CHAPTER 1

INTRODUCING INFRARED LIGHT

Infrared (IR) light surrounds you — you just can't see it. However, when you use a special filter on your digital camera, it is capable of recording IR light. The camera can capture this invisible light to transform ordinary landscapes into something magical and ethereal. Compare what you see in normal light in 1-1 to what the camera sees in IR in 1-2. You can see how incredibly beautiful the world is in this different light.

Photographers from the novice to the professional can photograph in IR. And although you can't detect IR light in your surroundings, you can learn to envision its behavior and effects — see it in your mind's eye — to help you create surreal photographs that utilize its marvelous qualities.

ABOUT THIS PHOTO *A winding path in North Carolina's Craggy Gardens creates an inviting composition in color. Taken at ISO 100, f/16, 1/6 sec. with a Nikkor 28-70mm lens.*

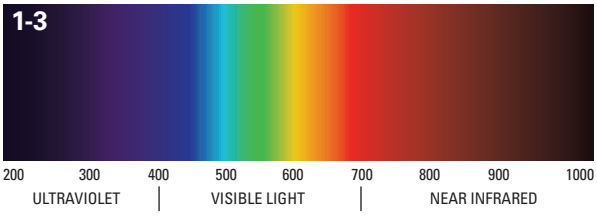
ABOUT THIS PHOTO *Photographed in IR, the same path shown in 1-1 creates a magical composition. Taken at ISO 100, f/16, 1/10 sec. with a Nikkor 24-70mm lens.*

WHAT EXACTLY IS IR LIGHT?

Like sound, light travels in waves. When its wavelength is measured in nanometers (nm) or billionths of a meter, the light you typically see ranges only from around 400nm (the color violet) to around 700nm (the color red). This narrow band, also known as the *visible spectrum*, enables you to see violet, blue, green, yellow, orange, and red colors, and all their combinations.

Light at wavelengths shorter than those for the color violet is aptly named *ultraviolet* (UV) light. Most UV light is invisible to the human eye. The IR spectrum begins at the other end of your range of sight, at wavelengths longer than those for the color red. The range of light from around 700nm to 1,000nm is referred to as *near IR* because it is near the visible spectrum (1-3). Digital cameras can record light in this range when they have an IR filter in place. The sun emits IR light including UV and visible light. You can create exquisite photographs using IR light from the sun (1-4),

ABOUT THIS FIGURE *This chart shows the wavelength ranges of UV, visible, and IR light.*



ABOUT THIS PHOTO *Cloud cover over Cades Cove in the Great Smoky Mountains, North Carolina, makes an exquisite statement in IR. Taken with an IR-converted camera at ISO 100, f/11, 1/25 sec. with a Nikkor 18-70mm lens.*

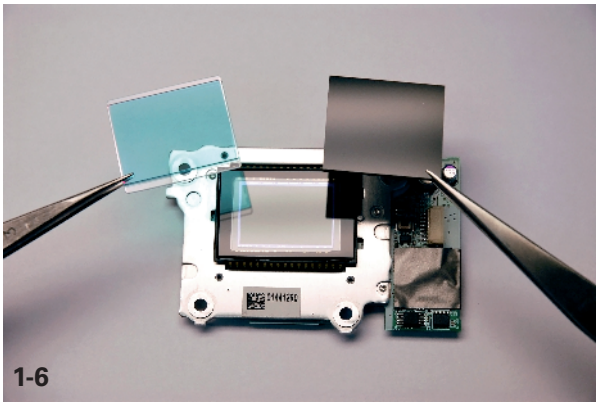
but light from sources such as candles or incandescent bulbs can also be recorded with IR photography. In other words, you can creatively photograph IR light at night (1-5).

SEEING IN IR

You can record invisible light using an IR filter (available at camera stores) on the lens of your digital camera. Alternatively, you can modify your digital camera by removing the *hot mirror* located over the camera sensor, and replacing it with a filter that allows IR light to pass through to the camera sensor. This is shown in 1-6. Either choice allows the camera to record the IR light that you can't see with the naked eye.

