Bryce 5 Tutorial: How to Drape a Satellite Image Onto a DEM

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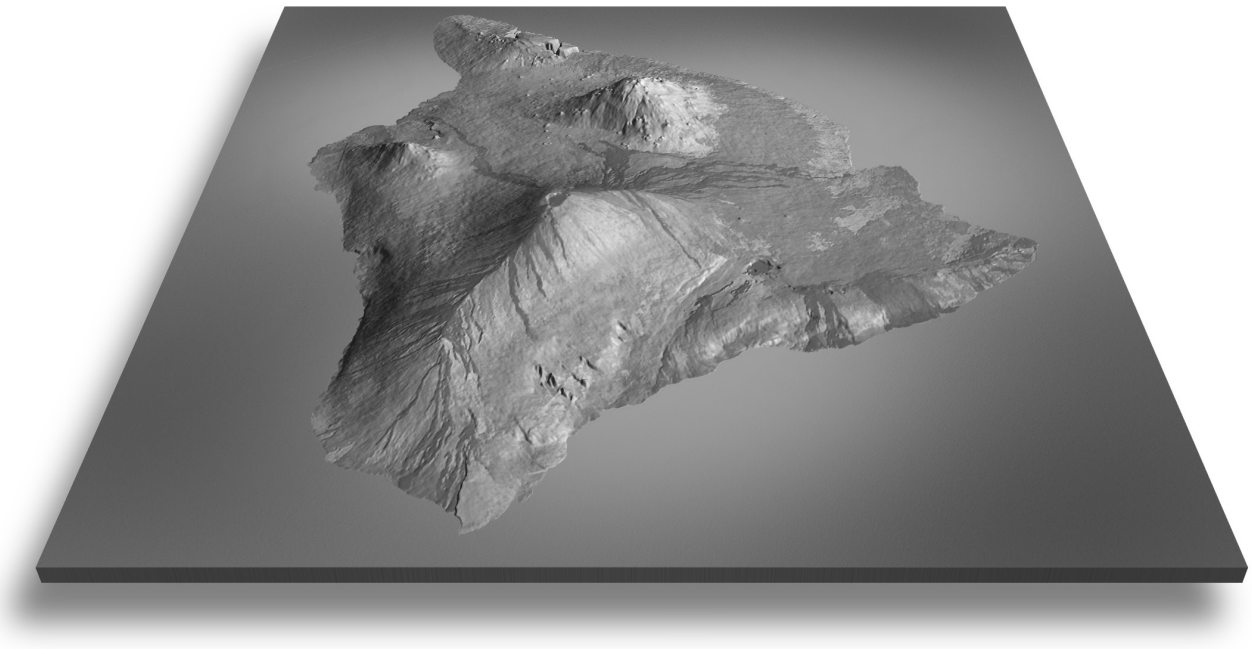
Few other programs can match the ease of use, affordability, graphical quality, and creative special effects of Bryce for depicting 3D cartographic landscapes. This tutorial introduces an easy technique for draping raster geo-images onto DEM surfaces in Bryce 5. Using a pre-registered 1,024 x 1,024 DEM and satellite image of the Island of Hawaii, you will be shown how to make a photorealistic 3D landscape visualization similar to the image below. It is just a matter of knowing which buttons, arrows, knobs, and widgets to click in Bryce's unique graphical user interface.



What you will need

In addition to Bryce 5 for Mac 9.x, Mac OSX, or Windows, you will need to download sample data from the companion website at:

www.nps.gov/carto/silvretta/drape/index.html

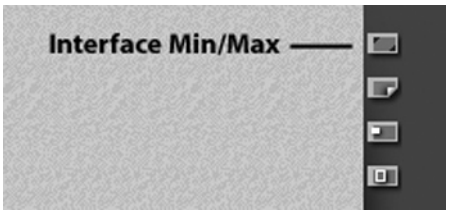
The data includes a DEM of Hawaii in Portable Grayscale Map (PGM) format and a registered satellite image in Photoshop (PSD) format. Mac users can also download the Bryce 5 file of Hawaii used to make the scene shown above (unfortunately, Mac and PC Bryce 5 files are not interchangeable).

Initial Bryce setup

The default settings in Bryce 5 assume that you work on a 13 inch monitor and use the application for creating artistic landscapes from low elevation views. These need to be reconfigured before making 3D maps viewed from higher elevations:

1. After launching Bryce, delete the default infinite plane, which appears as a wireframe grid at the bottom of the scene. Do this by selecting the infinite plane (click on it once; it will turn red when selected) and press the delete key.

