Multi-Zone Adjustment

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Introduction

Picture Window's *2-Zone Adjustment* and *3-Zone Adjustment* transformations are powerful image enhancement tools designed for images that separate into two or three fairly well-defined tonal zones. For example, many landscape photographs naturally break down into shadow, midtone and highlight or sometimes just shadow and highlight zones. For each zone, these transformations let you adjust contrast, brightness, and saturation independently. The final effect can often bring dull images to life by dramatically improving their clarity in a manner difficult or impossible to achieve by adjusting the image as a single zone. Images with very low or very high contrast or with severely clipped highlights or shadows may not be good candidates for *2-Zone Adjustment* or *3-Zone Adjustment*.

The original ideas and detailed workflows behind these transformations were created by one of our customers and regular message board contributors: David Neustel (a.k.a. den). More information on how they work (as well as a host of other useful Picture Window techniques) can be found at his web site:

   http://www.ncplus.net/~birchbay/3tone/3tone.htm   (3-Zone Adjustment)

and

   http://www.ncplus.net/~birchbay/tutorials/SI-3Tone/Ex1/   (2-Zone Adjustment)
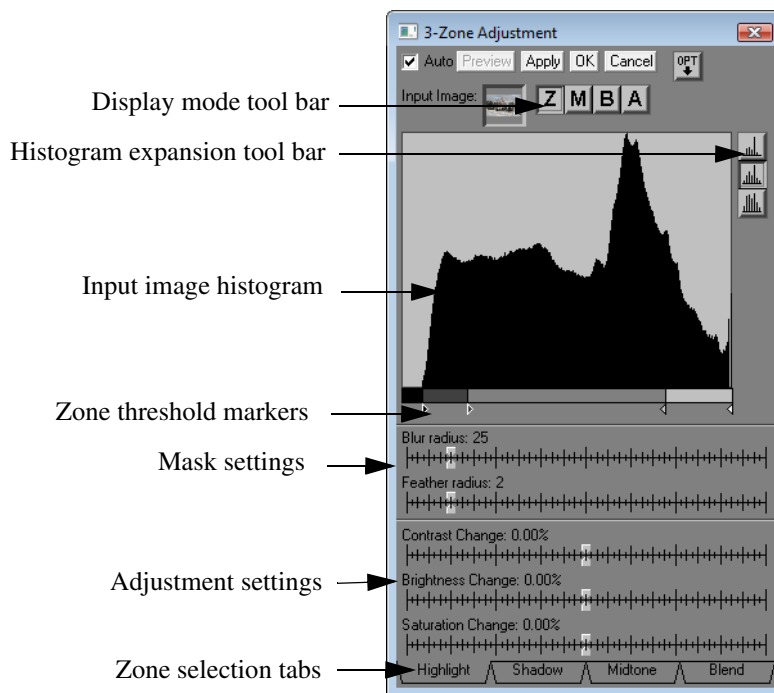
3-Zone Adjustment - Overview

