Chapter 1

WHAT ARE RAW FILES REALLY ABOUT?

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As a photographer, you need to understand something of what Raw is and is not in order to use Camera Raw file conversion software to its best. Raw is an important file format that offers a great deal of flexibility, but it is no magic bullet that can correct any problem with the original photography. The photo must be shot right from the start in order to get images like figure 1-1.

In addition, the debate of JPEG versus Raw often degenerates into one format being arbitrarily better than the other. Neither is automatically the best choice for a photographer. Raw offers much control, but also demands more in workflow. It is a terrific format for the thoughtful photographer and the careful worker who demands much from photography, but it has to be treated with a certain understanding of what it can and cannot do.

A Raw Start

This is a tremendous time to be photographing. Cameras are better than ever and the whole digital transition has brought a new excitement to the craft. While film still has its uses, digital capture of images offers so many great advantages to the photographer that film is rapidly becoming a specialized way of shooting in everything from nature to people photography like figure 1-2.

One terrific innovation that came with digital photography is the Raw format, although technically, it is really the Raw formats. Every camera manufacturer has its own Raw format unique to its products. There are variations as the companies have made modifications, plus there can be unique formulations of the format for advanced compact cameras compared to digital SLRs. Confusing, true, but it only has to be if you want to know all the formats. Really, all you need to know is the one specific to your camera.

Adobe's DNG (digital negative) format has some potential to be a universal Raw format, though only time will tell about that.

NOTE

Raw is not an acronym, but simply the name for the format type. You will see it as RAW and Raw. This book uses Raw as a convention.

How to Deal with Raw

This book also covers Raw as if it were one format. That's easy to do in a book specifically about Adobe's Camera Raw plug-in built into Photoshop CS and the program that comes with CS2 because Camera Raw treats all Raw formats equally well. It also deals with them seamlessly, without any need to think about format variations.

Raw is a unique format of image data that is unusable until opened and converted by a converter such as Camera Raw. Figure 1-3 shows a Raw file opened by Camera Raw (top) and the bottom image shows the file now converted. A Raw file holds a dense amount of information that you can mold and adjust in order to gain a high-quality image of your subject. You can also use other conversion programs, including those from the manufacturer, to achieve high-quality results, but other conversions require a more involved workflow because they do not have the integration with Photoshop that Camera Raw has.

A lot of confusing and misleading information on Raw has appeared in print and on the Internet — as well as much good and useful information. But misinformation, and even myths, about Raw can lead to unnecessary work in the computer in Camera Raw and could even yield results that might not truly enhance the image appropriate to your vision of the subject.

This book shows you how to use Camera Raw effectively and efficiently. You learn how Camera Raw works by seeing how it affects photographs and photography. I have a passion for helping photographers use new digital technologies to the photographer's benefit. I have no interest in working with computers unless they do something for the photographer, so every technical, computer-oriented aspect of Camera Raw stays grounded in terms the photographer understands.

The JPEG versus Raw Debate

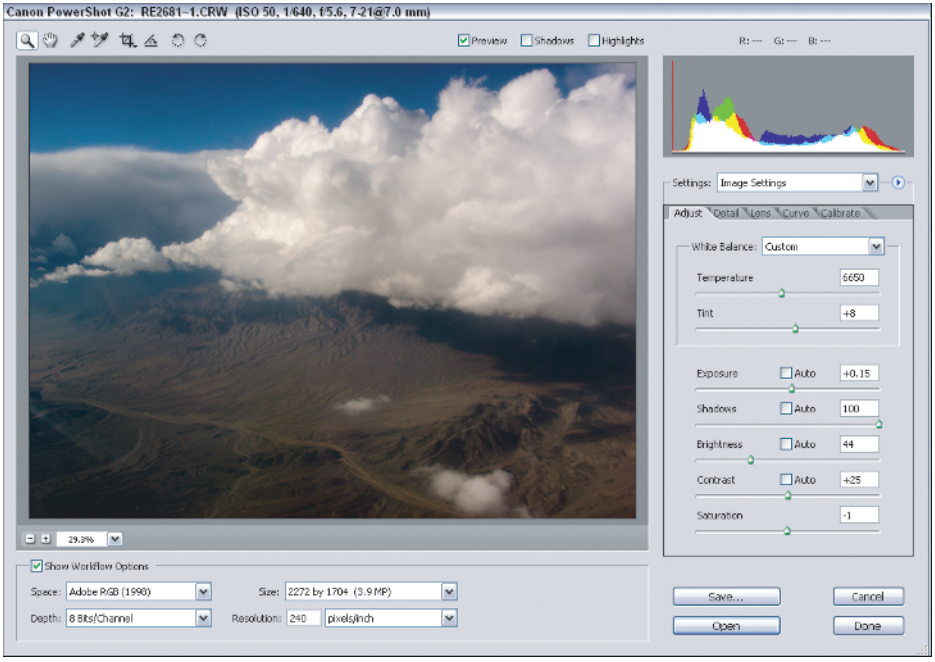
Digital offers so many new things that the choices are confusing at times. And sometimes the choices are not perfectly clear, such as Raw and JPEG. In this book, you see why Raw is an important tool for photographers, and you get a lot of ideas on getting the most from it. My goal is to make Raw really work for the photographer by better use of Camera Raw.

