Impact of the East Troublesome Fire

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Background

(Butzer, 2020)

- Considered one of the most destructive wildfires in Colorado's history.
- Began October 22, 2020 east of Troublesome Creek in Grand County

Timeline

Total Fire Size by Day for East Troublesome Fire

- October 14: Fire Reported
- October 15: 5,672 acres (Evening Estimate)
- October 16: 11,329 acres (Evening Estimate)
- October 17: 12,631 acres (Evening Estimate)
- October 18: 13,400 acres (Afternoon Estimate)
- October 19: 15,537 acres (Afternoon Estimate)
- October 20: 18,550 acres (Morning Estimate)
- October 21: 125,588 acres (Evening Estimate)
- October 22: 169,766 acres (Morning Estimate)
- October 23: 189,505 acres (Evening Estimate)
- October 24: 192,559 acres (Evening Estimate)
- October 27: 193,744 acres (Morning Estimate)
- November 30: 193,812 acres (100% Contained)

(NWS Denver/Boulder, 2022)

More Background…

- On October 21, 2020, high winds caused the original 25,000-acre fire to grow at a rate of 6,000 acres per hour heading northeast through Grand Lake and into Rocky Mountain National Park.
- On the afternoon of October 22, the fire crossed the Continental Divide adding another 50,000 acres, naming it the second-largest fire in state history.
- By November 30, the East Troublesome Fire was 100 percent contained.
- By the end, it had taken two people's lives (Lyle and Marilyn Hileman) and over 400 homes and other structures.
- It was the third record-breaking fire of 2020, with all three blazes destroying around 194,000 acres.

Landsat 8 – Operational Land Imager (OLI)

- Band 1 Coastal Aerosol (0.43 - 0.45 µm)
- Band 2 Blue (0.450 - 0.51 µm)
- Band 3 Green (0.53 - 0.59 µm)
- Band 4 Red (0.64 - 0.67 µm)
- Band 5 Near-Infrared (0.85 - 0.88 µm)
- Band 6 SWIR 1(1.57 - 1.65 µm)
- Band 7 SWIR 2 (2.11 - 2.29 µm)
- Band 8 Panchromatic (0.50 - 0.68 µm)
- Band 9 Cirrus (1.36 - 1.38 µm)
- Band 10 TIRS 1 (10.6 - 11.19 µm)
- Band 11 TIRS 2 (11.5 - 12.51 µm)

Landsat 8 – Operational Land Imager (OLI)

- Spectral resolution: 15-meter panchromatic, 30-meter multi-spectral, 100-meter (resampled to 30m) thermal
- Radiometric resolution: 12-bit
- Temporal resolution: 16 days with an equatorial crossing time of 10:00 a.m. +/- 15 minutes
- Swath width: 185 km (115 mi)
- Orbits the Earth in a sun-synchronous, near-polar orbit (98.2 degrees inclination)
- Achieved an altitude of 705 km (438 mi)

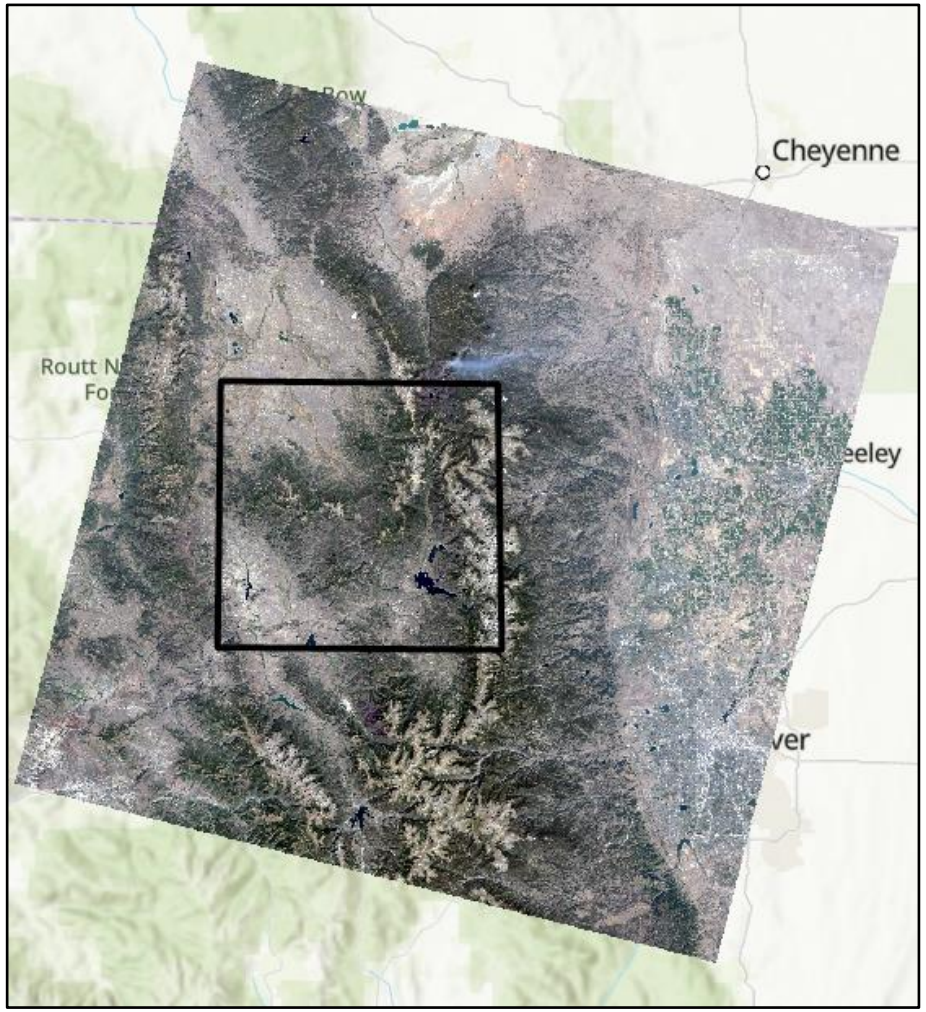
Dates used for analysis

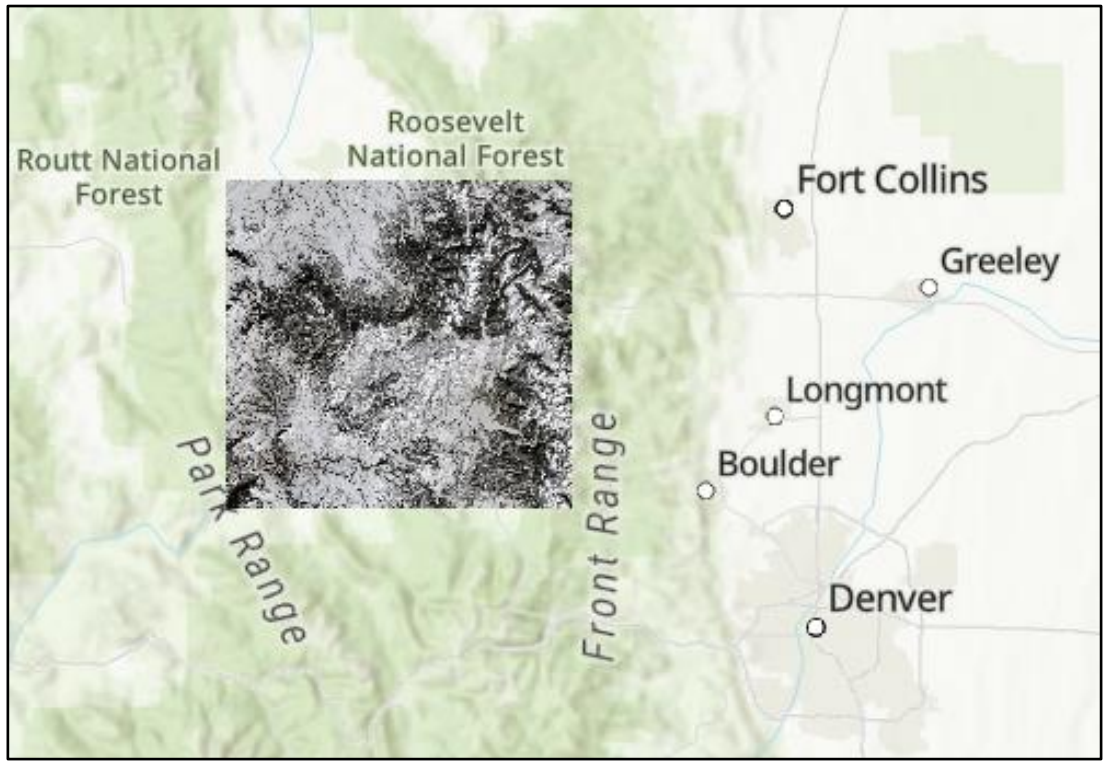
- September 4, 2020 (before the fire)
- December 9, 2020 (right after the fire was contained)
- November 22, 2021 (about a year after the fire)

