Natural Scene Designer Premium ™

Version 7.0 for Windows ®

User Guide

Natural Graphics

Contents

Introduction 1

The main interface showing a terrain with a photo overlay

Natural Scene Designer Premium 7.0 is a 3D terrain rendering and animation program, optimized for running on 64 bit systems with multiple processors. A 32-bit version is also included. It uses three dimensional terrain models to create realistic pictures, animations, and shaded relief maps of landscapes, complete with clouds, trees, bushes, rocks, lakes, oceans, snow, and imported 3D objects. These scenes can be explored from any perspective, or you can draw a flight path and create an animation. The lighting, colors, and many other settings are adjustable to achieve different effects.

The U.S. Geological Survey (USGS) has digitally mapped the United States. There are three common sampling resolutions available. The entire US is available at a 10, 30 or 90 meter sample spacing. In addition most of the world is available at 90 meter sample spacing.

Using these terrain models, you can reconstruct a realistic representation of the actual location. Additionally, Natural Scene Designer Premium generates realistic terrain texturing using algorithms that simulate natural processes in placing trees, vegetation, and snow. Or you can use a terrain overlay, such as a satellite photo, instead of the program generated texture.

The program CD-ROM contains nearly one thousand 30 meter terrain models for part of California and Nevada. These terrain models are easy to load—you simply drag or click the mouse pointer over
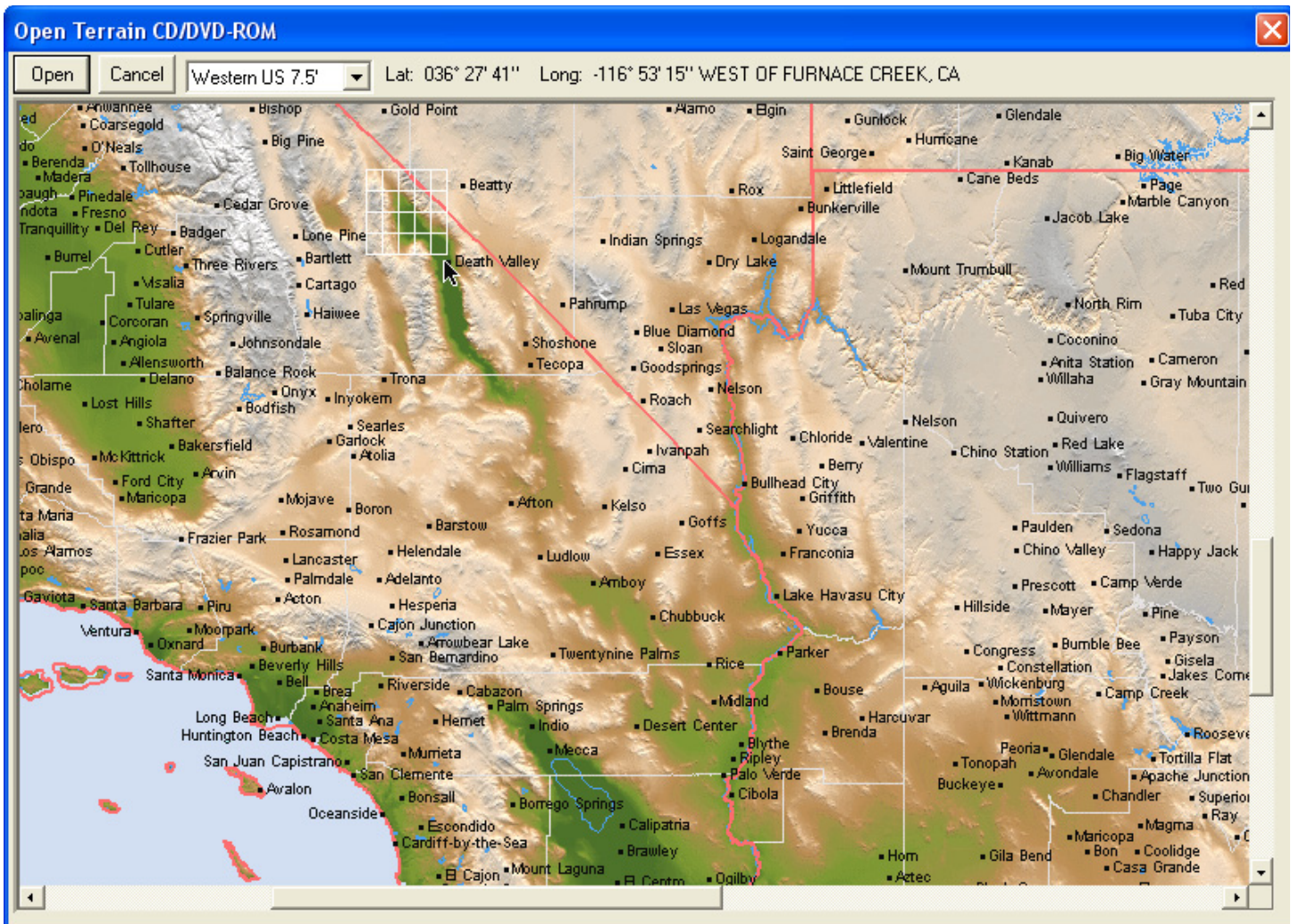
Load terrain models by clicking or drag selecting the area you want

the area you want. Additional CD-ROMs and DVD-ROMs covering most of the world are currently available separately from Natural Graphics. Please check the website at www.naturalgfx.com for the most current product information.

Also on the program CD-ROM are a simulated Moon landscape and a Mars landscape with a matching photograph overlay from NASA's Viking mission. Render a scene or simulate a flight through actual Mars terrain!

Explore imaginary landscapes with Natural Scene Designer Premium's fractal landscape generator. Fractal landscapes are created using random numbers to simulate the natural processes that formed the earth. By specifying a random "seed" number, mountain height, and the size of the fractal world, you have instant access to millions of fractal landscapes.

This program can render realistic natural scenes and animations, 360 degree panoramas , and shaded relief maps. It is a tool for creating map backgrounds, studying topography, 3D visualization of distant locations, planning trips, and creating fly-through animations.

Natural Scene Designer Premium was designed to be fast, powerful, and easy to use. For flexibility, there are many ways to accomplish some of the most frequently used functions — such as changing the camera location and viewing angle. This lets you choose whatever works best for you. Also, with the rapid update speed of the Camera window you can quickly compose the frame of view. You'll know what the scene looks like without having to fully render it.

New Features in Natural Scene Designer Premium 7.0

Texture Shading — NSD Premium 7 now includes texture shading as a built-in rendering option. Previously this required opening a separate program.

Improved Terrain Editor— The terrain editor is much faster, allowing you to paint with continuous brush strokes. There are keyboard shortcuts for toggling the tools and changing the brush size. Also you can now paint terrain over void areas (where there is no terrain) to fill any gaps.

Spherical VR Panoramas— There is a new rendering option in NSD Premium 7 to create a full 360 degree view in one image.

Background Tree Editor — The background tree editor now shows the tree mask as transparent green so you can still see the underlying terrain.

IMG DEM import— NSD Premium 7 imports IMG DEMs, which is one of the new DEM formats distributed by the USGS.

Improved TIFF DEM import — More types of TIFF images may be imported, including tiled TIFFs.

Ray Trace preview — The Camera View has a new 'Ray Trace' button, offering a convenient way to preview the final output.

Filling void areas of terrain— The Terrain menu now has a "Fill Void Areas" function, which was previously available only during SRTM DEM import. Now it can be done at any time.

Automatic update checking— At startup, there is an option for the program to automatically check for updates when connected to the internet. You can change this option in the **Preferences** settings.

Importable Background Tree Maps — The program can now import background tree maps, giving you total control of where you want background trees to appear.

Background Tree Color and Size Variation — There are new options available for randomly varying the size and color of background trees, for a more natural look.

New Settings Panel — A tabbed settings panel is now always available for convenient access to the most commonly used settings.

Shaded Relief Zooming — The Shaded Relief and Planimetric Oblique rendering dialogs now let you zoom in and limit the rendering to a selected area of interest.

Multiple File Loading and Importing — When opening NSD project files or importing DEMs, you can 'Shift' or 'Command' click to combine multiple files.

Export DEM as Ascii Grid — This DEM file format is now supported for both importing and exporting.

Adjustable Water Reflectivity — You can change the water reflectivity and preview the result.

New Option for Foreground Haze — Haze can be eliminated completely for a variable distance in front of the camera.

Remove Lakes Feature — Lakes can now be removed at any time, even after 'Undo' is no longer available.

Photoshop® PSD and PSB support — The program can now import and export Photoshop PSD and PSB files. PSB files are capable of storing extremely large images of up to about 4 exabytes in size. PSD files can store up to 4 gigabytes.

Improved Terrain Clipping — Terrain clipping is easier to use and more flexible. You can now change the terrain clipping rectangle after you draw it, or numerically enter the clip border. Clipping is performed only after you have had a chance to review or change the clipping rectangle.

Added Control of Bump Maps — You can set the transition range (in vertical meters) for bump maps. This avoids harsh transitions in texture.

Adjustable Brightness / Contrast — The brightness and contrast of pictures, animations, shaded relief, planimetric oblique relief and viewshed maps are now adjustable.

Shadow Mask — This rendering option is now available in the Render Picture dialog. You can create mask images to use along with full renderings for special effects.

Major Features

Rendering — Ray tracing, optimized for natural landscapes, provides the greatest level of realism. The program uses multiple processors, if present, to speed up ray tracing. Or you can use the "Quick Test" renderer, which allows you to check scene composition or view an animation flight path without spending the time to do a complete rendering. Many parameters are adjustable to achieve numerous creative effects. Rendered images may be saved in TIFF, PSD, PSB, JPEG, PNG or BMP format.

Animation — A built-in animation system lets you draw a camera flight path on the map and create an animation. The camera path may contain straight and curved segments, and the camera can be set to automatically bank (like an airplane) around curves. The program allows you to vary the speed along the path. 3D objects and clouds can be given a direction and speed during an animation. Animations are saved as either an AVI file, a QuickTime movie (32 bit version only), or a series of separate frames. You can render animations in multiple rendering sessions using the program's suspend and resume functions. The program can recover a partial animation that was stopped for any reason, even a power outage, so you can continue rendering from the point it stopped.

Shaded Relief Maps — The program can create relief maps with user selected colors and elevation ranges. Lighting, color blending, shading, and other parameters are adjustable.

Trees — Add realistic redwood, oak, palm, and sweet gum trees to your landscape scenes. The leaf and bark colors, leaf percent, elevation range and density of coverage can be changed. Tree trunks are textured for maximum realism when they are within close range. They can be exported as 3D objects for use in other 3D programs.

Background Trees — You can let the program place trees automatically, or paint the areas on a map where you want trees included (or excluded). Or you can import a bitmap image and use it as a background tree map. This could be used for simulating the cleared area of a ski slope, golf course fairway, or a path through a forest. Options are available for randomly varying the size and color of background trees, for a more natural look.

Settings Panel — A tabbed settings panel allows for convenient access to the most commonly used settings.

Multiple File Loading and Importing — When opening NSD project files or importing DEMs, you can 'Shift' or 'Control' click to combine multiple adjacent files.

Bump Maps — You can import a bitmap and use it as a terrain bump map, creating a virtually unlimited number of terrain texture varieties.

Adjustable Brightness / Contrast — The brightness and contrast of pictures, animations, shaded relief, planimetric oblique relief and viewshed maps is adjustable with a real-time preview.

Mask Rendering — You can render bitmap masks showing shadows, distance, height, or the sky. These can be useful for creating special effects in image editing programs.

World files — When saving a georeferenced image, you can optionally create a TFW "world file" for use with other software. The world file describes the location and scale of the image.

GeoTIFF support — The program can read and write TIFF files containing georeferencing information.

Terrain Editing — The program's terrain editing tools let you make changes interactively. There are tools for setting the elevation, raising, and lowering areas. With adjustable brush hardness, changes can be blended into the surrounding terrain.

Color — The color and texture of each terrain feature is adjustable. An additional coloring method is available, which lets you set the colors according to the elevation.

Fractal Terrains — The built-in fractal landscape generator can quickly create a random fractal terrain. Many parameters are adjustable, allowing you to create a wide variety of terrain types.

Terrain Models — The CD-ROM included with this program contains nearly one thousand 30 meter terrain models of California and Nevada. A Mars terrain with a matching photograph overlay is included also.

Terrain Overlays — The program can import images and drape them over the terrain. If the image is a GeoTIFF, Digital Raster Graphic (DRG) or has an associated "world file" it will be automatically aligned to match the underlying terrain. You can also import and overlay shapefiles.

Combining Terrain Models — Natural Scene Designer Premium can automatically combine adjacent terrain models, so you are not limited to working with only one at a time. You can easily combine hundreds of 7.5' terrain models by drag selecting them on a map when a terrain CD/DVD-ROM is loaded.

Clipping Terrain Models — Cut out the area of the terrain that you want and discard the rest, in order to save memory and rendering time.

Vertical Exaggeration — Terrains may be stretched vertically by a variable amount. This helps emphasize small features on low elevation terrain models.

Map — The Map window shows a shaded relief view of the terrain. It also shows the current camera location, field of view, flight path, overlays, and 3D objects placed in the scene. The program can zoom in on an area of interest up to a magnification factor of 512X. There is a zooming out tool to view the entire map at once. A "profile" mode is available to show the altitude changes of the camera flight path.

Camera window — The Camera window always shows the current view. Push buttons let you easily pan or move the camera viewpoint. Other tools let you change the composition of the picture.

The preview in the camera window is rendered using OpenGL™ (if available on your system). This allows the program to show textures and add realism to the preview.

Toolbar — The toolbar gives you instant access to some frequently used functions and tools. Some tools have keyboard shortcuts.

Input File formats — Natural Scene Designer Premium loads project files which contain terrain models, 3D objects, camera settings, and all of the other parameters needed to create a scene.

It imports Digital Elevation Models (DEMs) in many formats and DRGs from the U.S. Geological Survey.

The program can create a terrain by importing a picture, where the intensity of each pixel is used to determine the elevation. Or you can create a text file containing elevation samples at a regular spacing and import it as a terrain.

A terrain photograph overlay can be imported, replacing Natural Scene Designer Premium's algorithmic texture. You can also load shapefiles.

The program will load and display TIFF, PSD, PSB, JPEG, PNG, and BMP pictures.

3D Studio™ (3DS) and QuickDraw 3D™ (3DMF) objects may be imported and placed in your scenes. Many of the QuickDraw 3D primitives are supported. Textures (if present) are mapped to the object and rendered.

Output File formats — Natural Scene Designer Premium saves project files which may contain terrain models, 3D objects, and all of the settings to create a scene.

The currently loaded terrain can be exported as a USGS DEM, GridFloat DEM, Ascii Grid DEM, DXF, 3DS or 3DMF file, along with a matching color map for use in other 3D programs.

The terrain can also be exported as a grayscale image, where light pixels represent the highest elevations and dark pixels are the lowest.

Rendered images can be saved as TIFF, PSD, PSB, JPEG, PNG or BMP files. If the image is georeferenced, you may save it as a GeoTIFF and an optional "world file".

Animations are saved as AVI, QuickTime (32-bit version only) or separate pictures for each frame.

360 degree panoramas may be saved as spherical panoramic imagess.

Trees — Add realistic redwood, oak, palm, and sweet gum trees to your landscape scenes. The leaf and bark colors, leaf percent, elevation range and density of coverage can be changed. Tree trunks are textured for maximum realism when they are within close range. They can be exported as 3D objects for use in other 3D programs.

Background Tree Map Editing— You can let the program place trees automatically, or paint the areas on a map where you want trees included (or excluded). This could be used for simulating the cleared area of a ski slope, golf course fairway, or a path through a forest.

Bushes — Natural Scene Designer Premium's bush generator lets you create bushes for your scene. The leaf and bark colors can be modified. They can be exported as 3D objects for use in other 3D programs.

Rocks — The rock generator creates realistic rocks. The shape of each rock, its color, texture, and other parameters are adjustable. With this amount of control a wide variety of rocks may be created. They can be exported as 3D objects for use in other 3D programs.

Clouds — Natural Scene Designer Premium uses fractal methods to create realistic cirrus and cumulus clouds. You can set the cloud altitude, density of coverage, speed and their direction of movement during animations.

Sky — To add realism and depth, Natural Scene Designer Premium lets you choose sky colors or a blend to create a gradual transition from the zenith to the horizon. The amount of haze is adjustable.

Solar Position Calculation — You can enter the date and time and have the program determine the sun location.

Water — Add lakes to a landscape by clicking over the desired lake location in the Map window. Specify an ocean level to simulate flooding the landscape below the chosen level.

You can adjust the wave height and transparent water color for different effects.

System Requirements

Natural Scene Designer requires a PC with a 1 GHz or faster processor, 1 GB of RAM, a CD-ROM drive, and a 1024x768 or higher resolution monitor. It runs on Windows XP, Visat, 7, 8, and 10

QuickTime animations require the 32 bit version of this program and QuickTime 7.0 or higher.

Technical Support

If you cannot solve a problem after checking the appropriate section of the manual, you may call Technical Support at (916) 740-2953. Our hours are 1 to 5 PM Pacific time, Monday through Friday.

Online support: You may also contact us online for technical support at www.naturalgfx.com/contactus.htm . Be sure to indicate the program version and the operating system version.

Phone support: Please note the version number of the program before you call (shown on your program CD-ROM). If possible, have your computer on with the program running, and write down any error messages that were displayed and the procedure that resulted in the problem.

About this Manual

The first three chapters of this manual are designed to be read sequentially. They contain installation instructions, a basic overview, and some tutorials. After reading these three chapters you should have sufficient information to use Natural Scene Designer Premium.

The rest of the manual is for reference. It explains how to use all the dialogs, windows, menus, and tools. While reading the first three chapters, you might want to look up a topic in the reference chapters.

Some of the material in the tutorials is repeated in the reference chapters, which cover most topics in greater detail.

Getting Started   2

Installation

To install this software:

1. If you do not have a prior version of Natural Scene Designer Premium installed, skip to step 2.

    If you are upgrading from a prior version, you must uninstall it first. Run "Add/Remove Programs" from the control panel and select "Remove".

2. Insert the program CD-ROM in the CD disk drive.

3. To install Natural Scene Designer Premium, double click on "Setup32" or "Setup64" (if you have a 64-bit OS) and follow the prompts.

4. A shortcut to Natural Scene Designer Premium will be placed on your desktop. Also, a menu will be added to "Programs" in your "Start' menu.

5. The first time you run the program, it will require the presence of the CD-ROM in your drive. Subsequent usage will not require it, unless you want access to the examples and tutorial files.

You are now ready to begin using this program!

Conventions Used in This Manual

You should enter all distances and coordinates in meters. All angles are entered in degrees, and the Camera lens focal length is in millimeters.

Natural Scene Designer Premium lets you position a simulated camera anywhere, and pointing in any direction. The southwest corner (lower left corner as viewed on a map) is the origin or the point with the coordinates East 0, North 0. As you go farther east (farther right on the map) this East coordinate value increases. As you go farther north (farther toward the top of the map) the North coordinate value increases.

Coordinates
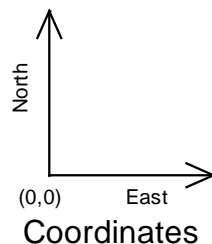
Natural Scene Designer Premium uses three angles to describe the camera direction. First, the compass direction (in degrees) indicates the direction that the camera is pointing. Enter north as 0 degrees, east as 90 degrees, south as 180 degrees, and west as 270 degrees. You may, of course, use any angle in between.
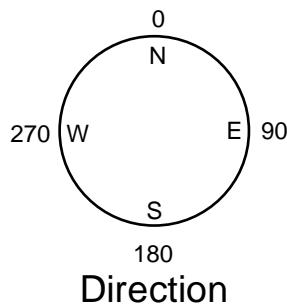
Direction

The second angle, referred to as "pitch", is the angle between level ground and the camera view direction. For example, a camera aimed at the horizon has a pitch of 0 degrees. If it points straight down it has a pitch of -90 degrees, and if it points straight up the pitch is 90 degrees. Pitch values greater than 90 degrees or less than -90 degrees indicate that the camera is upside down.

Pitch
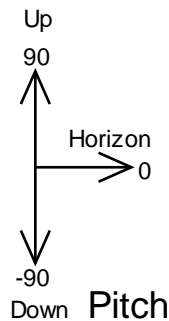
The third angle is the bank angle. In order to understand banking, it is helpful to consider a real world example such as an airplane. In this case, the airplane is said to bank when either wing dips in preparation for a turn. A positive bank angle is a clockwise rotation. For example, +45 would be for an airplane making a right turn. A value of either 180 or -180 would be like flying upside down. A value of zero is no banking (e.g. airplane flying level). Note that the ground will appear to have rotated in the opposite direction of the camera.

Bank
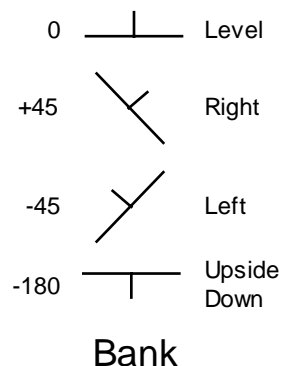
Specify the camera lens value as the desired focal length in millimeters. Use values that are appropriate for a standard 35 mm camera. A normal lens is 55 mm. Wide angle is 18 to 35 mm, and telephoto is 100 to 400 mm.

Note that you need to press **Return** after typing numeric values in the Camera Settings panel and the Camera window. Otherwise changes will not take effect.

However, you should not press **Return** in dialog numeric fields until you are done with the entire dialog. When you press **Return** in a dialog field, it will record the settings for all fields and exit out of the dialog.

Basic Overview for using Natural Scene Designer Premium

This section will give you an overall understanding of how to use Natural Scene Designer Premium. The details will be fully explained later.
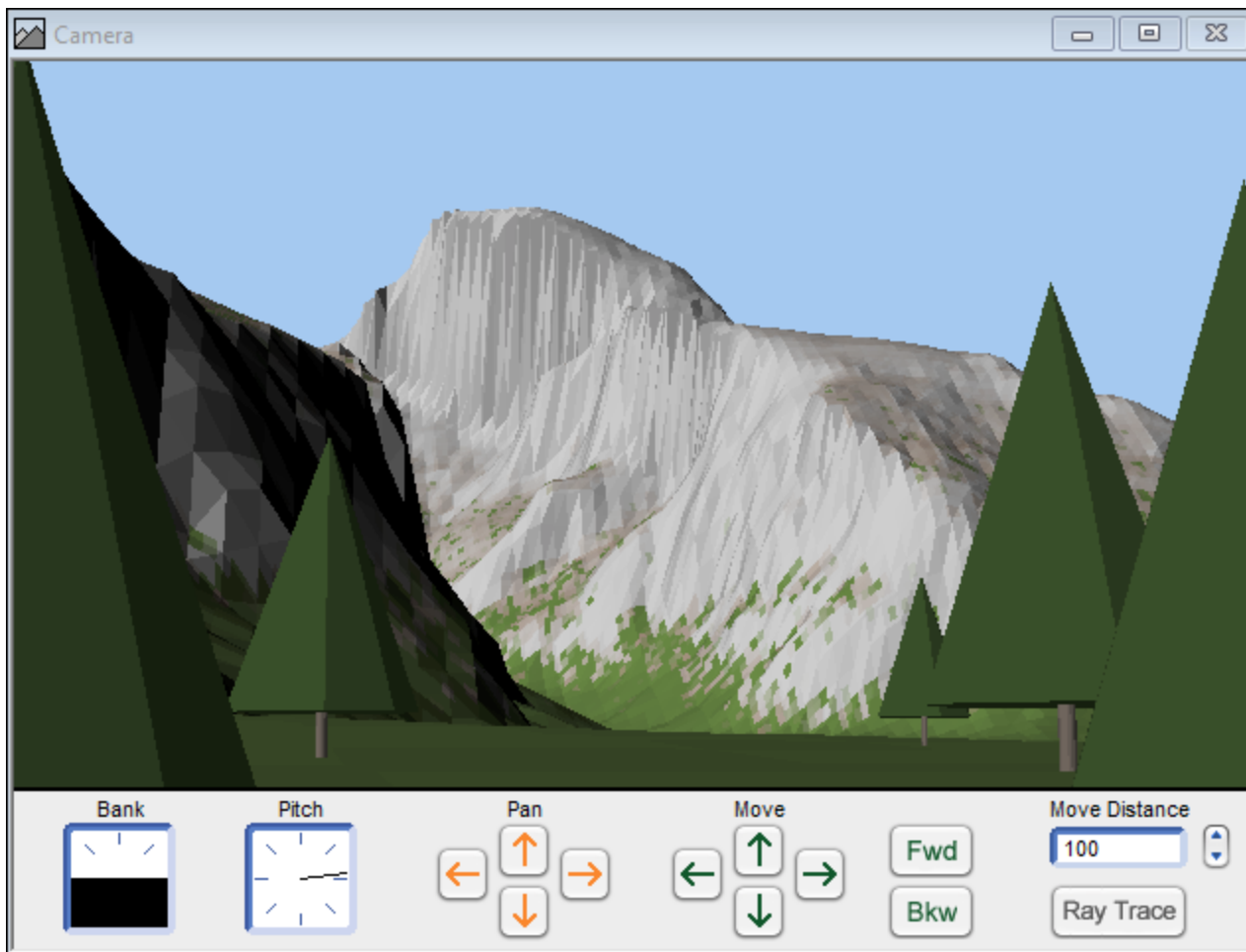
Natural Scene Designer Premium has two main windows. The window titled "Camera View" always shows a preview of the current camera view. It also has controls to adjust the bank and pitch, and buttons to move the camera.
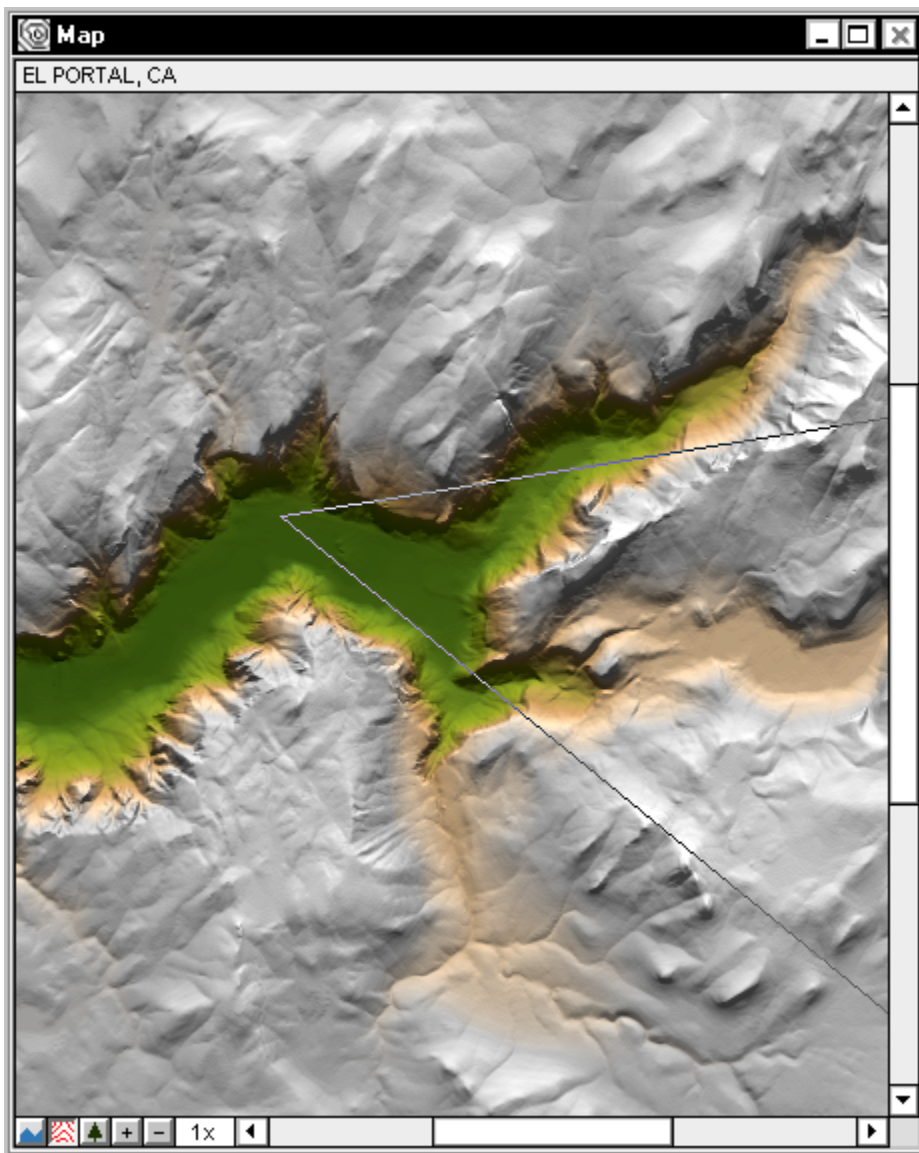
The Map window shows a shaded relief rendering of the terrain. Using the default settings, dark green indicates the lowest elevations. Brown indicates even higher elevations, and gray indicates the highest spots. If you run the mouse pointer over the map, you will see the coordinates displayed at the top of the window for the location the pointer is at. The two lines which form a "V" show the camera field of view. A curve shows the camera path (if one has been defined). Small squares along the camera path indicate the location of the key frames. (Key frames are described in the "Animation" chapter).

If a project contains 3D objects, they are shown on the map in solid white (red for the selected object). If the map scale is too large, the object will be represented by a small white or red square. You can magnify the map up to a factor of 512X for more precise object placement and manipulation.
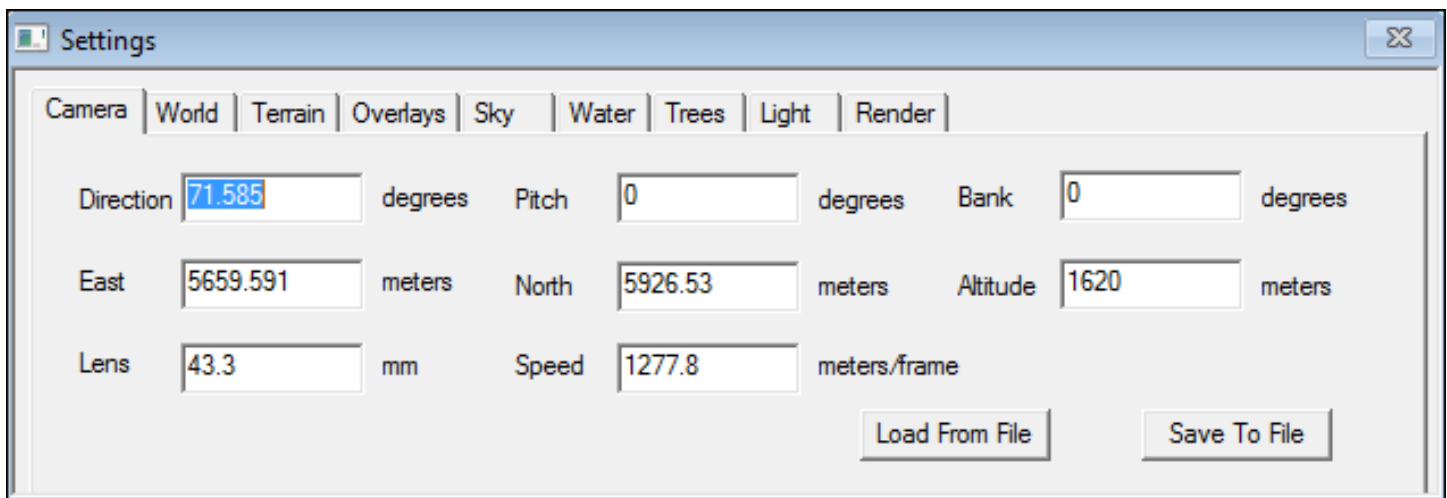
The Settings Panel is a tabbed window with access to the most commonly used settings. When the **Camera** tab is selected, it displays the current camera position (**East**, **North** and **Alt** fields) and the camera direction, pitch, bank, and lens focal length.

You can change the camera position and direction using any of the three windows — Map, Camera, or Camera Settings panel (whichever is most convenient). Changes will be instantly indicated in the other two windows. Often it is convenient to compose the view by selecting a rectangular area in the Camera window using the **Magnifying** tool. You can quickly zoom in on a particular area of interest.

 Magnifying tool

Another convenient feature is the **Undo** button. You can undo the most recent camera movement, direction or lens change, or terrain edit by clicking the **Undo** button on the Toolbar. You can also undo the placement of a lake if there is enough available memory.

Natural Scene Designer Premium can render a single picture from the current camera viewpoint, or animate camera motion along a flight path you define (described in the "Animation" chapter).

The basic steps required to create a single picture are simple. First you need to either load an existing landscape by choosing **Open Terrain CD/DVD-ROM** from the File menu, or create a new fractal terrain by choosing **Create Fractal Terrain**. Then you can use any of the camera controls to compose the view. You may change the settings in the Settings panels, modify the colors, and adjust the lighting. You can change the settings in any order, or use the default settings. Finally, when you are ready to render a picture, choose **Render Picture** from the Render menu.

To create an animation, you must define a camera path . Once a path is defined, choose **Render Animation** from the Render menu.

Natural Scene Designer Premium uses key frame animation to define a camera path. Each key frame contains the camera position, direction, bank, pitch, and speed. You create key frames at the critical points along the path. When the program processes the animation it interpolates the frames in between.

Clouds and 3D objects may be animated too. They may be assigned a speed and direction of travel, independently of the camera path.

You may save your complete or partial work environment including the landscape, settings, 3D objects, and camera path by choosing **Save** or **Save As** from the File menu.

Now you should have a basic idea of how to use Natural Scene Designer Premium. You may wish to begin experimenting, or continue reading for complete instructions.

Tutorials   3

Rendering a Picture

This tutorial will take you, step by step, through the process of rendering a picture. For a thorough explanation of each of the subjects mentioned here, please refer to the appropriate reference section following the tutorials.

