

Landscape Modeling and Visualization Training

U. S. Geological Survey, Geography Discipline

Five Days, Monday through Friday

3D Nature's landscape visualization, "World Construction Set", was embraced by the gaming community in the 1990s; but was the inspiration of Gary Huber, ... a geologist. Gary's vision came to life on the Amiga systems in the late 1980s, as it provided an affordable and programmable color palette not yet available on the Microsoft or IBM versions of the "personal computer". Because the color palette was "millions-of-colors" and "pixel programmable" to a memory buffer ... as was Pixar's pricier CHAPS color array on the Sun 3 systems, in the mid-1980s, ... Gary's vision of a "true-life environmental rendering tool" was developed on the affordable Amiga, the dream was embraced by the "gaming community" for terrain rendering background images in flight simulators; ... but Gary's "love of nature", and realistic depictions of it, carried WCS into the world of design, engineering, GIS and 3D modeling, as an artist at heart.

After the release of "World Construction Set", Version 5, 3D Nature integrated the General Cartographic Transformation Package (GCTP), originally authored by John Snyder of the USGS in Fortran, converted to C-code at the EROS Data Center; and now integrated into World Construction Set's "big brother": "Visual Nature Studio", or VNS.

*Version 3 of VNS was released in the summer of 2008
3D Nature's web site is www.3dnature.com*

*Gary is a fine artist, and you can see his "other work" on his web site:
www.garyhuber.com*

A geologist ... and an artist ... who shares his dream with a software blended of GIS, CGI, CAD/CAM, engineering design, landscape architecture and 3-D modeling. It is Gary's eye for fine artistic detail, and his programming skill of making fine detail easy to learn, that make the capabilities of VNS and WCS so incredible for those with substantially less artistic talent ... but only a willingness to understand his dream of "realism with controlled precision" with a keyboard, ... not with paint and brush.

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Overview of Training

The Project CD: the testing Data Sets

Day One – Morning

Day One – Afternoon

Day One covers basic VNS skills, loading terrain and vector data, Ecosystems and Environments, basic “Color” and “Texture” skills; generating single Frame Renderings (overhead); and how to set up an animation and run a Render Job.

Day Two – Morning

Day Two – Afternoon

Day Two covers post-production skills with Photoshop and Premiere; and Atmospheric capabilities of VNS: Sky, Cloud Models, Atmosphere and Light ... with a more advanced “Color” and “Texture” discussion.

Day Three – Morning

Day Three – Afternoon

Day Three covers more advanced post-production skills, VNS Coordinate Systems; adding Foliage; advanced Textures; and some of the other features of VNS not already covered: stereo Cameras, Lakes (Area Terrafactors), Roads (Terrafactors), Walls, Labels, Snow, Celestial Objects and Starfields, Streams.

Day Four – Morning

Day Four – Afternoon

Day Four is to address post-production and VNS projects underway; and issues raised about the VNS interface or project-specific problems to be resolved: projects need to complete, and this is the last “Render overnight” opportunity.

Day Five – Morning

Day Five – Afternoon

Day Five wraps up on concepts and completes animation projects underway.

Addendum: Import Wizard for terrain and vectors

Addendum: Database Editor

Addendum: Ecosystem Editor

Addendum: Texture Editor and texture Elements

Addendum: Keyboard Shortcuts for VNS commands

Addendum: Suggested USGS Geography Strategies

Visualization Training – Five Day Overview

3D Nature's "Visual Nature Studio" (VNS) is a complicated graphic user interface with many options for editing and rendering terrain, environments and project scenarios. With the many "buttons and switches" to push, this 5-day "short course" comes down to a person's ability to learn quickly, adapt creatively, ... and be curious. Although a computer background is important, VNS output requires "composition skills" that are as much art as science. In that respect, VNS provides an incredible palette for any scientist to compose geospatial concepts in print or video, quickly and easily:

See the 2001 animation “The Brown Cloud” (filename “clouds24h.avi”), a 12-hour Atmospheric model over 28-secs, developed for Front Range Urban Initiative.

... but to learn VNS and be proficient at its true abilities, you have to learn the basics: all these buttons and switches:



... and each button has ***hundreds of options*** to choose from. ***It is a very complicated and sophisticated GIS ... and I have seen experienced GIS users overwhelmed by the complexity of design. But, “success” is built on “quick memorization” and conceptualization of the VNS approach.***

It is as simple or as complex as you want it to be; once you learn the basics: about what all those buttons do, and the hundreds of options each button provides. It is incredible, if you are curious to recognize the full capabilities of VNS.

The Project CD: (20) unique database for users to load

Each CD contains elevation and image files to load into VNS:

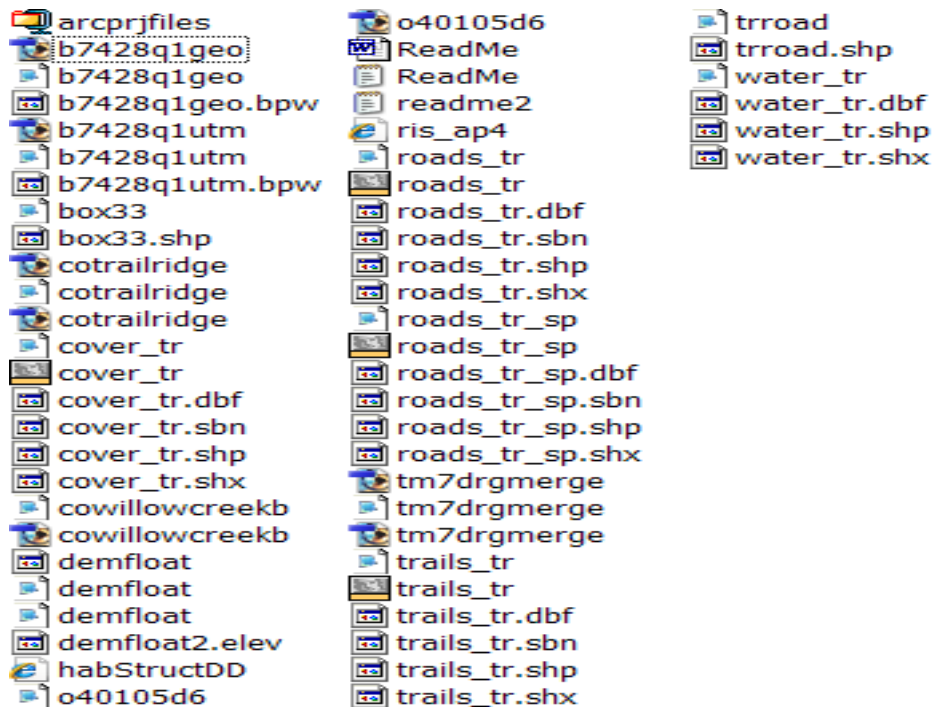
A copy of the Project Data directory ... plus ...

- added WCSComponents, and image Add-Ons (over 200 Mb)
- added the NLCD Geo-TIFF coverage(s) appropriate for the Project area (60 Mb each approximately), color-remapped and VNS-ready.
- added more Foliage from the “Foliage CD”
- the published version: large-scale shaded relief

The VNS NLCD coverage for the United States is available as a two-CD set, with the “NLCD Template” by 3D Nature. These files have been color-remapped, so the USGS-version of these NLCD files will not work properly: *they are mapping into a different color space.*

The Second CD: test data from Trail Ridge, Colorado

This is an older dataset used in early VNS Beta testing; but allows advanced VNS users to experiment with integrating data, and using Links to vector database items. See the ReadMe files on the CD:



Visualization Training – Day One Morning

Put the CD in the drive

Open VNS and short GUI discussion: “cursor over buttons”

- ▶ Create a Project (File, New ...)
 - ▶ Place the Project file in the coverage subdirectory (default)
- Short discussion on Templates and Other Users

“Do you want to load data?” ... *why*, “Yes, thank you”!

- ▶ Load the NED elevation data

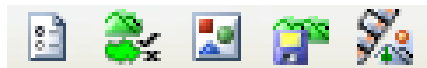
Search the CD drive, NED subfolder for the Arc GRID HDR file

Keep hitting “Next” (“return key”) many times; then “OK” (“return key”)

... but see the Addendum on the Import Wizard for an explanation of the menu options. VNS reads Arc GRID, or other georeferenced terrain.

- ▶ Make note of the Maximum (and Minimum) elevation values; shown in the Import Wizard pages and recalled after Import in the Information dialog window at the bottom right edge of VNS.

VNS Tiling; ... and multiple “surface coverages” in the Project

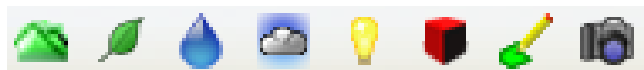


Preferences, Database, ImageLibrary, Import Wizard, Render Control
Help (F-1 key) will bring up help for that active window



- ◊ buttons are “inactive” (grayed-out) unless the Active Item can be Operated
- ◊ dialog window at the bottom will show the “Active Item”; or select from ...

“Scene-At-A-Glance” (S@G)... or the Big List (duplicate for drag-n-drop)



... view mode for “The Big List”



Enable, Disable, Add/Clone, Delete, Enabled, Animated, Layers
Expand the “Scene-At-A-Glance” (S@G) list with the right button.

At the bottom of the VNS window ...



Keyframe Group Toggle, Add, Delete, Expand Keyframes, or view “Timeline”



Locking a Parameter for Editing, and Expanding Dialog Info



Play Animation track

Help: highlight any submenu (Editor), and hit F-1 key

◇ *self help: learn the lexicology and terminology outside of GIS*

These buttons enabled for only for certain operations:



... Movement, as in “move the Camera”







.... Draw, add, change vectors, “Measure”



When I say, *“Kill the Editor”* means use the mouse to click here

► Save the Project (**Control-S**) ... or *File, Save*

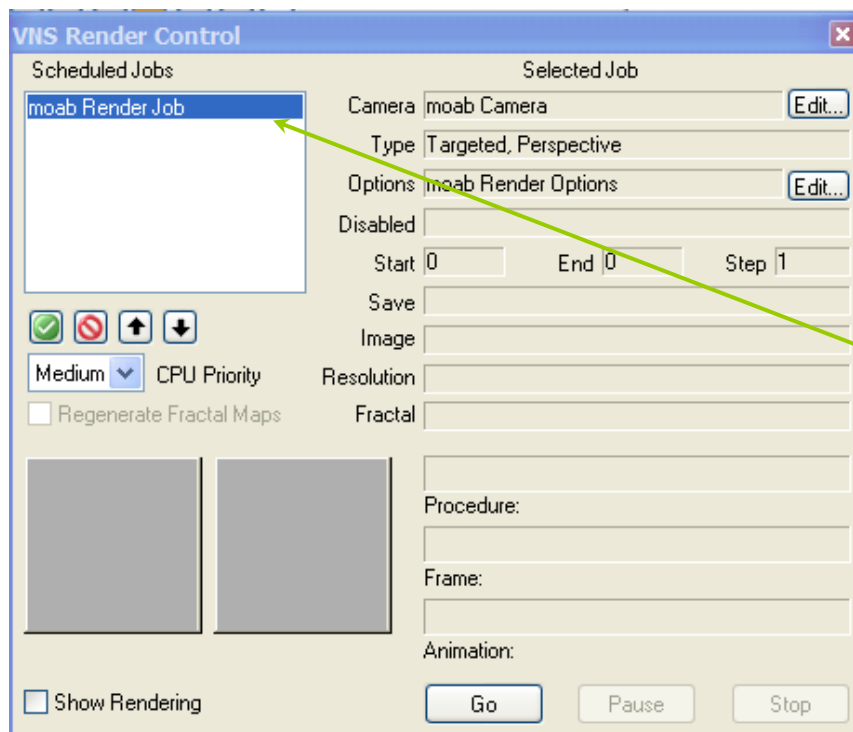
Using the “Import Wizard”: load terrain and vector/poly data
(*again, see the Addendum on the Import Wizard; and its options*)

- ▶  **Load** the SRTM elevation data with the “Import Wizard”
Search the CD drive, SRTM subfolder for the GRID HDR file.
- ▶ Disable Atmosphere ... “Disable”  or right-click Atmosphere
- ▶ Disable Sky ... “Disable”  or right-click “disable” the Sky
- ▶ Rename default Environment as “No Foliage Environment”
Double-Click the Environment category in S@G, and rename in the Environment Editor. No Ecosystems are attached, so no foliage will be drawn when this Environment is Enabled 

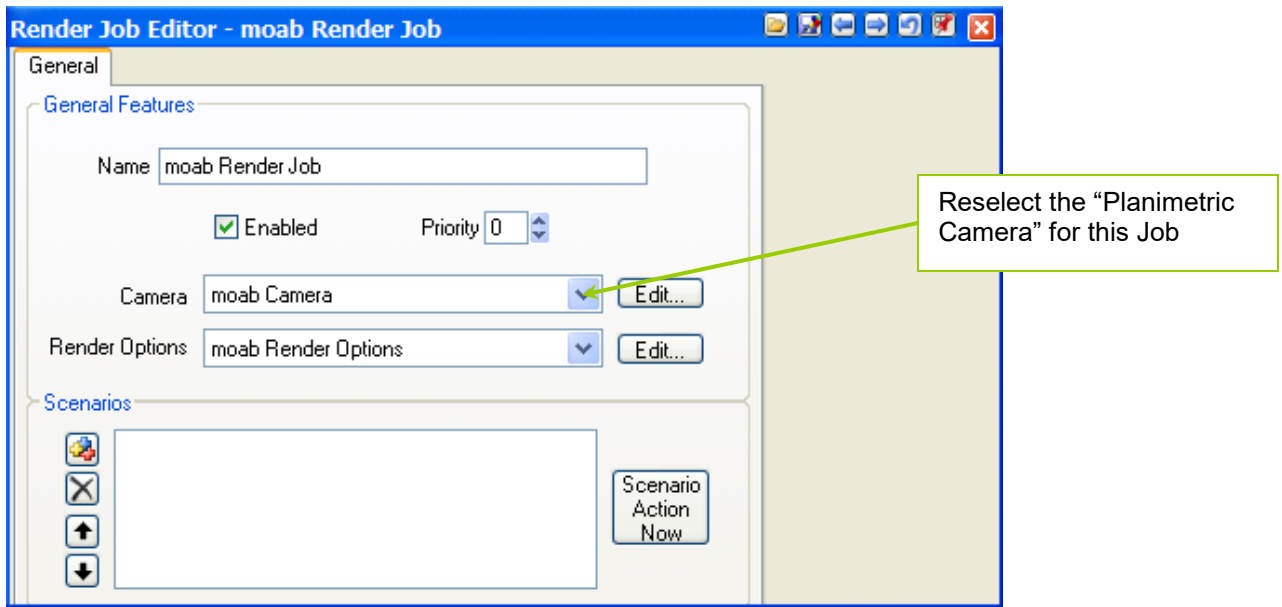
◇ VNS always needs an Environment active, or will create one

◇ When VNS creates a new Component, or detect a new one is needed, the default naming convention is for VNS to add a “.1” to the name extension. A common Coordinate System in VNS is “Geographic.1”, a clone of “Geographic”

- ▶  **“Render Jobs”**, select the “Planimetric Camera”



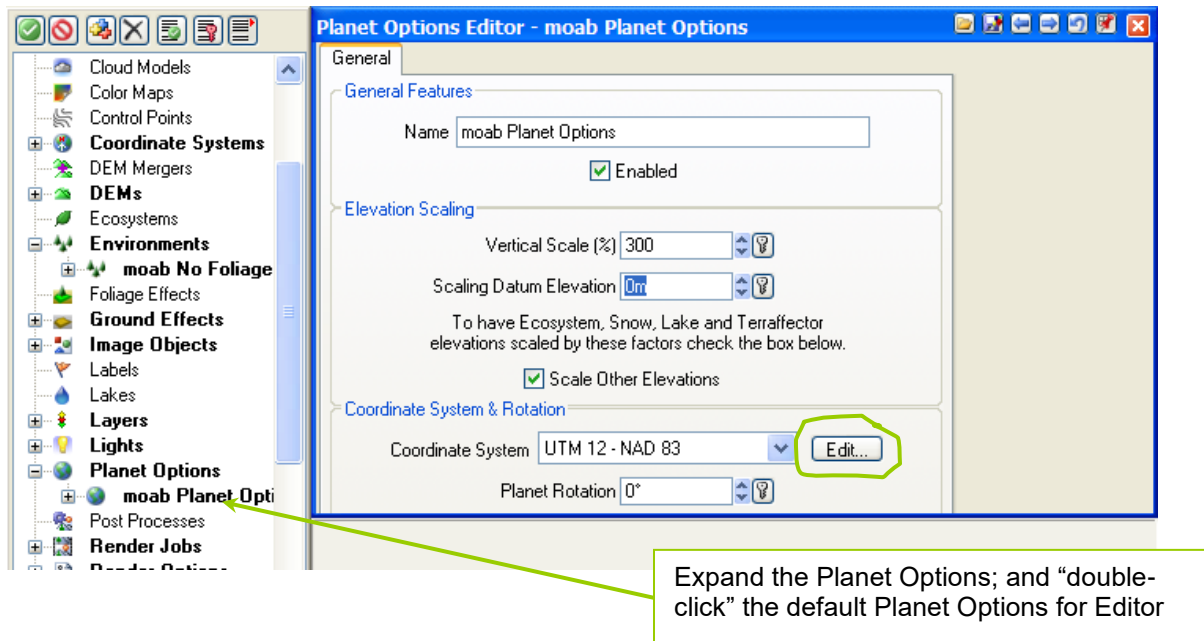
“Double-Click” the Render Job brings up the Job Editor



◇ You can also do this by double-clicking the “Render Job” category in the “Scene At A Glance” (S@G); or “expand” the list to search through multiple Render Jobs ... active items in **bold type**, and inactive a *lighter typeface*.

“Kill the Editor(s)” ... Render Control and Render Job Editor


► Adjust Planet Options, “Coordinate System” and VE
In S@G, expand Planet Options and “double-click” the Planet Options



Coordinate System, select “New Coordinate System”, VNS will create a default System; but then hit the “Edit” button to Coord Sys Editor.

Go to “System” tab in the Coordinate System Editor

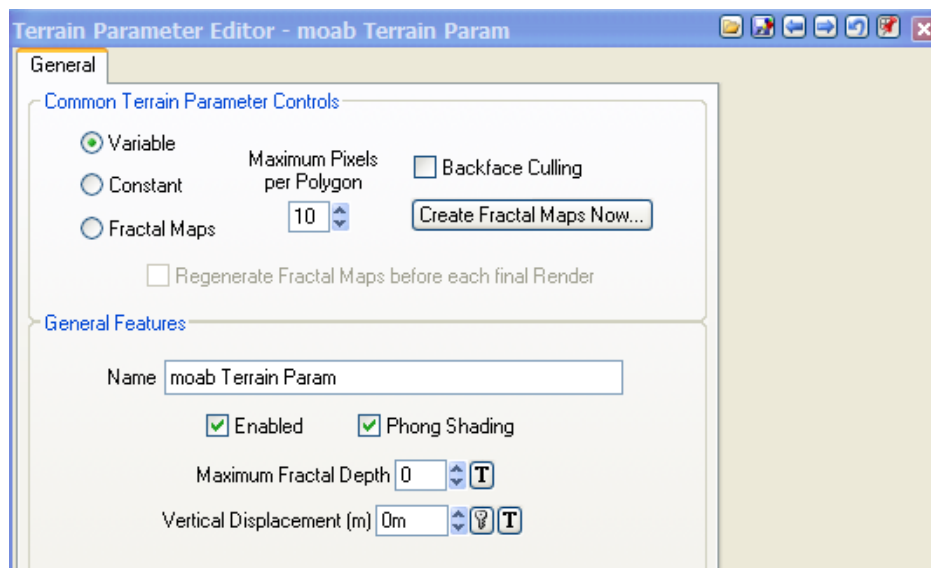
Change System to “UTM NAD83”

Select the Zone appropriate for the dataset (watch North or South). The information on the “Method”, “Datum” and “Ellipsoid” tabs is “hidden”; so enable the “Show Advanced Features” in the Editor top-bar ... this small button: 

“Kill the Editor(s)” ... Coordinate Systems and Planet Options

► Check the Terrain Parameters, “Fractal Depth” set to “Variable”, and “Maximum Fractal Depth” set to zero

◊ *just leave these the default values; but remember that “animated Camera movement with foliage” requires “Fractal Depth Maps” ... which are created and re-used, but can be recreated at Render Time. Raise the “Minimum Fractal Depth” to increase detail in the Rendered scene ... but start with zero.*



Discussion on “Fractal Depth Maps”, “Backface Culling”, “Vertical Displacement” and generating “Create Fractal Depth Maps” now, or at “run time” on animation (*there are also “Shadow Maps” for Clouds*).

“Kill the Editor” ... Terrain Parameter Editor

► **Save the Project (*Control-S*) ... or File, Save**



Database Editor: differentiate by “Layer” the two terrain sources, NED 1-arc second and SRTM 3-arc second.
(see the *Addendum on the Database Wizard*)

“TOP” is the default Layer name for ALL terrain “surface(s)”
VNS “Tiles” elevation datasets in a 300x300 optimum size
Search, Select, Layers “Add” ... the “SRTM” and “NED” Layers

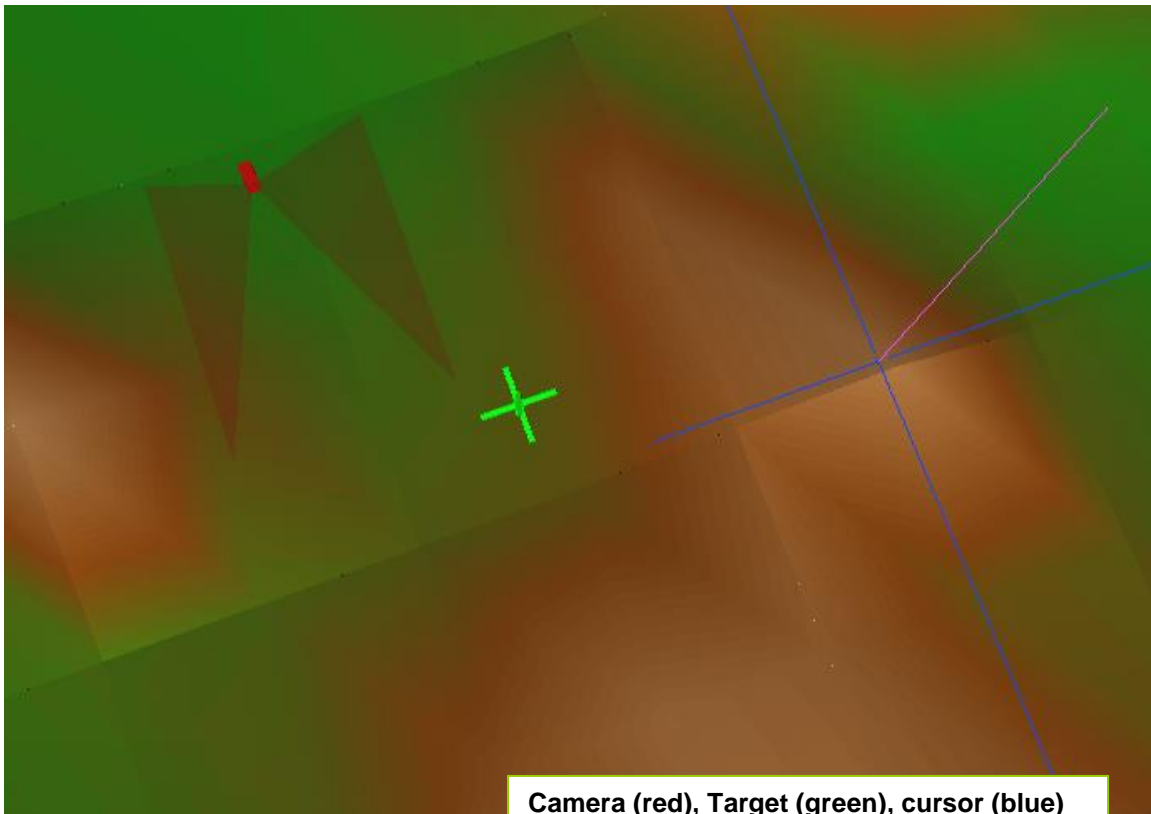
► Select All NED Tiles, add a “NED 1-arc sec” Layer; and then
“Disable” (checkbox) this Layer. The disabled NED Tiles will be listed in dark gray, but the SRTM will remain enabled for starting terrain. Use the SRTM terrain (“Enabled”) for regional views when starting a Project, with two terrains.

► *Save the Project (**Control-S**) ... or File, Save*

Ready to View the terrain

The “Matrix” and OpenGL “preferences” (do not touch for now ... later)

OpenGL Environment: terrain, Cameras, Target, “objects”



Camera (red), Target (green), cursor (blue)

◇ the “active object” is always highlighted in Yellow! ... so if it is a Color Map (georectified image), OpenGL shows it as “yellowish” with transparency. To this work within OpenGL, “Enable” and “Disable” an Atmosphere, or Color Map.

► “Right Click” the Matrix, and Select “View Planimetric Camera”

◇ the default lay-out for the Matrix is a “Quad”, four window “docks”; and this can be changed in Preferences. When Editors open for the first time, they may appear “Docked”; but will appear “un-Docked” when used a second time.



“Undock” the Camera from the Matrix “Quad” layout.

Grab a corner of the Camera window and resize to data extremes

Highlight the Camera window bar; and “right click” it.

◇ a lot of “options” to OpenGL, ... so don’t touch anything, just yet. Later!

“Select Option Set” pull-down and change to “Render Options”

◇ the “active object” is always highlighted in Yellow ... bright or faint yellow! If the Atmosphere is the “active object”, its “transparency” is shown as faint yellow tint.

► “Right Click” the Camera bar, select “Edit View’s Render Options”

In the Render Options Editor ...

► Rename the “Render Options” to “Overview NF Render Options”

► Define an Output Event, as TIFF, named “... TM”

► Set minimal options: the options (checkbox) that should be left enabled are (Enabled 1 tab) Terrain, ColorMaps, (Enabled 2 tab) Multi-pass Antialiasing, Depth of Field, Lights, Terrain Shadows, (Miscellaneous tab) Fragments Enabled, and Render Vectors.

◇ the “Render from Overhead” option is for Foliage, from overhead; but on this first “Render NF Options”, we are not Rendering Foliage (NF): no foliage

► “Right Click” the Camera bar, select “Edit View’s Camera”

In the Camera Editor ...

► Rename “Planimetric Camera” to “Overview Planimetric Camera”
Camera Editor, and camera types (this Planimetric, so no Target)

► Adjust Camera View window to size of the terrain coverage

► with the “Render Options”, adjust Frame size to Camera view

◇ *the Frame Size is shown as a light gray box in OpenGL ... unless the “Constrain Render Area” function is being used ... which will appear gray, also.*

► Adjust Camera Elevation (25Km) and Lens, View Width

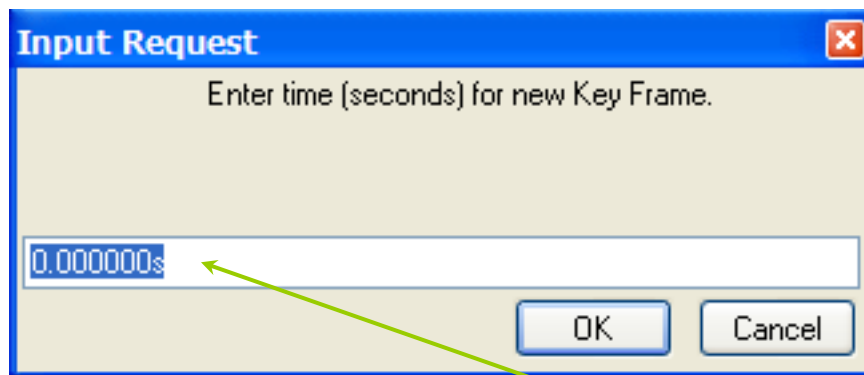
► “Fine-tune” all three: Camera window, Frame size, View Width

► once the OpenGL view with Overview Planimetric Camera matches the entire terrain surface with Camera View Width and Frame Size ...



... Create a **Keyframe**, Timeline Editor for parameter

... from the Overview Perspective Camera Editor, click the “Key” that is right of Camera Position Latitude, Longitude, or Camera Elevation.