Data Information

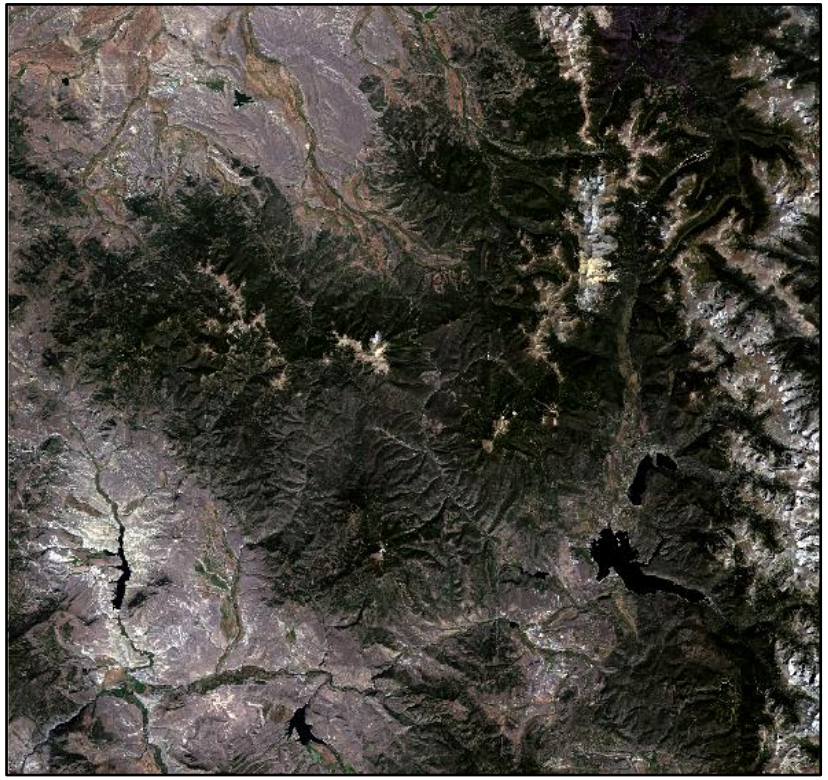
- Using WGS 1984 UTM Zone 13N
- Units are in meters
- Cell sizes of rasters are 30 by 30 meters
- Data from Earth Explorer
- Landsat Collection 2 Level-1 Datasets

Created ROI and Clipped Rasters

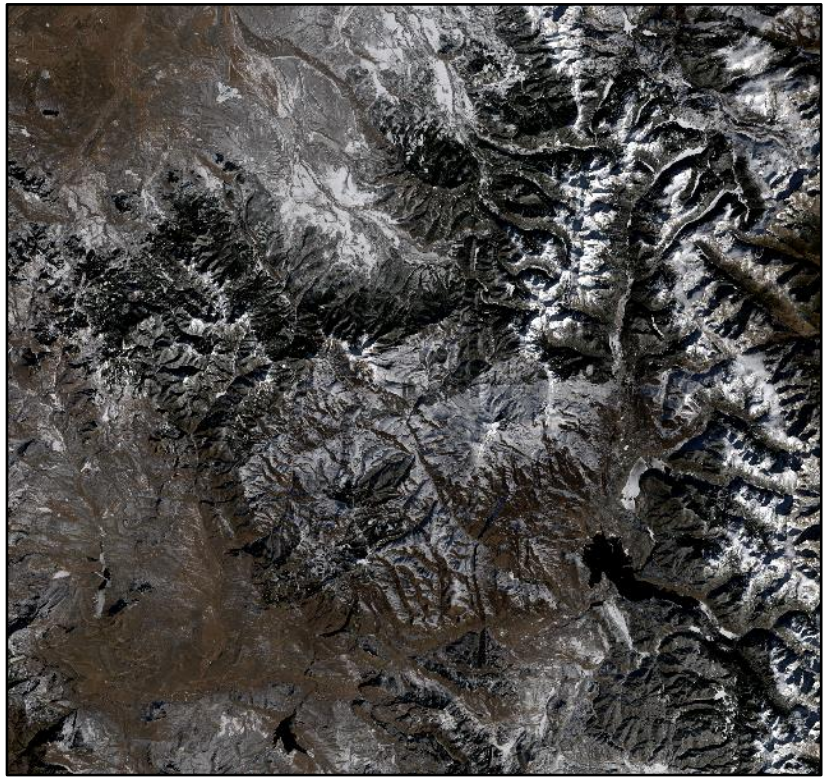




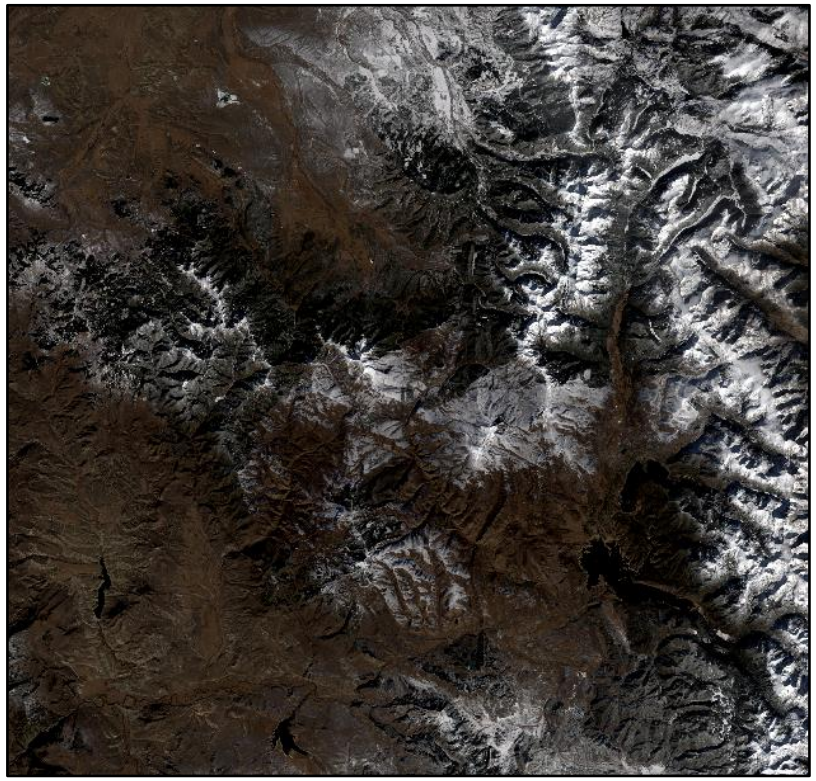
Natural Color (4-3-2)



