Getting the Correct Exposure for Nightscapes

Here's a great way to improve your Milky Way night scenes.

▲ **SHIFT THE HISTOGRAM** Milky Way nightscapes can benefit from the Expose to the Right (ETTR) technique — that is, exposing long enough so that the histogram plot of brightness levels is shifted to the right when shooting in the field. This blend of tracked sky and untracked ground images was taken at Alberta's Dinosaur Provincial Park with a full-frame Nikon Z6III camera and 20-mm lens.

Photographers shooting nightscapes for the first time ask the obvious question: "What's the best exposure to use?" Beginners soon encounter several exposure rules to guide them when capturing a starlit landscape. One technique I teach at every workshop I present is Expose to the Right, or ETTR. It's a concept I learned from the photo website **Luminous-Landscape.com** many years ago.

Here are some pointers to keep in mind for your next imaging session.

Don't Slam the Histogram

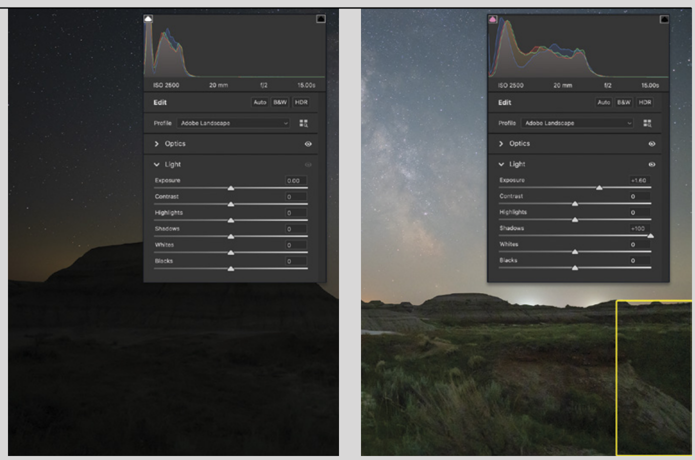
What ETTR means is to always expose so that the image's histogram is shifted over to the right. *Histograms* are graphs of how many pixels the image contains at every brightness level, typically labeled from 0 (pure black) at the left end to 255 (pure white) at the right; see *S&T:* Feb. 2025, p. 73.

However, today's 14-bit camera sensors can differentiate more than 16,000 tonal levels in RAW files (always shoot RAW!), in each of the three color channels — red, green, and blue. This sounds great, but most of those thousands of brightness steps sample the mid-tones and highlights. The dark regions, called the "shadows," are where most of the content of our nightscapes lies and are sampled by very few tonal values.

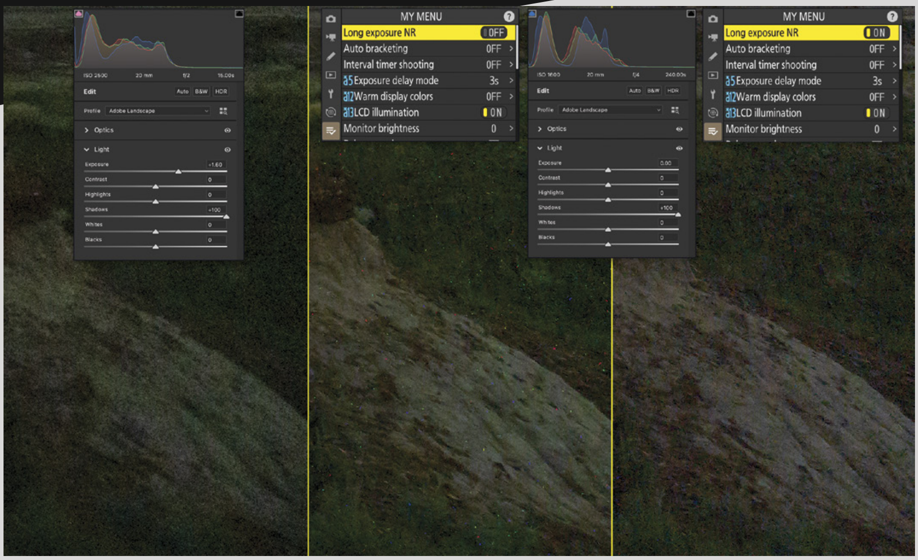
When reviewing images in the field, your camera's histogram display provides an objective indicator of the exposure. If you allow the histogram to appear like a steep cliff to the left, then the image is badly underexposed. Attempting to stretch or raise the shadows in processing often results in a litany of ugly artifacts, such as posterization, weak contrast, banding patterns, perhaps a green color cast, and most certainly noise!

