

# ***Using Geocoded TIFF & JPEG Files in ER Mapper 6.3 with SP1***

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This document describes how to use geocoded (or georeferenced) TIFF, JPEG and BMP files in ER Mapper 6.3 with Service Pack 1 (SP1) installed. It is intended primarily for those using ER Mapper to mosaic airphotos or scanned topo maps, but the general concepts apply to any images stored in these formats.

Use this document as a reference if you are trying to use the following file types in ER Mapper:

- **GeoTIFF files**
- **TIFF with world (.tfw) files**
- **JPEG with world (.jgw, .jpegw, or .jpw) files**
- **BMP with world (.bpw) files**

## What is new in 6.3 SP1 regarding World files?

ER Mapper 6.3 with Service Pack 1 (SP1) introduced two new capabilities that improve the way it handles World files:

- Rotation parameters are now read automatically when you open an image with a World file. See the section “How ER Mapper handles rotation in World file images” for details.
- The **Save As** dialog boxes for TIFF/GeoTIFF, JPEG, BMP and BIL/HDR formats now have an option to generate a World file when exporting images. See the section “Exporting images with World files in ER Mapper” for details.

## What is GeoTIFF format?

GeoTIFF is a type of TIFF (Tagged Image File Format) graphics file that contains georeferencing information embedded as “tags” in the TIFF file’s header section. This includes the datum, map projection, pixel size, registration coordinate, and other information needed to properly georeference the image when opened in applications like ER Mapper that understand the tags.

Using GeoTIFF files in ER Mapper is easy—just open the file(s) and go. ER Mapper reads the GeoTIFF tags and uses the georeferencing information automatically. It is

sometimes not easy to tell whether a file is a GeoTIFF or a plain TIFF just by the filename. See the section “What if I have GeoTIFFs with World files?” for details.

## What is TIFF, JPEG or BMP with World files format?

TIFF, JPEG and BMP are three generic graphics file formats in which images such as airphotos, scanned maps, and so on are commonly stored. Most applications can read these files, so they are commonly used for storage and delivery of image data.

Many times TIFF, JPEG and BMP files are accompanied by a “world” file that provides basic georeferencing information (but not all information) about the image file. ER Mapper recognizes files with the following extensions as World files:

- .tfw (when accompanied by a .tif file)
- .jgw, .jpegw or .jpw (when accompanied by a .jpg file)
- .bpw (when accompanied by a .bmp file)

The world file provides basic (but not complete) georeferencing information that allows “geographically-aware” software products like ER Mapper to position the image file in a coordinate system relative to other images or vector data. (The World header file format was developed by ESRI for use in their GIS products such as ArcView<sup>®</sup>, but it is commonly used by many other geographic software products and data vendors.)

## What information is in a World file?

A World file is a simple ASCII text file that contains the X and Y pixel size, the rotation, and the registration coordinate of the center of the upper-left corner pixel in the image. Following is a sample World file (descriptions have been added in parentheses):

```
5.25000 (X pixel size)
0.0 (Rotation term for row)
0.0 (Rotation term for column)
-5.25000 (Y pixel size, negated to represent upper-left of image)
6270000.00000 (X coordinate of center of upper-left pixel)
18262000.00000 (Y coordinate of center of upper-left pixel)
```

The pixel size and registration coordinates are expressed in units such as meters, feet, or decimal degrees. (The Y pixel size is usually a negative value to account for the differences between the origin of image and non-image data in ESRI products. Most other products simply ignore the negative sign when reading the data.)

**Note:** ER Mapper 6.3 with SP1 now reads and uses the rotation parameters in World files. This means that images with rotation will now display with proper coordinates when the projection information is defined to ER Mapper (see below).

