



FAQ: Shooting RAW vs. JPEG

by the Staff of Mountain High Workshops

We were recently asked by someone who signed up for our Mammoth Lakes workshop about shooting in RAW format (NEF, CR2, etc.) versus shooting in JPEG format.

QUESTION

Why shoot in RAW instead of JPEG format?

When you shoot with your digital camera set to save an image in JPEG format, the processor within the camera takes the information from the sensor and converts it to a color image, compresses it in a way that some data is discarded (lossy compression) and saves it to the camera's memory card.

When your camera is set to RAW format, the data from the image sensor is sent directly to the memory card without any processing. It is 'raw data' hence the term RAW. Each camera manufacturer has their own RAW image file extension. For example, Canon uses CR2, Nikon NEF, Sony SRF, etc.

What does this mean? First you need to realize that the sensor in your digital camera does not 'see' in color. Each individual sensing element on the sensor (ten million of them in a 10 Mega Pixel sensor) records brightness levels, from pure black to pure white. Some of the individual sensor elements have colored filters over them. Your camera's processor takes this raw data from each pixel sensor and does an interpolation to make a colored image. When you have your camera set to save the image in JPEG, by definition, you are saving an image where each pixel

element can have one of 256 different brightness levels. Shooting in RAW with 12-bits of data for each pixel element can record 4,096 brightness levels of brightness and if your camera uses a 14-bit RAW file, each pixel can record 16,384 brightness levels. So you can see that there is a whole lot more image information in a RAW file than there is in a scene captured in JPEG.

OK, but what does this really mean?

Let me put this another way. If you have a camera like a Canon 40D or a Nikon D80 that has a 10 MP image sensor and you shoot in RAW the camera will save the image in around 10 MB of file storage. If you are saving the image in JPEG format and you choose the highest level of compression, i.e. the smallest saved image file size, you will end up with an image that has about 2 MB worth of stored image data. If you choose the lowest level of JPEG compression, i.e. the largest JPEG image, you will end up with about 5 MP worth of image information in the file. So when you are shooting with your 10 MP sensor camera, and saving the image to the memory card in JPEG format, you are getting a lot less image data and you are throwing away 5 to 8 MB of image data with each shot. Now for taking snapshots, this is not a problem. **The reason you are interested in our Mountain High Workshop is that you no longer want to be a snapshot shooter. Most all serious landscape photographers shoot in RAW format.**

QUESTION

What camera settings apply to RAW and which to JPEG?

In general, settings that affect the operation of the camera will have an effect on the RAW and JPEG images, while settings that affect the appearance of the image after the shutter button is pressed will affect only the image saved in JPEG format.

Here is a list of some of the things that will affect the RAW and JPEG image:

ISO setting, f-stop setting (aperture), shutter speed, focus.

Here is a list of things that will affect only the JPEG and **not** the RAW image.

Color temperature, sharpening, color saturation (normal, vivid), contrast and 'black & white'.

QUESTION

What are the advantages of shooting in RAW and what are the disadvantages?

Disadvantages of shooting in RAW format:

1) Image size is larger, for example, 10 MB versus 2 to 5 MB in JPEG from a Nikon D60 or a Canon 40D. This takes up more room in your CF or SD memory card and on your computer's hard disk. It also takes longer and requires more DVD capacity to burn your images to disk. Larger images take longer to load and save in an image processing program.

2) Most image software cannot display your camera's RAW image. You will need software that has the ability to take the RAW data from your camera's image sensor and convert it to a digital image that can be displayed. Your computer's operating system will need a small program, called a 'Codec', that is developed by each digital camera maker so that their own unique RAW camera information can be understood by the computer operating system. For example, if you use Windows XP or Vista, your included image software, like the Photo Gallery and the Windows Explorer, cannot display a thumbnail or an image from a RAW file taken with a Pentax, Sony, Nikon, Canon or other make of camera unless you have downloaded the Codec for your camera from the manufacturer's web site. Once you have done that and installed the Codec, Win XP or Vista can understand what a SRF, a CR2 or a NEF file is and can display the image or thumbnail.

3) Since every RAW format is unique to a make and model of camera, there is some concern about long-term viability of the RAW image file. In other words, in 20 years, will the latest version of Photoshop or your computer's OS be able to display a RAW image created in your ancient digital camera? The answer is maybe, but probably not. So Adobe, the maker of Photoshop, Illustrator and Lightroom image processing software, has created a RAW image storage 'standard' called DNG, for Digital NeGative format. Adobe has stated that they will support the DNG format for as long as they are in business. So if you are concerned about archiving your digital RAW image file and having them readable in the future, it is a simple matter to convert them to DNG format from within an Adobe program like CS3/CS4 Bridge or Photoshop Elements Version 7 or with a free conversion utility available from Adobe.

4) Since there is no processing or correction to your RAW image file, the colors will seem a bit washed-out looking and lower in contrast. The images will also appear to be not as sharp as in a JPEG image. All of these conditions exist for the data from your camera's sensor, but when your camera's processor is set for JPEG mode, the processor corrects for this, with the settings you want applied via the setup menu or some set of default values (sharpness, color saturation, etc.). When shooting in RAW, you must do these tasks yourself in a separate step on your computer. If you are going to shoot a thousand images in one day, that's a lot of images to process outside the camera. You might consider shooting in both RAW and JPEG or just JPEG format. It all comes down to what is your goal in taking the image in the first place. If you are taking images to try to sell large prints or for display in a salon or if you post only your very best work to your web page, Flickr photostream or Pbase account, then you should shoot in RAW, even if you take 2000 images in a day. If you have a Photoshop product, you can do a batch processing of your raw images and give them all the same sharpness corrections and apply a color enhancement etc. and turn them into JPEGs just like your camera's process can do. You still have the original un-modified RAW image data files so for individual images, you can go back and tweak them.

