

Estierra Help

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Part



1 Index

Estierra is a program for modeling the terrain of the earth. It reads standard USGS Digital Elevation Model files (DEM's) and converts them into three-dimensional models of the earth's surface. These models can be colored, shaded, highlighted and overlaid with topographic maps or aerial photographs. This creates extremely realistic 3D images of the terrain. In addition, **Estierra** uses OpenGL technology that gives it the ability to do high-speed animations of the terrains. This means the terrains can be zoomed, panned and rotated in real-time. You can even fly over and through the terrain using a mouse.

Basics	DEM Files
Building Terrains	DEM File Errors
DEM Reader Page	Terrain Special Effects
Topo Editor Page	3D Options
3D Editor Page	Saving/Loading Data
Overlay Editor Page	Printing, Copying and Saving
	Environmental Options
	Geographic Coordinate Systems

1.1 Basics

Here is basic information about **Estierra** and an overview of how it works:

Requirements	Getting Started
Uses For Estierra	Overview
System Requirements	Getting Started
Hardware Requirements	Startup Problems
Terminology and Conventions	Test Objects

1.1.1 Uses For ExTierra

Estierra can be used in a variety of ways.

Better than Google Earth. While Google Earth can display terrain models overlaid with aerial photographs, the Google Earth Images are have relatively low resolutions which can miss subtle terrain features and details. **Estierra** allows you to control the terrain resolution and choosing high resolution aerial photographs allow you to see much more detail than Google Earth provides.

Recreation. Outdoor enthusiast such as hikers, mountain climbers, cave explorers, horse back riders, skiers and mountain bike riders can use **Estierra** to plan routes and to familiarize themselves with the terrain.

Earth Science. Geologist, hydrologists, and other earth scientist can use **Estierra** to analyze the origin and formation of various surface features. For example, **Estierra's** ability to view the terrain from any angle and create sun-shadows from any direction allows you see very subtle variations in the terrain. This makes it easy to see glacial remnants, river terraces, fault scarps, lava flows and other features that are virtually invisible on topographic maps and aerial photos. You can also create 3D geological maps that give a clear picture of how rock formations relate terrain features.

Engineering. **Estierra** can be used by civil engineers for planning roads, bridges, parks and

buildings. The ability to overlay various kinds of maps on the terrain allows you to take into consideration the locations of existing improvements and how they relate to hills, streams and other surface features.

Land Management. *Estierra* can be used by to locate wet lands, estuaries, and other environmentally sensitive features. It can also be used to locate flood planes, avalanche courses and other dangerous land features.

1.1.2 System Requirements

OpenGL. *Estierra* uses OpenGL to display the 3D surface terrain models. Therefore, your computer must have OpenGL installed. Most recently sold computer will have OpenGL installed. A generic version of OpenGL comes with Windows. More advanced versions come with video cards. Since most computers these days come with powerful video cards, most computer have the latest and most powerful versions of OpenGL.

Win 98. The program has been tested under Win98 and it does run. However, the program puts heavy demand on memory and you may encounter problems in some situations because Win98 has problems with memory bigger than 500-megabytes.

Win 2000, XP, Vista and Win7. Win 2000, XP, Vista and Win7 should run *Estierra* without any problems.

1.1.3 Hardware Requirements

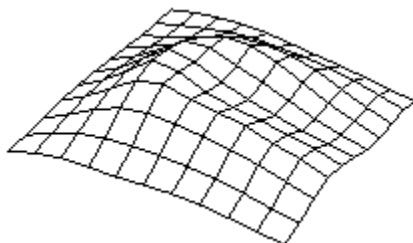
Estierra puts a heavy load on the computer when it draws images. For this reason, *Estierra* will work better with a powerful computer. You can get acceptable results with an old and slow 90 MHz Pentium with 64 Meg of memory and an ordinary video card. However, with large terrain models, the animation speed will be slow and the images will take a long time to load. For this reason, a faster computer is better. A 1-Ghz CPU with 250 megabytes of memory would be considered a minimum system for serious work. Modern multi-core processors with 1-gigabyte of memory or more is recommended

Video Cards. A fast video card can make a big difference in speed. For example, some of the newer accelerated video cards can run as much 50 times faster than an old, no accelerated card. Currently, the fastest video cards are made by NVidia and ATI.

1.1.4 Overview

DEM Files. *Estierra* works by reading Digital Elevation Model files (DEM) and converting them into three-dimensional models of the earth's surface. DEM files contain a grid of numbers that represent the elevations of points on the earth.

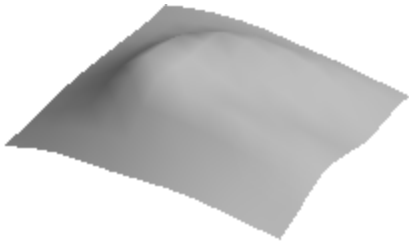
Meshes. *Estierra* takes the points from a DEM file and converts them into a series of rectangles called a "mesh." The mesh shows the shape of the land surface.



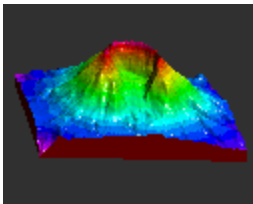
Shading and Highlighting. The face of each rectangle is then filled in with a solid color and shaded according to how the light would reflect off the surface. This gives the surface a three-dimensional appearance, with shadows conforming to direction the "sun." By moving the "sun" you can produce different patterns of shadow that can reveal hidden detail.



Smoothing. Finally, the mesh is smoothed to give it a more natural appearance. Once the mesh has been smoothed, it can be colored, highlighted and overlaid in a variety of ways.



Coloring. The surface of the mesh can be colored and highlighted in a variety of ways to make it easier to see terrain features. For example, the mesh can be colored by depth to make easier to see altitude-related information. You can also color by the steepness of the slope. This makes it easy to see slopes that are likely to avalanche or slide. It also allows you find watercourses and wet lands that might not be visible by other methods.



Overlays. The mesh can also be overlaid with any image, such as a topographic map, geological map or aerial photograph. The image is stretched, like a rubber sheet, to conform to the terrain. This gives it an extremely realistic representation of the topography.



Animations. The terrain image can be manipulated in real-time using the mouse and tool bar buttons. On fast a computer you can rotate, pan and zoom the image at a rate of hundreds of frames per second. You can even fly over and through the terrain using your mouse. Finally, you save your "flights" over the terrain as Windows movie files (AVI).

1.1.5 Getting Started

After *Estierra* is installed, there will be a *Estierra* icon on the Windows Desktop. You can run *Estierra* by double clicking on the icon.

Testing. If your are running the program for the first time, it is probably useful to test the program to make sure that your computer and your video drivers are working correctly. The easiest way to do this is bring up the Test Object and experiment with the features of the 3D Editor . This will make it easier to understand what is happening when you work with more complicated 3D objects.

Creating A Terrain Model. Once you have a basic familiarity with the way the program works, try loading a standard DEM File. DEM files are available for download from a number web sites. For complete information on getting DEM files, click here. To build a terrain from one of these DEM files, follow the instructions found here: Terrain Building.

1.1.6 Startup Problems

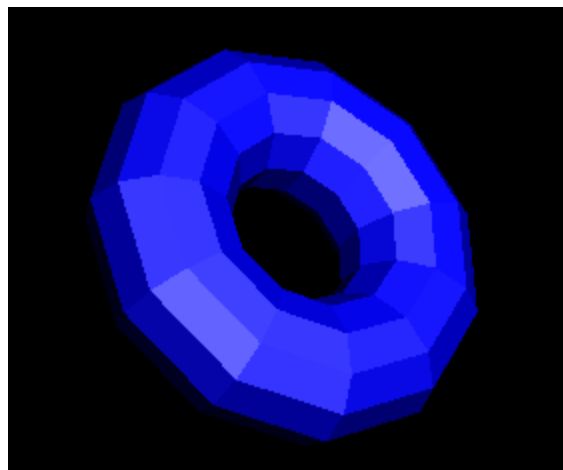
When you start *Estierra*, it initializes the OpenGL drivers in your system. If there are any problems with the initialization process, the program will display an error message, and in some cases abort. Here are detailed explanations of the causes of this problem:

Display Drivers. Every video card has special software that provides an interface between Windows and the card. These programs are called "drivers." Sometime these drivers have bugs in them that cause errors when *Estierra* tries to use OpenGL. In fact, it is fairly common that the driver for a newly release video cards will have bugs. These bugs often get fixed in later updates. For this reason, if you are experiencing an unexplained problem with *Estierra* or your video card in general, you may want to download the latest driver. They are usually available at the web page of the card manufacturer. Drivers for older video cards can be found at web pages that specialize in archiving old drivers.

1.1.7 Test Objects

Estierra allows you to create some simple 3D geometrical objects to experiment with. This makes it easy to test the program and verify that that your video card and drivers are working properly. To create test objects, select the "File|Test Objects" option from the menu bar. You then choose either the "Soccer Ball" or the "Torus."

Once the test object has been displayed, experimenting with the controls on the "3D Editor" will teach you how to maneuver in the 3D world.



1.2 Building Terrains

The main purpose of **Estierra** is build 3D terrain models from DEM files. In the simplest cases, it only takes three mouse clicks to create a terrain model.

You build terrains by opening a DEM file and then editing the data to get exactly the terrain you want and the image you want. You do this by moving through four editors which help you refine and enhance the data. Each Editor is reached selecting the proper tab at the top of the screen.



Here is detailed description of each page and each step:

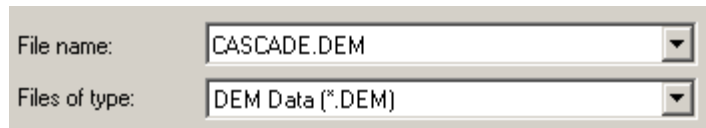
Loading A File.
The DEM Reader Page
Topo Editor Page
3D Editor Page
Overlay Editor

1.2.1 Loading A File

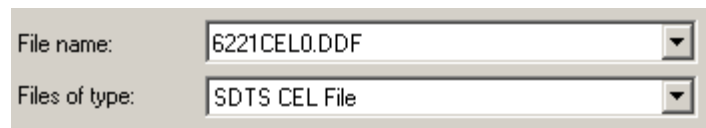
The first step in building a terrain is loading a DEM file. You do this by selecting the "File -> Open DEM File" option from the menu bar.

File Types. There are two types of DEM files, the old style DEM files which has the extension "DEM," and the new SDTS type which as the extension "DDF." You can choose either type by changing the "File Type" in the Open Dialog.

To find and load the old-style DEM files, set the "Files of Type" option to DEM data as shown to the right.



To find and load the new SDTS DEM files, set the "Files of Type" option to STDS CEL file as shown to the right.

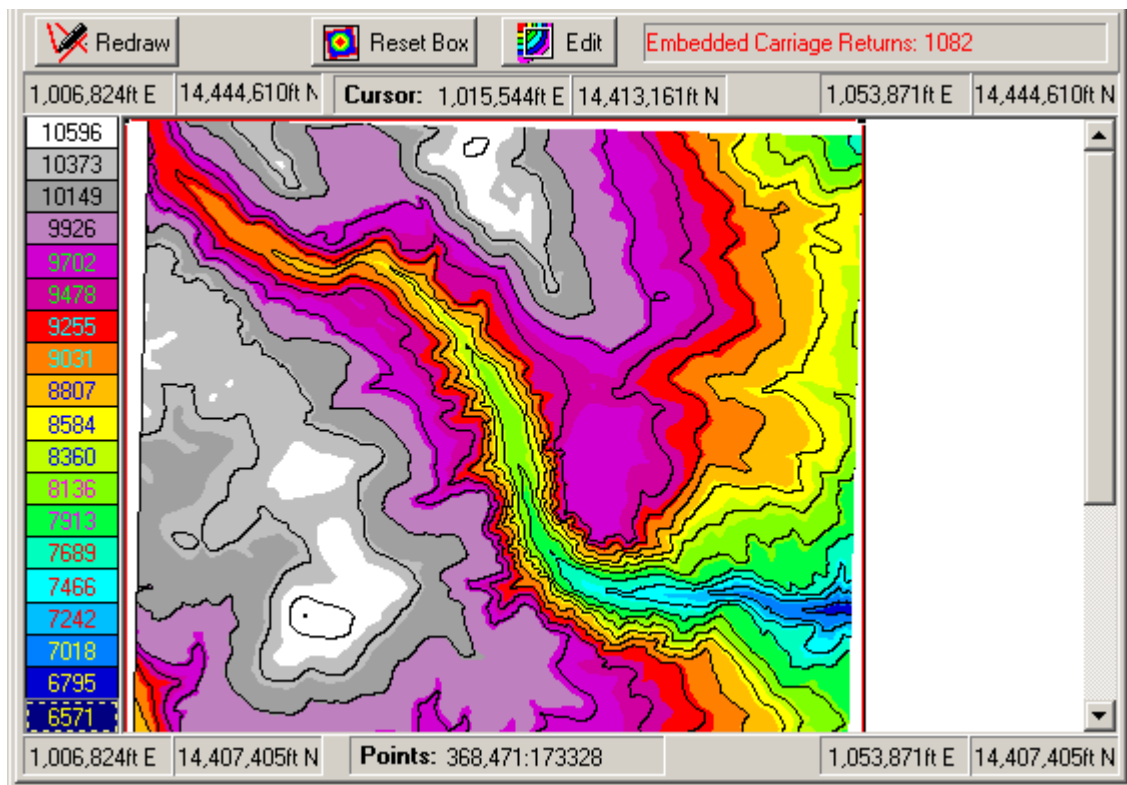


After the file loads, you will be taken to the DEM Reader Page, where the data will be displayed in preparation for editing and converting into three-dimensional terrain models.

1.2.2 DEM Reader Overview

The DEM Reader Page allows you view and select elevation data before you convert it to a 3D object. Here is detailed information about working with the DEM Reader:

The DEM Reader Page DEM Display Modes
DEM Tool Bar DEM Header Info



1.2.2.1 The DEM Reader Page

The first page in *Estierra* is the DEM Reader page. This page is displayed by selecting the tab labeled "DEM Reader" at the top of the *Estierra* window. The DEM Reader page displays an overview of the DEM data once it has been read into *Estierra*.

Reading DEMs. The first step in the process of generating a terrain model is to read the DEM file into *Estierra*. To read a file, just select "File|Open DEM File" from the menu bar. After you have selected a file, you will be presented with a window that allows you to select the Display Mode you want. You can also view a report about the contents of the DEM File.

Displaying DEM Data.

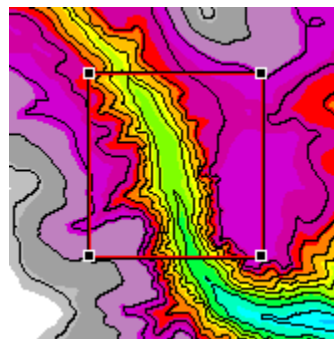
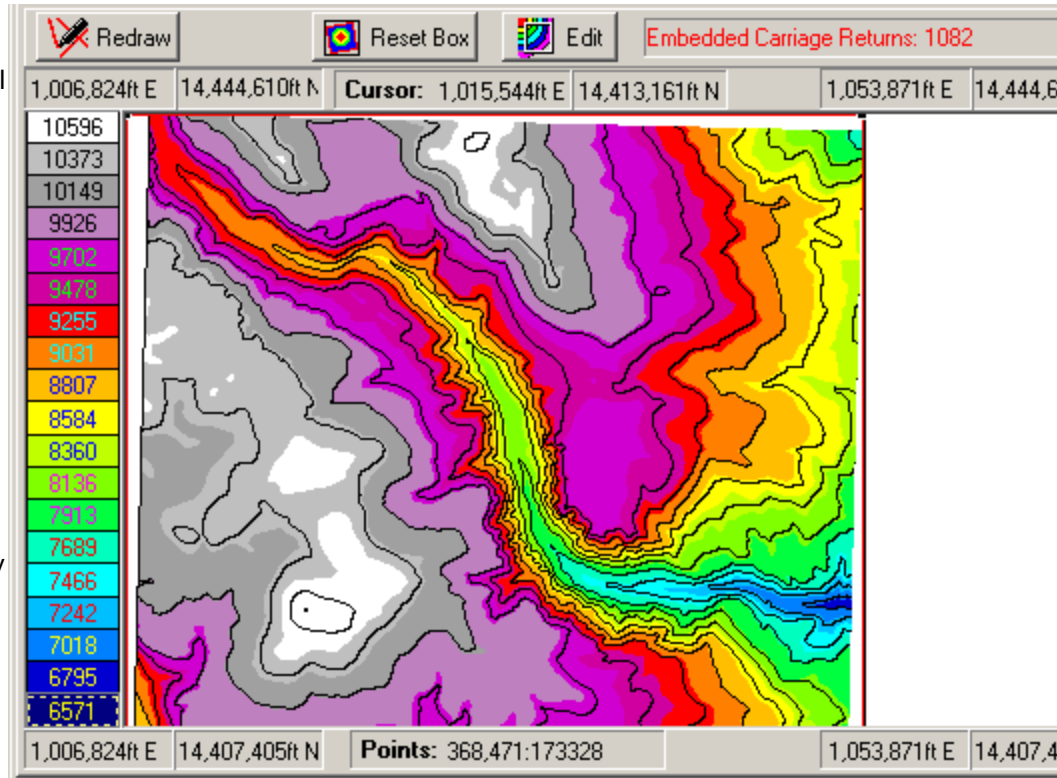
These files are very large, (they can contain as many as 1.5 million points) and as a result, depending on the speed of your computer, it can take 15 to 30 seconds to display the file. As the file is read, you will see the screen being painted one stripe at a time. You will also see a bar displaying the progress of reading the file.

