This support note addresses how ArcMap®, ArcPad®, and Pathfinder® Office handle georeferenced raster data and coordinate system information.

Terminology

Georeferencing: refers specifically to the way in which a digital photograph is registered to the earth's surface. Georeferencing information is stored internally in the file in some cases, and in an associated world file in other cases. ArcMap and ArcPad can read the georeferencing information from some files if it is present. Pathfinder Office cannot – it always requires a world file.

Spatial reference: an ESRI® term for coordinate system and datum reference plus other related items. In a geodatabase, a spatial reference is the coordinate system used to store each feature class and raster dataset as well as other coordinate properties such as the coordinate resolution for x,y coordinates and optional z and m (Measure) coordinates.

Software

ArcMap: Coordinate system information should be obtained from the data source if possible.

Shapefile (Vector file): A shapefile often does not have information that identifies which coordinate system was used to define its features. In this case, the Spatial Reference property will be Unknown or Assumed Geographic.

If the feature's bounding coordinates are within the range of –180 to 180 in the x direction and –90 to 90 in the y direction, ArcGIS® assumes the data to be geographic and its datum to be NAD 27. If the bounding coordinates are not within this range, the software considers the spatial reference Unknown.

Once the coordinate system is defined, this will be saved in a projection (.prj) file (e.g. roads.shp will now have an associated file called roads.prj).

Raster: The Spatial Reference section in the Properties dialog box shows the raster's map projection and lists parameters of the projection. The projection defines how coordinates describing locations on the earth's surface are mathematically transformed to accurately represent them on a flat map sheet with the least amount of distortion. There will always be some sort of distortion in geographic data when using 3D data on a 2D plane. When you choose a spatial reference, you need to choose the projection that will minimize the type of distortion you are most concerned about.

If the raster dataset does not have a coordinate system, you can assign one by clicking the Edit button. The Edit button will also display more details about the existing coordinate system if one is already defined. If the raster dataset is a grid, you will see the Define Projection Wizard. You can either define the coordinate system's parameters interactively or copy the information from another coverage, grid, or TIN.

If the raster dataset already has coordinate system information, you can use the Define Projection Wizard to change that information. Converting from one projection to another can also change the shape and area a cell represents on the surface of the earth. Each projection treats the relationship between a 3D world and a 2D one differently. You should be aware of the properties and assumptions for each projection before selecting one.

Depending on the raster file format, this information will be stored internally in the file itself, or externally in an AUX file.

An auxiliary (AUX) file accompanies the raster in the same location and stores any auxiliary information that cannot be stored in the raster file itself.

An AUX file can store the following:

- Color map
- Statistics, histogram, or table
- Pointer to the pyramid file
- Coordinate system
- Transformation
- Projection information

ArcPad: Although not mandatory, it is highly recommended that shapefiles used in ArcPad have associated map projection (.prj) files.

An ArcPad AXF file is a single file that is made up of multiple components including the spatial reference information. No extra files are required for the coordinate system information in ArcPad.

Raster files must have associated georeferencing information. This georeferencing information includes the size of the pixels, as well as the coordinate position of the reference pixel. The georeferencing information can be stored in three locations:

- Within the header section of the image, such as with GeoTIFF or MrSID® images.
- Within an associated Auxiliary (.aux) file, such as created by ArcGIS.
- Within an associated world file, such as a .jgw file with a JPEG.

All raster files must have either a world file or an AUX file, with the exception of GeoTIFF and MrSID images.

When adding a raster layer to an ArcPad map, ArcPad first looks in the image header for the georeferencing information, then in the associated .aux file (if present), then within an associated world file (if present).

The Add Layers dialog box only displays raster files that have an associated world or AUX file. The Add Layers dialog box does not check the contents of the world or AUX file for valid data. It simply checks for the existence of these files to determine whether the raster file is supported. The exceptions are the GeoTIFF and MrSID images.

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Pathfinder Office: When data is in Pathfinder's native data format (.ssf, .cor or .imp files), extra files containing coordinate system information is not required. To use a shapefile, .dxf or raster file as a background, coordinate system information should be obtained from the data source and supplied to Pathfinder Office.

Image files: The world coordinates of the area represented by the image must be supplied to Pathfinder Office as a separate world file or as part of the file (such as MrSID files). Georeferencing information is given in coordinate units and the values must be valid for the appropriate coordinate system. This is set through File>Background>Load Background Files.

Each background image file must be georeferenced, meaning it must have an associated world file. The world file determines the relationship between the pixels in the raster file and the corresponding real-world coordinates that each pixel represents. A raster can be georeferenced in any coordinate system supported by the GPS Pathfinder Office software.

A variety of world file extensions are recognized, as shown below:

Raster Image Extension	Examples of recognized world file extensions
*.bmp	BPW, WLD
*.ecw	EWW, WLD
*.tif	TFW, WLD
*.tiffw	TIFFW, WLD
*.jpg, *.jp2, or *.j2c	JGW, WLD
*.sid	SDW

TerraSync: Like Pathfinder Office, data used in TerraSync's native data format, (.ssf, .cor and .imp files) do not require separate coordinate system files.

Coordinate system information for background files of all types is stored in a .cs file found in \My Documents\TerraSync. For example, Jerome.sid would have an associated file called Jerome.cs, which is created in one of two ways:

- Using the Pathfinder Office Data Transfer Utility, using the settings supplied by the user when adding the background file.
- If a background file is copied over using ActiveSync/File Explorer directly to the TerraSync directory or SD card, it will not have a .cs file. When that file is added as a background file in TerraSync, a message will appear asking if you 'want to assume that the background file is the same as the map coordinate system'. Tap yes, and a .cs file will be created that matches the settings supplied by the user in TerraSync Setup > Coordinate Systems.

Note: If you copy a background file to the handheld using ActiveSync, be sure to also copy any associated world file.

References:

- ESRI's ArcGIS 10.2 Desktop Help
- ESRI's ArcPad 10.2 Help
- Trimble®'s GPS Pathfinder Office 5.60 Help

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