Mapping and Estimating Areas Affected by Wildfires in California

Kisman Bhattarai

Henry Ruiz

Noah Williams

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Agenda

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Methods
Results
Conclusions

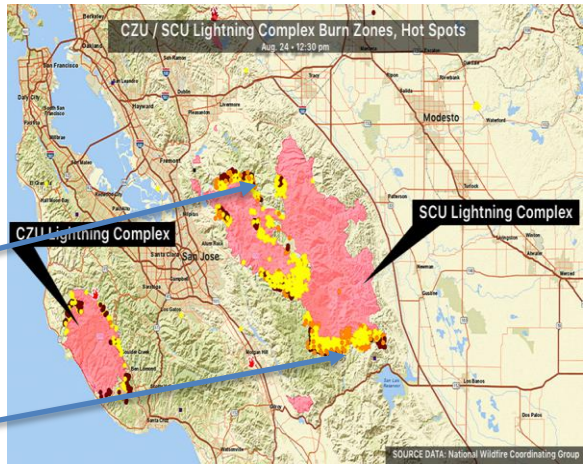
Objectives

1. Map and estimate the total fire burnt area during SCU wildfire
2. Analyze fire effect on the vegetation through NDVI

Background

- Historically, California has suffered from annual wildfires.
- These fires vary in severity due to differences in environmental factors (Mermoz et al., 2005)

Santa Clara Unit (SCU) Wildfires – study area



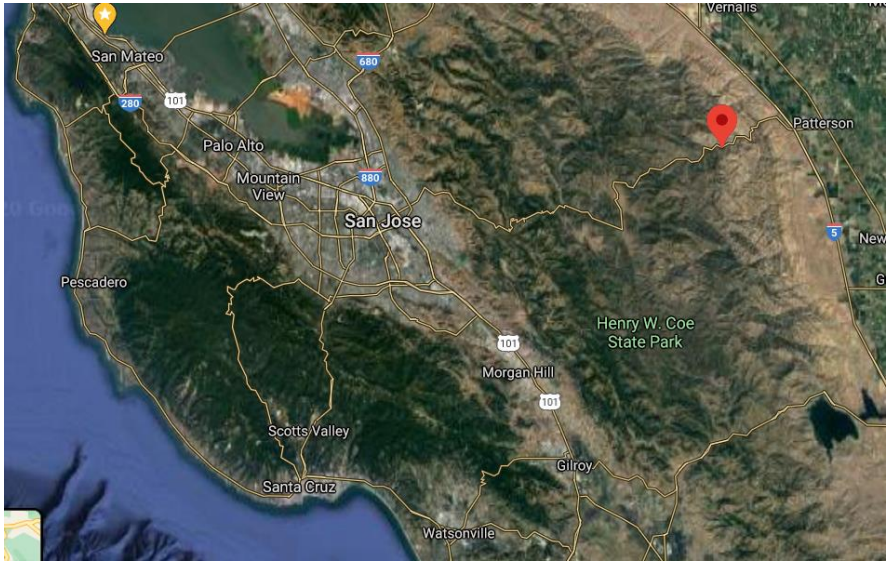
- Started from August 19, 2020
- 3rd largest in recent California history (Cal Fire, 2020)
- The cause of the fire is currently under investigation
- *Sequoia sempervirens* forest, while further inland is chaparral

Why is it important to map and estimate?

Identify the areas that are in prominent danger for better evacuation and management

Design and implement forest restoration activities effectively

How can we accomplish that?