9/4/20

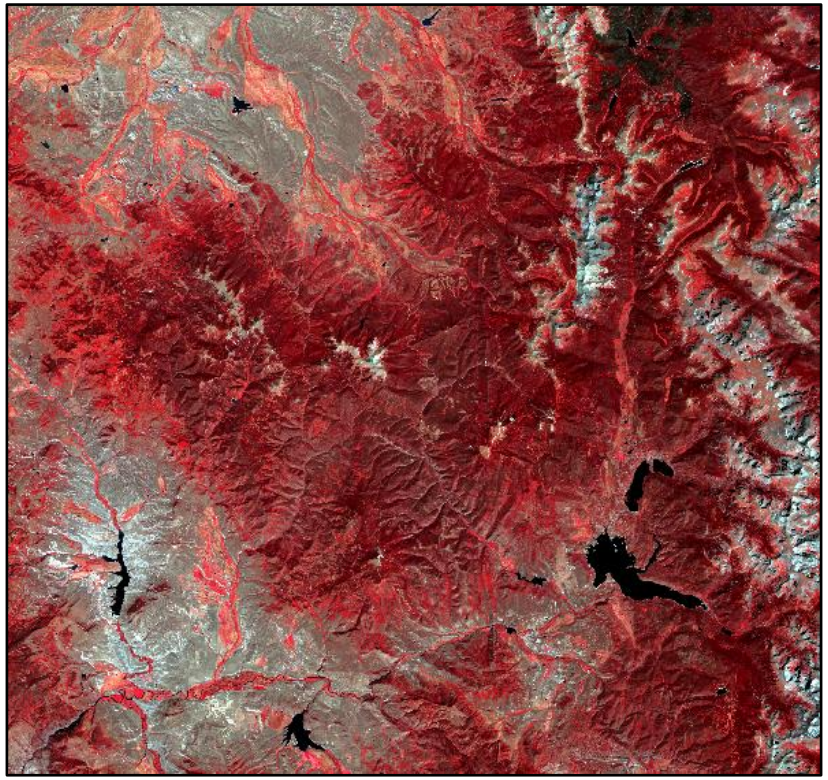


12/9/20



11/22/2021

False Color Infrared (5-4-3)



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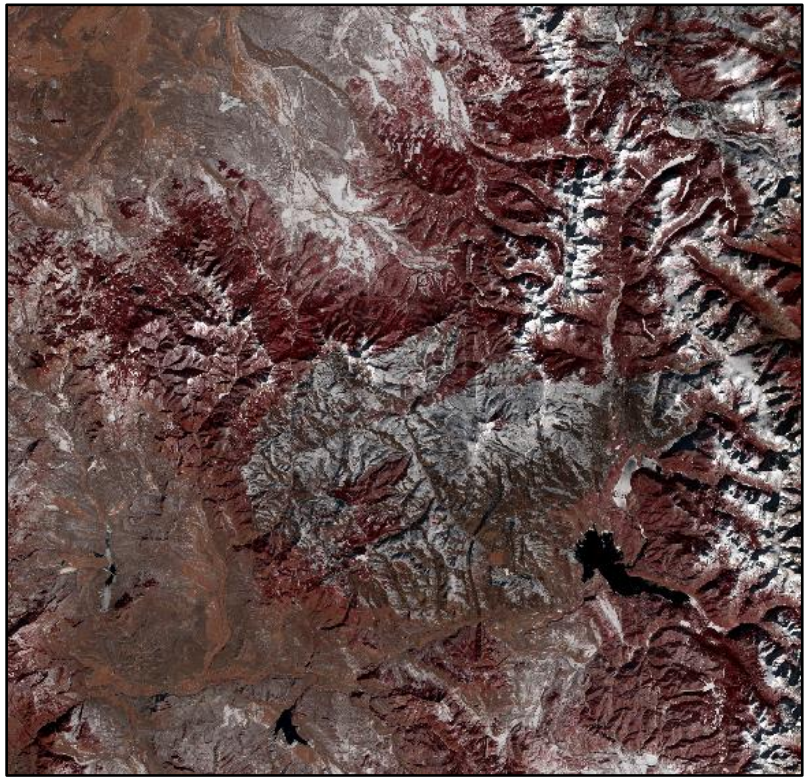

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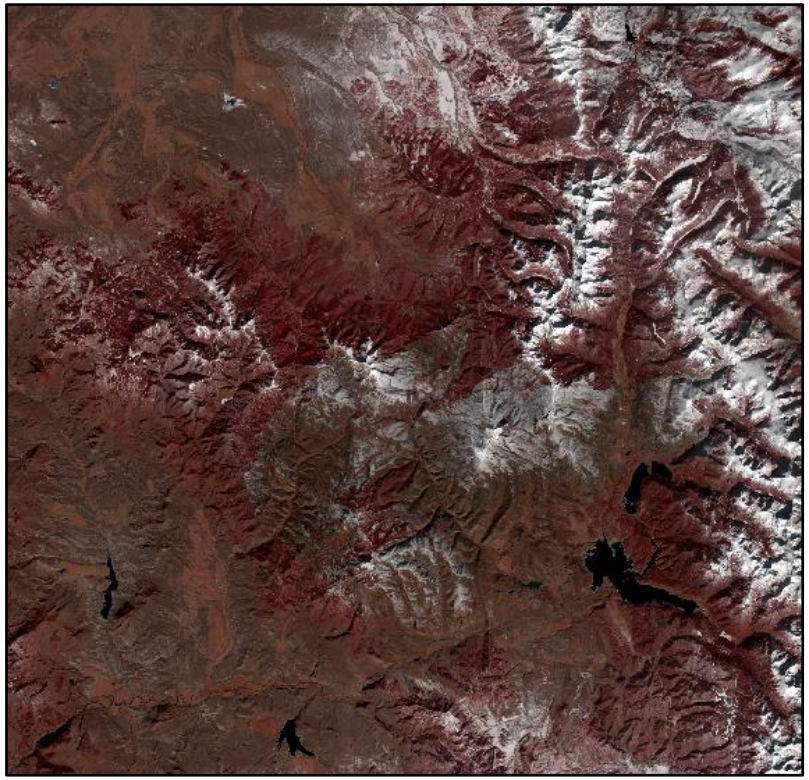
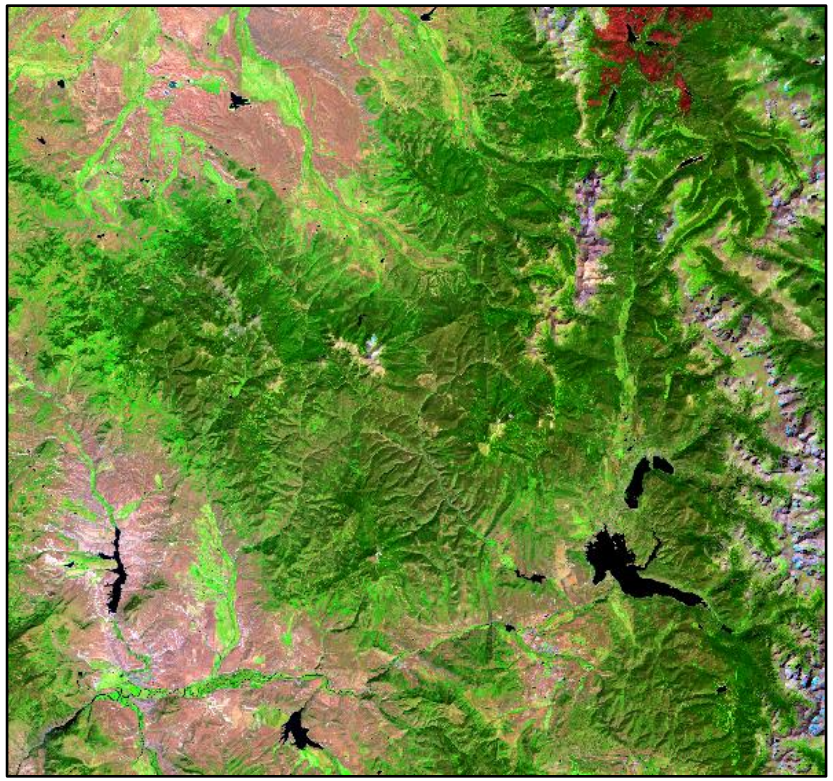


