

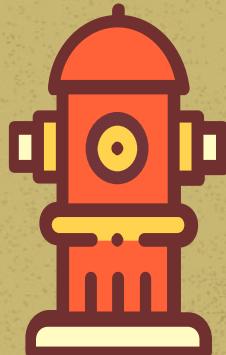
WILDFIRE SIZE PREDICTION

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Contents of this Presentation

- Why We Are Here
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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

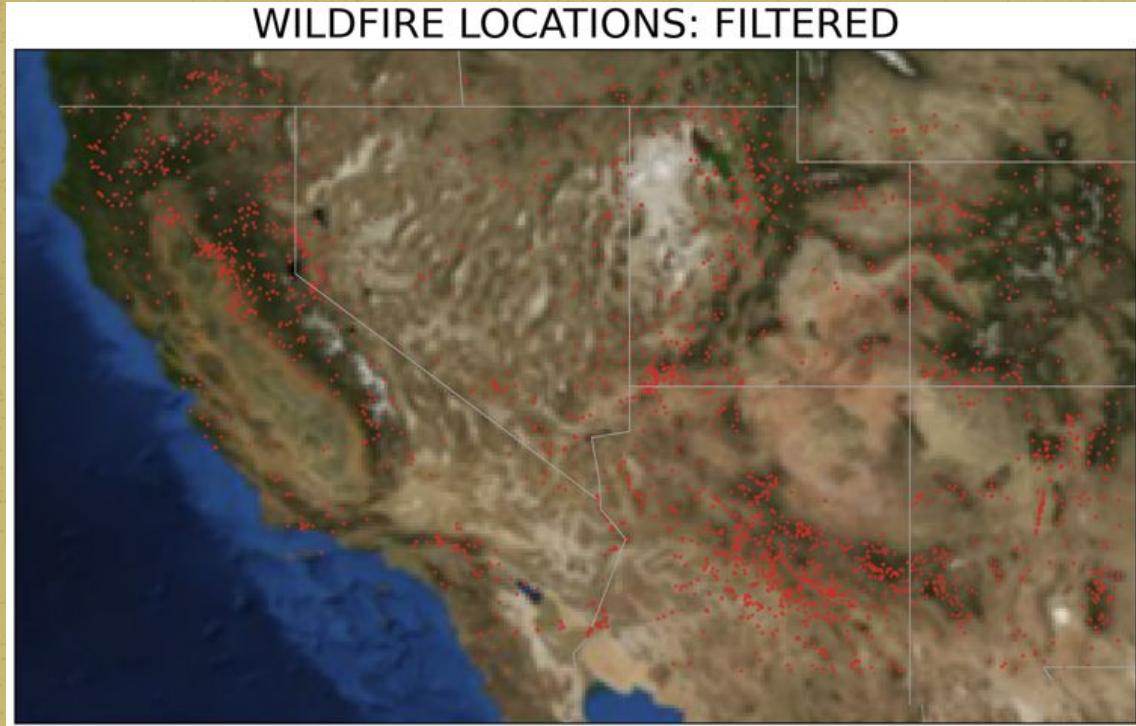
- Included initial location of a reported wildfire as well as the datetime
- Included many features unusable in our Problem Statement.



