

Exercise

Vegetation Analysis with ArcGIS Online

Section 2 Exercise 1

08/2017



Vegetation Analysis with ArcGIS Online

Instructions

Use this guide and ArcGIS Online to reproduce the results of the exercise on your own.

Note: ArcGIS Online is a dynamic mapping platform. The version of ArcGIS Online that you will be using for this course may be slightly different from the screenshots you see in the course materials.

Time to complete

Approximately 15-20 minutes.

Technical note

To take advantage of the web-based technologies available in ArcGIS Online, you need to use a fairly new version of a standard web browser, such as Google Chrome, Firefox, Safari, or Internet Explorer. Older web browsers may not display your maps correctly.

Note: For information on supported browsers for ArcGIS Online, visit <http://doc.arcgis.com/en/arcgis-online/reference/browsers.htm>.

Introduction

This exercise is designed to acquaint you with imagery from the National Agriculture Imagery Program (NAIP). This dataset, which is freely available, is collected over the United States at a 1m resolution. This imagery is designed for monitoring agriculture, so it is collected during the summer when the vegetation is full. Because of its high resolution, it often gets used for other purposes, such as determining storm water yields in urban areas. In addition to the visible bands (blue, green, and red), NAIP also has a near infrared band that is important for understanding the health of vegetation. Vegetation reflects near infrared energy strongly when it is healthy. An unhealthy plant is unable to reflect as much, and that energy gets absorbed.

When you are going through this exercise, you should focus on exploring different parts of the U.S. and trying to recognize patterns using the different band combinations and products. This exercise involves agricultural areas, but you should feel free to check out different cities or the desert areas.

Earth Imagery at Work

Using ArcGIS Online and Imagery for Vegetation Analysis

Step 1: Sign in to an ArcGIS Online organization

In this step, you will sign in to the ArcGIS Online organization for the *Earth Imagery at Work MOOC*.

- a Open a new Internet browser tab or window.
- b Go to www.arcgis.com and sign in to ArcGIS Online using the credentials provided at the start of this course.

Note: The Section 1 Exercise 1 PDF explains how to determine your ArcGIS Online credentials (username and password) for this course. If you have trouble signing in, email gistraining@esri.com for assistance.

Step 2: Create a new map

- a From the ribbon at the top of the ArcGIS Online window, click Map to start creating a new map.

Before making additional changes to your map, you will save it.

- b From the ribbon, click Save and choose Save As.
- c In the Save Map dialog box, in the Title field, type **BandComboMap**. Add an underscore and your first and last names so the map has a unique name.

Note: Because many other students are creating a similar map, adding your first and last name will ensure that you can find your map later.

It is also a good idea to add tags and other identifying information about the data, or metadata, to your items. This information will help you and others find this map, either in your organization or the general public, depending on how you want it shared. Tags also help group different types of items together, such as maps, map layers, or applications, so they can easily be searched.

- d In the Tags field, type **band combinations, EIAW**, and any additional tags you would like.

Note: Press Enter after each tag to save it in the Tags field.

- e If you like, you can add a summary description of your map in the next field. For example, in the Summary field, you could type **Exploration of imagery band combinations**.

Save Map

Title: BandComboMap_KevinButler

Tags: band combinations x EIAW x
[Add tag\(s\)](#)

Summary: Exploration of imagery band combinations

Save in folder: username_eiaw ▼

SAVE MAP CANCEL

- f Click Save Map.

Note: ArcGIS Online is a web-based platform; therefore, it is recommended that you save your map frequently.

