Getting Started with Imagery

Yuri Potawsky
Senior Solution Engineer @ Esri Charlotte

Esri Southeast User Conference

Why Utilize Raster Data in ArcGIS?

1. **Imagery is central to effective GIS Use**
   Raster data oftentimes forms the foundational information from which other data is created.

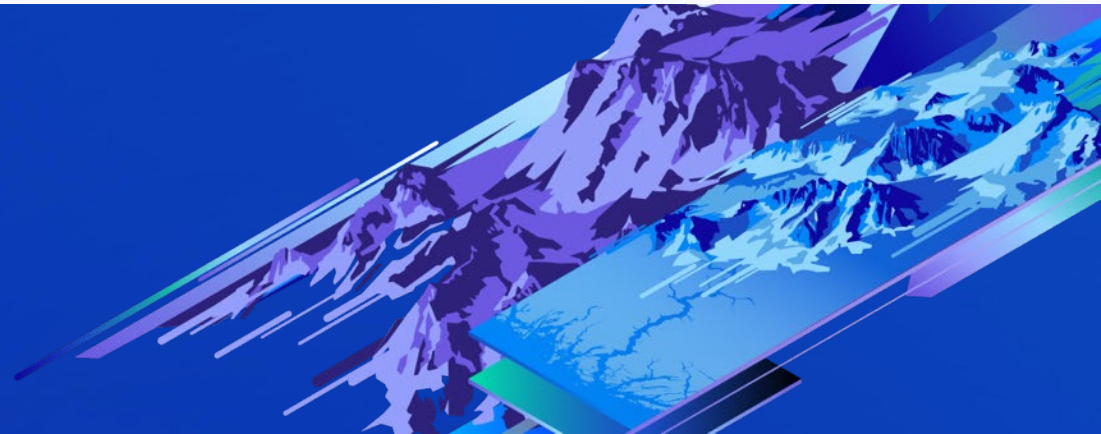
2. **Rich spatial analysis framework**
   Use the ArcGIS Geoprocessing environment and custom tools to extract information.

3. **Makes use of free and publicly available data**
   Use big data to support decision making.

Why Imagery and Remotely Sensed Data Are Crucial To a GIS

See Below

Visual & Compelling Tells a story Authoritative Pervasive	**Provides Understanding** Capturing data at scale for analysis.	**Authoritative** Digital tools ensure accuracy and relevance.	**Updates GIS Data** Raster data forms the basis for GIS data.
Map Change Visual and analytic change detection.	**Provides Context** Urban sprawl, wildland urban interface, natural environment	**Ideal for Mapping the Environment** Ag, Forestry, Water Resources	**Public Safety** Fire, EMS, LE



Features of the ArcGIS Platform

70+ **WORK WITH NATIVE RASTER DATA**
ArcGIS Pro supports 70+ native raster types.

SUPPORTED EXPORT FORMATS
Write data to 10 different raster types.

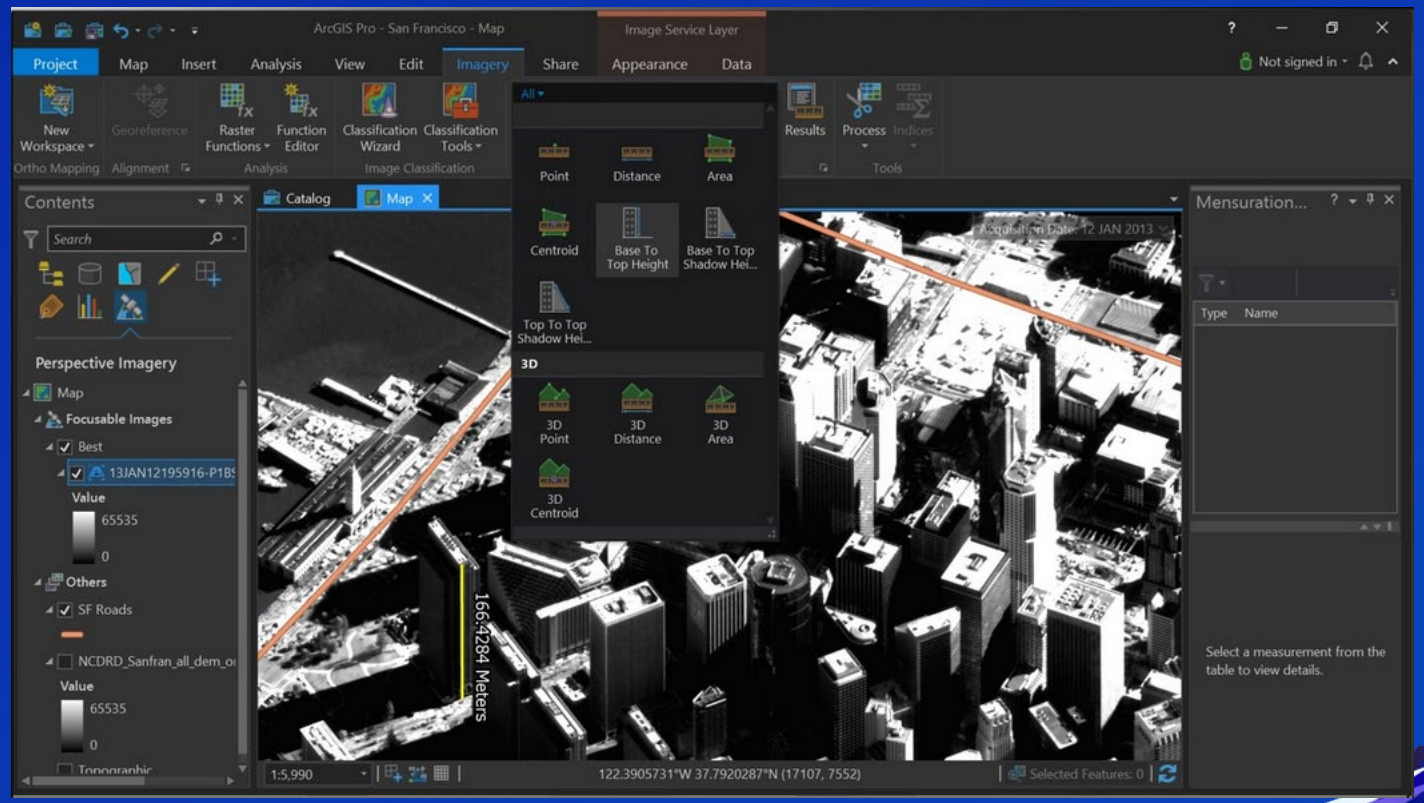
TIME ENABLED
Support a variety of time variables for imagery.

MANAGE MASSIVE COLLECTIONS OF IMAGERY
The Mosaic Dataset supports petabytes of data.

CREATE DYNAMIC IMAGERY PRODUCTS
Create rasters on-the-fly with Functions.

COMPLETE IMAGE MANAGEMENT SYSTEM
Frame Camera, Multispectral, and Drone Imagery.

I have Imagery...
So what do I do with it?



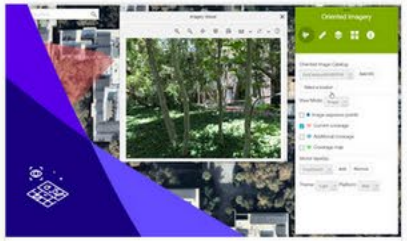
Clientside Rendering

Landcover with Image Tile Layer

Dynamic Raster Layer

ArcGIS Supports Multiple Workflow Process

Authoritative resources to help you manage, analyze, and use your imagery and rasters.



Managing and Visualizing Oriented Imagery

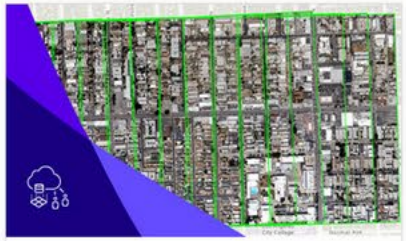
Find resources showing how to manage and visualize non-nadir imagery, including street-side, panoramic, and inspection images.

Managing Lidar Data

Find resources describing how to manage and share lidar point clouds and derived raster products.

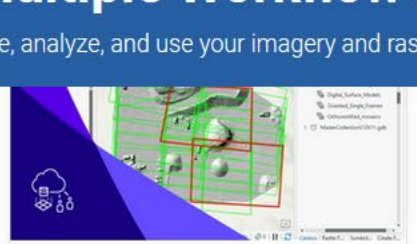
Serving Cached Imagery

Find resources describing how to serve imagery as cached image tiles hosted on ArcGIS Online or your ArcGIS Enterprise portal.



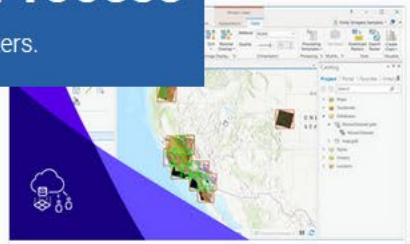
Managing Frame Camera Imagery

Find resources for managing raw imagery from frame sensors and applying a photogrammetric model within ArcGIS.



