WILDFIRE SIZE PREDICTION

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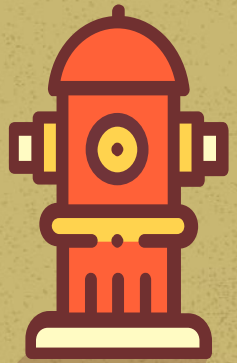
Contents of this Presentation

- Why We Are Here
- Data Collection
- Initial Findings
- Feature Selection and Modeling
- Conclusions/Recommendations
- Future Research



Problem Statement

Using only the reported initial location and time of a wildfire, can we use the historical and present meteorological and land cover data to predict the total acres burned in a wildfire incident?

Potential factors

- Current Meteorological conditions
- Historical Meteorological conditions
- Vegetation / fuel index
- Elevation
- Response time
- Natural and manmade barriers
- Local policies

Data Collection - Wildfire Locations

- Included initial location of a reported wildfire as well as the datetime
- Included many features unusable in our Problem Statement.

Initial Findings

Initial Findings

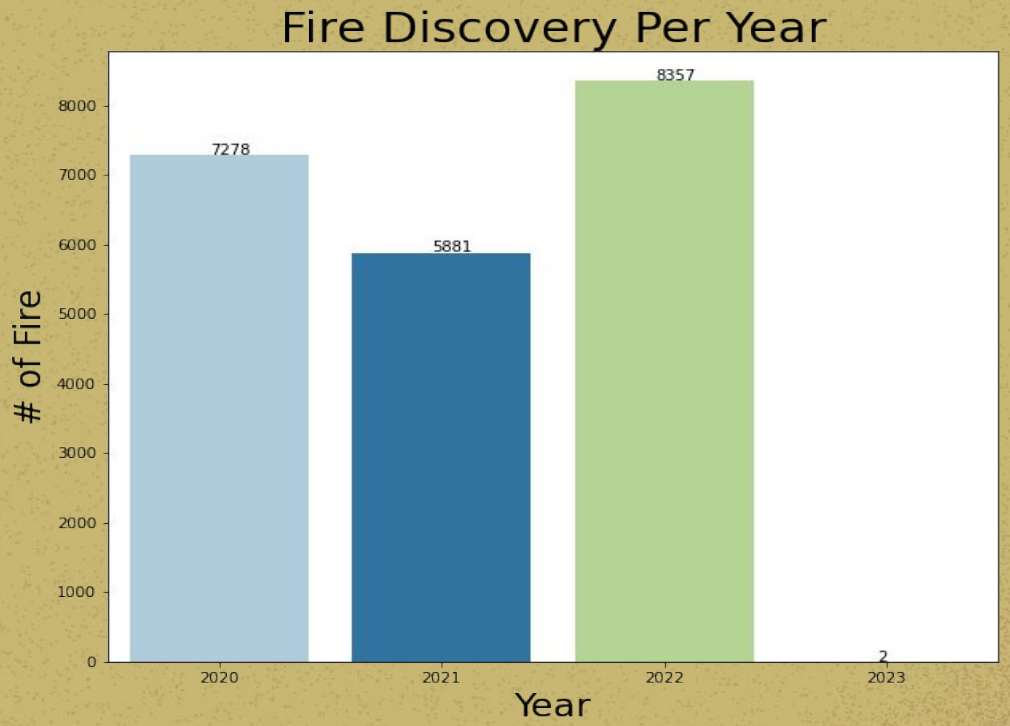
Data Collection – Meteorological

- POWER API by NASA powered by satellite. It was used to collect variety meteorological quantities using fire initial reported locations and dates

Initial Findings

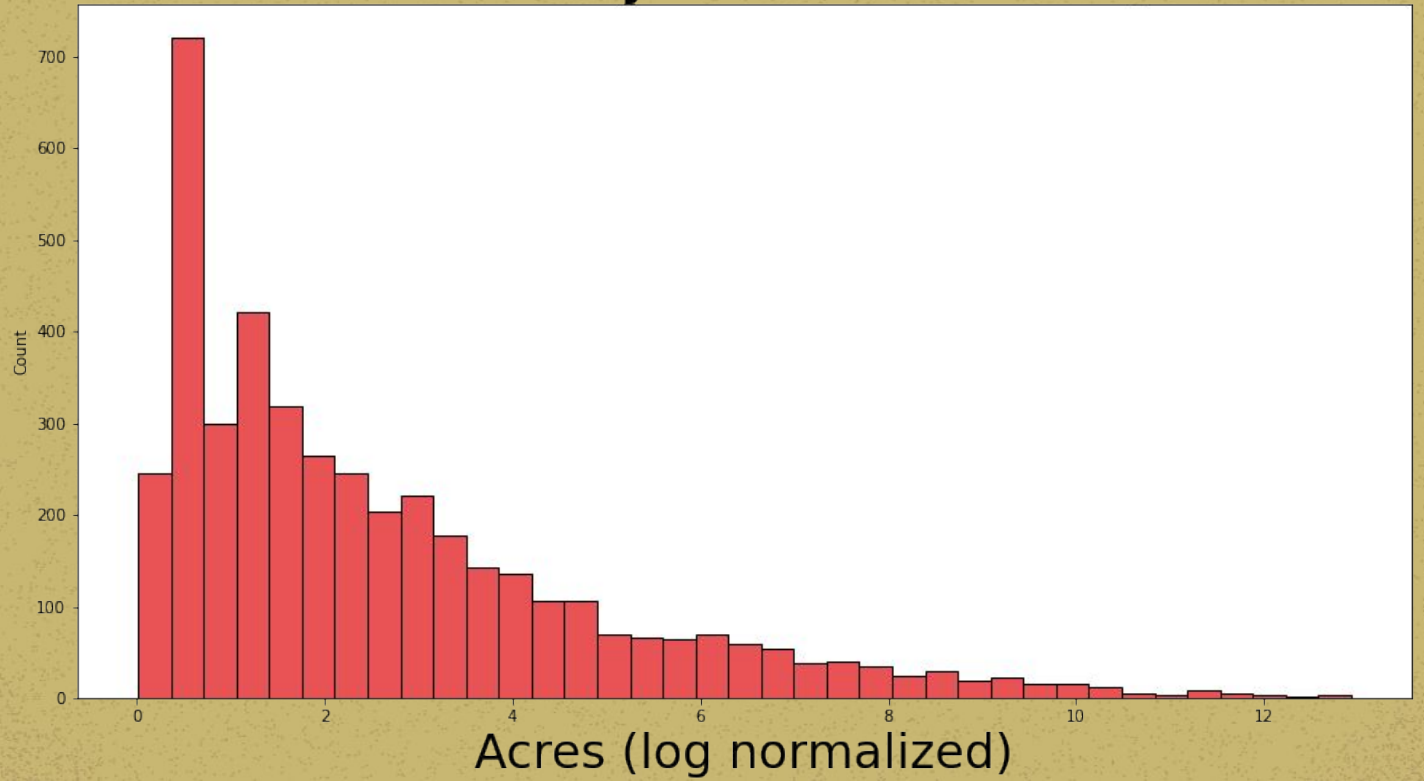
Total fires:

21518



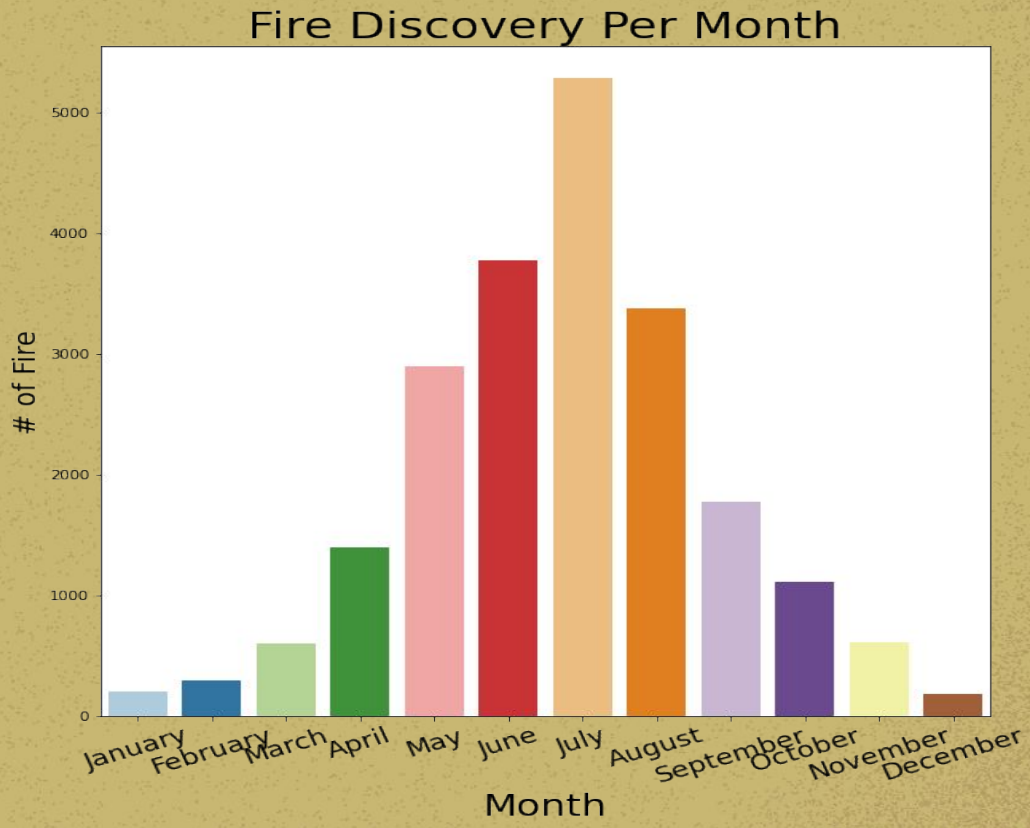
Initial Findings

Distribution Of Daily Acres Burned (acres > 1)



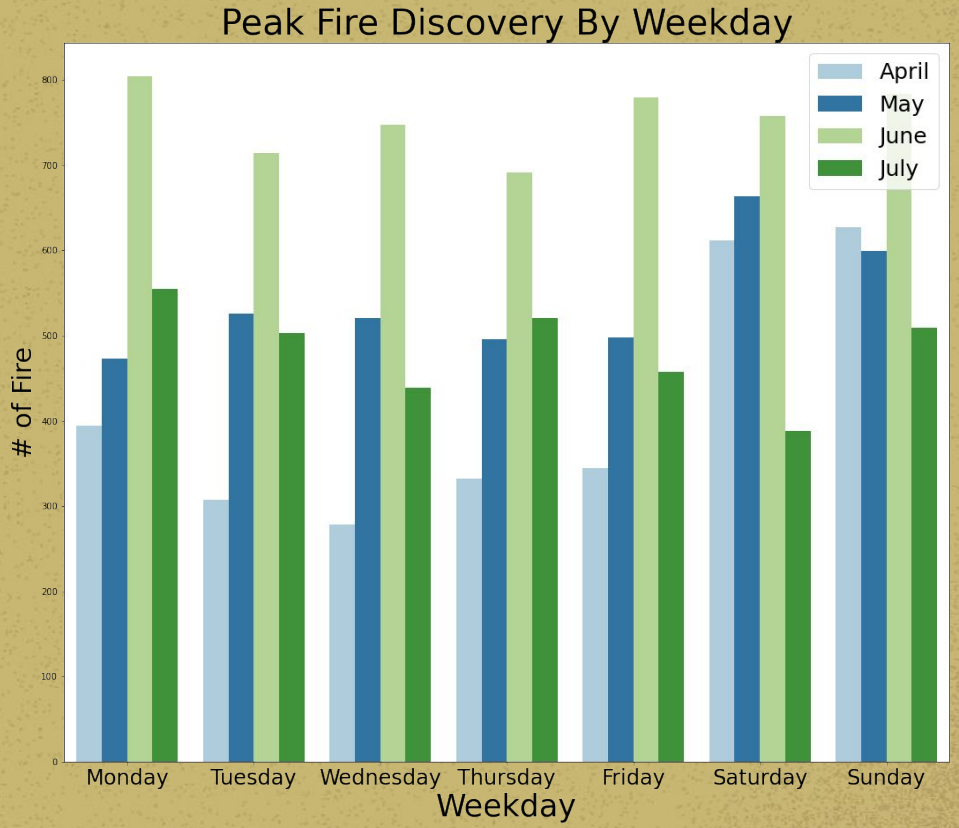
Initial Findings

Between months of May and August there were **15324** fire which is **71.2%** of total fires



