Enhanced TerraScene

Tutorial

by Pascal Lachat

English version 1.0
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Introduction

With this tutorial, I'll try to explain the method I use to design realistic sceneries based on Todd Klaus's TerraScene for Fly!2k and Fly! II. Note that this technique is still under development; nothing is finished or definitive in any way. This document might be updated in the future if I and other scenery designers optimize some steps and add further enhancements.

I use Photoshop 5.5 for the process. The method is based on many function and capabilities of the software, therefore you must have a good knowledge of Photoshop basics as well as TerraScene. I don't know exactly what changed in later Photoshop versions, but they should work fine.

If the whole process seems too complicated, try a scenery with few steps first. Read carefully the TerraScene manual and Photoshop help. If something is still not clear and you can't find an answer, ask in the Fly! Developer's Forum at Avsim.com or send me an e-mail and be patient; I'll try to help if the question is not related to Photoshop and Terrascene features which are already well documented.

Todd Klaus developed TerraScene for Fly! with the users in mind. His software, among many evident qualities, is very easy to use and fully customizable. I started to see it's great possibilities when version 2.0 was released with the addition of relief shadows. The TerraScene scenery files are heavy but have many great advantages over repetitive texture patterns. Some "Post-Production" work is possible, and the only limit to the enhancements that can be done is Fly!'s inner resolution.

Texture painting allows some nice enhancement. For example, you can design an accurate scenery if you just look at some good aerial pictures of the area and adapt the colours of the base textures (this is rather a Pre-Production work). Just try to get the colours right, replace some colours with others and you'll get a much more characteristic landscape.

On the other hand, the method below deals with shadows and some kind of bump mapping - we draw some shadows to create the illusion of 3-dimensional forests and cities. Whatever enhancements you try, I suggest you this basic question as a guideline : "What does most of the visual difference between an aerial pictures and a TerraScene rendering?" Always make direct pictures comparison, don't be too confident with your memory and imagination except if you have a good knowledge of colour and light effects. The steps explained here are only suggestions – I hope they will encourage you to try, tweak and experiment!

If you distribute on the web a scenery made with the help of this tutorial, please add my name somewhere down the Readme file. I spent much of my spare time for the development, and for this document as well! Don't use any original concept shared here for payware add-ons!

Please take a look at the acknowledgments page - my work is based on many other's! There is a link on the web page to download a ZIP file with the large size images. Go to the English web page : http://www.thesalters.org/fly2/

Pascal Lachat
pascallachat@bluewin.ch

Web design : Gérard "Azzurro" Calomili

Important note :
- In order to follow the following steps, you need to have TerraScene 2.0 or 2.1 installed on your computer.
- Please be aware that this tutorial is specifically written for Photoshop users. This said, if you use another graphic software package you will certainly find here some good inspiration to adapt and develop your own process.

Part 1 – Before starting a project

The selection textures and displacement maps are created before all other operations. We only need to make them once; they will serve for all the following projects. Of course, they can be shared on the web so that the job isn't done a hundred times.

1.1 Textures for selection

Mostly, the objects which cast a shadow are trees and buildings. Inside a forest zone, trees are closely grouped, so it's at the borders of the forest or inside clearings that we can observe cast shadows.

We will need to know which parts of one particular texture casts a shadow. This is the purpose of the textures used for selection map. For each forest and urban texture used in a particular TerraScene project, we have to create the corresponding texture for selection.

• Select carefully on the original texture each part that will be bumped up.

Tips for urban textures:
• Select the lightest shades.
• For manual work, switch to quick mask.
• Use the "facet" filter to eliminate some noise and get square houses.
• Erase the streets and parkings lots, paint the buildings which are not selected. Residential parts with many trees can be defined as a single object. The level of detail is your choice. It's a long work, so limit the number of texture types you will use for rendering.


• SAVE SELECTION as a new channel.
• Create a new document exactly the same size as the original texture.
• LOAD SELECTION from the first document.
• Fill the selection with a specific pure colour. You may want to fill the remaining parts (clearings, streets) with another colour, in case they would need some interventions later in the process. Else, keep them white.
• Save your textures as .jpg to a new folder inside the TerraScene texture folder.
  Suggestion : Give the same name as the original texture, with the letters "SEL" before. Ex: *Suburb-usa.jpg* becomes *SELsuburb-usa.jpg*
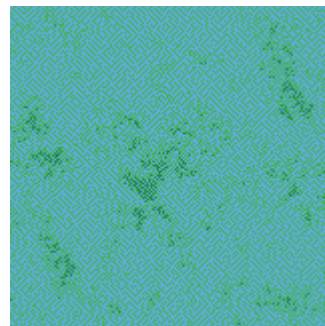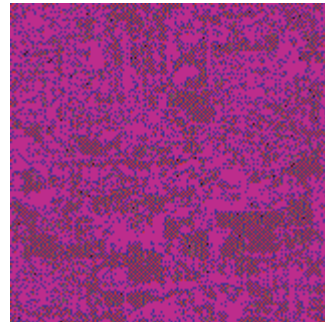
➢ Here are some samples for the standard TerraScene textures : *Cool-conifer-forest.jpg* and *City-heavy-usa.jpg*.

NOTE : The unselected parts have been filled with deeper color. The textures need some work yet - some streets were selected because of their light shade and must be deselected.
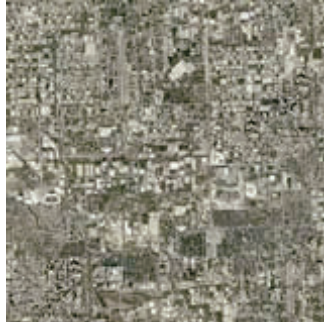
Texture	**Texture for selection**

➢ One more example with *Suburb-usa.jpg* (larger scale). Here you can see some trees and some grouped residential houses as well as individual buildings.