Managing Drone Imagery

For users with large drone imagery collections, find resources for implementing scalable data management solutions for use with Drone2Map or ArcGIS Pro ortho mapping.

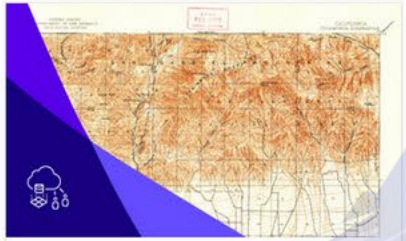


Using Mosaic Datasets to Manage Imagery

Find resources describing how to use mosaic datasets to manage all kinds of imagery and rasters.

Managing High-Resolution Satellite Imagery

Find resources explaining how to create mosaic datasets to manage and visualize imagery from high resolution (< 5m) satellites.



Managing Scanned Maps

Find resources explaining how to create mosaic datasets to manage and display collections of scanned maps.

Imagery Use Patterns

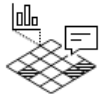
How Can Imagery Be Used Within The Platform...

Management

Catalog and publish imagery efficiently and securely.

Image Mapping

Create authoritative, imagery-derived maps and products.



Analysis

Use advanced analytical tools to extract location-based information from imagery.

Visualization and Exploitation

Leverage human interpretation to extract information from imagery.

Content

Add insight and context with Esri's collection of online imagery, terrain, and GIS layers.

Imagery as Part of ArcGIS

...To empower the Transformation of Imagery into Meaningful Information

ArcGIS Imagery Patterns

Transforming Imagery into Information

Analysis & Observations

Inspection

Monitoring

Loss of Infrastructure

HAZMAT

Debris Volume

Blue Roof Detection

Damage Assessment

Precision Mapping & Reality Capture

Site Models

Base Maps

Blue & Grey Skies Ortho-Base

Flood Imagery

Site Maps

DSM

DTM

Terrain Analysis

Finding Spatial Patterns

Built Environments

Natural Environments

Flood Impacts

Tornado Tracks

Recovery Logistics

Land Cover

Ag Assessment

GeoAI

Photogrammetry

Raster Analytics

Image Management

Search & Discovery

Mosaic Datasets

Image Cubes

Time

Platform

Content

Images, Video & Point Clouds:

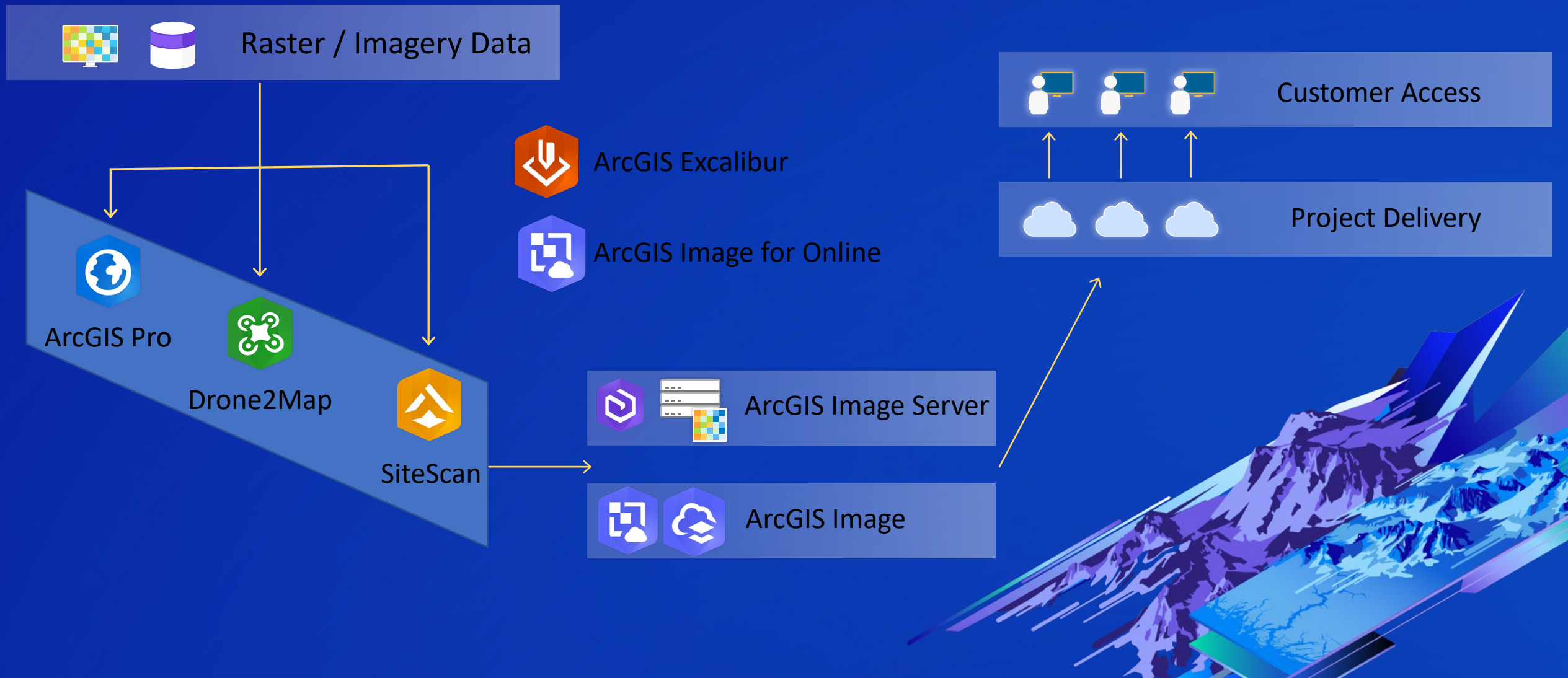
Formats

Platforms

Modalities

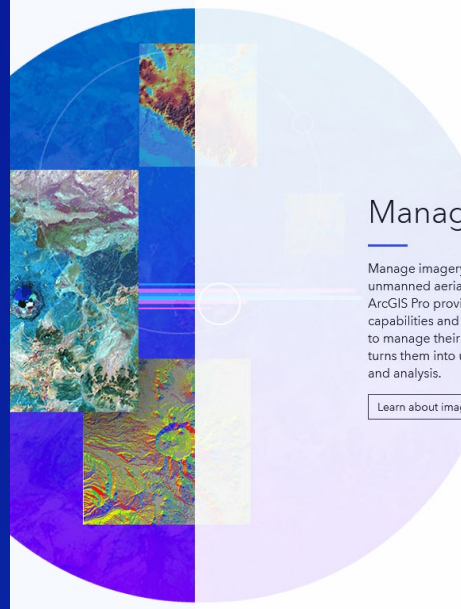
Services

Imagery Products



ArcGIS Pro

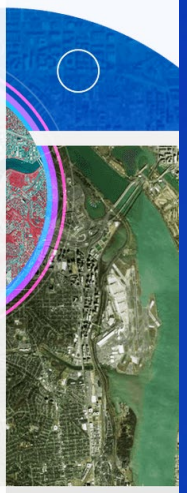
The world's leading GIS software



Manage imagery

Manage imagery from a wide variety of sources–satellites, drones, unmanned aerial systems, full-motion video, elevation, lidar, and more. ArcGIS Pro provides extensive enterprise image management capabilities and is used by organizations in a wide range of industries to manage their imagery holdings. This makes assets accessible and turns them into useful information products for both data visualization and analysis.

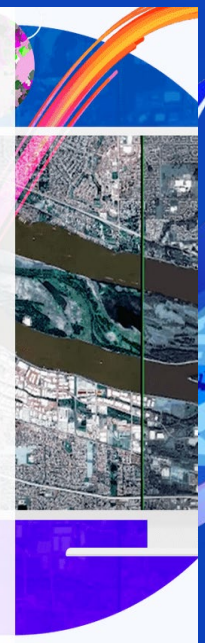
Learn about imagery management →



Process imagery

ArcGIS Pro has multiple methods for efficient image processing. On-the-fly processing enabled by raster functions avoids data duplication and quickly creates new views of your imagery. Dynamic mosaicking of overlapping images allows users to instantly access different views of the same area. Ortho mapping capabilities in ArcGIS Pro Advanced allow GIS users to process imagery from satellites, drones, and historical aerial photos to extract digital elevation models and create orthorectified mosaics.

Learn about ortho mapping →



Analyze imagery

ArcGIS Pro has the tools you need to find and understand patterns in imagery from a wide range of sources. Analyze imagery directly in ArcGIS Pro using ArcGIS Image Analyst to apply spatial analysis for land cover classification, temporal analysis to explore changes over time, and more. Additionally, integrate cutting-edge deep learning models to extract features of interest.

