuse map;

 Landuse

An *attribute table* containing information on the land use units;

 View3D1

A *domain*, explaining the content of the raster map View3D1;

 View3D1

A *raster map*, containing a three dimensional picture of the study area;

 View3D1

A *representation*, containing the color assignments of the pixels in raster map

 View3D2

 View3D2

 View3D2

A *domain, raster map and representation* of another 3D picture View3D2.

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- ! For a complete list of ILWIS objects and their icons, see the summary of section 1.1 or the ILWIS Help topic Basic concepts, ILWIS objects and icons.
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## Customizing the Catalog

To show only maps and tables in the Catalog:



- Click the Customize Catalog button  in the Standard toolbar (Figures 1.1 and 1.8) of the Main window. The Customize Catalog sheet is opened.

The object Selection tab contains a list box in which the object types that are shown in the Catalog appear highlighted. You see that *all* ILWIS objects are selected. To show only the map and table objects, i.e. the objects with the icons , , ,  and :



- On the object Selection tab, select the first object type (i.e. the  Raster Map), keep the left mouse button pressed and move the mouse pointer to the last object you want to select (i.e. the  Table).
- Release the mouse button and click OK.

You will see that the Catalog has changed and that now only the map and table objects are shown in the current Catalog. The ILWIS Main window may show more than one Catalog. You can thus keep your data organized in different directories.

- 
- ! You can open another Catalog by clicking the New Catalog button  in the Standard toolbar and selecting a new directory. You can also select the New Catalog command on the Window menu of the Main window.
- 



- Position the mouse pointer on an object, for example on polygon map Landuse. A description of this map will appear on the Status bar (Figure 1.7) of the Main window.

### 1.1.3 Title bar and Menu bar

The *Title bar* (Figure 1.4) shows the name of the currently active Catalog. You can move a window to another position on the screen by dragging that window's Title bar to another position.



Figure 1.4: Title bar of the ILWIS Main window.

The *Menu bar* (Figure 1.5) can be used for example to start an operation. The ILWIS Main window has six menus: File, Edit, Operations, View, Window and Help.



Figure 1.5: The Menu bar of the Main window.



- Click Operations in the Menu bar. The Operations menu is opened. The menu contains commands for all ILWIS operations, which are grouped. The triangles ▶ to the right of the commands on a menu indicate that there is another cascading menu.
- Position the mouse pointer on the command Image Processing. A submenu appears.
- Select the Filter command. The Filtering dialog box is opened. In this dialog box you can select among other things the input maps for an operation.
- Close the dialog box by clicking the Cancel button.
- Open some more menus and have a look at their contents. The Status bar (at the bottom of the Main window) gives short explanations.

### 1.1.4 The Operation-tree and Operation-list

Let us now concentrate on the another part of the ILWIS Main window. The *Operation-tree* and the *Operation-list* (Figure 1.6) are located on the first two tabs in the Operations/Navigator pane, by default along the left-hand side of the Main window.

- The Operation-tree provides a tree structure for *all* ILWIS operations, similar to the Operations menu.
- The Operation-list contains an *alphabetic list* of all ILWIS operations.

In the Operation-tree as well as in the Operation-list each item is preceded by an icon. The icon indicates the output data type of the operation. By double-clicking an operation, the operation will be started. We will do this later.

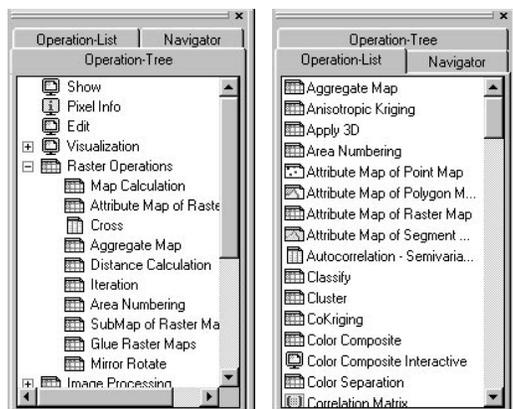


Figure 1.6: ILWIS Operation-tree (left) and ILWIS Operation-list (right).



- In the Operation-tree, double-click Image Processing, or click on the + in front of the Image Processing icon , to expand the Image Processing tree.
- Position the mouse pointer on one of the operations, for example on the Filter operation.

### 1.1.5 Status bar

When the mouse pointer is positioned on an operation, the *Status bar* (Figure 1.7), located at the bottom of the Main window, shows a short description of that operation.

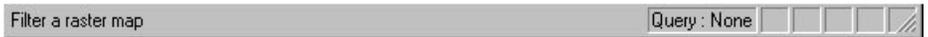


Figure 1.7: The Status bar of the ILWIS Main window.

