

UC



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*

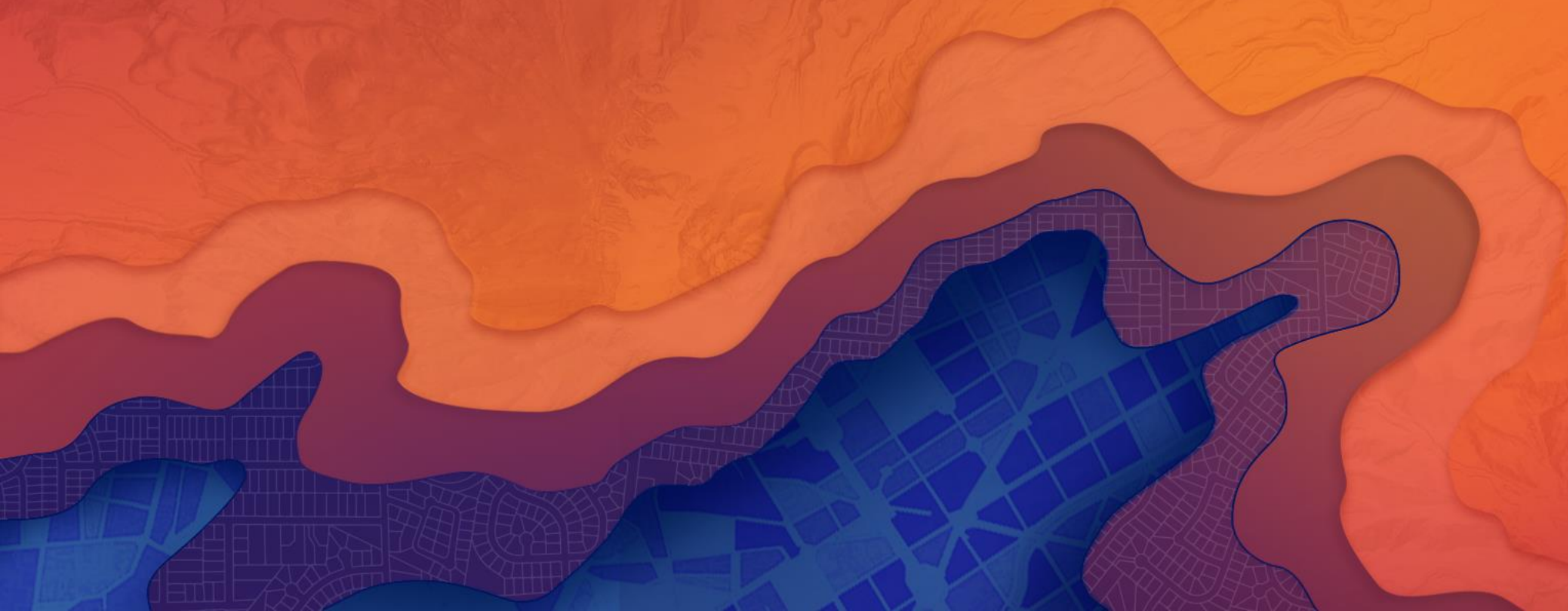
***Mosaic Datasets** define how their raster datasets are to be viewed and analyzed.*

***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

The screenshot shows the ArcGIS Online interface for an item titled "World Population Estimated Density 2015". The browser address bar shows the URL: www.arcgis.com/home/item.html?id=625e9da1afed40b78aaf412f519b22d3. The page has a blue header with the title. Below the header is a tab labeled "Overview". On the left, there is a thumbnail map of Brazil with labels for cities like Guarulhos, Itaquara, Osasco, São Paulo, Mauá, and São Bernardo do Campo. To the right of the thumbnail, the text reads: "Estimated global population density expressed in units of persons per square kilometer modeled by Esri for the year 2015." Below this text, it says "Subscriber Content" and "by esri". Further down, it says "Last Modified: May 26, 2017". A red box highlights the "Imagery Layer" icon and text. To the right of this, another red box highlights the "Source: Image Service" link. A red arrow points from the "Imagery Layer" box to the "Source: Image Service" box. On the far right, there are buttons for "Open in Map ..." and "Open in ArcGIS De...". Below these buttons, the "Details" section shows "0 ratings", "31,580 views", "Created: March 21, 2016", and "Size: 1 KB". At the bottom right, there are social media icons for Facebook and Twitter, and the word "Owner".

World Population Estimated Density 2015

Overview

Estimated global population density expressed in units of persons per square kilometer modeled by Esri for the year 2015.

Subscriber Content
by esri
Last Modified: May 26, 2017

Imagery Layer

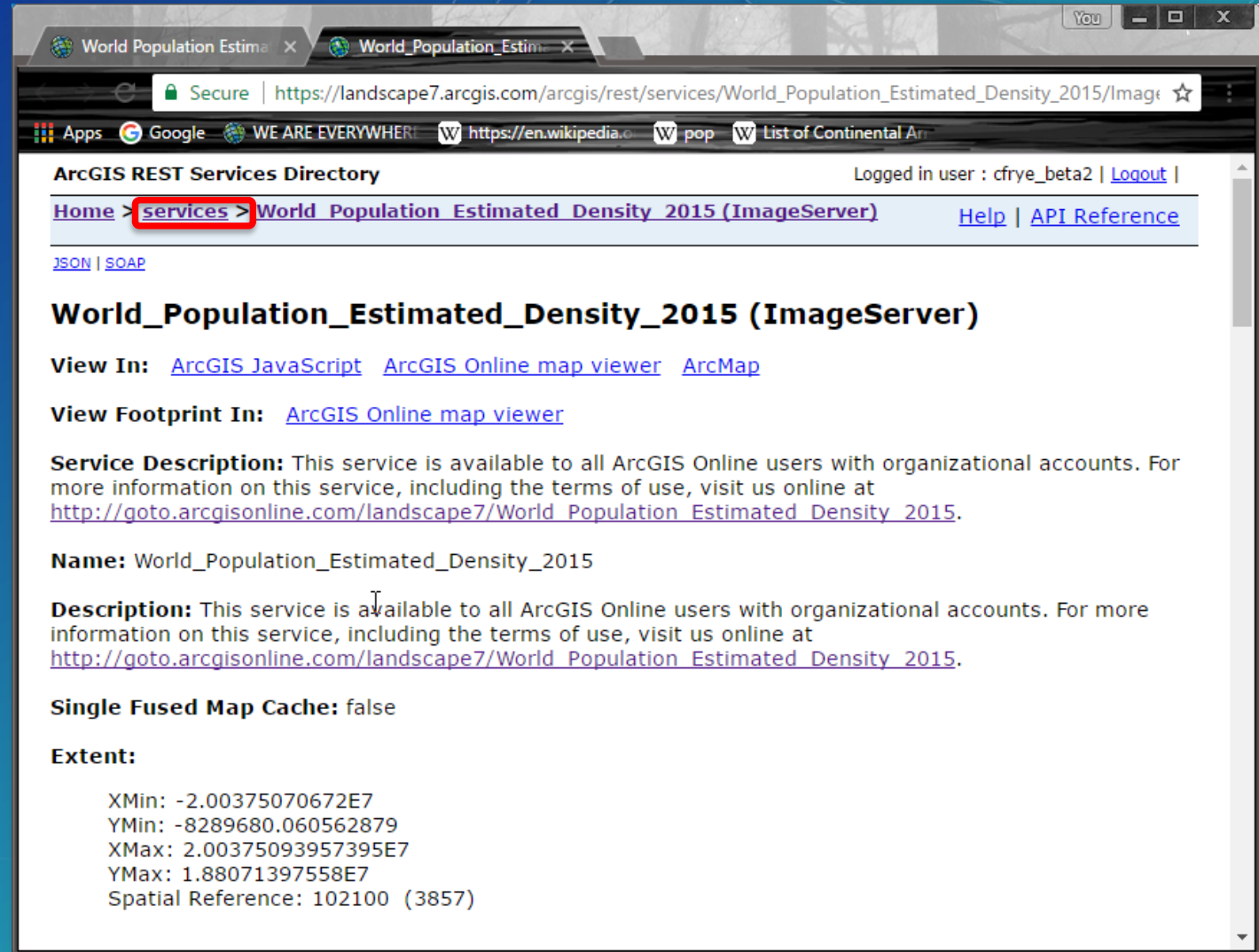
Open in Map ...
Open in ArcGIS De...