Before you begin this tutorial, be sure that you have properly installed this software (See Chapter 2, "Getting Started").
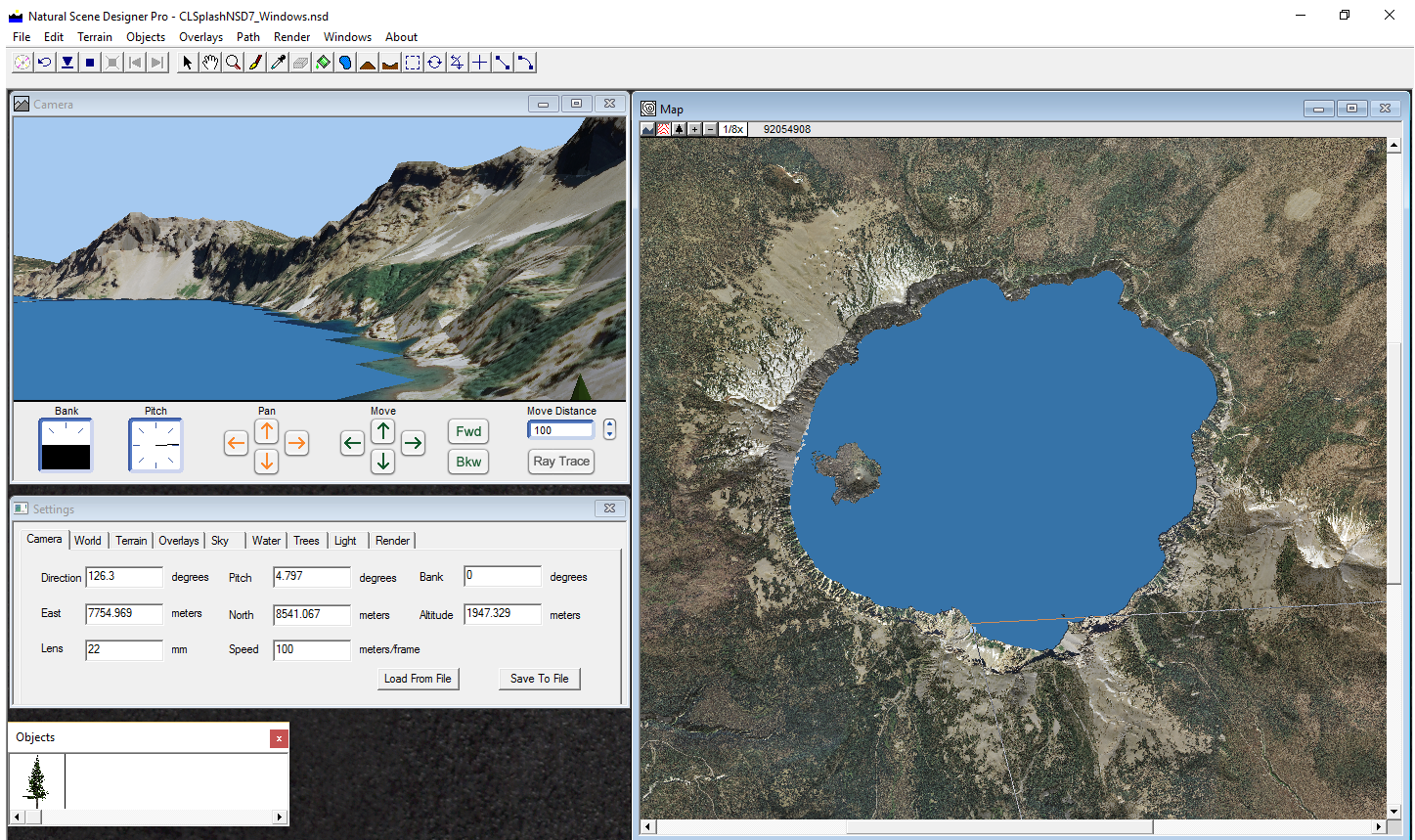
Soon after you start the program you will see the main windows — the Camera View window, the Map window, and the Settings panel. Whenever you load an existing landscape or create a fractal landscape, the Camera View window displays it from the current camera viewpoint. Changing the camera location, direction, lens, lighting, ocean level, and various other settings will automatically update this window. The Camera View window shows only a rough approximation of the actual landscape (it is much more detailed when rendered). The view will not show clouds, waves, background trees or textures.

First, make sure the program CD-ROM is in your CD drive. Then choose **Open Terrain CD/DVD-ROM** from the **File** menu. You will see a new window showing a large scale shaded relief map. Click or drag select the area you want. Then click **Open**. After the terrain has been loaded, the view will be quickly shown in the Camera View window.

First, position the camera to a good viewing location within the terrain. This is easily done using the six direction buttons below the preview image. There are buttons for moving up, down, left, right, forward, and backward. Clicking these buttons moves the camera in the specified direction. The camera will move by the amount (in meters) specified in the **Distance** field. Note that movement is always relative to the direction the camera is pointing, not the landscape. For example, if the camera is pointing straight up, then clicking the **Fwd** button will increase the camera altitude. If the camera is aimed level to the horizon, then clicking the **Fwd** button will move the camera toward the horizon.

Try clicking the six direction buttons a few times and experiment with various distance values. (Note that you need to press **Return** after changing the value in the **Distance** field, otherwise it will not take effect). You can use the **Undo** button in the Toolbar to return to your previous camera location and viewing direction.

Magnifier tool

You can change the composition of your picture by selecting the **Magnifier** tool and using the mouse to drag a rectangle over the desired area. First, select the Camera View window (if it is not already selected). Then move the mouse pointer to what you want to be the upper left corner of the picture. Press and hold down the mouse button while you move it to the lower right corner of the picture, then release it. You will now see the new camera view.

To change the view direction using the **Magnifier** tool without zooming in, click the mouse button anywhere in the Camera View window. The location you click will become the new center of view. To pan, select the **Hand** tool and drag the image.

There are keyboard shortcuts for panning and zooming. Press **Space** to temporarily switch to the **Hand** tool. When you release the space bar it will return to the previous tool. Press **Control + Space** to switch to the **Magnifier** tool, and **Shift**+ **Space** to zoom out.
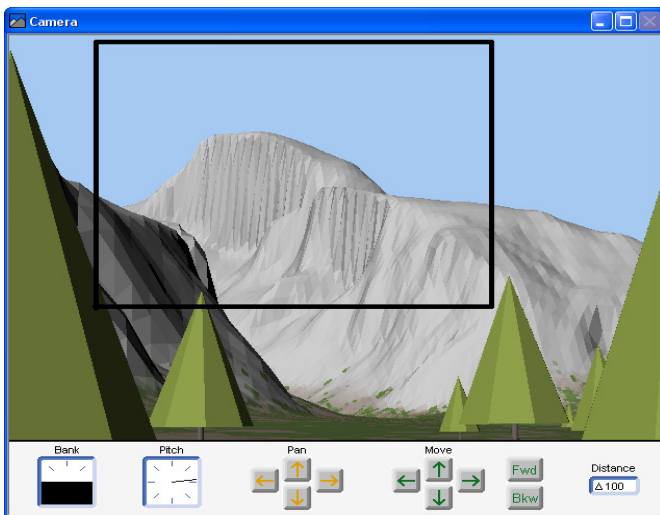
Dragging a rectangle using the Magnifier tool	The new view after zooming in
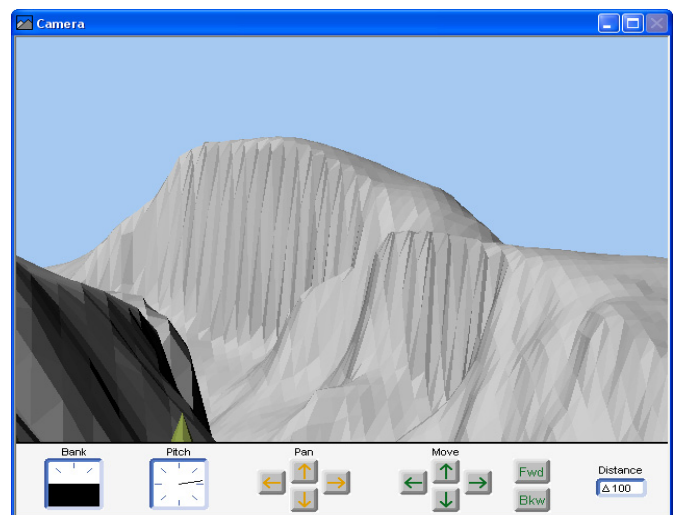
You can also pan (rotate) the camera view using the four pan arrow buttons. Each button press pans the camera view by a fixed amount. For finer panning control, you should use the **Hand** tool and drag the image in the Camera View window.
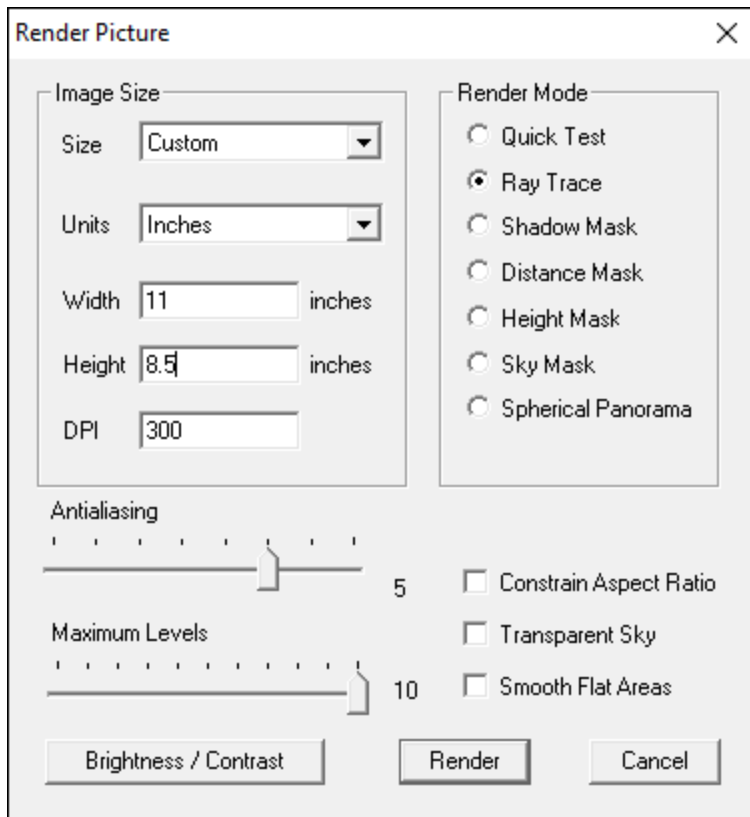
When satisfied with your picture composition, choose **Render Picture** from the Render menu. (Or click the **Render** tab on the Settings panel). You can adjust the picture dimensions, resolution, and some rendering options, or you may use the default settings. Note that there are multiple rendering options. If you want a quick test, but with visible polygons, select the **Quick Test** option. For a full rendering, select **Ray Trace**.

Once you have adjusted the settings as desired, click **Render**. A window will open showing blue sky. A rotating dial will appear at the top of the window to indicate that the program is busy. There are also countdown numbers on the window's status line to indicate progress.

If you want to stop rendering before it is finished, you may either click the box to close the window, or choose **Stop rendering** from the Render menu.

When the picture is completely rendered, you may save it if desired. First make sure the picture window is selected. Then choose **Save** or **Save As** from the File menu. (If either the Map or Camera View window is selected, then **Save** and **Save As** will save the landscape and settings instead of the picture).

For more practice, you may wish to try changing some of the values in the Settings panels and view their effects on rendered images.
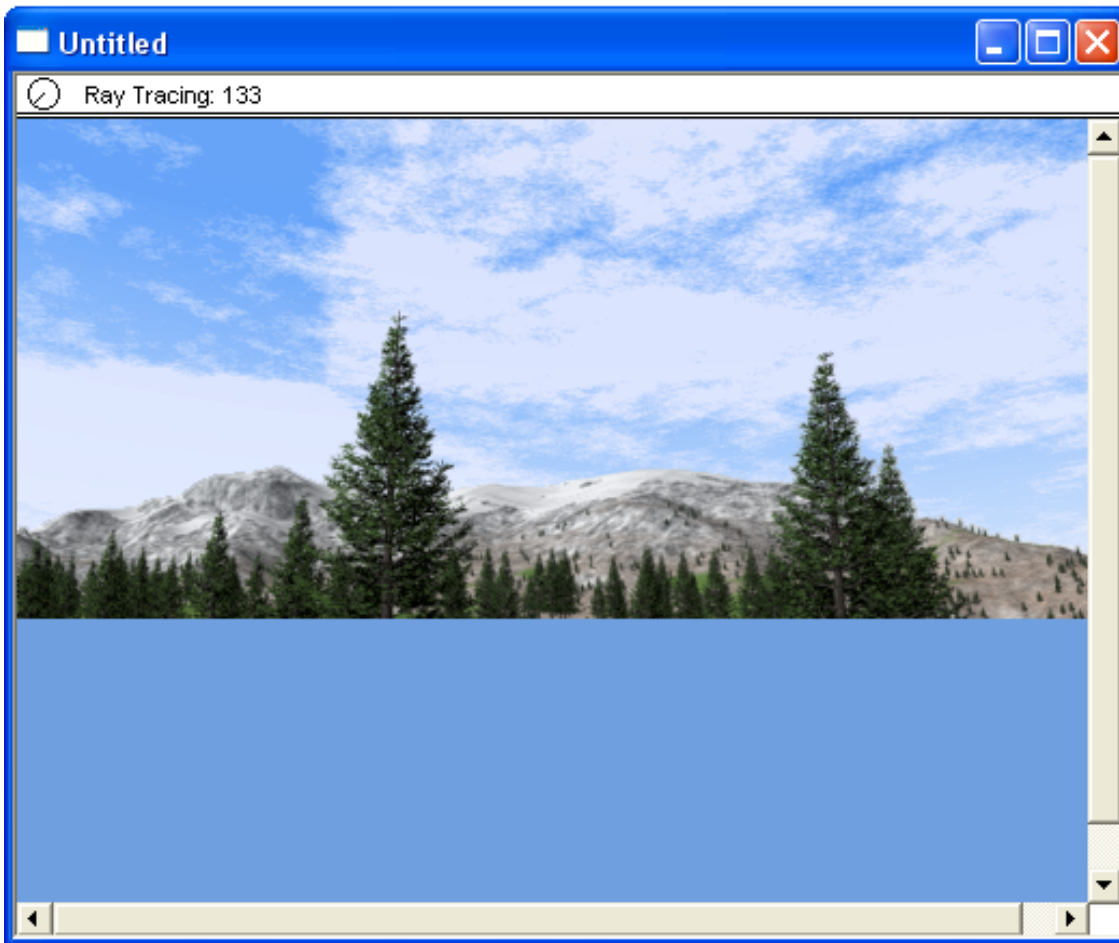
Rendering in progress

Tutorial: Using the Map and Camera Settings Panels

The previous tutorial showed you how to position the camera and adjust the view using only the Camera View window. You might have noticed that the lines in the Map window, which indicate the field of view, moved when changes were made in the Camera View window. The numeric fields in the Camera Settings panel are also updated to reflect the new camera coordinates.

You may use all three windows to view or modify the camera location and direction. This tutorial will give you practice in using the Map and Camera Settings panel.

If you do not currently have a landscape loaded, you will need to do so before proceeding. If this is the case, choose **Open Terrain CD/DVD-ROM** from the File menu. Select one of the terrain models and click the Open button.

After the terrain has loaded, click on the Map window title bar if it is not selected. Then select the **Location** tool by clicking its button on the Toolbar.
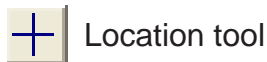
 Location tool

When you move the mouse pointer over the map, you will notice that the **East**, **North**, and **Elevation** values are constantly updated at the top of the window. The coordinates on the Map window's status line describe the location of the *pointer*, not the camera. The elevation of the land at the location under the pointer is also shown.

If the Settings panel is not visible, display it now by choosing **Settings** from the Windows menu. Then click the **Camera** tab.

Now try clicking anywhere on the map. The camera will instantly move to the new location, and the Camera View window will show the view from the new location. The **East** and **North** camera coordinates in the Camera Settings panel will be updated to reflect the new location of the camera. If you want to go back to the previous location, click the **Undo** button in the Toolbar.

 Undo button

You may wish to click the mouse in a few other locations to see what the landscape looks like.

 View Changing tool

Now we'll change the field of view. Select the **View Changing** tool. Press and hold the left mouse button while moving the mouse pointer. You will see the view field lines move. For telephoto lens selection, move the mouse pointer away from the camera while holding the mouse button down (the camera is located where the view field lines meet). To select a wider angle of view, move the mouse pointer closer to the camera. To change the view direction, move the mouse pointer around the camera. When you l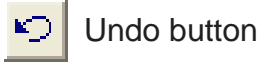et go of the mouse button, the program will update the Camera View window and the Camera Settings panel fields that changed.

Wide   Standard   Telephoto
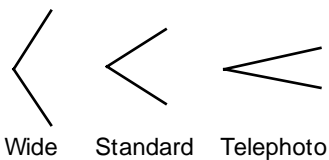
If you wish to change the view direction without changing the field of view, press and hold the **Shift** key before pressing the mouse button.

Now we'll see what happens when we enter a new value in the **East** field in the Camera Settings panel. First click in the **East** field to select it. Then enter a new value that is 500 meters greater than the current value. When you press **Enter**, the camera will move 500 meters to the east.

Now try entering a new value in the **Dir** field. Enter any number between 0 and 360 and press **Return**. The view direction will instantly change on the map and the view will be updated in the Camera View window.

You may wish to experiment with some of the other fields. Their function should be self explanatory from their field names, however for more information see the "Tools and Windows" chapter.
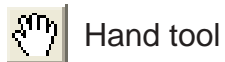
 Hand tool

Some terrain models may be larger than the displayed area of the Map window. If you want to view an area that is not displayed, select the **Hand** tool. Then press and hold the left mouse button while dragging the map to bring the desired area into view. If another tool is selected, you can temporarily switch to the **Hand** tool by pressing the **Space** bar. You may also move the map view by using the scroll bars, but they can move in only one direction at a time.

 Magnifier tool

To zoom in on an area of the map, select the **Magnifier** tool. (You can also press **Control + Space** to select it temporarily). Then drag a rectangle around the area of interest on the map, and it will be magnified to fill the window. You can continue zooming in this way until the magnification factor reaches 512X. To rapidly switch magnification levels, or if you are lost in the middle of a large landscape, select a magnification level from the pop-up menu at the upper left of the Map window. To switch one magnification level at a time, click in the "+" or "-" buttons, which are also at the bottom of the Map window.

 Lake tool

Now we'll create some lakes. First select the **Lake** tool. Next, click the mouse pointer anywhere over the map. You should see a lake fill the landscape at and below the point you click. You may create up to 64 lakes at a time in Natural Scene Designer Premium.

If you create a lake that you don't want, click the **Undo** button, or choose **Undo** from the Edit menu. However, a lake cannot always be undone if you perform another function after creating it. However, you can still choose **Remove Lakes** from the Terrain menu, but this will remove all lakes, not just the most recently created one

Sometimes, when changing the camera position, it may accidentally end up below the ground surface. The view in the Camera View window will look strange, with broken up polygons.

At other times the camera may be too high above the surface. Although you could correct either situation by entering a new value in the **Alt** (altitude) field, it is usually more convenient to click on the **Drop to Ground** button.

 Drop to ground tool

Clicking on this button instantly moves the camera to a location 10 meters above the ground surface. Try entering either a very large or very small number in the **Altitude** field of the Camera Settings panel (be sure to press **Return** when done), and then click on the **Drop to Ground** button and observe the result.

There are some other tools on the Toolbar that we haven't used yet. They will be described later.

Menus   4

This section describes the function of each Natural Scene Designer Premium menu. Some menus are summarized here and completely described in following chapters.

File Menu

File	
Create Fractal Terrain...	Ctrl+N
Open...	Ctrl+O
Open Terrain CD/DVD-ROM ...	Ctrl+M
1 CLSplashNSD7_Windows.nsd	
2 CLSplashNSD6_4.nsd	
Close	
Save	Ctrl+S
Save As...	
Import Grayscale DEM...	
Import USGS DEM...	
Import SDTS DEM...	
Import GTOPO 30 DEM...	
Import SRTM DEM ...	
Import TIFF DEM ...	
Import BIL DEM ...	
Import GridFloat DEM ...	
Import ASCII Grid DEM ...	
Import IMG DEM...	
Export 3D DEM...	
Export Grayscale DEM...	
Export USGS DEM...	
Export GridFloat DEM ...	
Export Ascii Grid DEM ...	
Page Setup...	
Print...	Ctrl+P
Exit	

Create Fractal Terrain — Brings up a dialog will let you set the parameters and create a fractal terrain. See the "Terrain Models and Settings" chapter for more information.

Open — Opens a previously saved Natural Scene Designer Project file or picture. If you wish to load multiple adjacent Natural Scene Designer Project files, press the **Shift** or **Command** keys in the Open File dialog.

Open Terrain CD/DVD-ROM — Lets you open terrain models by clicking on a large scale shaded relief map. The 3D Terrain Model CD-ROM or DVD-ROM (available separately) must be in your drive.

Open Recent — Displays a list of the most recently open files for quick access.

Close — Prompts you to save the current project (if necessary) and then closes the Map and Camera windows.

Save — Saves the project if either the Camera window or the Map window is selected. If a picture window is currently selected, the picture will be saved.

Save As — Same as above, except that you will be able to enter a name for the file to save.

Revert to Saved— Lets you reload the most recently saved version of the current project.

Import Grayscale DEM — Imports a picture and uses it to create a new terrain. The intensity of each pixel is evaluated to determine the height of each point. The highest intensity pixels become the highest points in the terrain, and the darker pixels become lower points. The imported picture may be grayscale or color.

Import USGS DEM — Imports a Digital Elevation Model (DEM) from the U.S. Geological Survey.

Import SDTS DEM — Imports a SDTS Terrain model from the U.S. Geological Survey.

Import GTOPO 30 DEM — Imports a GTOPO 30 Terrain Model from the U.S. Geological Survey.

Import SRTM DEM — Imports a SRTM (Shuttle Radar Topography Mission) HGT file. These DEMs were created by NASA in 2000 for most of the earth.

Import TIFF DEM — Imports a TIFF DEM. This is one of the DEM formats supported by the USGS National Elevation Dataset.

Import BIL DEM — Imports a BIL DEM from the National Elevation Dataset.

Import GridFloat DEM— Imports a GridFloat DEM from the National Elevation Dataset. These DEMs have the most precise elevation values.

Import Ascii Grid DEM— Imports an Ascii Grid DEM.

Import IMG DEM— Imports an IMG DEM. This is one of the DEM formats supported by the USGS National Elevation Dataset.

Export 3D DEM — Exports the current landscape as a QuickDraw 3D (3DMF), 3D Studio (3DS) or DXF file. You can choose the boundary of the area you want to export, and the sample spacing interval.

Export Grayscale DEM— Exports a grayscale picture of the current terrain. The highest elevations will become the lightest pixels, and the lowest elevations will be the darkest pixels. You can use this function to modify a terrain using an image editing program, and then import it back into Natural Scene Designer Premium using the **Import Grayscale DEM** function.

Export USGS DEM — Exports the currently loaded terrain as a USGS DEM file.

Export GridFloat DEM— Exports the currently loaded terrain as a GridFloat DEM.

Export Ascii Grid DEM— Exports the currently loaded terrain as an Ascii Grid DEM.

Page Setup — Brings up the standard printer page setup dialog box.

Print — Prints the contents of the currently selected picture window (if any).

Edit Menu

Edit	
Undo View Change	Ctrl+Z
Redo	Ctrl+A
Cut	Ctrl+X
Clear Selection	Ctrl+L
Preferences ...	

Undo — Restores the program to the way it was before you performed the most recent action. Moving the camera or changing the view direction can be undone. Changes to the camera path can be undone. If there is enough memory, terrain edits and lake placement can be undone.

Cut — If text is selected, it is saved to the clipboard and then the selection is deleted.
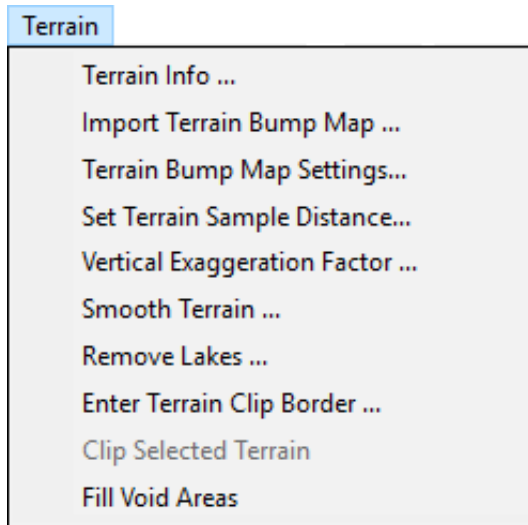
Copy — Makes a copy of the selected text and saves it in the clipboard.

Paste — Pastes the text in the clipboard into the currently active text field (if any).

Delete — Deletes the selected 3D object, overlay, or keyframe.

Clear Selection — Clears the clip rectangle or deselects the 3D object, overlay, or keyframe.

Terrain Menu

Terrain Info — Displays information about the current terrain.

Import Terrain Bump Map — Lets you import a terrain bump map and adjust its settings.

Terrain Bump Map Settings — Lets you adjust the settings for the terrain bump map.

Set Terrain Sample Distance — Displays a dialog where you can set the horizontal distance between terrain samples, or resample the terrain at a new interval.

Vertical Exaggeration Factor — Lets you change the vertical exaggeration factor of the terrain, which is set to 1 by default. Since the maximum allowed elevation in Natural Scene Designer Premium is 30000 meters, the scaling limits will be adjusted, if necessary, so that it does not exceed the maximum height.

You can optionally adjust the camera elevation, animation path (if any) and the elevations for terrain features and coloring. 3D objects and trees will automatically be moved vertically along with the terrain.

Smooth Terrain — Averages the elevation values to simulate the natural process of erosion. This function may be applied repeatedly until the desired effect is achieved.

Remove Lakes — Removes all lakes from the terrain.

Enter Terrain Clip Border — Lets you enter the coordinates of the terrain area you wish to be clipped. After entering the coordinates, you will still have a chance to drag the clip edges on the map.

Clip Selected Terrain — Removes all terrain outside the selected clip border.

Fill Void Areas— Fills areas with no terrain (shown on the map window as black). This function uses neighboring elevations to approximate the elevations in the void area.

Objects Menu

Objects

Import 3D Object...	
Create Tree...	Ctrl+Y
Create Bush...	
Create Rock...	
Create Sphere	
Create Block	
Create Cone	
Create Cylinder	
Properties...	Ctrl+J
Make Master	
✓ Show Object	Ctrl+F
Show As Box	Ctrl+B
Save View	Ctrl+G
Restore View...	Ctrl+H
Top View	Ctrl+1
Front View	Ctrl+2
Side View	Ctrl+3
Delete Object	
Delete Master	
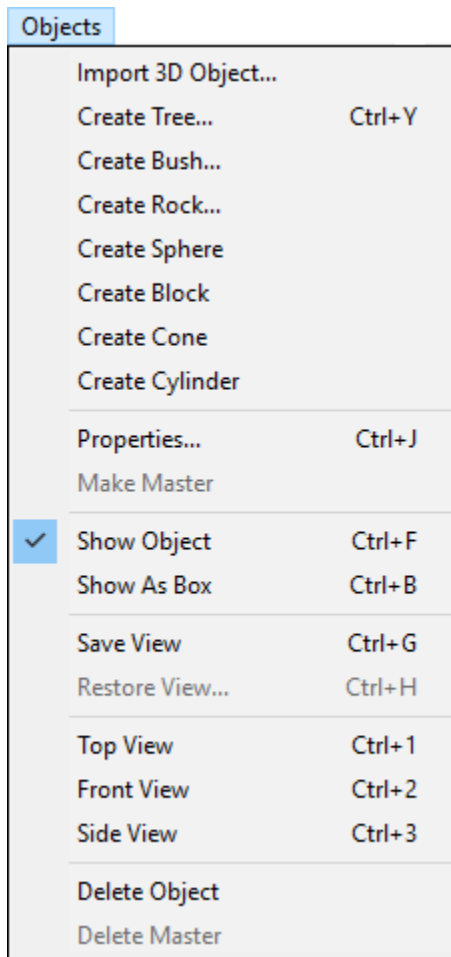
Import 3D Object — Imports a 3D object that can be placed anywhere in the scene. The program imports 3D Studio (3DS) and QuickDraw 3D (3DMF) objects. After the 3D object is imported, a small image will be added to the collection in the Objects window. Then when the small image is selected (indicated by a red frame around its border), you can place the object in the scene by clicking the mouse pointer in the Camera or Map windows.

If an object contains a texture map, it will be included in ray traced renderings and the Camera window if OpenGL is installed. However, the object will be shown in a solid color in the Object window.

Create Tree — Displays the Tree dialog. You can select the tree type — **Oak**, **Palm**, **Redwood**, or **Sweet Gum**. Changing the **Seed** yields a new tree with a unique trunk and branch structure. The leaf color, bark color, and the amount of leaf coverage are adjustable.

Create Bush — Displays the Bush dialog. You can adjust the settings and create a bush.

Create Rock — Displays the Rock dialog. You can adjust the settings and create a rock.

Create Sphere— Creates a sphere and places it in the Objects window.

Create Block— Creates a block and places it in the Objects window.

Create Cone— Creates a cone and places it in the Objects window.

Create Cylinder— Creates a cylinder and places it in the Objects window.

Properties — If an object is selected, this dialog lets you edit its properties. It contains numeric fields for the location, motion, and size. You can adjust the surface properties too. If a tree is selected, the Tree dialog is shown instead, where you can change the tree parameters.

Make Master — If an object is selected, this function creates a small image of it, and adds it to the collection in the Objects window. Once there, it is available for placing additional copies.

This function is useful when you import an object, modify it, and then wish to place additional copies without having to reapply the modifications for every copy.

Show Object / Show as Box — You can choose how you want to display the selected object in the Camera window. Complex objects with thousands of polygons can be manipulated much more quickly when they are shown as a box.

Save View — Remembers the current camera location, lens, direction, bank, and pitch.

Restore View — Restores the camera view with the previous settings.

Top View — If an object is selected, this function moves the camera to a preset position above the object.

Front View — Moves the camera to view the selected object from the front.

Side View — Moves the camera to view the selected object from the side.

Delete Object — If an object is selected in the Camera View or Map, it is deleted.

Delete Master— If an object master is selected in the Objects window, it is deleted. If the object has been placed in the scene a warning will be displayed, and you can choose to cancel or proceed with the deletion.

Overlays Menu

Overlays
- Import Image and Scale to Fit ...
- Import DRG or DOQ...
- Export Selected Overlay ...

- Projection Properties ...
- Overlay Properties ...
- Save Merged ...

- Move to Top
- Move Up
- Move Down
- Move to Bottom
- Delete Overlay
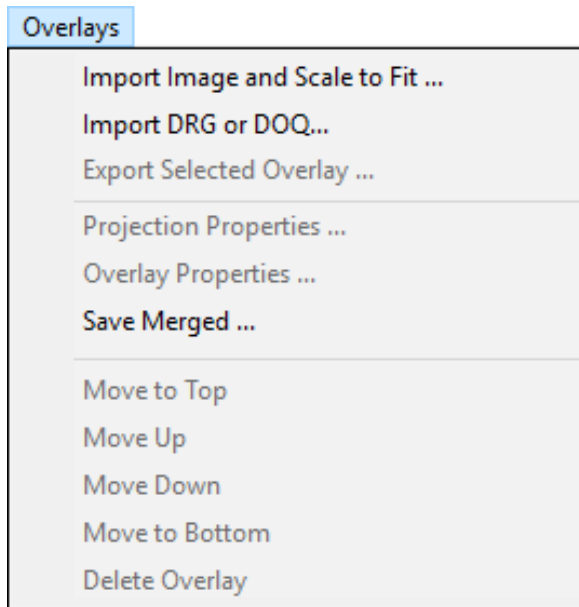
Import Image and Scale to Fit — Imports a picture and drapes it over the terrain. This function stretches the image in both dimensions to fit the terrain. So to avoid distortion, the aspect ratio of the image should match the terrain. The program will match the top of the overlay with the northern edge of the terrain, and the left edge of the overlay matches the western edge of the terrain. After importing, you can adjust the overlay image size and position using its handles in the map window.

Import DRG or DOQ — Imports a USGS DRG or DOQ and drapes it over the terrain. DRGs (Digital Raster Graphics) are digitized topographic maps. DOQs (Digital Orthophoto Quadrangles) are aerial photographs. These images typically have borders (collars) which can be removed by this function.

Export Selected Overlay — Exports the selected overaly as either a bitmap or shapefile (as appropriate).

Georeference Image— Guides you through the steps of georeferencing a bitmap image.

Projection Properties — Displays a dialog showing the current image's projection, datum, and other parameters.

Overlay Properties — Shows information about the selected overlay. This includes its borders, a small image of it, and overlay transparency settings.

Save Merged — This function is available if multiple terrain overlays are loaded. It allows you to combine them and save them as a picture. Among other possible uses, its also a good way to automatically combine adjacent topographic maps.

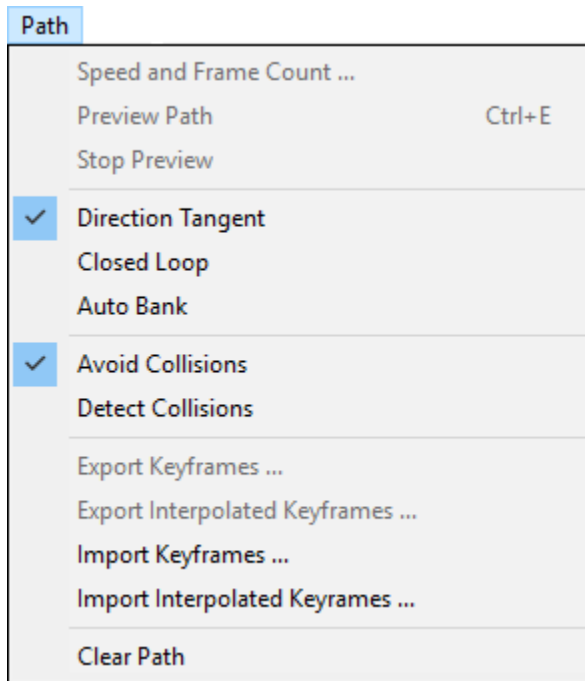**Move to Top** — Places the selected overlay above all others.