To get more information on an operation:



- In the Operation-list, click with the right mouse button on an operation and select Help from the context-sensitive menu. An Additional Help window appears with a short explanation of the operation.
- You can close the Additional Help window again by pressing the Close button  in the Title bar of the Help window or by double-clicking the control-menu icon .

The Status bar also gives short information when you move the mouse pointer over a menu command, over a button in the Toolbar or over an object in the Catalog.



- In the Catalog, click with the *right* mouse button on polygon map Landuse to get a *context-sensitive menu*.

A Context-sensitive menu is a menu, which gives only those menu commands that are applicable to the moment you use the right mouse button; thus you will get a different menu depending on where and when you use the right-mouse button. For example, if you use the right mouse button on a polygon map, the context-sensitive menu will only show the operations which can be applied on polygon maps. Context-sensitive menus are shortcuts for normal menu commands.

### 1.1.6 Toolbars of the Main window

You will go back to the Main window to see three more items. Below the menu, you find two toolbars:

- The Standard toolbar
- The Object selection toolbar

### The Standard toolbar

The *Standard toolbar* (Figure 1.8) provides shortcuts for some regularly used menu commands.



Figure 1.8: Standard toolbar of the ILWIS Main window.

The Standard toolbar has the following buttons:

 New Catalog	 Properties
 Open Map	 Customize Catalog
 Open Pixel Information	 List
 Copy	 Details
 Paste	 cd..
 Delete	

When you leave the mouse pointer for a short period of time on top of a button a *ToolTip* will appear with the name of the button/menu command that it will perform. Also the Status bar gives some information on the working of the button. So far, you have used the Customize Catalog button .

Other buttons that you will probably use frequently are:

-  List. Show the objects in the current Catalog *as a list* of icons and object names.
-  Details. Show the *details* of the objects in the current Catalog in a table-like form.

This will be explained in more detail in chapter 2.

### The Object selection toolbar

The *Object selection toolbar* (Figure 1.9) allows you to specify the object types that you wish to see in the current Catalog.



Figure 1.9: The Object selection toolbar.

Only the object types of which the button appears *down* will be shown. For a list of all ILWIS object types and icons, see the summary of section 1.1. The first button, the ILWIS button , is used to hide all objects (after which you can click specific object buttons, to show only these object types), or to show all object types. To add

coordinate system Cochabamba to the Catalog:



- Press the Coordinate Systems button  in the Object selection toolbar. Coordinate system Cochabamba is now added to the Catalog.

To hide the coordinate system again:



- Click the Coordinate Systems button again.

## 1.1.7 The Command line

The last item we will discuss now is the *Command line* (Figure 1.10).



Figure 1.10: The ILWIS Command line.

For beginners, the Command line is not so important yet. You can use the Command line to type MapCalc formulas when you want to calculate with raster maps (chapter 7) but also operations (like Filter, etc.) can be performed by typing an expression on the Command line (see chapter 12).

The Command line has a History. You can use:

- the Arrow Up key of your keyboard to retrieve previously used expressions and commands;
- the Arrow Down key to scroll forwards again, and
- the Arrow Down button  at the right hand side of the Command line to open a list of previously used commands and expressions.

## 1.1.8 Getting help



- Open the Help menu.

The ILWIS Help allows you to obtain information from any point within the program. The Help menu differs per window. In the Main window the Help menu has many options; we will explain a few of them now:

- Help on this Window. You obtain help on the current window. Depending on the window from which you select this help option, you can get help on the Main window, the map window, the table window, the pixel information window, etc.
- Related Topics. When this menu option is selected a dialog box appears with a list of topics that are related to the current window.
- Contents. Displays the Help Contents. By clicking the links in the table of contents you can go to any help topic you like.

- Index. The Index page of the ILWIS Help is displayed. Type a keyword or click any keyword in the list on which you wish to get help.
- Search. The ILWIS Help viewer is opened with the Search tab selected. Type some characters, a word, or a phrase on which you want to obtain help and press Enter ↵ or click the List Topics button to get a list of topics. In the Select topic list box select the topic you want to display and click the Display button or press Enter ↵.
- Basic Concepts. Gives an overview of the basic concepts of ILWIS. These concepts will be treated in chapter 2 of the User's Guide.



- From the Help menu, select the command Help on this Window. The ILWIS Help viewer (Figure 1.11) is opened and the help topic Main Window, Contents is shown.
- Click the hyperlink Introduction. The ILWIS Help viewer refreshes and displays the topic Main window: Introduction, in which all parts of the Main window are explained.
- Click any of the links. Another topic appears explaining you more.



Figure 1.11: The ILWIS HTML Help viewer.