Examining The Data. After the terrain has been displayed, you can examine the terrain in detail. There are several tools to help you. First, the scroll bars at the bottom and side of the image allow you to scroll parts of the image into view. As you scroll the coordinates of the corners of the map are displayed at the corners of the image. Also, the coordinates of the mouse cursor are displayed at the bottom of the screen. Coordinates will be displayed in longitude and latitude for one-degree maps and UTM for the 7.5-minute maps.

Manipulating The Data. You can manipulate and select the data displayed using tools on the DEM Tool Bar.

Selecting Terrain. DEM files contain a large number of points and it is often useful to select a subsection of data for rendering in 3D. As a result, *Estierra* allows you to use part or all of the DEM data for conversion to a 3D model.

Selection Box. Estierra uses a "Selection Box" to choose part or all of the DEM data for 3D rendering. When you first load the DEM data, all the data will be enclosed a box that appears around the border of the data. You can move the box by clicking in the middle of the box and dragging the mouse cursor. This will move the box. Dragging the corners will expand or contract the box. You can reset the box so it encloses all the data by clicking on the "Reset Button" that appears on the DEM Tool Bar.



Further Refinement. Once you are satisfied with the area you have selected, press the "Edit" button. The program will then switch to the Topo Editor page for further refinement of your data choice.

1.2.2.2 DEM Tool Bar

The DEM Tool bar contains several buttons that control the display on the DEM Reader Page. Here is a detailed description of each button

:



Redraw Button. The Redraw Button causes the program to re-read the DEM and re-display the DEM map. This allows you to make changes to the display mode and view the changes.

Reset Box Button. Pressing this button sets the selection box so it encloses all of the DEM data displayed on the DEM Reader Page.

Edit Button. Pressing this button copies the currently selected terrain to the Topo Editor where you can do very precise editing of the terrain.

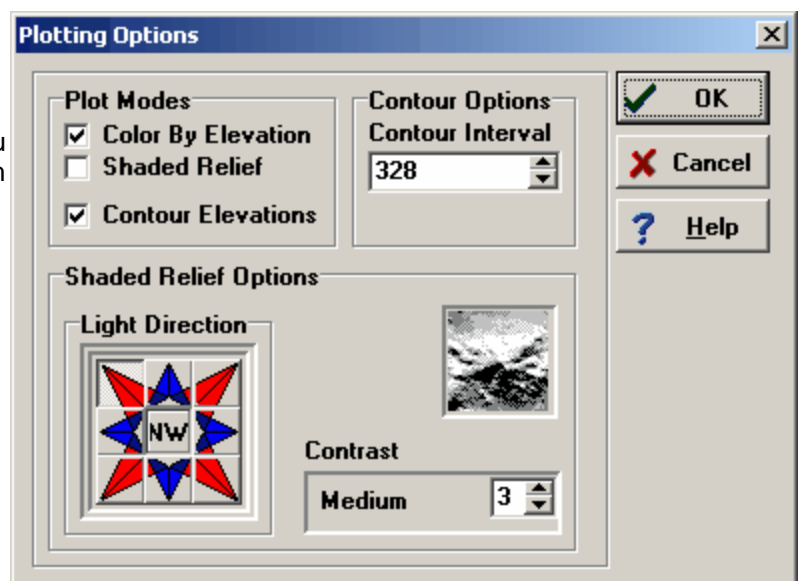
Terrain Status. This item displays any error that may have been detected while reading the DEM file.

1.2.2.3 DEM Display Modes

The program can display the DEM file data using three basic modes. When you open a new file, the program presents a dialog box that allows you to set the display options. If you already have a file open, you can change the display mode by selecting "DEM|Plot Options" from the menu bar. Once you have changed the display options, press the Redraw Button on the DEM Tool Bar to view the changes.

1. Color By Elevation. In this mode, the program colors each part of the map a different color depending on the elevation. The bottoms of valleys are colored blues, and purples, the tops of peaks are colored red, gray and white. There are a total of 15 colors used. If you select the "Dithering", option the program will use mix adjacent colors giving a total of 29 colors. This increases the resolution of small terrain details, but the edges of lines can be fuzzy.

2. Shaded Relief. In this mode, the program displays the terrain as if it were illuminated by the sun. The light, dark and gray areas show the rise and fall of the terrain. The images look very much like aerial photographs. This is the most detailed method of viewing the terrain, although some feature will be invisible if the sun is coming from the wrong angle. Also, in very flat terrain, there may not be



enough relief to get a clear image.

3. Topographic Contours. This mode connects lines of equal elevation in the same way as a normal topographic map. You have control over the contour interval. This is fastest mode for generating a map.

To compensate for variation in the terrain and the configuration of terrain features, the program allows you to set the contrast and sun angle. The contrast setting controls how sensitive the program is to small variations in the terrain. If the contrast value is high, the small variations in terrain will cause large changes between black and white. If the contrast is low, large changes are required to produce black or white areas. High contrast is most useful in flat areas, low contrast in rugged, steep terrain.

The sun angle controls the direction from which the simulated sun illuminates the ground. This is useful for visualizing features that are oriented in a certain direction. For example, if there is a cliff running east and west and the sun comes from the east, the cliff will be invisible. Normally, you want the sun angle to be at right angles to the feature. Also, be careful of southern sun angle. In spite of the fact that in nature, the sun usually comes from the south, setting the sun angle to south creates unusual effects. This is because the eye is used to seeing things illuminated from above. If the sun angle is from the south, the terrain may seem to reverse itself, with the mountains going down and the valleys going up.

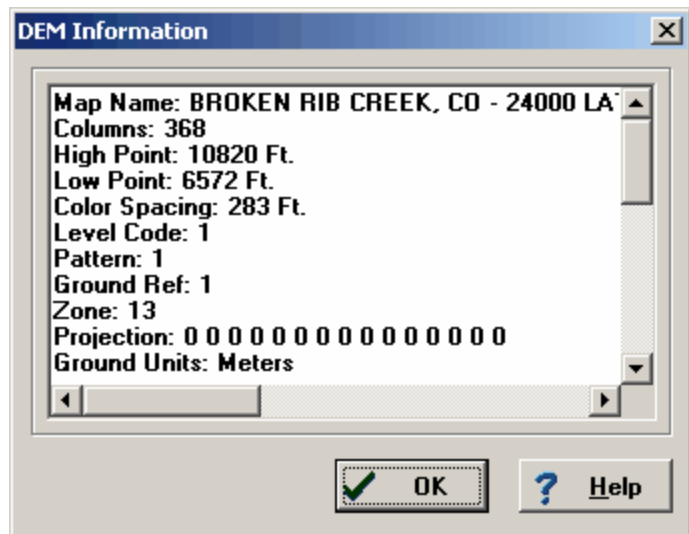
You can combine some of the modes to get more details. For example, you can combine color-by-elevation and contours. (This is the default mode.) At this time, you cannot combine color and shaded relief. Also, you can change these options on the fly while the image is being drawn. The map will have vertical strips with different attributes so you can compare the effect.

1.2.2.4 DEM Header Info

Each DEM file contains a header, which holds detailed information about the file. You can view this information by selecting "DEM|DEM Info" option from the menu bar. Here is an explanation of each of the header items:

Map Name. This item gives a description of the file. It usually contains the name of the quadrangle and some information about its location. If the file has been converted from another format, there may be notes on the conversion here.

Level Code. This information describes the quality of the data in the DEM file. Level 1 represents raw data where only gross blunders have been removed. Level 2 represents data where random errors have been removed and the data has been smoothed for consistency. Level 3 represents data that has been edited to insure positional accuracy relative to the points.



Pattern. This item specifies the pattern of the data. Code 1 represents regular data, Code 2 represents random data.

Ground Ref. This item describes which coordinate system is used to locate the points. Code 0 represents Longitude/Latitude coordinates. Code 1 represents UTM coordinates. Code 2 represents

State Plane coordinates.

Zone. If the Ground Reference is UTM, this item holds the UTM Zone.

Projection. This item gives UTM projection parameters. Refer to USGS Circular 895-B for further information.

Ground Units. This item represents the units for measurements in the file. Code 0 indicates radians, Code 1 indicates feet, Code 2 indicates meters, and Code 3 represents arc-seconds.

Elevation Units. This item indicates the measurement units used to represent the elevation of the points. Code 1 indicates feet and Code 2 indicates meters.

Poly Sides. This item indicates the number of sides of map. The number is usually four.

Corners. These items give the locations of the each of the corners of the map.

Min,Max Elevation. These items give the value of the highest and lowest point on the map.

Angle. This item shows how the map is rotated relative to geographic coordinates. Normally, this value is zero.

Accuracy. This item specifies the accuracy of the map. A value of 0 indicates that the accuracy is unknown. A value of 1 indicates that accuracy is specified at the end of the file. Refer to USGS Circular 895-B for further information.

Resolution. The three values in this item specify the resolution for the X, Y, and Z portions of the map respectively. For one-degree maps, this value is usually 3 arc-seconds. For 7.5-minute maps, the value is usually 30 meters.

Rows,Cols. This number specifies the number of rows and columns in the map. Normally, the row's value is set to one, so it is only the columns-value has meaning.

1.2.3 Topo Editor Overview

The Topo Editor allows you to make further refinements on the elevation data you have selected to be converted into a 3D image. Here is detailed information about the Topo Editor:

Overview	Manual Data Entry
Topo Editor Page	Edit Grid
Conversion Settings	Entry Grid Controls
	Entering Data
Tools	Saving and Loading Data
Data Filter	
	Synthesizing Data
	Generating Data From A Topo Map
	Importing Data
	Elevation File Format

1.2.3.1 Topo Editor Page

The Topo Editor allows you to trim and refine your choice of terrain to model. To display the editor simply select the "Topo Editor" tab at the top of the *Estierra* window.

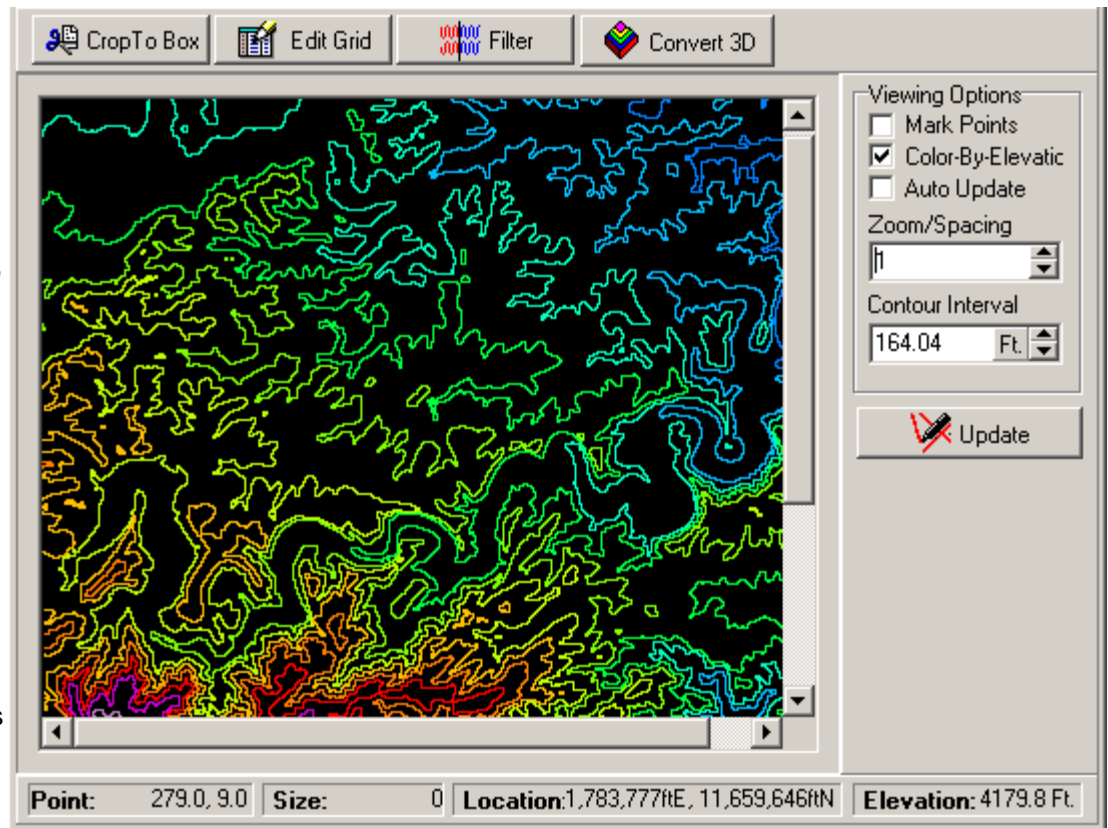
Topo Display.

The Topo Editor displays the terrain as topographic contours, but unlike the DEM Reader Page, it has the ability to infinitely zoom and draw contour lines between elevation points. This allows you to more accurately trim and refine you the terrain you select.

Display Options.

The Topo Editor gives you control over several aspects of the display. Here is a detailed description of each option:

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3. Auto Update. When this option is enabled, the program automatically updates the display every time you make a change. If the computer is slow or you have lots of contour lines, the display may take several seconds to update. Turning off the option may speed up making changes to the display. With this option off, you can update the screen by pressing the "Update" button described below.

4. Zoom/Spacing. Increasing the zoom factor magnifies the display by increasing the spacing between points. The Zoom factor is specified as the number of screen pixels between elevation points. The larger the number the more spacing between points. For example, if the zoom factor is set to 10, there are 10 pixels between elevation points.

5. Contour Interval. This option controls spacing between contour intervals. For example, if the interval is set to 200 feet, contour lines will be drawn at even elevation intervals of 200 feet. Decreasing the spacing increases the number of lines and increases the detail that can be seen.

6. Update Button. Pressing the Update Button causes the program to redraw the contour lines in the displays. If you have the Automatic Update mode turned off, pressing the button will allow you to see the effects of any changes you have made.

Status Bar. The Status Bar at the bottom of the Topo Editor pages displays status information about the display. Here are detailed descriptions of each status item:

1. Point. This item displays which grid points the mouse cursor is over. Since the mouse can be between points, the item displays fractions. For example, if the display was 12.5, 12.5, the cursor would be halfway between the 12th and 13th X and Y points.

2. Size. This item displays the total number of points contained within the display.

3. Location. This item displays the geographic location of the cursor. If the DEM file is a one-degree file, the location will be displayed in longitude and latitude. If the DEM file is a 7.5-degree file, the location will be displayed in UTM. Note: some DEM's have inaccurate longitude/latitude or UTM data associated with them. Thus, you should not rely too heavily on this information. (The units displayed can be set to either meters or feet in the Environmental Settings dialog.)

4. Elevation. This item displays the elevation of the cursor. (The units displayed can be set to either meters or feet in the Environmental Settings dialog.)

Tool Bar. The Tool Bar at the top of the Topo Editor contains several buttons that perform specific actions on the data represented by the display. Here are detailed descriptions of each button:

1. Clip To Box. If you find that the area you have selected is larger than you wanted, you can trim data to fit your needs. To trim the data, you need set the clip box to include the part of the terrain you want. To set the upper left-hand corner of the clip box, select the "Top-Left Box" cursor option. Next, move the mouse cursor to the upper left corner of the area you want to trim and click. Follow the same procedure with the lower right corner, selecting the "Lower-Right Box" cursor option. When you are satisfied that you have enclosed the area you want, click on the "Clip To Box" button. This will trim the data to the box. (Note: to select a larger area or reset to the original area, you have to go back to DEM Reader Page and reselect the base area.)

