



**Ozri2011**  
Esri Australia User Conference

# **Not Just a Pretty Picture** *Optimising Your Imagery*

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## Overview

- Image Management
- Image Processing
- Exploration
- Dissemination



## Characteristics of Imagery and Raster Data

- Many sources
- High resolution and large volume
- Requirements:
  - Store efficiently
  - Easy to search
  - Fast to process
  - Accessible



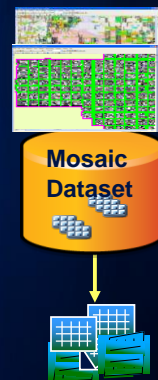
## Evolution of Raster Data Models in ArcGIS

- Raster Dataset (8.0)
- Raster Catalog (9.0)
- 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



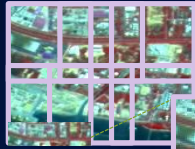
## Mosaic Dataset

- 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



## Optimising Mosaic Dataset Display - Overviews

Level 0



Pixel size range = 0 – 10m

Level 1

Max dimension = 5120 pixels



Pixel size range = 10 – 30m

Level 2

Dimension > 1000 & < 5120 pixels



Pixel size range = 30 – 90m

Level 3

Max dimension <= 1000 pixels



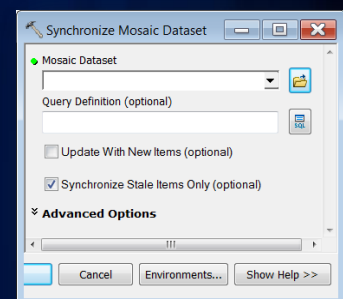
Pixel size range = 90 – 270m



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## 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



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# Demonstration

Mosaic Dataset

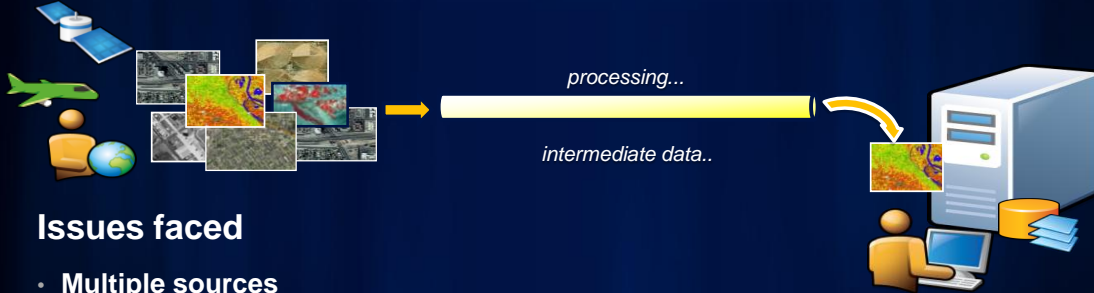
Image Analysis Window



# Large Image Dataset Management



# Data Management



## Issues faced

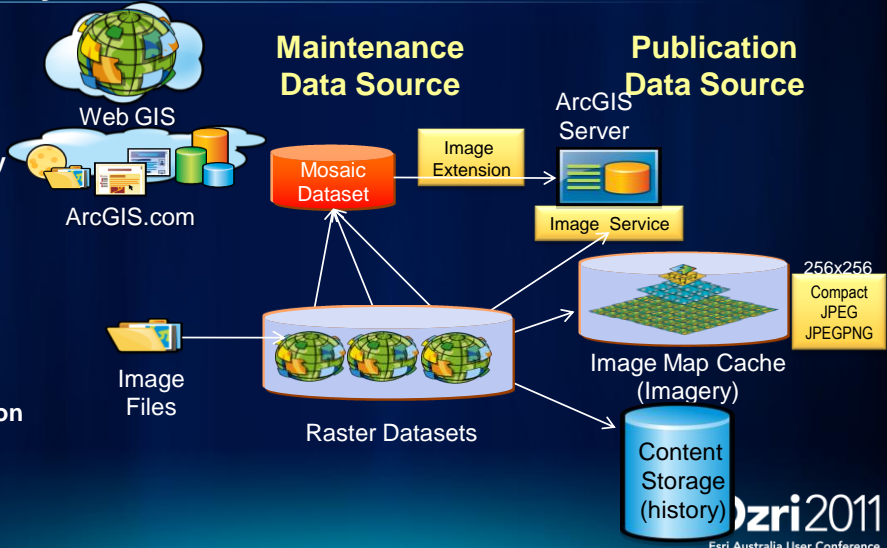
- Multiple sources
- Multiple formats
- Increasing bit depths and bands
- Metadata
- Different kinds of processing requirements
- Redundant intermediate data



# GIS Imagery Data Architecture

## Data Resources

- Raster Data
  - Aerial Photography
  - Satellite Imagery
  - Storage Formats
    - TIFF
    - IMG
    - MRSID
    - JPG2000
  - Lidar Point Elevation
  - Terrain Data