2. The cramped default Bryce Graphical User Interface (GUI) can be expanded to completely fill larger monitors by clicking on the Interface Min/Max icon at the right side of the desktop (see the illustration below). Since the Bryce GUI completely takes over your desktop anyway, there is no advantage in using the smaller size.



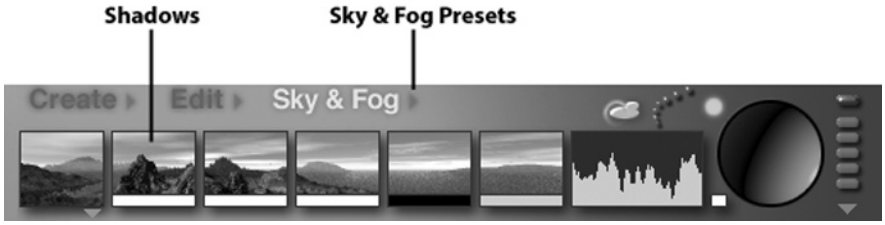
3. The Bryce project window (the hairline rectangle within which the scene is constructed and rendered) is preconfigured to 540 x 405 pixels. You can give yourself a larger size and/or a different format by going to File/Document Setup. I generally find 800 x 600 pixels to be a good starting point.

4. Bryce opens with default sky and fog settings turned on, which, although great for making artistic landscapes, need to be disabled for cartographic work (at least initially). The following steps will yield a plain vanilla Bryce environment with a white background and white illumination, and without clouds, atmospheric haze, or cast shadows:

   A) At the top of the Bryce desktop click the Sky and Fog label to activate the Sky and Fog palette (see illustration below).

   B) Click on the small triangle next to the Sky and Fog label to enter the Sky and Fog Presets. Choose “Simple White Background” from the scrolling list.

   C) To remove cast shadows from the scene, click-drag to the left in the Shadows window until the numerical amount reads 0 (displayed at the lower left corner of the Bryce desktop as you click-drag).



DEM importing and editing

DEM importation in Bryce 5 is a snap providing that the DEM is quadratic-sized and in Portable Grayscale Map (PGM) format. The sample DEM of Hawaii just so happens to meet these requirements:

> Note: For an online tutorial about DEM importation in Bryce go to: www.nps.gov/carto/silvretta/bryce_dem/index.html

DEM import procedure:

1) In the drop menu, go to File/Import Object and select the hawaii.pgm file that you downloaded earlier. When imported, the DEM will appear as a wireframe terrain object at the bottom center of the Bryce project window.

You will undoubtedly notice the excessive vertical exaggeration on the imported DEM. This can be diminished by two methods:

METHOD 1 - With the DEM selected, in the Edit palette (see the illustration below) click-drag the upper Y axis of the Resize icon to the left until the topographic vertical exaggeration looks about right. Although unscientific, this method is quick and effective for making visual adjustments.

METHOD 2 - For the numerically inclined, click on the tiny "A" next to the selected DEM to activate the Object Attributes dialog (see illustration below). Lessen the Y size at the bottom of the dialog. (Note: sizes are indicated in Bryce units, a somewhat arbitrary unit of measurement unrelated to real world elevations or percent vertical exaggeration, but nevertheless useful for making relative adjustments to vertical scaling). In general, high elevation views require more vertical exaggeration than low elevation views of the same area. Experiment.