11/22/21

Burn Scar Analysis (7-5-2)



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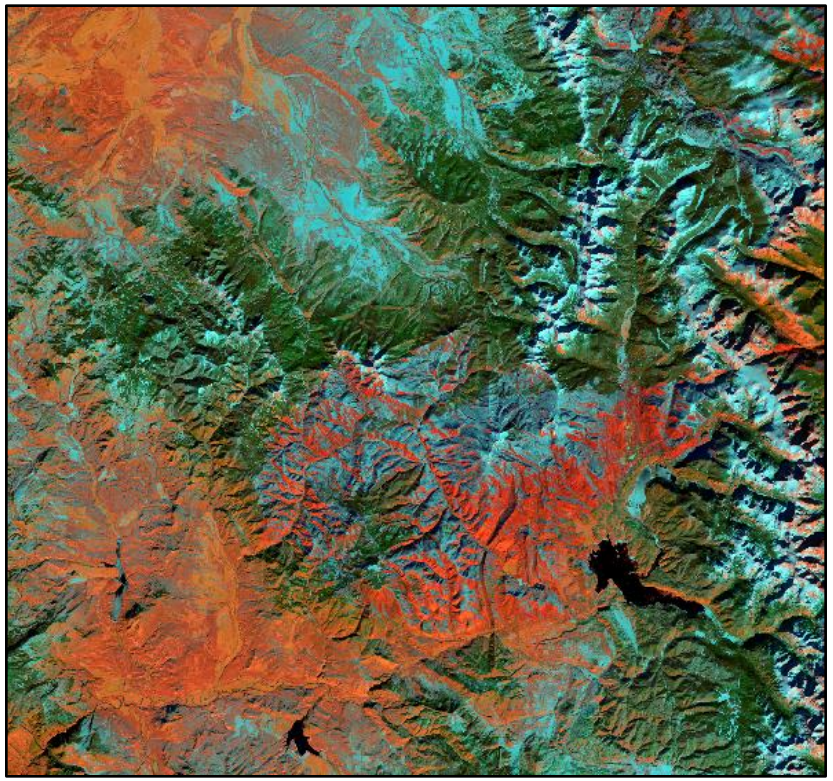

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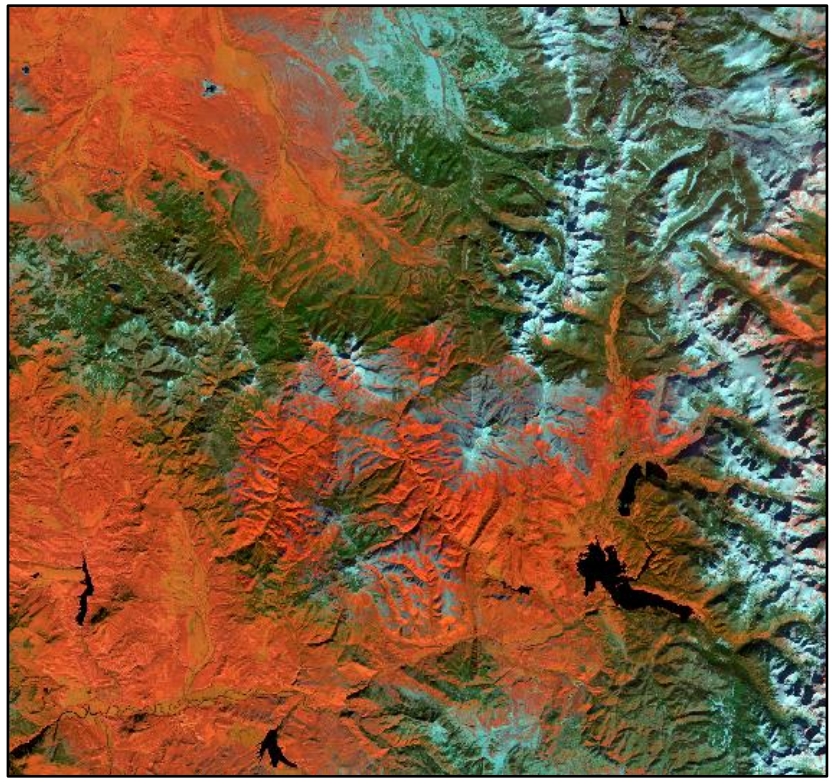
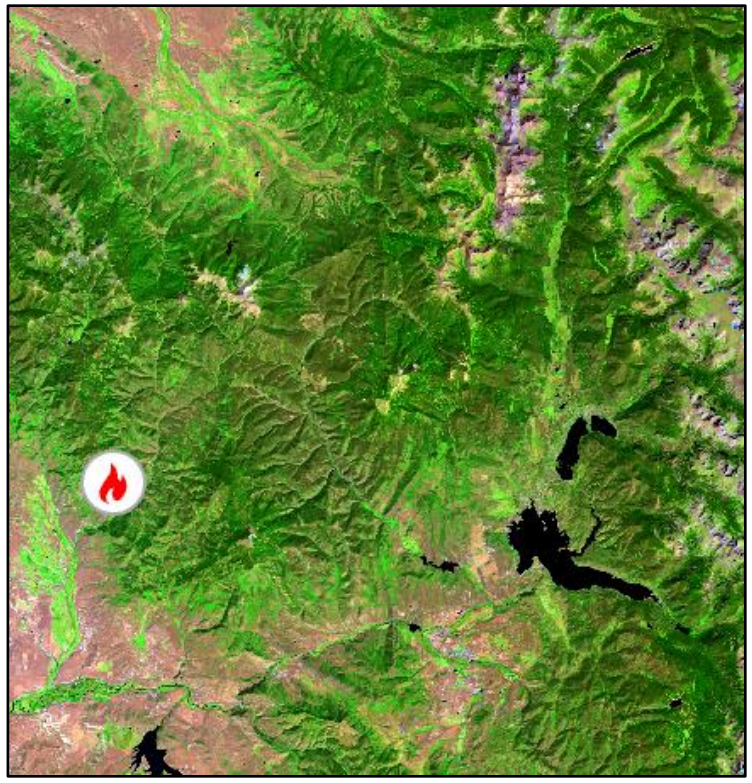


11/22/21

Burn Scar Analysis (7-5-2)