Details
0 ratings,
31,580 views
Source: Image Service
Created: March 21, 2016
Size: 1 KB

Description
This layer is a global estimate of human population density for 2015. The advantage population density affords over raw counts is the ability to compare levels of density anywhere in the world, in a standard, widely used unit of persons per square kilometer. Esri created this estimate

Image Service REST URL:

- Lists the Image Service's properties:



The screenshot shows a web browser window displaying the ArcGIS REST Services Directory. The URL bar shows a secure connection to https://landscape7.arcgis.com/arcgis/rest/services/World_Population_Estimated_Density_2015/ImageServer. The page title is "ArcGIS REST Services Directory" and it indicates the user is logged in as "cfrye_beta2". The breadcrumb navigation shows "Home > **services** > World Population Estimated Density 2015 (ImageServer)". The service name is "World_Population_Estimated_Density_2015 (ImageServer)". The "View In" section lists "ArcGIS JavaScript", "ArcGIS Online map viewer", and "ArcMap". The "View Footprint In" section lists "ArcGIS Online map viewer". The "Service Description" states that the service is available to all ArcGIS Online users with organizational accounts and provides a link to the terms of use. The "Name" is "World_Population_Estimated_Density_2015". The "Description" is identical to the service description. The "Single Fused Map Cache" is set to "false". The "Extent" section lists the coordinates: XMin: -2.00375070672E7, YMin: -8289680.060562879, XMax: 2.00375093957395E7, YMax: 1.88071397558E7, and Spatial Reference: 102100 (3857).

ArcGIS REST Services Directory

Logged in user : cfrye_beta2 | [Logout](#)

[Home](#) > **[services](#)** > [World Population Estimated Density 2015 \(ImageServer\)](#) [Help](#) | [API Reference](#)

[JSON](#) | [SOAP](#)

World_Population_Estimated_Density_2015 (ImageServer)

View In: [ArcGIS JavaScript](#) [ArcGIS Online map viewer](#) [ArcMap](#)

View Footprint In: [ArcGIS Online map viewer](#)

Service Description: This service is available to all ArcGIS Online users with organizational accounts. For more information on this service, including the terms of use, visit us online at http://goto.arcgisonline.com/landscape7/World_Population_Estimated_Density_2015.

Name: World_Population_Estimated_Density_2015

Description: This service is available to all ArcGIS Online users with organizational accounts. For more information on this service, including the terms of use, visit us online at http://goto.arcgisonline.com/landscape7/World_Population_Estimated_Density_2015.

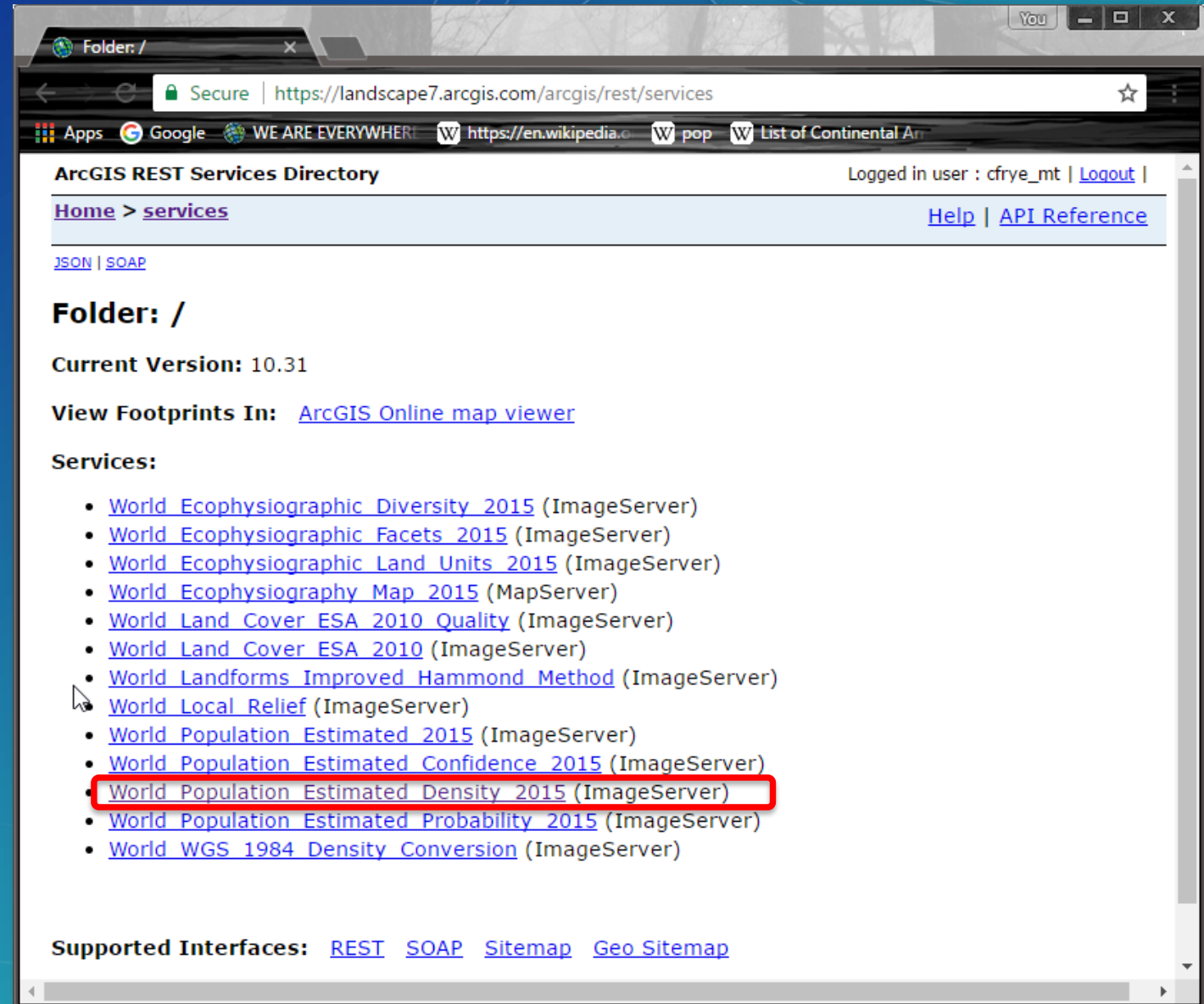
Single Fused Map Cache: false

Extent:

XMin: -2.00375070672E7
YMin: -8289680.060562879
XMax: 2.00375093957395E7
YMax: 1.88071397558E7
Spatial Reference: 102100 (3857)

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:

Contents Preview Description		
Name	Type	
System	ArcGIS Server Folder	
Utilities	ArcGIS Server Folder	
World_Ecophysiographic_Diversity_2015	Image Service	
World_Ecophysiographic_Facets_2015	Image Service	
World_Ecophysiographic_Land_Units_2015	Image Service	
World_Ecophysiography_Map_2015	Map Service	
World_Land_Cover_ESA_2010	Image Service	
World_Land_Cover_ESA_2010_Quality	Image Service	
World_Landforms_Improved_Hammond_Method	Image Service	
World_Local_Relief	Image Service	
World_Population_Estimated_2015	Image Service	
World_Population_Estimated_Confidence_2015	Image Service	
World_Population_Estimated_Density_2015	Image Service	
World_Population_Estimated_Probability_2015	Image Service	
World_WGS_1984_Density_Conversion	Image Service	
Drafts	Draft Services Folder	

Service Properties:

The Mosaic Dataset Path:

Service Editor

Connection: arcgis on localhost_6080 (admin) Service Name: World_Population_Estimated_Density_2015

Contents

Name

- System
- Utilities
- World_B
- World_B
- World_B
- World_B
- World_L
- World_L
- World_L
- World_L
- World_P
- World_P
- World_P
- World_P
- World_V
- Drafts

General

Parameters

Catalog

Editing

Function

Mensuration

Capabilities

Imaging

Pooling

Processes

Caching

Item Description

Parameters

Image

Data Source: C:\Data_2016Svcs\Mosaics2016.gdb\WPE_Density_2015

Maximum image size per request (rows x columns): 30000 x 30000

Default resampling method: Nearest Neighbor (for discrete data)

Allowed compression methods: LZ77,None,lerc

Return JPGPNG as JPG: ☐

Maximum samples count: 1000

Cluster

Choose the Cluster hosting the service: default

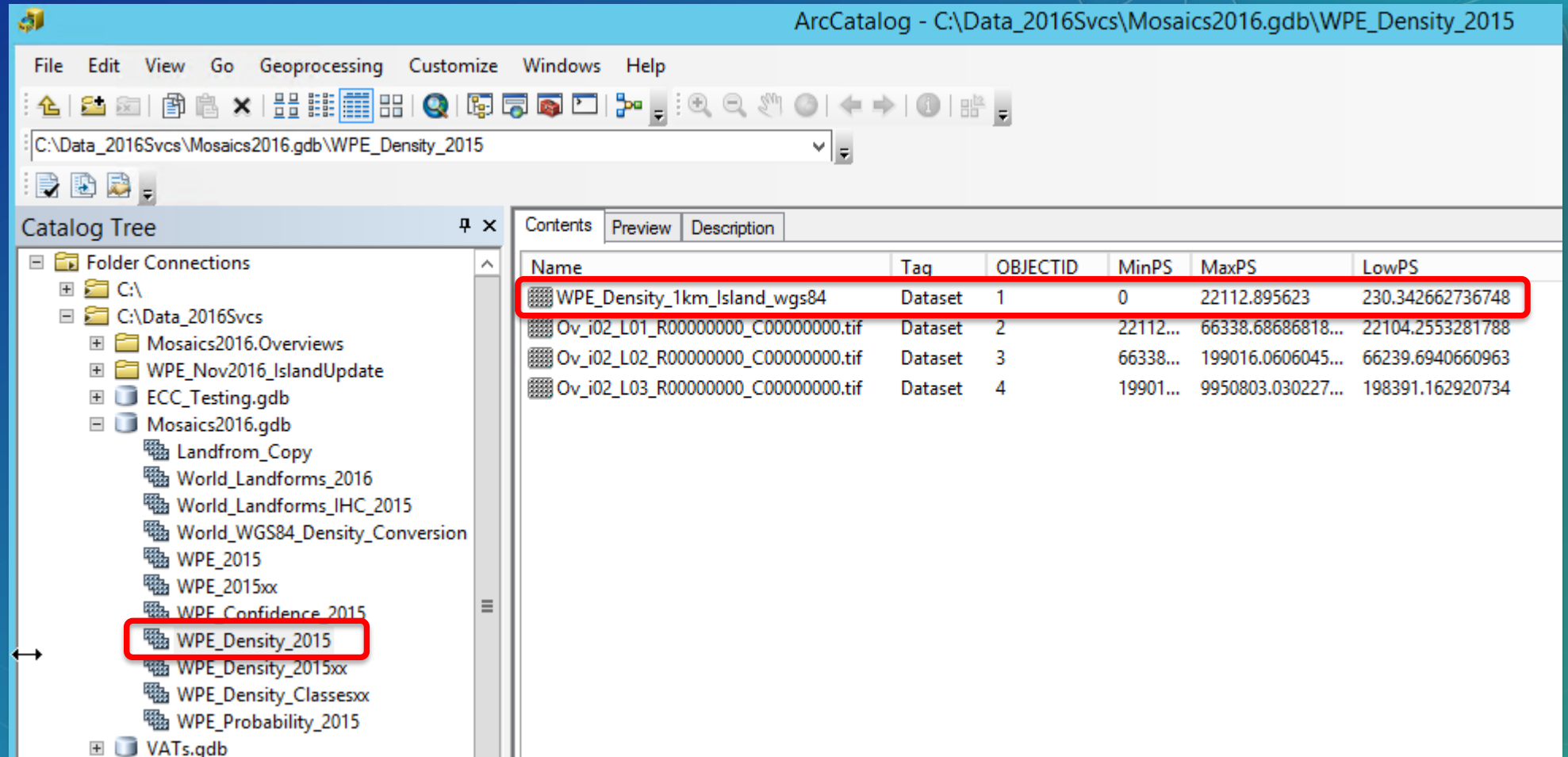
Output Directory

Directory: D:\arcgisserver\directories\arcgisoutput

Supported Image Return Type: MIME + URL

Inside the Mosaic Dataset:

The Raster Dataset File Name:

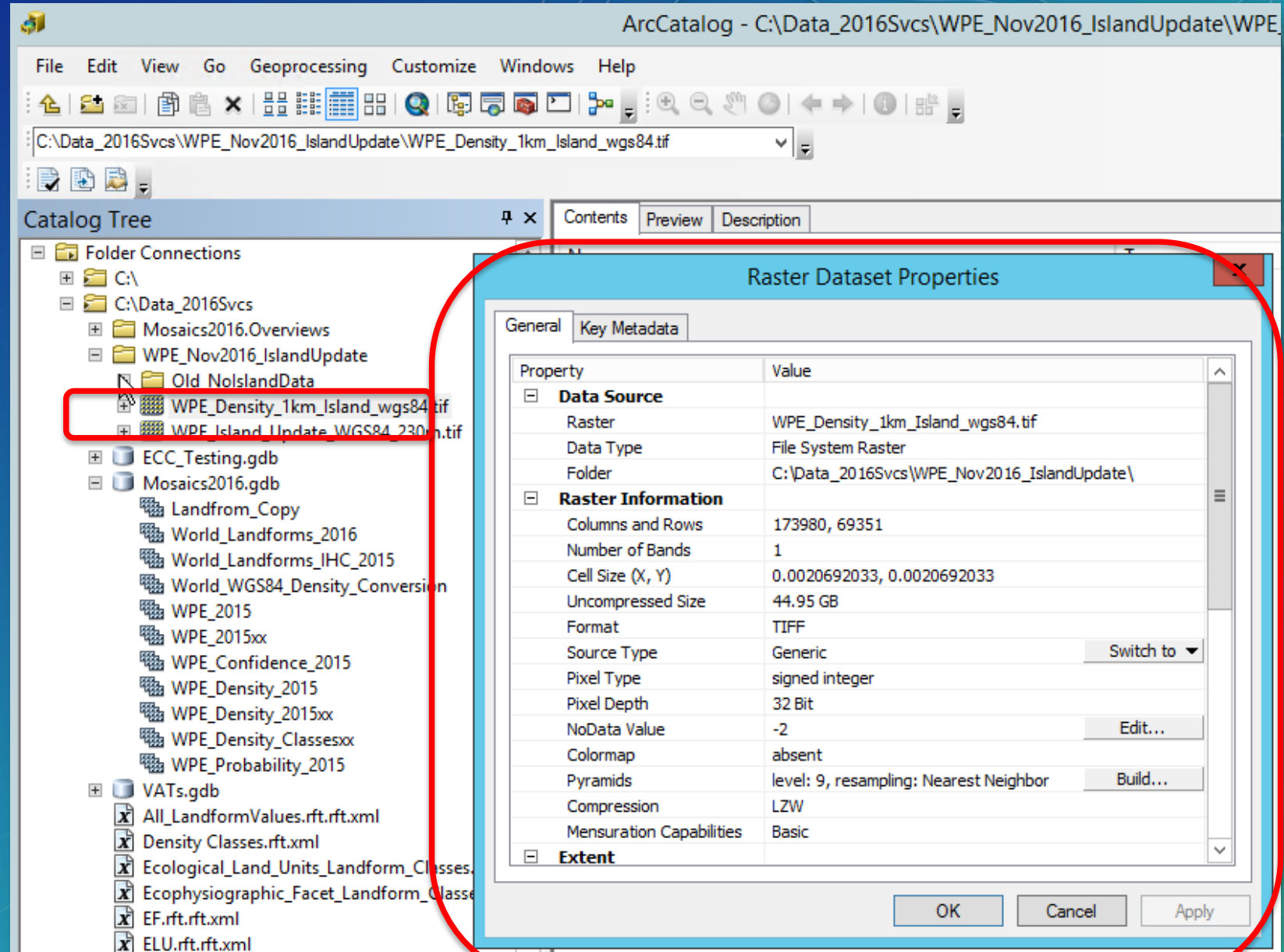


The screenshot displays the ArcCatalog interface. The title bar indicates the current workspace is 'C:\Data_2016Svcs\Mosaics2016.gdb\WPE_Density_2015'. The Catalog Tree on the left shows a hierarchical structure of folders and datasets. The 'WPE_Density_2015' dataset is highlighted with a red box. The Contents table on the right lists the datasets within the mosaic, with the first row highlighted by a red rectangle.

Name	Tag	OBJECTID	MinPS	MaxPS	LowPS
WPE_Density_1km_Island_wgs84	Dataset	1	0	22112.895623	230.342662736748
Ov_i02_L01_R000000000_C000000000.tif	Dataset	2	22112...	66338.68686818...	22104.2553281788
Ov_i02_L02_R000000000_C000000000.tif	Dataset	3	66338...	199016.0606045...	66239.6940660963
Ov_i02_L03_R000000000_C000000000.tif	Dataset	4	19901...	9950803.030227...	198391.162920734

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.

