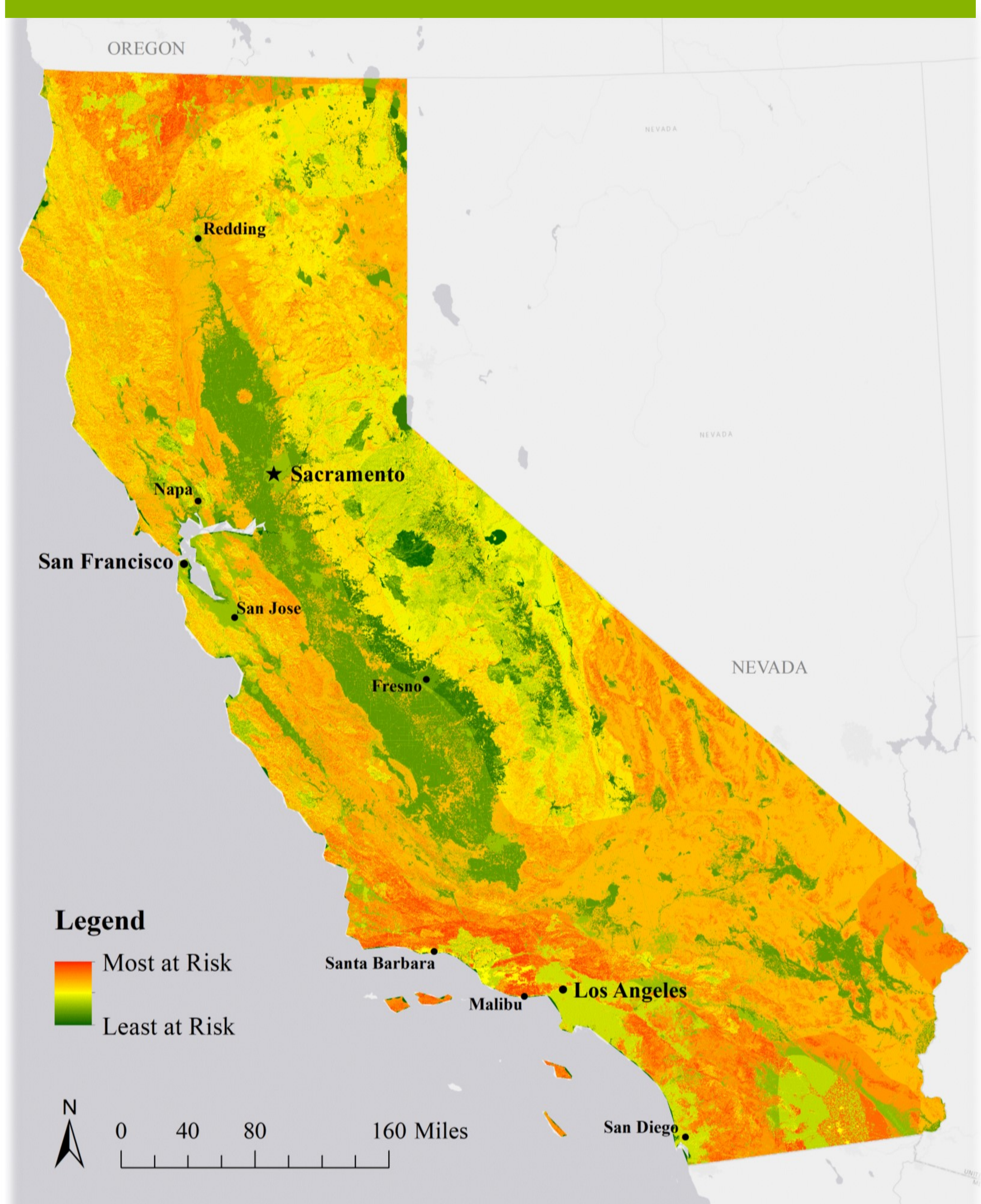
Playing With Fire: A VULNERABILITY ANALYSIS FOR CALIFORNIA WILDFIRES