Value in Seconds “ s ”, or add “ f ” for Frame



... “Keyframe Group” toggle

◇ If the “Keyframe Group Toggle” is “Enabled”, then “dropping a Keyframe” for the Perspective Camera position will create THREE Keyframes: Latitude, Longitude and Elevation ... all at once. These are all in the same “Group”

► “Keyframe Zero”: Keyframes for animation ... but locks position!
The Camera View, Latitude, Longitude, and Elevation all Keyframed
Use the Plus and Minus sign to crudely raise and lower the Camera Elevation.

The Left Mouse button controls movement in the X and Y axis (latitude and longitude); and the Right Mouse button controls Elevation. Because the Camera

Position is Keyframed to Zero, then adjust the “active Keyframe” count to return the Camera to it’s locked position. Use the Animation Bar widget:



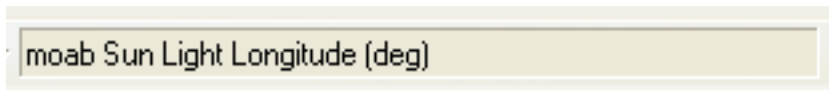
◇ in Animation (beyond Frame 0), the Keyframe number, in seconds, may not be entirely viewable in the Frame Counter window; so changing these values manually, watch for “hanging numerics” when you type these in manually!

For example, at 30 Frames per second (fps), Frame 00:00:29 is 0.9666667s

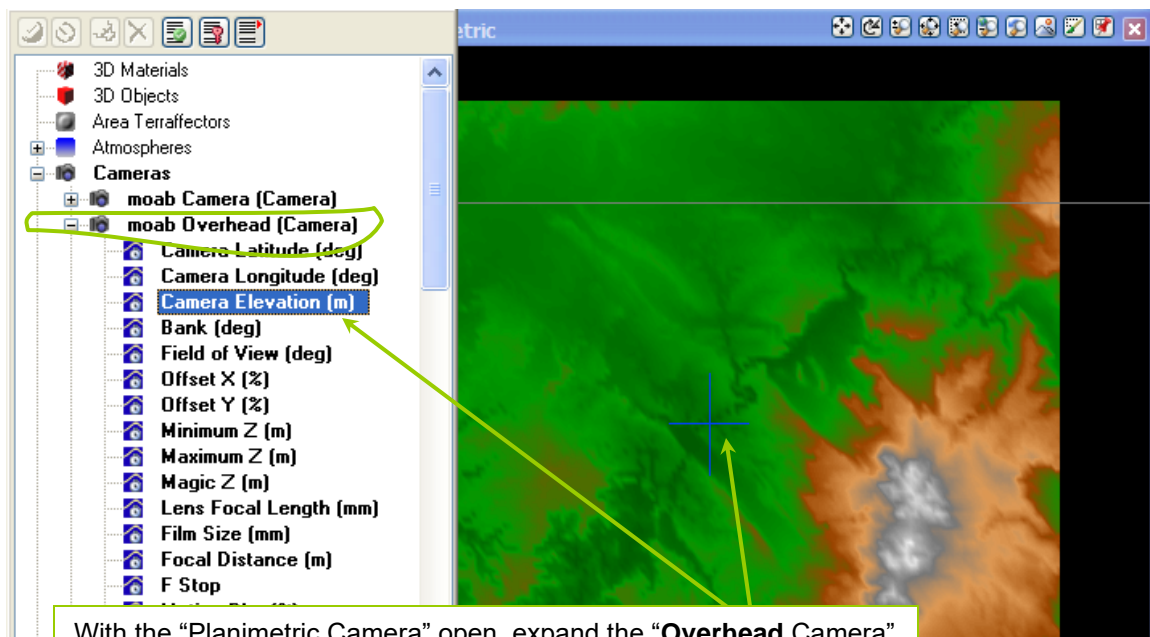
◇ “Set Camera Default Position” will prompt to “Delete All Keyframes”

◇ The Up-Down keys in Camera Position fields, and other uses within VNS, will move slowly in the count at first ... then increase the rate of change (turbo).

◇ Control-Click in an active Camera window places the “Active object”; so look in the lower left for “... *what you are placing on the ground*”.



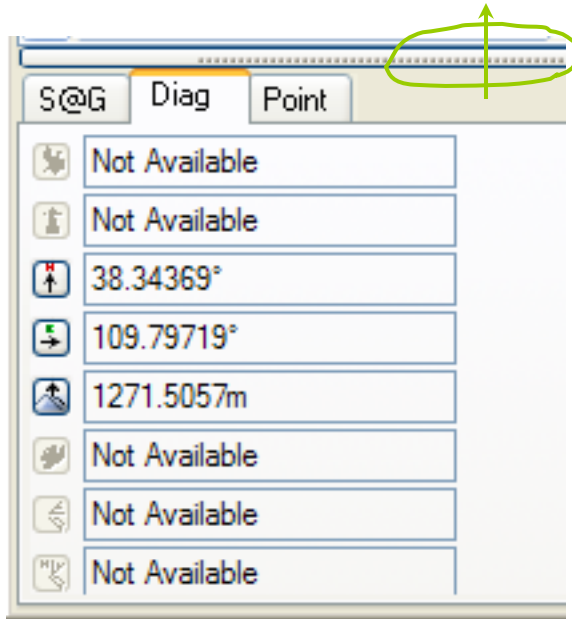
Changed position? “Up-Down” a Keyframe; and the Position will “reset”.



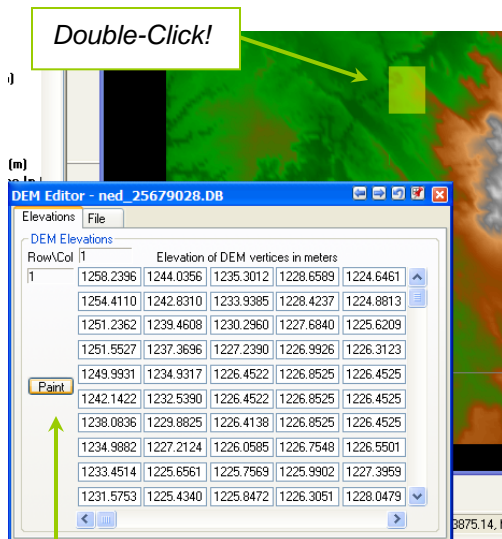
With the “Planimetric Camera” open, expand the “**Overhead Camera**” in the S@G, highlight “Camera Elevation”, then Control-Click in the active Planimetric view. The “**Overhead Camera**” will be “placed on the ground”. Now, hold your Right-Mouse-Button down, and “drag the Overhead camera up-and-down, changing “Elevation”

Alt-Period will prompt for a new Elevation of the Overhead Camera, ... so enter 30Km (above the Planimetric Camera). Now, open the Overhead Camera in the Matrix and “see” the Planimetric Camera, from above. “Cross-operate” two Camera Views at once to refine the position of a specific Camera; even the Perspective Camera ... called ... “Camera”!

In the “cloned” S@G (lower left), switch to the “Diagnostics” tab, and click in the window to get “at cursor” information. When displaying ColorMaps and Environments, “Diagnostics” will return Color (RGB) and Ecosystem detected; and slope/aspect information. Expand the Diagnostics menu by dragging up the top of the window:

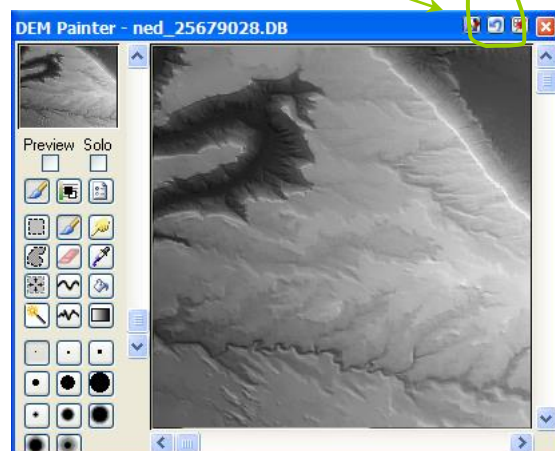


◇ Double-Click in a Camera View will bring up the Editor of whatever you touch: Ground Effects, the Ecosystem Editor, a Color Map, or the elevation Tile found:



“Paint” your DEM, ... fix a problem?

Un-Do changes; but VNS will ask to update DEM on “kill”



VNS folder structure, and “Preferences”

WCSPProject ... WCSFrames ... Components

Loading on different machine, and “File Not Found”?

VNS will start searching in the directory tree of the first file selected.

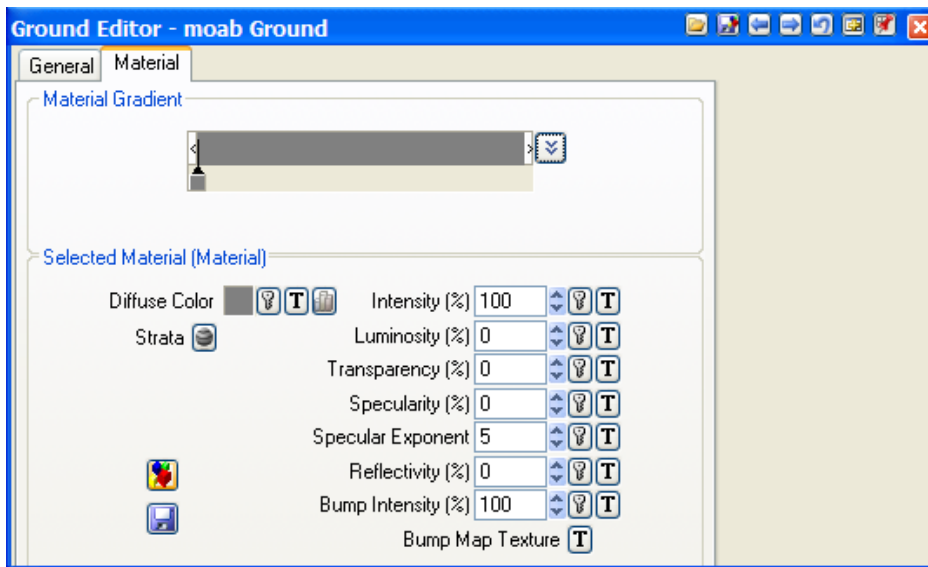
◇ *Preferences, path to elevation can be on another server*

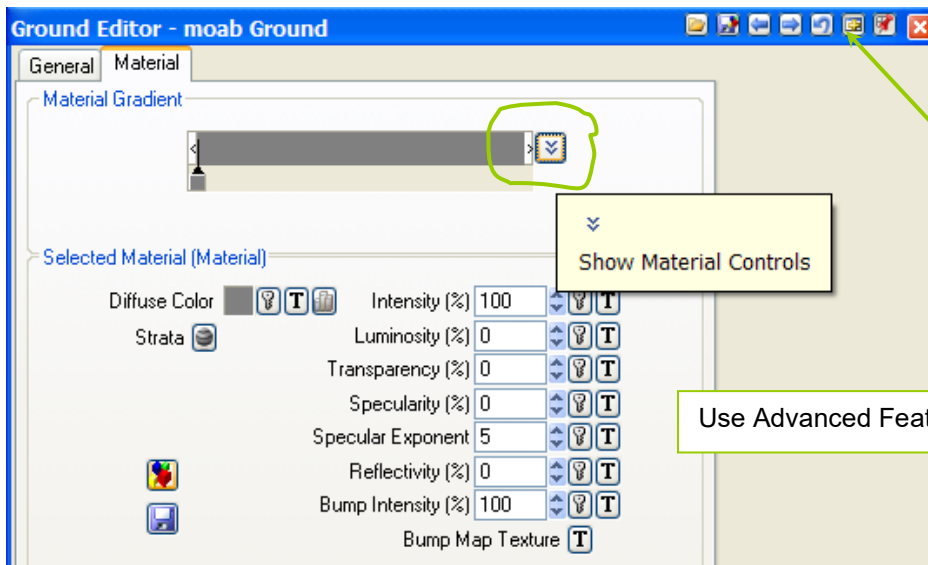
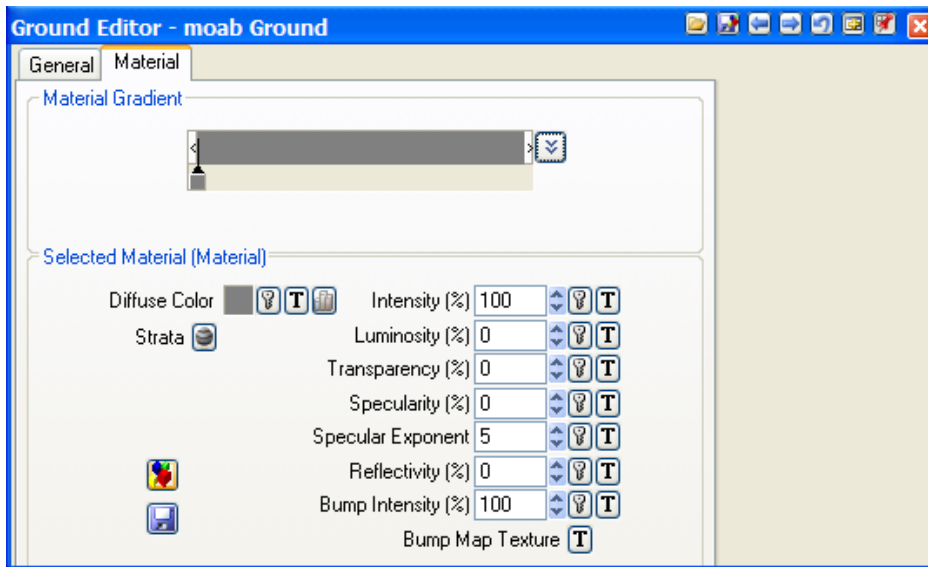
◇ *... so, “Paint that DEM” for everyone else using the terrain on a Project?*

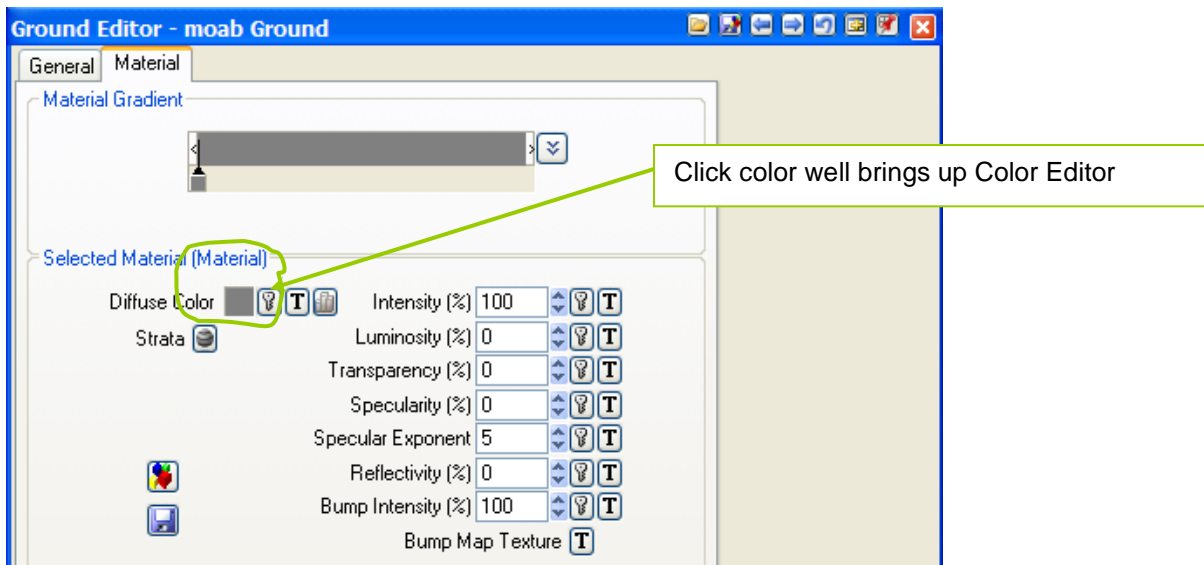
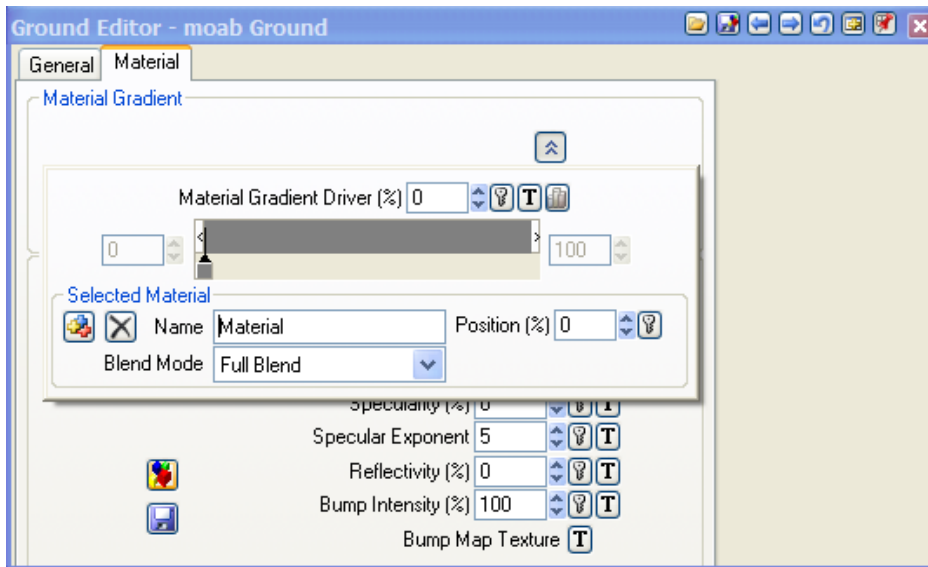
► *Copy data (on CD, except subdirectories) to the Project directory*

► **Edit Ground Effect: Materials, Color, Textures, and Elements**

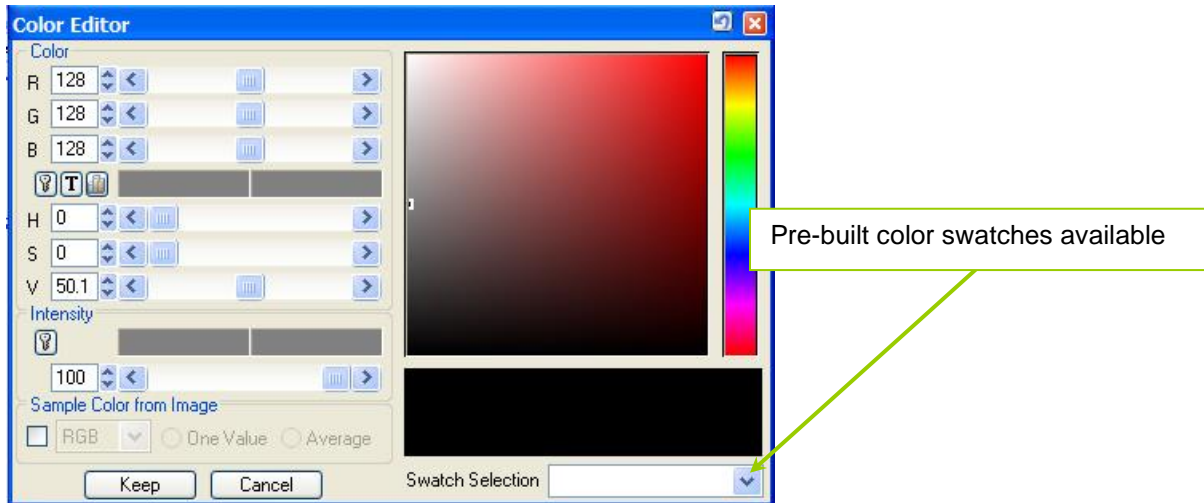
Expand Ground Effects in S@G, and “double-click” default Ground Effect



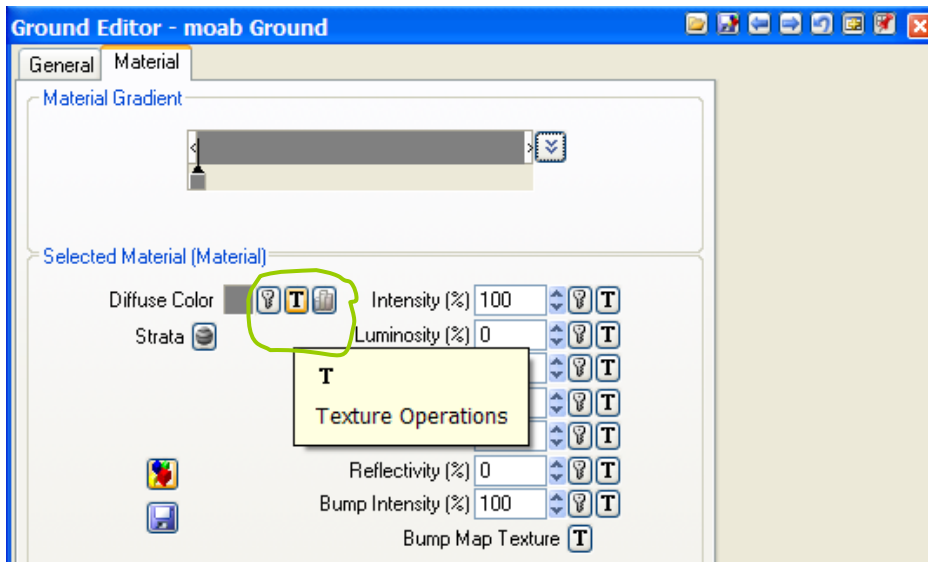


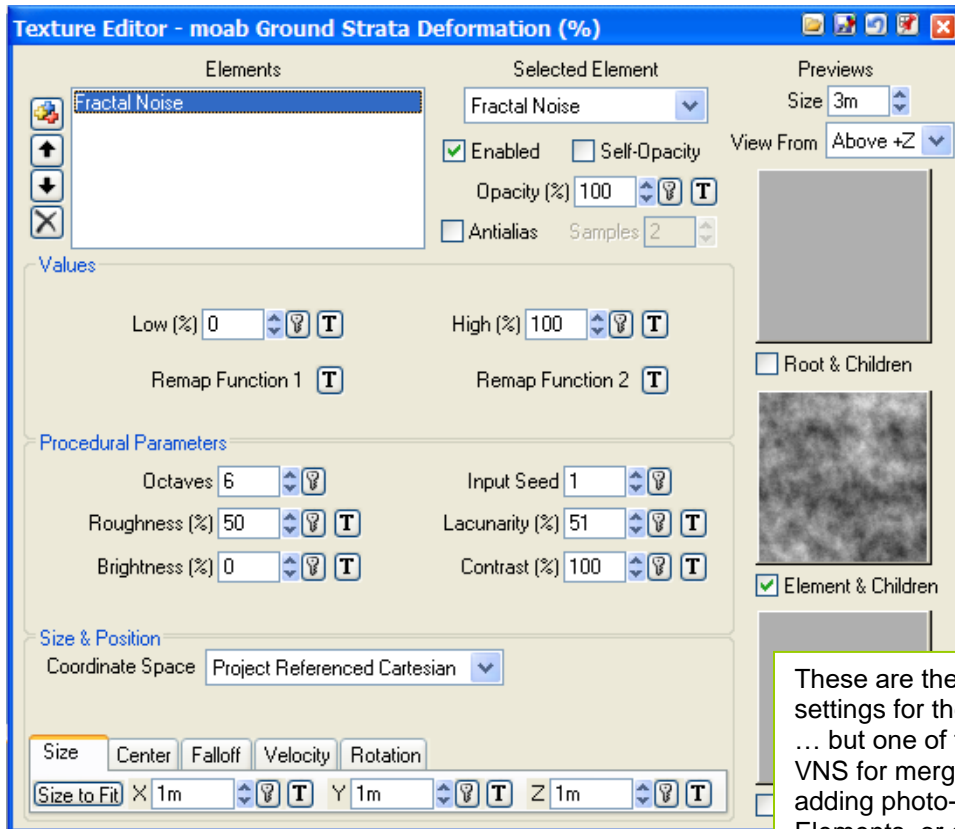


*Click on a color “chip”, ... and the Color Editor will appear. “Single-click” within the Material Gradient, or in the Texture Editor gradient, where there is **no color already defined**, and VNS will **add a new color** “where you click” ... and allow you to edit the color.*

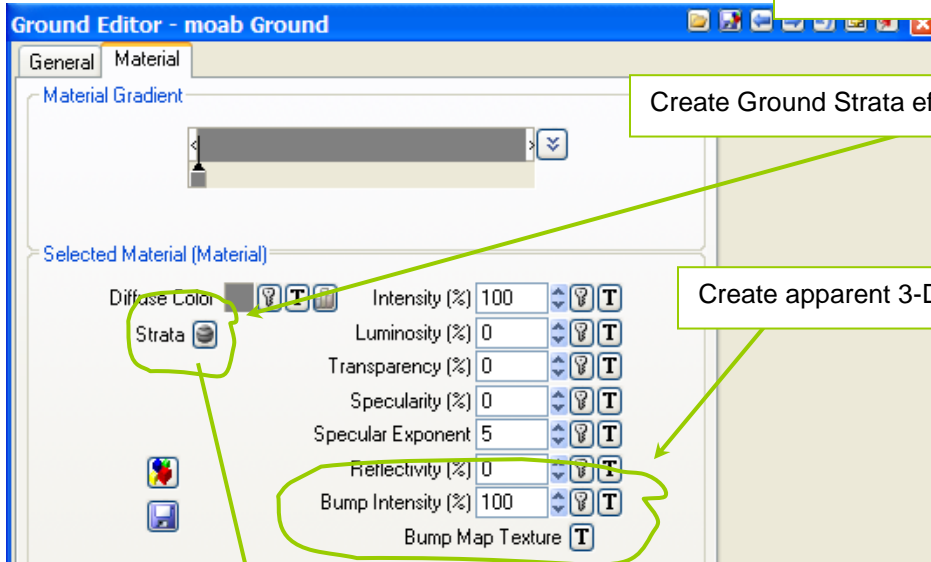


... so, “random clicking” these “wide areas of color” in Editors (Gradients and the Texture Editor) means you get to know the Delete button: when new colors appear unexpectedly, just “Delete” them.



