

# Remote Sensing with IDRISI® **A Beginner's Guide**

Timothy A. Warner  
David J. Campagna



Includes CD ROM

# **Remote Sensing with IDRISI<sup>®</sup>**

## **A Beginner's Guide**

**Timothy A. Warner**

**David J. Campagna**

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## About the authors

**Timothy A. Warner** is Professor of Geology and Geography at West Virginia University, in Morgantown, West Virginia, USA. He received a BSc (Hons) in Geology from the University of Cape Town, and a PhD in remote sensing from Purdue University. His research specialties include the spatial properties of images, high resolution remote sensing, and lidar. He has served as a founding board member and Secretary of AmericaView, and as Chair of the Remote Sensing Specialty Group (RSSG) of the Association of American Geographers (AAG). He received the 2006 *RSSG Outstanding Contributions Award*, and the 2006 *Boeing Award for Best Paper in Image Analysis and Interpretation* from the American Society of Photogrammetry and Remote Sensing. He is an editor of *Remote Sensing Letters*, and from 2014 will serve as the editor-in-chief of the *International Journal of Remote Sensing*. He also serves on the editorial board of *Geographical Compass* and from 2010 to 2013 was the progress reports editor for *Progress in Physical Geography*. He was a co-editor of the book, *The SAGE Handbook of Remote Sensing*.

**David J. Campagna** is a Geologist with over 25 years of non-profit, industry and academic experience. He has consulted for environmental groups using imagery to aid historical changes that document the impact of human activity on the landscape. In this role advised SkyTruth, Inc, where he was a founding board member for this non-profit remote sensing group. He has consulted for numerous energy firms worldwide in the investigations of unconventional reservoirs. He currently heads up the Unconventional Exploration efforts at Nexen Energy, ULC and also serves as Adjunct faculty in the Department of Geology and Geography at West Virginia University mentoring Ph.D. remote sensing students in their research. Dr. Campagna holds a Ph.D. in structural geology and remote sensing from Purdue University, MS in geology from University of Kentucky and a BA from Knox College.

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## Chapter 1 Introduction

### 1.1 Guide to Using the Manual

#### 1.1.1 Objectives

The objectives of this manual are twofold. The first objective is to introduce the reader to the display and basic processing procedures for enhancement, analysis and classification of satellite imagery. The second objective is to train the user in how to accomplish these tasks within the IDRISI environment. IDRISI is an excellent software suite for illustrating image processing in that the program has a wide array of basic programs, which the user combines in order to undertake an analysis. This ensures that each operation within the overall analysis is transparent and ultimately understandable.

You will be exposed to a wide variety of image analysis approaches and techniques through this manual. However, no single manual could ever be a comprehensive guide to either remote sensing or IDRISI. Nevertheless, at the end of this manual you should have the confidence and experience to continue exploring the wide range of functionality in IDRISI, and learning new approaches to image analysis. Indeed, probably the most important skill you will learn from this manual is not how to use IDRISI, but rather how to approach remote sensing problems.

#### 1.1.2 Organization

This training manual is primarily designed to be a stand-alone self-study guide. The skills you need before starting this training manual are only those of basic familiarity with the personal computer environment. Specifically, you need an understanding of files and directory structures, and the ability to maneuver around in the Windows environment. Basic knowledge of image processing concepts is useful, but not essential. However, access to a general remote sensing text (Table 1.1.2.a) is strongly recommended as a supplement to the coverage of topics introduced in this manual. More advanced texts may also be a useful supplement (Table 1.1.2.b).

The format of this manual was chosen to help the reader perform the included topical exercises. A section covering a specific image analysis topic begins with a brief general introduction to the subject matter, and then is followed by detailed instructions associated with example exercises.

- The **exercise instructions** are generally contained within a textbox with blue-colored text (Figure 1.1.2.a). These textboxes give step-by-step instructions in performing tasks in IDRISI. The first line of the text box, printed with a blue background, provides a summary of the activity. The second line, also with a blue background, gives the **menu location** of the IDRISI module described.
- **Icons** that provide shortcuts to Modules, or commands within modules, are printed in the left banner, next to the appropriate text (Figure 1.1.2a).
- **Program names**, such as DISPLAY LAUNCHER, are given in capitals.

Table 1.1.2.a Example introductory remote sensing texts.

Campbell, J., and R. H. Wynne 2011. *Introduction to Remote Sensing*. Guilford Press, New York, NY, 668p.

Jensen J R 2004. *Introductory Digital Image Processing: A Remote sensing perspective*. Prentice Hall Inc., Upper Saddle River, NJ, 526p.

Jensen, J. R. 2007, *Remote Sensing of the Environment: An Earth Resources Perspective*. Prentice Hall Inc., Upper Saddle River, NJ, 592p.

Lillesand, T. M., R. W. Kiefer, and J. W. Chipman, 2008. *Remote Sensing and Image Interpretation*. Wiley, New York, 756p.

Richards, J. A., and X. Jia, 2006. *Remote Sensing Digital Image Analysis: An Introduction*. Springer, Berlin, 439p.

Vincent, R. K., 1997. *Fundamentals of Geological and Environmental Remote Sensing*. Prentice Hall Inc., Upper Saddle River, NJ, 366p.

Table 1.1.2.b Example advanced remote sensing texts.

### **ASPRS Manual of Remote Sensing, 3<sup>rd</sup> Edition**

Henderson, F. M., and Anthony J. Lewis (eds), 1998. *Principles & Applications of Imaging Radar*. Volume 2. John Wiley & Sons, NY, 866p.

Rencz, A. (ed), 1999. *Remote Sensing for the Earth Sciences*. Volume 3. John Wiley & Sons, NY, 707p.

Ustin, S. (ed), 2004. *Remote Sensing for Natural Resource Management and Environmental Monitoring*. Volume 4. John Wiley & Sons, NY, 736p.

Ridd, M. K., and J. D. Hipple (eds), 2006. *Remote Sensing of Human Settlements*. Volume 5. ASPRS, Bethesda, MD, 752p.

Grower, J. F. R. (ed), 2006. *Remote Sensing of the Marine Environment*. Volume 6. ASPRS, Bethesda, MD, 338 p.

### **Other advanced texts**

Maune, D. F. (ed), 2007. *Digital Elevation Model Technologies & Applications*, 2<sup>nd</sup> Edition. ASPRS, Bethesda, MD., 620pp.

Liang, S., 2004. *Quantitative Remote Sensing of Land Surfaces*. John Wiley & Sons, NY, 534p.

Warner, T. A., M. D. Nellis and G. Foody (eds), 2009. *The SAGE Handbook of Remote Sensing*. SAGE, London UK, 490pp.



## Displaying an image

Menu Location: **Display – DISPLAY LAUNCHER**

1. Start the DISPLAY LAUNCHER.
2. Within the *DISPLAY LAUNCHER* window, select a file by clicking on the browse button (...) and then click on the ***etm\_pan*** raster file in the pick list window.
3. Select *GreyScale* in the *Palette File* section in the lower left corner of the DISPLAY LAUNCHER window.
4. Click on **OK** to display the image

Figure 1.1.2.a Example of instructions for the DISPLAY LAUNCHER program. Note that the first line is a general explanation of the task. The second line gives the menu location. The left banner displays the IDRISI menu icon, if available.

- The **names of dialog boxes and windows** are printed in italics, e.g. *DISPLAY LAUNCHER* window.
- **Text within the IDRISI program windows and dialog boxes** is also printed in italics. For example, the name of an input text box might be *Input file name*.
- **Names of files** that already exist are printed in bold italics (e.g. ***etm\_pan***).
- Text that you, the reader, should enter in a program (e.g. through a text box) is given in bold, including the names for new files you will generate. For example the text may specify: Enter the file name **pca\_123** in the text box.
- Terms that we wish to highlight are also shown in bold, for example **ground control point**.
- Finally, the sequence of menu options you should select to start programs is also highlighted in bold: e.g. **Display - DISPLAY LAUNCHER**.

### 1.1.3 Sample Data

This manual comes with sample data covering a number of different locations around the globe (Table 1.1.3.a). The locations were chosen to cover a variety of natural and human-modified environments.

The first data set, used in Chapters 1 through 4, comprises Landsat Thematic Mapper (TM) imagery of the coastal region of Hong Kong, China and part of the Pearl River estuary. We will be using these data to illustrate the importing, displaying, merging and creating maps. In addition, combination of imagery and elevation data will be used to create 3D displays and fly-throughs. The elevation data were acquired through the Shuttle Radar Topography Mission (SRTM), in which the Spaceborne Imaging Radar-C (SIR-C) was flown aboard the NASA Space Shuttle Endeavour during 11-22 February, 2000. The SRTM mission generated a near-global digital elevation model (DEM) of the Earth using overlapping radar images, through a process called radar interferometry (Maune, 2001).

Table 1.1.3.a Image data and directory location on the CD.

Directory Name	Geographic Area	Data
Chap1-4	Hong Kong, China	Landsat TM ETM+ (Multispectral & Pan), SIR-C SRTM Digital Elevation
Chap1-4/Raw images	Hong Kong, China	Landsat TM ETM+ (Tiff format)
Chap5/Chap5_3	African continent	Advanced Very High Resolution Radiometer (AVHRR)
Chap5/Chap5_4	Washington State, USA	Landsat TM
Chap5/Chap5_5	Atacama, Bolivia/Chile	Landsat TM
Chap6/Chap6_3	Hawaii	Thermal Infrared Multispectral Scanner (TIMS)
Chap6/Chap6_4	Hong Kong, China	Landsat TM (resampled to 90 meter pixels)
Chap6/Chap6_4alt	Hong Kong, China	Landsat TM (full resolution – 30 meter pixels)
Chap7	West Virginia, USA	Landsat TM (Summer)
Chap8/Chap8_3	West Virginia, USA	Mosaicked Digital Orthophotos (& results from Chapter 7 classification)
Chap8/Chap8_4	West Virginia, USA	Landsat TM (Autumn)
Chap9	Las Vegas, Nevada, USA	Landsat MSS (1972 & 1992)

Chapter 4 is followed by two chapters on image enhancement. Chapter 5 explores image ratios. In this chapter we first use coarse-resolution Advanced Very High Resolution (AVHRR) imagery of Africa to generate a continental scale vegetation map. We will then use Landsat data of Washington State to develop an index to discriminate snow from clouds. Finally, we will use TM imagery from the Andes of the Atacama region along the Chile-Bolivia border, where we will examine how image ratios can be used for geologic mapping.