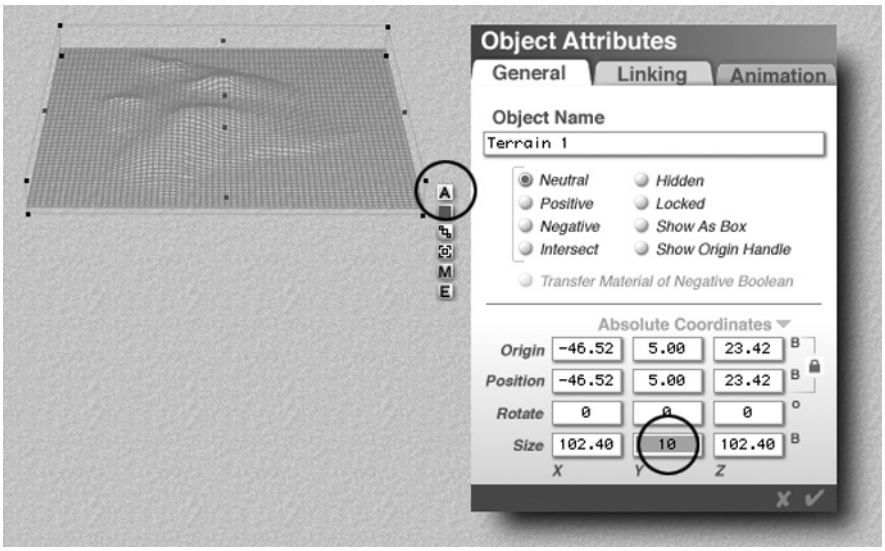
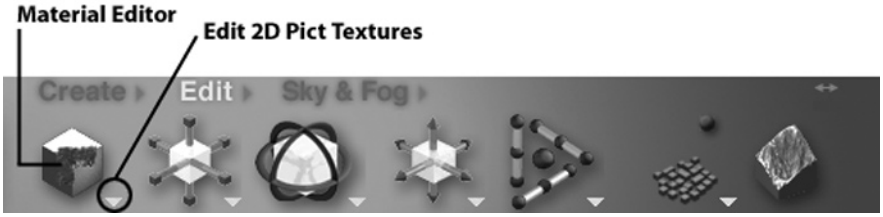


Image draping

In Bryce, as with all 3D landscape software, the image and the DEM upon which it will be draped must register to one another perfectly. Although DEMs in Bryce must conform to quadratic sizes, a draped image can be a square of any size, quadratic or otherwise. I usually prefer that the image used for draping have a resolution at least twice that of the DEM beneath—for instance, draping a 8,192 x 8,192 image on top of a 4,096 x 4,096 DEM, to show surface features with utmost detail and sharpness. However, this approach translates into huge file sizes. In the interest of download time, the tutorial satellite image of Hawaii is a modest 1,024 x 1,024 pixels, the same resolution as the DEM upon which it will be draped.

Draping procedure:

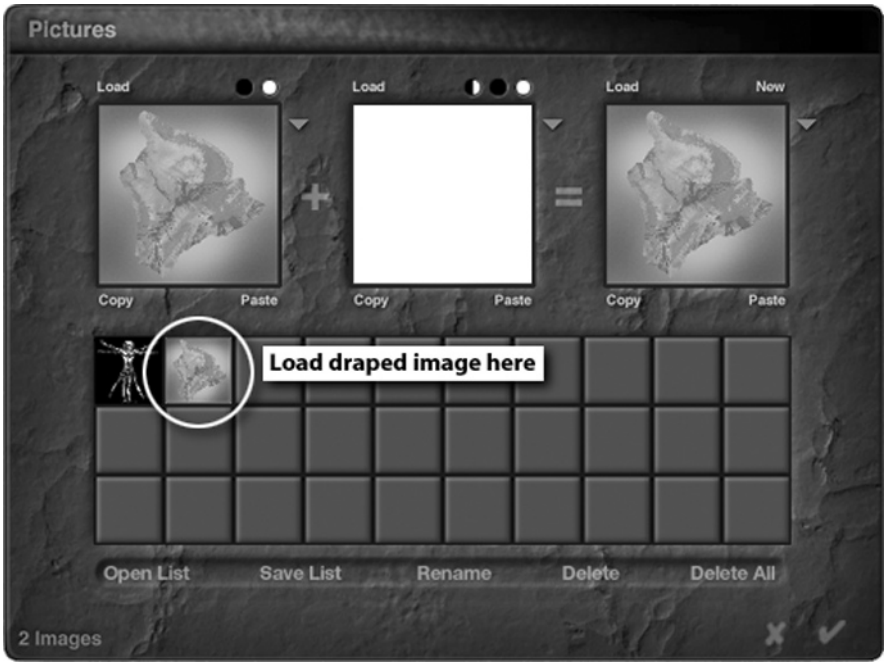
1. In the Edit Palette, click on the small arrow to the right of the Material Editor icon (see the illustration below) and choose the Edit 2D Pict Textures option.

