# Digital Imaging for Archival Preservation and Online Presentation: Best Practices

## Working Paper

MATRIX: The Center for Humane Arts, Letters and Social Sciences Online
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## Executive Summary

The following information aims to provide a general overview of digital imaging, specifically the presentation of visual images on the World Wide Web and the digital conversion of records for the purposes of Archival preservation. In terms of digital imaging for Libraries, Archives and Museums, web-access is obviously not the only major issue to be dealt with. The burgeoning field of digital preservation is becoming a vital area of expertise within these types of institutions. A central problem faced by those undertaking digitization projects has been lack of consistent or clear information regarding the best practices or standards for digital imaging. Nevertheless, recently institutions such as the National Archives and Records Administration (NARA) and working groups from the Colorado Digitization Project (CDP) and the California State Library (CSL) have suggested a series of recommendations for digitizing archival materials. This document has drawn from these sources in order to provide a condensed reference guide for those undertaking a digital imaging project.

Divided into eight parts, sections I & II explain the purposes for the digitization of materials, suggesting a series of issues to be considered when selecting sources for digital conversion. Section II gives a general overview of the more technical decisions to be made before the digitization process takes place, including the classification of material according to document type, and the need for both Master and Derivative file formats. Section IV provides a detailed explanation of the bit-depth, resolution, image size, and file format recommended for the digitization of original sources into Master, Access, and Thumbnail Files. Recommendations for image editing and scanning software, and hardware such as scanners and PCs are made in sections V & VI. The glossary of basic terms in section VII explains in detail the central terms and concepts used in digital imaging. Finally, section VIII suggests a number of online resources for further reading.

## I. Purposes for Digitization Projects

The disciplinary field of Digital Preservation is an area still very much "in flux," with no clear set of standards for the digital preservation of materials, and with some experts still very skeptical of the advantages. It is nonetheless apparent that as archivists, curators and librarians deal with problems of degradation and increasingly delimited space and storage facilities, professionals in these fields will need to turn to the potential of digital technologies for solutions. In terms of preservation, digital conversion can certainly extend the life of a particular artifact, limiting material access and providing instead a high-quality surrogate. In addition, digitization dramatically enhances access to that artifact. Not only can the image be seen on the Web by users across the world, patrons can also arrange to have the higher-resolution, uncompressed Master File sent them for offline viewing.

## II. Source Selection Criteria

Before the digitization process takes place, it is first necessary to consider which materials will be selected for the project. These decisions will directly affect the size, level of resolution, and download time of a particular file. Doing a virtual exhibit and creating an image database can be two very different ventures, with the latter being by far the most complex of the two. The criterion for document selection will change according to the specific goals of individual institutions, however we have provided the following questions in order to facilitate the decision-making process:

1. Is the source of sufficient cultural interest to warrant the level of access made possible by digitizing?
2. Will digitization enhance this interest, or are the original materials sufficient for this purpose?
3. Are visitors now using the proposed source materials?
4. Are materials being used as much as they might be?
5. Is current access to the materials so limited that digitization will create a new audience?
6. Would digitization create an opportunity to show interrelated materials in context?
7. What type of hardware and software will your visitors be using and will they be able to access the type of formats and file-sized your project would necessitate?
8. Are you intending to create a printed publication, an online exhibit, an image database, or embark on a digital preservation project?
9. Will your images act only as "finding aids" (i.e. a thumbnail in an online collection) and/or will they serve as surrogates for a deteriorating original that can have only limited access?

## III. General Standards for Creating Digital Images

**CLASSIFYING DOCUMENT TYPE**
According to the guidelines established by the California State Library and NARA, materials selected for scanning can be divided in the following classifications. However, decisions for scanning documents may need to be made on an individual basis, depending on the intended goals for digitization (see above):

- **TEXTUAL DOCUMENTS:** Including printed materials, photocopies, manuscripts, some bitonal line drawings and maps
- **PHOTOGRAPHS:** Including color, sepia-tone, and black and white photographic prints, negatives and transparencies.
- **MAPS, PLANS, AND OVERSIZED RECORDS:** In some cases the original document may be scanned, and more typically institutions will scan photocopies, copy transparencies, or photographic copy negatives
- **GRAPHIC MATERIALS:** More detailed graphic illustrations such as line-drawings, lithographs, water-colors and other artistic illustrations. Again, provisions may be made for scanning the original document, photocopies, copy negatives, or transparencies (as long as the scanner has this ability). In some cases graphic materials can follow the same guidelines given for photographic records.

