

1Infrared Photography

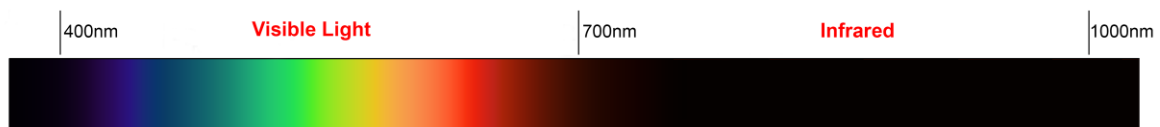
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What is Infrared

The range of colours visible to the unaided eye runs from blue (a wavelength of about 380nm²) to red (about 700nm). Beyond 700nm is the near infrared range. The near infra red extends to about 1400nm but standard camera sensors stop responding at about 1000nm. In comparison, thermal imaging used in wildlife photography uses much longer wavelengths in the range 3000nm to 14000nm.



Visible and Infrared spectra

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² “nm” is the standard abbreviation for “nanometre”. That is, one billionth of a metre or 10⁻⁹m.

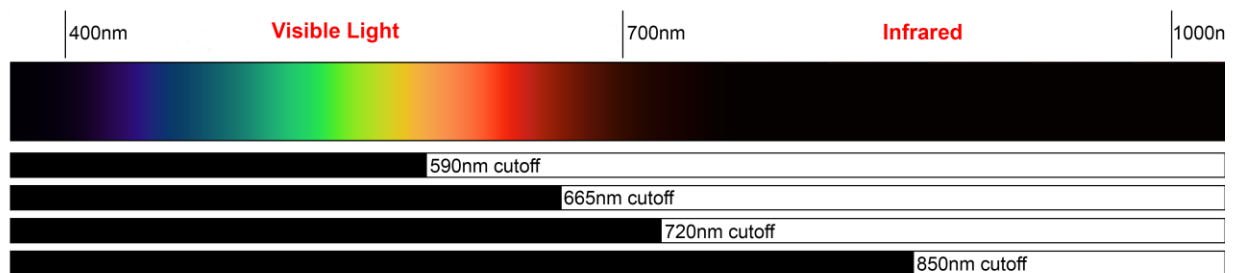
The point of infrared photography is to move away from visible light to explore the options available in the near infrared – beyond the capability of the unaided human eye.

Cameras and Lenses

Camera Conversions

Digital cameras are manufactured with a filter in front of the sensor which only allows the visible spectrum of light to pass through. When a camera is converted to infrared, the existing filter is removed. This is normally replaced with a filter which cuts the visible and UV parts of the spectrum, allowing through the IR. There are several options for the wavelength at which the filter cuts. The commonest are:

- 590nm
- 665nm
- 720nm
- 850nm



Common Infrared Filters

In the bars shown below the spectrum, black represents radiation which is filtered out, white represents the radiation which reaches the sensor.

Both 590nm and 665nm overlap with the visible light spectrum. The result is some colour combined with the infrared image.

720nm and 850nm cut off beyond the end of the visible light spectrum. The result is a monochrome image with the 850nm filter giving a starker result. Some 720nm filters may actually stray into the visual range so there may be some colour to play with.

The most popular camera conversion is 720nm.



A Path Through Trees.

Photographed with a 720nm cutoff.

The colour is an artefact of the process. Infrared images are formed outside the visual spectrum so have no “true” colour.

Alternatively, plain glass replaces the filter. This is called a Full Spectrum conversion. As the name suggests, this allows all wavelengths to pass. After a Full Spectrum conversion, the required filtration is screwed into the front of the lens. This allows a choice of cutoff for each image. However, the filters are not common and may not be readily available in the filter thread on your lens. Further, if you want to use a choice of lenses you may find yourself buying a set of filters for each lens.

After a Full Spectrum conversion you can, in principle, convert the camera back to normal use with a UV/IR cut filter. This allows just the visible Spectrum to pass. However, it is unlikely that the exact cutoff wavelengths and roll-offs off for this and the original filters will be the same. So, you will probably get a colour cast.



St Lawrence, Stratford-sub-Castle.

Photo by Ashley Pomeroy

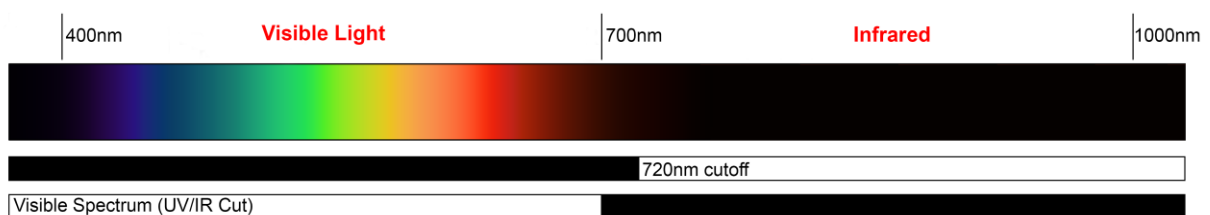
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An example of colour digital infrared photography. The camera's infrared blocking filter has been removed. Red and blue channels have been swapped for a more conventional sky colour.