The ILWIS HTML Help viewer (Figure 1.11) has three parts:

- a Topic pane that shows the topic the user has selected;
- a Navigation pane with 4 tabs: a Contents tab, an Index tab, a full-text Search tab, and a Favorite tab;
- a Toolbar which allows users to Show or Hide the Navigation pane, to move Forward to the next topic or Back to the previous topic, to go to the

Home/Contents Page topic, and to adapt the Font size, to Print topics and to change the Options.

To find a Help topic, click one of the following tabs in the help window:

- To browse through topics by category, click the Contents tab.
- To see a list of index entries, click the Index tab and then either type a word or scroll through the list.
- To search for words or phrases that may be contained in a help topic, click the Search tab. In the left of the Help window, click the topic, index entry, or phrase to display the corresponding topic in the Topic pane.



- Use the browse buttons Back and Forward to go page by page through the Help.
- Practice a bit more with the ILWIS Help. When you have finished, close the Help window by double-clicking the Control-menu icon  in the Title bar of the Help viewer.

### Summary: the Main window of ILWIS

When you start ILWIS, the first thing you will see after the opening screen is the ILWIS Main window. From this window you can manage your data, start all operations and select all data. The Main window contains the following items:

- A *Catalog* lists the available maps, tables and other ILWIS objects in the current working directory. When you double-click an object, the object will be opened. When you click an object with the right mouse button, you can choose to start an application with the selected object as input. The ILWIS Main window can show one or more Catalog(s).
- The ILWIS object types and their icons that can be shown in a Catalog are:

 raster maps	 georeferences
 polygon maps	 coordinates systems
 segment maps	 histograms of raster maps
 point maps	 histograms of polygon maps
 tables	 histograms of segment maps
 map lists	 histograms of point maps
 object collections	 sample sets
 map views	 two-dimensional tables
 layouts	 matrices
 annotation text objects	 (user-defined) filters
 domains	 user-defined functions
 representations	 scripts

- The *Operation-tree* provides a tree structure for all ILWIS operations, similar to the Operations menu.
- The *Operation-list* contains an alphabetic list of all ILWIS operations. Each operation is preceded by an icon; the icon indicates the output data type of the operation.
- The *Navigator* provides a tree structure for all drives and directories and has a history of recently visited drives and directories.
- The *Title bar* is always located at the top of the window. It shows the name of the window and can be used to move the window on the screen.
- The *Menu bar* can be used to start an operation, to create or edit objects, to view the properties of an object, etc.
- The *Standard toolbar* provides shortcuts for regularly used menu commands such as Customize Catalog, List/Details View, etc.
- The *Object selection toolbar* can be used to select the object types that should be visible in the currently active Catalog.
- The *Command line* is mainly used to type calculations (MapCalc) and expressions (i.e. perform operations).
- The *Status bar* gives short information on the item on which the mouse pointer is located: a menu command, a button in the Toolbar, an object in the Catalog, an operation in the Operation-list or the Operation-tree, etc.
- The *ILWIS Help* allows you to obtain help information from any point within the program. The ILWIS Help viewer has a Topic pane, a Navigation pane and a Toolbar.

## 1.2 Displaying geographic data

Geographic data are organized in a geographic database. This database can be considered as a collection of spatially referenced data that acts as a model of reality. There are two important components of geographic data (Figure 1.12): the *geographic position* and the *attributes, entities or properties*. In other words, *spatial data* (where is it?) and *attribute data* (what is it?) are distinguished. In the example of Figure 1.12, you can see that we have a (very simplified) map on one side and a table on the other.

Maps are considered spatial data, since the information they contain is directly related to certain locations on the earth's surface. The location of the units A, F and G are specified with respect to their X and Y coordinates.

Tables, on the other hand, do not contain direct information on a location. They contain descriptive information (in this case the names of the land use types and the value of the land in monetary units). If we would only have the table, the data would not be useful, since we don't know where the units are located. If we would only have the map, we still don't know anything about the units. In a Geographic Information System (GIS) like ILWIS, the link between spatial and attribute data is the key to get real information. Only by combining spatial and attribute data we can get answers to questions such as: Where are the land use units with a value more than 250?

*Spatial data: where is it?*    *Attribute data: what is it?*

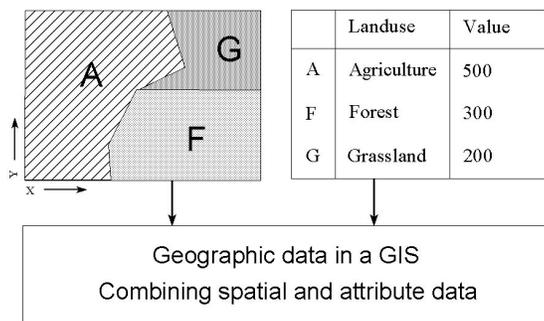


Figure 1.12: Spatial and non-spatial data in ILWIS.