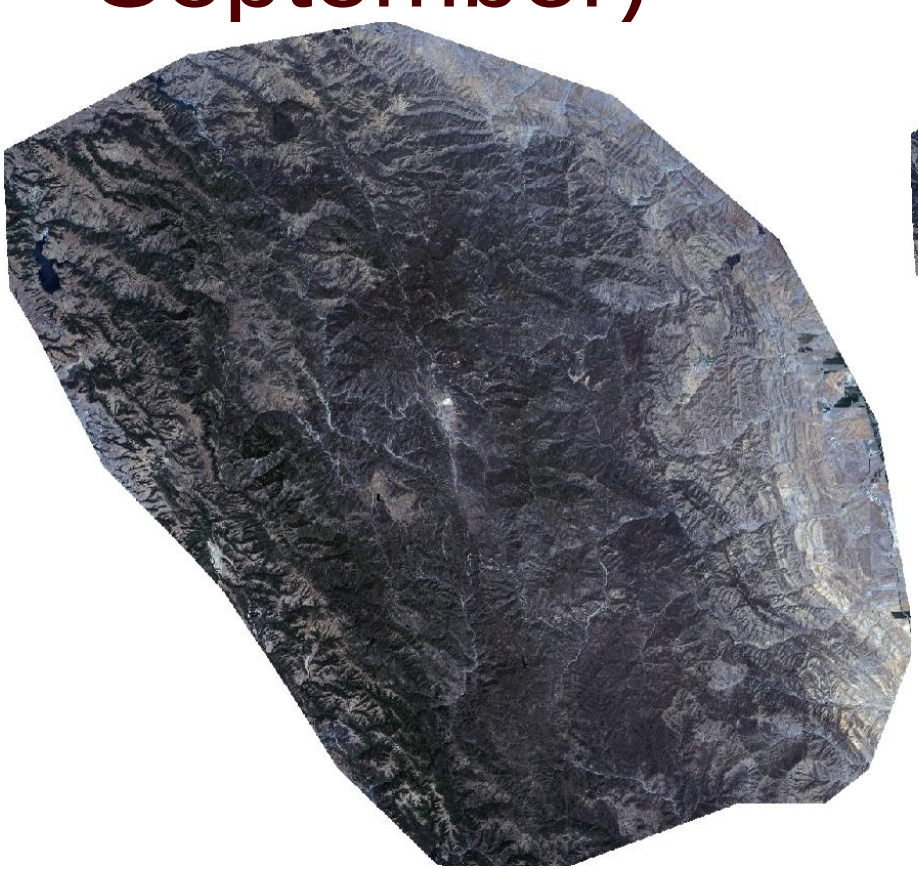


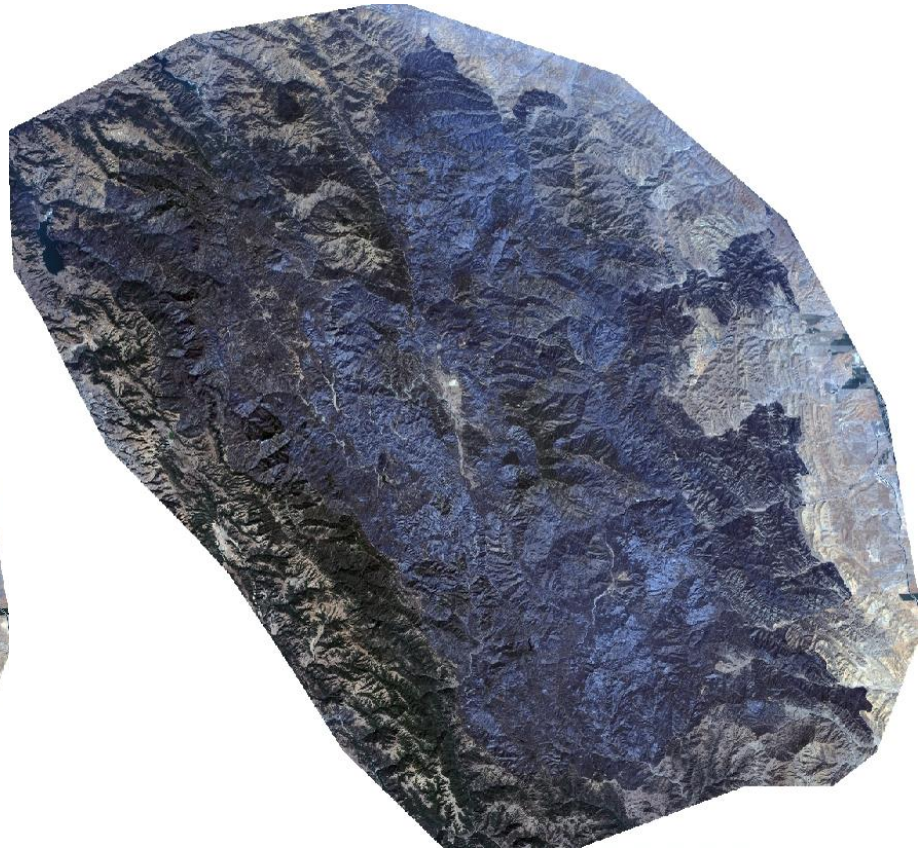
- Site visit of the massive fire burned area is time-consuming , hectic and expensive.
- We can take the advantage Landsat imagery; in no time we can see and estimate the area affected and execute plan effectively.
- Landsat imagery has been used previously to determine the extent of wildfires (Sirin et al., 2020)

