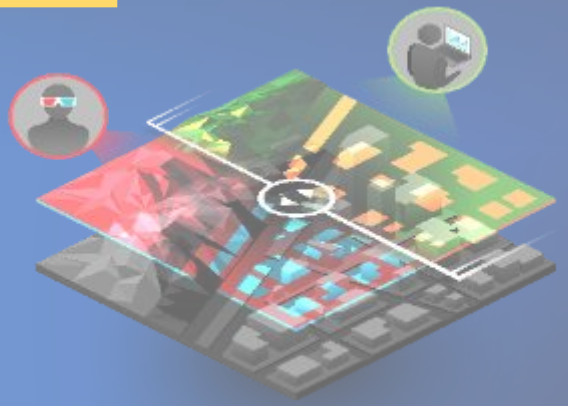
Managing Imagery using Mosaic Datasets and Image Services

Julia Lenhardt and Abhilash Narayanan

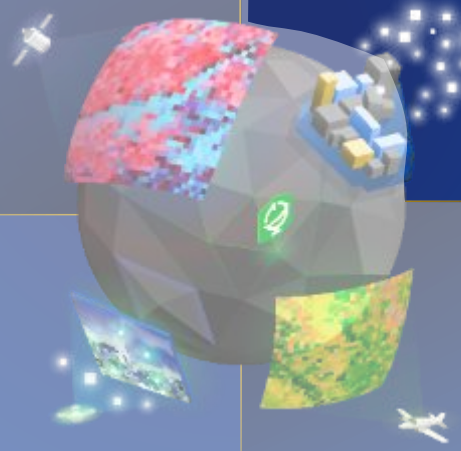
SEE WHAT OTHERS CAN'T

5 Key Imagery Capabilities of ArcGIS

Visualization & Exploitation



Management



Analysis

Content

Map Production

Image Management and Dissemination

Making Imagery Accessible

ArcGIS Pro – Authoring of Mosaic Datasets

Extensive tools for Image Management

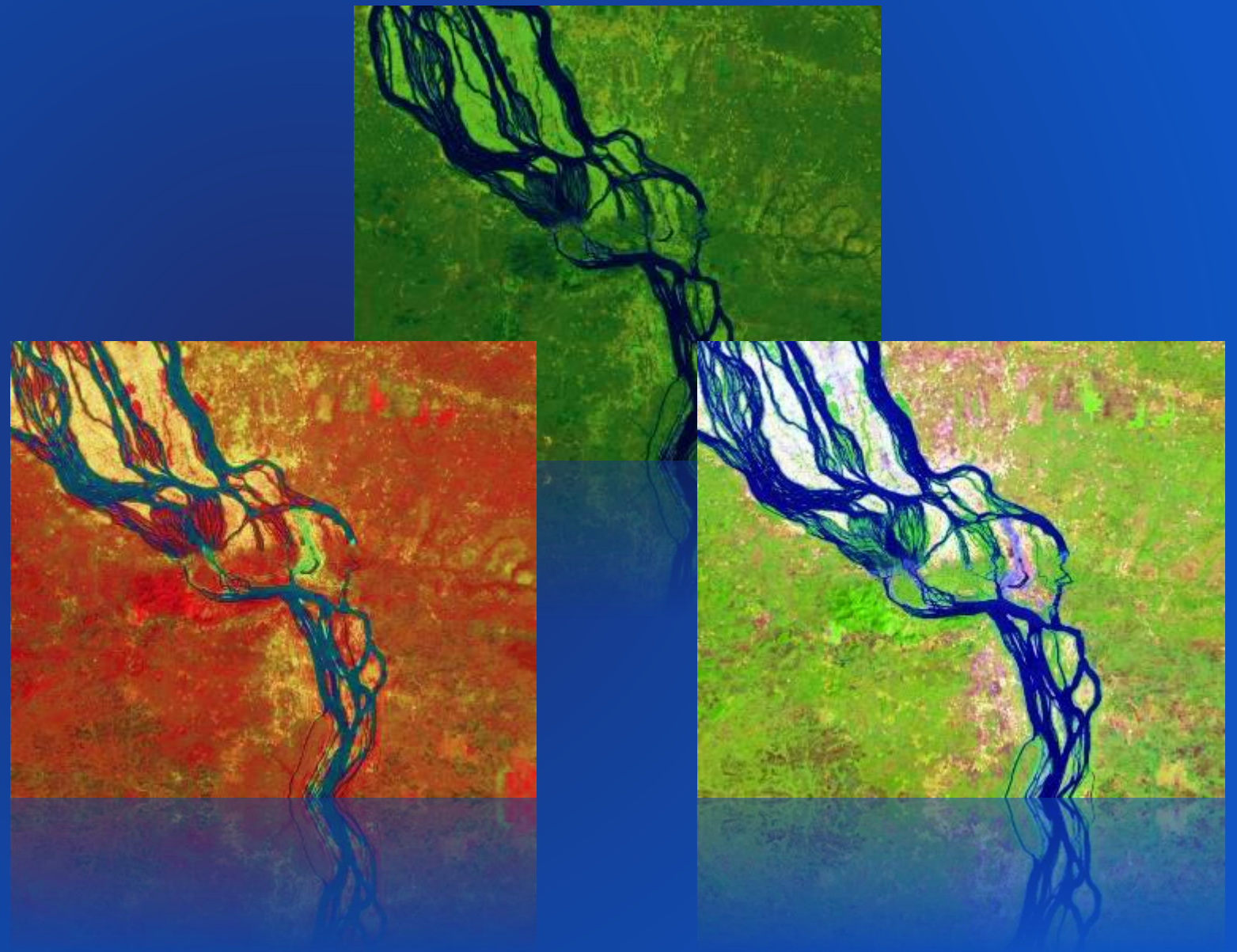
ArcGIS Image Server – Scaling Imagery On Premises and Cloud

- Imagery Hosting
- Dynamic Image Services
- Raster Analytics
- Ortho Mapping

The System of Record for Imagery

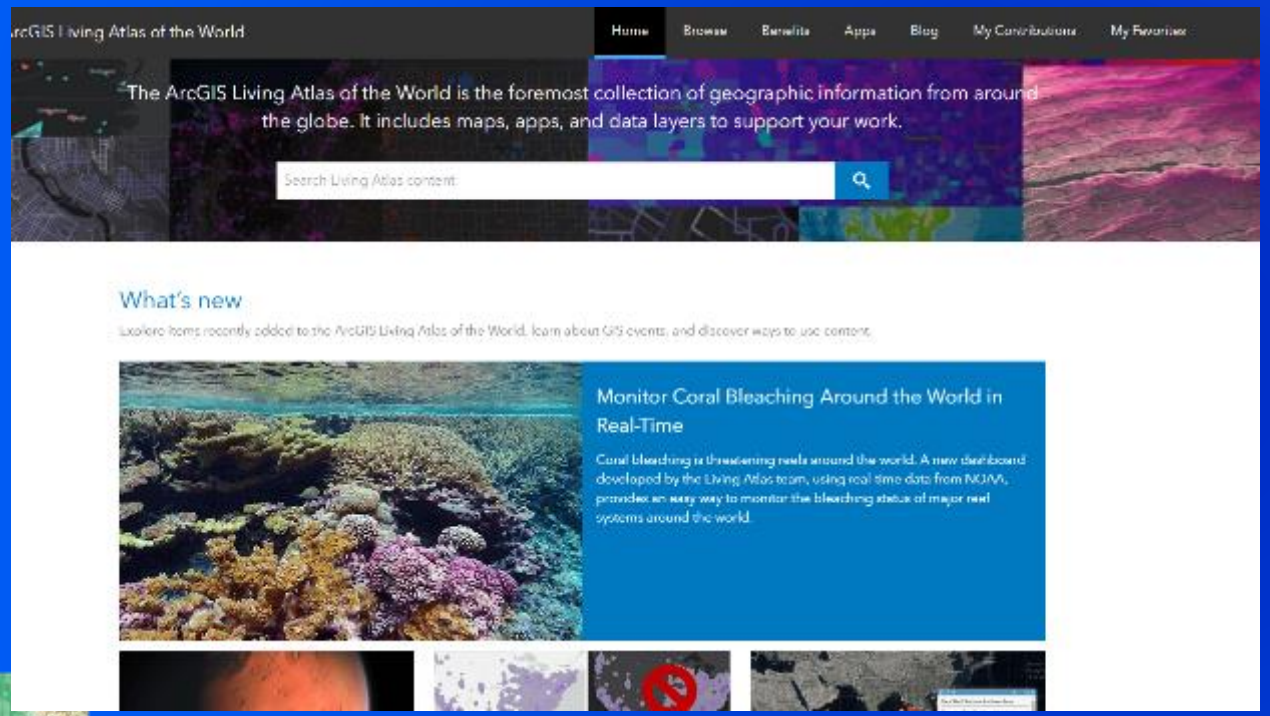
Agenda

- Introduction
- Managing Imagery
- Sharing Imagery
- Best Practices
- Questions



Terminology

- Raster format – defines how pixels are stored
- Raster type – defines the metadata to be read and used for processing
- Raster function – on-the-fly processing of pixels
- Mosaic dataset – data model in a geodatabase for managing imagery
- Image service – data model for accessing mosaic dataset technology as a web service

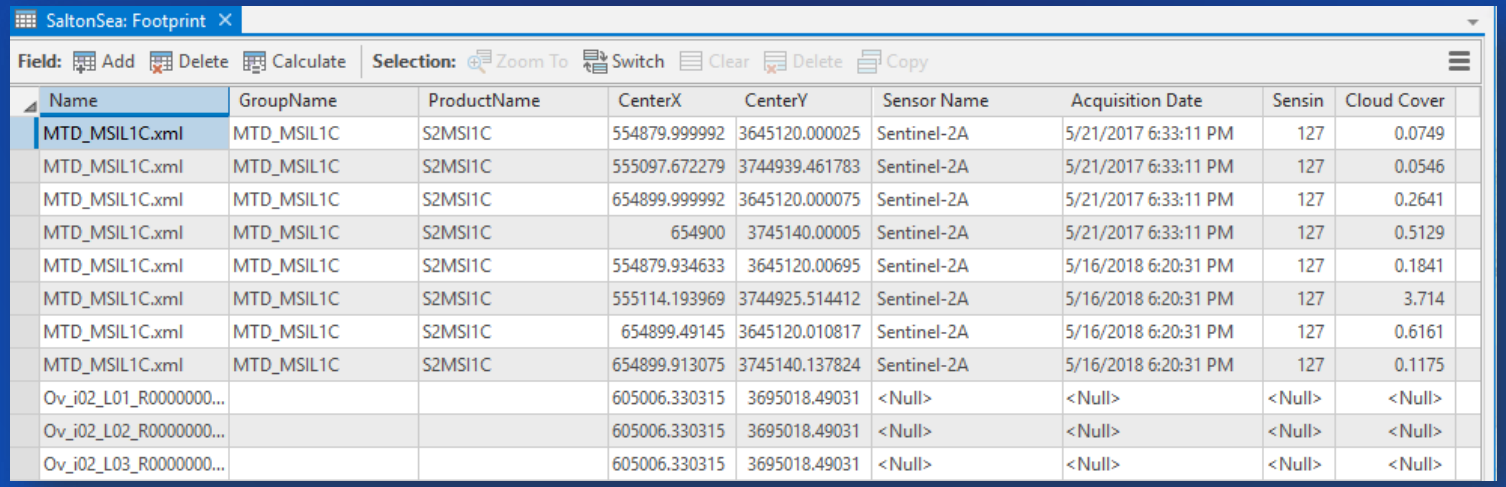


Imagery content on the Living Atlas

Julia Lenhardt

Supported Imagery

- Format: TIFF, JPEG, JPEG 2000, MRF, CRF, IMAGINE, NITF, netCDF, HDR, GRIB, MrSID…
- Data Structure: Bands, Bits, Tiling, Pyramids, NoData
- Compression: Lossless, Lossy, Limited Error
- Georeferencing: Extent, spatial reference system, RPC, Orientation Angles
- Metadata: Acquisition Date, Color Map, Source, Copyright, Band wavelengths



Name	GroupName	ProductName	CenterX	CenterY	Sensor Name	Acquisition Date	Sensin	Cloud Cover
MTD_MSIL1C.xml	MTD_MSIL1C	S2MSI1C	554879.999992	3645120.000025	Sentinel-2A	5/21/2017 6:33:11 PM	127	0.0749
MTD_MSIL1C.xml	MTD_MSIL1C	S2MSI1C	555097.672279	3744939.461783	Sentinel-2A	5/21/2017 6:33:11 PM	127	0.0546
MTD_MSIL1C.xml	MTD_MSIL1C	S2MSI1C	654899.999992	3645120.000075	Sentinel-2A	5/21/2017 6:33:11 PM	127	0.2641
MTD_MSIL1C.xml	MTD_MSIL1C	S2MSI1C	654900	3745140.00005	Sentinel-2A	5/21/2017 6:33:11 PM	127	0.5129
MTD_MSIL1C.xml	MTD_MSIL1C	S2MSI1C	554879.934633	3645120.00695	Sentinel-2A	5/16/2018 6:20:31 PM	127	0.1841
MTD_MSIL1C.xml	MTD_MSIL1C	S2MSI1C	555114.193969	3744925.514412	Sentinel-2A	5/16/2018 6:20:31 PM	127	3.714
MTD_MSIL1C.xml	MTD_MSIL1C	S2MSI1C	654899.49145	3645120.010817	Sentinel-2A	5/16/2018 6:20:31 PM	127	0.6161
MTD_MSIL1C.xml	MTD_MSIL1C	S2MSI1C	654899.913075	3745140.137824	Sentinel-2A	5/16/2018 6:20:31 PM	127	0.1175
Ov_i02_L01_R0000000...			605006.330315	3695018.49031	<Null>	<Null>	<Null>	<Null>
Ov_i02_L02_R0000000...			605006.330315	3695018.49031	<Null>	<Null>	<Null>	<Null>
Ov_i02_L03_R0000000...			605006.330315	3695018.49031	<Null>	<Null>	<Null>	<Null>

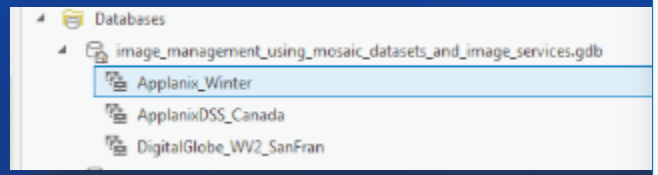
Managing Imagery

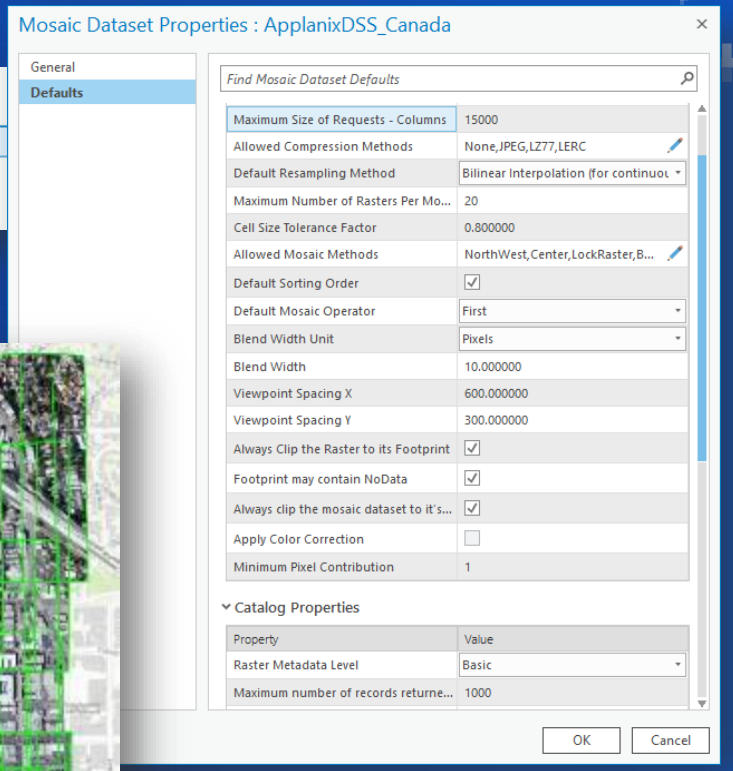
Mosaic Datasets

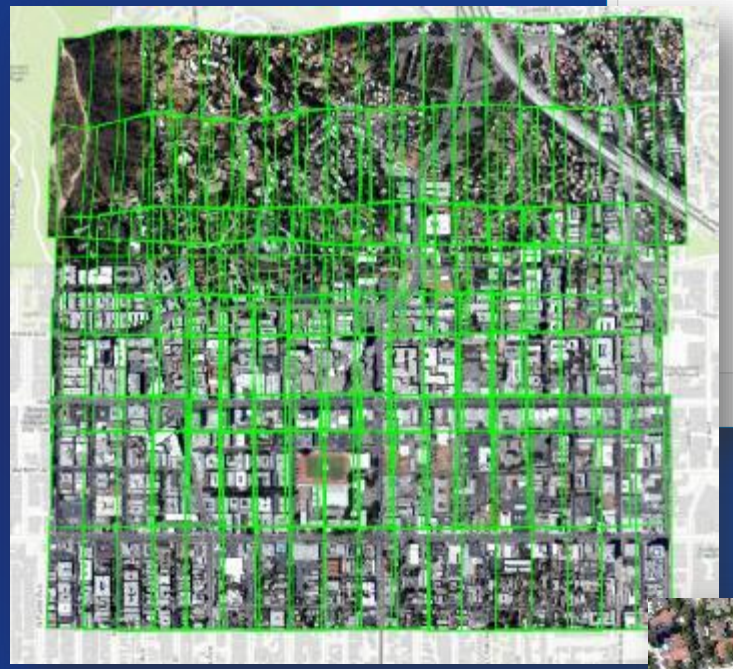
What is a Mosaic Dataset?