Initial Findings



Initial Findings



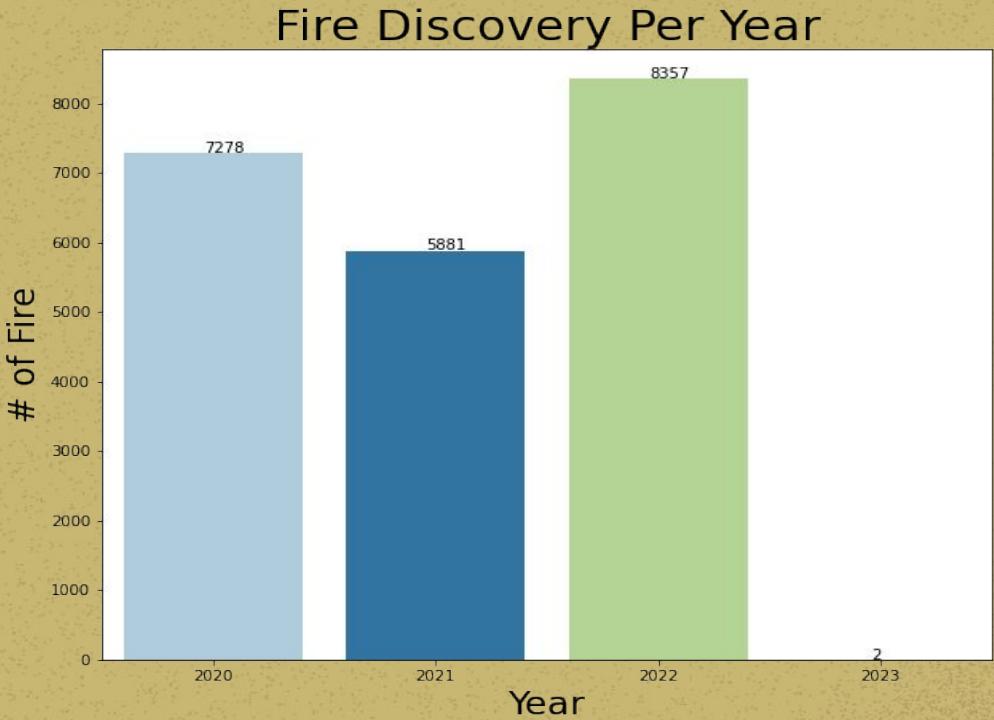
Data Collection - Meteorological

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



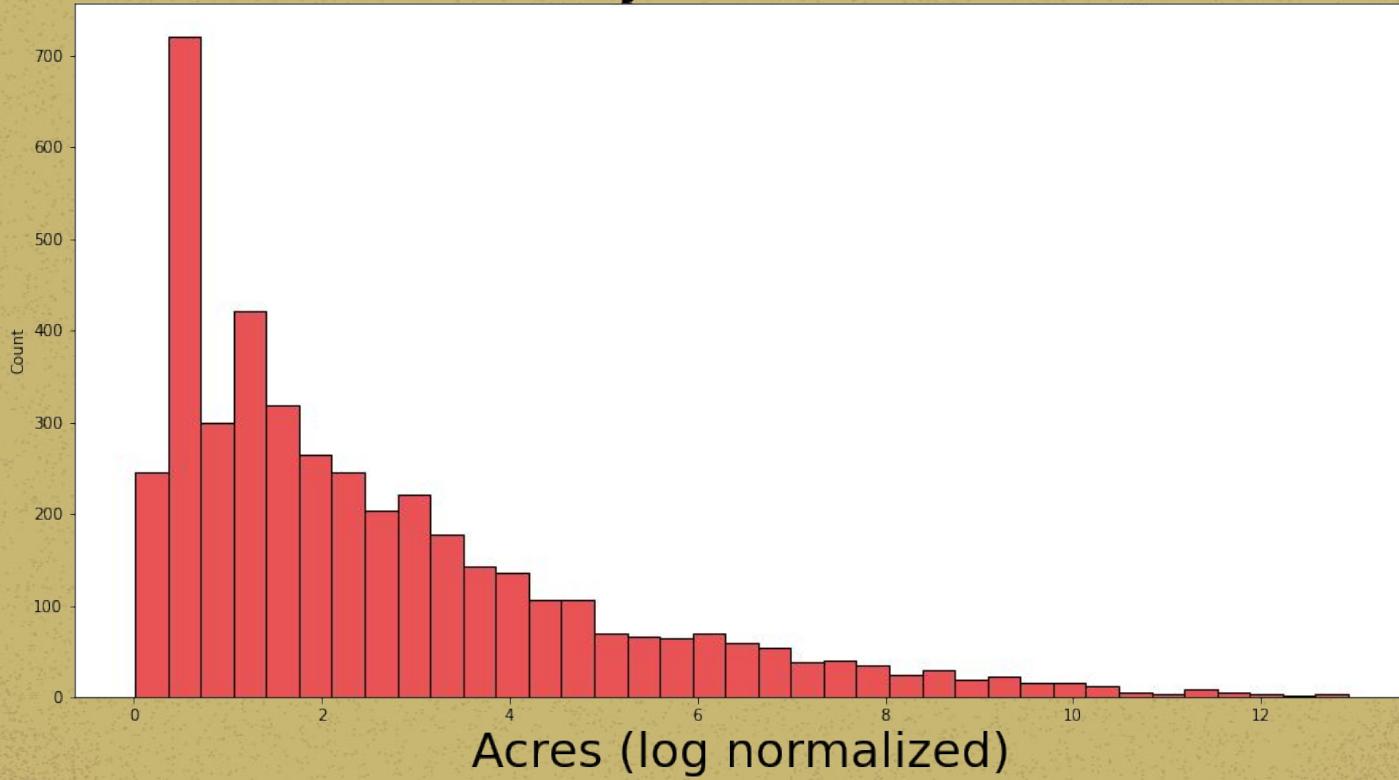
Initial Findings

Total fires:
21518



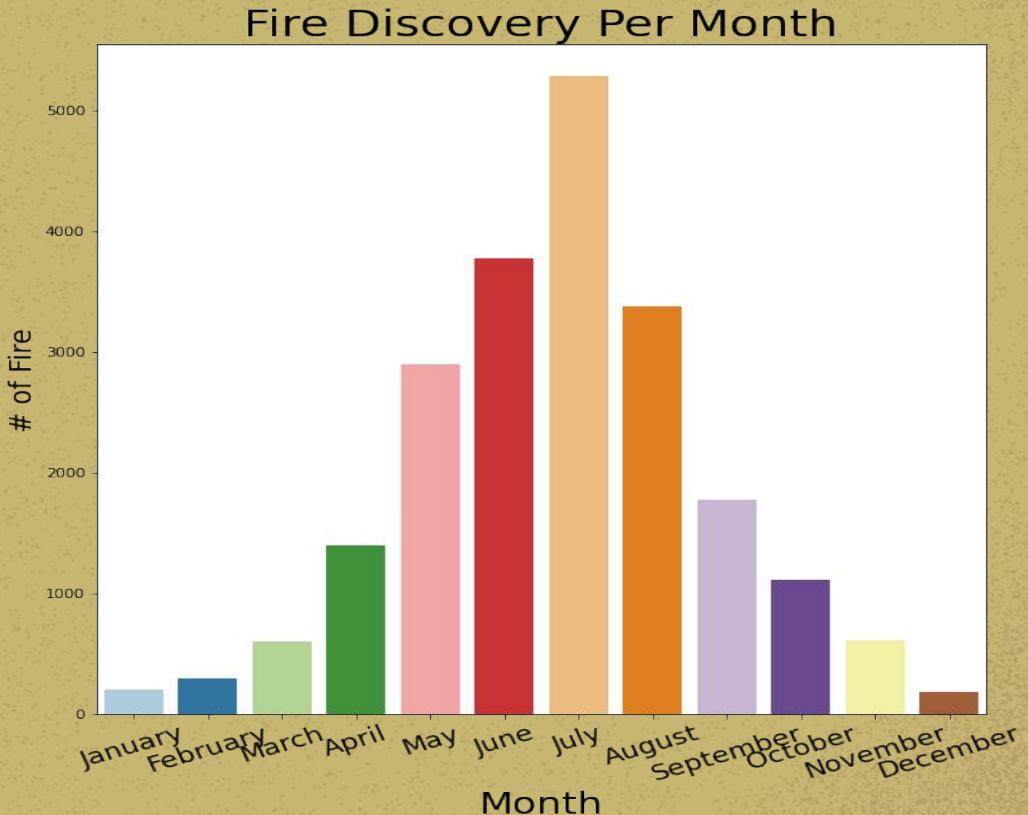
Initial Findings

Distribution Of Daily Acres Burned (acres > 1)