By exposing to the right, you lift the image content out of the inky shadows into the mid-tones for more precise sampling, with the higher signal also overpowering noise and sensor artifacts. On the other hand, don't increase your exposure so much that the histogram slams to the right. That blows out highlights beyond recovery. A good nightscape histogram should be a mountain of pixels rising from a valley at the left and descending into another wider valley at right, achieved "in-camera" and thus requiring minimal exposure correction later in post-processing.

ETTR is considered best practice with any form of astrophotography. Where ETTR becomes essential is for the most demanding of nightscapes — wide-field images of the Milky Way over a landscape illuminated only by starlight. In such scenes it's not the sky above that's the challenge; it and the Milky Way can be quite bright. The dark landscape below is what's tough to capture. That's where you'll see the most noise and color casts, especially in the corners of the frame, which are made even darker by the inherent light falloff, or *vignetting*, of fast, wide-angle lenses.



▶ **UNDEREXPOSED VS. PROCESSED** *Left:* This dark, "out-of-camera" image is a 15-second shot following the 300 Rule for the 20-mm lens used to minimize star trailing. *Right:* Raising the Exposure level by 1.6 stops and the Shadows to 100% reveals noise shown in the corner close-up on the next page.



▲ **GOING LONG FOR LOWER NOISE** *Left:* Compare this blowup of the corner of the previous 15-second exposure at ISO 2500 and f/2 with the same corner of an ETTR image at right, taken at ISO 1600 and a smaller aperture of f/4 (for more depth of field), but for 4 minutes, requiring no boost in processing. *Middle:* This shot with the camera's Long Exposure Noise Reduction (LENR) feature off shows hot pixels. *Right:* Activating the LENR produces the lowest noise and best color and detail.

Revisiting the Exposure Triangle

But how can you increase exposure? Every Photography 101 tutorial presents the concept of the exposure triangle, explaining how the three camera adjustments of shutter speed, aperture, and ISO work together to establish the brightness of an image. Increase one factor and you can decrease one or both of the other two.

All that's true, but ISO is often erroneously explained as the "sensitivity" of the sensor. Not so. Raising the ISO doesn't make the sensor more sensitive to light nor allow it to record more signal. It just amplifies the weak signal coming from the few photons the sensor does record, making the scene look brighter, but now with the noise also made more visible.

Only two factors in the exposure triangle actually increase the incoming signal: lengthening the exposure time (that is, using a slower shutter speed) and widening the lens aperture (opening up to a lower, faster f/ratio). Only those two adjustments let in more photons and improve the signal-to-noise ratio.

Breaking Exposure Rules

For Milky Way nightscapes, we typically shoot at wide apertures of f/2 to f/2.8, contending with optical aberrations that distort stars at the corners of the frame when lenses are used "wide open."

With shutter speeds there's also a limitation. While cameras can take as long an exposure as we'd like, we're shooting a moving subject — the sky. Various rules dictate how long a shutter speed we can use before we see noticeable trailing of the stars. The venerable "500 Rule" stated that the maximum exposure time was 500 divided by the lens focal length. With today's sharp lenses and high-resolution camera sensors, a 200 or 300 Rule is more accurate (see *S&T:* Apr. 2025, p. 55).

In our quest for the sharpest stars, we dutifully obey the rules and use short shutter speeds. But this often results in severe underexposure — a slammed histogram. Brightening the RAW image after the fact by raising the Exposure slider in your image-editing software does make the scene brighter, but it reveals all those ugly artifacts lurking in the shadows, just like cranking up the ISO does.

To increase the actual signal, don't be afraid to exceed the shutter-speed limits imposed by strict "no star trail" rules. Any trailing you get might not be that noticeable, especially when viewed on Facebook or Instagram. But you can gain a full stop, or more, of starlight.

Separate the Ground and Sky

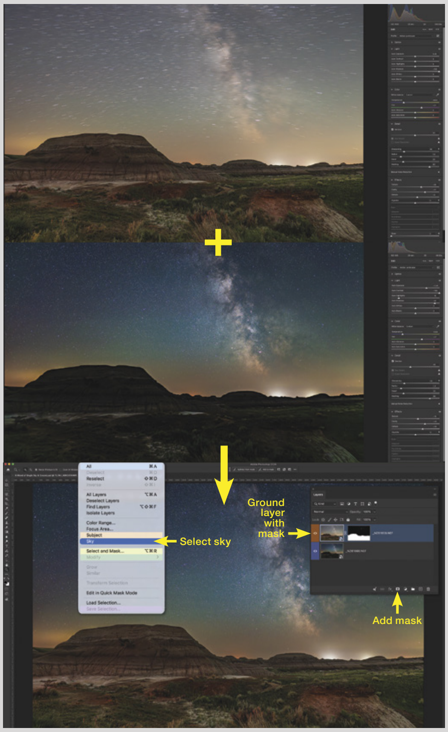
By far the best technique in the field, however, is to shoot separate exposures for the foreground and sky, using the shutter speed, aperture, and ISO that work best for each. Shoot the sky with 10- to 30-second exposures at high ISO and as wide an aperture as your lens will allow without showing objectionable aberrations. Then shoot the foreground at a lower ISO for less noise and at a smaller, slower aperture for enough depth of field to make foreground features appear in better focus. Decreasing both the ISO and aperture can lengthen your exposure time on dark, moonless nights to several minutes.