Unfortunately, tech folks often push Raw without consideration as to how photographers like to work. Photographers sometimes use Raw even when it does not meet their needs but they feel guilty if they shoot JPEG. Well-meaning experts often promote one approach to digital, because that is how they do it, but unfortunately, they don't adequately explore alternatives as really used by photographers. Figure 1-4 shows a whole set of image files, both Raw and JPEG, and each file type has its advantages.

I've written a bit about JPEG and internal processing in cameras in a number of publications because there are photographers who are well suited to shooting that way. You need to understand a bit about using JPEG as well, because shooting 100 percent Raw is not effective nor

PRO TIP

Many photographers now shoot Raw and JPEG to take advantage of the best of both — a great way to go (especially because memory cards now offer a lot of megabytes with less cost). This gives you the benefits of both formats — increased flexibility from Raw whenever you need it and the ability to work quickly with JPEG files when that is appropriate.


Canon PowerShot G2: RE2681-1.CRW (ISO 50, 1/640, f/5.6, 7-21@7.0 mm)
Preview
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Adjust Detail Lens Curve Calibrate
White Balance: Custom
Temperature 6650
Tint +8
Exposure Auto +0.15
Shadows Auto 100
Brightness Auto 44
Contrast Auto +25
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Resolution: 240 pixels/inch
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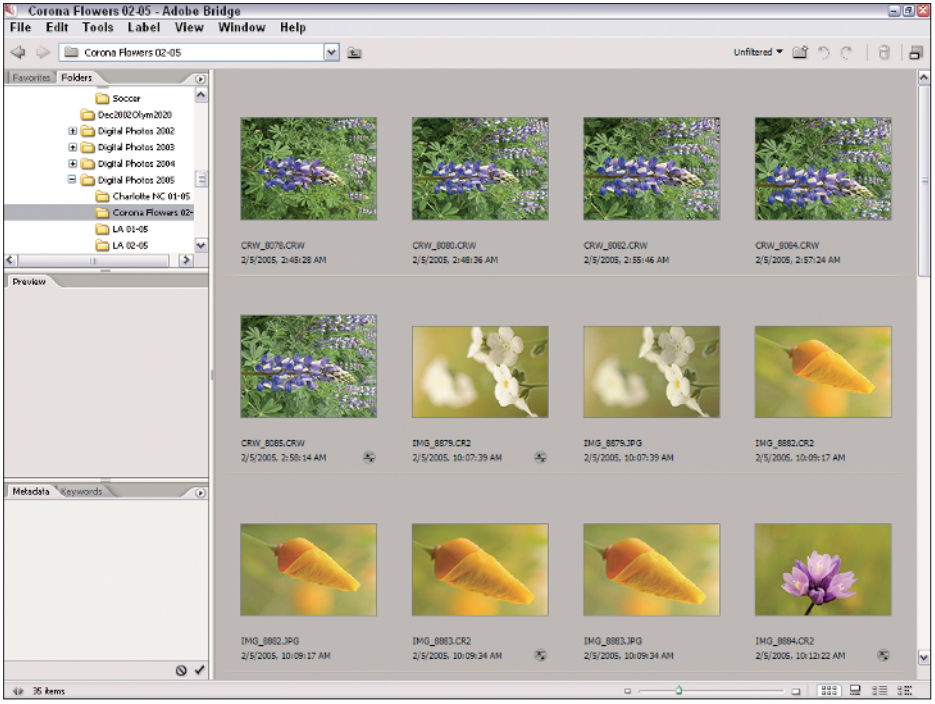