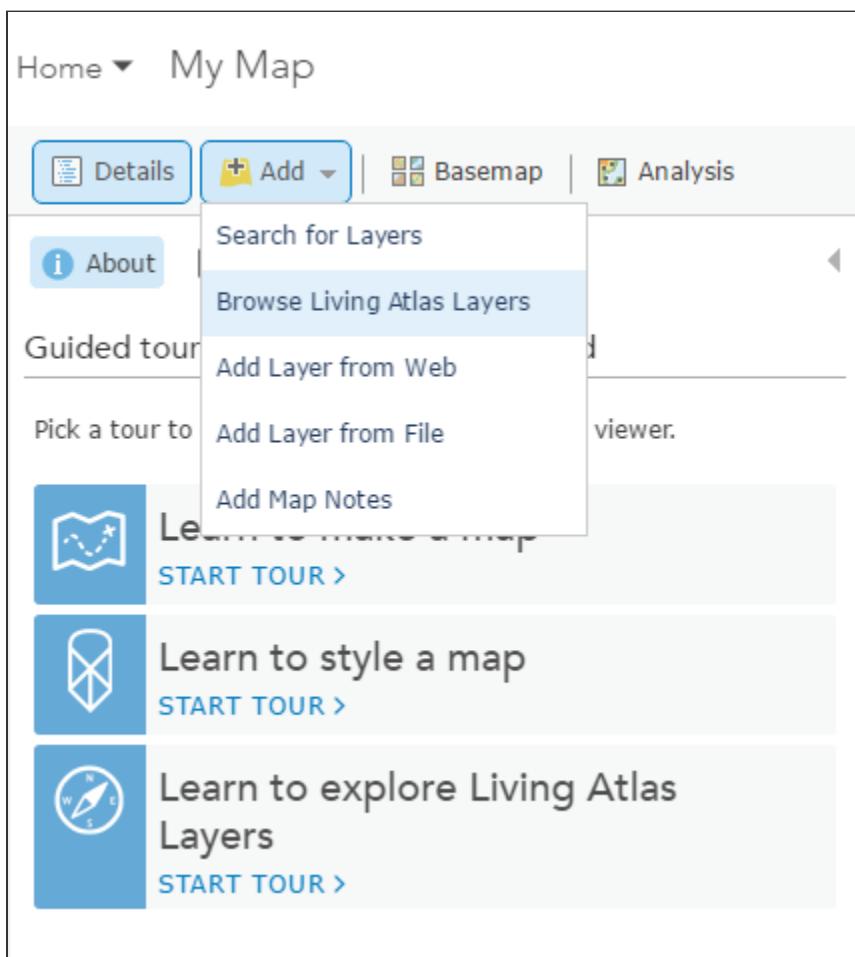
The map will be saved to your My Content collection, which contains all of the content that you have created in ArcGIS Online. You can access your My Content collection at any time.

Step 3: Add layers from the Living Atlas

Esri's [Living Atlas](#), available through ArcGIS Online, provides easy access to one of the largest highest-quality collections of ready-to-use geographic information that has ever been assembled. This collection is constantly growing and changing as Esri and the ArcGIS user community add or update maps, apps, and layers.

In this step, you will add layers from the Living Atlas to your map.

- a From the ribbon at the top of the window, click Add.



- b From the drop-down list, choose Browse Living Atlas Layers.
- c In the Categories drop-down list, choose Imagery, and then locate USA NAIP Imagery: Natural Color.

Browse Living Atlas Layers

Show Esri Layers Only Within map area

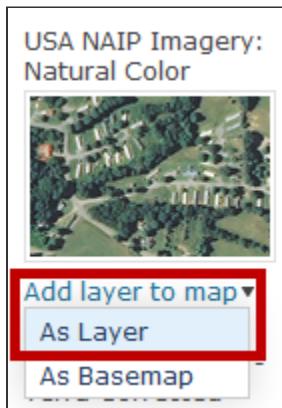
Imagery

World Imagery	Earth at Night	Multispectral Landsat	USA NAIP Imagery: Natural Color
			(circled)
Add layer to map ▾			

Recent GOES Weather Satellite	USA NAIP Imagery: NDVI	USA NAIP Imagery: False Color	MODIS True Color - Terra Corrected
Add layer to map ▾			

1 2 3 4 5 6 7

- d Beneath the thumbnail, click Add Layer To Map, and from the drop-down list, choose As Layer.