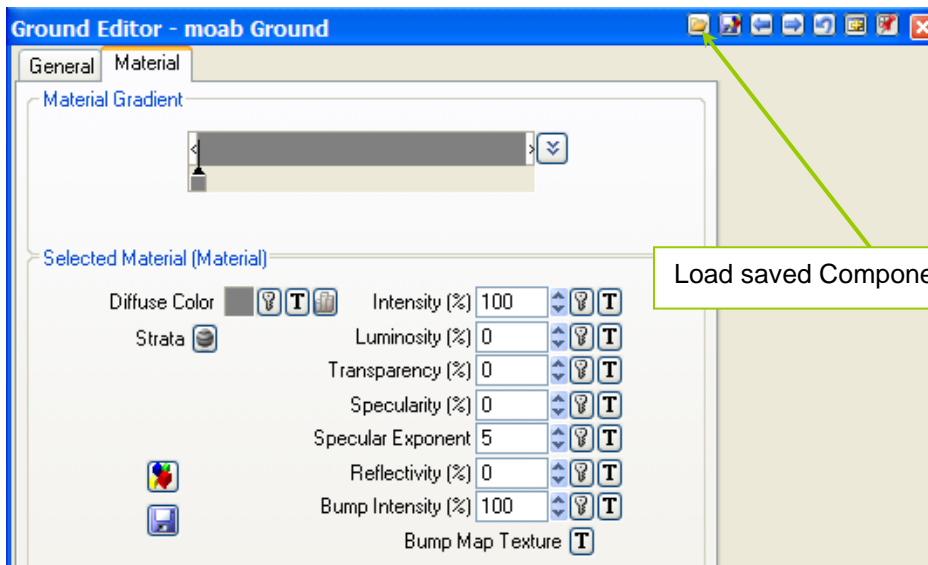
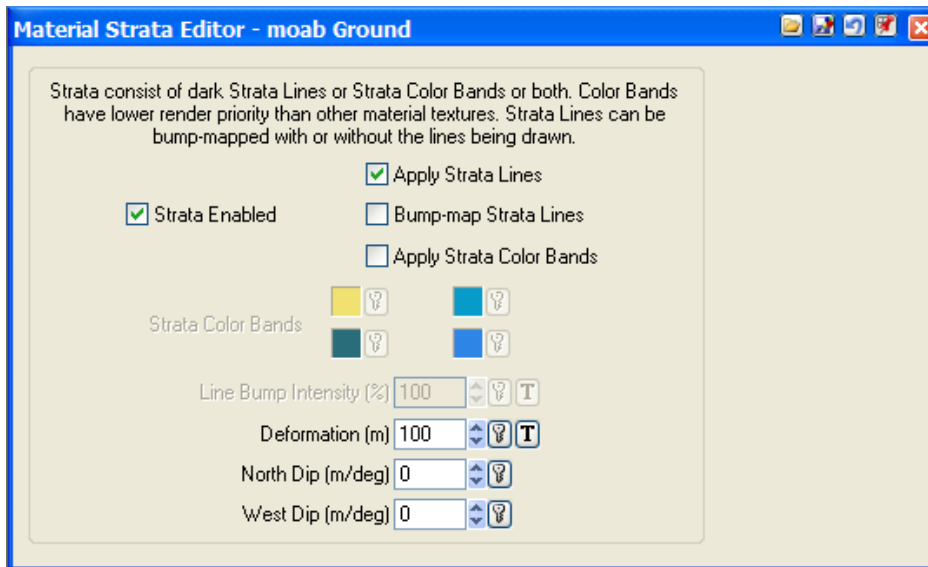


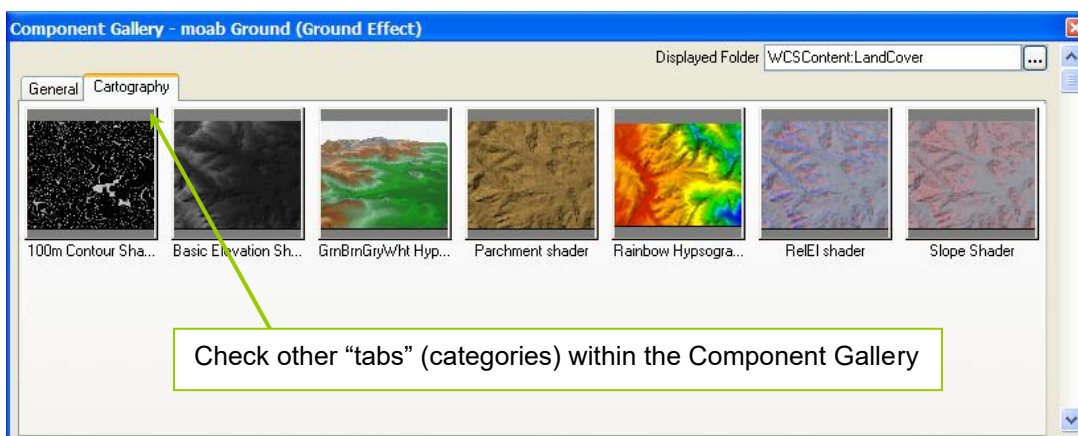
These are the “default” settings for the Texture Editor ... but one of the great tools of VNS for merging Colors, adding photo-realistic Elements, or creating Cloud Models with Z-Velocity



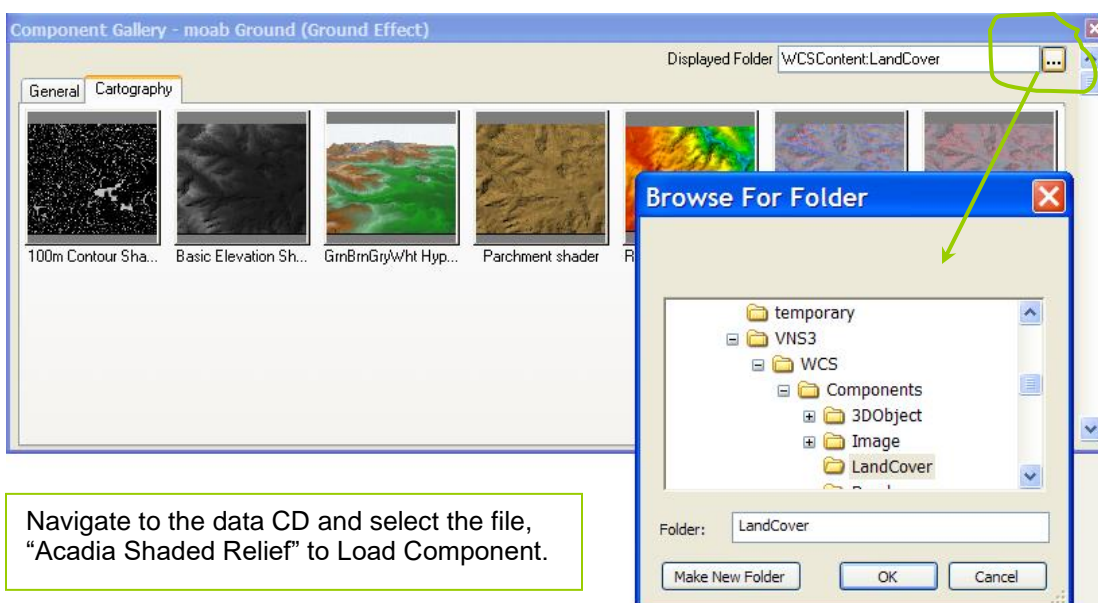
Create Ground Strata effects

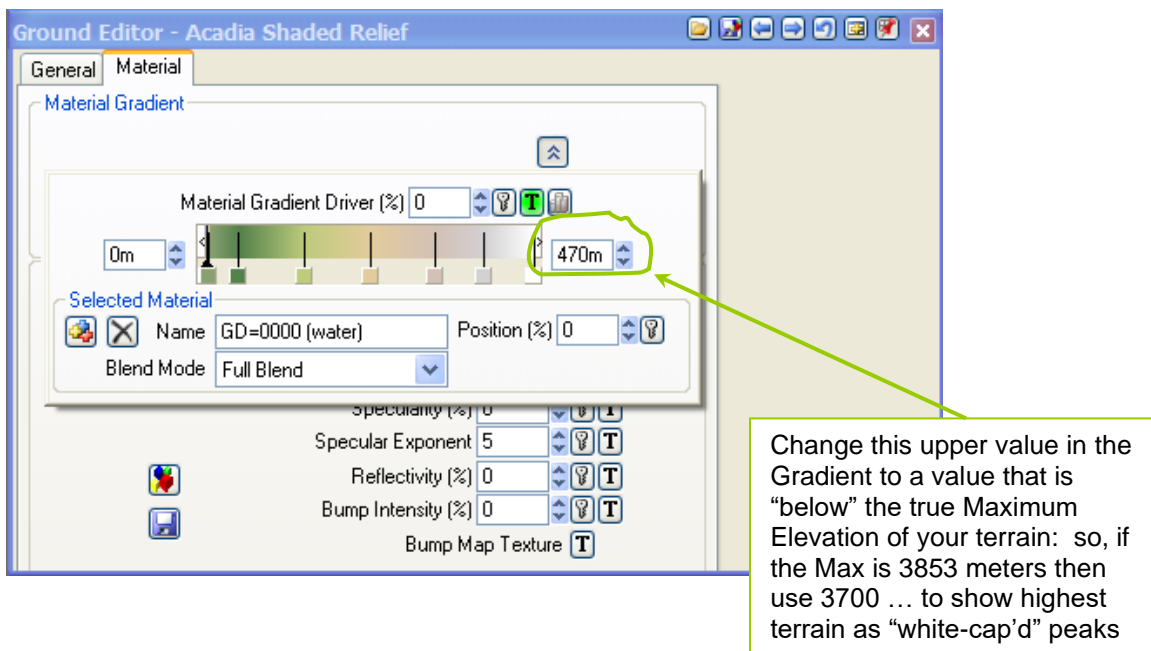
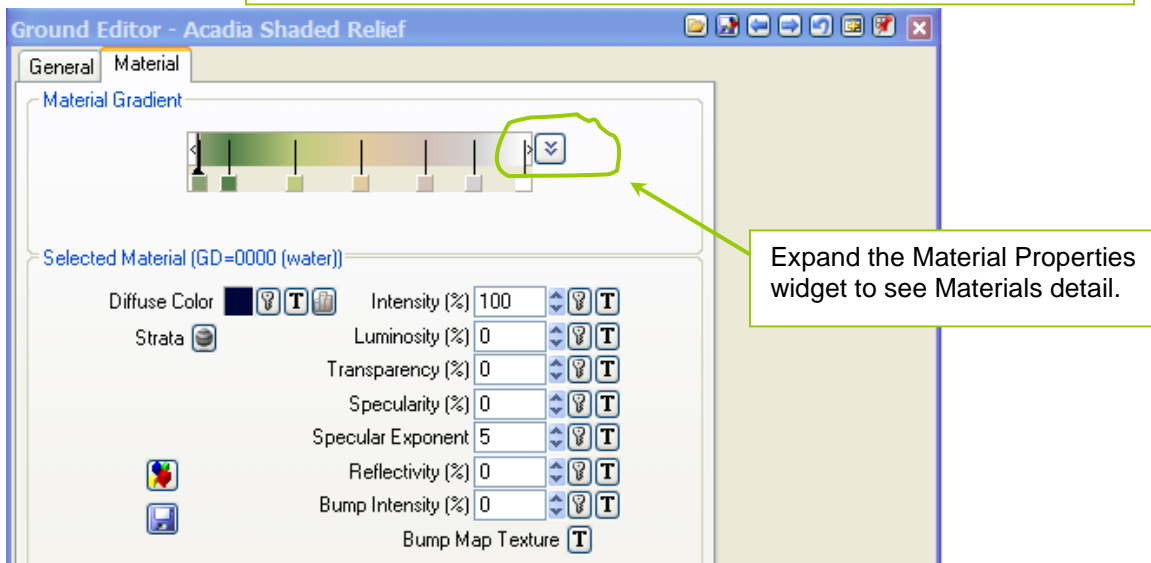
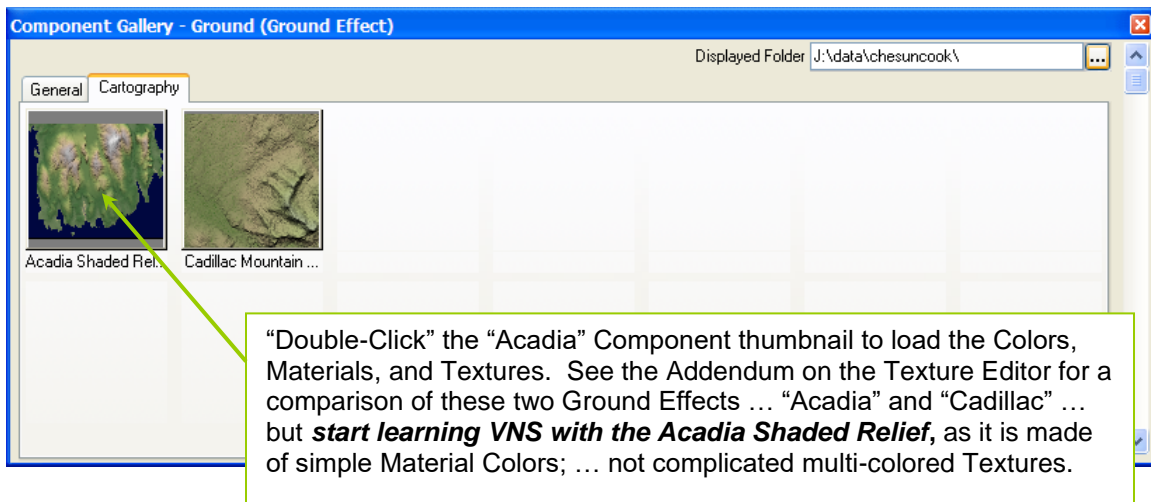
Create apparent 3-D relief effects

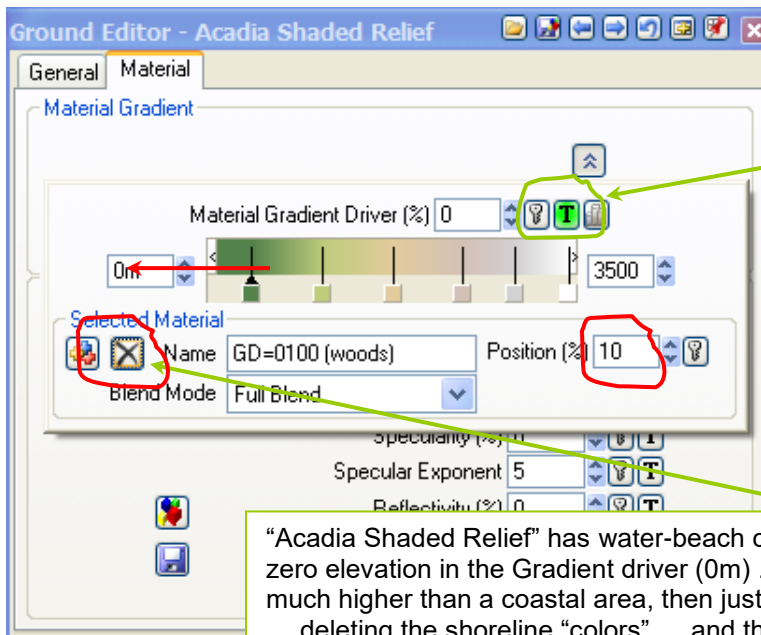
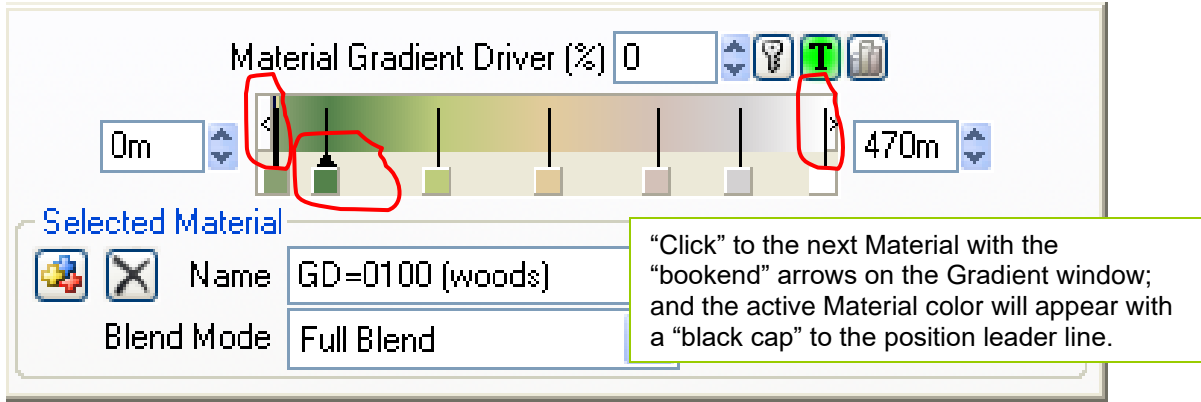




“Back-ups”: loading on different machine, and “File Not Found”
Preferences, path to elevation can be on another server
VNS knows where to look initially, and can “adapt” to new path!



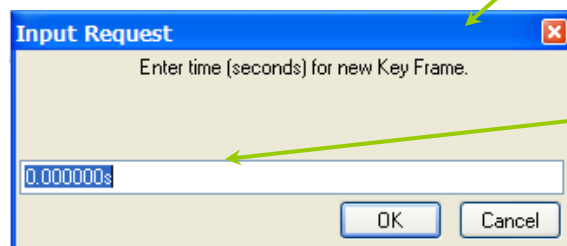
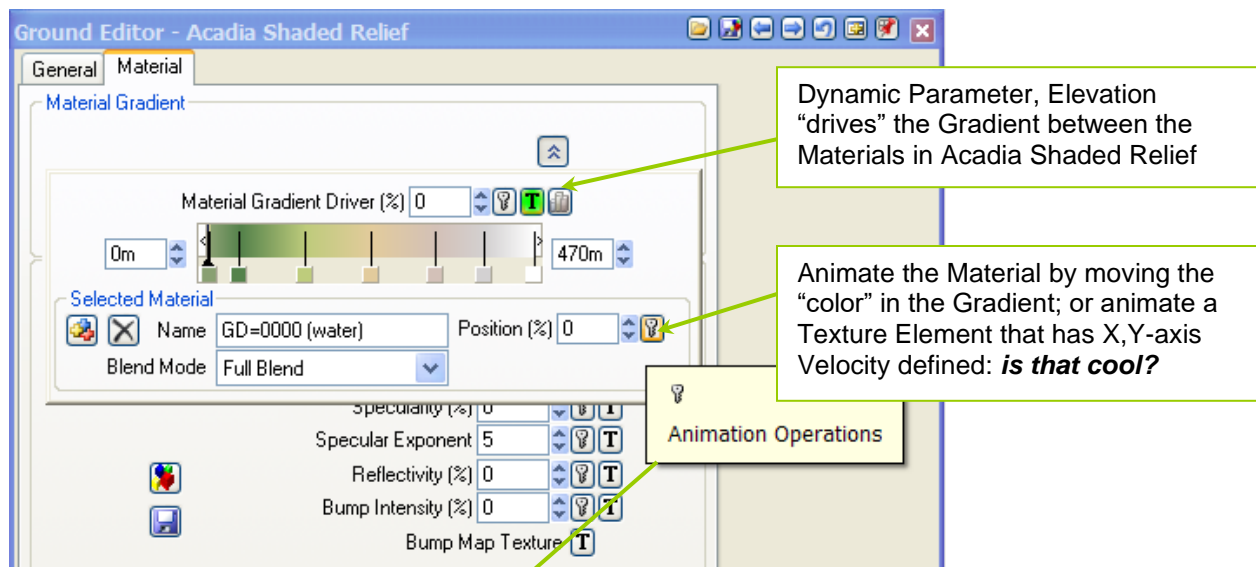
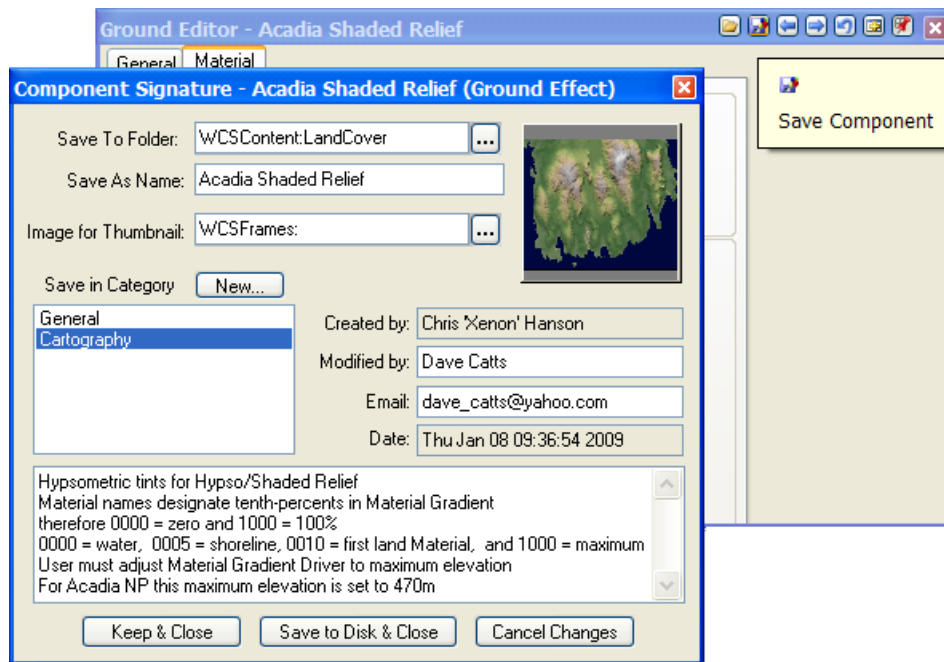




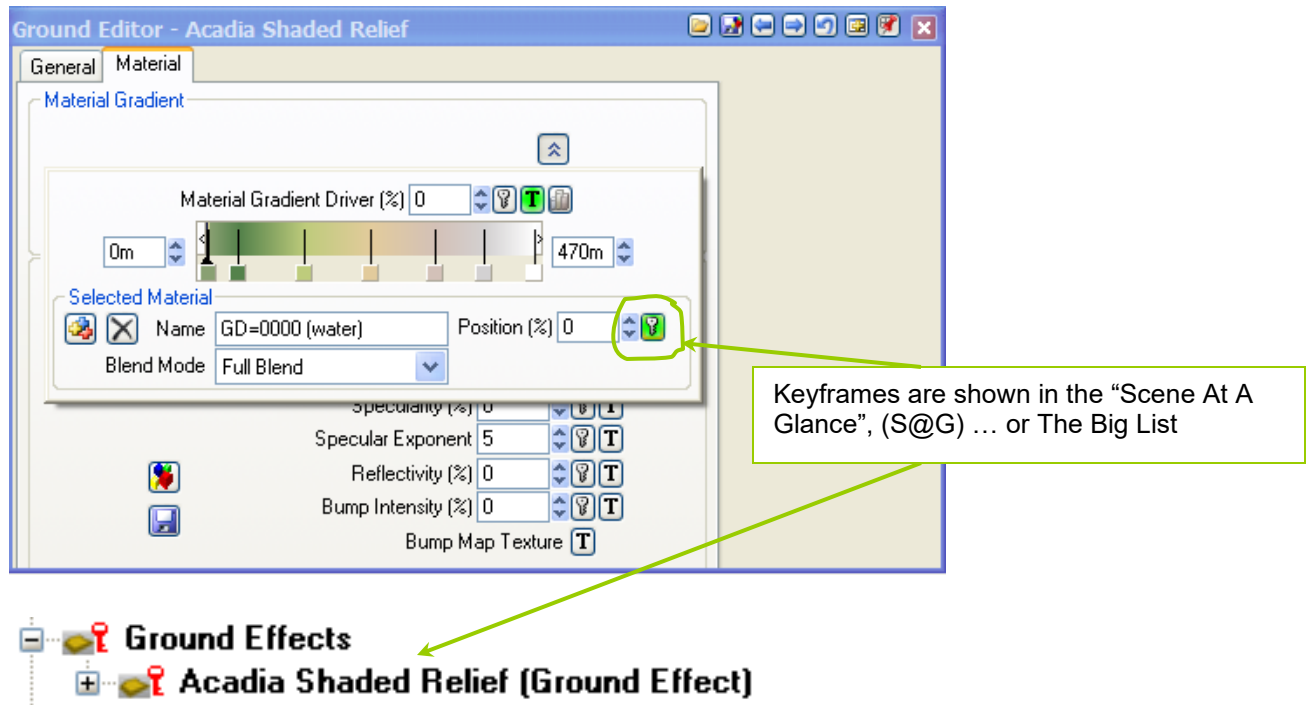
Look at how this Gradient is built to understand Texture Elements that are based on a Dynamic (geographic) Parameters ... in this case, “Elevation”, ... and the limits define the “spread” of the Material Colors (below): **a very cool feature, for more than just the Ground Effect! You can use this same Texture Element on Foliage!**

“Acadia Shaded Relief” has water-beach colors (“blue” and “sand” Material) at near-zero elevation in the Gradient driver (0m) ... so if your minimum terrain elevation is much higher than a coastal area, then just hit the “Delete” key (black “X”) three times ... deleting the shoreline “colors” ... and the “color cap” will shift to the lowest color in the Gradient “GD=0100 (woods)”: which means, “ten-percent in the Gradient of Gradient Driver”. Naming these Materials appropriately is important; as VNS will create many Materials called simply, “Material”. Now, shift the “black cap” to the left, at the zero-percent in the gradient ... and “dark green” will appear at the lowest terrain on your model. Now, adjust the spacing of the “other colors”, one click on the small color chip ... then drag ... then select another ... then drag ... (repeat) ... (repeat) ...

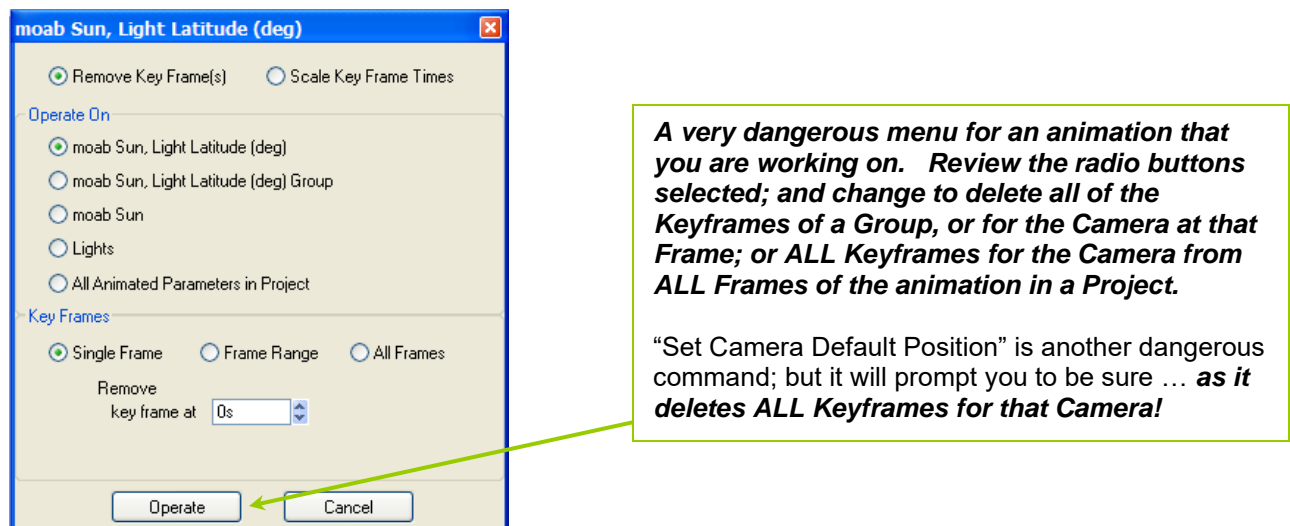




If you know the Frame, enter number then " f "
... otherwise the default is "seconds", " s "



Write over a Keyframe; or Deleting a Keyframe



WCS, Components, Landcover ... file Acadia Shaded Relief.gnd
 Load from Component Gallery, Load from CD or Project directory
 ► Change maximum elevation in Gradient (Acadia) to Project
 ► Remove ("Delete") Materials, if "water and shoreline" not needed;
 and adjust the "woods" (Green) Material Color to the Elevation
 minimum. Update Material Name for "woods"?: change 0100 to 0000.

►Draw (“Preview Render”) to screen: the F-9 key

Color, Materials, Textures ... and Foliage (images or objects)

“Material” can be augmented with Gradient or Texture ... including a “texture map” as a “Planar Image”: *photo the ground, and add it in!* (see the **Addendum on the Texture Editor and Texture Elements**)

Try the “Cadillac Textured Relief” Ground Effects and explore how it is made of “Textured Material Color”... to understand how VNS allows Textures to be created from layered Elements with defined Colors and Filters applied. Explore “bumpmapping” in Cadillac GE.

The “Un-Do” button on Editors: abandons changes while in an Editor

◇ the “Un-Do” button on Vectors: “Keep”, “UnDo”, “Restore”, “Cancel” changes.

◇ the “Un-Do” button on Timeline: “Keep”, “UnDo”, “Restore”, “Cancel” changes.

