How to put the Image Services in the Living Atlas to Work in Your GIS

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Esri, Redlands

Image Services in the Living Atlas of the World

- Let's have a look: https://livingatlas.arcgis.com
- Search: type:"Image service"
- A great way to Browse the Possibilities
- 317 Available

Today, my first job is prove the following (to you):

The image services
in the Living Atlas of the World
are raster datasets.

Use them just like
a raster dataset on
your computer’s hard drive.

What is an Image Service?

- A type of Service that ArcGIS Server serves
- The input to an Image Service is a Mosaic Dataset
- The input to a Mosaic Dataset is one or more Raster Datasets

When a Raster Dataset is added to a Mosaic Dataset, metadata is created and stored for that raster dataset

Mosaic Datasets define how their raster datasets are to be viewed and analyzed.

Image Services give others, who cannot see your file system, access to these mosaic datasets without having to copy them to their local hard drives.

http://esriurl.com/imageryworkflows

Seeing is Believing

Where the Pixels on your screen came from

ArcGIS Online Imagery Layer

- Each layer's documentation lists the service type and has a link to the service's REST URL where you can see all the properties

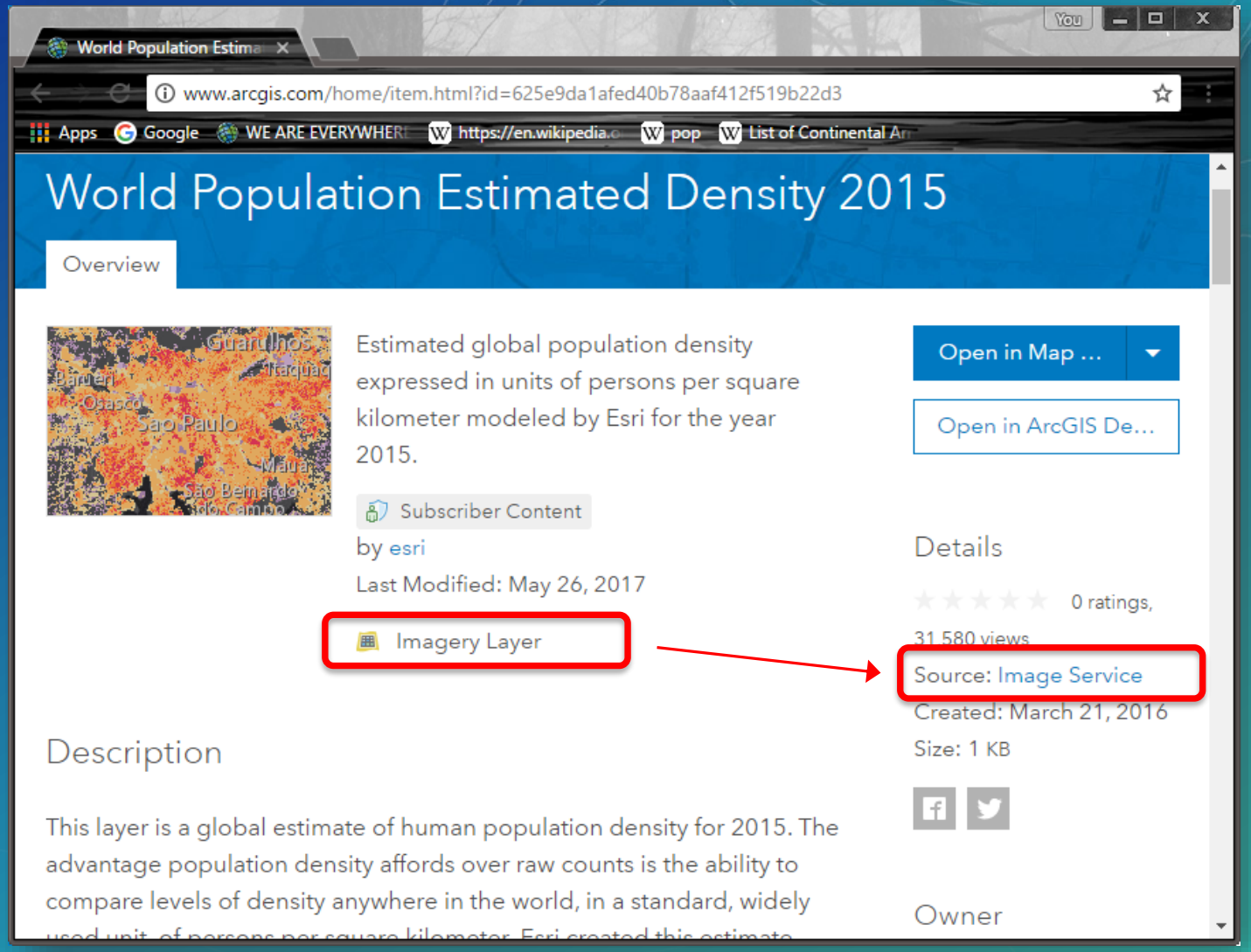
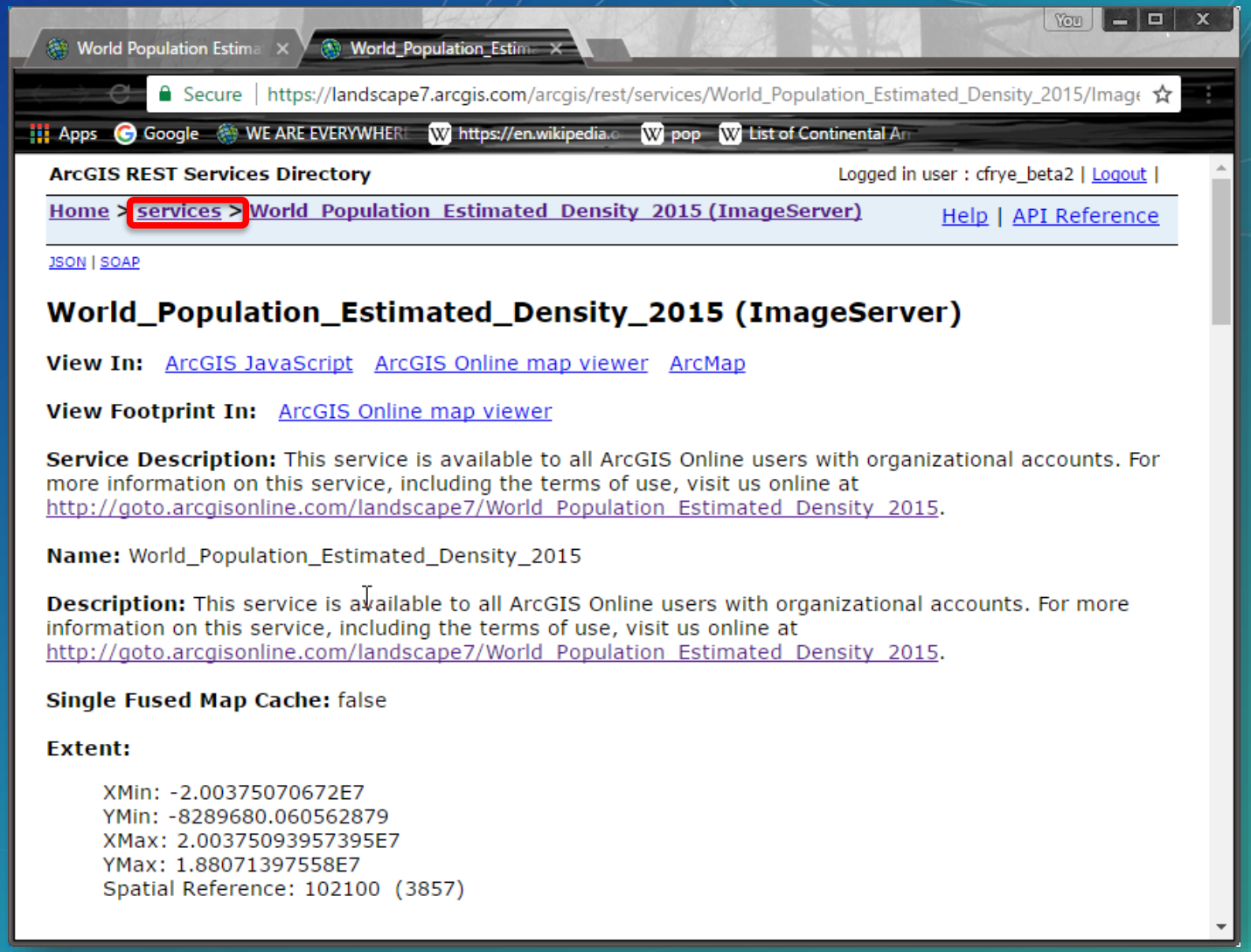


