



Available Imagery Resources for FHP Image Interpretation and use with Scoot and Sketch

Introduction

There are a variety of imagery resources available to the Forest Service that can be leveraged and used when evaluating and documenting conditions on the forest. It is important to know where these resources are, how to use them, and their limitations. This document will illustrate what remote sensing resources are available to Forest Service personnel and how to use them for forest health and monitoring.

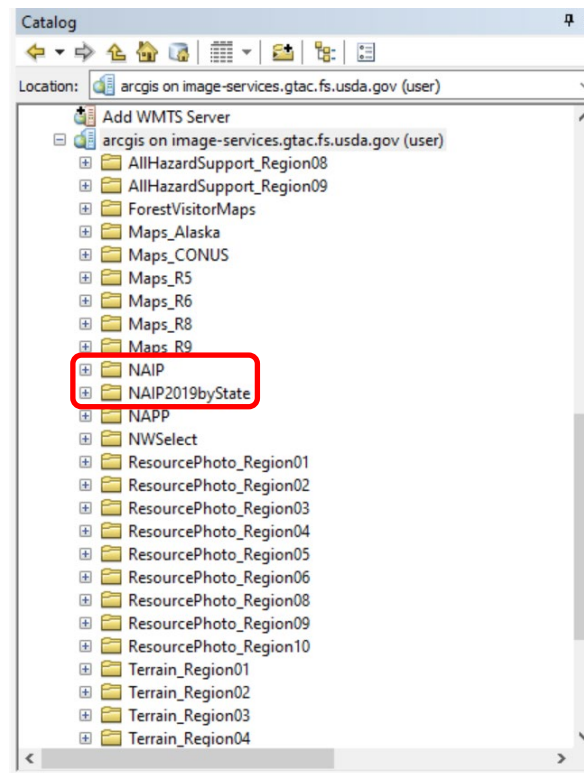
Image Resources

A. GTAC Image Services

The Geospatial Technology and Applications Center (GTAC) publishes a large variety of imagery and data that can be accessed via ArcMap. Historical, NAIP, Resource, and regularly collected imagery from satellites such as Worldview can all be found within this service. If you are interested in having data hosted as a GTAC image service, email SM.FS.GTAC@usda.gov.

1. Connecting to the Image services
 - a. The following quick connect guide will walk you through how to sync your instance of ArcMap with GTAC image services, where you can discover a broad range of imagery sources: [Quick Connect Guide](#). These image datasets could be used as background imagery in your scoot and sketch process.
2. Finding pertinent imagery for your project area within the Image Services
 - a. After connecting to the image services in ArcMap, you will need to navigate to the imagery that will be relevant to your project area.
 - b. For example, to find NAIP imagery for your area navigate to either one of the NAIP folders within the ArcCatalog window (see below).





- c. Within the “NAIP2019byState” folder, files will be labeled with their associated state abbreviation.
 - d. If you do not see your state within this folder, you will need to navigate to the “NAIP” folder. NAIP imagery is organized as a mosaic dataset for all states collected that year. If you don’t know the year your state was flown, you may need to sequentially add each NAIP year until the imagery includes your state or project area.
 - e. Imagery from other sources, such as WorldView, will often be found within one of the “ResourcePhoto_Region[XX]” folders.
 - f. If you can’t find the imagery that you are looking for or need, contact your Imagery Team Leader, Forest Health Monitoring Coordinator or Remote Sensing Coordinator.
3. Turning off the image “cache”
 - a. All images within GTAC’s image services are compressed or “cached” so that the imagery can be quickly loaded into ArcMap and can be panned around without excessive reload times. **Although caches decrease reload times, the cache decreases the resolution of the imagery and prevents you from changing band combinations.**
 - b. Once you have panned to your area of interest, it is recommended to turn off the cache so that you can view the imagery in its best resolution and enable you to view different band combinations.
 - c. Once you have added the imagery service of interest and panned to your project area, right click the layer in the Table of Contents and select “Enable Cache View Mode.”
 - d. The display should refresh and you will be able to view the native resolution of the imagery and adjust band combinations.

- i. Caution: This may cause the refresh time of the imagery after panning to increase significantly
4. Additional information on GTAC's Image Services can be found on GTAC's website: <https://apps.fs.usda.gov/gtac/products#imageservices>.

