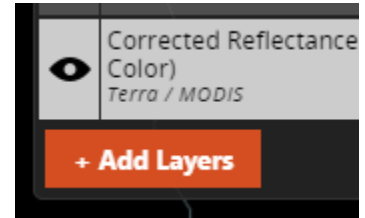


## Lab 6 – Active Fire Mapping

**Your mission** –In this lab you will be introduced to several common and very useful data sources and GIS processes. Your task will be to create a fire perimeter map using resources and directions from a variety of sources so that you can practice finding guidance on your own in the future. You will also be comparing active fire points from two satellites to your perimeter growth to see if there is a correlation between the size of fire growth and the number of active fire detections.

### 6.1. Viewing the active fire detections

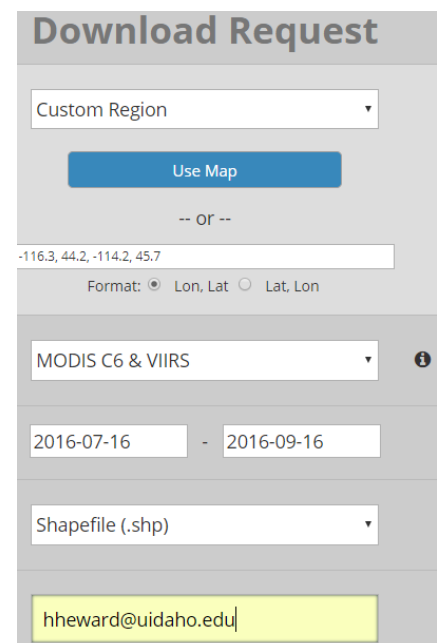
- Go to <https://worldview.earthdata.nasa.gov/> - From this site you can view near real time satellite imagery from MODIS and VIIRS for a variety of purposes.
- Select **Add Layers**
- Under *Fires* select **Fires and Thermal Anomalies**
- Check the box for *Aqua and Terra/MODIS* >> **Fires and Thermal anomalies (day and night)**
- Check the boxes for *SUOMI NPP/VIIRS* >> **Fires and Thermal anomalies (day) and Fires and Thermal anomalies (night)**
- Scroll down to *Corrected Reflectance* and for both *Terra* and *Aqua* check **Corrected Reflectance (7-2-1)** this will provide us with a base layer that optimizes the view of the burn scar.
- Close box
- Change date in the lower left to **2016 Jul 16**  
Take a moment to use the scroll bar to explore how fire changes around the world over a year – so cool. Use what you learn to answer the reflection question : What do you find interesting about the images provided on this site and the pattern of fire occurrences over the year?



- Zoom into the general region of the Pioneer fire just north of Boise Idaho. Zoom in to around 43.981, -115.614. Coordinates are in the lower right, drag and zoom to get to the general area. The active portion of the fire spans from July 16 to September 16, click around on various dates in the time period to get an idea where the fire is.
- Make a fire activity movie – click on the video icon in the lower left, span the time line from July 16<sup>th</sup> to September 16<sup>th</sup> to see how the fire progressed over time. *Video may take a minute or two to load.* Select a smaller area and create an animated GIF to impress your friends.

### 6.2. Downloading Active Fire products

- Go to the [Fire Information for Resource Management System \(FIRMS\)](#) site.
- Select **Archive Download** from the lower left
- Select **Create New Request**



- i. For *Download Request* select **Custom Region**
- ii. For coordinates paste in **-116.3, 44.2, -114.2, 45.7**
- iii. Fire source – **MODIS C6 and VIIRS**
- iv. Dates **7/16/2016 to 9/16/2016**
- v. Output format - **.shp**
- vi. Email address – **enter your email address**
- vii. Click **Submit**
- viii. You should receive an email confirmation of your request and then within 30 minutes receive two emails containing the data. (in the meantime continue with the lab)
- ix. Save unzipped files in your Lesson\_6>>inputs folder. *Note that each file has a readme.txt file. When you paste in the second group of files it is ok to just override the previous .txt file.*
- x. Open a new ArcMap project and add your active fire points.