Move Up — Places the selected overlay higher up in the stacking order.

Move Down —Moves the selected overlay lower down in the stacking order.

Move to Bottom — Places the selected overlay below all others.

Delete Overlay — Deletes the overlay and releases its memory.

Path Menu

Speed and Frame Count — Displays a dialog where you can enter the camera speed and animation frame count.

Preview Path — This function is available if a terrain model is loaded and a camera path is defined. It will play a preview of the animation in the Camera window. Also, the Map window will show the camera location and field of view as it moves along the camera path.

Stop Preview — Stops previewing the animation.

Direction tangent — Sets the camera direction tangent to the direction of travel for all animation frames. For example, it's like mounting the simulated camera to the front end of an airplane, pointing forward.

Closed loop — Selecting this option will allow you to create a closed loop camera path. You must have at least three key frames before the loop can be closed.

Auto bank — If you want the camera to automatically bank (like an airplane) when it goes around curves, select this option. This works only if the Direction Tangent option is on, and the path contains curves.

Avoid collisions — Activates the collision detector to automatically reposition the camera above ground when the camera path goes underground.

Detect collisions — Activates the collision detector to warn you when the camera path goes underground. Before the program begins rendering the animation, it will stop and give you a chance to correct the problem or ignore the warning.

Export keyframes - Keyframes are the control points that you place on the map. This function creates a text file describing the camera position and direction for each keyframe

Export interpolated frames - The actual number of interpolated frames is usually much higher than the number of keyframes. They are interpolated based on the keyframe locations and the camera speed. This function creates a text file describing the camera position and view direction for each interpolated frame

Import Keyframes - This function expects a text file describing the camera position and direction for each keyframe. Then it shows the imported path on the map.

Import Interpolated Frames - This function expects a text file describing the camera position and direction for each interpolated animation frame.

Clear path — This erases all the key frames.

Render Menu
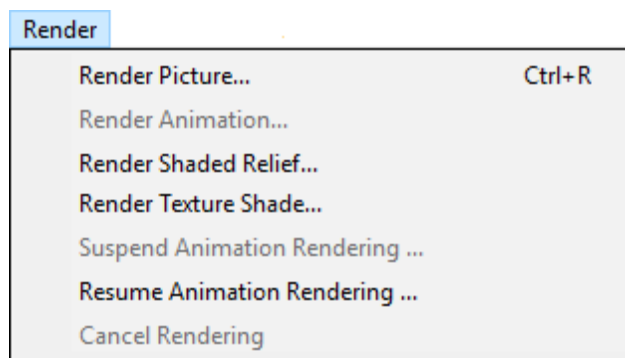
Render Picture — Displays the Render Picture dialog to adjust the rendering settings. Then it opens a window and renders the picture.

Render Animation — Renders an animation of the camera traveling along the defined path. First, a dialog will appear for you to choose the location to save the animation file. Next, it brings up a dialog box to set the resolution, compression, and frame range. Finally, it opens a progress display window and renders the animation, showing a view of each animation frame and estimated remaining rendering time.

Render Shaded Relief — Brings up a dialog that lets you adjust the colors and altitude ranges. Then it renders a shaded relief map of the current terrain.

Render Texture Shade— Creates a texture shaded map.

Suspend Animation Rendering — If an animation is in progress, this function suspends rendering. You can resume rendering later.

Resume Animation Rendering — Resumes an animation that was suspended. The program prompts you to locate the partially completed animation.

Cancel Rendering — Stops rendering the picture or animation currently in progress. Do not use this function if you think you might want to resume it later.

Windows Menu
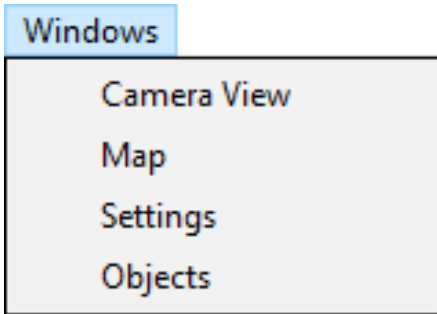
Camera View — This function activates the Camera window and puts it in front of the other windows.

Map — This function activates the Map window and puts it in front of the other windows.

Settings — This function brings the Settings panel to the front and makes it the active window.

Objects — Shows or hides the 3D objects window.

Terrain Models and Settings   5

Natural Scene Designer Premium supports several types of terrain models. They include grayscale, USGS DEMs (7.5 minute and 1 degree), SDTS (Spatial Data Transfer Standard 10 and 30 meter), GTOPO 30, SRTM, TIFF, BIL, GridFloat, Ascii Grid, IMG, a user friendly text format (described in this chapter), and its own proprietary project file format optimized for use in Natural Scene Designer Premium.

Natural Scene Designer Premium Terrain Models

The program CD-ROM contains nearly 1000 7.5 minute (30 meter) terrain models covering a portion of California and Nevada. The CD-ROM also has a large scale shaded relief map, which makes it is very convenient for loading terrain models – you just click or drag select on the area you want to load.

Adjacent 7.5 minute terrain models are automatically combined if you drag select more than one.

7.5 minute terrain models are grouped into "UTM zones", which are spaced 6 degrees apart in longitude. Since each UTM zone uses its own reference point, and the fact that the earth is spherical, the terrain models in one UTM zone do not match up with those in an adjacent zone without special processing.

A very advanced feature of Natural Scene Designer Premium is its ability to automatically transform and combine terrain model groups that span across a UTM zone. This feature is completely transparent, so you do not have to concern yourself with UTM zone boundaries.

Each 7.5 minute terrain model requires about 1 megabyte of memory to load and render. For fastest rendering it is best to limit the number of terrain models to the minimum number needed.

Additional CD-ROMs and DVD-ROMs covering most of the world (and Mars too!) are currently available separately from Natural Graphics. Please check our website at http://www.naturalgfx.com for the most current product information.

Opening Terrain Models from 3D Terrain Model Discs

To access the terrain loading screen, first make sure that either the Program CD-ROM or one of the additional coverage CD/DVD-ROMs (available separately) is in your drive. Then click on the **Open Terrain CD/DVD-ROM** button and you will see a new screen with a shaded relief map.

 The Open Terrain CD/DVD-ROM button
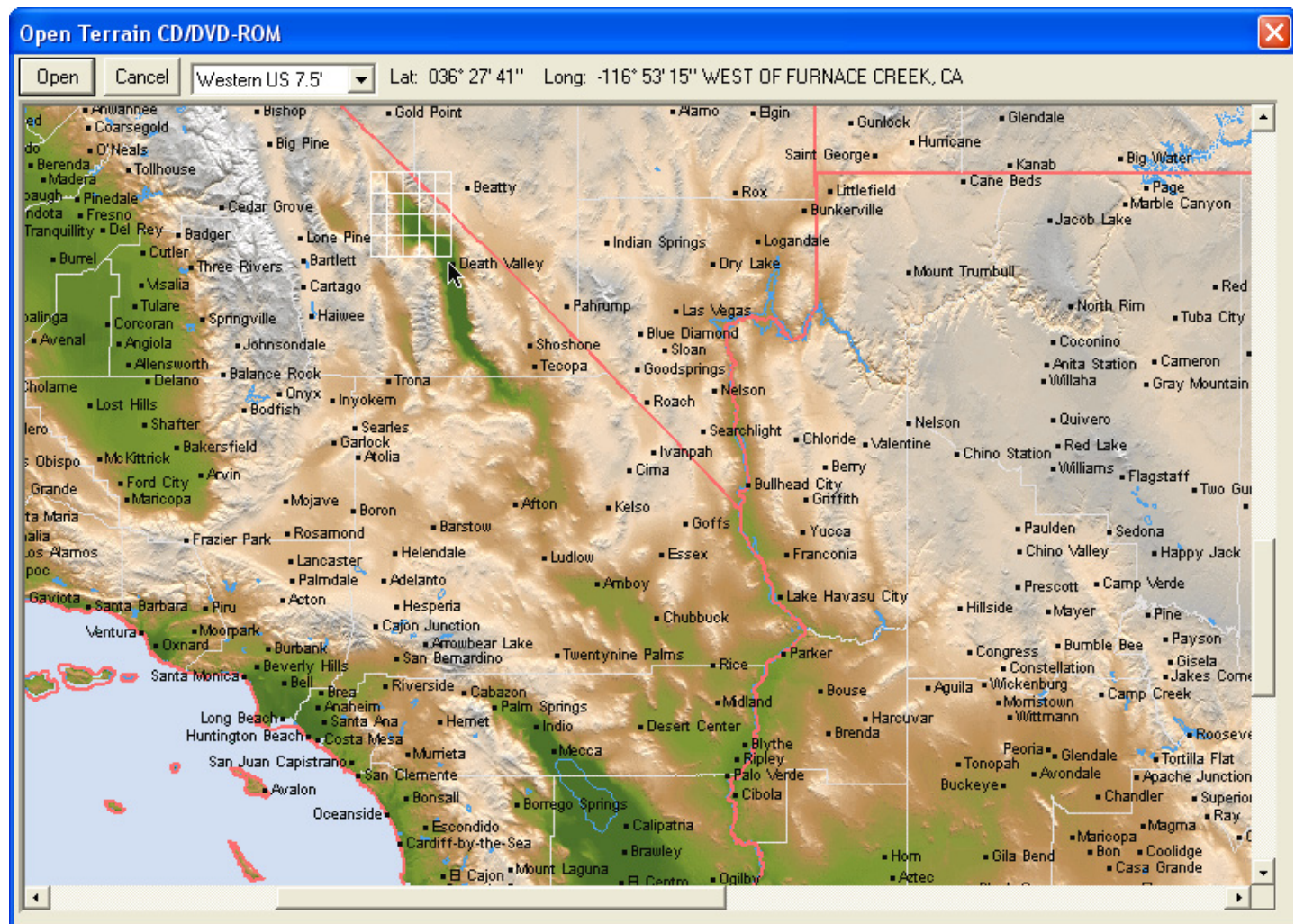
Some DVD-ROMs contain multiple coverage areas. If so, the program will display a pop-up menu for you to choose which one you want.

The selected area is shown with white outlined boxes. Each box is a 7.5 minute terrain model.
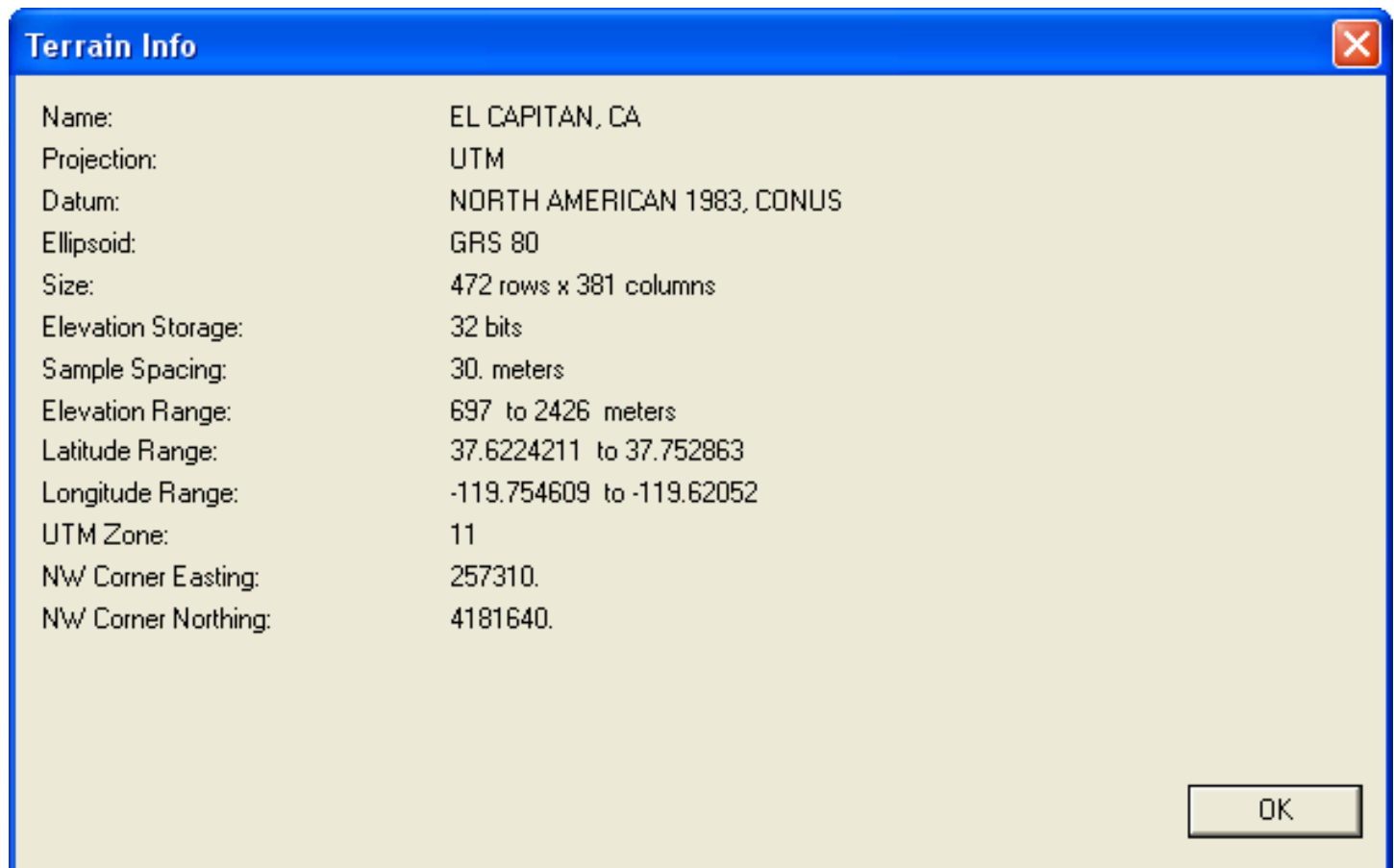
When you run the mouse pointer over the map, the top area of the map displays the name of the 7.5 minute map and the latitude and longitude at the current pointer location. If you want only one 7.5 minute terrain model, just click on the map at the desired location. For more than one, drag-select a rectangular area.

After you have selected the terrain model(s) to load, click **Open**. The program will return to the main screen and load the terrain models.

The terrain models included on the program CD-ROM are a small sample of what is available separately. Please visit our web site at "http://www.naturalgfx.com" for more information.

Terrain Information Dialog

Choose **Terrain Info** from the Terrain menu to view information about the current terrain.

```
Terrain Info                                                      X

  Name:                    EL CAPITAN, CA
  Projection:              UTM
  Datum:                   NORTH AMERICAN 1983, CONUS
  Ellipsoid:               GRS 80
  Size:                    472 rows x 381 columns
  Elevation Storage:       32 bits
  Sample Spacing:          30. meters
  Elevation Range:         697  to 2426  meters
  Latitude Range:          37.6224211  to 37.752863
  Longitude Range:         -119.754609  to -119.62052
  UTM Zone:                11
  NW Corner Easting:       257310.
  NW Corner Northing:      4181640.



                                                          OK
```

The information presented in this dialog should be self-explanatory. Note that the format of the information will differ from the example above if the terrain does not have UTM projection.

find all the information it needs.

Importing Grayscale Pictures as DEMs

Natural Scene Designer Premium can import a grayscale picture and convert it to a DEM. Each pixel is interpreted as an elevation. The darkest pixels are the lowest elevations, and the lightest pixels are the highest elevations.

If you import a color picture as a DEM, the red, green, and blue components of each pixel are averaged to determine the elevation.

Importing Ascii Grid DEMs

Ascii Grid DEMs are simple and editable with any text editor. They contain a 6 line header followed by the elevation values. It is not a very efficient DEM format because the files are often very large and it takes longer to load them than binary files.

Combining Adjacent Imported DEMs

Multiple DEMs that are geographically adjacent may be combined. Natural Scene Designer Premium automatically detects when you import or open a DEM that is geographically adjacent to the current one. If so, a dialog box will appear and you will be given a choice to either combine the two, or just load the new DEM (replacing the current one).

Note that if, for example, you want to combine three horizonatally adjacent DEMs, you cannot load the middle one last. There can never be a gap between them. Also, the DEMs must all have the same sample spacing, map projection, and map datum.

Combining large numbers of DEMs this way can be tedious. With the Terrain CD/DVD-ROMs that are sold separately you can quickly and easily combine hundreds of adjacent DEMs by drag selecting them on a map.

DEM Clipping

You can clip out a rectangular area from a larger DEM by selecting the clipping tool.

To use this tool, drag a rectangle on the map over the area you want to keep. The dimensions of the selected area are shown at the top of the map. When you let go of the left mouse button, the program will display dragging handles if you wish to adjust the area. When you are ready to remove the terrain outside the border, choose **Clip Selected Terrain** from the Terrain menu. If you don't want to clip the terrain, choose **Clear Selection** from the Edit menu.

To constrain the selected area to a square, hold the **Shift** key down before you start your selection.

Creating Fractal Terrains

Natural Scene Designer Premium has a built-in fractal terrain generator that can create millions of random landscapes. Benoit B. Mandelbrot coined the term *fractal,* which refers to objects that are self similar at different scales. The shape of many natural objects, including land, trees, clouds, coastlines, and plants may be described using fractals. Natural Scene Designer Premium lets you quickly and easily create fractal landscapes, without requiring familiarity with fractal mathematics.
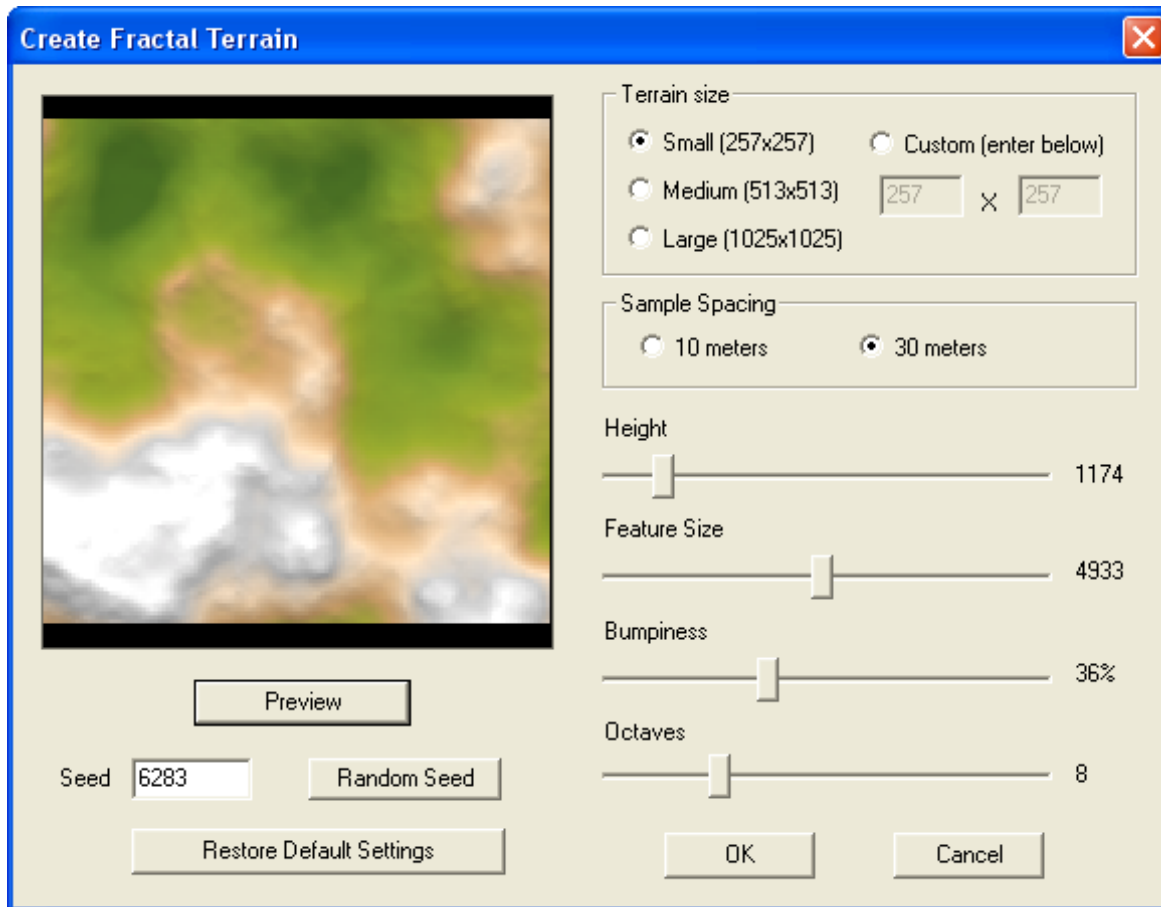
To create a fractal landscape, choose **Create Fractal Terrain** from the File menu. This will display the dialog box shown above. Many parameters are adjustable, and you can quickly get a preview of the terrain to be generated.

Terrain Size - This lets you set the number of rows and columns.

Sample Spacing - You have a choice of 10 or 30 meter sample spacing. If you choose 10 meters, the terrain will have more detail than it would with 30 meters. However, for a given size area a 10 meter sample spacing uses 9X as much memory as a 30 meter sample spacing.

Height Slider - This controls the maximum height of mountains in the terrain.

Feature Size Slider - This controls the average size (in meters) of terrain features, such as valleys and mountains.

Bumpiness Slider - This controls the amount of small bumps in the terrain.

Octaves Slider - This controls the level of detail in the terrain. When set to a value less than 8 you will notice the terrain is simpler and smoother.

Seed - Each "seed" produces a unique terrain. There is no obvious relationship between the value of the seed and the shape of the landscape that will result. However, the same seed will always produce the same landscape. You can change the seed number and click **Preview** until you see a terrain you like.

Note that both the Height and Feature Size affect the resulting steepness of the terrain. Large values will yield tall, steep mountains. Lesser values will yield gentle rolling terrain. The height value can range from 0 to 30000.

Creating Terrain Models

This is for users who would like to create their own terrain models. The format described here is very simple. It will enable you to create terrain models that will load into this program. The file must be pure ASCII text (not binary data). Fields may be delimited by spaces, tabs, or a new line. Include the following in the file:

"NSDF" (four characters, all uppercase).
The number of rows.
The number of columns.
The distance between elevation samples.
The elevation samples. (The number of samples must equal the product of the rows times the columns and all elevation values must be integers between 0 and 9999.

The first elevation sample represents the northwest corner of the landscape. The next value represents the location to the east of the previous one. And so it goes, until you get to the end of the row. Then you start the next row, which is south of the previous row.
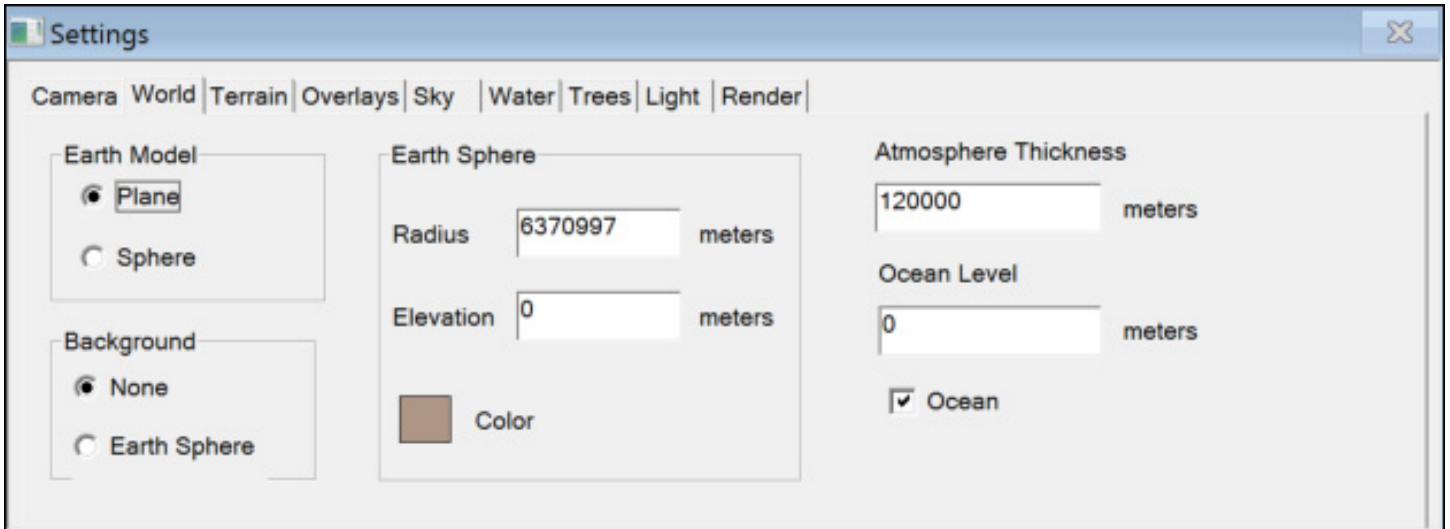
Example text file:
NSDF

```
4
5
30
10 10 10 10 10
10 20 20 20 10
10 20 30 20 10
10 10 10 10 10
```

Choose **Open** from the file menu to load the file into Natural Scene Designer Premium.

World Settings

The World Settings panel allows you to specify whether to use a planar or spherical earth model. For small and medium areas, selecting 'Plane' is usually best. Its the fastest option of the two.

If you are viewing a very large area from a high altitude and want to have the earth's curvature visible along the horizon, select 'Sphere'. Scenes render more slowly in this mode.

For the background, your choices are a sphere or nothing (as feared by ancient sailors!). If you choose "Earth Sphere" you can set the radius, or use the default value of 6370997 meters, which is the actual radius of the Earth. You can also set the color of the sphere. The sphere elevation is its distance above sea level.

The Ocean Level and check box in this dialog are the same settings as in the "Water" dialog. They are duplicated here for your convenience.

A field for entering the Atmosphere thickness (in meters) is available.

Note: The program uses the Atmosphere thickness value only when the earth model is set to 'Sphere' and the camera is above the atmosphere (such as when you are rendering an image of the entire globe).

Terrain Settings
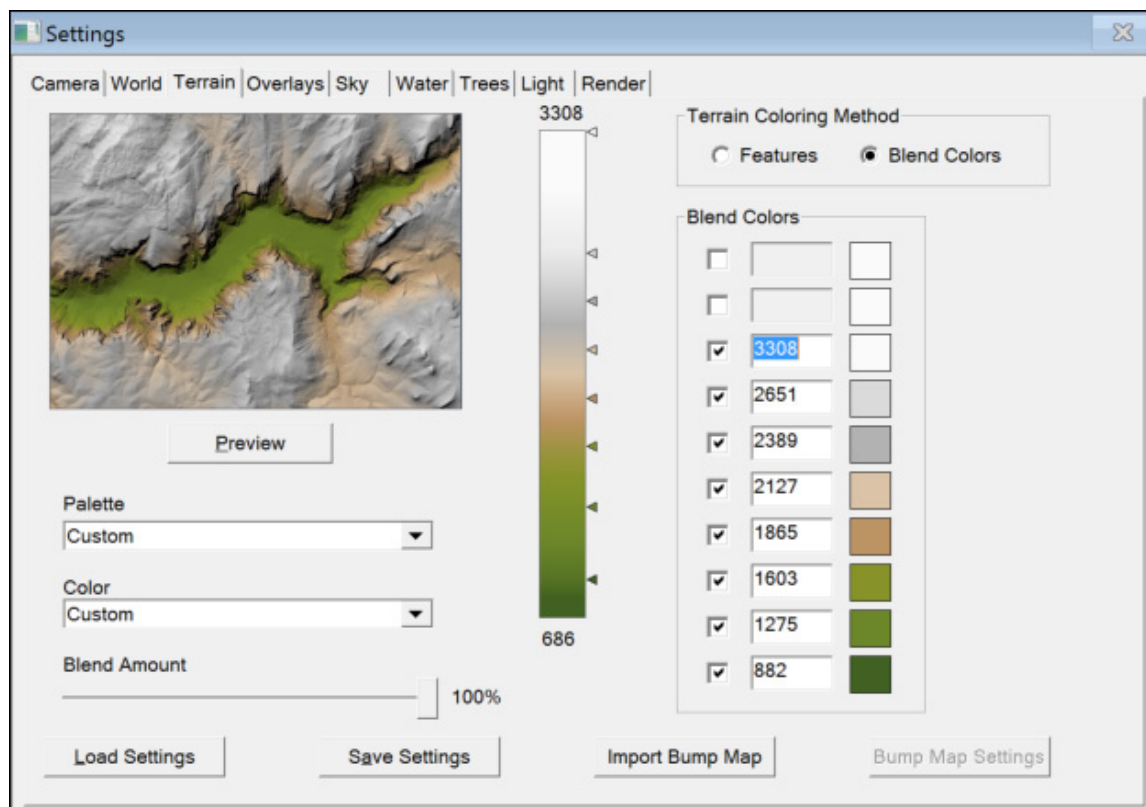
The Terrain Settings panel has a preview window and a choice of two terrain coloring methods. You can choose to have the terrain colors blended according to the elevation. Or you can have the terrain features colored according to slope, elevation, and fractal texturing. This choice is made using the radio buttons in the "Terrain Coloring Method" box.

When using colors blended according to elevation, you can set the "Blend Amount" slider. Transitions from one color to another can be abrubt (0% blending), or very gradual (100% blending). For convenience, there is a popup menu with some preset color combinations, and another popup for setting the color distribution. You can use the color sliders, numeric fields, or color distribution menu to adjust the color break elevations.

When using terrain features coloring method, part of the dialog changes as shown in the illustration at right. The Palette, Color Distribution, and Blend Amount are not available in this mode.

Click on a color square to change a feature's color. To the right of each selection box, except **Soil**, is a numeric entry field. This is where you enter the elevation for that feature. For **Snow** and **Rock** it is the desired approximate minimum elevation. It is the maximum elevation for **Grass**. **Soil** is a special case; it appears by default at locations where snow, rock, and grass are absent.

If you have chosen to use the "Feature" coloring method in the Terrain Settings dialog, you can click on the Snow, Rock, Grass, and Soil buttons. This brings up the "Terrain Texture" dialog for that
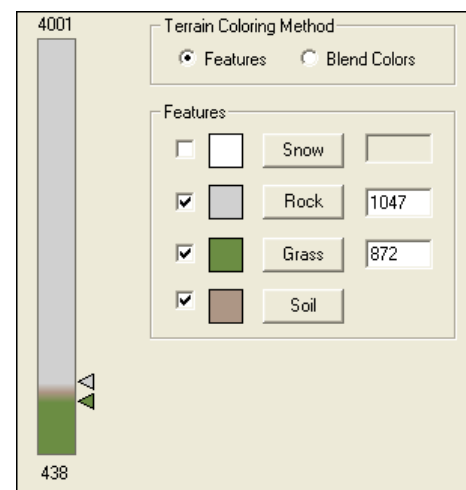
feature, as shown below. Soil and Grass have a choice of two texture types -- Fractal or Texture map. Rock and Snow only use a fractal texture.
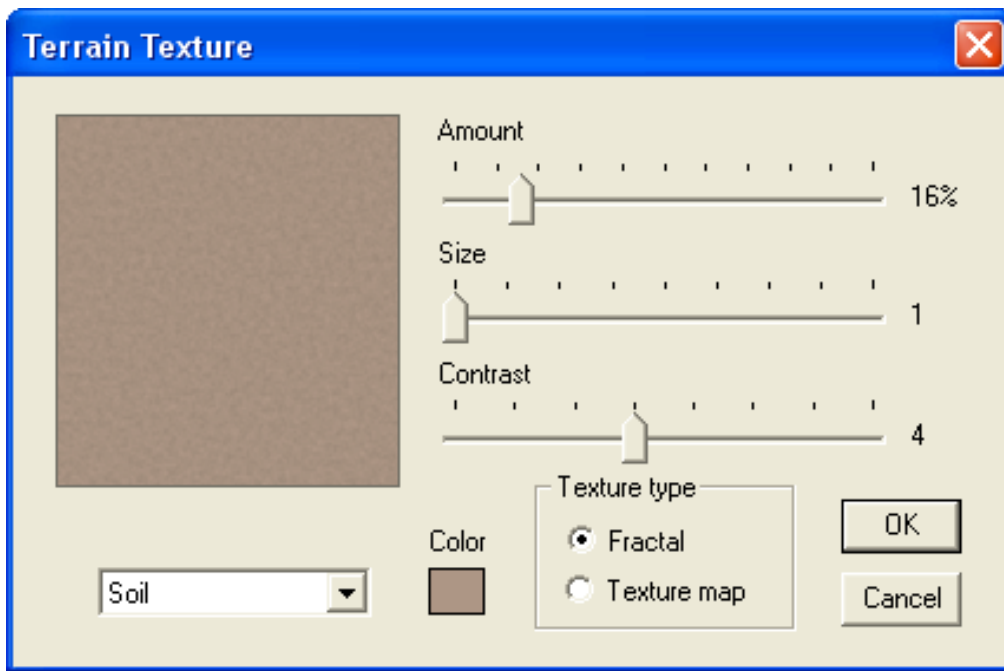

If you choose "Fractal" you can adjust the texture **Amount**, **Size**, **Contrast**, and **Color** settings as desired. With the immediate feedback in the preview square, you can readily learn the effect of each adjustment.

If you select "Texture map", the program uses a built-in photo texture map and no parameters are adjustable.

Bump Mapping

Bump maps can be used to add detail to the terrain to make it look more realistic. The program interpretes the grayscale value (or brightness) of pixels in the bump map to simulate small displacements.