**MASTER AND DERIVATIVE IMAGE FILES**
In accordance to the guidelines established by NARA and the Colorado Digitization Project, we propose that ***three versions of the image be created:*** **A Master Image, Access Image, and Thumbnail Image**. The following information is taken from CDP's *General Guidelines for Scanning* (http://coloradodigital.coalliance.org/scanning.html).

**Master Image:**
- Represents as closely as possible the information contained in the original
- Uncompressed
- Unedited
- Serves as long term source for derivative files
- Can serve as surrogate for the original
- High quality
- Very large file size
- Used for creating high quality print reproductions
- Usually stored in the TIFF file format

**Access Image:**
- Used in place of master image for general web access
- Generally fits within viewing area of average monitor
- Reasonable file size for fast download time; does not require a fast network connection
- Acceptable quality for general research
- Compressed for speed of access
- Usually stored in JPEG file format

**Thumbnail Image:**
- A very small image usually presented with the bibliographic record
- Designed to display quickly online; allows users to determine whether they want to view access image

- Usually stored in GIF or JPEG file formats
- Serves as long term source for derivative files
- Not always suitable for images consisting primarily of text, musical scores, etc.; user cannot tell what content is at so small a scale

## IV. SPECIFIC GUIDELINES FOR DIGITIZATION OF IMAGES

The following guidelines can be used as the minimum standards for the digital conversion of text, photographs, maps, and graphic materials:

**TEXTUAL MATERIALS**

**Master File:**

**Bit-Depth:** Bitonal, 8-bit grayscale, or 24-bit color (True Color)
**Scanning Resolution:** 300dpi for original documents if smaller than 11"x17"
200dpi if larger than 11"x17"
**Image Size:** Size of original document at scan resolution, for example, 8" x 12" at 300dpi or 16.6" x 20.5" at 200dpi
**Format:** uncompressed TIFF

**Access File:**

**Bit-Depth**: 8-bit grayscale or 24 bit color
**Resolution:** 72-90dpi, depending on character-height
**Image Size:** Original Size, at 72-90dpi
**Format for documents smaller than 8.5" x 14":** 4 bit interlaced GIF for 8-bit grayscale images or 8-bit interlaced GIF for 24 bit color images
**Format for documents larger than 8.5" x 14":** 8 bit grayscale JPEG for grayscale images, or 24 bit color JPEG, RGB mode for color images

**Thumbnail File:**

**Bit-Depth:** 4-bit grayscale/8-bit color
**Resolution:** 72dpi
**Image Size:** not to exceed 200 pixels across the long dimension
**Format:** JPEG or GIF (as formatted for Access File)

**PHOTOGRAPHIC MATERIALS**

**Master File:**

**Bit-Depth:** 8-bit gray scale or True Color
**Scanning Resolution:** 3000 pixels across the long dimension. For example, 3000 x 2400 for 8" x 10" or 4" x 5" prints or negatives, 3000 x 2000 for 35mm slides or negatives or 4"x 6" prints. (For square images adjust pixel arrays to 2700 x 2700)
**Image Size:** 10" across the long dimension at 300dpi. For example, 8" x 10" at 300dpi for a 4" x 5" negative. Square images should be set to a standard 9" x 9" at 300 dpi
**Format:** Uncompressed TIFF

**Access File:**

**Bit-Depth:** 4-bit--8-bit grayscale or 24 bit color (medium to high?)
**Image Size:** Reduce 3000 pixel range Master Files to 600 pixels across the long range. (For square images reduce to 540 x 540 pixels)
**Resolution:** 72dpi
**Format:** JPEG

**Thumbnail Files:**

**Bit-Depth:** 4 bit gray scale/ 8 bit color
**Image Size:** not to exceed 200 pixels across the long dimension
**Resolution:** 72dpi
**Format:** JPEG

**MAPS, PLANS AND OVERSIZED DOCUMENTS**

**Master File:**

**Bit-Depth: Bitonal, 8-bit grayscale, or 24-bit color (True Color)**
**Resolution: 300dpi for original documents if smaller than 11"x17"**
200dpi if larger than 11"x17"
**Image Size:** Size of original document at scan resolution, for example, 8" x 12" at 300dpi or 16.6" x 20.5" at 200dpi
**Format:** uncompressed TIFF

**Access File:**

**Bit-Depth:** 8 bit grayscale, or 24 bit color
(Set JPEG compression at low quality, 20:1)
**Image Size:** Resize files to 1200 pixels across the long dimension. For example—1200 pixels by 960 for 16"x 20" or 24"x30" documents. (For square documents, reduce files to 1070 x 1070 pixels)
**Format:** JPEG (GIF?)