Initial Findings

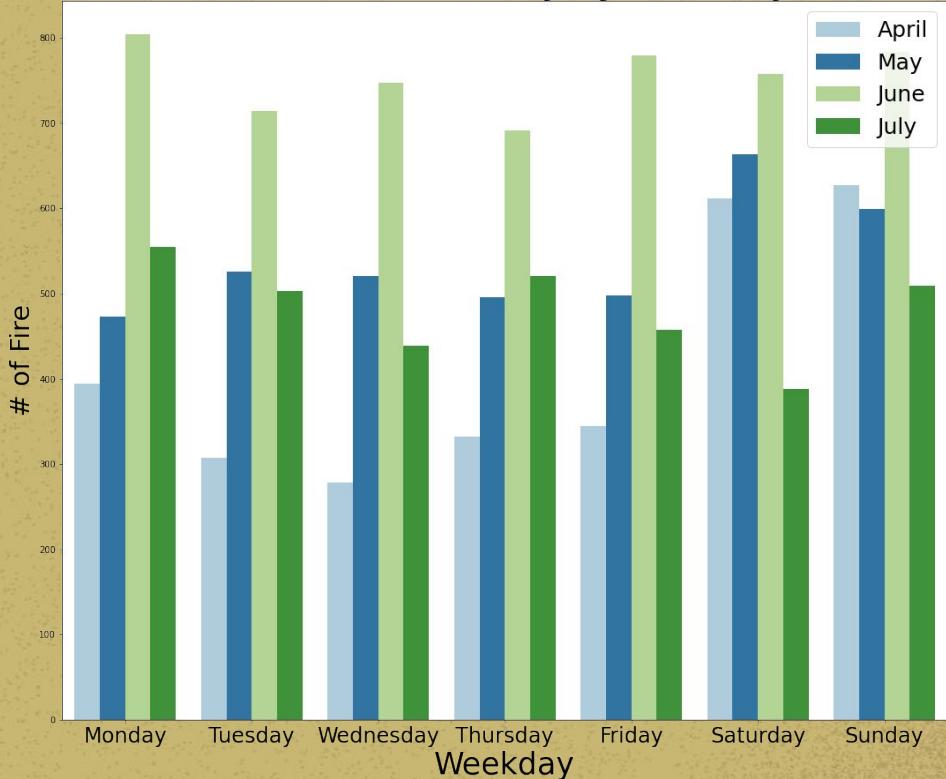
Between months of May and August there were **15324** fire which is **71.2%** of total fires