2. Edit Grid. Pressing this button takes you to the Edit Grid. The Edit Grid allows you to manually edit or enter elevation data. It is useful if you do not have a DEM file for the area you are working with. It also allows you to manually remove defects from the data.

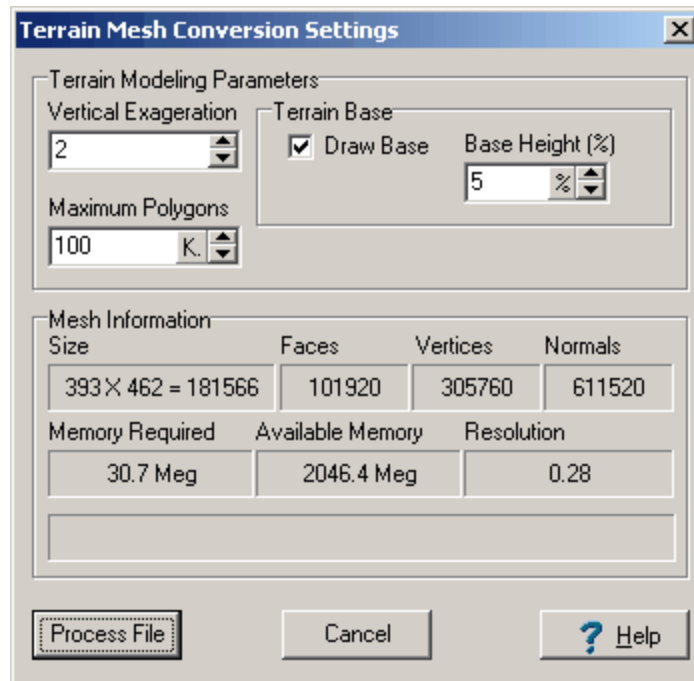
3. Filter. Pressing this button takes you the Data Filter tool. The Data Filter allows you to remove defects from the data such seams and noise.

4. Convert 3D. Once you are satisfied with the data you have selected, you can convert it to a 3D model. You do this by pressing the Convert 3D button. This will take you to the Terrain Mesh Conversion Settings dialog and finally to the 3D Editor page.

1.2.3.2 Terrain Mesh Conversion Settings

When you press the Convert 3D Button on the Topo Editor page, the program will begin the process of converting the selected data to a terrain model. Before the program does the actual conversion, it will display the Terrain Conversion Settings window. This window allows you to set options that control the way the terrain will be converted. Here is a detailed description of each option:

Vertical Exaggeration. This option can be used to increase or decrease the vertical aspect of the terrain. For example, if the Vertical Exaggeration is set to two, the elevation of each point will be twice as high as the actual elevation. This makes it easier to see small changes in the terrain. It is particularly useful when dealing with relatively flat terrain. Also, since people are relatively small compared to terrain features, terrains may seem flat when viewed on a computer. As a result, increasing the exaggeration can make the terrain models seem more realistic



Maximum Polygons. Most graphics cards and drivers have a limit to the number of polygons that can be displayed. This limit is typically around 64,000, although on some computers it can be less than 32,000. For this reason, *Estierra* allows you to set a limit to the number of polygons used to display the terrain. If the terrain you have selected contains more points than the limit, the program will reduce the mesh size by a process called “resampling”. The more the program has to reduce the points, the lower the resolution of terrain model and more fine detail that will be lost. The Resolution display item described below shows the amount of resolution that will remain after reducing the mesh size.

Terrain Base Options. Each terrain model has a square “base” that it sits on. This makes it easier to orient and manipulate the terrain model. You can remove the base by disabling the “Draw Base” option. You can also control the height of the base adjusting the “Base Height” option. The height is specified in terms of percentage of the height of the terrain. For example if the Height is set to 10% and the terrain has an elevation range of 10,000 to 14,000 feet, the base will have a height of 1000 feet.

Polygon Shape. This option controls whether the polygons that form the mesh are rectangles or triangles. Triangles can create smoother surfaces, but require twice as much memory. For most purposes, rectangles are the best choice.

Size. The Size display shows the width and height of the mesh that will be created as well as the total number of points in the mesh. This is based on the area of terrain that you selected in the DEM Reader Page and the Topo Editor Page. The larger the area selected, the more points in the mesh.

Faces, Vertices and Normals. A Terrain Mesh consists of Faces, Vertices (points) and Normals. This item display a count of number of these components needed to construct the mesh. The larger the mesh the greater the numbers for each item. You can increase or decrease these numbers by adjusting the Maximum Polygons option described above.

Memory Required/Available. This option displays the amount of memory required by the terrain and the amount of memory available on the computer. Generally speaking, if the terrain size exceeds the available memory, the program will run very slowly or stop working all together.

Resolution. When the mesh size exceed the Maximum Polygons option described above, the program reduces the number of polygons in the mesh. This reduces the resolution and some fine details in the terrain will be lost. This item displays the percentage of resolution. A 50% resolution would indicate that half of the original resolution has been lost. One option if you need high resolution, is to select a smaller area to work with.

Process File Button. When you press this button, the program will begin processing the mesh according to the parameter you have specified. Depending on the speed of your computer, this may take up to 30 seconds. Once the mesh has been processed, the program will switch to the 3D Editor Page and will display the terrain model.

1.2.3.3 Data Filter

DEM files can have various kinds of anomalies in them. These are usually caused by errors in data generating process. For example, there can be seams in the data where two pieces of surface terrain have been merged together. Also, you can have periodic data, such as sine waves, superimposed on the terrain giving it a corrugated appearance. The Data Filter options allow you to remove some of the artifacts.

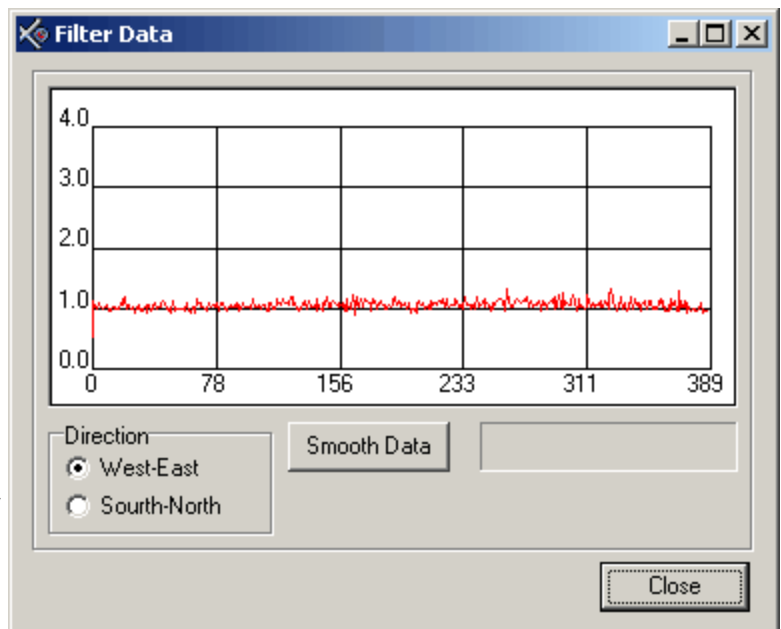
To access the Filter Options, press the Filter Button on the Topo Editor page. This will display the Filter Window. Here is a complete description of the filter tools:

Direction. One of the characteristics of data anomalies is that they usually occur along one axis. For example, a seam will usually occur along a single row or column in the data. As a result, you have a choice of analyzing and filtering the data in the east-west or north-south directions.

The Graph. The Graph allows you to visualize anomalies in the data. The graph always display anomalies along the axis specified by the Direction option described above.

The program looks for defects in the data by looking for patterns. For example, it would be very unusual for all the elevations to jump up on the same row of data. This would probably indicate a seam in the data. As a result, *Estierra* looks for any changes that occur across all the rows or all the columns at the same. It then graphs the result. Anomalies show up in the graph as sudden shift in the line of the graph.

Smooth Data Button. Pressing this button causes the program to smooth the data in the specified direction. Depending on the severity of the anomalies, it may require several passes before the anomalies will be removed.

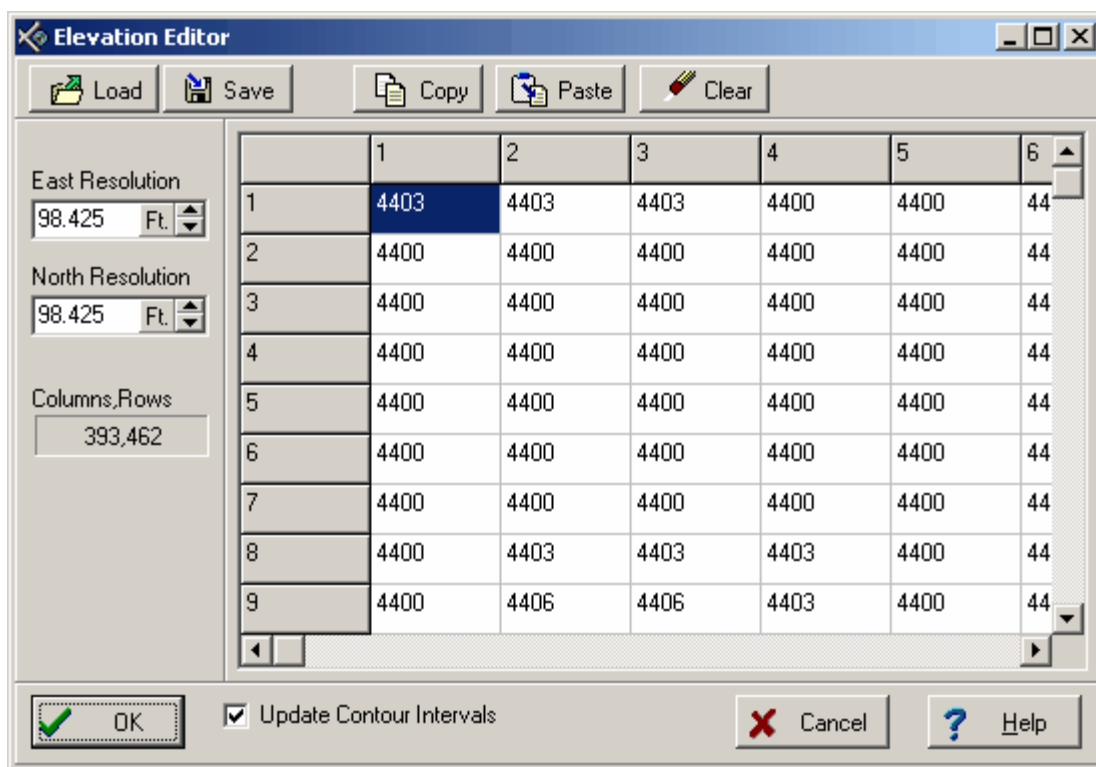


1.2.3.4 Edit Grid

The Edit Grid allows you edit or enter elevation data. For example, if you are unable to locate a DEM file for a particular area, you can manually enter data from a topographic map. You can also repair small defects in DEM files using the Edit Grid. To access the Edit Grid, go to the Topo Editor Page and press the Edit Grid button.

Here are detailed descriptions of how to use the Grid:

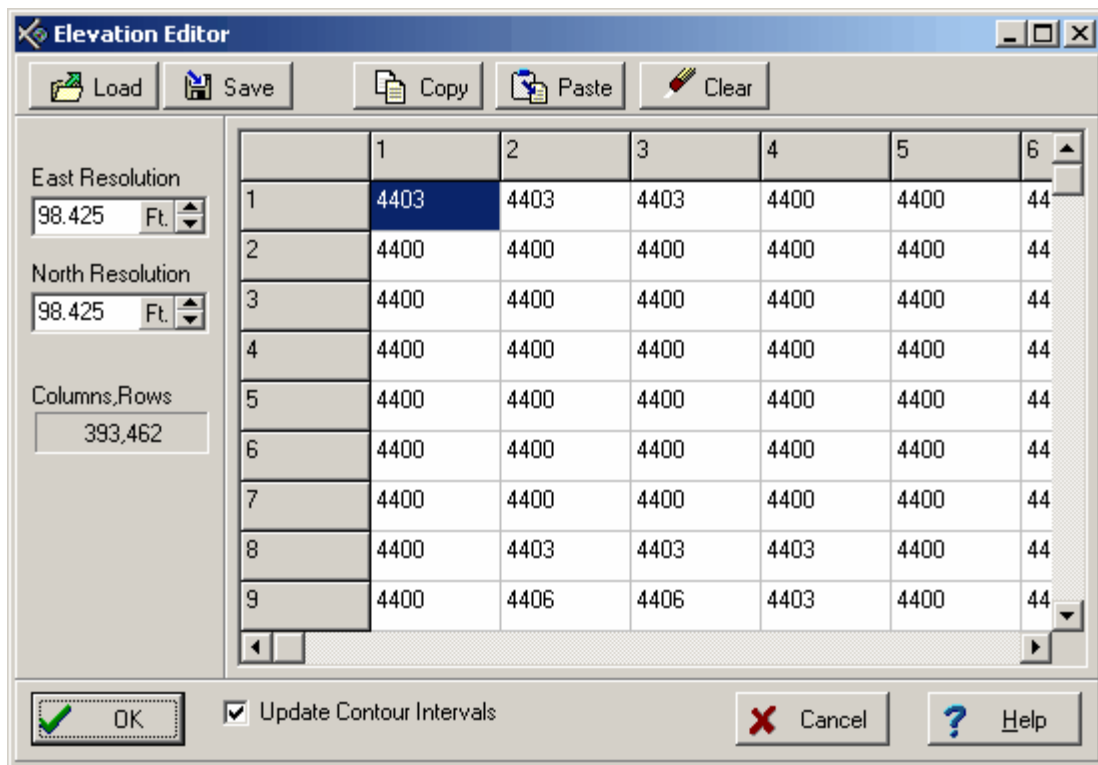
The Entry Grid
 Entry Grid Controls
 Loading/Saving Data
 Elevation Data Format
 Generating Data From A Topo Map
 Importing Other Data Formats



1.2.3.4.1 The Entry Grid

The Entry Grid. A DEM file consists of an array of points that correspond to the elevations of some area on the surface of the earth. The Entry Grid displays these points and allows you to enter or edit them. Cells in the upper left-hand corner of the grid correspond to the northwest corner of the terrain. Likewise, cells in the lower right corner of the grid correspond to the southeast corner of the terrain.

To enter points, you simply click on a particular cell and type a number. Hitting Enter or Tab will move you to the next cell to the right. When you are done entering or editing data, press the OK button at the bottom of the window and the new data will be used by the Topo Editor.



1.2.3.4.2 Entry Grid Controls

There are several controls that allow you to manipulate the Entry Grid. Here is a detailed description of each:

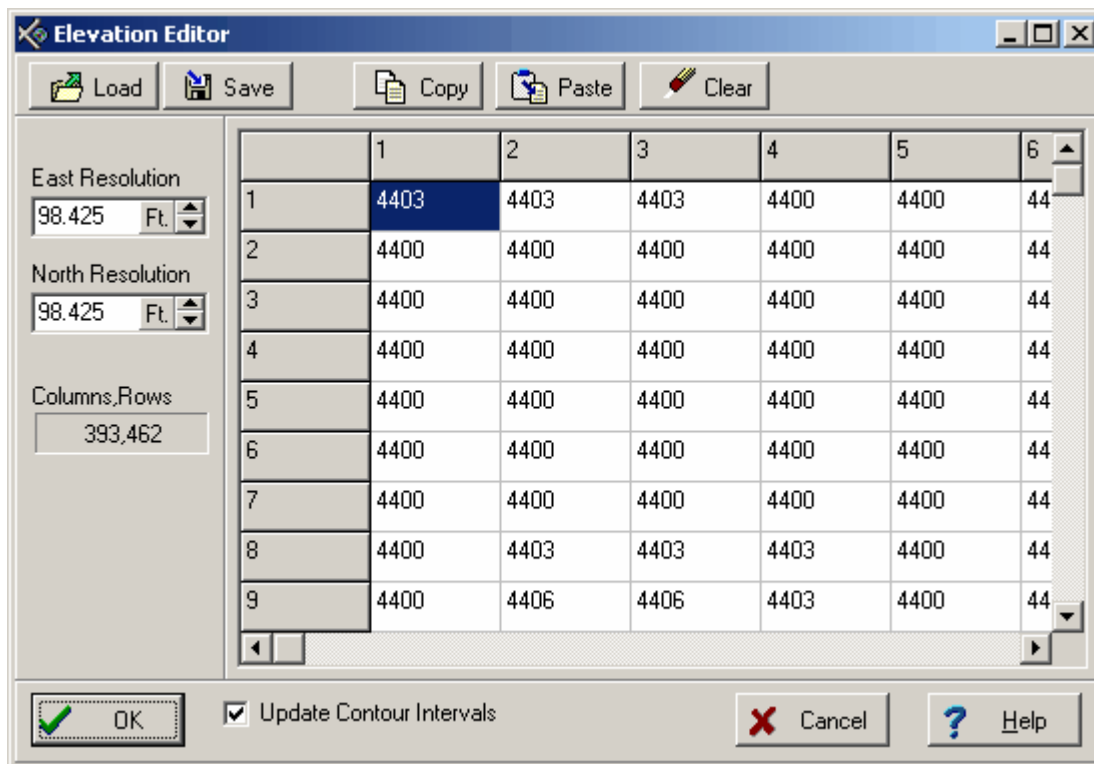
Copy and Paste Buttons. These buttons allow you exchange data with other programs via that Windows Clipboard. If you press the Copy Button, the program copies all the data in the Grid into the Windows Clipboard. The data in the Clipboard will be formatted so that it can be pasted directly into a spreadsheet such as Excel. (The data is formatted so each row is on a separate line ending with a Carriage Return and each data item separated with a Tab character.)