To import a bump map, choose **ImportTerrain Bump Map** from theTerrain menu. After selecting the file to open, click **Create new bump map** in the Import Bump Map dialog. You also have other options, such as tiling the bump map, georeferencing it, or adding it to an existing bump map (if already present). After choosing the options you want, click **Create new bump map** (or **Add to existing bump map**). Then you will see the dialog shown below.
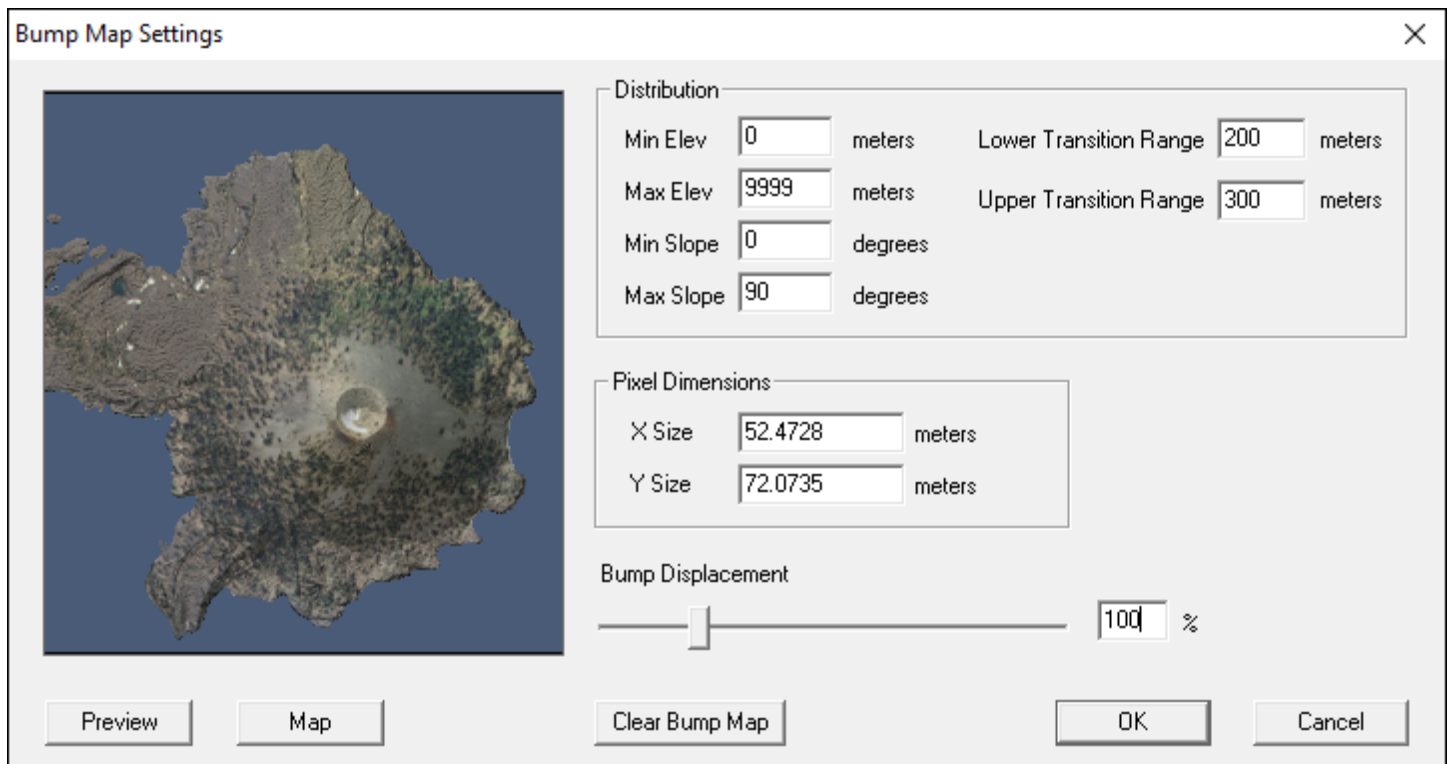
Click **Preview** or **Map** to see what the bump map looks looks like applied to the terrain.

You can set the minimum and maximum elevations of where you want the program to apply the bump map. To avoid a harsh transition where the bump map starts and ends, you can specify the transition range (in vertical meters) for the bump map to be phased in and out. You can also specify the range of the slope (in degrees) where you want to use it. The transition

The **Bump Displacement** field sets the vertical magnitude of the bumps. This may require experimentation to get the amount you want.

To be effective, bump map images should have a much higher resolution than the terrain. You can use random grayscale textures as bump maps. Another good choice are DOQs or high resolution satellite imagery. If you use a color image as a bump map, the program will calculate the brightness of each pixel to determine the bump displacement. However, to conserve RAM it's better to convert the bump map to grayscale first.

Vertical Exaggeration

To emphasize vertical features, or to bring out detail from relatively flat terrain models, you can use the vertical exaggeration setting. A value of less than 1 will flatten the terrain, and a value greater than 1 will make it steeper. Note that changing this setting does not alter the stored terrain, so you can change the vertical exaggeration an unlimited number of times without loss of vertical precision.
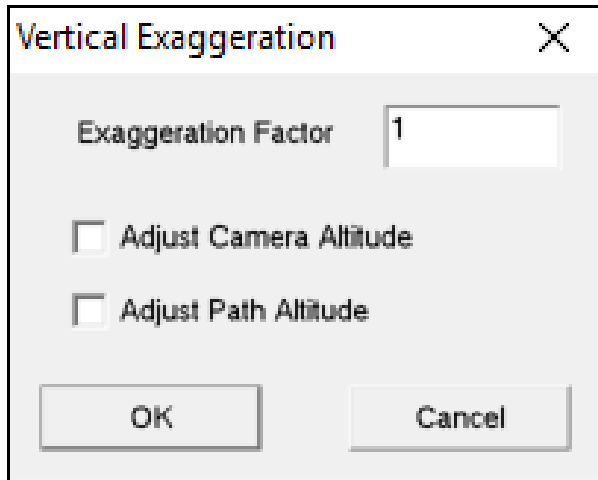
You may also choose to adjust the camera and path altitudes to correspond with the change in vertical exaggeration.

Bitmap Terrain Overlays and DRGs

Terrain overlay pictures, GeoTIFFs and DRGs may be imported into Natural Scene Designer Premium and draped over the terrain, replacing the program generated texture that is created by default. The program supports multiple overlays with full control over position and layering order. A Mars terrain with a matching overlay, courtesy of NASA's JPL, is included with this program.

To load a terrain overlay, select either **Import Image and Scale to Fit**, **Import DRG or DOQ**, or **Import Georeferenced Image** from the Overlays menu, depending on the type of overlay. You may also select **Use Displayed Image as Overlay** if an image is currently loaded in the Picture window. These functions process overlays differently, as explained in the next sections.

Import Image and Scale to Fit

This function simply takes an image and spreads it to the edges of the terrain. To avoid distortion, the aspect ratio of the picture should match the terrain. The program will match the top of the overlay with the northern edge of the terrain, and the left edge of the overlay matches the western edge of the terrain. After importing, you can adjust the overlay size and position using its handles in the map window.

Import DRG or DOQ

To use this function, a GeoTIFF picture with embedded alignment information or an accompanying ".tfw" file is required. It must be in the "UTM" or "California Albers" projection, otherwise you will need to use the **Import Georeferenced Image** function described later, which lets you georeference and reproject an image before overlaying it onto the terrain.
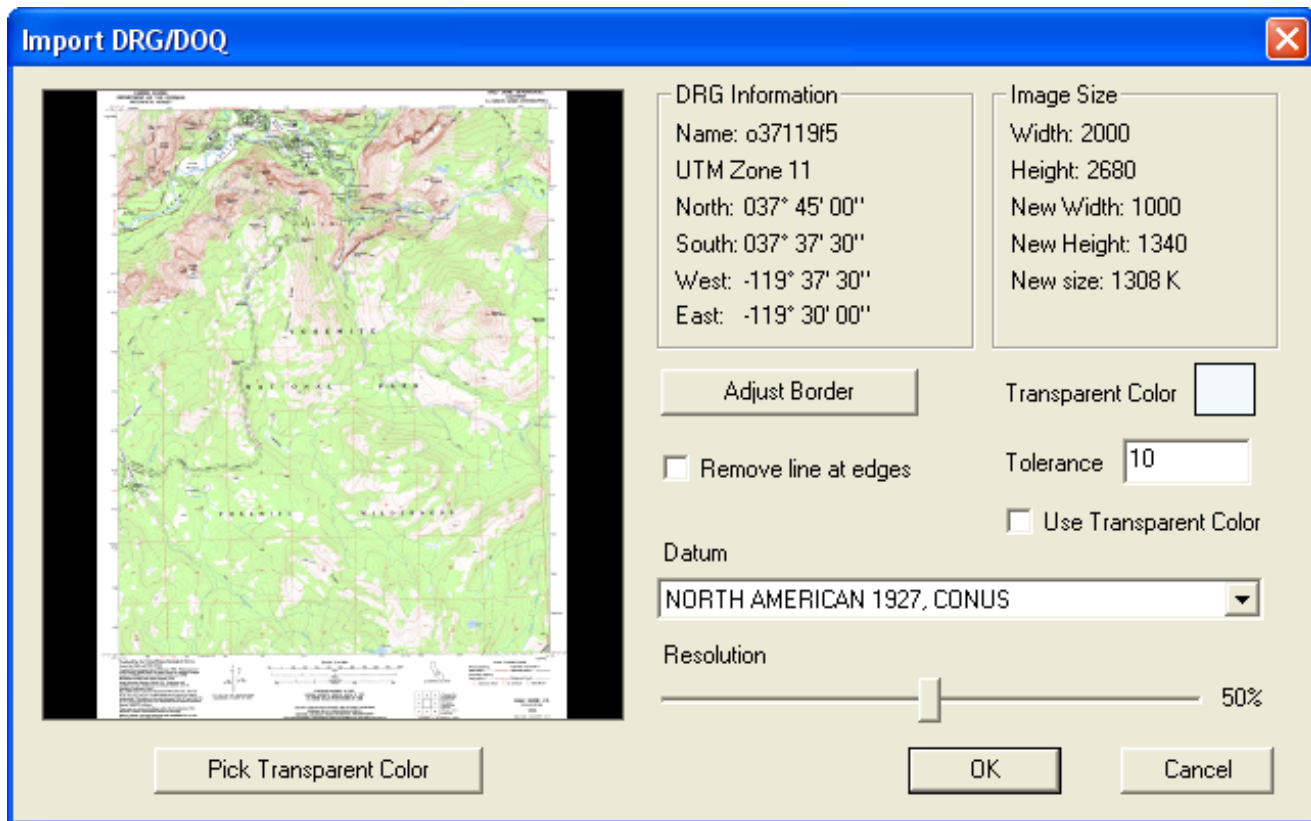
Import DRG or DOQ automatically aligns the picture to the current terrain if they overlap in coverage. Once you have selected the file to load, a dialog will be shown. It contains information about the DRG, including the lat/long range of coverage and the UTM zone.

Some DRGs cover an area that is shifted from its expected area of coverage, which is derived from its alignment information If Natural Scene Designer Premium detects a coverage shift, it will scan the DRG image and search for the thin black line surrounding the map coverage area. The coverage lat/long as determined by the program is shown in the DRG dialog. If it is incorrect (which might happen if the border is ambiguous) you can click the "Adjust Border" button and manually enter the correct lat/long boundary. Note that this does not affect where the DRG is centered on the terrain, it only changes the section of the map white border that will be clipped off.

The Import DRG dialog lets you adjust the resolution of the DRG, which is set to 50% by default. The dialog shows the resulting image size in pixels and memory usage.

If the DRG does not match the projection and datum of the current terrain, this function will automatically convert the DRG to match it.

In some cases, you might want to set the **Remove line at edges** checkbox, especially if you combine adjacent images.

To mask out unwanted areas of an overlay, you can define a color to be transparent. These transparent areas, when rendered, will either show the underlying terrain or the overlay below it in the stacking order (if any).

There are two ways to define a transparent color. You can either click the color box and enter it manually, or click "Pick Transparent Color" and use the tool to choose the color in the overlay preview. You can also specify a color tolerance so that similar colors will also be considered transparent.

Import Georeferenced Image

This is the most versatile image overlaying function. If necessary, it will handle images that have not been georeferenced. Then if the projections don't match it will reproject the image to match the terrain's projection. Finally it will drape it over the terrain. If you already have loaded a georeferenced image that matches the projection and datum of the current terrain, then choose **Use Displayed Image as Overlay** instead of this function.

After loading an overlay it will be shown in both the Map and Camera windows. You can reposition the overlay by selecting it using the **Arrow** tool and dragging the red overlay handles on the Map window. This should not be necessary with DRGs. They are locked to prevent accidental movement. To unlock an overlay or numerically adjust its position, use the **Overlay Properties** function.

If you have loaded adjacent overlays, you can combine and save them as a picture using the **Save Merged** function. It's useful for automatically combining adjacent overlays, such as topographic maps.

Other functions in the **Overlays** menu let you delete an overlay or adjust its vertical stacking order, if multiple overlays are loaded.
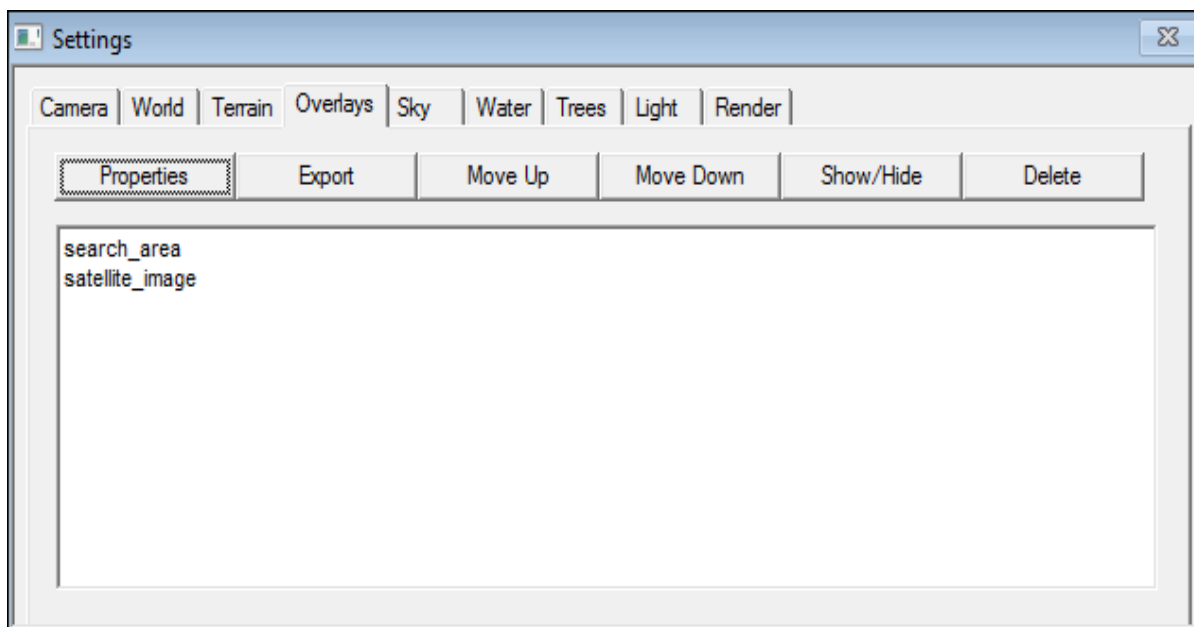
Importing Shape Files

Choose **Import Shapefile** from the Overlays menu to bring up the Shape Settings dialog box.
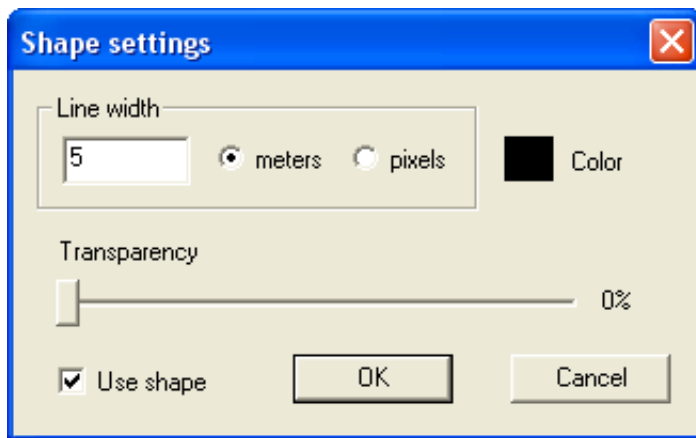
You can adjust the line width, color, and transparency. If the shape is filled, you will also be able to adjust the fill color.

Overlays Panel

The Overlays panel lists all loaded overlays.

Select an overlay or shape by clicking on its name. It will be highlighted. Then you can move it up or down in the list using the **Move Up** and **Move Down** buttons. You can toggle it between shown and hidden with the **Show/Hide** button. Hidden items are indicated by light gray text. The **Properties** button brings up the items Properties settings. Use the **Export** button if you wish to save the overlay as a bitmap or shapefile, as appropriate. And the **Delete** button removes the item from the overlay list (but not the file on your hard drive).

Sky Settings

Choose the **Sky** tab on the Settings panel to adjust various settings for the clouds, sky, sun, haze, and horizon. A quick preview window helps you find the best settings.
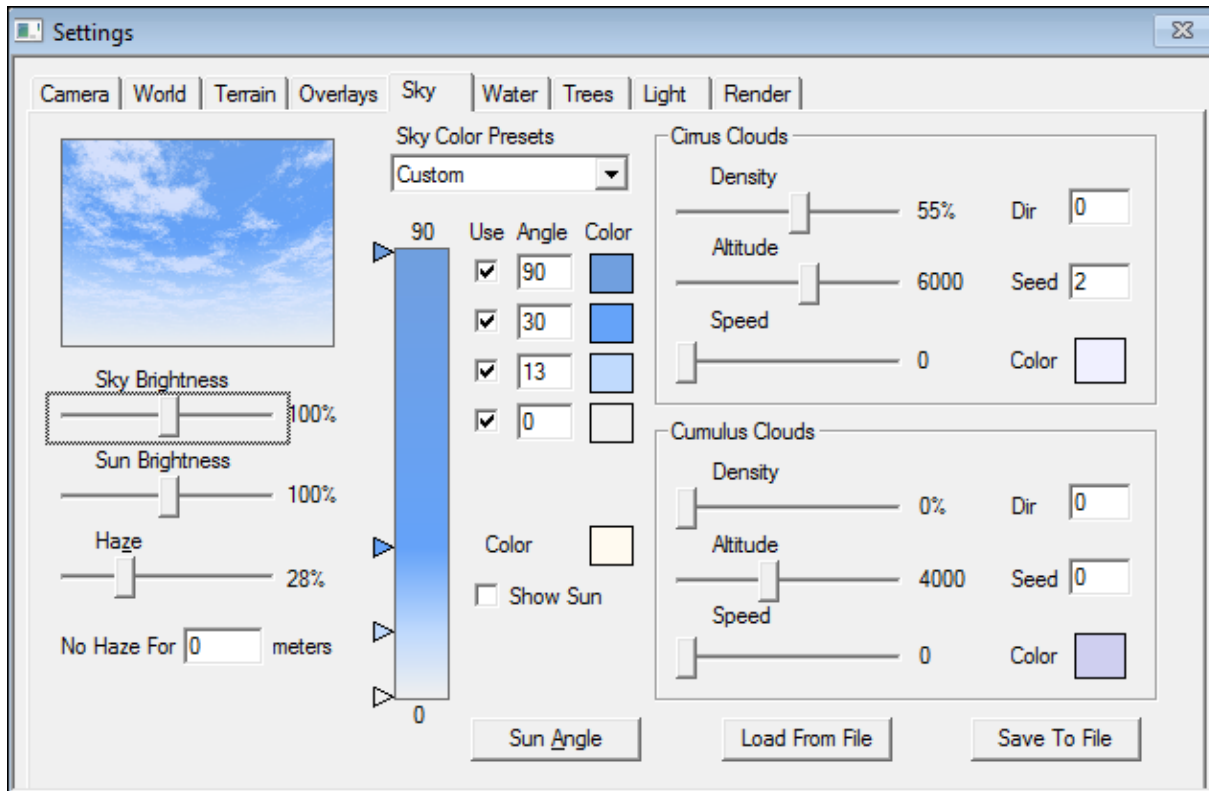
The sky color blend bar has sliding adjustments for color breaks. The bottom of the bar corresponds to an angle of 0 degrees (the horizon). The top of the bar is for 90 degrees (straight up). You can adjust the angles where color breaks occur using either the sliders or numeric fields. Click in a color square to change the color.

For added convenience, several preset color schemes are available from a popup menu. The choices are Simulation, Daytime, Sunrise, Sunset, High Altitude, Desert, and Globe. Selecting one of these sets the colors and break angles appropriately. If you select one of the preset color schemes and then make adjustments, the popup menu will change to "Custom".

"Simulation" is a special case. It uses a physical lighting model based on the lighting angle, haze, and sky brightness. It ignores the colors and break angles in this mode. You should not adjust the colors or break angles when "Simulation" is selected -- otherwise it will revert to your custom color scheme.

If you want to immediately see the effects of your adjustments, select "Automatic Preview".

You can adjust the brightness of the sun and sky using the two adjustment sliders. The sun color is also adjustable, and you can choose whether or not to render it.

There are two adjustments for haze. You can adjust the amount of haz using the slider control. The 'No Haze For' field is for entering a distance (in meters) from the viewpoint where there will be no haze. This lets you render the foreground unobstructed by haze.

You can save your favorite sky settings for use in other projects by clicking **Save Sky Settings**.

Clouds

The Sky Settings dialog has adjustments for Cirrus and Cumulus clouds. They can add dramatic effects to landscapes. There are separate groups of settings for each cloud type.

The **Density** slider lets you enter the percentage (0-100) of cloud cover. Zero percent specifies no clouds and 100% would create complete cloud cover. You can, of course, enter any value in between.

The **Altitude** slider controls the average cloud altitude. A value of 4000 here is usually best.

Clouds may be given a direction and speed for animations. The **Dir** field is their compass direction of travel. The **Speed** slider controls how far they travel between successive animation frames.

The **Seed** field lets you select completely different cloud patterns. It controls a random process, and there is no easily predictable relationship between the seed number and the resulting cloud pattern, however, the same seed will always produce the same cloud pattern. The seed must be an integer.

Tutorial: Animating Clouds

First, load any terrain. Then clear all the key frames, if any, by choosing **Clear path** from the Path menu. Select a wide angle value (18 to 35) for the camera lens using the **Lens** field in the Camera Settings panel. Now position the camera anywhere in the landscape. We need to aim it above the horizon so that a major portion of the sky is visible. The **Hand** tool is convenient for aiming the camera.

 Hand tool

Select the **Hand** tool and grab the image in the top of the Camera window. (It might be easier to press the **Space** bar to temporarily switch to the **Hand** tool). Then drag the preview image down (the view will aim upward).

Choose the **Sky** tab on the Settings panel. Select a density of 50% for cirrus clouds, and 25% for cumulus clouds. An altitude of approximately 4000 should work well for both cloud types. Set both speed sliders to any value between 100 and 500. This specifies the number of meters that the clouds will move between animation frames. Set the **Dir** field to 90 for both cloud types so that they will move eastward. Choose any value for the seed. Each seed number will generate a unique cloud pattern.

In the Path menu, turn off the **Direction tangent** option. This will prevent the animation processor from altering the camera direction.

Now we will create two key frames, since all animations require at least two, even when the camera is not moving or changing direction.

 Insert Key Frame tool

First, select the Map window. Then create two key frames by clicking the **Insert Key Frame** button in the toolbar twice. Each click creates a keyframe at the current camera location.

Select **Speed and Frame Coun**t from the Path menu. Enter 50 in the Total Frames field. Click **OK**.

Now choose **Render Animation** from the Render menu. Enter the name of the animation file and click **Save**. Clouds are not shown in **Quick Test** mode, so be sure to select the **Ray Trace** rendering method in the Animation dialog. Choose an image size and click **Render** to begin rendering the animation. When rendering is complete, you can choose **Open** from the File menu or use a movie player program to view it.

Water Settings

Choose the **Water** tab on the Settings panel to adjust the wave height, reflectivity, water color, and ocean level.
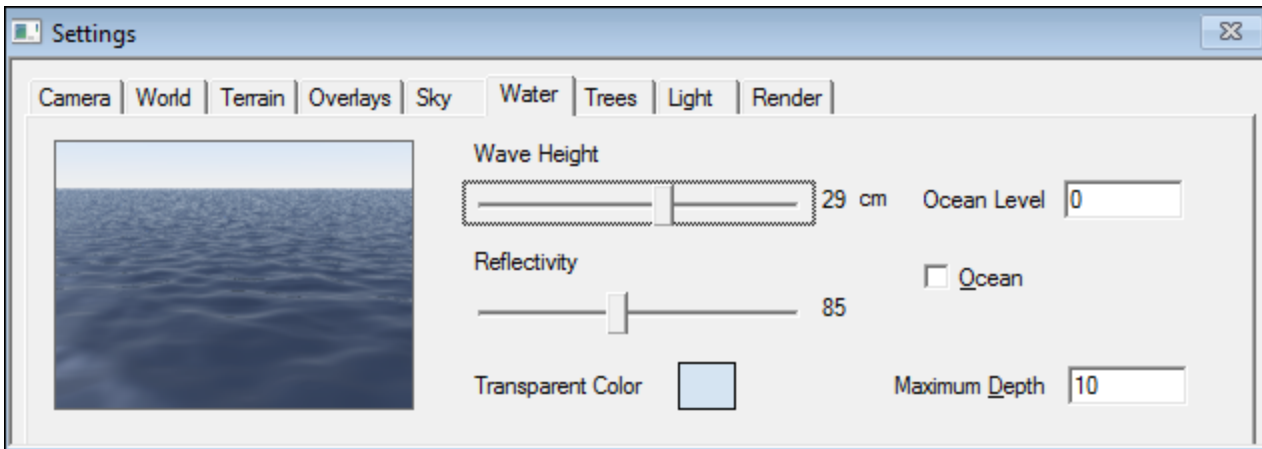

Oceans flood the entire landscape at or below the level you specify, as opposed to lakes (created using the Map window), which only fill isolated areas. An ocean will appear if the **Ocean** check box is selected and the water level is above land at some point. You can raise or lower the ocean level without permanently altering the landscape.

The **Wave Height** slider lets you specify the average vertical distance from the wave peak to the trough. Water scenes usually look best when the camera is positioned between 2 and 10 meters above the surface. The percentage reflection of water varies depending on the viewing angle. Water reflects the least amount when you look straight down on it. It reflects the most when viewed at a shallow angle (or from far away).

Trees

Natural Scene Designer Premium contains a built-in tree generator which can create realistic trees to enhance your scenes. You can create trees and individually place each one, or use the background tree generator to automatically position large numbers of them according to your placement specifications.
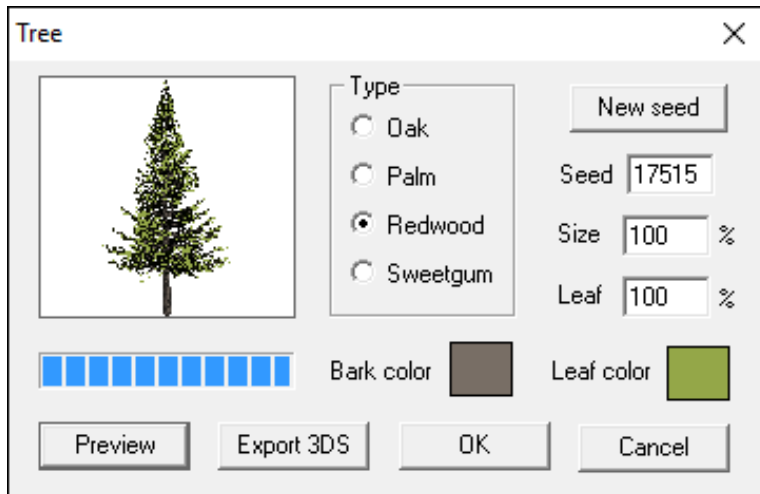
Four types of trees are available — Oak, Palm, Redwood, and Sweet Gum. It's easy to create and place a tree.

First, choose **Create Tree** from the Objects menu. When the dialog appears, select the type of tree you want. Then you can adjust the bark and leaf color, the leaf percent, and the seed.

The **Seed** value initializes a random number generator. Each seed will produce a unique trunk and branch structure. You can either enter a numeric value directly in the **Seed** field, or click the **New Seed** button to have the computer choose a seed for you. Click the **Preview** button to see what the tree looks like. After a few seconds a miniature tree picture will appear in the preview box. When satisfied with your new tree, click **OK**.

The **Size** value is 100% for average size trees. A value of 300% would yield a tree 3 times the average size.

The program will generate the tree and then add a small image of it to the collection in the Objects window. To place a copy of the tree in your scene, select the tree's small image in the Objects window. The selected small image should have a red border frame. Now click the mouse in the Map or Camera window at the location where you want to place the tree. Note that if you click on the sky in the Camera window, nothing will happen.

To place multiple copies of the same tree, *double-click* its small image. This "locks" the tree object tool until another tool is selected. If you *single-click* on the small tree image, you can place one tree and then the program will automatically revert back to the **Arrow** tool.

You may create as many trees as you have memory for. Each *unique* tree uses about 1 MB of memory. For example, creating 5 different trees and placing 1 copy of each would about 5 MB of memory, but placing 5 copies of the same tree would use about 1 MB.

Background Trees

It would be tedious to manually place large numbers of trees in a landscape scene. Instead, you can use **Background Trees**, which are automatically placed in the scene within the elevation range you specify. Oak, Redwood, and Sweet Gum trees work well as background trees. Palm trees have long, narrow trunks which don't show up very well when viewed from far away. You can create up to four unique background trees, each of which may appear in the scene thousands of times.
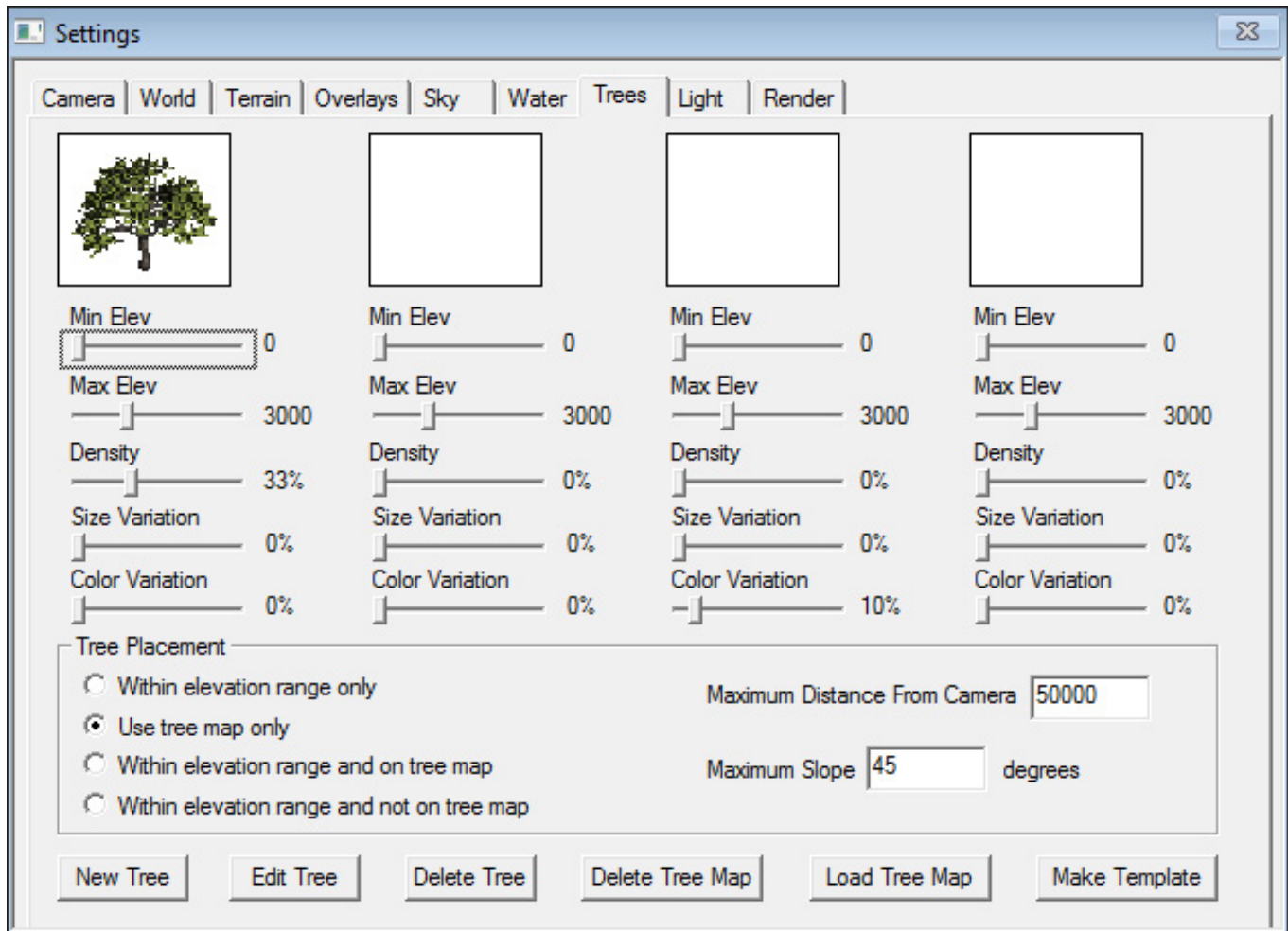
To setup a scene with background trees, choose the **Trees** tab on the Settings panel. The panel has four groups of settings. Click **New Tree** to create a new background tree. Then you'll get the same dialog as described previously for regular trees, except that the "Export 3DS" option is not available for background trees. (To export a 3DS tree you need to use the "Create Tree" function in the "Objects" menu). When you have entered the parameters for the new background tree, click **OK** and a small image of it will appear in the Background Trees dialog. You can set the elevation range where trees will be placed in the scene. The **Density** slider lets you adjust the percentage of coverage. At 100% density trees are placed as closely together as possible where the slope is not too steep. Setting the density to a high value will increase the rendering time, especially if the terrain covers a large area. If you set the percentage to 0, no trees will appear.