Dataset description

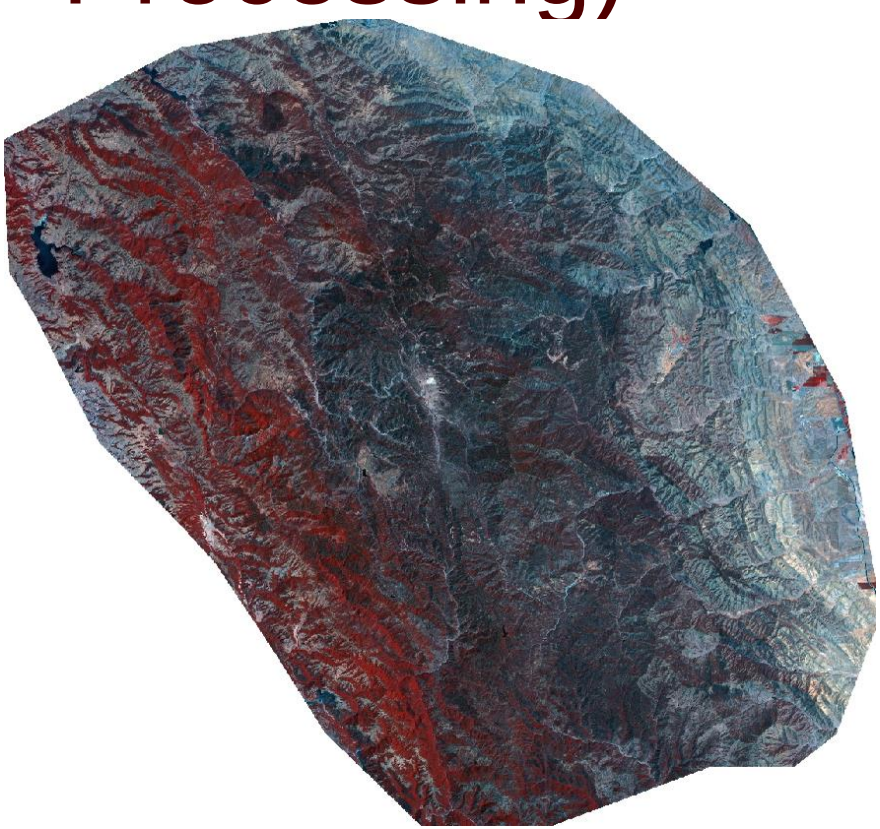
- We are using images from 08/09/2020 and the most recent available from Landsat.
- The WRS path/row are 44/34, respectively.
- The spatial resolution is 30m and consists of 7 spectral bands.
- The images were download from USGS Earth Explorer.

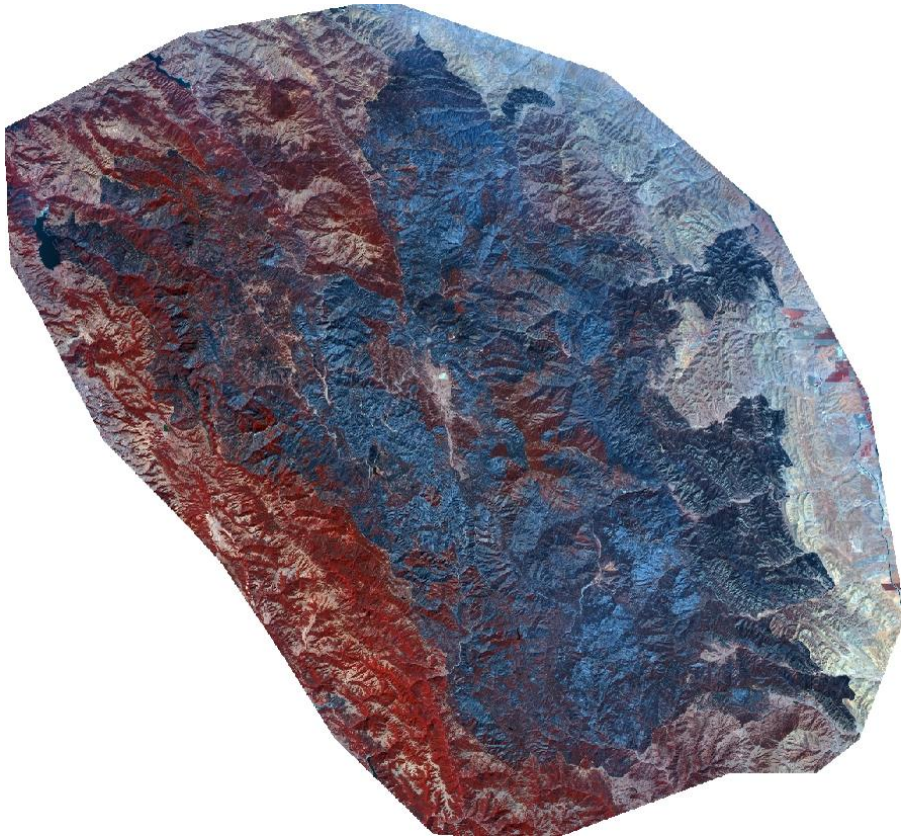
True Color Composites (August-September)