### 6.3. Downloading fire data from an FTP site

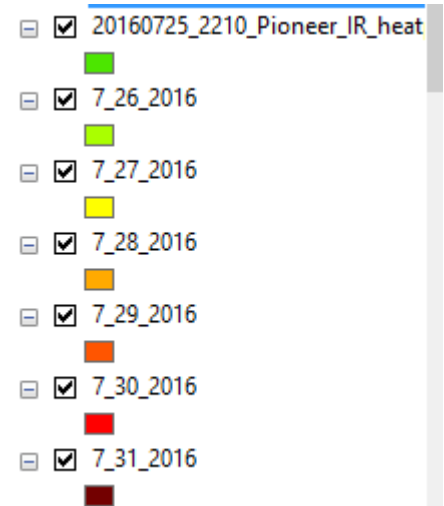
Fire perimeter data –The quality and completeness of the records on the FTP site vary. Take time to explore around the site and see if there are fires you might be personally familiar with.

- a. <http://ftp.nifc.gov/> >>**Incident Specific Data >> great\_basin >> 2016\_Incidents/ >> Pioneer >> IR/**
- b. In most folders there is a zip file with the shapefiles, several PDFs and KMZ files. **Open** some of the PDFs to see how final maps looks on fire incidents.
- c. Select 20160726 >> 20160726\_Pioneer\_IR\_Shapefiles.zip. The zip file will save to your downloads folder. Open it in the downloads folder.
- d. Copy the **7 heat perimeter** files into Lesson\_6>> Inputs.
- e. **Download** the heat perimeter files for the following folders: 7/26 to 8/01 for use in the fire progression and 9/15 to get a full view of the fire perimeter (if you would like to do the fire progression for the whole fire you can download all the layers).
- f. Add the perimeter files to your ArcMap project.

NOTE: The folders contain the fire perimeter for the previous days growth. Download the fire perimeter data from the indicated FOLDERS and you will end up with the dates of 7/25 to 7/31.

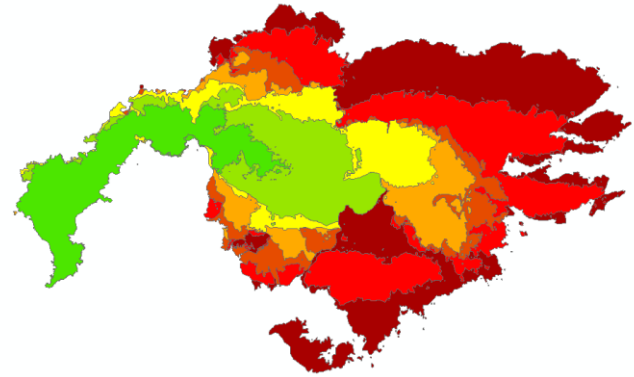
6.4. **Erasing** – We will eventually be comparing the number of active fire detections to the amount of fire growth. To do this we need to subtract the previous days fire growth from the current day so that we have a polygon with just the current days growth. See the “Unit\_18 ...” document on Bblearn for some additional directions on this process.

- a. Set up your workspace in Geoprocessing
- b. Navigate to the **Erase** tool by either searching for it or finding it in the toolbar.
- c. Erase each older polygon from the next in the progression (ex. 727\_0159 as input 725\_2210 as erase feature).



Notice that on the file from 7/27 the image was taken at 0159 (that is 01:59 AM) so it is actually the growth from the 26<sup>th</sup>, therefore label that file 7\_26\_2015.

- d. Put the layers in order from oldest to newest (the first layer should be the 7\_25)
- e. Change the colors to show oldest to newest fire perimeter.
- f. Updating area – open the attributes table, right-click on **GIS\_acres**, select **calculate geometry**, select **ok** to edit out of an edit session, for *Units* select **Acres** click **OK**. Complete these steps for each of the layers.