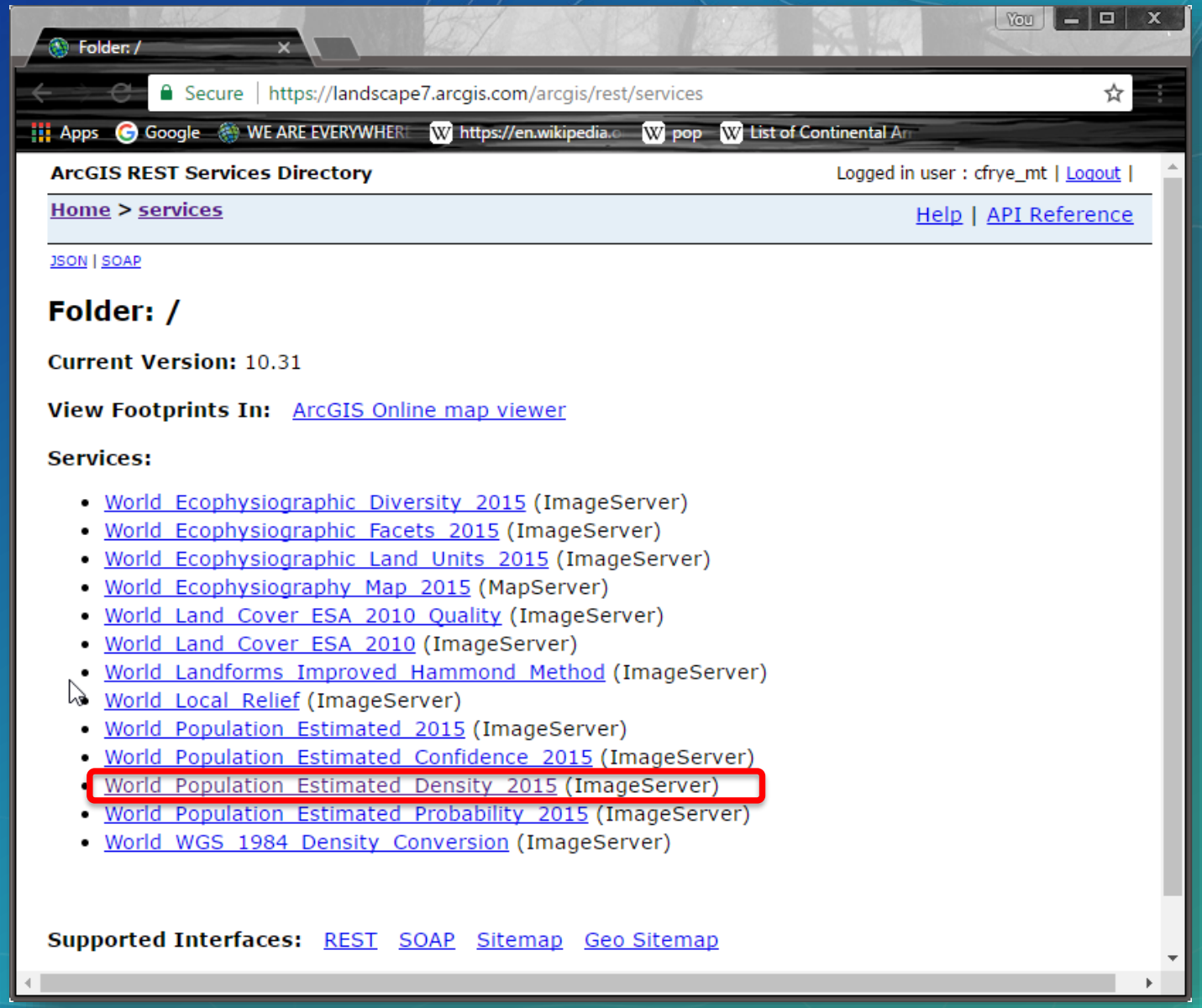
Image Service REST URL:

- Lists the Image Service's properties:



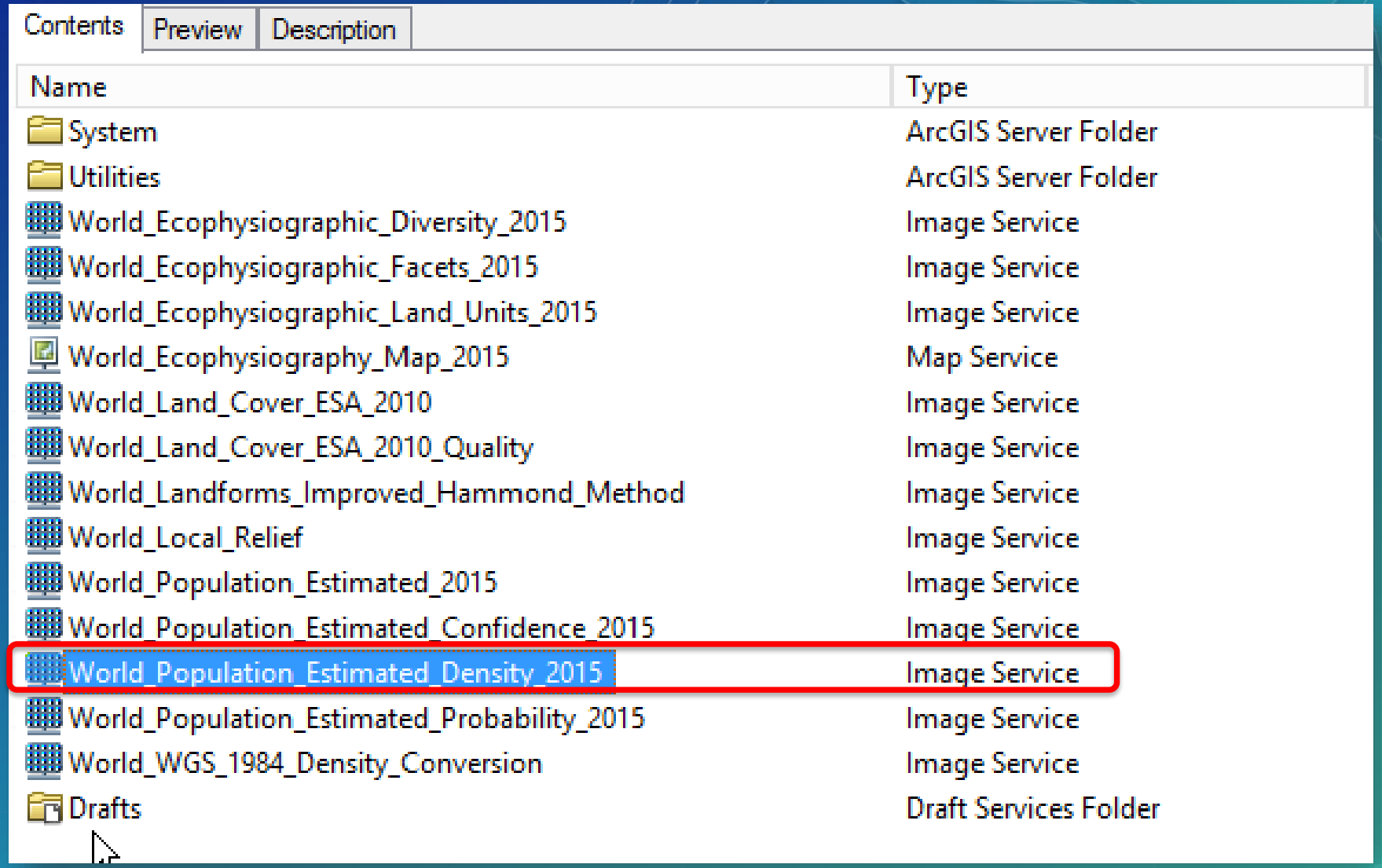
The Server from REST:

- Lists available services and their service type. All the services here are of type = “(Image Server)”:



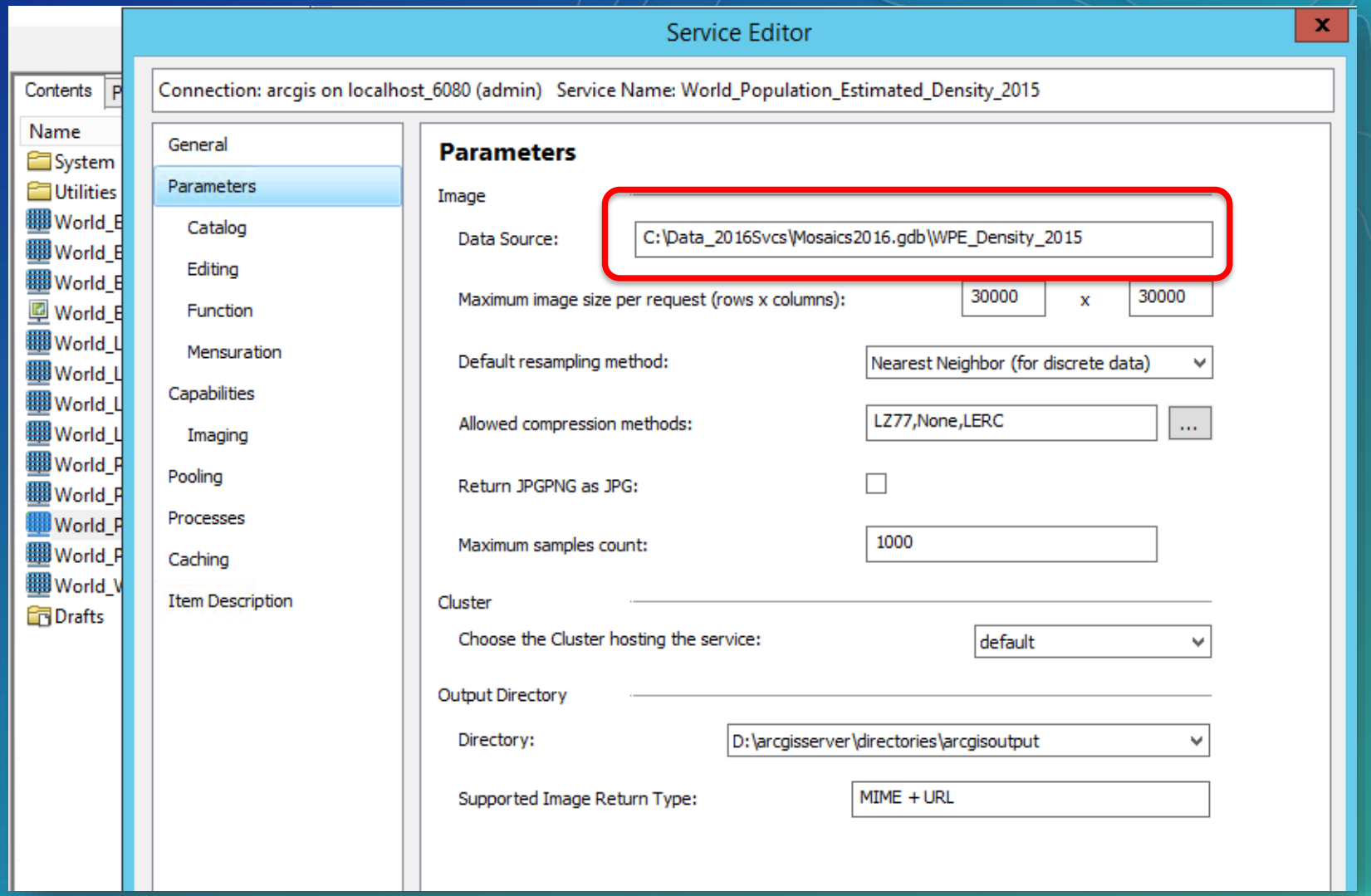
On the Server, in ArcCatalog:

The service is Highlighted:



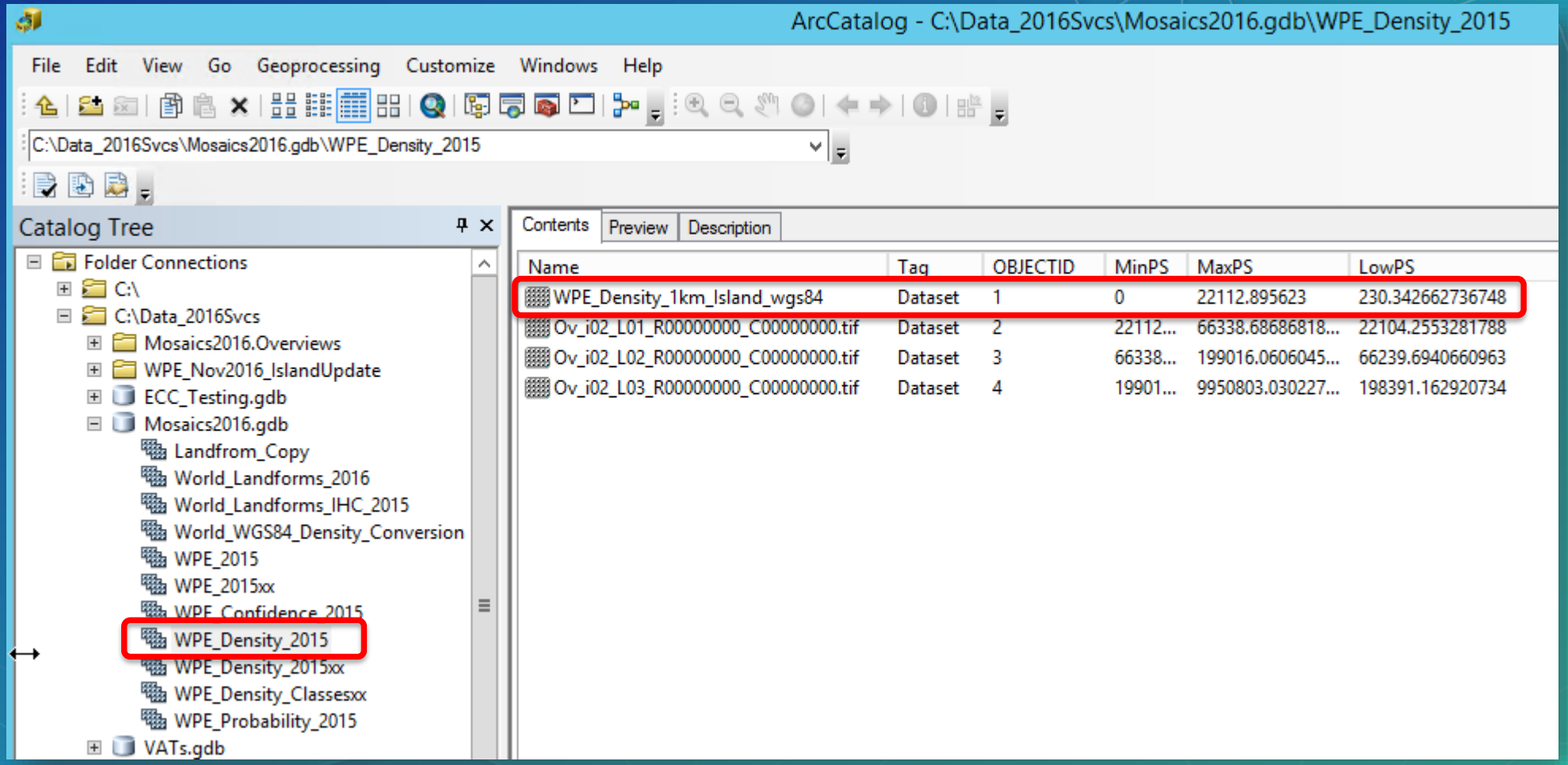
Service Properties:

The Mosaic Dataset Path:



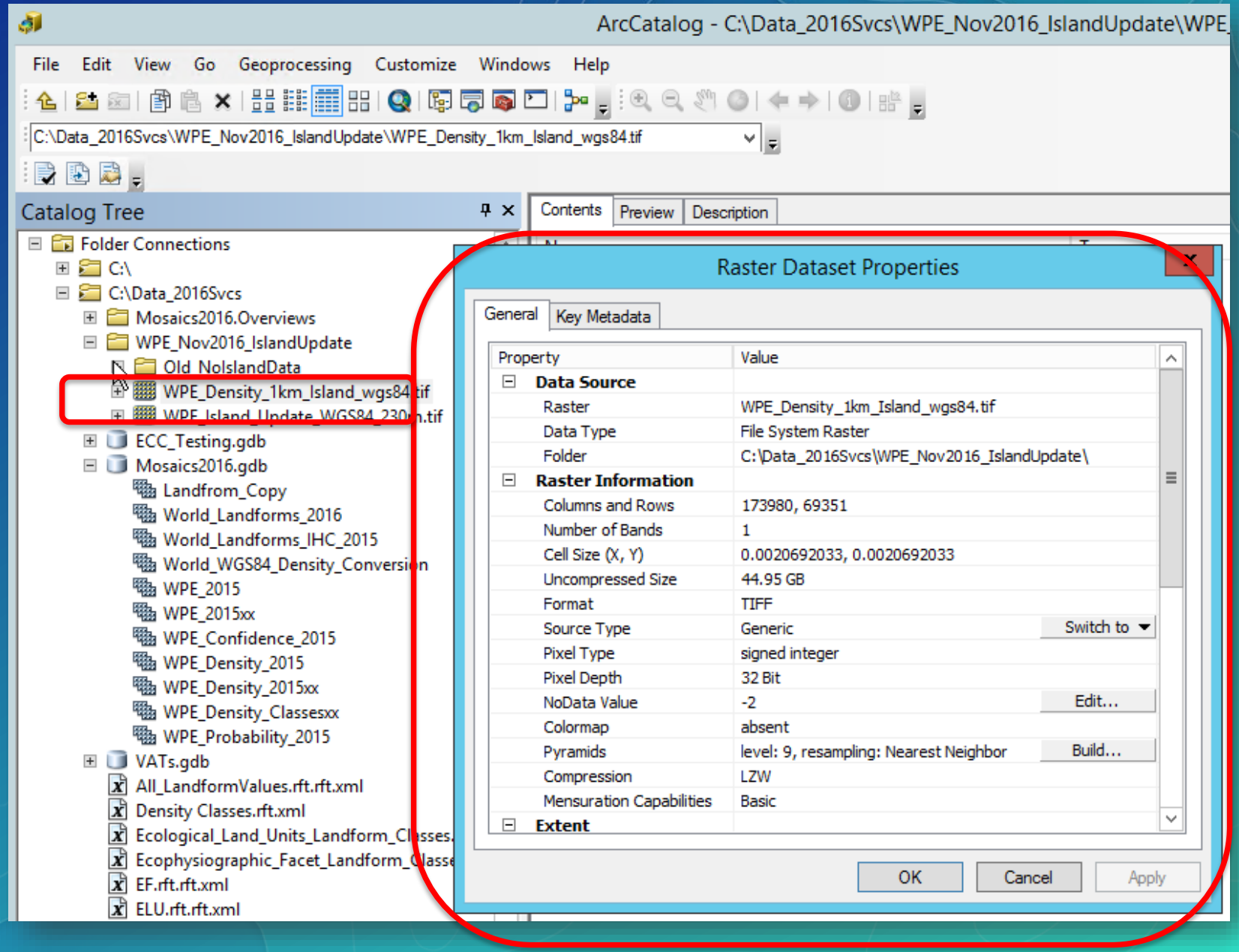
Inside the Mosaic Dataset:

The Raster Dataset File Name:



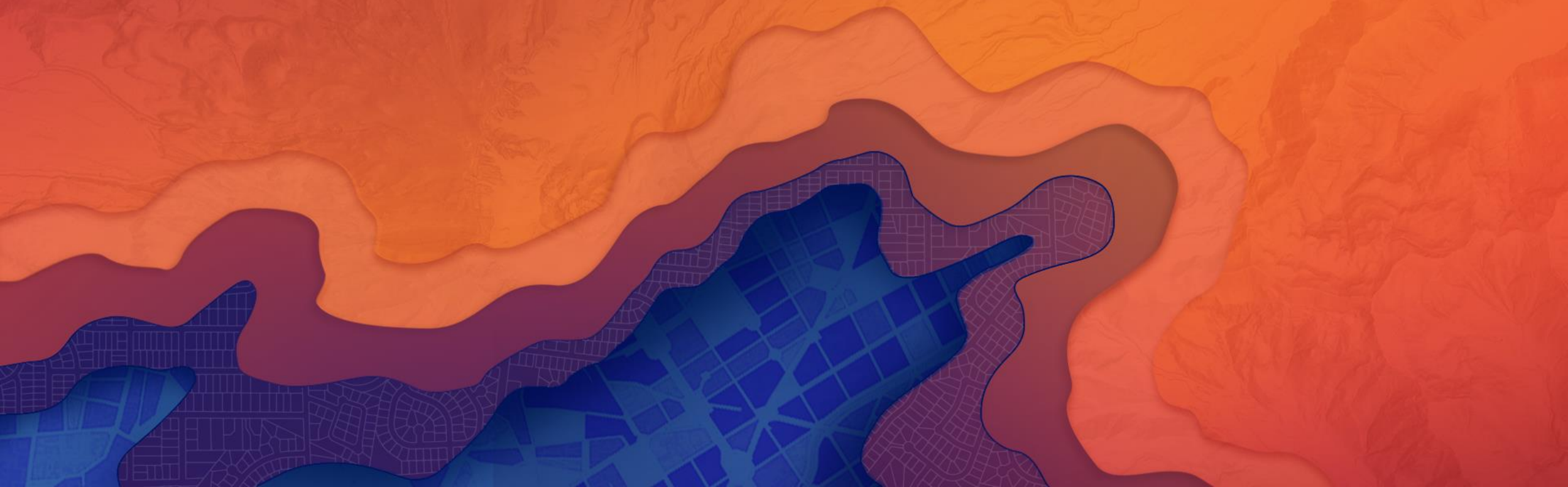
The Raster Dataset:

Finally, the Raster Dataset



Why does that matter?

Learning about, and how much to *trust,* online data is different than for local data.