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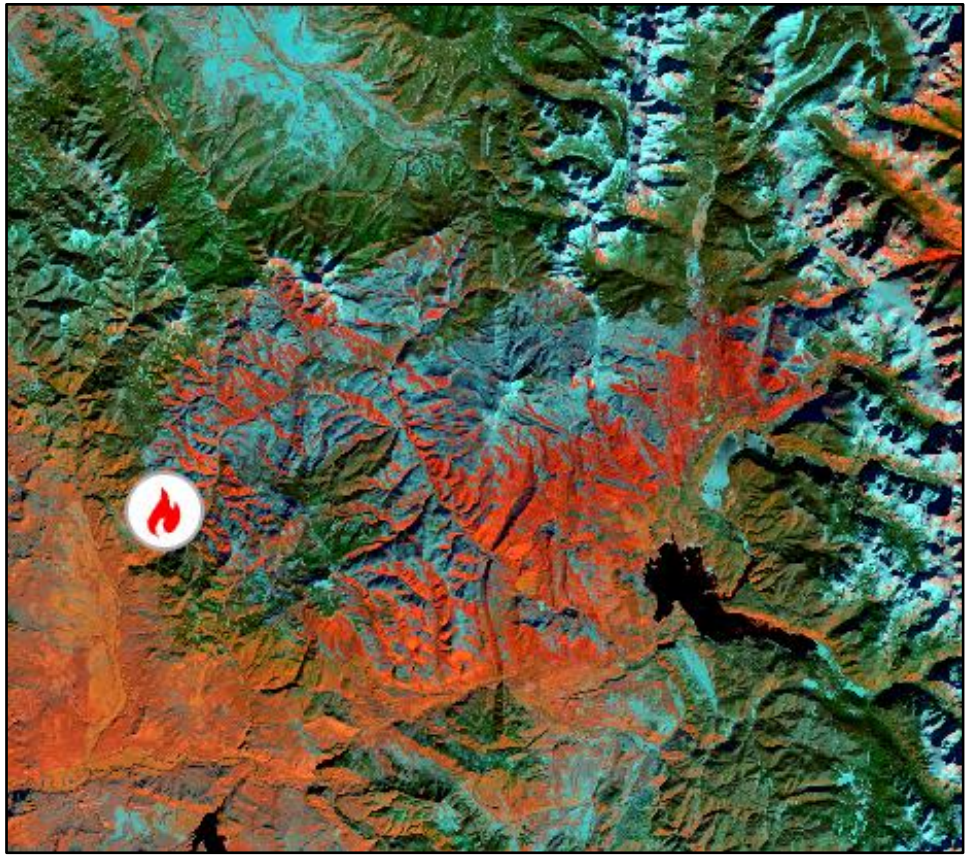

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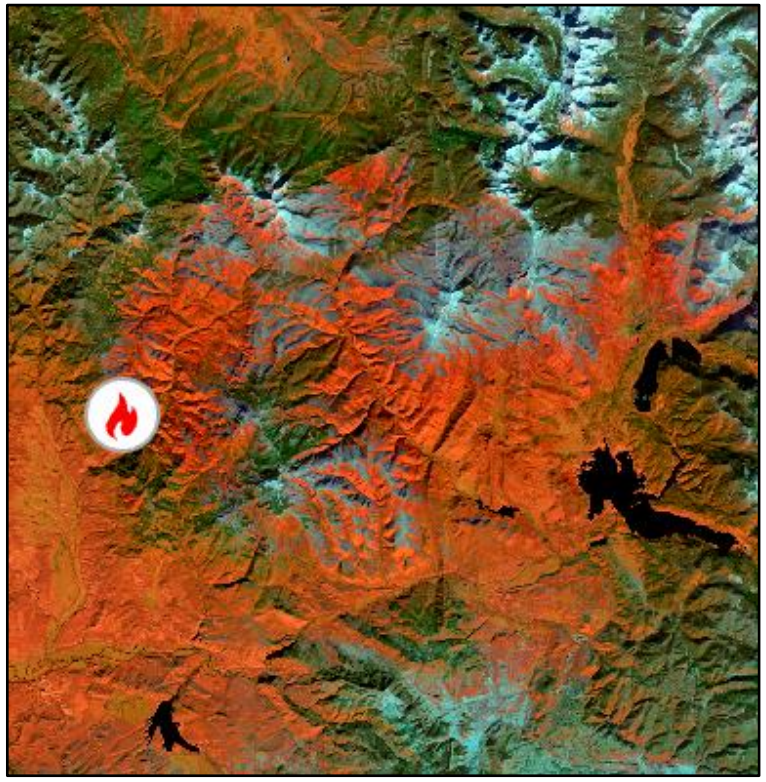
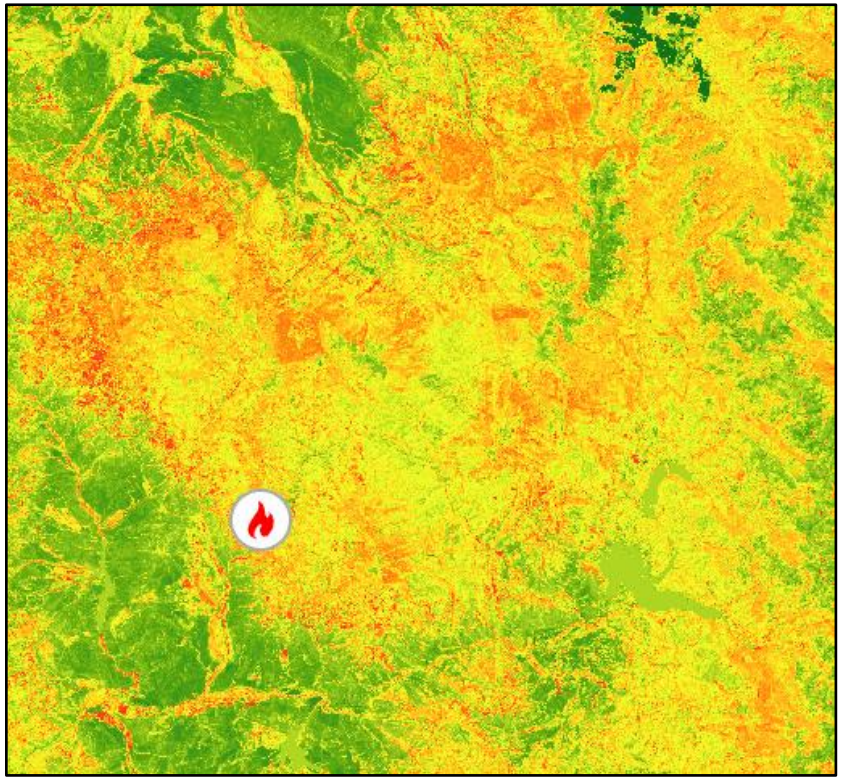


11/22/21

Normalized Burn Ratio (NBR)



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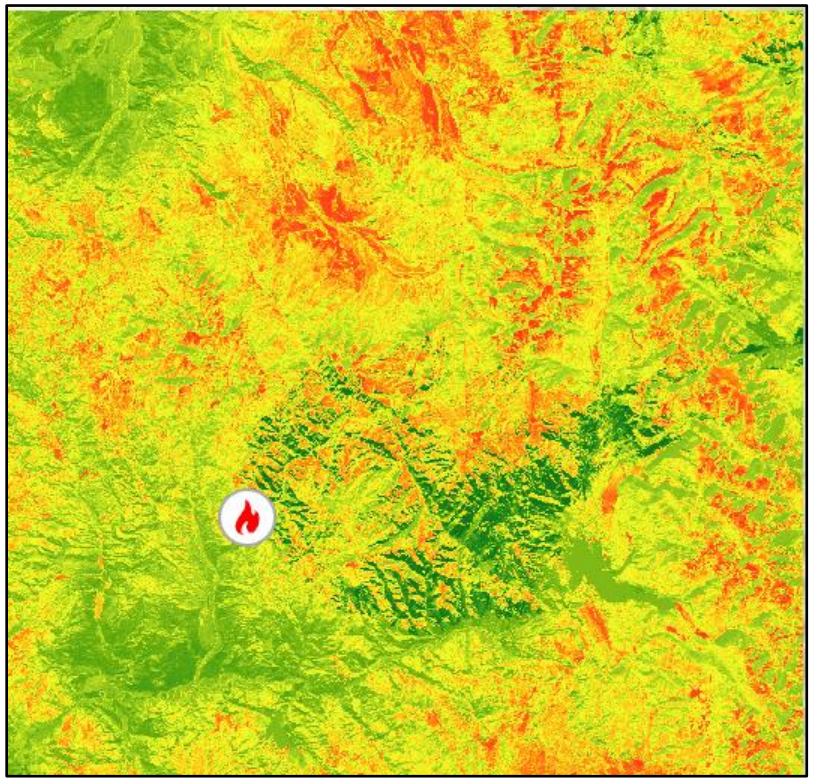