ArcGIS Imagery Information Model

- Catalog including:
  - References Imagery
  - Associated metadata
  - Processing to be applied
- Stored in Geodatabase
- Created using ArcGIS for Desktop
- Provides:
  - Dynamic Mosaicking
  - On-the-fly processing







- Highly scalable, from small to large volumes of imagery

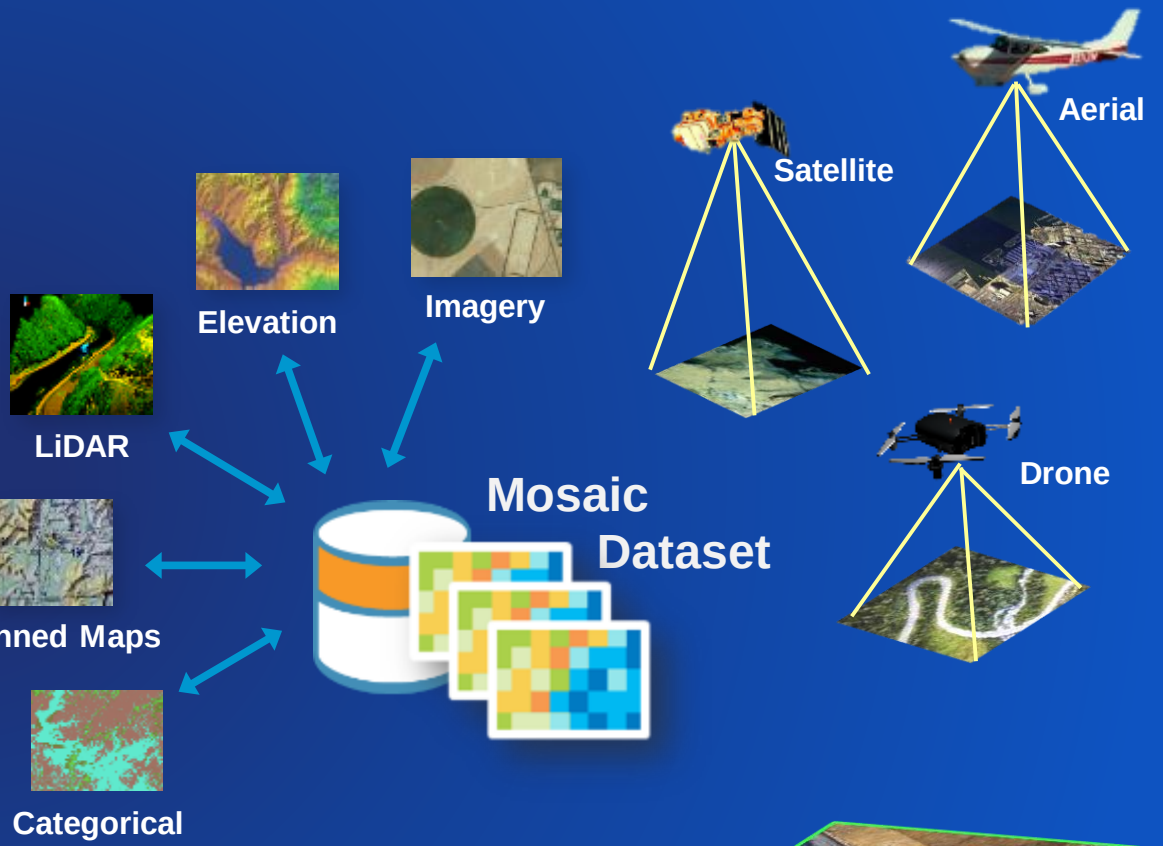
Image Management

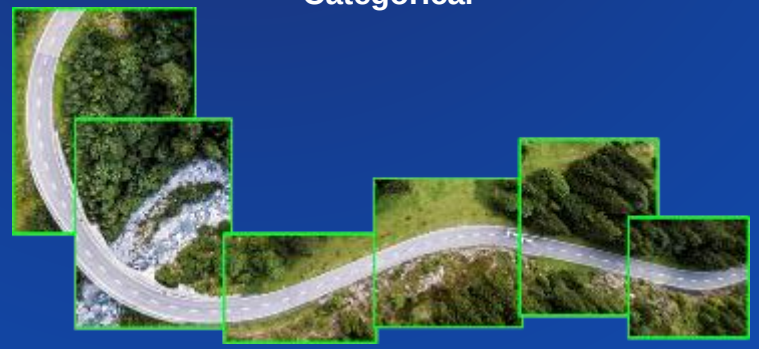
And so much more…

Image Management Using Mosaic Datasets

ArcGIS Imagery Information Model

- Supports multiple raster sources
- Supports many raster formats
- Maintains image quality
- Handles overlap and disparate datasets
- Supports over 50 sensor types
- Supports Image Services

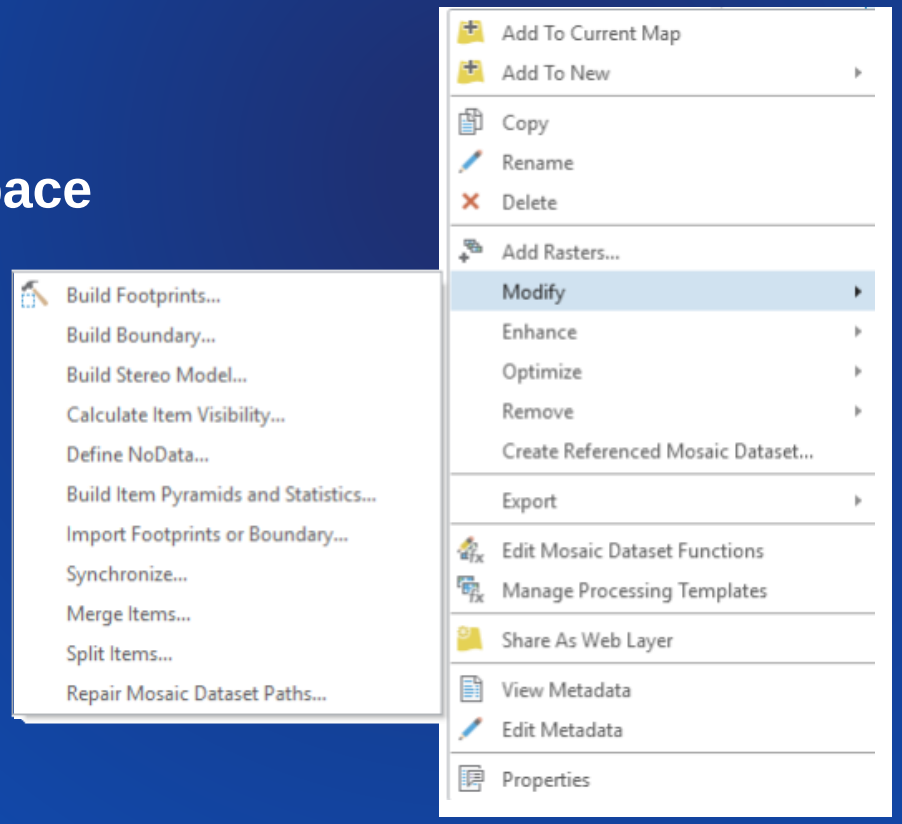


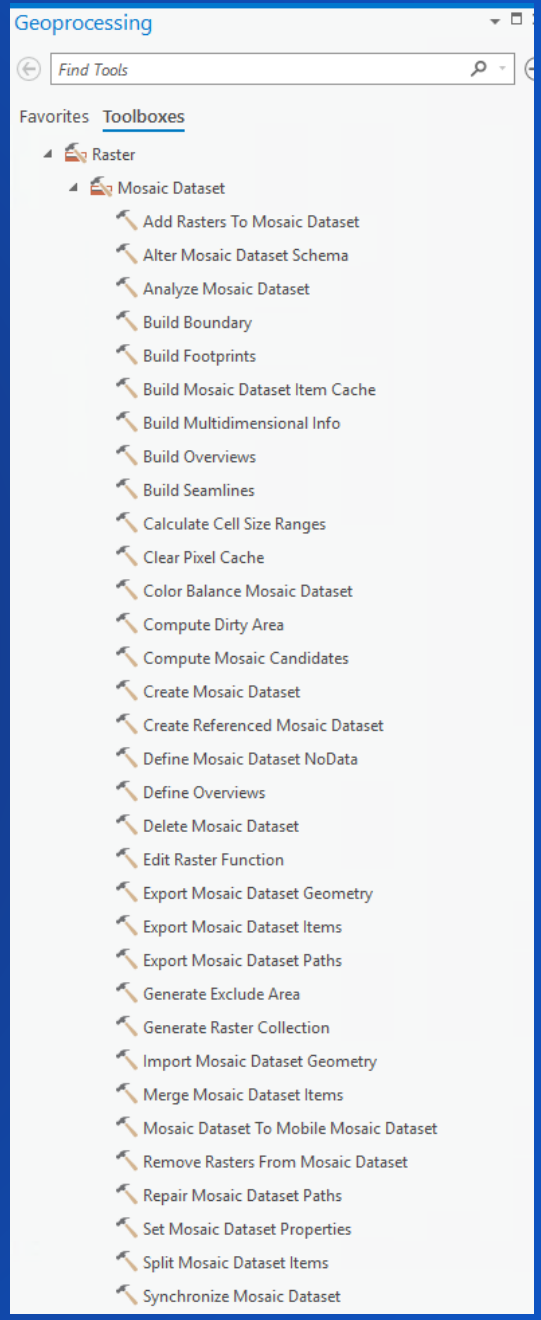


Ways to Create Mosaic Datasets

Tools, models and scripts

- Geoprocessing Tools
- Geodatabase/Mosaic Dataset Context Menu
- Model Builder
- Python scripts
- Ortho Mapping workspace





Creating Mosaic Dataset In ArcGIS Pro

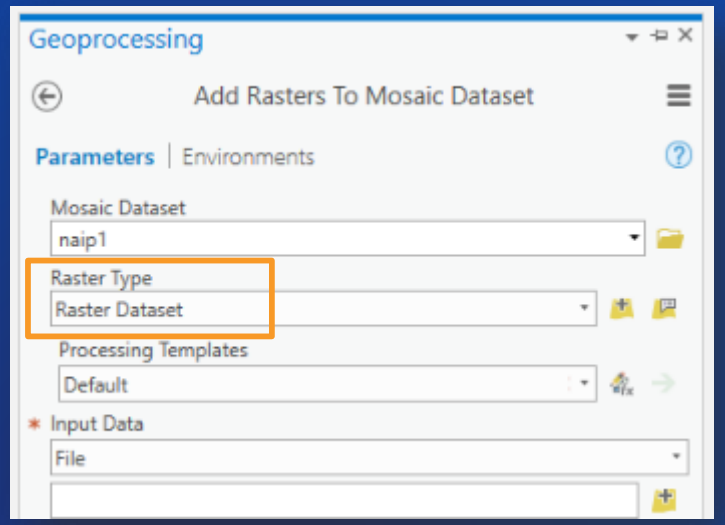
For the minimalist

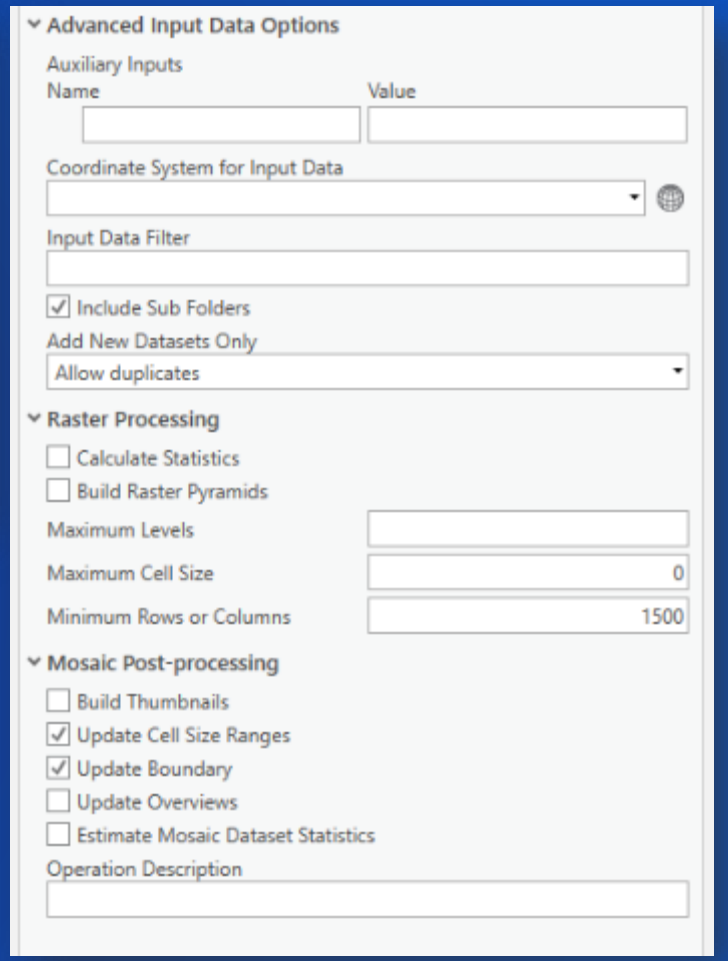
1. Create Geodatabase (File or Enterprise)
2. Create Mosaic Dataset
3. Add Rasters
4. Generate Overviews (optional)