The Paste Button copies data from the Windows Clipboard into the Grid. The program expects each row to be terminated with Carriage Return character and each data item to be separated with any non-numeric characters such as a comma, space or tab.

Clear Button. The Clear Button deletes all data from the Grid and empties all cells.

East/North Resolution. Each point in an elevation grid is spaced a specific distance apart. For example, a typical 7.5-minute DEM file will have data points spaced every 90 feet (30 meters). *Estierra* uses this information to scale the terrain models it displays. Normally, *Estierra* will read this information from the DEM file, however if you are manually entering data, you will need to specify the spacing yourself. Since some DEM files have a different spacing in the East-West direction than in the North-South direction, there are two boxes, one for each direction. To set the resolution, simply enter the values in East and North Resolution Boxes. The units used are set by the Environmental Options.

Update Contour Intervals. When this option is enabled, the program automatically adjusts the contour interval when you return the Topo Editor. This is useful when you have made changes to the Grid data that effects the elevation range. On the other hand, you may want to disable this option if you have made changes to the contour interval that you want to preserve.



1.2.3.4.3 Saving and Loading Grid Data

Load and Save Buttons. These buttons allow you to save elevation data in a simplified format. This is useful for saving manually entered data or when you want to save a subsection of a full DEM file. To save the data in the Grid, simply press the Save button and select a filename. Likewise, to Load data, press the Load Button and then select a file.

(For programmers and sophisticated users, click here for the detailed information about the file format.)

1.2.3.4.3.1 Elevation File Format

Data Format. In some instances, it may be useful for a programmer to create his or her own elevation files or to read the elevation data into another program. For this reason, here is a complete description of the data format:

1. ASCII. All data is represented as simple ASCII text. Numbers can be in any format including floating point. Arguments are separated by any non-numeric characters such as commas, spaces or tabs. The default separator is a comma. The data is generally organized in to lines separated by a carriage return and line feed pair.

2. Meters. All measurement units are in meters.

3. Data Items. The main items of the file are presented on separate lines. Here is a complete description of each data item in the file:

A. Grid Rows and Columns. This item specifies the number of Row and Columns in the elevation data. It consists of two integer values.

B. Resolution. This item consists of two floating point numbers that represent the spacing, in meters between each point in the data. The first argument is the West-East spacing. The second argument is the North-South spacing.

C. Location. This item represents the UTM location of the northwest corner of the elevation grid. The individual arguments are two floating point numbers representing the East and North Offset, and an integer representing the UTM Zone.

4. Sample Data. Here is sample data for a typical elevation file:

3,3	- Columns and Rows
30,30	- Resolution
0,0,0	- Location – East, North, Zone
2902.9,2891.0,2879.1	- Row 1
2909.9,2899.9,2888.9	- Row 2
2915.1,2906.0,2897.1	- Row 3

1.2.3.4.4 Generating Data From A Topo Map

In some instances, you may not be able to find DEM files for a particular area. Since topographic maps are more readily available than DEM files, one way to deal with this problem is to manually generate the data by reading it from a topographic map. Although the process can be very tedious, it is a very viable method of creating terrains. Here is a set of step-by-step procedures for generating data from topo maps:

1. Select A Map. Locate a topo map of the area you are working. Normally, you will want to use high-resolution maps to such as 7.5-minute quadrangles to get sufficient detail.

2. Select A Grid Spacing. Grid spacing is the distance between points. The closer the spacing the greater the resolution. However, it also means more points, which will take more time to enter. Spacing of 100 to 500 feet is typical.

3. Layout A Grid. Using the scale bar on the topographic map and a ruler, lay out a grid of evenly-spaced points on the map covering the area you want to model. You can use a piece of mylar, tracing paper or other clear media so you don't mark up the map. Your grid should be aligned with the map's grid system so that the rows and columns run along west-east and north south lines. Although it is not essential, you may want to align one corner of the grid to a specific UTM location.

4. Read The Elevations. Using the topographic contour lines, write down the elevation of each point on grid. If a grid point falls between topographic lines, you can estimate the elevation. For example, if a point fall 3/4 of the way between the 100 and 200 foot contour, the elevation would be 175 feet.

5. Enter The Data. Once you have gathered the data points, you should enter them into the Edit Grid . As you enter the data, be sure to periodically save the data so you will not accidentally lose your work.

1.2.3.4.5 Importing Data

There are many different data format that are used for elevation model files. The DEM formats supported by **Estierra** are U.S. standards. Other standards are used outside the United States. Some of this data can be easily imported into **Estierra** using the Paste option in the Edit Grid.

If you can find a way to get the data into a spreadsheet such as Excel, the data can be copied from the spreadsheet and pasted into **Estierra**. Excel has import features that allow you convert various

common data formats and bring them into a spreadsheet. It is also possible to use a good text editor to reformat data so it can be pasted into *Estierra*.

1.2.4 3D Editor Overview

The 3D Editor displays and manipulates the 3D image of the terrain. Here is detailed information about using the 3D Editor:

Tools

Tool Bar Controls
Materials
Lights
The Status Bar

Movements

Mouse Movements
Flying Through an Image

Special Features

Creating Movies

1.2.4.1 Tool Bar Controls

There are 18 items on the 3D Editor tool bar. These items allow you to control and manipulate the 3D images.



1. Zoom In/Out Buttons. These two buttons make the image bigger or smaller. They work by scaling the objects view larger or smaller. This is different from moving the camera in and out, because the zoom buttons actually makes the object bigger. This can be very useful when you want to get close to an object without seeing inside it.

2. Pan Buttons. The Pan Buttons move the objects in the scene right, left, up and down. Each button has an arrow that identifies the direction the object will move.

4. Yaw and Pitch Buttons. These buttons rotate the image. The yaw buttons rotate the image around the vertical axis. Pitch button rotates the image toward and away from the person looking at the image.

5. Increment Control. This controls the percentage of change that happens when each button is pressed. Increasing the number causes larger changes. Decreasing the number causes smaller changes. For example, if the value is 10, each time you press the Zoom button, the image expands by 10%.

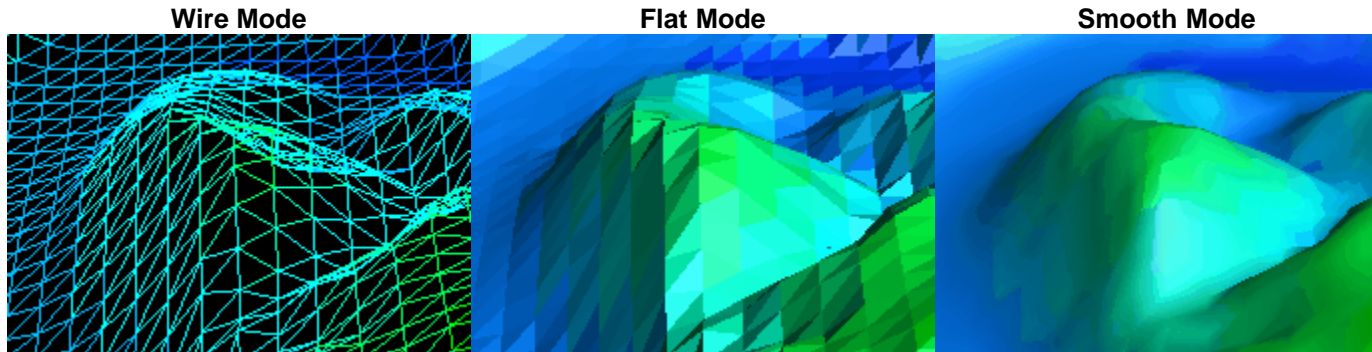
6. Animate and Stop Buttons. These two buttons allow you animate the image on the screen. If you click on the "Animation" button and drag the object with the left mouse button, the object will continue to rotate after you have released the mouse button. The rotation will continue until you press the "Stop" button or release the "Animation" button.

7. Reset Scale Button. This button resets the pans, zooms and rotates to their original values.

8. Start/Stop Capture Button. This starts or stops the AVI Movie capture option.

8. Shading. This option controls how the terrain surface is displayed. In Wire Mode, the terrain is displayed a wire skeleton of the surface. In Flat Mode, the terrain is displayed as a series of flat

facets. Finally in Smooth Mode, the terrain is displayed as smoothed surface.



1.2.4.2 3D Status Bar

The 3D Editor's status bar sits along the bottom of the page. It displays status information about the 3D image. Here is a detailed description of each status item:

Position:	1.0	0.2	8.1	Rotation:	-2.6	35.3	3.5	Tris:	103,734	TPS:	7,177,333	FPS:	69
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Position. This item displays the position of the terrain model on the screen in X, Y, and Z values. The X-value is the left and right position relative to the viewing screen. The Y-value is the up and down position relative to the screen and the Z-value is the position in and out of the screen.

Rotation. This item displays the rotation of the terrain model on the screen. The first value displays the Yaw rotation, which is rotation around the vertical axis. The second item displays the Pitch rotation, which is rotation around the horizontal axis. The third item displays the Roll rotation, which is rotation around the Z-axis or the axis running toward the user's eye.

Tris. This items displays the total number of triangles contained in the current scene.

TPS. This item displays the number of triangles being drawn each second. It is a measure of the speed of the computer and display. A good graphics card can hit display rates of well over 1,000,000 triangles per second.

FPS. This item displays the number of frames being displayed each second. It is a measure of the speed of the computer and display. The value will depend on number of triangles in the scene and the speed of the computer. A fast video card can display rates of over 100 frames per second even with a large number of triangles.

Display Speed. The speed of the display is effected by the speed of the computer, the speed of the video card and the properties of the object that is being displayed. For example, if the object has a large number of e polygons, the speed will decrease. Also, enabling special features such as texturing and shading can slow the frame rate with some video cards. Also, zooming into an object increases the frame rate because the program has to display fewer polygons. Finally, the frame rate can be effected by the video mode you are using. With some cards, displaying more colors and more resolution can slow the frame rate. However, the newest video cards are unaffected by colors and

resolution.

1.2.4.3 Creating Movies

Estierra has the ability to convert your terrain viewing sessions in to movies. In other words, **Estierra** can capture everything that happens on the 3D Page and save it as a Windows AVI file. AVI files can be played by the Windows Media Player and they can also be edited by the movie editing program such as “Windows Movie Maker”, which comes with Windows XP. Here the steps necessary for creating a movie:

1. Setting Options. There are several options that control the way a movie is captured and saved. To set them select “Options|Capture Options” item from the menu bar. The follow settings are available:

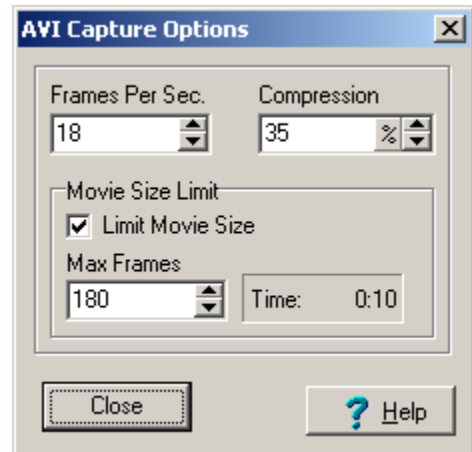
Frames Per Sec. This is the speed at which the finished AVI file will play back. The faster the speed, the smoother the animation. However, faster frame rates will make bigger files for the same elapsed time.

Compression. This option controls how compression is used to create the AVI files. More compression yields smaller files, but the image quality will decrease and the fine details in the images will be lost.

Limit Movie Size. Since movie files can consume hundreds of megabytes of disk space, this option allows you to limit your movie’s size.

Max Frames. This option sets the maximum number of frames for the program to capture. The program will automatically stop capturing when it reaches this limit if the “Limit Movie Size” option is enabled.

Time. This item displays the run time of the movie at the specified limit. Adjusting the “Frames Per Sec” and “Max Frames” option will change this value.



2. Arming Capture. The next step in creating is movie is to “Arm” the capture mechanism. This does not actually start the capture process, it simply get everything ready so the process can be initiated quickly. To Arm **Estierra**, select the “Edit|Arm AVI Capture” option from the menu bar. The program will then prompt you for the filename that will be used to save the image.

3. Begin Capturing. Once **Estierra** has been armed, the Start/Stop Capture button on the 3D Page Tool Bar will be activated. Pressing this button will start the capture process. You may notice that animation will slow down. This is because the program working extra hard both displaying and capturing the information. Pressing the button a second time will stop the animation program and save the information to the AVI file. If you are working in Windows you can double click on the file and the Windows Media Player should begin showing you the movie.

1.2.4.4 Mouse Movements

The easiest way to manipulate a 3D Model is using the mouse. Here are detailed descriptions of all the mouse movement options:

1. Left Mouse. Holding down the left mouse button and dragging allows you to rotate the object around two axes. Moving the cursor left or right rotates the 3D object around the vertical or Yaw axis. Moving the mouse cursor up and down rotates the object around X or Pitch axis.

2. Right Mouse. Holding down the right mouse button and dragging allows you to move the object left, right, up and down.

3. Middle Button or Left/Right Together. Finally, you can zoom in or out using the middle mouse button. If you don't have a middle button, you can get the same effect by holding down the left and right buttons simultaneously. Moving the cursor up the screen causes the program to zoom in on the object and makes the object appear bigger. Likewise, moving the cursor down causes the program to zoom out. To give the effect of flying through the scene, moving the mouse left and right while zooming, causes the scene to move in the opposite direction.

1.2.4.5 Flying Through an Image

One of the more interesting effects that Extierra is capable of is flying above and through the terrain. *Estierra* views the world through an imaginary "camera." Flying through the image involves moving the camera through the scene. This is different from the normal pan, zoom and rotate operation which are accomplished by moving the image rather than the camera.

Flying. Flying can be done using the middle mouse button. If you don't have a middle mouse button, use the left and right buttons together. With middle button down (or left and right together), moving the cursor up the screen "flies" the camera closer to the image. Likewise, moving the cursor down the screen moves the camera further from the image. Moving the cursor left or right moves the camera left and right. These motions give the impression of flying around the objects in the scene.

Penetrating Objects. As you fly very close to an object, you will notice that parts of the object will seem to disappear. This is because parts of the object are protruding through the imaginary lens of the camera. You can minimize this effect, using the "Plus" button on the tool bar. This scales the object larger so that you have the appearance of moving closer without parts disappearing.

Remember that you can reposition and rotate the object on the screen using the other mouse buttons. Once, you get good at manipulating the mouse buttons, you can easily fly around and through any object.

1.2.5 3D Options

There are several sets of options that control the way 3D objects such as terrains are displayed. Here is a detailed list of the options:

- Scene Settings
- Materials.
- Lighting.