1-4

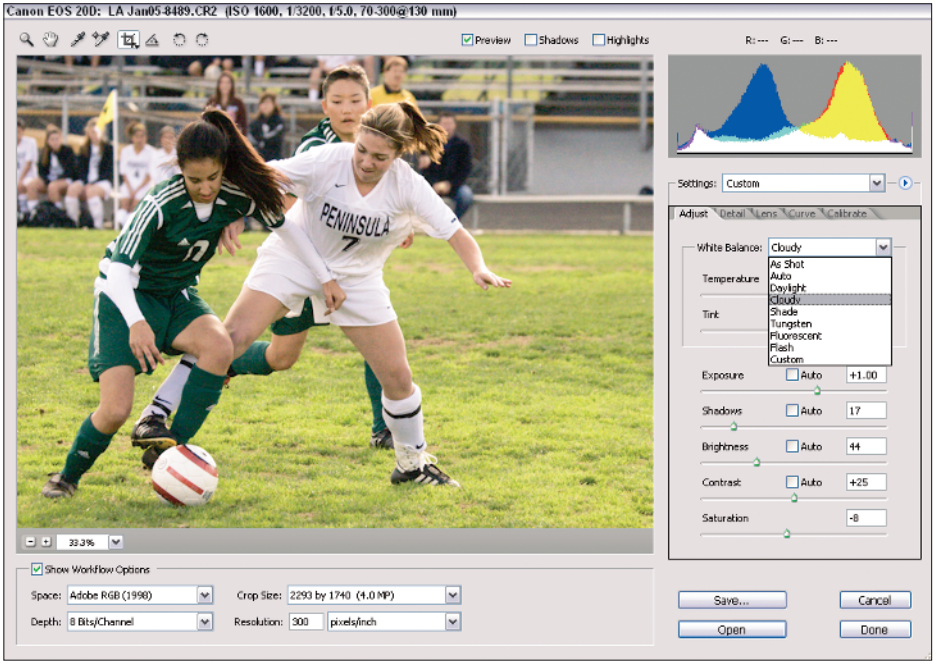
efficient for every photographer or in every situation. In spite of hype within the computer industry and from some Photoshop gurus, JPEG can be a high-quality format — it just is not as flexible and adaptable as Raw. In addition, for certain types of photography, JPEG has some advantages for any photographer.

Why Use Raw?

Raw is an extremely valuable tool for the digital photographer, but not because of the math. Too many well-meaning computer types tell you it holds 16-bit compared to the 8-bit data of JPEG. Even if you don't know what that means, it sure sounds impressive. But photography is not about math unless you are a camera designer. Photography should be about the images. Yes, the higher bit depth in a Raw file can help, but that shouldn't be the only reason for using a Raw file. There are some reasons that figure 1-5 does well coming from a Raw file, as you'll discover in this book, but if the photograph isn't adequate, no amount of Raw math will help it.

Raw is remarkable and important for its broad photographic capabilities. There are four key photographic reasons for photographers to use it:

- You gain some serious processing power for the image file.
- You need the increased flexibility that Raw offers.
- You have had problems due to the limitations that can come when shooting JPEG.
- You like working through an image to get the most from it.



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Once you do decide to work with Raw, it is very important to understand Raw requires a certain workflow to get the most out of it, a workflow you learn in this book.

Understanding Raw

To use Raw to its best advantage, it helps to know a little about it. Raw cannot fix every lighting or exposure flaw in an image. Unfortunately, a mythology around Raw implies it can do this.

"Don't worry about exposure or color, you can fix it when you shoot and process in Raw!" That way of thinking is seductive, yet very dangerous. An image like that in figure 1-6 is a problem, no matter if shot in Raw or not.

Raw is:

- A type of image file with minimal change to the data coming from the sensor.
- Not unprocessed data as you may have read. The sensor creates analog information that must be processed into digital data.
- Image data that is converted from analog information with the A/D (analog/digital) converter and is a complex engineering challenge that luckily camera manufacturers have mastered for you.
- Affected by exposure as it is increased or decreased to the sensor's limits; the A/D converter will have problems dealing with those conditions.

Raw Capabilities

A Raw file holds more tonal and color information than JPEG — 16-bit versus 8-bit — and offers a great deal of flexibility in how you can work the tones and color in an image. With Raw, you can frequently extract tones and details from the brightest and darkest areas of an image that have no detail in a JPEG file. This can be quite remarkable because it can at times allow you to show information in your photo that more closely resembles the real-world subject you want to preserve compared to what you find in a JPEG file or even from slide film. Figures 1-7 and 1-8 are two examples where the higher bit-depth of Raw helps. The light tonalities in the image can be difficult to manage if shot with JPEG.