## Optimising Systems Architecture

### Factors to consider / Impact

- Disk Speed / High
- Network/ High
  
- CPU / Low
- RAM / Low



## Formats (Performance)

- **Faster reading**
  - Tiff, Raw
- **Tiled formats – optimize disk access**
  - Tiled Tiff
- **Compression formats – less CPU intensive formats**
  - JPEG (LZW not a fast compression)
- **Define overviews on the mosaic dataset**



## Formats (Speed)

- Tiled TIFF with JPEG compression
- TIFF raw - large\* files are 20 percent slower.
- JPEG 2000 - Approximately 50 percent slower.
- MrSID - Approximately 75 percent slower.
- IMG with RRD - Approximately 50 percent slower.
- ECW – Proprietary format, fast but need a licence to serve on Server



## Patterns to Manage Imagery

### • Simple Collection

Multiple

- Files
- Format
- Projections



### • Cascaded Mosaic



### • Multi-Source Collection



### • Merged Mosaics



Mosaic of Mosaics, each managed separately



# Processing

## Preprocessing

- **Making imagery useful**
  - **Radiometric**
    - Correcting sensor distortions
    - Atmospheric corrections
    - Illumination corrections
  - **Geometric**
    - Georeferencing
    - Orthorectification

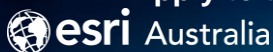
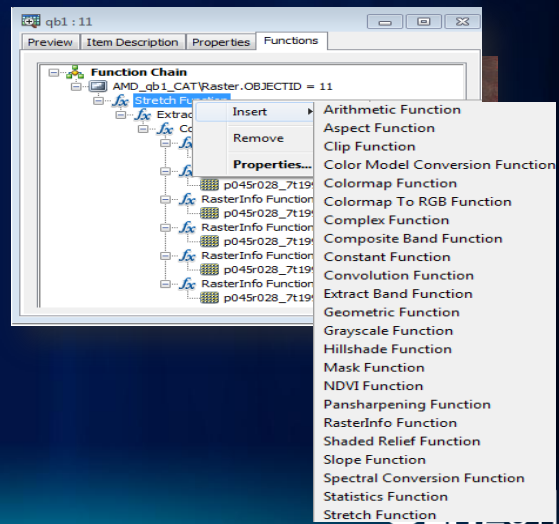
## Post-Processing

- Designing for a specific use
  - Merge bands or create specific band combination
  - Format conversion
  - Improve visual quality (enhance)
  - Pan-sharpen
  - Mosaic
  - Color correction



## 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



## Image enhancement

- Imagery may be enhanced by default
- Enhancements require statistics

None



Std dev - 2



Percent clip - 2



Histogram equalize

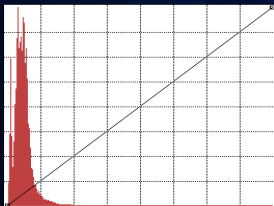
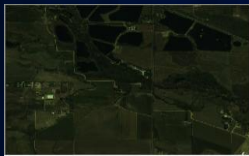


Percent clip - 0.25

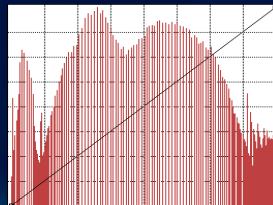


## Effects on the histogram

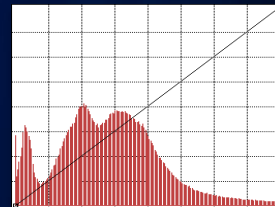
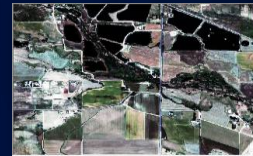
None



Histogram equalize



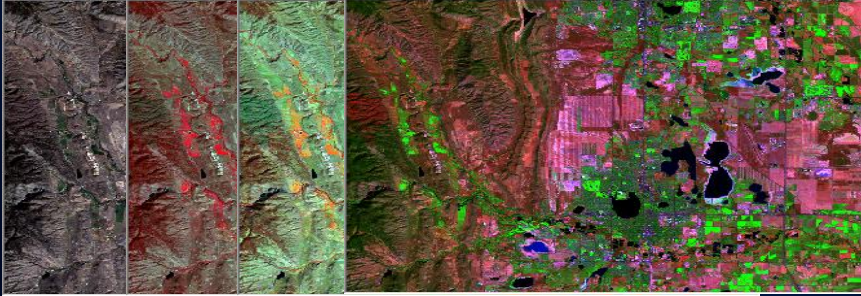
Percent clip - 2



## Combining bands

- Change bands to present different information

RGB – 321 RGB – 432 RGB – 543 RGB – 742 Vegetation and soil



## Panchromatic sharpening

- Fusing a lower-resolution with a higher-resolution



## Image processing—analysis

- Image classification
- Filtering (e.g. edge enhancements)
- Image or band algebra (e.g. indices, difference)
- Principal components analysis
  
- \* May require Spatial Analyst extension

## Demonstration

Colour Correction

# Exploration

## Outline

- **Classification – Supervised and Unsupervised**
- **Landsat Services**

## Problem 1: Supervised classification

- We want to create a map of land-use types
- We have a multi-band raster
- We can identify several of the different land-use types on the image from knowledge of the area
- It would be very time consuming to manually classify each cell into a land-use type