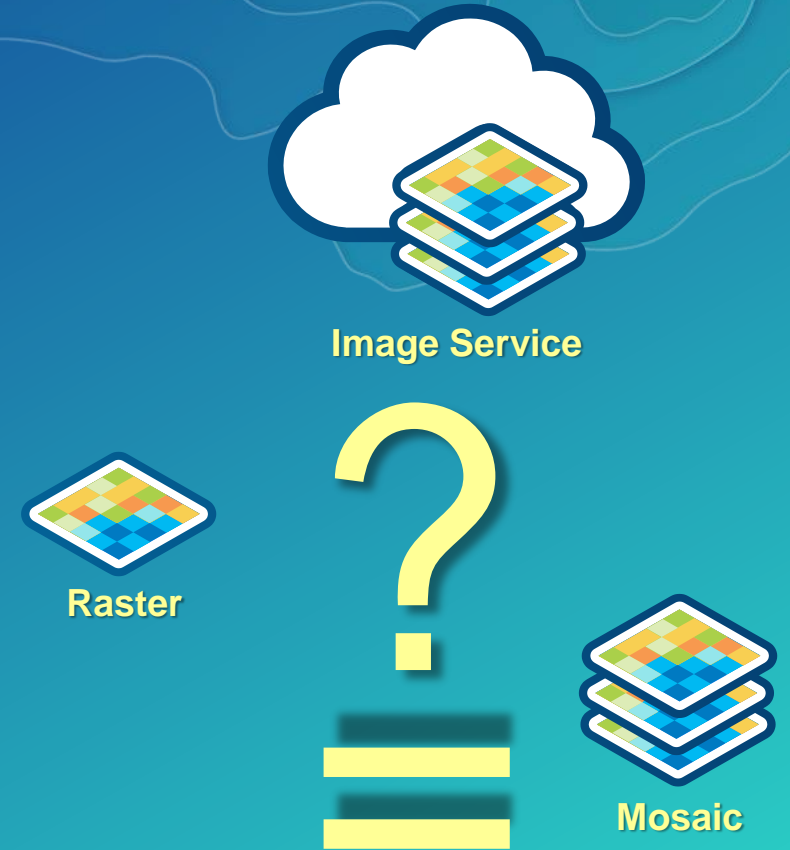


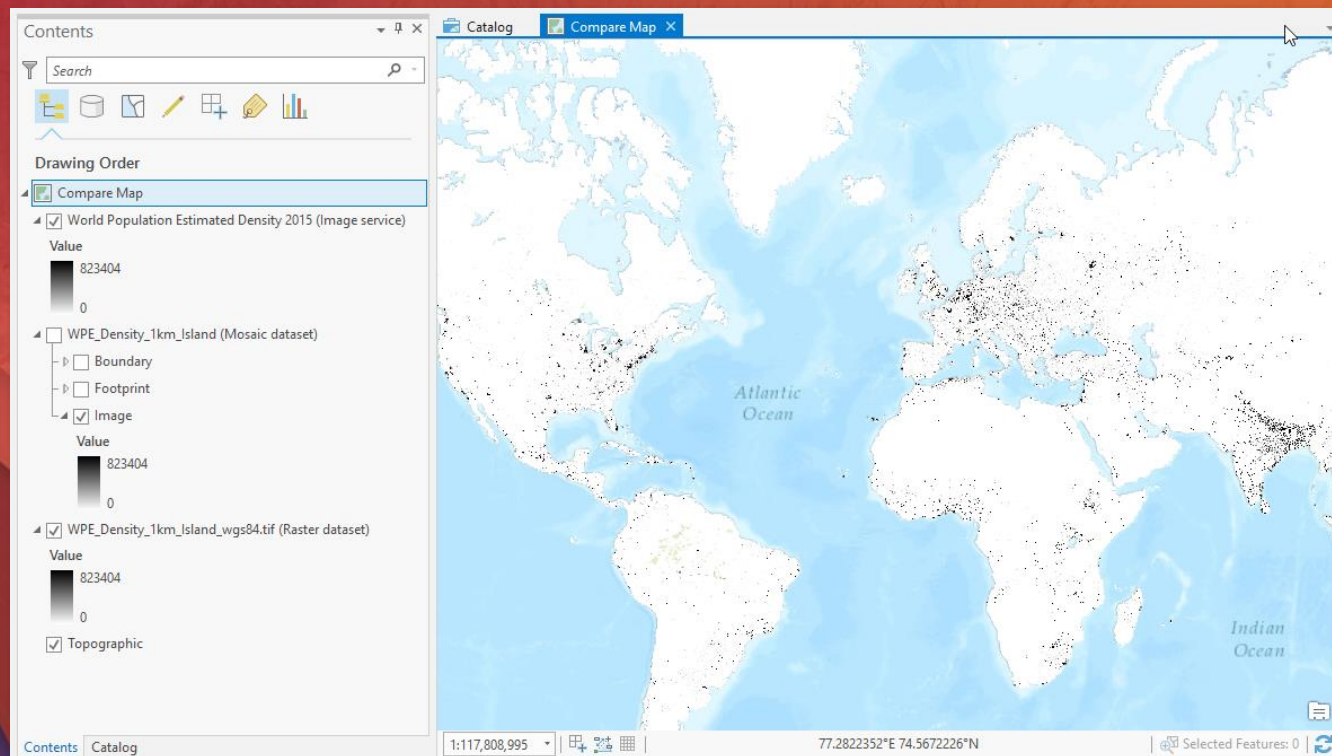
VS.



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.



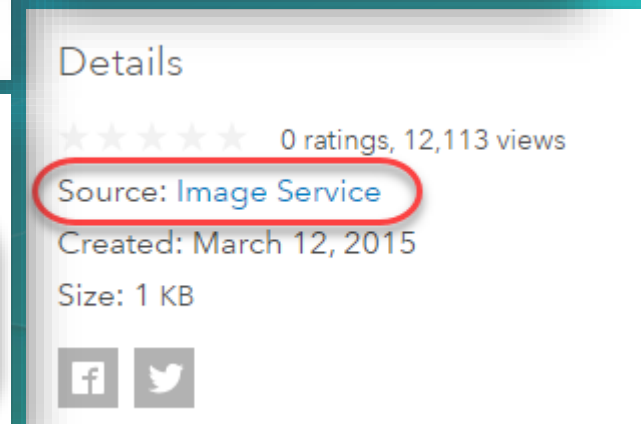
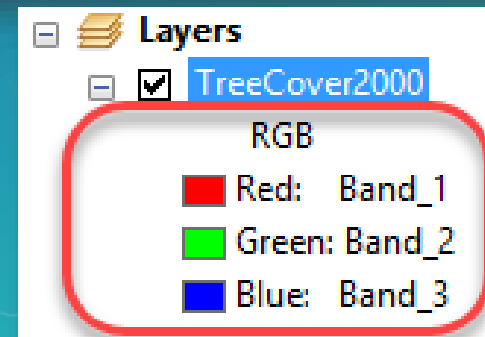
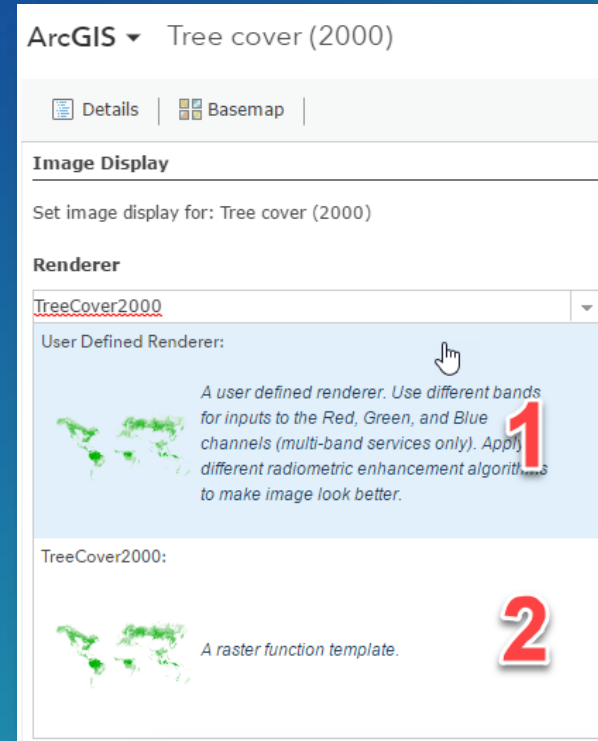