Chapter 6 is the second chapter on image enhancement. In the first half of this chapter, we will use Thermal Infrared Multispectral Scanner (TIMS) imagery of lava flows from Hawaii to investigate a range of enhancement methods for highly correlated data. The second half of the chapter draws on the Hong Kong TM data set, already used in Chapters 1-4, to investigate segmentation and non-standard false color composites.

For the classification in Chapter 7 we will use TM imagery of Morgantown, West Virginia, and the neighboring areas in the Appalachian Plateau of West Virginia, USA. The area is marked by deciduous forest and some farming activity.

Chapter 8 also has two major sections. First, the procedures for an accuracy assessment will be discussed using a classification from the previous chapter and a digital orthophotography mosaic. The latter half of the chapter is a linear pixel unmixing, and uses an autumn Landsat TM image.

The final data set comprises two multi-temporal Multispectral Scanner (MSS) images of Las Vegas, Nevada, USA, which is used in Chapter 9. The arid city of Las Vegas and its surrounding valley will be used to demonstrate the mapping of

change, in this case urban growth around the city of Las Vegas over two decades.

#### 1.1.4 Working with the Manual

This manual is written assuming that you will work progressively through the material. Thus, instructions are more detailed in the beginning chapters, especially Chapters 1-4. The instructions are generally slightly briefer the second and subsequent times any program is described. If you should find that the instructions for any program are too brief, you may wish to return to the earlier sections, to review the particular program or procedures described, and also draw on the extensive Help in IDRISI, as described below.

Some readers may prefer to sample the manual selectively. This should be fine, but do note that many chapters draw on images prepared earlier in the chapter, or skills developed in prior sections. If this is a barrier to your completing the exercise, you will need to do the earlier work first.

## **1.2 IDRISI Software**

### 1.2.1 What's in a Name?

The IDRISI software is named after the cartographer and botanist, Abu Abd Allah Mohammed al-Idrisi (1100-1165 or 1166 A.D.) (Wikipedia 2005, Eastman 2009). Al-Idrisi was one of the most important medieval scholars, producing maps for the Norman King, Roger II of Sicily that would serve as a primary reference for the next 500 years. In addition, he made a major contribution in cataloging medicinal and other plants, which had not previously been recorded.

### 1.2.2 History and Overview of IDRISI

First released in 1987, IDRISI provides raster-based GIS and image processing modules in a single integrated package (Warner and Campagna 2004). The latest version of IDRISI, IDRISI Selva, is a 32-bit version designed for Windows, and is the seventeenth release.

IDRISI specializes in analytical functionality covering the full spectrum of GIS and remote sensing analysis from database query, to spatial modeling, to image enhancement and classification. Although IDRISI is primarily oriented towards the use of raster data, vector data can also be displayed and used in some of the programs.

IDRISI includes routines for environmental modeling and natural resource management, including change and time series analysis, land change prediction, multi-criteria and multi-objective decision support, uncertainty analysis and simulation modeling. Spatial operations include interpolation, Kriging and conditional simulation. For image processing, a suite of tools for image restoration, enhancement and spectral transformation are available. IDRISI has a particularly sophisticated range of classification algorithms, including traditional "hard" classifiers, in which each pixel is assigned to a single class, as well as "soft" classifiers, in which multiple classes are potentially associated with each pixel. In addition, IDRISI offers hyperspectral image classification procedures, designed for use with images with hundreds of spectral bands (a *band* is an image layer associated with a specific wavelength region of the electromagnetic spectrum). IDRISI Selva is specifically designed to allow programmers and modelers to incorporate IDRISI routines into their own applications. Despite the highly sophisticated nature of these capabilities, the system is still easy to use.



The nearly 300 modules which make up IDRISI are organized in menus in seven major groups, with most of the analytical functionality concentrated in the *GIS Analysis* and *Image Processing* Menus. Because IDRISI tends to generate many individual files, a program for file management is an important component of the File menu.

A particularly effective IDRISI program module is the graphical MACRO MODELER, which allows users to develop and link a sequence of IDRISI modules. This program is useful for designing an image analysis in a conceptual manner, for speeding up implementation of a complex sequence of tasks, for building a macro for repeating an analysis sequence on different data sets, and for documenting analysis procedures.

IDRISI tends to be highly modular in design. This modular design tends to make an analysis in IDRISI more complex because of the many steps involved. However, this approach makes IDRISI a superb teaching tool, because the user is forced to understand every step in each procedure.

### 1.3 Starting IDRISI and the IDRISI Workspace

#### 1.3.1 Copying the Data from the CD

Before starting the IDRISI program, we will need to create and organize file folders for our project data.

We will begin by creating a folder called **ID Man** (short for IDRISI Manual), in which we will store our data. Depending on your preferences, you may wish to create this new folder on your desktop, the root directory (C:\) or elsewhere. We find that there is some advantage in keeping the paths (directory names) short, and so for this manual the examples we give will be based on creating this directory in the root directory. The choice of where to place the data, however, is up to you.

There are a number of ways to create a folder on your desktop, and one way is described below.

#### IDRISI folder creation

1. Click on the Windows *Start* button and select *Computer*.
2. Double click on the C:\ drive. (Note if you want to create your new folder in a location other than C:\, then you should now navigate to that location.)
3. Right-click in the folders panel.
4. Select *New*, then select *Folder* and name the folder **ID Man**.

We are now ready to copy some of the data provided with this project to your computer.

#### Data transfer

1. Put in the data CD to your CD drive.
2. If the file explorer window does not open automatically, double click on *My Computer*.
3. Double click on the CD drive.

4. Right-click on the CD folder labeled *Chap1-4*, and select *Copy* from the pop-up menu.
5. Move up the directory tree to *My Computer* and select the *C:\* drive. (Note if you created the *ID Man* folder in a location other than *C:\*, then you should now navigate to that location.)
6. Double click on *ID Man* folder.
7. Move cursor to the main folders pane, right click, and select *Paste* from the pop-up menu.

At the start of each section you will be prompted for the appropriate data for that section, so you do not need to transfer the remaining data from the CD now.

A very important final step in preparing your data each time you copy data from the CD is to set the appropriate folder properties. The data on the CD is marked as *Read-only*, which means the files cannot be changed. Therefore we must modify the *Read-only* attribute, as described below.

#### **Remove *Read-Only* attribute from the data folder**

1. Use the *Windows Explorer* or *My Computer* (as described in the previous instruction box) to display the contents of the *ID Man* folder (Figure 1.3.1.a).
2. Right click on the *Chap1-4* folder. (Note: Instead of selecting the *Chap1-4* folder, you can alternatively select the parent *ID Man* folder if you need to apply the *Read-only* attribute change to more than one folder in the *ID Man* directory.
3. Select the *Properties* option from the pop-up menu (Figure 1.3.1.a).
4. The *Properties* window will now open for that folder. Uncheck the *Read-only* attribute check box (Figure 1.3.1.b).
5. A *Confirm Attribute Changes* Window will open. Ensure that the radio button for the default option of *Apply changes to this folder, subfolder and files* has been selected automatically. (Figure 1.3.1.c).
6. Click on *OK*.
7. The check box in the *Properties* window will now be blank.

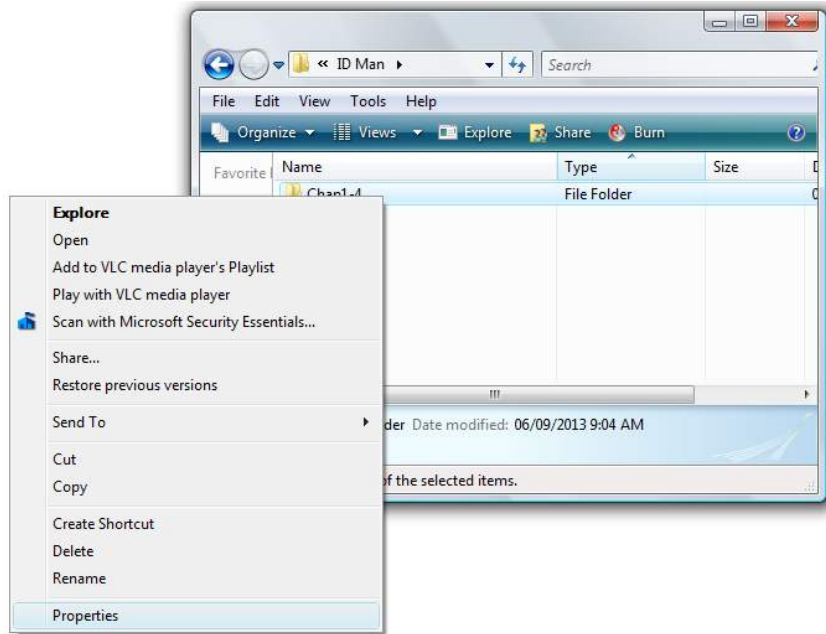


Figure 1.3.1.a Right click on the folder name to access a pop-up menu that includes the option to set the folder properties.