1.2.5.1 Scene Settings

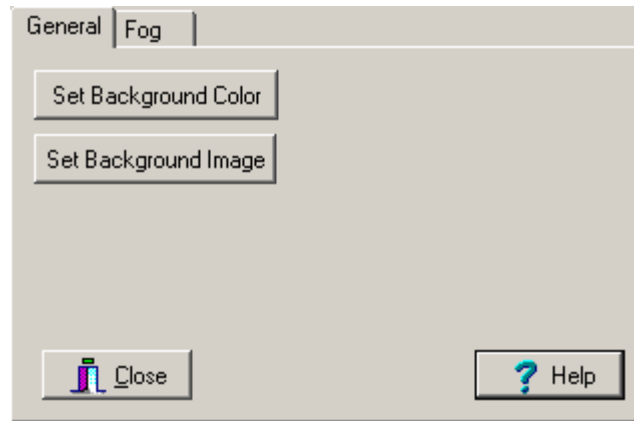
The Scene Setting option allows you to set general options about the scene background. To access Scene Settings, select the "Options|Scene Settings" from the menu bar. There are two pages in Scene Settings window. Here is a complete description of each one:

General Page.

Background Color. The Background Color is the color of the screen behind the objects. The program defaults to a dark gray background color. This can make it difficult to see dark objects. For dark objects, you may wish to choose a lighter background color.

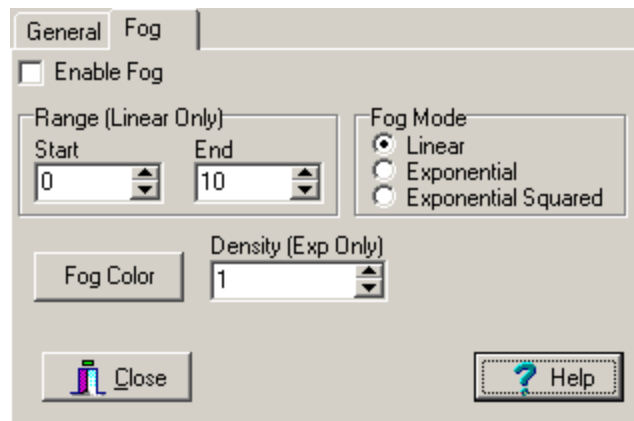
Background Image. You can also load a bitmap image to use as the background to a scene. For example, you display an image of clouds or rock formations as a background to the image. The image can be an ordinary Windows bitmap or BMP file.

It can also be a Windows "Portable Pixel Map" or PPM file. The dimensions of the image must be a power of two. For example, 64x64, 128x64, 32x128, etc



Fog. This option allows you to create a fog effect. When the fog effect is enabled, parts of the image that are further away, appear lighter as though shrouded in fog. (Note: to get the full fog effect, the Background Color should be set to white.) Here is a detailed description of the fog options:

Start. This controls the distance from the view port that the fog bank starts. If the number is negative, the fog bank starts before view port.



End. This controls the point in the scene where the fog bank become impenetrable and beyond which you can't see. The fog distributed between the start and end points. The more space between there is between the start and end, the more gradual the fog thickens. If you set the Start and End points to the same value, it will produce an abrupt, impenetrable fog bank.

Fog Mode. This mode controls how rapidly the fog density builds up. In Linear mode the fog density goes up linear with distance. In Exponential Mode, the density goes up exponentially. Finally, in Exponential Squared mode the density goes up exponentially by the squared distance. Note: many video cards do not support these modes.

Density. This option controls the density of the fog. The range of values is between 0 and 1. Larger values increase the density. Smaller values decrease it. Note: many video cards do not support these modes.

1.2.5.2 Materials

In the real world, all objects reflect light in different ways depending on the characteristics of the materials they are made of. For example, a shiny metal object reflects most the light that falls on it, while a piece of cloth defuses the light that falls on it.

To access the Materials Options, select the "Options -> Materials" item from the menu bar.

The Materials Dialog Box is divided into two pages. Here is a detailed description of each page:



Object Properties
Transparency.

1.2.5.2.1 Materials Properties

The Materials Page contains four sections. Here is a detailed description of each one:

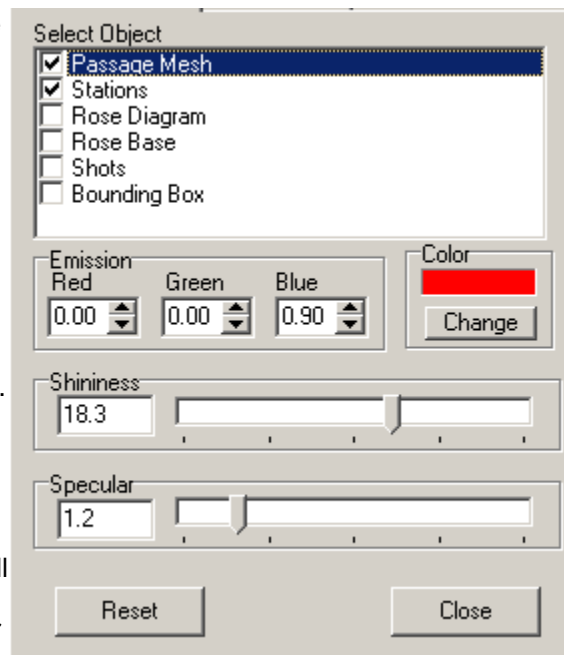
Select Object. Each object in the scene can separate and distinct material properties. For this reason you have to choose which objects the changes you make will apply to.

The control displays a list of all objects the may be displayed in the 3D scene. To selection one or more objects, check the box to the left of the item.

Emission. This options controls how much light comes from inside the object. The more light that comes from inside the object the more the object appears to glow. The Red, Green and Blue values control the color of the glow.

Shininess. This option controls how well reflects off the object. The more light that is reflected off the object the shinier and more metallic the object appears.

D. Specular. When light reflects off an object, there is often shiny spot where the reflection appears brightest. The Specular option controls the size of the reflected bright spot.



1.2.5.2.2 Materials Transparency

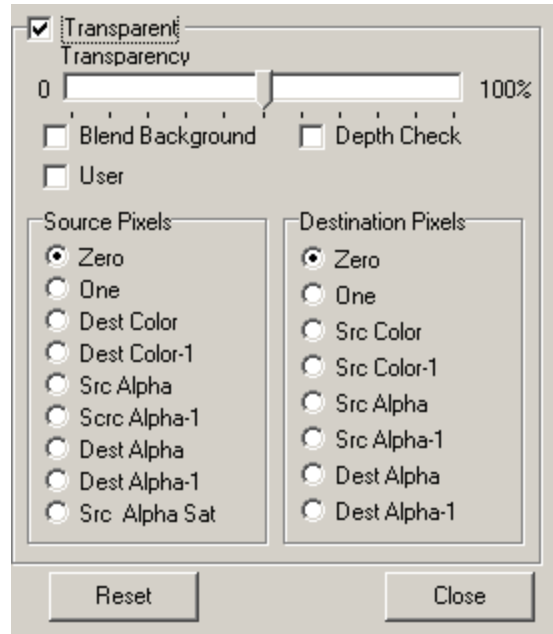
This option allows you to control the details of the transparency. When the Transparent option is enabled, the selected objects in the scene can be made transparent in various ways. Here is a description of the details of the controls:

Transparency. This slider controls the level of transparency of the selected objects.

Blend Background. When this option is enabled, the colors of background objects are blended with those in the foreground. In some instances, this creates a more pleasing and realistic transparency.

Depth Check. When this option is enabled, the program applies the transparency in the order of the furthest object first and closest object last. In some cases, this makes the transparency more realistic.

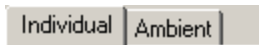
User. When this option is enabled, the transparency is controlled by the "Source" and "Destination" setting at the bottom of the window.



Source/Destination Pixels. These options control the way pixels are combined to create transparency. The Source Pixels are pixels in the the image that in the background. The Destination Pixels are pixels from objects that are in the foreground. The choices control how those pixels are combined. Since there a lots of combinations and it get complex, it is best just to experiment with different combinations to until you get the effects you are looking for.

1.2.5.3 Lighting

These options allows you to control the way scene images are lighted and various properties of those light. To access these options, select the "Options|Lighting" item from the menu bar. The Lighting Window consists of two pages. Here is a detailed description of each one:

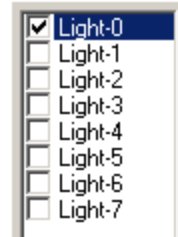


Individual
Ambient

1.2.5.3.1 Individual Lights

You can use up to eight individual lights to illuminate the scene. Each light can have different and distinct properties.

Light List. The light list appears on the left side of the Individual Light Page. It shows a list of all eight lights available for illuminating the scene. You select a light by checking the box to the left. Only those lights that are checked will be modified by the changes you make.



Light Properties. The right side of the Individual Light Page is divided into three sub-pages which allow you to change the properties of the selected light or lights. Here is a detailed description of each page:



Light Type Page

Light Position Page

Light Color Page

1.2.5.3.1.1 Light Type Page

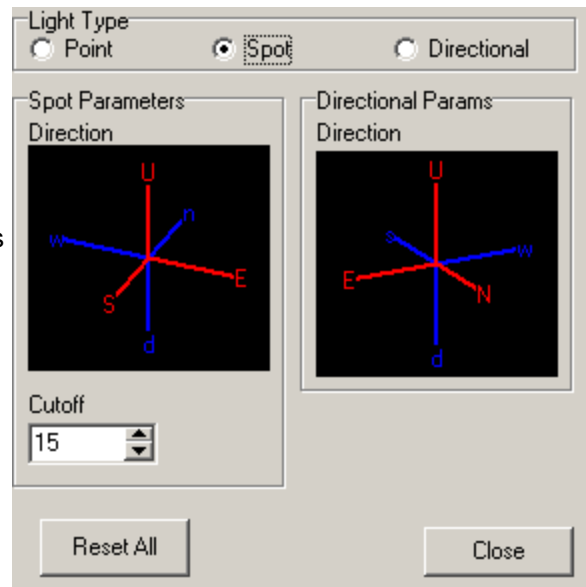
I. Light Type Page. This page allows you to set the light type.

A. Light Types. Each light can be one of three types.

1. Point Light. A Point Light is a light projected on the scene from a single source that radiates in all directions. It is like a bare light bulb in that it is not directional, however, by changing the position of this light, you can change the way shadows fall on the scene. You set a Point Light's position on the "Position Page," described below.

2. Spot Light. A Spot Light is a light that comes from a single source but is concentrated into a single beam like a flashlight. At a short distance from an object in the scene, a spot light projects a small circle of light on the scene. You control a spot light by setting its position and its direction. The position is set on the "Position Page," and the Direction is set on this page. Both options are described below.

3. Directional. A directional light produces parallel rays of light coming from a certain direction illuminating the whole scene. A directional light does not have a position but it has a direction which can be set on this page. Setting the direction is described below.



B. Spot Parameters. This option allows you to set a spot light's parameters. The Direction Option allows you to set the direction the spot light is pointed. The display shows the East, West, North, South, Up and Down orientation of the light beam. The spot light's beam will be directed along the North-axis in the display. You drag the E, W, N, S, U and D lines so the spot light beam is

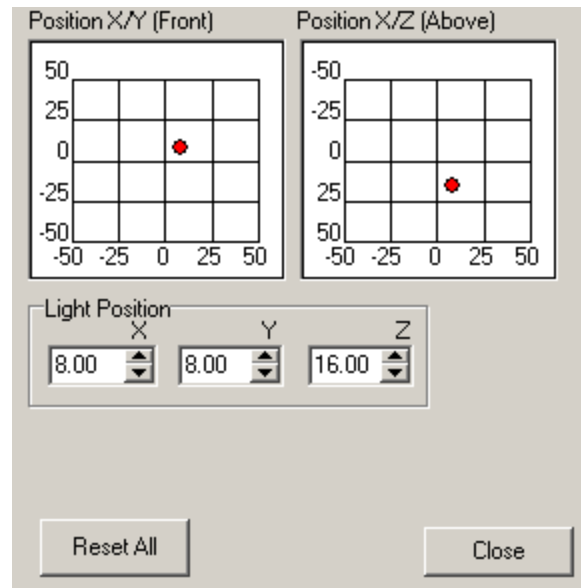
oriented the way you want. You will be able to see the spot light beam move in the display as you manipulate the control. (Note, the beam must be pointed directly at an object before you will see it.)

Cutoff. The Cutoff Parameter controls the how far the spot light beam travels before it dissipates.

C. Directional Parameters. This option allows you to set the direction the directional light points. The display shows the East, West, North, South, Up and Down orientation of the of the light beam. The directional light's beam will be directed along the North-axis in the display. You drag the E, W, N, S, U and D lines so the beam is oriented the way you want. You will be able to see the beam move in the display as you manipulate the control.

1.2.5.3.1.2 Light Position Page

II. Position Page. The Page Allows you to set the position of a Point Light source or a Spot Light. The position is controlled by two graphs that represent the position of the light. The first graph displays the position as viewed from the front. The second displays the position as viewed from above. The position is represented by a red dot on each graph. You can move the position by clicking on a graph and dragging the red dot to a new location. As you move the dot, the display will change showing the effect of the changes in the scene.



Light Position. You can also view and change the position using X, Y and Z coordinates with the control that appears at the bottom of the Position Page.

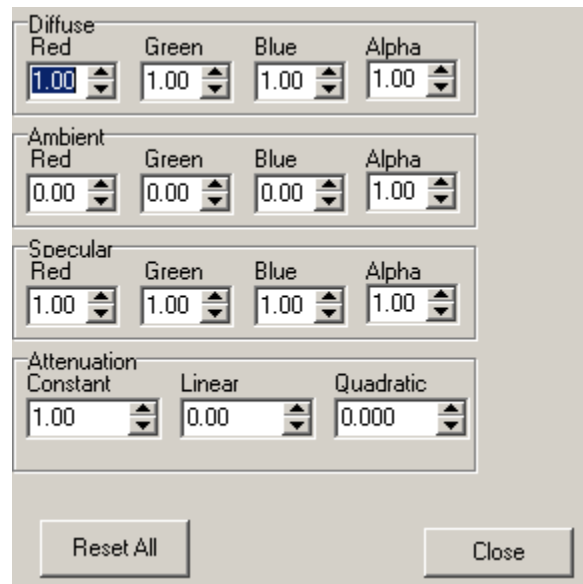
1.2.5.3.1.3 Light Color Page

III. Color Page. The color page allows you to set the color and other properties of the light.

A. Diffuse. This control set the Red, Green and Blue (RGB) color of the Diffuse part of the light. This is part of the light that appears on non-shiny parts of the object.

B. Ambient. Each light can have an ambient light associated with it. Ambient light is light that come from all directions like the light that filters through clouds on a cloudy dya. This control sets the RGB color of the ambient light. (This Ambient Light is different from the general ambient light for the whole scene.)

C. Specular. Light can reflect off certain parts of an object more than others. In the real world, this produces a shiny spot right at the peak of a rounded surface. This control sets the color of that shiny spot.



D. Attenuation. Light dims as it travels. This control allows you to set how much the light dims.

Constant. This option decreases the light a fixed amount, no matter how far the light travels. You can use this to set the basic brightness of the light.

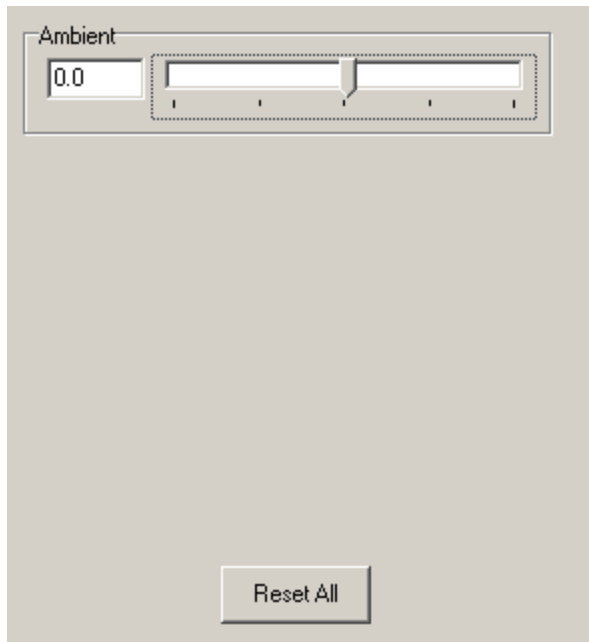
Linear. This option set the level of linear dimming the light has. If the number is zero, the light doesn't dim with distance. The larger the number the more dimming occurs with distance.

Quadratic. This option set the level of non-linear dimming the light has. Using this option causes the light to dim slowly at first then more rapidly. This is very similar to the way real light behaves. If the number is zero, the light doesn't dim with distance. The larger the number the more dimming occurs with distance.

1.2.5.3.2 Ambient Lights

The Ambient Light Settings controls the amount of light that hits the objects from all directions. It is similar to the kind of light you have when you have a cloudy day. In other words, there is no single point where the light comes from and all sides of an objects are equally illuminated.