Learn about Image Analyst →

ArcGIS Image Analyst

Extension to Pro for Advanced Analytics

Mosaic Dataset

Virtual

Points to the Imagery

Collection of many

Treats as One

Analysis Products

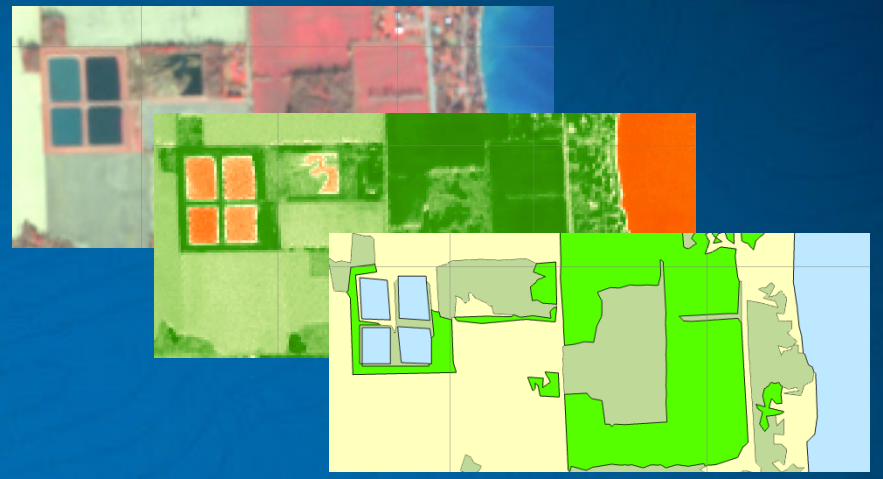


Image Functions

104 Common Functions

Dynamic, On-the-Fly

Function Chains

Segment Mean Shift

NDVI Colorized

Region Grow

Tasseled Cap (Kauth-Tho...

Pansharpen

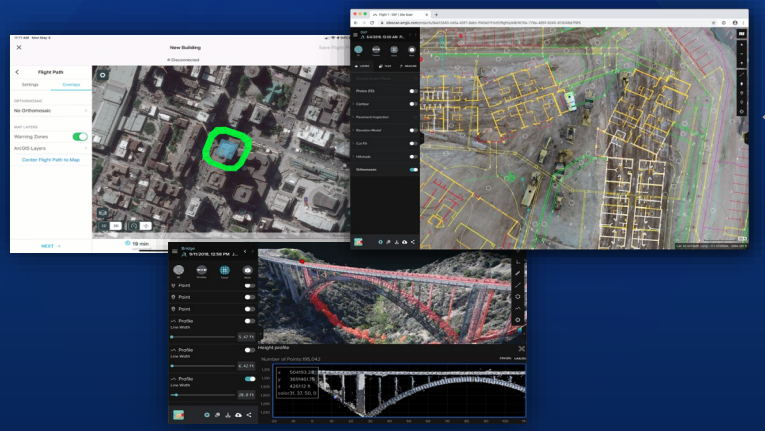
Stretch

Classify

ArcGIS Drone Solutions

Site Scan for ArcGIS

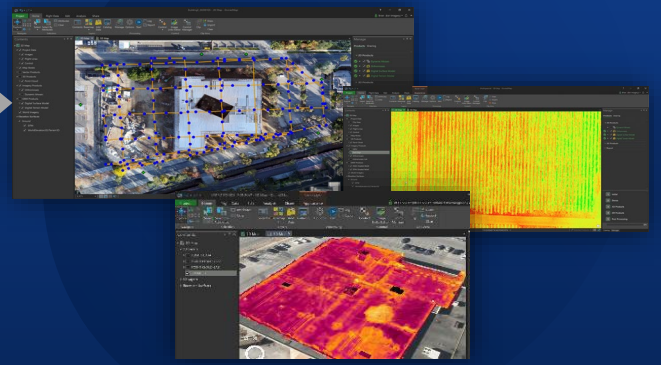
New



Site Scan Flight planning app

Tablet flight Planning

ArcGIS Drone2Map



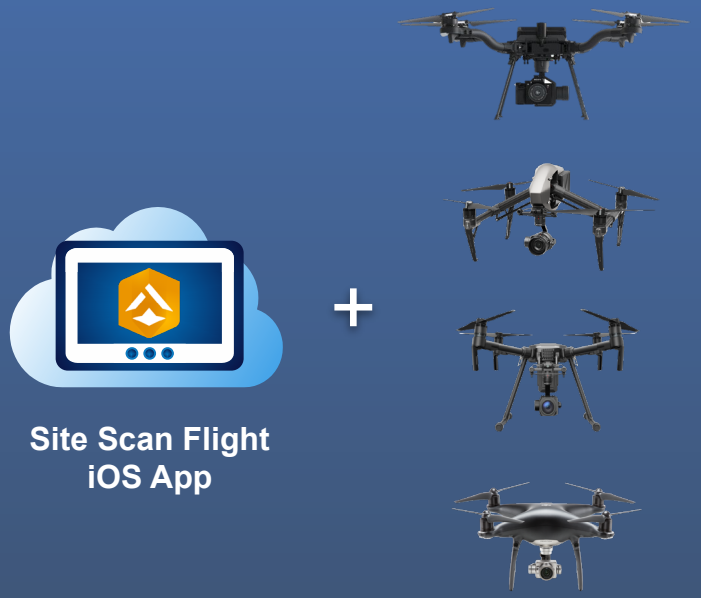
Connected environments
Cloud processing
Unlimited cloud storage
Automated drone fleet management

Disconnected environments
Desktop processing
Local storage
Offline and Online functionality