Initial Findings

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

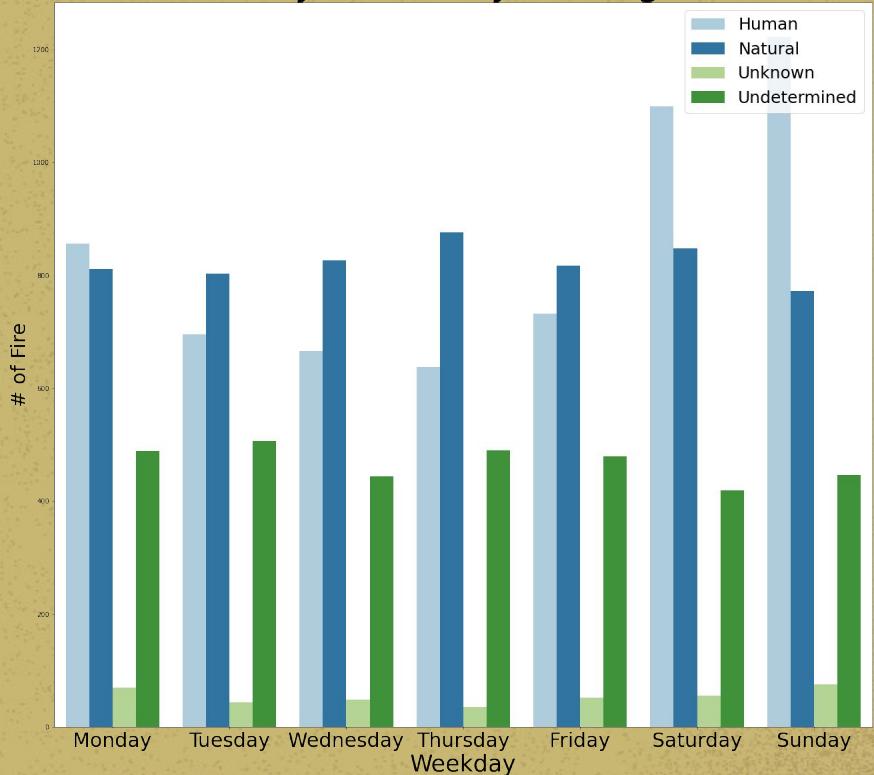
Peak Fire Discovery By Weekday



Initial Findings

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

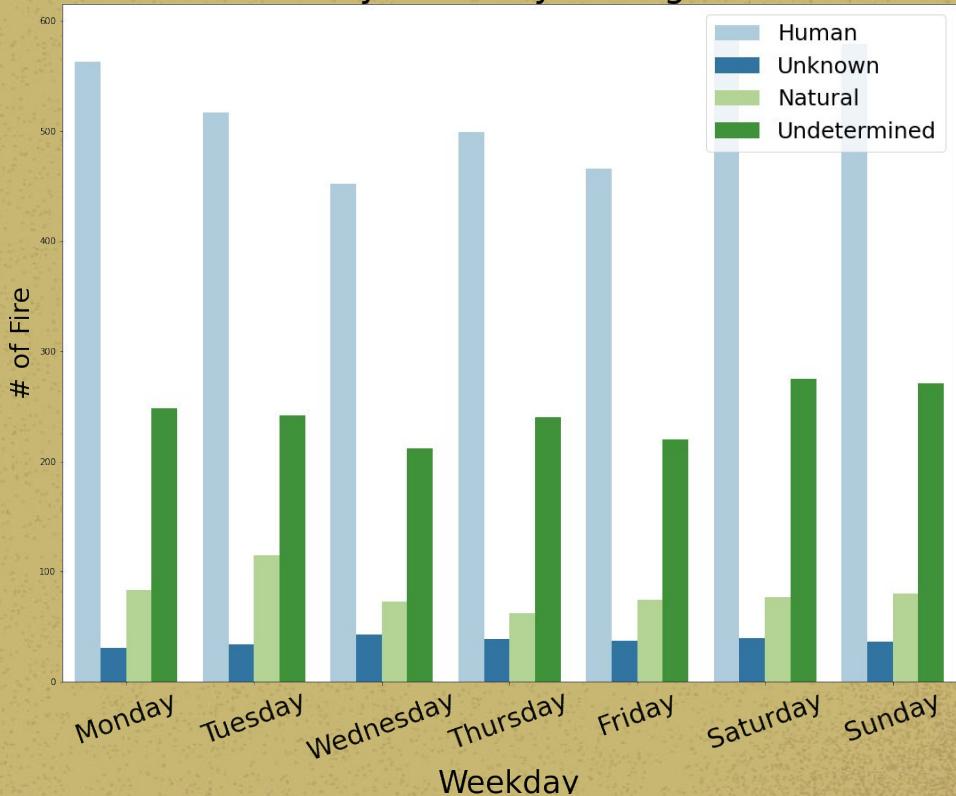
Fire Cause By Weekday During Peak Time



Initial Findings

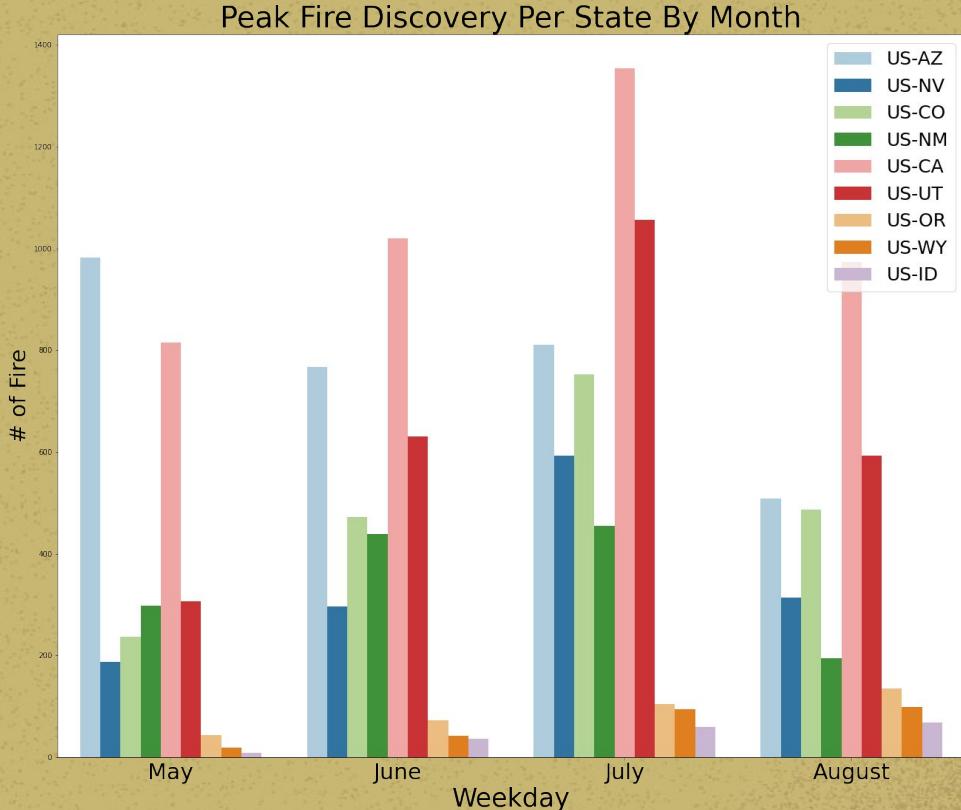
During low wildfire
season humans
dominate in causing
wildfire