Print film is a little different. Some people compared it to Raw, but there are significant differences between them. Both offer a great range of tones from black to white, but they handle the tones somewhat differently. That is neither

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1-8

good nor bad; it is just different. Because this is a book about Camera Raw, you may wonder why this is mentioned at all. The reason: Some photographers, especially wedding photographers who have much to gain from Raw capabilities, traditionally shot print film and expected Raw (especially when it is compared directly to a film negative) to give them the same results. The two media require different approaches, so these photographers get frustrated and disparage Raw. It is not Raw's fault, but misplaced expectations. With proper use, shooting Raw can be easy and fun even for the traditional print-film shooter.

In addition, image tonal qualities can be maintained through greater adjustments done in Raw. You can creatively push and pull the tones of a photo to make it better do what you want when you use Raw. This format also allows you to enlarge digital images to a larger size with higher quality than if you enlarge them later in Photoshop or using most other enlarging software. This allows the printing of very large prints from even small digital files that maintain superb quality.

Do Not Shortchange Raw

The misconception that Raw is so adaptable that there is no need to worry about exposure or color shortchanges with Raw creates more work to do in the computer (which can be frustrating), and can result in less than the best tonalities and color. Consider these three things:

- Raw still comes from a sensor that has a finite range from black to white — if your exposure is outside of that range, nothing can bring it back, not even Raw.
- Because Raw comes from a digital translation of analog information given by the sensor (the A/D

converter mentioned previously), the old adage of garbage in, garbage out is definitely appropriate here.

- Raw does its best when it has good information coming from the sensor right from the start.

That's the key to any good picture, not just Raw: Shoot it right in the first place. If you have doubts, try another exposure. Following is a look at a few problems that come from poor photographic technique when shooting Raw.

These techniques are all covered in depth in the following chapters.

- **Underexposure:** This is the worst problem. If you underexpose a Raw file so that the tonal information is mostly in the dark areas, you do not have the best tonal or color information to work with (see figure 1-9). When you brighten those areas, you also bring out noise. Even the best of digital cameras shows annoying noise when an image is underexposed.
- **Overexposure:** Excess exposure causes tonal and color problems in later adjustments, again because of weaker colors and less tonal information. Added noise is not the problem here, but you get blocked-up, detail-less highlights that are a pain to deal with, as shown in figure 1-10.
- **White balance:** Shooting on auto white balance does not cause quality problems when shooting Raw, but it can create workflow issues later. If you set a specific white balance on your camera when using Raw, no pixels are harmed. But a tag of information about that setting goes with the file so that when it opens, it opens in the Raw converter with that white balance. You now have a specific point of reference to adjust from rather than the arbitrary and sometimes capricious white balance chosen by the camera as shown in figure 1-11.

Underexposed

1-9

Overexposed

1-10

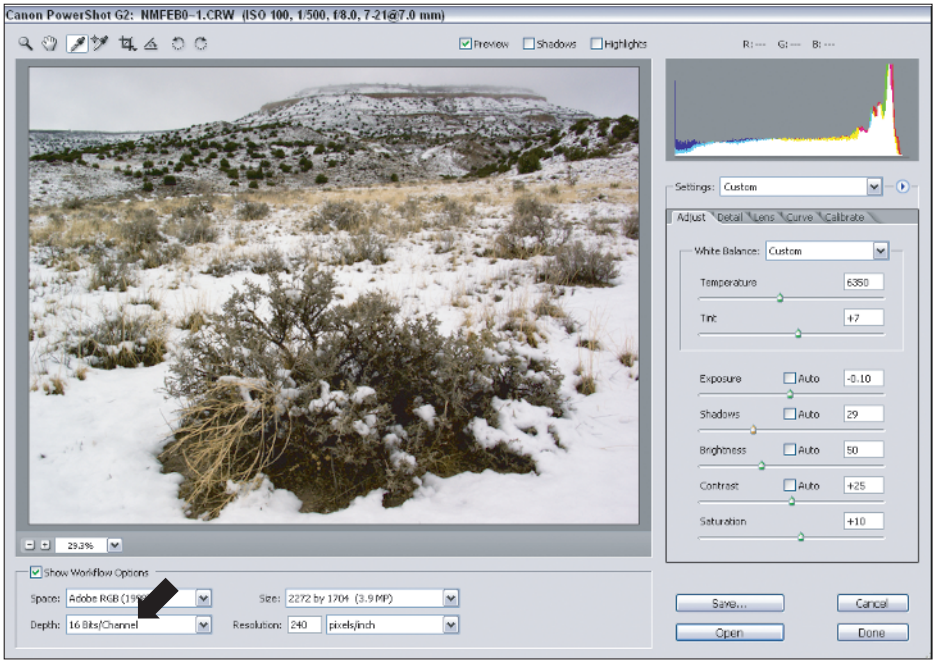
Wrong white balance

1-11

What is 16-Bit All About?