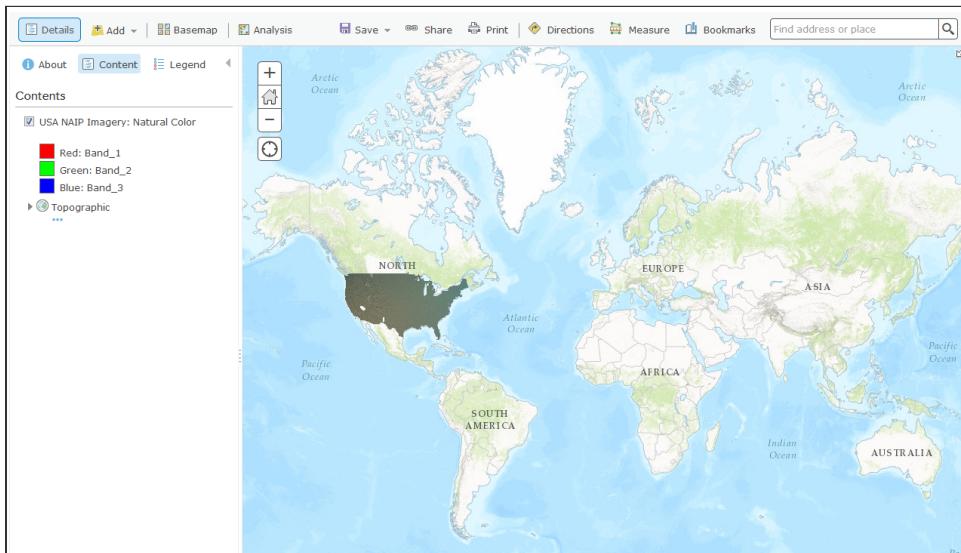


- e Click Close when you are finished.

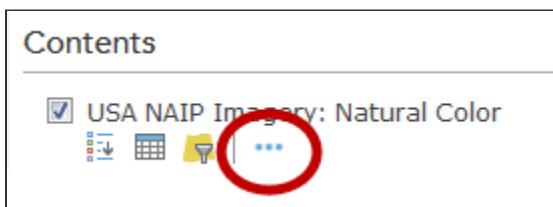
The layer is added to the map and now appears in the Contents pane.

- f In the Contents pane, click the name of the USA NAIP Imagery: Natural Color layer and examine the bands.

The imagery consists of three bands: Red, Green, and Blue.



- g In the Contents pane, pause your pointer over the USA NAIP Imagery: Natural Color layer name and click the More Options button.



- h From the drop-down list, choose Zoom To to zoom in to the layer.

Toward the bottom of the map, you can see the city of New Orleans, Louisiana.

- i Press Shift on your keyboard, click and hold your mouse pointer button down, and draw a box around New Orleans to zoom in to the city and its surrounding areas.



The map zooms in to the area and you can more clearly see the area's imagery. You will notice that the imagery displays in stripes.



This is normal for many kinds of imagery, and it is especially obvious over the water in this case. This is because the angle of the sun reflecting off of the water was effectively changing as the pilot flew over this area. Still, the imagery gives you a good sense of how wide the swath of the camera is.

- j) Zoom in closer to the city of New Orleans.



Hint: You can turn the imagery layer off by unchecking the box to the left of the layer name in the Contents pane to view place labels. After you have found the area that you are interested in, you can turn the imagery layer back on.

When you get out of the urban areas, the land quickly changes to farming, which is concentrated in narrow strips along the river. It's interesting that farms have this shape. Why do you think they are not square or more orderly?

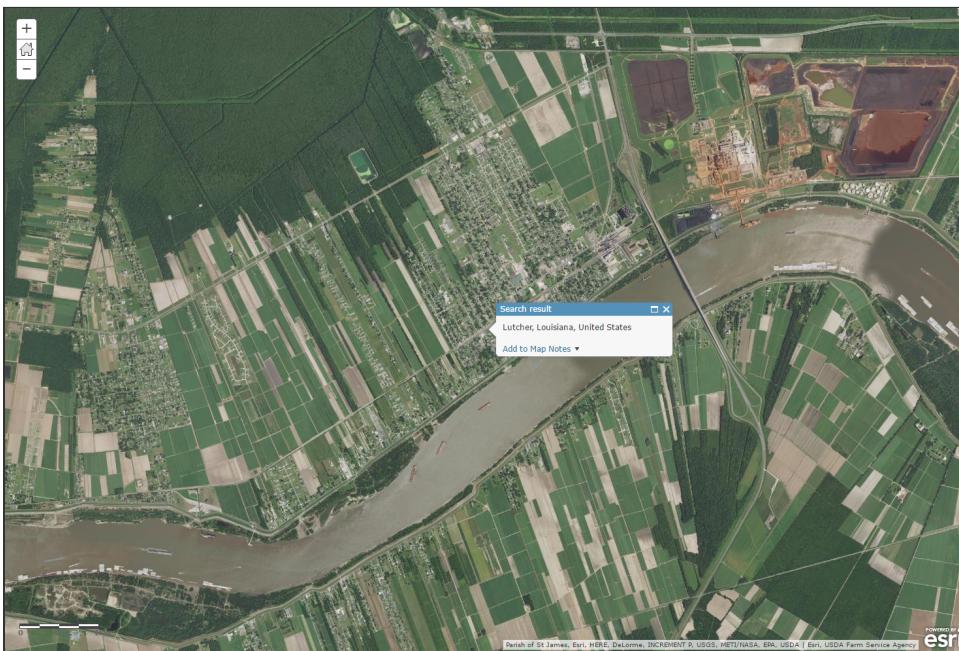
The river that flows through the city is the Mississippi River.