Since it comes from all directions, it will be noticeable in places where there is no direct light. As a result, it tends to control the contrast of the objects. The more ambient light, the less pronounced the shadows will be.



1.2.6 Overlay Editor Overview

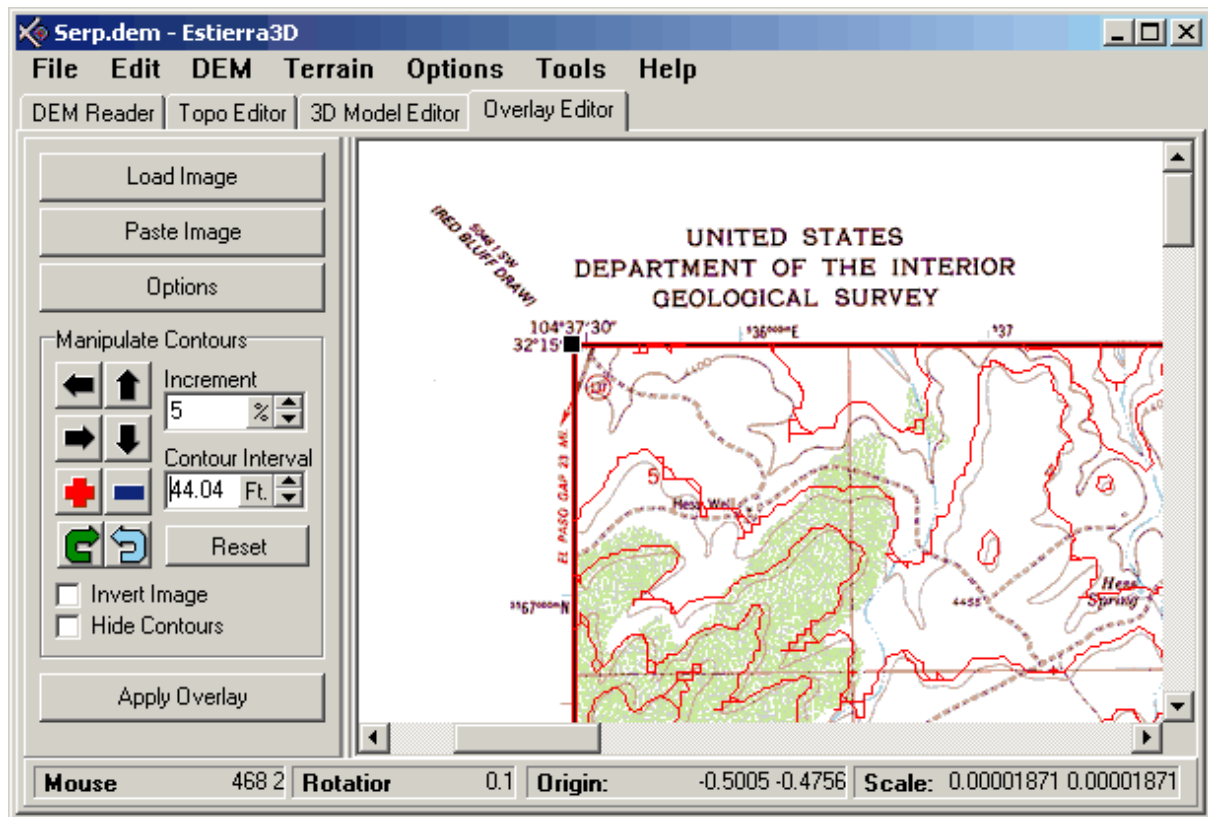
The Overlay Editor allows you to overlay the terrain with aerial photographs, topographic maps and even specialized maps such as geologic maps. The editor allows you to manually adjust the overlay image so even maps and photographs that are not geographically registered can be used with **Estierra**.

How It Works. The main purpose of the Overlay Editor is to align and scale the image to match the terrain. Editor works by drawing contour lines over the surface of the image. These contour lines correspond to the terrain. You then adjust the position and scale of the contour lines until they align

with the terrain features. This allows you to precisely align the surface terrain to the image. Here is detailed information about the using Overlay Editor.

Step-By-Step Procedures
 Mouse Contour Adjustment
 Overlay Controls
 Overlay Status

Overlay Options
 Alignment Techniques
 Geo-registered Files



1.2.6.1 Overlaying - Step-By-Step Procedures

The Overlay Process. (Note: before you can begin the overlay process, you must create terrain model.) The Overlay process consists of four steps:

1. Load Image. You begin by loading an image to overlay on your terrain. You do this by pressing the Load Image Button. This will allow you to load a bitmap image from your computer. The image can be in bmp, jpeg, jpg, tiff, geotif and drg formats. To make the image compatible with OpenGL, the image will be resized as it is read. This operation can take several seconds.

After the image has been loaded, the program will display topographic contour lines superimposed over the image

2. Adjust Topographic Contours. The next task is to align the topographic lines with the terrain. You do this using the Mouse to move, size and rotate the contours. You can also do this using the Move Buttons to move the topo-lines left, right up and down. You can also adjust the scale of the contours by pressing the Expand Contours and Shrink Contours buttons. Finally, you can rotate the contour lines to compensate for any rotations in the image. Click here for detailed information on the alignment process.

3. Overlaying. Once you are satisfied with the alignment between the contours and the image, press

the Apply Overlay button. The program will then apply the image to your terrain and switch you to the 3D Model Editor so you can view the results. If you are not happy with the alignment, just repeat steps 1 and 2 described above.

1.2.6.2 Mouse Contour Adjustments

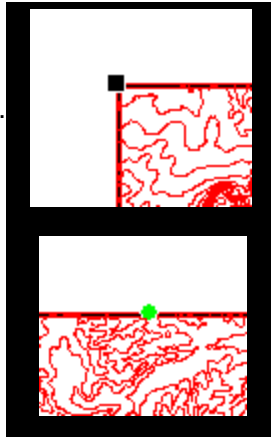
You can move, resize and rotate the contour lines using the mouse.

1. Moving Contour Lines. Clicking inside the box that holds the contour lines and dragging will cause the contour lines to move with mouse. This allows you to reposition the contour lines.

2. Resizing/Scaling Contour Lines.

You can resize the the contour box by clicking on the small blacks boxes in the corners of the contour area and dragging. Dragging toward the center shrinks the contours. Dragging away from the center expands the contours.

3. Rotating Contour Lines. You can rotate the contour box by clicking on the small green circle at the top of the contour area and dragging in a circular directions.



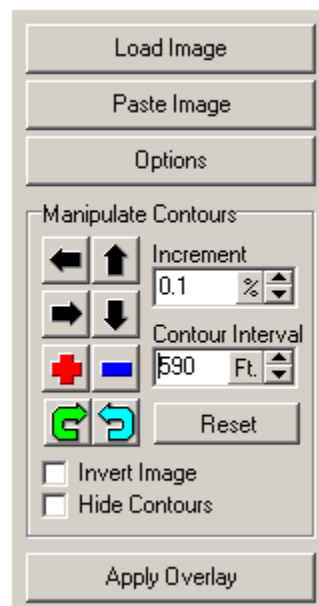
1.2.6.3 Overlay Controls

The Overlay Page contains controls that are used to manipulate the contour lines and move them into alignment with the overlay-image. Here is a detailed description of each control:

Move Buttons. The four Arrow buttons in the upper-left corner are used to move the contour lines left, right, up and down.

Expand/Shrink Buttons. The Plus and Minus buttons are used to expand and contract the contour map. In effect, this changes the scale of the contours and allows you to adjust the size of the image to match the size of the terrain.

Rotate Buttons. The Rotate Left and Right buttons rotate the contour lines. This is useful for aligning the terrain to images and maps that have rotations in them. **Note:** Once you rotate the terrain, the time it takes to draw contour lines will increase a great deal. For this reason, you probably want to do your rotations last. Also, it may help to increase the Contour Interval since the decreases the number of lines the program has to draw.



Contour Interval. When the program draws contour lines on the image, the lines are spaced at even values of elevation. For example, if the contour interval is set to 100 feet, the each line will drawn at multiples of 100 such as 100, 200, 300, etc. The smaller the contour interval, the more lines that will be drawn and the more details you will be able to see. Also, the resolution is limited by the number of points and accuracy of the DEM file. Generally speaking, values below 40-feet do not increase the accuracy of the display. Finally, smaller contour interval values increase the time it takes to update the display, which can be a problem for slower computers.

Invert Image. This option changes all the colors in the image to the opposite values. For example, if the overlay image is mostly light colors, the image will change to mostly dark colors. This can increase the contrast between the contour lines and the image and make the lines easier to see.

Hide Contour Lines. This option hides the contour lines. It may be useful at times to hide the contours so it is easier to see the image and locate features.

1.2.6.4 Overlay Status Bar

There is a status bar at the bottom of the Overlay Page that displays the status of various Overlay Controls. Here is a detailed description of each status item:

Mouse	48 194	Rotator	360.0	Origin:	-0.1730 -0.0917	Scale:	0.00000237 0.00000237
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Mouse. This item displays the position of the mouse cursor in pixels over the image and contour lines.

Rotation. This item displays the rotation of contour lines in degrees. You can change these values using the Rotate button.

Origin. This item displays the distance between upper left-hand corner of the image and the center of the terrain. The values displayed in percentage of the image width and negative when the terrain is moved down or to the right. Thus, the when the terrain is centered on the image, the number will be – 0.50, -0.50.

Scaling. This item displays the scaling between the image and the terrain. Since the terrain is generally many kilometers wide and the image is relatively small, the scale factors are very small numbers.

1.2.6.5 Overlay Options

There are several options that control the image and contour lines in Overlay Editor. To access these options, press the Options Button on the Overlay Page. This will display the Overlay Options window.

The Overlay Options window has three pages. Here are a detailed descriptions of each page:

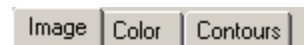
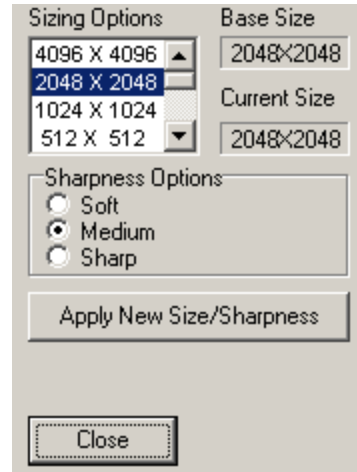


Image Page
Color Page
Contours Page

1.2.6.5.1 Image Page

The Image Page of the Overlay Options window controls qualities of the image that is used to overlay the terrain.

A. Sizing Options. Because of limitation in OpenGL, overlay-images are required to have sizes that are “powers of two” such as 256, 512, 1024, 2084, etc. For this reason, the program automatically resizes the image as it is read. Generally the program picks a size that is a good compromise between resolution and size. However, the program also limits the maximum size of the image to 4096x4096, to save memory and to speed up operations. The Sizing Options list offers other sizing options for the image you are working with. This allows you vary the resolution and size of the image.



Larger Images. Increasing the size can increase the resolution of the image, however larger images are slower and take up a lot memory. For example, a 4096x4096 image can take up 67-megabytes of disk space, memory space and video card memory, which could tax the resources of some computers and make the terrain files difficult to transmit over the Internet.

Smaller Images. Using a smaller size will decrease the amount of memory used and speed up the display. However, the smaller images have less detail, especially when the terrain model is viewed up close.

B. Base Size/Current Size. The Base Size displays the original size of the image on disk. The current size shows the size of the image that is currently stored in the program’s memory.

C. Sharpness. When the program resizes the image, it must make special adjustments to individual pixels to change the image size. For example, if the image is made bigger, the program must insert new pixels into the image to increase its size. Likewise, if the image is made smaller, the program must throw away some pixels in order to decrease its size. The Sharpness option controls the way in which the pixels are added and removed and this, in turn, effects the sharpness or clarity of the image.

Sharp. When this option is set, the lines and the edges of objects will be sharply demarcated, but some artifacts may appear in light-colored areas.

Medium. This is a good compromise option. With this setting, lines will be slightly softer, but there will be few artifacts.

Soft. This option produces virtually no artifacts, but line will be somewhat soft and slightly blurry.

Apply New Size/Sharpness. Pressing this button applies any size or sharpness changes that you may have made.

1.2.6.5.2 Overlay Options - Color Page

The Color Page allows you to control the color options of the image. Every bitmap image has a palette of colors that is used to display a picture. The bigger the palette, the more accurate the colors will be, however using more colors can quadruple the amount of memory or disk space that is used by the image.

Color Format Information. This item displays the color format of the original image that was read from disk and the format of the current image.

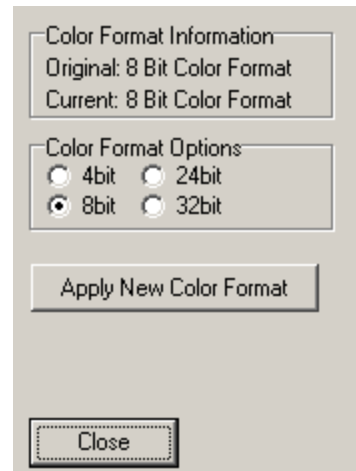
Color Format Options. *Estierra* can use bitmap with 4, 8, 24 and 32-bits of color. Here is a description of each color option:

4-Bit Color. This mode gives a total of 16 colors. Since there are two pixels per byte, images are much smaller, however because of the limited number of colors, the 4-bit color is only suitable for very simple images such as elementary drawings and maps.

8-Bit Color. This mode gives a total of 256 colors. Since there is one byte per pixel, images will be of medium size. With 256 colors, the image can display more complex maps and even photographs if as long as they don't have a broad range of colors.

24 and 32-bit Color. This mode provides 16-million colors, which is sufficient for even the most subtle color photographs. However, the images will be three or four times larger than an 8-bit image.

Apply New Color Format Button. Pressing this button applies any color changes that you may have made



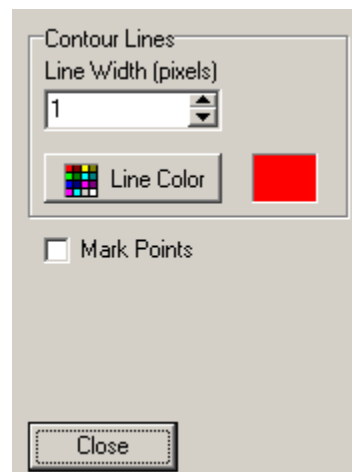
1.2.6.5.3 Overlay Options - Contours Page

The Contours Page controls the way the contour lines are drawn on the Overlay Image. Here is a detailed description of the options:

Line Width. This option controls the width of contour lines in pixels. The larger the number, the wider the lines. Wider lines may be easier to see when drawn on top of the overlay image.

Line Color. This option controls the color of the contour lines. Changing the color may make it easier to see the lines. For example, light colored lines will be easier to see when drawn on a dark image and vice versa.

Mark Points. Enabling this option causes the program to draw marks on the map that corresponds to the elevation points in the DEM file. **Note:** if the terrain is rotated, the Mark Points option will be disabled



1.2.6.6 Alignment Techniques

Pick A Feature. The best technique for aligning the contour lines with the terrain is to pick a terrain feature that you can find in both the image and the contour lines. It is best to choose features that are distinct and sharply defined. Lakes, cliff-edges and valleys are good choices.

Contour Visibility. If you are having trouble seeing the contour lines because of the color of the image, try changing the color or width of the contour lines.

Decrease Contour Interval. Once you have located a terrain feature that is visible in both the contour lines and the image, decrease the Contour Interval less than 100-feet. If your image is topographic map, set the Contour Interval to the same value that is used by the map.

Move and Scale. Now use the Move Buttons to position the corresponding contour lines over the feature in the image. Now move to another part of the image and see if other features align with each other. This time, if they out of align, adjust the scale of the contours using the Expand Contours and Shrink Contours buttons. You continue this process, moving from feature to feature, adjusting both the contour position and size, until all areas are correctly aligned.

Increments. As you make your adjustments, gradually reduce the Increment value so that each change is smaller and smaller. This will cause your adjustments to gradually converge on a perfect alignment.

Rotations. Some images will be slightly rotated relative to the terrain. For this reason, you may need to rotate the contour lines. **Note:** Once you rotate the terrain, the time it takes to draw contour lines will increase a great deal. For this reason, you probably want to do your rotations last. Also, it may help to increase the Contour Interval since the decreases the number of lines the program has to draw.