Fire Cause By Weekday During Slow Time



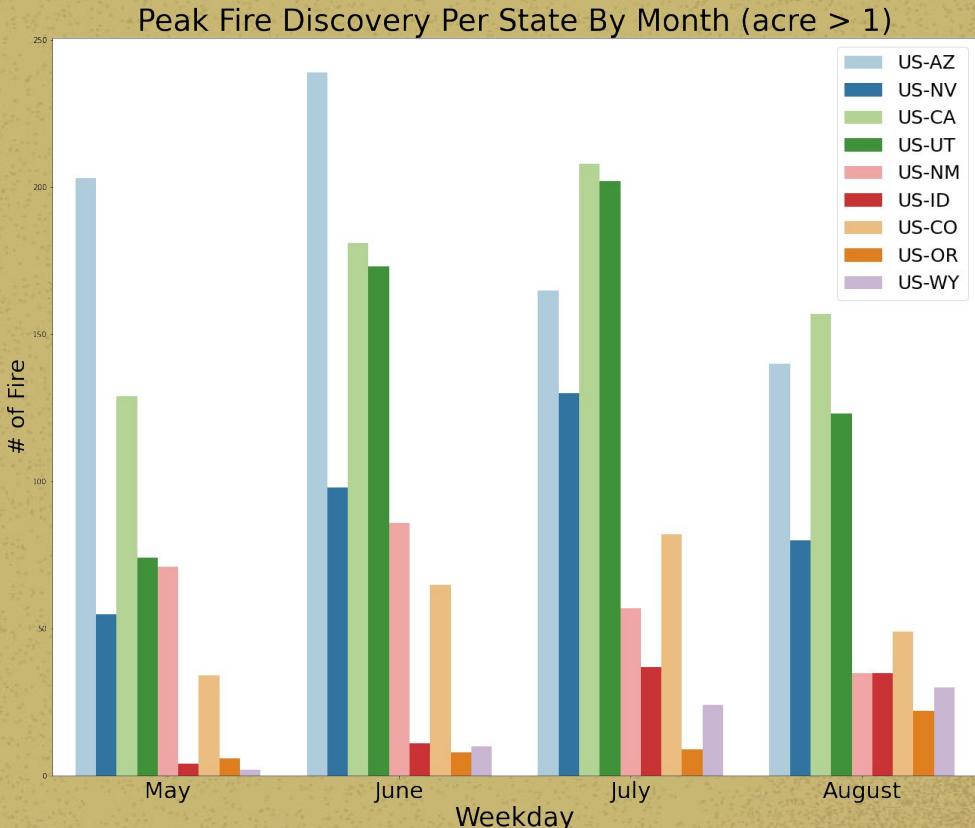
Initial Findings

New Mexico and California are leading for having the most wildfires



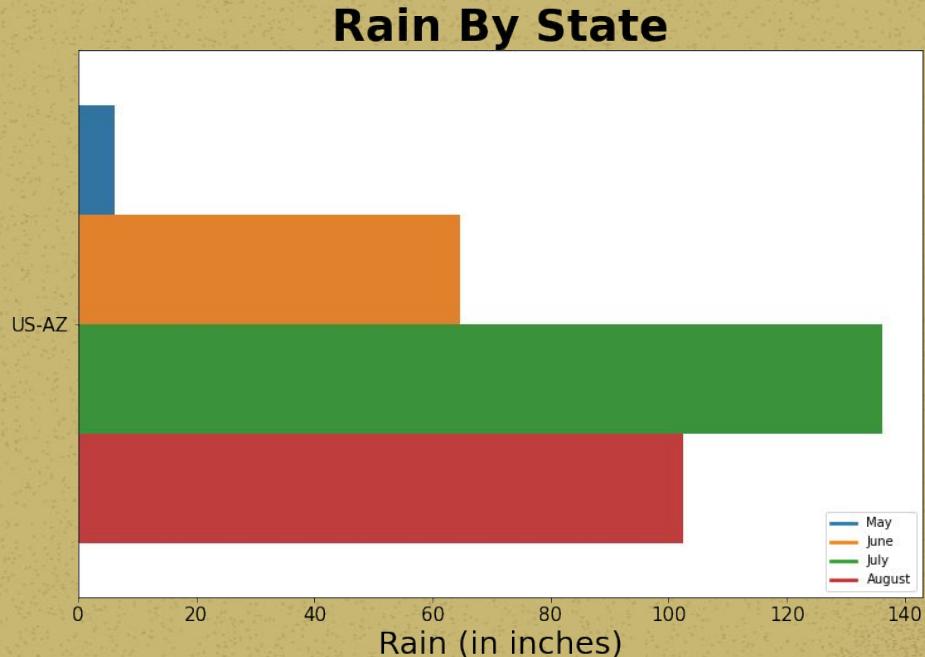
Initial Findings