The drawback is the introduction of another form of noise — random, colored "hot pixels" from thermal noise buildup in the sensor. It's worse on hot summer nights with high-megapixel cameras. This noise can be eliminated by *dark frames*, which are exposures of the same length as the "light frame" but with no light hitting the sensor.

While darks can be taken at the end of the session and subtracted later, I've found the best way to eliminate hot pixels is to turn on Long Exposure Noise Reduction (LENR), an option available on all cameras. The camera takes a dark frame right after the light and subtracts it in-camera. Because the sensor is then as close to the same temperature for both shots as it can be, an LENR dark frame is the most accurate. Yes, LENR locks up the camera for another few minutes, but the result is a cleaner image, needing less work in post-processing.

Stacking vs. Tracking

A single, long-ETTR exposure of the foreground can be blended with a short, untracked exposure of the sky. (See the workflow on page 55 at upper left.) Alternatively, many nightscapers opt to beat noise by taking a lot of untracked images and then stacking them. Clever software such as *Starry Landscape Stacker* for macOS (**tinyurl.com/starry-landscape-stacker**) and *Sequator* for Windows (**sites.google.com/view/sequator**) can stack short, untracked exposures and align the moving stars



separately from the static ground.

While stacking short exposures does smooth noise, I find the result doesn't produce the depth, detail, and contrast of a single, long-ETTR foreground exposure taken at a lower ISO. And with *Starry Landscape Stacker*, I find the app's imperfect masking of the sky and ground can introduce horizon "ghosts."

The method I prefer for most Milky Way nightscapes is to use a star tracker for the sky. This allows exposures to extend to a minute or more for a good ETTR sky, revealing rich detail in the Milky Way with no star trails. I shoot the even-longer ETTR foreground image with the tracker motor off, usually before the tracked sky shot.

The drawbacks of a tracker are the more complex setup in the field and the extra work in processing, since the camera motion will misalign the sky with the foreground. Even so, I feel the better results are worth the effort. However, applying the ETTR edict can improve your photos, no matter what gear you use to take images of the night sky.

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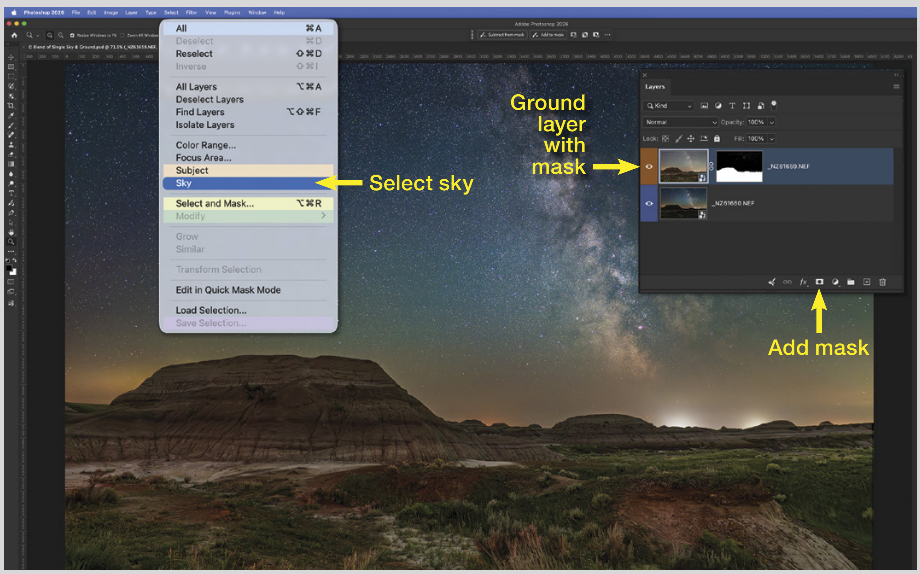

▲ **BLENDING THE GROUND AND SKY** In the final composite, the foreground is a 4-minute *untracked* ETTR exposure taken at f/4 *(top)*, while the sky is a 1-minute *tracked* exposure at f/2 *(middle)*. Bringing each developed RAW file into *Adobe Photoshop* as layers and using ***Select > Select Sky*** makes it easy to ***Add Layer Mask*** in the Layers panel to the ground layer *(bottom)*. Select the mask and ***Invert*** the selection to mask out its trailed sky and reveal the tracked sky below.