

Today, most of the published soil surveys are being formatted electronically in a "pdf" (portable document file) format utilizing digital images. This format can be used for the traditional printed soil survey report, for CDs, or for posting on the internet.

One of the big advantages of the electronically formatted manuscript is that it can utilize both digitally captured images and images stored on film.

If a digital camera is used, you must:

- 1) use the correct file format (uncompressed—TIFF preferred), and**
- 2) select the correct resolution (300 ppi—color; 150 ppi—B&W; 600—line drawings)**

If digital images are now acceptable, should I use a digital camera or should I continue to use film and scan and convert to a digital image? There are many high quality digital cameras in the marketplace today. These cameras are small, lightweight, and easy to use and the images are immediately available for evaluation or use. However, the camera must be able to capture the image at a resolution suitable for publication. The resolution recommended by GPO (Government Printing Office) for printed documents is 300 dpi (dots per inch). Even though a printer dot is not the same as an image pixel, they are roughly comparable. For example, a typical soil survey cover is 7.0 x 6.5 inches. To produce a quality image suitable for publication, the following formula would be used to determine the minimum number of pixels required:

$$[(7.0 \text{ in.} \times 300 \text{ ppi}) \times (6.0 \text{ in.} \times 300 \text{ ppi})] = [2100 \times 1800] = 3,780,000 \text{ pixels}$$

This would require a digital camera capable of storing a minimum of 4 megapixels or 4 million pixels per image. Prices vary widely depending on camera format--point and shoot or single lens reflex (SLR). The cost of a 4.0+ megapixel camera ranges from about \$200 to more than \$5000. A 4.0 megapixel camera kit is available on government contract for about \$450.00. Check with your procurement office for details.

The advantage of using film is that it can always be converted to a digital image and stored at any resolution depending on the publication need. The disadvantage is that some degree of quality will be lost during the scanning process. Some quality can be regained by photo manipulation, but this is time consuming and dependant on the experience of the user and software being used. Photo editing software can be very expensive.

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If you have any other questions about soil survey images or are unsure as to policy or procedures, please call the MLRA Office for additional information.

General Information

Number of Illustrations. In printed soil survey reports, you may use about one illustration per 25 pages of text or about 10 to 15 photos and block diagrams per a normal size manuscript (1:24000 scale). About 15 to 20 photos and block diagrams may be used if you have a large manuscript as with a survey mapped at a scale 1:12000. Make sure a concise caption identifying important soil or landscape features are provided for all illustrations, including soil profiles.

Use of Color. In printed soil survey reports, color may be used only for the cover and soil profiles. However, surveys published on CD may use color imagery throughout. Check with the MO prior to shooting only color. If a paper report is to be published, it is unlikely the MO will typeset the manuscript in an all color CD format and a paper hard copy format. Color photography may be taken using color slide

film or with a digital camera. GPO prefers slides (transparencies) in the processing of color photography. An 8 x 10 inch color reproduction is used for cropping purposes.

Color Soil Profile Photography. It is recommended that all profile photos be scaled using a measure tape or a electronically created scale. If a tape is used, the numbers on the tape must be clearly legible if the photo is to be approved. The scale may be in metric, but this is discouraged unless the unit of measurement in the report is metric. Photo tapes have been provided to all project survey offices. A minimum of 6 approved slides must be submitted for printed publication; therefore, 8 to 10 images should be submitted by the project office. The black photo tape provide by the NSSC is preferred.

Black and White Photography. It is recommended that B&W photography not be enlarged until the photos have been reviewed and the total number reduced to the appropriate amount by the SSPL. At the time of manuscript finishing the negatives should be provided to the MO for "hand processing" by the developer. If the enlargements are requested by the Soil Survey Office the negatives are "machine processed". This is why the "grainy" or "too light" condition commonly occurs. Most of the time the photo and negative is of sufficient quality for publication if the original 3 x 5 looks good. B&W images can be scanned by the MLRA office.