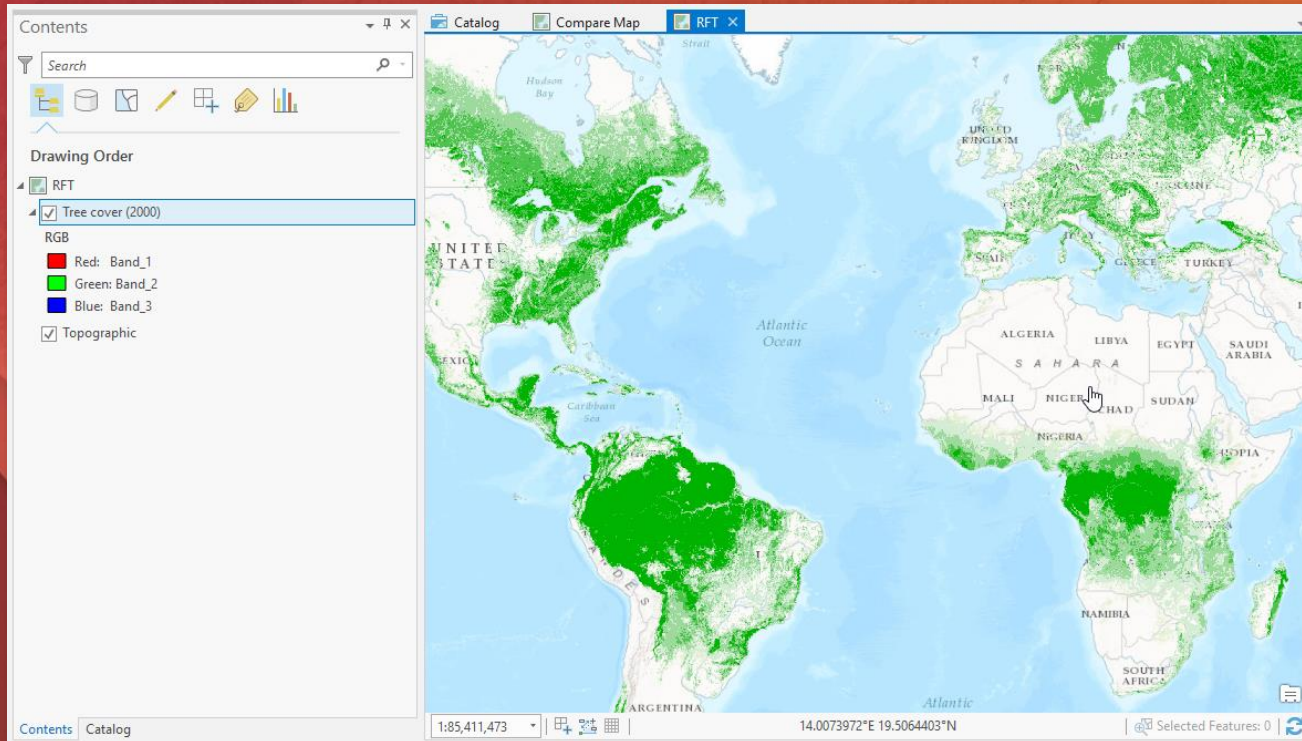
Compare a Raster to a Mosaic and an Image Service

How does the user experience compare?

Learn whether the Image Service has Data

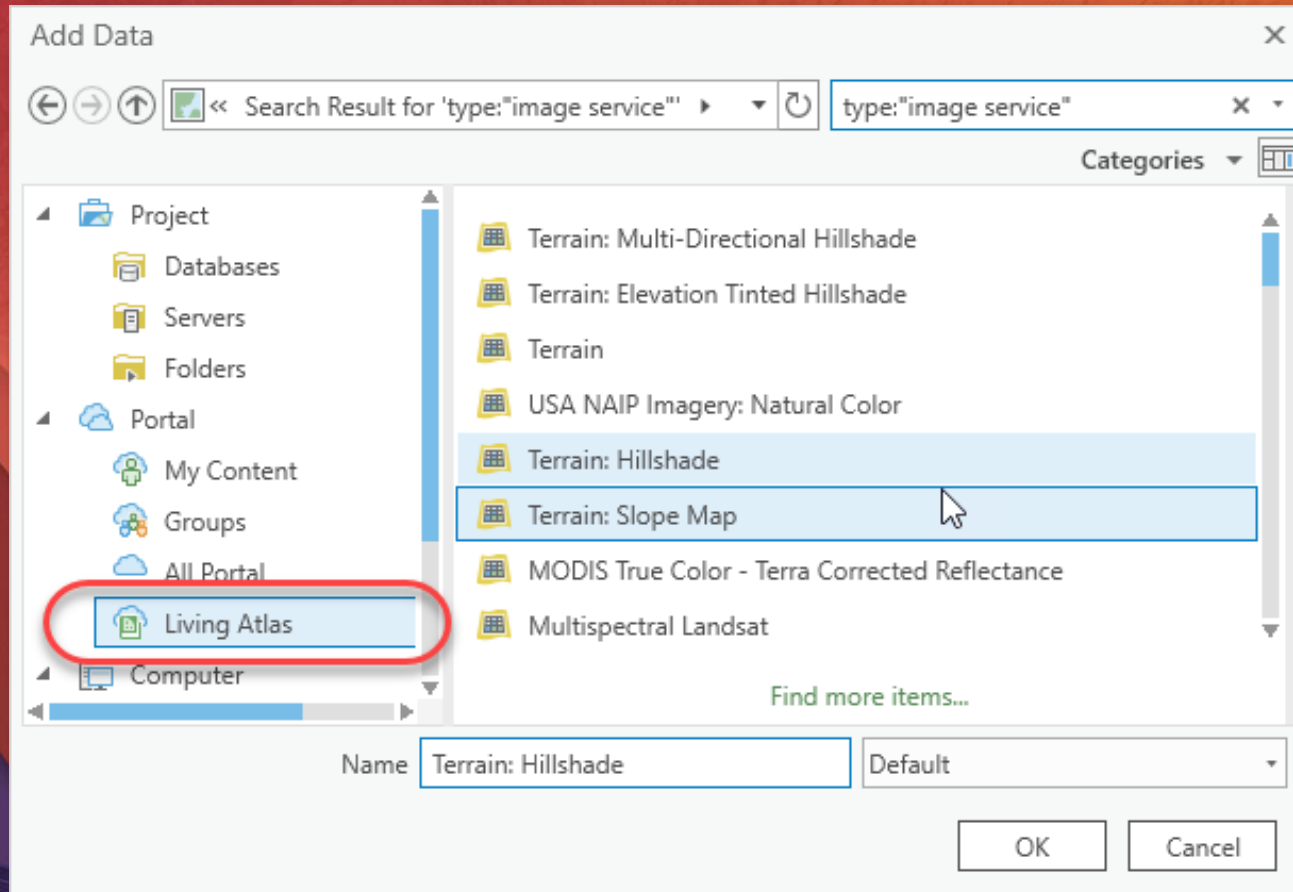
- In ArcGIS Online Search Results and the Living Atlas Image Services show as “Imagery Layers”
- Details Page shows Source as “Image Service”
- How to know if the data vs. RGB values is available
 - ArcGIS Online Image Display has two or more options
 - REST: two or more Raster Function Infos
 - Open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