*Question 1: Take a screen capture of your map and table of contents to show that you have completed the erase.*

### 6.5. Creating a new shapefile from selected features.

As a quick example of how you can use active fire points and fire perimeter data in some form of analysis you are going to be comparing the number of active fire points to the area growth per day. If there is a direct correlation between the number of points and the acres growth then we might be able to use the active fire points from around the world to get an estimate for area burned. To do this we first need to remove the active fire points with low confidence that were not

- a. Open the attributes table for **fire\_archive\_M67362**
- b. For the **Confidence** column sort Descending
- c. Highlight all the rows from 15 to 100 (there should be around (2356)
- d. Right-click on **fire\_archive\_M67362**
- e. Under *Selection* select **Create Layer from selected feature**
- f. Clear the selected feature and close the attributes table.
- g. Make the new layer permanent by right-clicking and selecting *Data>>Export*
- h. Name the new .shp file **fire\_archive\_M6762\_c** (for confident)
- i. Repeat these steps with the **fire\_nrt\_V1\_7363** – this time selecting all of the rows with “n” or normal confidence and excluding all the rows with “l” or low confidence.

### 6.6. Selecting by attribute

In this step you will be selecting the number of active fire points for a certain day and compare those totaled points to the acres growth per day.

- a. Copy and paste the following table into Excel for ease of processing. First populate the acres growth for the 26<sup>th</sup> to the 31<sup>st</sup> - In the attributes table of each fire progression day, right-click on *GIS\_Acres* , select **Statistics**, copy the value for **sum** and paste it into the table.

Date	Acres growth	# MODIS points	# VIIRS points	Total Active fire points
7/26/2016				
7/27/2016				
7/28/2016				
7/29/2016				
7/30/2016				
7/31/2016				

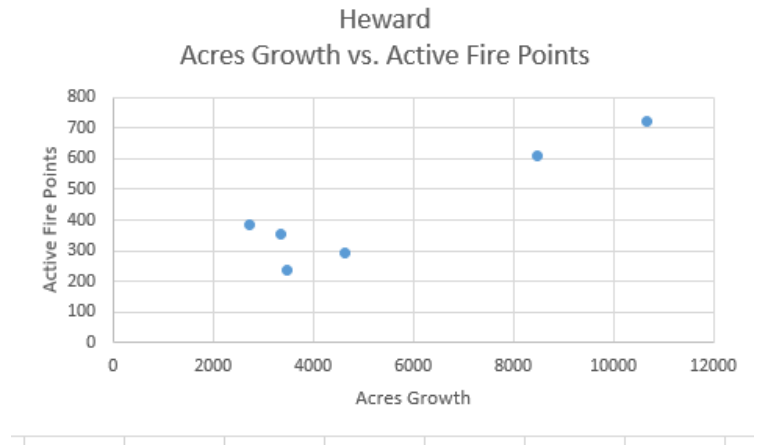
Active fire points from VIIRS and MODIS are in [Coordinated Universal Time \(UTC\)](#). UTC is 6 hours ahead of the Pioneer fire. This means that when you see a time of 9:00 AM it was acquired at 3:00 AM local time and represents fire growth from the previous day. For the VIIRS sensor there are acquisitions in the morning around 0900 or 1000 and acquisitions in the afternoon around 2100. In order to count the fire points for the 26<sup>th</sup> for example you will select active fire points from 2045 on the 26<sup>th</sup> and from 0900 and 1040 from the 27<sup>th</sup>.

- b. Open the attributes for the *fire\_nrt\_V1\_7363* selection
- c. Right-click on *AQU\_TIME* and select **Advanced Sorting** - Visually compare the selected points with the area growth for that day.
  - a. Sort by – **ACQ\_DATE – Ascending**
  - b. Then sort by - **ACQ\_TIME – Ascending**
  - c. Click **OK**
  - d. Highlight the corresponding dates and times and record the number of active fire points for each day in the table.
    - i. Fire Growth 7/26
      1. 7/26/2016 2045
      2. 7/27/2016 0900 and 1040
    - ii. Fire Growth 7/27
      1. 7/27/2016 2025
      2. 7/28/2016 0845 and 1025
    - iii. Fire Growth 7/28
      1. 7/28/2016 2010 and 2150
      2. 7/29/2016 0825 and 1005
    - iv. Fire Growth 7/29
      1. 7/29/2016 1950 and 2130
      2. 7/30/2016 0945
    - v. Fire Growth 7/30/2016
      1. 7/30/2016 1930 and 2110
      2. 7/31/2016 0925
    - vi. Fire Growth 7/31/2016
      1. 7/31/2016 1910 and 2050
      2. 8/01/2016 0910 and 1050