Helpful Hints For Taking Photographic Soil Profile and Landscape Pictures. Color may be used on the cover and for soil profiles. A minimum of four (4) and a maximum of eight (8) profile pictures are needed for publication. It is recommended 8 to 10 profile slides be submitted for review. Three (3) slides of each color illustration should be taken and two (2) should be submitted with the manuscript.

Recommended film types:

Fugichrome 100 or 200;
Ektachrome 100 (EB-135-24/36); or
Kodachrome 64 (KR-135-24/36)

REMEMBER—Film and film processing are relatively inexpensive in comparison to the cost of locating a good cover site or taking the time to properly prepare a soil site for soil profiles. Therefore, once the hard work has been done—take an adequate amount of exposures. It is recommended to shoot one roll per exposure. You should also take pictures without the photo tape and with the tape exposing both the centimeter and inch scale. This will allow the image to be used in various publications.

Processing and Distribution.

Black and white film: Send film to the MO requesting standard 3.5 x 5 inch prints. Record and carefully store negatives for submission with the manuscript. After the photos are reviewed by the MO, two 8 x 10 inch photos will be made for the English edit manuscript.

Color slides: Send slide film to the MO for processing. Slides will be processed by Kodak processors, Forth Worth, TX. Slides will be periodically reviewed by the MO for quality before returning then to the SSPL.

Please send to the MLRA Office, SDQS-Product Delivery two original slides of any profile, landscape, or cover. Soil Profile slides may be duplicated and used in older surveys that do not have color profiles available. It is also planned to use them in publications describing the soils in the MLRA Region.

Special Considerations

Soil Survey Cover Photos. The soil survey cover represents not only the survey area, but the National Cooperative Soil Survey program. Appropriate covers include landscapes (showing the general lay of the county) or conservation practices. The cover should have soil-related value and be typical for the survey area. Local historical monuments have been used in the past but are highly discouraged. However, monuments may be included in the photograph if they are not the central subject.

The final selection of the cover does not require permission or input from the local conservation district board. Cover options approved by the MO may be presented as a courtesy to the local board to identify their preference. Preferences identified by the local district board will be honored if the slide has prior approval by the MLRA office and State office.

Try to set aside special days for landscape photography when weather conditions are ideal. Atmospheric conditions are usually best after a cool front has passed through the area. If a polarizing filter is used, be careful not to over polarize creating unnatural colors.

Soil Profiles. Carefully prepare the profile face. This includes trimming all roots, and making sure the prepared face is perpendicular to the angle the profile will be taken. You may want to have one side of the pit picked and the other side smooth (in equal proportions). You may want to smooth the entire profile face, shoot several exposures; pick half the pit and shoot exposures; and finally pick the remaining pit face and shoot the remaining exposures.

The tape should be on the left side of the profile about 3 to 6 inches from the left margin and parallel to the margin. The tape should be hung by a nail, twig, etc. Do not use a rock or some other item that will show in the slide. There should be a 6 inch margin above the top of the pit. It is recommended to only use the black photo tape that has been provided. This will allow the slide to be used in different surveys or different soils publications.

Take a series of slides in both inches and centimeters and some of each profile in landscape (left-to-right) and portrait (up-and-down). Depth in inches should be used in the published soil survey report because "inches" are used in soil descriptions.

If you have a wide angle lens (28 to 35 mm), a 6-8 foot profile is about the maximum exposure for the letters on the tape to be clearly read. If you are using a standard 50 mm lens, a 4 to 6 foot profile is about the maximum exposure. Pit or roadcut sidewalls should not be seen in the exposure.

Using a flash is a good way to improve the quality of the slide in low light conditions or to remove shadows cast by overhanging trees.

REFER TO THE "SOIL SURVEY PHOTOGRAPHY--PRINCIPALS AND TECHNIQUES" POWERPOINT PRESENTATION FOR ADDITIONAL INFORMATION.