B. DigitalGlobe/Maxar ImageConnect for ArcMap

Another resource available to the Forest Service is imagery collected by Maxar – previously DigitalGlobe. Maxar is a company with a collection of satellites with varying image characteristics that can collect up to 1.3 m resolution every 5 days. Additional information about the characteristics of the imagery collected by their other satellites can be found here:

<https://gisgeography.com/digitalglobe-satellite-imagery/>.

Most of you will have either acquired DigitalGlobe imagery, like WorldView-2/3 through [EarthExplorer](#), or by putting in a request through the [CIDR tool](#) to task the satellite(s). Once in hand, this imagery can be hosted by GTAC's Image Services but could be available (with proper credentials, see below) using Maxar's Image Connect Add-in for ArcMap; however, this tool may not contain all available imagery for a given location. It seems that the only complete archive of DigitalGlobe imagery is available through <https://discover.digitalglobe.com/>.

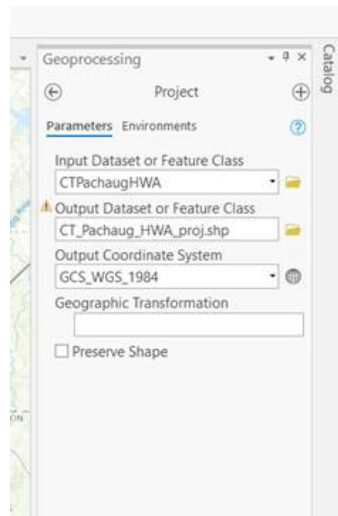
1. Getting EV WebHosting account (before you can access the ImageConnect Add-in)
 - a. To utilize this Add-in, you will first need to request a DigitalGlobe EV WebHosting account by filling out the following form: <https://evwhs.digitalglobe.com/myDigitalGlobeAdmin/RegistrationRequest.html>
 - i. NOTE: It may take several days for you to gain approval
2. Accessing the ArcGIS ImageConnect Add-in
 - a. To directly access Maxar image library from ArcMap, you will need the ImageConnect Add-in. To include the Add-in to your ArcMap, follow the instructions within this hyperlink: https://gcs-docs.s3.amazonaws.com/EVWHS/Miscellaneous/ImageConnect/IC_GettingStarted.htm
3. Navigating and exploring ImageConnect
 - a. Maxar has developed resources to help users navigate and explore the imagery that is made available through ImageConnect. Those resources can be accessed here: https://gcs-docs.s3.amazonaws.com/EVWHS/Miscellaneous/ImageConnect/IC_SearchDiscovery.htm
 - b. The default imagery provided by the ImageConnect Add-in is a mosaic of cloud free images with varying date ranges.
 - c. When you zoom into a zoom extent that allows you to view available imagery (i.e., ~1:65,000) organized by the date they were collected, your Table of Contents will be flood with imagery collected by Maxar that is within the geographic extent of your screen.

- d. You will need to filter through the imagery to find an image that meets your needs (cloud-free, clear, suitable date, etc.). If you have requested new imagery through the CIDR tool and had the imagery acquired, you will be able to find it via ImageConnect. To learn how to request new imagery through the CIDR tool, refer to the CIDR tool user guide:
https://fsapps.nwcg.gov/gtac/CourseDownloads/Training/Remote_Sensing/ORSI/Tutorial/story_content/external_files/CIDR_ug.pdf
 - i. The imagery that populates the Table of Contents cannot be enhanced or processed beyond adjusting the transparency.
 - ii. In order to perform any type of raster geoprocessing or access the other image bands from Maxar imagery, you will need to add the image to your ImageConnect library, download the images, and add the downloaded images into your ArcMap instance. Instructions for how to perform this step is outlined in this link: https://gcs-docs.s3.amazonaws.com/EVWHS/Miscellaneous/ImageConnect/IC_Images.htm.
- e. NOTE: Imagery is typically able to be viewed in ImageConnect and downloaded 2.5 hours after it has been acquired. This includes any imagery collected by request through the CIDR tool.