- e. Perform this same process with the MODIS – each day will include evening points from that day and morning points from the next day. Ex.
  - i. Fire Growth 7/26/2016
    1. 7/26/2016 1920 and 2101
    2. 7/27/2016 0450, 0628, 0859, and 1037

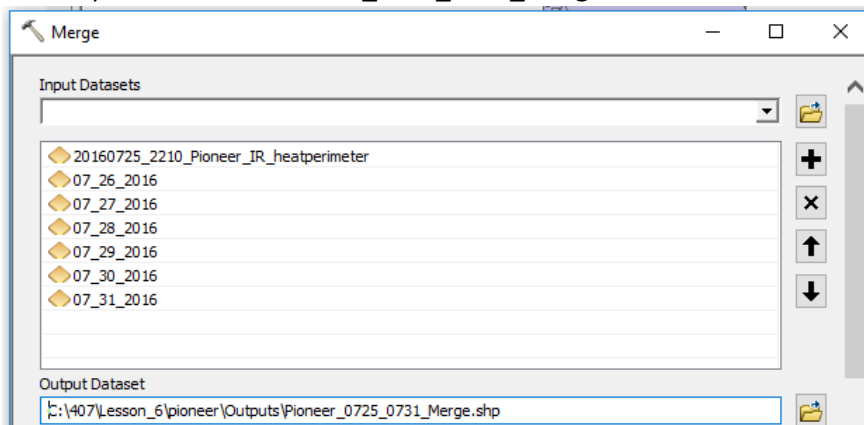
*Question 2: Submit a screen capture of your complete table comparing acres growth to active fire points. For an additional 5 points of extra credit include a scatter plot figure comparing the acres growth and total fire points.*

*Question 3: Based on this very small sample size, how well did these active fire points do at representing area growth?*

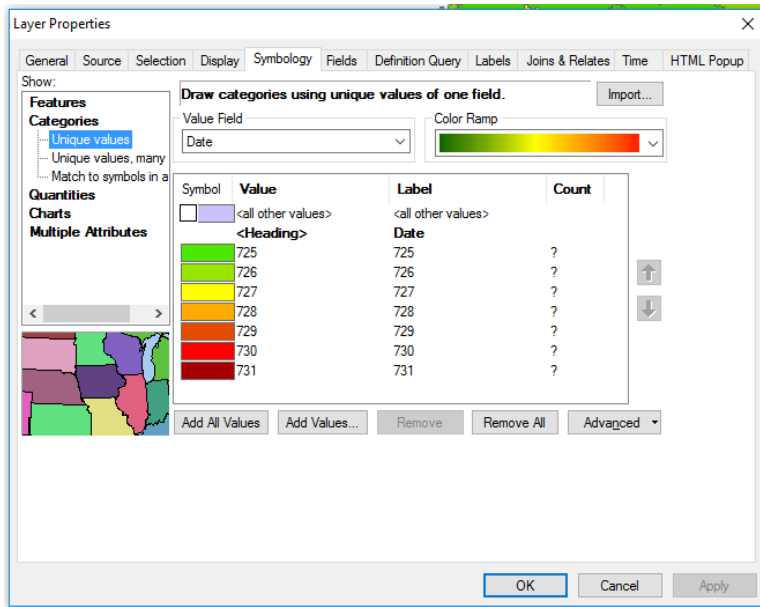


**6.7. Merge polygons** – Using the merge tool polygons can be combined to form distinct days of growth but in one layer. This is useful to have one feature to work with.

- a. To begin, each fire progression layer needs to have a common column with the DATE
- b. Open the attributes table for 20160725\_2210\_Pioneer\_IR\_heatperimeter
- c. Add a field and label it **Date**
- d. Right-click on the column title and select **Field Calculator** click **Yes** to work outside and edit session.
- e. In the dialog box type in **725** – the whole column should then populate with 725
- f. Repeat this process with each of the progression days.
- g. Locate the *Merge (Data Management)* tool – you can use the search function
- h. Add all of the fire progression days
- i. **Output Dataset = Pioneer\_0725\_0731\_Merge**



- j. In the new layer select **Properties**
- k. Select *Categories >> Unique Values*
- l. **Value Field** – Date
- m. Select **Add All Values**
- n. Uncheck the box for *all other values*
- o. Adjust the colors
- p. On the *Display* tab change the transparency to 35%.



