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Technical Workshops | 7/12/2011

Managing Imagery and Raster Data Using Mosaic Datasets

Hong Xu, Prashant Mangtani

Presentation Overview

- Imagery and raster data
- What is a mosaic dataset
- Use of mosaic datasets
- Build a mosaic dataset
- Migrate to mosaic datasets

- Q&A

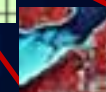
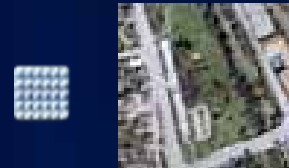
Characteristics of Imagery and Raster Data

- **Many sources**
 - Aerial photographs
 - Satellite imagery from many sensors
 - DEM and scanned maps
 - Analytical data
- **High resolution and large volume**
- **Requirements:**
 - Store efficiently
 - Easy to search
 - Fast to process
 - Accessible



Evolution of Raster Data Models in ArcGIS

- **Raster dataset (8.0)**
 - A single image
- **Raster catalog (9.0)**
 - A collection of raster datasets
 - Managed/unmanaged
- **Image Server (9.2)**
 - **Mosaic dataset (10.0)**
 - Enhanced raster catalog with mosaic view and on the fly processing capability
 - Managing and serving a collection of images



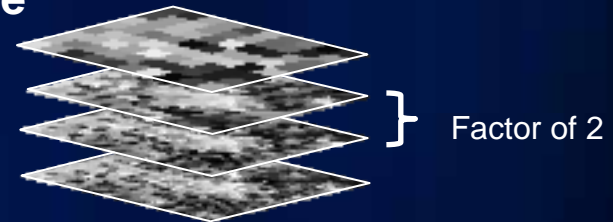
Raster Datasets

- **Formats**

- TIFF (bigTIFF), Mrsid, JP2000, NITF, CADRG, Geodatabase raster etc
- Compress: JPEG/LZW/LZ77/PackBits/CCITT

- **Pyramids**

- Reduced resolution copies of the source
- Improve display performance
- Support three resample methods
- Can be compressed



- **Statistics**

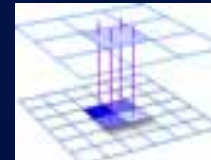
- Enhance visual display

- **Build Pyramids and Statistics tool**

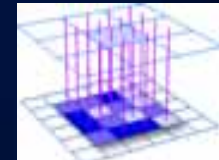
- Support mosaic dataset



Nearest
neighbor



Bilinear
interpolation



Cubic
convolution

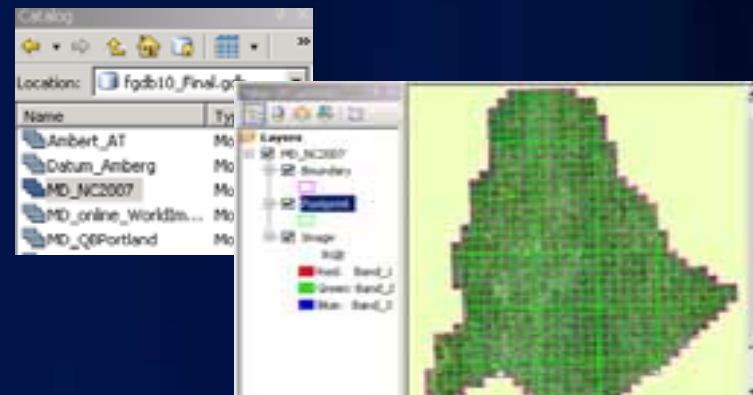
Mosaic Dataset

- A GDB data model for managing and serving image collections
- Supported in FGDB/PGDB/SDE
 - Do NOT store pixels but reference them
- Advantages
 - Reduce processing time and storage
 - Catalog large image collection fast
 - Seamless display at all scales
 - Multiple sensors and metadata
 - Streamline update and maintain quality



Mosaic Datasets – Storage Schema

- A composite layer in ArcMap
 - Footprint/boundary/seamline
 - Image



- Stored as a set of internal geodatabase tables

| Name | Purpose |
|-------------|---|
| Catalog | A raster catalog that stores function rasters and the footprints |
| Boundary | A feature class that defines the mosaic dataset boundary |
| Seamline | A feature class that maintains the seamlines for advanced mosaicking operations |
| Raster Type | A table holding each raster type instance |
| Log | A table that logs operations that have been performed |