NOTE : I used different colors for each urban map, because I want the *"City-heavy-usa"* buildings to cast longer shadows : thus I need to select them separately. However, if you don't use the advanced advices below (part 5), only one colour is needed.
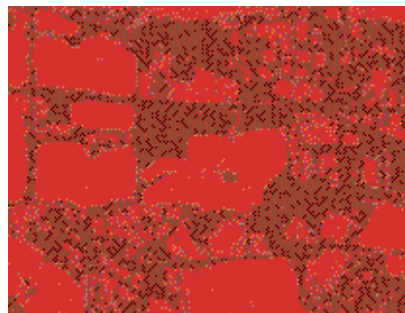
1.2 Displacement maps

As I said before, we'll add some shadows at the borders of selected zones . Hand painting them would be a nightmare. There would be one easy way : Photoshop layers are able to cast a shadow over the background.
But I chose a trickier way which gives much better results. The displace filter allows to move each pixel of an amount defined by a "displacement map", which is a picture in psd format. Therefore, it's easy to "stretch" some black pixels over the areas we want to shade. This allows us to make realistic irregular shadows.

Here are the specific "displacement maps" I use for
➢ Evergreen/mixed forest
➢ Urban areas.

NOTE : I called them *"DMtrees"* and *"DMBuildings"*. (Convert them to grey levels and save as psd if you want to use these). Note that *"DMBuildings"* is designed for a 220° sun position!
Refer to the Photoshop help files for more details about displacement maps.

- We'll use the displace filter as well in order to make the forest borders look irregular and random. I called this map *DMRandomLarge* and made also a much smaller version for smaller irregularities. (You can use it once converted to psd format – and experiment!)

Part 2 – Working with TerraScene

We must create three different projects; i.e render three .tga pictures that will help produce the final rendering. The water mask and night scenery can be made during the rendering of your choice, preferably the first one.

The idea is to handle separately the relief shadows and the land use textures map. Mostly, the enhancements will be done on the shadow layer, before merging again the two layers. Moreover, we'll need one more map, drawn with pure colors only, that will help to select some areas.

> Important note: If you render a large area, a Globe Tile for example, TerraScene cuts it into pieces, smaller than the "max segment size" in the RENDER box. TerraScene will rename the first image *Project1-1.tga*, and so on. This first segment will have exactly the same bounds as *ProjectSelect1-1.tga* and *ProjectShadow1-1.tga* (see below). And this stays true for each following segment (1-2, 1-3, …) if the projects bounds stay exactly the same during each of the three renderings.
>
> Be careful to deselect the "Delete segments after merge" option.
> Also, for each of the three projects be sure to keep the same bounds and the same segment size.

2.1 The texture layer project

- Create a standard project. For the forest and urban areas, only use the texture which have the corresponding "texture for selection" prepared.
- Before to render, deselect the relief shading. (Back to the early TerraScene days!).
- Generate the day scenery and the water mask, the night scenery is to your choice.
- Name the file *"Project"* in the project dialogue box and render.
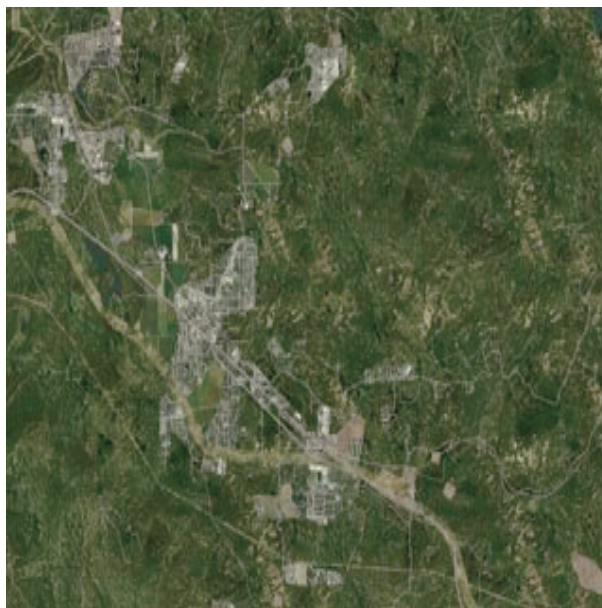
2.2 The shadow layer project

- This time, set all land types and line textures to none. Except for the background texture, which is set to 80% grey : (H,S,B)=(0,0,80).
- Select "Relief shading", sun color to white.
  NOTE : Here I chose the position of the sun 220° from North, and 45° elevation.