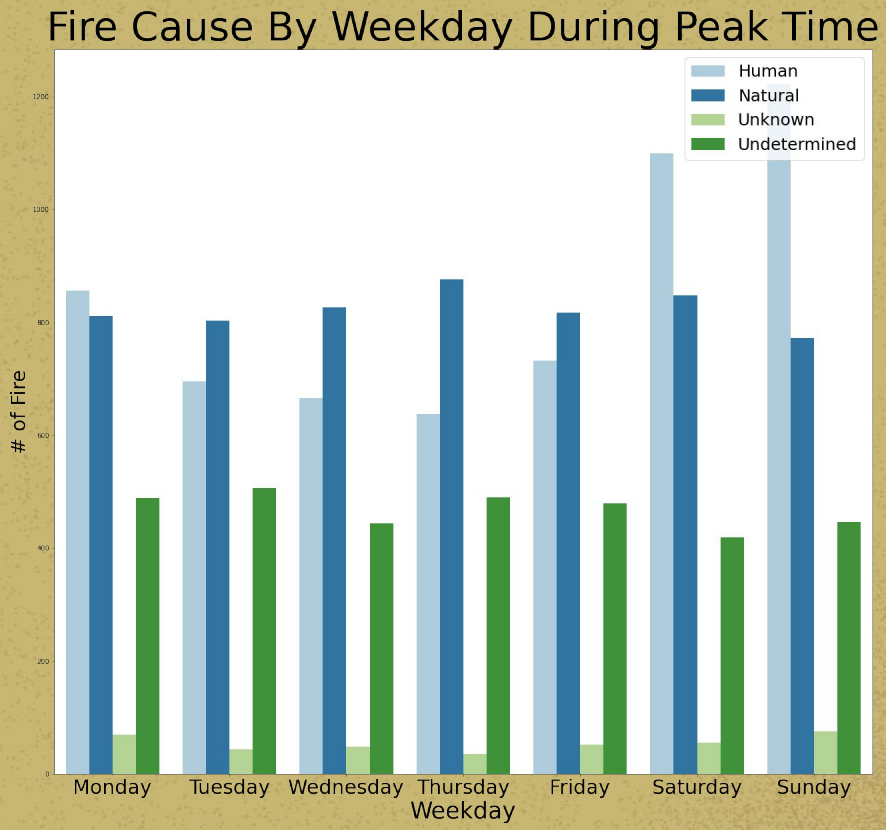
Initial Findings

During the peak wildfire months, it was **consistent** regardless day of week



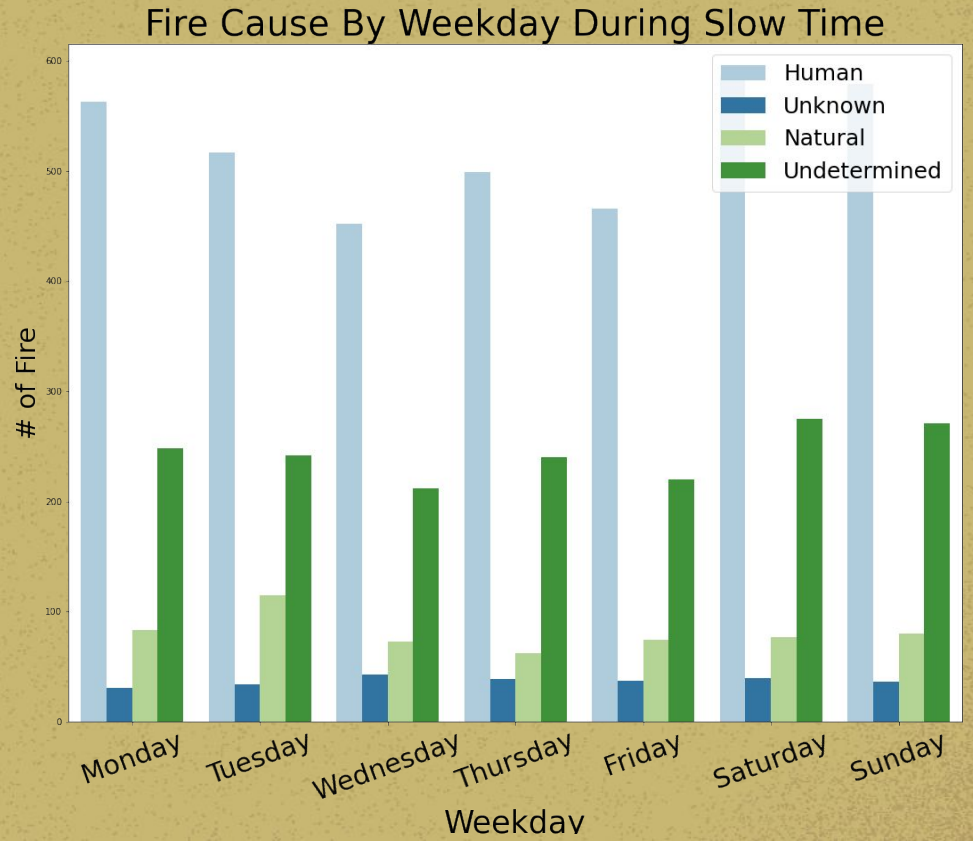
Initial Findings

Natural cause of fire has higher impact during weekday, however **human** cause peaks during weekend