The Site Scan for ArcGIS Workflow

Providing an end-to-end workflow for drone image capture

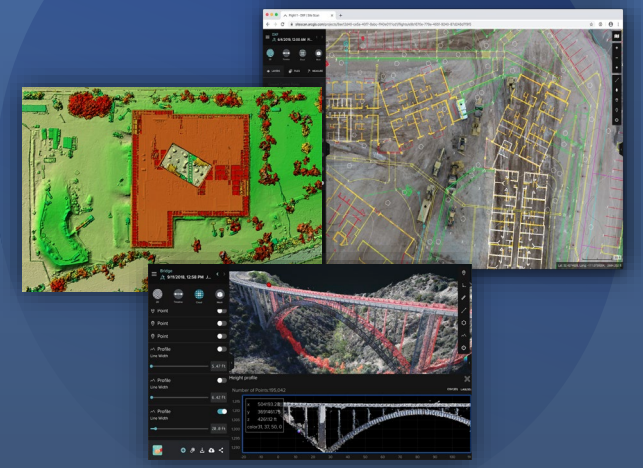
1 Plan & Capture



Site Scan Flight
iOS App

2 Process, Manage, & Analyze

Site Scan Manager
Web-App

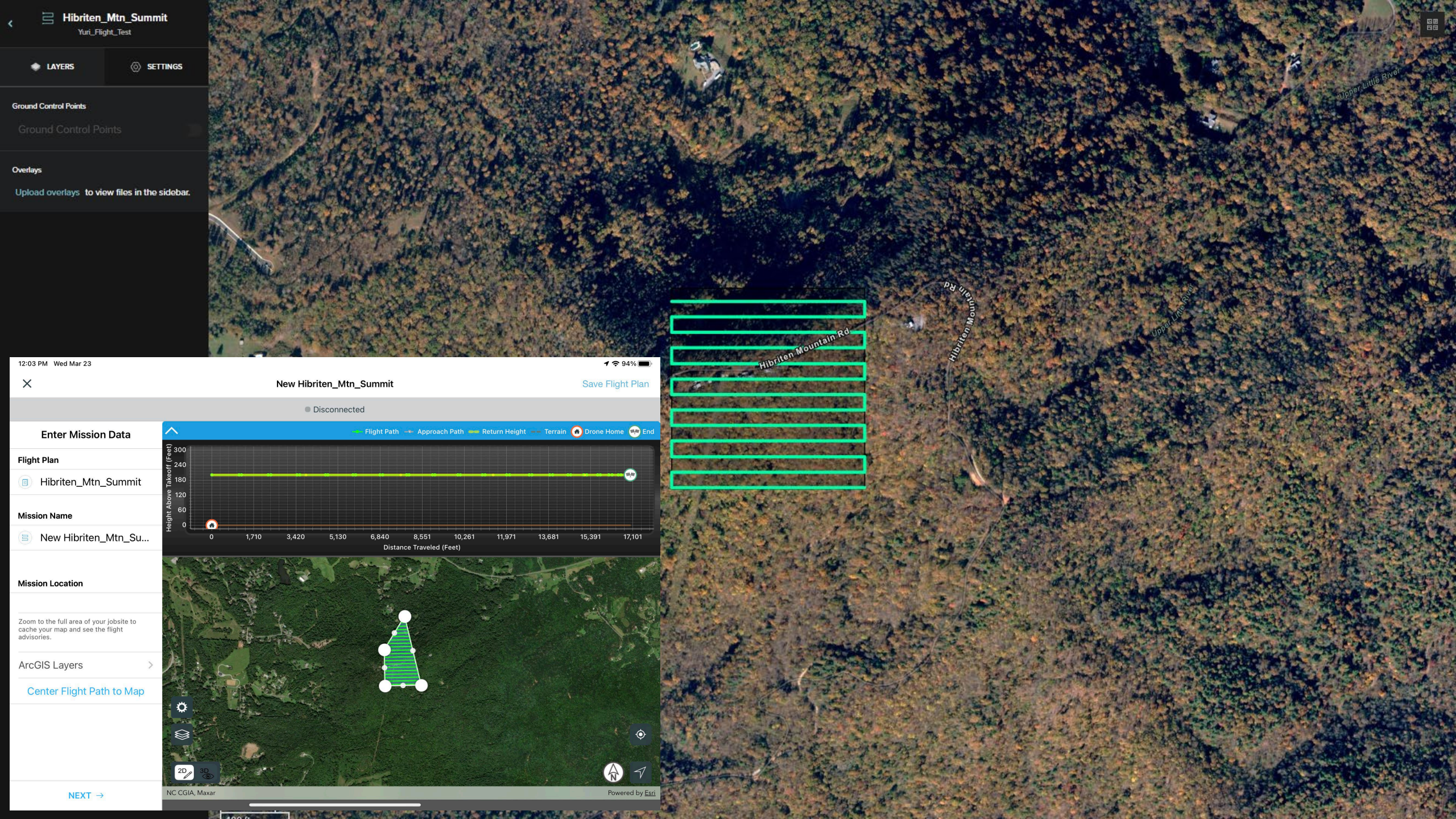


3 Disseminate & Collaborate

Advanced Analysis and Collaboration

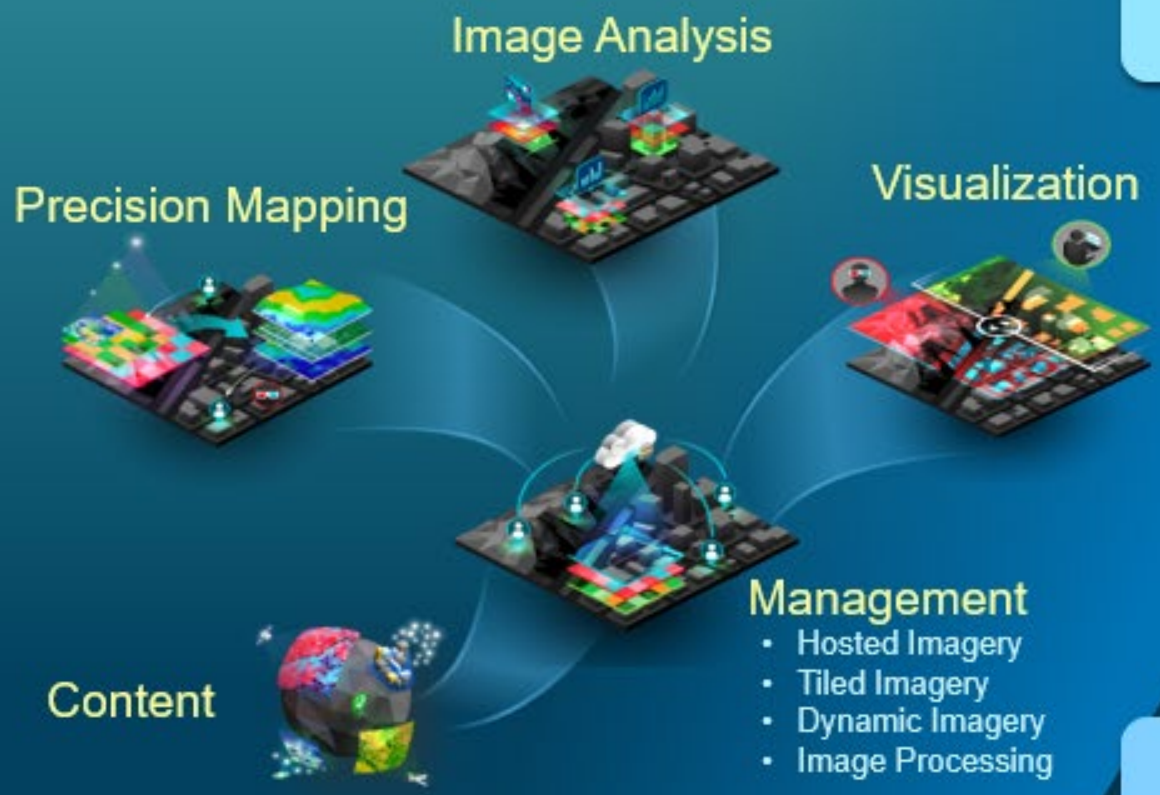
Leveraging Site Scan within the ArcGIS Platform

3 Disseminate & Collaborate


Hibriten_Mtn_Summit
Yuri_Flight_Test
LAYERS
SETTINGS
Ground Control Points
Ground Control Points
Overlays
Upload overlays to view files in the sidebar.
Hibriten Mountain Rd
Upper Little River
12:03 PM Wed Mar 23
94%
New Hibriten_Mtn_Summit
Save Flight Plan
Disconnected
Enter Mission Data
Flight Plan
Hibriten_Mtn_Summit
Mission Name
New Hibriten_Mtn_Su...
Mission Location
Zoom to the full area of your jobsite to cache your map and see the flight advisories.
ArcGIS Layers
Center Flight Path to Map
NEXT
Flight Path
Approach Path
Return Height
Terrain
Drone Home
End
Height Above Takeoff (Feet)
300
240
180
120
60
0
0
1,710
3,420
5,130
6,840
8,551
10,261
11,971
13,681
15,391
17,101
Distance Traveled (Feet)
2D
3D
N
NC CGIA, Maxar
Powered by Esri

ArcGIS Image

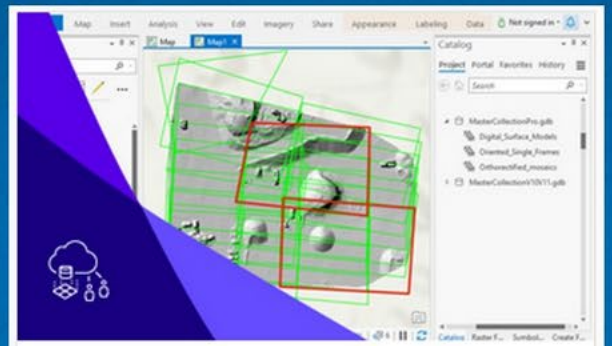
Extends ArcGIS to manage, visualize and analyze imagery collections on your desktop, on-premises, or in the cloud



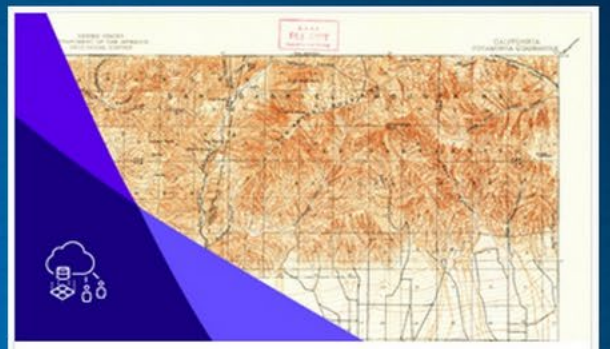
Deploy based on your organization's need

ArcGIS Pro	ArcGIS Image Analyst for ArcGIS Pro
ArcGIS Enterprise	ArcGIS Image Server for ArcGIS Enterprise
ArcGIS Online	ArcGIS Image for ArcGIS Online
Dedicated	ArcGIS Image Dedicated

ArcGIS Supports Multiple Raster Types



Managing Drone Imagery



Managing Scanned Maps

Visualizing Stereo Imagery

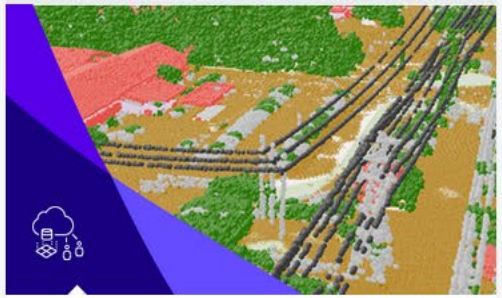
Exploiting Imagery in Image Space

Avenues for Image Management

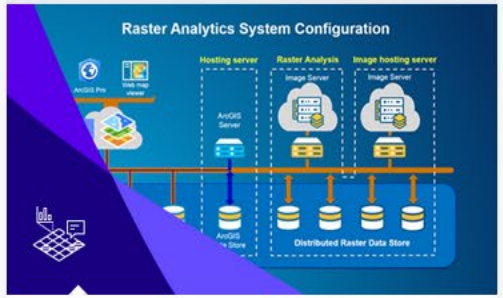
Contribute on Github.