- Name the file *"ProjectShadow"* in the project options and render (this one takes a while).
  NOTE : Convert this picture to greyscale before working on it. It saves a lot of RAM.
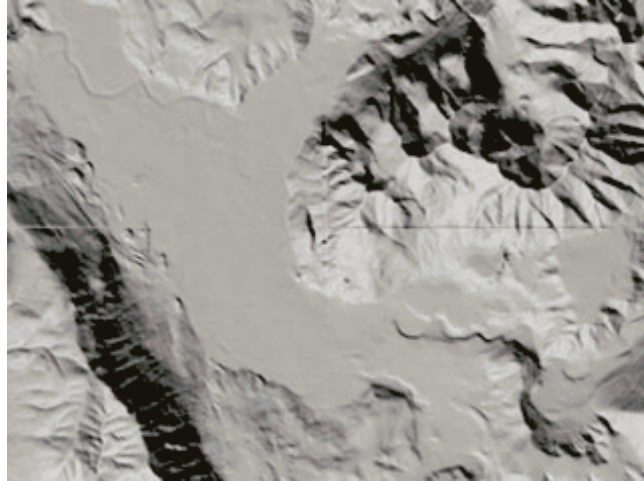
2.3 The selection map project

- Go into "Land Types – Day".
- For each forest and urban area, choose the *SEL* texture that goes with the TerraScene texture of the first project (2.1).
- Set the background color to white.
- You can assign any color not yet used to land types you would like to work on later (it's a good idea, for example, to color water). Else, white or "none" are ok.
- In the "Lines" box, select a color for the roads, railroads, streams and power lines. Choose the widths and colors you want, but remember they have to be drawn.
- Deselect the shading option.
- Name the file *"ProjectSelect"*.

In this example red is suburban – magenta : industrial and commercial buildings – green : mixed and deciduous forest – turquoise : evergreen.
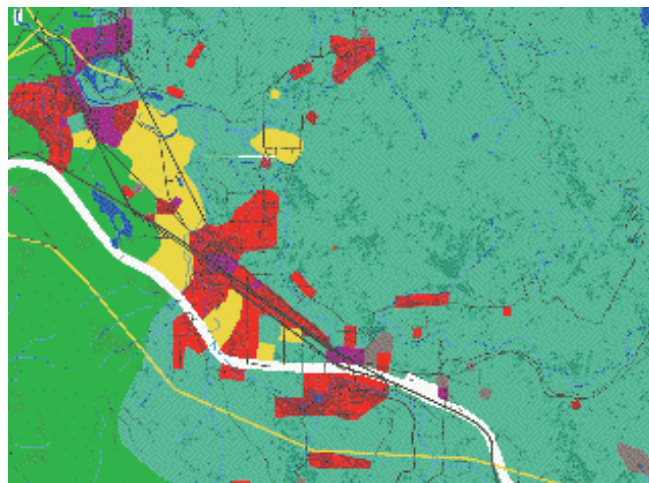
Part 3 – Working with Photoshop

Ok, lay those fine pictures aside just one moment, we must now find an efficient method to work with those big files. Fortunately, Photoshop has some useful functions that makes painting a joy instead of a pain!
I assume that you have some knowledge of Photoshop. I won't give all details for basic actions. For example, you'll find out that it's often necessary to deselect before doing another selection.
Here we go!

3.1 Introduction

When dealing with large surfaces and selections, I found channels to be very useful. They can be modified and painted like a grayscale layer, and can be loaded instantly as a selection. By default, the selected areas are drawn black, and shades of grey show some partial selection.
Some useful operations can be done between channels, and a selection can be "saved" as a channel, even to another document (it must be the same size). Thus, to make thinks clearer, we will save/load all the selections to/from channels of a work document, and make changes to the shapes and create shadows inside this document.

The first time you save a selection, go to SELECT > SAVE SELECTION…, select "document > new", name the channel. This will automatically create a new grayscale document. For further saves, choose the document name (usually *Untitled-1* by default) and a new channel (give it a name). You can stack the channels and delete them as soon as you don't need them.

Calculations with channels

We'll make extensive use of two similar Photoshop's functions : IMAGE > CALCULATIONS and IMAGE > APPLY IMAGE.
"CALCULATIONS" is when you want to save the result in a new channel; "APPLY IMAGE" is to modify the active channel.

The operation is defined by the blending mode. We'll use three of them. The results may seem paradoxical, but remember that it's much like mathematic operations on each pixel, black's value is 0 and white's ~1 (255/256). Thus to "add" doesn't mean that you put together all black surfaces. The addition is between the same pixel of each channel, and for instance, white added to black results in white. When you are not sure, refer to the examples given here :
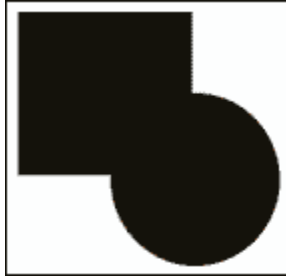
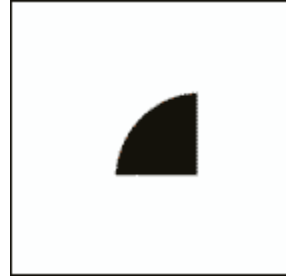**Channels:**   **Alpha 1**   **Alpha 2**
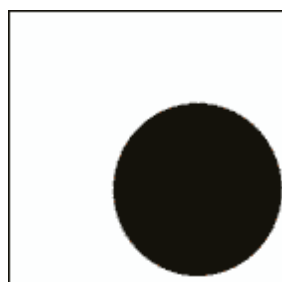
Calculations : **Multiply *Alpha 1* with *Alpha 2*** **Add *Alpha 1* and *Alpha 2***
Effect on selection : **Gathering of areas** **Intersection of areas**

Add reverse of *Alpha 2* to *Alpha 1*
Clip Alpha 2 from Alpha 1 area


3.2 The forest borders

The forest in TerraScene looks a little bit geometrical. We'll focus on the borders and try to give them a more natural look. The places where some forest and urban areas meet needs some adjustment too; it looks better if we manage some smooth transition.

Remember that we work on the shadow map - we don't draw the modifications directly to the texture map. If you want, you can do it however; I chose this method to limit the number of images simultaneously opened. The only way to modify the textures is to lighten or darken some parts of the shadow map which will later lighten/darken the textures themselves, after the final merging. Keep this in mind when reading the following chapters. If some operation seems unclear to you, look at the chapter 3.5 of this document to see the effect it will have once the shadow and the texture layers will be merged.