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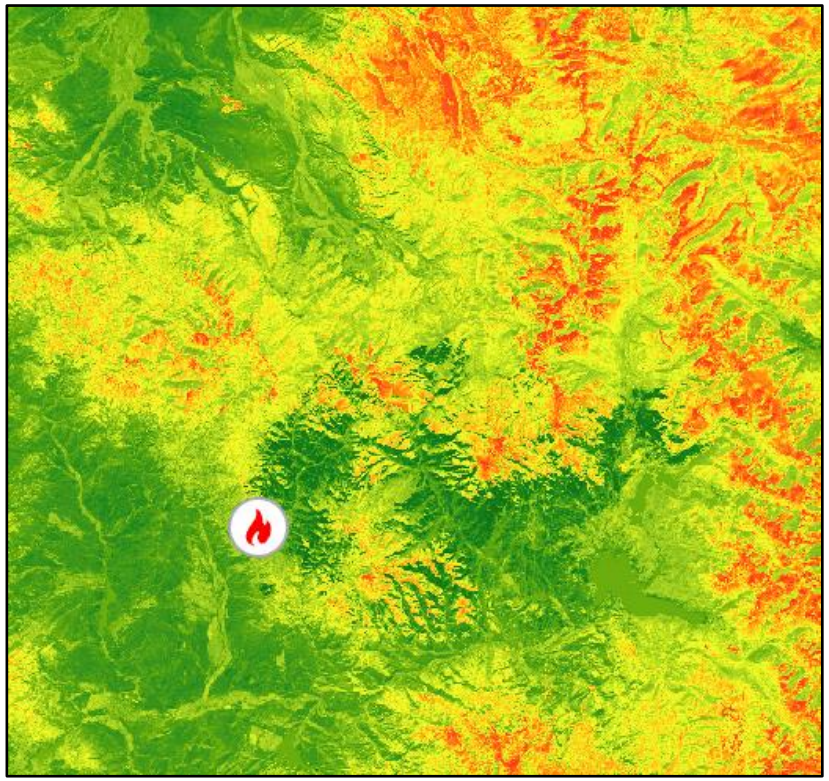
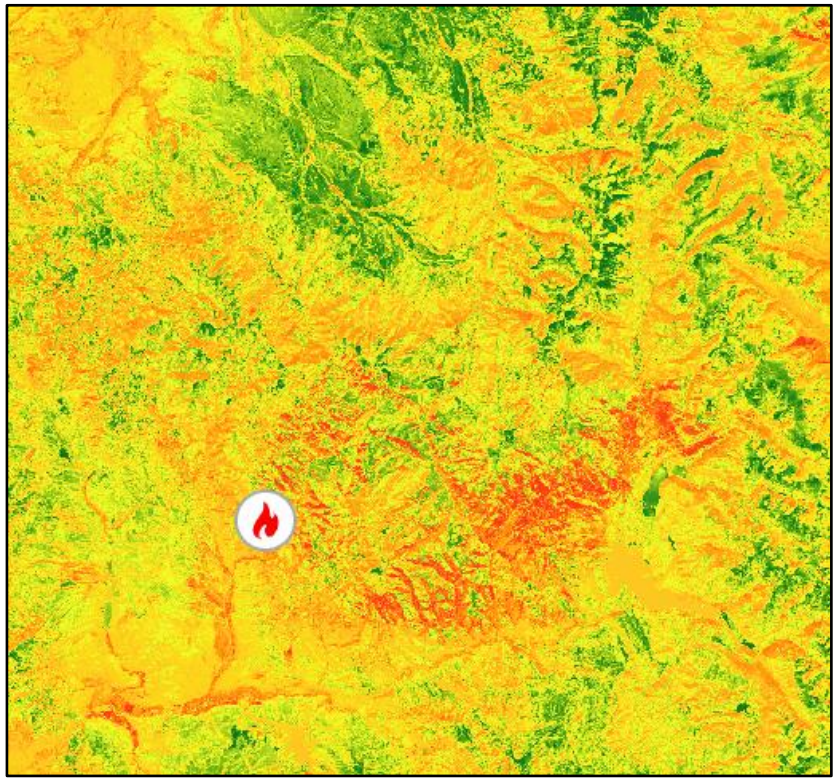
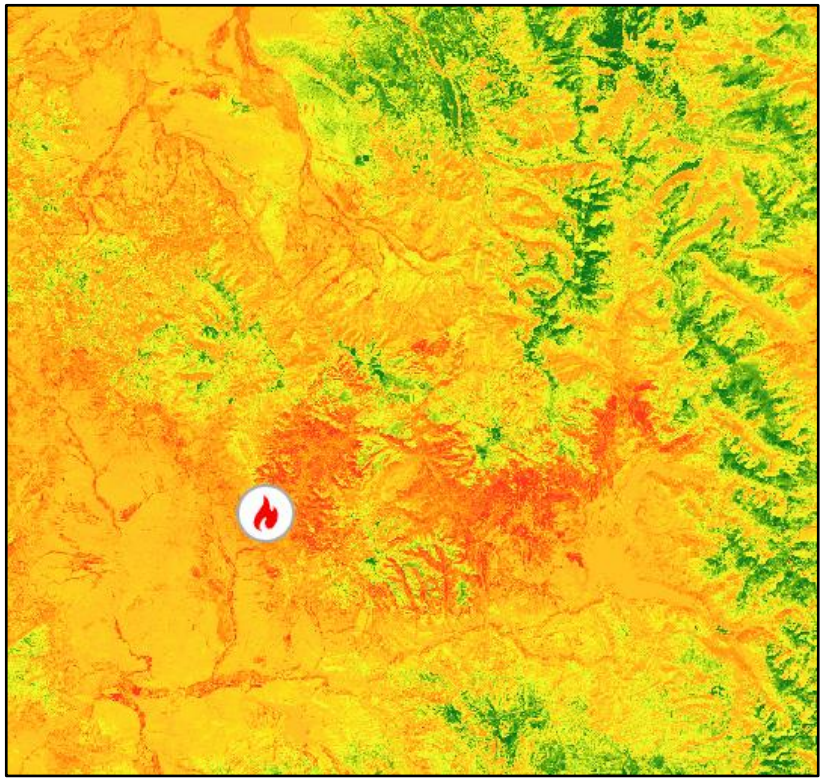