- k) Follow the Mississippi River up-stream (this will be west at first, but it soon turns north).
- l) Turn off the USA NAIP Imagery: Natural Color layer, and notice that as you move from the river and past the agricultural fields, the land here (which is a dark green on the NAIP imagery) is actually wetlands.

Although this area is less prone to flooding, it probably isn't as productive as the land immediately next to the river.

- m Turn the imagery layer back on, and use the search box at the top of the ArcGIS Online window to find the town of **Lutcher, Louisiana**.

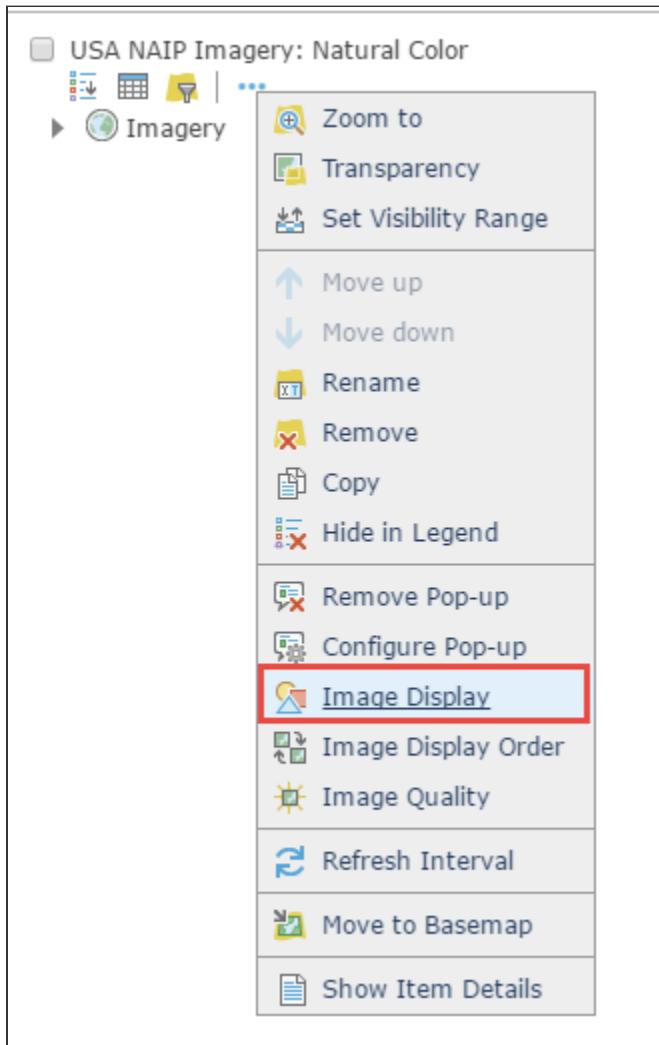
You can see what appears to be intensive agriculture along the river.



Now, you will look at the Near Infrared band and see what that shows you about agriculture in this region.

Vegetation reflects near infrared very strongly, especially when it is healthy. You can see that most vegetation is green because the plants and trees are reflecting that energy. Meanwhile, they are absorbing all of the blue and red energy that comes in. Although you can't see the near infrared with your eyes, sensors can detect these wavelengths fairly easily. In fact, **most digital cameras use a filter to keep infrared light out of photos** because photographers want the images to look like what people see with their eyes. If you perform an Internet search for "diy infrared camera," you can find many different tutorials showing you how to remove this filter.

- n In the Contents pane, pause your pointer over the USA NAIP Imagery: Natural Color layer name, and then click the More Options button.
- o From the drop-down list, choose Image Display.



- p In the Image Display pane, click the arrow to the right of the Renderer field to examine the options that are available in the drop-down list.

Image Display

Set image display for: USA NAIP Imagery:
Natural Color

Renderer

NaturalColor

User Defined Renderer:

A user defined renderer. Use different bands for inputs to the Red, Green, and Blue channels (multi-band services only). Apply different radiometric enhancement algorithms to make image look better.

NaturalColor:

Natural Color bands red, green, blue (1, 2, 3) displayed with fixed stretch.

FalseColorComposite:

Bands near-infrared, red, green (4, 1, 2) displayed with fixed stretch.

