Introduction to Imagery and Raster Data in ArcGIS

Simon Woo
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Overview of Presentation

- Varieties - types of rasters
- Raster properties
- Display Raster Data in ArcMap
- Display a Mosaic Dataset
- Process Raster Data in ArcGIS
- ArcGIS 10.2 improvements
- Questions / Comments
Varieties of Imagery and Raster Data

Aerial Imagery
Varieties of Imagery and Raster Data

Satellite Imagery
Varieties of Imagery and Raster Data

Elevation \ Hillshade
Varieties of Imagery and Raster Data

Scanned Maps \ Basemaps
Varieties of Imagery and Raster Data

Mosaic dataset representation of lidar and terrain
Varieties of Imagery and Raster Data

Pictures and graphics
Adding imagery and raster data

- **File on disk**
  - Introduced at Version 10
  - Images remain in original formats
  - Metadata is stored in attributes
  - Able to manage large collections

- **Geodatabase**
  - Introduced at Version 10.1
  - Able to display raw sensor files
  - Rendered with templates if possible

- **Raster product**

- **Mosaic dataset**
  - Images remain in original formats
  - Metadata is stored in attributes
  - Able to manage large collections
Adding Imagery and Raster Data

ArcGIS Online

Map Service

Image Service

WCS / WMS Service
Using Raster Data

Cody Benkelman
Raster Properties

Simon Woo

Raster Dataset Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data Source</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Raster Information</strong></td>
<td></td>
</tr>
<tr>
<td>Columns and Rows</td>
<td>1709, 1520</td>
</tr>
<tr>
<td>Number of Bands</td>
<td>1</td>
</tr>
<tr>
<td>Cellsize (X,Y)</td>
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<tr>
<td>Uncompressed Size</td>
<td>4.95 MB</td>
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<td>Format</td>
<td>GRID</td>
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<tr>
<td>Source Type</td>
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</tr>
<tr>
<td>Pixel Type</td>
<td>unsigned integer</td>
</tr>
<tr>
<td>Pixel Depth</td>
<td>16 Bit</td>
</tr>
<tr>
<td>NoData Value</td>
<td>0</td>
</tr>
<tr>
<td>Colormap</td>
<td>absent</td>
</tr>
<tr>
<td>Pyramids</td>
<td>present</td>
</tr>
<tr>
<td>Compression</td>
<td>Default</td>
</tr>
<tr>
<td><strong>Extent</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Spatial Reference</strong></td>
<td>NAD_1927_UTM_Zone_12N</td>
</tr>
<tr>
<td><strong>Statistics</strong></td>
<td></td>
</tr>
</tbody>
</table>

OK
Raster Properties

• Data source
  - Type of file and location

• Raster information
  - Information about the pixels

• Extent
  - Top, bottom, left and right extents

• Spatial reference
  - Coordinate system information

• Statistics
  - Min, max, mean, and standard deviation (per band)
Extent + Spatial Reference = Geographic location

- Extent = top, right, bottom, and left minimum bounding rectangle
- Spatial reference = projection
Raster Pyramids

- Multiple resolution dataset layers of the original raster

- Improves display performance
  - Uses closest resolution level, then resampled data is displayed

- Requires additional storage
  - But can now be compressed

- Pyramids are not used during analysis
Statistics

- Calculates the minimum, maximum, mean, and standard deviation for each band
- Used in applying a contrast stretch, classifying data, and color correction.
Pixel Depth

- Pixel or Bit depth - determines the possible range of values stored in each band.
  - A depth of 8 will store $2^8 = 256$ values (0 to 255),
  - A depth of 16 will store $2^{16} = 65,536$ values (0 to 65,535).

- Unsigned – only positive values
- Signed – negative and positive values
- Floating Point – decimal values
NoData

- Cells or pixels that do not have data values
  - NoData and "0" are not always the same.
  - "0" is a valid value

- Storage
  - A value for file-based raster
  - A bit mask for ArcSDE, and file-GDB rasters

- NoData does not participate in statistics calculation
Raster Properties
Cody Benkelman
Displaying Raster Data

Simon Woo
Displaying Raster Data

- Renderers
  - Display your data with a renderer that makes your data look good

- Image Analysis window
  - Common capabilities in one easy to access location
Stretched renderer

- Often used for elevation, satellite and aerial imagery
- Default: when raster has more than 25 unique values
- Stretches values along a color ramp
**Stretched renderer**

- Stretches values along a color ramp
- Uses a contrast stretch
RGB renderer

- Often used for satellite imagery and aerial photos
- Default: Raster has 3 or more bands
  - Displays each band through a different color (Red, Green, and Blue)
Unique Values renderer

- Often used for land use and scanned maps
- Default: Raster has fewer than 25 unique values
  - Uses random colors for individual values
Colormap renderer

