

GIS Data (Part 3)

1. Review: Raster Data
2. Downloading MassGIS Raster Data
3. Finding the Tile!
4. Bands vs. Image
5. Practice for Thursday

Course Website

<https://sites.google.com/site/garp0244fall2014/home>

GIS Resources

<http://www.westfield.ma.edu/cbraun/resources/gis-resources/>

Cool Maps

[10 Skills You Will Need!](#)

[The Internet Map](#)

[Columbia Glacier 1986 vs. 2014](#)

Raster data consists of a matrix of cells (or pixels) organized into rows and columns (or a grid) where each cell contains a value representing information, such as its color. Raster data are digital aerial photographs, imagery from satellites, digital pictures, or even scanned maps.

Downloading data is easy and fun!

But, there are a few ways you can get yourself in trouble!

- Not paying attention to data organization!
- Not paying attention to where to you download and unzip data!
- Not paying attention to file sizes!
- Not understanding what you are downloading!
- Not reviewing and understanding the data layer description!

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1) Review: Raster Data

Raster Data uses a grid and grid cells to represent the spatial variations of a parameter.

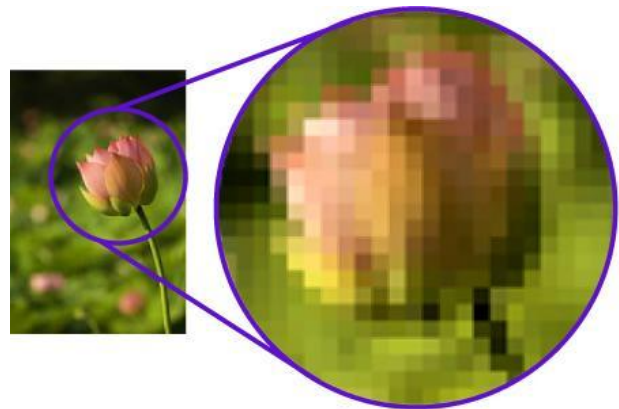
- The information about the parameter is the grid cell value.
- Raster data are suitable for representing continuous parameters (e.g. elevation, temperature, wind speed, etc.)
- The most commonly used raster data are air photos, satellite images, and digital elevation models.

Here we are primarily using the raster images available from MassGIS.

A raster image, also called a bitmap, is a way to represent digital images. The raster image takes a wide variety of formats, including the familiar .gif, .jpg, .bmp, and .tif.

A raster image is created using a digital camera or a scanner that converts a printed map or picture into a raster image. A raster image represents an image in a series of bits of information which translate into pixels on the screen. These pixels form points of color which create an overall finished image.

When a raster image is created, reality is converted into pixels. Each pixel is assigned a specific value which determines its color. The raster image system uses the red, green, blue (RGB) color system. An RGB value of 0,0,0 would be black, and the values go all the way through to 256 for each color, allowing the expression of a wide range of color values. In photographs with subtle shading, this can be extremely valuable.



When a raster image is viewed, the pixels usually smooth out visually for the user, who sees a photograph or drawing. When blown up, the pixels in a raster image become apparent. While this effect is sometimes a deliberate choice on the part of an artist, it is usually not desired.

Depending on resolution, some raster images can be enlarged to very large sizes, while others quickly become difficult to see. The smaller the resolution, the smaller the digital image file. For this reason, people who work with computer graphics must find a balance between resolution and image size.

2) Downloading MassGIS Raster Data

Downloading MassGIS raster data is easy, except you need to deal with additional new file types and determine out the correct tiles to download. Below is a description of the four most important raster image data sets available from MassGIS for this course.