**Additional soil profile images may be used from the MO14 Image library:
\\Ncraleigh0c001\shared\MLRA 14\SOIL IMAGES**

For individuals within the Agest domain, these image can be accessed by activating Internet Explorer and pasting (+enter) this address in the address box.

Taking Digital Soil Survey Pictures

Many of you now have access to digital cameras. But before you take to the field and begin shooting all those great pictures, there are a few basics concepts you must understand to get the image you want in a format suitable for publication in the soil survey report.

As with any photography technique, you must be knowledgeable of the camera, its accessories, its strong points and its limitations. This means understanding what the camera can do versus what your needs are.

Your Needs. Digital photographs used in printed soil survey reports must be of high quality. To be used in USDA publications, these photographs are required to have an image resolution of 300 ppi (pixels per

linear inch) at the image size to be printed. A higher resolution exceeds the capacity of most offset printers. Any less resolution results in a degradation of image quality.

A standard soil survey cover is typically published in a 7.0 x 6.0 inch format. At 300 ppi the image would contain about 4 million pixels [(7 x 300) x (6 x 300)] = 3,780,000 pixels. The following chart provides a comparison of image type, resolution requirements, and average file size.

Resolution Guide:

Image Type	Print Resolution Requirements	Average Publication Dimensions	Pixel Requirements	Avg. TIFF File Size	Avg. JPEG File Size*
Cover	300 ppi	7.0 x 6.0	3.8 mp	11+ mb	500+ kb
Cover	300 ppi	7.0 x 7.0	4.4 mp	14+ mb	700+ kb
Soil Profiles (2/page)	300 ppi	6.0 x 3.5	1.9 mp	5+ mb	200+ kb
Soil Profiles (1/page)	300 ppi	8.0 x 5.75	4.2 mp	12+ mb	350+ kb
Landscapes-B&W	150	7.0 x 6.0	1.0 mp	1+ mb	200+ kb
Landscapes-Color	300	7.0 x 5.0	3.2 mp	8+ mb	400+ kb
Landscapes-Color	300	7.0 x 6.0	3.8 mp	11+ mb	500+ kb

* Medium compression.

Limitations. Digital images submitted for printing in soil survey reports can not be in a compressed format. A "TIFF" file is the non-compressed file format used by most digital cameras. Images stored or recorded in a "JPEG" file format are compressed. These files do not retain all the digital data recorded by the camera's sensor. JPEG files however, do work well if the image is to be posted on the web or used in a power point presentation. When converting other formats to a JPEG format, the amount of compression can be scaled when using standard image editing software. What this means to you is--all digital photos printed in soil survey reports must be recorded in a non-compressed format. Tiff (tagged image file format) or BMP (Windows bitmap) are two most commonly used formats for recording digital images.

Your Equipment. Many of you now have access to the Olympus Camedia C-4000 digital cameras. These cameras provide you with a new and interesting way to produce quality images. It has a still image capture resolution of 2288 x 1712 pixels (3.92 megapixels). The camera utilizes a SmartMedia memory card. You will quickly learn the 16 megabyte card that comes with the camera does not provide adequate storage capacity for soil survey images. You will only be able to shoot about 5 images at the highest resolution setting (TIFF—2288 x 1712). Additional cards will be required. The largest storage capacity for the SmartMedia format is a 128 megabyte card that cost about \$50 to \$75 each. This will allow you to shoot up to about 40 images at the highest resolution before downloading to the computer or changing cards. Additional equipment, such as a lens adapter for use with a circular polarizer or UV filter, battery charger, carrying case, etc., are nice additions. They can be purchased at most camera shops or stores such as Circuit City.

Camera Settings (Olympus Camedia C-4000)

White Balance. White balance is how the camera adjusts color settings. Under differing light conditions a pure white may appear gray or brown. Adjusting the white balance will ensure the best possible color interpretation by the camera. Several setting are already programmed into the camera's optional settings. Refer to the camera's operating manual for making the necessary adjustments.