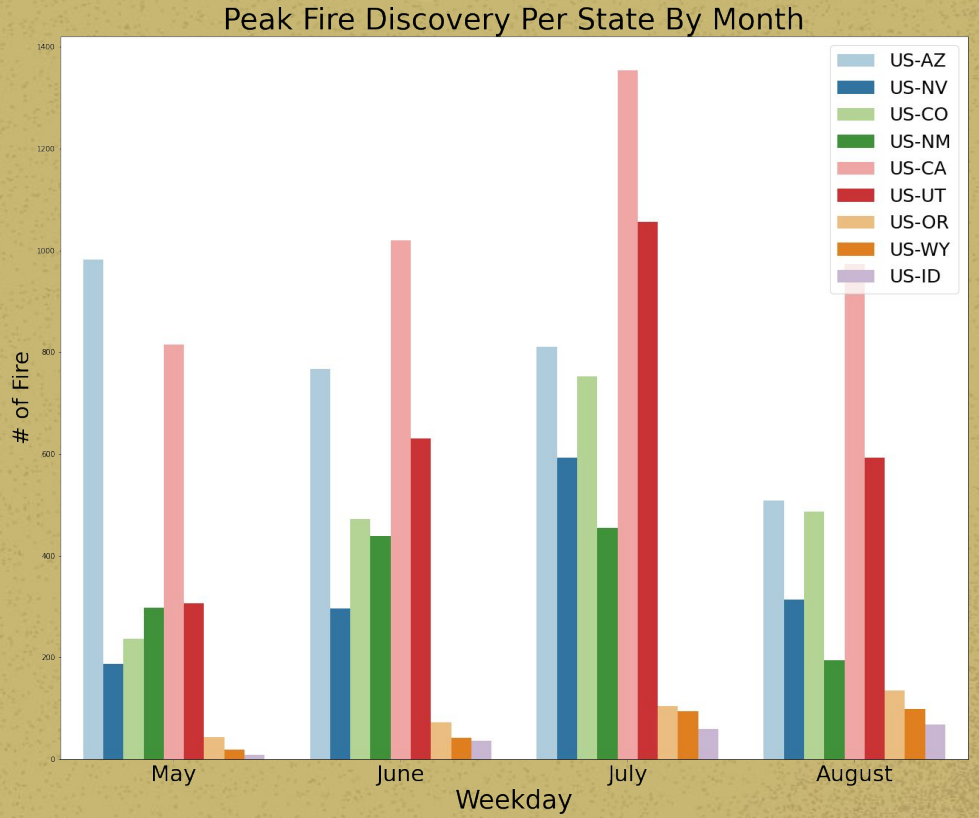
Initial Findings

During low wildfire season **humans** dominate in causing wildfire



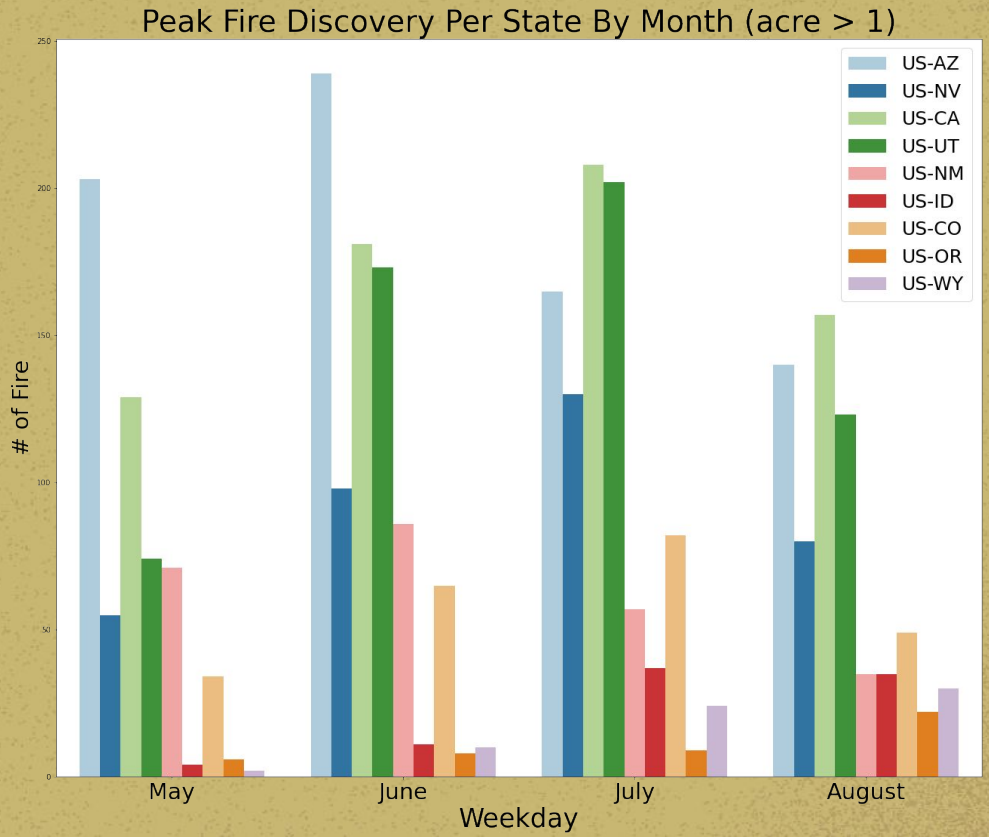
Initial Findings

New Mexico and **California** are leading for having the most wildfires



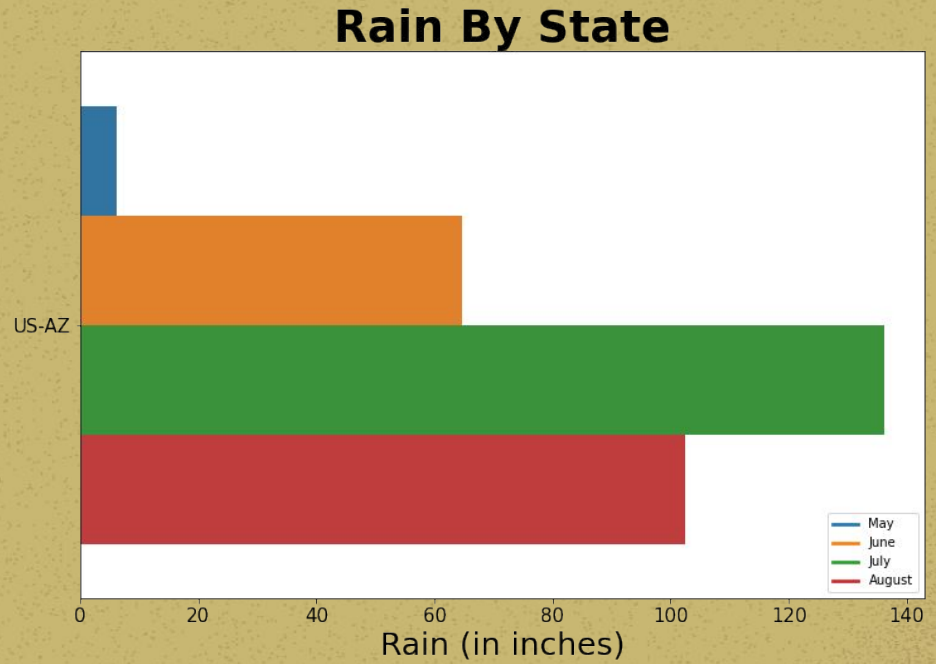