Image files work with data based on how many levels of gray tones exist between black and white for each of the three colors of digital: red, green, and blue (RGB). For a very long time, 8-bit data was the standard. It offers 256 distinct tones per color, for a total of over 16 million color values. This is a lot, obviously, and anyone who tells you that you can't get a quality image from 8-bit color is working by computer-ese and not photography. Photoshop is based on it, and digital camera files in JPEG use it. The use of 8-bit color does match how you see tonal and color information and can be perfectly capable of excellent results.

Problems with 8-bit occur if you have to stretch it a bit in processing as in figure 1-12. There is very little stretch room because as you stretch data, you lose steps of color and tonal information, resulting in problems with gradations of brightness and colors. If your exposure is off or



1-12

there are contrast issues in the image, you quickly run out of tonalities with which to adjust. In addition, the color of 16-bit expands the working range of colors and tones exponentially. You can do a lot of heavy-duty adjusting without the image suffering.

Technically, however, most digital cameras are only capable of capturing 12-bit color, which is still more than 8-bit. This 12-bit data is put into a 16-bit bucket, so to speak. At 12-bit, you get 4096 distinct tones per channel for a total of over 68 billion color values. That's 4,000 times 8-bit. That seems like a lot.

But remember, this is not expanding the capture range of the camera. For example, pure white and pure black still correspond to the limits of the sensor. What 16-bit (or the actual 12-bit of captured data) does is to give more steps in the working range, which increases the number of divisions between white and black, light and dark and provides a huge amount of flexibility and control over the tonality of the image. Frankly, you do not always need all those steps. Think of a staircase. The top and bottom stay put, but increasing the bit depth increases the number of steps between the top and bottom. This can be critical if you try to push a heavy object up the stairs, but it makes no difference if you run up the stairs skipping steps anyway.

Those extra steps really do matter when you want to find more detail in certain parts of the range. You can stretch that portion without damage to the overall tonality of the image. In addition, those extra steps allow you to make major changes anywhere along the range of tones without causing problems to the tonalities and colors that are left (because there will be a lot of them left). Figure 1-13 is a converted but unprocessed Raw image to give you an idea of an image with lots of dark tones and a group of light tones, but much less in the midtone range. This is an ideal subject for Raw.

PRO TIP

Remember that your camera meter wants to create an image with middle gray tones. It makes a bright scene darker and a dark scene lighter. Metering something with middle gray tones in a scene can give you a good starting point for exposure. If you use auto exposure, also use the plus and minus exposure compensation control — plus for bright scenes, minus for dark scenes.

1-13

Is Raw the Pro Format?

Some photographers think that Raw is the format for professionals and JPEG is for amateurs. This can get you into trouble as it gives the wrong impression of what Raw does for you. Both formats are capable of the highest quality images.

Raw is a tremendous tool when you need it, but it is not for everyone, pro or amateur. If you arbitrarily use Raw at all times, and it doesn't always fit your needs, personality, or style, you may begin to find you have less enjoyment from working digitally. I don't shoot Raw all the time, and I have had many JPEG-shot photos published. Earlier in the digital changeover in photography, I shot mostly JPEG because the memory and processing overhead for Raw was a pain to deal with.

Raw no longer has that overhead problem. I like the rich capabilities of Raw, and now that large memory cards have come down in price, I use it extensively because it is such a valuable tool. Cameras that shoot Raw and JPEG at the same time are very useful but require larger memory cards as seen in figure 1-14. Raw is very important for digital photography, but it should never be used as an odd way of separating good photographers from bad. That comes from what's in the Raw or JPEG file, not from the file itself. Don't let any photo guru bully you into using either Raw or JPEG when they are not appropriate to your needs.

1-14

PRO TIP

If you use JPEG, use only the highest quality settings. In addition, remember that this is a capture format and should not be used as a working format in the computer. Once you open and work on a JPEG-captured image, save it as a TIFF or Photoshop PSD file.