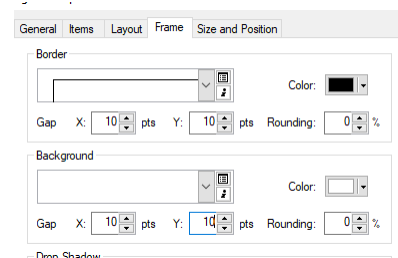
**6.8. Downloading Digital Elevation Model (DEM)** – you will download both a 30 meter resolution and 10 meter resolution DEM to compare output.

- a. LANDFIRE data – Using the directions from *How-to: Prepare LANDFIRE data* download the Elevation layer and the Existing Vegetation Type layer. Download data that covers the final fire perimeter – you will be needing the EVT file in lab 7 for the whole fire area. Don't forget to change the projection to **Best-fit UTM**.
- b. Inside Idaho – find the inside Idaho site and go to *Apps >> Elevation*.
  - i. Display different basemaps in ArcGIS to determine where your fire is in Idaho.
  - ii. Choose the **1999 10m Idaho** layer and download for your area (zoom into recognizable geographic features). This will take some time to download.
  - iii. Save the unzipped file to your Pioneer fire Inputs folder.
  - iv. Add to your Arc project

**6.9. Creating a shaded relief map** – watch both videos linked below to get a good idea of how to create a hillshade with your elevation layer. Create a hillshade for both the LANDFIRE DEM and the Inside Idaho DEM.

- 1. Watch - <https://www.youtube.com/watch?v=tRnanOXIMYg>

2. Watch - [https://www.youtube.com/watch?v=92\\_5y00733o&ebc=ANyPxKqSwlaUk3Snifu5jni6Y3avuGPARpQ6N4IujA0zKGTqO367tM5gO1QIcDkg0P7etoJHrIDbbTC8gJSYYZuv\\_ZH-rM5hqQ](https://www.youtube.com/watch?v=92_5y00733o&ebc=ANyPxKqSwlaUk3Snifu5jni6Y3avuGPARpQ6N4IujA0zKGTqO367tM5gO1QIcDkg0P7etoJHrIDbbTC8gJSYYZuv_ZH-rM5hqQ)
3. Complete the basic hillshade for the LANDFIRE DEM first. Notice how grainy the image looks since the cell size is 30X30 meters.
4. Complete the basic hillshade for the Inside Idaho DEM. Zoom into the fire area and try some of the techniques suggested in the video for improving the visual appearance of the DEM.
5. Display the vegetation layer with representative colors for the vegetation and make it 35% transparent to see the hillshade.
6. Create a quality map in the Layout view. Using the directions in *How to: create an organized map* include the following features. See the recommended videos in that document.
  - a. Basic map elements – Title, north arrow, legend, scale bar. If choosing to place map elements on top of map you should use a 10 point buffer for both the border and background
    - i. Only include the fire progression in the legend. Exclude the EVT.
  - b. Reference grids - 2.3 in the how-to document.
  - c. Reference data frame – 1.2 in how-to document. Remember you downloaded the USA states in Lesson\_3. You can extract Idaho. Clipping the data frame is optional.
  - d. Extend rectangle – 4.1 in how-to document



**Question 4: Upload the map you created for the Pioneer fire progress with hill shading**

**6.10. Arc to KML/KMZ Google Earth format.**

Watch - <http://blogs.library.duke.edu/data/2011/09/12/converting-arcgis-layers-to-google-earth/>

1. In Google Earth select *File>>Open* and navigate to the new file you made.
2. Play around with the viewing options to get what you believe to be the best angle. It is best to keep North **Up** on the map. (press r on your key board to get it in line)
3. From *File>> Save* - **Save Image**

**Question 5: Upload the saved image of your fire perimeter in Google Earth.**

Example map – there are many ways to display this data. Your map does not need to look exactly like the one provided, just make sure to include all the required mat elements and make it organized and visually appealing.

# Pioneer Fire Progression 7/25/2016 to 7/31/2016