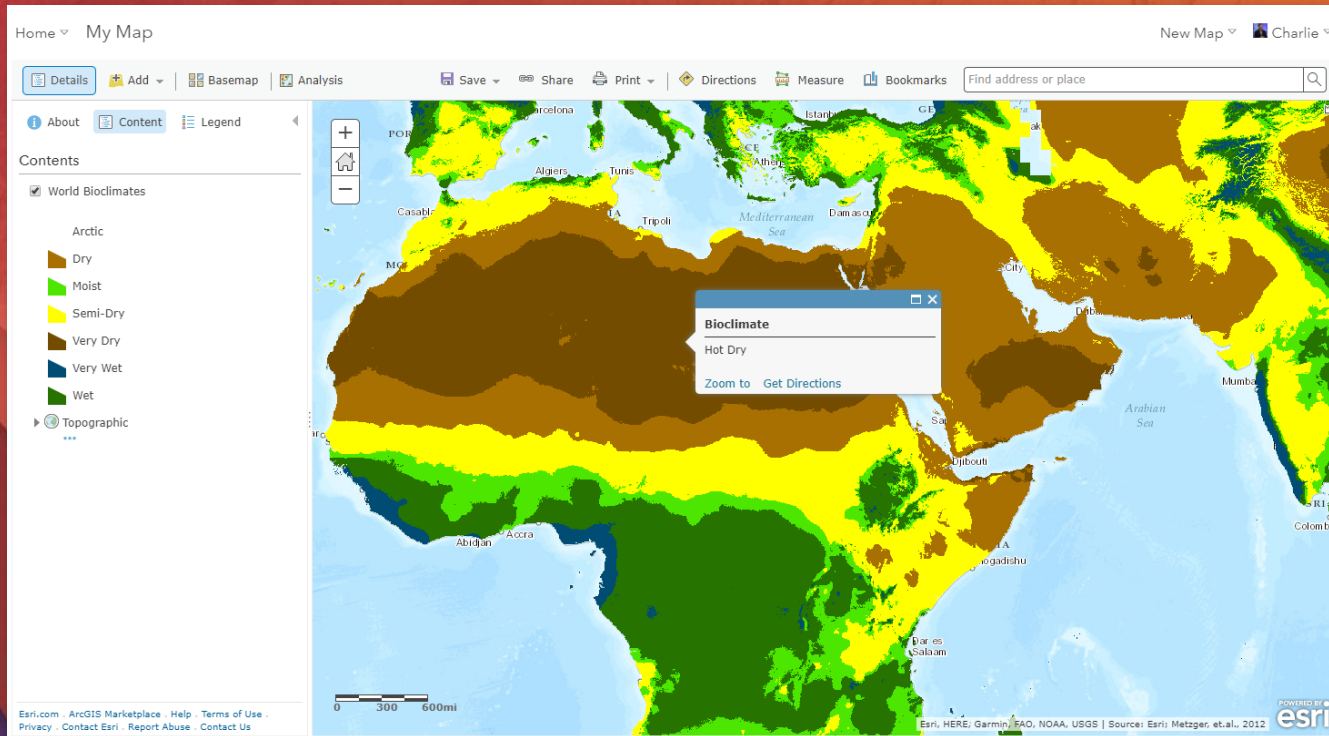
In a Browser or ArcGIS Pro

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

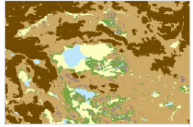
Green = Raster Layer Properties

Orange = REST URL only

Purple = Documentation only

World Ecological Facets Landform Classes

Overview



★ Add to Favorites

This layer classifies the global landscape into 16 classes of landform types and regions.

Subscriber Content

by **esri**

Last Modified: April 18, 2017

Imagery Layer

Description

Landforms are large recognizable features such as mountains, hills and plains; they are an important determinant of ecological character, habitat definition and terrain analysis. Landforms are important to the distribution of life in natural systems and are the basis for opportunities in built systems, and therefore landforms play a useful role in all natural science fields of study and planning disciplines.

Dataset Summary

Phenomenon Mapped: Landforms

Units: Meters

Cell Size: 231.91560581932 meters

Source Type: Thematic

Pixel Type: 8-bit unsigned integer

Data Coordinate System: WGS 1984

Mosaic Projection: Web Mercator Auxiliary Sphere

Extent: Global

Source: Esri

Publication Date: May 2016

ArcGIS Server URL: <http://landscape7.arcgis.com/arcgis/>

Open in Map Viewer

Open in Scene Viewer

Open in ArcGIS Desktop

Share

Details

★★★★★ (1) views: 4,232

Source: [Image Service](#)

Created: July 14, 2015

Size: 1 KB



Owner



Tags

[esri_landscape](#), [landscape7](#), [ecophysiography](#),
[landscape](#), [elevation](#)

Finding the properties of Image Services that Affect Analysis

Effect of Projecting Population Raster

Scenario: Project WGS_1984 World Population to several options

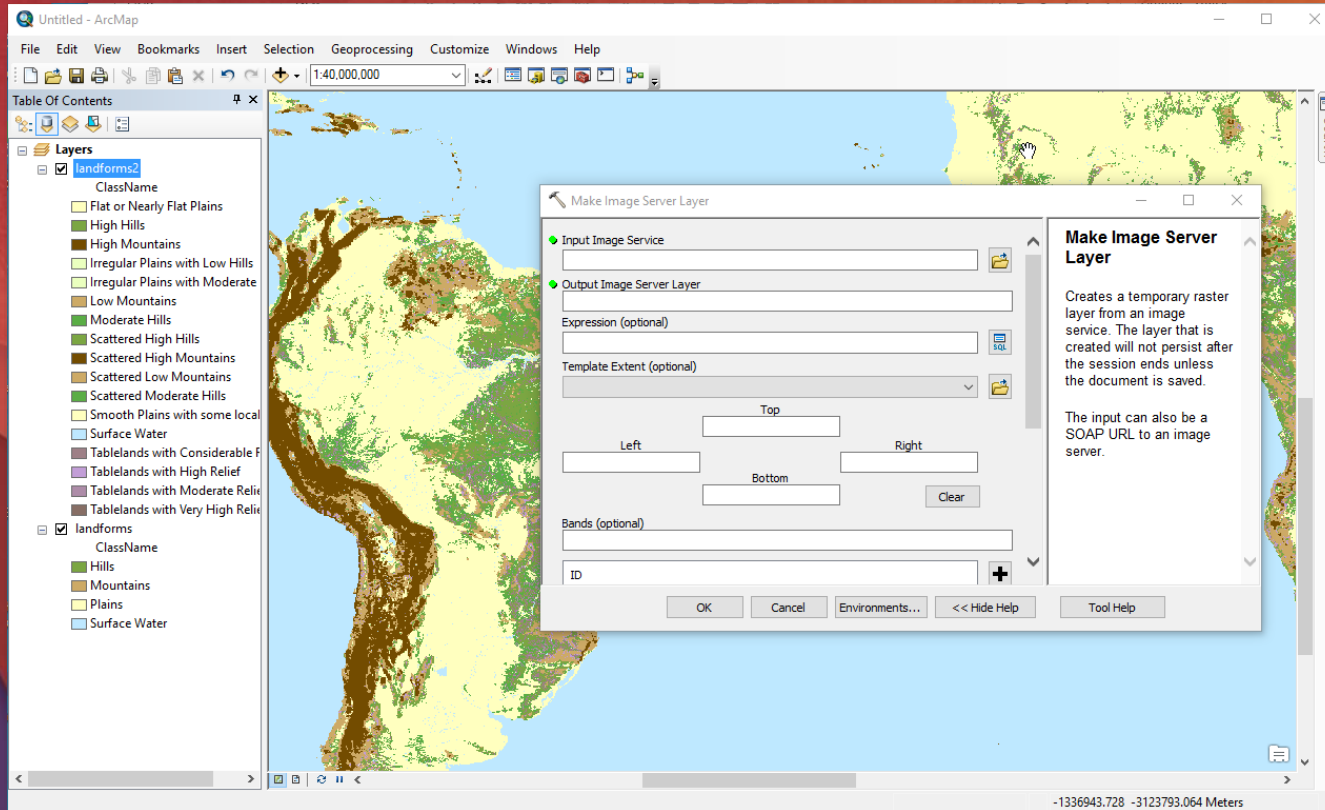
Coordinate System	Total Population	Percent Change	Resampling	Min Value	Max Value
(input) WGS_1984	7,126,379,999	N/A	N/A	0	331,383
Web Mercator*	8,583,012,071	20.44%	Nearest Neighbor	0	331,383
Mollweide	6,220,617,101	-12.71%	Nearest Neighbor	0	331,383
Equidistant Cyl.	7,106,069,816	-0.00285%	Nearest Neighbor	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