My goal in this book is to make Raw and Camera Raw work for you, to encourage you to have fun with photography through your use of this technology, and really enjoy digital photography. If you don't enjoy processing all of your photos in Raw, but feel guilty if you sometimes shoot JPEG, then that's sad to me. It means someone has made photography less fun for you. A push for Raw over anything else, regardless of the needs of the photographer, doesn't help anyone.

When should you shoot Raw or JPEG? Make that your own choice. Know that you can get top quality from both — figure 1-15 came from a JPEG file. Raw gives you a great deal of flexibility and control in processing your images to get the most from your subject, but it requires more work, more storage space, and slows down a camera. JPEG offers far less flexibility and control, but it is fast, requires less work, and needs less storage space.

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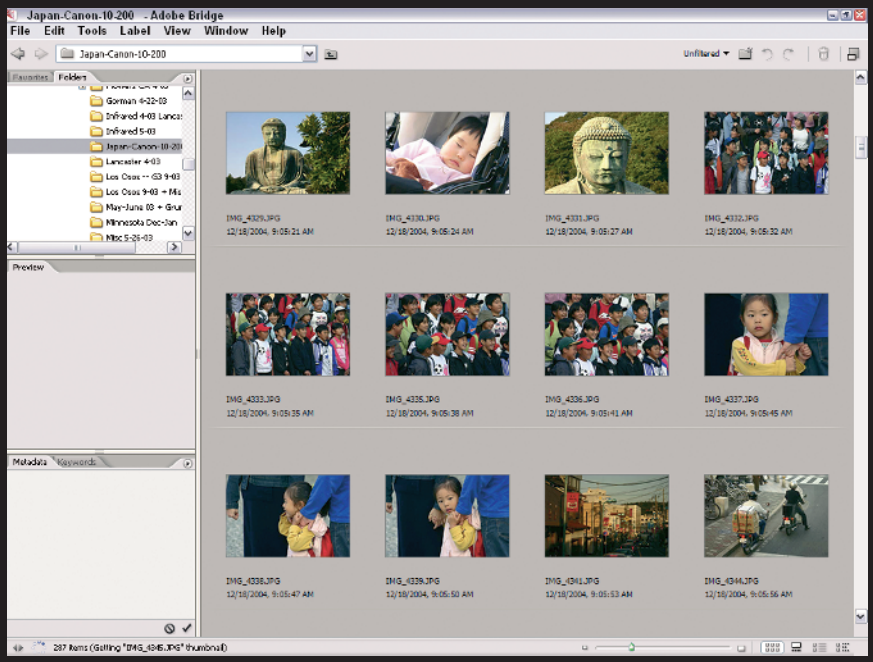
When JPEG Works

JPEG shot at the highest quality in modern digital cameras may look superior to Raw files when both are opened directly without much processing. The JPEG files often have a better tonal range (especially in the highlights) and deal with noise better. There is a good reason for this. All cameras today have advanced algorithms to convert the 12-bit data from the sensor to the 8-bit data that can be held in a JPEG file. Canon, for example, is well known for its quite remarkable DIGIC chip (in-camera processing circuitry), but all camera manufacturers include some amazing processing capabilities for the conversion of sensor data for JPEG files.

I know from talking to Canon that its DIGIC chip was designed to deal with highlights very, very well, and help minimize noise. The very powerful processing capabilities built into the camera (which essentially is processing the Raw file for you) can offer great results when shooting high-quality JPEG. It does require paying attention to how you work — exposure has to be done right, white balance chosen correctly, and so forth, as shown in this figure.



It is like having a little Raw expert doing conversions for you in the camera. That said, realize that this conversion is done automatically with no control by the photographer. Engineers working to maximize camera appeal and sales create algorithms that make good looking JPEG files, but if you want to have this control, then you must shoot Raw and make the conversions yourself. As you will see from this book, there are many benefits to doing exactly that, and you will be able to get files impossible to achieve from JPEG.

Proprietary Formats

One of the big challenges for everyone shooting and processing Raw is that camera manufacturers have refused, so far, to create a common Raw format that everyone can use. Here are some of the extensions associated with varied Raw formats to give you an idea of how many there are (versions unique to certain camera types actually extend this list): Nikon (NEF), Canon (CRW, CR2), Kodak (DCR), Olympus (ORF), Minolta (MRW), Sony (SRF), Pentax (PEF), Fuji (RAF), and Leaf Valeo (MOS).