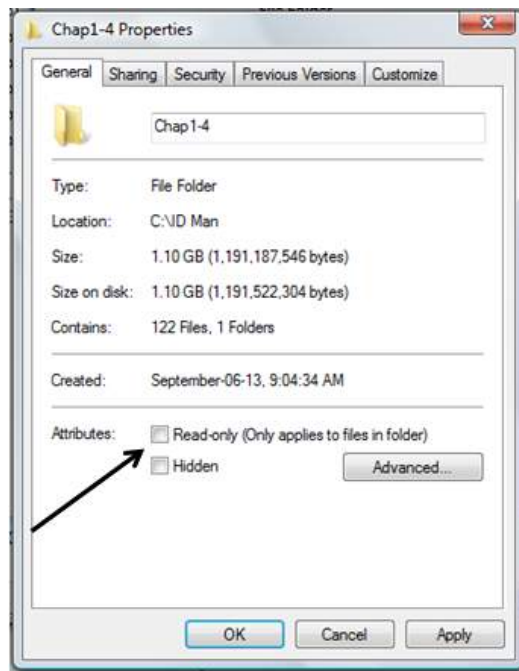


Figure 1.3.1.b Uncheck the *Read-only* attribute for the folder.

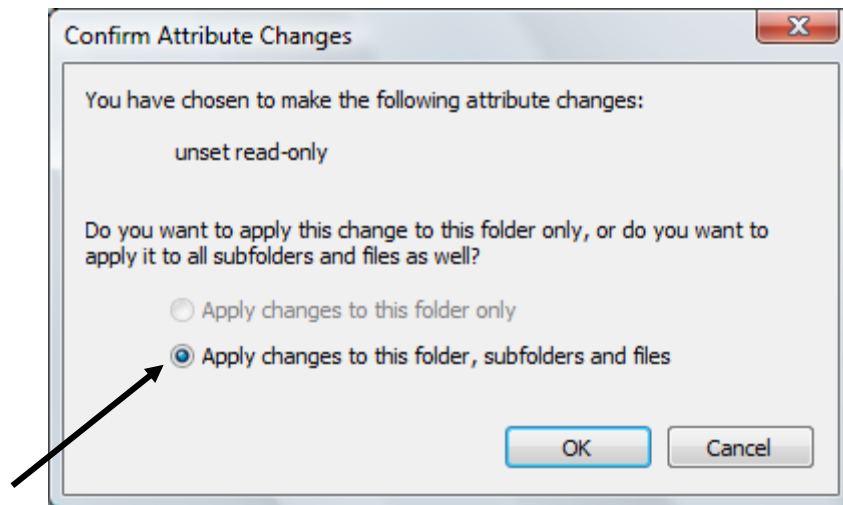


Figure 1.3.1.c Ensure the default option to apply changes to the folder, subfolders and files, has been selected.

### 1.3.2 Starting IDRISI

The IDRISI program is started by double clicking on the IDRISI icon on your desktop. Alternatively, you can use the Windows® Start menu, by selecting *IDRISI Selva* within the *IDRISI Selva* menu.

The IDRISI workspace window will now open. If this is the first time you have opened IDRISI, the *Quick Start Navigation Guide* will be displayed (Figure 1.3.2.a). Review the information in the guide.

If you do not want the guide to display every time you open IDRISI, check the box in the lower left corner labeled *Don't show this again*. (If you change your mind, and want to redisplay the *Quick Start Navigation Guide*, simply use the main IDRISI menu to access **File – User Preferences**, and then, on the System settings pane, checking the check box for *Show tip screen on start up*.) Close the navigation guide by clicking on the red x in the lower right corner.

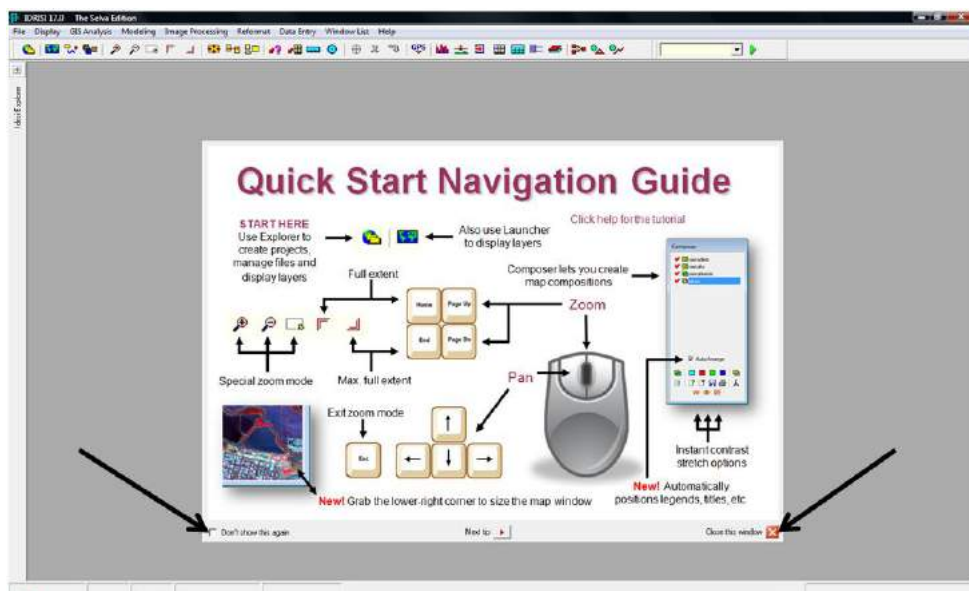


Figure 1.3.2.a The IDRISI workspace with the *Quick Start Navigation Guide*, which may be displayed when IDRISI first starts.

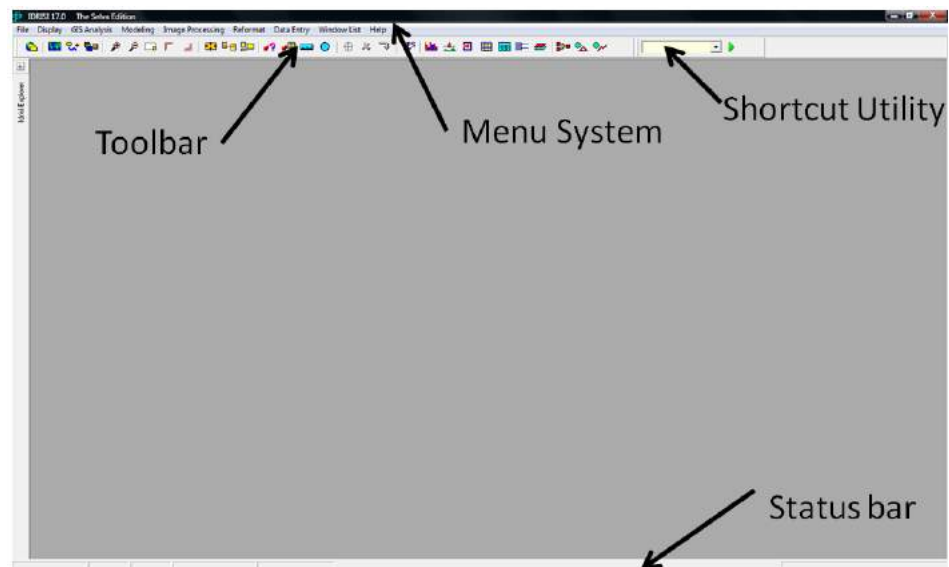


Figure 1.3.2.b The IDRISI workspace.

The IDRISI workspace includes the **toolbar**, the **menu system**, the **shortcut utility**, and the **status bar** (Figure 1.3.2.b). There are many ways to start an individual program. One of the simplest ways is through the **menu system**, which is at the top of the application window (Figure 1.3.2.b).

You can activate the menus by clicking on the menu with the mouse. If you select a menu option that includes a right-pointing arrow, a submenu will appear. You can navigate through the submenus using the arrows on the keyboard (on the number pad) or using the *Enter* key. Clicking on a menu option without a right-pointing arrow will cause a dialog box for that module to appear.

Alternatively, you can navigate through the menus with the keyboard, by depressing the ALT key and a particular letter. When you first press ALT, an initial letter of each menu is underlined, to help you identify the appropriate key. This will open the menu, which can then be navigated by pressing the key associated with first letter of the submenu or program. If you wish to access a submenu that starts with the same letter as an earlier submenu, press the key for the letter twice. You will then need to press the ENTER key to start the program.

Some programs can be accessed directly, via the icons, or buttons, below the menu. These buttons are collectively known as the **tool bar**. Each icon represents either a program module or an interactive operation that can be selected by clicking on that button with the mouse. Hold the cursor over an icon to display momentarily the name of the function or module represented by that icon. The set of icons represents interactive display functions as well as some of the most commonly used modules.

A third method for selecting a program is from the **shortcut utility**, a pull-down menu with a scroll bar, which is accessible from the **status bar**, along the bottom of the IDRISI window. You can navigate through this menu with the mouse, or you can type the program name in the box directly. Note that you can turn the *Shortcut* utility on or off on the main IDRISI window through the User Preferences dialog box, obtained from the menu *File-User Preferences*.

The **status bar** (Figure 1.3.2.c) provides a variety of information about program operation. When maps and map layers are displayed on the screen and the mouse is moved over one of these windows, the status bar will indicate the position of the cursor within that map in both column and row image coordinates and X and Y map reference system coordinate. In addition, the *Status Bar*

indicates the scale of the screen representation as a Representative Fraction (RF).

Figure 1.3.2.c also shows some of the major windows within IDRISI that we will be using extensively. On the left is the *IDRISI EXPLORER* window, which is used for organizing data. The *Display* window, shown in the figure in the center of the IDRISI window, is the major tool for visualizing images. The *Composer* dialog box, on the far right, allows one to manipulate how images are displayed in the *Display* window.