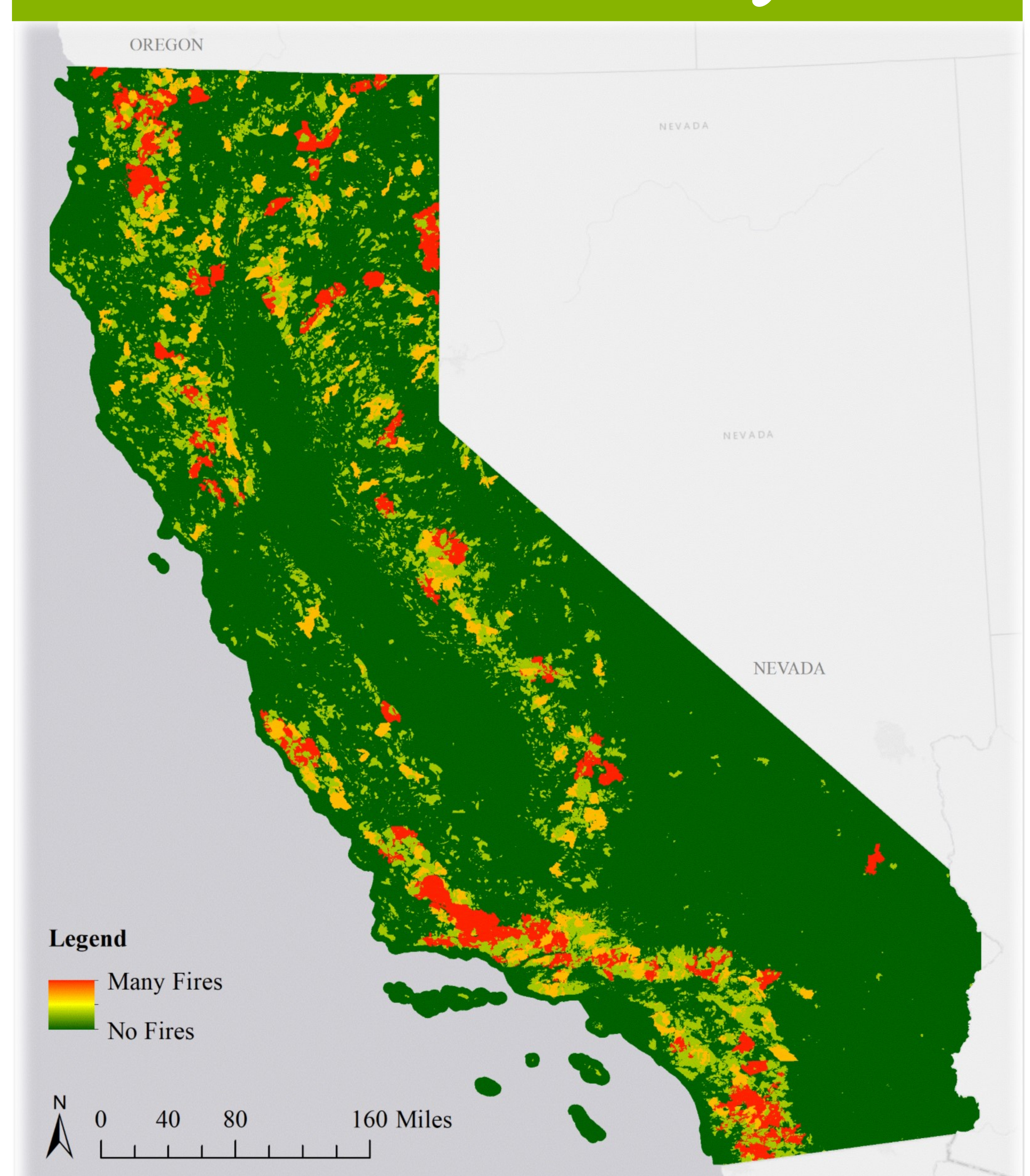
WILDFIRES IN CALIFORNIA

While wildfires have always occurred in California, in recent years, they seem to be developing at both higher frequencies and intensities. In 2017, at least 321,422 acres burned across the state, and in 2018, this number more than doubled with 876,124 acres burned (CAL fire). The October 2018 Camp Fire in Paradise, marked the state's most destructive and deadliest fire, with at least 153, 336 acres burned and 86 fatalities (CAL fire). While many factors contribute to the presence of wildfires, including rainfall, winds, and vegetation, there are many other factors that contribute to the increasing presence of wildfires. This project looks to identify how factors such as drought, flammability of vegetation, severity of previous burns, and spreadability (slope) can be used to predict where fires may occur next.

Wildfire Risk in California



Fire History



The map above indicates the state's fire history between 1878 and 2018. Most fires occurred in the southern and northern parts of the state, likely because of climate. A similar analysis is predicted by the vulnerability graph, however there is also an overall increase in risk across the state. This increase in more severe fires may be due to the change in climate over the past 140 years.

METHODS

In order to determine the locations with the highest risk of experiencing a wildfire, a vulnerability assessment was performed. A map depicting California's fire history within the last 140 years was also created. This map was used to provide a comparison of what has occurred and what may occur in the future. Four risk factors were used to make this vulnerability assessment: drought, slope, flammability of vegetation, and the burn severity within the past five years.

For the creation of both the fire history map and the 5-year burn severity map, the data was reclassified to account for those areas with no data. This was crucial to illustrate which areas had not experienced fires within the designated time frame. Similarly, for the drought data, "no data" was accounted for through reclassification to recognize the regions that are not currently experiencing drought. To analyze the flammability of vegetation types, land uses were also reclassified on a scale from 1-5, with 5 being the most flammable.

Once all data was accounted for, all layers were reclassified on a scale of 1 to 5, with 5 representing the highest risk. All layers received weights in the Raster Calculator tool. The flammability of vegetation was weighted the heaviest at 30%, followed by drought and 5-year burn severity each weighted at 25%, and slope weighted at 20%.