I have used multiple camera types from several manufacturers to take photos and find their Raw formats all equally good. Hard-core advocates of different brands, and especially their marketing folks, will tell you this isn't true and that there are significant differences worth really worrying about.

Not really. Yes, there are differences, but image quality is high among all of these competing variations of Raw. I challenge anyone to show me or anyone else a photograph that one could see differences that significantly affect the photographer's results. You cannot. Image differences among Raw images are far more affected by the sensors used by the cameras, A/D converters, lens quality, light, composition, and so forth. Different formats affect workflow, however, and some offer unique features that can be accessed only in a manufacturer's Raw conversion software.

Those features may or may not be worth it to you. They typically do little to affect actual image quality and more affect how you work on an image. On the other hand, the convenience of working with Camera Raw directly in Photoshop is huge. In addition, Camera Raw has been tweaked and refined to give you superb control over the photo.

NOTE

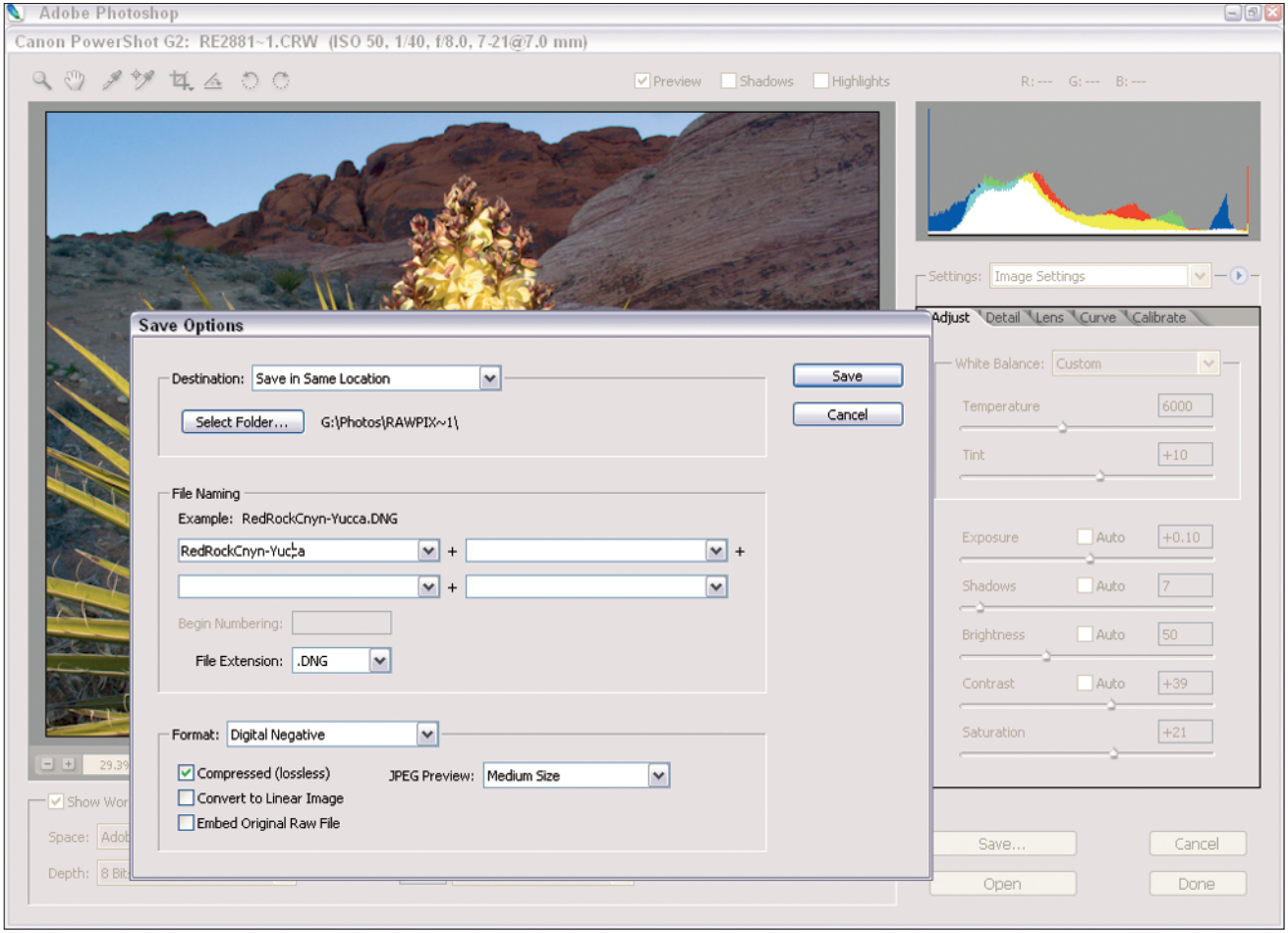
Those pesky proprietary formats are a problem for Adobe. None of the camera manufacturers actually shares details of how the format is put together. It so happens that the computer engineers at Adobe are very bright and have figured out how to deal with all Raw formats by literally taking them apart and examining how they are constructed. The problem with this approach, unfortunately, is that when a manufacturer comes out with a new or revised format, you are unable to use Camera Raw until the Adobe engineers deconstruct the new format and get it recognized by the software.