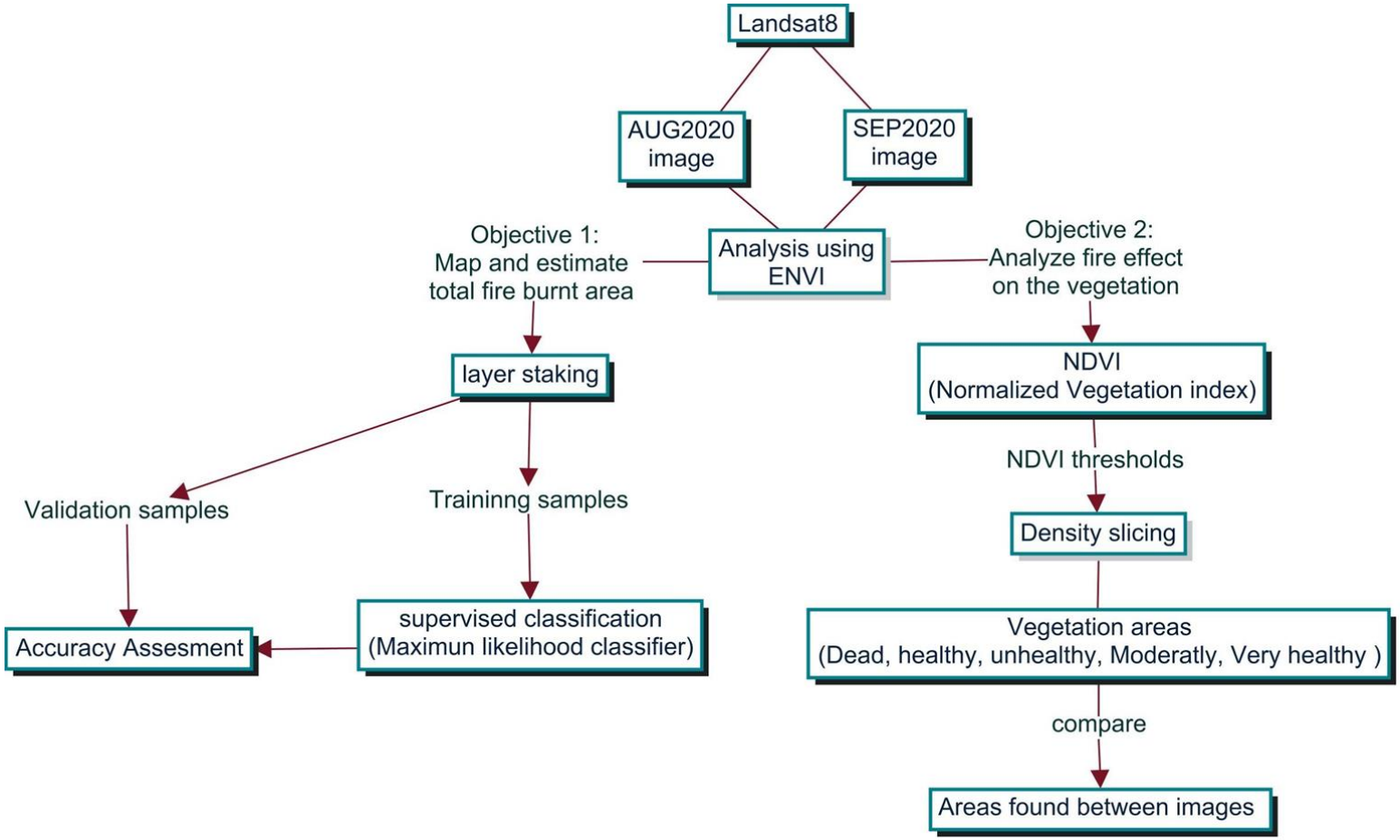


NIR False-Color Composites (Pre-Processing)





