

ACHIEVING CONSISTENT COLOUR – sRGB vs. Adobe RGB

Steve Brabner
December 2010

1. THE PROBLEM

This document assumes that you have set up your system in accordance with the separate handout *Why Doesn't My Print Match My Screen?* and are enjoying colour matching between your onscreen images in Photoshop and your prints.

Unfortunately this consistency can evaporate when images are;

- Viewed or printed via other programs (including other copies of Photoshop)
- transferred to other computers
- projected at the club
- displayed on the internet
- sent by email etc.

This handout explains the problem and offers a solution.

2. COLOUR SPACES

Images contain a variety of colours at a range of intensities. The ability to reproduce these varies from device to device and is called the 'gamut' of the device. Digital cameras and printers may have a larger gamut than screens but the human eye has a much larger gamut than all of them. In photo printers, dye inks have a slightly larger gamut than pigment inks and both are influenced by the paper being used. The problem is to transfer images between these varied devices without losing colour accuracy and fidelity.

Many organisations have defined sets of colours to try to standardise conversion between devices. These are called colour spaces or profiles. A colour space called **sRGB** was designed to represent the gamut of the average screen and most consumer screens, printers, scanners and cameras claim some conformance to it. Crucially, sRGB is the assumed colour space when nothing else is specified and most software (including the entire internet) is based on sRGB.

If sRGB is so universal what's the problem? Well, professional devices use many other colour spaces, most bigger than sRGB, and we all know that bigger is better, so we have been tempted into believing that if we use a larger colour space then our pictures will surely be better! In particular a colour space called **Adobe RGB (1998)** has gained popular support amongst photographers. The main difference is that Adobe RGB extends a little further towards the saturated greens, cyans and blues than sRGB.

Unfortunately neither consumer screens nor most printers can reproduce these colours, so the apparent benefits of the greater colour range of Adobe RGB are lost, indeed there are some disadvantages to using Adobe RGB rather than sRGB (for justification read the Appendix to this document).

3. THE SOLUTION

This is going to be pretty simple....

Cameras – if you are given an option, set it to sRGB (if not, it will be sRGB already)

Photo Editing Software – set the RGB working space to sRGB

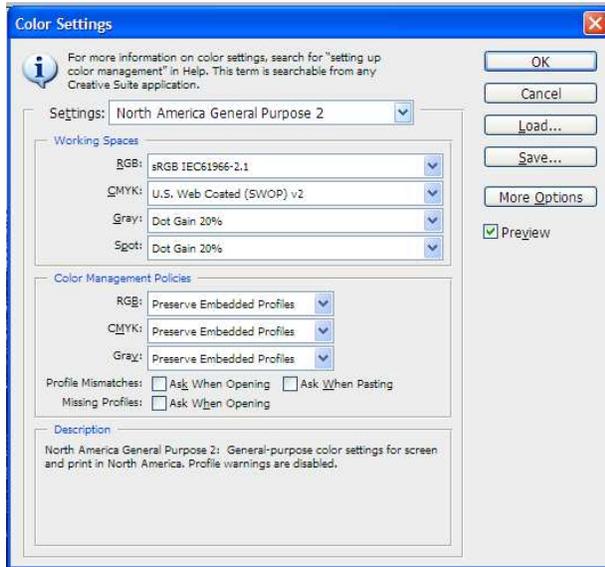
Submitting Digital Images for Club Competitions – ensure that they are in the sRGB colour space.

By making these choices, colour compatibility between photographic hardware and software should largely cease to be an issue. If you still believe that you must be losing something, then read the Appendix to this document.

3.1 Setting the Photoshop Working Space

- **For Photoshop:** Go to; *Edit>Color Settings* and select *North America General Purpose 2*.
- **For Photoshop Elements:** Go to; *Edit>Color Settings* and choose *Always Optimize Colors for Computer Screens* (In older versions this was called *Limited Color Management*).

These set sRGB as your working space and adopt some sensible defaults when images using other spaces are encountered.



3.2 Tagging your Images

When you save your images, use the *File>Save As* menu and always ensure that the *ICC Profile* box is ticked. This will embed or 'tag' your file with the sRGB profile that we have just set above.

3.3 Converting non sRGB Images

You may have old images already tagged with other profiles such as Adobe RGB. If you are going to send these for APS Competitions or in fact to anywhere that is not colour-aware (such as email and the whole of the Internet) they should be converted to sRGB;

NB Use a copy because this will permanently change the image data;

Open your image in Photoshop and choose *File>Save As*. One of the save options is an ICC Profile. If this says sRGB then that colour space is already in place for this image. If another profile is shown (eg Adobe RGB 1998) then cancel the dialogue box and go to;

- **For Photoshop:** *Edit>Convert to Profile>Destination Space>sRGB*
- **For Photoshop Elements:** *Image>Convert Color Profile>Convert to sRGB Profile*

Finally save the image using *File>Save As* and ensure that the *ICC Profile* option is ticked.