Refresh View (**F-8 key**) ... so, view the model with OpenGL


Preview Render (**F-9 key**) ... so, view the model with VNS




Constrain Render (**F-5 key**)... sets bounds on the Rendering area





<Esc> Key



◇ *manipulate the Active Camera Window? Use the “Space Bar” and  for the*

Camera you are viewing; or pick a specific Axis to move,    ; or use the Camera Editor to update position (for Targeted Cameras, the Target can be moved) , or open another Camera (Overhead) to “Move the Selected Camera”

*from S@G : , and  **from another Camera!** ... or select an active item you need adjusted by expanding the S@G Camera category, and Alt ●*

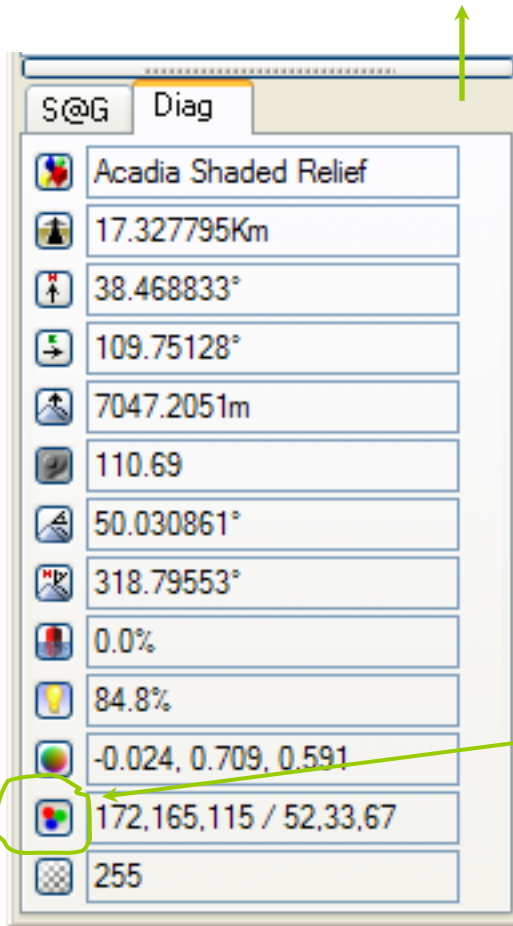
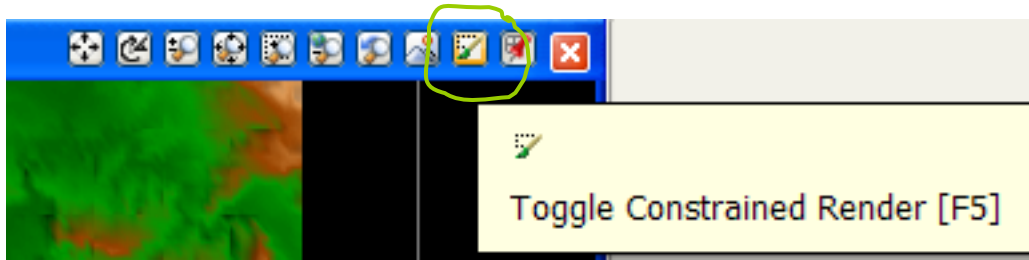
◇ Hold the Alt-key, hit ● prompts for “numeric entry” of the “active item”.

◇ Control-Click in a Camera View positions a Camera “On The Ground”: the Position of the Camera will prompt for an Elevation (if you want to change it.)

F-8 ... refreshes the OpenGL view of the Camera View window

F-9 ... redraws the Camera View in the Render Option selected


F-5 ... Constrain Render Preview ... good for Foliage




Switch from the “cloned” S@G menu to the Diagnostics tab ... and slide the viewable area up ... as the “default” view mode is RGB values. You can alter the view mode by clicking on the category button. “Pick” inside the Preview Render scene, and Diagnostics will return the value ...

... but watch for Vertical Exaggeration in the Planet Options; as Elevation values returned may be “factored” by your VE.

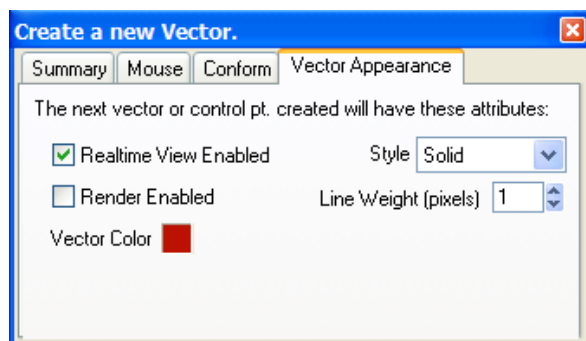
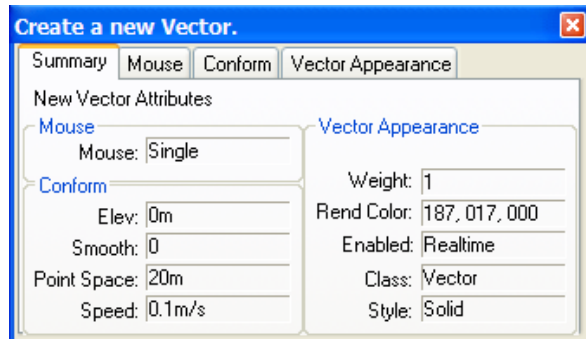
... again, the “default” view mode is RGB

- ▶  **Clone** the Light source: the Sun
Add 25-degrees to both the latitude and longitude of the northwest corner of the Project; and rename it “Northwest Relief Sunlight”
- ▶ Disable the default Sun in the Big List

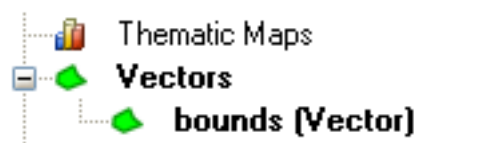
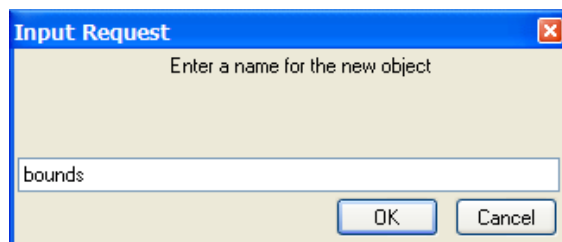
- ▶  **Clone** the “Overview NF Render Options” to “... Foliage”
- ▶ Adjust the Output Event, Options 1 and 2, Pixel Fragments 25

-  **Add Vector:** Project “bounds”, add 5 points (NW,NE,SE,SW,NW)

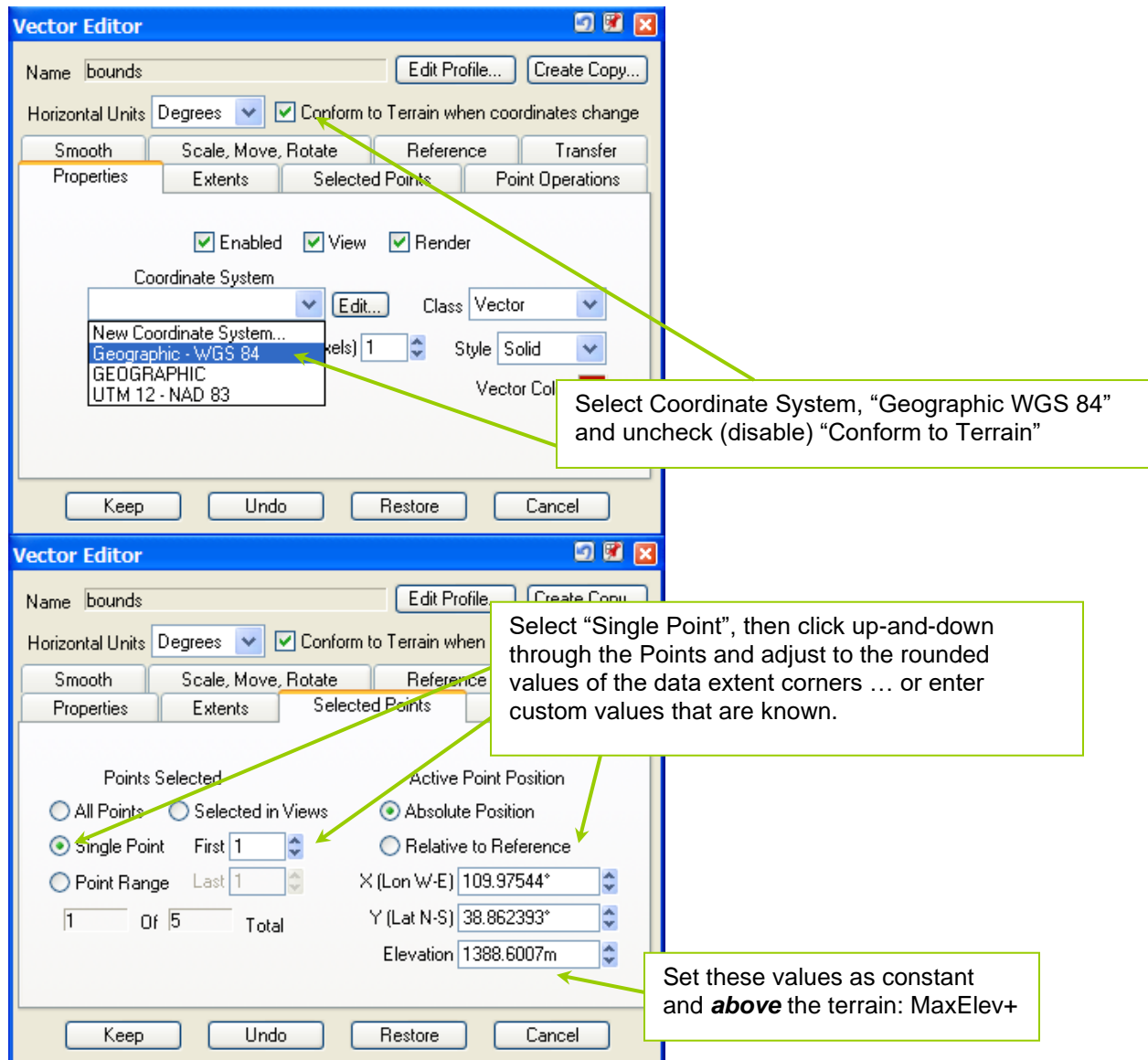
Highlight Vector S@G, Add (top right), set to “Render” check, adjust the Vector color and checkbox Render enabled



... in the Camera window (“Planimetric”) left-click adds a Vertex ... start at the northwest corner, then northeast, southeast, southwest, then back to northwest ... right-click to end digitizing; then name it “bounds”:



- Vector Editor, select the “Geographic WCS” coordinate system
 Selected Tab, radio to single, adjust values to “round-off”
 Set the Elevation at the terrain maximum (Planimetric, so “floats”)
 Point #1 should look like Point #5

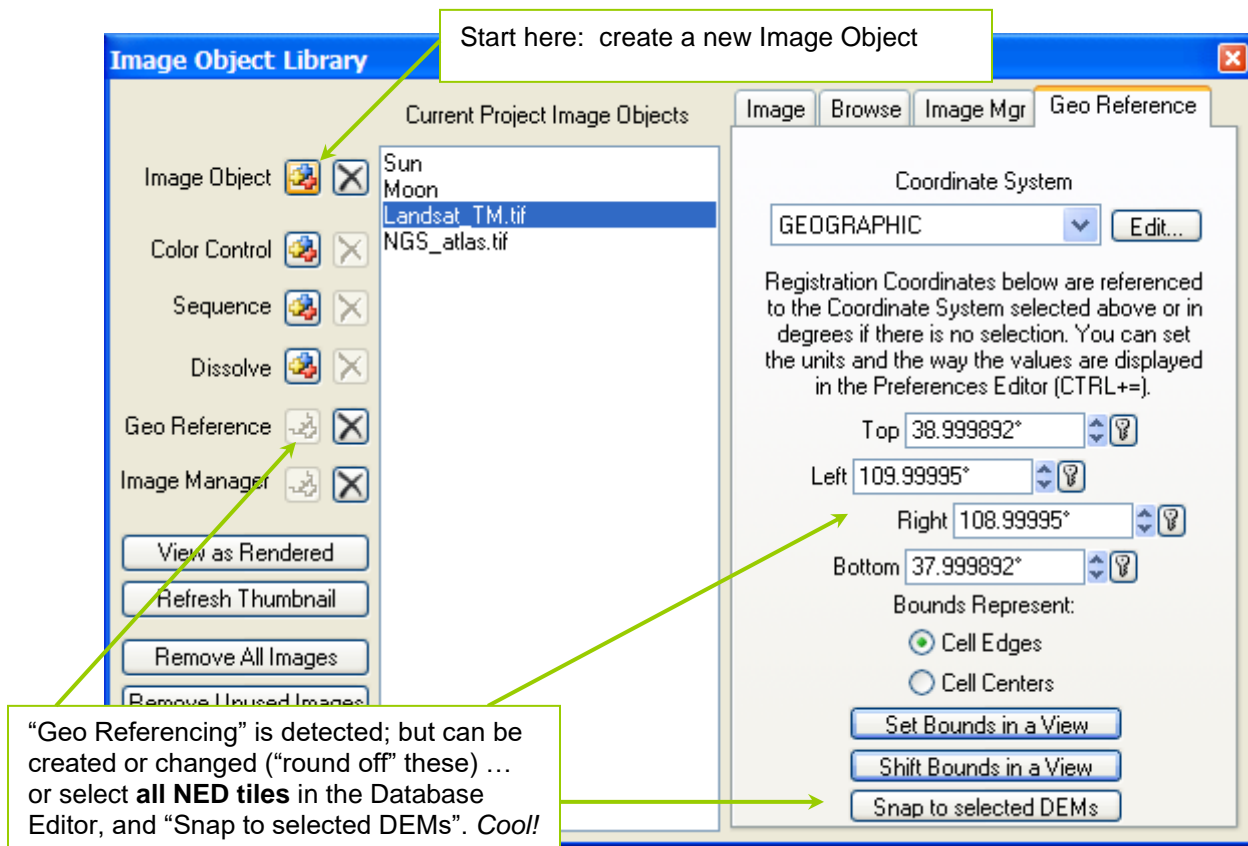


Add a Vector with Import Wizard: "bounds" versus "closeup"
 (Note: Relimport: reloads the Vectors at start-up)
 Linking data items and values, and the Database
 (see the **Addendum on the Import Wizard**)





Image Library: add the Landsat TM and Atlas images

► (You may have already ...) Copy Landsat (TIFF, TFW, PRJ), and NGS_atlas from the CD into the VNS Project directory; so, copy all files into the directory, **BUT not the ZIP files and the elevation subfolders**




◇ *images with georeferencing will create a “Geo Reference” tab in the Image Library ... but these values can be adjusted, or created; or “Snapped” to the selected terrain. In the Database Editor, select all the Tiles in the NED Layer, by the new Layer Name; then return to Image Library and “Snap” the new Image.*


- ▶  Create a Color Map for the Landsat TM scene
- ▶  Create a Color Map for the NGS Atlas image
- ▶ Copy NLCD (GeoTIFF) to Project: *you may have already done this? These are “color re-mapped” GeoTIFFs from the original USGS files. GeoTIFF contains georeferencing; or use the utility, “georegarcview” (on your CD) to write georeferencing to the header of a TIFF file.*

▶ Check for “complete coverage”: some datasets contain coverage for multiple States, so multiple NLCD State coverages are needed.


Note: if you Render an NLCD-derived Environment, and a portion of the area is Rendered with “Perennial Ice and Snow” (a light gray; so it will look like shaded

relief only), then there is no NLCD coverage of that area (Canada and Mexico). There are a few “tricks” to “mimic a ‘fill-in’ Environment” for adjacent areas with no NLCD coverage ... or just show them “blank”, and claim “artistic license”.

- ▶  Create a new Environment “mod. NLCD”, deactivate “No Foliage”. From the Environment Editor, load a “Component”, but search in your Project directory for the file for the Environment called, “updated NLCD Environment”, to load.

- ▶  Disable the “No Foliage” Environment: *VNS needs at least one Environment “enabled”, always; ... or it will create a new one.*

- ▶  Add NLCD Image to the Image Library

- ▶  Create a Color Map for the new NLCD image(s); and go to the Ecosystems tab: “Grab All” will attach all new Ecosystems.

- ▶ Clone the “No Foliage” Render Options, and adjust for Foliage
- ▶ Enable “Render Overhead”: foliage image re-generated as “tree crown”
- ▶ Rename “NF” to “Foliage”, and output Event to “... foliage”
- ▶ Adjust the bottom and sides “over Rendering” and Tiling
- ▶ Re-check that all foliage Options
- ▶ Drop the Pixel Fragment memory: 40 to 30, or 25
- ▶ Clone the “No Foliage” Render Options, and adjust for Foliage

To run an animation with terrain or image drapes with Variable Fractal Depth, a message will prompt “Create Fractal Depth Maps?”

- ▶ Use the “Constrain Render” function in the Plainmetric Camera View to Preview Render a portion of the terrain with the “mod. NLCD Environment” enabled ... *before running a Render Job: use the “Foliage” Render Options for this Render Job!*

The “Cookbook” Result?

- ☐ Two terrain surfaces: “NED” and “SRTM”

- ☐ Terrain has a Ground Effect, showing hypsography
- ☐ Two Color Maps for draping: “TM” and “NGS Atlas”
- ☐ One Color Map(s) for driving foliage: “NLCD”
- ☐ Two Environments: “No Foliage” and “NLCD”
- ☐ One data “bounds” Vector
- ☐ Two Render Options: “NF” and “Foliage”
- ☐ One Render Job, ready to operate Planimetric Camera called “Overview” by generating one Frame Zero, or “00000”

One terrain enabled, the other Disabled; Ground Effects defined, and Terrain Parameters defined; Planet Options with VE and Coordinate System; and Sun (light) at the northwest. No Sky, no Atmosphere.

◇ *conceptualize the “standardization issues” (►) names, procedures.*

◇ suggestion: generate Geographic bounds in Arc/INFO, “densify” and re-Project into UTM and correct Zone; export ShapeFile for Import use in VNS: “neatline”

Creating a quick Render of TM, Foliage, and hypsography

Using the SRTM data for terrain ...

Environment: enable “No Foliage”, disable “NLCD”
 Color Maps: enable “Landsat TM”, disable others
 Overview Render Options, adjust filename to “_TM”
 “Color Maps” enabled, and Foliage disabled
 “Vectors” disabled, “Diagnostics” disabled

Preview Render ... all or a portion (“Restrict” button)

Save the Project (Control-S) ... or File, Save



Start the 1st Render Job

Start a new session of VNS, and load the same Project

Color Maps: disable “Landsat TM”, so all disabled
Overview Render Options, adjust filename to “_Hypso”
“Color Maps” disabled, and Foliage disabled
“Vectors” enabled ... so drawing the bounding Vector

Preview Render ... all or a portion (“Restrict” button)



Start the 2nd Render Job

Whichever VNS session which a Render Job finishes first,
then just start working on the 3rd Job (... and just Quit/NoSave from
the session that finishes second)

Environment: enable “NLCD”, disable “No Foliage”
Color Maps: enable (or disabled) NLCD Color Maps only
Overview Render Options, adjust filename to “_Foliage”
“Color Maps” enabled (or disabled), and Foliage disabled
“Vectors” enabled ... so drawing the bounding Vector

Preview Render ... all or a portion (“Restrict” button)



Start the 3rd Render Job

Three output files in WCSFrames: TM, Hypso and Foliage

*Active item? Hold down the Alt-key and hot the “period” to
change the value of the parameter with numeric entry.*

Photoshop is next ...

Creating a quick 1-minute Animation



From matrix, Open “Camera” (default Perspective Targeted Camera)
Rename the “Camera” to “Animated CloseUp Camera”

Create (“Clone”) a new “Render Options” called “Animated CloseUp Render Options”; and select it for the “Animated Camera” window.

Change the “Animated Render Options” for HDTV 720p setting; and uncheck Render Options not being used (terrain with Color Map).

“Position and Orientation” tab, Add Keyframe at 0-sec and 60-sec

OpenGL Camera and Target characteristics: Red versus Green
◇ *remember: the “active object” is always highlighted in Yellow!*

Check “active object”, highlight Camera in list, then  “Move”
You can  Lock the parameter that is being operated on.

Drag the active Camera in the Planimetric View to the north edge
Add Keyframe at 30-sec. You can “Control-click” the position of active parameter (a “Camera position”); and VNS will prompt you for an “Elevation”, but provide “what elevation it found” at the location.

Keyframe for East ... 15-sec, and Keyframe for West ... 45-sec

Use the Animation Bar to check the Camera motion.

Adjust Target Position ... mostly elevation, mostly lower negative
Adjust Lens “Horizontal Field of View” ... lower default 45

Type in 7.5 in the Keyframe window at bottom, and then drag Camera to a “better position”; then add a Keyframe at 7.5 seconds ... so at the southeast corner of the Project.

Repeat 22.5 (northeast), 37.5 (northwest), 57.5 (southwest)

Use the Animation Bar to re-check the Camera motion.

Discussion of Keyframes in animation: Cameras and Timeline



Camera Editor

Banking Frames for Camera

Using a Stereo Camera and the “Panoramic Camera”

Modify the Animated Render Options

Start Frame 0, end Frame 1800 (enter 60s)

Set Frame Interval at 2 ... so at 30 fps, 15-Frames each second

Define a first output Event ... as the individual Frames

Define a second output Event ... as an AVI or MOV

Set up a Render Job with this Camera and Options, but disable.

“Save the Project” ... *Control-S ... Control-S ... Control-S ...*

Before you leave, restart VNS and let this 360-degree animation Render Job run over-night; but remember: check what Color Maps and Environments active; and what Camera and Render Options are active. Check the image being generated with the “Show Rendering” at lower left of Render Control ... but this eats up memory, so “kill” it.

Visualization Training – Day One Afternoon

NLCD, Template, Environment and Ecosystems

The Ecosystem Editor: see the Ecosystem Editor Addendum

Clone and “naming conventions”

“Overview”, “CloseUp”, “CloseUp #2”, “NLCD”, “NLCD Version 5”

You have to establish a “convention of names” right up front ...
... because you ease the burden of others, and “the replacements”.

Photoshop, Illustrator, VNS, Google Earth Pro with Sketch ...

“Train the least skilled laborer to do the repetitive Project grunt work”

“Cookbook to loading USGS Geography Discipline data into VNS”

“Pass your customized Ground Effect to your neighbor” to load in their project as a new Component, Ground Effect.

Put in LandCover directory ... start snooping around, in Foliage.

VNS uses a folder (“directory”) structure for pre-loading Components.

Your Project uses its VNS pathname (“WCSPProjects”) set in your Preference file ... along with ELEV tile pathname (a server?)

Before you leave, Day One ... a Render Job:

- Planimetric Job of Project: hypsography, Landsat, and NLCD
- (option) 1-minute fly-through animation around the terrain model

Visualization Training – Day Two Morning

Post-Production: a Cut-and-Splice session in Premiere

Photoshop: Layer techniques

Premiere: create animation from VNS Frames

Photoshop and Premiere: text techniques for animation

AfterFX: text techniques for animation

Premiere: create an extended animation

Photoshop: techniques for Foliage Objects

Re-coloring, textures, Dissolve, resolution and memory

Ecosystem Component Library

(see the addendum on “Why Visual Nature Studio?”)

Creating “posterboard” foliage and 3D Foliage

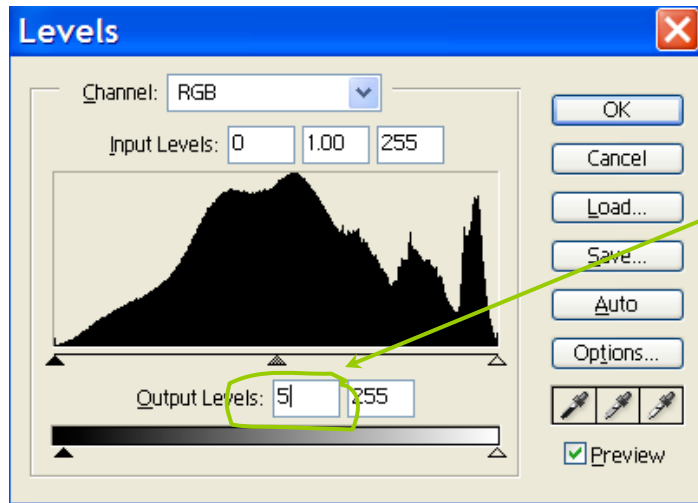


In Photoshop, Select, Color Range with a 10-15 Fuzziness value can be effective to select large areas of background sky and clouds; so isolating potential foliage specimens in the photography is important. As light bends, be sure to edit out any “background halo” (blue or white, in this case) between branches and leaves. For smaller specimens, a sheet or colored material can be set up behind the specimen; and the smallest specimens can be directly scanned ... *just make sure they are not endangered or threatened species, please!*



◇ In VNS, “transparency” is defined by black pixels (RGB=0,0,0) or by use of a separate “alpha channel” such as available for PNG and GIF formats. When “resampling” a foliage downward (say, 1000 to 500 pixels high) using Photoshop, be sure to use the Image, Image Size, “Nearest Neighbor” resampling method to preserve the black edges of foliage ... otherwise, the Bilinear and Bicubic methods of resampling will produce intermediate (anti-aliased) colors ... and you will see a “grayish edge” to the downsampled images in VNS.

◇ VNS will not “Render” black pixels; so in Color Maps, showing actual “dark areas” in draping an image should be defined as (5,5,5), as black (0,0,0) will show the underlying Rendering layer (the Ground Effects or another Color Map image). Before saving a Landsat image in Photoshop editing, use the Image, Adjust, Levels manual function to adjust the lowest Output Levels of black to be (5,5,5) at the bottom center of the Photoshop Levels window:



Use the Image, Adjust, Levels ... or Control-L shortcut ... to adjust the Output Levels of all three Channels (R,G,B) in an image that “dark areas near black” are to be shown ... otherwise, VNS will ignore “true black” (0,0,0) pixel values ... with Color Maps (Landsat) or foliage images, treating them as “transparent pixels”.

Fractal Depth Maps and the Terrain Parameters

“checkbox” for “regenerate Fractal Depth Maps” (Start, End, Interval)

“checkbox” for “Regenerate Cloud Shadows”

Using the “*Rules of Nature*”™ to place foliage

Create a new “ground perspective” Camera and include hi-rez Foliage

Create a new Ground Effect that is rocky in steep slope and high elevation

Create new Environment, create Two Ecosystems: field and woods


Add Foliage Effects for “more trees” where needed, in foreground


Create a new “Drop Down” Targeted Perspective Camera

Make a “Drop Down” Render Options, adjust tiles and overlap


Camera Editor: lens, focal length and “Box Filter”

◇ Open up the Drop Down Camera parameters in S@G, and switch between “target” Position parameters, and “Camera” Position parameters (both top of the

list). If you highlight a “Target” position, use the “Move Button”  to move the Target ... and if you highlight a “Camera” position, hold down the “Space Bar”,

enable the Move button  to move the Camera. The next time you use the Space Bar, Move will be already enabled (... so the Space Bar becomes a “toggle” to move the active Camera).

◇ “Control-Click” positions the “active object”: Perspective and Target

◇ “Lock” the item by highlighting it in [S@G](#), and using the  button ... just be sure to “unlock” the item when your finished, ‘cause it is “Lock’d” in VNS.

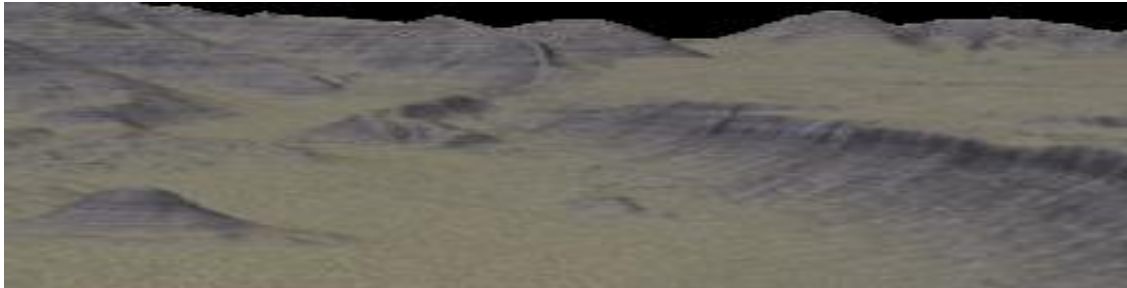
Create or adjust the Light source, or add a “spotlight”

Create a “RON Environment” and disable other Environments
Disable all “Color Maps” ... work with “just the Ground” on terrain.

◇ If a Color Map that drives Foliage (Ecosystems) is Enabled, then VNS will sometimes over-ride other Preview Render settings: “Disable all ColorMaps”

Create a “RON Ground Effect”: create a rocky appearance in steep slopes at high elevation; but a smooth “dirt-like Texture” in flat areas of lower elevation: two Materials with the Dynamic Parameter, Slope as a Material Gradient driver with the Texture Editor.

In the Ground Effect Editor, expand the “Show Material Controls” window. The default gray is at zero Percent; so add a second color at 100 percent. Add a Texture to each of the two Materials, and set their X and Y dimension to 21, 23, 27, 33, meters: pick dimensional values that do not “overlap” (20, 24, 30, ...)



