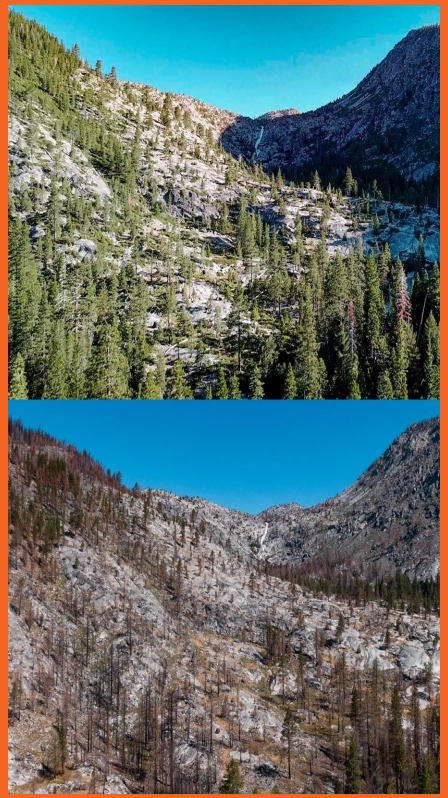


Low v. High Intensity Fire Impacts on NDVI

Mara Guerin, Graham DeLeon, Esther Duong, Kevin Gonzalez, Jasper Dong

Introduction

Research Question:

What are the impacts of high versus low intensity fires on NDVI from the 2021 Caldor Fire?

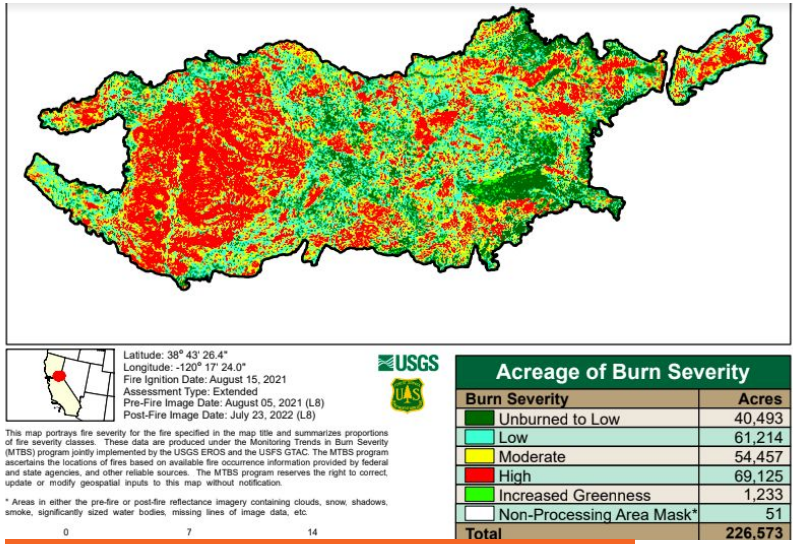
(Graham)

Analysis

- We will use NDVI raster analysis to see how the NDVI changed post fire in a high intensity burn area compared to a low intensity burned area in the Caldor Fire.

(Esther)

Caldor Fire



Source (US Forest Service, 2023)

(Mara)

- August 14 - October 21 2021 SW of Lake Tahoe
- Burn severity - measurement of immediate post fire impacts to vegetation.
- Spatial variation in topography and fuel loads lead to different levels of burn severity in different areas.

What is NDVI

- Normalized Difference Vegetation Index
- Measure of amount of vegetation vigor on land surface
- NDVI images help to differentiate between vegetation and bare soil
- NDVI values range from -1.0 to 1.0
  - Negative values indicate clouds and water
  - 0.0-0.09 bare soil
  - 0.1-0.5 sparse vegetation
  - 0.6-1.0 dense vegetation

(Jasper)

Data Acquisition and Editing

ArcGIS Online

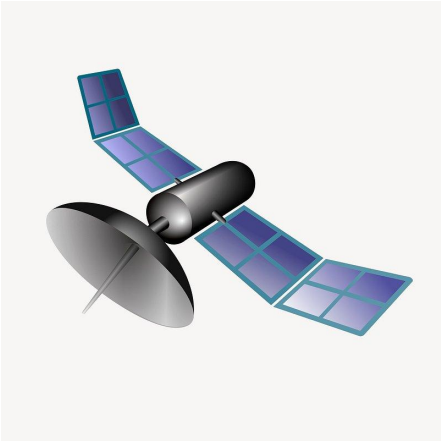
- Polygon layer of Caldor Fire Perimeter
- Exported a shapefile of the polygon of the spatial extent of the complicated multi-polygon layer