Methodological workflow

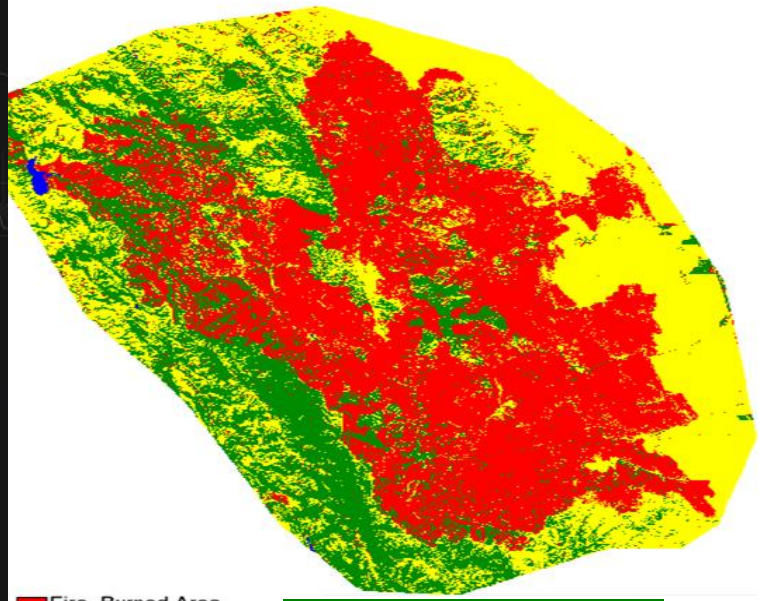


RESULTS

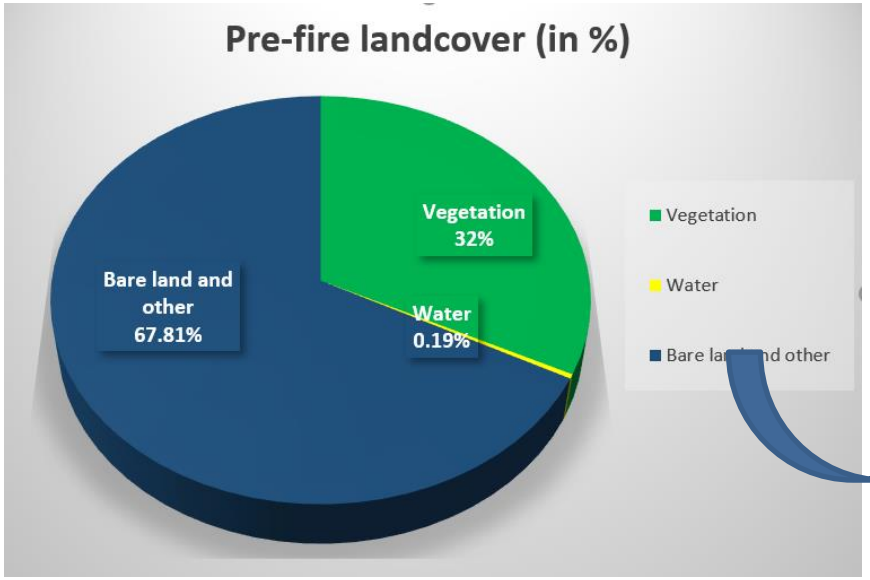
MAP AND ESTIMATE THE TOTAL FIRE BURNT AREA DURING SCU WILDFIRE

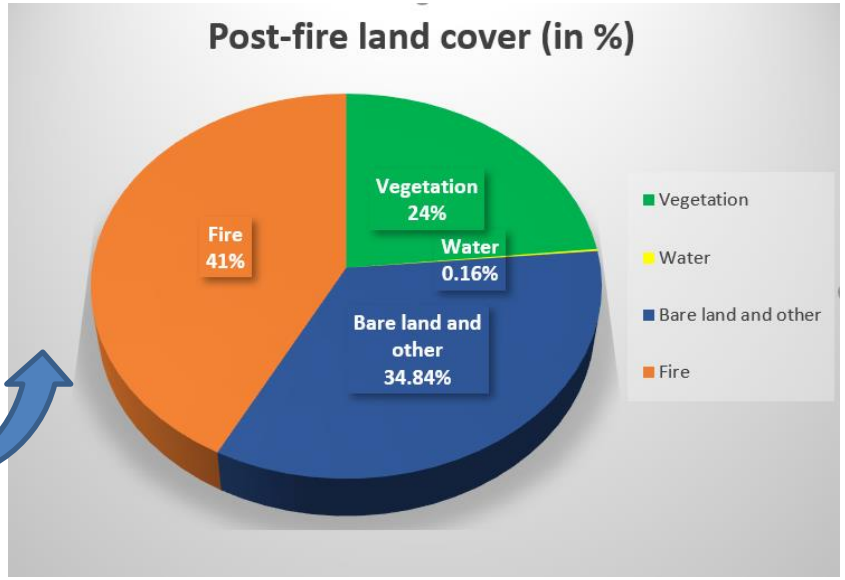
Mapping and estimating Burned area

Total burnt area estimated: 264,000 acres



Post-fire landcover (September 29)





8% decline in vegetation
32% decline in Bare land and others
41% of total area is affected by fire with-in span of one month

Accuracy assessment:

Confusion Matrix for August Image

Class	Vegetation	Water	Bare land and other	Total
Vegetation	916	0	1	917
Water	0	148	0	148