Initial Findings

However **Utah** is leading for number of big wildfires



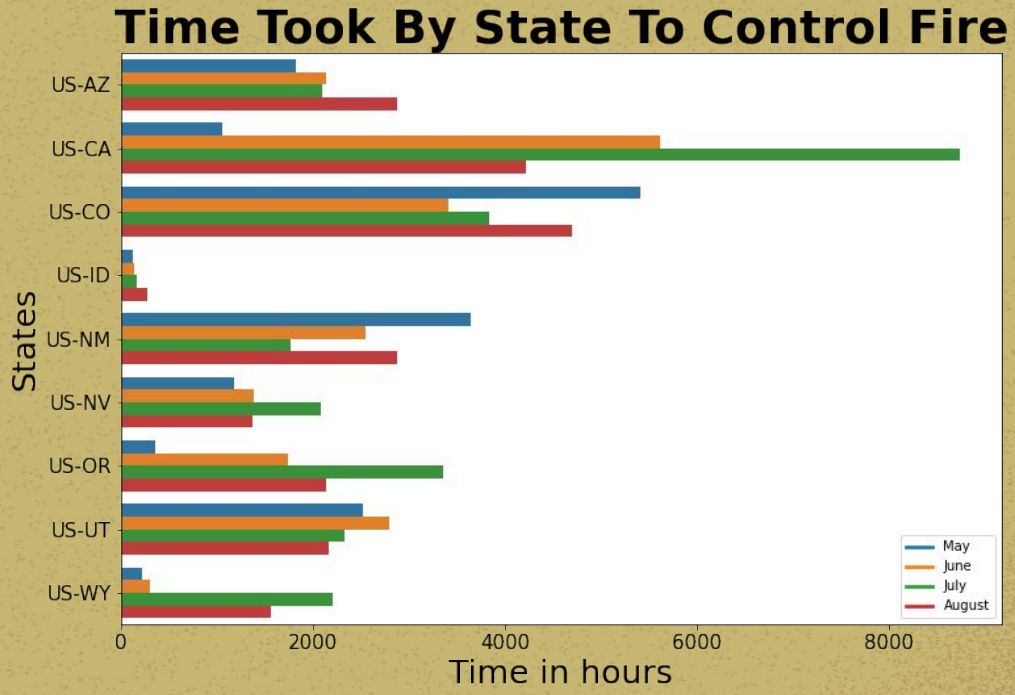
Initial Findings

It's highly possible when **Arizona** started having more rain, it directly correlated with number of wildfires when it was peaking during **May**

