Introduction to Imagery and Raster Data in ArcGIS

Simon Woo – slides
Cody Benkelman - demos
Overview of Presentation

- Varieties - types of rasters
- Raster properties
- Display Raster Data in ArcMap
- Display a Mosaic Dataset
- Process Raster Data in ArcGIS
- ArcGIS 10.1 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 or Base Maps
Varieties of Imagery and Raster Data

MD representation of lidar and terrain
Varieties of Imagery and Raster Data
Pictures or Graphics
Adding Imagery and Raster Data

- **File on disk**
  - Introduced at Version 10
  - Images remain in original formats
  - Metadata is stored in attributes

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

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

- **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 Demo
Cody Benkelman
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
- Adds 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 eight 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
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 Demo
Cody Benkelman
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

<table>
<thead>
<tr>
<th>Value</th>
<th>Color</th>
<th>RGB</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>yellow</td>
<td>255, 255, 50</td>
</tr>
<tr>
<td>2</td>
<td>blue</td>
<td>0, 0, 175</td>
</tr>
<tr>
<td>3</td>
<td>orange</td>
<td>255, 175, 20</td>
</tr>
<tr>
<td>4</td>
<td>brown</td>
<td>135, 90, 0</td>
</tr>
<tr>
<td>5</td>
<td>green</td>
<td>120, 215, 0</td>
</tr>
<tr>
<td>6</td>
<td>dark green</td>
<td>0, 100, 15</td>
</tr>
<tr>
<td>7</td>
<td>cyan</td>
<td>100, 220, 255</td>
</tr>
</tbody>
</table>
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
• 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 Demo
Cody Benkelman
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
- Access – Any ArcGIS application or as service
- As Image
  - Dynamic Mosaic, Processed on the fly
- As Catalog
  - Footprints, Detailed metadata
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

Utilizing the full image information content
Dynamic Mosaicking
Control which images to display

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

- Queries possible – ‘Landsat, no clouds, later than June 2001’
  - Display “best” available imagery
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 Demo
Cody Benkelman
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.

Composite Bands
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

• Display an image with more accuracy
  - Requires an image with sensor model and an elevation source
• Orthorectify with geoprocessing tool, or Image Analysis window
Image Analysis window

- Clip
- Export data
- Composite bands
- Mask
- Orthorectify
- PAN-sharpening
- NDVI
- Difference
- Colormap to RGB
- Add Function
- Mosaic
- Filter
- Shaded relief
Raster Processing Demo
Cody Benkelman
What is new in ArcGIS 10.1

- More raster formats (16)
- Raster products
- Image Analysis window updated
- Automatic rendering based on data type
- New GP tools (8)
- Batch editing functions
- New raster functions (5)
- Improvements for the mosaic dataset
- Auto Georeferencing
Recommended Raster Sessions

Managing imagery and raster data using mosaic datasets
- Wednesday 3:15 pm – 4:30 pm – 15A
- Thursday 1:30 pm – 2:45 pm – 15A

Using World Elevation services
- Thursday 3:15 pm – 3:35 pm – 1A

Creating a mosaic dataset
- Wednesday 10am-10:30am
  Imagery Demo Theater

Understanding Raster Functions
- Wednesday 10:30am -11:00am
  Imagery Demo Theater

Improved georeferencing workflows in 10.1
- Thursday 4:05pm – 4:25pm

Raster Products – Making imagery easier
- Wednesday 11am -11:30am
  Imagery Demo Theater
Please fill out your user evaluations. Thank you!

Imagery Resource Center
http://resources.arcgis.com/en-communities/imagery/
Recommended Raster Sessions

Managing imagery and raster using mosaic datasets (75min)
Tuesday 3:15PM – 15A
Wednesday 8:30AM – 15A

Creating a mosaic dataset (20min)
Tuesday 9:30AM
Thursday 9:00AM
GDB Island

Using the Image Analysis window (20min)
Tuesday 4:00AM
Wednesday 3:30AM
GDB Island

Sharing imagery and raster data in ArcGIS (75min)
Tuesday 3:15PM – 14A
Wednesday 1:30PM – 14A

Georeferencing imagery (20min)
Tuesday 12:00PM
Wednesday 9:00AM
GDB Island

Using an image service in Desktop (20min)
Wednesday 10:00AM
Web & Server Island

Image processing in ArcGIS (20min)
Wednesday 8:55AM – 6A

Color correcting imagery (20min)
Tuesday 3:30AM
Wednesday 11:00AM
GDB Island

Using mosaic datasets for serving working with elevation data (20min)
Thursday 12:00PM
Imagery Island