1-5

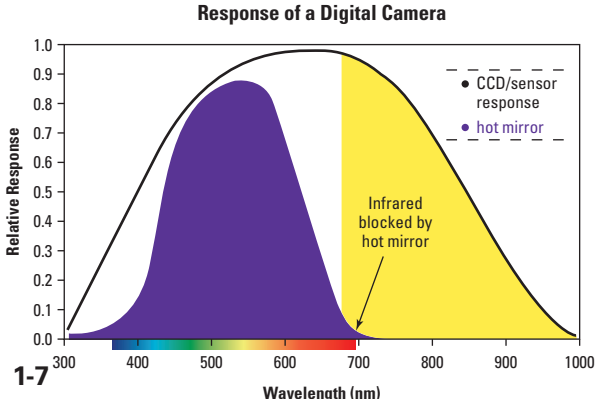
ABOUT THIS PHOTO *Night proved to be more interesting than twilight in this IR photograph taken in downtown Orlando, Florida. Taken with an IR-converted camera (enhanced color IR filter) at ISO 100, f/11, 13 sec. with a Nikkor 18-70mm lens.*



1-6

ABOUT THIS PHOTO *This photo shows the camera sensor, hot mirror, and replacement IR filter. © Life Pixel (www.lifepixel.com).*

A digital camera is a very sophisticated device. Its imaging sensor is responsive to wavelengths from about 350nm to 1000nm. It also can record ultraviolet light in the near UV range (1-7), and with a special filter, light in the near IR range. A digital camera is so sensitive that camera manufacturers place a hot mirror inside the camera. The hot mirror reflects most IR and UV light, serving as a filter, and transmits visible color by allowing it to reach the camera sensor.



1-7

ABOUT THIS FIGURE *This chart shows the response of a digital camera to UV light, visible light, and IR light.*

Using an IR filter on or inside the camera allows IR light to reach the camera sensor but blocks most visible and UV light. The camera can now record IR light and you can create stunning photographs in IR. A whole new world of creativity lies before you. You are an instant artist. When the natural color is removed from the scene, some of the reality is removed, and when some of the reality is removed, your pictures become more creative and artistic.

tip

With a little practice, composing for IR will become second nature. This is covered in Chapter 3.

From a photographic perspective, the world is captivating in an entirely different way. Many subjects reflect or absorb IR differently than they do visible light. In an IR image, the contrast range between the sky and clouds is often quite wide. There is more clarity in shadows, and bodies of water can appear very dark. Foliage appears white and is unexpectedly beautiful and unique.

Skin tones take on an ethereal appearance that is very attractive for wedding photographers and for fine art nude photography. IR photography can look similar to timeless black-and-white photography, yet there is something enchantingly unique about it.

With an IR filter, digital cameras capture light in the near IR range, recording how light is reflected and absorbed by various surfaces, not the actual temperature of the surfaces. When some people think of IR, *thermal imaging* (the capture of recorded temperature patterns) comes to mind.

A common misconception about digital IR photography, or even IR film, is that it records heat patterns or thermal energies — it does not. The much-coveted halation effect that is typically associated with capturing IR images using Kodak

high-speed IR film (HIE) causes a visible aura around the very light areas in a photograph. This is explained by the lack of an anti-halation layer on that specific type of IR film, and is not the outcome of IR light, body heat, or thermal energy. An example of the desired halation effect is shown in a film photograph (1-8) taken by professional photographer and author Joe Paduano.

Thermal imaging sensors, on the other hand, register IR energy emitted by subjects in the mid- and far-IR ranges. This is in comparison to digital cameras recording near IR light that is reflected from subjects. Two interesting applications for thermal imaging processors are night vision for the military, and enhanced vision systems in ultra-sophisticated business jet avionics that employ the use of mid- and far-IR light.