In the following pages we will show you how to display spatial data and attribute data in ILWIS. We will introduce you to the map window and you will practice displaying a map. The map to be displayed is the polygon map *Landuse* that shows the different land use types in the Cochabamba area in Bolivia. This map was digitized from a paper map. A *polygon map* is a vector data object containing closed areas including the boundaries making up the areas, which in this case represent land use units. In chapter 2 there will be a more detailed explanation about polygon maps.

## ILWIS dialog boxes



- Press the polygon map button  in the Object selection toolbar to show the polygon maps again and double-click the polygon map Landuse in the Catalog. The Display Options - Polygon Map dialog box appears (see Figure 1.13).

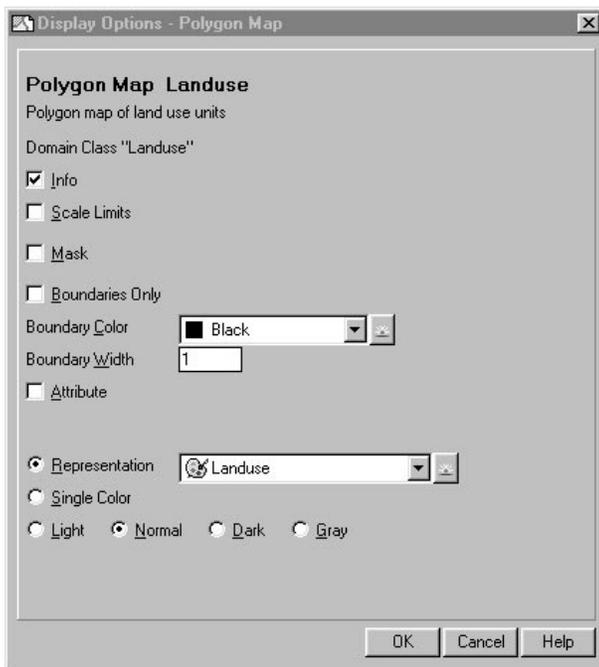


Figure 1.13: Example of a Display Options - Polygon Map dialog box.

A *dialog box* allows the user to enter the information required by ILWIS to carry out an operation. Dialog boxes differ depending on the application you are performing. The dialog box, which is displayed now, is used to specify how you want to display a polygon map. In general, an ILWIS dialog box can have features such as:

**Title bar.** Shows the name of the dialog box and can be used to move the dialog box on the screen. In this case the title is: Display Options - Polygon Map.



**Text box.** A small box, which can be used for typing text or values. The dialog box shown on your screen contains a Text box in which you can specify the Boundary Width of the land use units lines.



**Drop-down list box.** A small box with an Arrow Down button , which allows you to select items. A list, including the available data, will be displayed when the arrow button or list box is clicked. The button  on the right hand side is the *create button*. The Create button can be used to create an object when the list excludes a

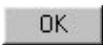
proper object. When you click the Create button, the program proceeds to a new dialog box.

The dialog box in Figure 1.13 contains two list boxes: one in which you can specify the color of the boundary lines of the land use units (Boundary Color), and another (Representation) in which you can indicate the color of the units themselves. These colors are stored in an object called *representation* (see section 2.4).



Check box. This is a small square in the dialog box, which allows you to select or clear an option. The Display Options – Polygon Map dialog box has five check boxes. When you select the Info check box, you will be able to read information about the meaning of the land use units, once the map is displayed. The second box Scale Limits allows you to define the scale limits of the map. The third check box Mask allows you to selectively display some land use types. If the fourth box, Boundaries Only is selected, only the boundaries of the land use units will be shown. Finally, the fifth box, Attribute, can be selected if you want to display an attribute value from a table connected to the map, instead of the land use units themselves.

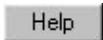
Command buttons are used to initiate an action. The OK, Cancel, and Help are common command buttons.



OK button: whenever you click the OK button (or press Enter ↵ on the keyboard) the dialog box is closed and the action will be executed.



Cancel button: when you click the Cancel button (or press ESC on the keyboard) the dialog box is closed and the action is canceled.



Help button: when you click the Help button (or press F1 on the keyboard) context-sensitive help information will be displayed. *Context-sensitive help* means help dealing with the specific dialog box.



Option buttons. Option buttons can be seen as circles and represent a group of mutually exclusive options. The selected option button contains a black dot. You can select one option at a time. Selecting another Option button, clears the other. As you can see, ILWIS gives suggestions for options in the dialog box, which are called the *defaults*.