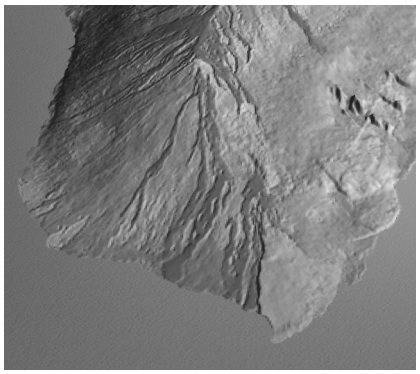


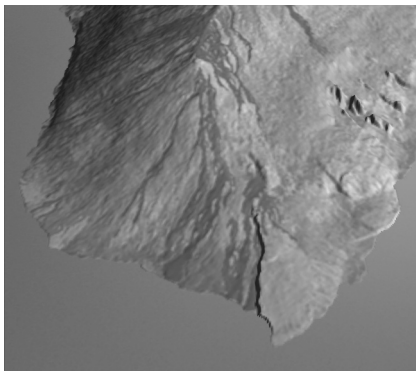
2. The Pictures library then appears (see the illustration below). Load the satellite image of Hawaii into the Pictures library by clicking the empty square to the right of Leo, the default Bryce picture of a da Vinci-like human figure. In the open dialog box that appears, choose the downloaded satellite image named drape.psd.

3. Close the Pictures library by clicking the check mark "okay" at the lower right.

4. In the main Bryce window click the render button (the lowest ball on the left side of the desktop) to render the draped satellite image and DEM. Congratulations, you are done.







Bump mapping

Images draped onto DEMs sometimes can appear stretched and blurred, especially in steep areas when large amounts of vertical exaggeration is used. Bump mapping is a technique that counteracts this tendency, giving landscapes a more natural appearance by depicting subtle light and shadow detail, or bumps, on terrain surfaces. Although bump mapping is more often created from procedural (algorithmic) textures, in this case we will use the draped satellite image itself as the bump map data. Illumination within the 3D scene reacting with contrast information contained within the image, such as forest and lava flow boundaries, will cause these edges to appear embossed. The illustration to the left shows Hawaiian lava flows rendered with bump mapping (top) and without (bottom).

To load the satellite image as a bump map texture:

1. With the DEM selected, go to the Pictures library using the procedure described previously.

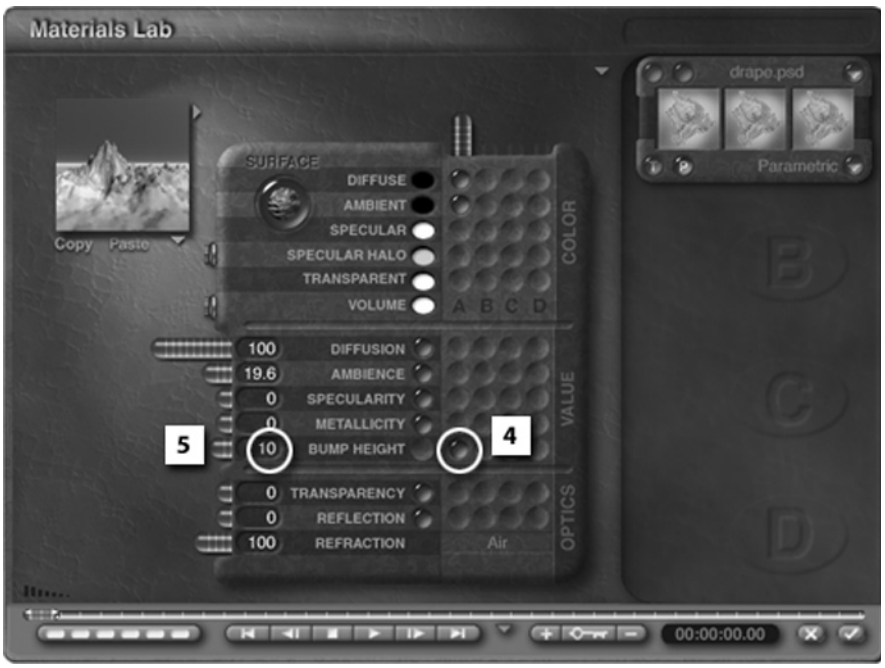
2. Click the load label above the middle preview square (see the illustration below). Choose the file named drape.psd. Exit the Pictures library.

3. Now you must enter the daunting world of Bryce's main Material Editor by clicking the Material Editor icon in the Edit palette (it is on the far left side). The following instructions will guide you through the maze:

4. In the matrix at the center of the Material Editor, click the empty circular depression where the Bump Height row and A column intersect. A glass-like button will appear where you just clicked (see #4 below).

