

# RDSC Workshop #4

## Finding, Organizing & Creating Data

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# Overview

- Briefly discuss different online data sets
- Adjust the Scanned Map in Photoshop
- Georeference Scanned Map in ArcMap

# Finding Data:

## Assorted Government Data

- <https://www.data.gov/open-gov/>
- <http://data.lexingtonky.gov/>
- [www.kygeonet.ky.gov](http://www.kygeonet.ky.gov)
- <https://www.census.gov/geo/maps-data/data/tiger.html>

## Assorted Data:

- <https://earthworks.stanford.edu/>

## Health & Demographic Data

- <http://spatialdata.dhsprogram.com/home/>

## Public Domain

- <http://www.naturalearthdata.com/>
- <https://livingatlas.arcgis.com/en/#s=0>

## Transportation

- <https://maps.bts.dot.gov/>

## Raster Images

- <https://www.loc.gov/maps/>
- <https://nationalmap.gov/>

## Spatial Reserves: A guide to public domain spatial data

<https://spatialreserves.wordpress.com/>

### Reminder:

1) Vector: Shapefiles, geodatabases, feature services, other vector formats.

2) Raster: JPEGs, GeoTiffs and other image files

### Spatial Analysis:

From [Esri](#): “The process of examining the locations, attributes, and relationships of features in spatial data through overlay and other analytical techniques in order to address a question or gain useful knowledge. Spatial analysis extracts or creates new information from spatial data.

Or: It is how we understand our world – mapping where things are, how things are interconnected, and what it all means.

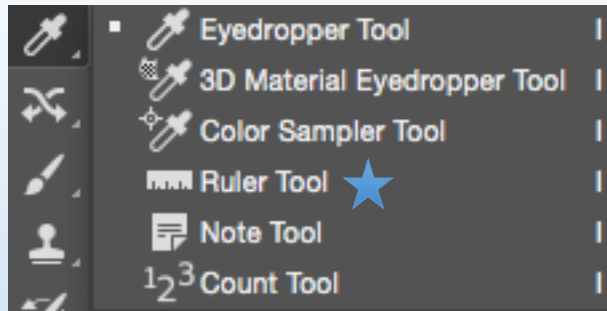
# Creating Data: Georeferencing


Scanned maps or aerial photos don't normally contain spatial reference information (either embedded in the file or as a separate file).

- Therefore, to use some raster datasets in conjunction with other spatial data, you may need to align or “georeferenced” them to a map coordinate system.
- Georeferencing
  - The process of taking an image and assigning it a coordinate system by transforming (shifting, rotating and stretching) to locate it correctly in space.
  - You do this by identifying common or known points in your un-georeferenced image, and choosing the corresponding point in a georeferenced space.
    - For example, if you see the corner of a building in your un-georeferenced image, which you can also locate precisely on a correctly georeferenced image, you simply pick on the point in the first image, pick on the corresponding point in the second image, and then it shifts the image accordingly. You repeat the process with several points (a minimum of four typically) and keep going until the images overlay accurately

# Adjusting The Image in Photoshop


- Open the scanned map file
- Hold down the eyedropper tool and select the ruler tool:



- Use the ruler tool to draw a line from the top left edge of the map to the top right edge.
- Select “Image” from the toolbar and then select: Image Rotation → Arbitrary
- Now select the crop tool to crop the map. 
- Once you are happy with your file save it.



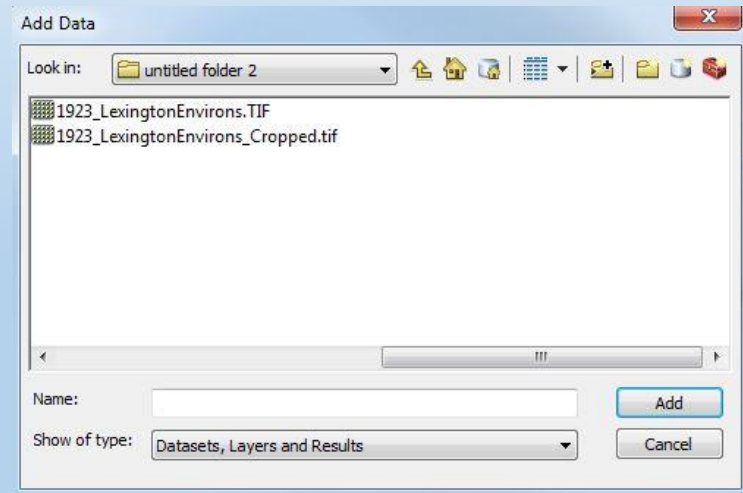
# Step 2: Fitting the Image to the Basemap

- Now, we will locate the scanned map to the center of the display window
- Zoom in until the basemap is roughly the same area as your scanned map
- Select Add Data → Connect to Folder  → Find the scanned map and select
- If prompted, click “yes” to build pyramids” and ignore the “Unknown Spatial Reference” error message.
- You should now see the title of the map image in the georeferencing toolbar box
- Under the Georeferencing toolbar, click “Georeferencing” and select “Fit to Display.”
  - The image should be roughly aligned to the data layers, though if not, this is not a problem.