**Thumbnail**

**Bit-Depth:** 4 bit gray scale/ 8 bit color
**Image Size:** not to exceed 200 pixels across the long dimension
**Resolution:** 72dpi
**Format:** JPEG

**GRAPHIC RECORDS**

**Master Files**

**Bit-Depth:** 8 bit grayscale/8 bit color

**Image Size:** For documents smaller than 11" x 17" adjust scanning resolution to 3000 pixels across the long image dimension. Final image size shall be set to a standard 10" across the long range at 300dpi. For larger documents images size shall be the size of the original document at scan resolution of 200dpi, for example, 16.5"x20.5" at 200dpi.
**Resolution:** 11" x 17" or smaller, 300dpi; larger than 11" x 17", 200dpi
**Format:** Uncompressed TIFF

**Access Files**

**Bit-Depth:** 4-8 bit grayscale/24 bit color JPEG
**Image Size:** Reduce documents smaller than 11" x 17" to 600 pixels across the long dimension. For larger documents, resize files to 1200 pixels across the long dimension. (Set JPEG compression at medium or low quality, 10:1 or 20:1)
**Resolution:** 72 dpi
**Format:** GIF or JPEG

**Thumbnail Files**

**Bit-Depth:** 4 bit gray scale/ 8 bit color
**Image Size:** not to exceed 200 pixels across the long dimension
**Resolution:** 72dpi
**Format:** GIF or JPEG

## V. HARDWARE RECOMMENDATIONS

Scanner Suggestions according to the Colorado Digitization Project (http://coloradodigital.coalliance.org/scanning.html#Scanners):

**Scanner Types**

Common Scanner Types:

- Flatbed scanner
- Slide scanner
- Microfilm scanner
- Drum scanner
- Sheetfed scanner
- Digital camera

Flatbed scanners are one of the most popular scanners used in libraries and archives and are suitable for scanning papers, flat photographs, and other printed materials. Flatbeds can be purchased with an optional attachment called a transparent media adapter, which allows you to scan directly from slides or negatives. However, transparency adapters do not always produce as high a quality of image as a slide or film scanner. If you plan to scan predominantly transparent materials that are smaller than 4 x 5, you may want to consider a slide or a film scanner (there are some slide/film scanners that can handle larger transparent formats). Scanners that combine flatbed scanner capabilities and 35mm slide capabilities are also on the market. Some slide scanners can deliver a better dynamic range than flatbeds; however, the resolution may not be sufficient to create digital masters or meet the resolution requirements of some users.

If your collection contains predominantly oversized materials, you may want to consider outsourcing the scanning to an imaging vendor or purchasing a high-end digital camera that can capture oversize materials, which works much like a copystand setup. There are also flatbed scanners that handle originals that are 12" x 17", and some flatbed scanners can accommodate even larger sizes, although they tend to take up considerable space and produce enormous file sizes.

Some participants in the CDP Project have asked about drum scanners. In general, the CDP does not recommend them for formats of significant value or that are fragile or brittle in any way, as drum scanners can cause a great deal of stress to the document. The original is also taped to the rotating cylinder, so consider how this may also affect the document. Drum scanners are designed for the graphic arts community and, as such, provide an extremely high level of resolution. Drum scanners can scan transparent as well as reflective media, in grayscale and color

SCANNER SUGGESTIONS FOR VARIOUS MATERIAL TYPES

| Single leaf, regular size, flat materials | Single leaf, oversized, flat materials | Bound materials | Transparent media |
|---|---|---|---|
| • Flatbed scanner<br>• Sheetfed scanner (if non-brittle)<br>• Digital camera | • Oversize flatbed scanner<br>• Sheetfed scanner (if non-brittle)<br>• Digital camera | • Digital camera with book cradle<br>• Right angle, prism, or overhead flatbed scanner | • Slide scanner<br>• Film scanner<br>• Multi-format flatbed scanner<br>• Digital camera |

| | | | |
|---|---|---|---|
| | | scanner | |

Not all scanners take the same amount of time to scan the same image at the same resolution. If high production levels are important, it will be necessary to look at the time it takes for both preview and full scan images of materials similar to what you intend to scan. In general, flatbed/slide scanners accommodate a higher production rate than digital cameras, but they also are limiting in the size and type of media formats they are able to scan.
All electronic devices suffer from "noise," which often appears on scans as blotchy or matte-like areas in the dark shadow parts of an image when these areas are lightened or have their contrast range increased. Noise can obscure details in the shadows. Higher quality scanners, with higher bit depths, will give better results, as they tend to use higher quality (lower noise) components.