➢ Open the selection map and select every color which maps the forest zones (be careful : not the clearings). Use the magic wand or SELECTION > COLOR RANGE.
   NOTE : I added a dark mask to the picture to highlight the selected zones.

• Save this selection as the *"Forest"* channel inside a new document. You have now a document named *"Untiltled-1"*, which will be a "container" for all the work channels to be created.
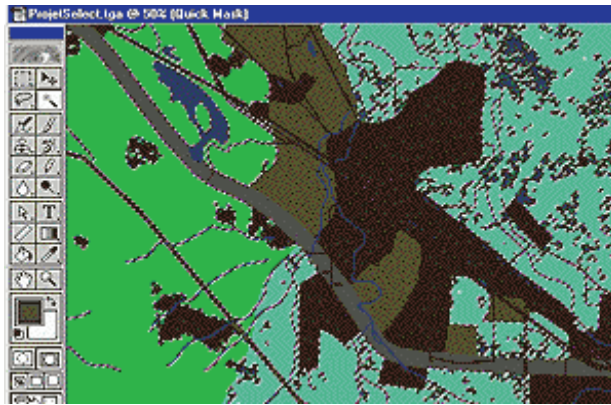
➢ Select all kind of urban areas. SELECT > MODIFY > EXPAND the selection to give some more room to buildings.
  • Save selection as a new channel (*"ExpandedUrban"*) to the document you created before (usually *Untitled-1*).
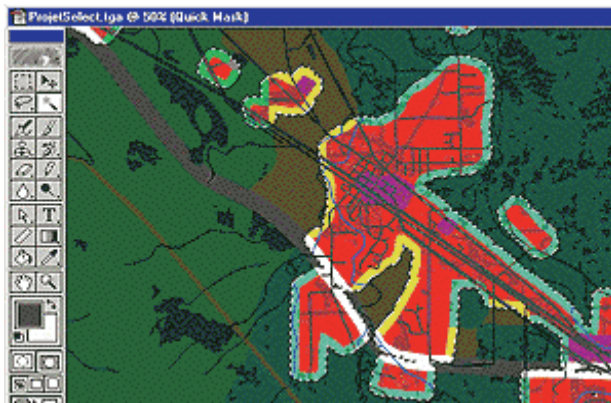

Transition with urban areas

➢ Select the new document; take a look at the channels you just created.

➢ Now let's go for some calculation. IMAGE > CALCULATIONS… Ok, do you remember the explanations before?
  • Add the reverse of *"ExpandedUrban"* to *"Forest"* channel. Choose "New channel" as a result.
  • Rename the new channel as *"Forest2"*. The borders of the urban zones have been removed.

Jagged borders

➢ Select the channel *"Forest2"*. Click "LOAD CHANNEL AS SELECTION" icon on the channels palette.
  • Expand the selection a bit. The borders of the selection will not follow the roads anymore. It will preserve them from being too jagged.

➢ Contract the selection more than you expanded.
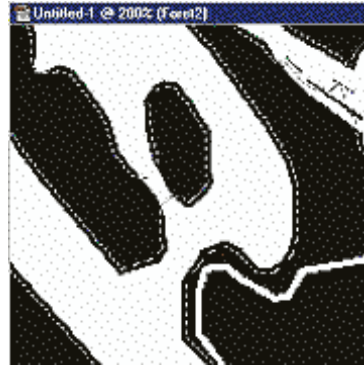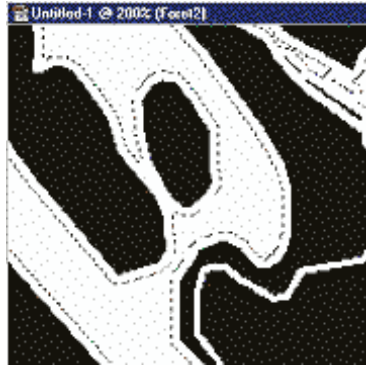
➢ Set foreground color to white
  • EDIT > STROKE the outside of the selection. The edge is erased.

➢ Select > Modify > Border…
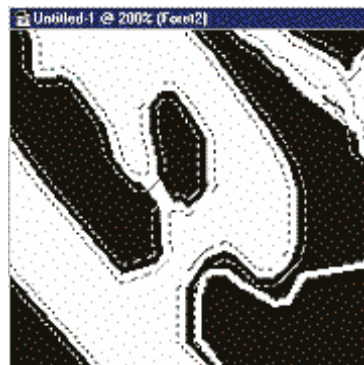
➢ Filter > Distort > Displace…
  Try the *"DMRandomLarge"* displacement map I gave before, or create your own. Here it is set to 10%.

➢ Add some contrast until the border is sharp.
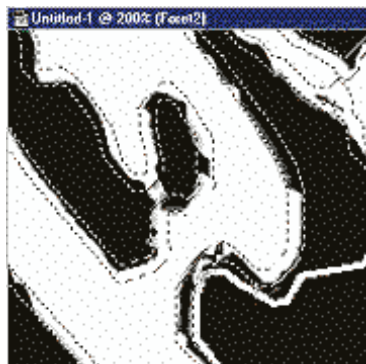
➢ (Optional) Select the borders again and FILTER > DISTORT > DISPLACE with a smaller and less contrasted displacement map, this time doing the roads too.