CHECKING YOUR CAMERA FOR IR SENSITIVITY

Many ordinary, unconverted digital cameras can detect IR light. To determine how sensitive your camera is, point your TV remote control at the

ABOUT THIS PHOTO *The much-admired halation effect that occurs with certain kinds of IR film is evident in this image Joe Paduano took of the Acoma Pueblo church in New Mexico. © Joe Paduano*

camera lens and press a button. If you are able to view the illuminated light on the camera's LCD, or if you can photograph it, the camera should be sensitive enough to record in IR with the use of an IR filter (1-9). Most IR-capable cameras that can be converted are listed on professional IR camera conversion company Web sites, such as www.lifepixel.com or www.maxmax.com.

ABOUT THIS PHOTO *This photo shows a TV remote control showing the illumination that the camera can detect (which is not visible to our eyes).*

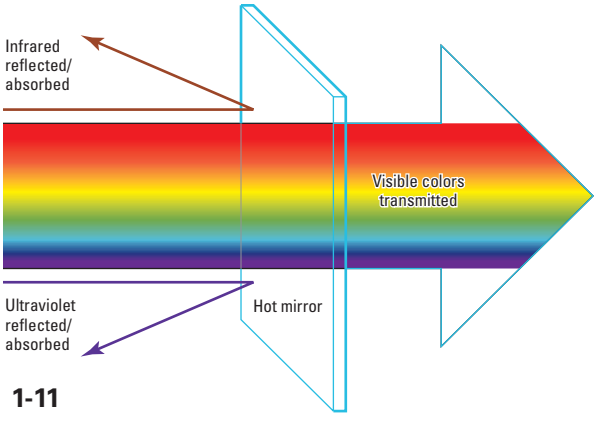
1-9

METHODS OF RECORDING IR LIGHT

How do you capture something you can't see with your own eyes? Basically, there are two methods that enable you to shoot in IR. You can place an IR filter (1-10) on the lens of the camera, or you can have a digital camera converted to photograph in IR only (1-11). The former requires long exposure times and the camera may not autofocus or auto expose properly. The latter is more expensive, but the camera operates normally with the major exception being that you can no longer use it to capture images with visible light. The difference in cost may be well worth the investment considering the cost of a premium 77mm IR filter.

1-10

ABOUT THIS PHOTO *An IR filter in place on the lens of a digital camera.*



1-11

ABOUT THIS FIGURE *The function of the hot mirror in a digital camera is to prevent UV light and IR light from reaching the camera sensor as shown. In the IR conversion process, it's replaced with an IR pass filter, which blocks most visible light.*

In either case, each method allows the camera to now record invisible light — the IR light that is allowed to pass through the lens to the camera's sensor. With an IR-converted camera, the filter that blocks IR light is removed and replaced with an IR filter that blocks nearly all light except for IR.

IR FILTERS

You can choose from several types of IR filters. A numeric system called *Wratten* is used to identify IR filters and can be a bit daunting especially when combined with many filter manufacturers' own proprietary numbering systems. The simplest way to understand how an IR filter functions is to look at the filter number. The higher the number, the smaller the amount of visible light that reaches the camera sensor.

For example, a filter labeled R72 means that the cutoff point for visible light is 720nm. This filter may also be called a Wratten 89B. It offers a good mix of bright foliage and some color.

If you choose a filter such as the 87C (830nm), the cutoff point for visible light is higher, producing an image that has more contrast in IR, the brightest foliage, and very black/white IR images. Singh-Ray (www.singh-ray.com) produces an IR filter called the I-Ray, which blocks most visible light.

The 665nm filter is often referred to as the *enhanced color filter*. This filter allows the most visible light to reach the camera sensor and creates an image that is very detailed and has many options for creative color use. The tradeoff may be noticeable on cloudy days where the foliage appears less white than with the 87C (830nm).