However Utah is leading
for number of big
wildfires



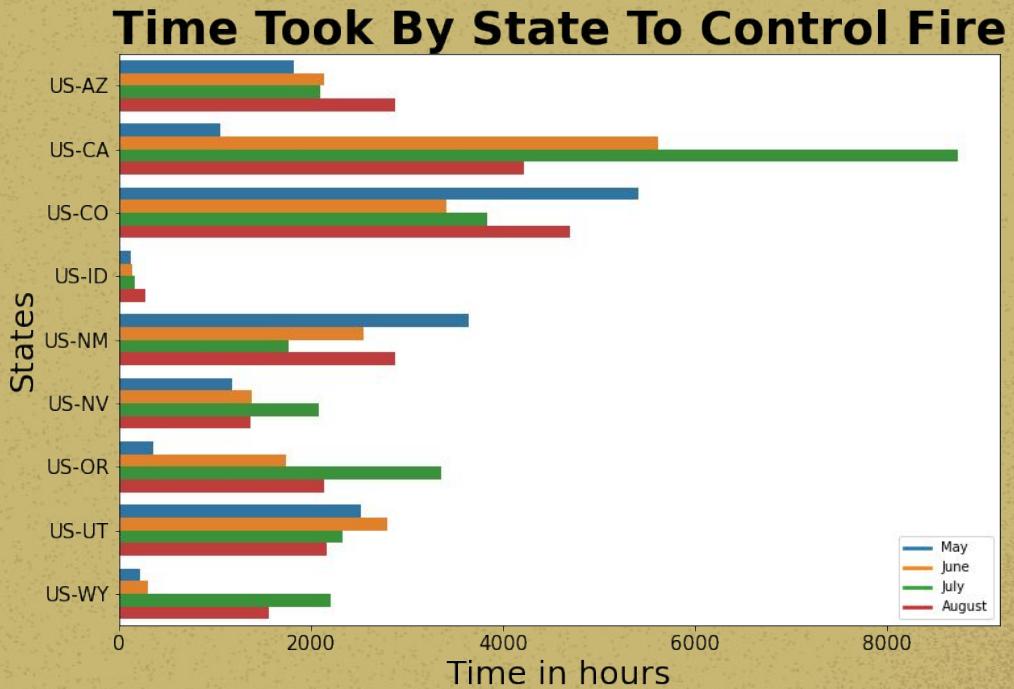
Initial Findings

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

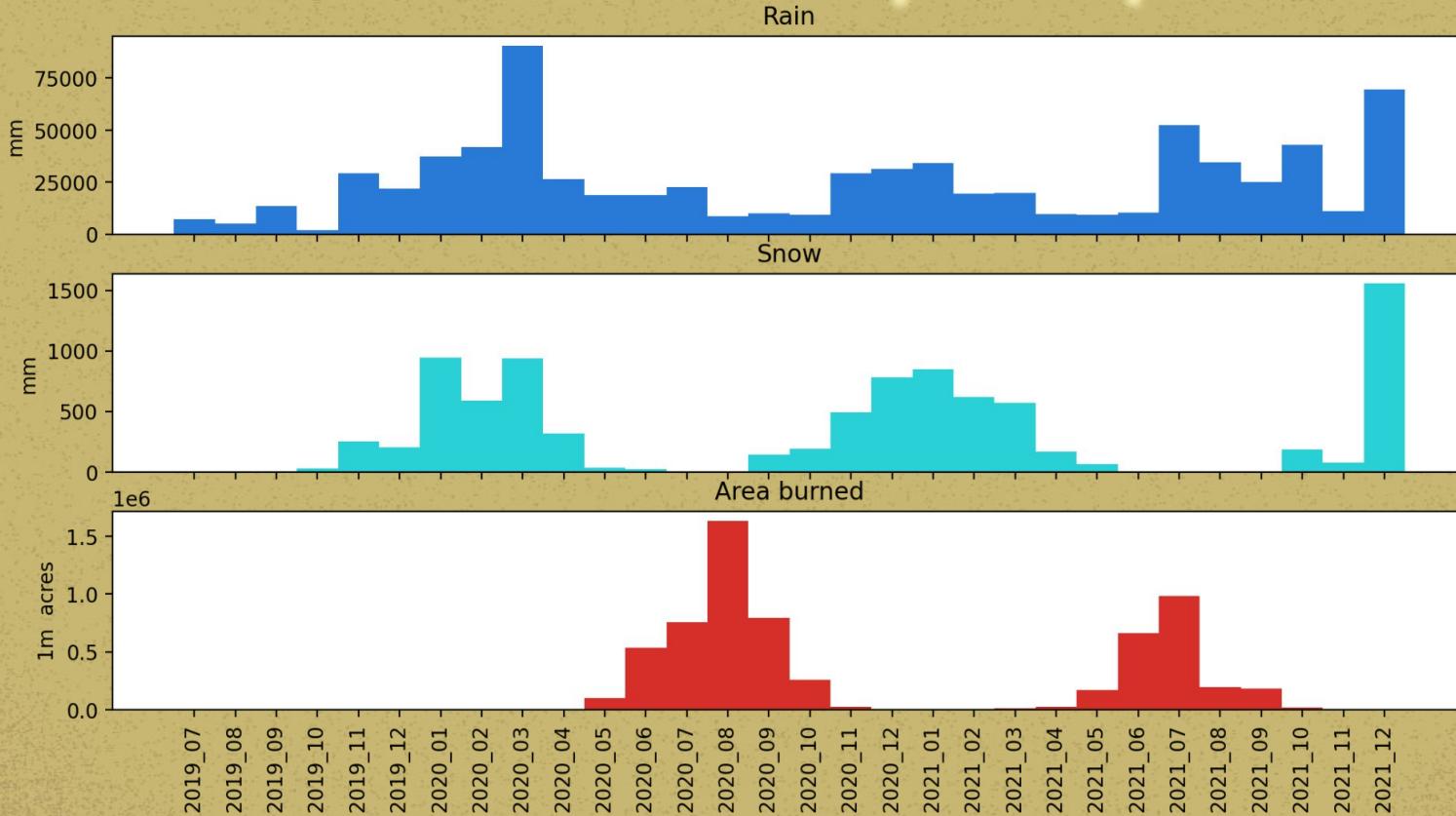


Initial Findings