EarthExplorer Landsat

- Entered the shapefile and selected two dates
  - Before burn- 7/17/2020
  - After burn - 9/25/2022

(Mara)

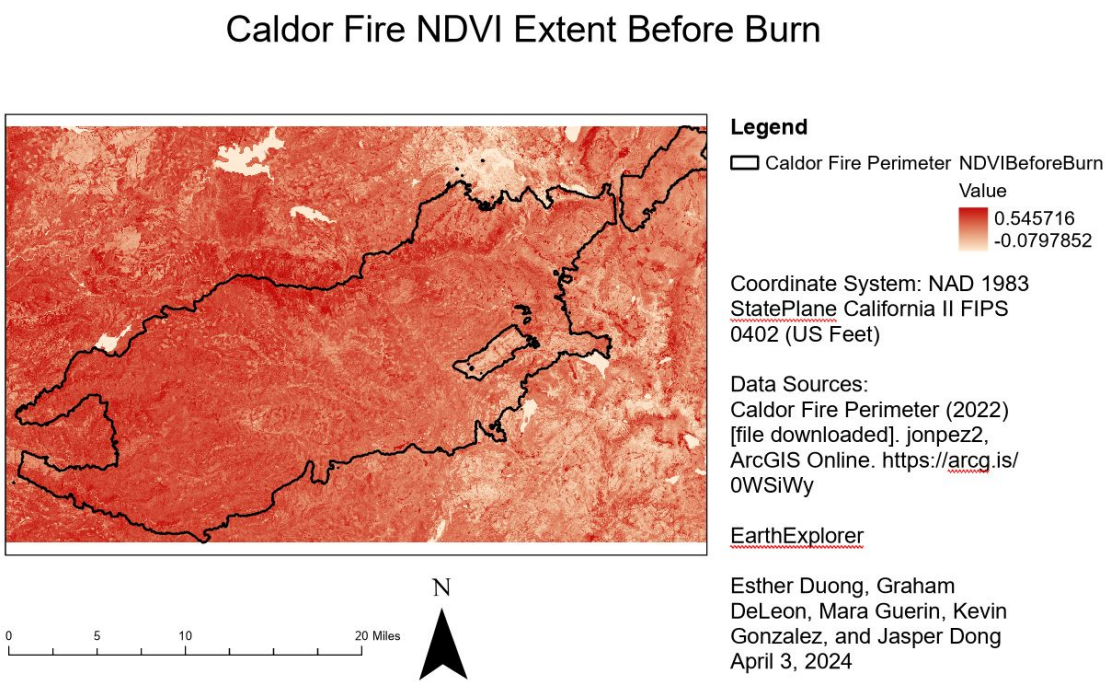
Band to NDVI Calculations



- Downloaded EarthExplorer folder of Landsat 8 Bands including -
  - Band 2 Blue (0.450 - 0.51 µm) 30 m
  - Band 3 Green (0.53 - 0.59 µm) 30 m
  - Band 4 Red (0.64 - 0.67 µm) 30 m
  - Band 5 Near-Infrared (0.85 - 0.88 µm) 30 m
  - Band 6 SWIR 1(1.57 - 1.65 µm) 30 m
- Used the following formula in “Raster Calculator” geoprocessing tool
  - NDVI = (Band 5 – Band 4) / (Band 5 + Band 4) (USGS.gov)
- This created our NDVI layers

