



Image Compression INFORMATION SHEET March 2011

What is compression?

In computer terms, compression means to make file sizes smaller by reorganizing the data in the file. Data that is duplicated or has no value is saved in a shorter format or eliminated, greatly reducing the file size.

Probably the most common compression format is a zip file. Files within the zip file return to their original state when unzipped and viewed.

What is imagery compression?

Compressing imagery is different than zipping files. Imagery compression changes the organization and content of the data within a file, not necessarily to be restored to its original condition upon opening. Image compression reorganizes and may degrade the data when necessary to achieve the desired compression level. Depending on the compression ratio, the sacrifice of data may or may not be noticeable.

The amount of image compression can be affected by the type of imagery. Higher compression ratios can be achieved in portions of the image that have similar tone, such as areas of the sky that are the same shade.

Why compress files?

Compression is done for a number of reasons:

1. Make files easier to send via email
2. Fit data on media
3. Save storage space
4. Archive data
5. Organize projects
6. Make files easier to open and use

For example, many images can be mosaicked together and compressed into one image to make the product more usable with image viewing software. Image file sizes without compression can be so large, that some computers are unable to store or process the data.

Conversely, compression can make a file size so small, that image quality becomes extremely poor. If the zoom level is low when viewing the imagery or the user doesn't need very high quality, this technique is useful to save storage space or for applications such as indexing image archives or thumbnail prints.

Can imagery become better with compression?

If by "better", one means more user friendly, then yes. However, imagery cannot be made "higher quality" or "higher resolution" through compression.

So what is the downside of compression?

Compressed image files can lose data, even though it may not be apparent to the user. Sometimes this is not a desirable side effect, especially if done incorrectly on high quality raster data. Image analysis or other compatibility with some image processing software may not be achievable with compressed imagery.

What is a compression ratio?

The easiest way to understand a compression ratio (shown as 50:1 or 15:1, etc.) is to think of it in terms of file size and quality. The higher the compression ratio, the smaller the file size (more data is packed into a smaller space), but the lower the quality of the compressed product.

Is prep work required to compress imagery?

Before compressing imagery, image processing may be desirable to prepare images for compression, including: orthorectify or georeference the source images, mosaic and color balance, combine multi-resolution imagery, add vector data, etc.

What is Lossless and Lossy Compression?

Lossless compression reduces an image so its quality matches the original source, mathematically nothing is lost. Although lossless sounds ideal, at times it doesn't provide enough compression and files could remain quite large. The maximum ratio is usually about 2:1.

Lossy means that the compressed image isn't quite the same as the one you started with. Lossy compression degrades images to some degree and the more they're compressed, the more degraded they become. In many situations, such as posting images on the web or making small to medium sized prints, the image degradation isn't obvious. However, compress an image too much or enlarge an image enough and it will show.

❖Are there many compression formats?

Yes. However, in the geospatial arena three main formats dominate image compression. Two are proprietary and one is open source. The proprietary formats are: MrSID (Multiresolution Seamless Image Database) from LizardTech and ECW (Enhanced Compressed Wavelet) from ERDAS ER Mapper. JPEG 2000 is the main open source format used by geospatial software. The software from LizardTech and ER Mapper also support the JPEG 2000 format.

Compression file extensions:

1. MrSID (.sid)
2. ECW (.ecw)
3. JPEG 2000 (.jp2)

❖What image formats does the Aerial Photography Field Office (APFO) use?

The USDA, Farm Service Agency (FSA) has used image compression for many years in order to save disk space as well as to distribute and/or package data in a more convenient form.

The MrSID format was originally selected for use by APFO, in large part because other federal agencies were already using this format. Many government agencies and private companies use compressed imagery. Some of the compression software can also mosaic multiple images into a single seamless, tone matched, compressed mosaic. FSA creates county mosaics but other extents such as a forest area are also possible. This makes for an easy to use and pleasing to the eye base layer for GIS or hardcopy uses.

APFO has used several compression formats over the years for the NAIP program. For additional NAIP information go to: <http://www.apfo.usda.gov>

1. All Compressed County Mosaics (CCMs) from 2004 and earlier have the following specifications:
 - a. MrSID MG2 format
 - b. Compression ratio of 50:1
2. All CCMs from 2005 through 2007 have the following specifications:
 - a. MrSID MG3 format
 - b. Compression ratio of 15:1
3. 2008 compression specifications:
 - a. All 4-band CCMs are JPEG 2000 format.
 - b. All 3-band CCMs are MrSID MG3 format.
 - c. Both formats have a 15:1 compression ratio.
4. 2009, 2010, 2011 CCMs specifications are:
 - a. MrSID MG3 format
 - b. Compression ratio of 1:15.

Note: Some compression software can do more than compress data; they can reproject imagery into different coordinate systems or allow images to be added to existing compressed files without having to start over from scratch.

❖How do I view compressed imagery?

Most GIS software and no-cost image viewers can view the majority of compressed imagery formats. Listed below is information for no-cost viewers as well as software used by FSA and other organizations.

Links to no-cost data viewers and instructions for using the software can be found on the APFO website: <http://www.fsa.usda.gov/FSA/apfoapp?are=a=home&subject=prod&topic=vdj>

APFO does not endorse or support these programs. The information is provided as a service to users of the NAIP imagery or other data. The software listed are:

1. Tatuk GIS Viewer
2. Global Mapper
3. PCI Geomatica FreeView

Note: The Tatuk and Global Mapper software can display 3-band imagery while Geomatica can display both 3-band and 4-band imagery. Each program has different capabilities. To meet your needs you may want to try more than one of the programs for viewing the NAIP imagery or other data.

ArcGIS 9.x & 10 can view MG2, MG3, and JPEG 2000.

ArcGIS 8.3 can view MG2, MG3, and JPEG 2000 with the ArcGIS 8.3 Raster Update, which can be downloaded from the ESRI website here: <http://resources.arcgis.com/content/patches-and-service-packs?fa=viewPatch&PID=43&MetaID=579>

ArcView 3.x can view the MG3 format with the MrSID AVMrSID.dll plug in, which can be downloaded from the LizardTech website at: <http://www.lizardtech.com/downloads/plugins.php>

ArcView 3.x can view the JPEG 2000 format by installing the following plug in: <http://forums.esri.com/Attachments/12333.zip>

❖Who do I contact for more information?

For more information on compression, contact GIS Specialist, David Davis, at (801) 844-2933, or GIS Specialist, Zack Adkins, at (801) 844-2925.