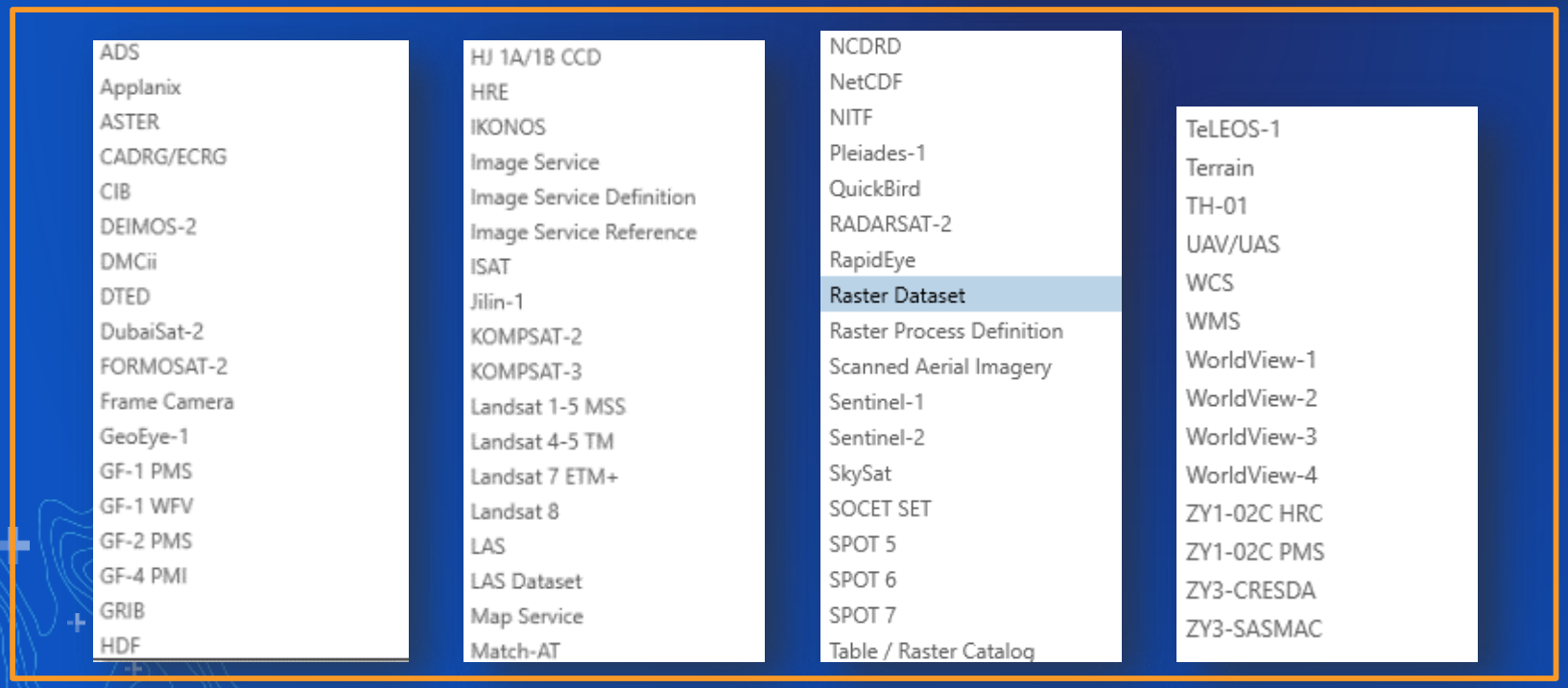
Add Rasters

Populate your mosaic dataset

- Specify parameters
- Crawls for imagery according to the raster type
- Defines the initial processing



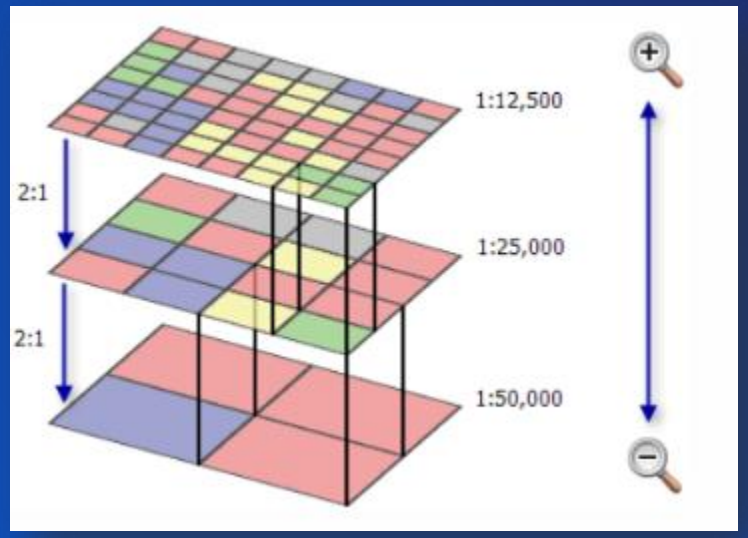


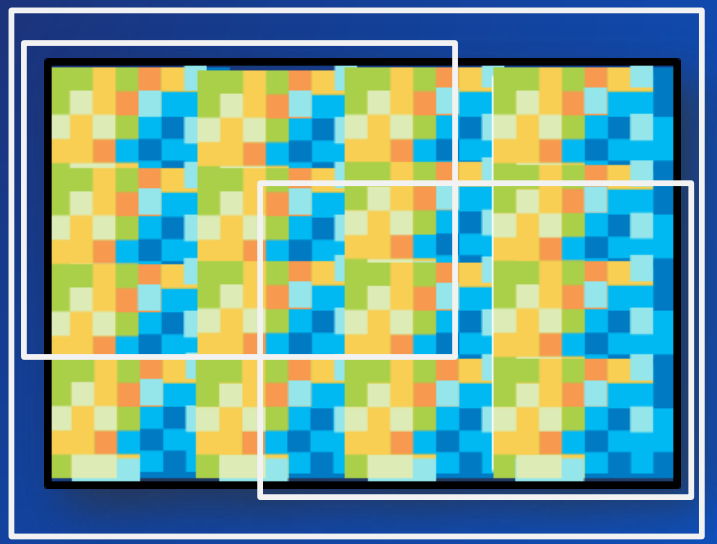


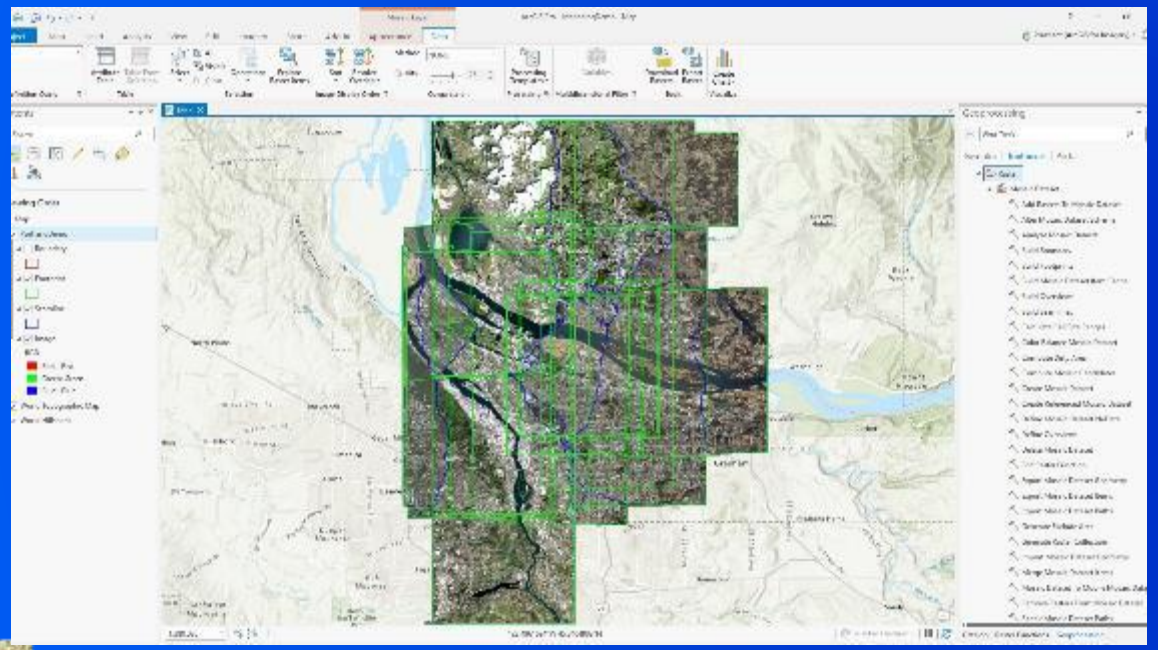
Overviews

Why can’t I see my data?

- Like pyramids for the Mosaic Dataset
- Used for faster access at smaller scales (zoomed out)
- Optional - if not created, imagery may not appear when zoomed out
- May also consider adding smaller scale imagery







Create a Mosaic Dataset

Julia Lenhardt

Creating Mosaic Dataset In ArcGIS Pro

For the minimalist

1. Create Geodatabase (File or Enterprise)
2. Create Mosaic Dataset
3. Add Rasters
4. Generate Overviews (overview)

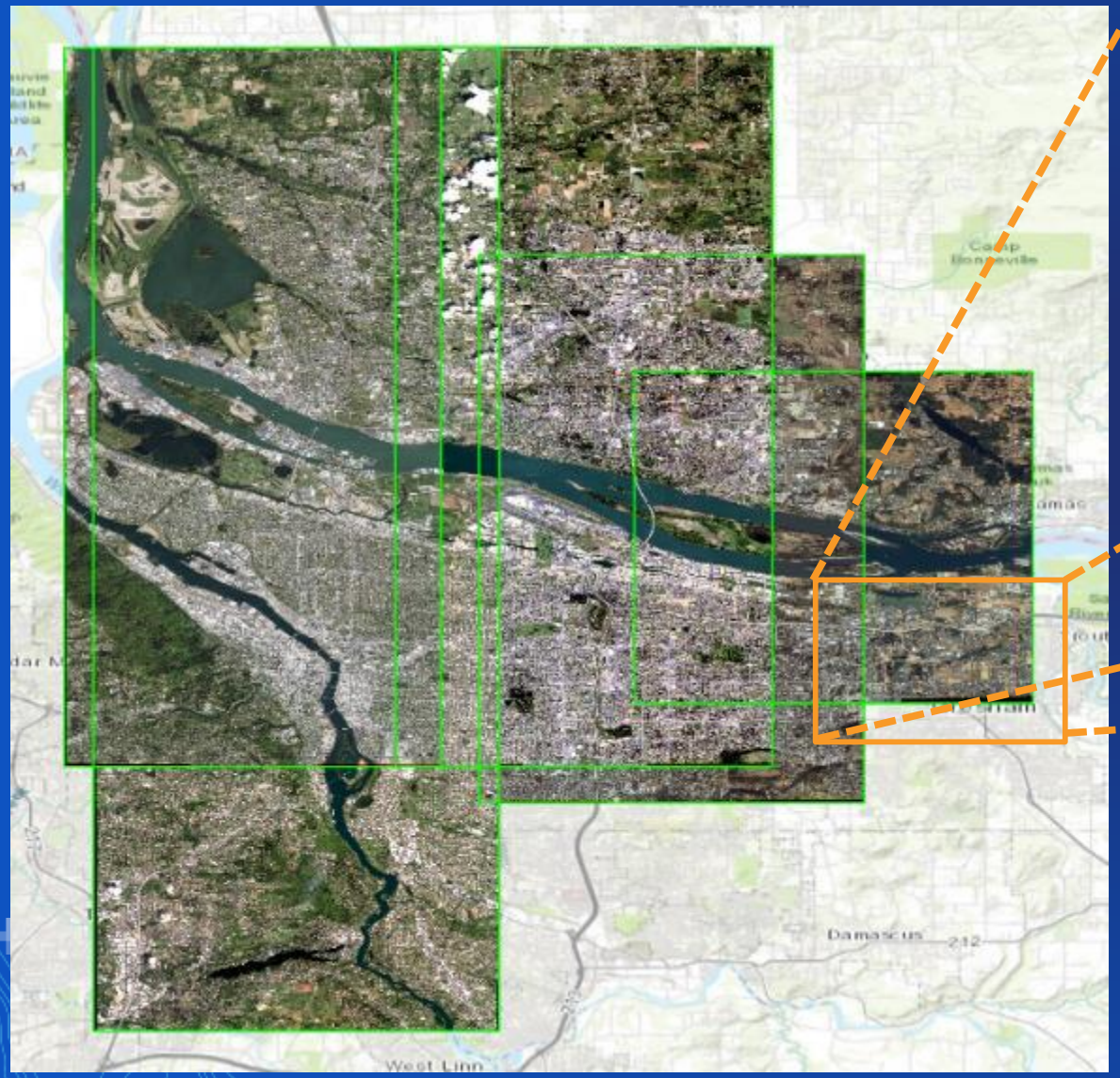
Creating Mosaic Dataset In ArcGIS Pro

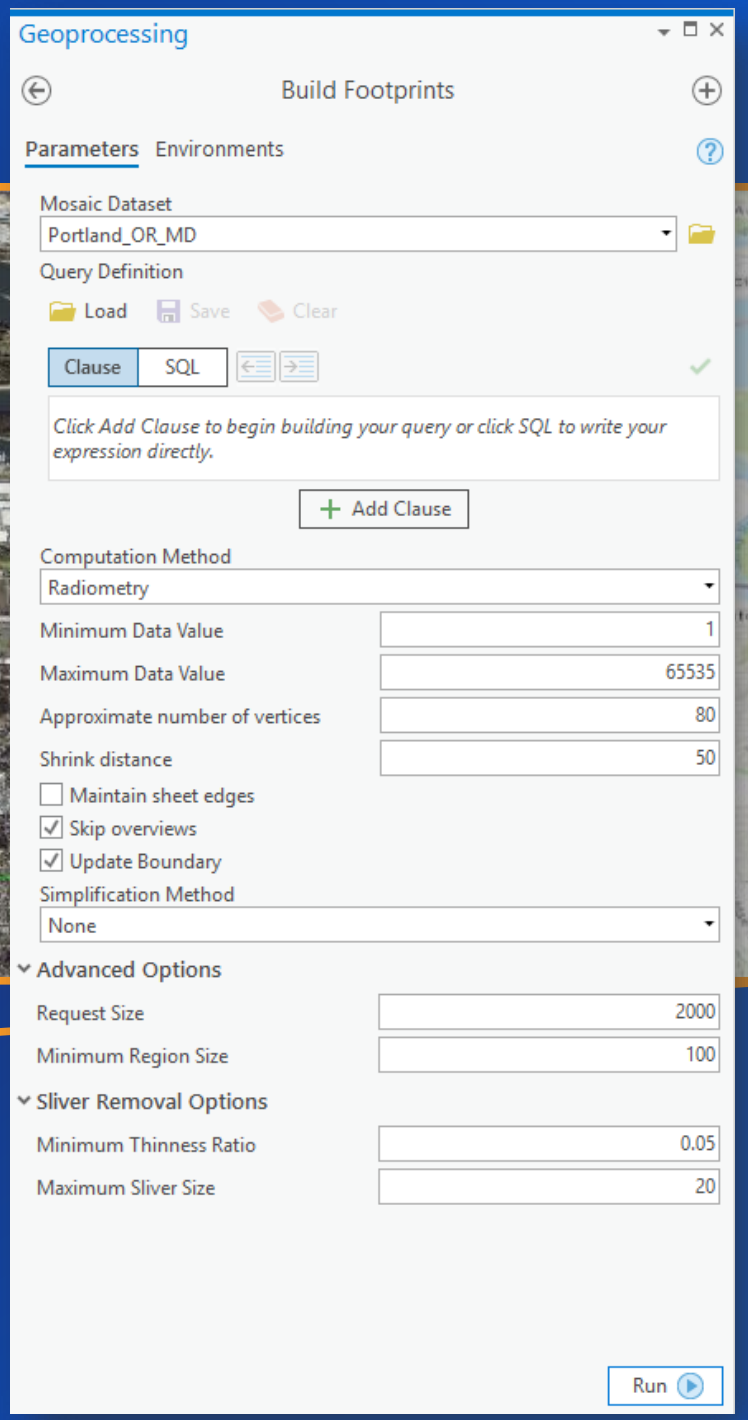
For data-specific management and modification