Use the Size and Color variation controls to increase the variety of trees in the scene. At zero variation, all trees will be the same. The variation becomes more noticeable as you increase these settings. With the color variation set high, trees will vary between green and brown. Note that these two settings do not affect the shape of the tree. To do so, click the **New Tree** button and create a tree with a different seed value.

Background tree images are shown in the Background Tree dialog *and also the Objects window*. This feature allows you to conserve memory by reusing the same tree for both background use and manual placement.

Background trees are placed at randomly selected locations. The program simulates natural processes, and avoids placing them on very steep terrain and in water. It also avoids placing them where there are other 3D objects.

The background tree settings in this dialog work in combination with the background tree map editor in the Map window (as described in the next section. To use painted areas for trees, set the tree placement to "Use tree map only". Or you can have the program ignore manually painted areas by setting tree placement to "Within elevation range only". Then it will only use the elevation rules, and not the painted areas.

There are two other choices for tree placement. If you want background trees only in painted areas that are also within the selected elevation range choose "Within elevation range and on tree map". Or you can do the opposite and exclude the painted area from consideration for trees. This could be useful, for example, if you are modeling a golf course or ski run where trees have been cleared out of the way. In these cases, the painted areas would represent golf fairways or ski runs.

Since background tree rendering can be time consuming, you can set the maximum distance in meters (from the camera) to render background trees. The default value of 5000 should work for most pictures. You might want to set it much higher for high altitude renderings (where trees are visible from far away) or for animations. Also, the rendering time increases proportionally to the tree density and the total number of background trees in the scene.

Background Tree Map
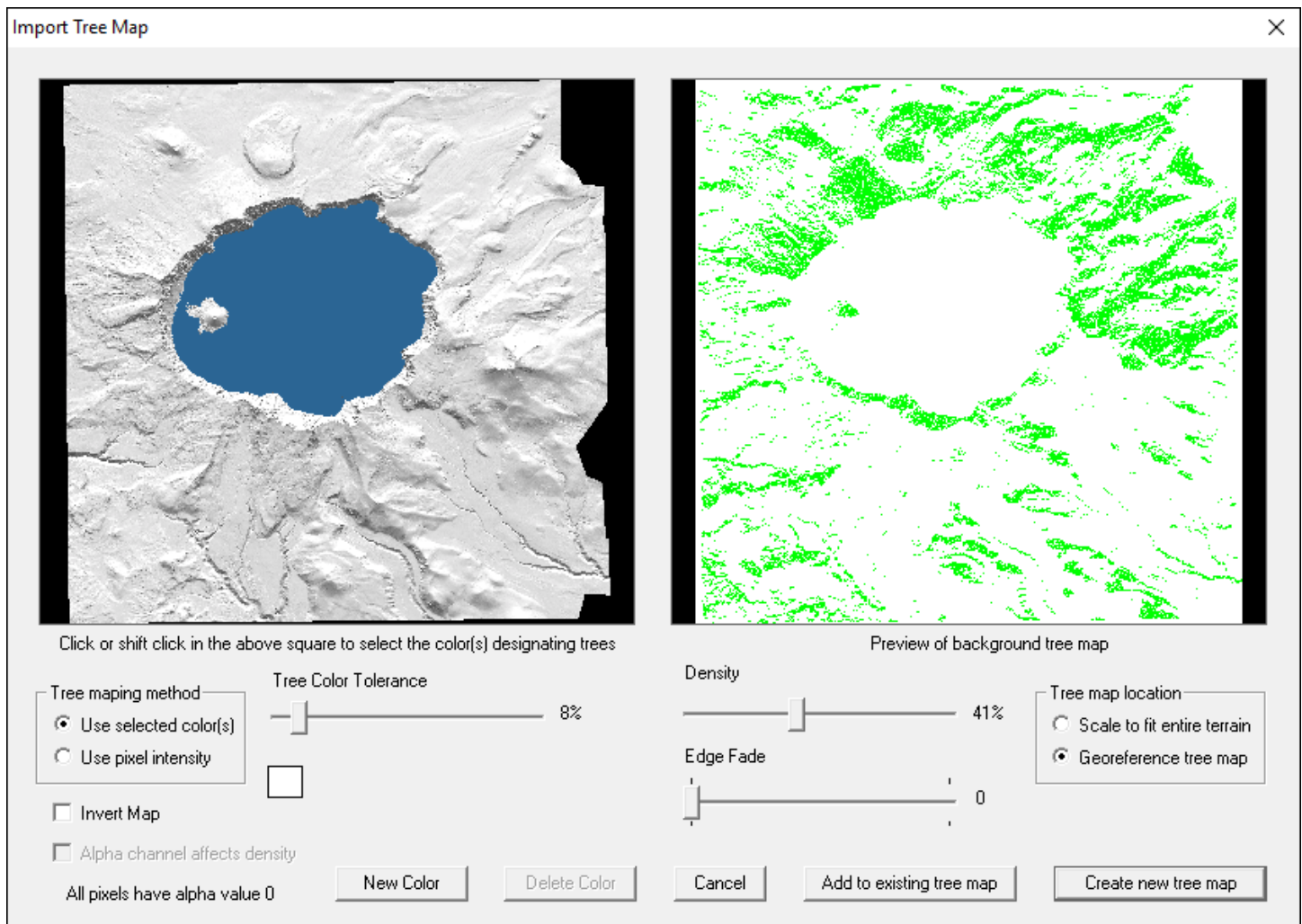
Click the **Load Tree Map** button on the Tree Settings panel to display the dialog shown above. This lets you load a tree map and determine which color(s) are used to represent trees. The original loaded image is shown on the left side, and the resulting tree map is shown on the right, with green representing where background trees will actually be placed.

The background tree map dialog is very powerful and gives you maximum control. It displays immediate feedback for all of the settings. The controls are mostly self explanatory but are fully described below.

There are two background tree mapping methods -- **Use selected color(s)** and **Use pixel intensity**. The first method lets you choose one or more colors from the source image that designates trees. The second uses the pixel intensity (or grayscale value) to determine the *probability* that a tree will be placed in a given spot. Using the pixel intensity mapping method, white pixels have the most likelyhood of producing a tree, and the probability drops as the pixel gets darker. Or you may reverse the effects of white and black by checking the **Invert Map** checkbox.

To select a tree color from the source image, you may either click the color square or select it from the source image by moving the mouse pointer over the desired color. For additional colors (up to 8), click the **New Color** button and then either use the 'eye dropper' tool in the source image or the color selector. After selecting a color, you will see instant feedback in the image on the right side of the screen showing (in green) where trees will be placed.

If the tree map image has an alpha channel, you will be given a choice of whether or not to let it affect the density of background trees.

The **Tree Color tolerance** slider lets you adjust the amount of variation from the selected color(s) where trees will be placed. For example, setting the tolerance to zero means that trees will only appear where the source image pixels match exactly, but increasing the tolerance allows more variation from the selected color(s).

The **Density** slider changes the number of trees in the green areas. The **Edge Fade** slider softens the transitions from green to white along the edges.

The **Tree Map Location** radio box gives you a choice of scaling the tree map as necessary to cover the entire terrain, or you may georeference it.

For maximum realism, georeferenced satellite photos work well for background tree maps. You can nearly match the real world tree locations. And you may combine georeferenced satellite photos, as necessary to cover the entire scene, by clicking the **Add to existing tree map** button.

Digitized topographic maps (DRGs) are another good source for background tree maps. Most of the United States is available for free download. Please see the 'Sources' appendix for details.

If you wish to manually edit a tree map, you may do so using the background tree map editor as described in the next section.

Background Tree Map Editor

The lower left corner of the Map window contains three little buttons to select the mode.

The tree button activates background tree painting mode. You use this mode to "paint" on the map where you want background trees to appear in your scene. To paint areas with trees, use the paint brush tool as described in the "Terrain Editor" section. To clear an area, use the eraser tool.

Bushes

Bushes add detail and a more natural look when placed in the foreground of your scene. You can place them on the ground surface, or you can use the **Arrow** tool in the Camera window to move them partially underground. This creates the appearance of many smaller bushes.

Seed - The seed gives each bush a unique shape. Different seeds yield different bushes. You can either click the **New Seed** button for a computer selected seed, or choose the seed yourself by typing it into the seed field. It must be an integer number.

Size percent - The **Size** value is 100% for average size bushes.

Leaf percent - This controls the percentage of twigs that have leaves. Enter a value (from 0 to 100 percent). Zero percent will yield a dead bush with no leaves.

Branch / Leaf color - Click in these boxes to set the branch and leaf color.

Preview button - Click this button for a preview of the bush.

Export button - To export the bush for use with other 3D programs, press the "Export" button.

Rock Generator

The rock generator in Natural Scene Designer Premium can create a wide variety of rocks.
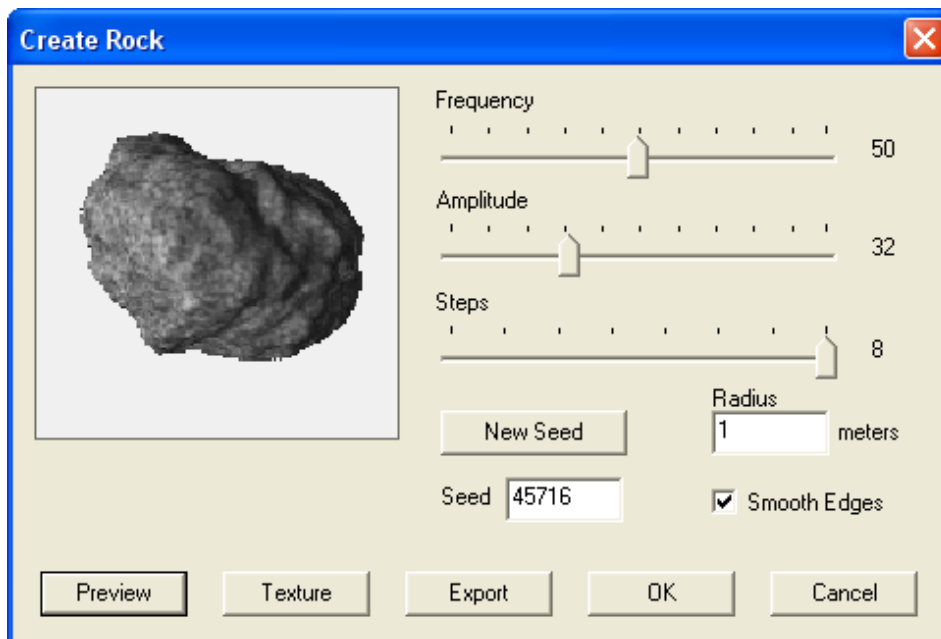
You have control over several parameters, including shape, texture, size, color, and smoothness. In addition, you can change the dimensions of the rock after it's been created and placed in the Camera window. You can adjust the reflectivity and the amount of highlighted area using the **Object Properties** dialog.

To create a rock, you must first open a terrain or create a new fractal terrain. Then choose the **Create Rock** item in the Objects menu.

Frequency slider - Controls the size of the major features of the rock. A low value will create a relatively round rock. A high value will create a rock with lots of small spikes. A good starting value to use is 50.

Amplitude slider - Controls the amount of displacement for the rock features (from the center of the rock outward). A low value will make a round rock. A high value will make a very rough rock. A good starting value to use is 32.

Steps slider - Controls the rock's level of detail. A low value will create a smooth rock without fine details. A high value will create a more detailed rock. A good starting value is 8 (which is the maximum). For rocks that will be in the distance, you might want to use a lower value to avoid aliasing.

Seed - The rock seed gives each rock a unique shape. Different seeds yield different rocks.

Radius - Controls the average radius of the rock (in meters).

Smooth edges - When this is not set, the rock will have a faceted appearance up close. Turning on this option eliminates the facets.

Export button - To export the rock for use with other 3D programs, press the "Export" button.

Rock Texture

Click the **Texture** button in the **Create Rock** dialog to display the **Rock Texture** dialog. The texture consists of two colors. The program automatically displays a preview whenever you change any of the settings.
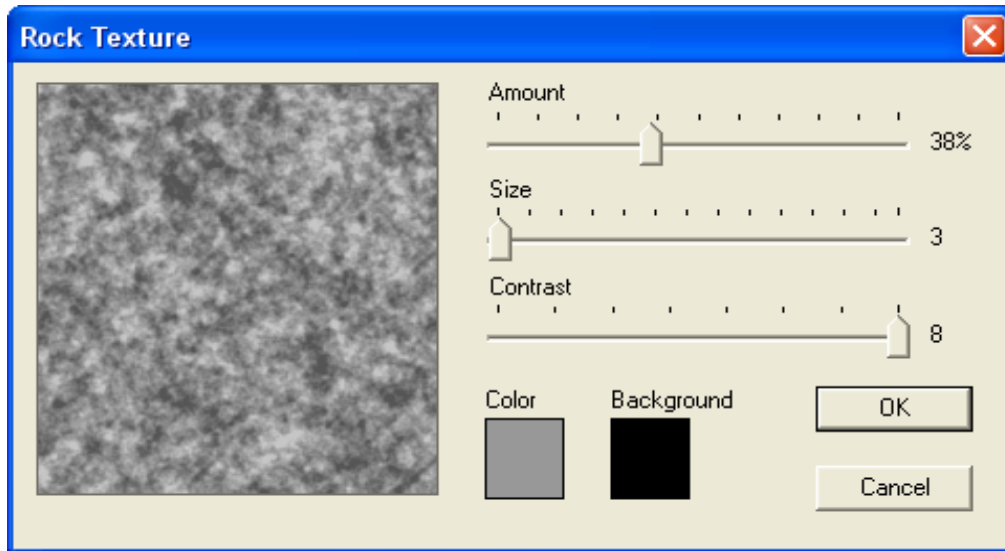
Amount slider - This controls the amount of background color used in the texture. A value of 0% creates a solid color texture (without any background color). A value of 100% uses the most background color.

Size slider - This lets you adjust the size of the texture features. A low value will create a grainy texture. A high value creates more of a marbled appearance.

Contrast slider - Controls the amount of blending between the main color and the background color. A low value yields the most blending. A high value has the least amount of blending (which is higher contrast).

Color / Background color boxes - Click in these squares to change the texture colors.

When you first start Natural Scene Designer Premium, the default settings for the sliders are Amount 38, Size 3, and Contrast 8. The main color is gray and the background color is black. These settings yield a granite texture.

Exporting Terrain

You can export terrain from Natural Scene Designer Premium for use with other 3D programs. Choose **Export 3D DEM** from the **File** menu to bring up the dialog.
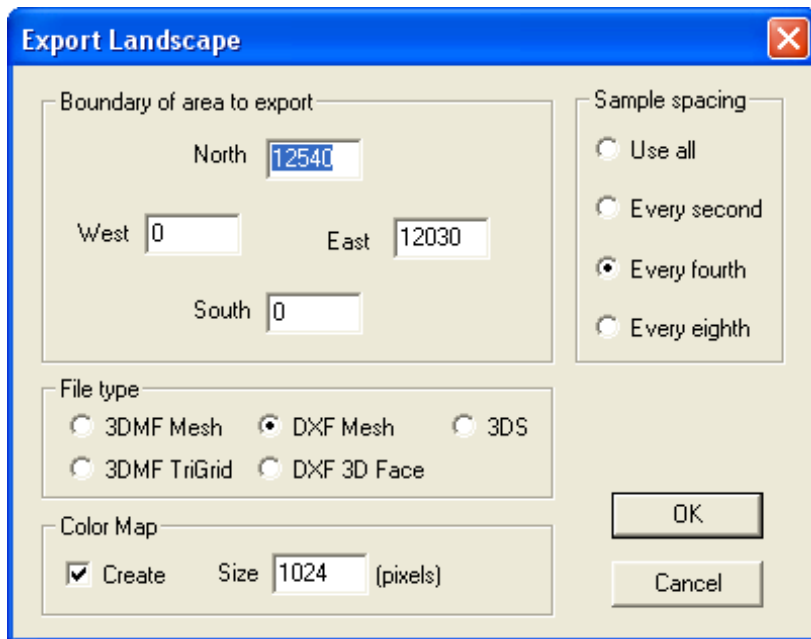
The terrain may be saved as a 3DMF, DXF, or 3DS file. 3DMF and DXF files each have two save options. Other 3D programs vary in the type of file that they work best with, so it may require experimentation to determine which format works best with your 3D program.

The sample spacing determines the resolution of the 3D file. Lower sample spacings produce more realistic results, however memory and disk usage may be a limiting factor.

You can select whether of not you want a color map generated along with the 3D file. The pixel dimensions of the color map are adjustable.

Light Settings

The Light Settings panel, lets you control the lighting angle, ambient light, and shadows. You can also set the light according to the date and time.
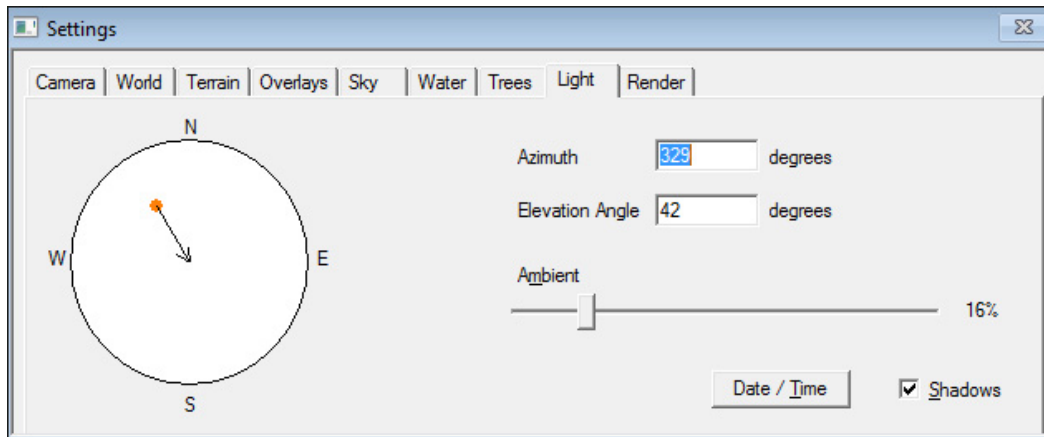
The large and small circles in the panel graphically indicate the lighting direction and angle. The large circle represents the earth. The small circle represents the position of the sun. The center of the large circle corresponds to the sun's position when it is directly overhead. The edge of the large circle represents the horizon; place the little circle there to simulate sunrise or sunset.
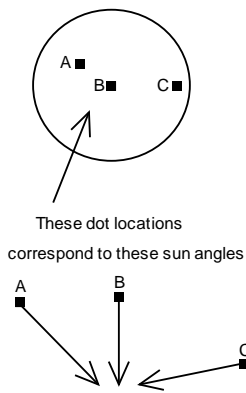
The Light Settings panel displays the numeric values for the compass direction and horizon angle. You have a choice of setting the direction and angle of the sun by locating it with the mouse pointer, or by entering numeric values. Changing the sun location with the mouse affects the numeric display, and vice-versa.

The **Ambient light** percentage slider controls the amount of light coming from all directions. Outdoor scenes usually look good with ambient light set at between 15 and 30 percent. Higher percentages can be used to simulate a heavy overcast.

The **Shadows** check box determines whether or not there will be shadows. They appear very dark when the ambient light percentage is low. The **Quick Test** rendering mode and the preview in the Camera window do not include shadows. They only appear in ray traced scenes.

Most landscapes look best with side lighting (relative to the camera view), and they appear flat and two dimensional with direct overhead or frontal lighting. The lighting angle is often the most important setting affecting the quality of pictures rendered by Natural Scene Designer Premium.

Setting the Sun Position According to the Date and Time
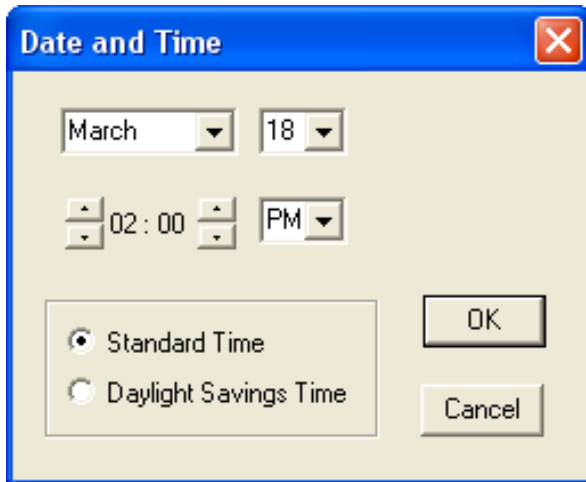
You can set the month, date, and time and have Natural Scene Designer Premium calculate the sun position and lighting direction. This function is accessed through a button in the Light Settings panel. If you change the sun position manually in the Light Settings panel, it will override the Date and Time dialog.
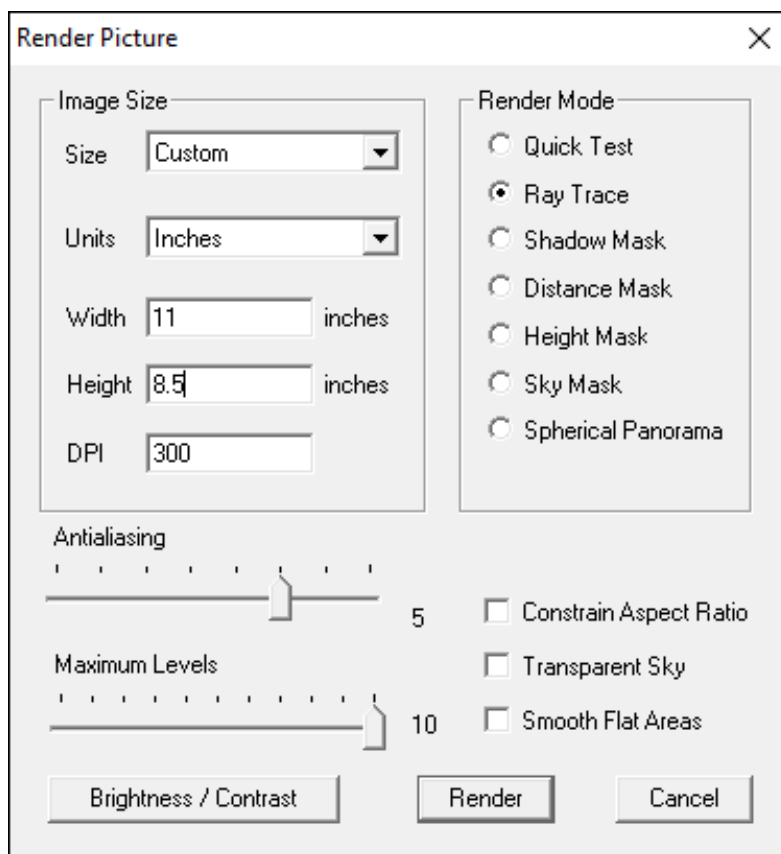
Rendering   6

Natural Scene Designer Premium offers several rendering methods including pictures, masks, panoramas, shaded relief, plan oblique relief, texture shading, viewshed maps, and contour maps. These are all available from the **Render** menu.

Rendering a picture

When you have set the camera location, composed the view and adjusted the settings as desired, choose **Render Picture** from the Render menu to create a picture.

The Render Picture dialog lets you set the size, resolution, rendering mode, and anti-aliasing setting of the renderer. The **DPI** in the **Resolution** field lets you adjust the number of pixels per inch.

The **Size** menu has many preset size options, along with a **Custom** choice for you to enter any size desired. The **Units** menu has three choices — **Inches**, **Centimeters**, and **Pixels**.

There are seven rendering modes — **Quick Test**, **Ray Trace**, **Shadow Mask, Distance Mask, Height Mask, Sky Mask** and **Spherical Panorama**.

Quick Test Rendering

The **Quick Test** mode renders the terrain as a faceted triangular mesh. The sky is a solid color, and clouds, background trees, shadows, reflection, texture, anti-aliasing, and haze are not included.
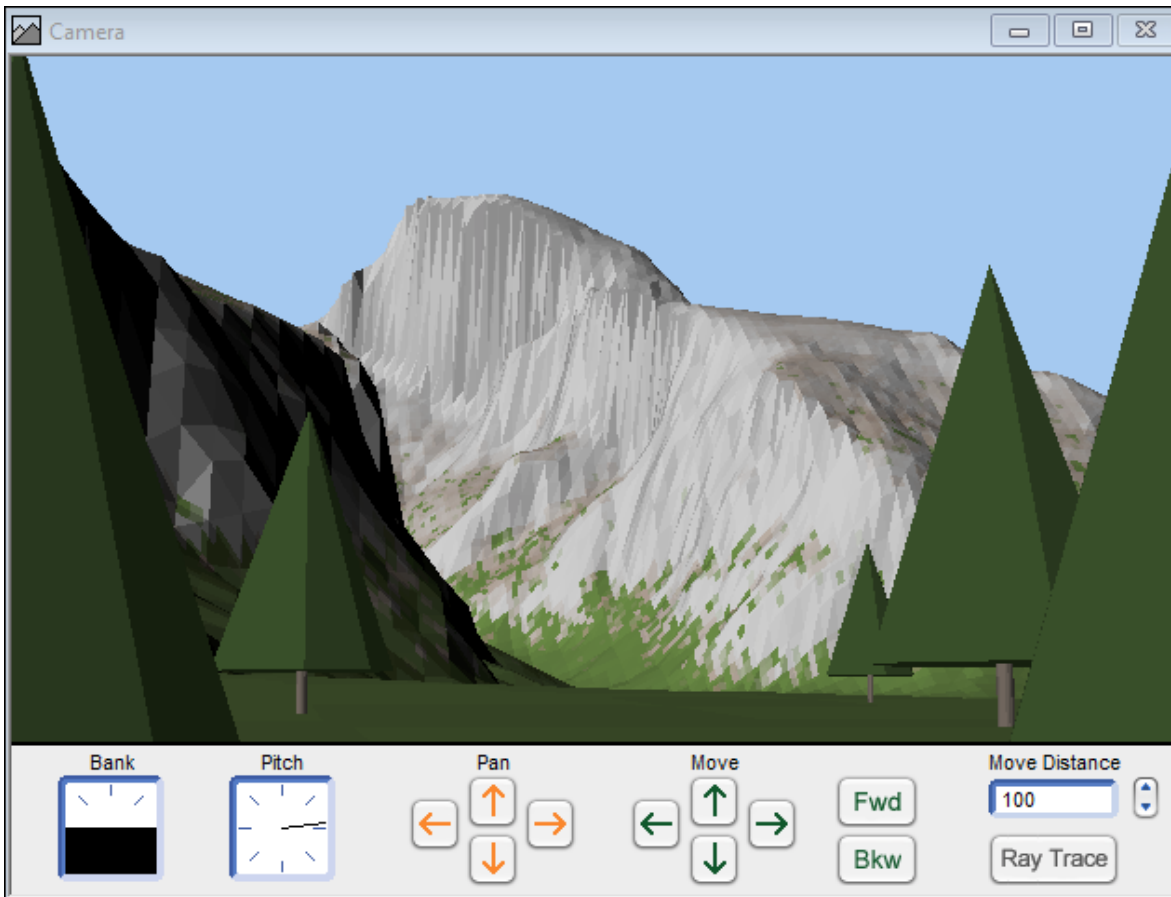
Individually placed trees are represented simply as basic cylinders, cones, and spheres, just to show you where they are placed. 3D objects are rendered without edge smoothing and textures. The Quick Test renderer is intended only to show you the view composition and object positioning.

Ray Tracing

For your final rendering, choose **Ray Trace**. An anti-aliasing setting of 3 or 4 usually represents the best trade-off between rendering quality versus time. An anti-aliasing value of 0 specifies no anti-aliasing. Set the slider to 7 when you want the maximum amount.

The **Maximum Levels** slider lets you set the maximum number of times each ray can reflect or refract. Reducing the value below 10 can save time in scenes with lots of reflective surfaces, but it may yield unusual results if set too low.

Click on the 'Brightness / Contrast' button to bring up a dialog for adjusting the image. You can fine tune your adjustment with a real-time preview.

After you adjusted all the settings, click **Render** to begin rendering the picture. If you want to discontinue rendering before it has completed, choose **Stop rendering** from the Render menu or close the rendering window.

When the picture has finished rendering, you can save it to disk by choosing **Save As** in the File menu. Be sure the picture window is selected before you use the **Save As** menu command, otherwise Natural Scene Designer Premium will save the landscape and settings instead.

Shadow Mask

This rendering mode displays all shadows as black.

You can use this mask in an image editing program to alter the look of shadows

Distance Mask

This rendering mode creates a grayscale image. The shade of gray is based on the distance from the camera. The foreground renders as black and the most distant areas of the scene are white, with gradually changing shades of gray in between. The sky is white.
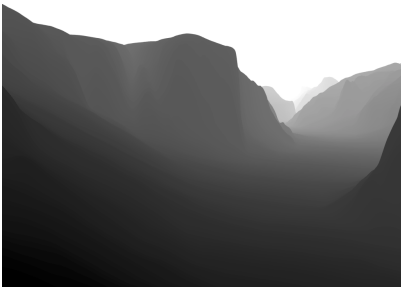
This rendering mode can be used to add special effects in an image editing program. You can combine a normally rendered image with a distance mask to create special effects.

Height Mask

A height mask is a grayscale image where the shade of gray is used to represent the elevation. The lowest areas are black and the highest areas are white.
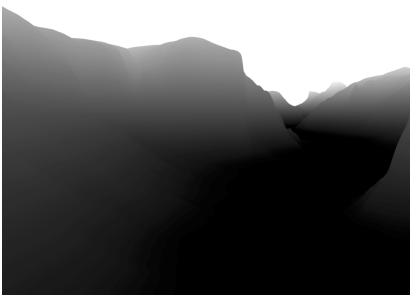
You can combine a normally rendered image with a height mask in an image editing program to blend in another image or apply special effects.

Sky Mask

This rendering mode simply renders the sky white and the terrain black.

You can use this mask in an image editing program to merge a terrain rendering with a background sky photograph.

Panorama

This rendering creates a full 360 degree spherical panorama. It works best when the width is twice the height, since it covers a 360 x 180 degree field of view.

There are several web based and stand alone spherical panorama viewers available for computers, tablets, and phones. For a full list, please see http://wiki.panotools.org/Panorama_Viewers . You will need a viewer which supports spherical panoramas (also known as "equirectangular). Most of them support this type of panorama.

Transparent Sky

When you check the **Transparent Sky** option, the program will create an image with a transparent sky using the "alpha" channel. When using this option, you should save the image as a TIFF file to preserve transparency. You could use this option to add a sky photograph to the background in an image editing program.
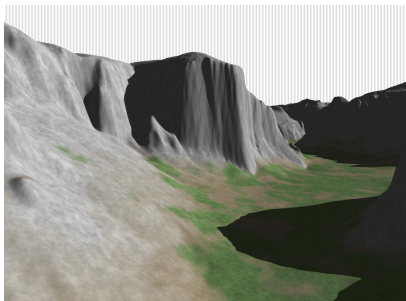
Transparent sky is shown in Natural Scene Designer as light gray and white vertical stripes. Transparent areas will probably be indicated differently in other software.

Shaded Relief Maps

When a terrain model is loaded, choose **Render Shaded Relief** from the Render menu to bring up the dialog.
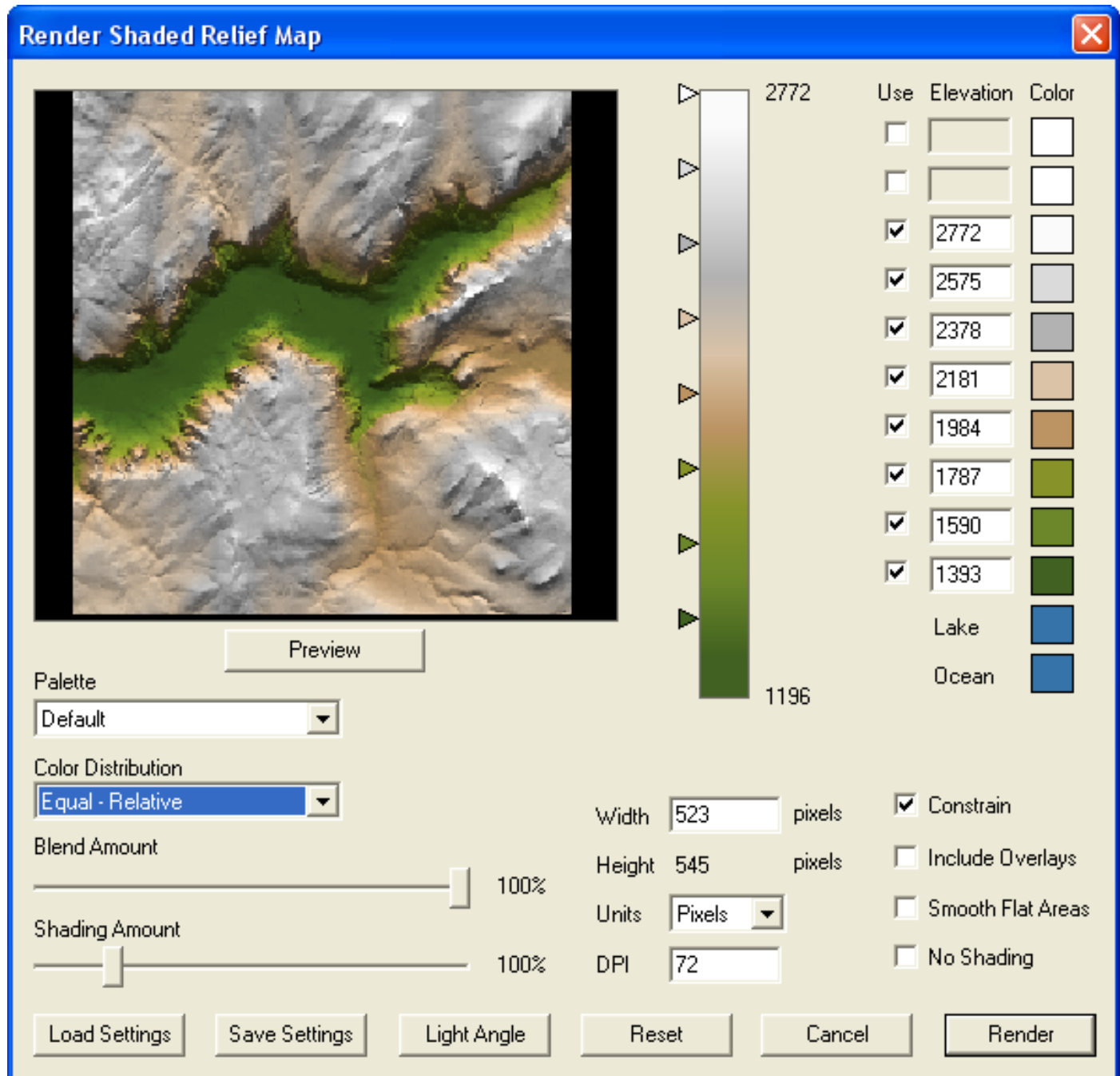
Many settings are adjustable to create a wide range of shaded relief maps. You can adjust the altitude range for each color using the triangular vertical sliders. Or you can enter a numeric value in the corresponding elevation field.