The *3-Zone Adjustment* transformation uses masks to isolate three tonal zones in an input image: shadows, midtones, and highlights. Masks for each zone are created automatically based on zone markers you adjust to set the brightness thresholds between zones and by additional mask settings for each zone. Once zone masks are established, each zone's contrast, brightness and saturation can then be adjusted independently. Finally, the three adjusted images and the original input image are all blended together to create a composite result with selected contributions from each one as illustrated below:
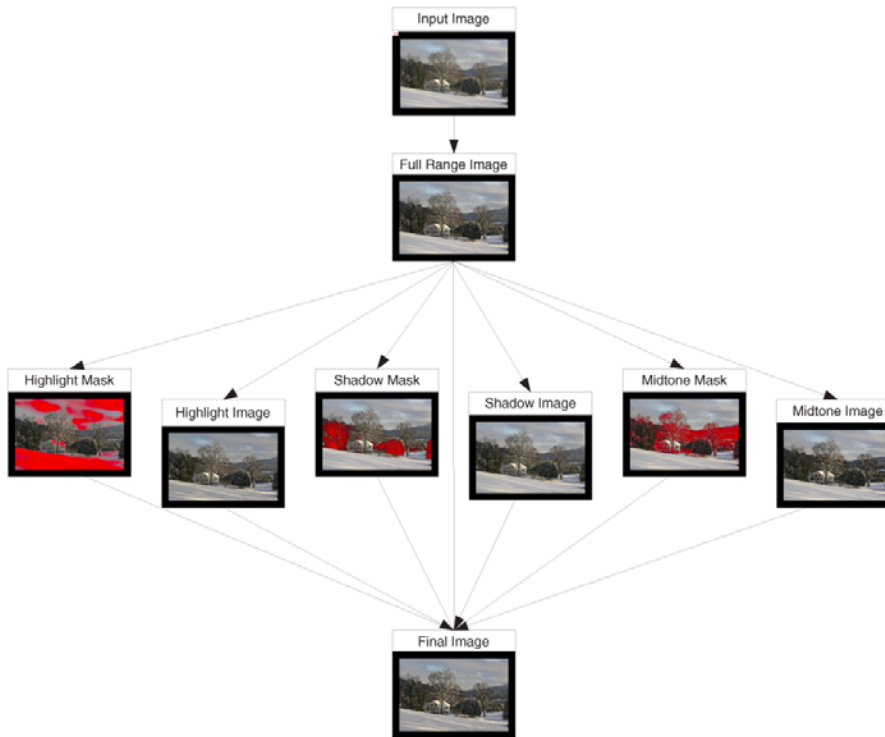
3-Zone Adjustment - The User Interface

Below is an example of the *3-Zone Adjustment* dialog box:

Display mode tool bar

Histogram expansion tool bar

Input image histogram

Zone threshold markers

Mask settings

Adjustment settings

Zone selection tabs

Note that this dialog box can be resized horizontally to spread out the histograms and sliders which can make fine adjustments easier to make.

Step 1 - Adjusting the Zone Threshold Markers

There are four zone threshold markers displayed below the input image histogram—from left to right they are black, dark gray, light gray and white. To facilitate setting the zone markers, click the *Z* button on the display mode tool bar to display in the *Preview* window a version of the input image with each zone identified by a different gray level.

To get the best results from the *3-Zone Adjustment* transformation, it is important to set the outer (black and white) markers so they just bracket the non-zero part of the histogram. This causes the input image to be expanded to use the full range from black to white. Pixels darker that the brightness corresponding to the black marker are shown in the preview as pure black; pixels lighter than the white marker threshold show as pure white. If your image already spans the full range from black to white, leave the black and white markers at their initial extreme left and right positions.

Next adjust the light gray and dark gray markers to divide the remaining tonal range into highlight, shadow and midtone zones as displayed in the *Preview* window. Generally the settings that work best are those that separate the visual elements of the image as cleanly as possible—usually at a local minimum in the histogram. Don't worry if the zones are not perfect since the transformation is somewhat forgiving and you can always go back and reposition the zone markers later if necessary.