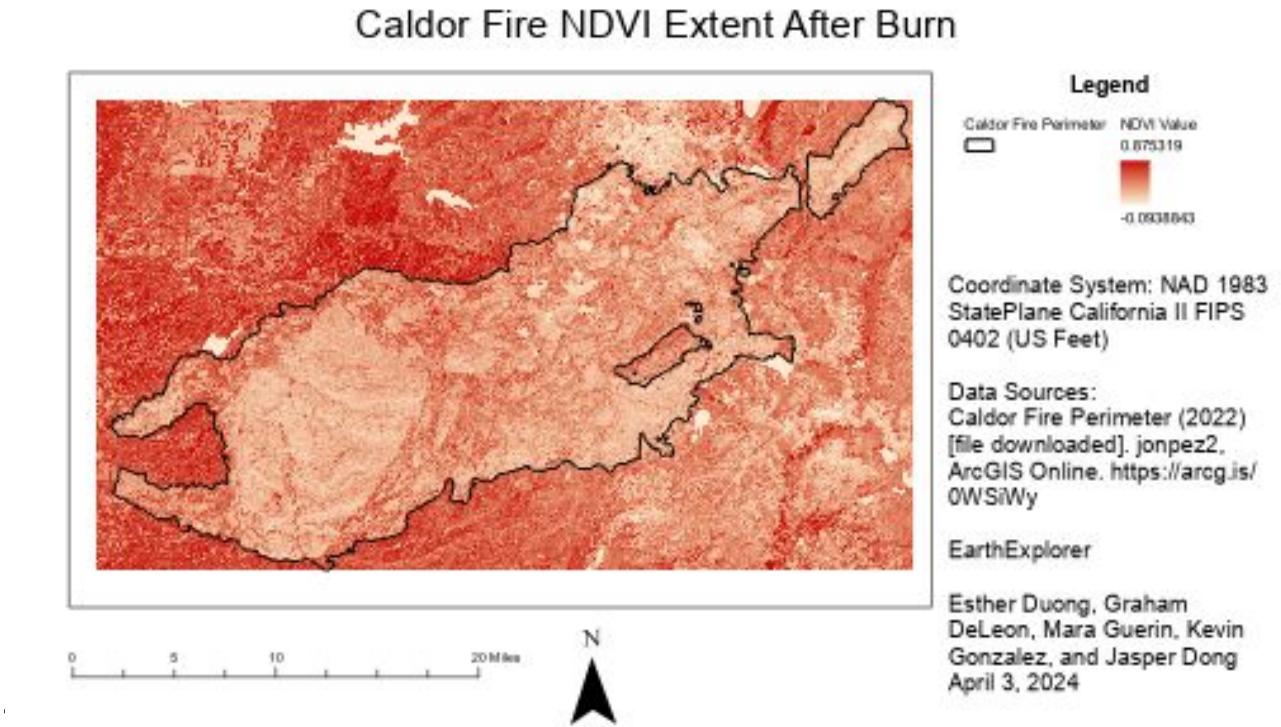
(Mara)

NDVI Values Before Burn



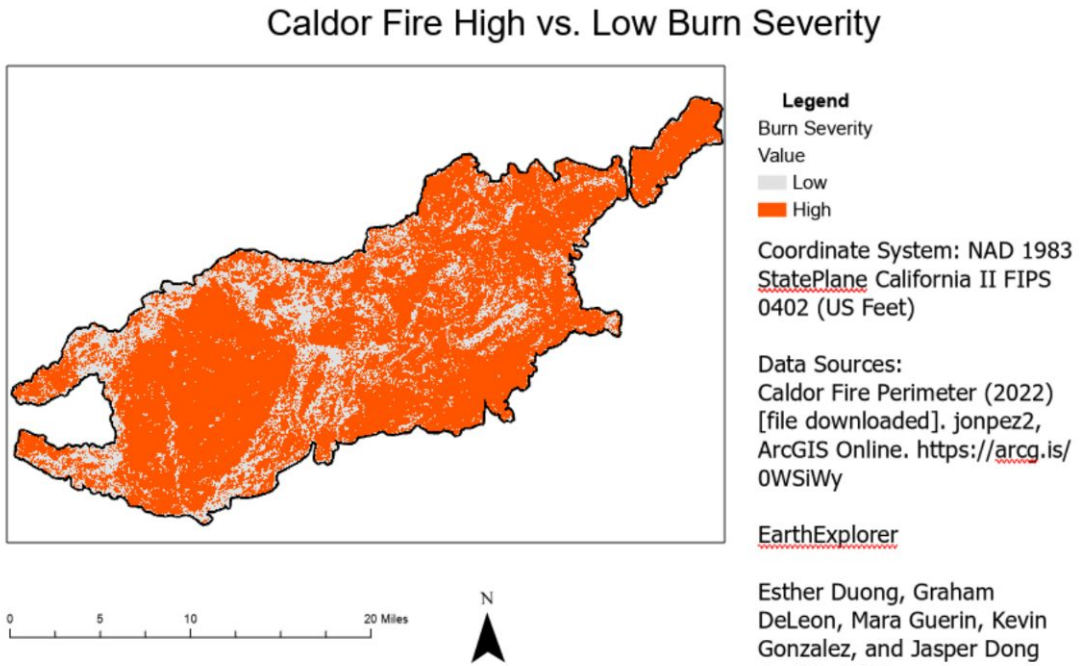
(Graham)

NDVI Values After Burn



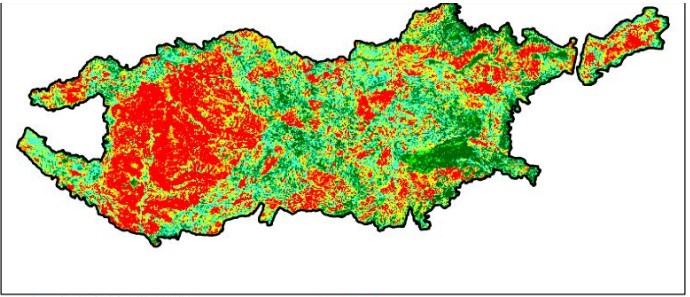
(Esther)