If one or more program modules are currently still processing, the **status bar** will also indicate the progress of the most recently launched analytical operation with a percent done measure, and sometimes a graphic bar (Figure 1.3.2.d). Note that in the figure, the program dialog box remains present, even though it was that dialog box that created the program that is indicated as still running. This “persistent window” approach is useful because it facilitates running programs multiple times without having to reopen the dialog box each time. (You can, if you want, turn off this persistent window feature through the *File - User Preferences* menu, and unchecking the option for *Enable persistent dialogs*.) Despite the benefit of persistent windows, users should exercise caution in exploiting this capability because you should not try to open a file that is still being processed by another program.

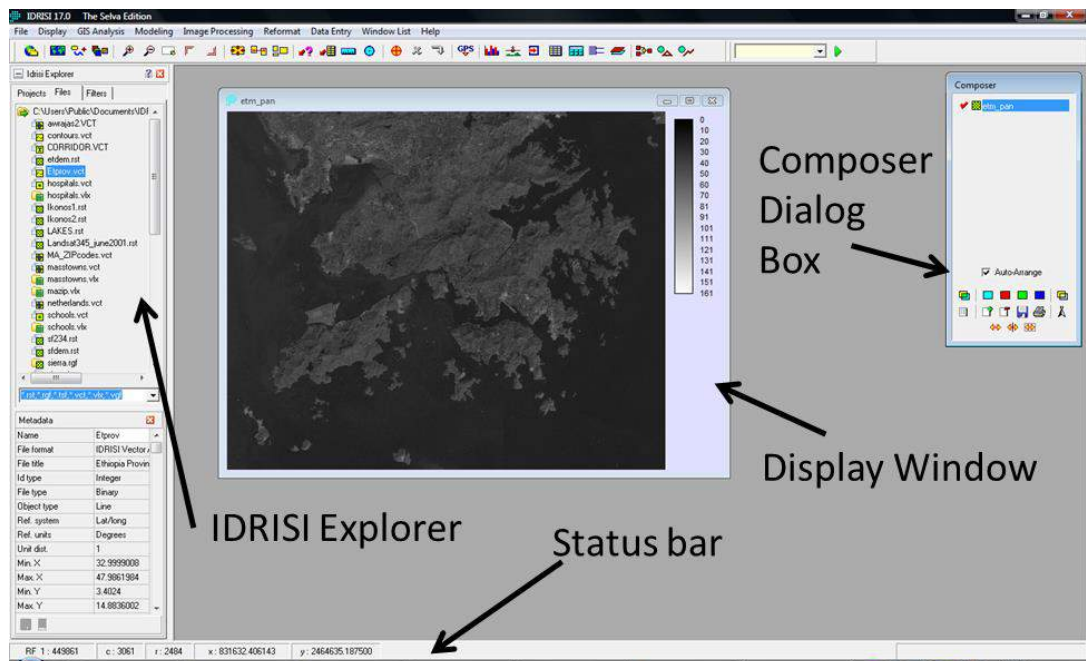


Figure 1.3.2.c The IDRISI status bar, and related main windows.



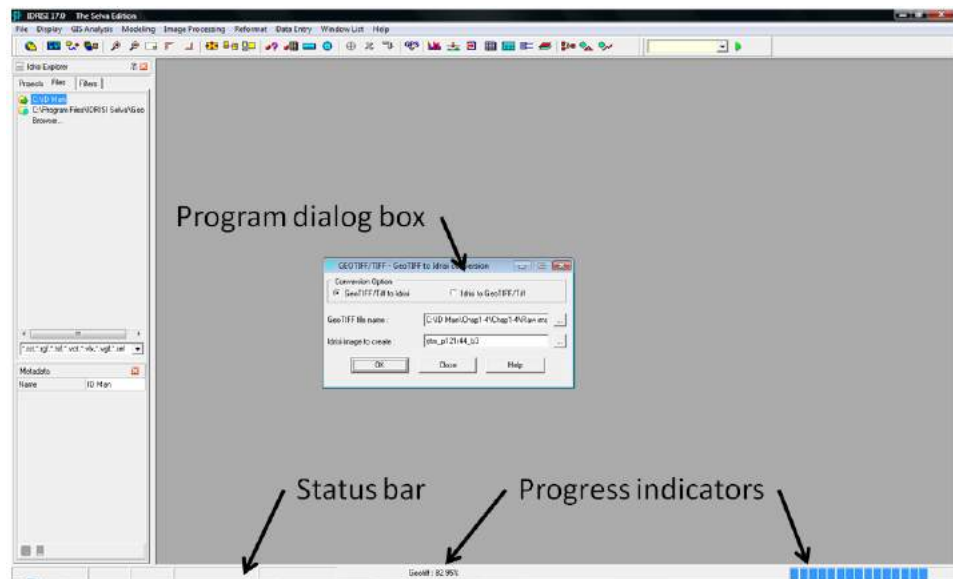


Figure 1.3.2.d Progress indicator within the status bar.

Since IDRISI has been designed to permit multi-tasking of operations, it is possible that more than one operation may be working simultaneously. To check active processes and their status, simply double click on the bottom right hand part of the *status bar* panel. A *Progress of modules* window will open, listing the current programs running. Modules may also be terminated from this window.

Figure 1.3.2.d also shows a typical program dialog box. Dialog boxes are used to provide information to the IDRISI programs regarding input and output data, as well as important processing parameters.

### 1.3.3 IDRISI On-Line Help

IDRISI has excellent on-line documentation and help. In our own use of IDRISI, and in developing this manual, we have drawn extensively on the IDRISI help material, and we encourage all users of this manual to take advantage of this outstanding resource.

You can access the IDRISI help from the main IDRISI menu bar: **Help – Contents.**

Another way to access the on-line help is through the button labeled *Help*, found in the dialog box that controls each program (Figure 1.3.3.a). This button automatically opens the help material for the particular program from which the help was called. The help material is very useful for understanding the general nature of each program, as well as the limitations, such as the type of data that can be used. The on-line help also provides a comprehensive **glossary** and an **index**, which can be found through the *Glossary* and *Index* tabs on the left hand

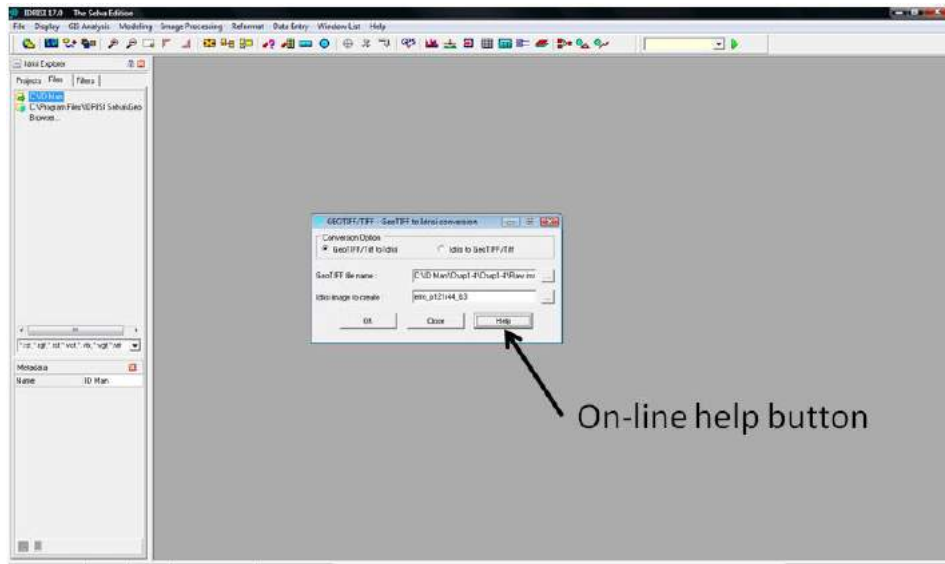


Figure 1.3.3.a Typical dialog box showing button for on-line help.

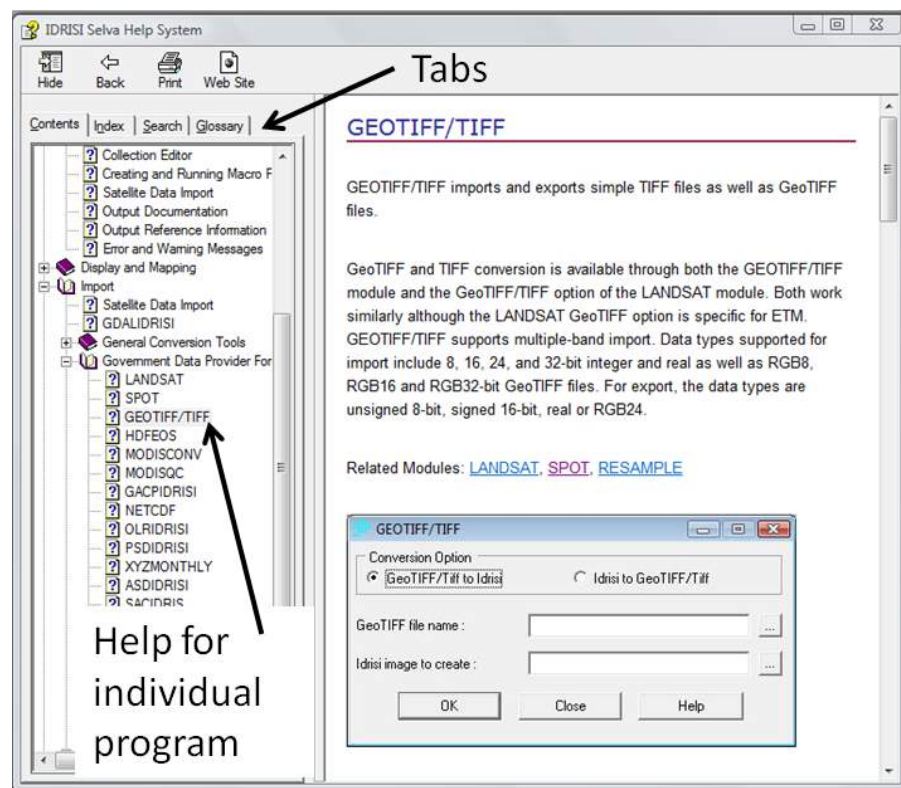


Figure 1.3.3.b The IDRISI on-line Help.

side of the Help window (Figure 1.3.3.b). The glossary is helpful for clarifying the meaning of remote sensing terminology in general, and IDRISI terms in particular. The index provides a tool for rapid searches through the main sections of the Help system. You can also identify the specific subsections within the Help, by clicking on the *Contents* Tab, and navigating through the hierarchical structure, as shown in Figure 1.3.3.b.