In a nutshell, the 665nm filter has the most color options; the 720nm is the most common and can be used for the blue-sky effect; and the 830nm allows the least amount of visible light, which creates strong black-and-white IR images. Comparison photos of an image in color and in IR, using the R72 and 87C filters, are shown in 1-12 and 1-13, and 1-14.

ABOUT THIS PHOTO *A color photograph of the Golden Gate Bridge, San Francisco, California. © David Twede.*

1-13

ABOUT THIS PHOTO *A photograph of the Golden Gate Bridge using the standard R72 filter. Images produced using this filter can achieve the blue-sky effect with enhancements in Photoshop, or can be converted to black and white.* © David Twede.

Each filter is very dark red, almost black. When you use an IR filter in front of the camera lens, exposure times are longer because the hot mirror is in place and doing its job to block IR light. Once you attach the IR filter to the lens, it is so dark that seeing through it is impossible. You'll need a tripod for the long exposure, and a cable release to prevent camera shake. This unfortunately prohibits spontaneous, in-the-moment IR photography.

The filter you choose depends on your desired outcome and budget. I used a Hoya R72 filter (1-15) until I had a camera converted to photograph in IR. The filter is easy to use and provides great results.

x-ref

You can create the blue-sky effect discussed in Chapter 8 with an R72 filter.

You need to consider some factors before purchasing a filter or having your camera converted. If you are just starting out, you may want to see the effect of IR photography before jumping in and having a camera converted. The lens you use most frequently will determine the size of the filter, and in turn, the cost. If you purchase a filter to fit a 77mm lens, it can be quite expensive and the incremental difference in cost might be better put toward converting a camera. If you use a filter on the lens of a compact camera, you may find that the camera's lens lacks a lens thread. It may be a bit of a challenge figuring out an adaptor system to allow for the use of an IR filter.

You can purchase IR filters online from companies such as LDP Net (www.maxmax.com), Adorama (www.adorama.com), B&H Photo (www.bhphotovideo.com), and Singh-Ray (www.singh-ray.com). I discuss converting a compact camera in the next section.

ABOUT THIS PHOTO *A photograph of the Golden Gate Bridge using the 87C (830nm) IR filter. Very little fine-tuning in Photoshop is needed. This filter is great for black-and-white IR images with good tonal range. © David Twede.*

1-14

1-15

ABOUT THIS PHOTO *The readily available Hoya R72 filter mounts on the camera lens.*

IR-CONVERTED CAMERAS

Quick and candid IR photographs are best accomplished with a converted camera. The camera functions just like an ordinary camera with similar exposure times but without slow shutter speeds that require setting up a tripod.

If you have decided that you want to be more spontaneous and tripod-free, then camera conversion is the choice for you. There are several

companies (Life Pixel, LDP Net, among others) that will convert either your digital single lens reflex (dSLR) camera or your compact camera, or both.

Capturing in RAW format is desirable for the serious digital photographer, but many compact cameras photograph in JPEG and cannot photograph in RAW. While JPEGs are smaller in file size and take up less space on a memory card, there is less flexibility because the dynamic range is often reduced with the JPEG format. Therefore, many adjustments, such as white balance, exposure compensation, and recovery of over- or underexposed shadows and highlights, are unavailable in post-processing unless you open your JPEG in Adobe Camera RAW 4.0 or later. This capability was recently introduced in Photoshop CS3 and allows for only a limited amount of fine-tuning with JPEG files. On the plus side, compact cameras fit in your pocket, and they're easy to bring everywhere — just point and shoot.

Following are some of the advantages of having your dSLR camera converted to photograph in IR:

- The camera can usually record in RAW format for better image quality.
- The images have less digital noise than if you were to use an IR filter or a compact camera in JPEG format.
- You can adjust and fine-tune images in RAW, such as recovering under- or overexposed images.

You can find more information on the RAW file format in Chapter 2.