DNG

Manufacturers do not really care about Adobe's challenges. However, having multiple and changing Raw formats presents a challenge to the consumer. First, you may have two cameras with two different Raw formats, even from the same manufacturer (especially if your cameras are very different in age). That can be a pain to deal with. Second, it is entirely possible that older Raw formats will be discontinued over time making them difficult to use in the future.

For these reasons, Adobe introduced the DNG or Digital Negative format. Adobe's engineers thought a lot about creating a consistent Raw format that can be used by all camera manufacturers and can be archived by photographers without fear that they cannot access it in the future as seen in the Save As dialog box in Camera Raw shown in figure 1-16. They even included flexibility in this format to allow camera manufacturers to add their own unique tweaks to it as well.

As of the writing of this book, camera manufacturers are not showing much interest in this format. In spite of



1-16

DNG's potential to reduce confusion and make it easier for the average photographer to work with Raw now and in the future, manufacturers show more interest in protecting their proprietary algorithms than in working together to help the photographer. Hopefully, this will change and there will be a consistent Raw format such as DNG that everyone can use.

For now, DNG is available for use in Photoshop CS2. Many photographers use it as an archiving format for Raw files because Adobe has said it is committed to preserving this format for use into the future for just that reason. You can save any Raw format file to a DNG file in Camera Raw in Photoshop CS2, or if you have Photoshop CS or 7, you can download a program from Adobe's Web site that can convert any Raw file to DNG.

Q&A

When should I use Raw?

You can use Raw for any photography, but it should be used for how it can make a good photographer better, not as a substitute for craft. It is extremely valuable for the photographer who really likes to work his or her image, prodding tones and colors to get the most from the image file. Raw offers the greatest amount of tones and colors possible from your digital camera.

But it can also waste time and memory space if you shoot quickly and expect to make minimal changes to your images later. It can be a problem to use when you want to work fast, such as sports photography. Many cameras shoot faster and longer before having to stop to empty their buffers when shooting JPEG.

Raw is especially valuable when shooting scenes with a lot of important highlight or shadow detail. Its 16-bit capabilities allow much more adjustment of such tonalities than the 8-bit capacity of JPEG. This format is also very valuable when shooting under changing conditions where you cannot precisely control exposure or white balance. Its versatility and adaptability mean even problem images can often be brought under control.

Can any photographer use the DNG format?

Absolutely. It just is not being used by any of the major camera manufacturers, yet. What many photographers are doing is using this format as an archival Raw format. Some camera manufacturers have already changed their Raw formats in the relatively short history of digital cameras. Who knows if these variations of Raw will be supported in the future?

Because DNG is a broad-based format that any photographer can use at any time and can be made from any Raw format image, and because it is supported by Adobe, who does not make digital cameras, there is strong likelihood that this format will be around for a very long time. Adobe promises to always support it. This makes it ideal to use for important images that you want to archive in a Raw format. You can convert any Raw file into the DNG format in free software available from Adobe (www.adobe.com) or in the Camera Raw converter.

What if I shoot in JPEG? Can it be changed to Raw?

In most cases, no. You have to set the camera to Raw (or Raw + JPEG) in order to have an image recorded in Raw. You cannot convert a JPEG file to a Raw file once the image is recorded, either.

However, Canon did something very unique with its advanced PowerShot cameras that would be well worth having on all digital cameras. In situations where JPEG works well and keeps the camera working faster, it is worth photographing simply in JPEG. But if you take a shot that begs to be recorded as Raw, for example, an image with a wide tonal range or lots of detail in bright areas, wouldn't it be great to instantly record in Raw? In these Canon cameras, you can do just that. As soon as the shot appears in the LCD for review, you simply press a button and you can record the image as a Raw file (on some cameras, you push the Function button; on others, the Flash button — check the manual).