1. Create Geodatabase (File or Enterprise)
2. Create Mosaic Dataset
3. Add Rasters
   - Add metadata
   - Refine mosaic dataset properties
   - Compute mosaic dataset statistics
   - Refine geometry
   - Refine footprints and NoData
   - Color balancing
   - Generate seamlines
4. Generate Overviews (optional)

Creating Mosaic Dataset In ArcGIS Pro

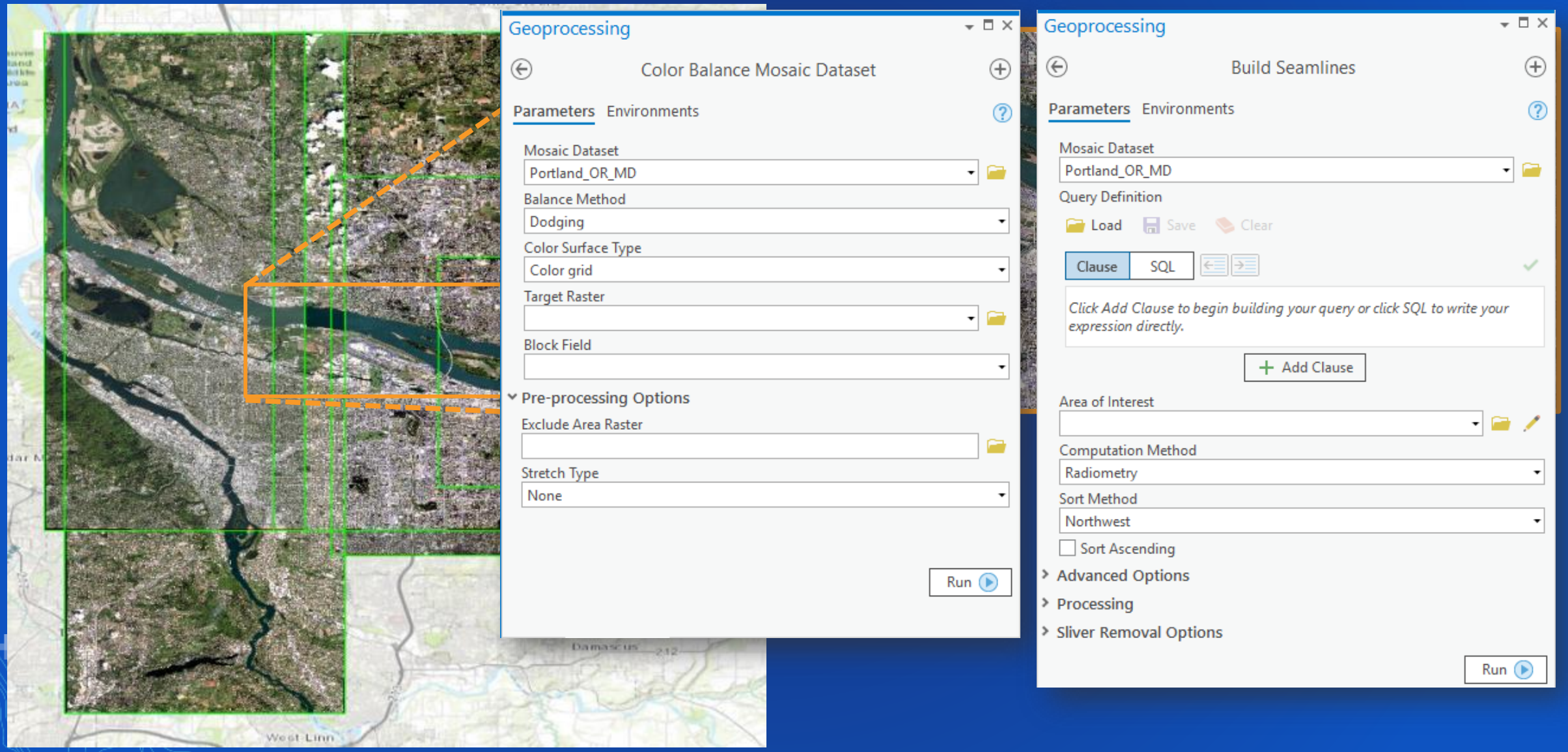
For data-specific management and modification





Creating Mosaic Dataset In ArcGIS Pro

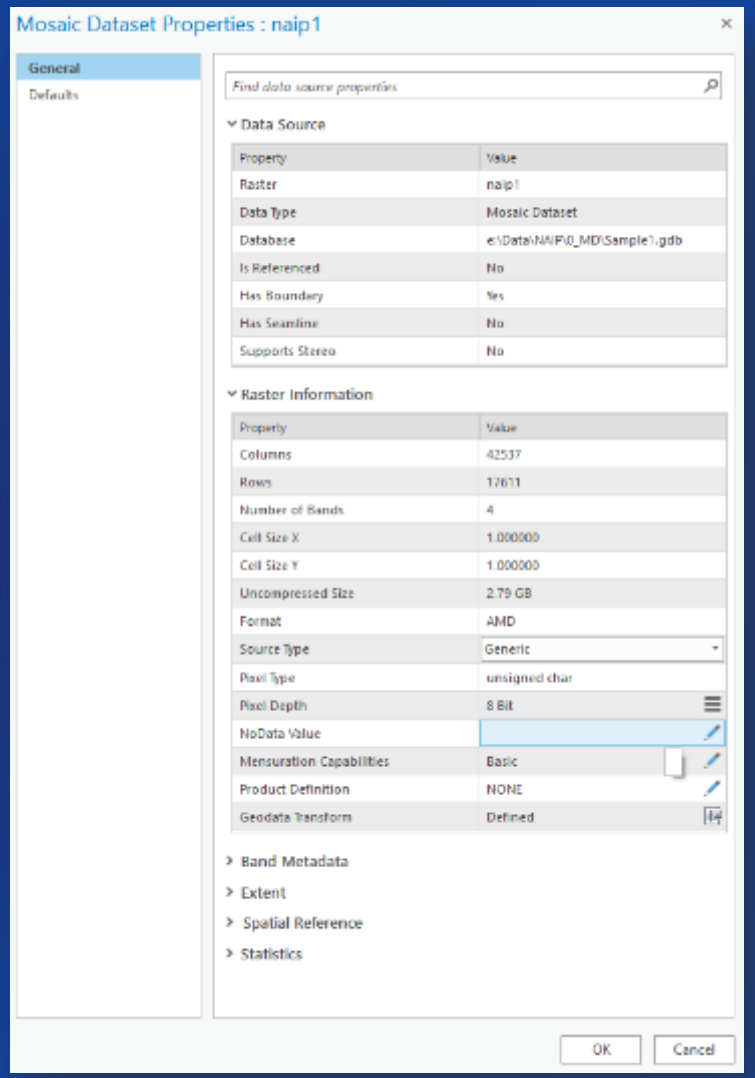
For data-specific management and modification

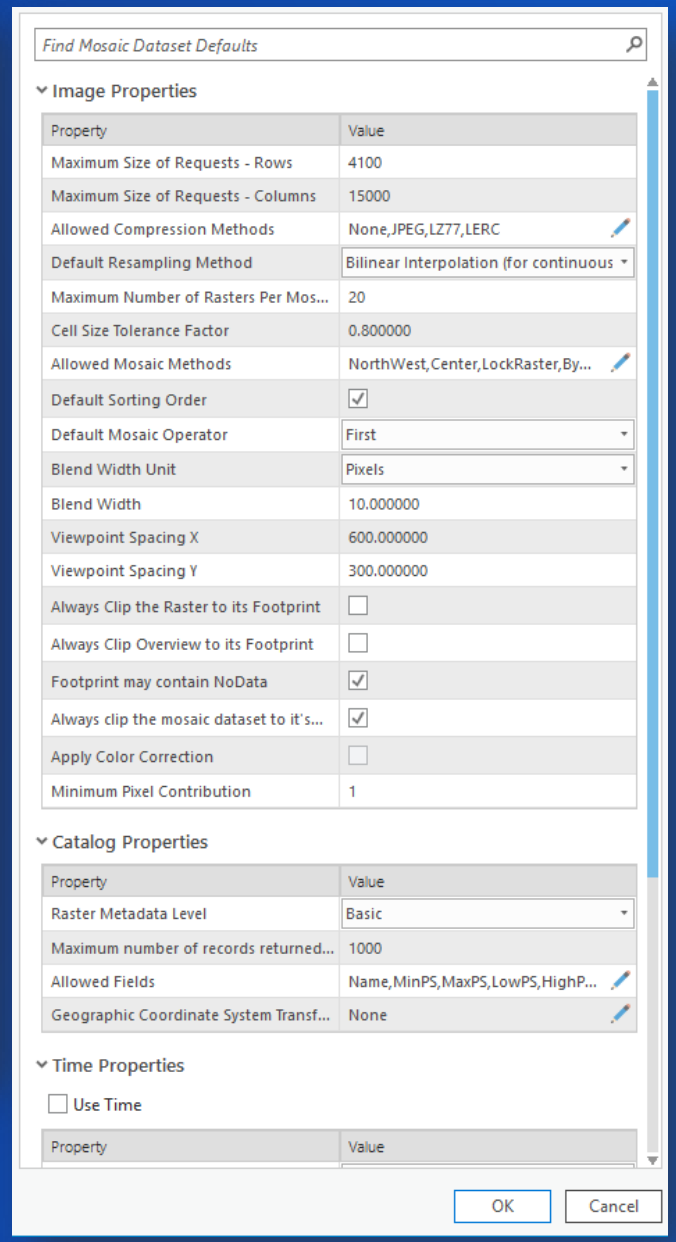


Mosaic Dataset Properties

From the Catalog or Contents pane

- General
  - General properties
- Defaults
  - Direct use of Mosaic Dataset
  - When Published
  - Sets some limits on Publishing
- Multidimensional Info
  - Variables and dimensions
  - For multidimensional-aware MDs

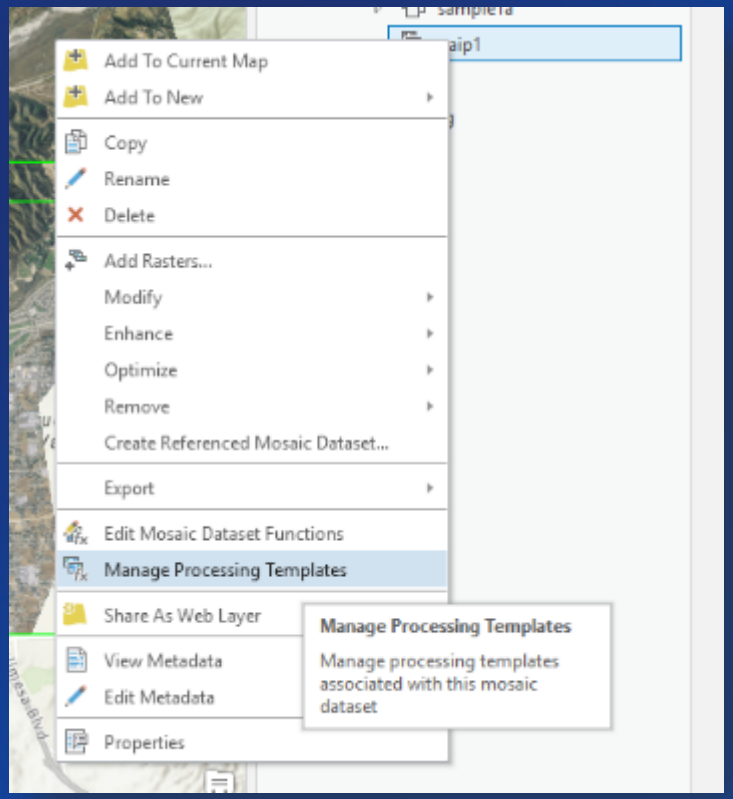


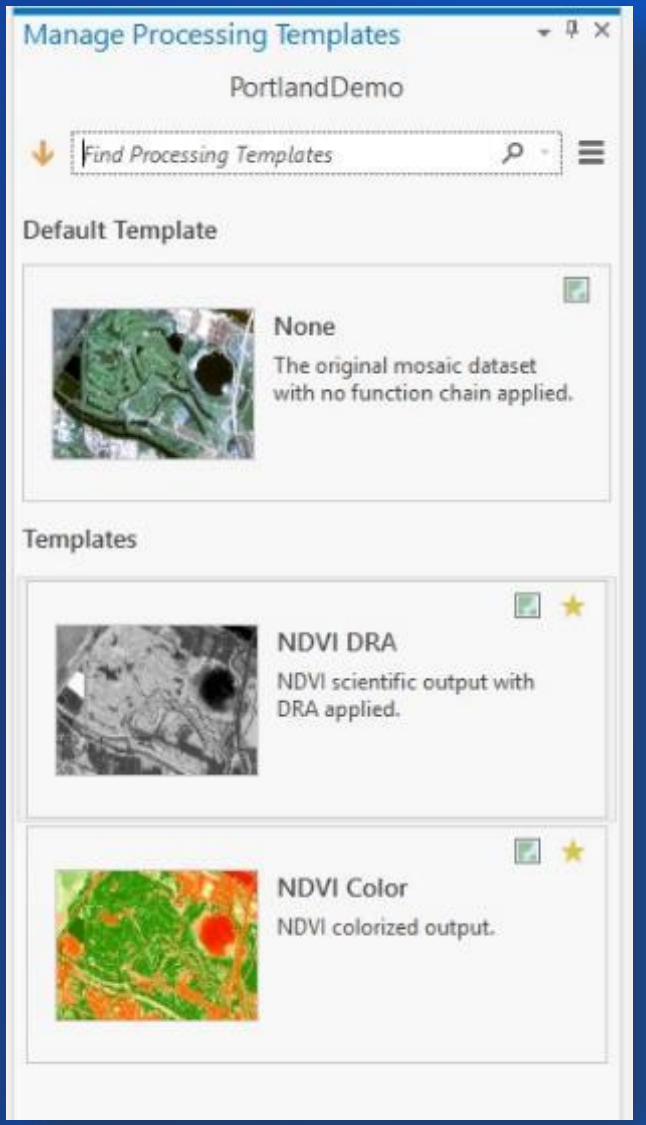


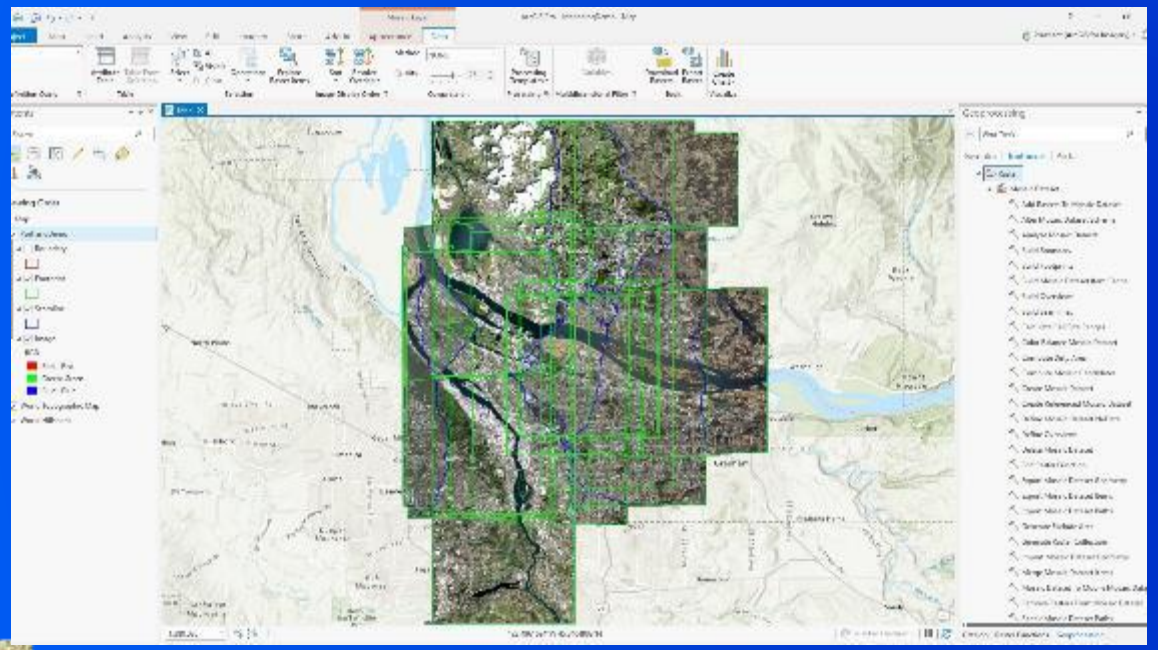
Mosaic Dataset Processing

For easy and efficient visualization and exploration

- Initial Raster Function Chain defined by Raster Type
- Apply additional processing
  - a) To items in mosaic dataset
  - b) By adding to raster function chain
  - c) *By attaching to mosaic dataset*
- Persists when shared