Bare land and others	176	38	1292	1506
Total	1092	186	1293	2571

→ The overall accuracy is 91%
Kappa Coefficient is 0.84

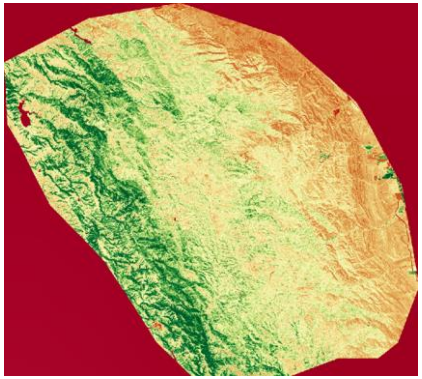
Confusion Matrix for September

Class	Fire-burned area	Vegetation	Water	Bare land and othe	Total
Fire-burned area	455	16	0	0	471
Vegetation	27	507	0	16	530
Water	0	0	386	0	386
Bare land and others	203	78	16	1277	1574
Total	685	601	402	1293	2981

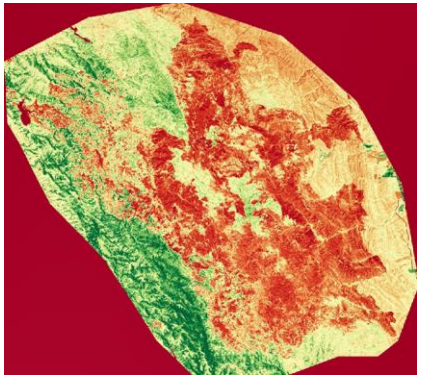
264,000 acres

→ The overall accuracy is 88%
Kappa Coefficient is 0.82

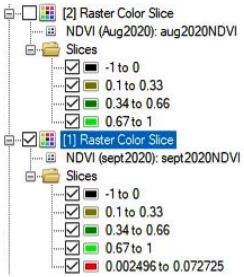
ANALYZE FIRE EFFECT ON THE VEGETATION THROUGH NDVI