View all ›

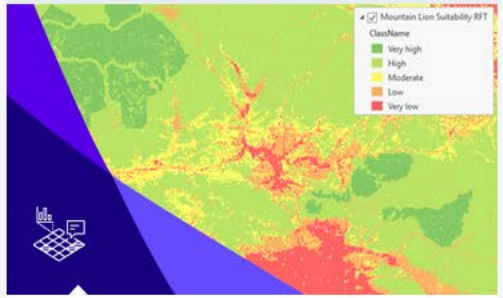
SATELLITE



DRONE



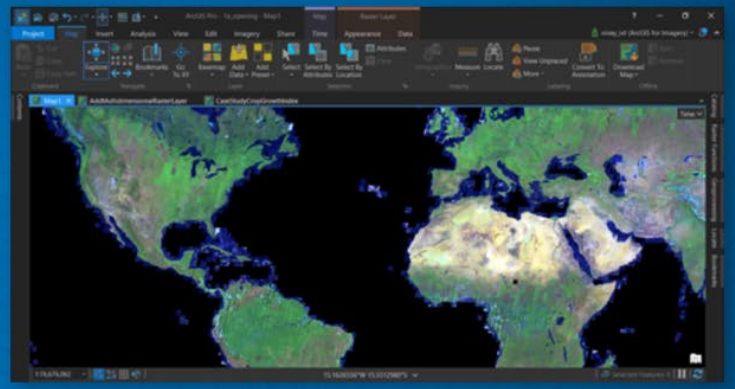
LIDAR



ANALYSIS

ArcGIS Imagery Management

Making Imagery Accessible –
Image Management and Dissemination



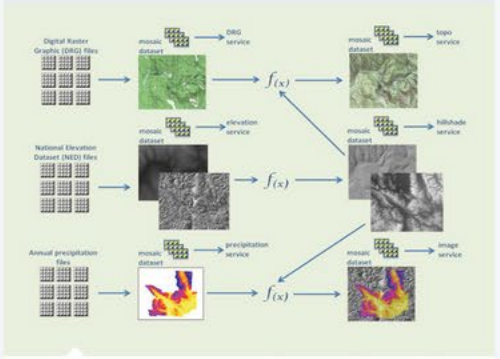
ArcGIS Pro
- Authoring Mosaic Datasets
- Raster Types/Products

ArcGIS Image Server
- Scalability
- Dynamic Image Services

Too Many Images...

Why the Mosaic Dataset is Important

MANAGE TERRABYTES OF NATIVE IMAGERY.



COMPLETELY SCALABLE REGARDLESS OF IMAGE TYPE.

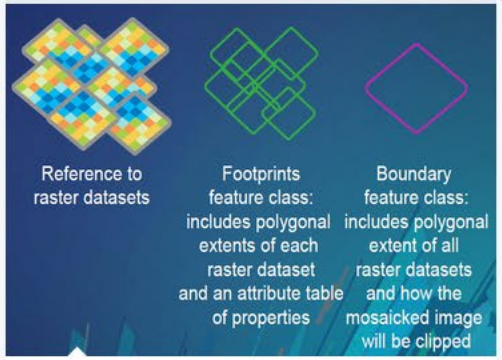
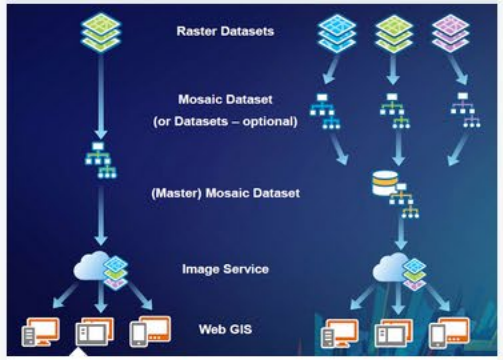


TABLE STRUCTURE ALLOWS FIELD EDITS AND UPDATES.

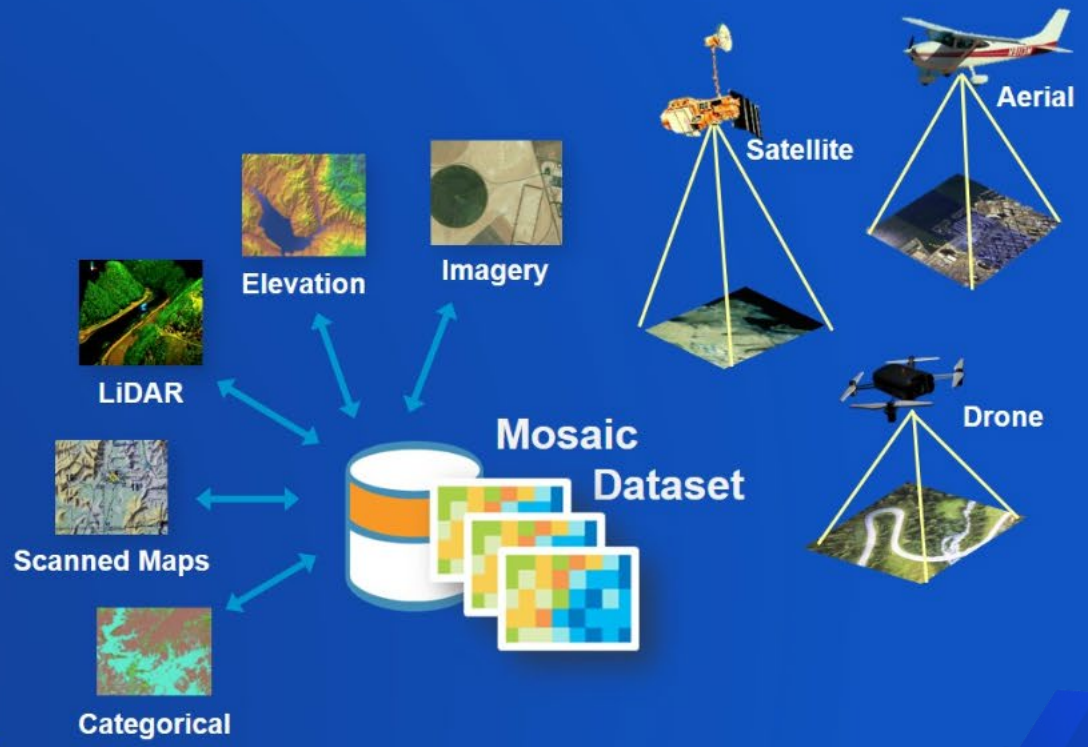


IDEALLY SERVED PUBLICLY AS IMAGE SERVICES.

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



Raster Functions

Perform analysis on the fly in seconds...

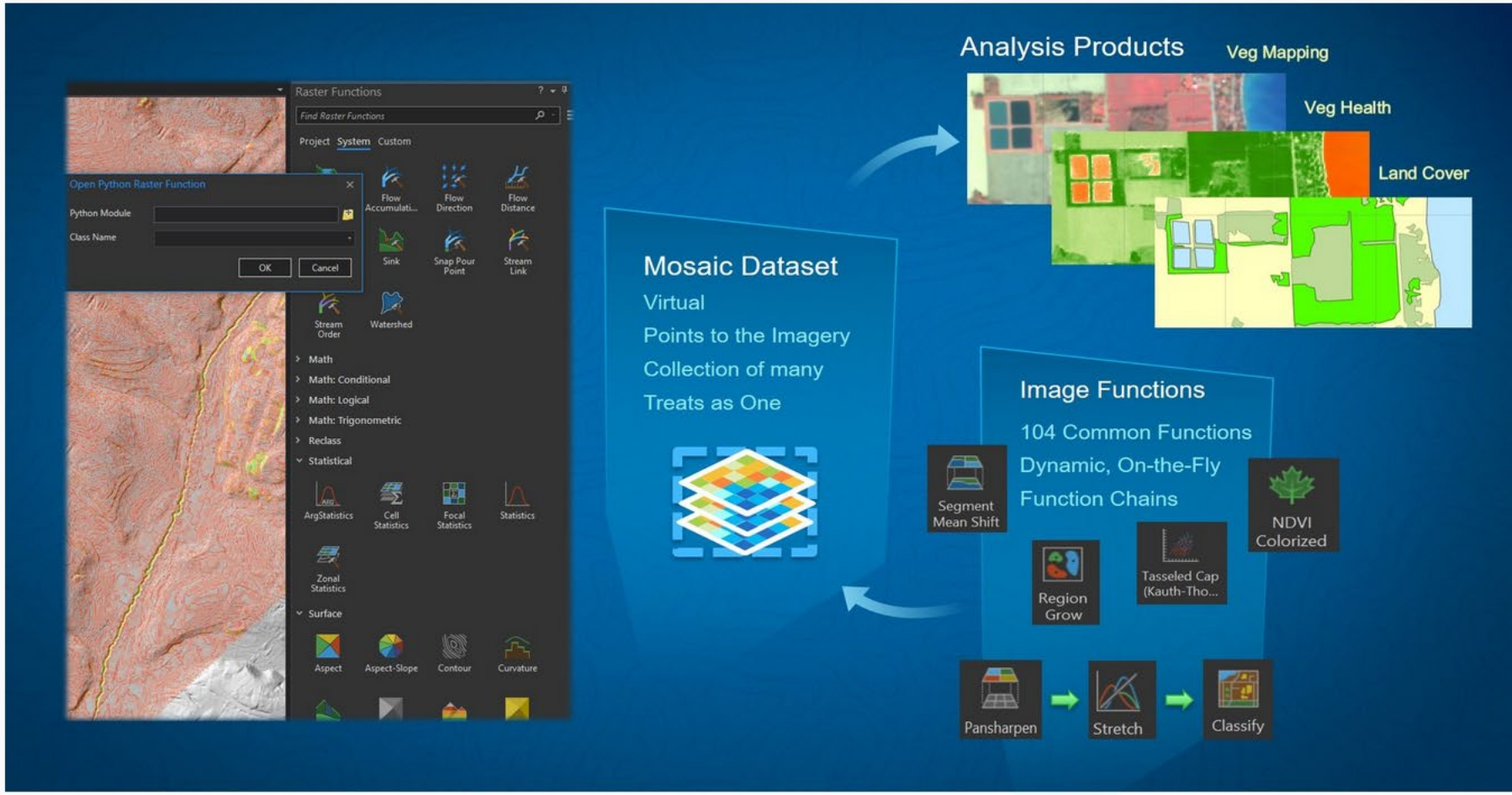


Image Analysis

Map | Imagery | UNET

Edit View Insert Cell Help

Run Code

```
In [ ]:
1 import arcgis
2 from arcgis.learn import*
3
4 path = r"C:\Users\Desktop\NAIP_Imagery\Train_NAIP"
5
6 data = prepare_data(path, batch_size=8, imagery_type='naip')
7
```