Mosaic Datasets – Catalog Table

| OID | Shape | Raster | Name | MinPS | MaxPS | LowPS | HighPS | Category | ... |
|-----|---------|----------|---------------|-------|-------|-------|--------|-----------|-----|
| 1 | Polygon | <Raster> | P01.met | 0 | 90 | 10 | 30 | Primary | |
| 2 | Polygon | <Raster> | P02.met | 0 | 90 | 10 | 30 | Primary | |
| 5 | Polygon | <Raster> | filename1.tif | 90 | 270 | 90 | 90 | Overviews | |

- **A special raster catalog**
 - Shape field stores the footprints
 - Raster field stores function raster datasets
- **Function raster datasets**
 - Store references to the image along with processing
 - Process on the fly during access
- **MinPS and MaxPS define the visibility ranges of the rasters**

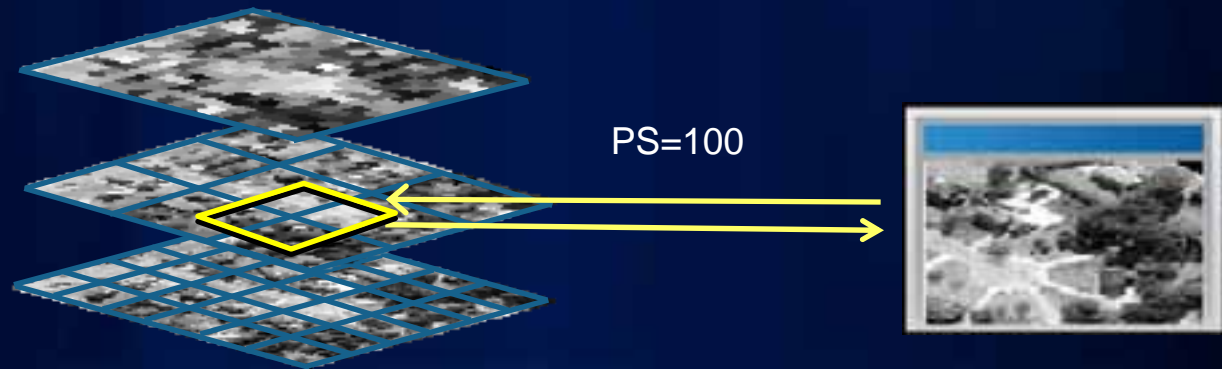
Mosaic Dataset – Overviews

- **Fast and seamless display**
- **Overview vs. Pyramids**
 - **Overviews** for mosaic dataset
 - **Pyramids** for raster dataset
- **A set of resampled rasters**
 - **Multiple levels**
 - **Each level has multiple tiles**
 - **Each tile is a tiff file**

Overview: 180m
(range: 180-1800)

Overviews: 60m
(range: 60-180)

Sources: 20m
(range: 0-60)



Mosaic Dataset – Mosaic Rules

- **Control which raster/pixels to display**
- **Mosaic method to sort the rasters**
 - Closest to center (default)
 - By attribute
 - Closest to nadir
 - North west
 - Seamline
- **Mosaic operator to resolve the overlaps**
 - First/Min/Max/Mean/Blend

Closest to the center



By attribute: cloud cover

Use of Mosaic Dataset

- Use as a catalog

- Selection/query
- Add selected images to Map
- View raster and metadata
- Time aware

| OBJ | Raster | Name | Min | Max | Low | HighPS | Category |
|-----|----------|----------------|-----|-----|-----|--------|----------|
| 1 | <Raster> | op2008_59515_N | 0 | 6 | 1 | 2 | Primary |
| 2 | <Raster> | op2008_59516_N | 0 | 6 | | | |
| 3 | <Raster> | op2008_59517_N | 0 | 6 | | | |
| 4 | <Raster> | op2008_59518_N | 0 | 6 | | | |
| 5 | <Raster> | op2008_59519_N | 0 | 6 | | | |



- Use as a raster dataset

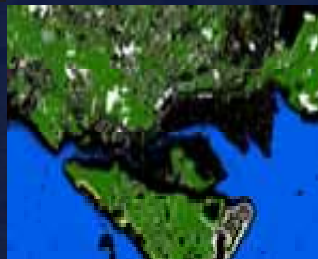
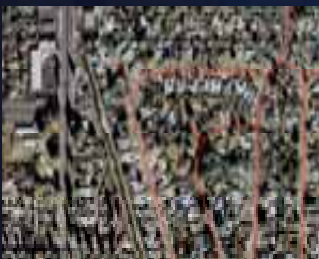
- Seamless display
- Export a raster dataset
- Use as an input to geoprocessing tool