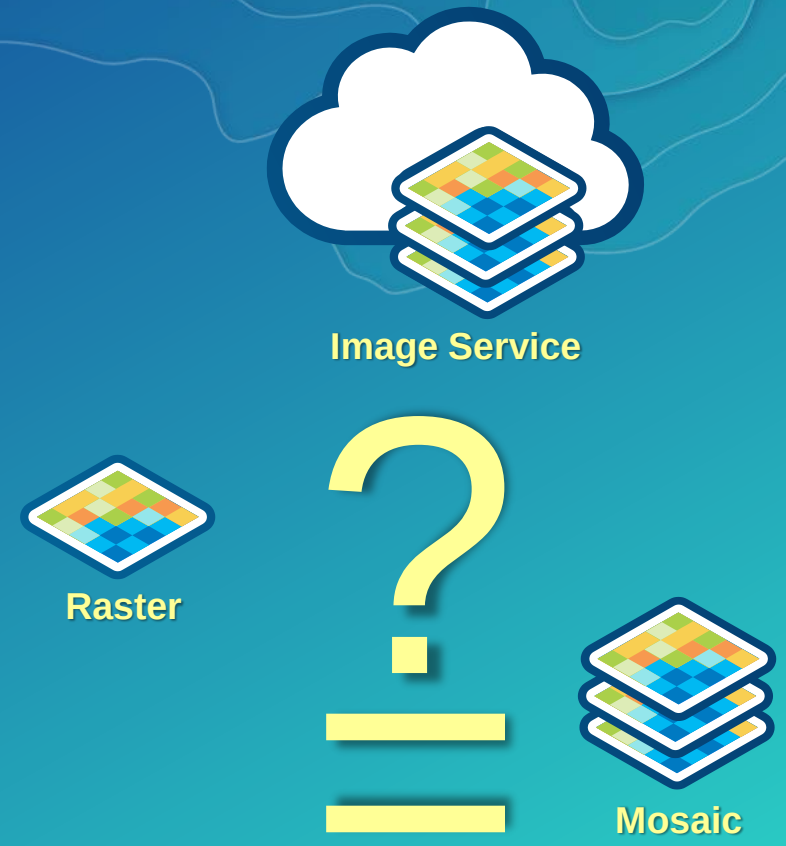


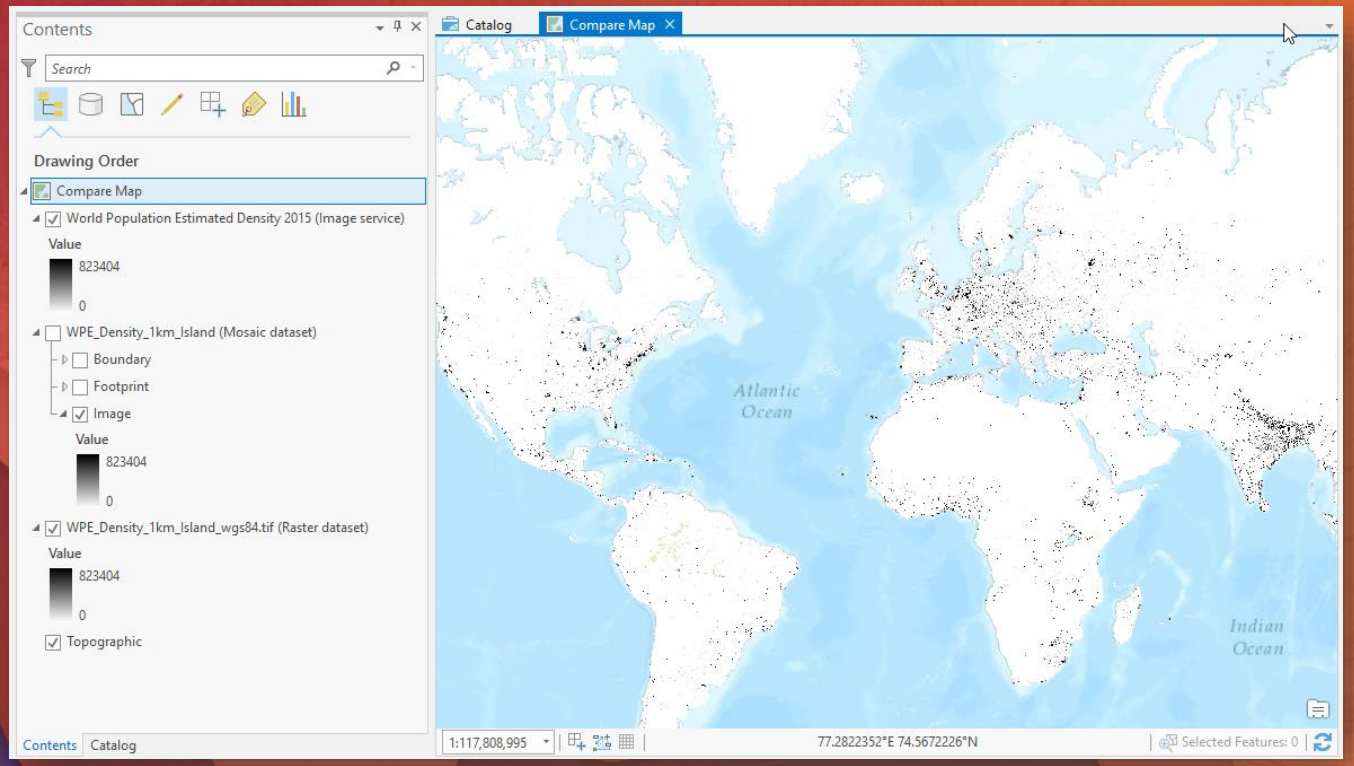
Learning to Trust Online Raster Data

- **My job: Show you how to save time, effort and expense**
  - Build confidence
  - Demonstrate that copying raster data from an image service to your local hard drive is a waste of time and resources.
  - Show how Image Services are a better way to consume raster data
- **The easy part:**
  - Raster Datasets, Mosaic Datasets, and Image Services are all inputs to **Raster Layers**:
  - We use Raster Layers in
    - ArcGIS Pro and Desktop
    - Geoprocessing and Raster Functions.
  - A Raster Layer is a set of properties that determines how we draw and query raster data.

Are Image Services, Rasters, and Mosaic Datasets Equal?

- Yes but, Mosaic Datasets and Image Services ***also*** have function templates and mosaic properties such as mosaicking method.
- Mosaic Datasets and Image Services can source more than one raster dataset, *thus*:
  - The table for their raster layer is for the Mosaic footprints, not a Raster Attribute Table, which can come from a raster function
  - Raster Attributes may not be available from a mosaic dataset or image service (by default):
    - Check to see if there is more than one raster function template:
    - Default template may not make the original pixel values available
    - No template may be available for the raster attributes
  - A single raster dataset can be generated from a mosaic dataset, and this can have a raster attribute table.



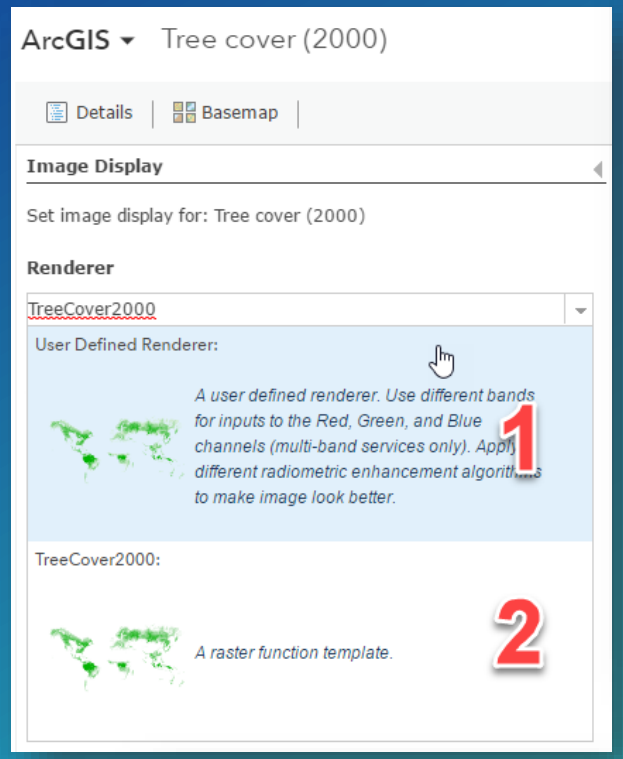


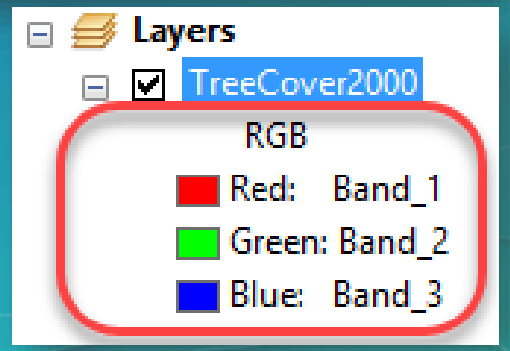
Compare a Raster to a Mosaic and an Image Service

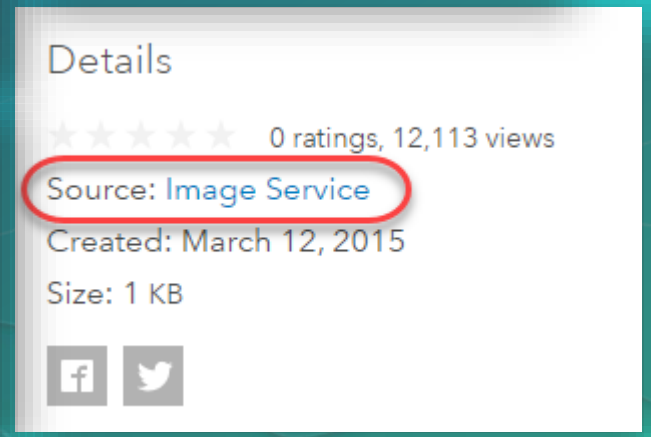
How does the user experience compare?