For the Material Gradient Driver, change to 100-percent; and activate a Texture with a Dynamic Parameter Element, select “Slope (deg)” and the “Input High” at 40 degrees.

Add a Component Strata to the new Material (at 100%)

Two Materials: one Material a light tan and darker brown Fractal Element, and the X and Y dimension increased; and a second Material a light gray to dark gray Fractal Element, the X and Y dimension increased, and with a Strata Effect enabled (pick Crenulated Limestone ... a copy in your Project directory).

One Gradient Texture with 100% Dynamic Parameter Driver

Slope range zero to 40 degree: from Zero to 20 percent slope shows Material One; and from 20 *and above* percent slope shows Material Two.


Turn on a Sky, and adjust the Color.

Adjust the Camera Elevation to “down on the Ground” + 10 meters.

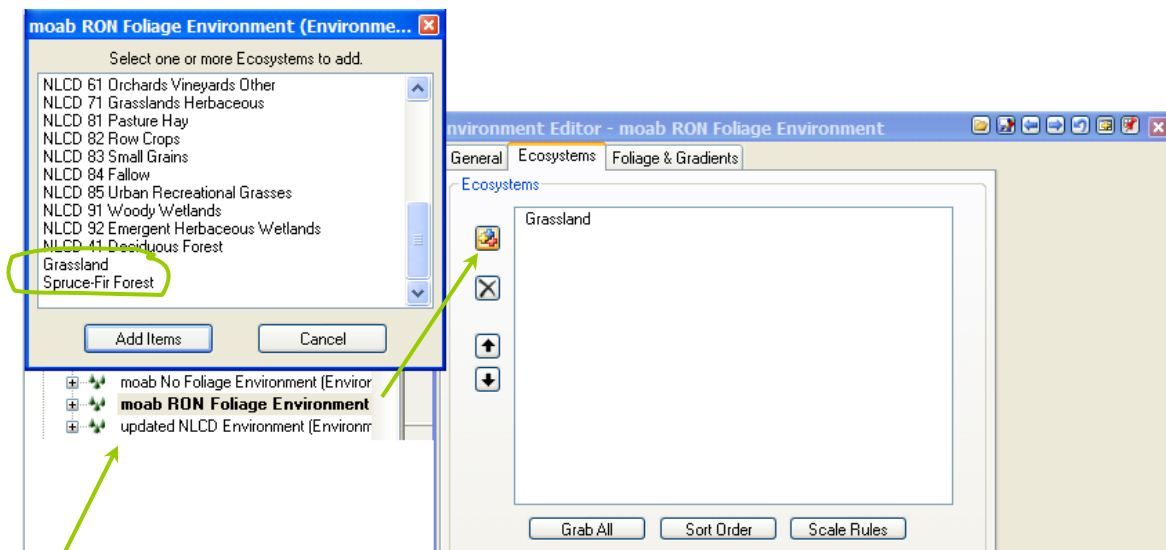
◇ If you are using “Fractal Depth Maps” for the Terrain Parameters, then it is best to “Create Fractal Depth Maps Now” for a valid Rendering of the terrain: set the “Start Frame” as zero, and the “End Frame” of zero; and VNS will quickly scan the DEM Tiles for all Jobs that are active in the Render Job queue. If you have an animation in the queue, set the Start and End Frame, and define a Frame interval to create Fractal Depth Maps for the entire Job.

Create a “RON Environment”, and disable other Environments

Create two new Ecosystems, “RON Grassland” and “RON Spruce-Fir Forest” from loadable Components (as an alternative, use the matched “RON Colorado Prairie” and “RON Colorado Evergreen Forest”)

Highlight the “Ecosystems”. category In S@G and “Create” , double-click “RON Grassland” or use “RON Colorado Prairie.”

When you add these two new Ecosystems to the RON Environment, they will be at the bottom of the list, as they are new:



Environment “RON Ecosystems” enabled, with all other Environments disabled; add only the two new RON Ecosystems to the RON Environment.

◇ Defining the “Distance Dissolve Color” or “Distance Dissolve Texture” is critically important to reduce processing time, **as much as 40-65+ percent!** When dissolving Foliage in the distance, **VNS accounts for Light ...** so

illuminated Foliage (perpendicular to the surface) and the Dissolve Texture **will need to be adjusted** for each scene; or throughout an animation **if the Camera moves**: VNS **illuminates** upright Foliage, and this **changes** from the Camera perspective according to the source of **Light**.

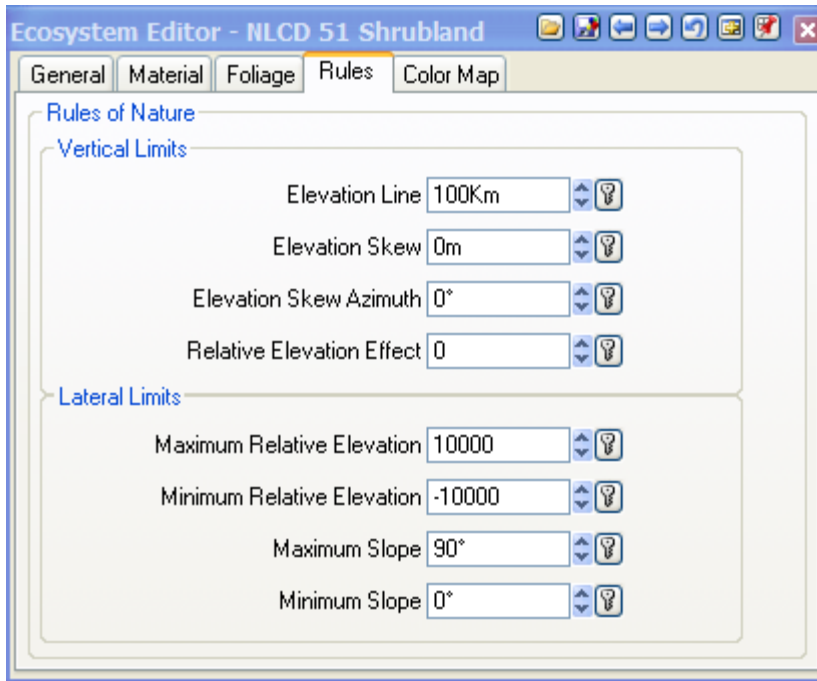
◇ Distance Dissolve is Enabled and adjusted on the "Distance Dissolve for this Ecotype" Group on the Foliage tab of the Ecosystem Editor when an Overstory Material or Understory Material are selected ... and the application of Dissolve is done in two ways: "Absolute Pixels" or "Relative to Image Height" (Common Distance Dissolve Group). See the Ecosystem Editor Addendum.

The Relative Elevation Effects

Under 3D Nature's "Rules of Nature", relative elevation is used in two ways to control the placement of Foliage: local relative elevation and regional relative elevation.


Local relative elevation, in the Lateral Limits Group, can be determined for the terrain with the "Diagnostics" cursor-pick after the surface is Rendered. Normal ranges in flat areas are 10 (convex surfaces) to -10 (concaved, or "depressions"); and 20 to -20 in variable terrain as the surface approaching slopes. The "defaults" are huge values! ... 10000 to -10000 ... so adjusting these in ranges below 100 and above -100 in any terrain allows "transition" between Ecosystems to merge more naturally. For mountainous terrain, try adjusting this range between 500 to -500; and for flat terrain, try adjusting the values between 10 to -10.

Regional relative elevation, or "Relative Elevation Effect" in the Vertical Limits Group, allows Ecosystems to venture outside of a hard-set "Elevation Line" in Vertical Limits. Positive values allow the Ecosystem to grow up valleys (concaved) and repress growth downward on ridges (convexed); and negative values have the opposite effect. Values of 10 to -10 work well.

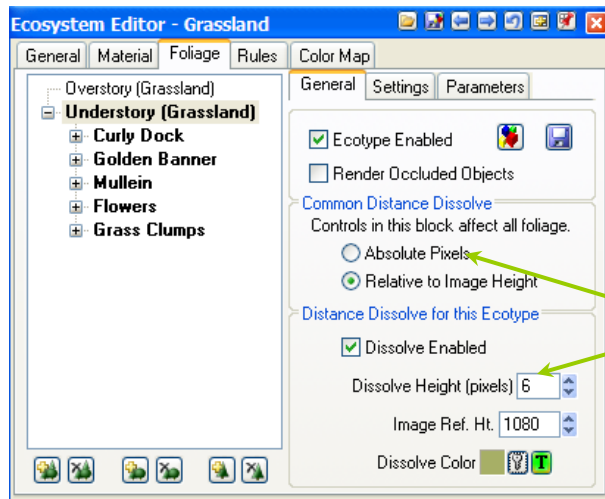


Foliage can also be skewed in one compass direction: “Elevation Skew” and “Skew Azimuth”. The Ecosystem will increase elevation in the Skew direction (an azimuth) with a positive number, or lower elevation if you use a negative number for the “Elevation Skew”. Values of 500 to –500 recommended in mountainous terrain.

Setting “slope limits” is also a great way to naturally break up the interface between Ecosystems. Use 15 to 30 degrees for transitional terrain between “flats” and hills or mountains; and 45 degrees in mountainous regions, allowing rocky Ground Effects predominate.

Once the “Dissolve” Color or Texture is adjusted for “Grassland”, highlight “Ecosystem” in S@G and “Create” , double-click “RON Spruce-Fir Forest” (or RON Colorado Evergreen Forest) and repeat the adjustment of Foliage placement and Dissolve Texture for forested areas at higher elevations.

On the RON Environment, Foliage and Gradients tab, increase the “Foliage Height Factor” to 200 to 300 percent: lots of foliage, proportioned to terrain.

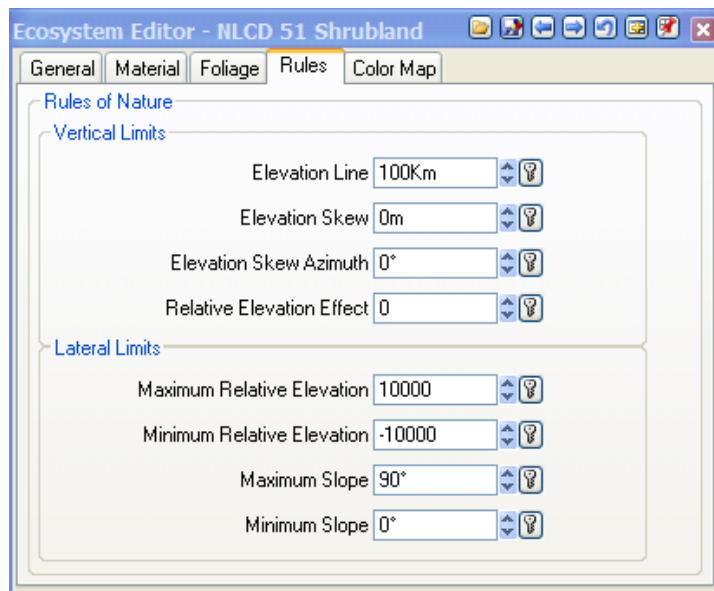


In the Grassland Understory, adjust the Dissolve “Relative to Image Height” and set the Image Reference Height to HDTV 1080i; and reset the Dissolve Height to 3 pixels. VNS will “confirm” the setting; and the Spruce-Fir Understory will be reset as the same settings ... except “Dissolve Pixel Height” will need to be adjusted: 6 pixels? Adjust these two values, as needed, so that the “Dissolve Distance” for these two Ecosystems is enabled in the distance. They will be apparent; but then adjust the Dissolve Color, or add Texture.

Change the Understory Dissolve Texture for “Grassland” and Spruce-Fir Forest” to something “less saturated”, less green. Preview Render the Ecosystems; and try to match the Dissolve Color in the background (*add a Texture?*) with the actual foliage showing in the foreground. An optimum distance is “just over halfway” to the horizon.

◇ The Color Editor allows “Sample Color from Image” checkbox!


◇ For Color Images, VNS ignores the “Replace Gray Color”



Relative Elevation allows the maximum elevation of an Ecosystem to drift upward, or lower. Positive Relative Elevation allows an Ecosystem to increase maximum elevation in convex regions (such as a riparian ecosystem in a river valley) and Negative Relative Elevation allows the Ecosystem to climb concaved regions (a ridgeline of rocky shrubs). Combined with Slope and Elevation Skew, the foliage for an Ecosystem can blend with the terrain; rather than a “hard edge”. “Prioritize” the Ecosystem in the Environment list (up/down arrows); bottom to top in Elevation Line.

Adjust the “Rules of Nature” (RON) to place the field grasses in low slope areas below the mid-elevation of the terrain (Max-to-Min). Use the “Rules of Nature” to place the forest 300m below the Max elevation. Pre-view Render with the “RON Environment” enabled, and refine the placement of “Grassland” and “Spruce-Fir”.

◇ If you want to hide something in the foreground, then add a “Foliage Effect” in

front of it. Highlight “Foliage Effect” in S@G, “Create” , add a Vector ... and a Foliage object will be placed at each vertex ... so “densify” the Vector for more Foliage objects to appear (Vector Editor, Add Points with Spline or Linear).

Visualization Training – Day Two Afternoon

Atmosphere and Sky

Light sources and color

Animated light sources over animation

Cloud modeling

Before you leave, Day Two ... one Render Jobs:

- 1-minute Light animation Job: Light, Sky, Atmosphere, Clouds
- (option) Re-run the Day One Job, with more Frames or in Stereo
- (required) *Finish that 1-minute fly-through terrain animation.*

Visualization Training – Day Three Morning

More Post-Production: Photoshop and Premiere

Linking and Dynamic Linking to a Object

Terraeffectors and Area Terraeffectors

Lakes and Area Terraeffectors

Foliage Effects, “posterboards”, 3D-models

Visualization Training – Day Three Afternoon

Coordinate Systems and Planet Options

Terrain Parameters

Terrain Generator

Terrain Gridder

Data pull-down, “Forestry Wizard”

Data pull-down, “Gridder Wizard”

Data pull-down, “Merger Wizard”

Search Queries


Thematic Maps

“Clone” a new (perspective) Camera, rename it “Just For Fun” Camera; create a “Just For Fun” Render Options for it (use the HDTV 1080i parameters), redefine the Output Event (*don’t want to “write over” something*) Pixel Aspect 1:1 but use the HDTV) and “Set Default Position” (clear Keyframes).

Hit the “plus sign” a few times; enable the NLCD Environment and the NLCD Color Map only; and set the Render Options for “foliage” (not “overhead”, Misc tab). Preview Render; and it should show foliage.

Check the Render Options for the Camera; and Render a Preview.

Terraeffectors: add a pathway or a major road

Highlight **Terraeffectors** and “create a Vector” . Draw a polygon and the Vector automatically attaches itself to the Terraeffector. Open the Component Gallery of the new Terraeffector, and double-click “2 Lane Highway”. Examine the Asphalt, double-click it, and understand how the Texture is made: the Diffuse Color Texture on the Materials tab of the Asphalt Ecosystem Editor. *Very cool!*

Area Terraeffectors: land transformations, such as cut-and-fill or an excavation. Areas can be “excavated”; then the same Vector can be used in the Lake Effect ... defining it as a “shoreline”.

Wave Models, for water ... but as Lakes or Cloud Models

Starfields: check that Longitude of Rotation! Think “backwards”

Celestial Objects: Sun and Moon exist by default, but disabled

◇ Celestial Objects and Starfields depend on the amount of Light involved; so “Keyframe” the Light (Sun) source to simulate sunrise and dusk, lighten-to-darken and pick orange-red colors transitioning to a dark blue-purple at “sunset” then have The Moon rise or fall, and Starfields rotate to simulate nature.

Snow Effects: use Rules of Nature to place snow on peaks, but predominates on a “north aspect slope” (the shady side).

Streams: just like a road (Terraeffector), highlight and Add Vector

Lakes: with Area Terraeffectors, can excavate and fill with water:

Highlight **Area Terraeffector** in S@G, the “Add Vector” by drawing a polygon (left mouse, close with right mouse). Name it “shoreline”. Open the Component Gallery for Area Terraeffectors and select the “Terrain Lowerer” Component. Now, “Create” a **Lake** by selecting the “RMNP Ocean” from the Gallery, then locate the Vector “shoreline” in the lower S@G; and drag it onto the new Lake Effect in the upper S@G (drag-and-drop). Use the cursor to find a shoreline elevation of the “lowerer terrain” excavation; and set the “Lake Elevation” to the new Area Terraeffector “rim”. Reset the “Optical Depth” of the “RMNP Ocean” to 50 meters; and redraw the scene to see a translucent lake in the area excavation: one Vector!

◇ Look at how the Wave Model for the RMNP Ocean is made; and that Wave Models (as used with Clouds) are separate categories; but built the same.

Walls

Labels: in animation, these “stick” with position or move.

3D Objects
3D Materials
Render Scenarios
Post Processing

Before you leave, Day Three ... any Render Jobs:

- re-run the 1-minute Color Map animation?
- re-run the 1-minute Atmosphere animation?
- Run a new Job ... your choice ... recommend Foliage
- Create a Stereo Job ... either single Keyframe hi-rez or animate
- Create a Panoramic Job (... *but I don't have a viewer*)

Visualization Training – Day Four Morning

More Post-Production: Photoshop and Premiere

OpenGL options that can be changed, ... *but you are responsible for “recovery”, not me; so remember what you “changed”.*

More Atmosphere, Lights, Clouds and Sky

Advanced Textures: Size, Center, Falloff, Velocity, Rotation

Animating Clouds Models and the Sky: Texture Velocity

Visualization Training – Day Four Afternoon

Post-Production: Photoshop/Premiere “in Stereo”
(covered after the first Stereo animation is generated)

Post Production available in VNS; but I recommend you learn these skills with interactive changes ... not provided as a final result; as a final Frame, or a composite AVI in VNS.

Fill-In: open discussion on “loose ends” or details

Before you leave, Day Four ... any Render Jobs:

- your choice, but if someone has not run a Render Job yet, then they are in trouble with me.

Visualization Training – Day Five Morning

Quick clean up on Jobs run overnight.

“Swap with a neighbor” on the datasets. **“Team Up”**?
Load and repeat the initial steps from Day One:

- load terrain dataset (SRTM only)
- adjust the Planimetric Camera position
- adjust the Render Options, and Keyframe the Camera
- adjust the Planet Options and Terrain Parameters
- adjust the Ground Effects for the terrain
- adjust the Light (Sun): “... plus twenty five to thirty”
- add the bounding Vector (or load the Vector ShapeFile)
- load the Images of TM and NLCD
- load the new NLCD Environment
- create the TM and NLCD Color Maps
- link the Ecosystems to the NLCD Color Map
- create two Render Options: Foliage and No Foliage
- run the Three Jobs, three Frames at Keyframe Zero
- (2) Color Maps (no Environment), (1) Environment with NLCD Foliage
- Don't forget: “What about the neatline?”; so a fourth Job, or integrated (hypso)*
- load into Photoshop ... three Layers (or four with “neatline” blank)
- clip, color adjust, separate content Layers, “Blending Options”
- add logo or text, more “Blending Options” ... “sign it”.
- ... then “flatten” and save the image

Visualization Training – Day Five Afternoon

Clean Up: open discussion and “back-ups” of data

“Nature Academy” ... and “gateway software”:

www.vterrain.org for software packages and evaluations

Bryce, ... and test the “Trial Versions” (30-day)

3D Studio Max and “the light version”, 3D Studio Viz

NewTek Lightwave, WaveFront Technologies Maya

RenderMan on the SGI platform, for “cinematography” quality

Free-ware for 3D model creation, or at least small 3D objects

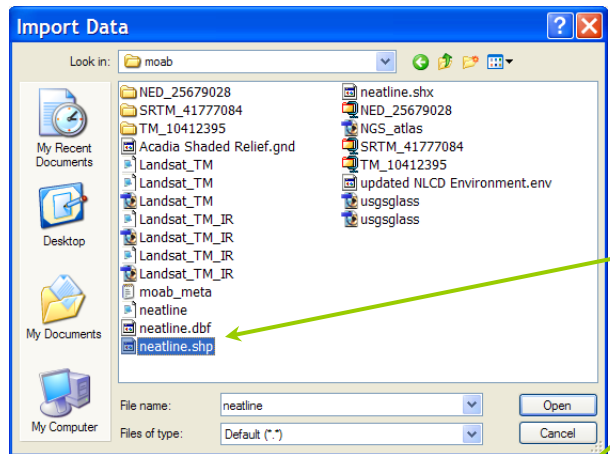
Software for Panoramic viewing

Addendum: Import Wizard for terrain and vectors

Warning: if the Import Wizard “mis-detects” the type of file you are loading, try another “file type selection” ... or you may have “selected” the wrong file (adf versus hdr): “byte-order” can solve problems.

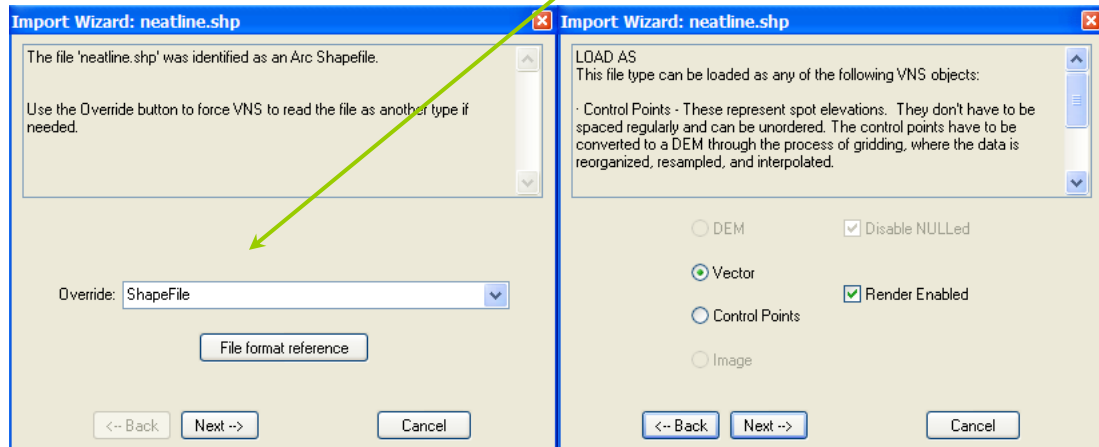
Use the “Back” button to review options and changes, then “Import”

Importing Vector data ...



For Vector data, select the Shape (*.shp) file ... or the Header (*.hdr) or the Projection (*.prj) for Vector (or Raster) data. The Import Wizard will figure it out.

Not correct? Then, change the File Type ... as you can always “Back” (button) to change it again; ... for Vectors or Raster.



The file 'neatline.shp' was identified as an Arc Shapefile.

Use the Override button to force VNS to read the file as another type if needed.

Override: ShapeFile

File format reference

<- Back Next -> Cancel

LOAD AS
This file type can be loaded as any of the following VNS objects:

- Control Points - These represent spot elevations. They don't have to be spaced regularly and can be unordered. The control points have to be converted to a DEM through the process of gridding, where the data is reorganized, resampled, and interpolated.

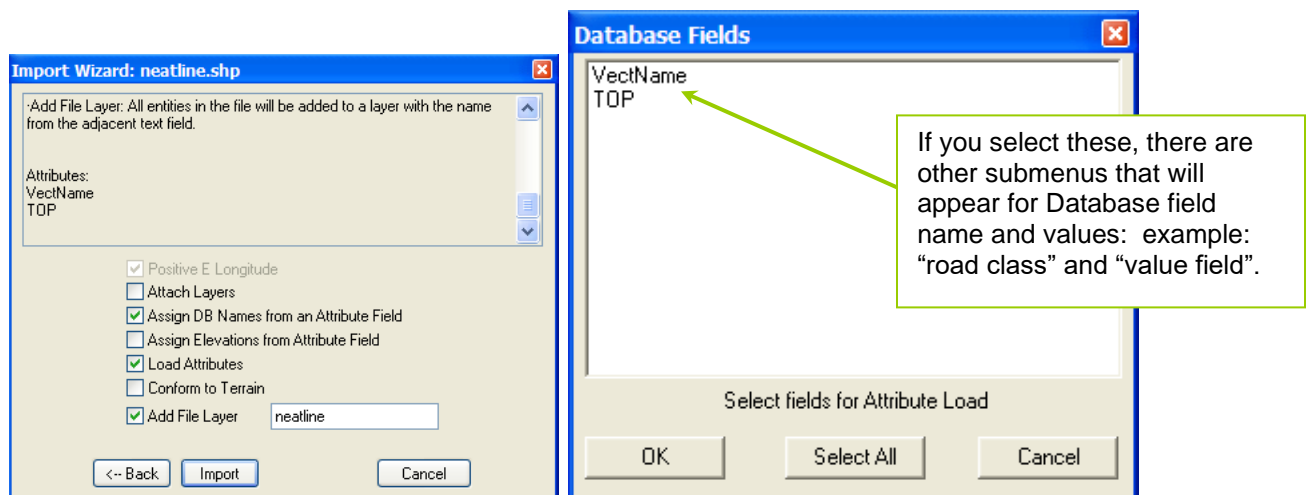
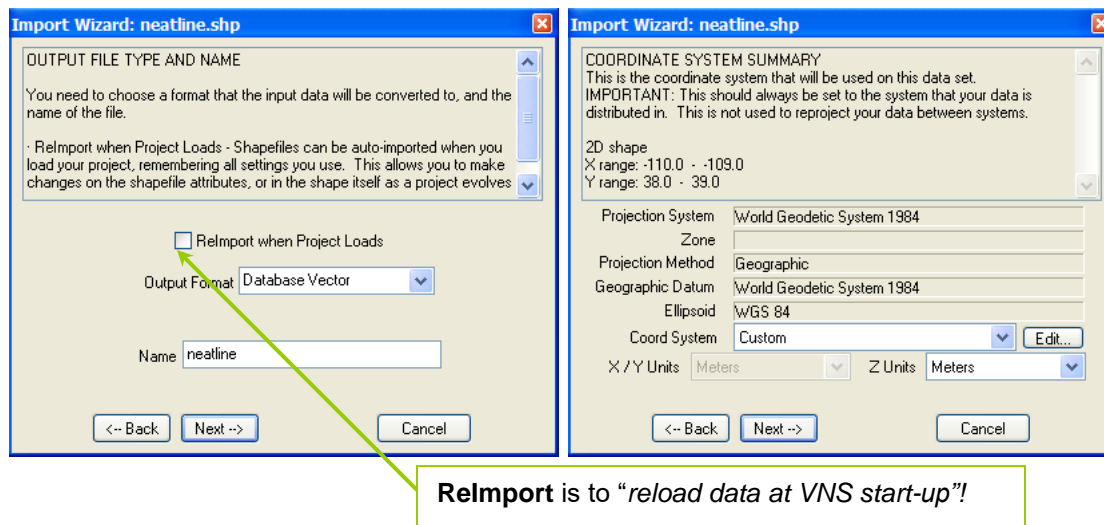
☐ DEM ☒ Disable NULLed

☒ Vector ☒ Render Enabled

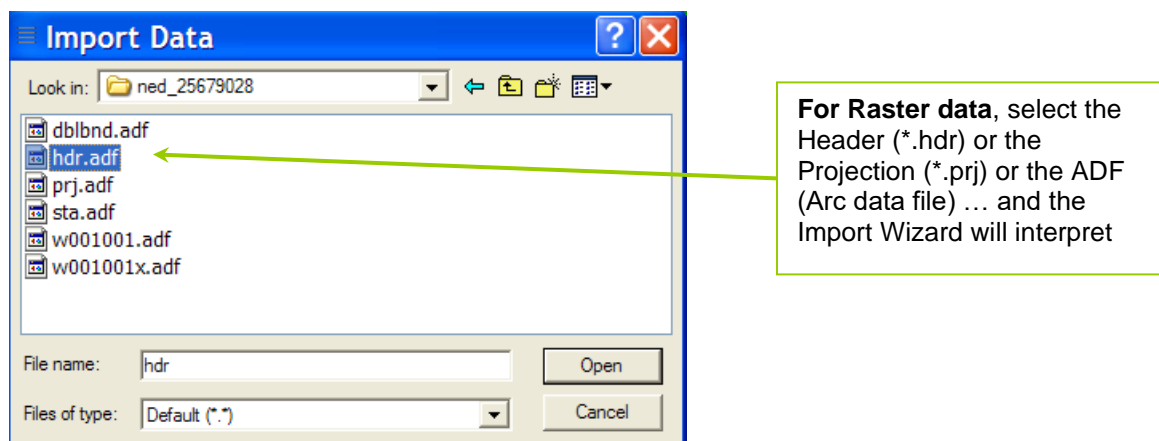
☐ Control Points

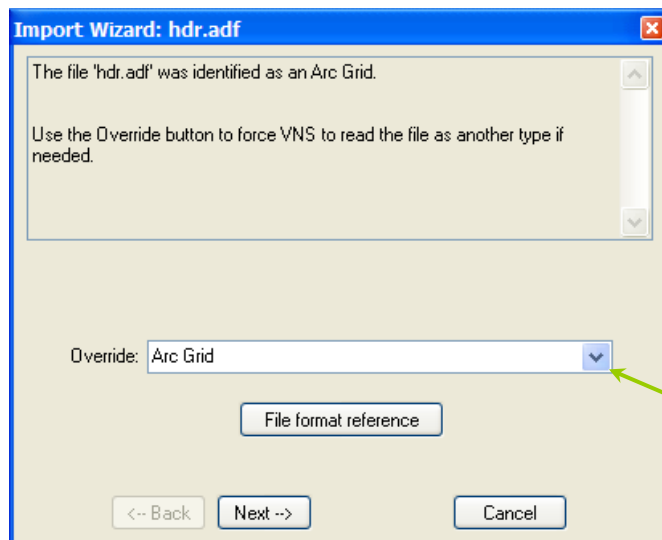
☐ Image

<- Back Next -> Cancel

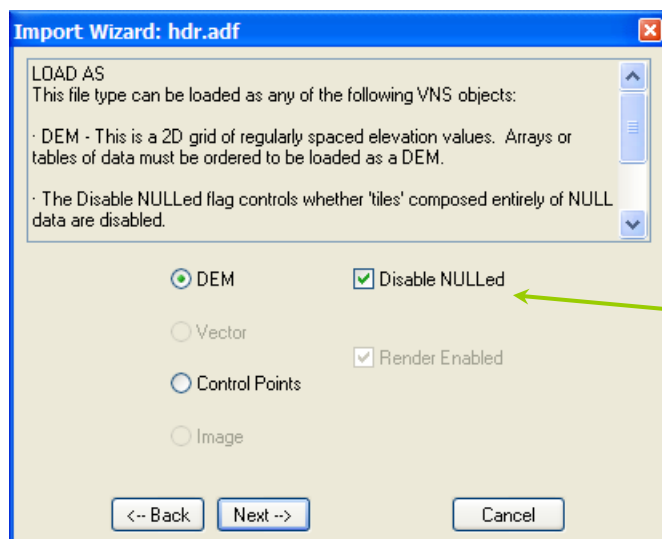


Importing Raster data ...