Zone Threshold Markers
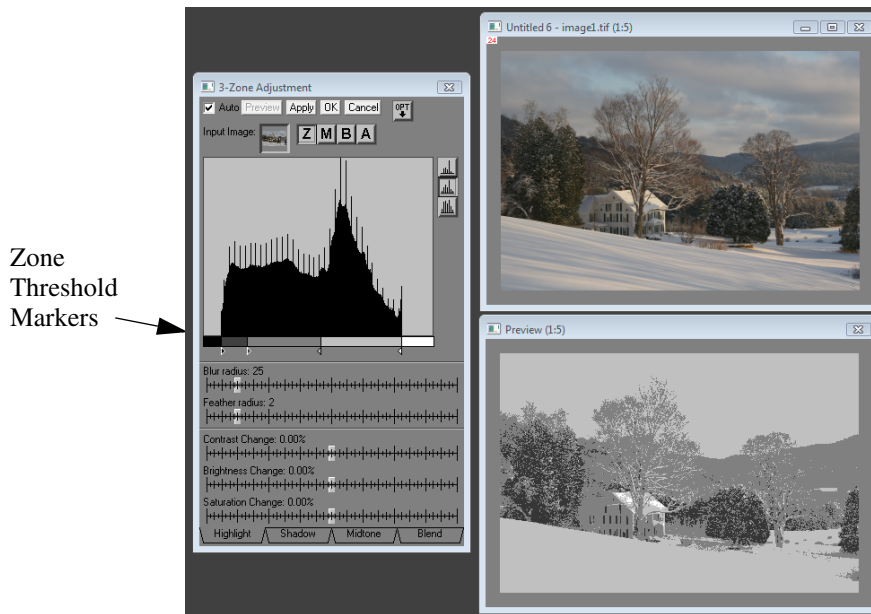
Step 2- Adjusting Highlights

You can view the current highlight mask in the *Preview* window as a red overlay over the full range input image by clicking the *M* button on the display mode tool bar. This mask should more or less cover the highlight areas of the image although its edges should be blurred somewhat. The degree of blurring of the boundary between the highlight mask and the midtone mask is controlled by the *Midtone-Highlight Blur* slider. The default settings usually work fairly well, but you can adjust them later if necessary to reduce halos or other artifacts that can show up around zone edges in the result image, especially if you make large adjustments to the image. More on this later.

By clicking on the *A* button in the display mode tool bar you can preview the results of making image adjustments. Having done this, try playing with the *Contrast*, *Brightness* and *Saturation* sliders to get an effect you like. Increasing contrast will generally add snap to the highlights while changing the brightness makes the highlights lighter or darker. The *Saturation* slider is only displayed for color images and similarly can increase or decrease highlight saturation. To get a better idea of what the sliders are doing, you can switch back and forth between the *B* (before) and *A* (after) buttons of the display mode tool bar to toggle the adjustments on and off.

Increasing the highlight contrast will open up the highlights and help make more highlight detail visible. The only way to do this is to darken the darker highlights while leaving the brighter highlights alone. The overall effect is to darken the highlight zone. You can compensate for this somewhat by increasing the highlight brightness setting.

Step 3- Adjusting the Shadows

To work on the shadow zone, click the *Shadow* tab at the bottom of the dialog box to expose a new set of adjustment sliders which are pretty much the same as the corresponding highlight sliders. Blurring of the boundary between the shadow mask and the midtone mask is controlled by the *Shadow-Midtone Blur* slider.

Increasing shadow contrast will open up the shadows and help make more shadow detail visible. The only way to do this is to lighten the lighter shadows while leaving the darker shadows alone. The overall effect is to lighten the shadow zone. You can compensate for this somewhat by lowering the shadow brightness setting.

Step 4- Adjusting the Midtones

To work on the midtone zone, click the *Midtone* tab at the bottom of the dialog box to expose the midtone adjustment sliders.

Step 5 - Blending the images

To view the results of blending the adjusted highlight, shadow and midtone images, click the *Blend* tab at the bottom of the dialog box.

To see a map showing what parts of the image are controlled by which zones, click the *M* (mask) button on the display mode tool bar. This displays the various zones as follows:

Controlled by Highlight Settings: *White*
Controlled by Shadow Settings: *Black*
Controlled by Midtone Settings: *Gray*
Shadow-Midtone Transition Zone: *Blue*
Midtone-Highlight Transition Zone: *Yellow*
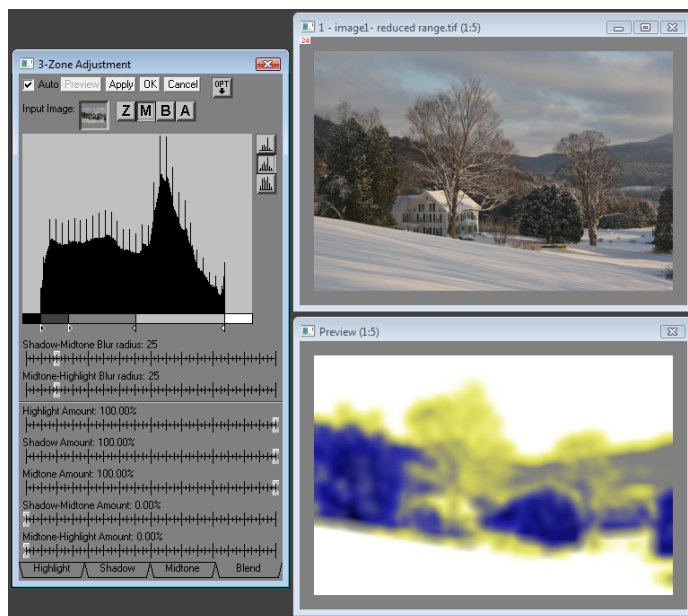
To compare the final blended image with the input image, switch back and forth between the *B* (before) and *A* (after) buttons of the display mode tool bar which will toggle between the two versions.

When the *Blend* tab is selected, five sliders are displayed for adjusting the relative contributions of the adjusted highlight, shadow and midtone images plus two additional sliders for the midtone-highlight and shadow-midtone transition zones.

When the highlight, shadow or midtone sliders are set to 0%, they let the original input image show through in their respective zones. When set to 100%, they completely replace the input image in their zone with the adjusted image. Intermediate settings have a partial effect. Thus you can scale back the effect of any of the three zones as much as you wish at this stage if you find the effect too strong or to reduce halos.

The *Midtone-Highlight* and *Shadow-Midtone* sliders affect the boundary areas between highlights and midtones and between shadows and midtones. The higher the sliders are set, the more of the original input image shows through in the corresponding transition zone. Increasing the sliders is one of the best way to reduce halos in the output image.

When the final result is to your liking, click *OK* or *Apply* to generate the result image and terminate the transformation.

3-Zone Adjustment - The Finer Points

Avoiding Halos

For some images, it can be tricky to make the desired adjustments without creating artifacts such as halos or solarization in the transitions at the zone boundaries. You have several tools at your disposal to try to minimize such artifacts.

1. Try adjusting the mask *Blur* sliders for the zone boundaries in question. Generally the larger the blur setting the softer the edges of the mask. Either increasing or decreasing the blur radius may help with halos by widening or narrowing the transition zone.

2. Try adjusting the *Contrast* and/or *Brightness* sliders so as to reduce the brightness discontinuity between the two zones.

3. Try adjusting the *Highlight*, *Shadow* and *Midtone Amount* sliders in the *Blend* tab. Scaling them back can help reduce halos.

4. Try adjusting the *Midtone-Highlight* and *Shadow-Midtone* sliders in the Blend tab.

5. Try adjusting the zone threshold marker between the two zones to make the boundary less obvious.

Hint: To see the mask for the current zone, click the *M* (mask) button in the display mode tool bar. This will display the mask as a red overlay over the input image so you can see what parts of the image will be altered by the adjustment sliders. To see all the masks at once, click the *Blend* tab and also set the display mode to mask.

### Working with black and white images

Working with black and white images is exactly the same as working with color images with the sole exception that no *Saturation* sliders are displayed in the *Highlight*, *Shadow* and *Midtone* tabs.