- 
- ! To select a check box or an Option button click the check box or press the
  - ! Spacebar. If the name of the option or check box has an underlined letter, you can select the Option button or check box by pressing and holding down the Alt-key while typing the underlined letter.
- 



- Select the check box Boundaries Only. Now you will see that the contents of the whole dialog box changes. If you only want to show the boundary lines of the units, no input is needed anymore on how you want to





display the units themselves. The contents of the dialog box depends on the input of the user. That is why we call it *context-sensitive*.

- Select the drop-down list box Boundary Color. You will see a list with all different types of colors that you can select.
- Practice some more with the different options in the dialog box. After that, change all options again so that they are the same as in Figure 1.13. Then confirm your input by clicking the OK button or by pressing Enter ↵.

- 
- ! You can move through the various options within a dialog box by using the Tab-key or the Shift+Tab-keys on the keyboard.
- 

### A map window

The polygon map *Landuse* is displayed in a map window (see Figure 1.14). All maps in ILWIS are displayed in a map window. The map window has many similar features as the Main window of ILWIS, which we have seen before. It consists by default of a:

**Title bar:** located at the top of the map window. The Title bar shows the name of the window and can be used to move the map window.

**Menu bar:** located just below the Title bar. A map window has 5 menus: File, Edit, Layers, Options and Help.

**Toolbar:** located just below the Menu bar. The Toolbar provides shortcuts for some regularly used Menu commands. The Toolbar of the map window has the following buttons:

 Entire Map	 Zoom Out
 Redraw	 Normal
 Measure Distance	 Add Layer
 Pan	 Remove Layer
 Zoom In	 Save View

**Scale box:** Text box in which you can type the scale on which the map(s) should be displayed.

**Layer Management pane:** The left central part of the map window displays the layers (maps) that are added to the map window and the legend of each map. In the Layer Management pane, you can for instance change the order of the layers that are displayed. The Layer Management pane will be extensively treated in the next chapter.

**Map viewer:** The right central part of the map window where the maps are displayed.

Status bar: located at the bottom of the window. The Status bar displays coordinates in meters and/or geographic coordinates.

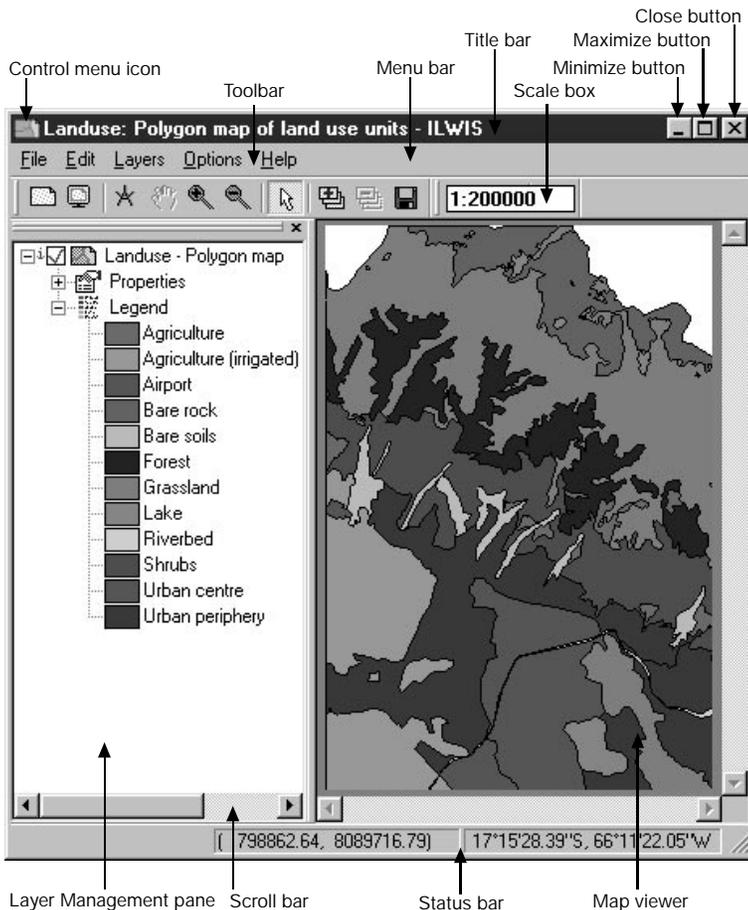


Figure 1.14: An ILWIS Map window.

The map window can be moved, like all windows, by activating it and dragging it to another position. The size of the map window can be changed in several ways.



- Move with the mouse pointer to a border or to a corner of the map window. The mouse pointer changes into a two-headed arrow.
- Drag (press the left mouse button and hold it down) the border or corner until the window has the size you want and release the left mouse button. The map window has been resized.
- Maximize the map window by clicking the Maximize button  in the upper right corner of the window.