C. Finding and Downloading Archival High-Resolution Imagery

The most complete Digital Globe archive is available at <https://discover.digitalglobe.com/>. Once the Image ID is acquired for an image you would like to acquire, it can be downloaded from <https://evwhs.digitalglobe.com/> (recall, you will need login credentials, see Part B Step 1). Below are the steps to find and download archival high-resolution imagery from these portals:

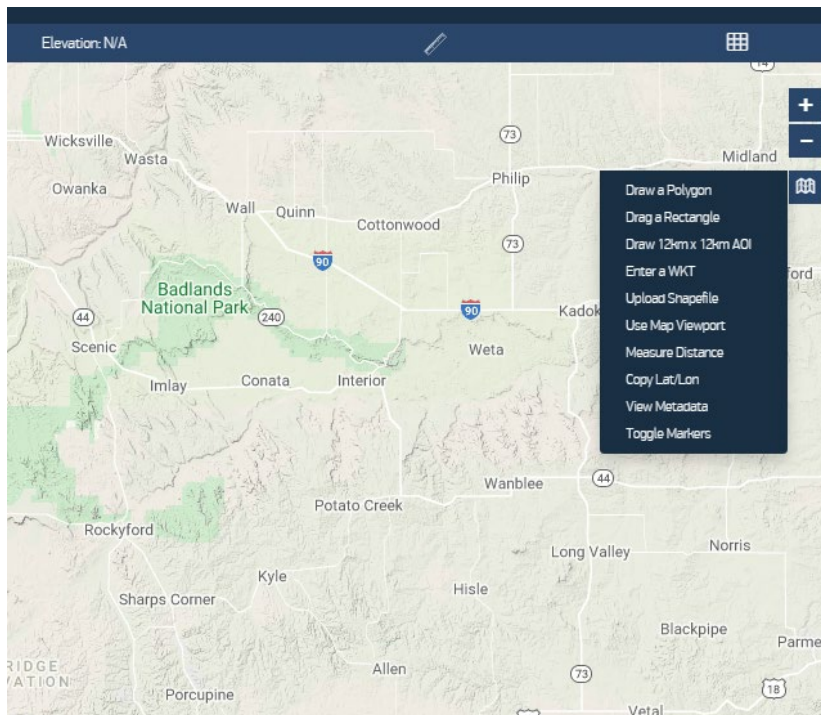
1. First you need to create a shapefile for each individual AOI you want imagery for (i.e., each polygon needs to be its own shapefile).
 - a. Shapefiles need to be unprojected, but with the appropriate coordinate reference system for use in both Discover and EVWHS. The easiest way to do this is with the “Project” tool in ArcMap or ArcPro. The output coordinate system should be set to: **Geographic coordinate system > World > WGS 1984**. The tool should look like the image below.



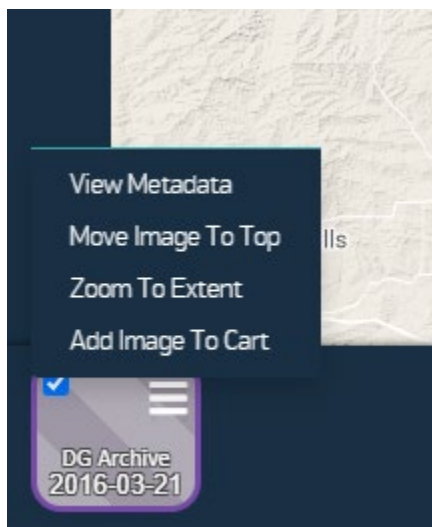
- b. Once the shapefile is created and exported; the individual files need to be in a zipped folder with a .zip extension.
2. Navigate to <https://discover.digitalglobe.com/> and upload your zipped shapefile to the portal by clicking on Area of Interest > Upload a Shapefile/KML.
3. The toolbar will populate with available imagery, which can be filtered with options in the Filters dropdown menu.
4. Once you find an image that you would like to download you can click on the + sign next to it. Copy the Image ID into a Word Document. Repeat this for all images you would like to download.

Source	Collected ▼	Area Clouds	Area Off Nadir
<input checked="" type="checkbox"/> WV03	2020-03-14	0.0%	26.1°
<div> <div>Image ID: 1040010059A63400</div> <div>Image Clouds: 0.0%</div> <div>Image Off Nadir: 26.7°</div> <div>Bands: 8-BANDS</div> </div> <div> <div>Max GSD: 0.38m</div> <div>Sun Elevation: 43.3°</div> <div>Max Target Azimuth: 261.3°</div> <div>Browse: view</div> </div>			

5. Once you have all the Image IDs you need, you can log into <https://evwhs.digitalglobe.com/>.
6. First, upload the same AOI shapefile that you used previously. This can be done by clicking on the folded map icon on the right side of the screen and then selecting Upload Shapefile.