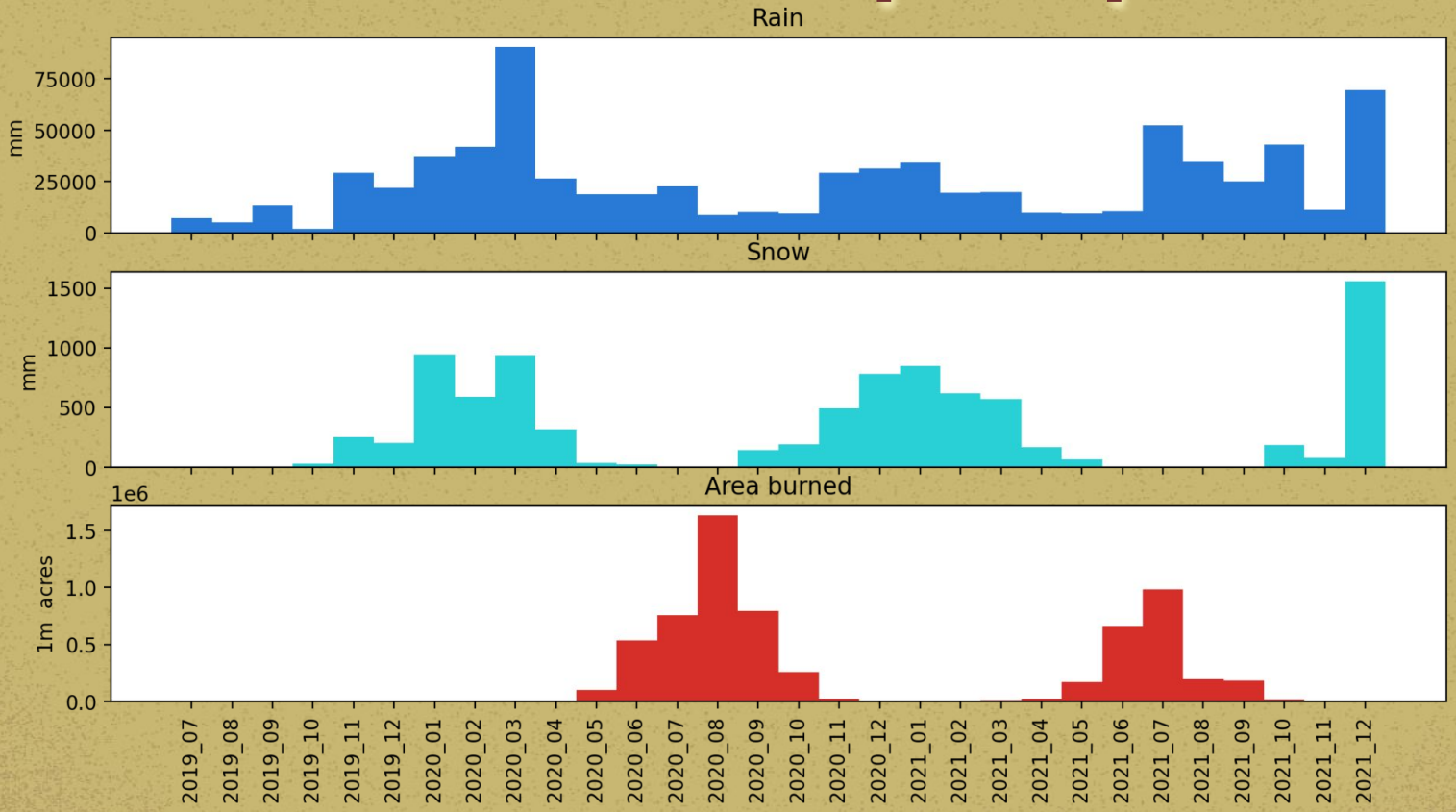


Initial Findings

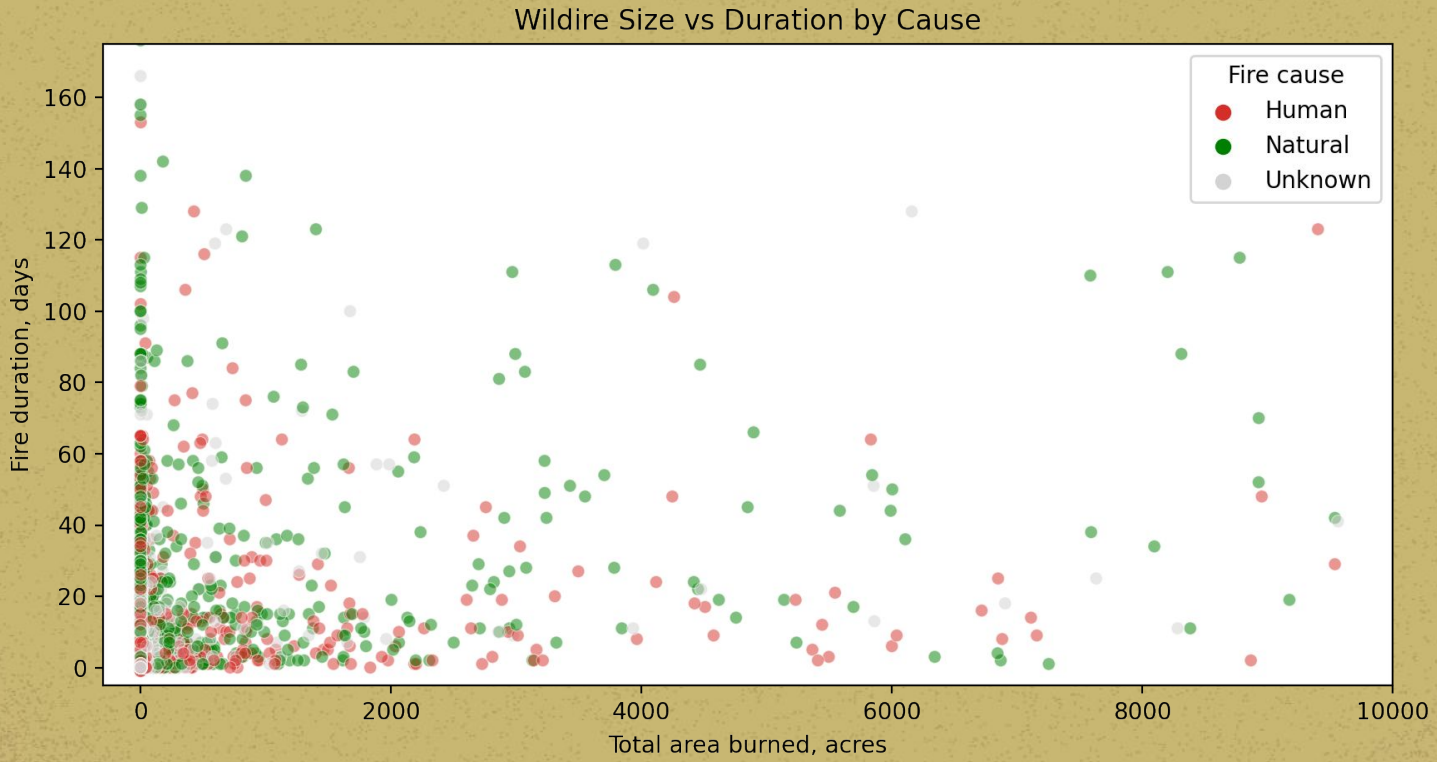
Even if **Utah** had a lot of wildfires, the response time to contain wildfire was impressive