In addition, a very good PDF-format tutorial document can be accessed from the main IDRISI menu: **Help – IDRISI Tutorial**.

#### 1.3.4 Managing IDRISI Project Files with the IDRISI EXPLORER

In a typical image analysis activity you will produce many files. It is therefore essential to have an effective method to organize your files. Firstly, you should

specify meaningful file names for files you generate with IDRISI. Do not simply use the IDRISI default names. Instead use names that have meaning within your analysis, perhaps referring to the program used, or crucial parameters used in the processing. In addition, you should keep good notes on the names of the input and output files, as well as all parameters selected.

In addition to using appropriate file names and keeping good notes, it makes good sense to organize your data in a series of folders, much as the data for the exercises in this manual are organized.

A powerful tool to assist you in organizing your data folders is the concept of an **IDRISI Project**. An *IDRISI Project* is a file that keeps track of the *working folders* and *resource folders* for a particular task. The **working folder** is the main location for the data for your project. It is also the default location for the output for the files created by IDRISI. A **resource folder** is a location where additional files can be stored. For example, in a large project, you might store the original copies of your orthophotography, satellite imagery, and elevation data in separate resource folders.

There is no limit to the number of resource folders used in a single project. Resource folders are listed in file pick lists, and are searched in the orders they are specified (after the working folder) for file names that you type in manually.

In summary, the *IDRISI Project* file determines the default locations where IDRISI will look for data, and the locations to which it will write the output files. Although you can over-ride the *Project* file in determining file locations, it can be tedious to do so, and the chance of becoming confused and making mistakes becomes quite high.

*IDRISI Projects* may be stored anywhere, however the default folder for projects is located in the *IDRISI Selva* program folder under the subfolder *Projects*. A single Project Environment file, *default.env*, is automatically created. Some users will find it convenient simply to change the working folder of this default Project Environment file each time they work on a new data set. However, you may wish to set a new *Project* file for each section of this manual, in order to facilitate switching back and forth between the different sections.

### Creating a new project file and specifying the working folders with the IDRISI EXPLORER

Menu Location: **File – IDRISI EXPLORER**

1. Start the IDRISI EXPLORER from the main menu or toolbar.
2. The *IDRISI EXPLORER* window will open on the left side of the IDRISI workspace. It is anchored to this location, and although you can change the width of the window, you cannot move it to other locations.
3. Practice minimizing the window by clicking on the “-” icon on the top left of the *IDRISI EXPLORER* window. The window will collapse into the left hand side of the IDRISI workspace.
4. Reopen the *IDRISI EXPLORER* by clicking on the “+” icon in the minimized window.
5. Select the *Projects* tab (Figure 1.3.4.a).



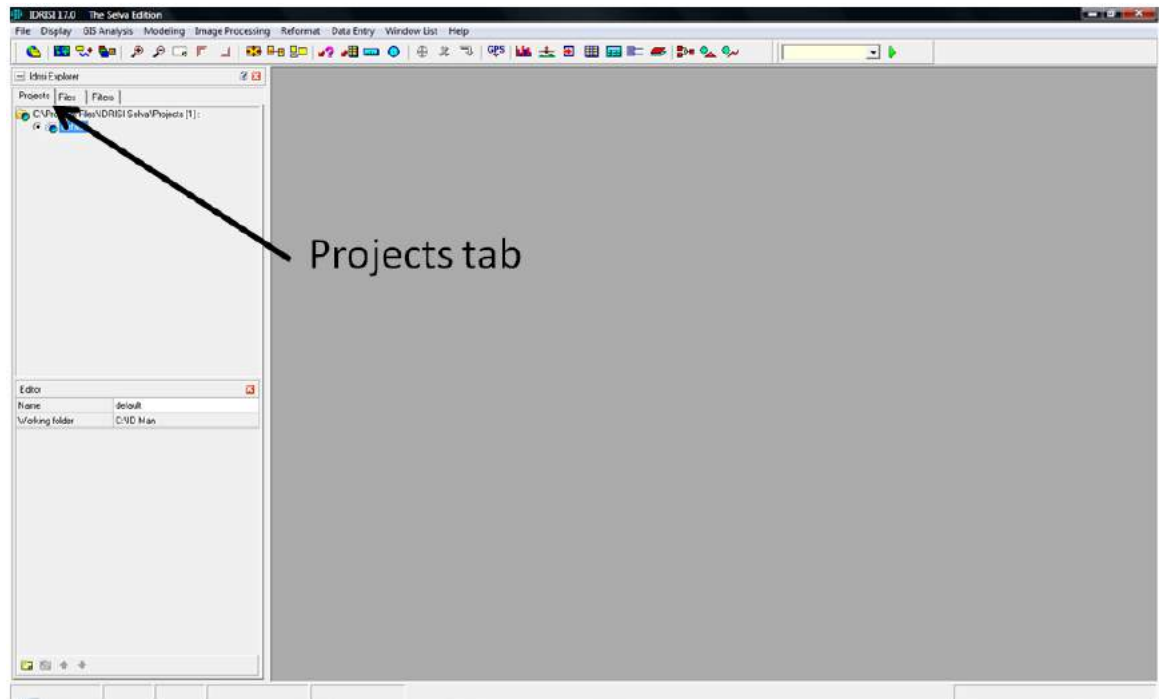


Figure 1.3.4.a The *Projects* and *Editor* panes in the IDRISI EXPLORER.

### Creating a new project file and specifying the working folders with the IDRISI EXPLORER (cont.)

6. There should now be two panes within the *IDRISI EXPLORER* window. The first is the *Projects* pane, and below that should be the *Editor* pane (Figure 1.3.4.a). If the *Editor* pane is not shown right click in the *Projects* pane, and select *Show Editor*. (It is possible to close the *Editor* pane by clicking on the red "x" in that pane, hence the need to have a way to open the pane again.)
7. Note also that the boundary between the *Projects* and *Editor* panes can be dragged with the mouse, in order to change the relative size of the two panes. This is convenient if the *Editor* pane is obscuring information in the *Projects* pane.
8. Right click within the *Projects* pane, and select the *New Project Ins* option (Figure 1.3.4.b).

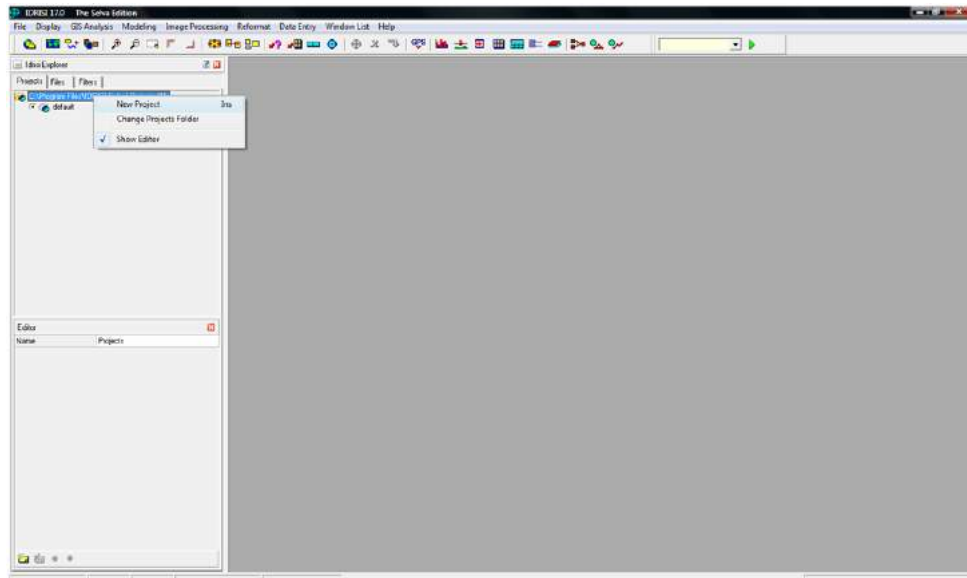


Figure 1.3.4.b Right click within the *Projects* pane to select the *New Project Ins* option.

### Creating a new project file and specifying the working folders with the IDRISI EXPLORER (cont.)

9. A *Browse For Folder* window will open. Use this window to navigate to the folder *Chap1-4*, which you copied to your computer to the new *ID\_Man* folder, in section 1.3.1.
10. Click *OK*.
11. A new project file will now be created.
12. Note that you can switch between the original default environment and the new environment by selecting the appropriate radio buttons in the *Project* pane.
13. The project's default name is the directory name. If you wish, you can rename the project by editing the text in the *Name* text box, within the *Editor* pane.
14. You can also modify the *working folder* by clicking on the name of the current file listed in the text box next to *Working folder*. This will generate a browse icon (a button with three dots). Clicking on the browse icon will open a *Browse For Folder* window. If we wanted to specify a new file, we would now navigate to that file, and then click *OK*. However, for now, we will leave the existing file, and therefore press *Cancel*.
15. Add a resource folder by right clicking in the *Editor* pane, and selecting *Add folder*.
16. A new line in the Editor pane will open, with the text *Resource folder (1)* in the left cell. Click in the right cell, and a browse icon will appear (a button with three dots). (Figure 1.3.4.c).
17. Click on this browse button, and the *Browse for Folder* window will open. Navigate to the *Raw Images* subfolder, within the *ID Man\Chap1-4* folder on your computer. Click on *OK*. (Figure 1.3.4.c).