Alignment Problems. Depending on how the image was scan or generated, you may have alignment problems. For example, photographs and scanners can distort the image in ways that make it difficult to align. Also, you may notice that the alignment is perfect in one area, but misaligned in others. You may also notice that the image is rotated making it difficult to align. In these cases, the best option is get a better image. Failing that, your best option is to find a compromise alignment that you can live with.

1.2.6.7 Geographically Registered Maps

Some maps and aerial photograph files contain detailed information about the geographic location of the image. For example, GeoTiff files, (which Estierra can read), contain UTM information about the location of the map. Since DEM files also contain this information, it should be possible for Estierra to automatically align maps images to the underlying terrain.

Poor Data Quality. Unfortunately, the quality of the data in DEM's and GeoTiff files is so bad, that it is seldom possible to use the information. As a result, Estierra does not currently incorporate this feature. However, this is not much of a problem because it is so easy to align the images manually. Besides, the manual alignment capability gives you much more flexibility. It allows you to use non-registered images scanned from books and paper maps. It also allows you to work with small sections of terrain that are smaller than the DEM file. This is very useful for focusing on the details of the terrain in specific areas.

1.3 DEM Files

Digital Elevation Model files (DEM) are special files that contain a grid of elevation points for a particular part of the earth's surface. **Estierra** uses these points to construct a three-dimensional

model of the surface. The United States Geological Survey (USGS) creates and distributes DEM files for the United States. Here is detailed information about acquiring and using DEM files:

Getting DEMs	Decompressing DEM Files
DEM Data Format	Merging DEM Files
DEM File Errors	

1.3.1 Getting DEMs

Before you can create a model of the terrain, you must acquire DEM files for the area you are working in. This data is available from United State Geological Survey (USGS) and there are several web sites that contain the data. Here are some links:

Government Sites

Alphabetical: <http://dds.cr.usgs.gov/pub/data/DEM/250/>

Commercial Sites

Free Downloads: <http://data.geocomm.com/dem/>

Free Downloads: <http://www.mapmart.com/>

Free Downloads: <http://www.atdi-us.com/>

Notes: you may have to do some searching to find the free downloads on these pages. The companies that offer them are in the business of selling other information and they sometimes hide the data away in the back part of their web pages. Nevertheless, with some persistence, you find the data.

Also, these file often need to be decompressed and the filename changed so Estierra will recognize them. Refer to the section on Decompressing Files for more information.

1.3.2 DEM Data Format

I. File Formats. The USGS currently produces DEM's in two file formats: the original DEM format and the SDTS format. Here is a detailed description of each:

DEM Format. The original format keeps all DEM data in single file, usually with the extension ".DEM". This file format dates back many years and has many odd artifacts and variations that date back to the earliest days of computers. *Estierra* has special routines that can read this data and deal with problems that other programs cannot handle.

SDTS. The "Spatial Data Transfer System" (SDTS) is a new standard that has been adopted by the USGS. In the SDTS format, the data is split between half a dozen files. All the files have the extension "DDF" and the key file has this format "????CEL0.DDF," where the question marks can be any characters. Here are two real examples:

6221CEL0.DDF

7103CEL0.DDF

II. File Sizes. DEM files come in several sizes and resolutions. The most common are one degree and 7.5 minutes files.

One Degree Files. The one-degree files cover one square degree of the earth's surface. This covers a rectangle about 50 miles wide and 60 miles high at middle latitudes. At the standard resolution the

data points are spaced about 300 feet apart. This means that hills, valleys, sinkholes and other features smaller than 300 feet, may not be visible on these maps. One-degree files are readily available over the Internet free of charge. [Click here for links to DEM download sites.](#)

7.5 Minute Files. A 7.5-minute file covers a smaller portion of the land surface and their data points are much closer together, typically 90 feet, although some versions are as close as 30 feet. This gives much finer detail than one-degree maps. The files are also smaller, about one megabyte apiece uncompressed.

The quality of some of the 7.5-minute data is poorer than the one-degree maps. Some of the files seem to have artifacts in them, like horizontal lines through the data or rectangular blocks equal elevation. [Click here for links to DEM download sites.](#)

1.3.3 DEM Errors

Many DEM files have errors in them. These errors come from a variety of sources. Some errors are introduced when the original data was created. Other errors are introduced when the data is translated between different formats.

Estierra can compensate for many DEM errors so that a defective file can still be used. However, the errors can distort the surface terrain or produce inaccurate geographic coordinates. To find detailed information about the DEM file errors, select the "View|DEM Error Info" option from the menu bar. The window will display a list of DEM errors. Here is a detailed description of each error type:

Carriage/Line Feed Return Embedded. The DEM file format specifies that there should be no Carriage Return or Line Feed (CR/LF) characters embedded in the DEM data. In some cases, DEM files will have CR/LF embedded in them, presumably to make them more easily edited with a text editor. (DEM files are divided into 1024 byte blocks, which is a throwback to when the data was stored on magnetic tapes with 1024-byte record size. For some reason, some programs insert CR or LF characters at the end each block, however, this is not a part of the USGS standard.)

These CR/LF characters will shift the position of certain fields in the file, making them difficult for most programs to read and display the data. Estierra removes these characters so that file can be read, displayed and manipulated. This process generally leaves no residual problems, but it does indicate that the file is non-standard and other inconsistencies may exist, making the data unreliable.

Invalid Corner Values (0). Each DEM files specifies the geographic location of the quadrangles boundaries. If this information is missing, the Estierra cannot accurately locate the DEM's position on the earth. It also cannot display or manipulate the DEM. For this reason, the program will substitute dummy corner coordinates. This at least allows the DEM to be displayed and manipulated. However, all location information will be inaccurate.

Profile outside boundaries. The elevation points in a DEM file are organized into north-south columns called "profiles." Every point in a profile should fall inside of the boundaries specified by the file. This error occurs when the location of an individual profile or data point falls outside the boundaries specified in the file. This can cause part of the data hidden off the edge of the screen.

To solve the problem, Estierra will adjust the data so that all points will fall within the boundaries and will be displayed, however this may cause certain columns to be shifted northward, distorting the image. The error also indicates an internal consistency problem and it may indicate other aspect of the data is inaccurate.

1.3.4 Decompressing DEM Files

Decompressing Files. If you download a file in the compressed form, you must decompress it before it will be usable by *Estierra*. The files are generally compressed in one of two formats. You can usually tell which format by the extension. Here is a complete description of each type:

ZIP Files. ZIP files have the extension "ZIP". If you are using Windows XP, the operating system treats ZIP files as though they were ordinary folders. This means that to extract data from a ZIP file, all you have to do is remove it from the folder. If you are using a different operating system, you will need to use WinZip or IZArc to decompress the file. Once one of these programs is installed on your computer, you can just double click on a ZIP file and the program will automatically decompress it. (See below for more information on WinZip and IZArc.)

WinZip/IZArc. There are several programs that will decompress these two files. I have used two programs to decompress files. WinZip is a shareware program and IZArc is free. I currently prefer to IZArc. Here are links for downloading the programs:

WinZip: <http://www.winzip.com/>

IZArc: <http://www.izsoft.dir.bg>

GZ Files. Many DEM files, particularly the SDTS files are compressed using GZip format. GZip files have the extension "GZ". To decompress these files you will need to use WinZip or IZArc, installed on your computer. Here are the steps for extracting DEM files.

1. Correct Extension. Sometimes these files will be described as being GZip files but won't have the proper extension. Programs like WinZip and IZArc need to be able to find an extension in order to process the file. For this reason, you may need to change the extension to "GZ" for the file.

2. Open GZ File. You should now double click on the GZ file. If WinZip or IZArc is installed on your computer, one of them will open the GZ file and display the contents.

3. TAR Files. Some of these compressed files will contain a "TAR" file. If so, you should double click on the file so the decompression program can open it too. At this point, WinZip may ask you for an extension for this file. Just give it an extension of TAR. This will enable WinZip to understand that it is a TAR format archive file and it will automatically extract all the files inside. IZArc seems to be able to open the file without changing the extension.

4. Copy Files. Once WinZip or IZArc has opened the TAR file, copy the contents to your hard drive.

5. Correct Extension. DEM files normally have the extension DEM or DDF. *Estierra* relies on these extensions to display available files when you open and load a DEM file. Some DEM files will be missing the extension or will have an extension such as ".txt." These are usually ordinary DEM files and not the SDTS files. If you have one of these files, you need to rename it so it has the DEM extension. For example if you have a file named: "PikesPeak" you should rename it "PikesPeak.dem." Likewise if the file is named "PikesPeak.txt" you would rename it "PikesPeak.dem."

1.3.5 Merging DEM Files

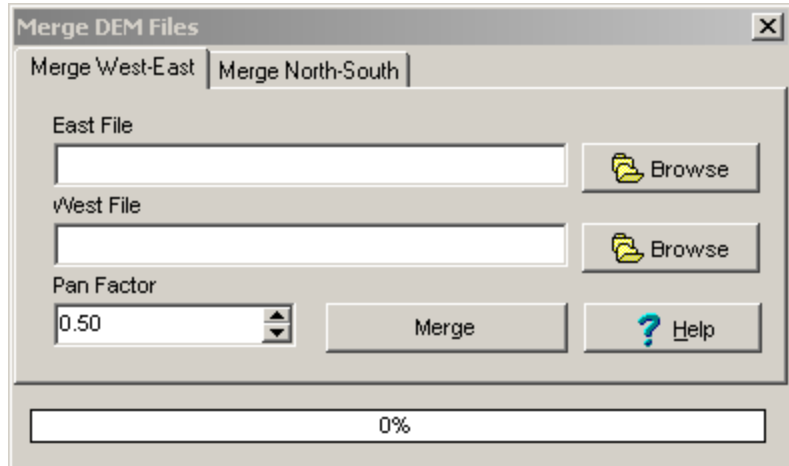
Sometimes the area of interest on a DEM falls on the border between two files. For this reason, *Estierra* can merge any two DEM files. It does this by creating a new DEM file that combines parts of the two original files. After the two files have been merged, the edges of the original files will be

moved to the center of the combined file. To combine files, select the "Tools|Merge DEM Files" option from the menu bar.

Caveats. The merge capability has been tested with one-degree and 7.5-minute DEM files. It may be able to process other scales, but these have not been tested. The program is designed to process the original DEM format and but not the new SDTS format files. If you are using SDTS format data, you must convert them to the old format.

Merge Direction. The program can combine two files that are adjacent in the east-west direction or in the north-south direction. The file merging utility window has two pages, one for merging west-east files and one for merging south-north files. The first step in merging files is to select the proper page.

Choosing Files. Each page has two edit boxes for the west and east files or the south and north files. You can type the filename into each box, or you can use the browse button to search for and select the proper files.



Pan Factor. Once you have selected the files to merge, you can set a Pan Factor. The Pan Factor controls what proportion of the two source files will appear in the output file. For example, if you select a Pan Factor of 50%, half of each file will appear in the new combined file. Smaller Pan Factors mean more of the west or south files will appear in the new file. Large Pan Factors mean more of the east or north files will appear in the new file.

Merging Files. After you have selected files and a Pan Factor, press the "Merge" button. The program will prompt you for an output file and then combine the two files.

Merging Corners. For locations that fall at the corners of four DEMs, you can merge all four files. First, you combine the two pairs of adjacent files in the east-west direction. This will create two new combined files. Finally, you combine these two files in the north-south direction. Be sure to use the same pan factor for each of the pairs of files.

Errors And Problems. You may encounter errors or problems when you attempt to merge DEM files. Here are detailed descriptions of some of the problems you may see:

1. Non-Adjacent Files. The two source files must represent land areas that are immediately adjacent to each other. They also must be specified in the correct order. Otherwise, the program will not be able to join the edges of the data. If the files are not adjacent, the program will tell you how far apart the edges are and ask if you really want to merge the files.

2. Anomalies. Anomalies may exist at the border between two files. There are two types of anomalies. The first kind is missing data points and gaps at the border of the files. These are due to inconsistencies in the way the DEMs are created by the USGS. The second type of anomaly is the result of an elevation offset between the two files. For example, the elevations of one file could be consistently 30 feet higher than the other file. This would result in a hump at the boundary of the file.

1.3.6 Convert SDTS Files

Estierra can read both the old-style DEM files and the new SDTS files. However, the new files are awkward to use because they need 18 files just to old one DEM map. For that reason, it is sometimes useful to convert the newer files to the old format. Also, Estierra requires the old style files if you want to merge adjacent DEM files.

To Convert an SDTS file to the old format you need to get a the Compass files converter. You can find a copy here.

<http://www.fountainware.com/compass/download.htm>

The "SDTS Converter" can be found half-way down the page. Follow the instructions in the help file.

1.4 Terrain Special Effects

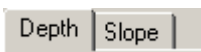
Estierra has a number of special effects that can be applied to terrain models such as coloring by depth and slope. Here is detailed information on special effects:

Special Effects Adjusting Color Bars

1.4.1 Special Effects

The Terrain Special Effects options allow you to color and enhance the terrain in a variety of ways. To access these special effects, select the "Terrain|Special Effects" option from the menu bar.

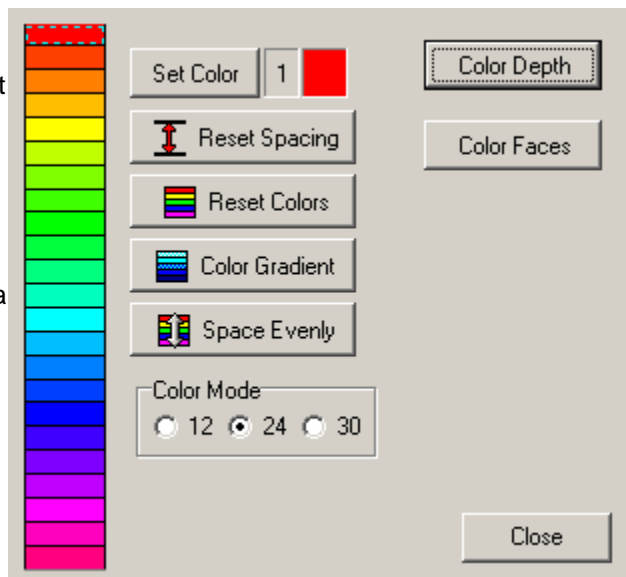
The Special Effects are divide into two pages. Each Page is select by clicking on the tabs at the top of the windows



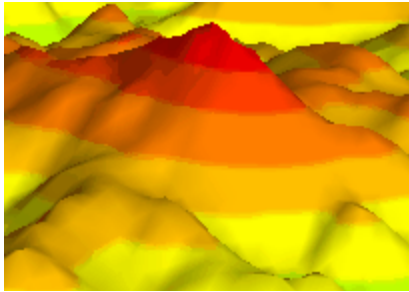
I. Depth Effects. The Depth Effects are available on the first page of the Special Effects dialog. The Depth Effects allow you to color the terrain by depth. You have complete control over the hue, range and distribution of colors. Here are descriptions of the color by depth features:

A. Depth Color Bar. The Depth page has a "Color Bar" on the left side of the page that graphically illustrates the distribution of colors. Each color band represents a particular depth in the terrain. You can set the color, position and width of each band individually, there by creating a broad range of color effects.

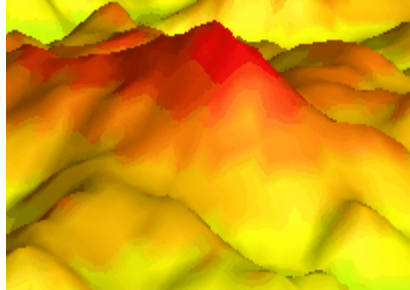
B. Color Mode. This option allows you to select different color schemes with different numbers of colors.



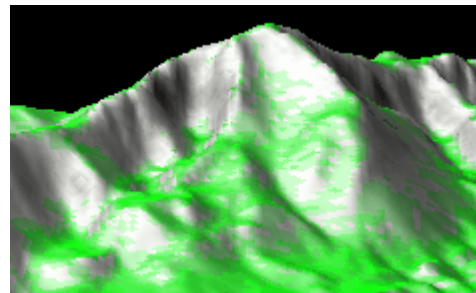
C. Color Depth Button. Pressing this button causes the program to color the terrain according to the colors in the Depth Bar. In this mode, the program uses a bitmap image to color the terrain, which produces a more precise color pattern, with very sharp contour lines.