Use of Mosaic Dataset (Continue)

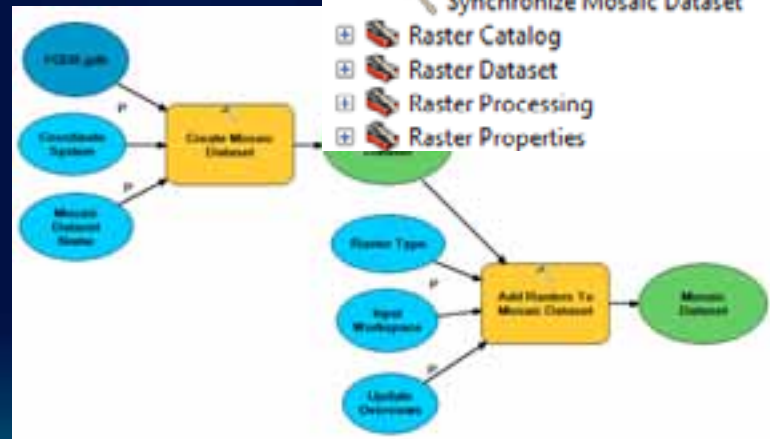
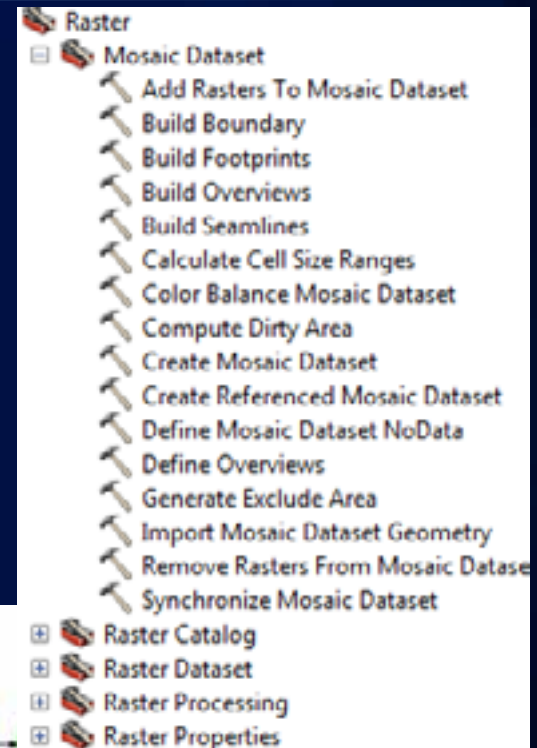
- **Serve as an image service**
 - **Similar functionality as local mosaic dataset**
 - **Access as a catalog**
 - **Select/download selected images**
 - **Time aware**
 - **Access seamless mosaic**
 - **REST**
 - **WCS/WMS**
- **Image Extension license**

Demo: Using Mosaic Datasets



Build a Mosaic Dataset

- **Mosaic dataset toolset**
- **Automate with model and python**
- **Typical workflow**
 - Create a mosaic dataset
 - Add rasters
 - Calculate cell size range
 - Build boundary
 - Build overviews (optional)
 - Edit properties (optional)



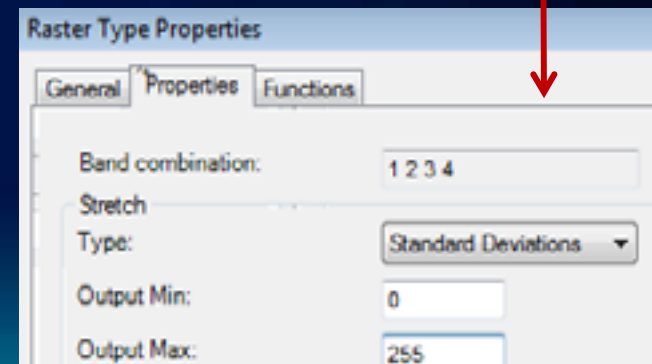
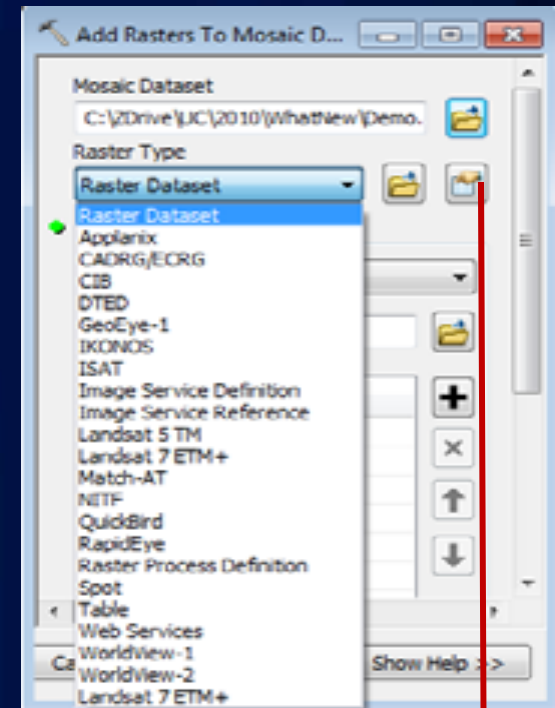
Build a Mosaic Dataset - Create