Adjusting only one or two zones

Just because you can adjust all three zones doesn't mean you have to. If you leave all the adjustment sliders for a given zone at zero, no adjustments are made to that zone. Thus you can easily confine your changes to a single zone or to two zones. For example, if all you want to do is open up the shadows or highlights in an image, just adjust the shadow or highlight zone.
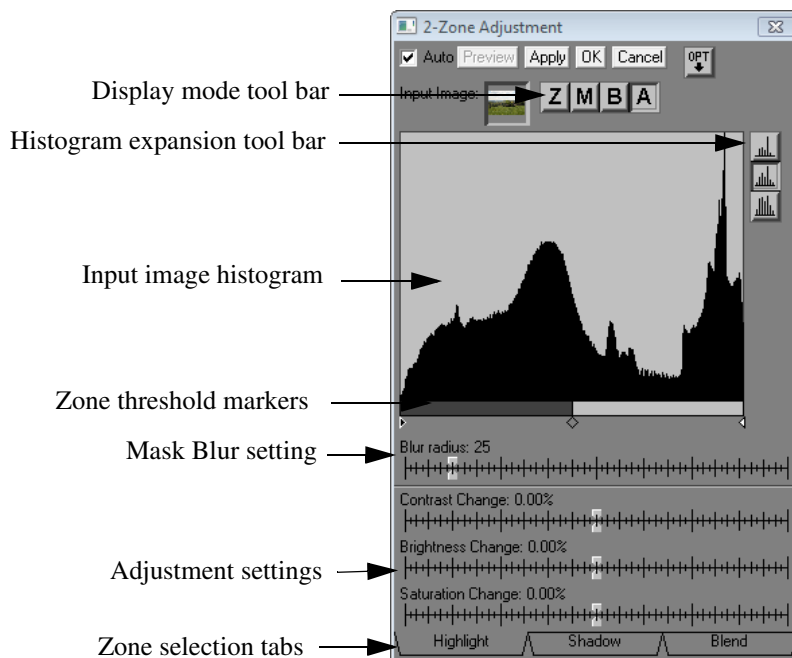
2-Zone Adjustment - Overview

The *2-Zone Adjustment* transformation is very similar to the 3-Zone Adjustment transformation. It uses masks to isolate highlight and shadow zones in an input image by splitting it at a selected tonal value—usually set to a notch in the input image histogram. Masks for each zone are created automatically based on zone markers you adjust to set the brightness threshold between the light and dark zones and by additional mask settings. A third transition mask is also created which can be used to help eliminate halos in the so-called transition zone at the boundary between the light and dark zones. Once all the masks are established, each zone's contrast, brightness and saturation can then be adjusted independently. In a final step, the adjusted images and the input image are all blended together to create a result image that includes selected parts of each one.
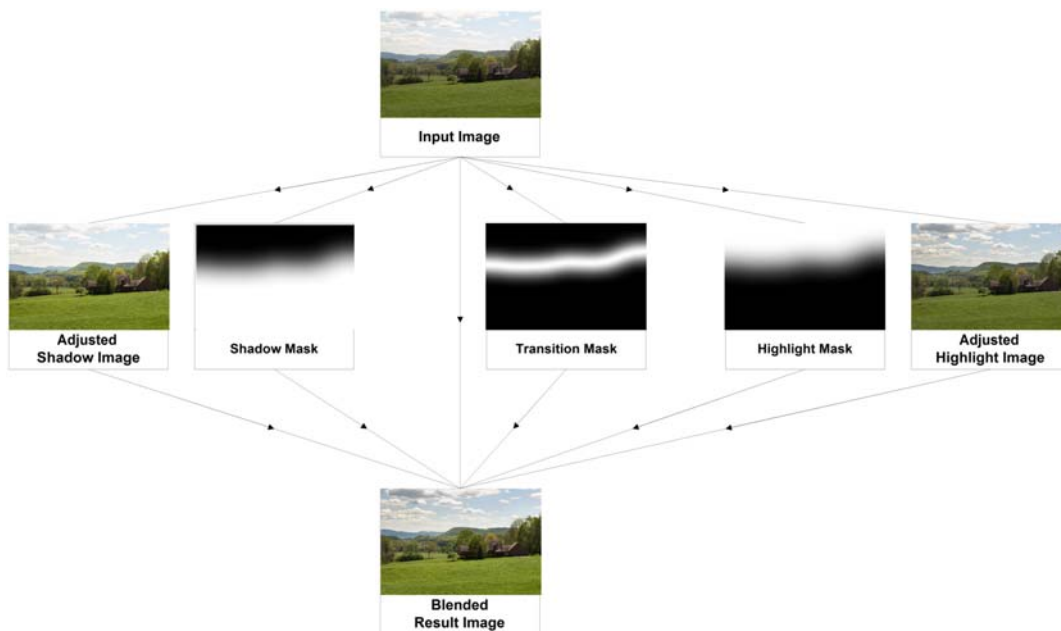
2-Zone Adjustment - The User Interface