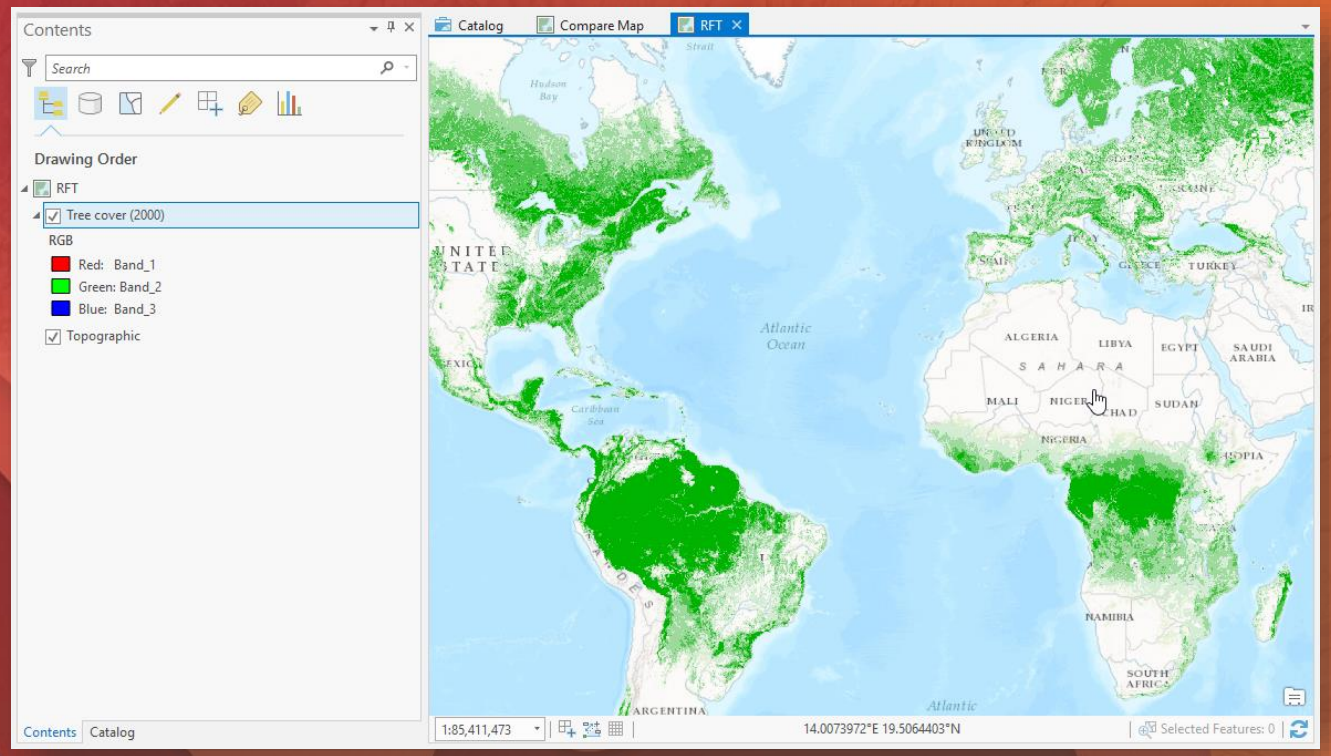
Learn whether the Image Service has Data

- In ArcGIS Online Search Results and the Living Atlas Image Services show as “Imagery Layers”
- Details Page shows Source as “Image Service”
- How to know if the data vs. RGB values is available
  - ArcGIS Online Image Display has two or more options
  - REST: two or more Raster Function Infos
  - Open in ArcMap – is an RGB legend shown.



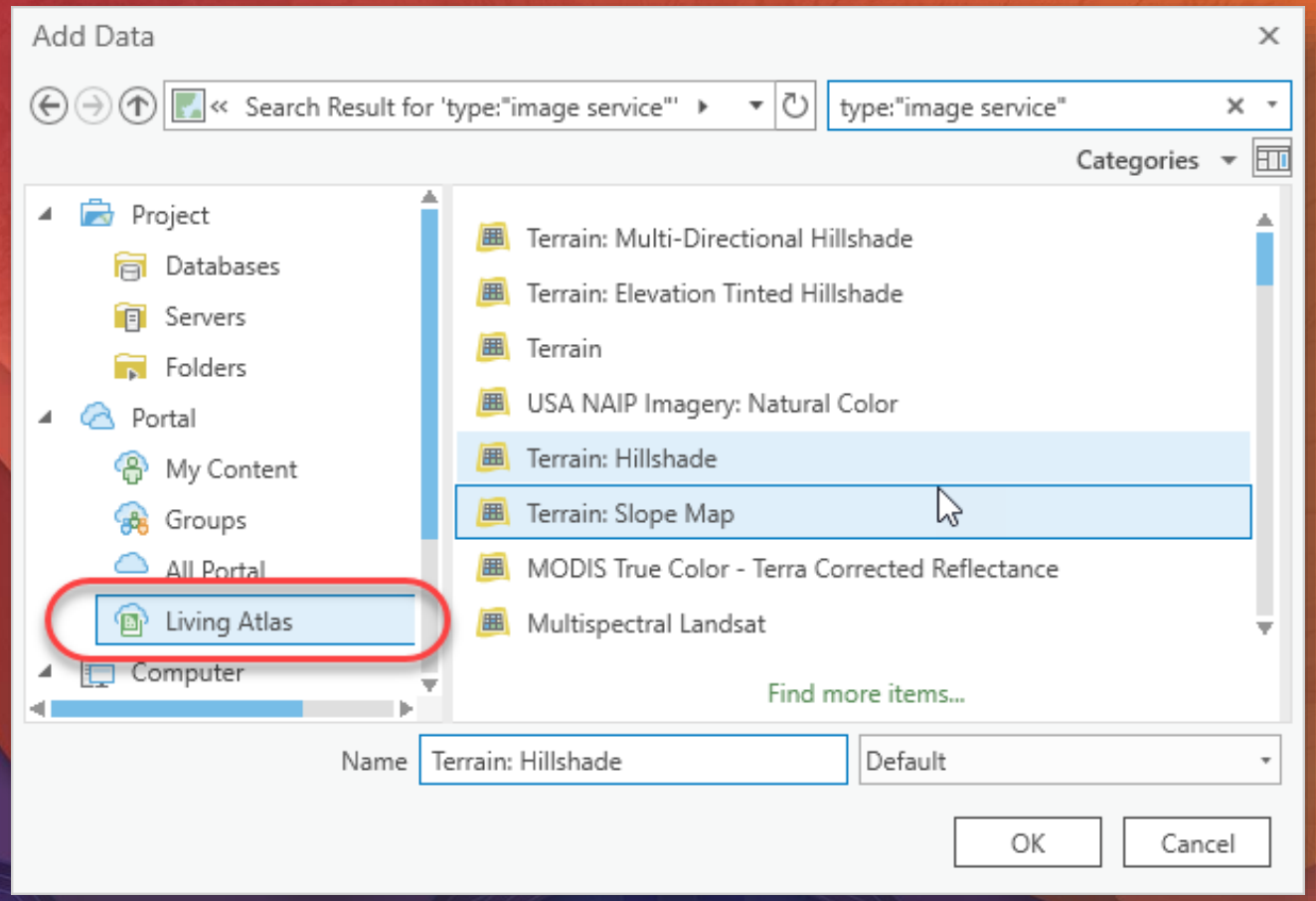






Is there data in that Image Service?

Sometimes the valuable data is not immediately apparent



How to find Living Atlas Image Services in ArcGIS Pro

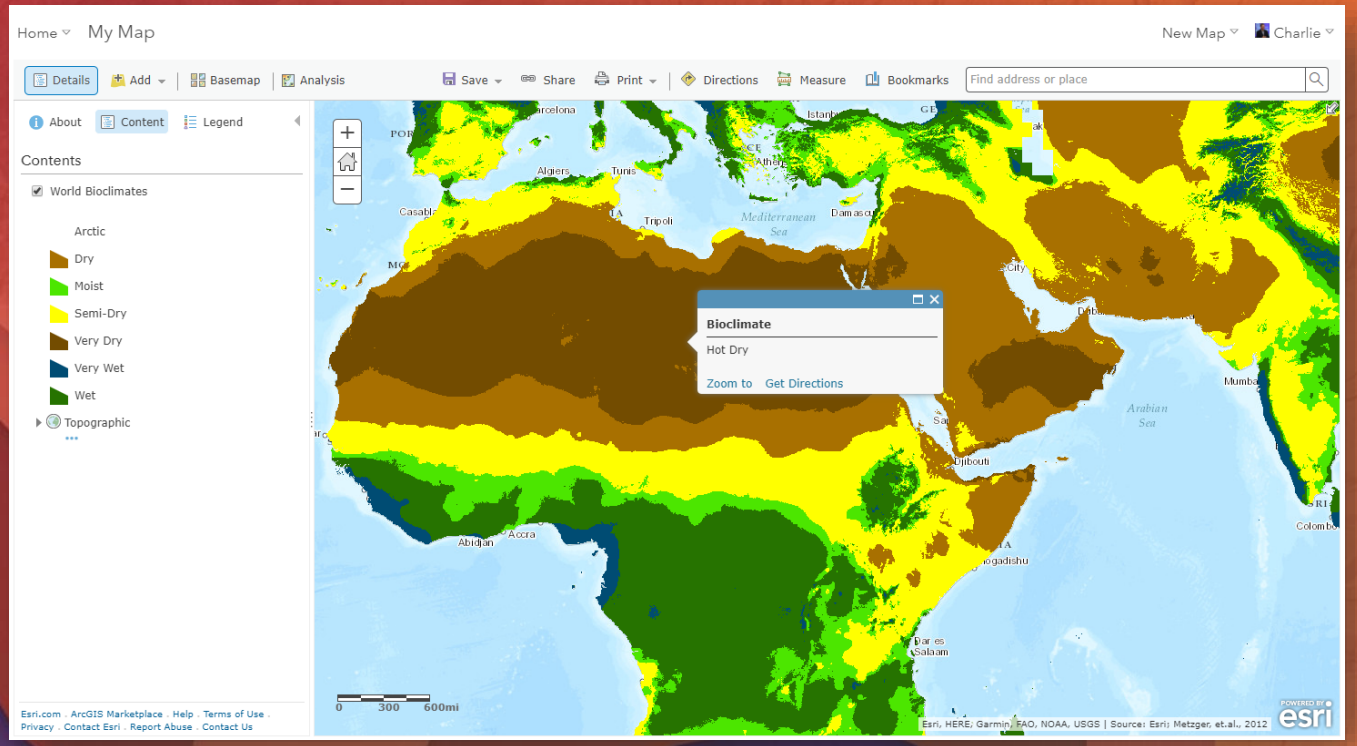
In a Browser or ArcGIS Pro

Adding Image Services from the Living Atlas to Desktop Aps

- In ArcGIS Pro:
  - Add Data, choose “Browse the Living Atlas”
  - Project Window (1.4.1) or Catalog (2.0)
    - Portal Tab,
    - Living Atlas mode: Type Layer Name to search
  - Catalog, Favorites, Add Item for a GIS Server, then Add to Project