2.1) USGS Topographic Quadrangle Images

MassGIS provides the scanned USGS topographic maps as a seamless mosaic of tiles across the state at

<http://www.mass.gov/anf/research-and-tech/it-serv-and-support/application-serv/office-of-geographic-information-massgis/datalayers/imquad.html>

Download the index map to find the tiles for your area:

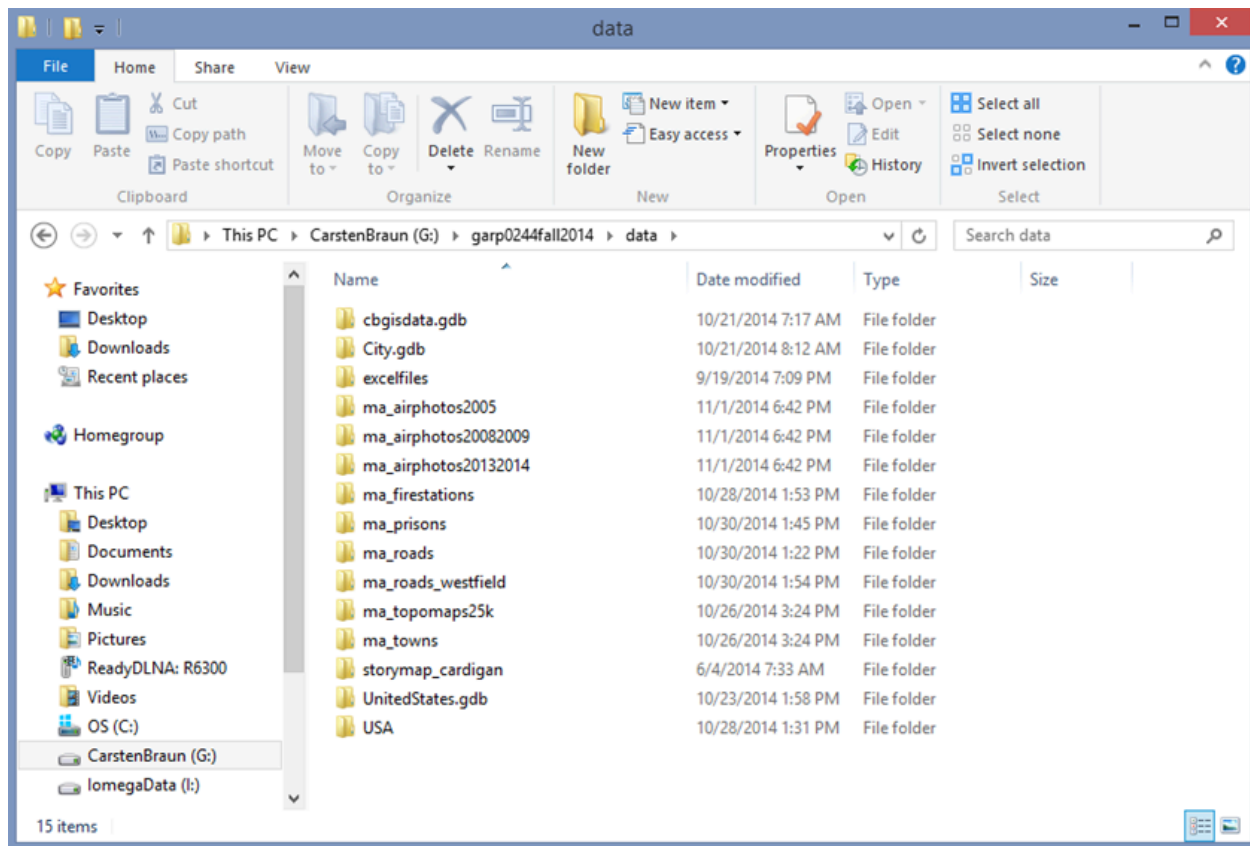
<http://www.mass.gov/anf/docs/itd/services/massgis/ix-oq.pdf>

Tiles are named with a 6-digit numerical ID, for example q237898.

- These maps are available as 4,000 m by 4,000 m tiles for the entire state as zip archives.
- Available as TIFF and MrSID files. MrSID is the recommended file format for ArcGIS.