## What information is not in a World file?

Unfortunately World files do *not* contain some georeferencing information that is required to properly georeference the TIFF, JPEG or BMP image file in ER Mapper . These include:

- **Geodetic Datum**—A spheroid and tie point, this defines the local variation in the shape of the earth's surface in that area of the world. (Common datums used in the USA include NAD27 and NAD83. Each part of the world has it's own datums used locally.)
- **Map Projection**—The model used to translate spherical earth coordinates onto a flat 2-D surface (the map). Common projections include Universal Transverse Mercator (UTM), Transverse Mercator, Lambert Conformal Conic, and many others. (US State Plane map projections are either Tranverse Mercator or Lambert Conformal Conic depending on the state, but are often referenced simply by name such as "California State Plane Zone 6.")
- **Units**—The measurement units used for coordinates in the selected map projection. Most projections such as UTM use meters, but US State Plane projections usually (but not always) use feet. Units of decimal degrees are also used for generic Latitude Longitude projections sometimes called "geographic" (the "Geodetic" projection in ER Mapper).

Since this information is *not* contained in the World file, it must be added by the user to ensure that the TIFF or JPEG images are georeferenced properly in ER Mapper and that any subsequent processing and output to GeoTIFF, ECW, etc. will be correct. (This is explained in the following sections of this guide.) To get the datum, projection and units information, you may need to contact the person who provided the TIFF, JPEG or BMP files, *so be sure to ask for it.*


## Opening TIFF, JPEG or BMP images in ER Mapper

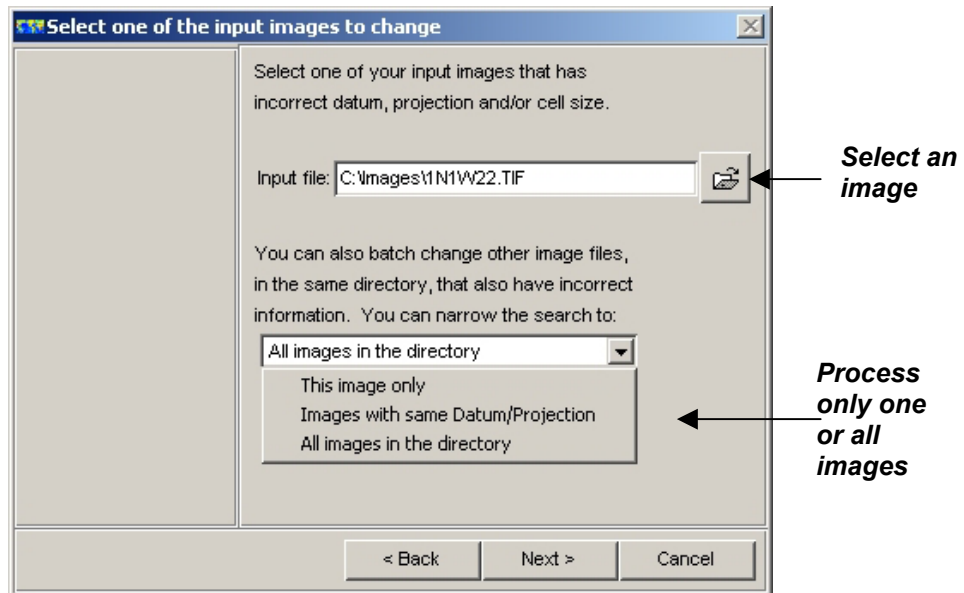
ER Mapper 6.3 can directly read the TIFF, JPEG and BMP formats, so you simply need to select **File/Open** to load and display the image. If a World file with the same base filename is present in the same directory as the TIFF, JPEG and BMP file, ER Mapper will automatically transfer the pixel size, rotation, and upper-left coordinate information when it displays the image. (If the file is a GeoTIFF, that information overrides information in the World file.) This also goes for mosaicking multiple TIFF, JPEG or BMP images using ER Mapper's Image Display and Mosaic Wizard.

As mentioned previously, you can display TIFF, JPEG and BMP images and often mosaic them successfully without entering the undefined datum, projection and units information. If you are simply “making pictures” this is OK, but if you want to create truly georeferenced image products or export results to a format like GeoTIFF or ECW, you *must* enter the undefined projection information.