You can control the amount of blending between color transitions. This elevation based blending can be sudden (at 0% blending) or gradual. The **Preview** button will show the resulting shaded relief map.

Several preset color palettes are available via a dropdown menu. You have a choice of Default (as shown above), Atlas I, II, III, and IV, Green, Brown, Gray, and White. Or you can create your own custom palette and save it in a file. If you click on a color square you can adjust the color.

The **Color Distribution** menu offers several schemes for setting the color elevations. There are six distribution methods.

Equal Relative - Spaces colors at equal intervals. Colors are set between the lowest and highest elevations in the terrain.

Equal Absolute - Spaces colors at equal intervals. Colors are set every 500 meters starting at 0 (sea level).

Arithmetic Relative - Spaces colors at increasing intervals according to an arithmetic progression. Colors are set between the lowest and highest elevations in the terrain.

Arithmetic Absolute - Spaces colors at increasing intervals according to an arithmetic progression. Sets colors starting at 0.

Geometric Relative - Spaces colors at increasing intervals according to a geometric progression.

Geometric Absolute - Spaces colors at increasing intervals according to a geometric progression. Sets colors starting at 0.

The Shading Amount slider controls the shading contrast. A value of 100% is the default setting. Flat areas might look better with values above 100% to help bring out the terrain's features.

You might wonder why there is a check box for **No Shading**. This can be used to create a color map for use as a terrain overlay. You can edit the color map in a painting program, add roads, names, etc. and then import it back into Natural Scene Designer Premium as a terrain overlay.

To zoom in to a selected portion of the map, drag select an area in the preview. This will limit rendering to the zoomed area. To go back to the full map, click the **Zoom Out** button.

Click on the **Brightness / Contrast** button to bring up a dialog for adjusting the image. You can fine tune your adjustment with a real-time preview.

The width and height of the final rendered map are adjustable. Select **Constrain Proportions** to maintain the aspect ratio. You can also select whether or not to include terrain overlays in the shaded relief.

Use the **Preview** button to fine tune your settings. If you wish to retain the settings for use with other projects, use the **Save Settings** button. Then you can reload the same settings later as needed.

When you save the shaded relief map, the **Save File** dialog you will have an option to create a "TFW" file which contains alignment information necessary for automatically matching it to a DEM.
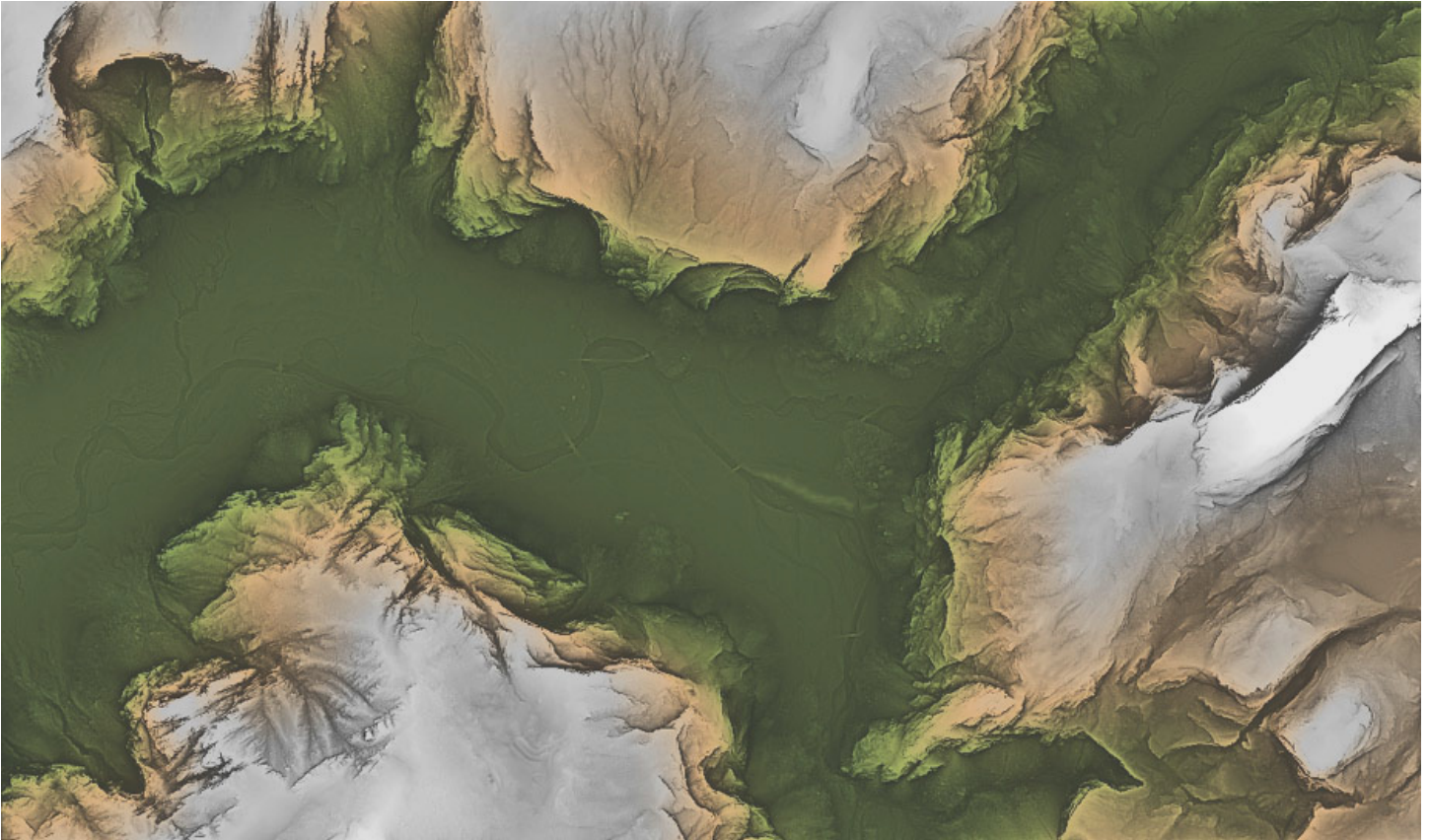
Texture Shading 7

Texture Shaded image of Yosemite Valley

Introduction

Texture Shading is a relatively new method of creating highly detailed images from terrain models. Leland Brown developed the core algorithm and program code for texture shading. He presented his research in a presentation given at NACIS 2010 (an annual mapping conference) and the 2014 Mountain Cartography Workshop in Banff, Canada. He also created a command line program for texture shading GridFloat terrain models. For a complete description of Texture Shading along with presentations and source code, please see Leland's website at https://app.box.com/textureshading/

Outline of the steps to produce a texture shaded image

1) Open or import a terrain model in one of many available formats. It will be shown on the Map window.

2) Optionally clip a selected area of interest or reproject the terrain model.

3) Choose **Render Texture Shade** from the Render menu.

4) Adjust the shading parameters in the dialog.

5) Click the **Render** button.

You may wish to begin experimenting now, or continue reading for complete instructions.

Texture Shading Tutorial

This tutorial will take you, step by step, through the process of rendering a texture shaded image.

Choose **Import GridFloat DEM** from the File menu. Navigate to the **Tutorial** folder on the Program Disc and select the file named "GrandCanyon.flt". Then click Open and you should see the terrain model displayed as shaded relief in the Map window as shown below. You can use the controls in the upper left corner of the Map window to zoom in or out. You can scroll the viewable area with the scrollbars or the **Hand** tool in the toolbar.
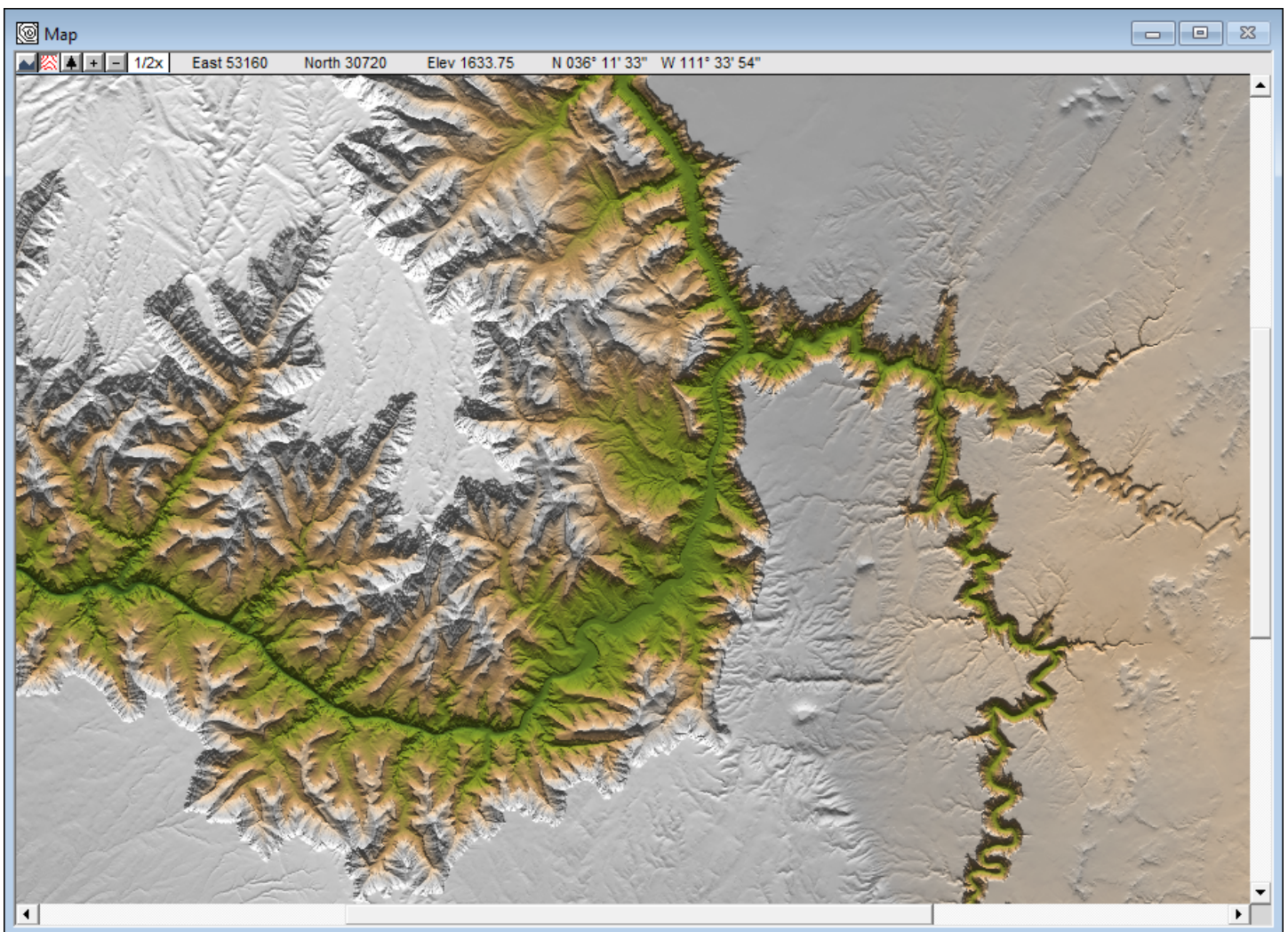
Next, choose **Render Texture Shade** from the Render menu. This will bring up a dialog as shown below.
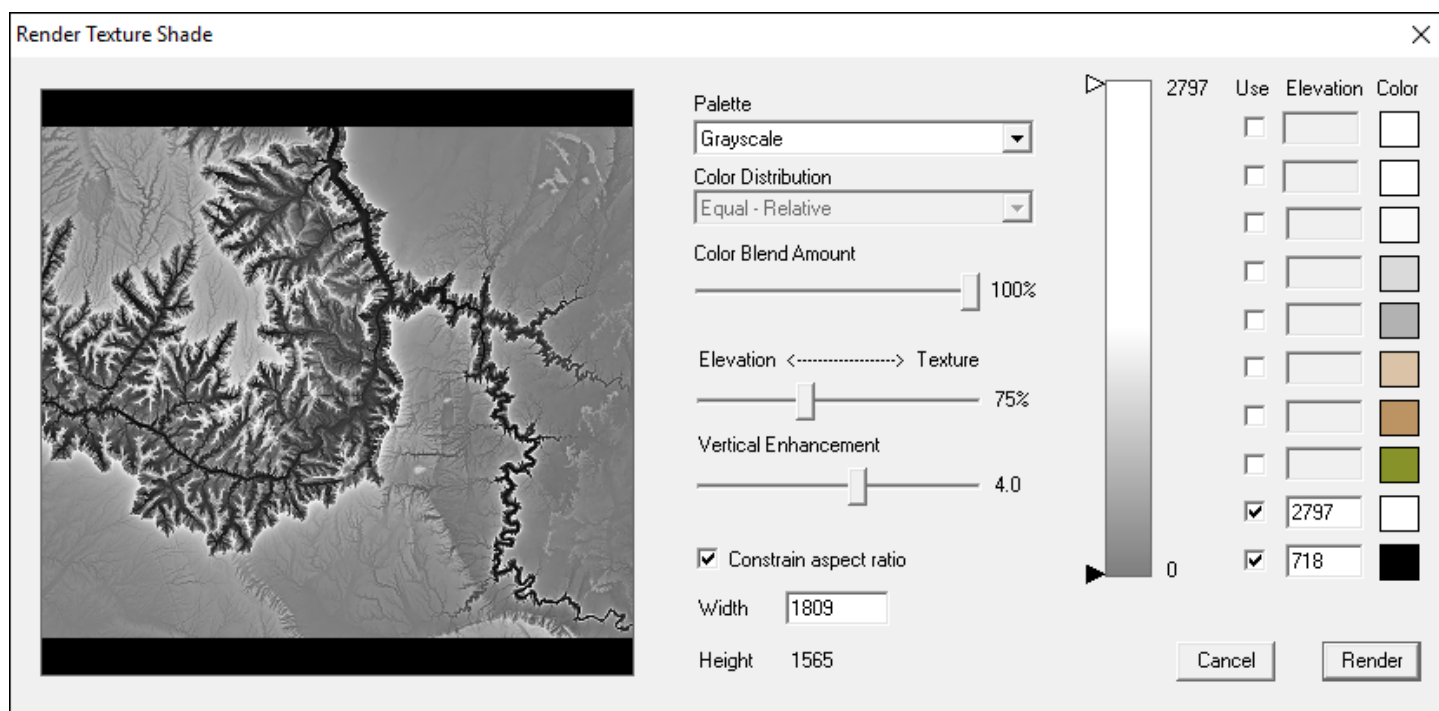
This dialog gives you control over the settings and the output dimensions. Changes to the settings are displayed instantly in the preview square so you can see what your output will look like ahead of time.

Choose **Green** - **Brown** - **Gray** from the **Palette** dropdown menu. This adds color to the image based on elevation. Several other color palettes are available. For more information about the color controls in this dialog, please see the section of this manual where it covers the Shaded Relief dialog.

The **Elevation <------> Texture** slider controls the amount of texture shading, and ranges from 0 to 200. A value of 0 here creates images shaded solely by elevation, with texture shading absent. As you increase the slider you will see increased detail as texture shading does its work, bringing out detail that may be hidden in shaded relief images (as seen in the Map window).

The default value of the **Elevation <------> Texture** slider is 75. This generally works well for many terrain models. However, this terrain model has vast areas above the canyon that are relatively flat. Move the slider to about 119, which seems like a good amount of detail without being too much.

The **Vertical Enhancement** slider adjusts the vertical exaggeration of the terrain on a logarithmic scale. Visually it appears similar to adjusting the image contrast. You may wish to experiment with various settings. A value of 5.9 seems to work well in this situation. If you set this value too high, detail will be lost in the darkest and lightest areas. If it is too low, you may not be able to see the texture shading.

After adjusting the controls, the dialog should look like it is below.
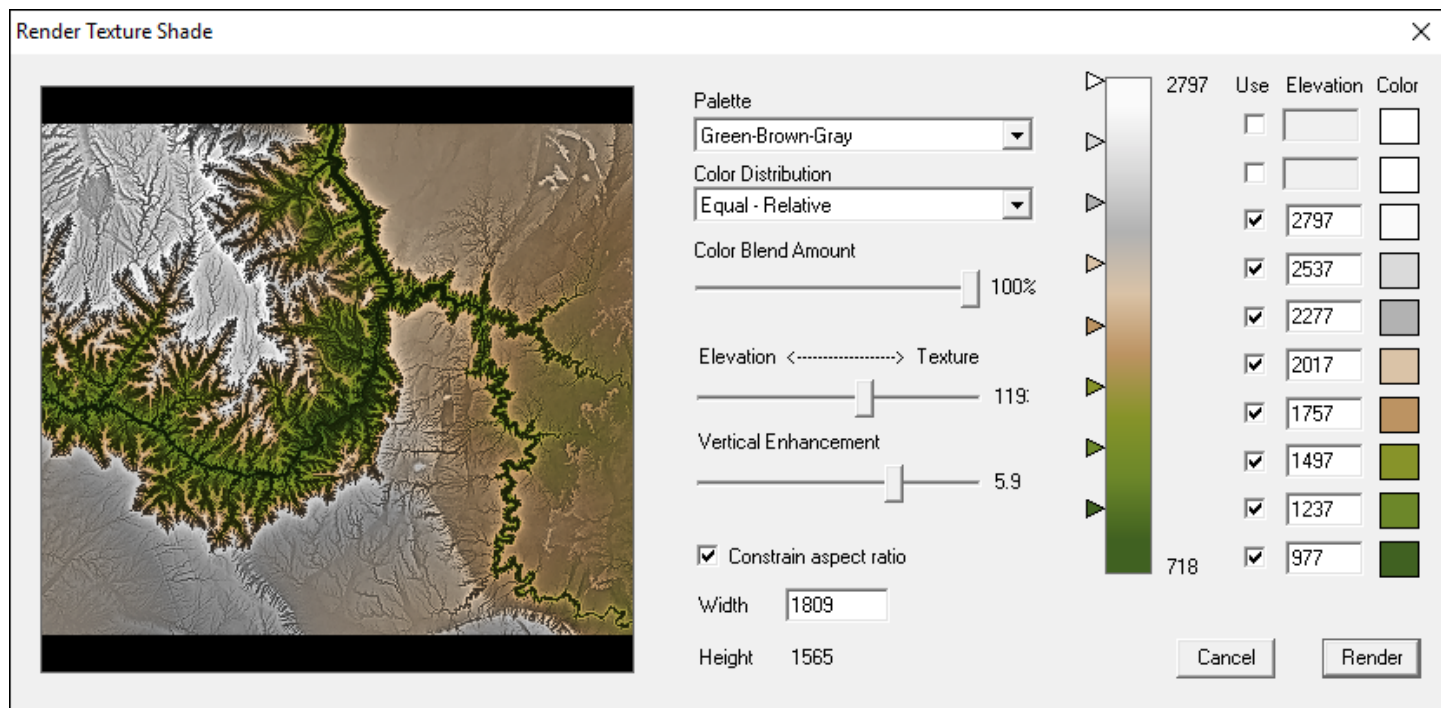
Now click the **Render** button. The program will now display the **Texture Shading Progress** dialog, followed by the **Coloring Progress** dialog. (If you had chosen the **Grayscale** palette, the coloring stage would have been skipped).

After rendering is complete, you will see the texture shaded image as shown below. Compared to the shaded relief in the Map window you can see increased detail, especially in the flat areas above the canyon. However, the depth of the canyon does not seem as perceptible as it is in a shaded relief map. For this reason, you might decide to use an image processing program to blend texture shaded images with corresponding shaded relief images from Natural Scene Designer Premium.
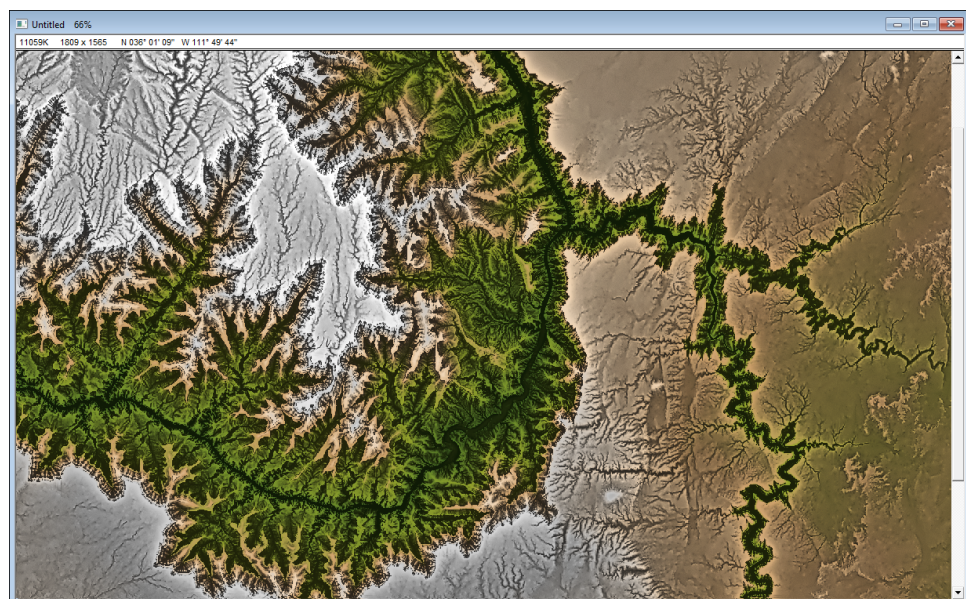
Tools and Windows 8

Toolbar Buttons

The Toolbar contains two groups of buttons. The buttons in the left group are for frequently used commands. The buttons in the right group are tools. Natural Scene Designer Premium displays a brief summary of each button when the mouse pointer travels over it.

Open Terrain CD/DVD-ROM – To use this function, you must have the program CD-ROM or a 3D Terrain model CD/DVD (sold separately) in your drive. Clicking this button will bring up the Open Terrain CD/DVD-ROM dialog, which lets you open terrain models using a large scale map.

Undo Button — Click this button to undo the most recent camera view change, terrain edit, lake, key frame movement, insertion or deletion.

Drop To Ground Button — Places the camera 10 meters above the ground. If a 3D object is selected, it will be placed at ground level and the camera location will not change.

Insert Key Button — Inserts a key frame at the current camera location.

Delete Key Button — Deletes the currently selected key frame (if any).

Previous Key Button — Selects the previous key frame and positions the current view there. Then it updates the Camera window.

Next Key Button — Selects the next key frame and positions the current view there. Then it updates the Camera window.

Arrow Tool — This tool is used for selecting and dragging key frames, overlays and 3D objects. It also resizes a 3D object when you drag its scale handle. You can only resize a 3D object in the Camera window, not in the Map.

Hand Tool — Some terrain models are larger than the displayed area of the Map window. If you want to view an area that is not displayed, select the **Hand** tool. Then press and hold the mouse button while dragging the terrain to bring the desired area into view. You may also accomplish this by using the scroll bars, but they can move in only one direction at a time.

In the Camera window, the **Hand** tool can be used for panning the view. After selecting this tool, press and hold the mouse button while dragging the view. The view will move as you move the Hand pointer.

Tip: Press the Space bar to temporarily switch to the Hand tool. When you are done, release the Space bar and the program will switch back to the previous tool.

Paint Brush - Paints the terrain with the current elevation, as shown in the Tool Options panel. Areas painted will be changed to this elevation.

You can also use this tool for painting the background tree map. To go into this mode, click the little tree button in the lower left corner of the Map window.

Eye Dropper - Use this tool to set the current elevation for painting. You can click on the terrain where it has the elevation you want. Or you can enter the elevation numerically in the Tool Options panel.

Eraser - This tool is functional only in background tree editing mode. Use it to clear painted areas in the tree map.

Magnifier - Enlarges or reduces the image in the Map, Camera, or Picture display window. (To reduce the image, press and hold the Option key first). If you drag select an area, the program will zoom in on it.

Tip: Press Control + Space to temporarily switch to the Magnifier tool. Or, press Shift + Space to reduce the image.

Paint Bucket - This tool is similar to the **Lake** tool. But instead of filling with water, it fills low areas with terrain. The area lower in elevation than where you click on the Map is filled with flat ground.

Lake Tool — Select this tool to create a lake. Then click the mouse with the pointer positioned at what you want to be the shore of the lake. You should see a lake fill the landscape at and below the point you click. If you have enough available memory you will be able to undo the lake if you are not happy with it. You may create up to 64 lakes per project.

Raise Tool - This raises the terrain at the location where you click on the map. The Tool Options panel lets you set the size of the area and distance to raise it. The raised area will be blended into the surroundings.

Lower Tool - This lowers the terrain at the location where you click on the map. The Tool Options panel lets you set the size of the area and distance to lower it. The lowered area will be blended into the surroundings.

Clipping Tool — Lets you clip an area of terrain in the Map window. After you drag select an area, the area outside it will be removed.

If you press and hold the **Shift** key before drag selecting, it will constrain your selection to a square area.

After you select the area to be clipped, the program displays a dialog to confirm your selection.

Rotate Tool — Use this tool to select a 3D object in the Camera window and rotate it using its handles.

On the map, you can rotate an object around its vertical axis by dragging the mouse pointer around the object. Rotate handles do not appear on the map.

View Changing Tool — This tool lets you change the field of view and the viewing direction. For telephoto lens selection, move the mouse pointer away from the camera (located where the view field lines meet) while holding the left mouse button down. To select a wider angle of view, move the mouse pointer closer to the camera. To change the view direction, move the mouse pointer around the camera. When you let go of the mouse button, the program will update the Camera window and the Camera Settings panel fields.

To change the view direction without changing the field of view, press and hold the **Shift** key and then press and hold the mouse button.

Location Tool — When this tool is selected, the camera will move to wherever you click on the map. The Camera window will show the view from the new location. The **East** and **North** camera coordinates in the Camera Settings panel will be updated to reflect the new location of the camera. If you want to go back to the previous location, click the **Undo** button in the Toolbar.

Straight Path Tool — When this tool is selected, clicking the mouse will insert a key frame at the location of the mouse pointer. If other key frames already exist, it will create a straight path between the previous key frame and the newly created key frame.

Curved Path Tool — This tool is similar to the straight path tool, except it creates curved instead of straight paths. To create a curved path, select this tool and then click the pointer over each location on the map where you want a key frame.

Camera Window

The Camera window always shows a simplified image of the current camera view. You may use it to interactively position the camera, change the view direction, and adjust the bank and pitch angles.
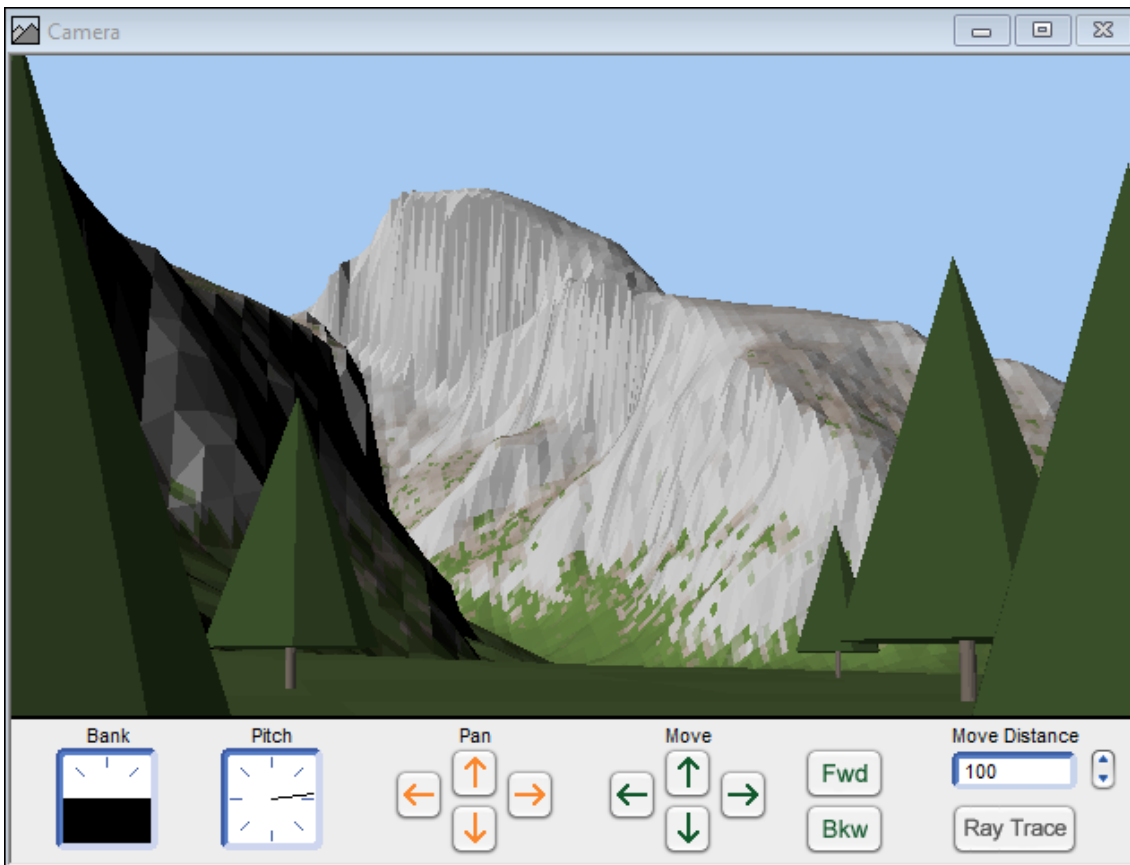
Whenever you load an existing terrain, or create a new one, the Camera window displays it from the current viewpoint. Changing the camera location, direction, lens, lighting, ocean level, and various other settings will automatically update the Camera window. The Camera window can show a preview, which a rough approximation of the actual landscape. The preview will not show clouds, waves, or background trees in order to save time. To see those, click the **Ray Trace** button. Note that it is a one-time use button. After the ray traced image is displayed, the display will, by default, go back to preview mode the next time you move the camera or do anything to trigger an update. Depending on the complexity of the scene, ray tracing may take a significant amount of time.

You can easily move the camera using the six direction buttons below the preview image. There are buttons for moving up, down, left, right, forward, and backward. Clicking these buttons moves the camera in the specified direction. The camera will move by the amount (in meters) specified in the **Distance** field. (You must press **Return** after entering a new value in the Distance field). For example, if the distance is 100, then clicking the **Fwd** button will move the camera forward 100 meters. Note that movement is always relative to the camera, not the landscape. For example, if the camera is pointing straight up, then clicking the **Fwd** button will increase the camera altitude. If the camera is aimed level to the horizon, then clicking the **Fwd** button will move the camera toward the horizon. You may click the **Undo** button in the Toolbar, or choose **Undo** from the Edit menu to return to your previous camera location and viewing direction.

Click the small up and down arrows to the right of the **Move Distance** field to quickly double or halve the move distance. You can, of course, click it multiple times until the desired move distance is shown.

The Camera window can be used to change the composition of your picture. You may frame your view by using the mouse to drag a rectangle over the desired area.

[Magnifier tool icon] Magnifier tool

To zoom in on an area, first select the Camera window (if it is not already selected). Then select the **Magnifier** tool. Move the mouse pointer to what you want to be the upper left corner of the picture. Press and hold down the mouse button while you move it to the lower right corner of the picture, then release it. The view will quickly zoom in to the framed area.

To change the view direction without zooming in, click the mouse button anywhere in the preview window. The location you click will become the new center of view.

```
   0   ─┴─   Level

 +45    ╲    Right

 -45    ╱    Left

-180   ─┬─   Upside
             Down
```
Bank
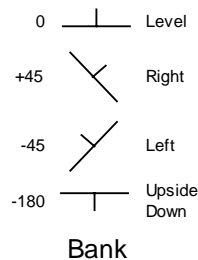
The **Bank control** is a square with black representing the earth and white representing the sky. There are little marks every 45 degrees for reference. To alter the bank angle, press and hold the mouse button while dragging and rotating the black area to the desired setting. The numeric bank angle is shown in the Camera Settings panel.

```
        Up
        90
        ↑
            Horizon
        ├──────→ 0

        ↓
       -90
      Down    Pitch
```
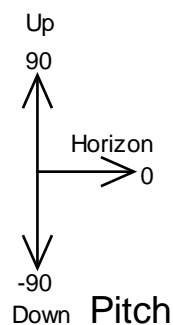
The pitch is adjustable using the **Pitch control**, located immediately to the right of the bank control. The black line represents the pitch. There are marks every 45 degrees. A pitch of 0 degrees (camera pointing at the horizon) is represented by the black line going from the center of the square to the right. A pitch of 90 degrees (straight up) is represented by the black line going from the center to the top of the square. A pitch of 180 degrees or -180 degrees (looking at the horizon upside down) is represented by the line going from the center to the left of the square. To adjust the pitch, just drag the pitch indicator to the desired setting. The numeric pitch angle is shown in the Camera Settings panel.