11/22/21

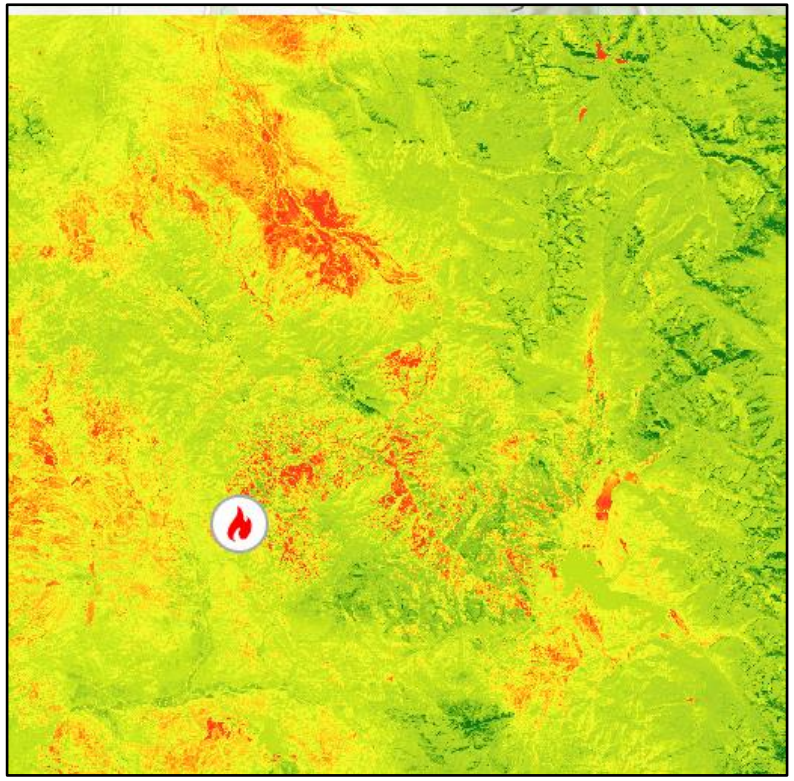
Difference



9/4/20 to 12/9/20

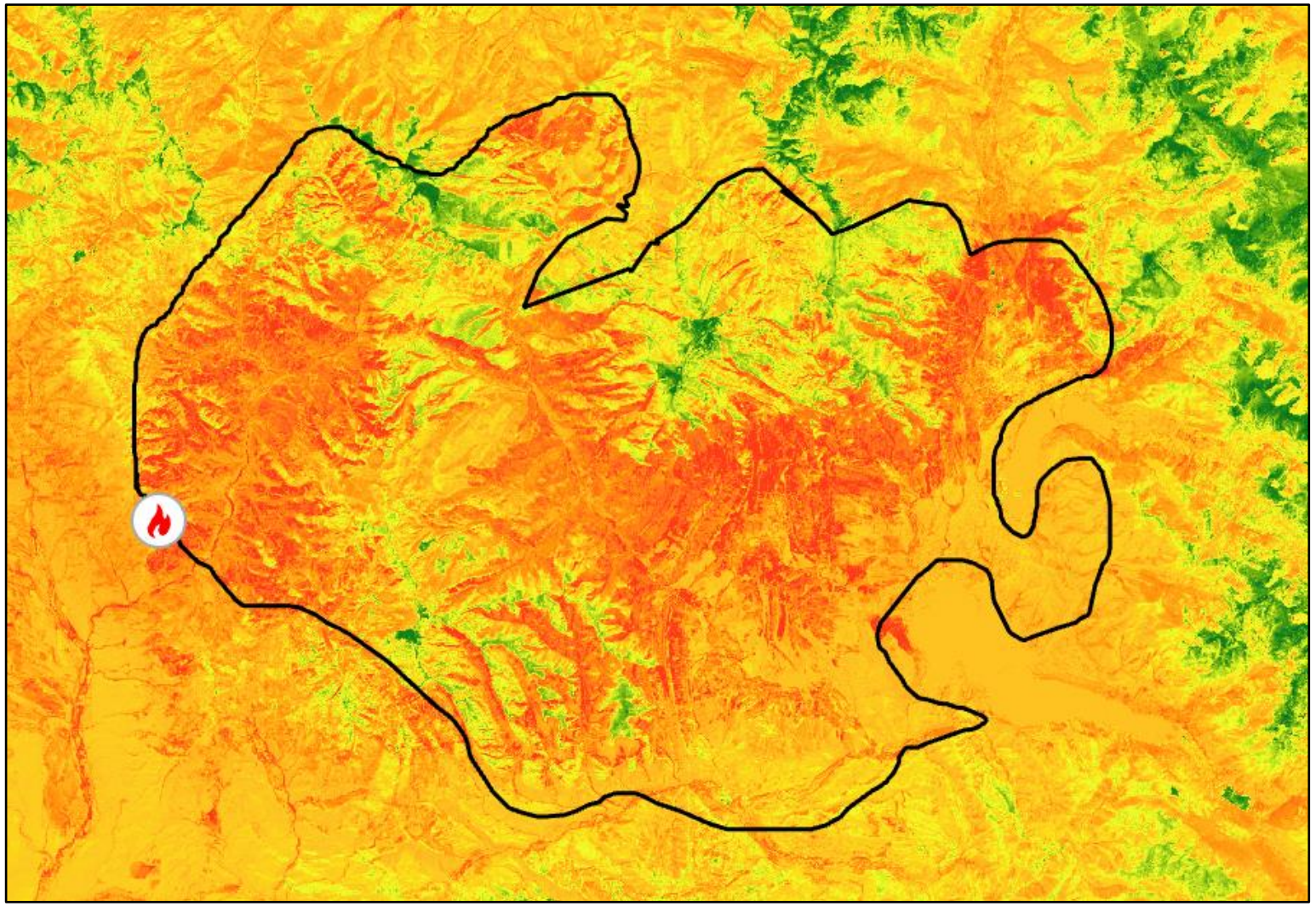


9/4/20 to 11/22/21



12/9/20 to 11/22/21

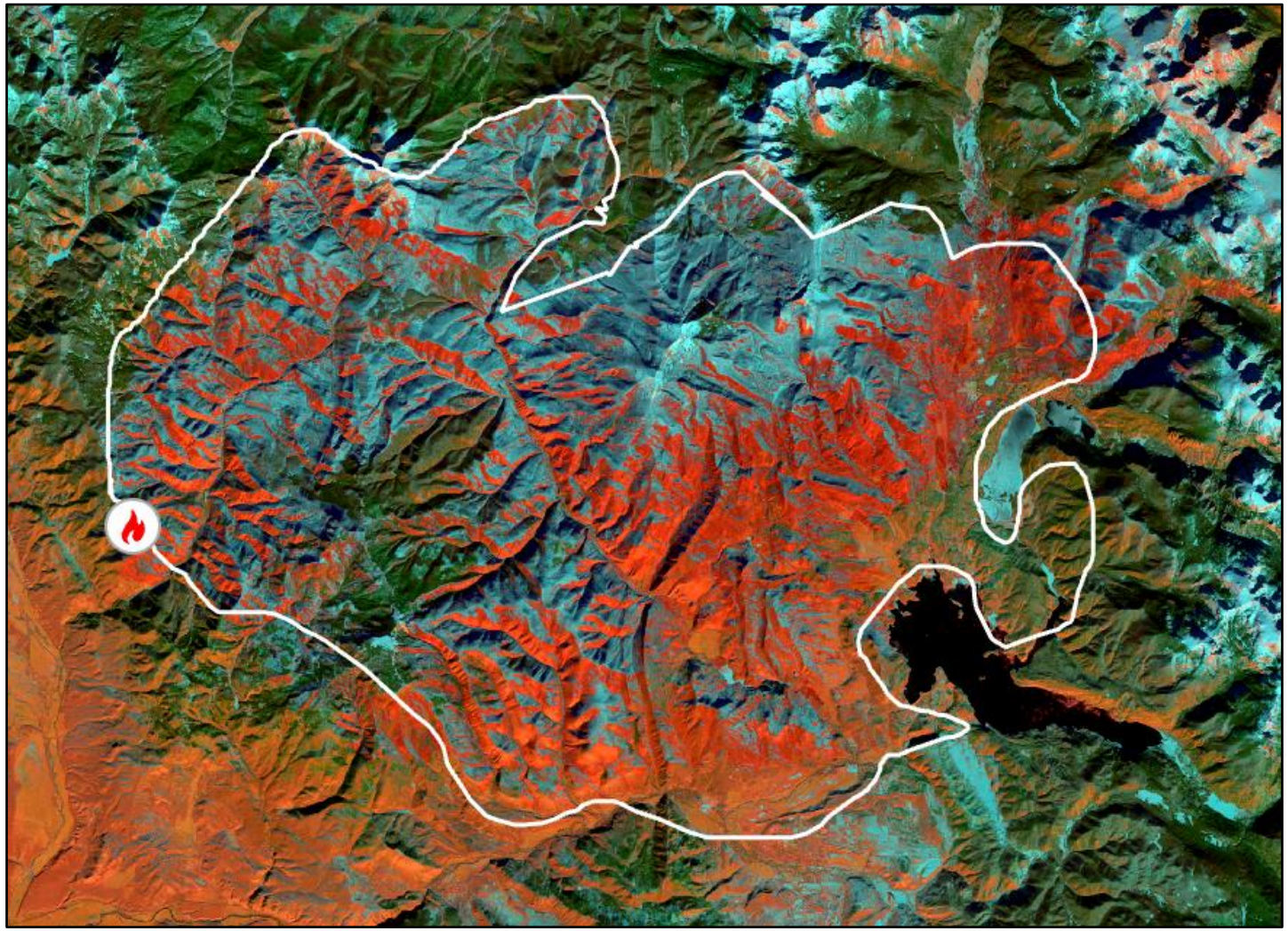
Fire Perimeter



Equal to
187,971 acres

Change NBR 9/4/20 to 11/22/21

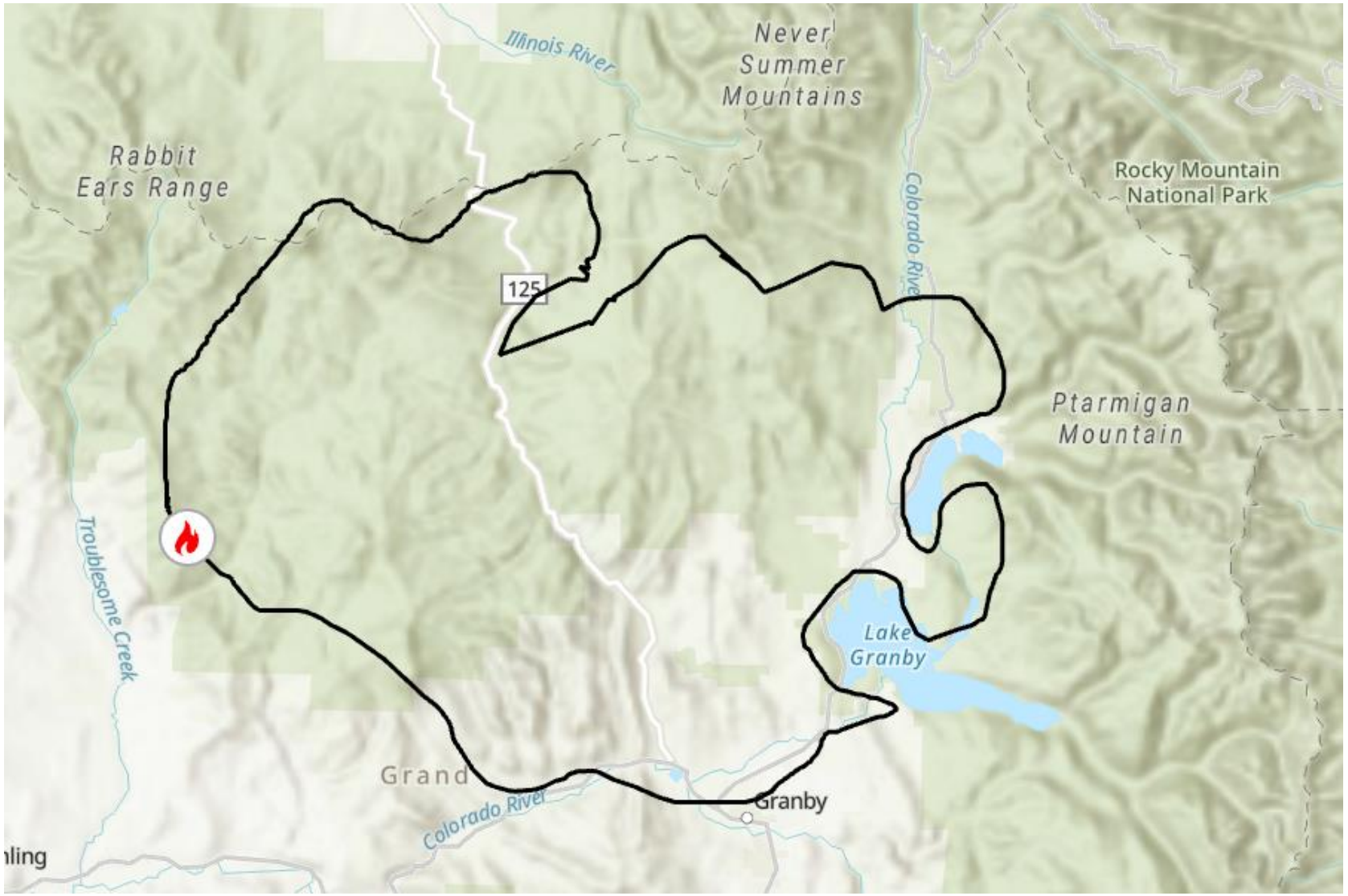
Fire Perimeter



Equal to
187,971 acres

Also shows up well on the burn scar image from right after the fire was contained on 12/9/20

Fire Perimeter



Recovering From Devastation

- During this time in 2020 five major wildfires simultaneously burned over 300,000 acres (more than 25%) of National Forest System lands on the Arapaho and Roosevelt National Forests– Cameron Peak, East Troublesome, Williams Fork, Lefthand Canyon and CalWood.
- In 2022, more than 8,000 acres of mulching occurred to reduce erosion and debris flows and over 800 acres were planted within the East Troublesome Fire burn scar.
- Although efforts have been made, the Forest Service states that recovery from these fires will take years, not months to address and warn people visiting near or in fire-impacted areas to be aware of flash flooding risks.

Conclusion

- Professionals may have access to more data making their analysis more complete.
- I tried to use the most recent data for that area dated on April 6, 2023, but there was too much snow cover to see anything significant.
- Overall, based off this analysis and image interpretation, we can see that there is a slow recovery from the damage done from this wildfire.
- If I were to do this again, I would choose other data sets from other dates to see if any striking differences can be seen.
- It is also hard to see in some images as a lot of forest fires were occurring in that region around that same time.