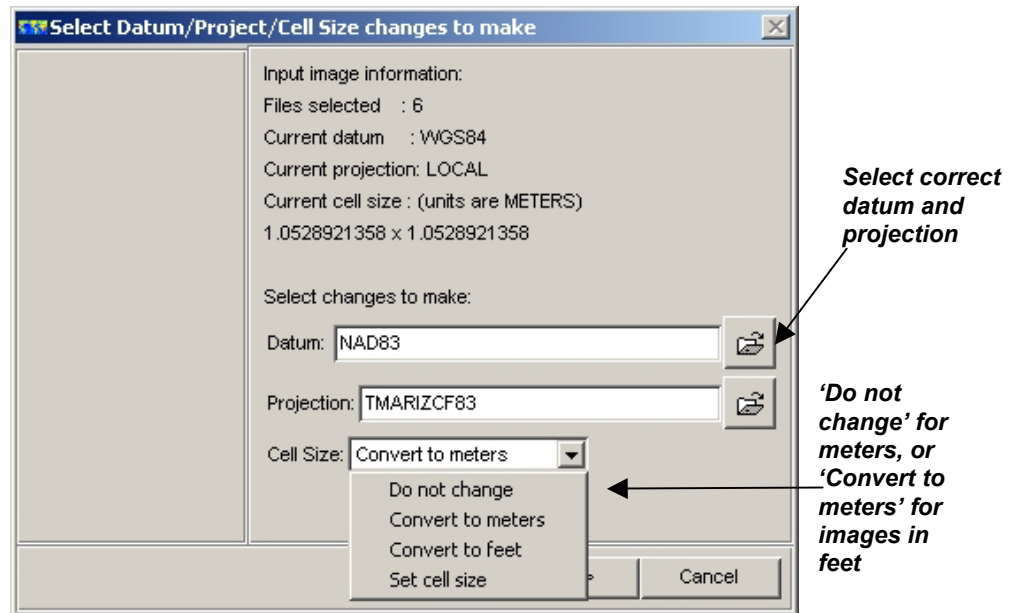
## Generating ERS headers for TIFF, JPEG or BMP images

Doing this is easy. Simply run ER Mapper’s “Change Projection/Datum/Cell Size” wizard. This will create ERS header files with the correct datum and projection to accompany the image and World files. It can be run in batch to process all files in a directory, or a single file. Follow these steps to perform this procedure:

1. Click the **Change Projection/Datum/Cell Size for many images**  button on the ESG Utilities toolbar. (If the toolbar is not displayed, select Batch Processing from the **Toolbars** menu.)
2. On the “Select one of the input images to change” page, load one of your TIFF, JPEG or BMP files. Then select the appropriate option to process one image or all images in the directory.



3. Click **Next>**. On the “Select Datum/Projection/Cell Size changes to make” page, select the correct datum and map projection. If your input images are in a meter-based projection (UTM, etc.), select “Do not change” for Cell Size. If your images are in foot-based projection (such as some U.S. State Plane), select “Convert to meters.” (This is very important. See “Meters vs. Feet in ER Mapper” later for an explanation as why you need to do this.)



**Note:** If you need help selecting the appropriate ER Mapper projection for US State Plane projections, go to ER Mapper's **Help->User Guide->Appendices->Supported Map Projections and Datums** for a list.