Add processing to mosaic dataset

Julia Lenhardt

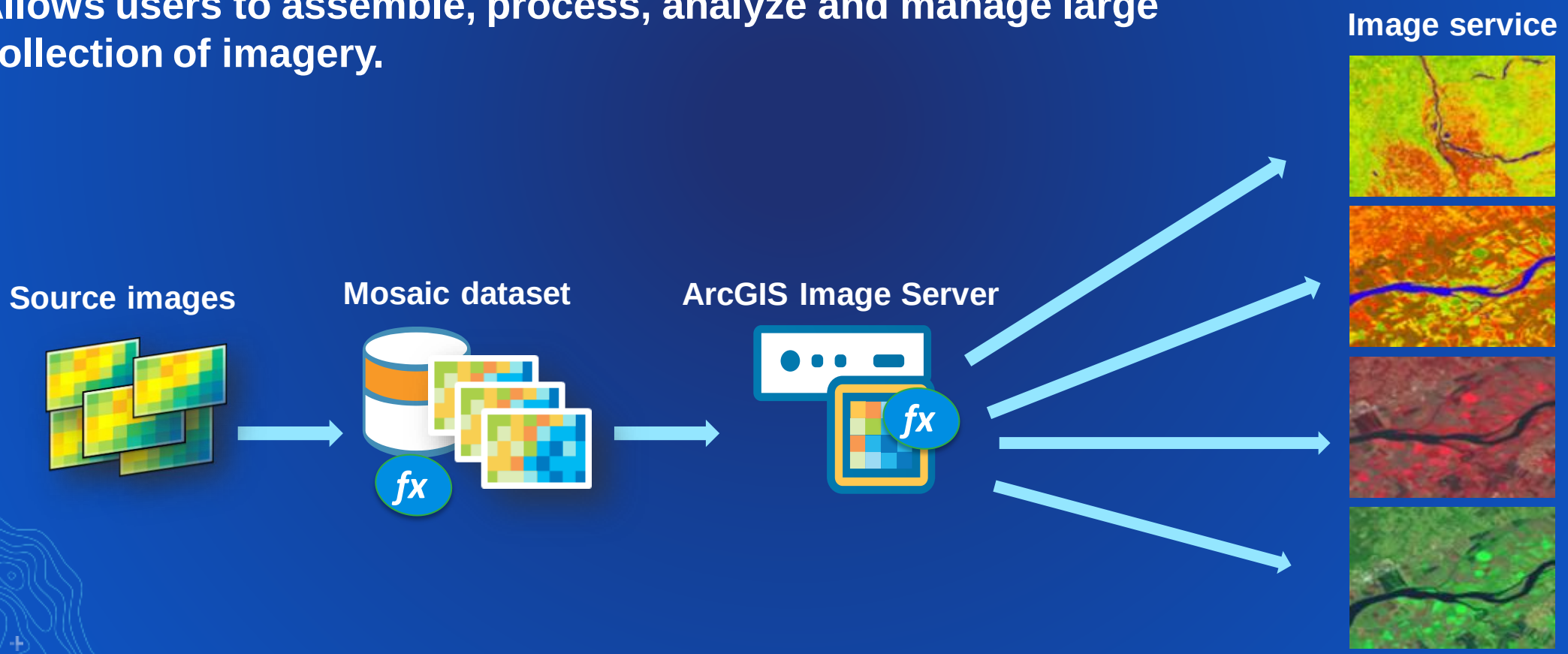
Sharing Imagery

Image Services

What is ArcGIS Image Server?

The Enterprise solution to imagery sharing

- Part of ArcGIS Enterprise.
- Serves large collection of data for analytical processing.
- Allows users to assemble, process, analyze and manage large collection of imagery.



ArcGIS Image Server

Key Capabilities

- **Dynamic image services**
  - Web accessible imagery which can have processing applied on-the-fly.
- **Raster Analytics**
  - Quickly process and persist data to create new information products.
- **Ortho mapping**
  - Processing of satellite, aerial or drone imagery into digital elevation models and ortho mosaics.
- **Imagery hosting**
  - Enables users within organization to upload imagery into ArcGIS Enterprise and serve it as dynamic imagery layers.

ArcGIS Image Server

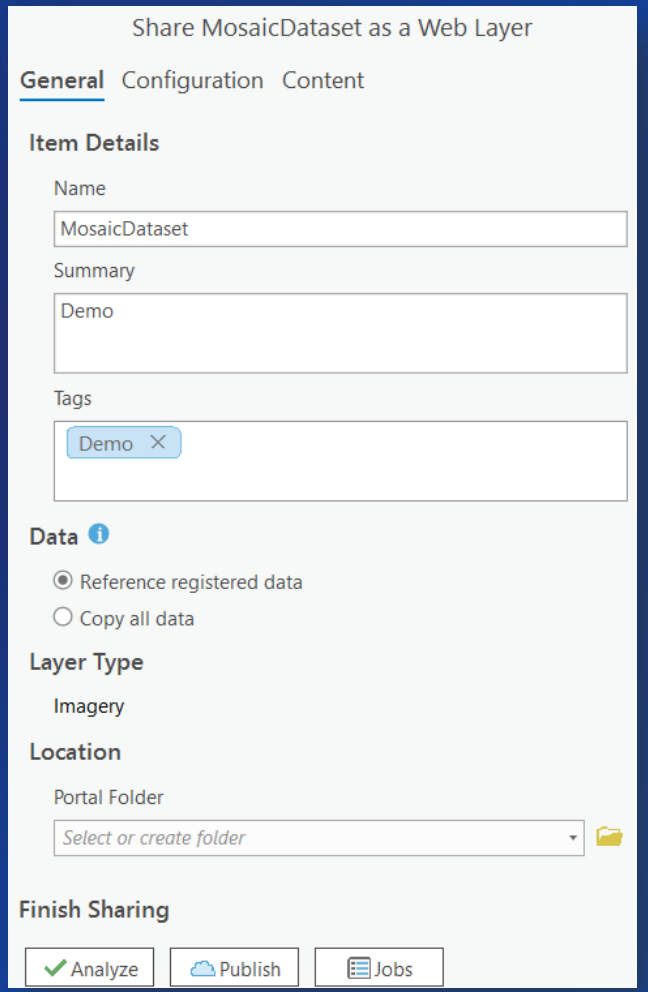
What is the image service?

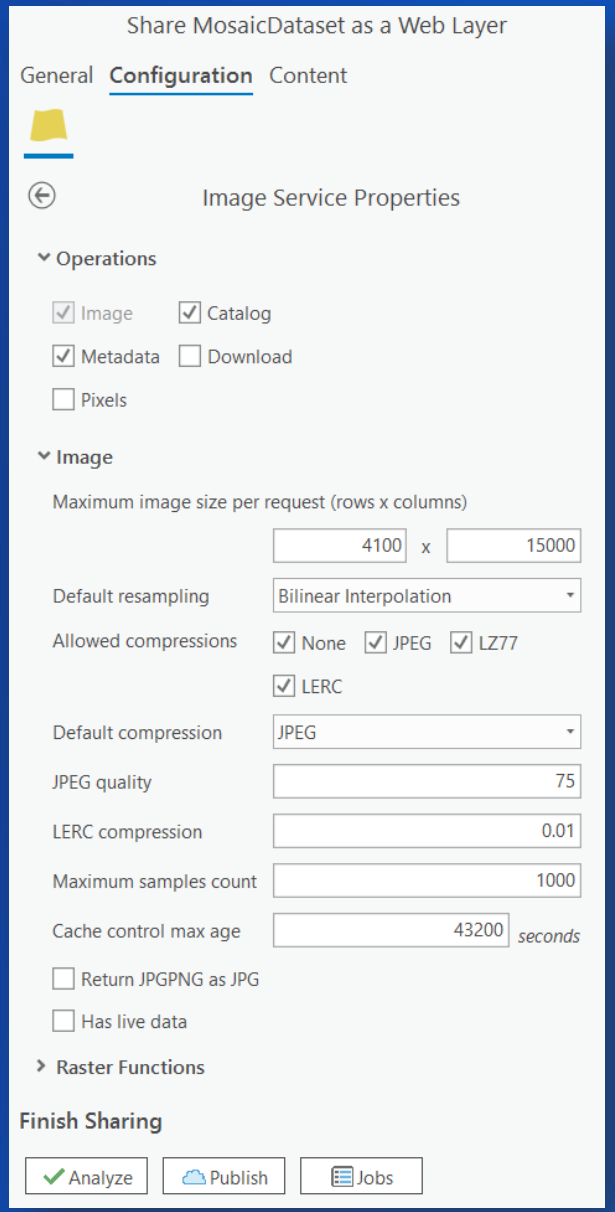
- The Image Service is the primary information model for imagery on the web.
  - Single Images
  - Large collections using mosaic datasets
- Puts valuable imagery to use quickly.
- Serves multiple views using the original imagery.
- Access the catalogs of imagery that make up the mosaic dataset.
- Can perform on-the-fly image processing and explore temporal changes.

Sharing imagery from ArcGIS Pro

How to publish an image service

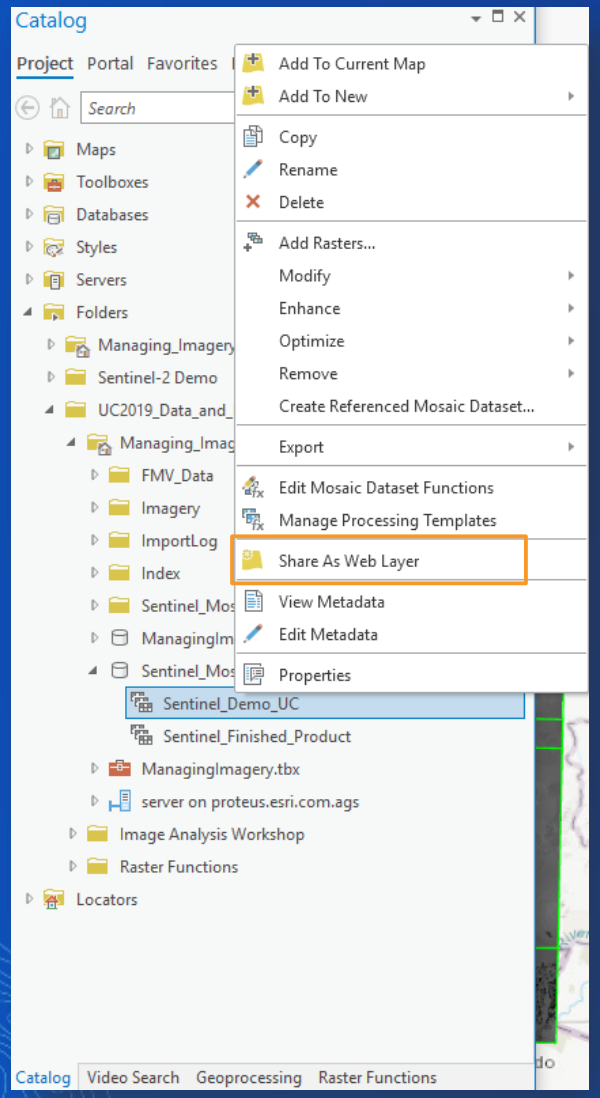
- Must invoke the wizard from Catalog pane, *not* Contents pane
- Share by Reference or Share by Value
- Define processing to be applied by the server
- Allow downloads.
- Allow mensuration.
- Enable WMS (Web Map Service) and WCS (Web Coverage Service) capabilities.