Download Procedure

1. Create your dedicated data folder inside your \data folder called \ma_topomaps25k. Do this first, *before* you start downloading anything!
2. Determine the 6-digit ID numbers for the tiles you want to download by checking on the index map. Write these numbers on a piece of paper if needed.
3. Goto
<http://www.mass.gov/anf/research-and-tech/it-serv-and-support/application-serv/office-of-geographic-information-massgis/datalayers/imquad.html>
4. Click-on Download these images, MrSID, and download the zip archive(s) for your tiles into your \data\ma_topomaps25k folder.
5. Browse to your \data\ma_topomaps25k folder in Windows Explorer and extract/inzip.
6. Preview the topographic maps in ArcCatalog and map in ArcMap.



As always: make your folders!

2.2) 1:5,000 Color Ortho Imagery (2005)

This photography for the entire commonwealth was captured in April 2005 when deciduous trees were mostly bare and the ground was generally free of snow. Download at <http://www.mass.gov/anf/research-and-tech/it-serv-and-support/application-serv/office-of-geographic-information-massgis/datalayers/colororthos2005.html>

Download the index map to find the files for your area:
<http://www.mass.gov/anf/docs/itd/services/massgis/ix-oq.pdf>

Tiles are named with a 6-digit numerical ID, for example 237898.

- This is a great data set of aerial photographs from 2005 covering the entire state.
- Only use the contrast-stretched version of these images – they look much better than the original images.
- Each tile covers 4,000 m by 4,000 m on the ground.

- Available as JPEG2000 and MrSID files. MrSID is the recommended file format for ArcGIS.
- The maps are available for download as zip archives.

The topographic maps and 2005 aerial photographs are available for the entire state as a seamless mosaic of individual tiles. This means that each tile perfectly aligns with the surrounding tiles to create a seamless mosaic of the state without gaps, distortions, or overlays.

Download Procedure

1. Create your dedicated data folder inside your \data folder called \ma_airphotos2005. Do this first, *before* you start downloading anything!
2. Determine the 6-digit ID numbers for the tiles you want to download by checking on the index map. Write these numbers on a piece of paper if needed.
3. Goto
<http://www.mass.gov/anf/research-and-tech/it-serv-and-support/application-serv/office-of-geographic-information-massgis/datalayers/colororthos2005.html>

Now you have choices: JPEG 2000 as Original or Contrast Stretched?

4. Click-on Contrast Stretched and download the zip archive(s) for your tiles into your \data\ma_airphotos2005 folder.
5. Browse to your \data\ma_airphotos2005 folder and extract/unzip.
6. Preview the air photos in ArcCatalog and map in ArcMap.

2.3) USGS Color Ortho Imagery (2008/2009)

This is a new data set of aerial photographs from 2008 and 2009. The entire state is covered at 30 cm resolution (~ 12 inches) and selected areas are also available at 15 cm (~6 inch resolution). These images are extremely detailed and high-quality!

As a result, each tile only covers an area of 1,500 m by 1,500 m on the ground (~ 1 mile by 1 mile) so you need to download a lot of tiles to cover an area of interest.

Statewide Index Map: Zoom in and find the 8 digit ID of your place of interest.