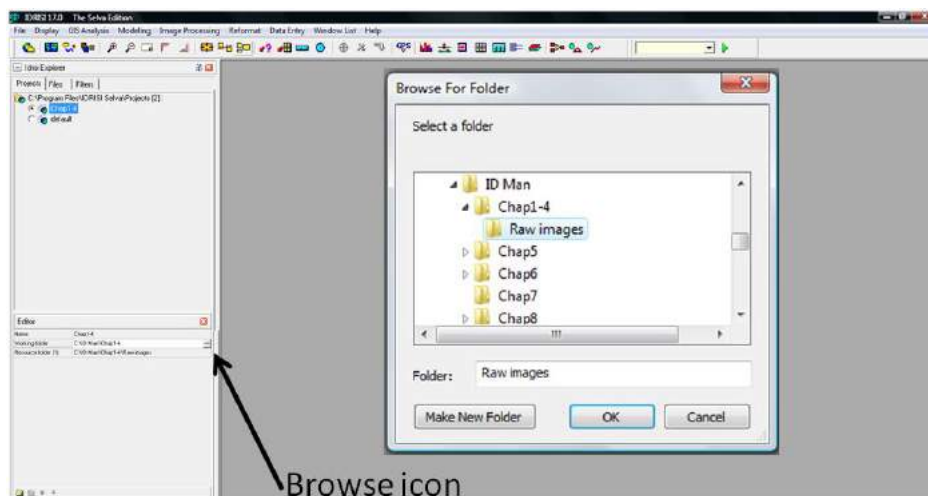


Figure 1.3.4.c Adding a *Resource Folder*.

### Creating a new project file and specifying the working folders with the *IDRISI EXPLORER* (cont.)

18. Once the *Browse for Folder* closes, your project should now be specified. If necessary, you can drag the *IDRISI EXPLORER* window boundary to the right, in order to provide more room to show the complete path file for the folder locations (Figure 1.3.4.d)

The new *project* file now points to the location of the working folder and resource folder for Chapters 1-4 in this manual, as shown in Figure 1.3.4.d. When you exit and re-launch IDRISI, the project file most recently used is retained. Therefore you only need to change the *project* file information when you start a new project. For example, we will create a new *project* file when we start Chapter 5.

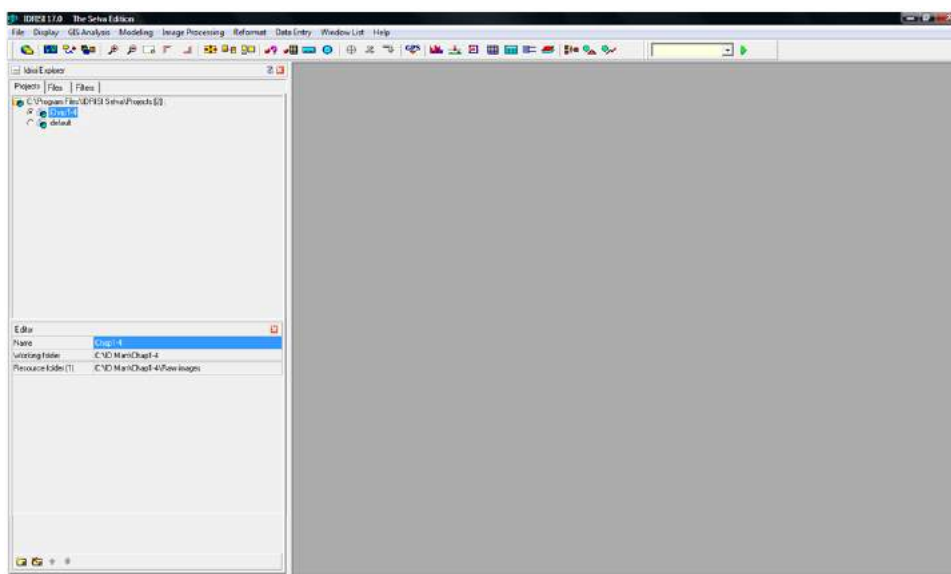


Figure 1.3.4.d The new project file successfully created.

### 1.3.5 Basic File Management with the *IDRISI EXPLORER*

The *IDRISI EXPLORER* is a powerful tool that has functionality well beyond that of simply managing project files. For example, you can manage all aspects of IDRISI-specific files, including regular file maintenance as well as examining a file's metadata, binary contents and structure.



IDRISI files are often linked. For example, an image has two separate files, one that contains the raw image brightness values, and a second file with the metadata, which specifies how the image is to be constructed (for example, the number of rows and columns) from the raw image brightness values.

Because of this linking of files, doing file maintenance in the *Windows Explorer*, instead of the **IDRISI EXPLORER** is likely to lead to disaster. For example, if you were to use the Windows Explorer to rename the image file *etm1.rst* to *HongKong.rst*, you would not be able to display it, unless you also remembered to change the associated *etm1.rdc* file to *HongKong.rdc*. On the other hand, the IDRISI EXPLORER would automatically change both files, if you changed the name of the *etm1.rst*. **Thus it is crucial always to use the IDRISI EXPLORER for all file maintenance work, especially for tasks such as copy, deleting or renaming files.**

We will now examine how we can use the IDRISI EXPLORER to manage files.

### Basic file management with the IDRISI EXPLORER

#### Menu Location: File – IDRISI EXPLORER

1. If the *IDRISI EXPLORER* window is not already open, open it again.
2. Click on the tab for *Filters* (Figure 1.3.5.a).
3. Observe the list of file types listed. These are only the primary IDRISI extensions. The many different types of file extensions that IDRISI recognizes give some indication of the wide range of functionality that IDRISI offers.
4. Note that it is possible to check which types of files one wants to list in the *Files* pane, an option that we will look at in a moment. The default is to list raster Image files, as well as five other file types.

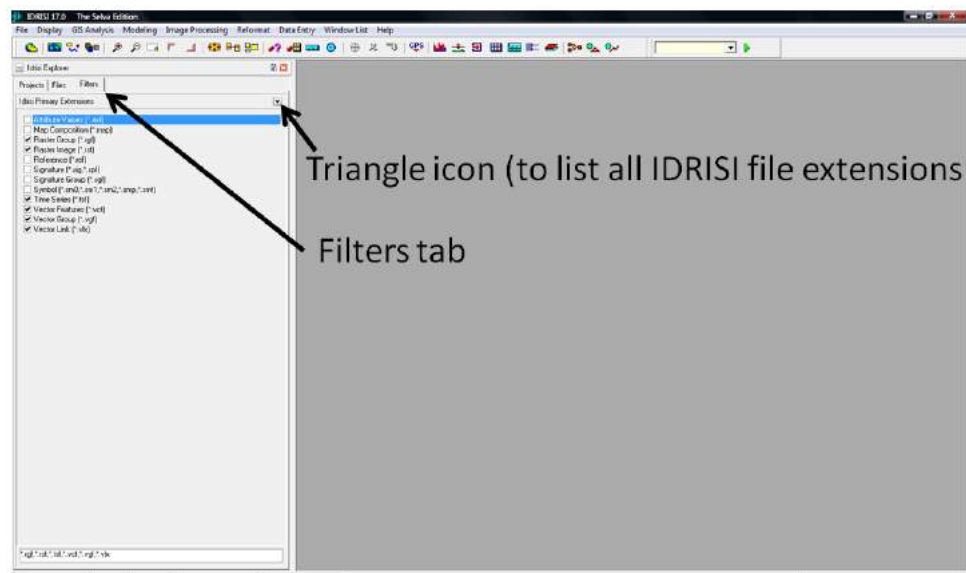


Figure 1.3.5.a IDRISI EXPLORER showing the *Filters* pane.

### Basic file management with the IDRISI EXPLORER (cont.)

5. Click on the small downward pointing triangle on the top right hand side of the pane (Figure 1.3.5.a), representing the icon to switch between the primary and entire list of IDRISI file extensions.

6. After clicking on the downward pointing triangle, observe the much greater list of file types listed.
7. If you want to check all the file types listed, in order to display all the files in the *IDRISI EXPLORER* window, there is a short cut that is much quicker than clicking on each box. Simply right click in the *Filters* pane, and in the resulting pop-up menu click on *Select All*.
8. Before leaving this section of the IDRISI EXPLORER, right click in the *Filters* pane once again, and select *Clear Filter*. This will uncheck all the check boxes.
9. Now scroll to the check box for *Raster Image (\*.rst)*, and click in the box.
10. Click on the tab for *Files* (Figure 1.3.5.b).
11. Practice clicking on the directory name to show and hide the file names (Figure 1.3.5.b). In many cases when you open the IDRISI Explorer the files may be hidden, and you need to click on the directory to show the files.
12. If necessary, drag the *Metadata* pane boundary up, so that you can see more of the metadata information.
13. Click on the file ***etm1.rst*** in the Files pane.