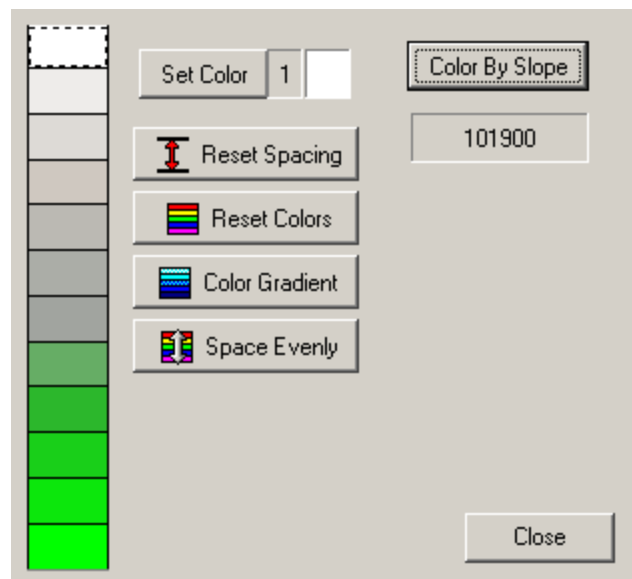
D. Color Faces Button. Pressing this button causes the program to color each face in the terrain according to the Color Bar. In this mode, the colors are more diffuse and less precise, but more natural and smooth.



II. Color-By-Slope. The Color-By-Slope option appears on the second page and it allows you to color the terrain according to the steepness of each face of the terrain. This will give color-coded information about the steepness of the terrain. It can also give a realistic appearance to a terrain for which you do not have an Overlay image. Here are detailed instructions for using the Color-By-Slope option:



A. Slope Color Bar. The Slope page presents a "Color Bar" on the left side of the page, which graphically illustrates the distribution of colors. Each color band represents a particular range of slopes in the terrain. For example, bands at the top of the color bar will represent faces whose slope is near 90 degrees. Likewise, the bands at the bottom of the color bar represent slopes near zero degrees. By manipulating the color bands, you can map any color to any slope.



Default Colors. The default color set for the Slope Color Bar uses greens for flat terrain. This logical because flat terrain is more likely to have plant growth than steep cliff. Likewise, steeper terrain is colored with grays and pinks simulating the rocks that you would expect to

see exposed on very steep terrains. This color pattern gives a realistic appearance to terrain as long as you don't zoom in too close.

B. Color By Slope Button. Pressing this button causes the program to color the terrain according to the slope and the color bar.

1.4.2 Adjusting Color Bars

Overview Of Color Bars. Color Bars are columns of color bands that are used to set the colors for 3D objects. Generally speaking, the position each of the color in a Color Bar corresponds to a physical property of the object such as depth. Several features of *Estierra* use Color Bars to set the colors of terrains.

Adjusting Color Bars. Color Bars are adjustable in a variety of ways. Here is a description of how to manipulate Color Bars:

Selecting Colors. You can select any color band by clicking on it. When a color is selected, a dotted line appears around the border of the color band. Once a color is selected, you can change the color by clicking on the "Set Color" Button.

Dragging Colors. You can also copy colors from one band to another by clicking on a color band and then dragging the color to a new band. This will copy the color to the new band.

Dragging The Tops and Bottoms. You can also manipulate the Top and Bottom values of a color band by moving the mouse cursor to the line separating the bands and then dragging the line to a new position. This will resize and reposition the adjacent bands.



Reset Spacing. The "Reset Spacing" button restores the original even spacing of the bands.

Reset Colors. The "Reset Color" button restores the default colors of the bands.

Color Gradient. The "Color Gradient" button takes the top and bottom color bands and creates a smoothly changing series of intermediate colors. This is useful for creating special color effects.

Space Evenly. The "Space Evenly" button takes the top and bottom of the color bar and spaces all the bands evenly. This allows you to set a narrow range of evenly spaced color bands. The "Space Evenly" button is different from the "Reset Spacing" button. The "Reset Spacing" button resets the color bar to the original spacing; whereas, the "Space Evenly" button maintains the position of the top and bottom bands and then evenly spaces all the intermediate bands.

1.5 Device Drivers

OpenGL uses special software called "Device Drivers" to take advantage of the capabilities of today's graphics cards. When **Estierra** first starts running, it tries to select the best or most powerful device driver. You have the option of choosing a different device driver that may work better on your computer.

Reference Drivers. OpenGL usually installs a set of "Reference Drivers" on your computer. These are drivers that will work on any system and they are meant to be the standard from which all other drivers are written. They do not take advantage of hardware acceleration so they are slow, but they always work. Reference Drivers can be useful for diagnosing problems with **Estierra**. If you switch to a Reference Driver and the problem goes away, it is probably caused by your device driver and you should contact the card manufacturer for a driver-upgrade. Finding and selecting Reference Drivers are discussed below.

Changing Drivers. To change device drivers, select "Render|Devices" from the menu bar. This will display a list of device drivers available on your computer. The current device driver will be highlighted. To select a different device driver, simply highlight the driver and click on the Okay Button.

The Device Driver display has four different sections. Here is detailed explanation of each section:

1. Device Driver. This item shows the name of the device driver. Usually there will be at least three drivers: "Default", "Ramp Emulation" and "RGB Emulation". The Default driver is a driver that is guaranteed to work on any machine. **Estierra** will choose this driver if it cannot make any other driver work properly. The other two drivers are standard software drivers that are included with every installation of OpenGL. If you have an accelerated graphics card that has been properly installed, you will have other drivers that support the advanced features of your card.

2. Hardware. This item specifies whether the driver supports the accelerated hardware on your graphics card. Hardware drivers can be as much as 50 times faster displaying and animating the images than software-based drivers. All non-hardware-based drivers are Reference Drivers.

3. Color Mode. This item specifies how the driver will deal with colors. In Mono mode, the number of colors is limited and all lights are white. In RGB mode, there are more colors in the display and all lights can have colors. RGB mode works better with the Fog and Texture Filtering options. However, if Windows is set 8-bit graphics mode (256 colors), you may get banding effects in your colors.

4. Device ID. This item display the Identification Number (GUID) of the device driver. This is useful for debugging OpenGL problems.

Choosing Device Drivers. When **Estierra** starts, it will try to pick the best device driver. Normally, it will try to choose a hardware driver that supports RGB coloring. This is because a hardware driver will be faster and RGB will produce better colors. However, there are many situations where **Estierra** may not choose the best driver.

Hardware drivers are usually written by the manufacturer of the video card and sometimes they have bugs that prevent them from working correctly. For example, I have seen hardware drivers that don't render textures correctly or produce jerky motions. When this happens, it may be useful to choose one of the other drivers. All the Microsoft software drivers have been extensively tested and will always work correctly, even though they can be slower.

Which drivers are available to you depends on what color mode you are using. **Estierra** can run using 8, 16, 24, and 32 bit color, however some of the faster device drivers will only run in high resolutions. As a result, **Estierra** will only display the drivers that will work with the current display mode. You may find faster drivers if you switch a different color mode. Generally, you can switch color by going to

"My Computer" and then "Control Panel." Go to the "Settings" tab and try testing different "Colors" options. Also, if you are running in 8-bit graphics mode, colors may be improved by choosing one of the Mono Color drivers.

1.6 Saving/Loading Terrains

Once you have gone to all the trouble of creating a 3D terrain-model, it very useful to be able to save and reload it without going through all the steps of recreating the image. For this reason, **Estierra** allows you to save complete terrain models including overlays and coloring. There are two file format that terrains can be saved to:

1. Terrain Files. These files are the standard format for Estierra Terrains. They can save all the details of terrains. They are the best method for saving files, although can be a bit large. To save files in this format, select the "File -> Save Terrain File" option from the menu bar. To load a Terrain file, select the "File -> Load Terrain File" option from the menu bar. Terrain files have the extension ".xml."

2. X Files. You can also save any terrain as X-Files. The X-File format was developed by Microsoft, so these files can be loaded, viewed and manipulated by other 3D imaging and editing programs. The X-files don't always save all the details of the terrains, particularly the overlays. To save files in this format, select the "File -> Save X File" option from the menu bar. To load an X-file, select the "File -> Load X File" option from the menu bar.

1.7 Printing, Copying and Saving Images

You can print, copy to the clipboard or save as a bitmap any of the images displayed in **Estierra**. There are four **Estierra** Pages that show images: the DEM Reader Page, the Topo EditorPage, the 3D Editor Page and the Overlay Page. The images on any of these pages can be printed, copied to the clipboard or saved to a file:

Printing. To Print an image, select the "File|Print Image" option from the menu bar. The program will prompt you to choose one of the four **Estierra** Pages. Next, it will display the standard print setup window. You have the option of fitting the image to page or printing at the actual size. Fitting to the page is usually the best option because the images will be very small other wise.

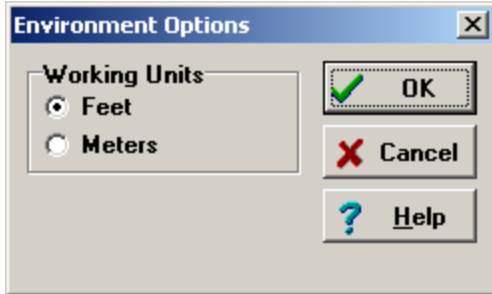
Warning! Printing images with a black background can cause problems with inkjet printers to. Printing a picture with a black background will usually soak the paper. With the 3D Editor page, you can set the background color to white another light color to circumvent the problem.

Saving As Bitmap. Any **Estierra** Image can be saved as a bitmap file (.bmp). This allows you to import the images into a word processors or drawing programs. To save an image, select the "File|Save Image As Bitmap" option from the menu bar. The program will prompt you to choose one of the four **Estierra** Pages. Finally, you will be prompted to select a filename for your bitmap file.

Copying To The Clipboard. To copy an image to the clipboard, select the "Edit|Copy Image" option from the menu bar. The program will prompt you to choose one of the four **Estierra** Pages. After you choose a page, the image will be copied to the clipboard.

1.8 Environmental Options

The program allows you to display parameter in either meters or feet. You can set the proper units by selecting "Options|Environmental Options" from the menu bar.



1.9 Geographic Coordinate System

There are several systems that are used by cartographers to locate landmarks and terrain on the surface of the earth. Here is a description the systems that are used by *Estierra*:

Longitude And Latitude. One of the standard systems for locating a point on the face of the earth is called longitude and latitude. The system measures the location of a point on the surface of the earth in degrees. Longitude measures the number of degrees east or west of a north/south line (meridian) that runs through Greenwich, England. Latitude measures the number of degrees north or south of the equator.

Longitude and Latitude are usually displayed in Degrees, Minutes and Seconds. It is often displayed on maps with single and double quotes used to specify the minutes and seconds part:

106° 37' 30"

Longitude and Latitude can also be displayed as decimal degrees. For example:

106° 37' 30" = 106.625

Locations west of the England have negative longitudes and locations east of England have positive longitudes. Locations north of the equator have positive latitudes and locations south of the equator have negative latitudes.

Geodetic Datum. One of the problems with any measurement on the surface of the earth is the fact that the earth is not a perfect sphere. In fact, it has a lumpy pear shape to it. To deal with this problem surveyors have developed complicated equations that compensate for the shape of the earth and calculate locations. The numeric constants used to calculate locations are called Geodetic Datum. Over the years, surveyors have gradually refined the constants to make them more and more accurate. The result is that there are dozens of different constants that have been used to make maps and surveys. Some of them are specially refined for particular countries or regions. For this reason, different maps done at different times or in different parts of the world use different constants.

Each datum is given a special name and most maps specify which datum was used to create the map. For example, in the United States, most maps have been created using either "North American 1927 (NAD27)" or "North American 1983 (NAD83)".

Universal Transverse Mercator (UTM). While Longitude and Latitude is universally used for navigation, it is awkward for tasks like survey land. For example, there are several problems with

Longitude/Latitude in this situation. First, while the earth is a sphere, most maps are printed on flat pieces of paper. When you project longitude and latitude lines on a flat piece of paper, it inevitably results in distortion. For example, in some projection systems, the lines will be curved. Trying to adjust a land survey map to curved lines would be very awkward and confusing. Second, since the longitude/latitude system uses degrees as the unit of measure, it is hard to calculate the distance between two points.

UTM is a more useful system in many instances because it uses a square grid of Cartesian coordinates. In order to maintain the square grid on a curved earth, UTM divides the earth into 60 narrow zones, each one six degrees wide, running north and south at right angles to the equator. Each zone is about 415 miles (668 kilometers) wide at the equator. The zones are narrow to minimize the effect of the curvature of the earth. This means that a square grid can be used inside the zone. It also means you don't have to worry about mapping against curved lines.

Each zone is numbered. Zones in the Northern Hemisphere are positive and zones in the Southern Hemisphere are negative. Because, of the curvature of the earth, the zones narrow toward the north and south poles.

UTM coordinates are the measured distance north from the equator and east from the left edge of the zone. Thus with these two numbers and a zone number, you can specify the location of any point on earth. UTM coordinates are usually specified in meters, but occasionally they may be converted to feet.

Convergence. Because UTM places a square grid on top of a curved earth, the longitude lines will appear to curve underneath the grid. For this reason, the UTM grid lines do not always point directly at the North Pole. "Convergence" is the amount the UTM grid is misaligned with the earth's North Pole.

Part



2 Terminology and Conventions

If you are new to the computer or Windows, some of the nomenclature can be confusing. Here is a description of some of the terminology that is used throughout this documentation:

1. Selecting Items And Executing Actions. In many situations, you will be expected to select an object on the program window. For example, you might be expected to select a button, an edit box or notebook tab. The easiest way to do this is to click-on it with the mouse (as described below.) With some items, clicking-on the item also causes an action to occur. For example, clicking on a button causes the button to be both selected and pressed.

You can also use the keyboard to select items and execute actions. This technique uses a highlight that can be moved from section-to-section and item-to-item. For example, the "Tab" key causes the highlight to move between sections or pages of the window. Also, the "Arrow" keys move the highlight between individual items. Once you have moved the highlight to a particular object, you may need it to carry out some action. You do this by pressing the "Enter" key. For example, if you move the highlight to a button, hitting "Enter" will press the button.

2. Clicking-On. In many situations, you will be expected to move the mouse cursor to a specific location on the screen and then press the left or right mouse button. This is often referred to as "clicking-on." So if you read that you should "click the left mouse button on" something, it means that you should move the mouse to that location and press the mouse button.

3. Double-Clicking vs. Single-Clicking. Double-clicking means clicking twice, in rapid succession, on the same point. In Windows, single clicking is usually used to select some item on the screen and double clicking is used to carry out some action. However, Windows can now be configured so it works like a web page, where actions are carried out with a single click. For this reason, when you see the phrase "double-click" in this document, it may actually mean single-click, depending on how you have set Windows to work. To control this option, select the "View\Folder Options" from Windows Explorer or My Computer.

4. Left- and Right-Mouse Clicks. There are always at least two buttons on a PC mouse. "Left-mouse-clicking" means pressing the left button. Likewise, "right-mouse-clicking" means pressing the right button. The left button usually carries out actions; the right button usually displays menu relevant to the portion of the screen you are clicking on. (If you are left handed, Windows can be configured to reverse the meaning of the buttons.)

5. Dragging. Dragging is usually accomplished by moving the mouse cursor to a specific location on the screen, pressing the left mouse button down, and while the button remains pressed, moving the mouse cursor to a new location. This process is usually used to highlight a large area or select more than one object.

6. Dragging and Dropping. Dragging and dropping is usually used to move things from one location to another. It begins the same way as dragging. That is, you begin by moving the mouse cursor to a specific location on the screen, usually to an object on the screen. Next, you press the left mouse button, and while the button remains pressed, you move the mouse cursor to a new location. Usually, the object will move with the mouse cursor. This gives you the sensation of actually "dragging" the object around. Once the object reaches its destination, you "drop" the object by releasing the mouse button.

7. Menu Terminology. Most Windows programs have something called a "Menu Bar" at the top of the screen. The Menu Bar has a series of words like "File, Edit, View, etc.," along its length. If you click-on a menu item, a menu box will drop down. Each menu box can contain additional menus so that you may have a series of menus, one inside the other. In this documentation, a series of menu items like this are specified by the words separated by a vertical bar. For example, "View|Toolbars|

Forms” tells you to select “View” from the main menu bar and then “Toolbars” and then “Forms” from its submenus.

Part



3 DirectoryFolder

Folders and Directories. *Folders* are a way in which Windows subdivides disk space into separate spaces. They are used to keep files separate from one and other and they are also used to help organize information and programs. *Folders* can be nested inside each other and this allows you to create hierarchical organizations. The term *Folder* and *Directory* are interchangeable. The word *Directory* originated in the DOS environment and the word *Folder* originates in Windows.

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