- Create table schema and define pixel properties
- Spatial reference (required)
 - Used in footprints and overviews
 - Can be different from input
 - Datum consideration
- Number of bands
 - Taken from the first added raster
- Pixel type
 - Taken from the first added raster



Build a Mosaic Dataset – Add Rasters

- **Specify a raster type**
 - Define the format to crawl
 - Metadata to read and fields to create
 - Processes to apply
- **Support many raster types**
 - Raster Dataset/NITF/CADRG/etc.
 - QB/IKONOS/Landsat/WVI/WVII/etc
 - Web Services
 - Table/Image Service Definition

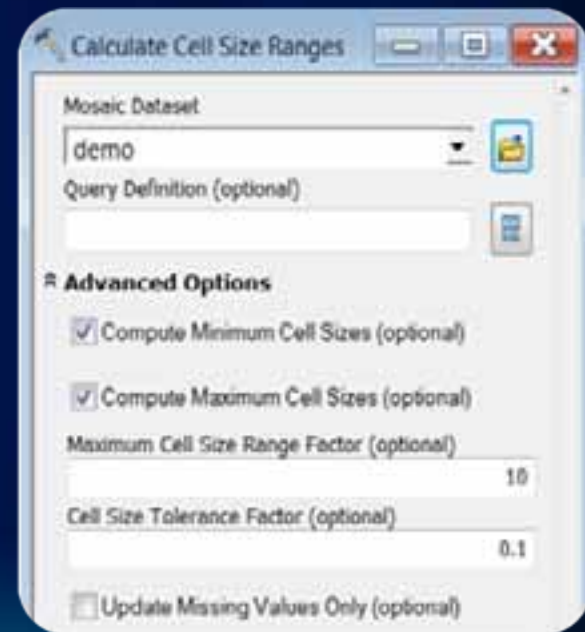


Build a Mosaic Dataset – Cell Size Ranges

| OBJECTID * | Raster | Name | MinPS * | MaxPS * | LowPS * | HighPS * | Category | Tag |
|------------|---------|------------------|---------|-----------|----------|----------|----------|---------|
| 1 | <Raster | Campus_08May2008 | 0 | 12.329262 | 0.616463 | 1.232926 | 1 | Dataset |
| 2 | <Raster | Campus_14May2008 | 0 | 11.338233 | 0.566912 | 1.133823 | 1 | Dataset |

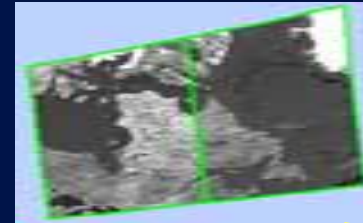
- MinPS and MaxPS define the visibility of the rasters
- Use Calculate Cell Size Ranges tool
- Based on source and overlaps
- Default cell size range factor is 10

| | | |
|-----|----------------------|--------|
| 30m | visible range 30-300 | |
| 5m | visible range 0-50 | → 5-30 |
| 1m | visible range 0-5 | |

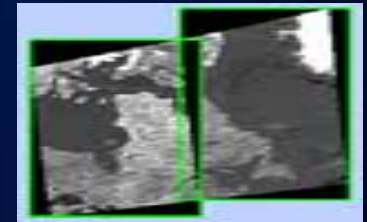


Building a Mosaic Dataset – Background

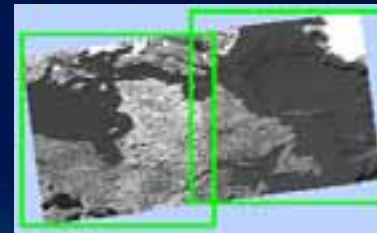
- **Footprint**
 - Build Footprint tool
 - Edit using Editor
 - Import Mosaic Dataset Geometry tool
- **Define NoData**
 - Based on a value
 - Based on a range