➢ Some cleaning : APPLY IMAGE, Add *"Forest"* channel to erase the pixels which were displaced past the limit of the original forest area.
The new forest is entirely included inside the limits of the old one.
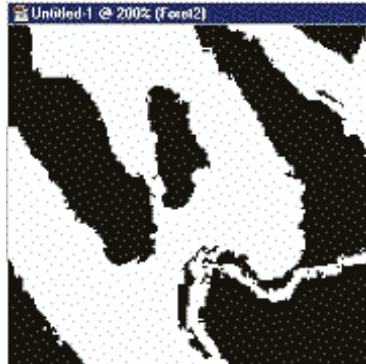
Apply the changes

Now we want to apply this new shape, keeping in mind that we can only modify the final picture through the shadow map.
We'll use a little trick : the forest is generally darker than other textures. We have to clip the *"Forest2"* shape *"* from *"Forest"* channels : the remaining pixels are those that must change their look. We'll just lighten those pixels and they will loose the forest aspect.

➢ Open the *"ProjectShadow.tga"* document. Convert it to grayscale.
 • IMAGE > CALCULATIONS : add *Forest2* to inverted *Forest* channel, this time, choose "Result > Selection".

➢ Adjust Brightness – Contrast for selection.
Contrast must be high, and brightness slider must bring most parts to white. Be careful to keep the relief shadows dark enough. That's it! (Also see Part 5 : Advanced)
NOTE : We have now virtually adjusted the forest shape, but we'll not see the result before the final state, when the shadow and texture layers will be merged.

3.3 The forest shadow

This adjustment will greatly improve the forest's look with the illusion of relief. We will add some stretched shadows along the forest edge, and for this we'll use the Displace filter again. To achieve this effect, many ways are possible, feel free to experiment other techniques than displacement maps. If you want to do only a limited number of steps to improve TerraScenery, this chapter and the next one will achieve the best effects.

> NOTE : Each time we use a displace filter to create some shadows, LOAD THE CHANNEL AS A SELECTION, and then INVERT this selection. Or select the white area with the magic wand. Only then, apply the filter. In case of successive displace filters on the same channel, no need to reload the selection each time.

Draw the shadows

Duplicate the channel *"Forest2"*. Rename the new one *"ForestShadow"*. This will be the work layer.

➢ LOAD CHANNEL as selection and invert selection.
   In this way, the black area won't be messed when applying the filter. The Displace filter uses the pixels at the edge of the selection, and the black edge pixels will be "stretched" like tree shadows.
➢ FILTERS > DISTORT > DISPLACE. You may use here the small displacement map given at the beginning of this document. Do only small displacements each time. It avoids jagged shadows near the very small areas. The parameters depend on the position you gave to the sun in the shadow rendering's options.
   IMPORTANT NOTE : The "tile" option must be selected.

> NOTE : As a rule of thumb, with the sun at 220°, I did each single displacement at –2% horizontal and 5% vertical parameters.

➢ Repeat the displacement filter 1 to 4 more times until you are happy with the result. Keep in mind the vertical angle you gave to the sun : in the evening, shadows are longer. (See the "Advanced" part for finer enhancements)
➢ IMAGE > APPLY IMAGE : add channel *"Forest2"* with invert. This removes the forest and keeps the shadows.

Apply the shadows

➢ Go to the "*ProjectShadow*" document.
SELECT > LOAD SELECTION : choose "Untitled-1" document, load the "*ForestShadow*" channel.
EDIT > FILL with black.

Darken and emboss

One can observe in reality that any type of forest looks much darker than fields, grass or towns. I suggest to paint it a bit darker. (See also "Advanced" part).
   NOTE : For this purpose, you may prefer to modify the base TerraScene textures.

Finally we'll add some "emboss" effect to the forest. We do these steps on the "*ProjectShadow*" document.

➢ Create a new layer ("*GreyLayer*") over the shadow map. Fill it with neutral grey (brightness=50%).
Note : This layer will capture the lightning effects applied on the upper layer. I found this way to eliminate some weird bright spots inside the deep mountain shadows.

• Create a second new layer ("*EmbossLayer*") on top of the others. SELECT > LOAD SELECTION : *Forest2* from *Untitled-1*. Fill with a dark grey (here Brightness=25%).

➢ LAYER > EFFECTS > BEVEL AND EMBOSS. Choose the "Emboss" effect. You can play with "Opacity" of shadow and light, or keep the defaults. Use the same angle you entered in TerraScene for the direction of the sun. Merge down this layer with "*GreyLayer*". (Blending mode : Normal)
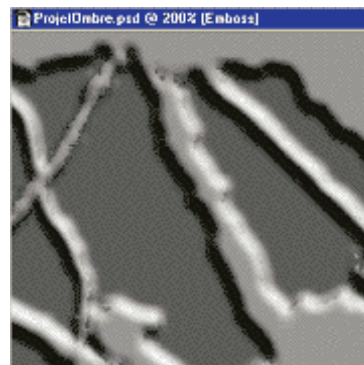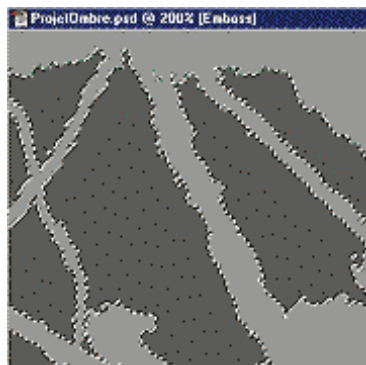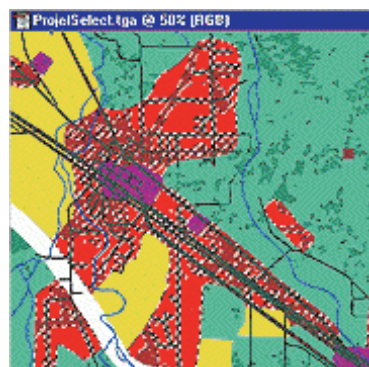
➢ Set blending mode of *"GreyLayer"* to "Overlay".
  • MERGE DOWN again.
    And it's all done for the forest!
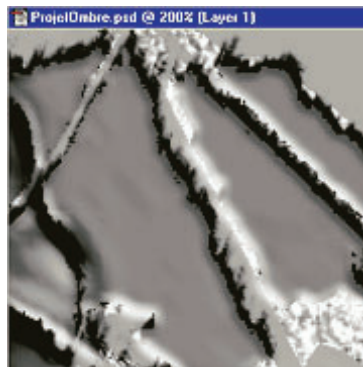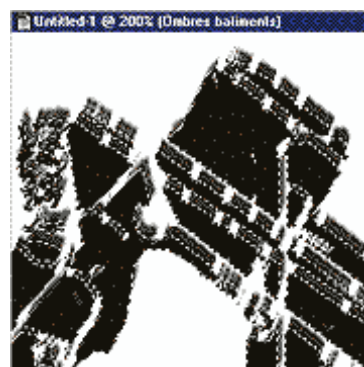

