AppEEARS Area CASE STUDY I – Monitoring National Parks: Using shapefiles to obtain Remote Sensing Data-derived Environmental Descriptors

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Research Question:

How can the AppEEARS area sampler be used to generate remote sensing-derived environmental descriptors to monitor Yosemite National Park that are mosaicked and cut to the park.

Goal:

Access remotely sensed data that can be used to derive environmental descriptors for use in monitoring natural phenomena within Yosemite National Park without downloading or processing the source data for the remote sensing datasets.

Data Needed:

Sensor / Mission	Product	Layer
NASA Visible Infrared Imaging Radiometer Suite (VIIRS)	Thermal Anomalies/Fire (VNP14A1.001)	1km Daily Fire Mask
Moderate Resolution Imaging Spectroradiometer (MODIS)	Normalized Difference Vegetation Index (MOD13Q1.006)	250 m 16 Day NDVI

Software/Tools Needed:

AppEEARS: https://lpdaacsvc.cr.usgs.gov/appeears/

Estimated Time: 20 minutes

Instructions

Step 1: Download Data

Go to https://git.earthdata.nasa.gov/projects/LPDUR/repos/2019-agc-workshop/browse and download the Yosemite shapefile file. This file is the park boundaries of Yosemite National Park, as identified by the National Park Service.

Source Data: Data.gov

Step 2: Extract Area Sample in AppEEARS

- Go to the AppEEARS **homepage https://lpdaacsvc.cr.usgs.gov/appeears/ and sign-in using your NASA Earthdata Login. (If you do not have an account you can create one here: https://urs.earthdata.nasa.gov/)**
- From the top panel, select "Extract" → "Area Sample"
- Start a new request
- Provide a name for your sample (AGC 2019 Use Case #1)
- Drag and drop in the "Yosemite" zipped folder to upload your file.
    - Note: The shapefile preview will not look exactly like the park but when you download the data you will see that it is clipped exactly to the park boundaries.
- Set Start Date to 01-01-2013 and End Date to Today's date.
- Ensure "Is Date Recurring" is unchecked.
- Under "Select the layers to include in the sample," choose the following layers from these products (find products by typing in the product name in the search and selecting the appropriate data product. Click on the layer to select.)

Data Product	Layer
Thermal Anomalies/Fire (VNP14A1)	FireMask
Normalized Difference Vegetation Index (MOD13Q1.006)	_250_m_16_days_NDVI

- Review the data product layers in the "Selected Layers" box that you have chosen and use the "–" symbol to remove any unwanted layers.
- Keep file format a GeoTiff
- Select "Geographic" for the Projection.
- Submit the request. Click on the "Explore" tab to view submission progress.

Step 3: Reviewing Results in AppEEARS Test Location

- The length of time for an AppEEARS request to process is dependent upon a number of factors including size of the request and server traffic. In the meantime, you can log-on to an AppEEARS Demo account to view the outputs for the above request:
- Go to https://urs.earthdata.nasa.gov and sign out of your personal account. Next, sign in using the username and password provided. From there, return to AppEEARS.
    - **Username: AppEEARSTesting**

- **Password: NASApixels2017**
  - Note: AppEEARS may try to automatically log you back in with your personal NASA Earthdata Login account. If this happens please click on sign out while the page is loading. Then navigate back to AppEEARS and sign in with the AppEEARS Testing account.
- Once you are logged in, from the top panel, select "Explore" then click on "View the contents of the request" for "AGC Use Case #1".

Step 4: Exploring Results of an Area Sample Request

Yosemite National Park has had many large fires during this time frame. Let's see if we can observe one of these fires with fire data and then see what the NDVI values were around the time of the fire.

Fires:

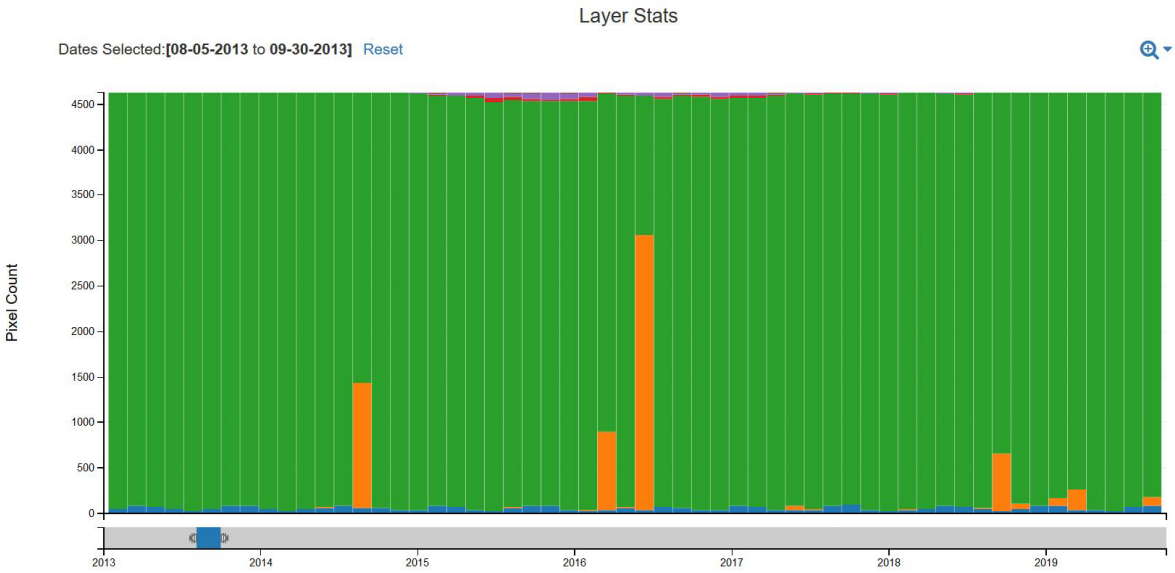
1. 2013: The Rim Fire: 8/17 – 10/24. Burned 77,254 acres in Yosemite, 255,000 acres in California.
2. 2014: El Portal Fire – 7/26 – 8/4. Burned 4,689 acres in Yosemite and Stanislaus National Forest.
3. 2017: Empire Fire – 8/1 – 11/27. Burned 8,094 acres.
4. 2018: Ferguson Fire: 7/13 – 8/18. Burned 96,901 acres.

Stats

- Let's view the 2013 Rim Fire.
- Select VNP14A1 from the Layer dropdown

- Figure 1 shows a bar graph of S-NPP NASA VIIRS thermal anomalies and fire data

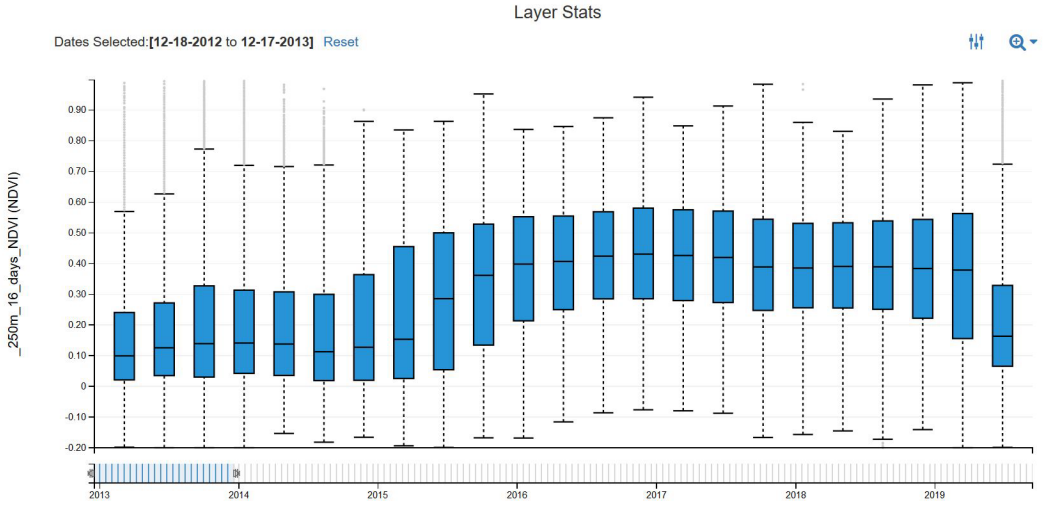
- Click on the magnify glass and select 2013. Alternatively, you can click and drag to select the year 2013 on the timeline below.
- Further slide the timeline left and right to filter down to August and September 2013.
- The S-NPP VIIRS fire mask indicates 3 for water, 4 for cloud, 5 for land, and 7-9 for fire at various confidence. Hover over the colors in the graph to see which values correspond to the colors.