## Problem 1: Supervised classification

- We know that each land-use type generally has a unique spectral signature
- From the locations we have identified the land-use types we wish to classify the areas not yet identified into the classes (as closely as possible)

## The supervised classification process

- Identify the locations of the land-use types (classes) by drawing polygons around them – create training sets
- Calculate the statistics of the cells for each class to define the characteristics of the class – calculate signatures
- Evaluate signatures

## Problem 2: Unsupervised classification

- We wish to map an area into 10 levels of forest productivity
- We know that forest productivity can be determined by certain criteria (e.g., slope and aspect)
- We do not know which areas should belong to each class but we do know that similar levels of productivity have similar characteristics relative to the input criteria

## The unsupervised classification

- Determine which data layers (the criteria) that are to be used to determine forest productivity
- Define the number of clusters to group the area into
- Create and evaluate the clusters
- Classify the entire study area into the clusters and interpret the results



## Difference in creating classes and clusters

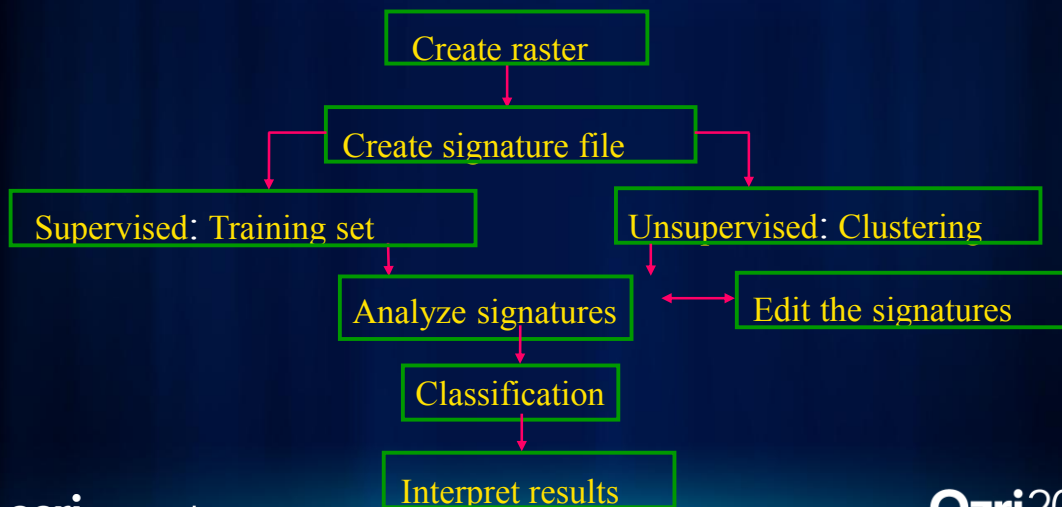
- Supervised – define the classes by training samples
- Unsupervised – identify the number of clusters



## Classification tools

- Individual tools in the Multivariate Toolbox
- Classification toolbar
  - Creates training samples
  - Calculates signature files
  - Edits the signature files
  - Classifies the data
    - Supervised
    - Unsupervised

## Multivariate Analysis review



## Landsat Services

- 2008 - Release of Landsat Archives
- Fast and easy access to 30 years of imagery through ArcGIS Online



## Demonstration

Landsat Services

Supervised Classification



# Dissemination



## Think about...

- You have an orthophoto or a mosaic dataset that you wish to share across your organisation.
  - How can you make this possible?



## Think about...

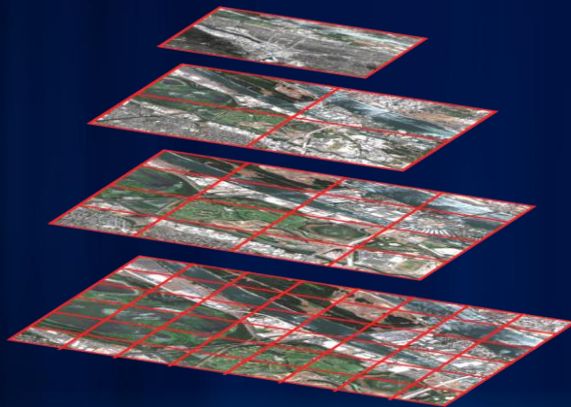
- You have lots of imagery that you want to serve to the Web with very minimal load on the server.



What do you need to do to accomplish this?



## Accelerating display performance - Caching



1:90,000

1:60,000

1:30,000

1:15,000





## Before we begin...

- How do you use imagery for various applications?



## Demonstration

Publishing a Mosaic Dataset

## Summary

- Image Management
- Image Processing
- Exploration
- Dissemination

## Data Provider

- GeoEye

## Training Courses

- **Managing Imagery Using ArcGIS**
  - <http://www.esriaustralia.com.au/esri/172.html>



## Additional Information

- **Resource Centre**
  - <http://resources.arcgis.com/content/imagery/10.0/about>



Thank you

Questions?



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