Pre-fire season precipitation



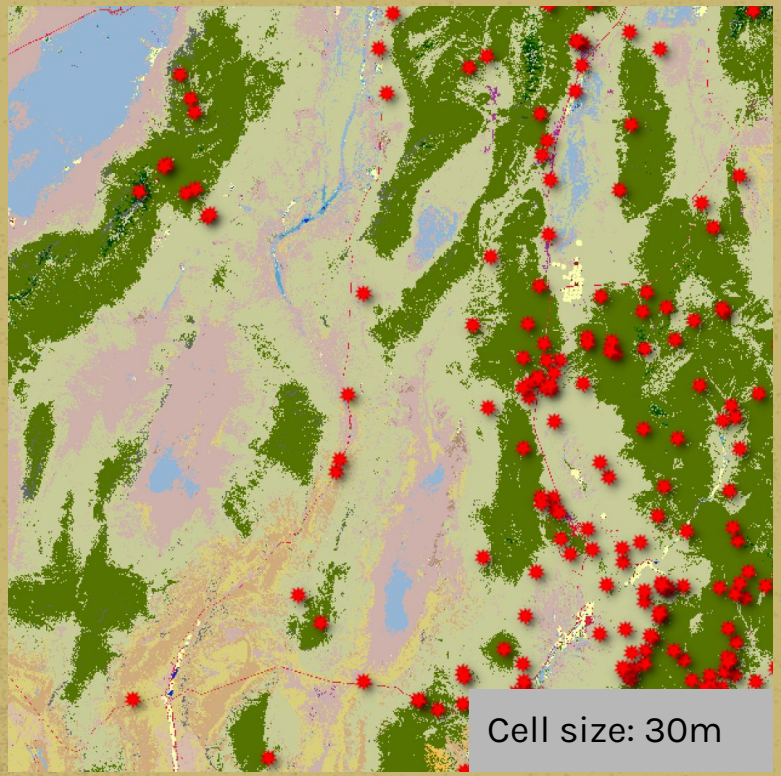
Findings

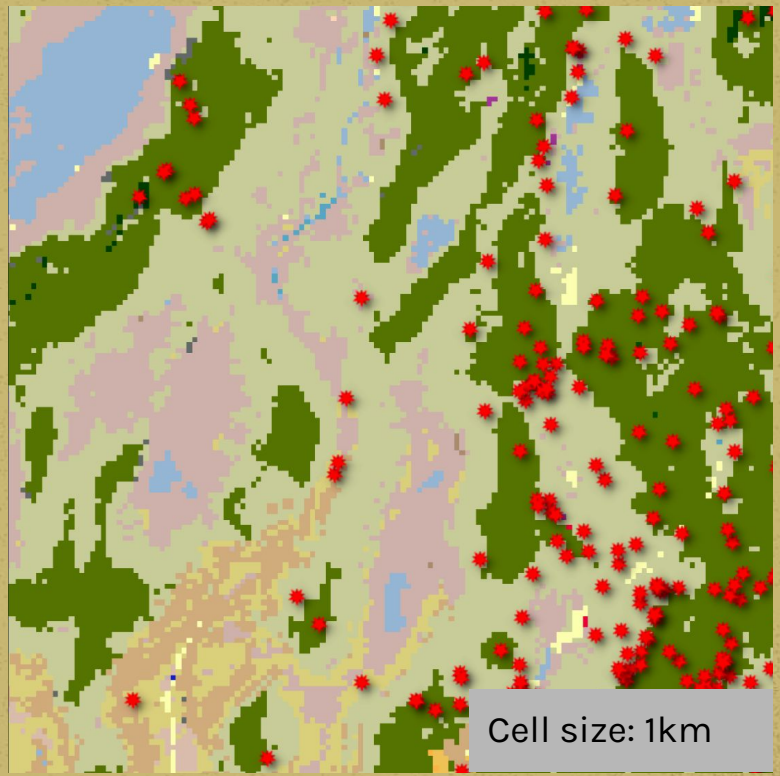

Wildire Size vs Duration by Cause
Fire cause
Human
Natural
Unknown
Fire duration, days
0
20
40
60
80
100
120
140
160
Total area burned, acres
0
2000
4000
6000
8000
10000

Data Collection: Land Cover zones

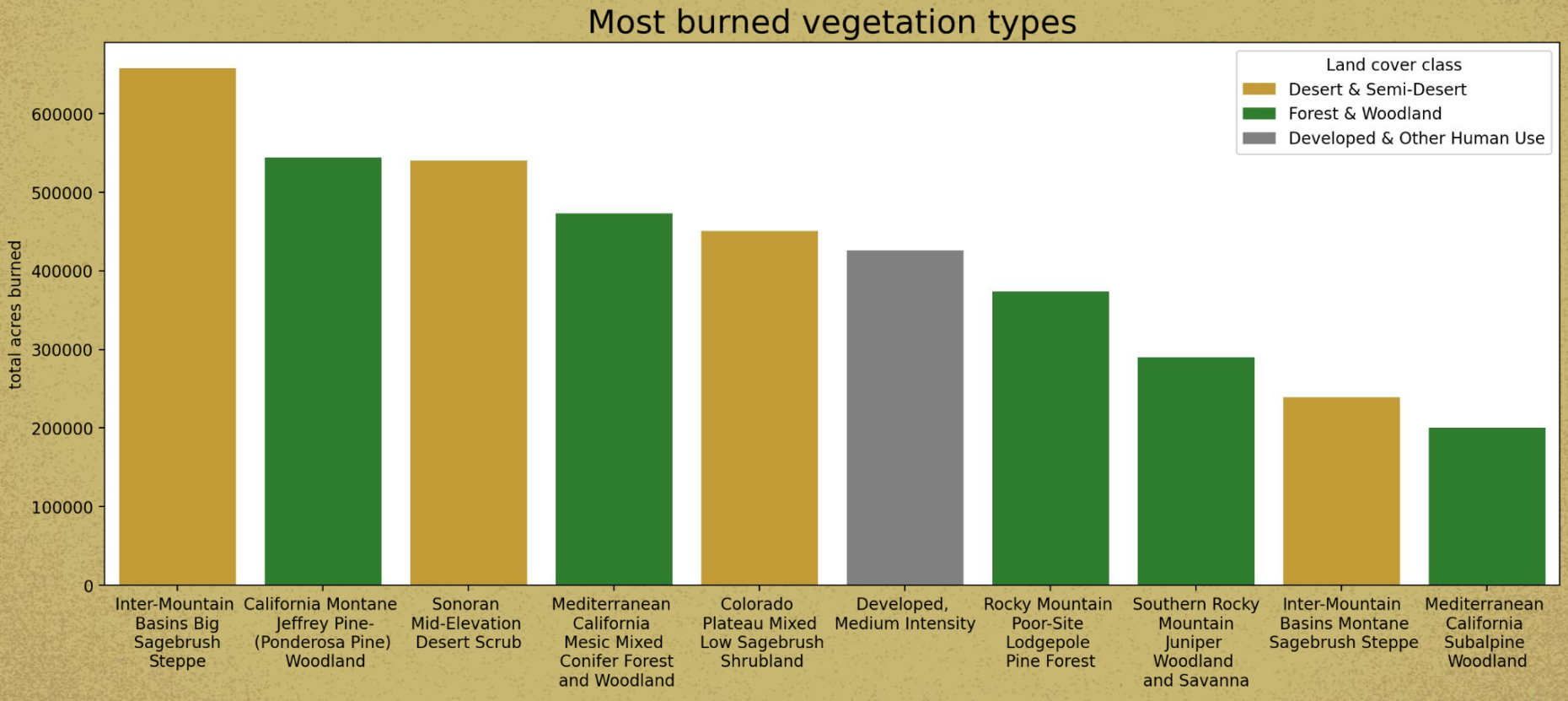
- The GAP/LANDFIRE **National** Terrestrial Ecosystems dataset
- 524 unique land cover categories
- Spatial resolution 30 m