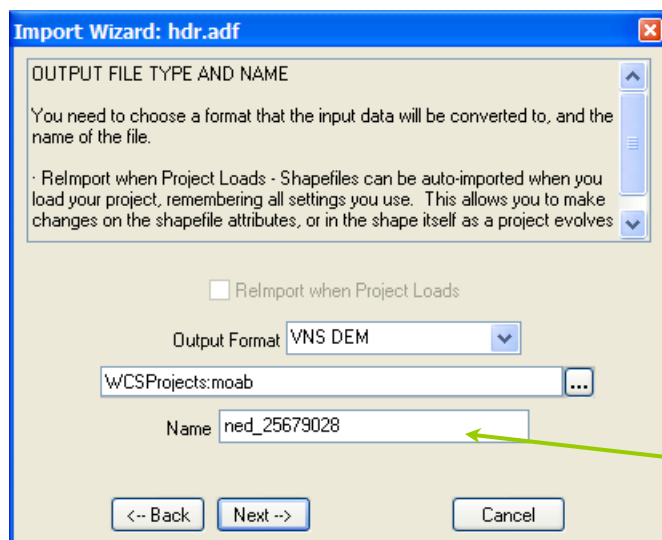




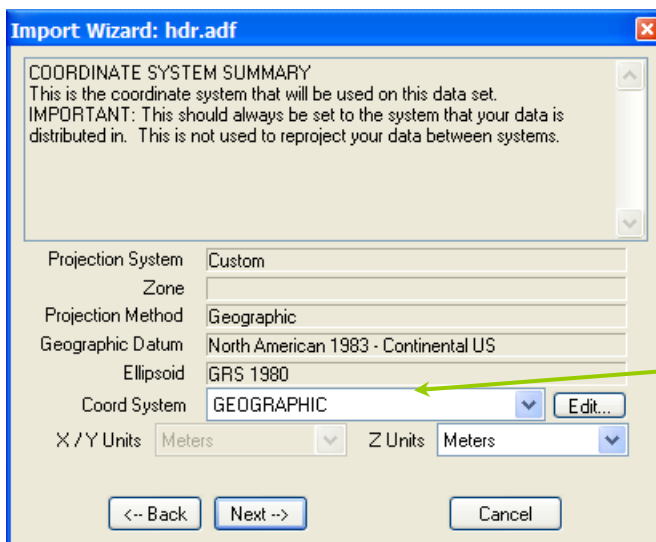
Options for binary file types, BIL, BSQ, and “byte order” from “other machines are available



Elevation files in “Open Water” (coastal areas) may not appear (“NULL”) in the Camera views of the terrain. See the Database Editor, “Extent” tab, to locate these “Null Value” elevation tiles: *they could be a sign of mis-reading the dataset!*



You can change the name of the Tiles ... but this keeps the “link” back to the original data



Import Wizard: hdr.adf

COORDINATE SYSTEM SUMMARY
This is the coordinate system that will be used on this data set.
IMPORTANT: This should always be set to the system that your data is distributed in. This is not used to reproject your data between systems.

Projection System: Custom
Zone:
Projection Method: Geographic
Geographic Datum: North American 1983 - Continental US
Ellipsoid: GRS 1980
Coord System: GEOGRAPHIC (dropdown menu with Edit... button)
X/Y Units: Meters (dropdown menu) Z Units: Meters (dropdown menu)

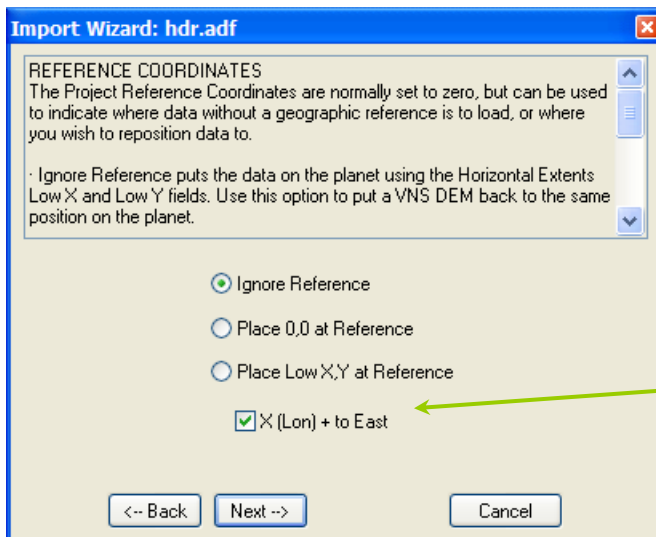
<-- Back Next --> Cancel

Projection System OK? You have a chance to change it; or modify it later ...

... but "looks OK" here.

VNS will create a Coordinate System, even re-create an existing one, "Geographic.1"

That's fine ... don't argue.



Import Wizard: hdr.adf

REFERENCE COORDINATES
The Project Reference Coordinates are normally set to zero, but can be used to indicate where data without a geographic reference is to load, or where you wish to reposition data to.

· Ignore Reference puts the data on the planet using the Horizontal Extents Low X and Low Y fields. Use this option to put a VNS DEM back to the same position on the planet.

☒ Ignore Reference
☐ Place 0,0 at Reference
☐ Place Low X,Y at Reference
☒ X (Lon) + to East

<-- Back Next --> Cancel

"Legacy" from World Construction Set ... a positive Longitude in the western world ... but watch for Export/Import conflicts ... and think!

Import Wizard: hdr.adf

HORIZONTAL EXTENTS
This shows the number of elevation points in the DEM, the area that each elevation point covers, and where the DEM is positioned on the planet.

- The size of the DEM is shown in the Cols & Rows field.
- Grid Units indicate the unit of measure used for Grid Spacing.

Grid: Linear Units Cols: 3600, Rows: 3600 Bound: Degrees

Grid Spacing (W/E): 24.20659 Grid Spacing (N/S): 30.93067

Total DEM Size (W/E): 87.14374 Total DEM Size (N/S): 111.3504

Width: 1° Height: 1°

North Lat: 39°

West Lon: -110° East Lon (+): -109°

South Lat: 38°

<-- Back Next --> Cancel

Do these values look OK? ... then, they probably are. Here is where you can spot “negative Longitude” mis-calculations on “mystery data” data that you get nefarious sources: if it doesn’t “look good”, then change the Binary Options on the first page by hitting “Back” many times! If the values are “way off”, then the “byte order” or length could be off!

Import Wizard: hdr.adf

PRE-PROCESSOR SETTINGS
Use the checkbox by Floor and Ceiling to enable these fields. When Floor is enabled, any input value below the floor value is replaced with the floor value. When Ceiling is enabled, any input value above the ceiling value is replaced with the ceiling value.

- Use the Crop fields to eliminate rows or columns from the input array while

0 ☐ Ceiling
0 ☐ Floor

Crop Top: 0

Crop Left: 0 Crop Right: 0

Crop Bottom: 0

☐ Keep Original Geo Bounds

<-- Back Next --> Cancel

I have never used these options on the Import Wizard: “leave it alone”.

Import Wizard: hdr.adf

VERTICAL EXTENTS
These settings control the interpretation of the elevations.

- You can change what unit of elevation VNS interprets the data as here.
- You can change the elevation range by changing the Low Elevation and/or High Elevation fields. This allows you to flatten, exaggerate, or invert the data.

Elev Units: Meters

Scale: 1 Elev Modifier: 0

High Elev: 3875.137

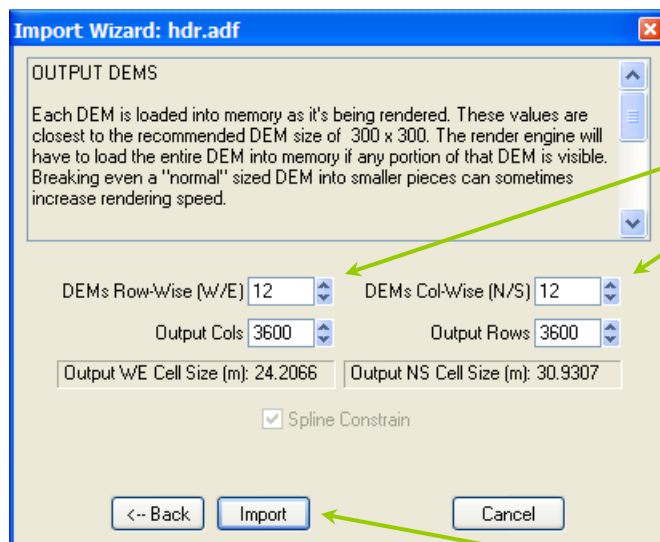
Low Elev: 1156.037

☐ Invert Data

Switch to Scaling

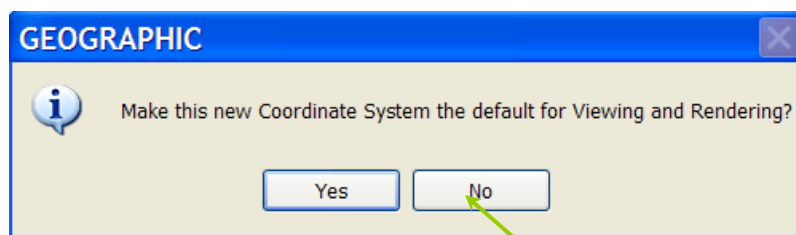
<-- Back Next --> Cancel

These two numbers are important ... especially the High Elevation ... but they will “reappear” in the Information Dialog window at the bottom of the VNS screen: make note of these, ... as the Maximum used later!



You can change these Tiling parameters; but these are values that are VNS easy for VNS to manage ... so recommend that you "just go with these values"

... or just close your eyes and hit the "return key" ten times from the first "Open" file:
Open, ... Next, Next, Next, Next, Next, Next, Next ...

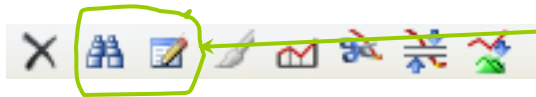


VNS **always** asks this when it detects a new Coordinate System (not already defined); but get in the habit of always saying "No Thanks" ... or as Nancy Reagan said, "Just Say No".

Max elev = 3875.14, Min elev = 1156.04

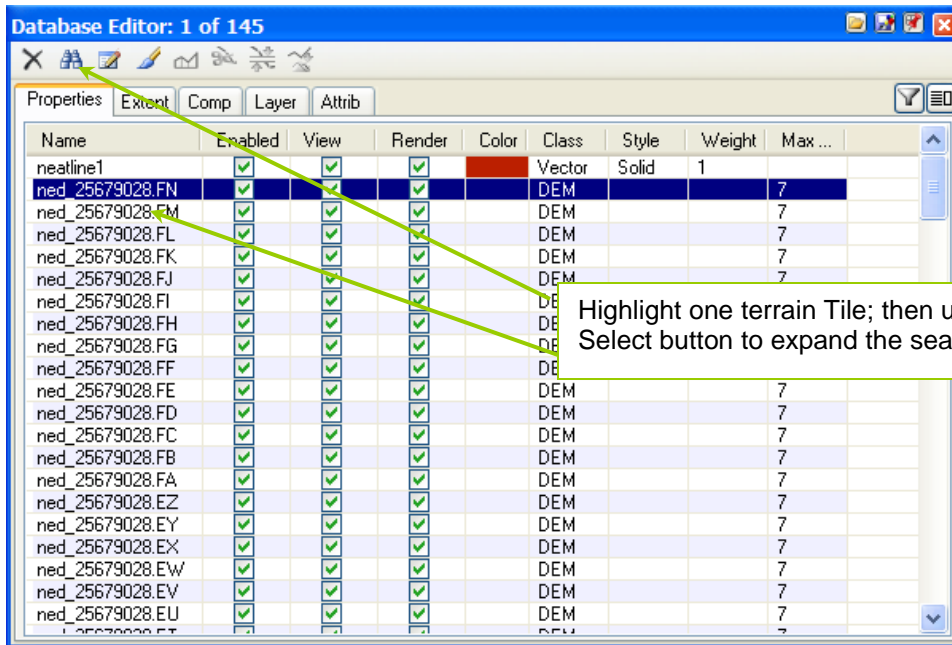
... Information dialog window, at bottom

Addendum: Database Wizard

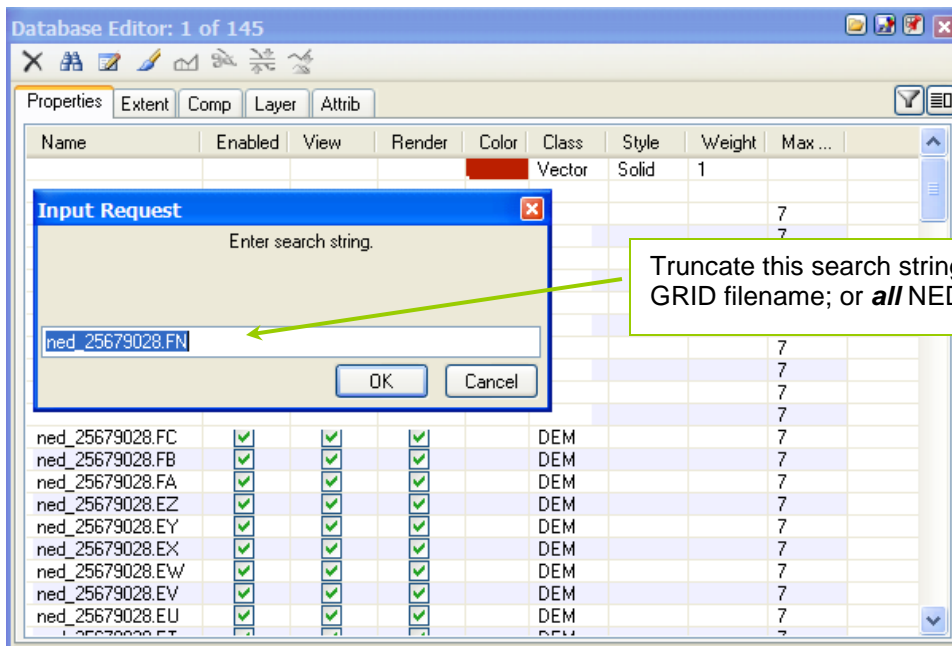


Search for, or Edit, a Database item(s)

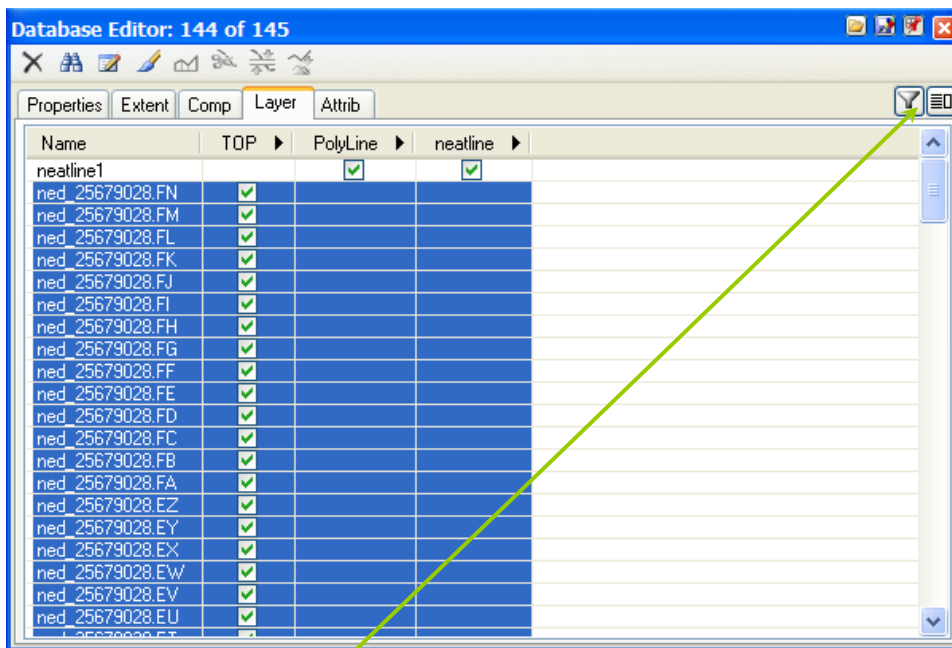
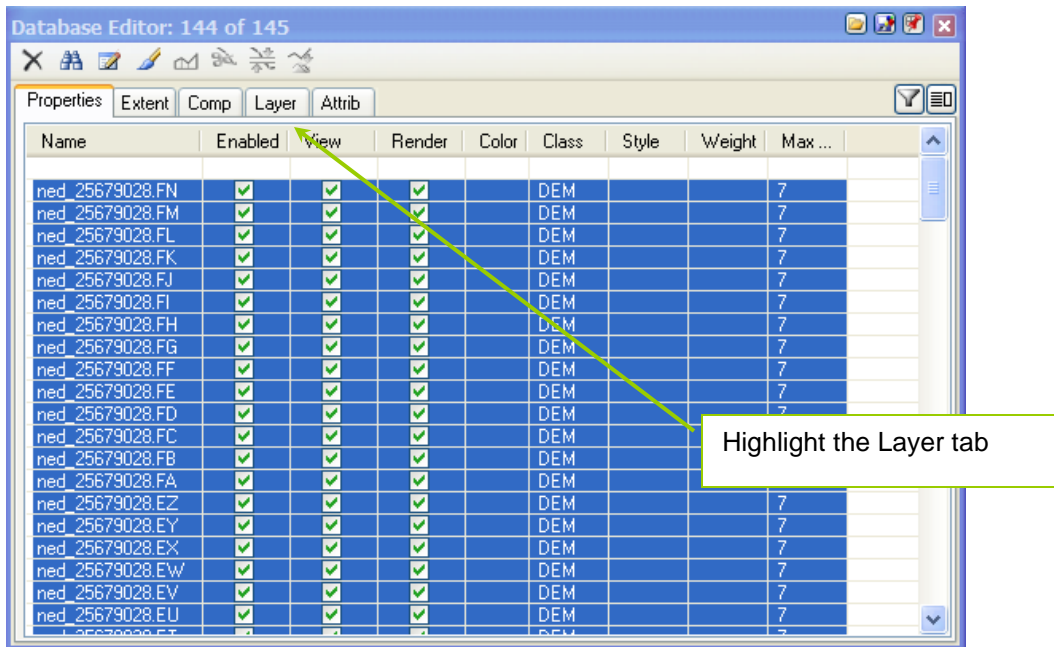
Enable/Disable terrain by Layer name (all are “TOP”)

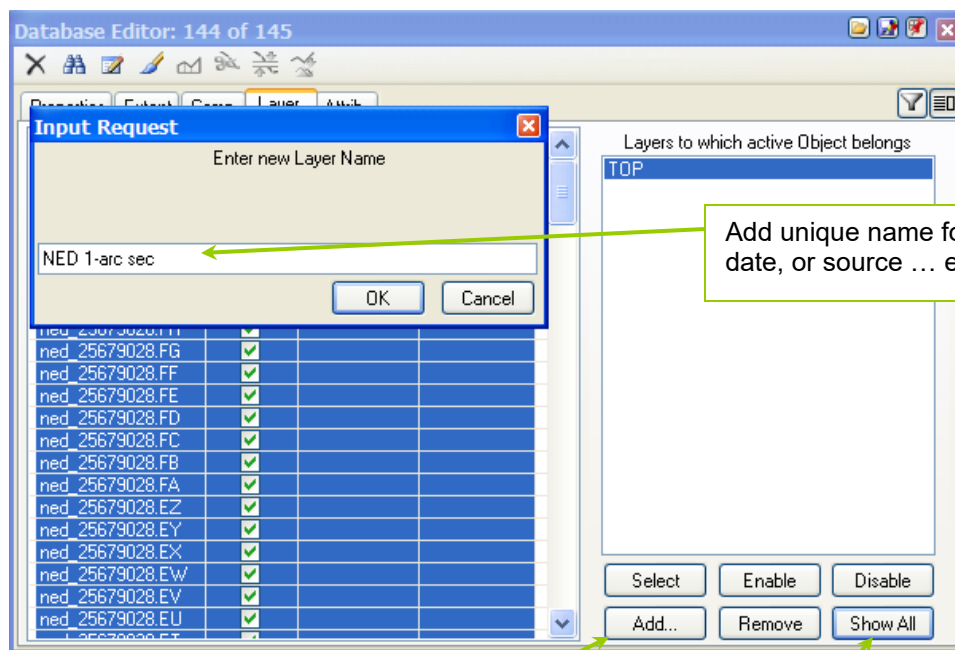
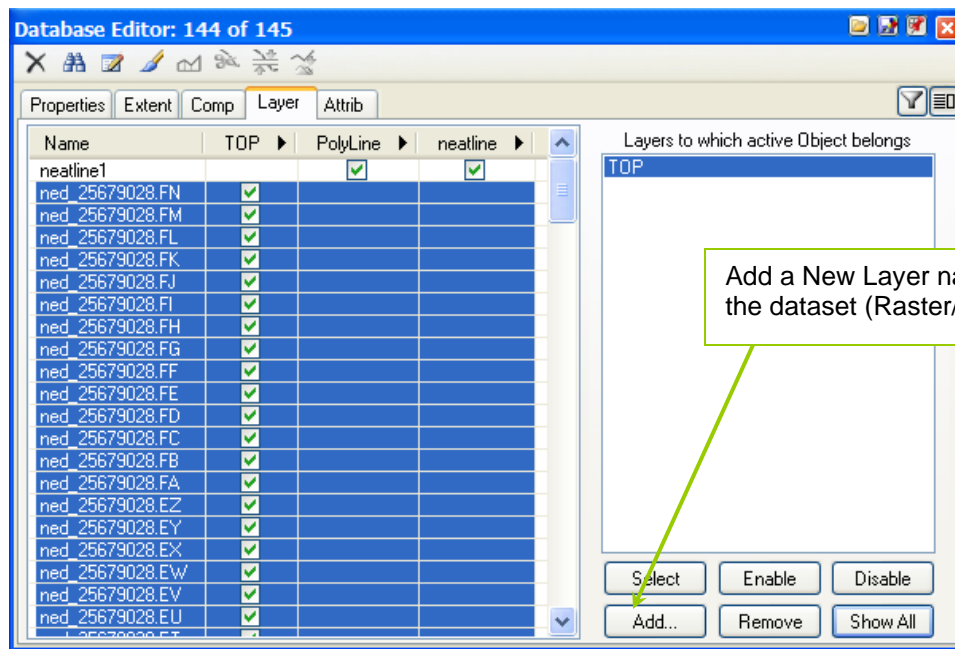


Highlight one terrain Tile; then use the Select button to expand the search



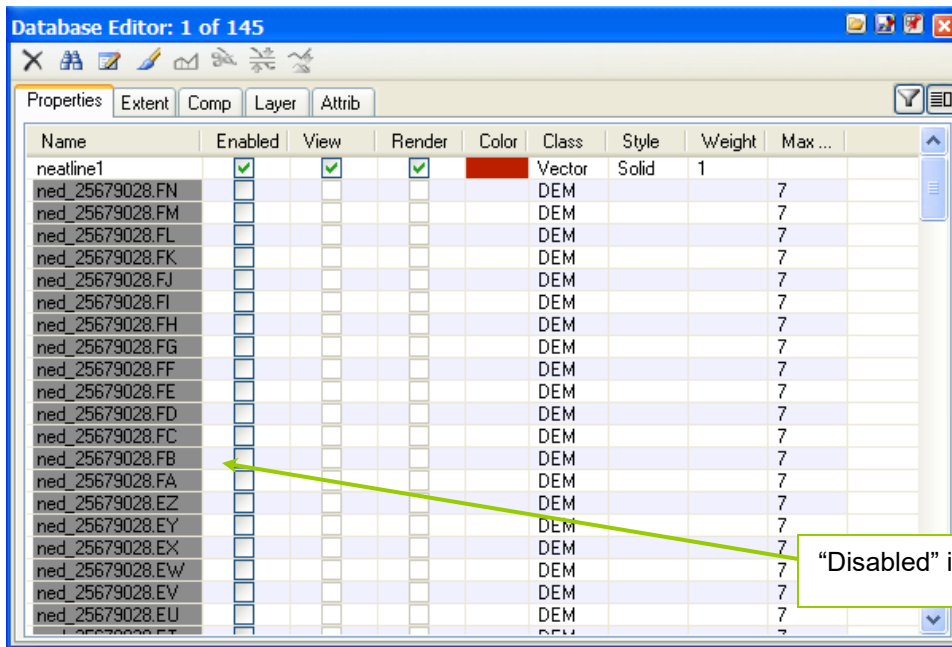
Truncate this search string to the parent Arc GRID filename; or **all** NED sets (“ned_”)