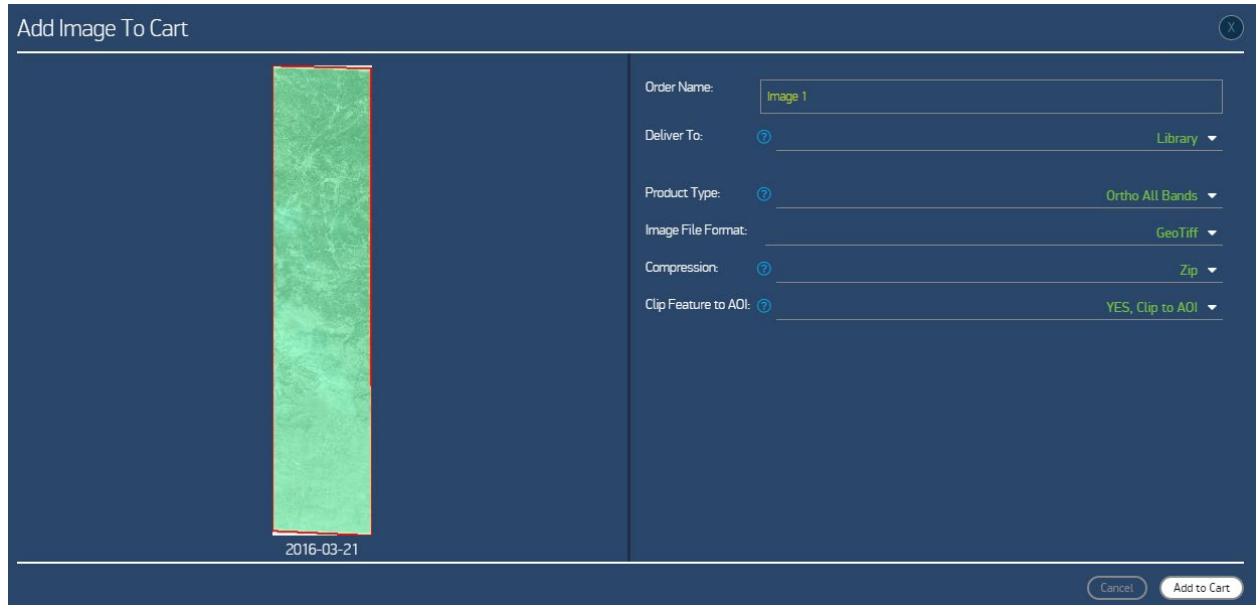


7. Copy the first Image ID and paste it into the search bar at the top left of the screen. The viewer will automatically navigate to the image.
8. At the bottom of the screen, a thumbnail will appear with the DG Archive data. Hover your mouse over that image until 3 bars appear in the top right-hand corner. Click on this and select Add Image to Cart.

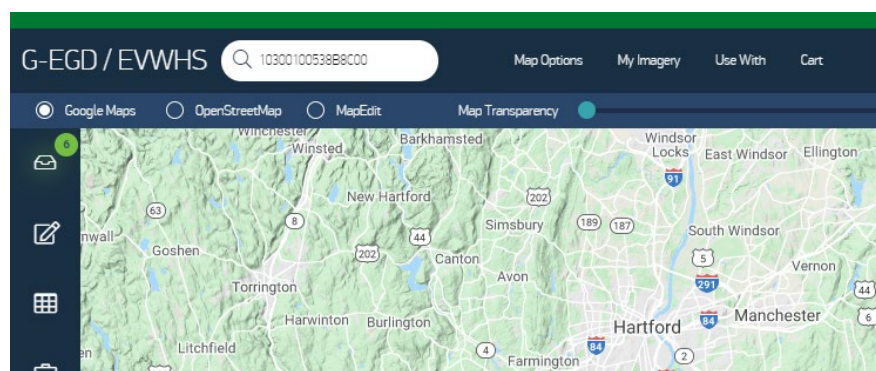


9. In the popup menu, enter an Order Name and set the other sections as needed, making sure that the image is delivered to your library, in GeoTiff format, and as a .zip file. It is also

suggested to select Ortho All Bands as the product type, but a specific project may have other requirements:

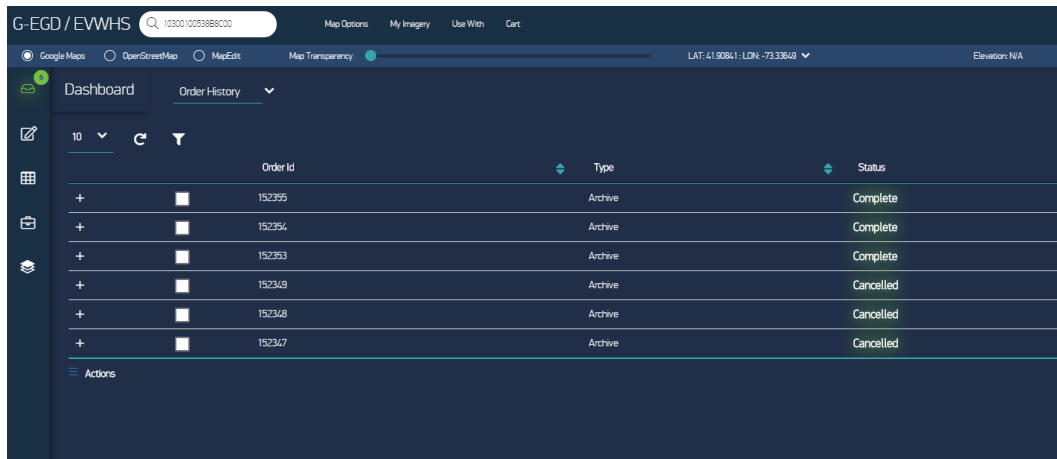


10. Under, Clip Feature to AOI you can either select “NO, Order Full Strip” or “YES, Clip to AOI” depending on your project. If you select clip it to AOI, the image will be clipped to the shapefile that you previously uploaded.
11. Once you add all the images to your cart (you can only request 600 GB of imagery at a time, which is ~ 75 full scenes), you can click on the Cart button at the top of the screen, and then select Cart from the dropdown menu.

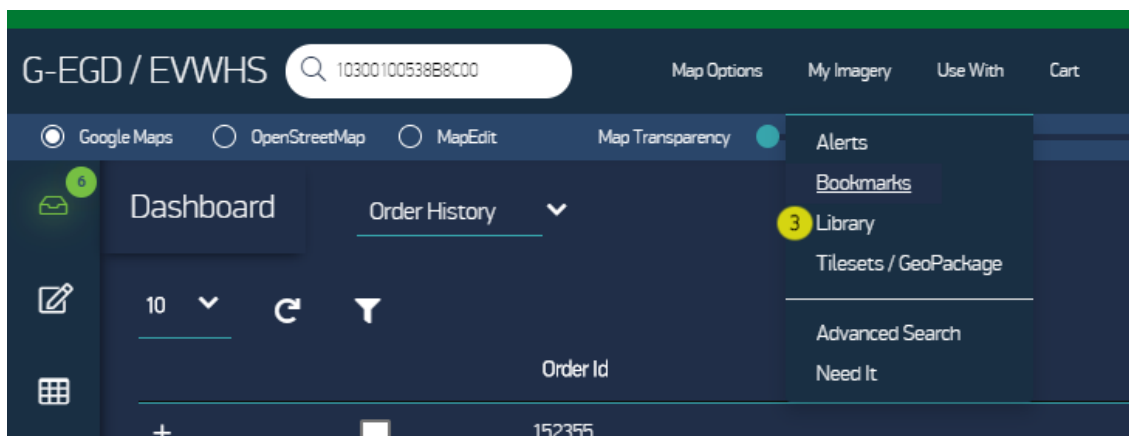


12. Make sure all the images have a blue checkmark next to them, and then select Submit Order(s). This will submit your order to the Queue. You will then receive email updates as the imagery progresses through the queue. The more images in the queue, the longer it will take for your images to become available for download. With 15 images in front of a recent request, it took about 8 hours from submitting the request until the image was available for download.

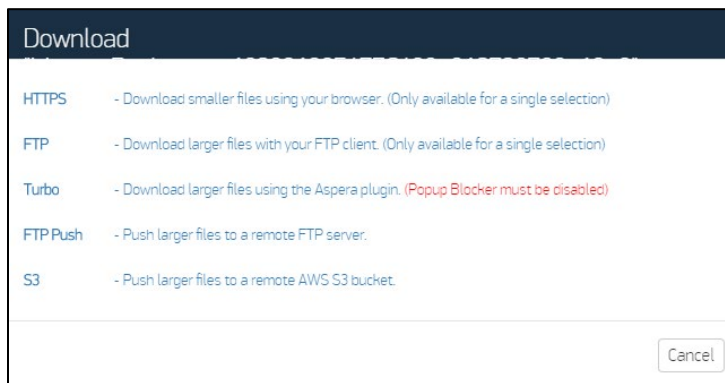
13. To check the status of your order, you can click on the box icon on the left of the screen – which should have a green circle with the number of orders in it. In the popup menu, select Order History from the drop-down menu.