5. Next, enter a value by pulling the Bump Height slider bar to the left (see #5 below). Alternatively, numeric Bump Height values can entered by clicking directly on the number field. Restraint is advised when assigning bump height values; too much will give the satellite image a coarse appearance.

6. Exit the Material Editor and then render the final bump mapped image.



Additional comments about bump mapping:

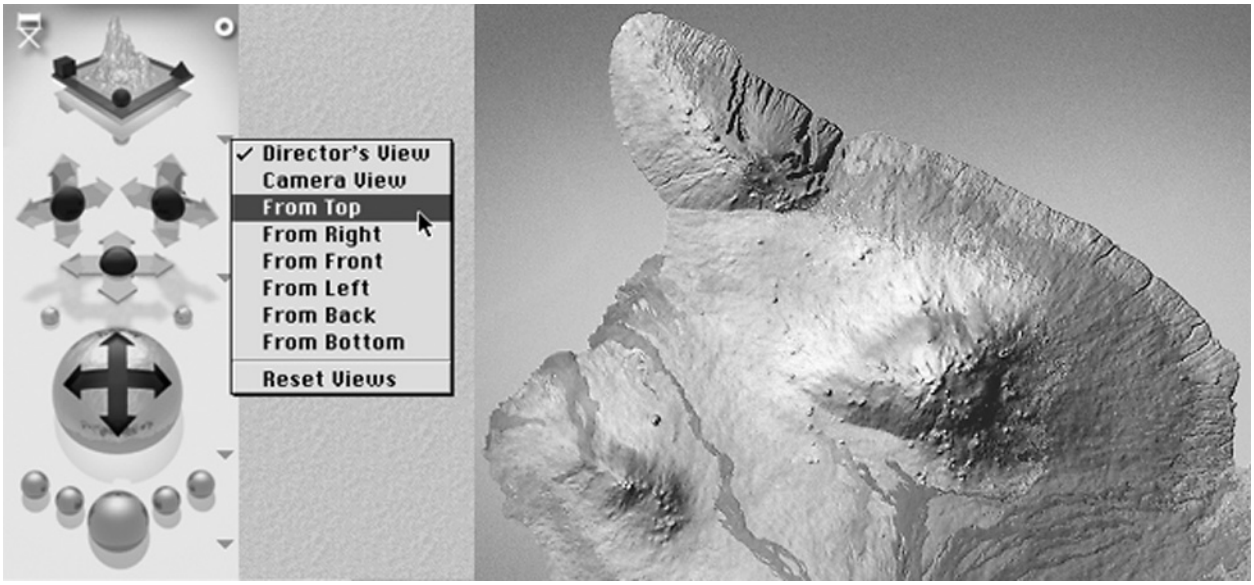
- Bump mapping effects are non-permanent. To adjust or turn off bump mapping, simply go back to the Materials Lab.

- Custom bump map textures can be created by modifying a duplication of the original satellite image in Photoshop, and then loading the modified image as the bump map texture in Bryce. For example, using Photoshop, green forest areas could be selected and given a light application of the noise filter and, perhaps, a touch of Gaussian blur, which would translate to a lumpy forest canopy when used as a bump map. Conversely, diminishing 2D image contrast diminishes the effects of 3D bump mapping--a useful technique for applying variable amounts of bump map texture locally within an image.

- In Bryce, bump map textures are read as 8-bit grayscale data, so there is no qualitative penalty for preparing custom bump map textures in grayscale color mode.

Shaded relief

Shaded relief can be rendered in Bryce 5 by choosing "top" from the view control menu (see illustration below).



Shaded relief hints:

- The illumination direction works best in top view when "Link Sun to View" is disabled in the Sky and Fog palette (click the options arrow on the lower right side of the palette).

- Resizing the Y dimension (which controls vertical exaggeration) in the Object Attributes dialog has a dramatic effect on shadow intensity and the overall appearance of three dimensionality.

- Simple gray shaded relief can be created by assigning flat gray or white color to the terrain. Look for these in the Material presets in the Edit palette under the simple and fast category.

Conclusion

This tutorial only hints at the creative possibilities in Bryce 5. As you use Bryce's powerful graphical tools using a GUI that invites exploration, you will, undoubtedly, discover new and innovative techniques for visualizing geo-data.