3.4 The buildings shadow

This chapter develops basically the same process (a bit easier) as for the forest shadows. Refer to the preceding chapter for more details.

➢ Select the buildings on the selection map.
➢ Save selection to *Untitled-1*. Rename new channel "*Buildings*".

➢ Go to *Untilted-1*. Duplicate the channel *"Buildings"*. Rename the new one *"BuildingsShadow"*. Load channel as selection and invert selection.

➢ Use the displacement map from chapter 1.2, or use one you created according to another sun position.

➢ APPLY the *"Buildings"* channel with invert.

➢ LOAD *"BuildingsShadow"* as a selection inside the *"ProjectShadow"* document. FILL SELECTION
with black.
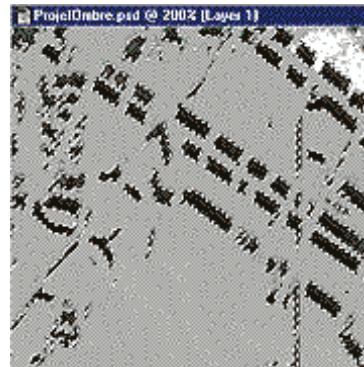
➢ The shadow map is ready!
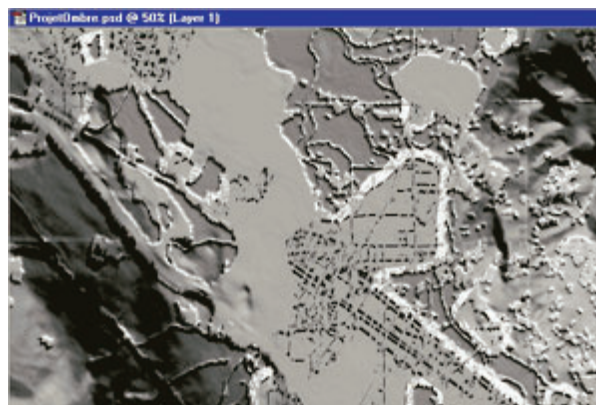
3.5 Merge the layers

At last, we are going to see the result of this long work. It's time to merge the texture and the
shadows.

There are many blending modes in Photoshop. I suggest using the "multiply" mode. As the result of
this blending mode is much darker than the separate layers, we must adjust the colors. The pictures
will be brightened before they are multiplied.

The aim is to keep as much as possible the fine terrain relief from the shadow map. It's a deal :
whether you have contrasted texturing, and the fine details of the relief are hidden, or you make
visible even the faintest relief's shades, thus tuning down the texture's contrast. I suggest some
numbers and curves here, which keep some nice relief, but you are free to tweak until you find the
best result. Create some adjustment layers linked to each picture layer, so that you won't loose the
original bitmaps.

It's always good to do some attempts on small areas, slice and see the results within Fly!, note the
changes to do and come back to Photoshop. It's now your eye's job to make the right decisions and
this is not easy. And sure some knowledge about color tweaking, color curves and histograms would
be very useful. But, if you don't feel comfortable with colour tweaking, start with the suggested
numbers.

➢ Open the *"Project.tga"* file. Adjust lightness and saturation. Some contrast is lost, but it's needed for better relief shading.
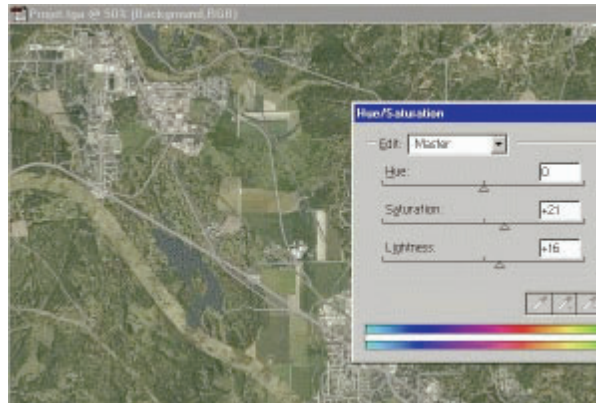
• Now we add the shadow layer : go to *"ProjectShadow"*, hold shift and drag the layer on top of *"Project"* document.