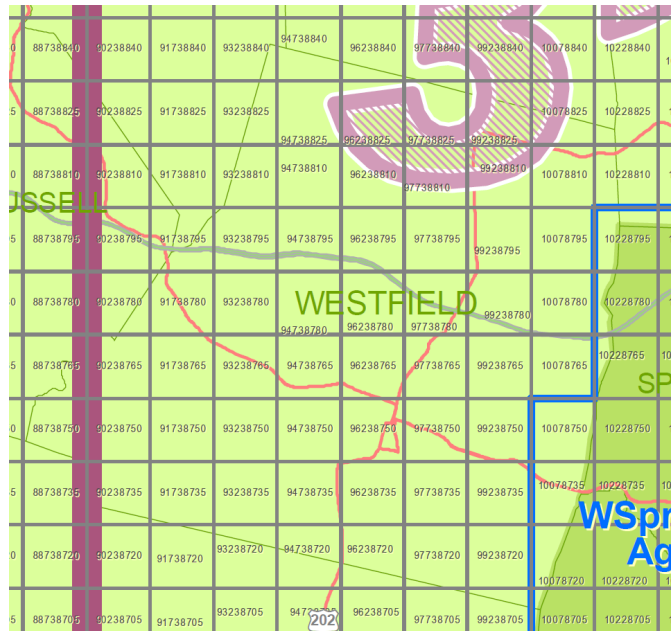
<http://www.mass.gov/anf/docs/itd/services/massgis/coq2008-09-index.pdf>

For example: to create a map of WSU using the 2008/2009 aerial photographs as a base layer you need to download four tiles:

91738750 93238750
91738765 93238765

The images are available for download in MrSID format as zip archives.

The 2008/2009 aerial photographs are available for the entire state as a seamless mosaic of individual tiles. This means that each tile perfectly aligns with the surrounding tiles to create a seamless mosaic of the state.



Download Procedure

First, as always, create a dedicated folder for these 2008/2009 aerial photographs inside your \data folder called \ma_airphotos20082009.

1. Goto
<http://www.mass.gov/anf/research-and-tech/it-serv-and-support/application-serv/o/office-of-geographic-information-massgis/datalayers/colororthos2008.html> and review the data layer description. Then click-on: *Download these images in MrSID format*

You now have Method 1 (fancy) and Method 2 (simple).
I prefer the simpler Method 2 using a file listing.

2. Click on *tile index* to open the index map and save the index map to your \data folder.
3. Open the index map and determine the 8-digit ID numbers for the map tiles that you want to download.
4. Click on DOWNLOAD to display the listing of all tiles for Massachusetts.
5. Find your tile(s) and download the zip archive into your \data\ma_airphotos20082009 folder and extract/unzip.
6. Preview the air photos in ArcCatalog and map in ArcMap.

2.4) USGS Color Ortho Imagery (2013/2014)

The three urban areas (Boston, greater Worcester, and greater Springfield) were flown in spring 2013, the rest of the state a year later. Download at

<http://www.mass.gov/anf/research-and-tech/it-serv-and-support/application-serv/office-of-geographic-information-massgis/datalayers/colororthos2013.html>

Download Procedure: Go to the above website, click on Download these Images, and follow the directions.

Note: you can also view the images in ArcGIS Online at

<http://massgis.maps.arcgis.com/home/item.html?id=3dbb839b26ec40f991379cda90912399> and use it as a layer in ArcGIS Desktop.

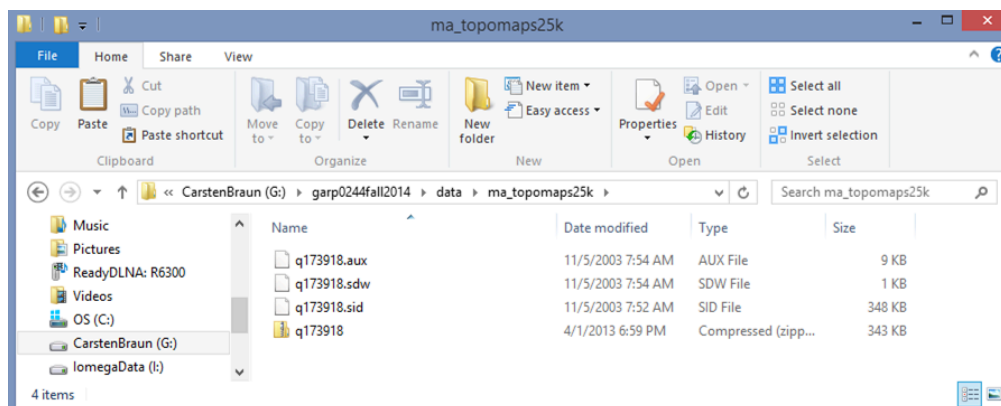
2.5) MrSID / JPG 2000 / GeoTIFF

Each MrSID image or raster data set consists of 3 individual files: *.aux, *.sdw, *.sid