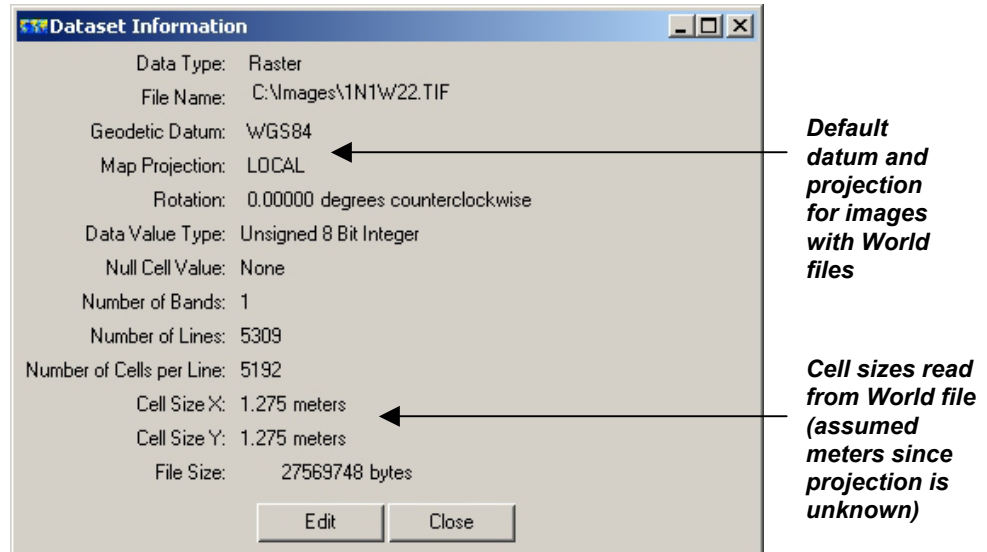
4. Click **Next>** to show the proposed changes. Verify, then click **Next>** to start the processing. When finished, you will now have a set ERS headers files in the same directory as your image and world files. Use these files from now on when opening or mosaicking images in ER Mapper.

## Meters vs. Feet in ER Mapper

This section describes how ER Mapper handles coordinate units (meters or feet) when using TIFF, JPEG and BMP files with World files. *This is especially important for those using foot-based map projections such as many of the U.S. State Plane projections.*

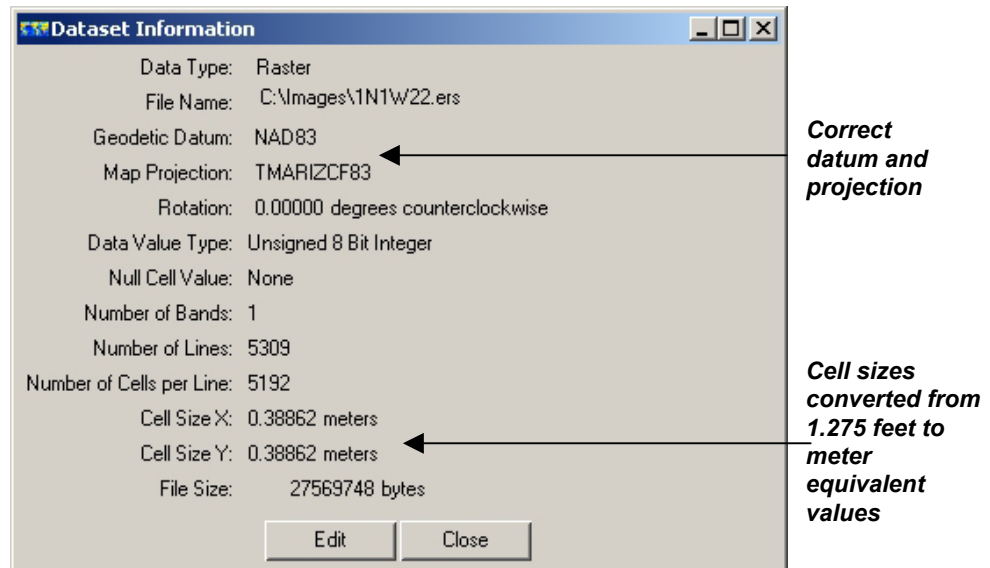
ER Mapper always internally stores the cell (pixel) sizes of images in meters. (The only exception is for images in the Geodetic projection, which uses decimal degrees.) This is not a problem, but issues can arise when you are not aware of this.

When you open a TIFF, JPEG or BMP image with a World file in ER Mapper, it internally reads the registration coordinate and cell size from the World file, and sets a default datum of "WGS84" and default projection of "LOCAL." This is because World files do not contain datum or projection information. (LOCAL tells ER Mapper that the image is projected, but in an unknown coordinate system.)