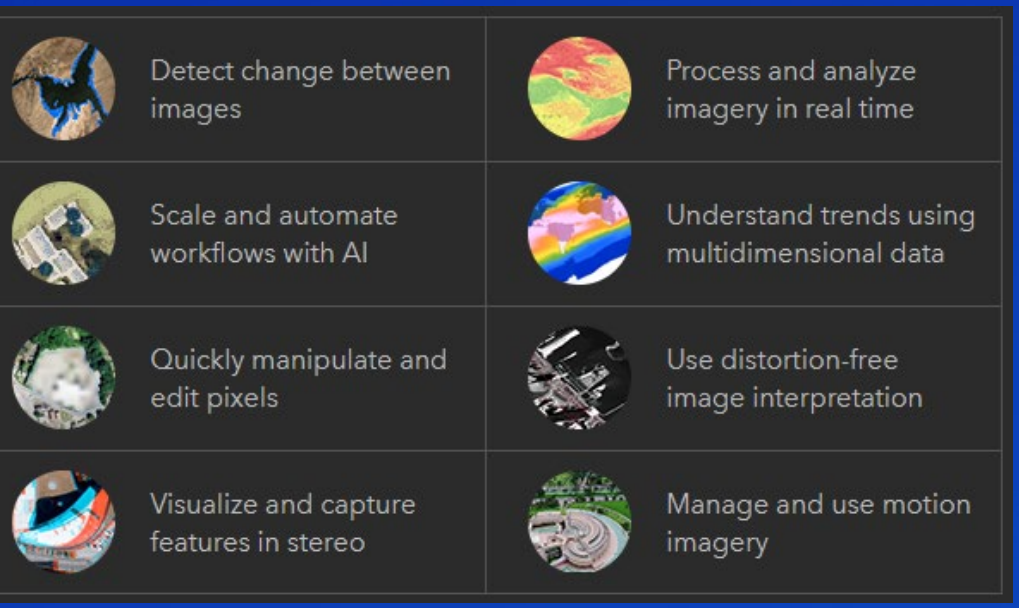
```
In [ ]:
1 data.classes
```

```
In [ ]:
1 data.show_batch(rows=3)
```

```
In [ ]:
1 unet = UnetClassifier(data, backbone='resnet34', ignore_classes=[0])
```

```
In [ ]:
1 unet.fit(20)
```

```
In [ ]:
1 unet.show_results()
```



Analyze terrains

Derive useful insights from your data. Create a hillshade to use as a backdrop of the terrain to support other data layers. Calculate slope, aspect, and contours, or create a map displaying visibility

Select best locations

Find the ideal location with features that match your requirements. Consider criteria such as suitable demographics, environment and terrain to find the best site

Find best routes

Find the straight-line distance between two locations or create cost-weighted distance surfaces to understand the cost of getting from one location to another based on the criteria you specify

Perform hydrologic analysis

Derive insights from hydrologic and landscape data. Model where water will flow, create watersheds and stream networks and discover other hydrologic characteristics

Gain statistical insights

Analyze data distribution for a period. Calculate the mean crop yield over ten years, study variety of species contained within each neighborhood, or find the mean elevation per forest zone

Manage risk

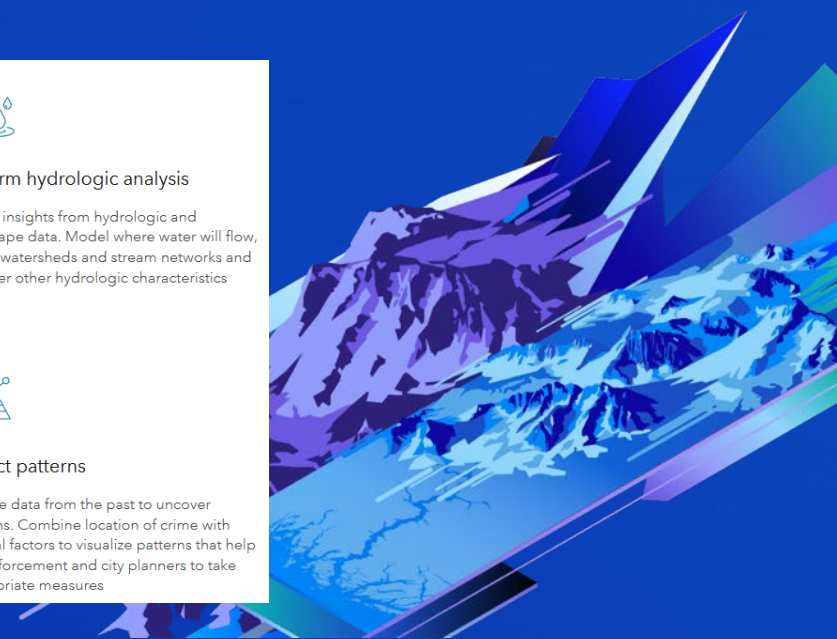
Model risk factors such as ground slope, aspect, stability, forest fuel load and coastline inundation to understand the risk over your study area so you can come up with the appropriate mitigation plan

Estimate cost

Depending on your industry, factors such as terrain, waiting time, or any other physical obstacles can add to your cost. Analyze and predict costs taking into account multiple factors

Detect patterns

Analyze data from the past to uncover patterns. Combine location of crime with societal factors to visualize patterns that help law enforcement and city planners to take appropriate measures



Storing and Serving Imagery

Deployment scenarios for managing Raster data.

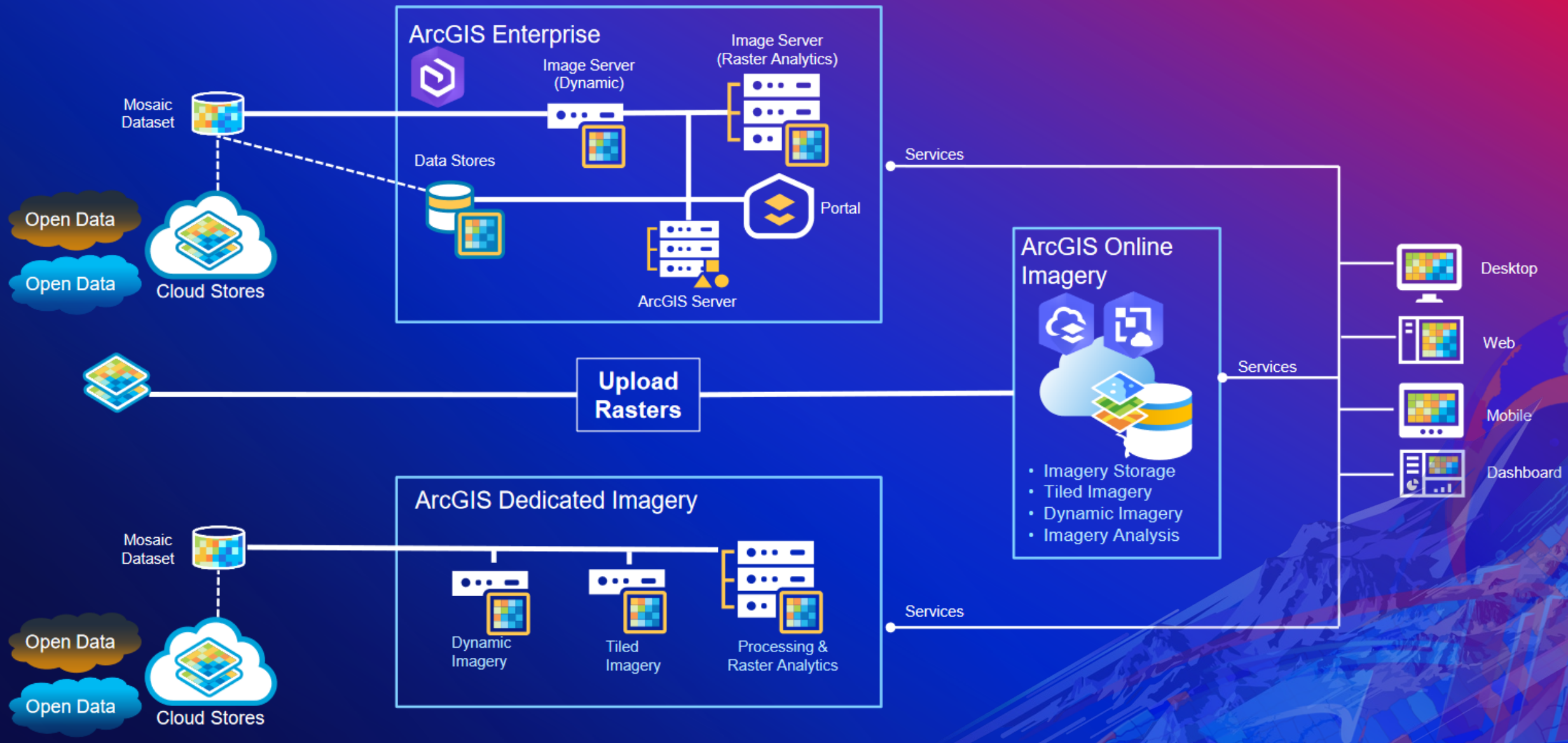
1. **Mosaic Dataset + Local File Storage**
   Analysis for Internal Resources