➢ The shadows usually have a faint blue tint because the sky drops some blue light, which is not noticeable in the sunlight. Ask the Impressionists about this point!
For this purpose, I made the following curves adjustment. This example needs some tweaking yet, since the deep shadows tend to be too blue. Flatten the curves a little bit.
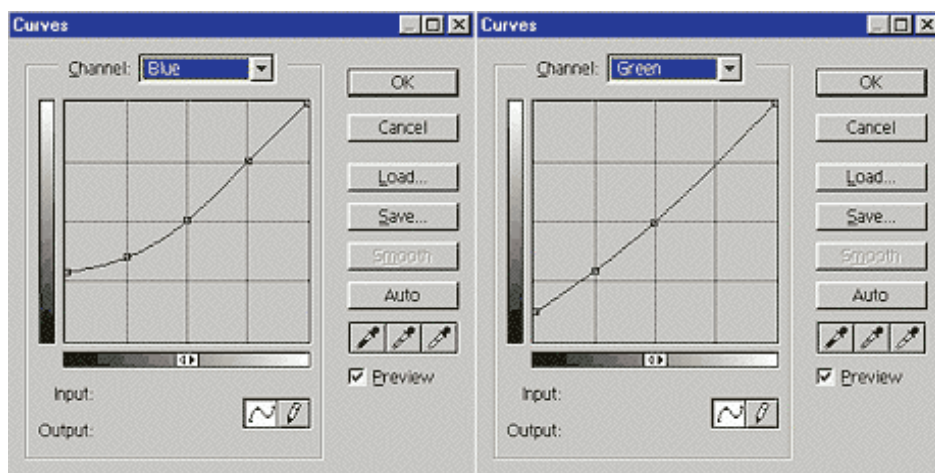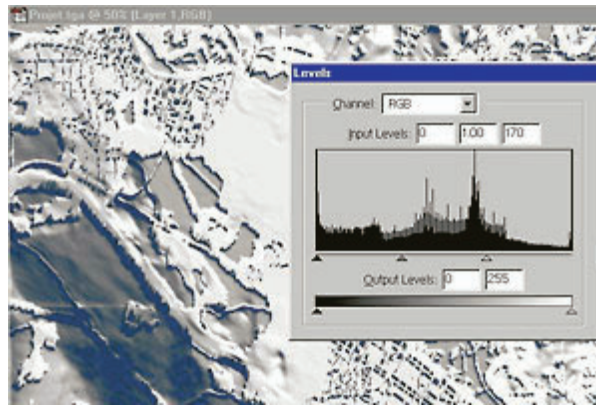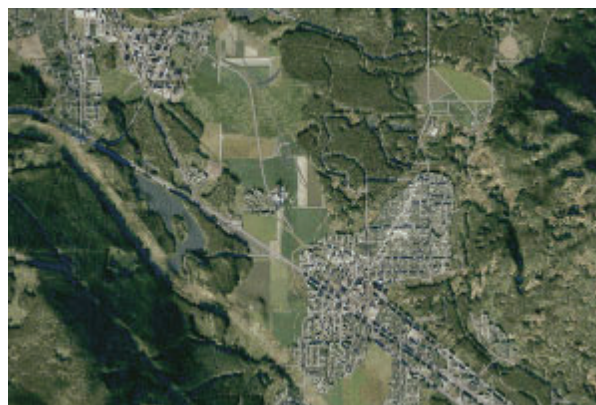

➢ And the result :
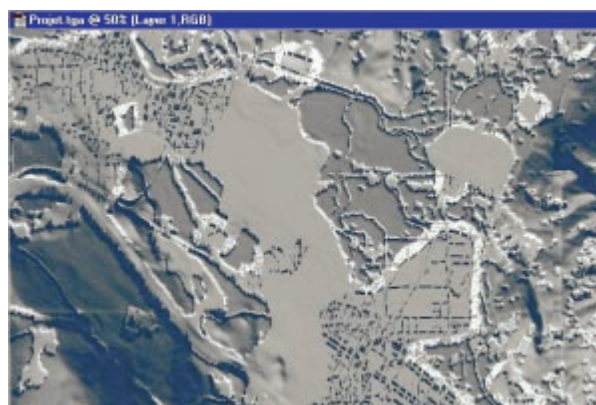
➤ Tune the level to make it much lighter.

Now the long awaited moment, when the final picture is revealed!

➤ Set blending mode of upper layer to "Multiply".
 • Flatten image.
 • Save it as Targa file (.tga)

Part 4 – Slicing the scenery

If your project was split between different files, be sure that you saved each with the right name (i.e. Project1-1.tga, Project1-2.tga, ...). Put the files back to the TerraScene/Output folder in case you moved them.

Open your Fly! II/Data folder. If you see some folders here, drag them to another secure folder. This simple act, as well as deleting the folders that are created during the process after the rendering, will avoid a lot of troubles and calls for help in the Fly! Forums !