Below is an example of the *2-Zone Adjustment* dialog box:

Display mode tool bar

Histogram expansion tool bar

Input image histogram

Zone threshold markers

Mask Blur setting

Adjustment settings

Zone selection tabs

Step 1 - Adjusting the Zone Threshold Markers

There are three zone threshold markers displayed below the input image histogram—from left to right they are black, gray and white. To facilitate setting the zone markers, click the *Z* button on the display mode tool bar to display in the Preview window a version of the input image with each zone identified by a different gray level.

To get the best results from the *2-Zone Adjustment* transformation, it is important to set the outer (black and white) markers so they just bracket the non-zero part of the histogram. This causes the input image to be expanded to run the full range from black to white. Pixels darker that the brightness corresponding to the black marker are shown in the preview as pure black; pixels lighter than the white marker threshold show as pure white. If your image already spans the full range from black to white, leave the black and white markers at their initial extreme left and right positions.

Next adjust the gray marker to divide the remaining tonal range into highlight and shadow zones as displayed in the Preview window. Generally the settings that work best are those that separate the visual elements of the image as cleanly as possible—usually at a local minimum in the histogram. Don't worry if the zones are not perfect since the transformation is somewhat forgiving and you can always go back and reposition the zone markers later if necessary.
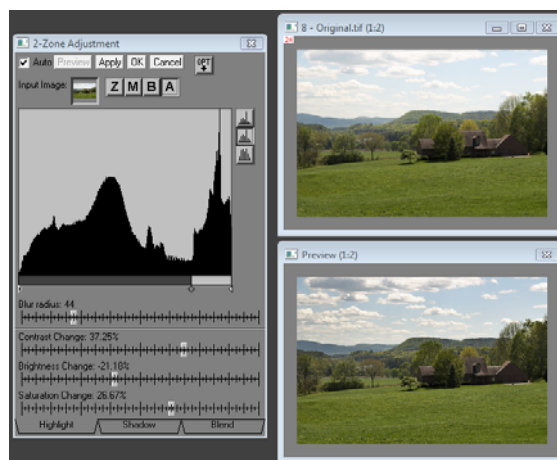

Zone
Threshold
Markers
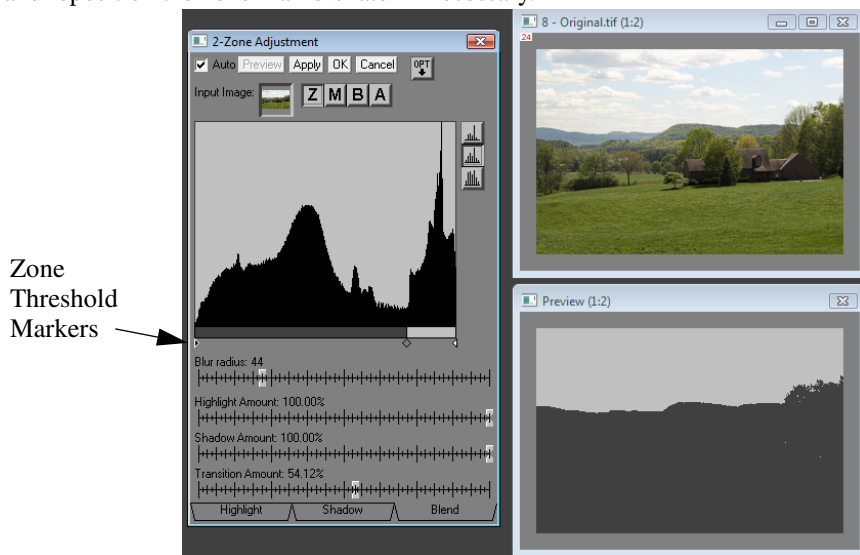
Step 2- Adjusting Highlights