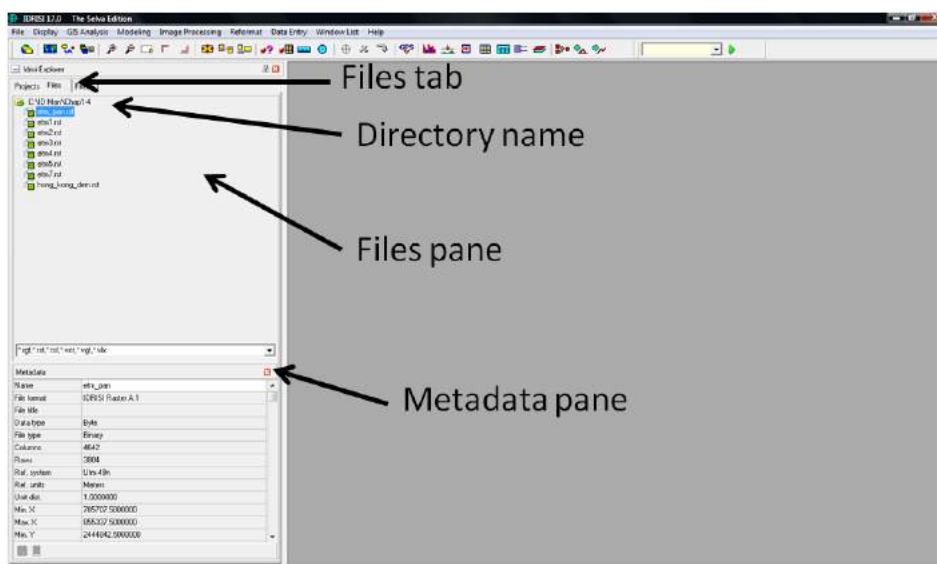


Figure 1.3.5.b The *Files* and *Metadata* panes in the IDRISI EXPLORER.

The *Files* tab has two panes (Figure 1.3.5.b). The top pane that shows the list of files based on the list of filter selections chosen through the options available via the *Filters* tab, and also listed in the text box above the *Metadata* pane. The lower pane shows the metadata for the file selected in the *Files* pane. The slider bar on the right allows one to scroll through the entire metadata file.

The basic file maintenance routines in the IDRISI EXPLORER window are accessed by selecting one or more files, and then right clicking in the *Files* pane. A pop-up menu will appear (Figure 1.3.5.c). The menu has options for *Copy*, *Move*, *Rename* and *Delete*. These functions work in the way you would expect.

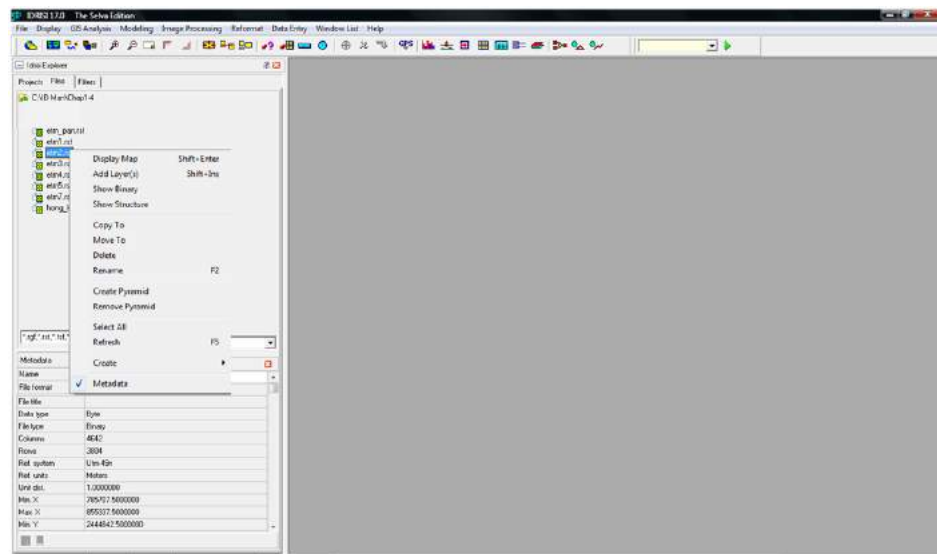


Figure 1.3.5.c The pop-up menu for basic file maintenance commands.

The IDRISI EXPLORER also provides shortcuts for displaying images and also the raw data that underlie an image. When a raster or vector file is selected in the IDRISI EXPLORER, right clicking and selecting the option for *Display Map* will display the image using default options. We will learn about the program DISPLAY LAUNCHER, which allows greater control over how an image is displayed in Chapter 2.

The IDRISI EXPLORER pop-up menu for the *Files* pane also offers options to view the underlying data from in a file. A file may be viewed in its byte-by-byte binary and/or ASCII representation by choosing the *Show Binary* menu option. This is useful for viewing binary raster images to determine their file structure for importing into IDRISI. (Binary is a dense type of coding typically used for images or other large, structured data sets.) Images can also be shown as a grid of pixel values through the *Show Structure* pop-up menu option. The topic of how an image is constructed from a grid of numbers is explored further in the introduction to Chapter 2.

### 1.3.6 Working with Metadata Using the IDRISI EXPLORER

Note that the last option on the pop-up menu in the *Files* pane of the IDRISI EXPLORER is *Metadata*. You can control whether the *Metadata* pane is displayed by checking or unchecking the *Metadata* option in the pop-up menu.

To investigate further this concept of Metadata, click on the **etm\_pan.rst** file in the *Files* pane of the IDRISI EXPLORER. Scroll through the metadata values for that file in the *Metadata* pane below. Note that in the Metadata window, each row has two cells. The left cell is a category, for example *Name*. The right cell is the attribute. In order to change the attribute, you simply click in the cell, and type the new value. Be warned, though: if the new values you enter are inappropriate, you can make it impossible to display the file.

Observe the type of data about the image that is recorded in the metadata file: the data type (which determines the potential range of the values stored), number of columns and rows, pixel size, map information, file lineage as well as user-supplied titles, legends and notes. Notice that no title has been specified for the **etm\_pan** file. In the next exercise, we will add the image title information to the metadata, so that when the image is displayed we will have the option of automatically also displaying a title.



## Modifying image metadata with IDRISI EXPLORER

Menu Location: **File - IDRISI EXPLORER**

1. If the *IDRISI EXPLORER* window is not already open, open it again.
2. In the IDRISI EXPLORER, click on the tab for *Files*.
3. If the files are not listed in the *Files* pane, double click on the directory name to display the files.
4. In the *Files* pane, select ***etm\_pan.rst***.
5. If the *Metadata* pane is not displayed, right click in the *Files* pane, and select the option for *Metadata*.
6. In the *Metadata* pane, click in the text cell to the right of *File title*, and enter **Hong Kong Landsat Panchromatic Band** (Figure 1.3.6.a).
7. Click on the *Save* icon at the bottom left side of the *Metadata* pane (Figure 1.3.6.a). (Note: the *Save* icon is grayed out most of the time, and is only shown in color when the metadata has been changed, and therefore can be saved.)

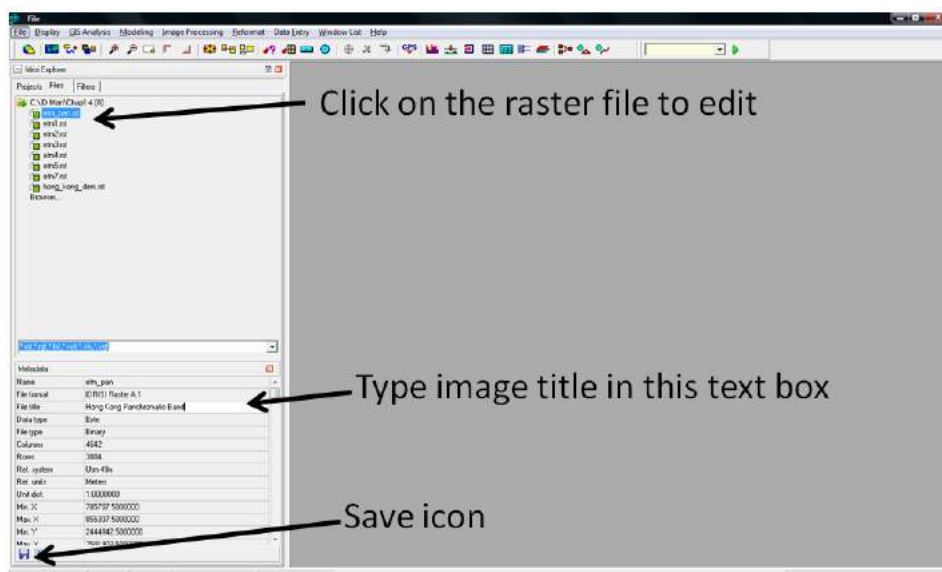


Figure 1.3.6.a Modifying the metadata of an image.

### 1.3.7 Working with Collections in the IDRISI EXPLORER

A useful management tool in IDRISI is the concept of collections. A layer collection is a group of layers that are associated with each other, for example the different image bands that together make up a single satellite image. Collections are used to facilitate the input of filenames to dialog boxes. They may also be required as input for particular analytical modules. Finally, raster files that are grouped into a collection and linked when displayed can be viewed in a systematic way, such as through linked zooming and panning.

In this part of the exercise, we will use the IDRISI EXPLORER to create a raster group file with the Hong Kong Landsat data, as a preparatory step for displaying two bands as linked displays in Chapter 2. IDRISI also offers a dedicated program for dealing with collections, available through the menu: *File – Collection Editor*. However, generally, the IDRISI EXPLORER provides a more powerful interface for working with collections.



## Creating a file collection with the IDRISI EXPLORER

### Menu Location: File – IDRISI EXPLORER

1. If the *IDRISI EXPLORER* window is not already open, open it again.
2. Click on the tab for *Files*.
3. Highlight the files ***etm1.rst*** through ***etm7.rst*** (note that there is no ***etm6.rst*** in this data set. The Landsat band 6 is a thermal band, and we will work with that band later, in Chapter 5). You can select multiple bands either by clicking on each file sequentially, while simultaneously pressing the *Ctrl* key. Alternatively, you can click on ***etm1.rst***, then, while simultaneously pressing the Shift key, click on the ***etm7.rst*** file. This will highlight the beginning and end files, as well as all those in between. (Figure 1.3.7.a).
4. Right click in the *Files* pane. Select the menu option for *Create – Raster Group* (Figure 1.3.7.a).