Converting the profile should not result in any visible change to the image onscreen. Never use the *Assign Profile* option in Photoshop as it can lead to permanent damage to the image colours.

APPENDIX

WHY RECOMMEND sRGB OVER ADOBE RGB?

A.1 The Tests

Facts;

- Adobe RGB is a larger colour space than sRGB
- Digital cameras capable of more than 8 bit colour and Adobe RGB, can capture more colours than if set to sRGB
- RAW files contain no colour space information, cameras only assign colour information to JPGs.
- Most software and all of the internet is not colour-aware and assumes sRGB.

Arguable;

- Consumer screens and printers cannot reproduce a greater gamut than sRGB

It's hard to prove that consumer screens cannot reproduce a wider gamut than sRGB but is taken here as a working assumption. However the bigger issue is the widely held belief that the latest consumer photo-printers can reproduce a greater colour gamut than sRGB. To test this requires a test image with colours that extend into the range where Adobe RGB exceeds sRGB.

The PhotoDisc test image (available from the APS website) is often used as a real-world reference and although it's usually found with an attached Adobe RGB profile there is no way to determine if any particular copy has been converted to sRGB and back again, thus losing it's extended colour range. I obtained an original file certified to be in Adobe RGB and used this in some tests;

1. I printed this with a profiled Epson R2400 printer, then converted it to sRGB and printed it again. The results were identical.
2. Using Photoshop CS3's colour profiling and gamut warning features, I looked for the colours in the Adobe RGB image that were outside the sRGB gamut. They were extremely few and existed only in the deep shadows. Looking again at the particular areas highlighted by the gamut warning I still could not see any difference between the two prints.
3. A homemade colour wheel of highly saturated colours was produced in the Adobe RGB colour space, printed, converted to sRGB and printed again. This time there were some small differences in the blue/cyan range where the sRGB version was slightly less saturated. Other colours were identical.
4. Documented tests of the colour gamut of an R2400 printer show that it is considerably smaller than the Adobe RGB colour space (but not quite as small as the sRGB colour space).

My conclusions from these tests are that although in theory, highly saturated blues and cyans suffer slightly in the sRGB colour space, in real-world images the difference becomes invisible in the much greater conversion that the printer driver has to make to the smaller gamut of the printer inks and papers.

A.2 Disadvantages of using Adobe RGB

In a normal 8-bit colour space the same number of colour values (16 million) is available whether Adobe RGB or sRGB is set. However if the larger Adobe RGB space is chosen this fixed number of values must be 'stretched' over a larger range and so the steps in tone between each one are larger. In theory, this can result in a greater likelihood of banding during image processing or printing.

Your screen is the window on your photographs but it's only capable of displaying colours within the sRGB gamut. If you truly believe that your printer is capable of producing more colours from an image in Adobe RGB, then the logical conclusion of this is that despite having paid to have your screen and your printer profiled (hopefully) you will be deliberately creating a situation where the screen and the printer cannot match.

The internet and most software applications are not colour aware. This includes internet browsers, APS competition software and many image viewers. This means that they will ignore any profile attached to an image and treat it as though it is sRGB. Because of the 'stretching' effect mentioned above, a given colour in Adobe RGB will have a lower numerical value than in sRGB. The result of this is that images in Adobe RGB will look less noticeably less saturated in such applications.

Taking all of the advantages and disadvantages into account I have therefore taken the view that setting everything to sRGB and forgetting about the whole business is the best policy for 95% of our members. If you think that you might be in the 5% then read on...

Amersham Photographic Society

A.3 You Still Don't Trust sRGB

Maybe you are obsessive about quality or you are just happy with your Adobe RGB workflow and don't want to change it. No Problem – leave your camera and your software set to Adobe RGB and ideally work in 16 bit colour where possible ...**BUT**... you should convert to sRGB any image that you send to the Internet, or to the APS for projection.

Ideally, shoot and archive your images in RAW which is not restricted to any colour space. Then, when more wonderful devices come along in the future you will be able to re-open them into a larger colour space than is currently possible to reproduce. Processed images cannot be saved in RAW and some colour space must be chosen for the .PSD .JPG or .TIF files. You will probably be content with Adobe RGB but some extremists are now choosing ProPhotoRGB as their working space in Photoshop. This is a huge colour space and will give ultimate future-proofing but in this case you **ABSOLUTELY MUST** convert your images to a smaller space such as sRGB when they leave your computer. If they escape 'into the wild' in the ProPhotoRGB space they will look dreadful – you have been warned!