The Map Window

The Map window shows a shaded relief view of the terrain. Dark green indicates the lowest elevations. Brown indicates higher elevations, and gray indicates the highest spots. The two lines which form a "V" show the camera field of view. Another set of lines (or curves) shows the camera path if it has been defined. A dot on the path indicates the location of a key frame (described in the "Animation" chapter).

When you move the mouse pointer over the map, you will notice that the east, north, and elevation values are constantly displayed at the top of the window. These coordinates describe the location of the pointer, not the camera. The elevation of the land at the location under the pointer is also shown.

There are three viewing modes available. They are selected using icons in the upper left corner of the Map window. The shaded relief view mode has already been described. There is also **Profile** mode which shows a side view of the landscape underneath the camera path. The small tree button is for background tree editing mode. You may switch between the three modes at any time, however, **Profile** mode is most useful when there is a camera path defined.

The Map Window in Profile Mode

The **Profile** mode shows the camera and ground elevation, the pitch, and the vertical field of view. Altitude is represented on the vertical axis (it is displayed constantly at the top of the screen). Distance along the camera path (if any) is represented on the horizontal axis. Profile mode is useful for adjusting an animation path. Although it can still be used when rendering a picture from a stationary viewpoint, you will see only a dot and some lines representing the camera field of view. The ground will be completely flat since only the elevation below the camera is shown. The main purpose of profile mode is for adjusting animation paths.
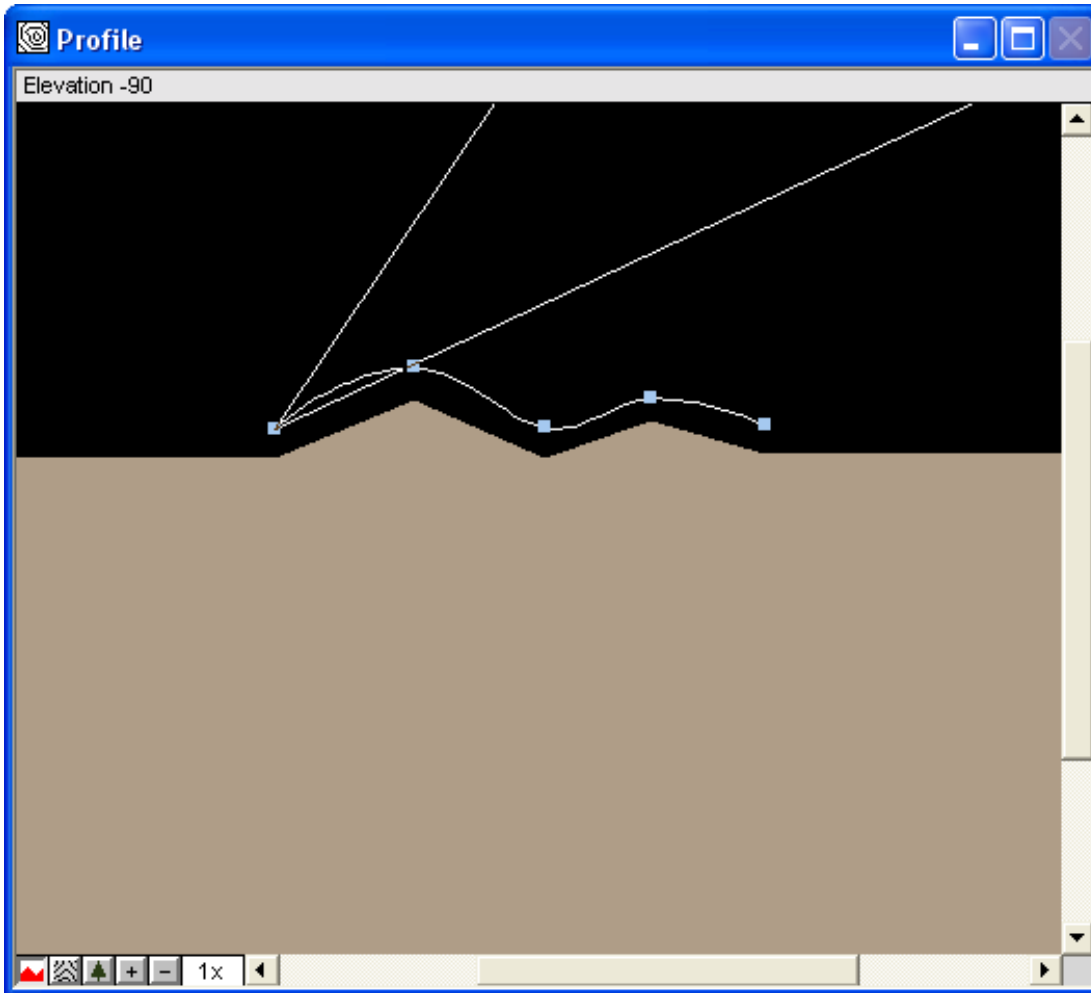
You may modify the altitude and pitch in this mode. To change the altitude, use the **Location** tool and click with the pointer at the desired altitude. To move a key frame, use the **Arrow** tool to drag it to the desired altitude. You can only change the *altitude* of a key frame, not its east or north coordinates in Profile mode.

To change the pitch and field of view, use the **View Changing** tool the same as you would in shaded relief mode.

The **Lake**, **Straight Path**, **Curved Path, Terrain Editing, and 3D Object** tools are not available in **Profile** mode. To return to map mode, just click on its button.

Terrain Editor

Five tools are available for editing terrain. These tools include a paint brush, eye dropper, paint bucket, raise terrain tool, and a lower terrain tool. To use these tools, you first click on the tool to select it. Then you click or drag the pointer in the Map window. Note that these tools do not work in Map Profile or Background Tree Map mode.

Select **Map** mode for editing terrain

To undo a change to the terrain, choose **Undo** from the Edit menu. You can undo only the previous change, so be sure you are satisfied with each change before clicking the mouse again.

Some of these terrain editing tools will bring up a Tool Options panel, which will be displayed on the right side of the toolbar. All values should be entered in meters. The exception is **Brush Hardness** which is entered as a percentage (0 to 100). Note that **Brush Hardness** is available only when the round brush shape is selected.

Eye Dropper - Use this tool to set the current elevation for painting. You can click on the terrain where it has the elevation you want. Or you can enter the elevation numerically in the Tool Options panel.

Paint Bucket - This tool is similar to the **Lake** tool. But instead of filling with water, it fills low areas with terrain. The area lower in elevation than where you click on the map is filled with flat ground.

Paint Brush - Paints the terrain with the current elevation, as shown in the Tool Options panel. Areas painted will be changed to this elevation. You can use this tool for many tasks, including leveling off an area or building a "dam" at a lake outlet. The Tool Options panel allows you to set the brush size and shape (round or square).

When the brush shape is set to **Round**, you have control over the brush hardness. If you want the change in elevation blended with the surrounding terrain, enter a hardness value of 0. For abrubt changes, use a hardness value of 100.

Raise Tool - This raises the terrain at the location where you click on the map. The Tool Options window lets you set the size of the area and distance to raise it. The raised area will be blended.

Lower Tool - This lowers the terrain at the location where you click. The Tool Options window lets you set the size of the area and distance to lower it. The lowered area will be blended.

The Camera Settings Panel

The Camera Settings panel has numeric fields describing the current camera location and view direction.
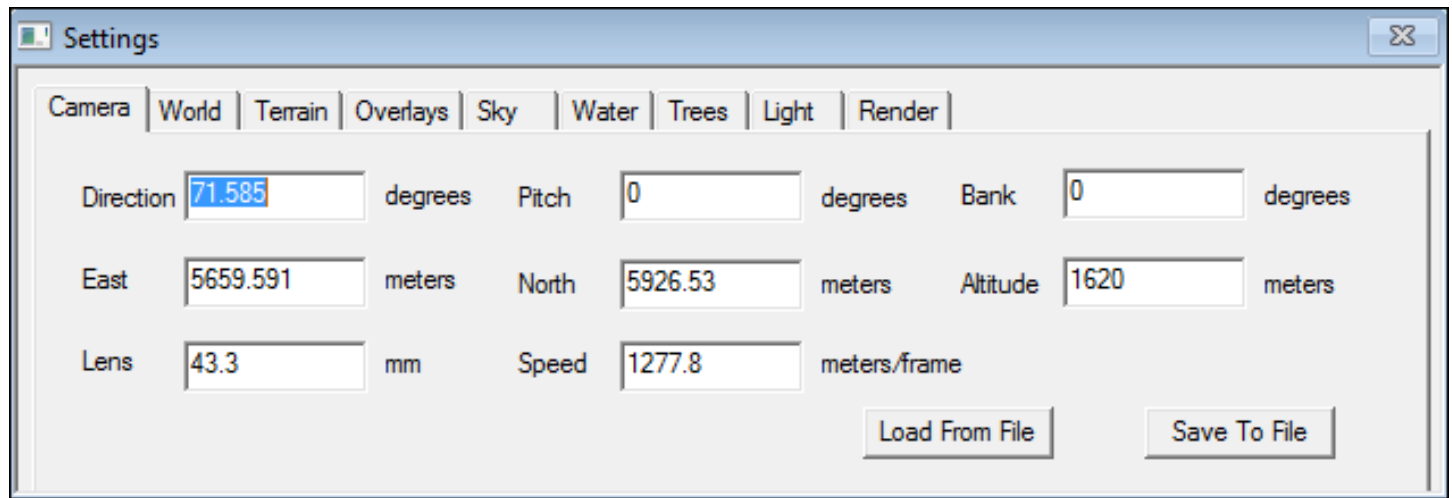
There are eight numeric fields in the Camera Settings panel. Note that you must press **Return** after entering a new value in any of these fields. Otherwise, the new value will not take effect. As confirmation, when you significantly change a value in these fields, you should see it reflected immediately in the Camera and Map windows.

East, North, Alt — These three numbers are the coordinates of the current camera location (in meters).

Dir — This field is the camera view direction in degrees. The camera view direction is also indicated in the Map window.
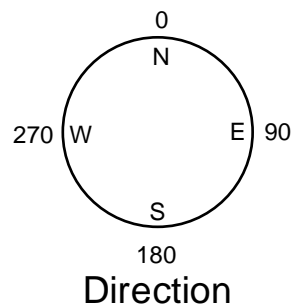
Pitch — This is the horizon angle in degrees. Zero is perfectly level. The pitch is also indicated in the Camera window.

```
        Up
        90
         ↑
              Horizon
         ┼───→ 0

        -90
       Down   Pitch
```
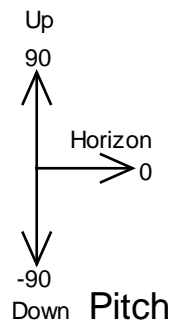
Bank — This is the camera bank angle in degrees. For example, 0 is level and +45 is like being in an airplane making a right turn (right wing drops). The bank is also indicated in the Camera window.

```
    0  ───┴───  Level

  +45    ╲      Right

  -45    ╱      Left

                Upside
 -180  ───┬───  Down
```

Bank
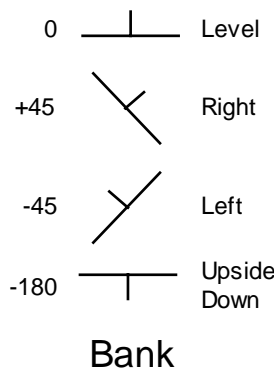
Lens — This field is the focal length of the camera, in millimeters. Use values that are appropriate for a 35 mm camera. For example, wide angle is 18 and telephoto is 400mm.

Speed — This is the camera speed in meters per second. You can change it at any time, but it is used only during animations.

If you want a constant camera speed throughout the animation, set the speed value before you begin to create keyframes. The speed value is stored in each keyframe.

For a variable speed animation, enter the desired speed in each keyframe. Select the keyframe on the map and enter the speed. Be sure to press **Enter** so that the change takes effect. Continue this process for each keyframe you want to change.

Preferences Settings

Natural Scene Designer's **Preference** dialog lets you set many program options. It also gives you a choice to automatically load any project file at startup. You can access it from the **Edit** menu.

Initial Camera Placement - Enter the elevation (relative to the terrain) to place the camera when importing a DEM or creating a new fractal landscape. You can also enter the starting pitch angle.

Change Startup Settings - The selected Natural Scene Designer Project file will automatically be loaded every time the program starts. If you click **Startup With Default Settings**, the program will not load a project file at startup.

Camera Move Distance - This controls the distance (in meters) that the camera moves when you click one of the Move buttons in the camera window.

Auto Bank Speed Limit - When the **Auto Bank** option is on in the **Path** menu, Natural Scene Designer Premium uses the camera speed and turn radius when computing the camera bank angle along a flight path. If the camera is going too fast you will always end up with 90 degree banking in turns, unless you set an appropriate speed limit. Note that the speed limit you enter is only for computing the amount of banking, not the actual camera speed or the distance it travels between.

Auto Bank Amount - You can use this to control the amount of camera banking in turns. 100% is normal. You can change this value if you want a different amount of banking.

Reset Warning Messages - Some of the warning messages displayed by this program contain check boxes where you can turn them off. Clicking **Reset Warning Messages** will turn them all back on.

Terrain Elevation Storage - This lets you select the elevation precision. You have a choice of **Automatic**, **16 bit**, and **32 bit**.

The **Automatic** setting uses 32 bits per elevation if enough RAM is available. If not, it uses 16 bits per elevation.

The **16 bit** setting rounds all elevations to the nearest meter. This allows for more efficient storage, but can result in a loss of vertical precision and may cause stair-stepping artifacts, especially on low sloping surfaces or when the sampling distance is 10 meters or less.

The **32 bit** setting uses a 32 bit floating point number storage format. This allows for much better vertical elevation precision, but doubles the amount of memory needed.

Camera Window Aspect Ratio - The Camera Window aspect ratio may be changed (within limits) to match the aspect ratio of fully rendered output. You can either set it at **Fixed** and enter a value, or have it use the same aspect as the Render Settings.

Note that the aspect ratio is the width (in pixels) divided by the height.

Automatically check for updates - If you choose to check for updates automatically you will be informed at program startup when a newer version is available.

Or you may check for updates manually at any time using the "Check for newer version" function in the **About** menu.

Use Terrain Blend Colors in Map Window - By default, the program uses a fixed set of colors for display in the Map window. With this option on it uses the blend colors you have set within the Terrain Settings dialog.

Disable Multithreading - Setting this check will turn off multithreading. Normally you should leave this unchecked (not disabled) for maximum rendering speed.

However, you might want to disable multithreading if you are rendering, for example, a time-consuming animation and you want Natural Scene Designer to limit itself to only 1 processor, so you can do other work on the computer while rendering.

Display Decimal Latitude / Longitude - By default, the program displays latitudes and longitudes in degree / minute / second format. This option changes it to display decimal degrees.

3D Objects 9

Natural Scene Designer Premium lets you easily create, import and place 3D objects in your scenes. There are three categories of objects supported: primitives, imported QuickDraw 3D (3DMF) or 3D Studio (3DS) objects, and internally generated objects (trees, bushes, and rocks). Each category of object will be discussed in this section, along with examples for common operations.

The Objects window displays small size previews. It's used as an object holding area, which makes it easy to manage objects. Using this window you can place multiple copies of the same object in a scene without having to reload it each time.
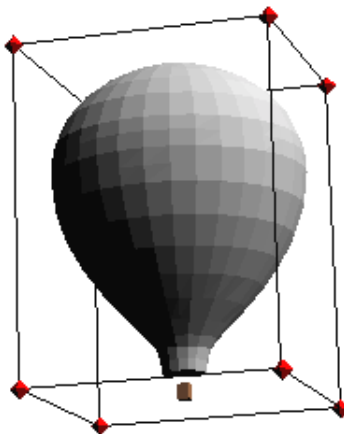
Once an object is placed in the scene, you can rotate, move and resize it. When an object is selected, it appears in the Camera window with a box when the **Arrow** tool is active. You may use the **Arrow** tool to resize an object by dragging its scaling handles. If you press the **Shift** key before you move the scale handle, the scaling will be uniform in all 3 dimensions.

When the **Rotate** tool is active, the program draws the object with 3 circles and rotation handles where the circles meet. To rotate an object, drag the rotation handle in the desired direction. The object will follow the rotation of the handle. You may use either the **Arrow** or **Rotation** tools to move an object left, right, up, or down. To move it toward or away from the camera, just press the **Control** key before you begin to drag the object. Then you will be able to move the object forward, backward, left, or right.
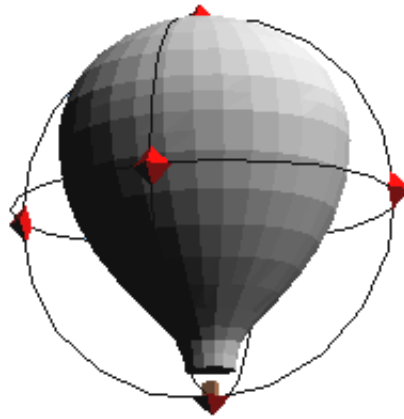
Objects are shown in the Camera window with solid 3D shading. Objects appear on the Map window from an overhead view without shading. You may manipulate objects in either the Map or Camera View windows, or you may find it convenient to switch back and forth.

Primitive Objects

Natural Scene Designer Premium supports 4 primitive object types: cones, cylinders, boxes, and ellipsoids (including spheres). To create, position and manipulate a primitive object:

1. First make sure you have either opened an existing project, or created a new fractal landscape.

2. Choose the desired primitive object from the Objects menu. The program will create the object and place it in the Objects window. Click in the Objects window to select the object.

3. Click in either the Map or Camera windows at the location where you want to place the primitive object.

4. Once placed in a view, you can use the **Arrow** tool to select, drag or resize the object in the Camera View window.

5. To rotate the object, select the **Rotate** tool and drag the rotation handles around in the Camera window. To rotate the object around its vertical axis in the Map window, select the object and drag around the center of the object. A box with alignment axes is drawn during rotation on the Map.

6. To change the surface or to get numeric information about an object, choose **Properties** from the Objects menu.

7. To place multiple copies of the same primitive, double-click on its image in the Objects window. This "locks" the tool to stay set. Now, each click in either the Map or Camera window will create a new object. To get out of "locked" mode, just click on another tool in the Toolbar.

Importing Objects

Natural Scene Designer Premium imports objects in Apple's QuickDraw 3D (3DMF) and 3D Studio (3DS) formats. If the object contains a texture, it will be seen in ray-traced renderings, but not in the Object window.

The 3D Object Options dialog gives you the chance to make some preliminary adjustments to an object as you begin to import it.
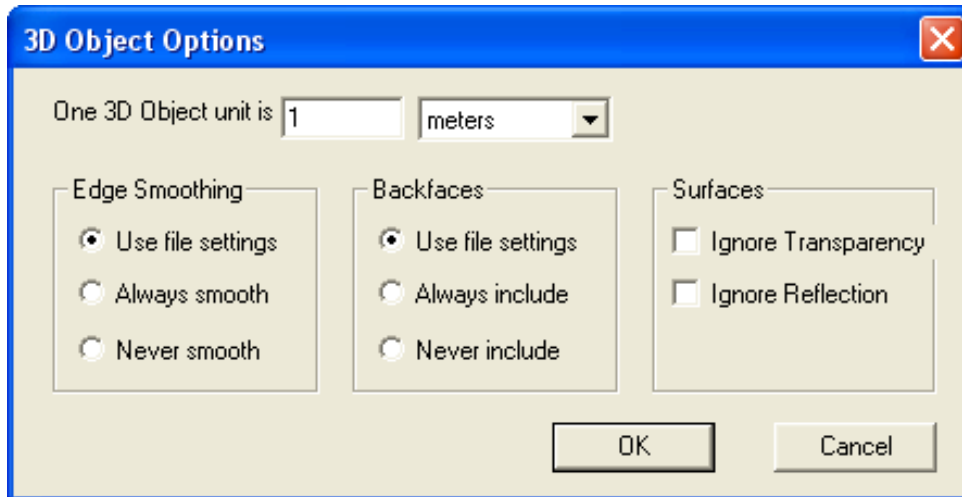
If you know what units (inches, feet, meters, etc.) were used when the object was created in its modeling program, you can select the appropriate unit of measurement. Then the object will appear in the correct scale when placed in a scene. For example, if you are importing a model of a building and its measurements are in feet, the correct setting would read "One 3D Object unit is 1 foot". If you want to make the building 2 times larger, you could enter a 2 in the numeric field. If you don't know what the model unit of measurement is, you can adjust its size after importing it by using the Object Properties dialog, or by dragging its scale handles in the Camera View window.

The **Edge Smoothing** buttons control whether the object edges will be smoothed during rendering or appear faceted. You may use the settings in the object file or you may override them. Edge smoothing can also be adjusted in the Object Properties dialog. You can see the effect of smoothing in ray traced renderings, but not in the **Preview** or **Quick Test** rendering modes.

The **Backface** buttons control whether or not backfacing polygons will be rendered. The polygons in some imported objects may be facing the wrong direction. If so, the object will appear to have missing pieces when rendered. You can correct this situation by choosing **Always Include**, however you should not do this unless you're sure that you need to. Checking Always Include will increase the rendering time and may result in a slight reduction in the rendering quality.

To import an object:

1. First make sure you have either opened an existing project, or created a new fractal landscape.

2. Select **Import 3DMF** from the Objects menu.

3. After entering the file name and clicking **Open**, you will see the 3D Object Options dialog. You can scale the object while loading, choose whether or not you want backfacing polygons, and decide whether or not you want edge smoothing. Usually, it works fine if you go with the default settings.

4. After the object loads, a small image of it will appear in the Objects window. This window is a holding area where objects may be selected and placed on the Map or in the Camera window.

5. To place the object, first make sure it is selected in the Objects window. It should have a red frame around its border. Natural Scene Designer Premium treats imported objects in the Object window as tools. So when its small image is selected, the active tool is considered to be the imported object.

6. Click the mouse pointer in the Camera or Map window where you want to place the object. (The window must be active before it will accept objects).

7. To place multiple copies of the same object, double click on its small image in the Object window. Then every click in the Map or Camera window will place a new copy of it. When done placing multiple copies, just select another tool.

Creating and Placing Trees

Natural Scene Designer Premium can create four types of realistic trees - Oak, Palm, Redwood, and Sweet Gum.

To create and place a tree:

1. First make sure you have either opened an existing project, or created a new landscape.

2. Choose **Create Tree** from the Objects menu.

3. Select the type you want and adjust the settings as needed in the Tree dialog. Press the **Preview** button to see what the tree will look like.

4. Click **OK** and the program creates a small tree image in the Objects window.

5. Select the tree in the Objects window. The tree becomes the selected tool.

6. Click in the Map or Camera Window to place the tree. Note that the point you click is where the base of the tree will be. If you click a point in the sky, nothing will happen.

7. Now you can drag the tree to move it as previously described for other types of objects.

8. To place multiple copies of the same tree, double click on its small image in the Objects window. Then every click in the Map or Camera window will place a tree. When done placing multiple trees, just select another tool.

Bushes and rocks are created and placed using a similar procedure.

Note: Trees and bushes may be moved, but not rotated or scaled.

Placing Objects in the Map Window

The Map Window is useful for placing multiple copies of the same object. You may zoom in to a particular area of a landscape and place objects like you are using a rubber stamp. When placing objects in the Map window, they are automatically positioned at ground level.
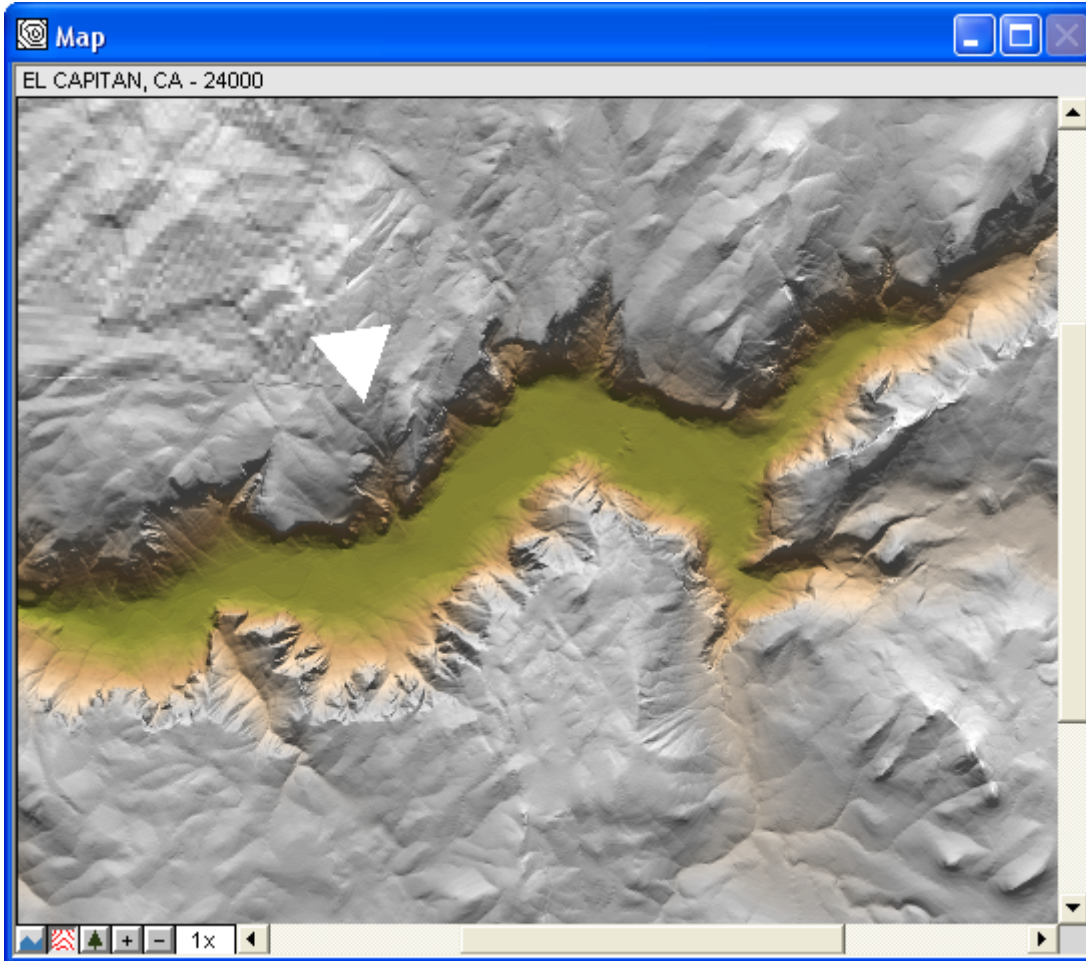
You may find it convenient to place objects on the map at first, and then "fine tune" their position by returning to the Camera View window. Both windows are always updated when an object changes.

To rotate an object on the Map, select the **Rotation** tool. Then select the object and drag the mouse around its center. On the Map, rotation is limited to the object's vertical axis only.

Object Properties Dialog
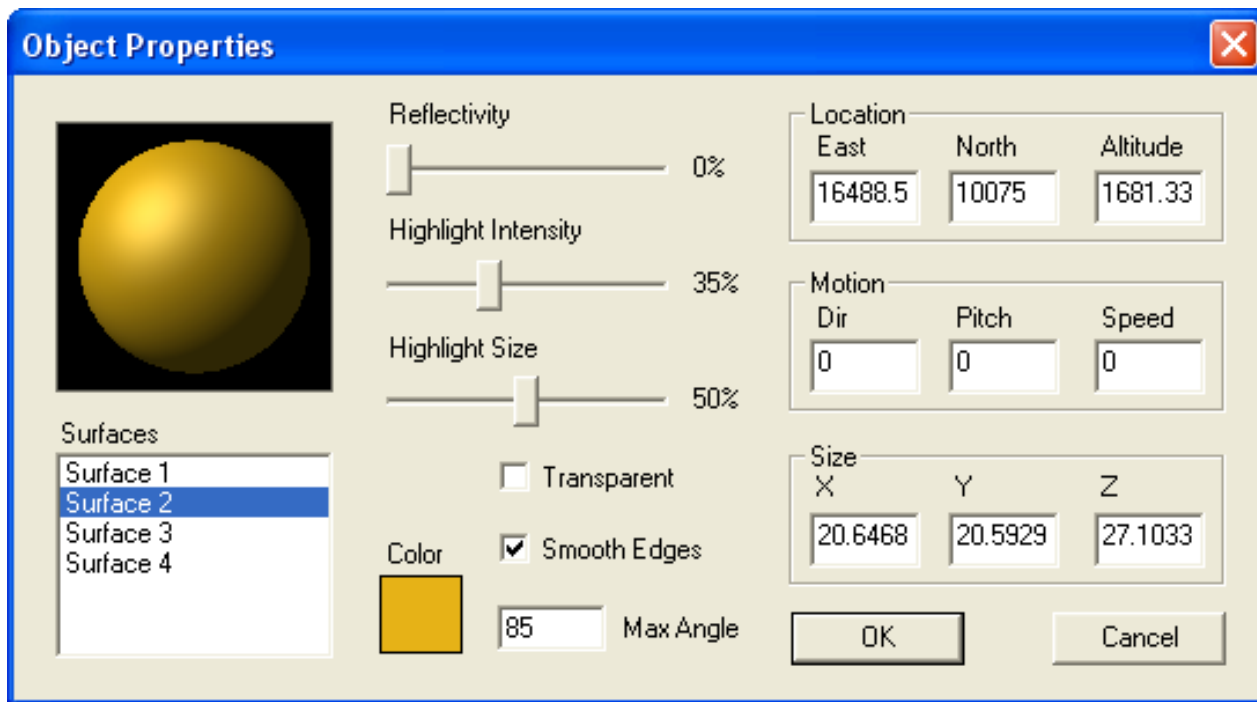
For numeric information about an object, select it and choose **Properties** from the Object menu. This displays the Object Properties dialog. You can set the object's surface properties, numeric position, size, direction, and speed. Trees have a special properties dialog that lets you change their parameters.

The **Location** fields let you adjust an object's precise location. For objects that move during an animation, the Location entered is the object's starting point. The number in the **East** field is the object's distance from the western edge of the landscape (left hand side of the map). The number in the **North field** is the object's distance from the southern edge of the landscape (bottom edge of the map). The **Altitude** field contains the distance above sea level, not the distance from the ground surface.

The **Motion** fields let you define an objects direction and speed along a straight path during an animation. The Motion fields are ignored when rendering single frames. The **Direction** field is the compass direction of travel, specified in degrees. The **Pitch** is the upward or downward angle in degrees. Positive pitch values specify upward motion. Zero pitch is level, and negative pitch is downward motion. The **Speed** field contains the distance that the object will travel between successive animation frames. For example, if the speed is set to 10 and there are 50 frames in the animation, then the object will travel a total of 490 (10x49) meters during the entire animation.

The **Size** fields let you scale an object along any of its axes. The X, Y, and Z size fields contain the size along each of the object's axes. When an object is rotated, the axes move with it. Note that some imported objects may only be two dimensional. If this is the case, one of the fields will be zero and disabled.

The **Reflectivity slider** lets you adjust the amount that the selected object reflects its surroundings. If the reflectivity is set to 100%, then the objects surface color will be ignored.

The **Highlight Intensity slider** controls the object's shininess (or the amount of light that is reflected by it).

The **Highlight Size slider** controls the amount of surface area reflects the light. Low percentage values for the highlight size make the object look shiny, and high values make it look rough or chalk-like.

Clicking the **Color Square** brings up a color adjustment dialog. The color adjustment does not affect the surface of imported objects with texture maps, because the texture is used instead of the solid color (in ray trace rendering mode).

The **Transparent** check box selects whether or not an object is transparent. Note that transparent objects will not be visible in a scene unless they have a reflectivity greater than 0%.

The **Smooth Edges** check box and **Max Angle** fields apply only to imported 3D objects that contain polygonal meshes. When edge smoothing is enabled, adjacent faces that meet at an angle less than the maximum specified value will be rendered without a sharp, visible edge. Edge smoothing is only done in ray trace mode, not in the Camera View or Quick Test modes in order to minimize the rendering time.

Imported 3D objects often consist of multiple object parts, each with unique surface characteristics. They are independantly adjustable. Select the surface (by name) that you want to adjust and then make the desired changes. A sphere shows what the resulting surface will look like when it is ray traced. Textures (if any) are not shown in the Object Properties dialog.

Copying an Object Master

You can copy an object that has been placed in the scene, and make it available for future use by choosing the **Make Master** function in the Objects menu. The program will create a small image of the object and add it to the collection in the Objects window. This function is useful if you import an object, modify it, and wish to place additional copies of the modified object.

For example, suppose that you import a gray rock object and you wish to place 4 gray rocks and 4 black rocks in the scene:

1. Import the gray rock.

2. Place 4 copies of it in the scene.

3. Place another copy of the gray rock where you want one of the black rocks.

4. Change the gray rock you just placed to black using the Object Properties dialog.

5. Select the black rock. Choose the **Make Master** function from the Objects menu. You will see a small image of the black rock added to the collection in the Objects window.

6. Double-click on the small image of the black rock in the Objects window.

7. You can now easily place three more black rocks in the scene.

Using Preset Object Views

To facilitate object placement, orientation, and size adjustments, you can switch to various preset views of an object. There are five commands in the Objects menu for switching views - **Save View**, **Restore View**, **Top View**, **Front View**, and **Side View**.

To store the current view (so you can quickly return to it later) choose the **Save View** command in the Objects menu. **Restore View** will return to the most recently saved view. To switch to a preset view (top, front, or side), first select the object in the Camera or Map window. Then select the desired preset view. When you are done making adjustments to the object, you can use the **Restore View** command (if you saved it before switching views). If you forgot to save the original view, you might be able to restore it using the **Undo View Change** command in the Edit menu. Note that the Undo function does not affect adjustments made to the object, only the camera viewpoint and direction.

Tutorial: Creating Trees and Importing Objects

Natural Scene Designer Premium can import QuickDraw 3D (3DMF) and 3D Studio (3DS) objects. You can create 3D objects in your favorite 3D modeling program, and then import them into this program to place them in a natural environment. Trees, bushes, rocks and primitive objects can be created within Natural Scene Designer Premium.