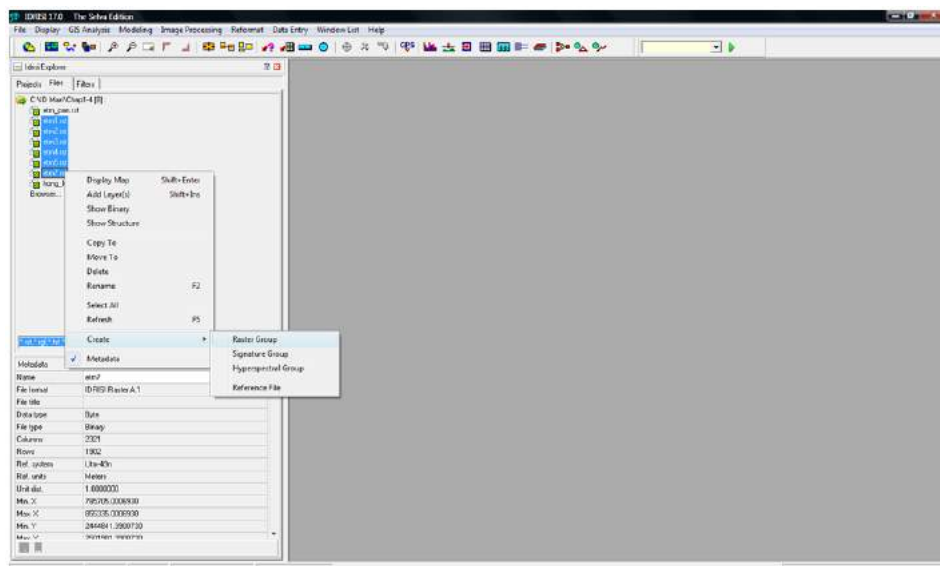


Figure 1.3.7.a The pop-up menu for creating a *raster group file*.

### Creating a file collection with the IDRISI EXPLORER (cont.)

5. A new file, ***Raster Group.rgf***, will be listed in the *Files* pane. Click on this file.
6. In the *Metadata* pane, enter a new name in the right hand cell of the first row, typing over the default name of *Raster Group*. Since this is an entire collection of satellite image bands, we will enter ***hk\_etm\_all*** (Figure 1.3.7.b).
7. Press Enter on your computer keyboard.
8. Click on the *Save* icon, at the bottom left hand corner of the *Metadata* pane. The name will immediately be updated in the *Files* window.



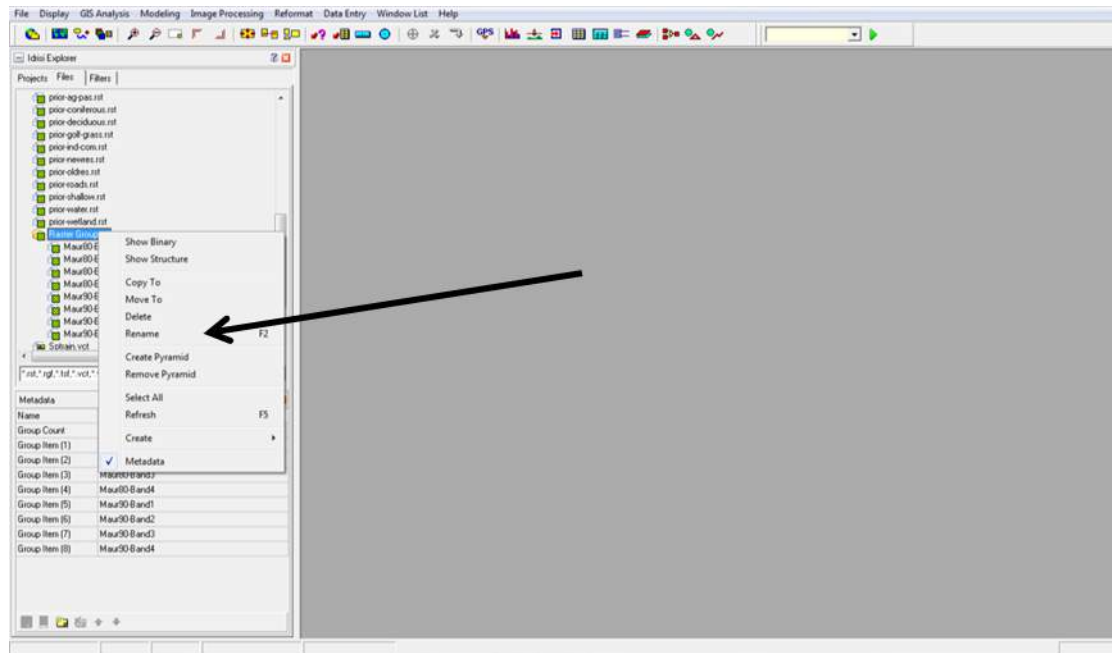


Figure 1.3.7.b Entering a new name for the *raster group file*.

The *Metadata* pane has additional powerful built-in functionality to add, delete, and reorder the individual layers in the collection. This can be observed by highlighting the **hk\_etm\_all.rgf** raster group file in the *Files* pane, and noting how the *Metadata* pane lists the file names associated with this collection. Now click on the *Metadata* cell for *etm2*, and then right click. A pop-up menu will list options such as *Remove*, *Move up* and *Move down* (Figure 1.3.7.c). The latter two options change the order of the layers within the collection. This can be important if the order of the layers in a group file have an associated meaning.

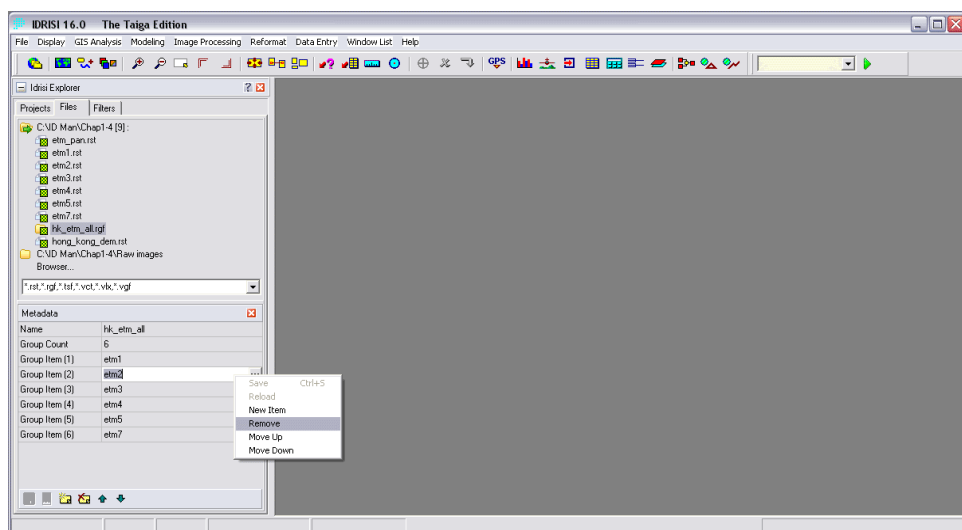
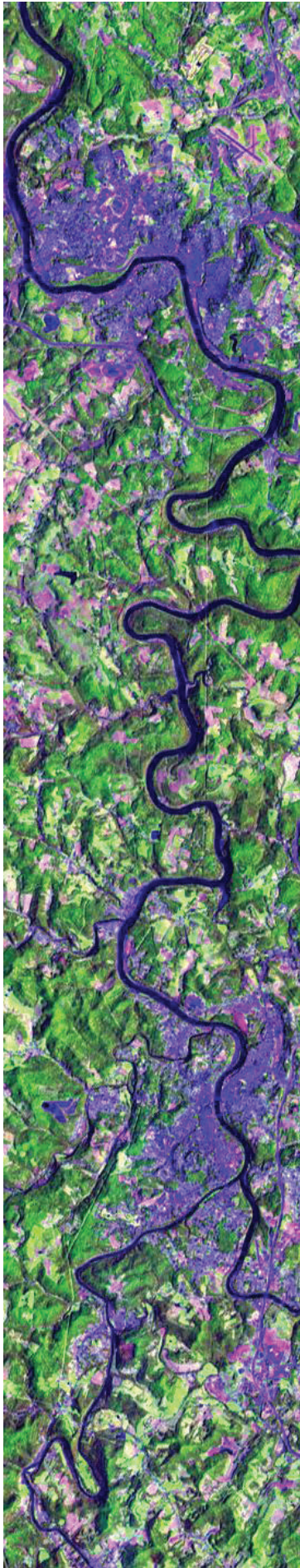


Figure 1.3.7.c Manipulating individual files in a raster group file.





# Remote Sensing with IDRISI®

## A Beginner's Guide

Timothy A. Warner

David J. Campagna

### Overview

This book provides a comprehensive introduction to the IDRISI® Taiga remote sensing software package. With clear instructions and more than 260 color illustrations, the text is ideal for students and professionals seeking a hands-on and guided exploration of the fundamental issues in remote sensing and image processing.

### Outline

- Introduction
- Displaying remotely sensed data
- Importing, georeferencing, mosaicking, and exporting images
- Enhancing images spatially
- Image ratios
- Other spectral enhancement techniques
- Introduction to classifying multispectral images
- Advanced classification issues
- Image change analysis

**Includes a CD ROM** with satellite imagery from Asia, North America, South America, and Africa.

### Illustrations

The cover shows a Landsat-7 false color composite of Landsat band ratios chosen to enhance minerals associated with economic deposits. The region shown is in the Atacama region of Chile. (Landsat bands 3/1, 5/4 and 5/7 as RGB.)

The image to the left is an Enhanced Thematic Mapper Plus satellite false color composite image of a region in the Appalachian Mountains of West Virginia, USA. (Landsat bands 5,4,3 as RGB.)

### Geocarto International Centre Ltd.

G.P.O. Box 4122, Hong Kong

Tel: (852) 2546-4262 Fax: (852) 2559-3419

E-mail: [geocarto@geocarto.com](mailto:geocarto@geocarto.com)

Website: <http://www.geocarto.com>

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