Tip: Esri’s GIS Servers with Image Services:

- Landscape 2,3,4,5,6,7,10 and 11; Elevation (ex. http://Elevation.arcgis.com/arcgis/rest)
- Descriptions in service REST URLs link to corresponding ArcGIS Online content items

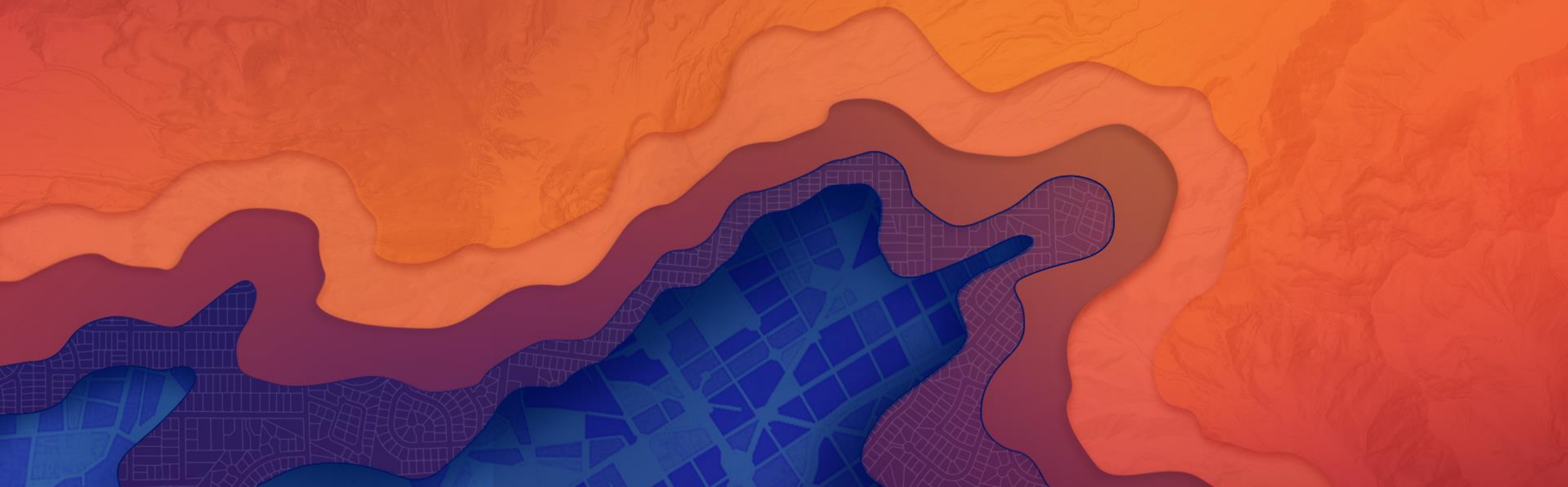


New Image Service Display Options in ArcGIS Online

Stretch, Classified, and Unique

Analysis with Image Services

My second job: Show best practices and critical variables



Analyzing Image Services: Key Properties

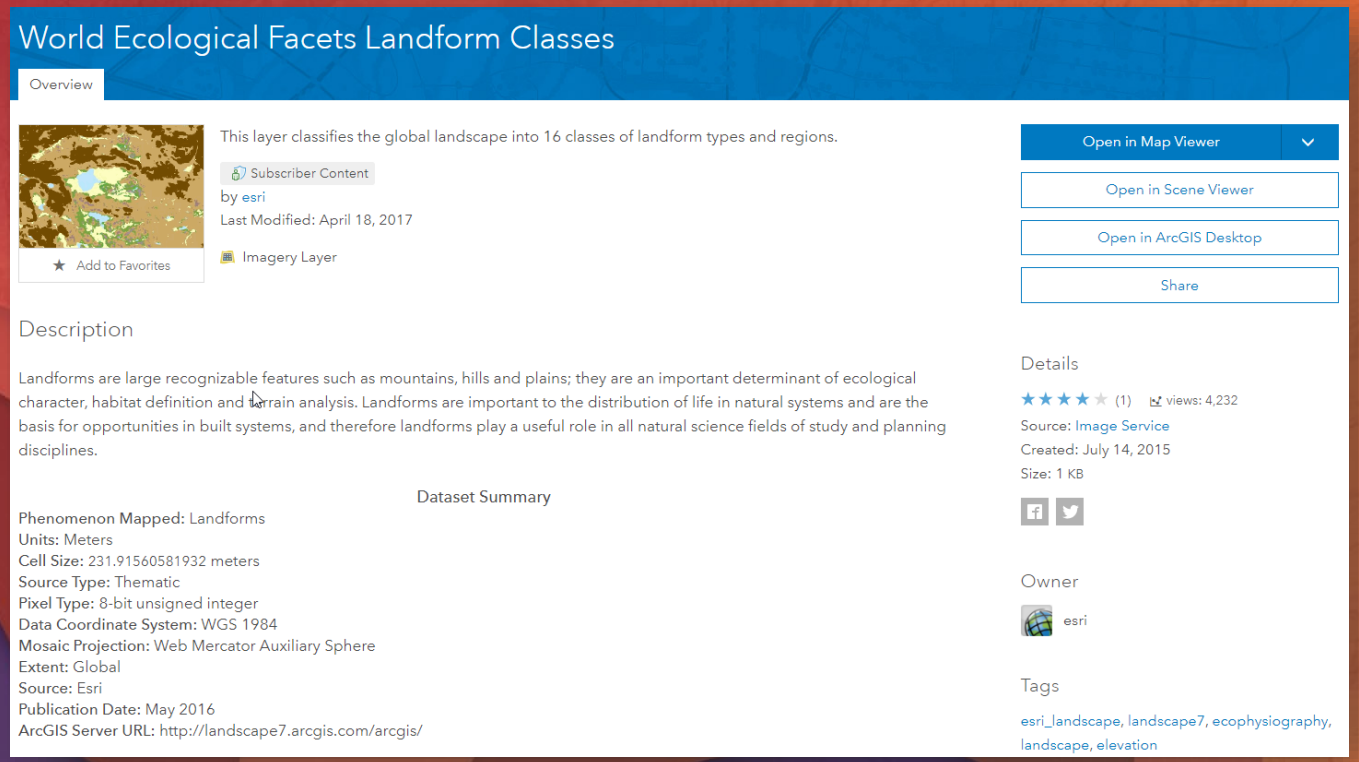
- Important information that should be found in the documentation
  - **Source data coordinate system** (aka spatial reference)
  - Cell size
  - No Data Value
- Relevant Image Service/Mosaic Dataset Properties
  - Coordinate System (units = cell size units)
  - Statistics
  - Raster Extent
  - **X/Y extent available**
  - **Number of records available**
  - **Number of images available for download**
  - Mosaic Method

Source for this information

Green = Raster Layer Properties

Orange = REST URL only

Purple = Documentation only



Finding the properties of Image Services that Affect Analysis

Effect of Projecting Population Raster

Scenario: Project WGS_1984 World Population to several options

Coordinate System	Total Population	Percent Change	Resampling	Min Value	Max Value
(input) WGS_1984	7,126,379,999	N/A	N/A	0	331,383
Web Mercator*	8,583,012,071	20.44%	Nearest Neighbor	0	331,383
Mollweide	6,220,617,101	-12.71%	Nearest Neighbor	0	331,383
Equidistant Cyl.	7,106,069,816	-0.00285%	Nearest Neighbor	0	331,383
Equidistant Cyl.	7,089,750,406	-0.00513%	Bilinear	0	304,264
Equidistant Cyl.	7,064,451,757	-0.0083%	Cubic Convolution	-6,093	367,405

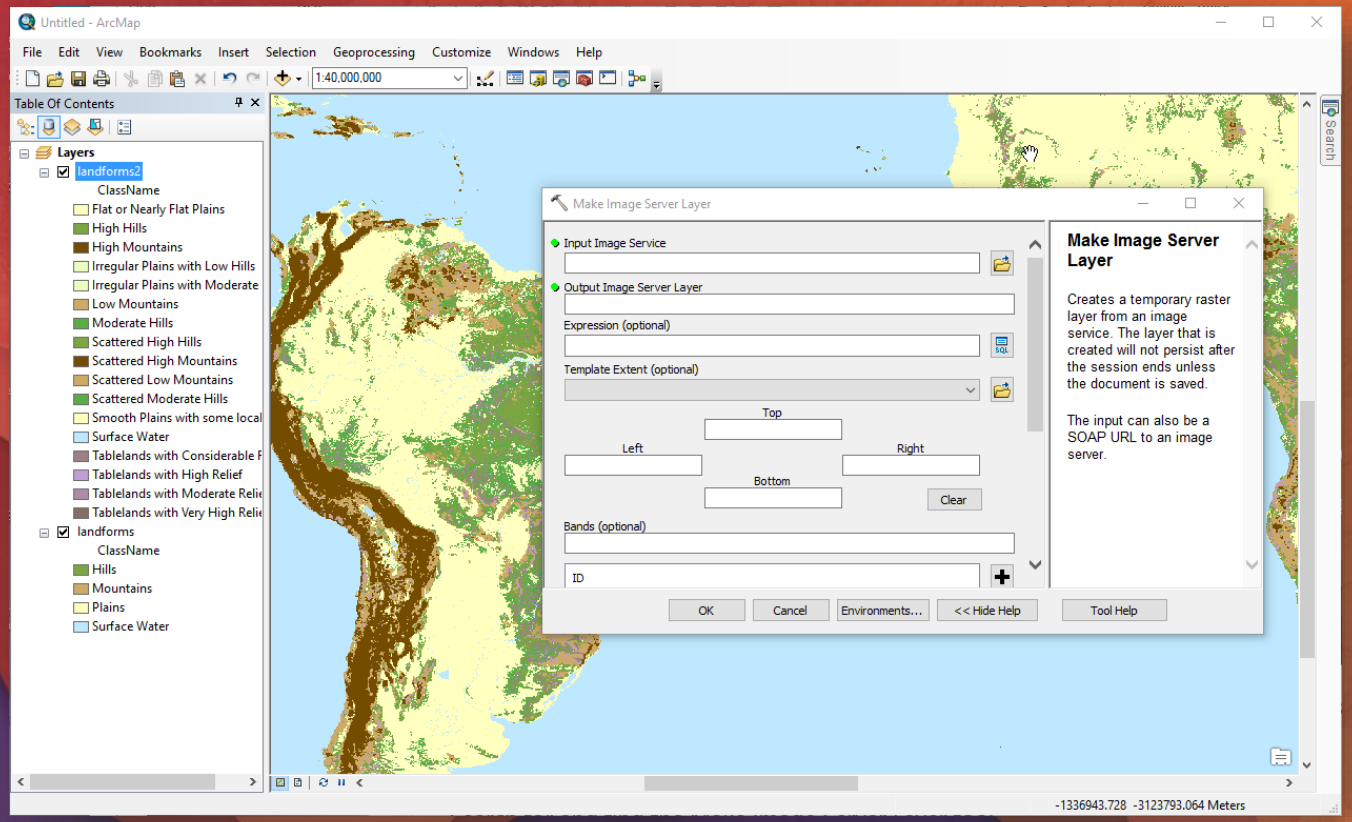
** When projecting from Web Mercator to WGS_1984, the inverse percentage results, but cell locations vary, thus it is not possible to reverse the process and return the original data.*