Use footprint

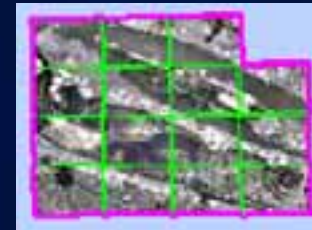


Use NoData



Build a Mosaic Dataset - Boundary

- Define the boundary of the mosaic dataset
 - Pixels outside the boundary will be clipped
- Build using Build Boundary tool
 - Calculated based on footprints
- Can be modified using Editor
 - Import Mosaic Dataset Geometry tool



Build a Mosaic Dataset – Overviews

| OID | Shape | Raster | Name | MinPS | MaxPS | LowPS | HighPS | Category | ... |
|-----|---------|----------|---------------|-------|-------|-------|--------|-----------|-----|
| 1 | Polygon | <Raster> | P01.met | 0 | 90 | 10 | 30 | Primary | |
| 2 | Polygon | <Raster> | P02.met | 0 | 90 | 10 | 30 | Primary | |
| 3 | Polygon | <Raster> | filename1.tif | 90 | 900 | 90 | 90 | Overviews | |
| 4 | Polygon | <Raster> | filename2.tif | 90 | 900 | 90 | 90 | Overviews | |

- **Build Overviews tool**
 - **Generate overview images**
- **Define Overviews tool**
 - **Redefine the default parameters**
- **Optionally add an external raster as overview**

Default overview parameters:

TIFF format with JPEG

Size is 5120x5120

Factor of 3

Overview location

Build Mosaic Dataset – Advanced Processing

- **Color Correction**

- Based on a calculated color surface
- Based on an existing target raster
- Support excluded area



Before



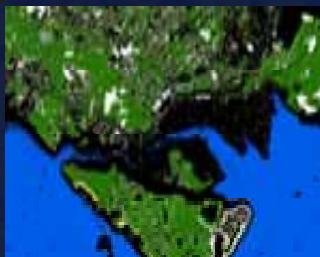
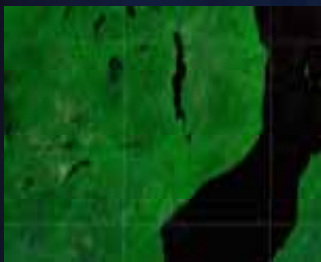
After



- **Seamlines**

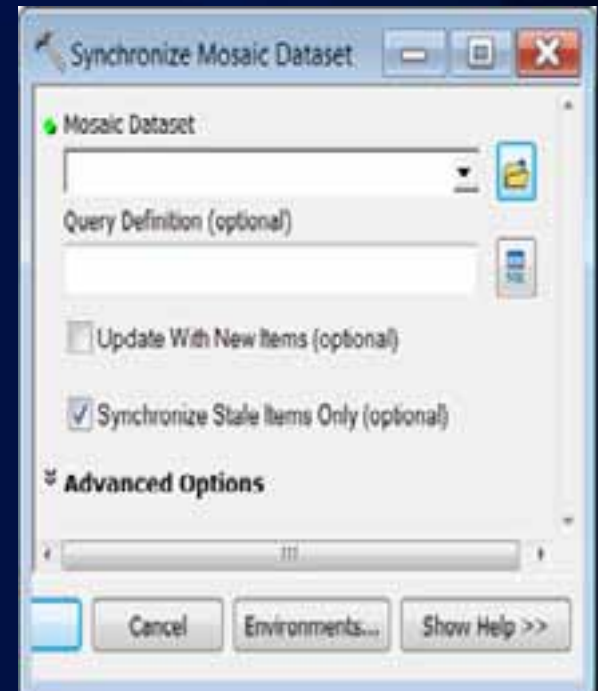
- Used for seamline mosaicking
- Build Seamlines GP tool
- Edit and Import seamlines