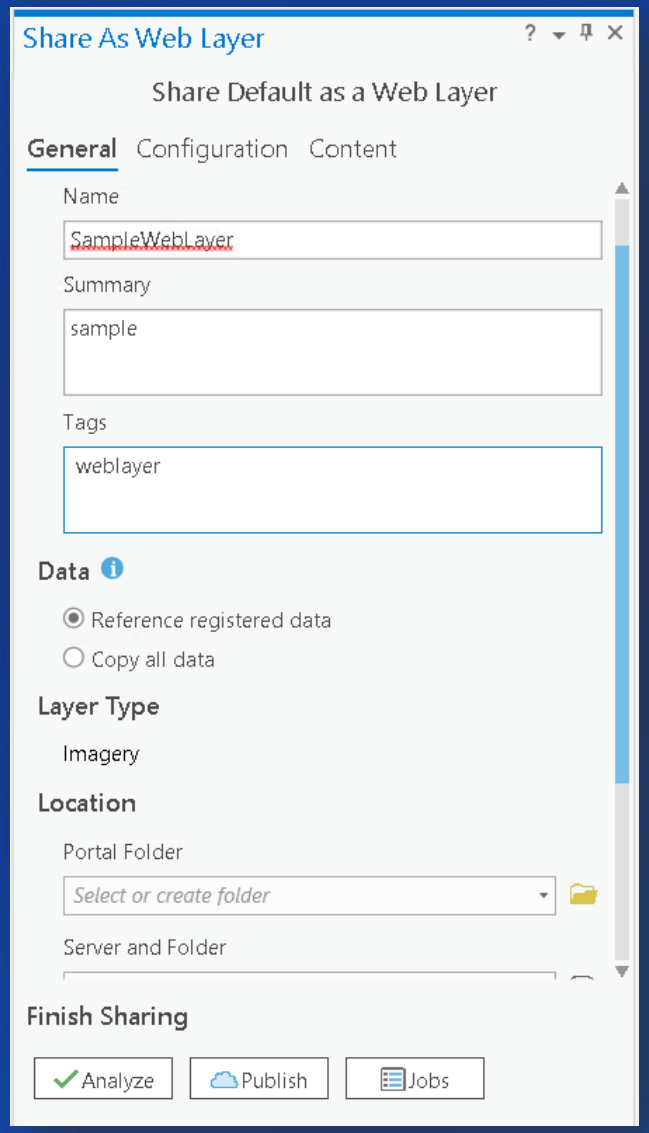


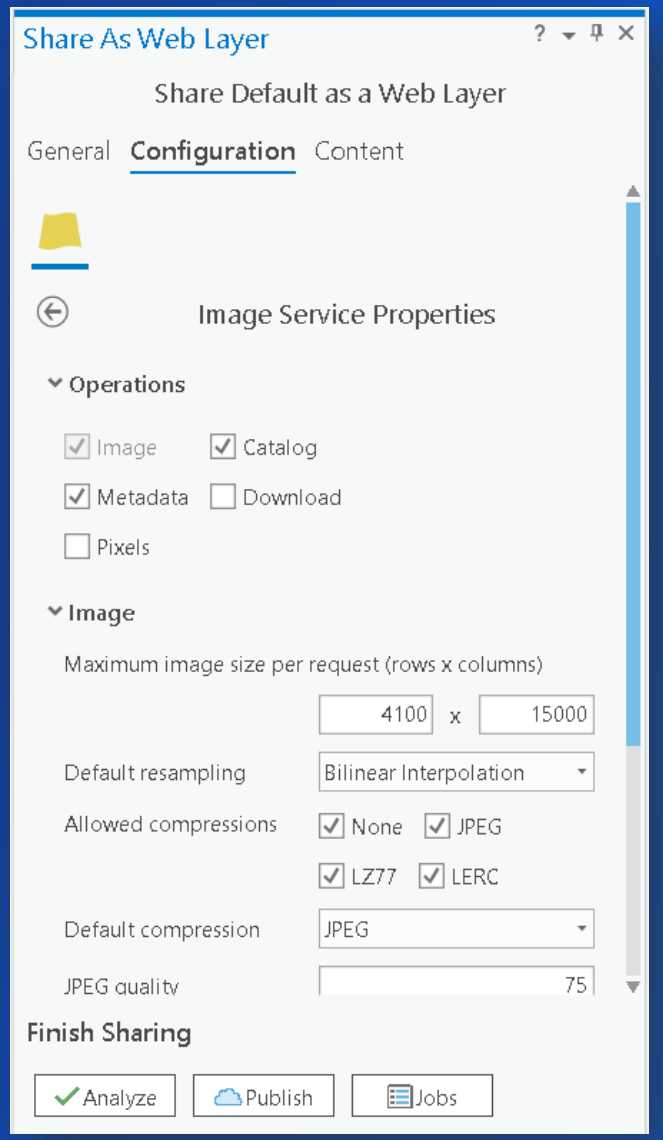


Sharing imagery from ArcGIS Pro

How to publish to Portal for ArcGIS



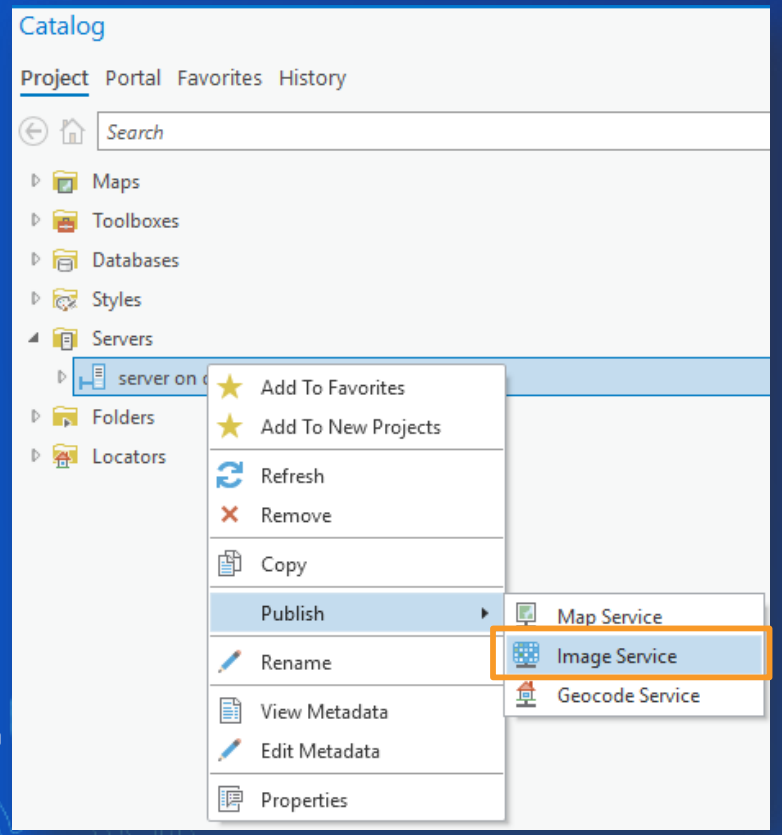


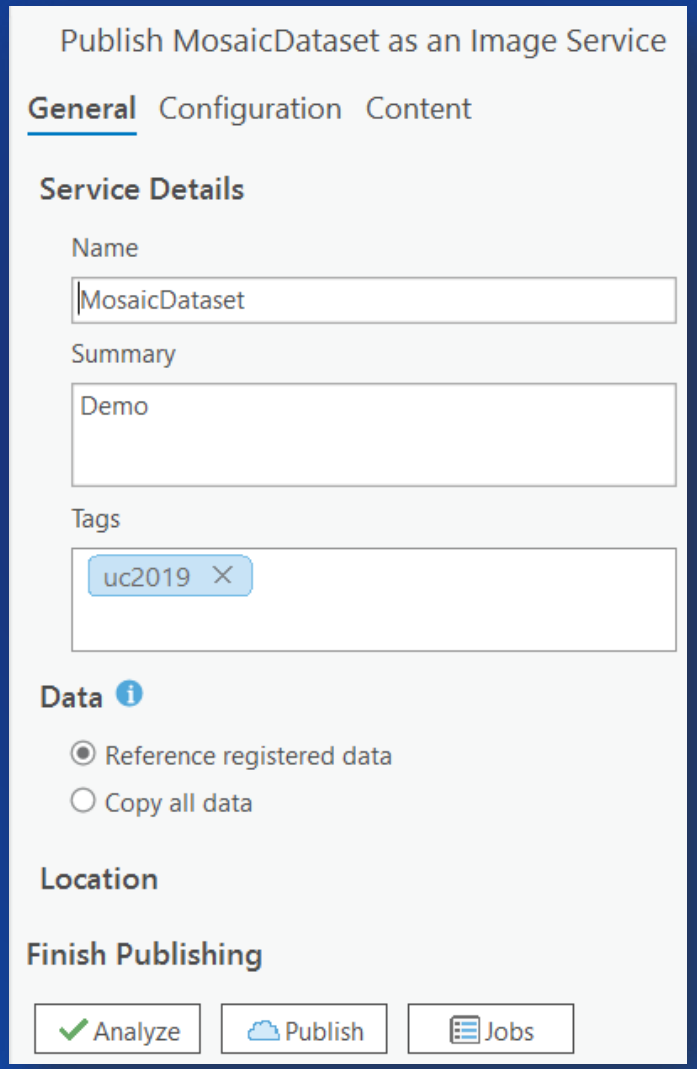


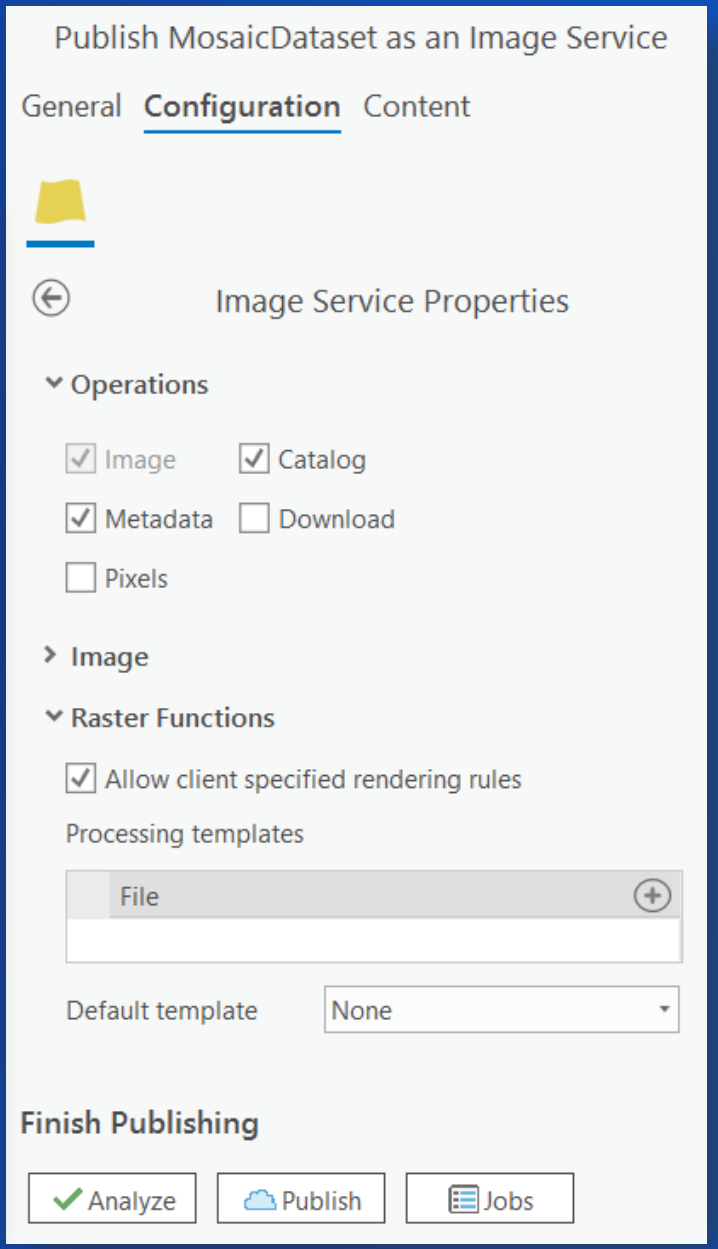
Sharing imagery from ArcGIS Pro

How to publish to standalone ArcGIS Server

New Feature in ArcGIS Pro 2.4





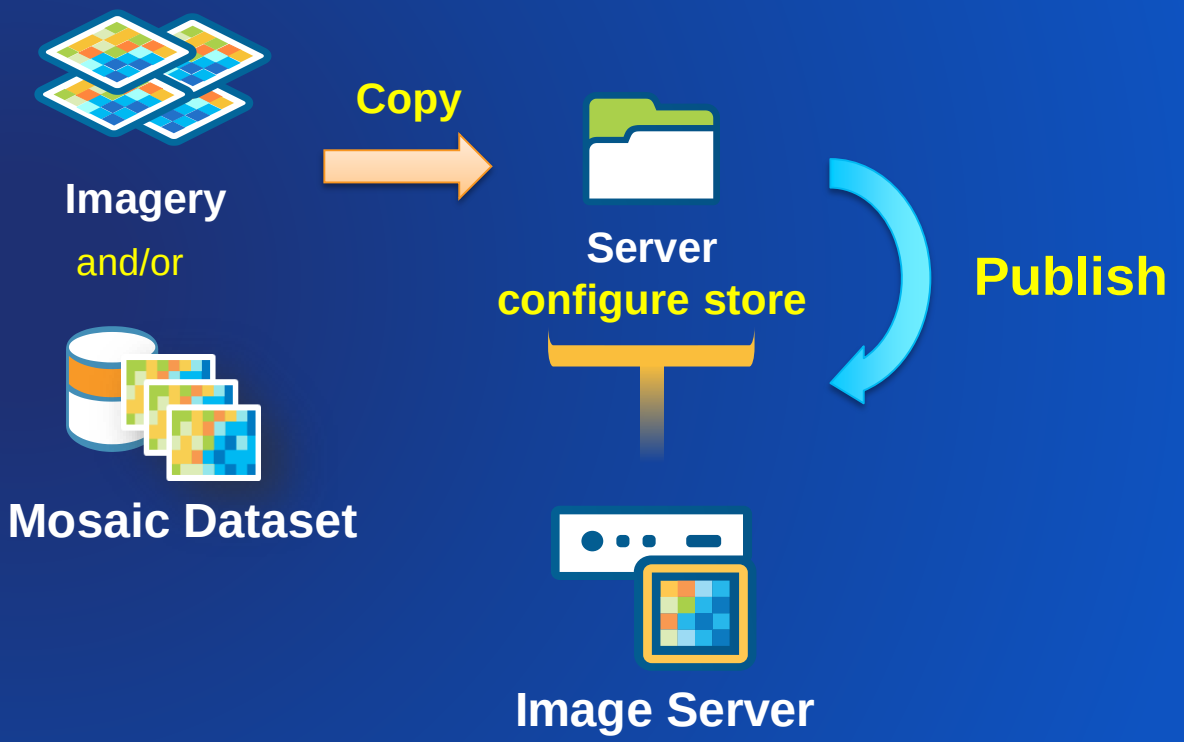


Sharing an Image service from ArcGIS Pro

How to publish an image service

Share by Value

- Imagery is copied to the ArcGIS Server configuration store
- Data will be converted into File Geodatabase
- NOT recommended for large image collections