Keys to Successful Analysis with Image Services

- Impact of Projecting raster data
- Impact of Resampling – Data loss/gain will occur—does it matter?

- How to avoid problems: use Make Image Server Layer Tool
  - "Server-side processing" (undocumented feature)
    - Environment settings: Coordinate System
    - Uses the server to process the source raster and deliver the results to the resulting layer

It is vital to be aware of, and control how raster processing options will affect the output cell values.



How to use Make Image Server Layer tool

The basis for successful Web GIS analysis with image services

[Use Make Image Server Layer tool first]

Leveraging Server-side Processing

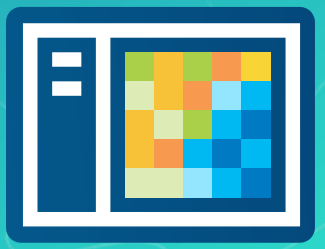
- ArcGIS Servers can provide versions of the source raster data other than the default
  - Saves a step of local processing
  - Allows for direct use of the source rasters
- Make Image Server Layer tool will tell the server to process the source image based on these settings
  - Snap grid – standardize origin for all rasters in a given model
  - (Query) Expression – restricts the output raster to use only the specified source rasters
  - Extent – Allows Services to conform to desired Snap Raster
  - Coordinate System – Projects from the raster source, rather than the Mosaic's coordinate system
  - Cell Size – allows

Raster values and statistics types & Common Bit Depths

- Nominal (Nearest Neighbor Resampling) 1-, 2-, 4-, 8-, and rarely 16-bit unsigned
- Ordinal (Nearest Neighbor Resampling) 1-, 2-, 4-, 8-, and sometimes 16-bit signed and unsigned
- Interval – Discrete (Nearest Neighbor Resampling) 8-, 16-, and sometimes 32-bit signed and unsigned
- Interval – Continuous (Bilinear Resampling) 16- and 32-bit signed and unsigned
- Ratio (Bilinear Resampling) floating point, with remaps to 16- and 32-bit signed and unsigned

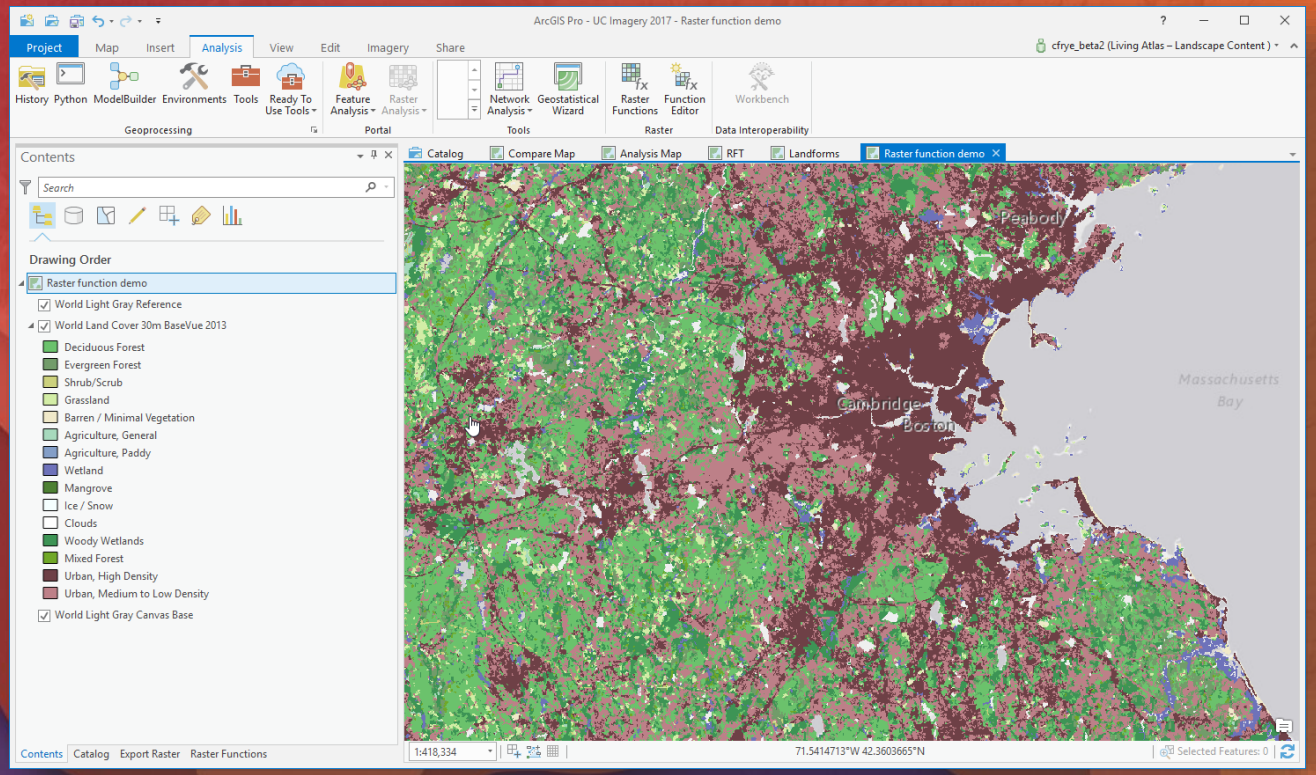
Default Symbology and Raster Dataset Statistics

- Raster Statistics and Histograms:
  - Enable classified and unique values renderers
  - Improve experience for setting the stretch renderer.
- Why Calculate Statistics?
  - If no statistics calculated, bit depth determines default data range for symbolizing
  - Calculate Statistics tool is only way to produce the internal histogram
    - Range: Affects Stretch Renderer, Use Minimum Maximum method
    - The histogram is based on a sample and may not represent all values!



When Analyzing (Geoprocessing) and Saving Results

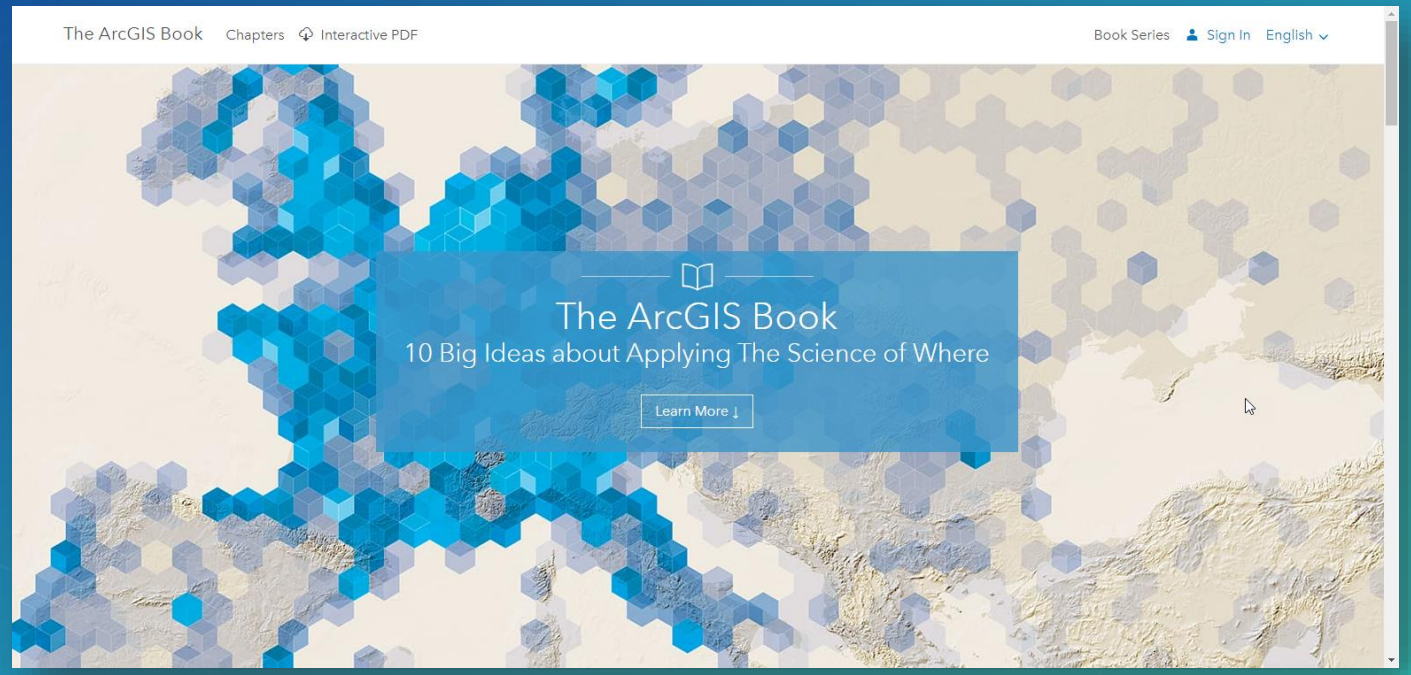
- When working with large rasters & image services,
  - Do:
    - Use Geodatabase or .tif format
    - Set Temp and Scratch workspaces to a file geodatabase
    - Compression
      - Use LZ77 (LZW) – it is lossless
      - LERC and JPEG – Lossy – based on compression level; 0 = no loss, and no compression
      - LERC: The higher the bit depth, the better the compression
    - Check remaining disk space
  - Avoid
    - GRID format – has operating system/format limitations
    - “In Memory” Workspace (uses GRID format for temp rasters) – Use SSD with GDB or .tif instead