Analysis

- First downloaded bands 1 to 11 from each date from EarthExplorer.
- Input all the bands into ArcGIS Pro and created a composite band for each date using the *Composite Band* tool.
- Then, by going into the geodatabase and creating a feature class, I created the region of interest (ROI) using the polygon tool and drawing the area I wanted to focus on. I also created the fire origin point by researching where they think the fire began and estimating the location based off other maps and images.
- Clipped each composite raster to the ROI using the *Clip Raster* tool.
- Made Natural Color images using the band combination 4-3-2.
- Made False Color Infrared images using the band combination 5-4-3.
- Made Burn Scar Analysis images using the band combination 7-5-2.
- Analyzed the Normalized Burn Ratio (NBR) by choosing the *NBR* tool under *Imagery* > *Indices*.

Analysis

- After that, I calculated the NBR differences from each date making sure to choose the oldest date first. I included all three dates to compare the images. Overall, I think the best representation of the change is shown from before the fire to a year after the fire. (9/4/20 to 11/22/21). Changing the symbology was also helpful in seeing the contrasts.

- Finally, I created another feature class named *Fire Perimeter* and outlined the estimate of where the burn scar and NBR differences were the greatest.

- Adding a new field in the attribute table named *Acres* and calculating the value by taking the shape area and dividing it 4046.86 was the last step to getting the area of my *Fire Perimeter* polygon. The area I calculated was 187,971 acres which is very close to the estimated 194,000 total acres.

References

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