## A Word About Digital Cameras

At this point in time, we feel that commercially available, hand-held digital cameras are not suitable for archival scanning, excepting the high-end digital cameras (Kontron, Zeutschel, Leica) used by several larger institutions and imaging vendors. High-end digital cameras have no scanning limitations when it comes to size and shape, and can scan at an extremely high resolution (up to 15,000 pixels across the long dimension). They do require certain lighting requirements and a high level of operator skill. However, if you can afford a high-end, overhead digital camera, they present great potential for scanning oversize materials, media in all formats, bound materials with the aid of a book cradle, and present a lower risk to fragile materials by allowing face-up, contact-free scanning.

Digital Camera Reviews http://www.steves-digicams.com/digresources.html#reviews
Digital Camera Reviews http://www.inconference.com/digicam/camera.html
Digital Photography Online http://www.digital-photography.org/default.html
Digital Camera Online http://www.digicamera.com/
Leica http://www.leica-camera.com/digi_img/digi_sys_e.htm

## VI. SOFTWARE RECOMMENDATIONS

(Directly from the Colorado Digitization Project: http://coloradodigital.coalliance.org/Scanners):

**Scanner software**

There are two types of software that you will need for most digital imaging projects. The first is the scanning software that comes with the scanner. The second type of software is the image editing software, normally applied to the image after it has been scanned. Some software, such as Adobe Photoshop®, can serve as both the scanning software and the image editing software.

The scanning software is usually limited in its functionality. You should choose scanning software that is at least capable of saving image files into standard formats such as TIFF, JPG, GIF, etc. This functionality will help production and also ensure a wide range of image delivery options. Software that converts image files from one format to another may also be useful.

To produce images of acceptable quality, it is important to invest in image editing software, which is normally used for "cleaning up" an image (removing dust spots, for example) and for correction (adjusting the level of brightness and contrast, for example). Image editing software should come with the capability to crop, deskew, and rotate; adjust brightness and contrast levels; sharpen (if needed); zoom in and out; accommodate different file formats; provide controls for gamma, black and white, and color (RGB); provide a histogram and look-up table; support compression types; and possess the capability for the user to create and save customized settings, among other functions.

The choice of image editing software is based on the level of image manipulation desired for your project and the level of expertise of staff. Some image editing software, such as Adobe Photoshop®, is very advanced, and may require some time and training to learn. Other software is more basic and allows for only limited operations, such as cropping and rotating, and is not difficult to master. Consider the range of operations you will normally need to perform. The cost of this software can range from free (freeware) to several hundreds of dollars. When considering cost, think about not only the cost of the product, but also how easy it is to use—and factor in additional costs for training, accordingly.

In addition to considering the capability and usability of image editing software, make sure that your current technology can support the software. Do you have the appropriate amount of memory, hard drive space, processor power, and display capabilities (a 24-bit color display card is recommended for image editing work)?

The amount of image editing performed on the images should be defined in your project goals, possibly decided in consultation with the collection curator or an archivist or librarian who is knowledgeable about the materials being scanned. Some digitizing projects aim to create a "pleasing image" that may require a great deal of editing. Other projects may be more concerned with the fidelity of the digital image to the original (this may be important to scholars), and may require very minimal editing. Do you intend to match the digital image as closely as possible to the original? Are you more concerned with the photographer's/creator's intent when editing the digital image (i.e., high contrast; scanner operator makes decisions about tone and color values of the digital image)? Or are you more concerned with reconstructing the appearance of the original as it would have existed when first created (to digitally reconstruct deteriorated originals)? What constitutes a "good image" for the purposes of your project--a faithful reproduction or a pleasing image--should be defined prior to scanning.

## VII. GLOSSARY OF BASIC CONCEPTS

**IMAGE CAPTURE**
A digital camera or scanner captures an image via a light sensitive sensor that converts that information into a digitally coded image-file that can be viewed on a monitor or printed out. For discussion of the pros and cons of digital cameras vs. scanners, see section V.