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

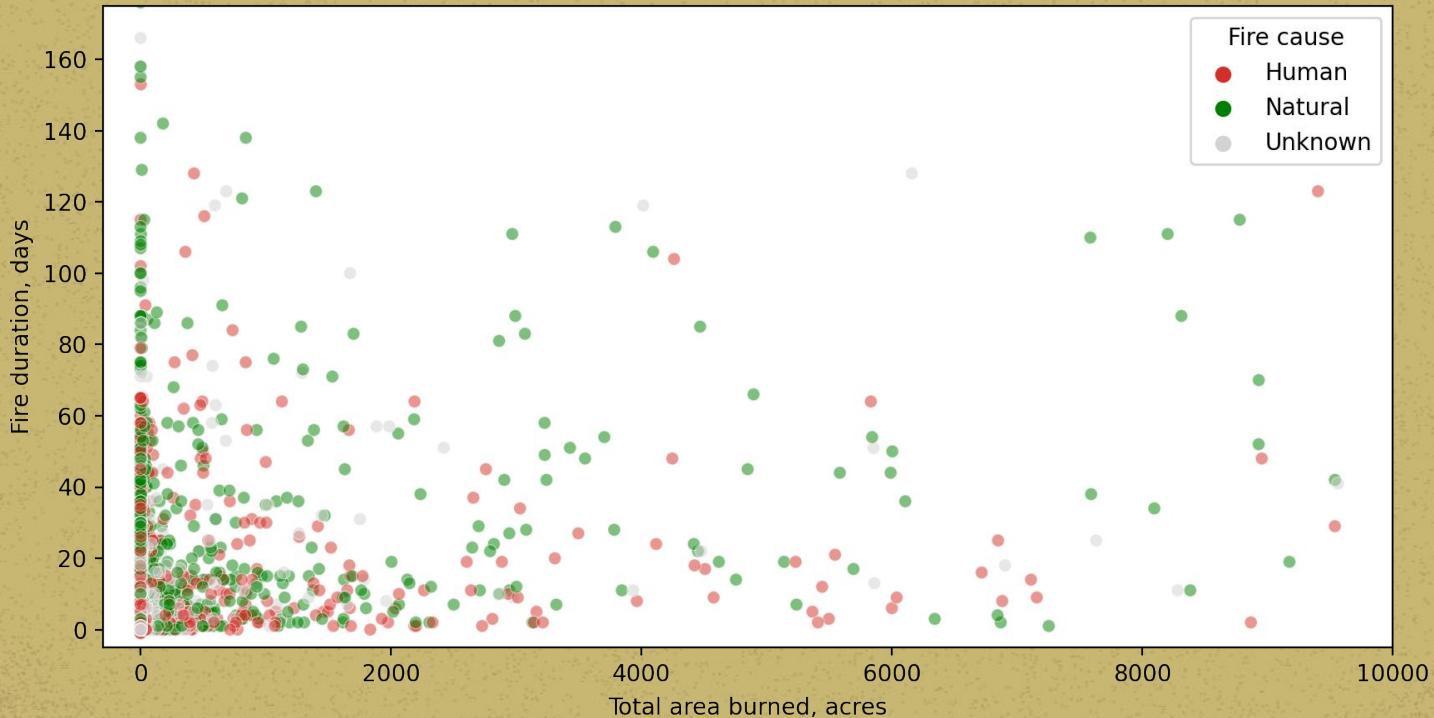


Pre-fire season precipitation



Findings

Wildfire Size vs Duration by Cause

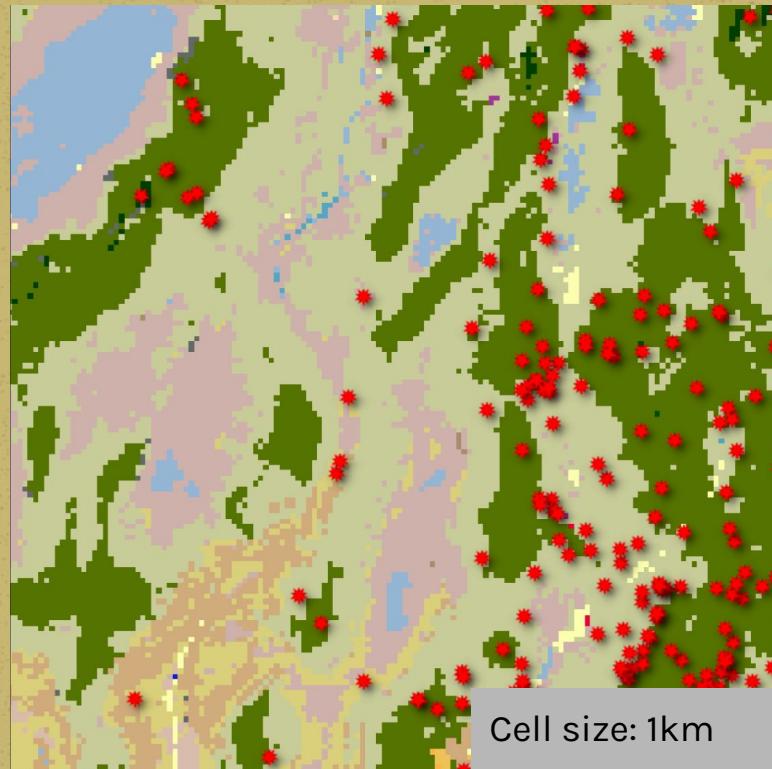
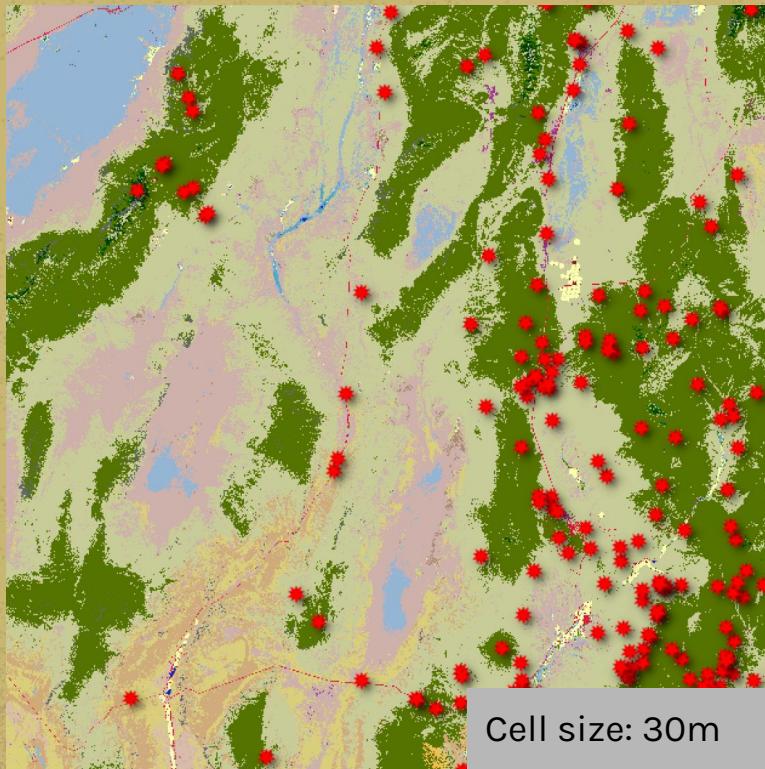


