Image File Formats - JPG, TIF, PNG, GIF
Which to use?

The most common image file formats, the most important for cameras, printing, scanning, and internet use, are JPG, TIF, PNG, and GIF.

- Digital cameras and web pages normally use **JPG** files - because JPG heroically compresses the data to be very much smaller in the file. However JPG uses lossy compression to accomplish this feat, which is a strong downside. A smaller file, yes, there is nothing like JPG for small, but this is at the cost of image quality. This degree is selectable (with an option setting named JPG Quality), to be lower quality smaller files, or to be higher quality larger files. In general today, JPG is rather unique in this regard, using lossy compression allowing very small files of lower quality, whereas almost any other file type is lossless (and larger). The meaning of Lossy is discussed [Below](#).

  Frankly, JPG is used when small file size is more important than maximum image quality (web pages, email, memory cards, etc). But JPG is good enough in many cases, if we don't overdo the compression. Perhaps good enough for some uses even if we do overdo it (web pages, etc). But if you are concerned with maximum quality for archiving your important images, then you do need to know two things: 1) JPG should always choose higher Quality and a larger file, and 2) do NOT keep editing and saving your JPG images repeatedly, because more quality is lost every time you save it as JPG (in the form of added JPG artifacts... pixels become colors they ought not to be - lossy). More at the JPG link at page bottom.

- **TIF** is lossless (including LZW compression option), which is considered the highest quality format for commercial work. The TIF format is not necessarily any "higher quality" per se (the image pixels are what they are), and most formats other than JPG are lossless too. This simply means there are no additional losses or JPG artifacts to degrade and detract from the original. And TIF is the most versatile, except that web pages don't show TIF files. For other purposes however, TIF does most of anything you might want, from 1-bit to 48-bit color, RGB, CMYK, LAB, or Indexed color. Most any of the "special" file types (for example, camera RAW files, fax files, or multipage documents) are based on TIF format, but with unique proprietary data tags - making these incompatible unless expected by their special software.

- **GIF** was designed by CompuServe in the early days of computer 8-bit video, before JPG, for video display at dial up modem speeds. GIF always uses lossless LZW compression, but it is always an indexed color file (8-bits, 256 colors maximum), which is poor for 24-bit color photos. Don't use indexed color for color photos today, the color is too limited. PNG and TIF files can also optionally handle the same indexed color mode that GIF uses, but they are more versatile with other choices too. But GIF is still very good for web graphics (i.e., with a limited number of colors). For graphics of only a few colors, GIF can be much smaller than JPG, with more clear pure colors than JPG). Indexed Color is described at [Color Palettes](#) (second page of GIF link below).

- **PNG** can replace GIF today (web browsers show both), and PNG also offers many options of TIF too (indexed or RGB, 1 to 48-bits, etc). PNG was invented more recently than the others, designed to bypass possible LZW compression patent issues with GIF, and since it was more modern, it offers other options too (RGB color modes, 16 bits, etc). One additional feature of PNG is transparency for 24 bit RGB images. Normally PNG files are a little smaller than LZW compression in TIF or GIF (all of these use lossless compression, of different types), but PNG is perhaps slightly slower to read or write. That patent situation has gone away now, but PNG remains excellent. Less used than TIF or JPG, but PNG is another good choice for lossless quality work.
- Camera **RAW** files are very important of course, but RAW files must be processed to regular formats (JPG, TIF, etc) to be viewable and usable in any way. However, the point is that RAW offers substantial benefit in doing that. The debate goes on, some cannot imagine NOT taking advantage of the greater opportunities of RAW. Others think any extra step is too much trouble, and are satisfied with JPG - my own biased opinion is they just don't know yet. :) More detail Below.

We could argue that there really is no concept of RAW files from the scanner. Vuescan does offer an output called RAW, which is 16 bits, includes the fourth Infrared noise correction channel data if any, and defers gamma correction. Vuescan itself is the only post-processor for these. But scanner color images are already RGB color, instead of Bayer pattern data like from cameras. Camera RAW images are not RGB (the meaning of RAW), and must be converted to RGB for any use.