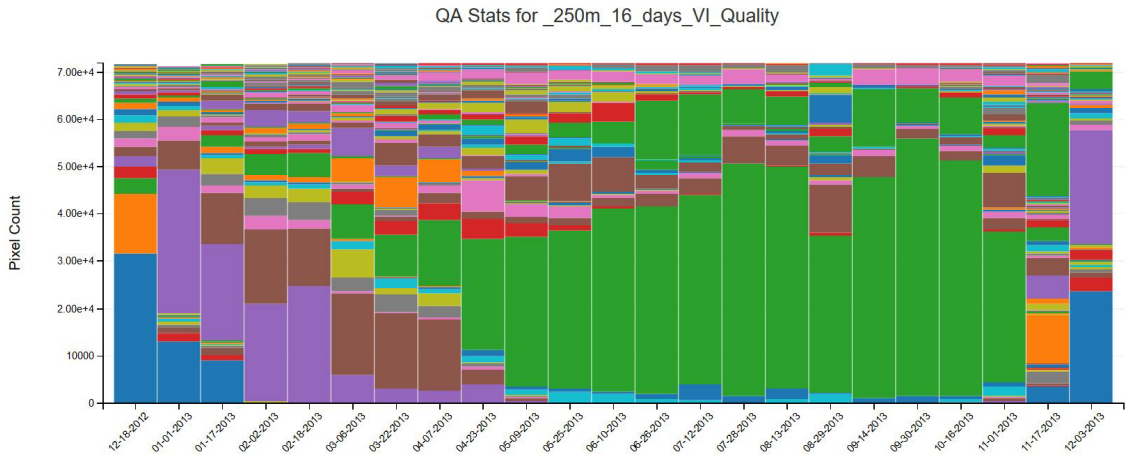
  - Figure 2 shows the bar graph closer to the time period of the Rim Fire.

- Note that starting on 8/23 the top of the bars indicate there was a fire, the Rim Fire, during this period.
- Now got back to the top and switch to the NDVI layer.
- You will now see a box and whisker plot with the NDVI values.
- The fire product is a daily product, so we can see values in the park every day. The NDVI layer is a 16-day composite, so we only see four sets of values. We can see these values have a slight decrease over time.

- To see a larger sample of time, update the graph to show the year 2013 either by clicking on the magnify glass or interacting with the timeline below.

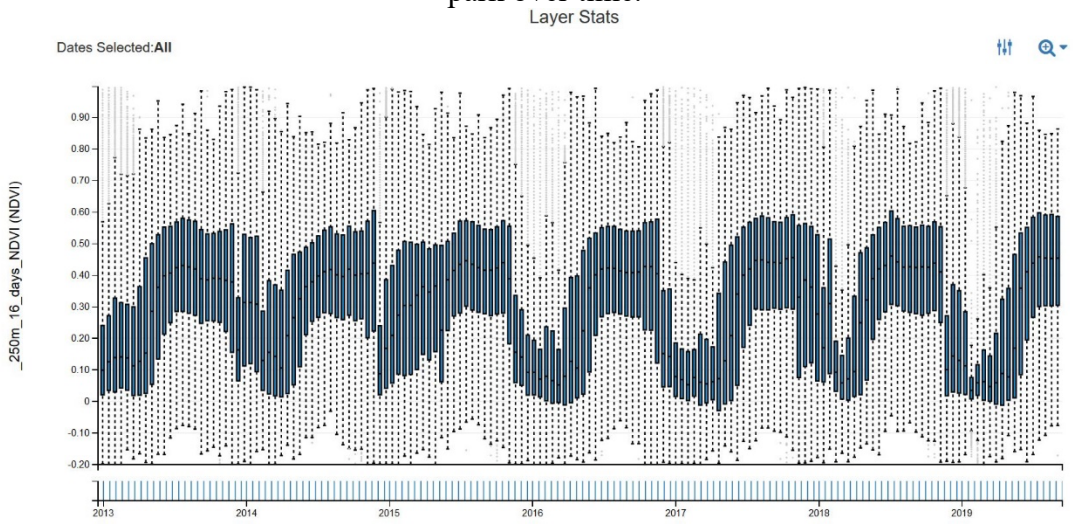


  - Figure 3 shows box and whisker plots of NDVI values for the year 2013. Note: The first composite of data in 2013 started in December of 2012.
- As we would expect, NDVI values increase in the summer but a potential initial analysis is that there is a slight dip during the Rim Fire (8/29, 9/14, 9/30). The NDVI value does slightly increase again before decreasing again for the winter.
- Below this graph, if available depending on the data product, you can find decoded quality information that relates to the graph you are seeing above. As you update the graph above, this graph will also update.
- The quality information for this graph is based on the MODLAND QA bits with the data. Again, hover over a color to see what the value means and to determine the quality of the data.



  - Figure 4 shows the quality information for the NDVI data.