**PIXELS**
Digital images are composed of pixels, tiny little dots that are arranged into columns and rows to comprise the entire image. Each pixel represents a minute section of the image, and can represent a number of different shades of gray, or grayscale or color. When asked to define Image Size, pixels are typically used as the unit of measurement for the long and short dimensions of a particular image, although it is also possible to view the dimensions of an image represented in inches or centimeters. Most monitors provide a screen space of around 480 x 540 pixels (and sometimes larger). Resolution refers to the amount of pixels per inch (or dots per inch) used in a particular image file. The more pixels per inch, the higher the resolution (and download time) of the file. While Master Files require high resolution and bit-depth, the Web can represent only 72dpi.

**RESOLUTION**
The resolution of a digital image is the measurement of how many pixels (ppi) or dots (dpi) there are in a given area (in both height and width) normally an inch. The resolution of an image, determines the clarity and detail of either that particular image-file. Resolution is determined in two key stages of the digitization process: First, it is established by the scanning software, which will determine the resolution a particular source is scanned at. As scanning will normally be done for the capture of Master Files, resolution will be at the highest optimum level. Second, the resolution of an already scanned or digitized image can also be adjusted by Image Editing software such as Photoshop. For instance, the resolution of images that are to be viewed on the Web (Access Files) can be reduced to 72dpi in order that download time is kept to the minimum.

**BIT-DEPTH**
Bit-depth, dynamic range, or tonal-depth all refer to the number of colors or shades of gray that can be represented by a single pixel. Bits are the smallest unit of data stored in a computer, and bit-depth refers to the number of bits used to represent each pixel in a digital image. The more color an image has, the more bits it will require. Using 8-bit color means that each pixel can represent one of 256 shades of color; using 8-bit grayscale means that each pixel can represent one of 256 shades of gray. Image Editors can now work in True Color or 24 bit-color, and pixels can represent any one of 16 million shades of color. Master Files will require the optimum bit-depth in order that the integrity of the original source be maintained. As increased bit-depth will necessarily create a larger file and download time, it is important that Access Files be optimized for the web by stripping redundant color not visible to the human eye.

**IMAGE SIZE**
When asked to define **Image Size**, pixels are typically used as the unit of measurement for the long and short dimensions of a particular digital image, although you can also see the dimensions of an image represented in inches or centimeters. For an 8” x 10” photograph would typically have the pixel dimension of 2400 x 3000 pixels, although how large this would look on your screen would depend on how many pixels per inch, or what resolution is defined.

**IMAGE EDITORS**
An Image Editor is the software program used to create graphics and format the spatial dimension, resolution, bit-depth, and overall visual appearance of a scanned digital image. The industry standard among Image Editors is Adobe Photoshop, the most versatile program on the market.

**FILE FORMAT**
The most common image file formats for Access and Thumbnail Files are JPEG and GIF, which are both supportable by the Web. For the higher resolution, uncompressed or lossless Master Files, TIFF is the standard format.

- **GIF (Graphic Interchange Format)**
  One of the most effective ways of reducing the size (and thus the download time) of an Access File is to reduce the number of colors required to display the image. Using only the 256 colors of the web, GIFs are the best format for saving simpler graphic images such as line-drawings or some maps. Unlike photographs, these types of graphics don't require a great spectrum of colors or shades of gray in order to look sharp. In addition, to further improve on download speed, when optimizing a graphic created for the web it is possible to reduce even more color and still not significantly affect the visual appearance of that image. Other advantages to GIFs are that they can be progressively displayed and that they support transparency. GIFs are generally smaller files and are lossless (see below). However, GIFs are not well suited for presenting photography. Even when you use the full 256 colors of the web, the quality of a photograph is significantly diminished when saved as a GIF. If your Access File is a photograph, JPEG is almost always the best option

- **JPEG (Joint Photographic Expert Group)**
  JPEGs handle smooth transitions and subtle variations in brightness and color very well. Unlike GIFs, JPEGs do not limit the number of colors an image can contain. For instance, if an original image contains 2,000,002 colors, 2,000,002 colors is what the JPEG will show. However, JPEG is a *lossy format*. This means that in order to decrease file size, data is thrown out when the image is saved: the image loses information that can never be retrieved. While it is possible to establish how much data is discarded in the Image Editor, it is crucial that Master Files be kept in a lossless format such as TIFF.

- **TIFF (Tagged Image File Format)**
  Archival or Master Files will require the lossless TIFF format. While not supported by the web, TIFF is a widely supported format for storing bit-mapped images on personal computer hard-drives. It is also the common format for exchanging images between application programs.

**MASTER IMAGE**
The Master or Archival Image file represents as closely as possible the information contained in the original source. This uncompressed, high-resolution, unedited file serves as a long term source for derivative access file, and is usually stored in the TIFF format.