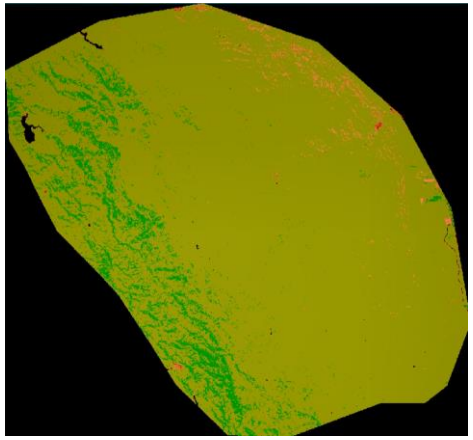
AUG2020
NDVI



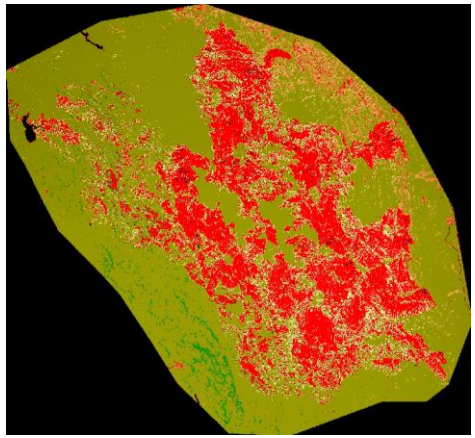
SEPT2020
NDVI



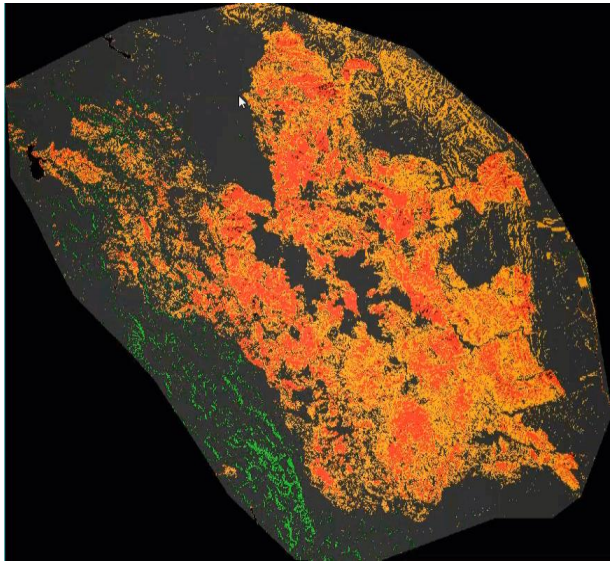
SPLIT
CLASSES



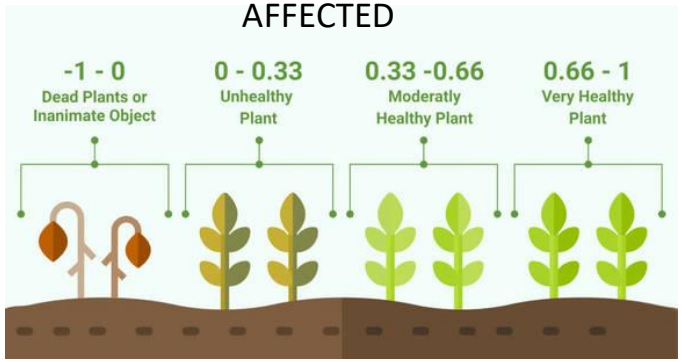
CLUSTER IMAGE



CLUSTER IMAGE

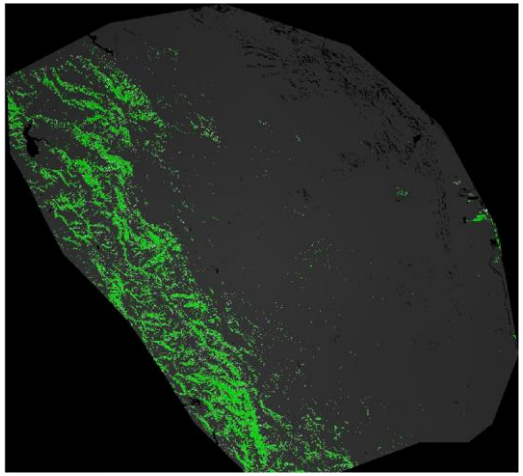


VEGATION
AFFECTED



NDVI SCALE

Results



TOTAL AREA BEFORE SCU wildfire

Unhealthy area ~ 61.85 %
Moderate healthy area ~ 4.38 %
healthy area ~ 0.10 %

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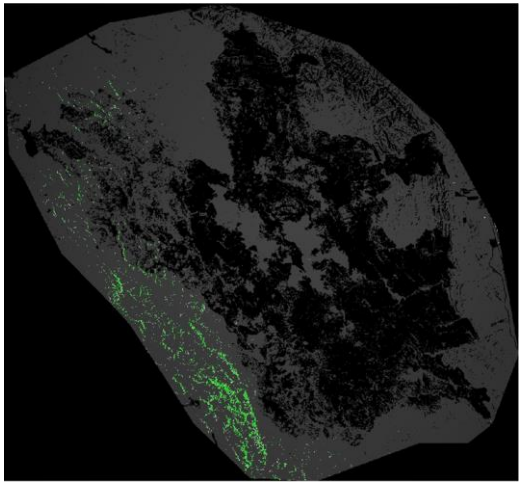