2. **Tile Cache in ArcGIS Pro + Publish to ArcGIS Online**
   Basemap Creation in Pro

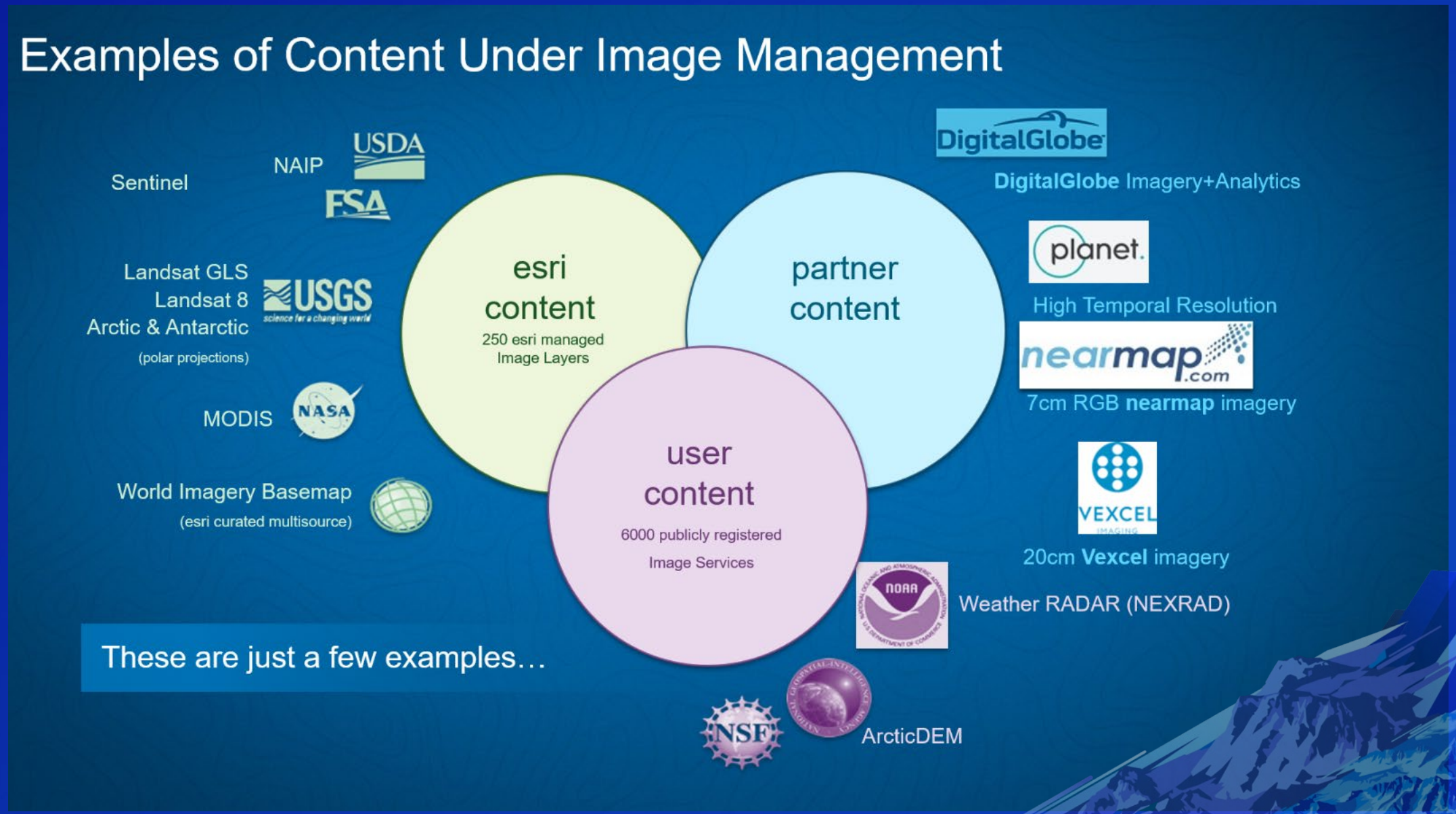
3. **ArcGIS Enterprise + Image Server**
   Hosted Imagery through Portal for ArcGIS

4. **Standalone ArcGIS Image Server**
   Image Hosting

Making Imagery Accessible



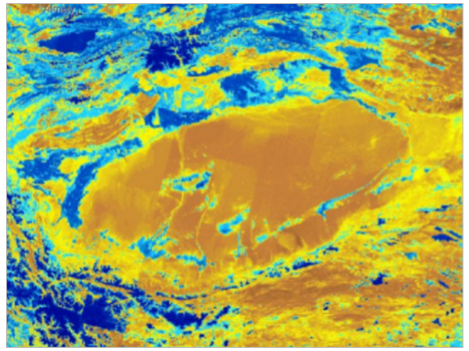
Examples of Content Under Image Management



INTRODUCTION TO

IMAGERY & REMOTE SENSING

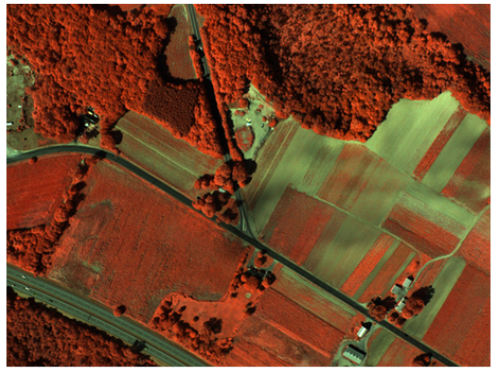
A Learn ArcGIS Project



Get started with imagery: *Explore 40 years of Landsat imagery from around the world.*

- **Type:** Exercise based on real-world scenarios
- **Level:** Beginner
- **Software:** Esri Landsat Viewer
- **Data:** Landsat imagery
- **High-Level Tasks:** Explore Landsat imagery through the Esri Landsat app; Lea
  Experiment with
  across time.

35 mins

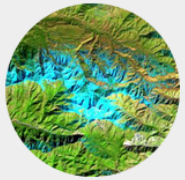


Learn the fundamentals of image interpretation: *Explore and make sense of satellite and aerial imagery.*

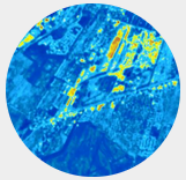
- **Type:** Guided lesson based on real-world examples
- **Level:** Beginner
- **Software:** ArcGIS StoryMaps
- **Data:** Various satellite and aerial imagery
- **High-Level Tasks:** Learn about what image interpretation is, the importance of ground sample distance, and 7 essential cues of visual interpretation (shape, size, pattern, text
  signature, shadow, and context). Use these el
  natural color, panchromatic, and color infrare

30 mins

Activities: Interactive web apps



Explore filters:
Apply different image filters to Landsat imagery.