14. To check where the images are in the queue you can click the My Imagery drop down menu at the top of the scene, and select Library.



15. Once you receive an email that your images are available for download, you can download them from the library. It seems that the easiest way to download the imagery without error, is to download each image one at a time. Click on the empty box next to the image you want to download and click download at the bottom of the popup. A new window will open with several download options. Click on the FTP option and then on Download Using Browser in the new popup window. This will start a new download and it will ask where you want to save the file before it begins. Repeat this step for all images.



General Tips and Tricks for Image Interpretation

Interpreting features from imagery is a subjective process that can vary from user to user. There are some helpful attributes of imagery that, if interpreters are aware of, can help make interpretation easier and vary less from user to user.

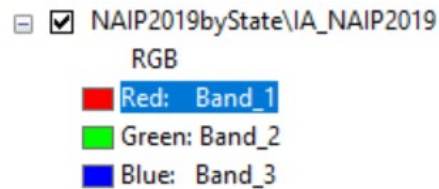
Generally, there are seven characteristics of features in an image an interpreter can notice to help identify or classify objects. Those characteristics are size, shape, tone/color, texture, shadow, association and pattern. The importance of any characteristic can depend significantly on the scale of the imagery and the properties of the features of interest.

The following self-paced tutorial will provide helpful advice on how to use these characteristics and how they relate to manual digitization: http://fsweb.gtac.fs.fed.us/training-site/tutorials/Fundamentals%20of%20Image%20Interpretation/story_html5.html?lms=1

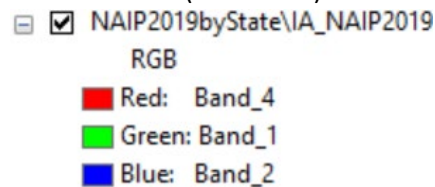
Adjusting the band combinations from imagery can also be very beneficial for bringing out differences of features of interest to make interpretation easier. Multispectral imagery is collected using a sensor that can record information from the earth's surface in wavelengths other than just the visible (R, G, B – the wavelengths humans eyes are sensitive to). You easily adjust the band combinations in ArcMap on un-cached imagery. The following will take you through how to view false color near-infrared (NIR) NAIP imagery from the GTAC image server. Additionally, you can refer to GTAC's "Band Combination Cheat Sheet" (found here: <https://fsapps.nwcg.gov/gtac/CourseDownloads/Reimbursibles/FY20/FHM/Day2/Track3/BandComb oCheatSheet.pdf>) to quickly reference helpful band combinations from commonly used image sources.

False color imagery is great for observing differences between vegetation types, vegetation health, and presence of vegetation. It is important to keep in mind when viewing false color NIR imagery is that the redder an object is, the more photosynthetically active the object is.

1. After un-caching the NAIP imagery using the steps outlined above, you will be able to access the NIR band.
2. By default, the NAIP imagery will be displayed as true color where the red band will use the first band of the NAIP imagery, green will use the second, and blue will use the third (see image below)



3. For false color NIR imagery, the bands will need to use the fourth, NIR band, for the red band, band 1 for the green and band 2 for the blue (see below).



4. To do this, *left click* on the red square to the right of the “Red: Band_1” located beneath the NAIP layer.
5. A drop down menu will open up and display the four image layer options.
 - a. If the image is still cached you will not be able to adjust these image layers.
6. Select the “Band_4” option.
 - a. This will cause ArcMap to refresh the screen and may take several seconds.
7. You have just adjusted the first image layer. Do this for the green band and the blue band so that it is similar to the image above.
8. Pan around the image and notice the differences between different vegetation species and objects to gain familiarity with the NAIP false color NIR imagery.
9. Most other image sources (i.e. Maxar) will also have a NIR band to create a false color NIR image but there layers may be numbered differently. You will need to reference the image source, metadata, or someone familiar with the imagery to know the appropriate band combinations.