5) In most cameras, the RAW file is not suitable for printing directly from the camera.

Advantages of shooting in RAW format--

- 1) Your image, the one you spent so much time traveling to get and composing, will have a lot more information content. This will give you better image quality and provide more image detail.
- 2) Using a RAW image processing program, like Nikon's Capture NX2, Canon's Digital Photo Professional V2, Adobe Camera Raw, Adobe Lightroom 2.0, or other RAW image processing programs, allows you to make a whole range of image changes that are not available to you if you shoot in JPEG format. When you shoot an image in JPEG format, you are relying on a tiny and very limited image processor and software within your camera to process the RAW image data. When you shoot in RAW format, you have a much more powerful processor in your computer and much more sophisticated and flexible software to do that task.
- 3) When you use software to process your RAW image, you do not actually change the RAW image. All changes are saved to a small file, called a 'sidecar file' named like this: **DSC_2009-4-0002.xmp**. This has a very great advantage in that your original image always stays unchanged and you can go back to it and find it in its original state.
- 4) A RAW file will contain data that can produce an image with a much higher dynamic range of exposure. This means that you can have your image with more detail in the highlights and shadows.
- 5) Remember, when you shoot in JPEG mode, even at the biggest or highest density JPEG option available, your camera's processor converts the raw data from the sensor and produces a JPEG file that it saves to your memory card. The raw data is then deleted from the processor's buffer and is lost forever. You only have the data contained within the JPEG image. You can never get that RAW image data back.

When should one shoot in both RAW and JPEG format?

Shooting in both RAW+JPEG mode gives you the ability to preview the images quickly (both because the files are smaller and no conversion from RAW format is necessary). Doing this is also convenient if you are wanting to share images in the field with someone who's computer software does not support your camera's RAW format. For example, at our workshop, if you had a camera who's RAW format is not supported by the image viewing software on your instructor's laptop computer, then you would not be able to have your image evaluated in the field. If you saved in both RAW and JPEG format, then your instructor could see and evaluate your image as a JPEG. You might also want to shoot in RAW and JPEG formats so you could send the images to others without having to do any other processing.

One last note on RAW shooting. If you purchase a new camera, you might want to shoot in both RAW and JPEG formats for a few months. This is because the post-processing software companies are behind the camera manufacturers in making RAW image converters for their software. What's worse is that some new camera RAW formats are not supported in older

image processing software. For example, Adobe's Photoshop CS3 will not open a RAW file from Canon's new 5D Mark II. You will have to use Canon's software to convert to a TIFF file or upgrade to Photoshop CS4. The same will be true for Nikon, Pentax and Sony's newest high-end digital cameras with the 24 MP sensors.

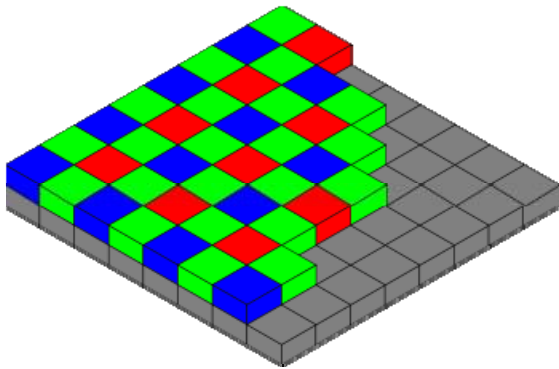
QUESTION

What color space should I be using for my serious land and seascape images?

First, since we hope you are convinced to shoot your serious land and seascapes in RAW format, the camera processor does not convert the raw data into a color image. The data sent from sensor to memory card is raw, meaning that there was no processing applied to it by the camera's internal processor. It consists of brightness data for each sensor element on the image sensor. So no color space is used or needed.

But let's take a minute to talk about color space anyway because it is very important downstream in your processing.

The sensor in your camera has a pattern of individual sensor elements. They are covered with red, green and blue filters. There are usually twice as many green sensor elements as there are blue and red. Our eyes are more sensitive to green so there are more green-filtered sensor elements.



The color information for the image you have captured comes from an interpolation algorithm that is applied by your camera's processor when you save in JPEG format or from external software (like Adobe Camera Raw or a program from your camera's manufacturer) when you save in RAW format.

The process you choose to convert the RAW data to a colored image (inside your camera or on your computer) requires a 'color space'. We don't have space go into this deeply here but 'color space' is a standard used by computer devices that display or print colored digital images. The color space you use is normally dictated by the end use of your images.

Here is what the experts at Adobe say.

"When you shoot JPEG, you typically have a choice between capturing images in either sRGB or Adobe RGB (1998). Yet the vast majority of today's cameras can capture colors that lie outside the gamut of either of these spaces, especially in the case of saturated yellows and cyans, and those colors get clipped when you convert to sRGB or Adobe RGB.

Raw converters vary in their ability to render images into different color spaces, but Adobe Camera Raw offers four possible destinations. One of these, ProPhoto RGB, encompasses all colors we can capture, and the vast majority of colors we can see."

So the setting in your camera's setup menu for color space only applies when you shoot in JPEG format. The color mode you choose is according to what device you will use to view or print your images. The older sRGB color-space is closer to most ink jet, pigment, and lab printers. For posting images on web sites such as flickr.com, the sRGB color space is best. Some photo agencies require one standard or the other. For the very best color you will want to use the ProPhoto RGB color space in Adobe Camera Raw and send your image for printing as a TIFF file.

If you join us in our upcoming workshop in Mammoth Lakes, June 3-7, 2009, you will learn a lot more on how to make the most of your investment in photographic equipment.

More information here:

www.mountainhighworkshop.com