All three files together make-up one MrSID file! For example, for the Downtown Boston/Fenway Park tile you need to download the zip archive q237898.zip. Once extracted you end-up with 3 files: q237898.aux, q237898.sdw, q237898.sid

*The three files together make-up the one MrSID file covering Downtown Boston/Fenway Park
MrSID file = a family of files!*

- The same concept also applies to most other aerial photographs and topographic from MassGIS.
- You will find other data type choices, such as JPEG 2000 or GeoTIFF with similar characteristics: one file is actually 2, 3, or more files.
- ArcCatalog helps you with the file organization and management.



3) Finding the Tile!

Finding the correct tiles for the aerial photographs and topographic maps that cover a specific area, for example Westfield State University, can be frustrating at times!

3.1) Topographic Maps and 2005 Aerial Photographs

The topographic maps and 2005 aerial photographs use the same statewide numbering system! Statewide index map:

<http://www.mass.gov/anf/docs/itd/services/massgis/ix-oq.pdf>

This is a large PDF file - download it to your USB flash drive for easier and faster use. You'll need it in the future.

1. Open the index map and zoom-into Westfield. It takes a bit to get used to what you are looking at, but you see the town line (as a dashed line), the Mass Pike (in green), Route 10 and Route 20 (in red), and the larger water bodies (in blue). The black grid shows the air photo and topographic map tiles (with the six-digit ID).
2. Now you have to estimate where the campus is located and which tiles you therefore need to download...trial and error!
3. In this case you need two tiles (93874 and 97874) as the campus is split in the middle between these two tiles.
4. Navigate to the download page for the contrast-stretched JPG 2000 images.
5. Scroll-down and around until you find six-digit ID, download the zip archives, extract/unzip, and add to your map.
6. Zoom-in so you can see all of campus, set a spatial bookmark, and save your map.

3.2) 2008/2009 Aerial Photographs

The 2008/2009 aerial photographs use an 8-digit statewide numbering system.

Statewide index map: <http://www.mass.gov/anf/docs/itd/services/massgis/coq2008-09-index.pdf>

The basic procedure is the same, except MassGIS provides two ways to download these images: a map-based tool and a traditional file listing – choose whatever you prefer!

3.3) 2013/2014 Aerial Photographs

Here the downloading is Oliver-based - just follow the instructions:

<http://www.mass.gov/anf/research-and-tech/it-serv-and-support/application-serv/office-of-geographic-information-massgis/datalayers/colororthos2013.html>

Or: use a base layer from ArcGIS Online.

Or: download a (state-wide) mosaic.