- Often used for land use and soil maps for consistency
- Default: Colormap is present
  - Uses pre-chosen colors for individual values
Classified renderer

- Often used for grouping data values
- Not a default renderer; can be used for single band data
- Places ranges of pixels into separate categories
Image Analysis window

- Common rendering and processing tools to make your imagery work easier and faster
- You are able to change the following display parameters:
  - effects tools
  - symbology tools (gamma level, DRA, stretch, etc)
  - choose the resampling method
  - accelerate raster
Raster Display
Cody Benkelman
Mosaic Datasets

Simon Woo
Mosaic Dataset

Optimum Model for Image Data Management

- Quick Catalog
  - All raster datasets
  - Imagery from different sensors
- Create – In Geodatabase
  - Metadata
  - Processing to be applied
  - Default viewing rules
- As Image
  - Dynamic Mosaic, Processed on the fly
- As Catalog
  - Footprints, Detailed metadata
Dynamic Mosaicking
Control which images to display

- **Control of Mosaic Method (Manager/User)**
  - By Date – ‘Latest’, ‘Closest to May 2001’
  - By Attribute – ‘Lowest cloud cover’
  - By Viewpoint – North, South, East, West
  - Seamline – Feathered blend

- **Queries** – ‘Landsat, no clouds, later than June 2001’
  - Display “best” available imagery
On-The-Fly Processing
Create Multiple Products from a Single Source

- Imagery processed as accessed

Processes
- Stretch, Extract Bands
- Clip, Mask
- Reproject, Orthorectify
- Pan Sharpen, Color Correction
- Vegetation Index, Classify
- Shaded Relief, Slope, Aspect

Applied to
- Individual rasters in mosaic
- Compete Mosaic Dataset
Mosaic Dataset rendering

- Footprint view
  - View the minimum bounding rectangle for each raster
Mosaic Dataset rendering

- Rendering pixels – similar to a raster dataset
  - Level of detail – like scale dependency
  - Overviews – display rasters quickly at all resolutions
Mosaic Dataset
Cody Benkelman
Processing raster data in ArcGIS

Simon Woo
Processing raster data in ArcGIS

- Combining bands
- Clipping
- Mosaicking
- Pansharpening
- Orthorectifying
- …
Combining Bands

• Combine many images into a multi-band raster

• Input bands can be from a single or multiple band raster dataset

• Composite with geoprocessing tool, or Image Analysis window
Clipping

- Clip a portion of raster to fit your study area
- Clip with geoprocessing tool, or Image Analysis window.
Mosaicking

- Combine two or more adjacent and overlapping rasters together
- Mosaic with geoprocessing tool, or Image Analysis window
Pansharpening

• Fuse a low resolution RGB image with a high resolution panchromatic image
  - Output is a high resolution color image

• Pansharpen with geoprocessing tool, or Image Analysis window
Orthorectify

• Increase the geographic accuracy of an image
  - Requires an image with sensor model and an elevation source

• Orthorectify with geoprocessing tool, or Image Analysis window
Image Analysis window

- Colormap to RGB
- NDVI
- Difference
- Pan-sharpening
- Orthorectify
- Clip
- Export data
- Mask
- Shaded relief
- Add Function
- Mosaic
- Composite bands
- Filter
Raster Processing
Cody Benkelman
What is new in ArcGIS 10.2

- Improved Search Window options
  - All raster data types are returned
  - Search on metadata and key properties
- Improved Sensor support
  - SPOT6, Pleaides, DMCii, BAE, Chinese Raster types
- Improved Image processing
  - Local function, improvements on many existing functions
- Improvements for the web developer
  - New Image Service capabilities
- Easier
  - New and Updated data management tools
- **Overall focus on improving quality!**
Recommended Raster Sessions

- **What's New With Imagery in ArcGIS**
  - Tuesday 3:15 pm– 4:30 pm
  - Room 5A

- **Understanding Pyramids, Overviews, and Caching**
  - Wednesday 5:00pm-5:30pm
  - Imagery Demo Theater

- **Using the Image Analysis window**
  - Wednesday 11:00am-11:30am
  - Imagery Demo Theater

- **Easy Ways to Use Imagery in ArcGIS**
  - Thursday 11:00am-11:30am
  - Imagery Demo Theater

- **Understanding GIS imagery**
  - Wednesday 11:30am– 12:00pm
  - Hall H – Discussion Lounge

- **Building Your First Mosaic Dataset**
  - Thursday 12:00pm-12:30pm
  - Imagery Demo Theater
• Thank you for attending
• Open for Questions
• Imagery Resource Center
  • http://resources.arcgis.com/en/communities/imagery/

• Please fill out the evaluation:
  • www.esri.com/ucsessionssurveys
  • Offering ID: 1187
Imagery Resource Center
http://resources.arcgis.com/en/communities/imagery/

Please fill out your user evaluations. Thank you!