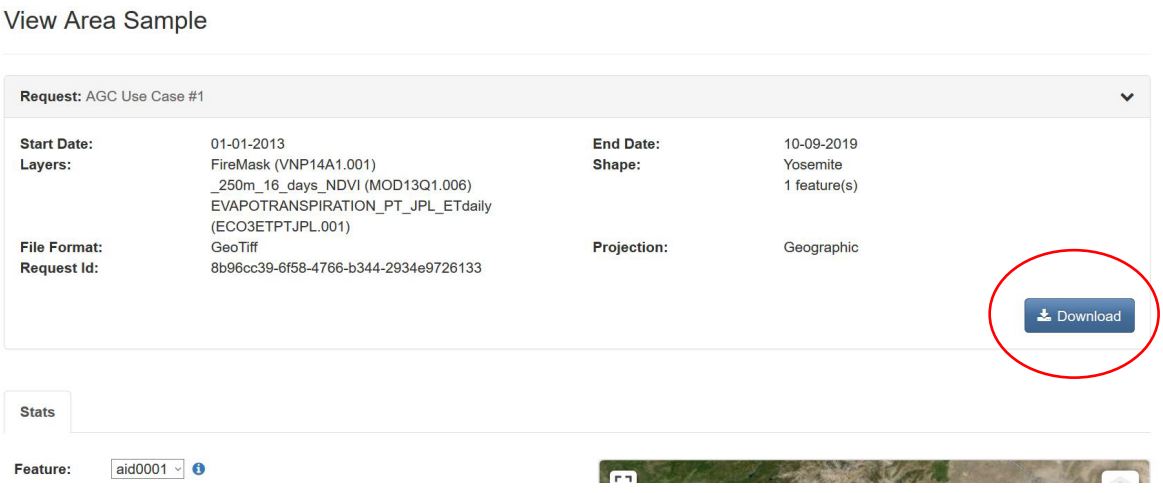
- Now scroll back up to the top graph and click on “Reset” to observe NDVI trends in the park over time.



  - Figure 5 shows Box and Whisker plots for the study period.
- Here we can again start to make some initial analysis. For example, the NDVI values in 2015 started off higher than normal seasons but seemed to have plateaued during the spring and early summer, whereas summer values in 2016 were more consistent than other years.

Step 5: Downloading the Contents of an AppEEARS Request

- If you are satisfied with the initial exploration and would like to further download the data to investigate more, you have two options to download the data. You can either click on the arrow to the right of the request above the map when viewing the Area Sample, see image below, or you can return to the Explore Tab and select “Download the contents of the request”.



  - Figure 6 shows the location to download data while viewing the sample.

Now you can see the list of files you can download within the request to further explore the data.

Request: AGC Use Case #1

Supporting Files

AGC-Use-Case-1-ECO3ETPTJPL-001-metadata.xml	ISO 19115 Metadata	21.59 KB
AGC-Use-Case-1-MOD13Q1-006-metadata.xml	ISO 19115 Metadata	21.57 KB
AGC-Use-Case-1-VNP14A1-001-metadata.xml	ISO 19115 Metadata	21.57 KB
AGC-Use-Case-1-granule-list.txt	URLs for all source data used in the extraction	309.86 KB
README.txt	Instructions and details about the request	24.03 KB
AGC-Use-Case-1-request.json	JSON file which can be used to create a new request	964.93 KB
ECO3ETPTJPL-001-Statistics.csv	Statistics for layers	12.08 KB
MOD13Q1-006-250m-16-days-VI-Quality-Statistics-QA.csv	Statistics for quality layers	145.97 KB
MOD13Q1-006-250m-16-days-VI-Quality-lookup.csv	Lookup values for the quality bits	62.32 KB
MOD13Q1-006-Statistics.csv	Statistics for layers	28.29 KB
VNP14A1-001-FireMask-Statistics.csv	Statistics for layers	156.54 KB
VNP14A1-001-QA-Statistics-QA.csv	Statistics for quality layers	141.8 KB
VNP14A1-001-QA-lookup.csv	Lookup values for the quality bits	95 B

    - Figure 7 shows some of the files you can download from AppEEARS.
- These files include:
    - The metadata
    - URLs for all the source data
    - A README Text file
    - A JSON file which you can share with your colleagues so they can repeat your request.
    - Statistics for the layers and quality layers.
    - Lookup values for the quality bits
    - Mosaicked and clipped GeoTiffs for each data product and an associated quality file for the corresponding quality information, if available.
- This concludes Use Case #1. Please feel free to download any of the data to explore the values via your favorite GIS or Spreadsheet program.
    - Note: Once the order has completed on your AppEEARS account the data will be available for 30 days. After 30 days you will need to resubmit your request.