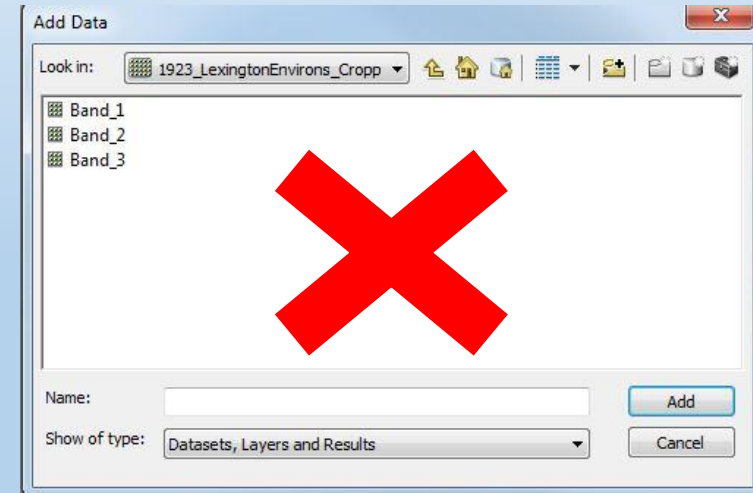
# Step 2: Fitting the Image to the Basemap

- Note that if it is a .jpg or .tif file, make sure you choose the entire image file (left image below).
- If you double click on the file and see the individual bands listed in the dialog box (right image below), you have gone down too far. Back up and add the full .jpg or .tif file.

Great!



Go Back!





# Step 3: Adding Control Points

- Now, we need to use the basemap to transform the image. This is done by adding several “control points.”
- Control points—known x,y coordinates—link locations on the raster dataset (the scanned map) with locations in the spatially referenced data (the basemap).
- Control points are locations that can be accurately identified on the raster dataset and in real-world coordinates. Many different types of features can be used as identifiable locations:
  - Road Intersections/Street Corners, Famous Landmarks, The Mouth of a Stream, etc.
- Overall, the control points are used to build a transformation that **will shift the raster dataset from its existing location to the spatially correct location.**
  - The connection between one control point on the raster dataset (the from point) and the corresponding control point on the aligned target data (the to point) is a link.

# Step 3: Adding Control Points

- The number of control points you need depends on the complexity of the transformation you plan to use to transform the raster dataset to map coordinates.
  - **However, adding more links will not necessarily yield a better result.**
  - **Very IMPORTANT – spread the control points across the entire raster image so that you have points in all corners and a couple in the interior area.**
    - If you concentrate the points in one area, the entire image will be warped incorrectly.
- Now, before adding control points look for the following:
  - Avenue of Champions
  - MLK Blvd

# Step 3: Adding Control Points

Choose a point visible on both the map and the basemap (you may need to zoom around and toggle on and off the two layers)


- Once you have found a good control point location.
  - Click the location (a green X (or crosshair) should appear)
  - Move your mouse over to the Table of Contents and de-select the map image
  - Now move your mouse until you find the corresponding location the basemap and click again (a red X (or crosshair) should appear).
- You have now added one control point.
- Continue to add control points. As you do this the image should move and align with the basemap.

# Step 3: Adding Control Points

## Tips:

- If the image becomes extremely warped during georeferencing, try the procedure again but turning the auto-adjust off. This allows the image to be adjusted at the end of the placement of all control points.

# Step 3: Adding Control Points

- You should check your control points occasionally by choosing **View Link Table icon** on the Georeferencing toolbar. The icon is a small rectangular button with a light blue background and a thin border. It contains three horizontal arrows: a blue arrow pointing left, a green arrow pointing right, and a red arrow pointing right.
- This will show you all the control points, and when you have more than three it will show you the RMS error.
  - Root Mean Square error is the measure of the fit between the true locations and the transformed locations of the output control points. If there is a control point with a high level of error, consider deleting it by highlighting the point in the link table and clicking the delete icon.
  - HOWEVER, everything will depend on the quality of the map being georeferenced, the quality of the target (base) map, and the purpose of the georeferencing.
    - Overall, the RMS provides a rough guide to how consistent your control points are to one another with reference to the map.
  - You can delete control points that have large errors and re-enter them or enter other points which result in a lower error.

# Step 4: Rectifying

Once you are happy with georeferenced image, it can be saved:

- Click “Georeferencing” → “Rectify” to save the transformation information with the raster.
- Accept the default for Cell Size, NoData as, and Resample Type.
- Click Browse to save the georeferenced image to a specific location
- The default TIFF is the suggested file format with no Compression Type
- Also, should have an .aux file that contains the coordinate information. The text file that allows you to later reload the unregistered image and modify your registration patterns (i.e. change, add, or delete control points and change the transformation type).
- IF you selected for pyramids to be built, will also have an .ovr file.

# Types of Transformations

- A zero-order polynomial is used to shift your data.
  - Commonly used when your data is already georeferenced, but a small shift will better line up your data. Only one link is required to perform a zero-order polynomial shift. It may be a good idea to create a few links, then choose the one that looks the most accurate.
- A first-order or affine transformation can shift, scale, and rotate a raster dataset. Need a minimum of 3 control points.
- A second-order polynomial requires 6 control points
- A third-order polynomial requires 10 control points

Most of the time either a 1st or 2nd order will suffice. Try all three and choose the one that works best

# Georeferencing

- Is central to making aerial and scanned images useful for digital mapping
- One way to create your own data for unique projects