Raster Functions in ArcGIS Pro

The Living Atlas of the World = Gateway to Web GIS

- Using Services means
  - No need to download data
  - Some new kinds of information to learn about
  - Greater re-use and efficiency



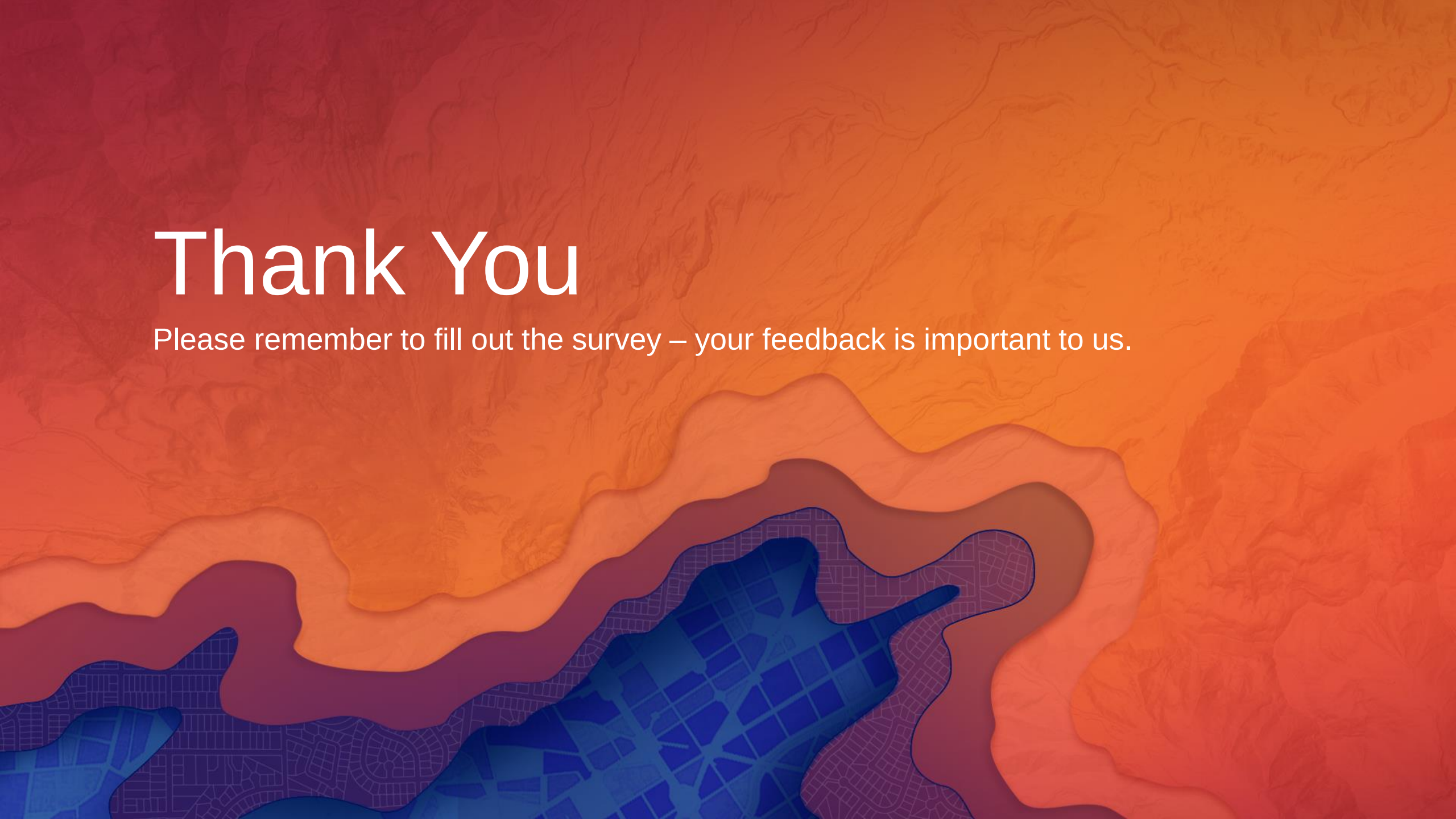
http://learn.arcgis.com/en/arcgis-book/

Related Sessions

- Wednesday
  - Using the Living Atlas in Analysis
    - 10:15 – 11:30 SDCC Room 3
  - Using Ocean Data from the Living Atlas of the World
    - 11:30 – 12:15 SDCC Demo Theater 4
  - Enterprise: Building Multi-Modal Image Services
    - 1:30 – 2:15 SDDC Demo Theater 14
  - Using Living Atlas Elevation Layers in Your GIS Workflows
    - 3:15 – 4:30 SDCC Room 1A
- Thursday
  - Image Management Using Mosaic Datasets and Image Services
    - 8:30 – 9:45 SDCC Room 3
  - Raster Function Processing
    - 10:30 – 11:15 SDCC Demo Theater 14

Thank You

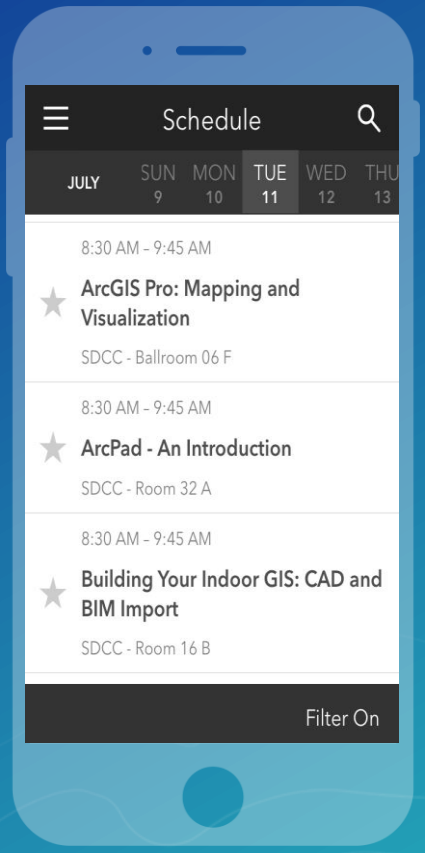
Please remember to fill out the survey – your feedback is important to us.



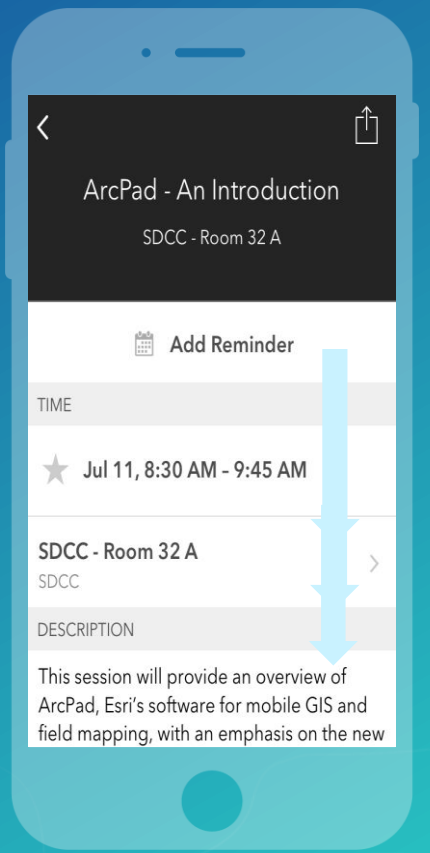
Please Take Our Survey on the **Esri Events App!**

Download the Esri Events app and find your event

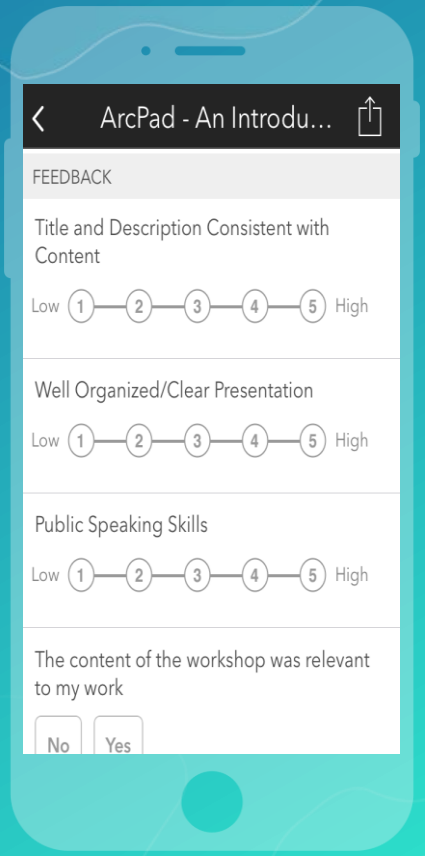
Select the session you attended



Scroll down to find the survey



Complete Answers and Select "Submit"




esri
THE
SCIENCE
OF
WHERE

Extra (if time allows) Did you know?

- You can **add** an image service as a raster to a mosaic dataset.
- You can a mosaic dataset as a raster to another mosaic dataset.

- Why would anyone that?
  - To set additional properties and functions on a mosaic dataset or image service
  - Override default values of the service, e.g. no data value.
  - Optimize / tailor re-use:
    - One dataset, three classifications or look-ups = 4 mosaics, rather than repeating functions for classifying in your models.
    - Standardize mosaic definition practices.
      - Referenced Mosaic: Lock mosaic properties, allowing functions to be added based on a known standard.
      - Copy – allow editing of all properties allowing the source mosaic to be a starting point.

Extra

- Avoid common “Errors” in Python code for Rasters
  - Use “from arcpy.sa import *” method
  - Raster Calculator is not fully supported and fails with ERROR 000539
  - 64-bit vs 32-bit Python Win. Use both as needed
- Resources for managing imagery:
  - http://esriurl.com/imageryworkflows