Land Cover: preprocessing





Findings


Most burned vegetation types
Land cover class
Desert & Semi-Desert
Forest & Woodland
Developed & Other Human Use
total acres burned
0
100000
200000
300000
400000
500000
600000
Inter-Mountain Basins Big Sagebrush Steppe
California Montane Jeffrey Pine-(Ponderosa Pine) Woodland
Sonoran Mid-Elevation Desert Scrub
Mediterranean California Mesic Mixed Conifer Forest and Woodland
Colorado Plateau Mixed Low Sagebrush Shrubland
Developed, Medium Intensity
Rocky Mountain Poor-Site Lodgepole Pine Forest
Southern Rocky Mountain Juniper Woodland and Savanna
Inter-Mountain Basins Montane Sagebrush Steppe
Mediterranean California Subalpine Woodland

Initial Modeling

- Began with investigatory modeling of data collected for all fires
- Investigated fires over 1 acre and lasting longer than 24 hours

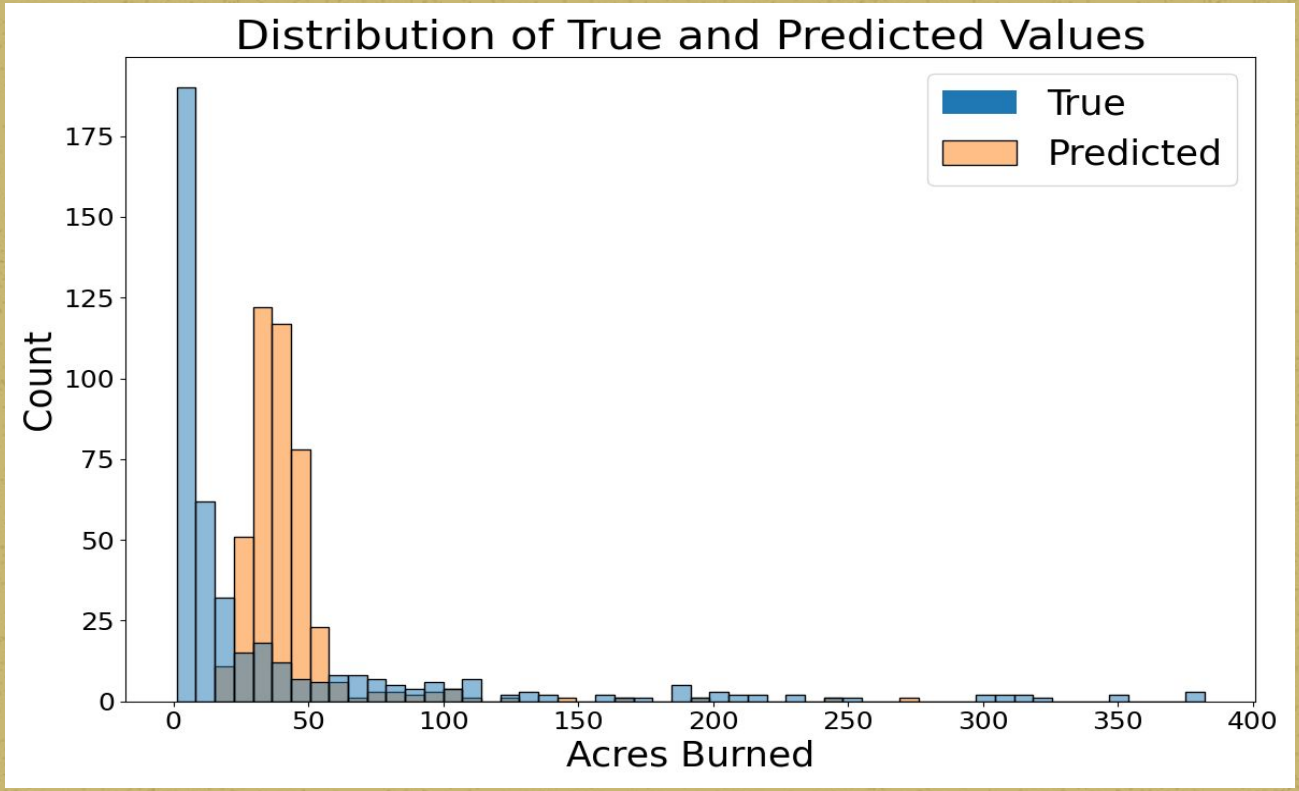
Modeling and Feature Selection

- Without the landcover_class categorical feature
- With the landcover_class categorical feature dummied
- With the landcover_class categorical feature dummied and then PCA-transformed (to reduce dimensionality)
- Without the categorical feature polynomial transformed and then PCA-transformed (to reduced dimensionality)

Best Models

	Dataset Used	RMSE	R-Squared Training	R-Squared Testing
Stacked Ensemble	X_train	62.05	0.126	0.205
Linear Regression	X_train	62.93	0.117	0.183

Model Analysis



Model Analysis

	Coefficient
wind_speed_2m_max	25.131269
wind_speed_10m	23.760358
surface_soil_wetness_to_bedrock	2.494384
temp_2m	2.367230
DiscoveryAcres	1.592272
rain	1.299634
sum_snow	0.509858
humidity	0.333696
sum_rain	-0.024284
temp_2m_max	-1.318652
wind_speed_10m_max	-12.463318
surface_soil_wetness_5cm_below	-14.805358
wind_speed_2m	-41.718141

Conclusions

Based on the wide variety of analysis conducted, it is challenging to build a model that could predict how many acres would burn during a wildfire event. Since the direct cause is often by humans and often during a time perfect for wildfires, correctly predicting the size of the resulting fire is nearly impossible with just the initial location.

Future Research

- Accurate Slope Data
- Geography – Human Elements
- Geography – Natural Elements
- Investigation on Select Elements (i.e. – Certain Vegetation Coverage)
- Investigate predicting daily growth rather than total acres burned

THANK YOU

TEAM PAWESOME

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