➢ Launch TerraScene. Open the *"Project"* file.
   Make sure you didn't change the file name in the project option. It must be named "Project" if the .tga files have this name. Otherwise TerraScene will not recognize them.
   • Open the "Render" options. Check that everything is the same as in the picture below, except for night scenery which is optional. Just keep the option "One image per globe tile" as it was before.
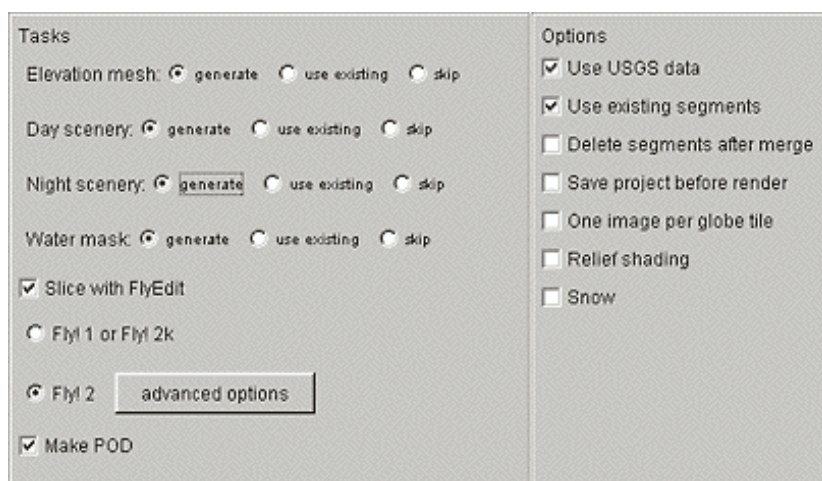
   • Hit the "Render" button.

   • Go drink a coffee, do some home tasks … but don't eagerly stare at your screen!
   • When the Fly! slicer finishes his job, go to Fly! II/Data folder again, ERASE all the folders that you see here (only the folders).
   • Change the name of your *"Project.pod"* and *"Project.scf"* files in the scenery folder for something more explicit.

It's time to FLY!

Are you pleased with your scenery? Share it on the web. If the file is too big, at least show some pictures on the forums.

If you feel comfortable with this method and want some more enhancements, don't stop here, there comes the advanced chapter…

Part 5 – Advanced enhancements

The forest borders (see 3.2 – Apply the changes)

For better flattening of the forest texture where it might disappear, I did the brightness/contrast adjusment using an adjustment layer with a mask. Create this mask with the Project.tga converted to grayscale, invert it, lighten it a lot with levels, with a high gamma (most parts of the mask must be near white). Then, tune Brightness and Contrast through this mask. This allows to erase the textures details more efficiently.

Selective forest shadows (see 3.3)

I handle the forest with two different displacement maps, whether it's conifer forest or evergreen/mixed. The shadows are sharper for conifers. (But I should once travel to the U.S just to see if these are some fir and not some round head pine trees!)
Just use some different colour when you design the "textures for selection" (1.1).

Varying shadow lengths (see 3.3)

I wanted trees to cast different shadow's lengths depending on the sun's angle with the terrain. We have this information with the shadow map! The deeper the terrain shadow, the smaller the angle, and the longer are the shadows cast by the trees (or any object).

➤ With the help of SELECTION > COLOR RANGE, create three channels with the selections including shades from black to a decreasing level of lightness. Remove the black areas in each. The pictures show the three channels (red) used as masks over the selected areas (for of better understanding purpose).
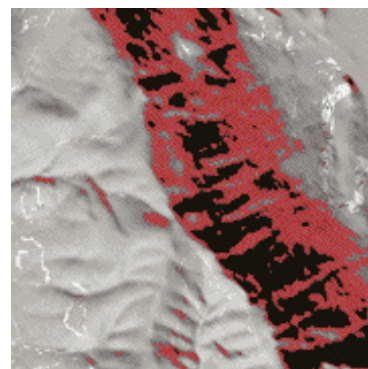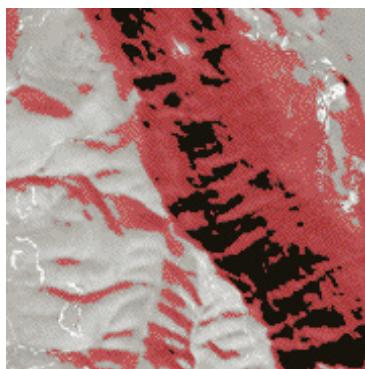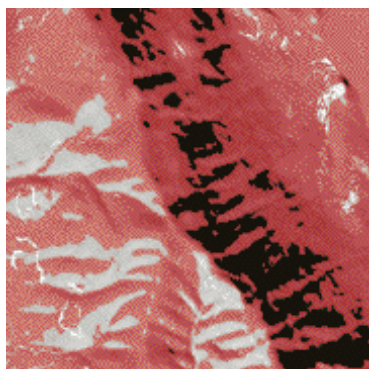
During the shadowing process :

1. Apply only once the displacement map on the forest.
2. Use the first channel to select a limited forest area, copy it to a new layer and apply two DISPLACE filters.
3. Go on with the other channels, each time applying more successive DISPLACE filters.

This effect adds a lot to the picture's realism. See the result on the final sample below, especially the lower left corner.

Selective buildings shadows (see 3.4)

Larger buildings cast longer shadow. I draw suburban and commercial textures for selection with different colors, and handled them separately with the help of the selection map. For an even better effect, you may use a special color for all the large buildings on each sel texture (thus using three colors on each texture) and thereafter let them cast really long shadows (i.e. apply a lot of displace filters).

Automation in Photoshop

The whole process explained in this document is quite time consuming, and when it comes to create vast landscapes as wide as full globe tiles, it would be a real pain if we couldn't do some macros to automate those repetitive tasks. It was a main objective in the development; therefore all the steps can be programmed as Photoshop "actions". Read the software's help for good understanding and use of actions. The following aspects need some attention when using actions :

• Don't select the colours with the magic wand tool, rather use SELECTION > COLOR RANGE.

• Don't drag the layers from one document to another. Use COPY / PASTE.

• Possibly some problems may appear if the result of a selection is empty. I'll give a look at this issue.

After enhancements - a close look :

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