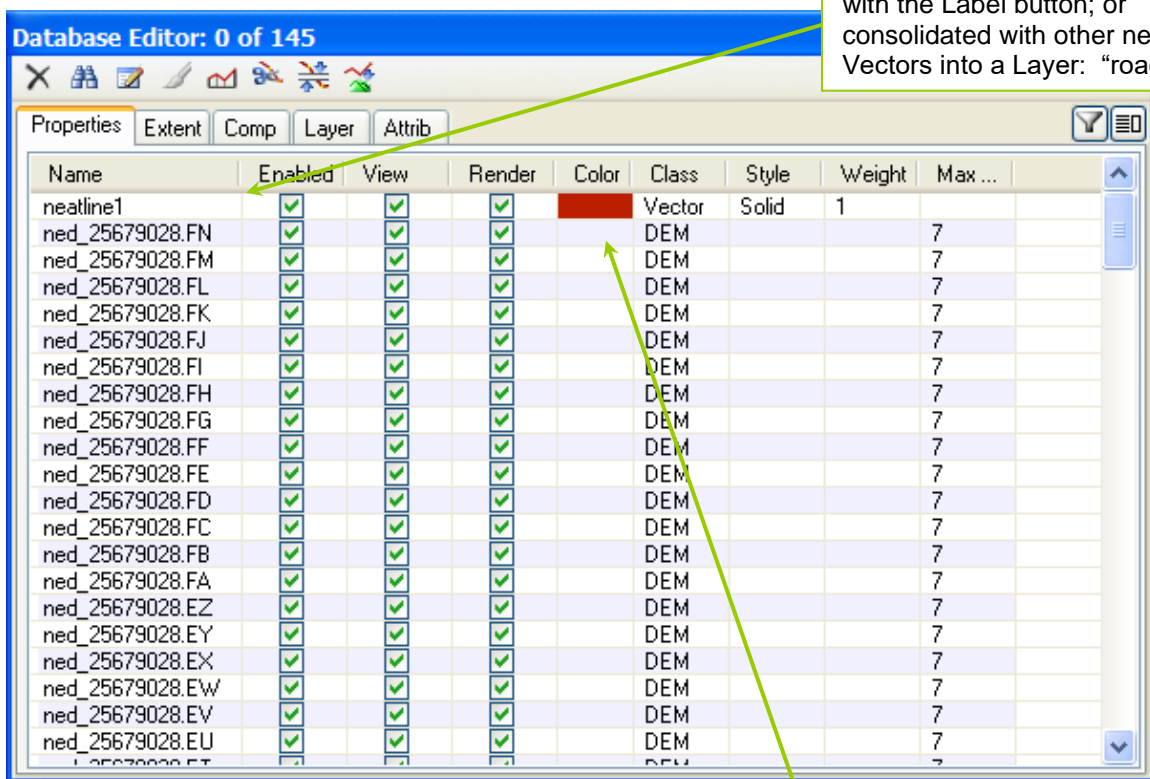
Add a New Layer name that is unique to the dataset (Raster/Vector) for re-Selecting

"Show All" Layers in the List ... including other Layers of terrain, which can be Selected, Enabled, and Disabled



"Disabled" items are "grayed-out"

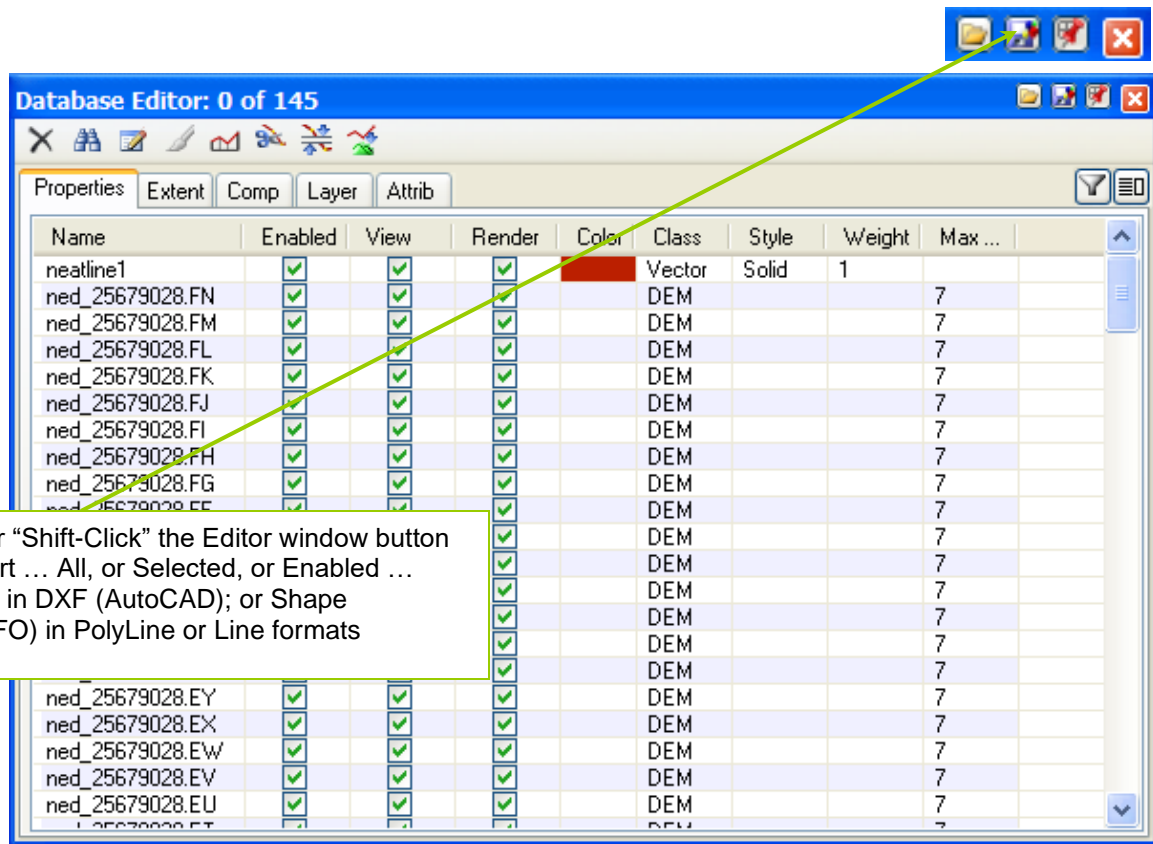
Exporting Vectors ...



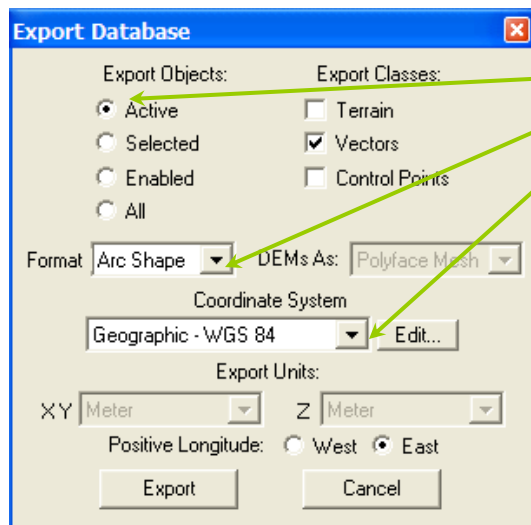
New Vector can be renamed with the Label button; or consolidated with other new Vectors into a Layer: "roads"

Where's the "export data" button?

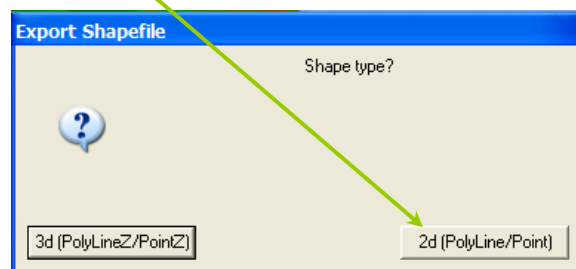
Highlight a Vector; then change its appearance, or Edit its position, in the Vector Editor



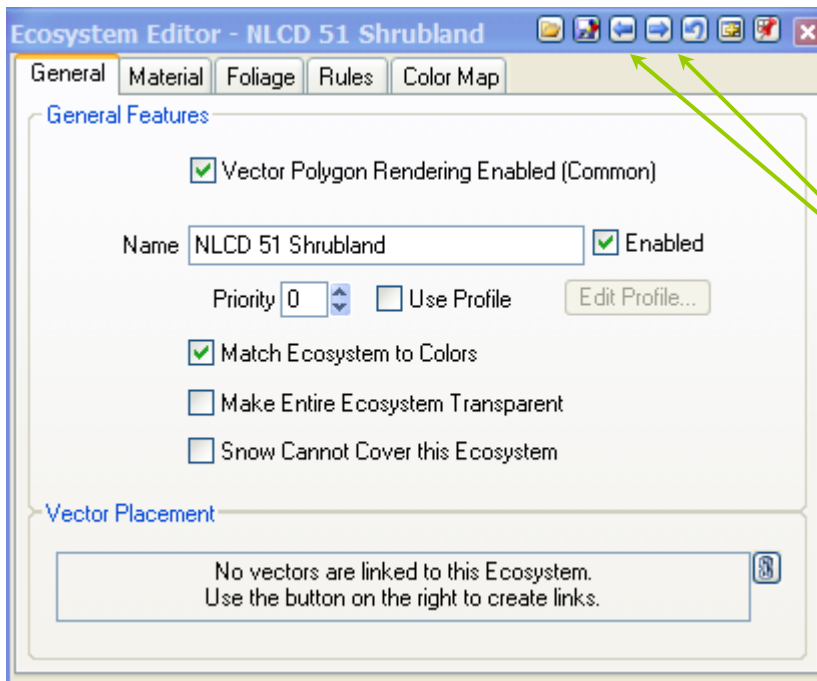
Click, or "Shift-Click" the Editor window button to Export ... All, or Selected, or Enabled ... Vectors in DXF (AutoCAD); or Shape (Arc/INFO) in PolyLine or Line formats



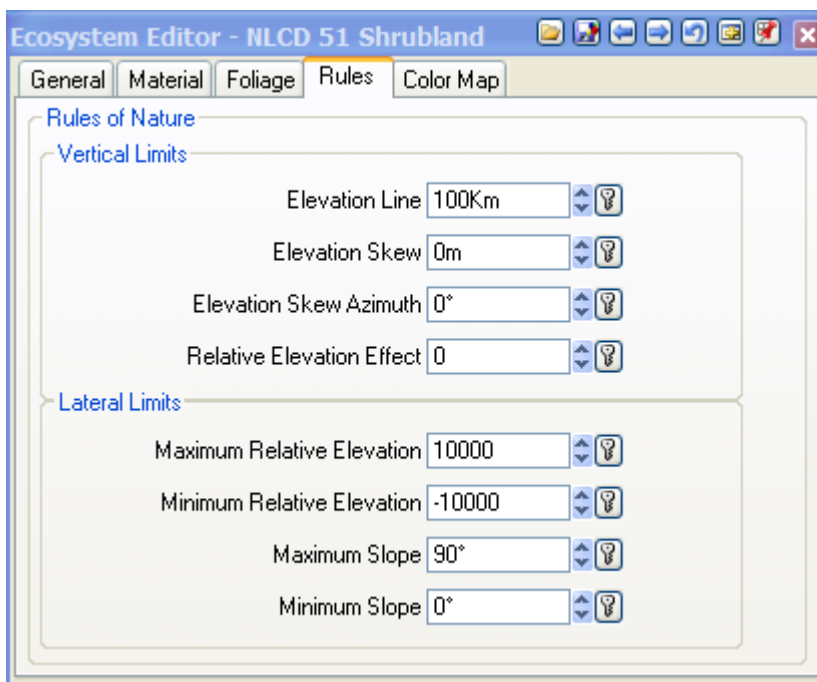
For **Exporting** a simple Vector created in VNS (such as "bounds"), set or select these four parameters before saving the file ... and leave *Positive East*.



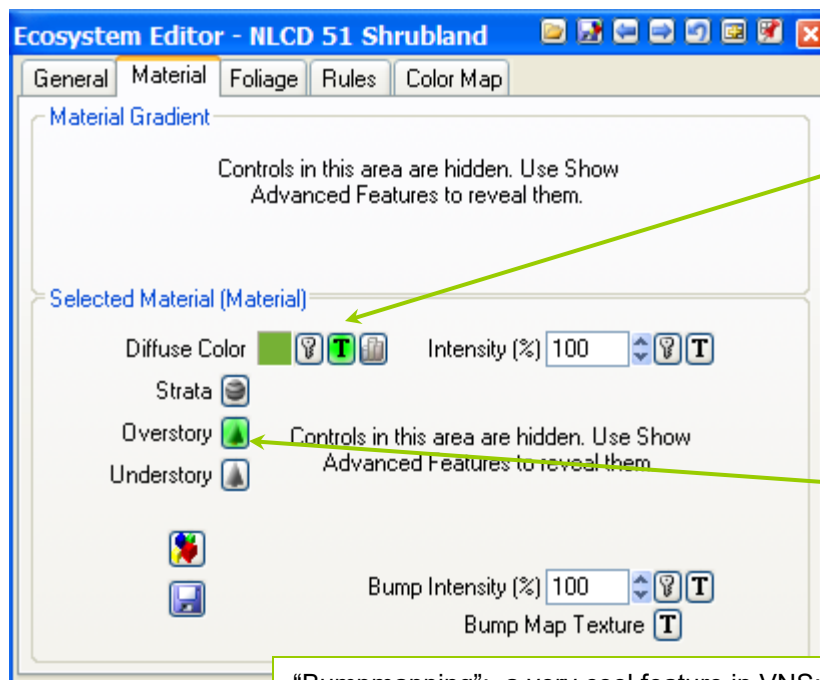
Addendum: Ecosystem Editor



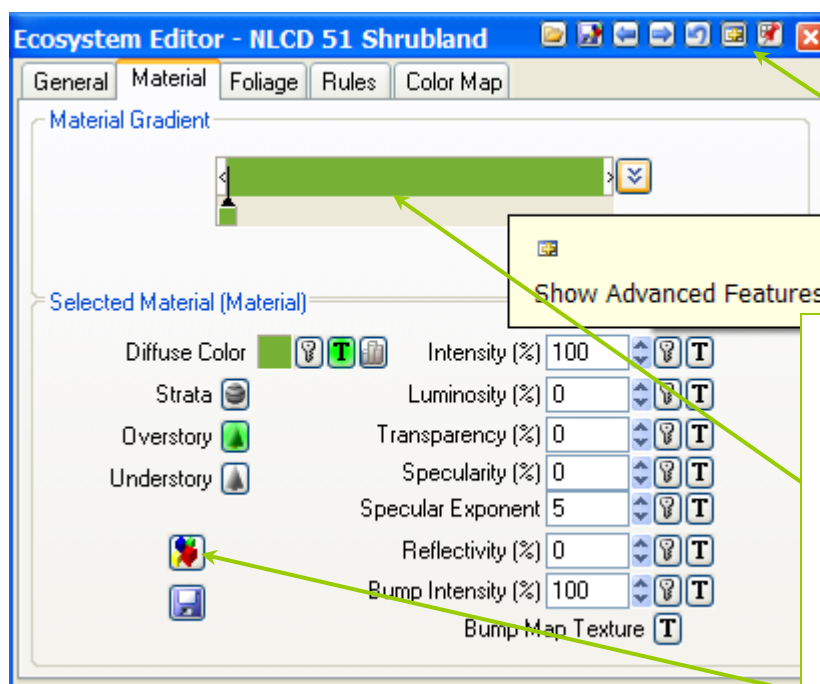
Next Page and Back Page button make it easy to navigate through other Editor menus of the same level and category. Using this for navigating through the various Render Options, a good example.



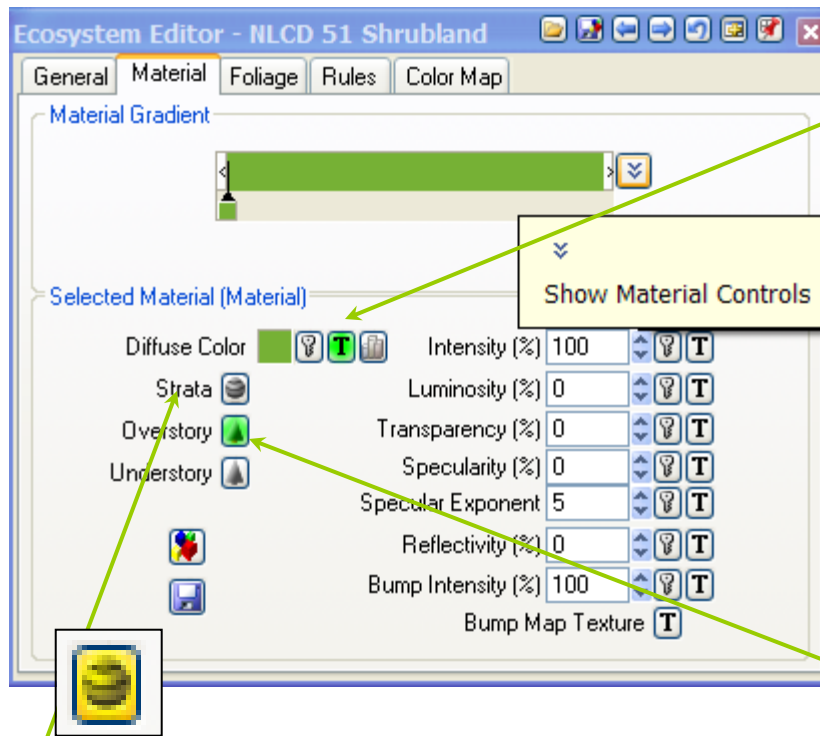
The "Rules of Nature" page allows Ecosystems to be placed on the terrain based on natural terrain parameters; rather than by a land cover classification, by Color Maps like NLCD



"Bumpmapping": a very cool feature in VNS: apparent local relief ... and if used with a "Planar Image" can generate a simple 3D effect by using light-and-shadow to offset the local relief.



Click here ... and VNS will add a "new Material" in the Gradient ... then, change its Diffuse Color, add a overriding Texture, and define an Overstory or Understory for that Material: *it can get complicated with many Materials; ... so "build" on what other people have already created: "Components"*



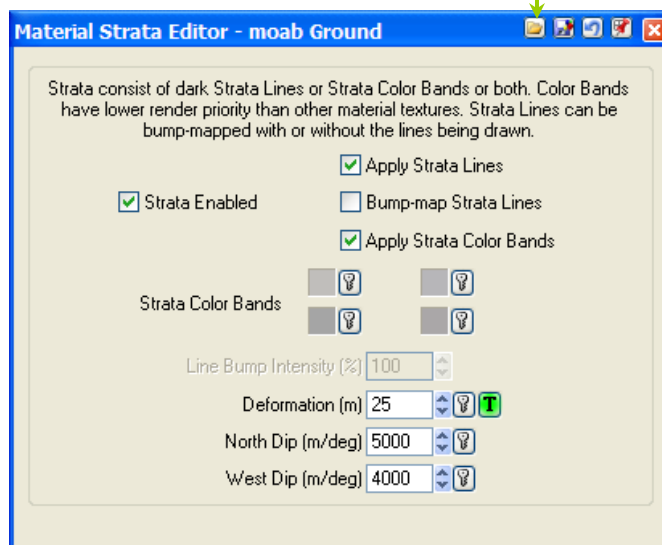
When a Texture is Enabled for a Color, then the original "material color" is *NOT USED* ... so the original color could be "green", as VNS will *ONLY* use the color(s) defined in the Texture Editor ... not the green Color "chip" shown here:

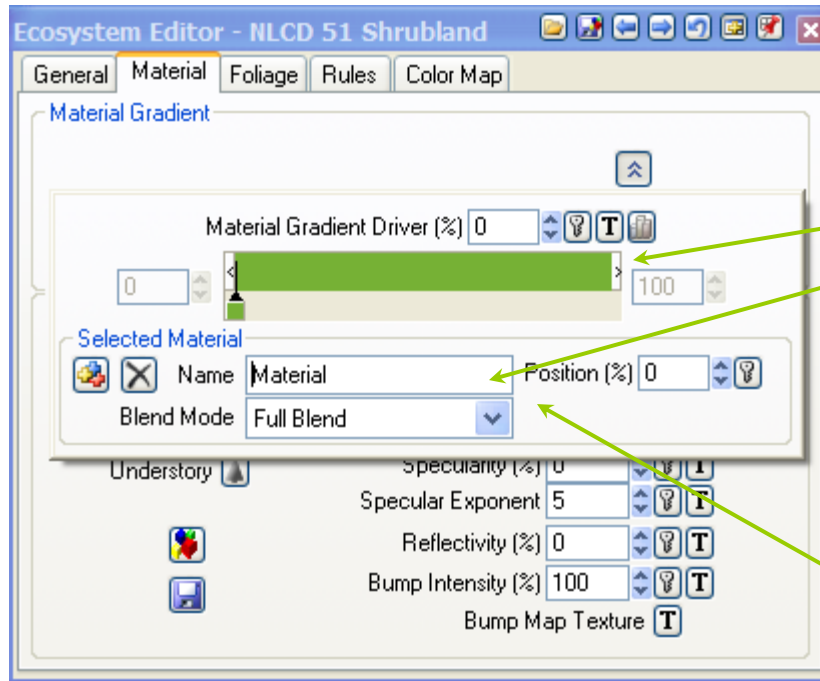


Textures: read the Addendum on Textures and Elements; as the "long version" is 67 pages in F-1 help!

"Tree is Green" means there is a Overstory defined ... but no Strata or Understory defined in this example.

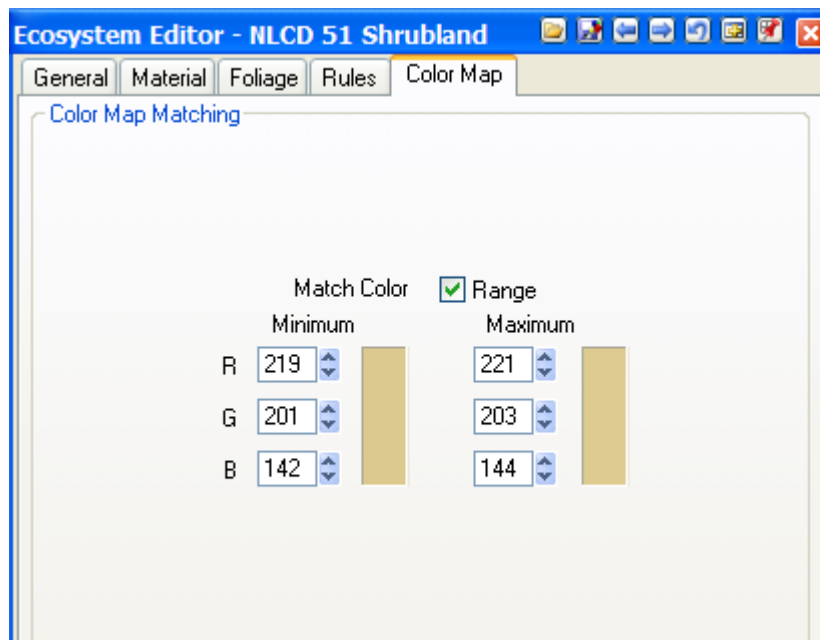
Strata: a great option for barren rock, or cliffs ... but the loadable Components from Scott Cherba are a great place to learn how these Strata Textures are built: create a Strata; then click on the Strata Effects Components that are loadable in the Strata Editor.





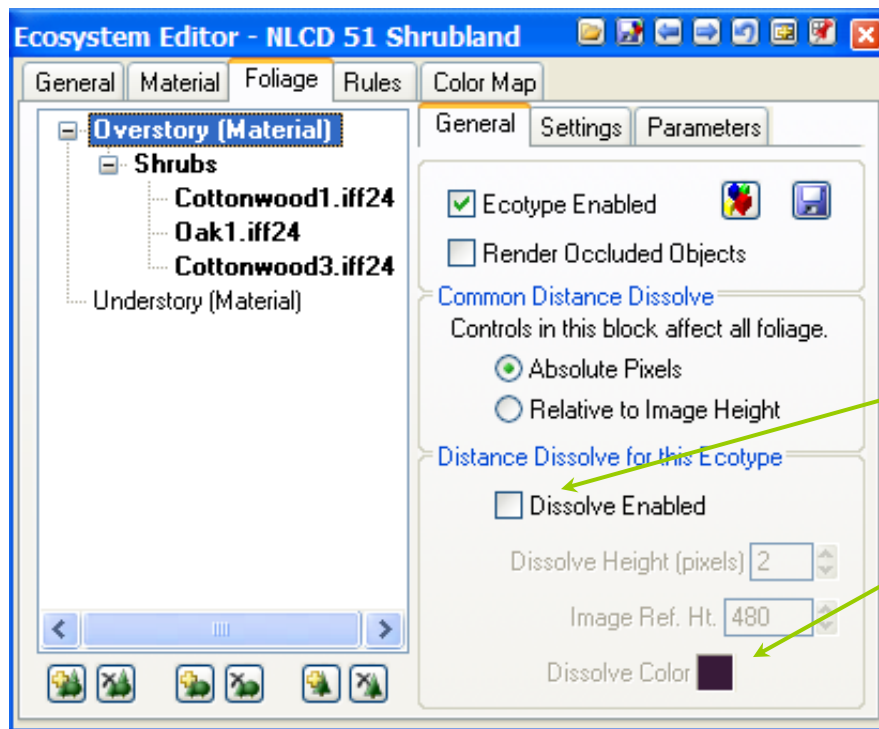
Overlapping Materials in the Gradient can be “selected” from the list below, or the Gradient “bookend” arrows; and then edited ... so naming Material helps differentiate the “purpose” of the entry

If the Material has a **specific use** in the Gradient, then change the Material name to something appropriate.

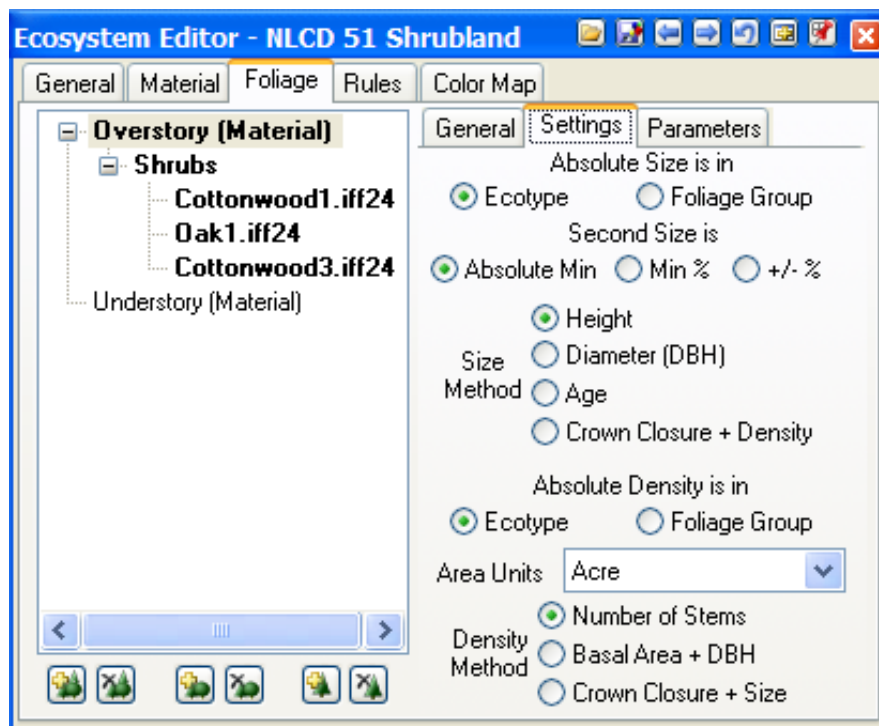


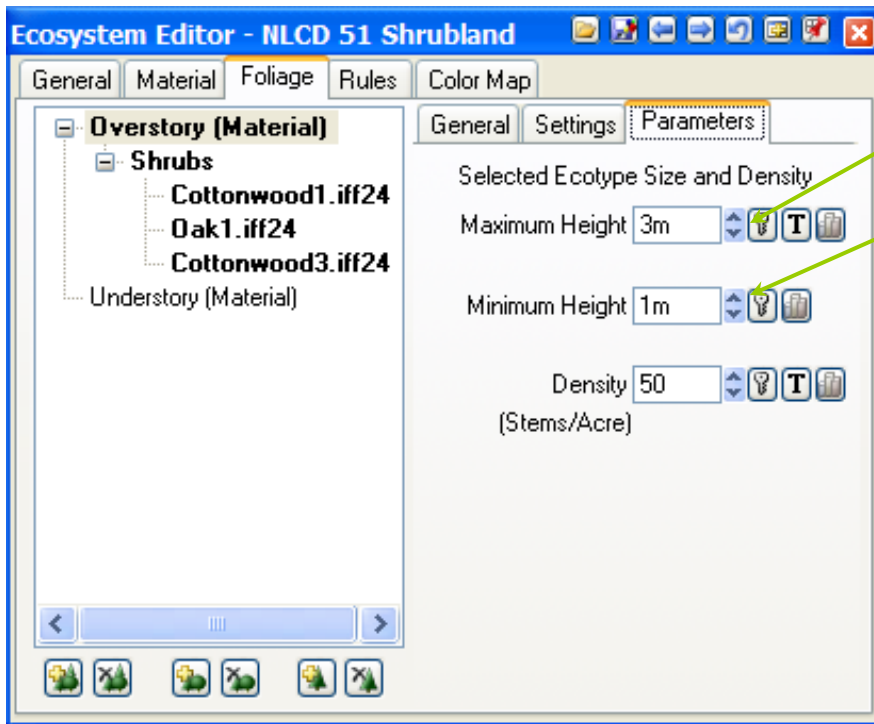
If the NLCD-derived Foliage output is a light gray “terrain relief” only ... or if Preview “Diagnostics” returns “Perennial Ice and Snow”, ... then there is no NLCD ColorMap for that area: Mexico, Canada, or you missed coverage of an adjacent State or area

Hint: 3D Nature has “re-colored” the original USGS NLCD images; and set the “Range” of “Match Color” to one value, up-and-down, in the re-colored image. Now, “what if” Geography “re-colors” these NLCD land cover classifications according to the Ecoregion that the pixel is in? You could do this according to general latitude and longitude coordinates; but overlay Bob Bailey (USFS) or Jim Omernick (EPA) “Ecoregions of North America” ... and “Area 51”, “Shrubland” would look appropriate for the region: there are no palmetto trees in Washington State, right? “Shrubland” can be Rendered as “Shrubland”, when regionally defined.