This means that if the cell size stored in your World file is in feet, then you need to convert those values to their meter-equivalent values. (If your cell sizes in the World files are in meters, such as for a UTM meters projection, then you don't need to convert them.)

This is the reason for selecting the "Convert to meters" setting when generating your ERS headers in the previous section. This lets ER Mapper correctly interpret the cell sizes in relation to the registration coordinates of the image (which were feet in the World files and remain feet in ER Mapper.) So, after generating an ERS header for the image above (in Arizona State Plane Central in feet), the updated image information now looks like this:



Now you are ready to proceed processing and mosaicking your images in ER Mapper.



## Do I still need ERS files for meter-based images?

Yes! Even if your World file images are in a meter-based projection or geographic/Lat Long projection, you should still run the “Change Projection/Datum/Cell Size” wizard to generate ERS headers for them. Why? Because without knowing the datum and projection, you can’t display Lat Long values for the images, add a Lat Long grid in map composition, or export them to a GeoTIFF or ECW file so other applications can also read the projection information.

For example, assume you have a TIFF, JPEG or BMP image in a UTM projection (zone 11 north in this case). If you open the image in ER Mapper without creating an ERS header, then select **View->Geoposition->Extents**, this is what you see:

The screenshot shows the 'Algorithm Geoposition Extents' dialog box with the 'Extents' tab selected. The 'Algorithm extents' section contains a table with the following data:

	Top Left	Bottom Right	Size
Latitude:	0:0:0.0N	0:0:0.0N	0:0:0.0N
Longitude:	0:0:0.0E	0:0:0.0E	0:0:0.0E
Easting:	472552.48E	514552.48E	42000.00
Northing:	3650694.38N	3595674.38N	55020.00
Cell X:	-0.00	1400.00	1400.00
Cell Y:	0.00	1834.00	1834.00

An arrow points to the placeholder values in the Latitude and Longitude rows.

***Lat Long values cannot be calculated without knowing the projection***

After generating the ERS header and redisplaying the image, this is what you see:

The screenshot shows the 'Algorithm Geoposition Extents' dialog box with the 'Extents' tab selected. The 'Algorithm extents' section contains a table with the following data:


	Top Left	Bottom Right	Size
Latitude:	32:59:45.72N	32:29:59.81N	0:29:45.91
Longitude:	117:17:37.68W	116:50:42.32W	0:26:55.36
Easting:	472552.48E	514552.48E	42000.00
Northing:	3650694.38N	3595674.38N	55020.00
Cell X:	-0.00	1400.00	1400.00
Cell Y:	0.00	1834.00	1834.00

An arrow points to the correct values in the Latitude and Longitude rows.