Data Collection: Land Cover zones



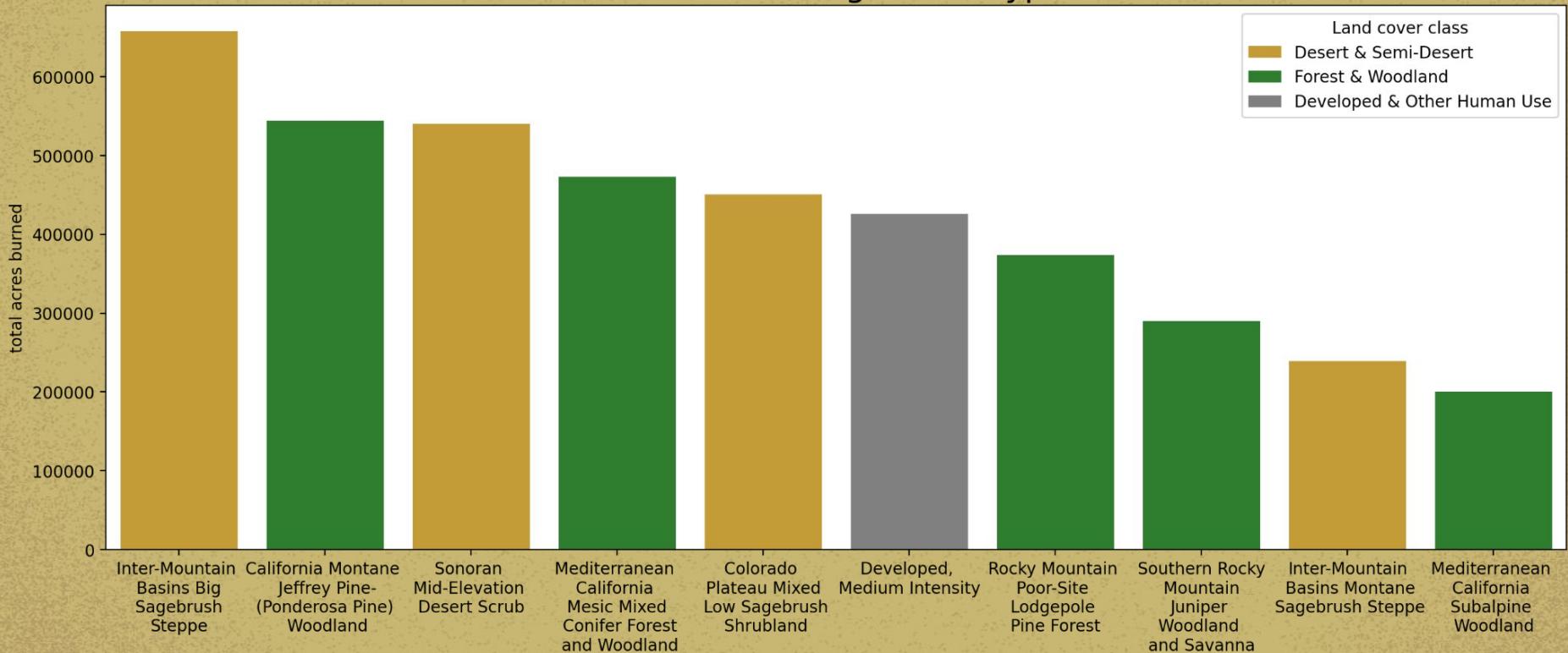
- The GAP/LANDFIRE National Terrestrial Ecosystems dataset
- 524 unique land cover categories
- Spatial resolution 30 m

Land Cover: preprocessing



Findings

Most burned vegetation types



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

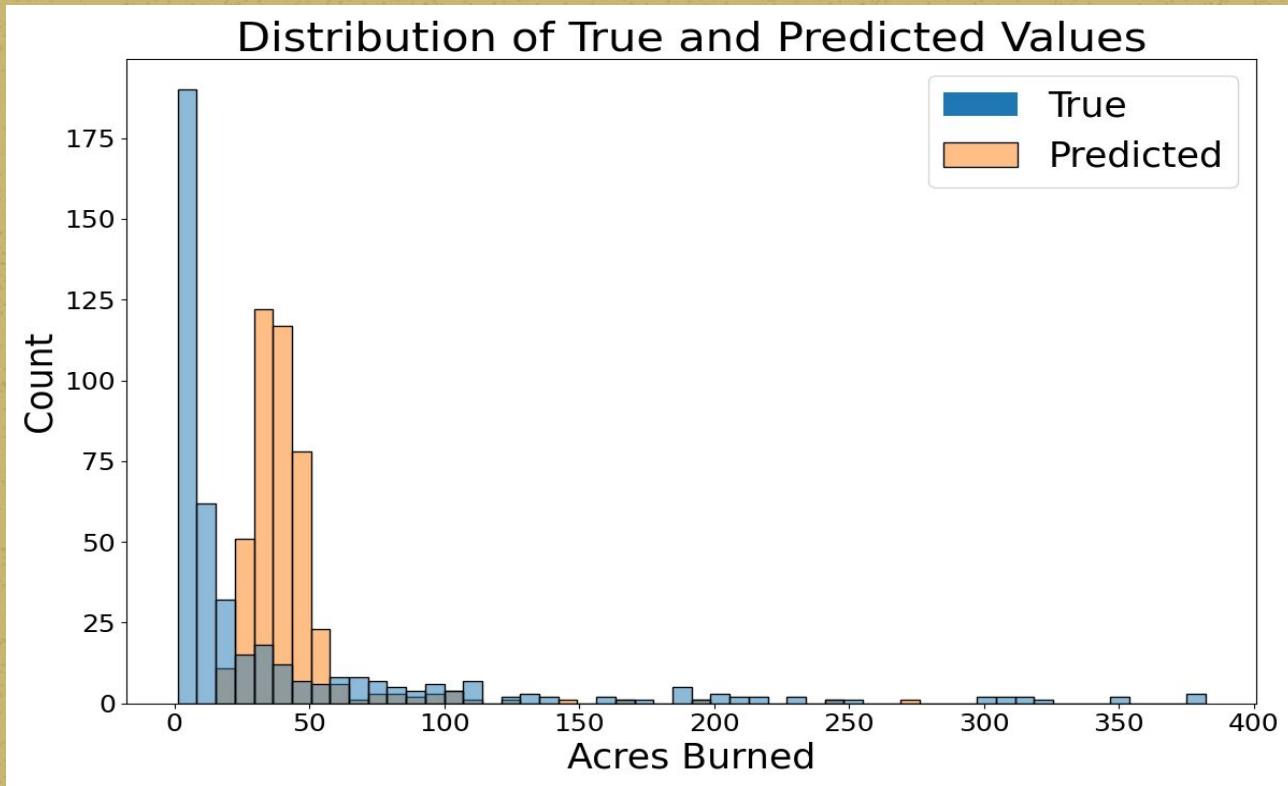
- Without the `landcover_class` categorical feature
- With the `landcover_class` categorical feature dummied
- With the `landcover_class` categorical feature dummied and then PCA-transformed (to reduce dimensionality)
- Without the categorical feature polynomial transformed and then PCA-transformed (to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



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ALTERNATIVE RESOURCES



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