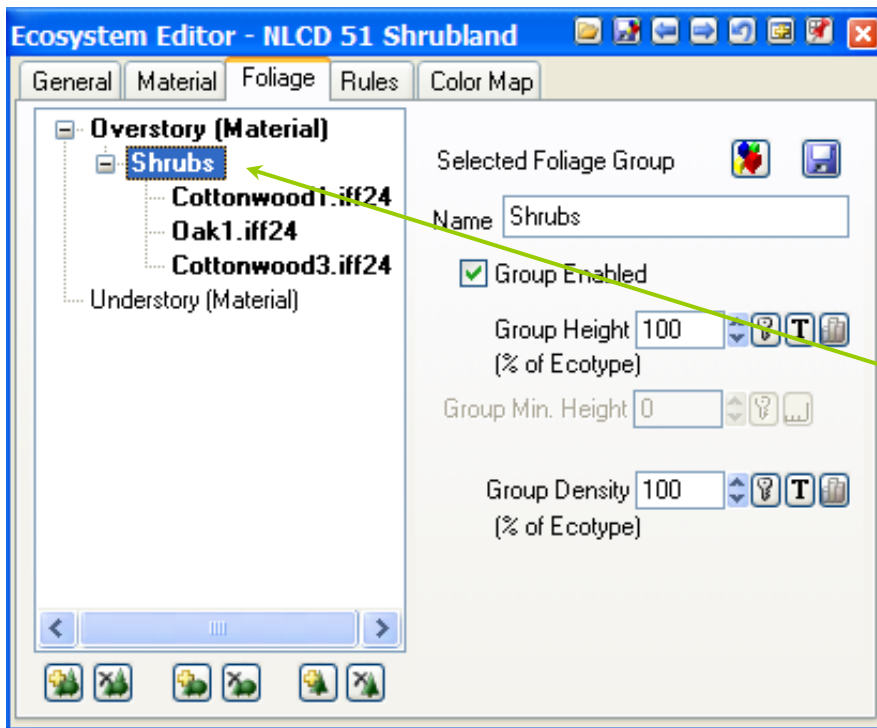
Foliage that is taller than the Dissolve Height are draw in the Dissolve Color only ... reducing content in the far-ground and speeding up processing: **very important** ... but "Relative" to output ... and it is applied to ALL Ecosystems and output



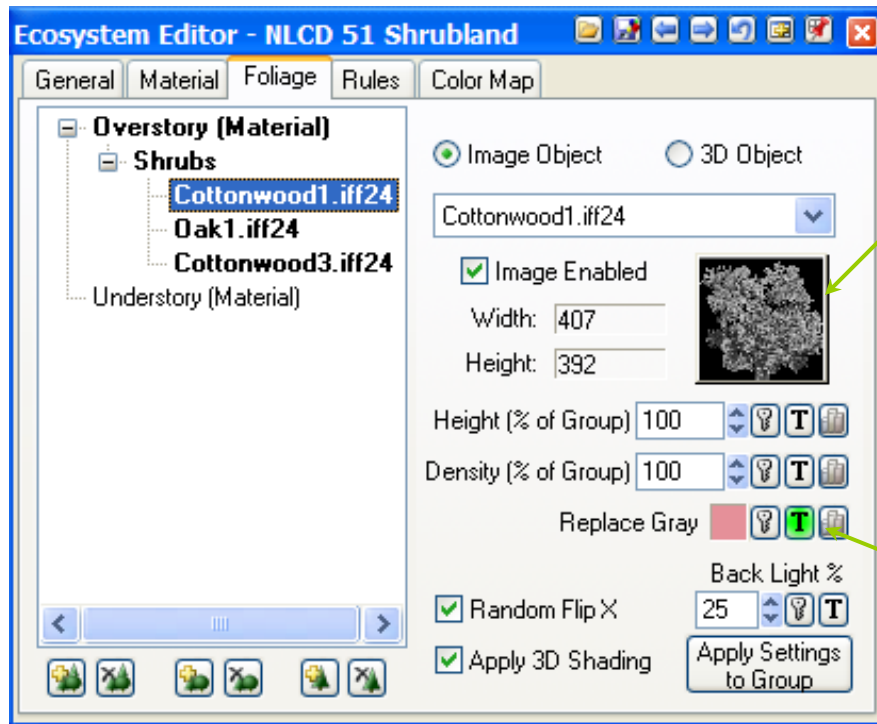


It is easy to get "carried away" on the Foliage Height ... but "keep it real" ... and use the Planet Options to increase the Foliage Height globally ... if ya just gotta have more height to your vegetation!

If you build-on or add a Foliage Group that is not working properly; ... then just **disable** it. Maybe "the problem" is interrelated ... so "disable" rather than "delete" it ... then check the Rendering again for changes. It could be "one image" being used ("disable" that image; or the Group needs "more variety" ... add more images. Lower the Group Density: "adjust" rather than just "delete" the Group.



This lower-level of loading foliage Groups as pre-built Components is **important** (and makes it easy) to build on these saved Groups ... and develop more complex Ecosystems by Adding, modifying and replacing the Objects



This is one of the best features of VNS: being able to use your own vegetation to build up realistic looking ecosystems. Use the Foliage images that are provided; or buy Objects from a 3rd Party ... or create your own foliage images to include!

Again, when a Texture is Enabled for a Color, then the original "material color" is **NOT USED** ... so the original color could be "bright pink", as VNS will **ONLY** use the color(s) defined in the Texture Editor ... not the pink Color "chip" shown here.

Overall Rule for Rendering Foliage:

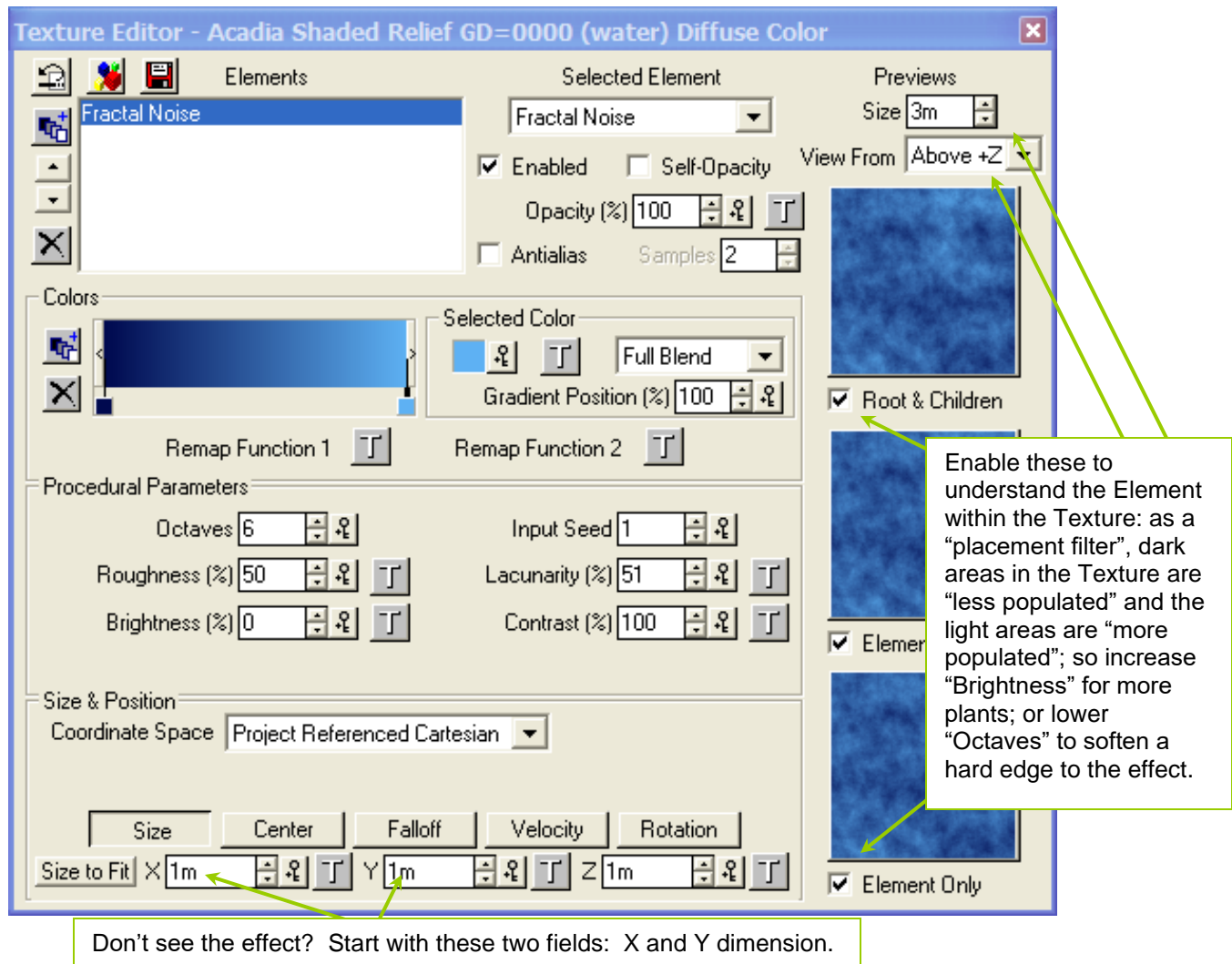
Adjust the details in the foreground; but don't let the "far distant" foliage" impede overall Rendering speed: make sure the Dissolve is Enabled for each Ecogroup; and the "Dissolve Height", proportional to the "Image Height" (see your settings in the "Render Options" for Foliage). If this Foliage Height is less than the specified "Dissolve Height", VNS will render the "Dissolve Color" instead of the actual Foliage images. This "distant foliage" blending takes some experience, to match the appearance of trees to a Color or Texture"; but saves a lot of Rendering time for details in the distance that no one is going to see. In "Perspective", try getting this to enable at two-thirds to three-quarters the distance to the horizon; ... and if the dissolve distance is too apparent, then "add Atmospheric Haze!"

... or create a few Foliage Effects to hide the "dissolve" anomaly.

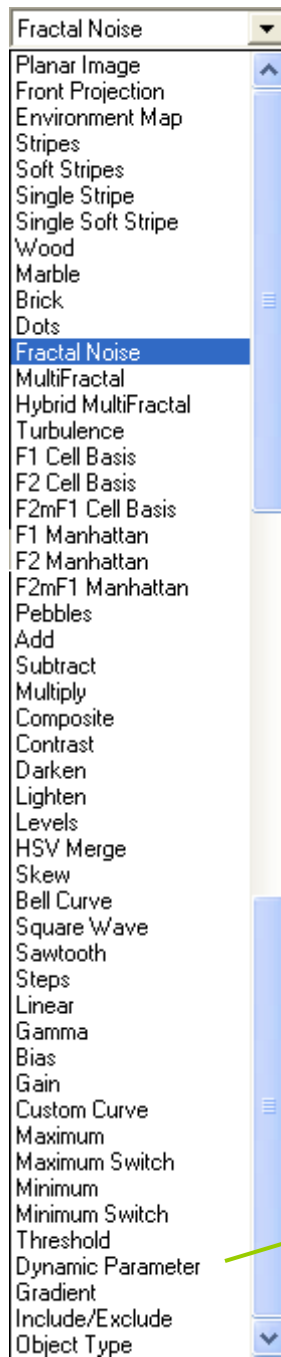
Addendum: Texture Editor and texture Elements

One of the great features of VNS is being able to use “Dynamic Parameters” (geographic limits) to Rendering effects for Materials, or placing foliage within an Ecosystem: aspect, slope, “relative elevation” ... or simply use a “Planar Image” to drape on the ground repeatedly, like “laying sod”; or over the entire terrain: an old map that has been Geo Referencing defined in the Image Library.

*The “default” Texture Element is “Fractal Noise” ... and the easiest way to **see** the Fractal Noise on the terrain is by increasing the X and Y dimension of the Element ... in this case, only “one meter”.*



Learn the Texture Editor by experimenting in Ground Effects; then understanding the concepts in the Ecosystem Editor is easier.



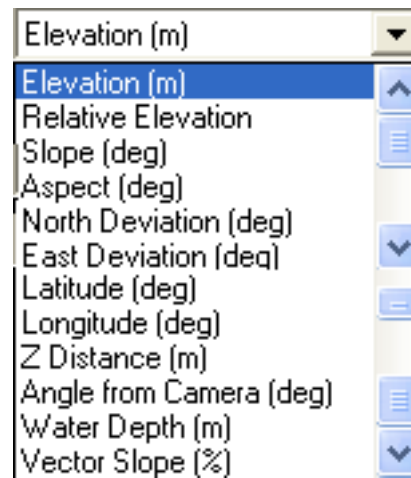
Elements available

All the Fractal Elements available; ... and below, all the Dynamic Parameters available to “drive a Texture” of a Material’s appearance; or “placement” of foliage in Ecosystems.

Learn the Texture Editor by “experimenting”, or by loading the saved Components built by others, and understand “how they work”.

The “Dynamic Parameter” (listed below) with “Elevation” range defined is the basis for how “Acadia Shaded Relief” Ground Effect works ...

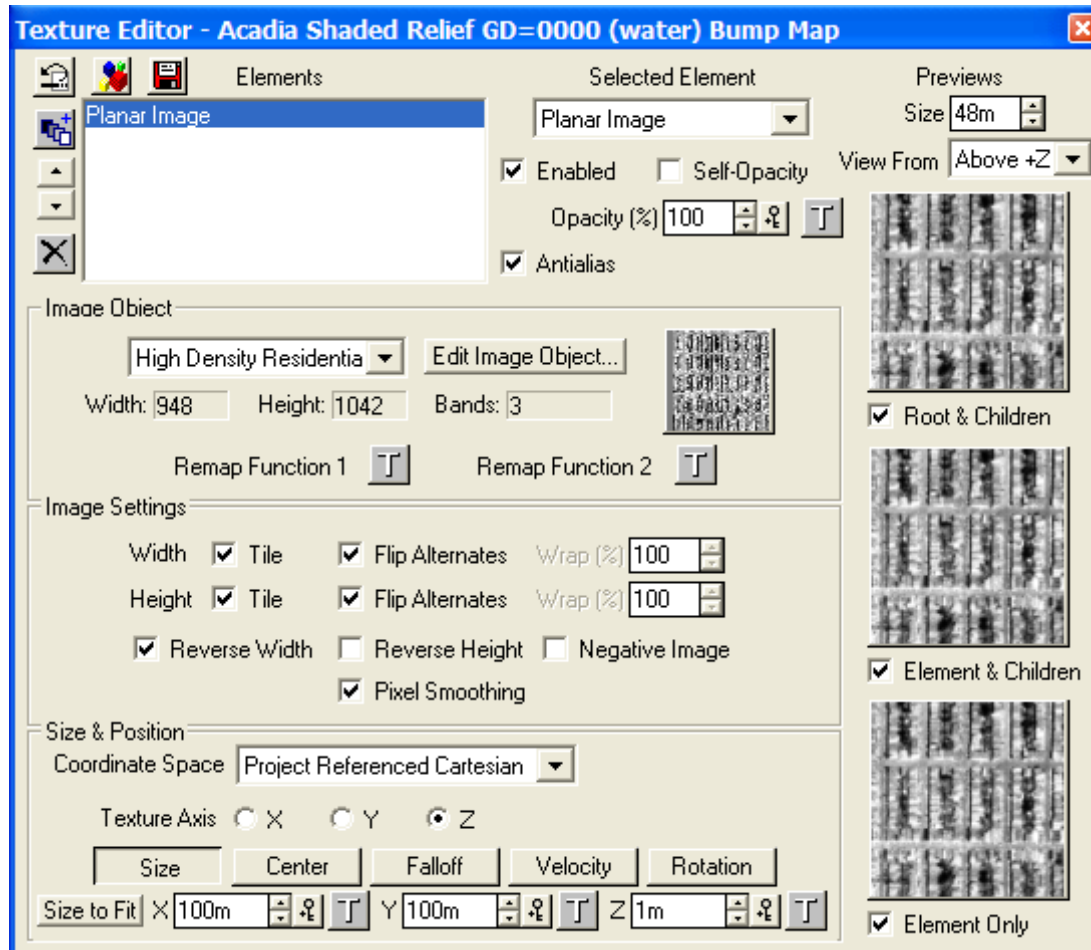
... and a “Turbulence” Element with “Velocity” is the basis for VNS creating “Cloud Models” in an “Atmosphere”.



Dynamic Parameters available

*The Help (F-1) for the Texture Editor is **67-pages!***

*“The Lacunarity Percentage field lets you stretch or compress the frequency interval between octaves (see above). This lets you vary the fractal noise pattern. You can also use it to avoid repetitive patterns in the noise. At a value of 50%, each octave will be twice the frequency of the previous octave. This can potentially show repetitive patterns in the noise. Values less than 50 compress the frequency intervals between octaves. Values above 50 stretch the frequencies. By compressing or stretching the interval between the octaves, you can avoid regular patterns in your turbulence. It’s best to avoid even multiples of 25. The default value is 51.” ... so I say, **“Leave it at 51, ... and leave it alone!”** ... and move onto something more important!*



Here’s a “neat trick” (above): use a Planar image of an overhead view of the terrain (in this case, the “High Density Residential” image) for the Material ... Tile it’s Width and Height, “Flip Alternates” in both dimensions; increase it’s X and Y dimension, then look at the Texture from a higher elevation (48m here) ...

... then **“replicate” the exact same Texture Element dimensions for the Material’s “bumpmapping”** ... and the “apparent Texture height” will increase for “rooftops” (the light areas), and the pavement (black) suppresses “bumpmapping”, making it appear lower: Image matches “bumpmapping”

Replicating patterns in Textures used in Materials can be a pain; but in this case, using “matched Texture and bumpmapping” can produce a 3-D effect to the Material on the terrain ... in this case, Rendering “houses” with apparent height.

Acadia Shaded Relief (left) versus Cadillac Mountain Textured Relief (right)



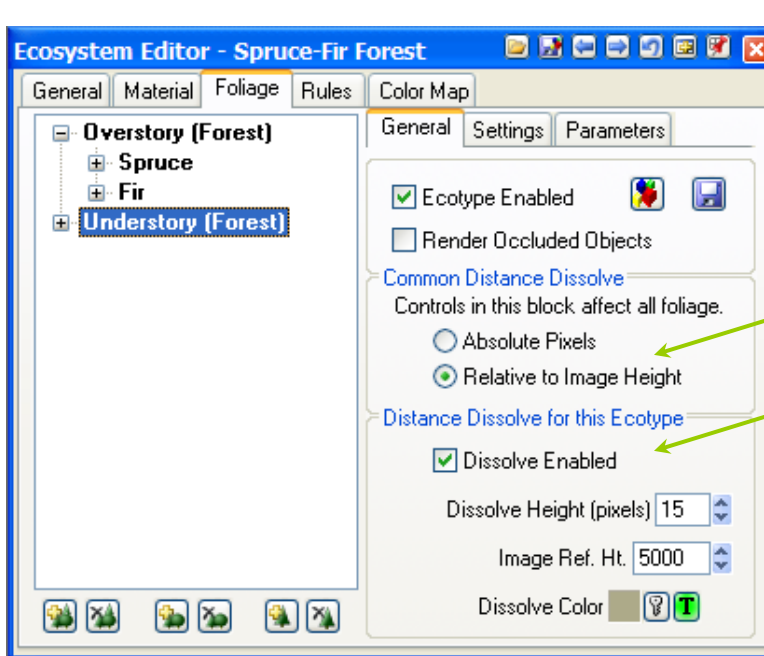
From a single-color for nine Materials in the elevation Gradient of Acadia GE, to nine Materials each with multi-colored Textures and bumpmapping enabled in the Cadillac GE, the Rendering time for Chesuncook, Maine dataset doubled!

*Rendering time with Acadia Ground Effect (Materials are **one Color**): **02:28**
Rendering time with Cadillac Mountain **Textured** Ground Effect: **06:05***

◇ bonus trick: add the georectified Landsat image or registered NGS Atlas as a new Ground Effect using the “Planar Image” Element option in a single Material with the Texture Editor: one Material, as one image, draped over the terrain. Although this appears as a “Color Map” draped over the terrain, as a Texture (rather than Color Map) it can be “bumpmapped” with a slope gradient to the Bump Intensity... adding some more “bumpiness” to the image draped over terrain only in the steeper areas (cannot do that with simple Color Map drapes).

*It is easy to get “caught up” in the capabilities and details of the Texture Editor, Element Filters, and “bumpmapping”; but adding all the capabilities of Textures increases the computation that is necessary; and the final Rendering time: **use Textures wisely!***

And, here is an example: use a Texture for “Distance Dissolve for Ecotypes”, adjusted for the height of your output image (“Relative to Image Height” radio button), to Render a Texture rather than actual foliage. VNS will alert you that ALL Ecotypes will use this image dimension ... but you are Rendering a Texture rather than actual foliage images. A good “dissolve distance” is two-thirds to three-quarters to the horizon ... and just add Atmospheric haze! Start with just the Understories in each Ecosystem of an Environment, then work up to Dissolving the Overstories at-or-near the horizon:



Addendum: “Why Visual Nature Studio?”

The power of geographic information systems (GIS) is computation and data management; but its impact of graphic communication has roots in the computer graphic interface and early pen plotters. GIS uses computer graphic languages to draw, change pen color, and symbolize the results of data overlay and analysis. Computer visualization of landscapes became widely available and affordable in the late 1980s, as VistaPro sponsored by The Nature Conservancy; but access to the “modeling language” and rendering interface was restricted to set libraries of foliage and objects and simulated flight paths only. World Construction Set,

Addendum: Keyboard Shortcuts for VNS Commands

Command	Keystroke
Interactive Reference Manual	F1

Command	Keystroke	Command	Keystroke	Command	Keystroke
New Project	Ctrl N	View Database	Alt D	Matrix Layout: Two & Three	Alt Shift 6
Open Project	Ctrl O	View Image Object Library	Alt J	Matrix Layout: TWO & Three	Alt Shift 7
Save Project	Ctrl S	View Component Library	Alt L	Matrix Layout: One & Three	Alt Shift 8
Save Project As	Alt S	View Component Gallery	Alt M	Matrix Layout: Column Split	Alt Shift 9
Import Wizard	Ctrl I	View Status Log	Alt G	Terrain Task Mode	Ctrl 1
Import Scene	Ctrl Shift I	View Last Rendered Image	Alt [Land Cover Task Mode	Ctrl 2
Export Scene	Ctrl Shift X	View Image From Disk	Alt]	Water Task Mode	Ctrl 3
Scene Express	Ctrl Shift E	Terrain Generator	Alt F	Sky Task Mode	Ctrl 4
Open Resume File	Alt O	DEM Interpolator	Alt P	Light Task Mode	Ctrl 5
Open Recent Projects 1-6	Alt 1 to Alt 6	Path-Vector Transfer	Alt H	3D Object Task Mode	Ctrl 6
Prefs: General	Ctrl P	Numeric Entry	Alt .	Vector Task Mode	Ctrl 7
Prefs: Matrix Layout	Ctrl -	Matrix Layout: Single	Alt Shift 0	Render Task Mode	Ctrl 8
Prefs: Units	Ctrl =	Matrix Layout: Double Tall	Alt Shift 1	Render Control	Alt R
Prefs: File Paths	Ctrl E	Matrix Layout: Double Wide	Alt Shift 2	Copy Component	Ctrl C
Prefs: DEM Directory List	Ctrl D	Matrix Layout: Triple Top	Alt Shift 3	Paste Component	Ctrl V
Select User	Alt U	Matrix Layout: Triple Left	Alt Shift 4	Goto Frame Number	Ctrl G
Quit	Ctrl Q	Matrix Layout: Quad	Alt Shift 5	Close Active Window	Ctrl W

The following controls are only available if there is an open and active viewport in one of your matrix cells:

Command	Keystroke	Command	Keystroke	Command	Keystroke
Manipulate View's Camera	Spacebar	Make Key	Enter	View Preferences	?
Move Mode	1 or M	Open Diagnostics	F4	Realtime Foliage File Preferences	/
Rotate Mode	2 or R	Set Render Area	F5	Zoom In	+
Scale/Zoom Mode	3 or S	Constrain Render	F6	Zoom Out	-
X Axis Lock	4 or X	Save Displayed Image	F7	Joystick: Drive Mode	j
Y Axis Lock	5 or Y	Clear Preview Render	F8	Joystick: Multiaxis/Slide Mode	J
Z Axis Lock	6 or Z	Render Preview	F9	OpenGL Benchmark	&
Abort Render	Esc	View Refresh	v	Display OpenGL Version Info in Status Log	g

Addendum: Suggested USGS Geography Strategies

- pick a single VNS Point-of-Contact within USGS Geography
- find a “willing partner” in US Forest Service, as they use VNS. This could be a source of Components shared, and develop energy. Next thing you know, Forest Service may actually understand the ECL. Could be a “teckie”, not a “bureaucrat” ... but check with Fort Collins on who continues Bob Bailey’s work.
- develop an internal mailing list (POC), which the contact monitors and manages: quarterly “news letter”. Highlight “accomplishments”, products and projects.
- **get on the Yahoo Egroups WCSML mailing list**
 - read** the entries on the web interface, *not dumped to your email*
 - read** the WCSML Main Page link on “Stupid Questions”
 - read** the entries ... but **“post”** only when Geography can’t explain
- develop “standards” for all data models (*start here ▼, or here ►*)
- develop Ecosystems and gathered Environments that can be pre-loaded
- start to develop “Components” that can be pre-loaded ... or at least think about “how” and “design” the “library” of anything saved, by project. If you can’t use the Project file, you can save the “relationships” and “textures”, ... *like the “Acadia Relief” hypsography on the first day? Saves typing, at least, ... right?*
- **expand the 3D Nature NLCD concept to Ecoregions** Select “*Ecoregions of North America*”, the version developed by Jim Omernick of EPA, or Bob Bailey of US Forest Service, ... or both, and make everyone happy.
- **develop a “DLG Hypsography/Tagged Vector Contour” 2-meter strategy for project areas featuring VNS** “Over edge” the vector coverage, convert to GRIDs with GRIDTOPO (ANUDEM) and cut 3.25-minute quarter-quads of elevation. (*a “set parameter” in Arc/INFO: “memory buffer”, SETGRIDALLOCATE?*)

- ... now imagine that “topography” augmented with actual “bathymetry”
... not some innocuous Elevation = Zero (*SeaGrant?*)
- train-up the least qualified people that show ambition and technical expertise
- develop some Premiere, AfterFX, and Illustrator **expertise**
- develop some Lightwave, 3DStudio or Maya **experience**, *at least the lingo.*
- attend 3D Nature’s “Nature Academy” in Colorado: *great course, and setting.*
- when someone shows *expertise and proficiency*, have them contact 3D Nature and ask about the “Beta Team”. With VNS3 just out, it may be a wait anyway (Version 4). I got involved with GCTP, and testing the projections and datums: *ask me.*

Draft of Monday, January 19, 2009, 10:06:52 PM