Demo: Build Mosaic Datasets



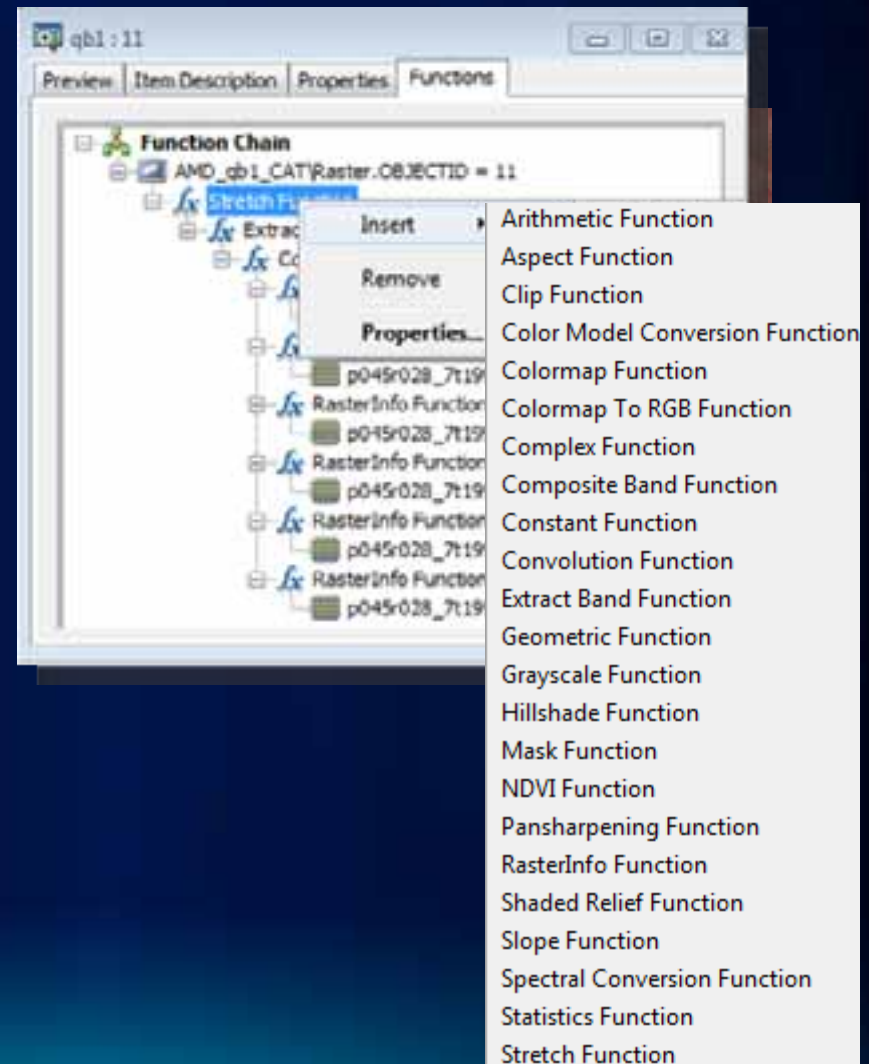
Mosaic Dataset – Update

- **Add new rasters from a folder**
 - **Synchronize Mosaic Dataset tool**
 - Identify new data in the folder
 - **Add Raster tool**
- **Source rasters are changed**
 - Changes in geometric/metadata/etc.
 - **Run Synchronize Mosaic Dataset tool**
- **Remove Rasters**
 - **Use Remove Rasters from Mosaic Dataset tool**



Mosaic Dataset – On-the-fly Processing

- **Process image on-the-fly**
 - Image enhancement
 - Orthorectification, Pan-sharpen
 - Shaded relief, hillshade, etc
- **Add at mosaic dataset level**
- **Add at raster level**
 - Apply to the raster



Reference Mosaic Dataset

- References an external mosaic dataset or raster catalog
 - Supported in GDB and file (.amd)
 - Catalog table is read-only

- Created by specifying
 - Definition query
 - Area of interest



Boundary = My County

Where Sensor = Landsat
and Cloud <10%

Add NDVI processing

- Provides multiple views of the source mosaic dataset
- Prevents editing of the source mosaic dataset

Mosaic Dataset - Derived

- Adding mosaic datasets to a mosaic dataset
 - Using Table raster type
 - Copy all records and the raster type to the master mosaic dataset