Best file types for these general purposes:

	Photographic Images	Graphics, including Logos or Line art
Properties	Photos are continuous tones, 24-bit color or 8-bit Gray, no text, few lines and edges	Graphics are often solid colors, with few colors, up to 256 colors, with text or lines and sharp edges
For Unquestionable Best Quality	TIF or PNG (lossless compression and no JPG artifacts)	PNG or TIF (lossless compression, and no JPG artifacts)
Smallest File Size	JPG with a higher Quality factor can be decent.	TIF LZW or GIF or PNG (graphics/logos without gradients normally permit indexed color of 2 to 16 colors for smallest file size)
Maximum	TIF or JPG	TIF or GIF

Compatibility (PC, Mac, Unix)		
Worst Choice	256 color GIF is very limited color, and is a larger file than 24 -bit JPG	JPG compression adds artifacts, smears text and lines and edges

These are not the only choices, but they are good and reasonable choices.

Major considerations to choose the necessary file type include:

- Compression quality - Lossy for smallest files (JPG), or Lossless for best quality images (TIF, PNG).
- Full RGB color for photos (TIF, PNG, JPG), or Indexed Color for graphics (PNG, GIF, TIF).
- 16-bit color (48-bit RGB data) is sometimes desired (TIF and PNG).
- Transparency or Animation is used in graphics (GIF and PNG).
- Documents - line art, multi-page, text, fax, etc - this will be TIF.
- CMYK color is certainly important for commercial prepress (TIF).

See chart near bottom of page. We select the file type that supports the options we need.

The only reason for using lossy compression is for smaller file size, usually due to internet transmission speed or storage space. Web pages require JPG or GIF or PNG image types, because sone browsers do not show TIF files. On the web, JPG is the clear choice for photo images (smallest file, with image quality being less important than file size), and GIF is common for graphic images, but indexed color is not normally used for color photos (PNG can do either on the web).

Other than the web, TIF file format is the undisputed leader when best quality is desired, largely because TIF is so important in commercial printing environments. High Quality JPG can be pretty good too, but don't ruin them by making the files too small. If the goal is high quality, you don't want small. Only consider making JPG large instead, and plan your work so you can only save them as JPG only one or two times. Adobe RGB color space may be OK for your home printer and profiles, but if you send your pictures out to be printed, the mass market printing labs normally only accept JPG files, and only process sRGB color space.

Difference in photo and graphics images

Photo images have **continuous tones**, meaning that adjacent pixels often have very similar colors, for example, a blue sky might have many shades of blue in it. Normally this is 24-bit RGB color, or 8-bit grayscale, and a typical color photo may contain perhaps a hundred thousand RGB colors, out of the possible set of 16 million colors in 24-bit RGB color.

Graphic images are normally not continuous tone (gradients are possible in graphics, but are seen less often). Graphics are drawings, not photos, and they use relatively few colors, maybe only two or three, often less than 16 colors in the entire image. In a color graphic cartoon, the entire sky will be only one shade of blue where a photo might have dozens of shades. A map for example is graphics, maybe 4 or 5 map colors plus 2 or 3 colors of text, plus blue water and white paper, often less than 16 colors overall. These few colors are well suited for Indexed Color, which can re-purify the colors. Don't cut your color count too short though - there will be more colors than you count. Every edge between two solid colors likely has maybe six shades of anti-aliasing smoothing the jaggies (examine it at maybe 500% size). Insufficient colors can rough up the edges. Scanners have three modes to create the image: color (for all color work), grayscale (like B&W photos), and lineart. Line art is a special case, only two colors (black or white, with no gray), for example clip art, fax, and of course text. Low resolution line art (like cartoons on the web) is often better as grayscale, to add anti-aliasing to hide the jaggies.

JPG files are very small files for continuous tone photo images, but JPG is poor for graphics, without a high Quality setting. JPG requires 24-bit color or 8-bit grayscale, and the JPG artifacts are most noticeable in the hard edges of graphics or text. GIF files (and other indexed color files) are good for graphics, but are poor for photos (too few colors possible). However, graphics are normally not many colors anyway. Formats like TIF and PNG can be used either way, 24-bit or indexed color - these file types have different internal modes to accommodate either type optimally.