When you want to study details of the map, the zooming possibility can be used.



- Click the Zoom In button  in the Toolbar to zoom in on a selected area.
- Move the cursor (now in the shape of a magnifying glass) to the first corner of the area that has to be displayed in detail and click on the left mouse button. Keep the mouse button down and drag the cursor a little bit to the second corner of the area of interest; then release the mouse button. Now the selected area will appear enlarged. You can also click in the map window to zoom in.
- To roam through the map on which you zoomed in, use the Pan button  or use the Left/Right/Up/Down scroll boxes in the horizontal or the vertical scroll bar.
- A fast scroll can also be achieved by dragging the scroll boxes in the scroll bars Left/Right or Up/Down, or by clicking in the scroll bar itself.
- Select the Zoom Out button  in the Toolbar and click (repeatedly) in the map to zoom out.
- Click the Entire Map button  to show the entire map in the map window again.

Another way to zoom in or out is by re-scaling the map.



- Activate the Scale box which is by default located next to the Toolbar of the map window and type another scale factor for the map (e.g. 1 : 200000) and press Enter ↵.

Next, we will pay attention to another part of the map window: the Status bar, which can be found at the bottom of the map window. If you move with the mouse pointer over the map, you will see that the Status bar displays the position of the mouse pointer in the map. To specify the position in an absolute way a *coordinate system* is used. There are many different coordinate systems in use around the world.

Coordinates can be displayed in two ways:

- as metric coordinates (X,Y), or as
- geographic coordinates (latitude, longitude).

The Status bar displays the coordinates in meters and/or geographic coordinates. First, the X, Y values of metric coordinates are given; these are followed by the degrees, minutes and seconds of the latitude and longitude (i.e. geographic coordinates).



- Click the Normal button  in the Toolbar to go back to the normal view.
- Move the mouse pointer through the map and verify in the Status bar that the X values increase when going to the right of the map (towards the east), and the Y coordinates increase when going to the top of the map (towards the north).
- Try to locate the mouse pointer on the following X and Y coordinates: X=803384, and Y=8074877, and find the corresponding latitude and longitude.

With the Measure Distance button  it is easy to measure the distances and the angle between two points.



- Click the Measure Distance button  in the Toolbar of the map window, or choose the Measure Distance command from the Options menu.
- Locate the mouse pointer somewhere in the map, and press the left mouse button. Move to another point, while keeping the left mouse button pressed. When you release the mouse button a message box appears.

The Distance message box will state:

From: the XY-coordinate of the point where you started measuring;

To: the XY-coordinate of the point where you ended measuring;

Distance on map: the distance in meters between starting point and end point calculated in a plane;

Azimuth on map: the angle in degrees between starting point and end point related to the grid north;

Ellipsoidal Distance: the distance between starting point and end point calculated over the ellipsoid;

Ellipsoidal Azimuth: the angle in degrees between starting point and end point related to the true North, i.e. direction related to the meridians (as visible in the graticule) of your projection;

Scale Factor: direct indicator of scale distortion, i.e. the ratio between distance on the map/true distance.



- Click OK in the Distance box and click the Normal button in the Toolbar to go back to the normal view.

### The contents of the map: domain

You can obtain information on the map contents simply by pressing the left mouse button on any of the colored units in the map.



- Press the left mouse button on different units in the map to find out what they represent.
- Find the land use class around the location: X=801830 and Y=8089283.



#### Domain

As you can see, the units of the Landuse map are described by classes, with names such as Forest, Grassland, Bare rock, Lake, etc. The list of all class names that can occur in a map is called in ILWIS a domain. A domain defines the possible contents of a map, a table, or a column. In other words, what do the items in a map, table or column mean? Are they classes (such as land use classes), or values or something else? The domain concept is very essential in ILWIS, and we will therefore come back to it in chapter 2. The full list of class names of the land use units can be seen in the Layer Management pane of the map window when the map is displayed, but you can also open the domain of the polygon map Landuse yourself.



- Make the ILWIS Main window active. If the Main window is visible on the screen, then you can just click any part of the Main window. If the Main window is not visible anymore, click the ILWIS button on the Windows Taskbar at the bottom of your screen.
- Make all the objects visible by clicking the ILWIS button  in the Object selection toolbar.
- Double-click the domain Landuse in the Catalog of the Main window.

The Domain Class editor is opened. The Title bar reads: Domain Class "Landuse" - ILWIS. As you can see, the domain lists all possible class names of the map. It is simply a list of all land use types, which can occur in the map. Since these are different classes, we speak of a *class domain*. In chapter 2 you will also see some other domain types.



- Close the Domain Class editor by clicking the Control-menu icon  and select Close.