Another benefit to a converted dSLR is that you can use your favorite lenses, and you don't have to purchase a filter for each lens. Note that you may need to manually focus for different lenses. Life Pixel provides a standard lens calibration or you can choose a specific lens to be calibrated to autofocus in IR. An IR filter is now inside the camera and you can hand-hold the camera. There is a huge advantage being able to look through the camera viewfinder and easily see and compose your subjects. A tripod isn't necessary unless you intend to use longer exposures — the same as color photography.

If you have a digital camera that you're no longer using (perhaps you upgraded to the latest and greatest model as the older camera no longer suits your needs) this is the perfect opportunity to convert your old camera to an IR camera.

It is possible to convert your own camera, but it requires a measure of comfort in disassembling and reassembling sensitive electronic camera parts as well as a steady hand — not to mention a dust-free environment. If the engineer in you wants to attempt it, tutorials and resources are available online. You can purchase IR filters to use inside the camera through Life Pixel (www.lifepixel.com).

Life Pixel converts a wide variety of digital cameras using various conversion methods, ranging from enhanced color IR to standard IR and deep black-and-white IR. They adjust the focus for certain Canon or Nikon lenses so that autofocus can be used, or a custom calibration is available for a specific lens of your choice.

LDP Net has a great range of services and products, including IR camera conversion and IR filters you can use on the front of the lens. LDP Net also offers a wide variety of ready-to-use dSLR bodies and compact cameras preconverted to IR. They also provide IR flashes for various cameras such as Nikon and Canon.

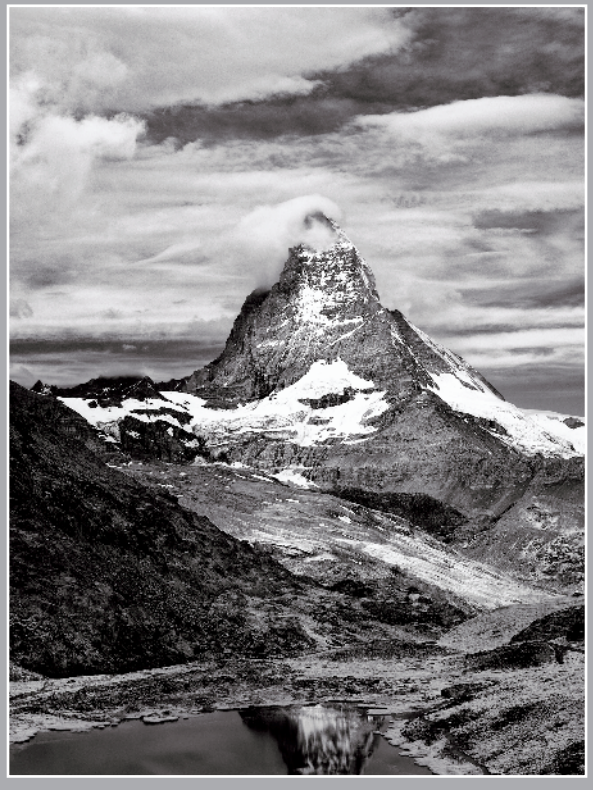
Assignment

Starting to Capture in IR

I created my very first IR photograph using an R72 filter. I took a photo of a bottlebrush branch on a black background. I was surprised at how much detail there was in an image that was basically shades of white.

For your assignment, photograph both IR and color images of the subject of your choice — a landscape, a lake or pond, the sky, or people. View both color and IR images on your computer monitor at the same time and compare the differences. Note the most significant differences between your color photograph and your IR photograph. What surprises you most about the differences? What inspires you and what would you like to try for your next IR photograph?

For my example, I liked how IR enhanced the definition of clouds that surrounded the majestic Matterhorn in Zermatt, Switzerland. I used a camera that was converted to IR using the enhanced color filter, and then converted the image to black and white in Photoshop, giving it a timeless, traditional look.



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