Infrared Filters on an Unconverted Camera

It is possible to get some infra red results without modifying the camera. In this case a 720nm filter is screwed onto the front of the lens. The built in filter will block infrared while the infrared filter on the front will block visible light. In theory, this should mean that no radiation reaches the sensor!

In practice, the cutoff wavelengths are not precise and the response of each filter will taper off. This means that a small amount of radiation will get through. This limited radiation can be used to create an image. However, the limited amount of radiation reaching the sensor means that the exposure times will be long.



Unmodified Camera with a 720nm filter.

The Visible Light Filter blocks the IR while the IR Filter blocks the Visible Light

Hot Spots

Some combinations of lenses and filters produce a “hot spot” in the centre of the image. This appears as a light spot in the centre of the image. There are several databases online which suggest lenses which exhibit limited hotspot.

So, experiment with the lenses you have available to determine whether any of your lenses are unsuitable for infrared. Some writers suggest that wider apertures minimise the effect of hotspots.

Camera Settings

Your camera will not have a colour balance setting for infra red images. So, you need to improvise by trying the various options offered by your camera to see which seems best. If your camera allows you to create a custom white balance by photographing a sheet of white paper, then this is likely to be your best option.

Shoot in RAW. This means that you can play with the colour later.

Modern “live-view” cameras should not have problems with focussing.

The camera sensor has not been designed to work with infrared. So, look for places where it fails. I find that the images tend to have blown highlights. So, I underexpose between half and one stop to maintain highlight details. I also shoot in RAW to give me more flexibility to recover highlight detail.

Post Processing

Images out of camera are low contrast with distorted colours.

In Adobe Lightroom, a good start is:

- Set the profile to Adobe Monochrome;
- Set the colour balance to Cloudy;
- Set the contrast to +50.
- Set the highlights to -100
- Set the shadows to +50

At this point the image will still look flat and the histogram will show no bright tones. It is now up to you to decide what to do.

If you are using an image containing some colour information, a common approach is to play with the colour channels.

Subjects for Infrared Photography

Infrared is heat

As infrared images look flat, a high contrast subject will produce a better image. So, look for strong lighting: bright midday light is a good starting point.

As to the image content, the key differences between infrared images and conventional images are the dark, dramatic skies and the white foliage.



*Darkened Sky and White clouds above
Thornbury Castle.
Photographed with a 720nm cutoff.*

Blue Sky and White Clouds

The blue of the sky is well outside the range of and infra red filters and, therefore turns black in contrast to white clouds. A cloudscape which, in conventional photographs, would look dramatic is likely to look rather flat in infrared. (You sometimes see an infrared image with a blue sky. This will have been taken with a filter cut-off well into the visible spectrum, and then modified using channel swapping.)

Brightly Lit Foliage

Brightly lit foliage turns white. This is, perhaps, the most striking effect. And can make woodland scenes look ethereal. The white effect on foliage comes from reflected radiation. So, backlit leaves do not turn white!

Why do Leaves turn White under Infrared?

Leaves contain two light absorbing chemicals: chlorophylls and carotenoids. They both absorb visible light and are both transparent to infrared. Infrared passes through to the internal structure of the leaf where it is reflected back. As no infrared is absorbed, the leaves show as white in infrared photography.



*White Foliage on Thornbury Pump.
Photographed with a 720nm cutoff.*

In most leaves the chlorophylls dominate. They absorb red and blue leaving green to be reflected which is why leaves look green. In autumn, the chlorophylls break down leaving the red/yellow carotenoids: hence the colour change in autumn. The other change in autumn is that the leaves start to die. As the internal structure of the leaf breaks down, it ceases to reflect the infrared. So, while recently coloured autumn leaves will look white in infrared, as the season progresses, the white foliage will disappear.

Evergreen plants retain their infrared reflectivity throughout autumn and winter and, so, remain white.

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In summary, the features of good infrared subjects:

- Blue sky with white cloud
- Brightly lit Green foliage

Portraits - Eyes

The human eye absorbs infrared radiation. So, the pupil goes dark. This is a fact of life! You may find ways to use this effect but you certainly need to be aware of it if you are going to photograph people.



*The eye goes dark in infrared
Photographed with a 720nm cutoff.*

Links

Kolari

A US based supplier of conversions. The website contains an extensive discussion of infrared photography.

<https://kolarivision.com/>

In particular, it is worth looking at the description of hotspots:

<https://kolarivision.com/the-science-of-infrared-hotspots/>

Protech Photographic

A UK based supplier of conversions. The website contains examples of images taken with different conversions.

<https://www.protechrepairs.co.uk/>