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

- 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



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

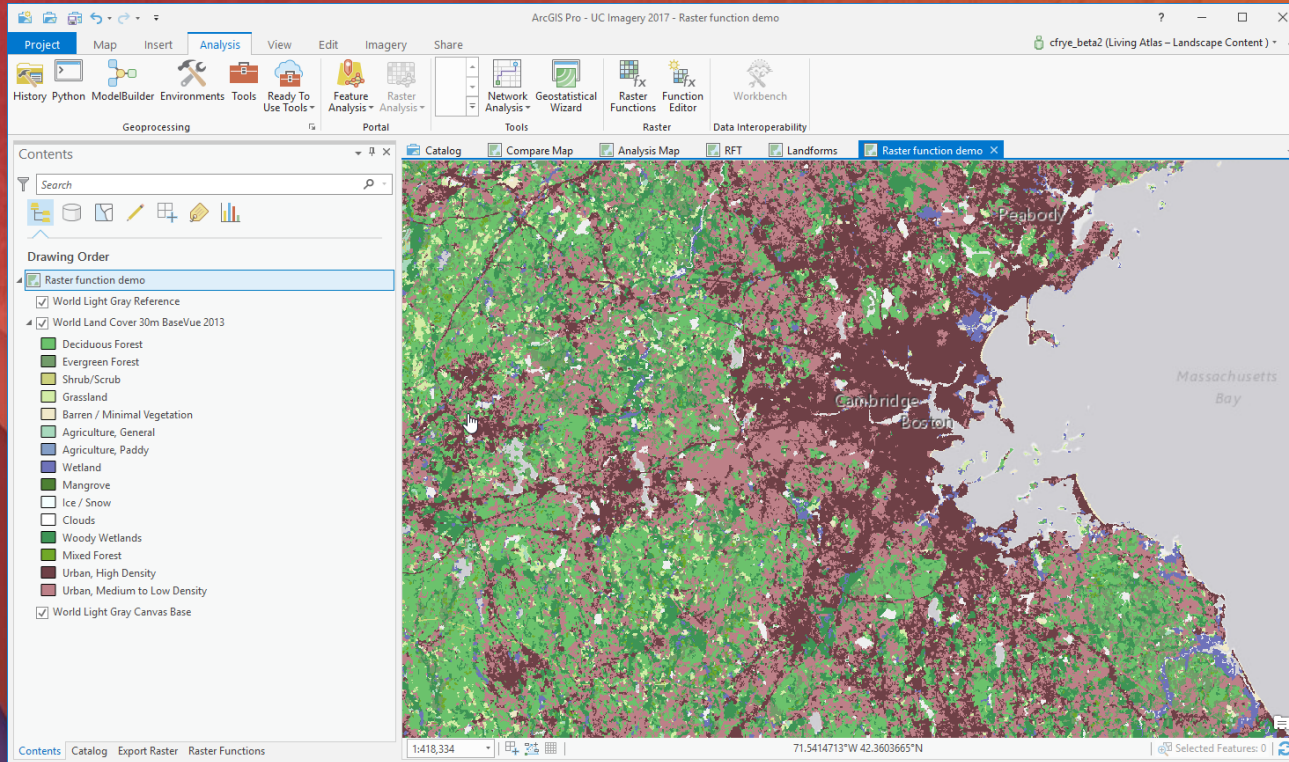
- Raster Statistics and Histograms:
 - Enable classified and unique values renderers
 - Improve experience for setting the stretch renderer.
- Why Calculate Statistics?
 - If no statistics calculated, bit depth determines default data range for symbolizing
 - Calculate Statistics tool is only way to 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

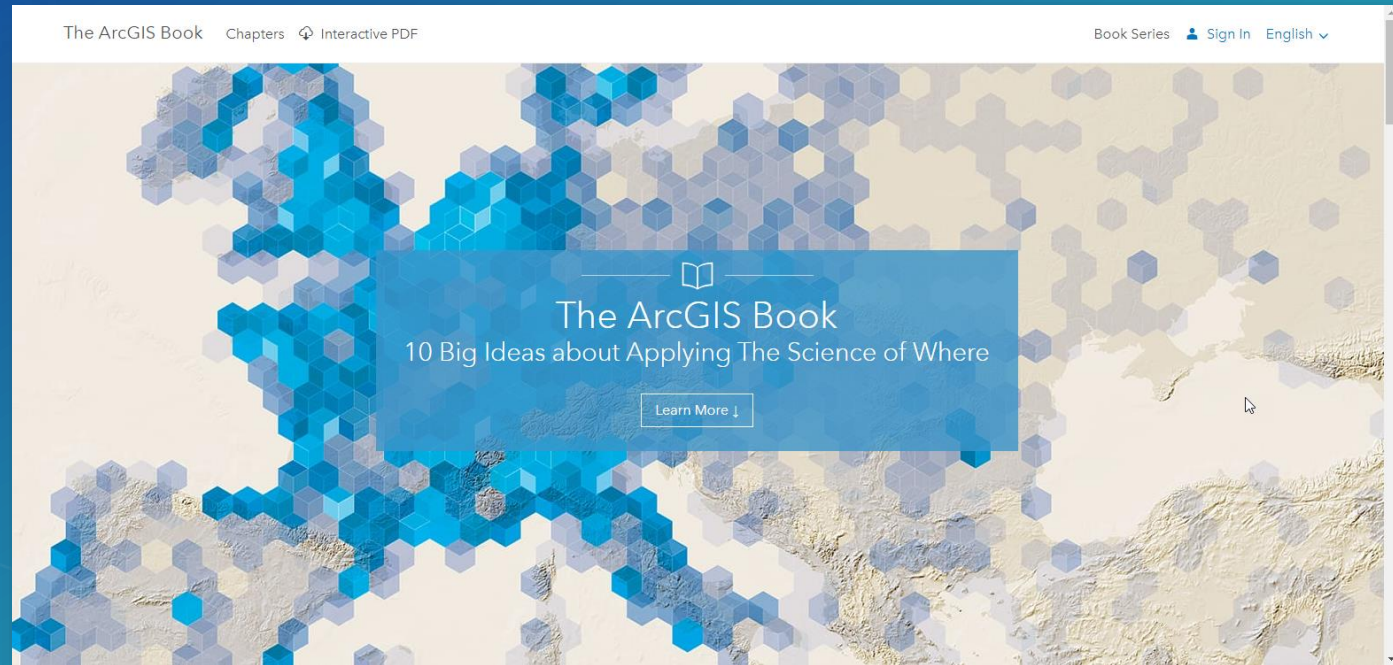




Raster Functions in ArcGIS Pro

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 SDCC 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"





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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>