For this tutorial project, we are going to create and place some redwood trees and hot air balloons on Wizard Island, which is in Crater Lake, Oregon. We'll use a terrain model of Crater Lake and some hot air balloons.

First, choose **Open** from the File menu. Select the "Tutorials" directory on the program CD-ROM and open the file "CraterLake.nsd".

This Crater Lake file already has the camera positioned on Wizard Island. After it opens you should see Wizard Island in the foreground, the lake, and the rim of Crater Lake in the background.
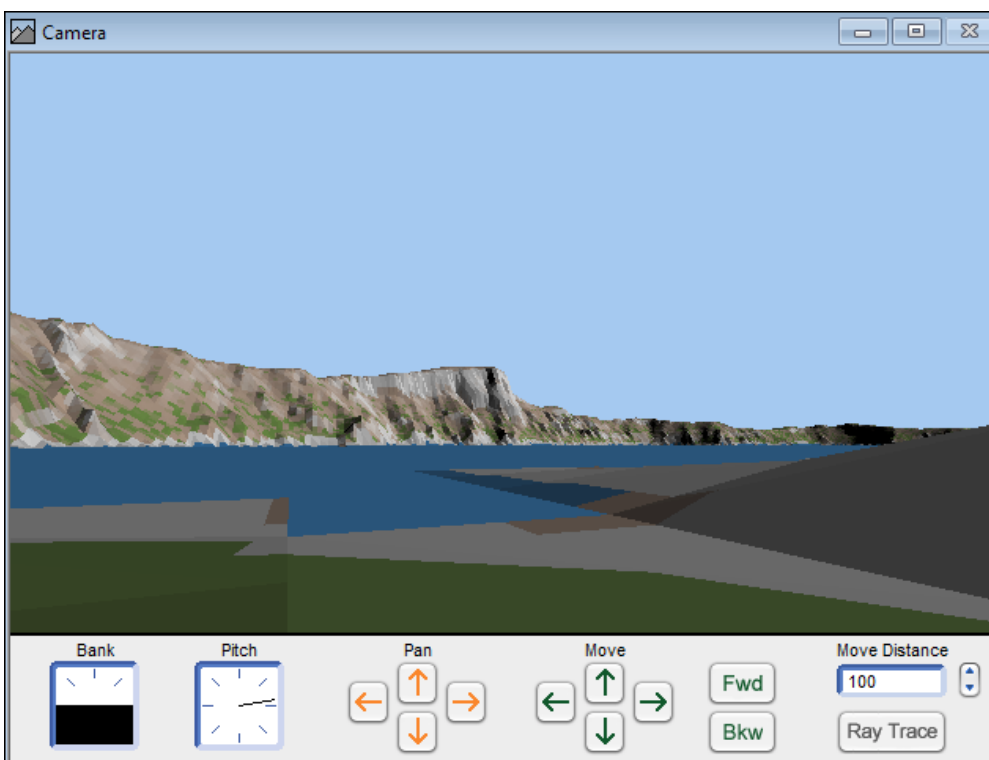
The view from Wizard Island

The Map is set to 1X scale, so every pixel represents 30 meters. We need to zoom into the location where the camera is at so we can see the objects we are placing. To do this, select the **Magnifier** tool.

 Magnifier tool

Now drag a small box around the location where the camera view field lines meet (the camera location). When you let go of the mouse, the program will enlarge the map scale so the area in the rectangle occupies all (or most of) the view area.
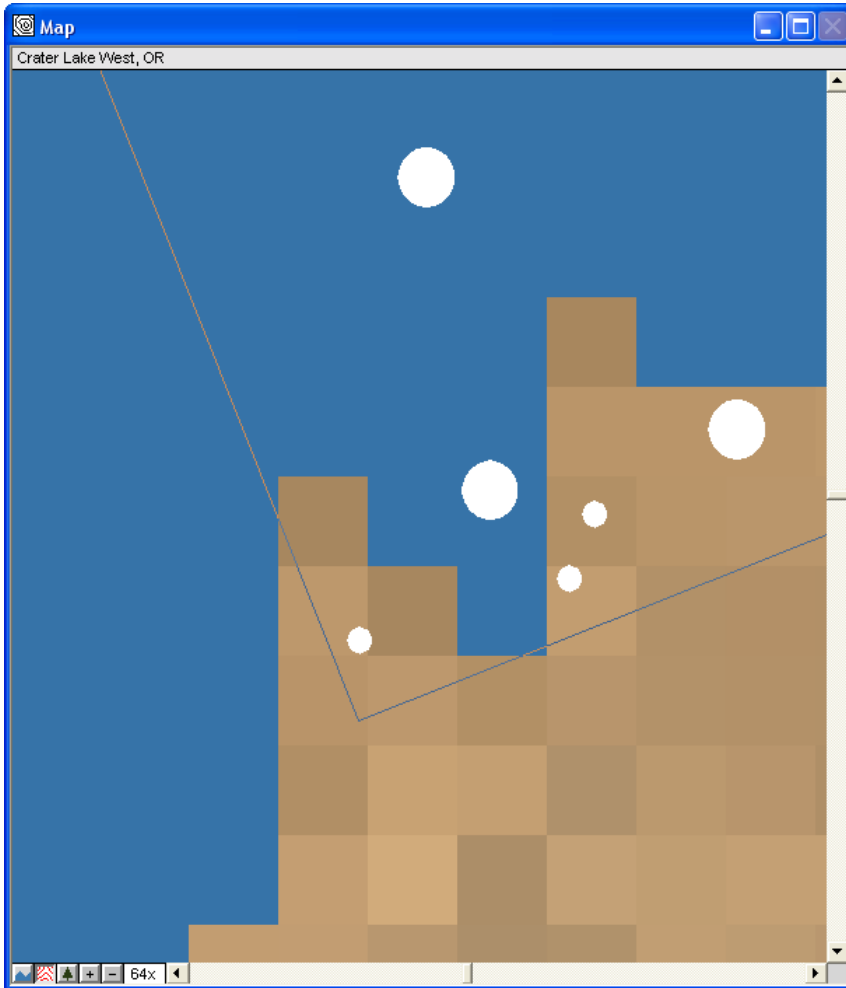
Now, the Map window should have a zoom factor of about 32X. The zoom factor is shown in the upper left corner. If it is not 32X, you can set it quickly using the zoom pop up menu (it is accessible by clicking on the scale factor).

Next, we are going to create and place three redwood trees. Choose **Create Tree** from the Objects menu. Select the **Redwood** tree type. You can change the seed and click **Preview** until you get a tree that you like. Click **OK** and a small image of the tree will be placed in the Objects window.

Double click on the tree image in the Object window (the small window below the Camera View window). This "locks" it as the current tool. If you were to single click on the small tree image, then the program would automatically revert back to the **Arrow** tool after placing a single tree. Now locate the mouse pointer over a spot on the map (within the view field) and click to place some trees. You can
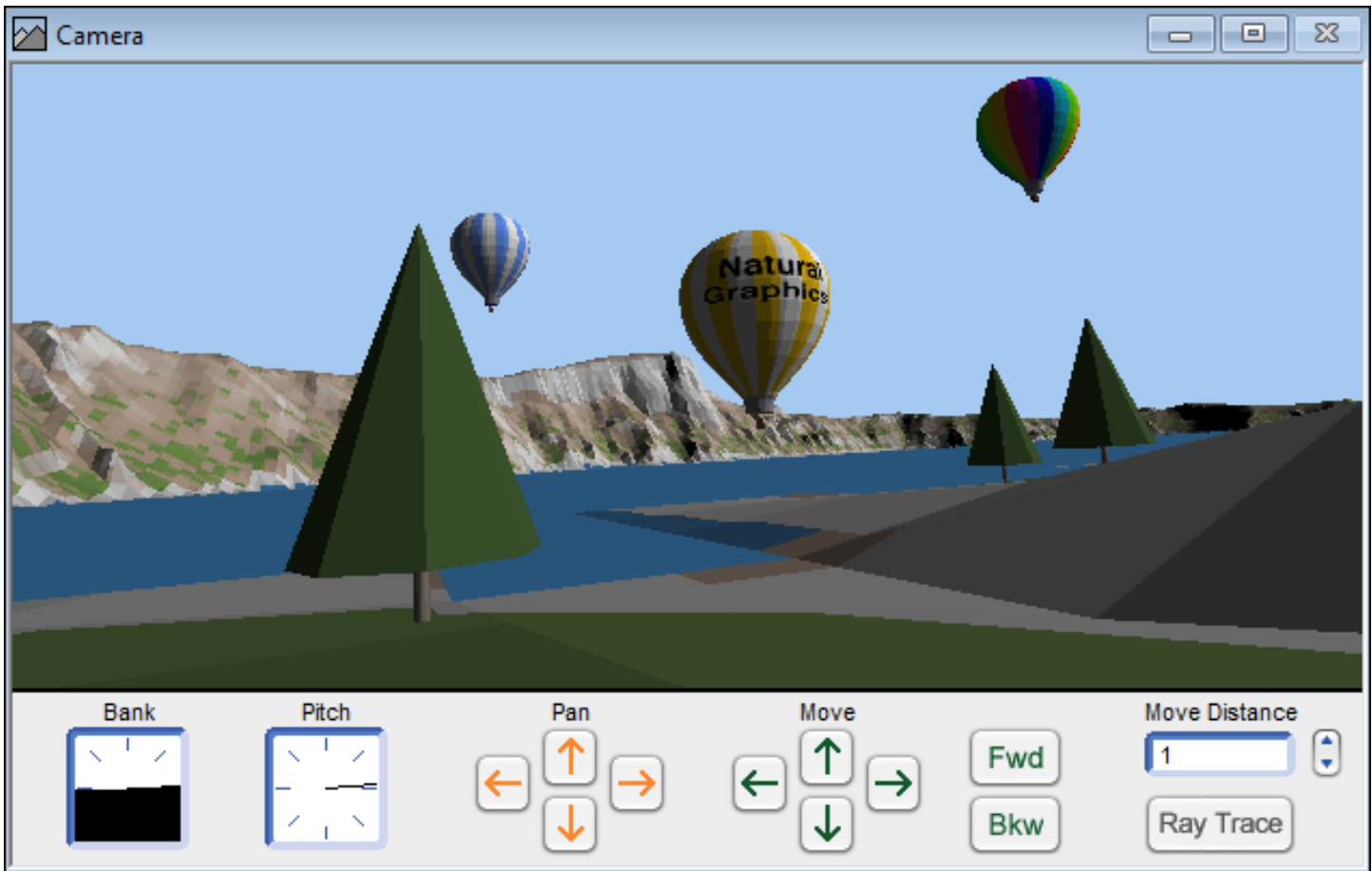
use the small white circles in the Map window shown above as a guide to their placement. The hot air balloons, which we will place later, are the three large circles. Now, place the remaining trees by clicking over their location on the map.

Now we need to import and place the hot air balloons. Choose **Import 3D Object** from the Objects menu. Select the "Tutorial" folder and open one of the hot air balloon objects. After clicking **OK**, you will see the 3D Object Options dialog. Click **OK** to accept the default options. The object will load and then be displayed in the Objects window.

We will place the balloon using the Camera View window. Make sure the balloon is selected in the Objects window (with a red frame around it). Now make the Camera View window active by clicking on its title bar. To place the balloon, just click the mouse pointer in the sky. A balloon will be put there.

If you want to move the balloon, select the **Arrow** tool. Then select the balloon and drag it. If you want to change the depth of the balloon, press and hold the **Control** key *before* dragging it.

To delete an object that has been placed in the scene, select it with the **Arrow** tool and choose **Delete Object** from the Objects menu, or press the **Delete** key.

If you move a tree and want to make sure its base is at ground level, select it in the Camera or Map window using the **Arrow** tool and click on the **Drop to Ground** button.

Drop to Ground tool

When satisfied with the composition of your scene, choose **Render Picture** from the Render menu. You might want to do a **Quick Test** render first to check object placement before using the **Ray Trace** rendering mode.

The final rendered image from Wizard Island

Animation   10

Key Frames

Three-dimensional key frame systems are the most popular type of animation system in use today. You can specify the position and direction of the camera and various other settings. The program interpolates a camera path and evaluates the frames in between. This saves you from the tedious chore of manually calculating and entering coordinates for each frame.

This software lets you easily create three-dimensional camera paths. You simply create key frames at critical points along the camera path and the program automatically creates a smooth three-dimensional curve that passes through them. You may freely intermix straight and curved segments (using the **Straight** and **Curved Path** tools).

When a keyframe is selected, the Map window will display its tangent arrow. *Note that this tangent arrow is only used to control the shape of the path curve, not the camera view direction.* You can drag the arrowhead and interactively change the curve. In addition to the direction, you can also control the magnitude of the tangent by dragging the arrow closer or farther from the keyframe. You will get an instant preview of the resulting path.

You may select an option that sets the view direction of the camera to one that is always tangent to its path. This option is available by choosing **Direction tangent** from the Path menu.

There is another option to connect the last key frame to the first key frame. This option is selected by choosing **Closed loop** from the Path menu. There are some guidelines to follow for this to work properly. You need at least three key frames. We recommend that you use a curved path and turn the **Direction tangent** option on.
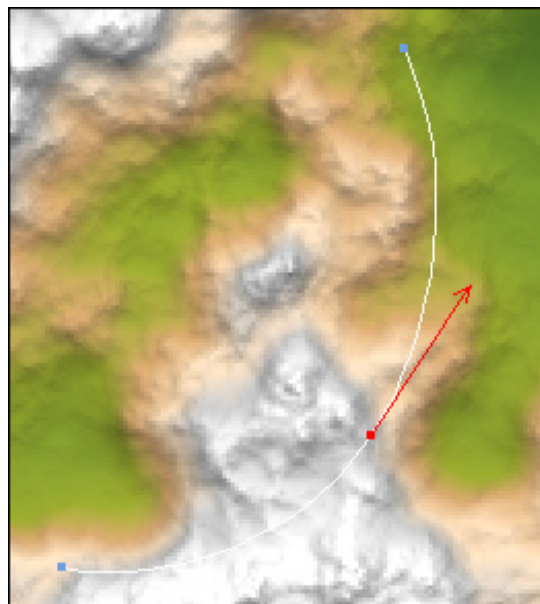
A selected keyframe and its tangent arrow

The speed and total number of output frames for the animation is set in the **Camera Speed and Frame Rate** dialog. You can access this dialog from either the Path menu or the Render Animation dialog. The total number of output frames is independent of the number of key frames used for defining the path.
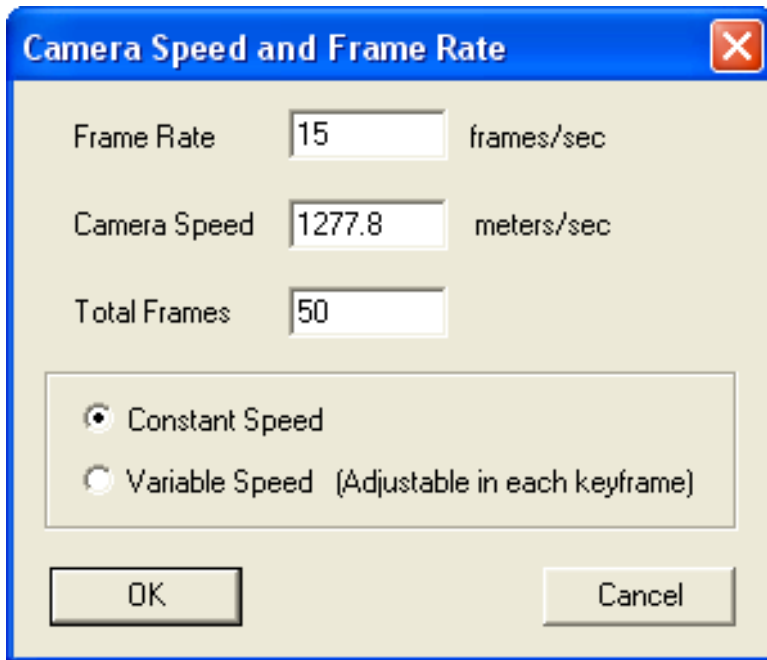
To define an animation whose speed varies along the path, you should set the speed by selecting each keyframe. Then enter the speed in the Camera Settings panel.

For variable speed animations, the above dialog can be used to adjust the frame rate (frames per second during playback), but the **Speed** and **Total Frames** fields in the dialog are disabled. The program computes the total number of frames according to the camera path distance, speed (which may vary) and the frame rate.

For a constant speed animation, all fields are enabled. Adjusting one field will affect another. For example, if you change the speed or the frame rate, it will automatically change the total number of frames. If you the change total number of frames, it will adjust the speed so that the camera is able to cover the entire path in the desired number of frames.

For smooth animation you should use slow speeds when the camera is close to the ground or going around sharp curves. At high altitudes you might need a higher camera speed. Determining the best speed for smoothly animating a given path may require experimentation. The **Preview path** command in the Path menu will help you determine the best speed.

You may animate changes in the following using key frames: the camera position, direction, bank, pitch, and lens setting. Cloud and 3D object animation is independent of the key framing system. 3D object animation is accomplished by setting a starting location, speed, and direction in the Object

Properties dialog. See the cloud animation tutorial in the "Terrain Models and Settings" chapter for an example of how to animate clouds.

Animation Dialog

The Render Animation dialog is similar to the Render Picture dialog. It has the same controls for the picture size.
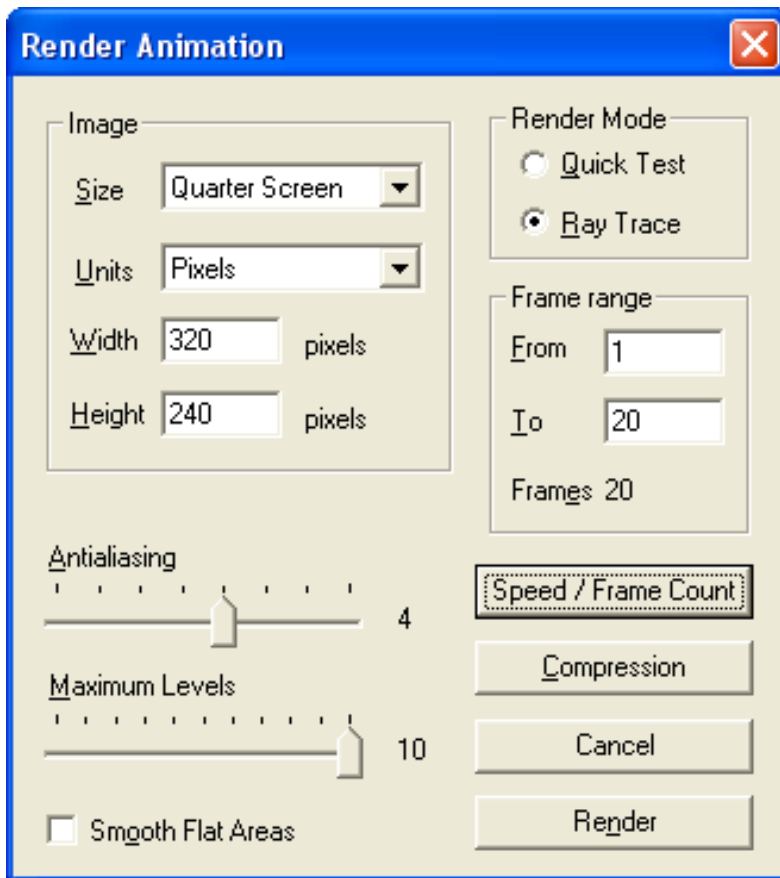
You can choose to render only part of the animation by entering the desired frame range in the **From** and **To** fields. These fields are initialized assuming that you want to render every frame in the animation.

The **Antialiasing** and **Max Levels** sliders serve the same function as in the Render Picture dialog. They are described in the "Terrain Models and Settings" chapter.

QuickTime Compression

If you specified QuickTime for saving your animation, you will be able to specify the compression method. You can specify the type of animation compression from among those available on your system, and the frames per second. The various compression methods available on your computer have trade-offs in playback speed, compression ratio, compression speed, and compressed image quality.

AVI Compression
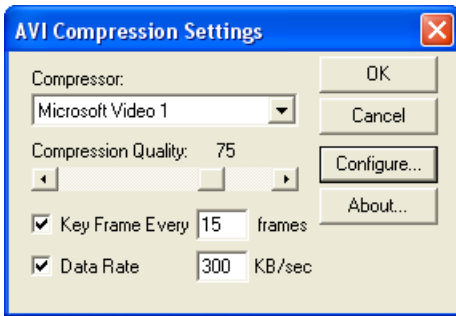
The AVI dialog lets you choose which compressor to use, the compression quality, key frame rate, and data rates.

The list of available compressors may vary depending which version of Windows you are using and which compressors that you have installed.

Suspend and Resume
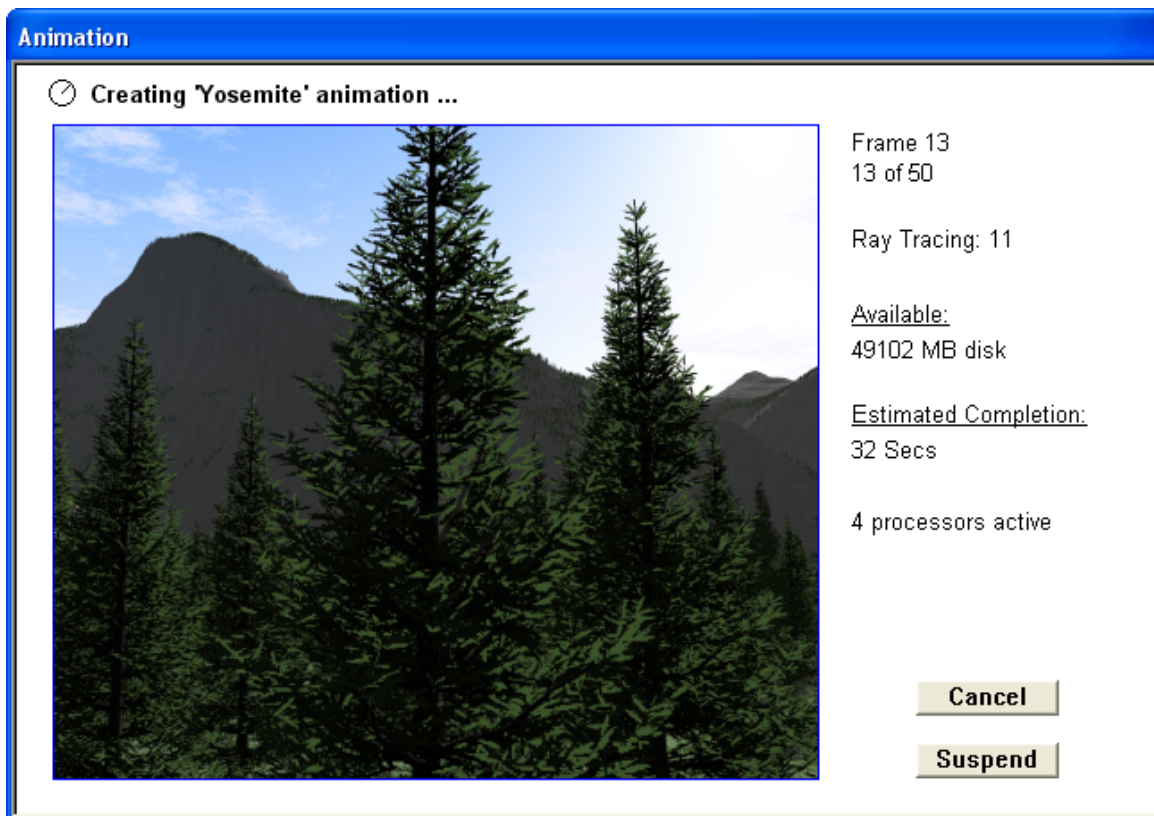
Natural Scene Designer Premium can render an animation in multiple sessions. This feature is very easy to use. If you wish to stop rendering, simply click the **Suspend** button (in the Animation Progress window shown above) any time after the program has rendered at least one complete frame. You can also select the same function from the Render menu. You can use the Resume function even if there was a power outage and you never had a chance to click the **Suspend** button!
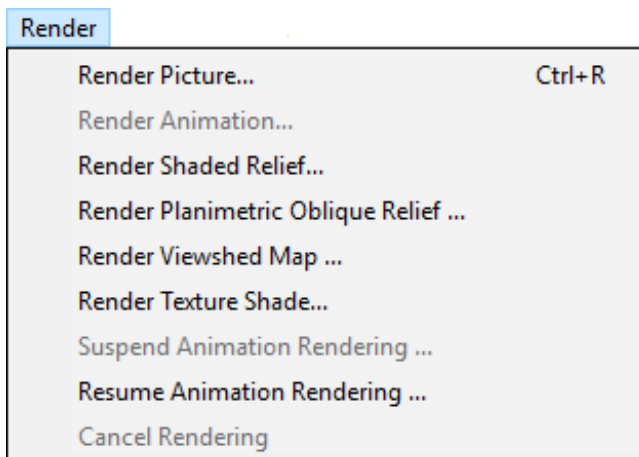
Later, when you are ready to resume rendering the animation, choose **Resume Animation Rendering** from the Render menu. It will prompt you for the name and location of the suspended animation file (which is the same name you chose when you originally started the animation rendering).

Note that if you click **Cancel** you will not have a chance to resume the animation later. You should only use **Cancel** if you notice something wrong with the animation and want to change the settings, flight path, etc. and start over.

You might be wondering how suspend and resume works -- even if you never click **Suspend** and there is a power outage. The program automatically saves a copy of your settings in the Preferences folder at the beginning of animation rendering. The partially rendered animation is saved in another file, which is the file name you choose when you started the animation. After each frame has completed rendering, it is saved in the file automatically.

Tutorial: Example Animation

Natural Scene Designer Premium has a built-in key frame animation system. A key frame stored in the computer contains the camera position, direction, pitch, and bank. An animation consists of two or more key frames, with the program interpolating the camera position and direction for each frame of the animation between key frames. Before creating a key frame sequence yourself, it may help to study an existing one. The "Animation" chapter will fully explain the details.

First, choose **Open** from the File menu. When the dialog appears, select the "Tutorials" directory and open the file named "ExampleAnim.nsd".

This project is based on the previous tutorial. A straight path was created which flys out over the lake. It only took a few mouse clicks to create the path, which is shown on the Map window as a line connected by two small squares. They mark the starting and ending points. You can also create curved camera paths with multiple keyframes, which is demonstrated in the next tutorial.

To get a quick idea of what this animation looks like choose **Preview path** from the Path menu. Then you will see a low resolution preview of the animation in the Camera View window. The Map window will show the camera location and its field of view as it moves along the flight path.

To fully render the animation, choose **Render Animation** from the Render menu. Then Natural Scene Designer Premium will ask you for the name of the animation file you want to create. After entering the name of the animation file click the **Save** button. Then the program will display a dialog for you to set the size, resolution, and rendering mode. Just click **Render** to accept the default settings, and the program will begin rendering the animation.

While the animation is rendering the program displays a status window with progress information, remaining disk space, and estimated time until completion. It will also display an image of each frame after it is finished. Note that the picture displayed is always the previous frame, so it will be blank until the second frame.
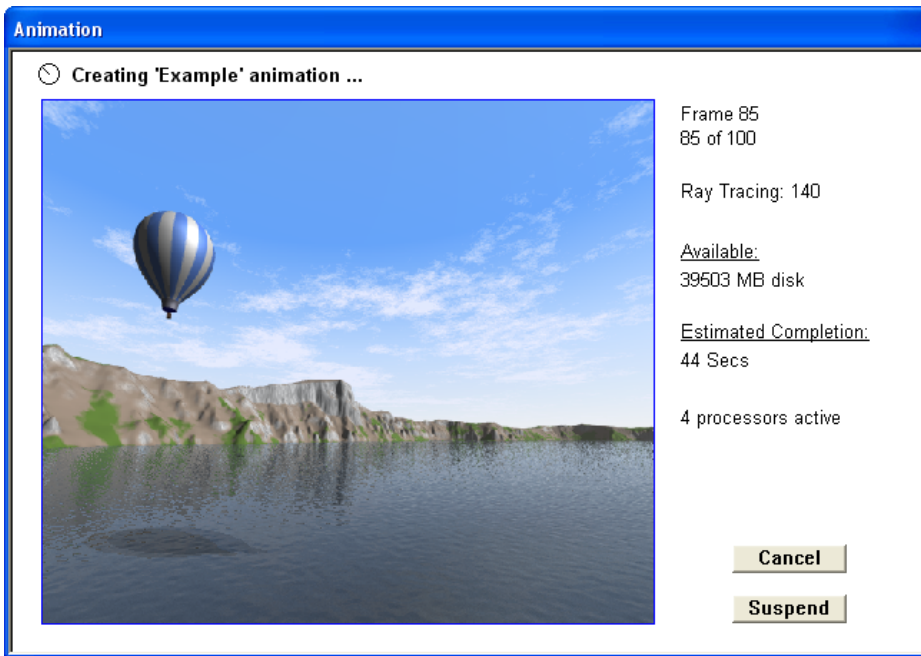
If you wish to terminate the animation before it finishes, click the **Cancel** button in the Progress window To view the completed animation, open it from the **File** menu or in a media player program.

Tutorial: Creating a Camera Path

We are going to create an animation of a short flight through Yosemite Valley. First, choose **Open** from the File menu. When the dialog appears, find the "Tutorials" directory and open the file named "YosemiteValley.nsd".

For this animation, we want the camera to always point in the direction of travel. In order to accomplish this, make sure that **Direction tangent** in the Path menu has a check next to it. This is the default setting so you shouldn't need to change it.

Now we are going to create four key frames to define the shape of the flight path. The flight path will follow a smooth curve through each key frame. Note that the key frames are used to define the shape of the curve only, and they do not affect the output frame count.

Note: When a key frame is selected, the program displays its tangent arrow. You can drag the arrowhead to control the shape of the path. In addition to the direction, you can control the magnitude of the tangent by dragging the arrow closer or farther from the keyframe.

If there is already a path defined, choose **Clear path** from the Path menu to erase it. If there is no path, then the **Clear path** menu item will be ghosted (unavailable).

Display the numeric Camera Settings panel by selecting the Camera tab from the Settings panel.

The Yosemite Valley floor has an elevation of about 1200 meters. Enter 1900 in the **Alt** field of the Camera Settings panel so our flight will be about 700 meters above ground.

Enter 1320 in the **Speed** field. This gives the camera a speed of 1320 meters per second, or about 3000 miles per hour! We could, of course, set a lower speed, but 1320 will allow us to complete the animation with only about 50 rendered frames.

Activate the Map window by clicking on its title bar. Then select the **Curved Path** tool.

Curved Path tool

When this tool is selected, a key frame will be created each time you click the pointer over the land-scape. Now position the cross pointer so that the reading at the top of the Map window is approximately East 6750, North 6600 and click the left mouse button to create the first key frame. (The location doesn't have to be exact, but it might help if you select a map magnification factor of 4X). Next, place a key frame at East 8010, North 7500. Place another at East 9420, North 7020. Finally, place the last one at East 10650, North 7200. Now you have defined a camera flight path! The path is a white curve. Each little square marks the location of a key frame.

To see what the animation will look like, choose **Preview path** from the Path menu.

After seeing the preview, you might want to modify the path. To do this, choose the **Arrow** tool.

Arrow tool

To select a key frame, just left click over its little box. Try selecting the first key frame now. It will turn red and its tangent arrow is displayed. Once selected, you can drag the key frame to a new location by dragging the little square box. Try dragging it around now. For more precise positioning, you may enter a numeric value in the **East**, **North** and **Alt** fields in the Camera Settings panel. Now, make sure the first key is selected and enter 7000 in the **East** field and press **Enter**. You should see it move to this location on the map.

Another way to modify the path is by using the Camera View window. Make sure that the first key frame is still selected (red). Then enter 200 in the **Distance** field in the Camera View window (press **Return** after entering the number). Now click the **Fwd** button and watch what happens to the key frame on the map. *When a key frame is selected, changes you make in any of the three windows affect that key frame. When no key frame is selected, camera position changes affect only the current view, not a key frame.* Deselect the first key now by clicking over a spot on the map that has no key frame. Now see what happens when you click the **Fwd** button. The key frames should remain unchanged, but the current view will still change.

Now we'll move the first key frame back to where we originally set it and start the animation. First, select it using the **Arrow** tool. Then enter 6750 in the **East** field, 6600 in the **North** field, and 1900 in the **Alt** field. Be sure to press **Enter** after entering each value. Now deselect all key frames by clicking over a blank spot on the map (this will help prevent accidental changes).

To fully render the animation, choose **Render Animation** from the Render menu. Name the animation file and click **Save**.

Next, the program will display a dialog for setting the size of the picture and the rendering mode. Just click **Render** to begin rendering the animation.

Sources 11

Terrain Model Sources

The program CD-ROM includes terrain models of part of California and Nevada. To access these terrain models, insert the Natural Scene Designer Premium CD-ROM in your CD drive. Then choose **Open Terrain CD/DVD-ROM** from the **File** menu. The program displays a large scale shaded relief map of the area covered by the CD. Click on a location to select a terrain model. If you want to combine a group of models, drag a rectangle around the desired area. Then click the **Open** button.

You may order additional CD-ROMs and DVD-ROMs from Natural Graphics. Please see our web site at "www.naturalgfx.com" for more information.

Natural Scene Designer Premium can also import data from other sources, such as the United States Geological Survey (USGS). The program accepts numerous DEM formats. Sometimes these files are compressed. If so, they need to be decompressed before importing into Natural Scene Designer Premium.

National Map

Natural Scene Designer Premium can import United States DEMs from the USGS's National Map Viewer. They are available at http://viewer.nationalmap.gov/basic/

To obtain DEMs from this website, select "Elevation Products" on the left. Your best choice for the file format is either **GridFloat** or **IMG**. Be sure **not** to select ArcGrid, as it is a proprietary format which is not supported by Natural Scene Designer. Note that you will probably need to read the "How to" guides to actually download data, as the process is not immediately obvious.

Once downloaded, you may import these DEMs into Natural Scene Designer by selecting the appropriate import function from the File menu.

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