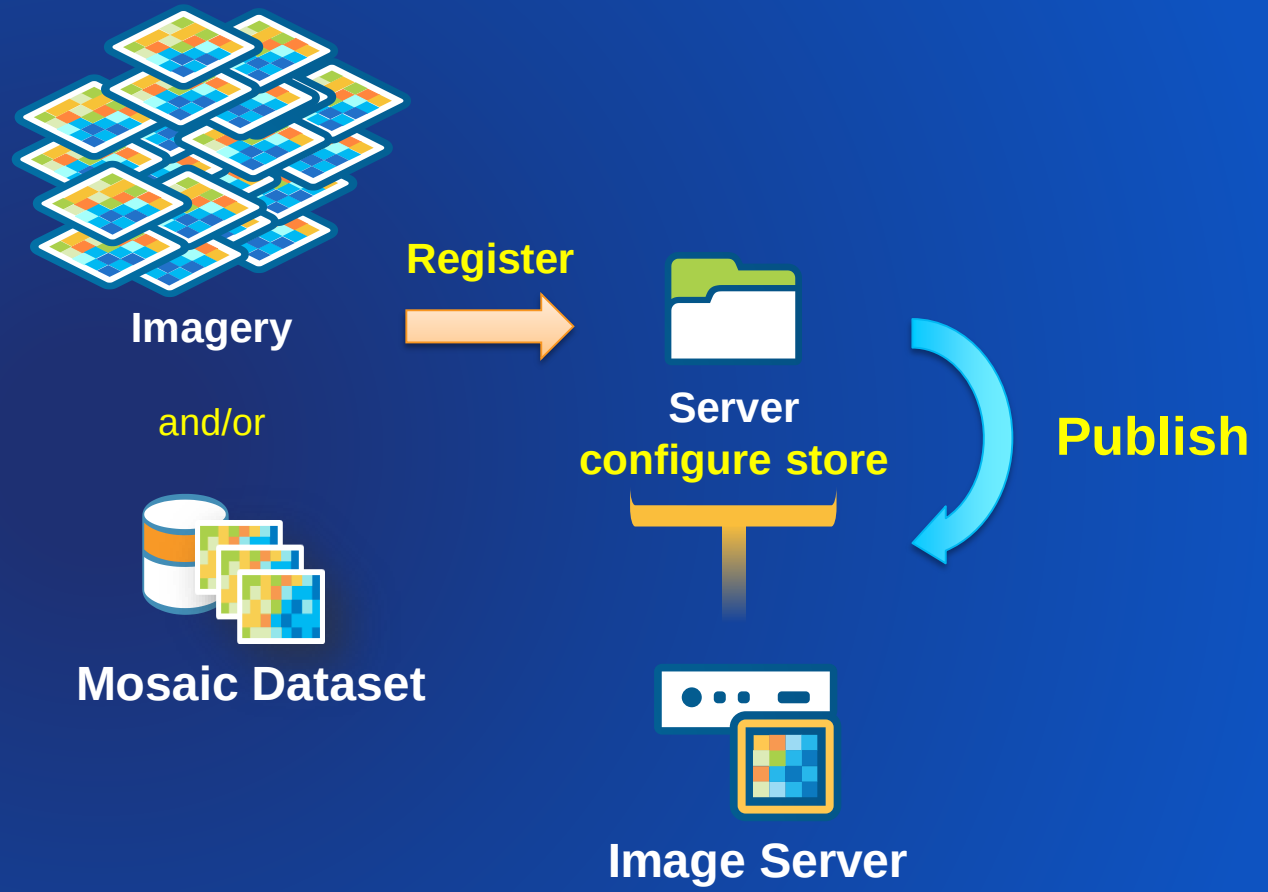


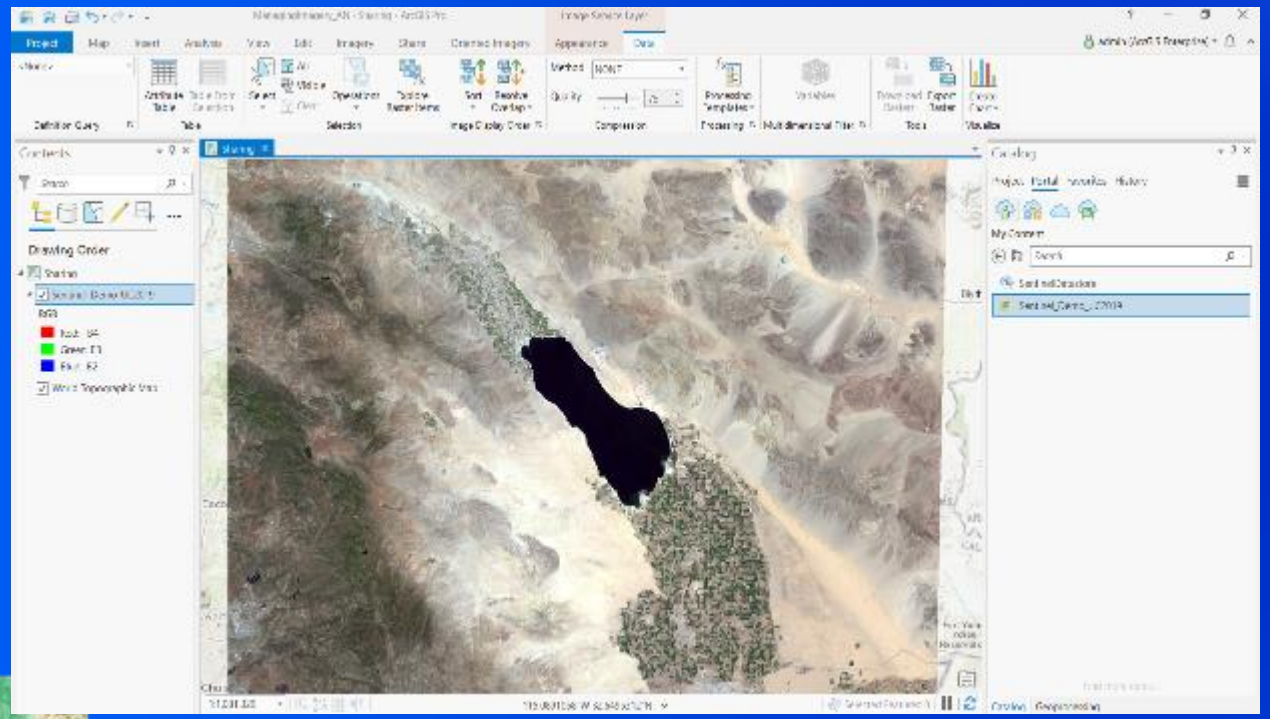
Sharing an image service from ArcGIS Pro

How to publish an image service

Share by Reference

- Register a file share and/or enterprise geodatabase(s) with the server data store
- Data is not moved
- Recommended for publishing mosaic dataset or large single images or large single raster data



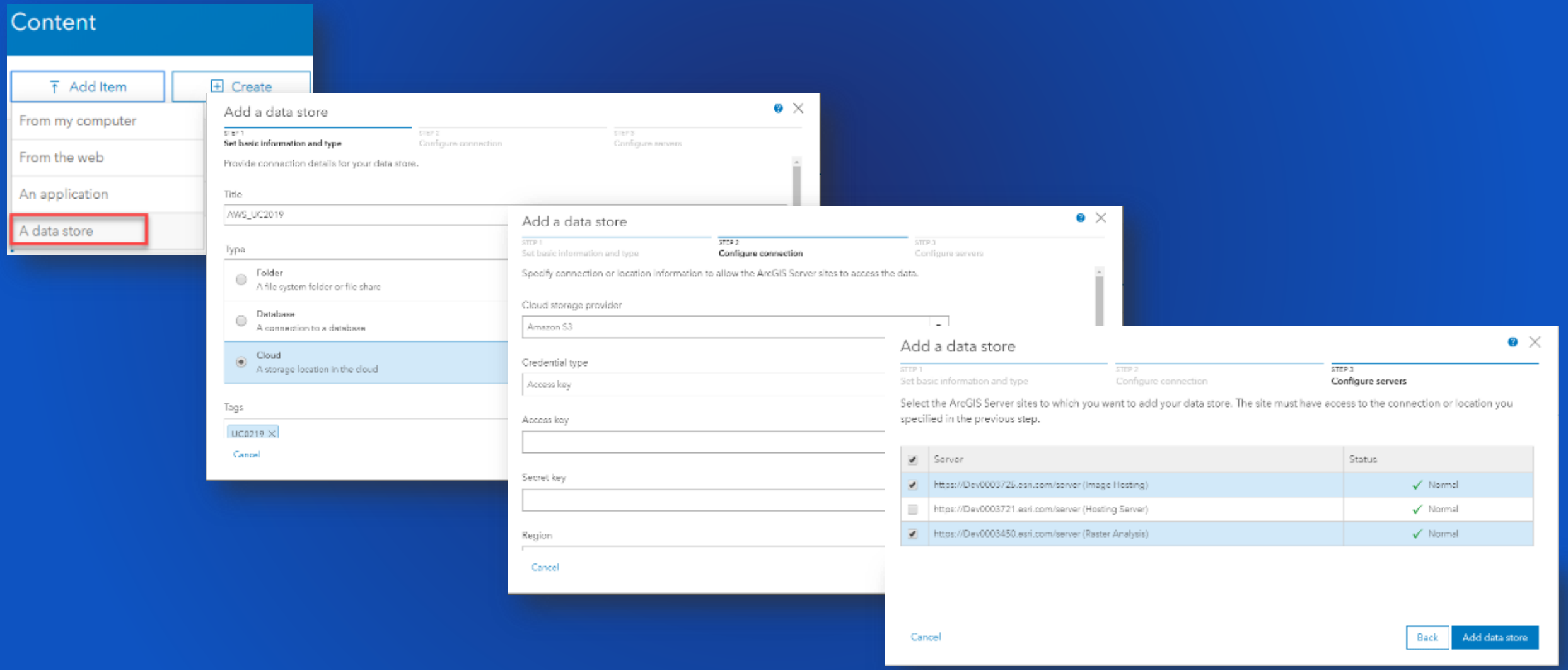


Publishing imagery from ArcGIS Pro

Abhilash Narayanan

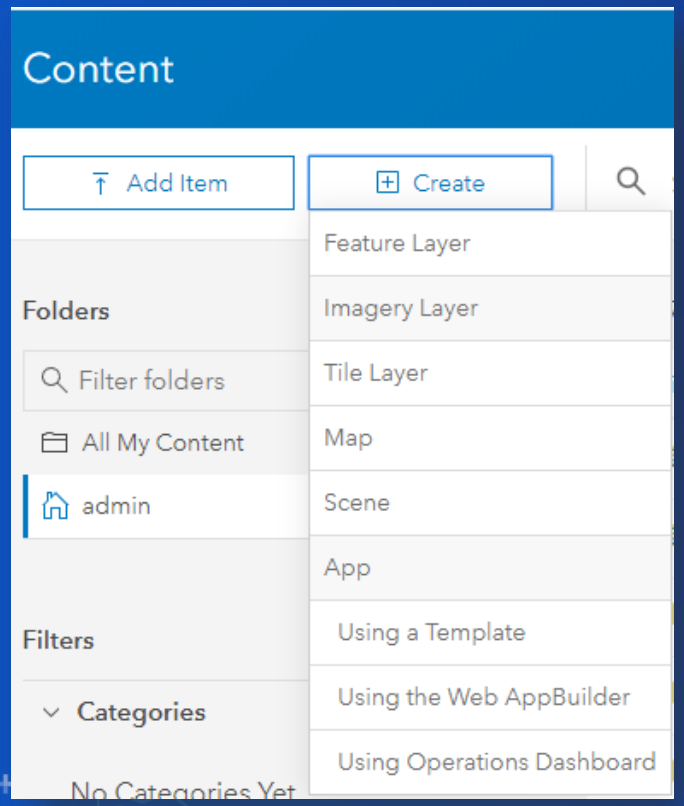
Sharing imagery from Portal for ArcGIS

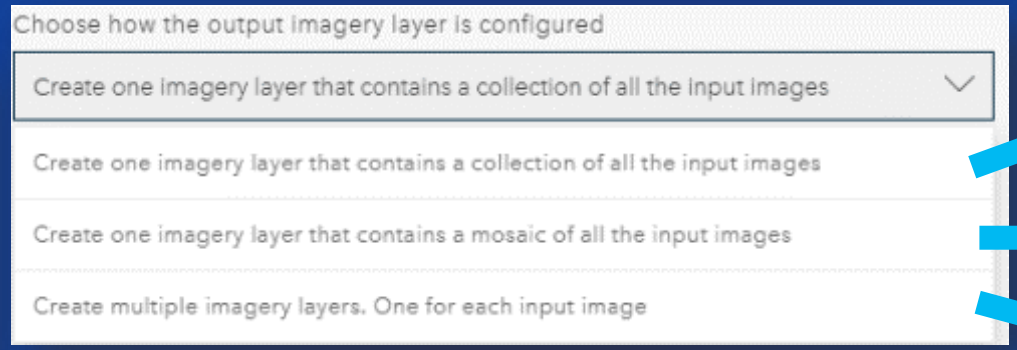
Registering a Data Store

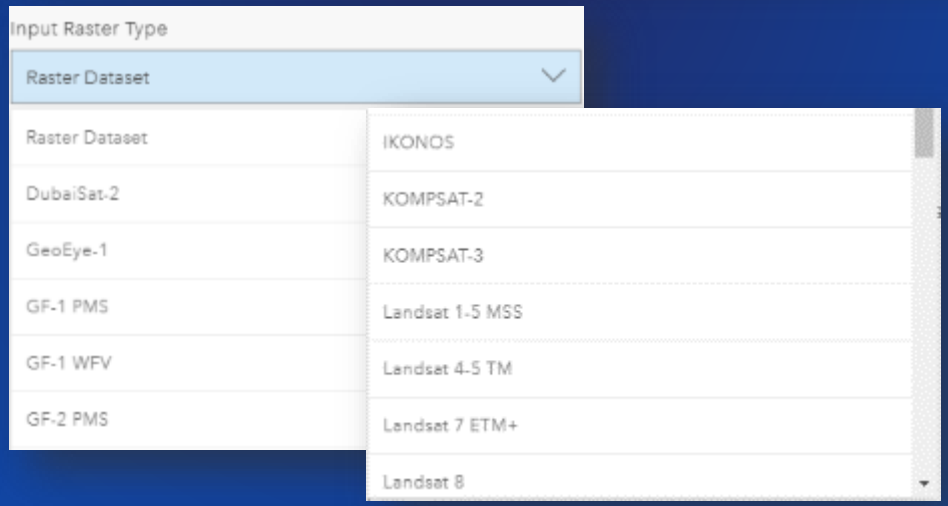


Sharing imagery from Portal for ArcGIS

Creating an Imagery Layer



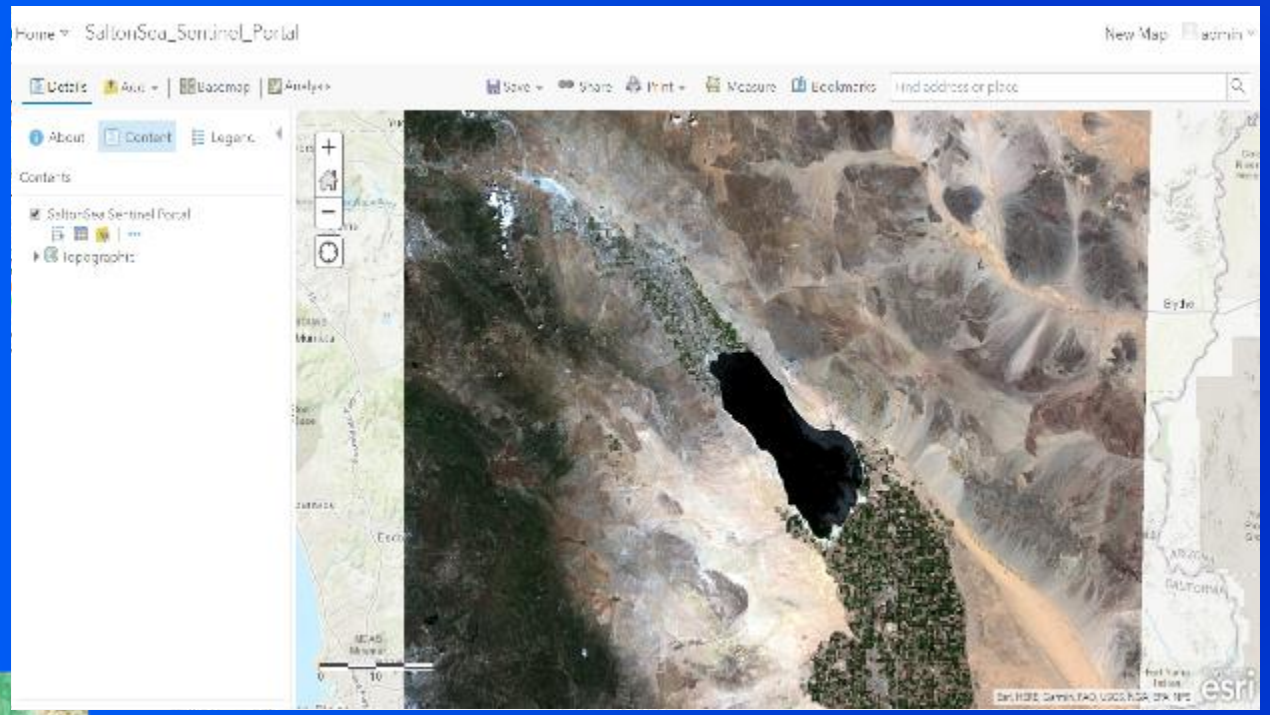




Creates a collection of all the input images in a mosaic dataset

Creates a mosaic (in CRF format) of all the input images

Creates one layer for each input image



Publishing imagery from Portal for ArcGIS

Abhilash Narayanan

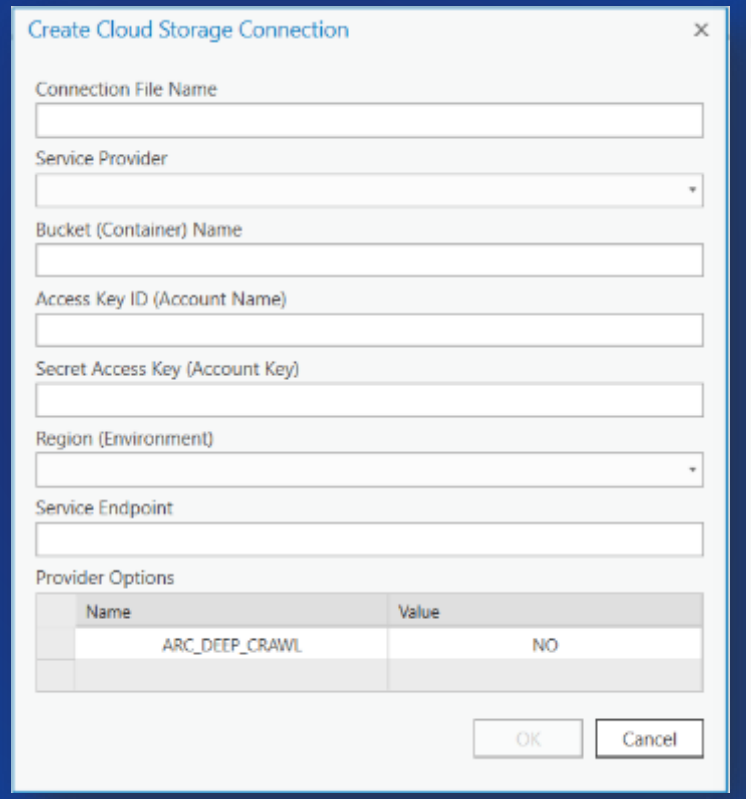
Accessing Imagery in the Cloud through ArcGIS Pro