NDVI_Color:

Normalized difference vegetation index (NDVI) with color map. Dark green is thick vigorous vegetation and brown represents sparse vegetation.

A Renderer is the method of displaying the imagery based on the bands selected. You have several options. NaturalColor, which is composed of the Red, Green and Blue bands, is what

you have seen so far. This representation is close to what you would see if you were in the plane that collected the imagery. It is the default way of viewing the NAIP imagery. FalseColorComposite uses the Near Infrared, Red, and Green bands and is designed to show you where vegetation is healthy and vibrant.

- q From the Renderer drop-down list, choose **FalseColorComposite** and then click **Apply**.
- r Zoom in or out to examine the image.

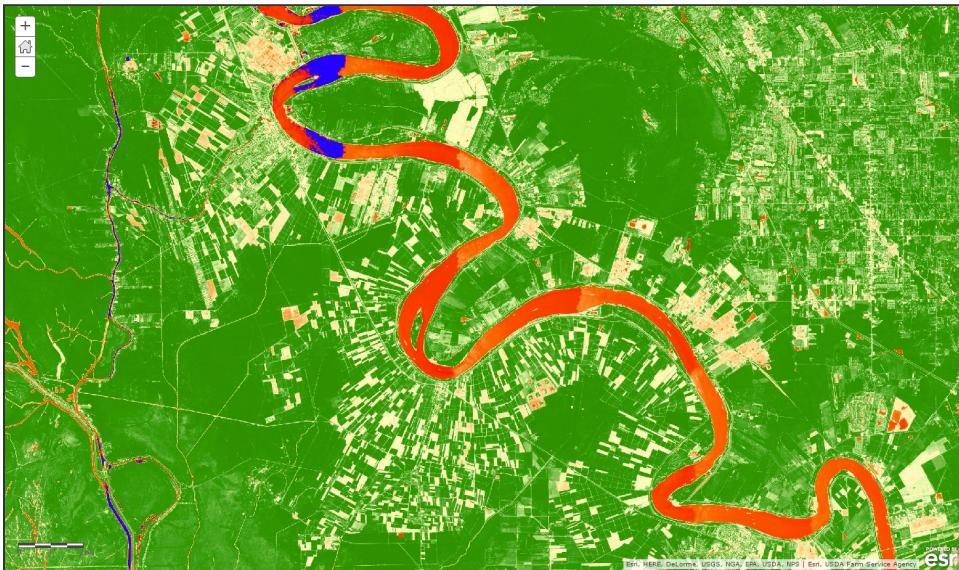
Now you can really see the patterns in the agriculture compared with the wetlands. The deeper reds are where the vegetation is strongest and thus reflecting near infrared energy the most. The white fields are probably fallow at this point or were just harvested. Water is also interesting in this scene. The Mississippi River just south of Baton Rouge has some color to it. This is due to either sediment or algae in the water, as well as the force that it is flowing with. The smaller rivers and streams that run through the wetlands are dark. This is what you normally expect of calm, deep water; it absorbs most energy wavelengths. Depending on how far you are zoomed in, the image may appear more or less intense. As you zoom out, you are actually viewing an overview of the imagery. Generally speaking, as you zoom out, you increase the likelihood that you will see clouds, which can skew the distribution of pixels because they are so bright. This can cause your imagery to look a little washed out compared to what you see below.



You can also use the normalized difference vegetation index (NDVI) to get a quantitative sense of how healthy the vegetation is.

- s In the Image Display pane, from the Renderer drop-down list, choose **NDVI_Color**, and then click **Apply**.

In this image, the deep greens represent healthy vegetation, blues signify no vegetation and reds symbolize light or sparse vegetation.



The United States is a huge country that changes its agricultural practices to suit the surrounding environment. Check out some other areas of the country, and let the rest of the MOOC students know what you find. [Here are several interesting places to get you started:](#)

- Malheur Lake, Oregon
- Salton Sea, California
- Little Hoover Island, Pennsylvania
- Unaka, North Carolina

Cities are also incredibly interesting to look at. Can you find any examples of urban farming?

Step 4: Sign out of ArcGIS Online

When you have finished exploring areas using various imagery band combinations, [you should sign out of ArcGIS Online.](#)

- a At the top of the ArcGIS Online window, click your name.
- b From the drop-down list, choose Sign Out.

Conclusion

In this exercise, you examined agriculture using the visual (Natural Color) and Near Infrared bands, and you also explored the patterns that you see in farming practices throughout the United States.