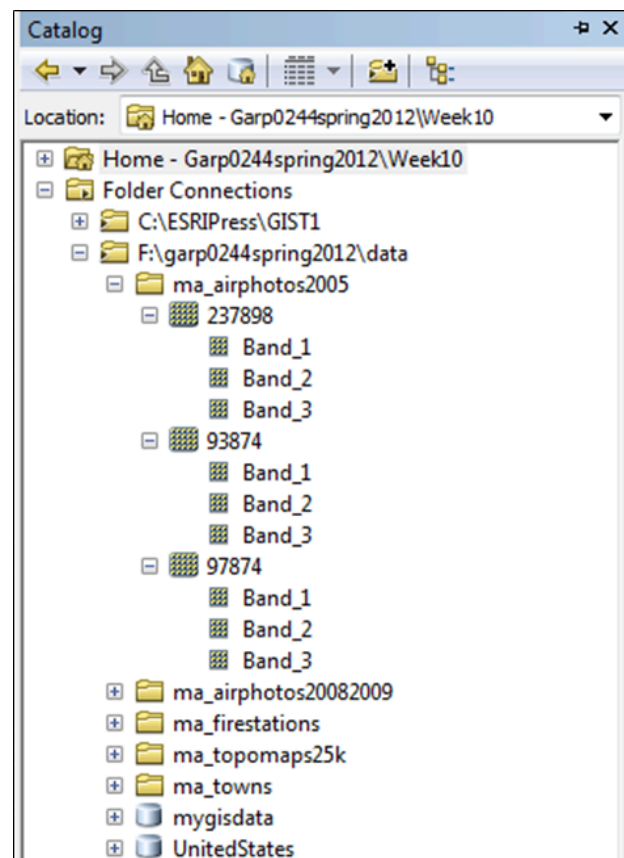
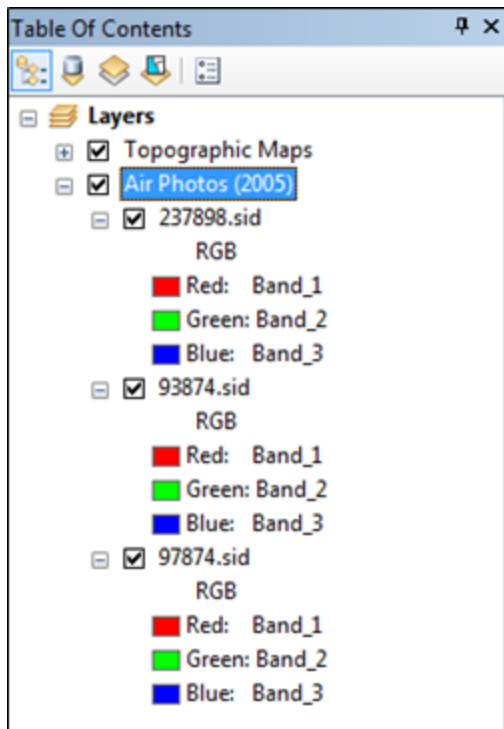
4) Bands vs. Image

MrSID or JPG 2000 images from MassGIS are composed of three spectral bands and you can display either the composite image or any of the individual bands. Band 1 = red; Band 2 = green; Band 3 = blue.

For example, the screen shot below show a folder called \ma_airphotos2005 that contain three composite MrSID images: 237898, 93874, and 97874. Each of these three composite images is composed of three individual bands: Band_1; Band_2; Band_3

You can add the composite images to your map = they look 'natural'. You can also add any of the individual bands = they appear in greyscale. Once you add the composite images to your map, the three bands are shown as the symbology. Obviously, in most cases, you will simply add the composite MrSID image to your map as you are usually interested in showing the Earth's surface in its natural colors.

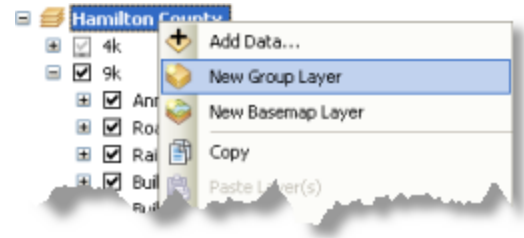
If you want to learn more...take the Remote Sensing class!



5) Practice for Thursday

First - finish the map of Fenway Park.

Second - learn about group layers. Group layers are perfect when you have a large number of tiles and want to keep your map document and Table of Content organized. Have a look at [Working with group layers](#) and make sure you use them when beneficial!



For example: you download 29 aerial photograph tiles from 2008/2009 to cover your study area - now create a group layer called Airphotos (2008/2009) and add all 29 tiles into that group layer.

Third, download the 30 m modeled wind speed grid from MassGIS and answer the following questions:

What's the data format?

What's the coordinate system / projection?

Where is the highest wind speed in Massachusetts? (Ignore the coastlines!)