We started this lesson by explaining the difference between spatial and non-spatial (or attribute) data. From the map window, we can also obtain information on attributes, related to the different land use units of the map, which is displayed.



- In the map window, double-click with the left mouse button a unit in the polygon map `Landuse`.

Now you will see a small window appearing with the title `Attributes`. Inside the window you will see two lines. The first line contains the land use class name of the unit you clicked, and the second line contains the word `Landvalue` followed by a number, which is the average monetary value of this land use type. The line with `Landvalue` information is a line from an attribute table `Landuse`, which is linked to the map.

Let us look now in more detail to tables, but first close the map window.



- Close the map window by opening the `File` menu in the map window and choose `Exit`, or click the `Close` button  in the map window.

## A table window



Table

We will finish this chapter by showing you how to display attribute data.



- In the `Catalog`, double-click the table `Landuse`.

The table `Landuse` is now displayed in a table window (Figure 1.15). As you can see from Figure 1.15, a table window contains many of the features we have already seen in the `Main` window and in the map window. It has a `Title bar`, a `Menu bar` with the menu options: `File`, `Edit`, `Columns`, `Records`, `Graphs`, `View` and `Help` and a `Toolbar` with the buttons:



Copy



Paste



Delete



Print



Properties



Update all columns



New Graph Window



Goto First Record



Goto Previous Record



Goto Record



Goto Next Record



Goto Last Record

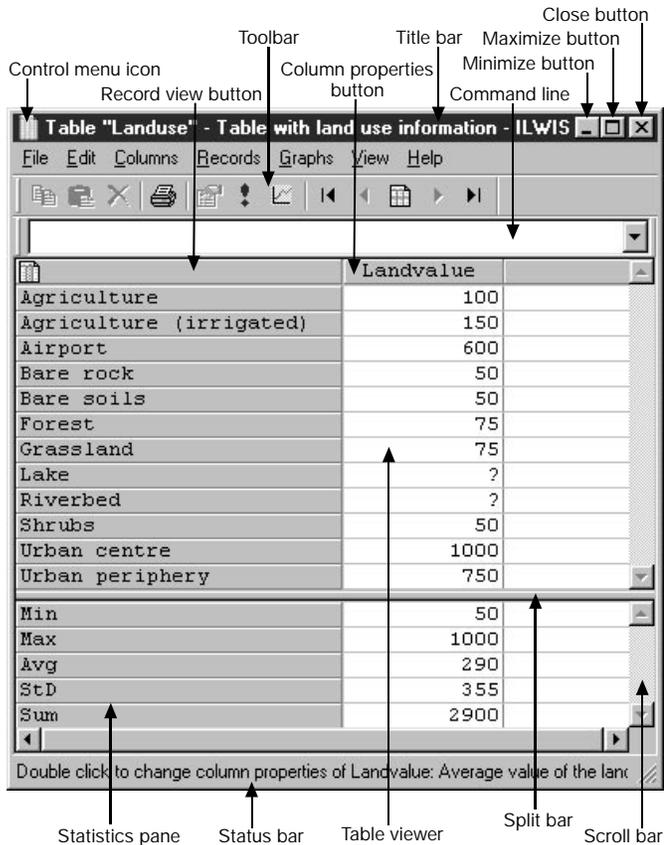


Figure 1.15: An ILWIS table window.

Furthermore, there is a Command line, a Table viewer, a Split bar with the Statistics Pane below it and a Status bar.

The table contains two columns. The left column, in gray color, has no header. If you look closely to the names in this left column you will remember that those are the names that you have seen also in the map Landuse. This is again the domain; a domain can thus define the contents of a map, but also the contents of a table.

Next to the left gray column containing the domain items, the table has one more column, called Landvalue. This column is an attribute column that contains the average value of the land in fictive monetary values. As you can see, this column contains values.



- Double-click the Column header with the name Landvalue on it. The Column Properties dialog box (Figure 1.16) appears.

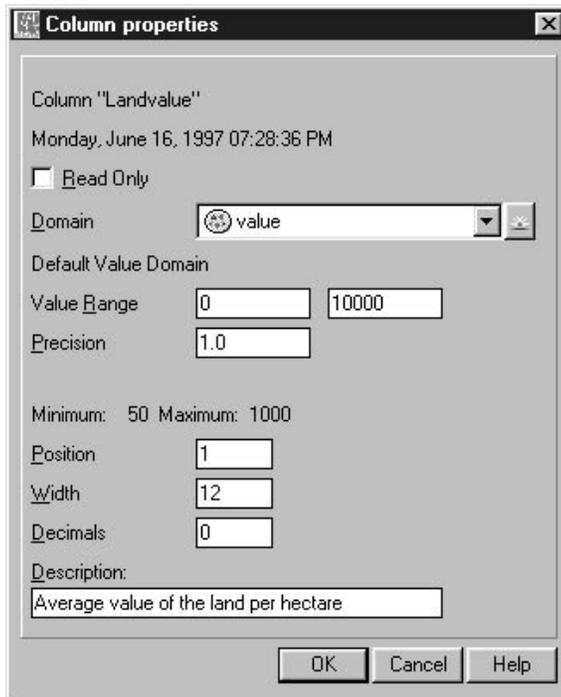


Figure 1.16: Example of a Column Properties dialog box.