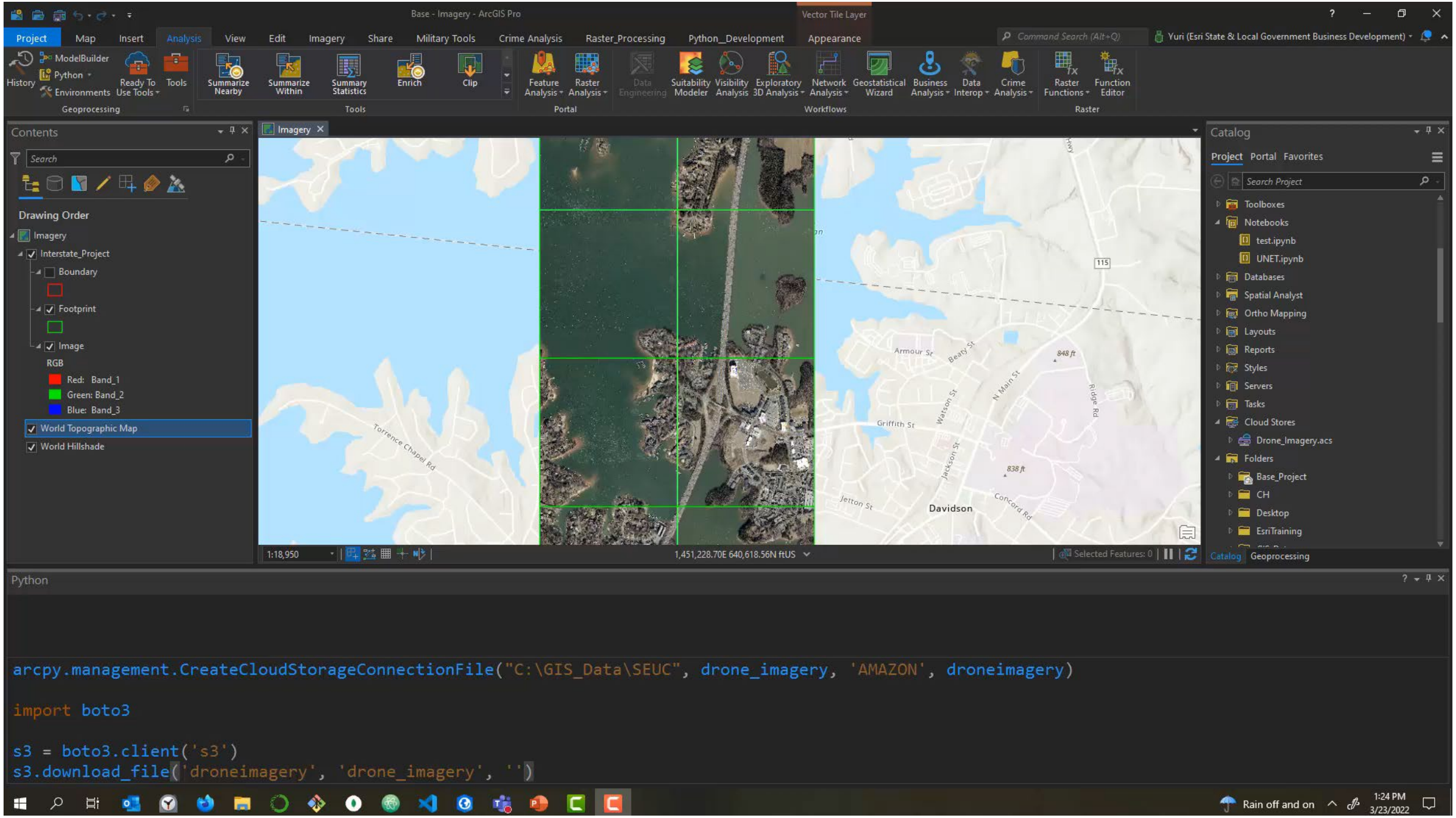


Rendering New Orleans:
Explore different Landsat band combinations and indexes.

Imagery Demos

2 Example Workflows

Choose the workflow & tools that fit your needs.


Base - Imagery - ArcGIS Pro
Vector Tile Layer
Project
Map
Insert
Analysis
View
Edit
Imagery
Share
Military Tools
Crime Analysis
Raster_Processing
Python_Development
Appearance
Command Search (Alt+Q)
Yuri (Esri State & Local Government Business Development)
History
ModelBuilder
Python
Environments
Ready To Use Tools
Tools
Geoprocessing
Summarize Nearby
Summarize Within
Summary Statistics
Enrich
Clip
Tools
Feature Analysis
Raster Analysis
Portal
Data Engineering
Suitability Modeler
Visibility Analysis
Exploratory 3D Analysis
Network Analysis
Geostatistical Wizard
Business Analysis
Data Interop
Crime Analysis
Workflows
Raster Functions
Function Editor
Raster
Contents
Search
Drawing Order
Imagery
Interstate_Project
Boundary
Footprint
Image
RGB
Red: Band_1
Green: Band_2
Blue: Band_3
World Topographic Map
World Hillshade
Imagery
Torrence Chapel Rd
Armour St
Beaty St
N Main St
Watson St
Griffith St
Jackson St
Jetton St
Concord Rd
Ridge Rd
848 ft
838 ft
115
Davidson
1:18,950
1,451,228.70E 640,618.56N ftUS
Selected Features: 0
Catalog
Project
Portal
Favorites
Search Project
Toolboxes
Notebooks
test.ipynb
UNET.ipynb
Databases
Spatial Analyst
Ortho Mapping
Layouts
Reports
Styles
Servers
Tasks
Cloud Stores
Drone_Imagery.acs
Folders
Base_Project
CH
Desktop
EsriTraining
Catalog
Geoprocessing
Python
arcpy.management.CreateCloudStorageConnectionFile("C:\GIS_Data\SEUC", drone_imagery, 'AMAZON', droneimagery)
import boto3
s3 = boto3.client('s3')
s3.download_file('droneimagery', 'drone_imagery', '')
Rain off and on
1:24 PM
3/23/2022

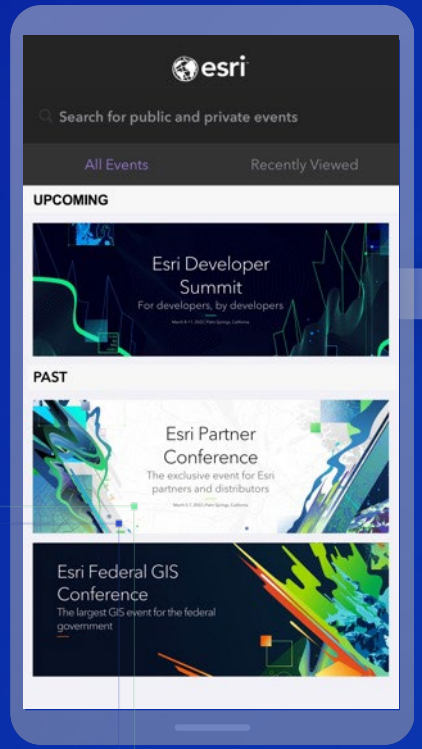
Questions?

Thank You.

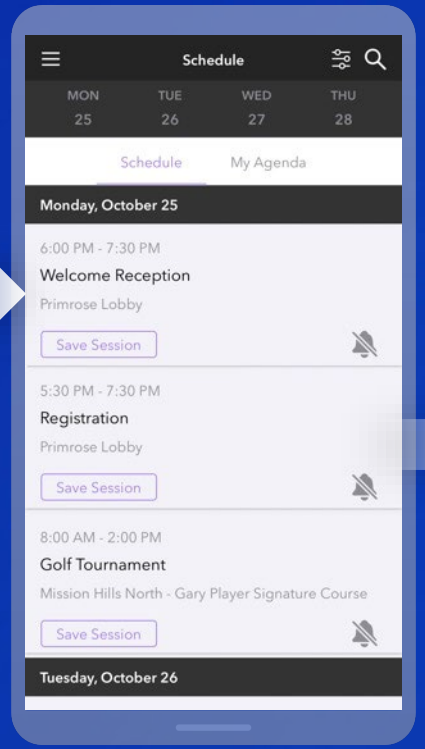
Yuri Potawsky
Esri Solution Engineer
Charlotte, NC

Please Share Your Feedback in the App

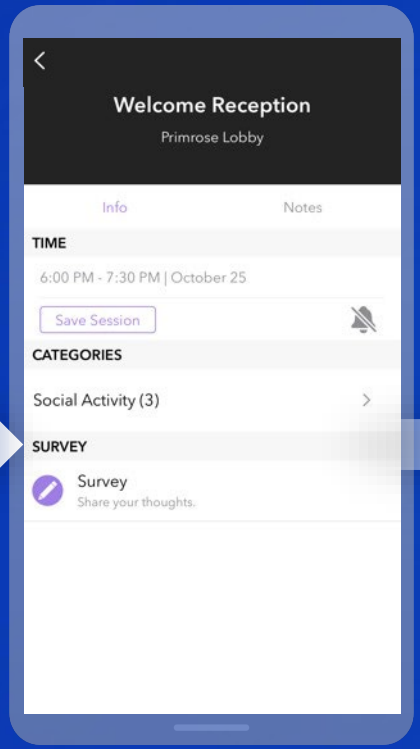
Download the Esri Events app and find your event



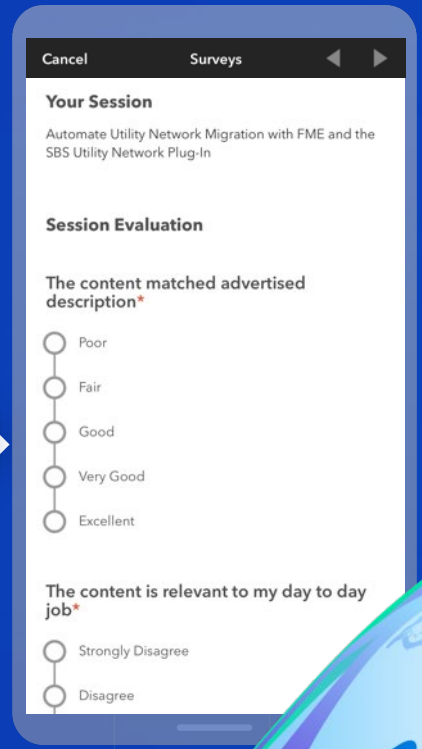
Select the session you attended



Scroll down to “Survey”



Log in to access the survey



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