***Correct Lat Long values now shown***

## What if I have GeoTIFFs with World files?

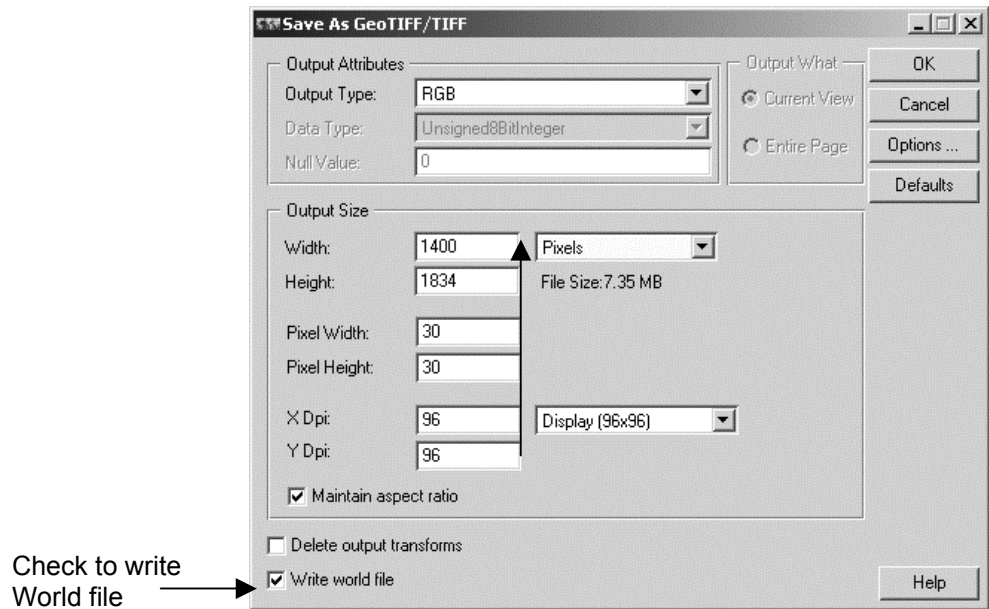
Some data vendors will give you images in GeoTIFF format, but also supply a World file in addition. The World file is redundant for products like ER Mapper because all the needed information is contained in and read from the GeoTIFF (.tif) file. However the fact that a World file is present may make you think the images are not in GeoTIFF format, when in fact they might be. This can be very confusing!

To test whether a TIFF image is a GeoTIFF, use this procedure (*before* you generate an ERS header). Open it in ER Mapper. Click the **Load Dataset**  button on the main menu (2<sup>nd</sup> row), then click **Info**. Then:

- If the datum is *not* RAW or WGS84 and the projection is *not* RAW or LOCAL, you have a GeoTIFF file. Then you do not need to generate ERS headers at all, just load and use the images as is.
- If the datum is WGS84 and the projection is LOCAL, you have a plain TIFF image with a World file. Although it is possible to use these images to some extent as is, you should generate ERS headers with the correct datum and projection to fully georeference them.
- If the datum is RAW and the projection is RAW, you have a plain TIFF image *without* a World file. This image is either not geocoded, or the geocoding information is provided in a different format that ER Mapper cannot read automatically. If the image is geocoded, you need to manually enter all the information to create an ERS file using the Dataset Header Editor. If it is not geocoded, you can use the Geocoding Wizard to rectify or orthorectify the image.

## Exporting images with World files in ER Mapper

ER Mapper 6.3 with SP1 adds the capability to automatically write World files when exporting (saving as) images to TIFF/GeoTIFF, JPEG, BMP and BIL/HDR formats. This can be nice when your clients are used to having World files for GeoTIFFs. World files are also the easiest and most universal way to provide basic georeferencing information for JPEG or BMP images.




**Note:** The “Write world file” setting can be enabled/disabled in the **Save As** dialog as shown above, or can be set as a product default setting using the **Edit->Preferences->General** “Write world file on save” option.

## How ER Mapper handles rotation in World file images

ER Mapper 6.3 with SP1 adds the capability to read and use the rotation parameters in World files, and also to save them as part of World files when exporting images (see “Exporting images with World files in ER Mapper”). The rotation parameters in World files (the 2<sup>nd</sup> and 3<sup>rd</sup> fields) are actually X and Y translation parameters. When ER Mapper opens an image with a World file, it automatically converts those parameters into a single rotation value that it uses internally. This means that the geographic locations show in ER Mapper will be true once the correct datum and projection are defined. (ER Mapper expresses rotation as the number of degrees rotated from north, which is just a different way than using X and Y translations).

To see whether an image with a World file is rotated from north, open it in

ER Mapper. Click the **Load Dataset**  button on the main menu (2<sup>nd</sup> row), then click **Info**. If the Rotation value is not 0.00000, then the image has been rotated from north according to the World file.

When exporting rotated images to formats that use World files (TIFF, JPEG, etc.), ER Mapper converts its single rotation value back into the equivalent X and Y translation parameters in the World file. This also means that the cell sizes in the World files may be slightly different than those listed in ER Mapper. They are adjusted as part of the translation, and this is normal.

I hope all this has helped! Please contact me if you have any questions or find any errors.

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