This dialog box contains information on column `Landvalue`. The dialog box shows for instance the domain of column `Landvalue`: Default Value Domain. The next line gives the Value Range of column `Landvalue`: between 0 and 10000. The actual values in the column are also shown: Minimum: 50, Maximum: 1000.



- Click the Cancel button to close the Column Properties dialog box.

Information on the Minimum (Min) and Maximum (Max) values in the column, together with the Average (Avg), Standard Deviation (StD) and Sum of the column, is visible in the Statistics Pane in the lower part of table `Landvalue`.

You will now practice with the various items related to the display of tables. First we will show you how to switch between Table View (in which you will see the table ordered in such a way that the information of one record is displayed in different columns) and Record View (in which you will see only the information related to one record):



- In the table window, click a Record button, for example the Record button `Grassland` (the left gray button with the name `Grassland` on it). A small Record View window appears. It shows the current record 



(Grassland) and the attribute value(s) we have for this unit (in this case only the Landvalue).

- In the Toolbar of table Landuse, click the Goto Next Record button  or the Goto Last Record button  to go to the next or to the last record respectively.
- Click the Goto Previous Record button  or the Goto First Record button  to go to the previous record or to the first record respectively.
- Click the Goto Record button  to go to a specific record in the table.

By default, data in a table are sorted on the domain of the table. The records of a table can also be sorted on one of the columns in the table.



- Open the Columns menu and select the Sort command. The Sort dialog box is opened.

By clicking the Column option in the dialog box, you can select the column which you wish to sort. The record order of the table will change as well.



- In the Sort dialog box, select the Column option, and then select column Landvalue from the drop-down list box. Accept the Sort Order Ascending and click OK. Now the table is ordered ascendingly according to the values in the column Landvalue.
- Resort the table using the Record sequence Domain.

In chapter 5 many more options of the table window are treated. For now, close the table.



- From the File menu, select Exit or double-click the Control-menu icon  of the table window.

### Summary: displaying maps and tables

In this section you have learned:

- How to use dialog boxes: How to enter parameters to define the way in which a map is displayed.
- The basics of a map window: How to open a map; the different components of a map window: Title bar, Menu bar, Toolbar, Map viewer, Layer Management Pane, Status bar; to resize a map window; to zoom in and to zoom out; to read the coordinates of a map (coordinate system); to know the contents of a map (domain).

- The basics of a table window: How to open a table; the different components of a table window: Title bar, Menu bar, Toolbar, Command line, Table viewer, Split bar, Statistics Pane, Status bar; the fact that contents of a table are defined by the domain of the table; the fact that columns also have a domain. The display of an entire table (i.e. Table View), or only the contents of a certain record (i.e. Record View); to sort a table.

## 1.3 The Cochabamba area

Before we will have a more detailed look at the main concepts of ILWIS in the next chapter, it is maybe good to introduce you to the study area from which most of the data for the ILWIS User's Guide are taken: the Cochabamba area.



- In the Catalog, double-click raster map `View3D1`. The Display Options – Raster Map dialog box is opened.
- Click OK.

The picture which is displayed is a three dimensional view of the Cochabamba area. This picture was made by the Display 3D operation which will be treated in chapter 10, using a Digital Elevation Model (DEM) and a False Color Composite (FCC) derived from Landsat TM bands.



- Zoom in on the right-hand side of the picture (Cochabamba city).

Cochabamba city is a fast growing center with a population of approximately 300,000. The city is located in the Andean region of Bolivia, at an elevation of about 2600 meters above sea level. It is located in a large valley, bordered on the northern side by steep mountains, rising up to an elevation of 4500 meters. The northern part of the city is located on the alluvial fans at the foot of the mountains. Due to the high-intensity rainfall in the period November-January, the mountain area is subjected to landslides and soil erosion, and the city itself occasionally suffers from flashfloods on the alluvial fans. These processes affect the local farmers, and also hinder the expansion of the city.

A more detailed 3D view of the city of Cochabamba itself, made from a scanned aerial photograph, is also available.



- Close the map `View3D1`, and open raster map . Have a look at it, and close it when you have finished.