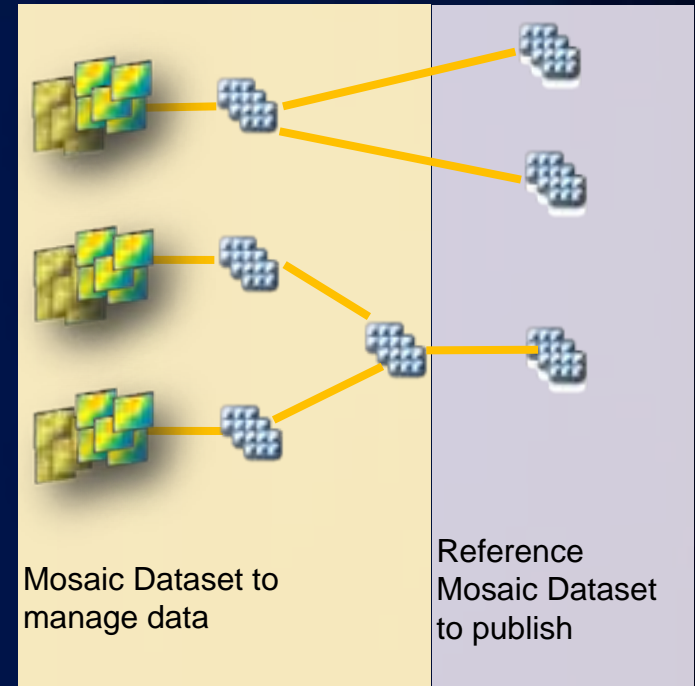


- Adding selected items of a mosaic dataset
 - Save as a mosaic layer
 - Add mosaic layer use Table type
 - Selected records will be added to mosaic dataset

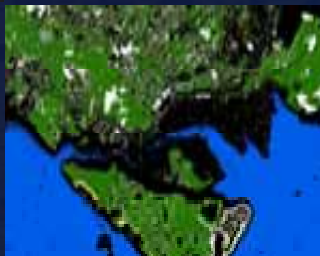
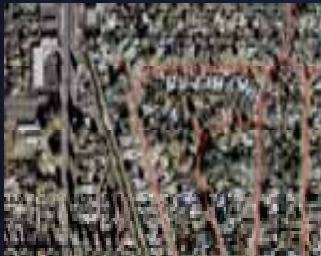


Image Management Patterns

- **Create mosaic datasets with data of similar type**
 - Elevation
 - Ortho images of same date
 - QuickBird/IKONOS
 - Landsat 5 or 7
- **Create derived mosaic datasets if needed**
- **Create referenced mosaic datasets**



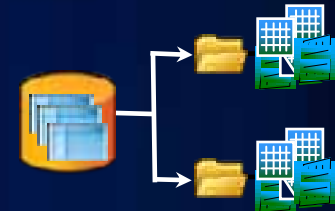
Demo: Reference Mosaic Dataset



Moving a Mosaic Dataset

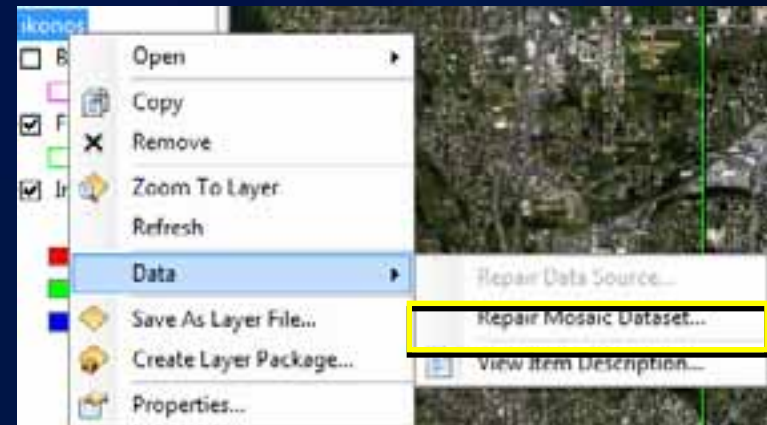
- **Move all**

- Copy the FGDB where the mosaic dataset resides
- Copy the source and overview images
- Use Repair dialog to repair the paths



- **Extract a portion**

- Create a new folder
- Create a target File geodatabase
- Use Distributed Geodatabase toolbar
- Copy/move the whole folder