You can view the current highlight mask in the *Preview* window as a red overlay over the full range input image by clicking the *M* button on the display mode tool bar. This mask should more or less cover the highlight areas of the image although its edges should be blurred somewhat. The degree of blurring is controlled by the *Blur* slider. The default settings usually work fairly well, but you can adjust them later if necessary to reduce halos or other artifacts that can show up around zone edges in the result image, especially if you make large adjustments to the image. More on this later.

By clicking on the *A* button in the display mode tool bar you can preview the results of making image adjustments. Having done this, try playing with the *Contrast*, *Brightness* and *Saturation* sliders to get an effect you like. Increasing contrast will generally add snap to the highlights while changing the brightness makes the highlights lighter or darker. The *Saturation* slider is only displayed for color images and similarly can increase or decrease highlight saturation. To get a better idea of what the sliders are doing, you can switch back and forth between the *B* (before) and *A* (after) buttons of the display mode tool bar which will toggle the adjustments on and off.

Increasing the highlight contrast will open up the highlights and help make more highlight detail visible. The only way to do this is to darken the darker highlights while leaving the brighter highlights alone. The overall effect is to darken the highlight zone. You can compensate for this somewhat by increasing the highlight brightness setting.

Step 3- Adjusting the Shadows

To work on the shadow zone, click the *Shadow* tab at the bottom of the dialog box to expose a new set of adjustment sliders which are pretty much the same as the corresponding highlight sliders.

Increasing shadow contrast will open up the shadows and help make more shadow detail visible. The only way to do this is to lighten the lighter shadows while leaving the darker shadows alone. The overall effect is to lighten the shadow zone. You can compensate for this somewhat by lowering the shadow brightness setting.
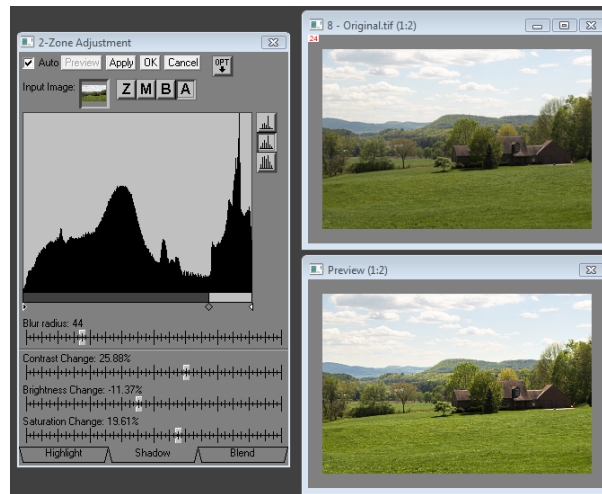
Step 4 - Blending the images

To view the results of blending the adjusted highlight, shadow and midtone images, click the *Blend* tab at the bottom of the dialog box.

To see a map showing what parts of the image are controlled by which zones, click the *M* (mask) button on the display mode tool bar. This displays the various zones as follows:

   Unchanged from Input: *Red*
   Controlled by Highlight Settings: *White*
   Controlled by Shadow Settings: *Black*
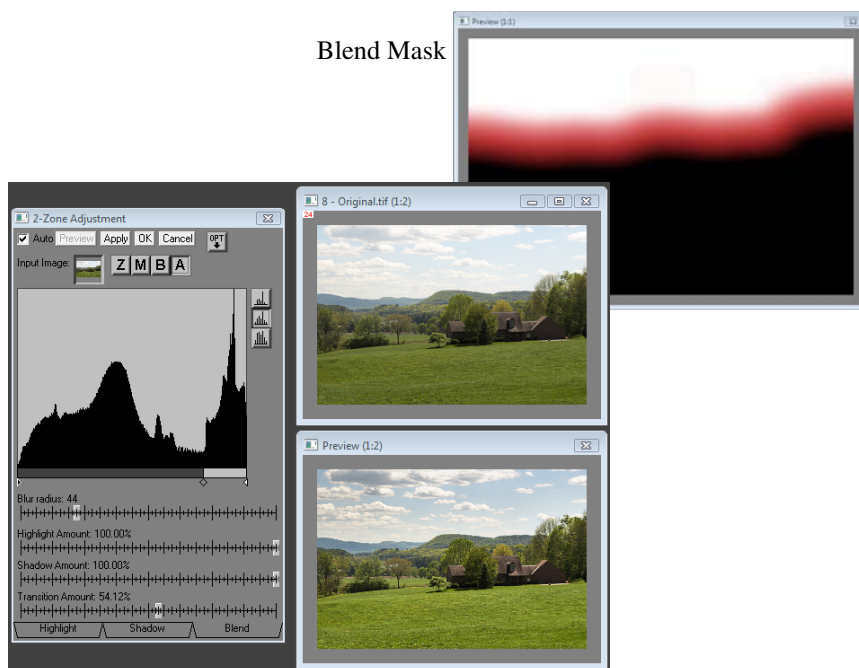
Blend Mask

To compare the final blended image with the input image, switch back and forth between the *B* (before) and *A* (after) buttons of the display mode tool bar which will toggle between the two versions.

When the *Blend* tab is selected, two sliders are displayed for adjusting the relative contributions of the highlight and shadow images. When set to 0%, these sliders let the original input image show

through in their respective zones. When set to 100%, they completely replace the input image in their zone with the adjusted image. Intermediate settings have a partial effect. Thus you can scale back the effect of any of the three zones as much as you wish at this stage if you find the effect too strong or to reduce halos.

The third *Transition Amount* slider blends the input image over the transition zone which is a blurred area between the highlight and shadow zones. Sometimes increasing the transition amount slider can reduce halos in the transition zone.

When the final result meets your approval, click *OK* or *Apply* to generate the result image and terminate the transformation.

2-Zone Adjustment - The Finer Points

Avoiding Halos

For some images, it can be tricky to make the desired adjustments without creating artifacts such as halos or solarization around the zone boundary (also called the transition zone). You have several tools at your disposal to try to minimize such artifacts.

1. Try adjusting the mask *Blur* slider. Generally the larger the blur setting the softer the edges of the mask. Either increasing or decreasing the blur radius may help with halos by widening or narrowing the transition zone.

2. Try adjusting the *Contrast* and/or *Brightness* sliders so there is less of a brightness discontinuity between the two zones.

3. Try increasing the *Transition Amount* slider. This blends the original input image into the boundary between the two zones.

4. Try adjusting the zone threshold marker between the two zones to make the boundary less obvious.

Hint: To see the mask for the current zone, click the *M* (mask) button in the display mode tool bar. This will display the mask as a red overlay over the input image so you can see what parts of the image will be altered by the adjustment sliders. To see all the masks at once, click the *Blend* tab and also set the display mode to mask.

Working with black and white images

Working with black and white images is exactly the same as working with color images with the sole exception that no *Saturation* sliders are displayed in the *Highlight* and *Shadow* tabs.

Postprocessing

To achieve additional clarity and make small details stand out after performing 2-Zone or 3-Zone adjustments, try using the *Sharpen* transformation on the result image with the *Bilateral Sharpen* option. Here is an example from a cropped section of a larger photograph:

Original

3-Zone
Adjustment   Sharpened

Memory Usage

Because of the serial nature of processing within the 2-Zone and *3-Zone Adjustment* transformations, internal storage is required for a number of additional masks and images, all of the same dimensions as the input image, in addition to the space taken up by the result image. All this temporary storage is released when you eventually exit the transformation. Thus if you are working with a very large input image these transformations will place considerably higher demands on your virtual memory than other transformations that simply use a single input and output image.