**ACCESS IMAGE**
The Access Image File is usually derived from the Master File, and is used for general web access. It will have a smaller file size for faster download time, may be edited and compressed, and will be stored in the JPEG or perhaps GIF format.

**THUMBNAIL IMAGE**
This is a very small image usually presented with the bibliographic record of a source. It is desinged to display quickly online, allowing users to determine whether they want to view the larger access image. It is usually stored in the GIF or JPEG file formats.

## VIII. Bibliography of Online Resources

Conservation Online
CoOL, a project of the Preservation Department of Stanford University Libraries, is a full text library of conservation information, covering a wide spectrum of topics of interest to those involved with the conservation of library, archives and museum materials. Although this is more of a reference site than a "how-to" guide, CoOL provides invaluable links to essays on digital imaging and preservation.

"Using Kodak Photo CD Technology for Preservation and Access: A Guide for Librarians, Archivists, and Curators" (Anne Kenney and Oya Y. Reiger)
This brochure that summarizes the findings of a study--coordinated by Cornell University Library's Department of Preservation and Conservation--that evaluated Kodak Photo CD technology as a tool for preserving and making available electronically a broad range of research materials.

Image Permanence Institute (RIT) The Image Permanence Institute is a university based, nonprofit research laboratory devoted to scientific research in the preservation of visual and other forms of recorded information. (see pdf file on Digital Imaging)

Archives and Preservations by National Archives and Records Administration (NARA) This page is designed to offer guidance concerning archival preservation, management, and training to all levels of archivists and preservation professionals from the at-home record-keeper, to the family genealogist, to professionals seeking technical guidance from the National Archives and Records

NARA Guidelines for Digitizing Archival Materials for Electronic Access Although NARA is careful to state that these guidelines should not be seen as a set of standards for digital imaging, this report offers excellent advice for digitization projects.

Safeguarding Digital Library Contents and Users: Digital Images of Treasured Antiquities An IBM collaboration with the Biblioteca Vaticana Apostolica is an early experiment to explore the technical, financial, and practical challenges of making illustrated mediaeval manuscripts accessible via the Internet. The Vatican collection is important to literary scholars, historians, and art historians because it contains not only seminal texts but also magnificent illustrations. We convey what the Vatican Library project and several other IBM joint studies--studies with el Archivo General de Indias de Sevilla (Spain), the lifetime collection of Andrew Wyeth's paintings, a collection held by the Hebrew Union College, and the Yale Beinecke Library--teach about administering intellectual property rights. The question is how to maintain both the intellectual integrity of disseminated images and also the reputations of the institutions making their collections digitally accessible.

Preservation of Library and Archival Materials: A Manual
(Full Online version available)

Selecting Research Collections for Digitization by Dan Hazen,
Jeffrey Horrell, Jan Merrill-Oldham
This invaluable book is available as a full online version. See especially, "Selection for Digitizing: A Decision-Making Matrix" , a very useful graphic aid for considering the various steps to selecting and processing images for a database.

Research Library Group: Diginews (December 1997)
RLG is a not-for-profit membership corporation of institutions devoted to improving access to information that supports research and learning. The home site describes their activities and services, offers assistance to their members and users, and shares news. Although this particular issue is a couple of years old, Frey's "Digital Imaging for Photographic Collections" is useful.

"Digital Libraries: A Selected Resource Guide" by K. Klemperer & S.Chapman.
An extremely comprehensive resource guide to the major publications and educational sites in the field. The essay covers many issues, including quality standards, technology products, and source selection.

"Preservation in the Digital World" by Paul Conway
Written by one of the foremost experts in the field of digital preservation, this publication is widely considered as the seminal text of the field.

"Digital Technology Made Simpler" by Paul Conway
Also written by Conway, this is an extremely informative article published by the Northeast Document Conservation Center.

"Manuscripts and Archives in a Digital Age" by Steven Douglas Miller
Although in a rather dense format, Miller's article will be useful for those considering the digitization of archival manuscripts. In addition, the essay provides a number of very useful external links.

"Selection for Digitizing: A Decision-Making Matrix"
Invaluable for considering the various stages in selecting and processing images for a database

California State Library Scanning Standards by Liz Bishoff
(http://www.library.ca.gov/assets/images/scandocrev1122.PDF)

Colorado Digitization Project: General Guidelines for Scanning
(http:/coloradodigital.coalliance.org/scanning.html)