Contrast/Saturation. As a general rule, most digital cameras are preset for taking pictures of people, not landscapes. For landscape photography, the images may need adjustment for contrast and color saturation. These can be preset using the camera's options menu. You may find that adjusting contrast

or saturation may be best after the image has been captured and then brought into a photo editing software.

Record Mode. If you are taking pictures for soil survey publications, the highest record mode should be selected.

Record Mode	Setting*	File size (kb)	Image size @ --72 PPI	Image size @ --300 PPI	Images/16 Mb
TIFF	2288 x 1712	11,490	31.78 x 23.78 in.	7.63 x 5.71 in.	1
SHQ	2288 x 1712	1,823	31.78 x 23.78 in.	7.63 x 5.71 in.	5
HQ	2288 x 1712	642	31.78 x 23.78 in.	7.63 x 5.71 in.	16
SQ1	1600 x 1200	340	22.22 x 16.67 in.	5.33 x 4.00 in.	40
SQ2	640 x 480	74	8.89 x 6.67 in.	2.13 x 1.60 in.	150

* There are several sub-settings within each mode that will vary the image size.

Unless the image is needed for publication, the HQ record mode is adequate and produces a quality image for a 5 x 7 inch print or computer application. If the image is to be used only for computer applications, it may be converted to a resolution of 72 ppi and an appropriate image size. This will significantly reduce the file size.

Changing File Size Using Windows XP.

1. Within Windows Explorer, double click on the file to activate Windows Picture and Fax Viewer.
2. Use Ctrl+E (or the next to last button on the tool bar) to activate the Microsoft Photo Editor.
3. Click on File/Properties to determine image resolution. Adjust to desired resolution-- (300 ppi for print products).
3. Click on Image/Resize to reset the image size. (5 x 7, 8 x 10, etc.)
4. Save the file to a new file name. Don't save the file to the old name unless you are sure you do not need the original resolution and/or image size.

Editing Digital Images. Once you have taken the picture, you may be tempted to use an image editing software to edit color, contrast, saturation, etc., or to delete unwanted features or add new features. Editing the image has the potential for improvement, but also disaster. Remember, your monitor's settings for color, contrast, or brightness most likely will not match those of the editor or ultimately the printer. Editing images can be a creative and fun process. However, caution should be taken to retain the concept the image was meant to portray.

Before you consider any editing, **SAVE** the image as originally captured by the camera. Most of the time, a great deal of work has gone into preparing the soil profile or selecting the right time to shoot a scene. If you get too far down the editing road, it may not be possible to recover the original image and reshooting the image may not be a practical alternative. Original images should be submitted to the MLRA office, along with any additional edited versions.

Storing and Submitting Digital images. Digital images will require significant disk space for storage. Writing files to a CD is a good way to maintain a library of images without tying-up your computer's hard drive.

Images used for printed soil surveys must be in a non-compressed format. Do not submit images that were recorded in a JPEG format and converted to a TIFF file. These images, when taken were compressed. When files are compressed, image data is irretrievably lost. These files can be resampled to a set resolution, but image quality will not be sufficient for the printed soil survey report. *(In other words--you can't make a silk purse out of a sow's ear!)*

Do not submit images that were initially shot in a non-compressed format, stored as a JPEG file, and converted back. When a file has been compressed and then uncompressed, software deletes pixels and then adds or creates new pixels. The file size will increase to its original size, but image quality is not the

same. Every time a file is resampled, image quality diminishes. *(In other words--you can't put spilled milk back into the bottle!)*

References. You will want to begin building a reference library or bookmark helpful web sites. "Digital Photography for Dummies" is a good place to start. It has very helpful information, references, and software goodies. It is especially helpful when using Adobe PhotoDeluxe or Photoshop.

Please contact the MO if you would like additional training or have questions about procedures, techniques, or operation of your camera equipment.