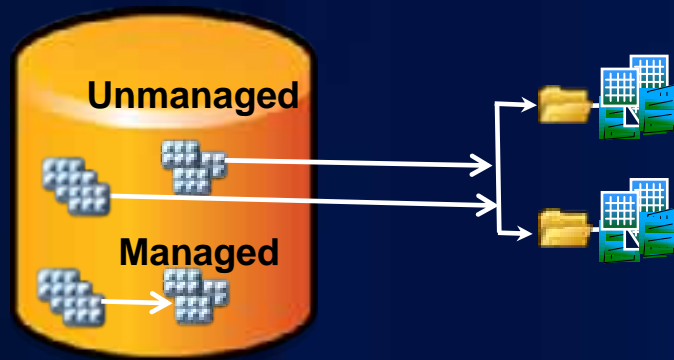
Migrating to Mosaic Datasets

- **From Image Server Service Definition**
 - Create a mosaic dataset
 - Use Image Service Definition raster type
 - Add the ISDef file
- **Raster Process Definition raster type**

| Image service Definitions | Mosaic dataset |
|---------------------------|--------------------------|
| .\Amberg.ISDef | |
| ImageService.ISDef | Mosaic dataset |
| Footprint.dbf | Footprint feature class |
| Boundary.dbf | Boundary feature class |
| Seamline.dbf | Seamline feature class |
| .\RPDefs\rasteris.RPDefs | Function raster datasets |

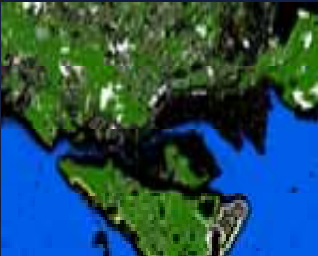
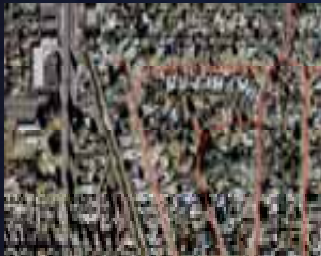
Migrating to Mosaic Datasets (Continue)

- **From a raster catalog**
 - Create a mosaic dataset
 - Use Table type to add
 - Raster datasets are re-added as function raster datasets



- Find the source data and re-create mosaic dataset

Demo: Migrate to Mosaic Dataset

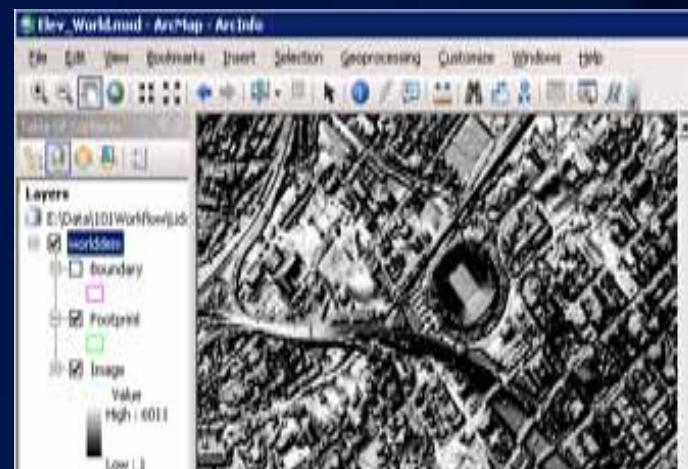


Summary

- **Mosaic dataset advantages**
- **Usage of mosaic datasets**
- **How to build a mosaic dataset**
- **Reference and derived mosaic datasets**
- **Update and deploy mosaic datasets**
- **Migrate to mosaic dataset**

What is New for Mosaic Dataset in 10.1

- **Support more raster types**
 - LAS, LASDataset, Terrain
 - Radarsat2, Kompsat, Formosat
- **Many New tools**
 - Analyze Mosaic Dataset
 - Edit Raster Function
 - Set Mosaic Dataset Properties
 - Alter Mosaic Dataset Schema
- **New raster functions**
 - Remap Function/Band Arithmetic Function/Attribute Table Function
- **Enhancements**
 - Automatic seamline generation
 - Calculate footprint by geometry
 - Create good looking mosaic dataset easily



Additional Information

Technical workshops:

Introduction to Imagery and Raster Data in ArcGIS (Tue:1:30, Wed:3:15)

Sharing Imagery and Raster Data in ArcGIS (Weds:1:30)

Satellite and Aerial Imagery Support in ArcGIS (Thursday 10:15)

Additional resources:

Desktop/Online Help

Imagery section at resources.arcgis.com

Image Blog <http://blogs.esri.com/Dev/blogs/imagery/default.aspx>

Fill evaluations online

http://events.esri.com/uc/2011/sessionEvals/index.cfm?fa=app_login_form

Questions?

Evaluations

Fill evaluations online

http://events.esri.com/uc/2011/sessionEvals/index.cfm?fa=app_login_form

Your comments help us meet your conference needs each year.

THANK YOU VERY MUCH FOR ATTENDING !