Supported Service Providers

- Microsoft Azure
- Amazon Web Services
- Google Cloud
- Alibaba Object Storage Services

Connect to Cloud Storage

- Create Cloud Storage Connection File
- Access through Catalog



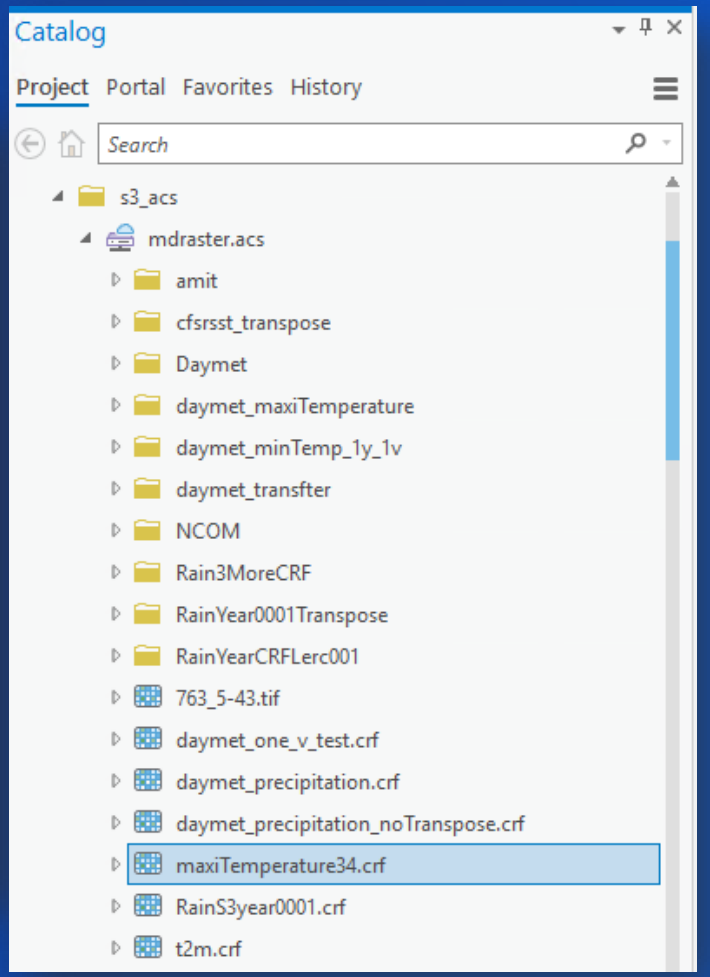
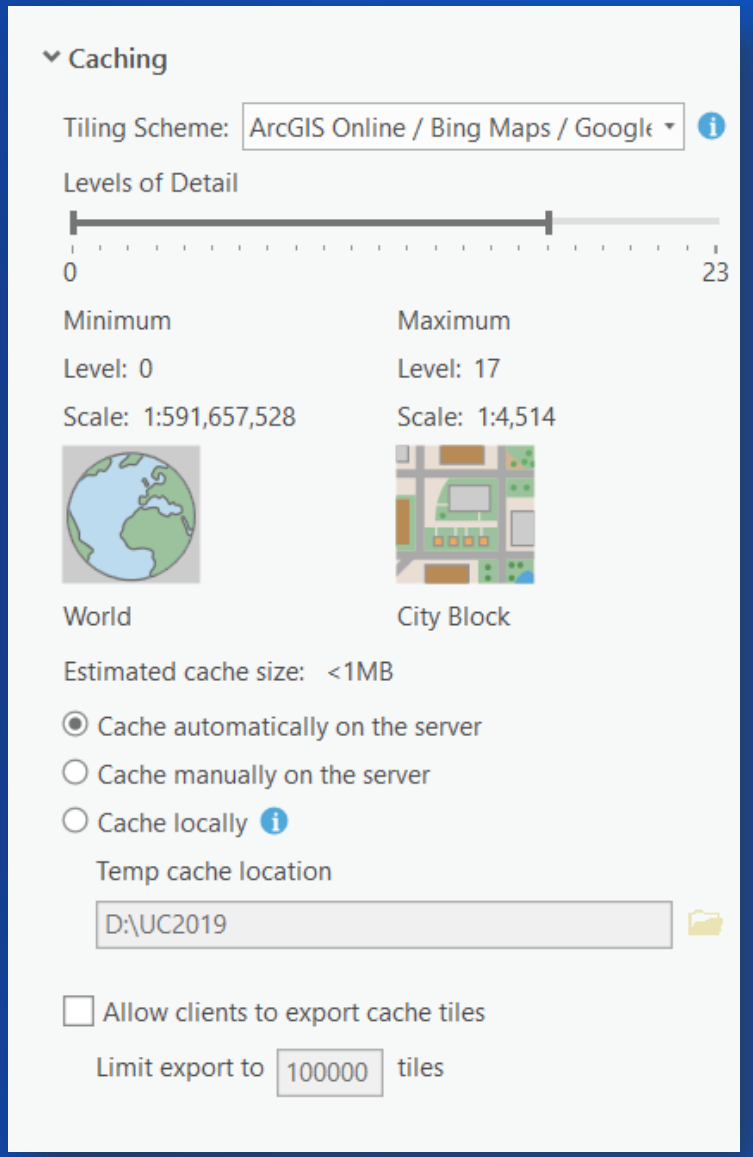


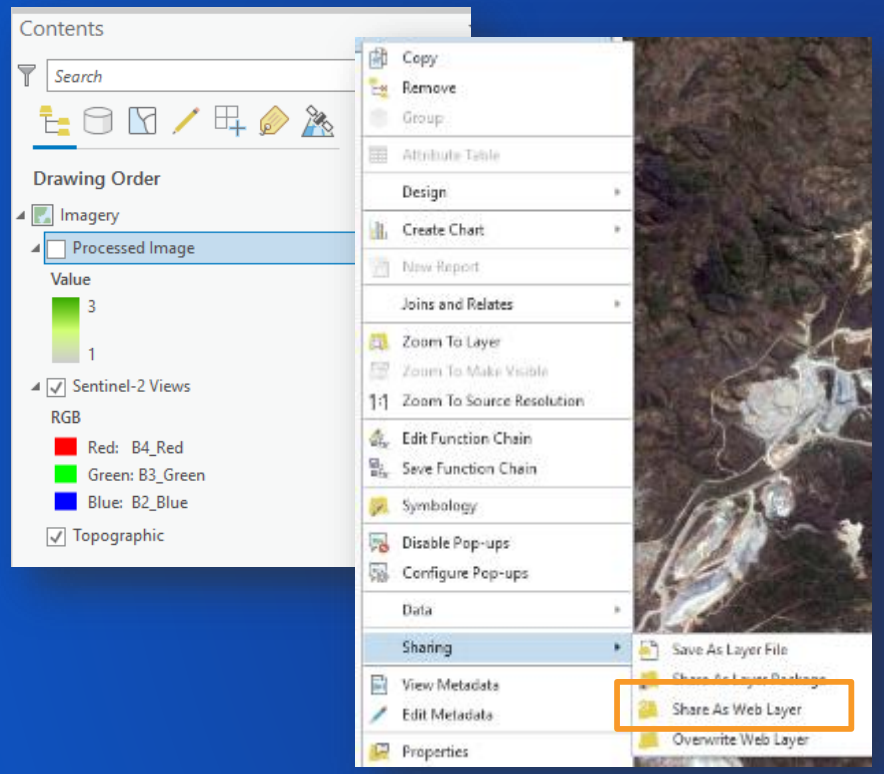
Image Service Caching

- When you cache an image service, it generates a collection of image tiles at multiple, predefined scale levels or pixel sizes.
- Image service caching improves the performance of services in client applications.
- Cache will have to be updated if the underlying data is updated.

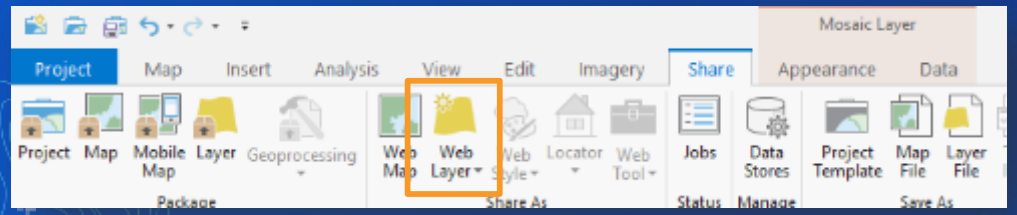


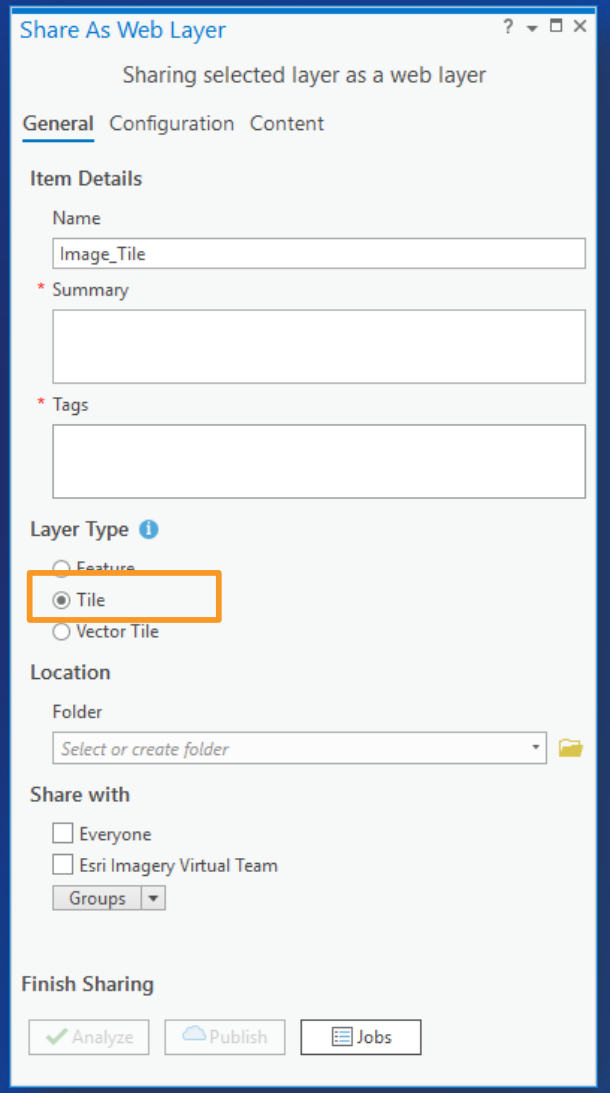
Create and Publish Tile Cache from ArcGIS Pro

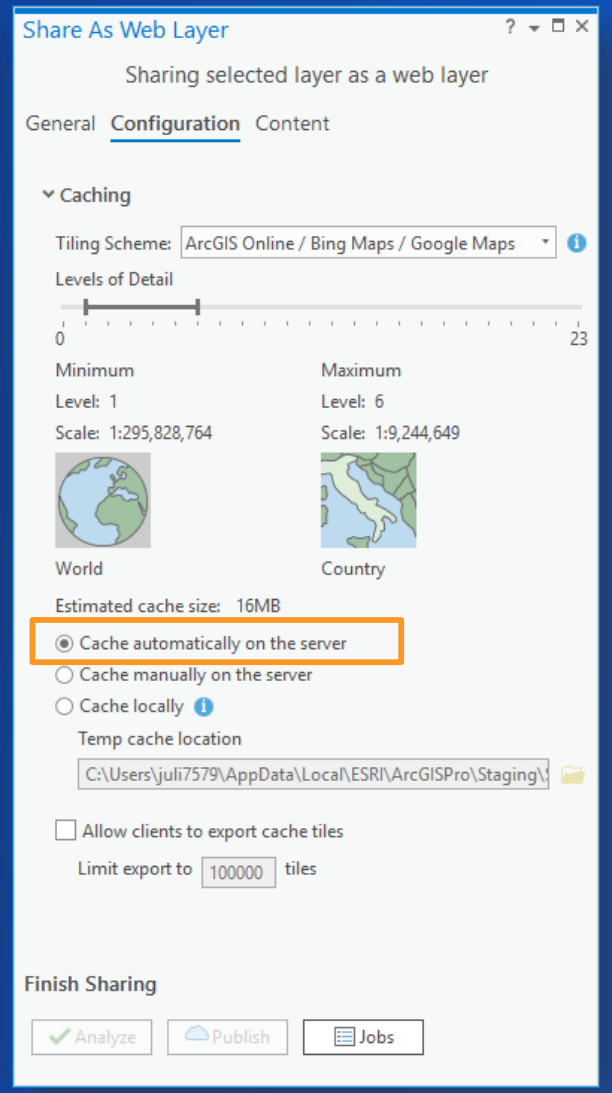
From Contents Pane



From Share Tab

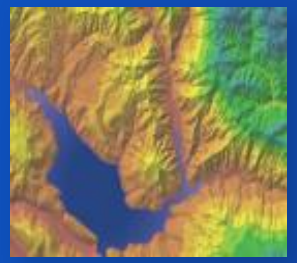






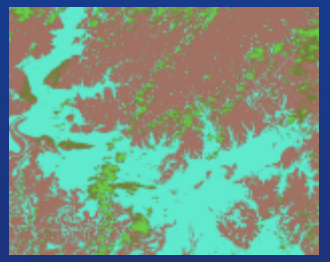
Best Practices

Best practices are data-specific!



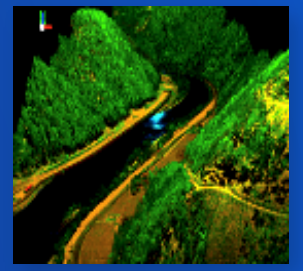
Elevation

Imagery



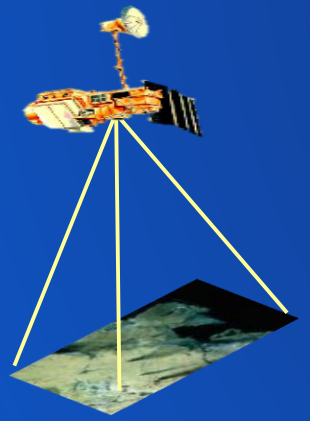
Categorical

Scanned Maps



LiDAR

Satellite



Aerial

Drone

Use the Imagery Workflows website for best practices:
https://doc.arcgis.com/en/imagery/workflows/

Best practices for managing imagery

Storing source images and data

- Store each collection of image files in a separate directory
- Try to keep the number of files per directory under 1,000
- One mosaic dataset per geodatabase, or a small number of md’s
- Store metadata files in the same directory as your data
- Consistent naming convention

Best practices for managing imagery

Preprocessing to prepare

- Build pyramids for source images
- Identify NoData values
- Familiarize yourself with your data
- Verify the units of measurement

Best practices for managing imagery

Creating and improving mosaic datasets

- Default values are your friends!
- Set the product type and/or raster type
- Pay attention to metadata
- Use a mask or build footprints to clip the data
  - Use Radiometry option
  - Use Shrink distance
- Use Seamlines for blending when necessary

Best practices for managing imagery

Creating and Publishing Image services

- Publish using share by reference method (instead of copying data to server)
- Caching is recommended for services which will serve as basemap imagery
- Suggest to cache services that were published with low performing or highly compressed formats

Summary

- Mosaic Datasets - Primary information model to manage imagery
  - Supports Dynamic mosaicking and on-the-fly processing
  - Can be modified to fit your data
  - Can be accessed across the platform when shared a web services
- Can use ArcGIS Image Server for dynamic image services
- Can use ArcGIS on the cloud to make imagery accessible
- Use best practices specific to your data