TOTAL AREA AFTER SCU wildfire

Unhealthy area ~ 41.02 %
Moderate healthy area ~ 0.51 %
healthy area ~ 0.0 %

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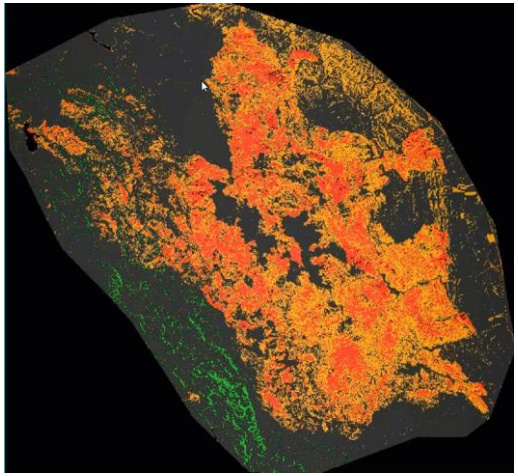

LOST AREA

Unhealthy area ~ 20.83 %
Moderate healthy area ~ 3.87 %
healthy area ~ 0.10 %

NDVI slices distribution

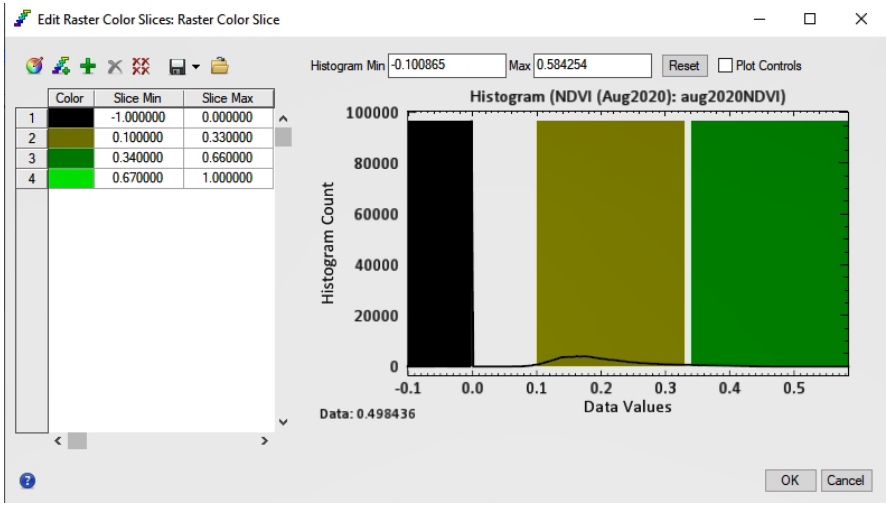

IMAGE BEFORE SCU wildfire

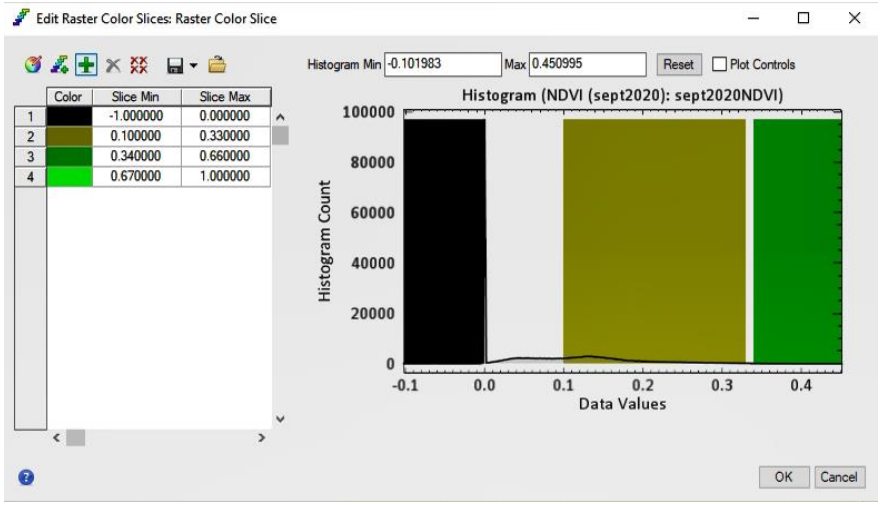

IMAGE AFTER SCU wildfire

Conclusions

Landsat imagery is capable of streamlining measurements for wildfire extent.

Vegetation indices are a useful tool for determining the effect wildfires have on vegetation.

References

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Thanks for listening…