Caldor Fire High v Low Severity



(Jasper)

High v Low Severity



Latitude: 38° 43' 26.4"
Longitude: -120° 17' 24.0"
Fire Ignition Date: August 15, 2021
Assessment Type: Extended
Pre-Fire Image Date: August 05, 2021 (L8)
Post-Fire Image Date: July 23, 2022 (L8)

USGS

This map portrays fire severity for the fire specified in the map title and summarizes proportions of fire severity classes. These data are produced under the Monitoring Trends in Burn Severity (MTBS) program jointly implemented by the USGS EROS and the USFS GTAC. The MTBS program ascertains the locations of fires based on available fire occurrence information provided by federal and state agencies, and other reliable sources. The MTBS program reserves the right to correct, update or modify geospatial inputs to this map without notification.

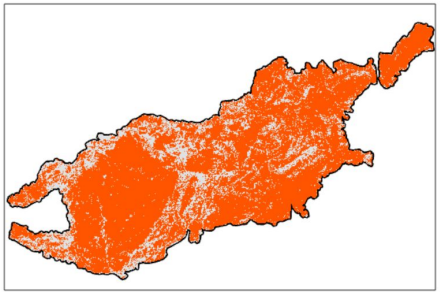
* Areas in either the pre-fire or post-fire reflectance imagery containing clouds, snow, shadows, smoke, significantly sized water bodies, missing lines of image data, etc.

0 7 14

Acreage of Burn Severity

Burn Severity	Acres
Unburned to Low	40,493
Low	61,214
Moderate	54,457
High	69,125
Increased Greenness	1,233
Non-Processing Area Mask*	51
Total	226,573

Caldor Fire High vs. Low Burn Severity



Legend
Burn Severity
Value
Low
High

Coordinate System: NAD 1983 StatePlane California II FIPS 0402 (US Feet)

Data Sources:
Caldor Fire Perimeter (2022) [file downloaded]. jonpez2, ArcGIS Online. https://arcg.is/0WSiWy

EarthExplorer

Esther Duong, Graham DeLeon, Mara Guerin, Kevin Gonzalez, and Jasper Dong
April 3, 2024

0 5 10 20 Miles

N

- Comparing the burn severity map to Jasper's map, we can see that the highest differences in NDVI can be seen in areas that experienced high severity burns.

Source (US Forest Service, 2023)

(Mara)

Conclusions

What are the impacts of high versus low intensity fires on NDVI from the 2021 Caldor Fire?

- Comparing before and after the fire, the low NDVI values in our 2nd map show that bare soil and very low vegetation exists a year into the fire.
- Our 3rd map shows us the areas where the severity of the fire was low or high. This emphasizes that the areas where fire severity was highest are areas that have not yet significantly recovered.

(Kevin)

Conclusions

- This data may be used in order to determine the areas where more intentional efforts may be focused to encourage restoration of vegetation.
- Going Forward:
  - Since, the NDVI after burn data was captured a year after the fire, it may be useful to revisit the NDVI values after a few years to observe how the area's vegetation is recovering.
  - We may be able to see how well ongoing restoration efforts are progressing and how well vegetation is returning to pre-burn levels.

(Kevin)

Sources

“Normalized Difference Vegetation Index (NDVI).” International Production Assessment Division (IPAD) - Home Page, USDA, ipad.fas.usda.gov/cropexplorer/Definitions/spotveg.htm#:~:text=The%20Normalized%20Difference%20Vegetation%20Index,green%20vegetation%20from%20bare%20soils. Accessed 22 Feb. 2024.

“Landsat 8.” Landsat 8 | U.S. Geological Survey, www.usgs.gov/landsat-missions/landsat-8. Accessed 1 Mar. 2024.

“Caldor Fire Perimeter” Michael Baker International. Aug 22, 2022. ArcGIS Online. https://www.arcgis.com/home/item.html?id=5fbc21a9382643db812c9e507cb9cf7c

“Landsat Normalized Difference Vegetation Index.” Landsat Normalized Difference Vegetation Index | U.S. Geological Survey, www.usgs.gov/landsat-missions/landsat-normalized-difference-vegetation-index#:~:text=In%20Landsat%208%2D9%2C%20NDVI,shown%20in%20the%20table%20below. Accessed 1 Mar. 2024.

Thank you!