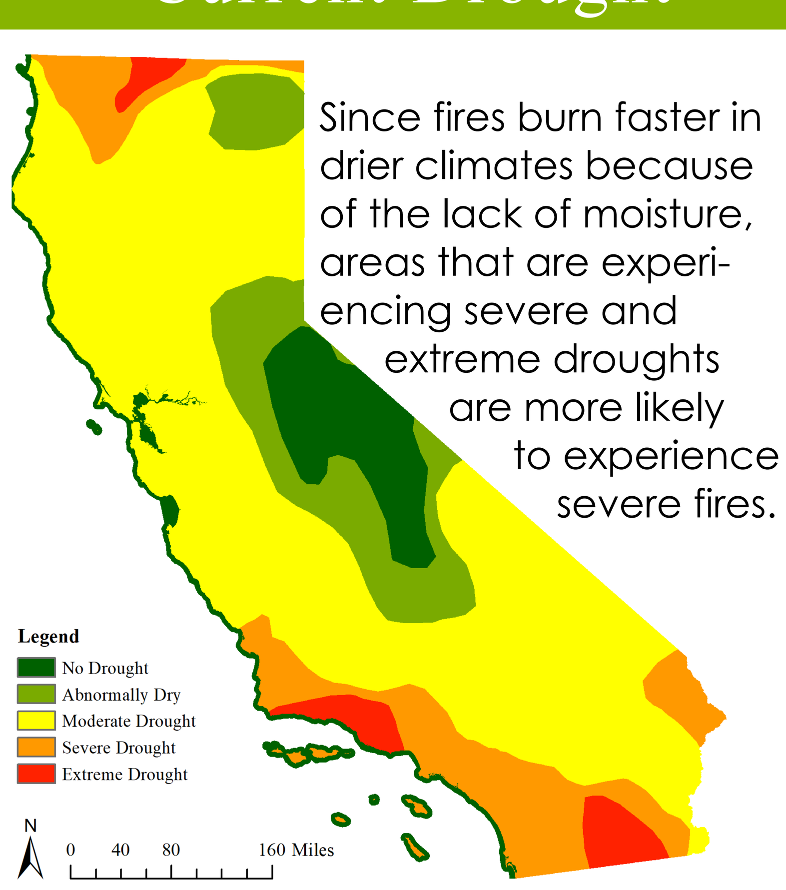
RESULTS & DISCUSSION

Since California is currently seeing an increase in the severity of its wildfires, it is expected that the vulnerability map would show an increase in wildfire severity, when compared to the historical data. However, there are many more factors that could make the vulnerability assessment more accurate, including annual rainfall and wind patterns. Precipitation not only affects drought, but also the rapid increase in vegetation, which often provides fires with more fuel. Since many of California's recent fires grew in severity because of extreme wind conditions, including this factor in a vulnerability analysis would also create a more accurate prediction. There is also a possibility that the weights used for the vulnerability assessment may not have been exact representations of the factors' influence on wildfire presence.

However, after performing the analysis, it is still evident that data can be used to predict the locations and the severity of wildfires. While more data is likely needed to improve these predictions, this data provides an initial illustration for how the behaviors and intensities of California wildfires will change in the coming years.

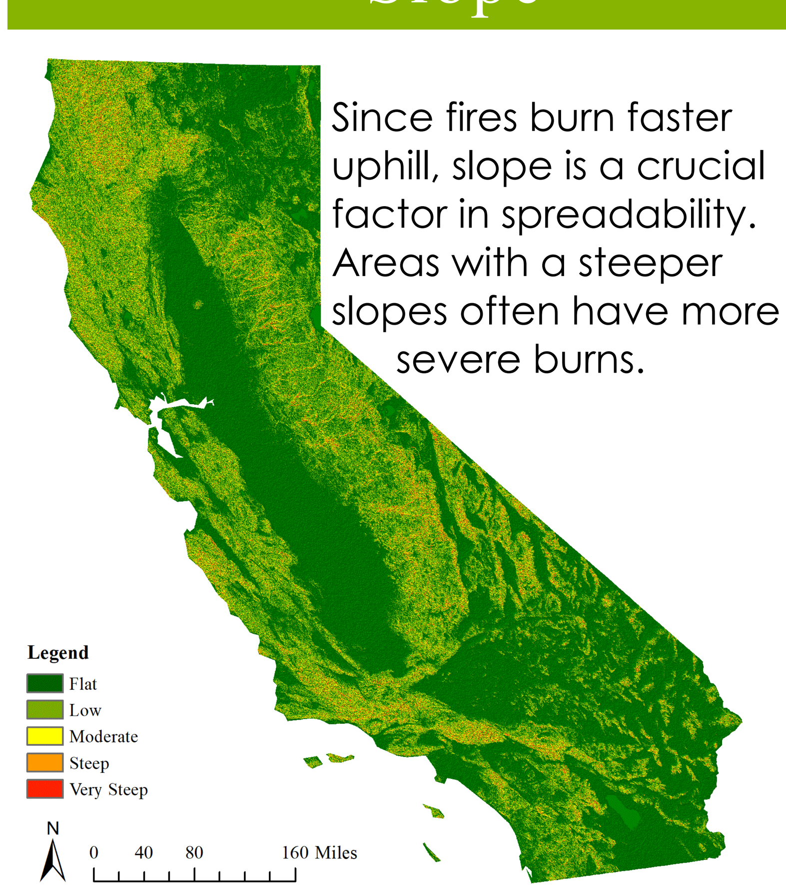
RISK FACTORS

Current Drought



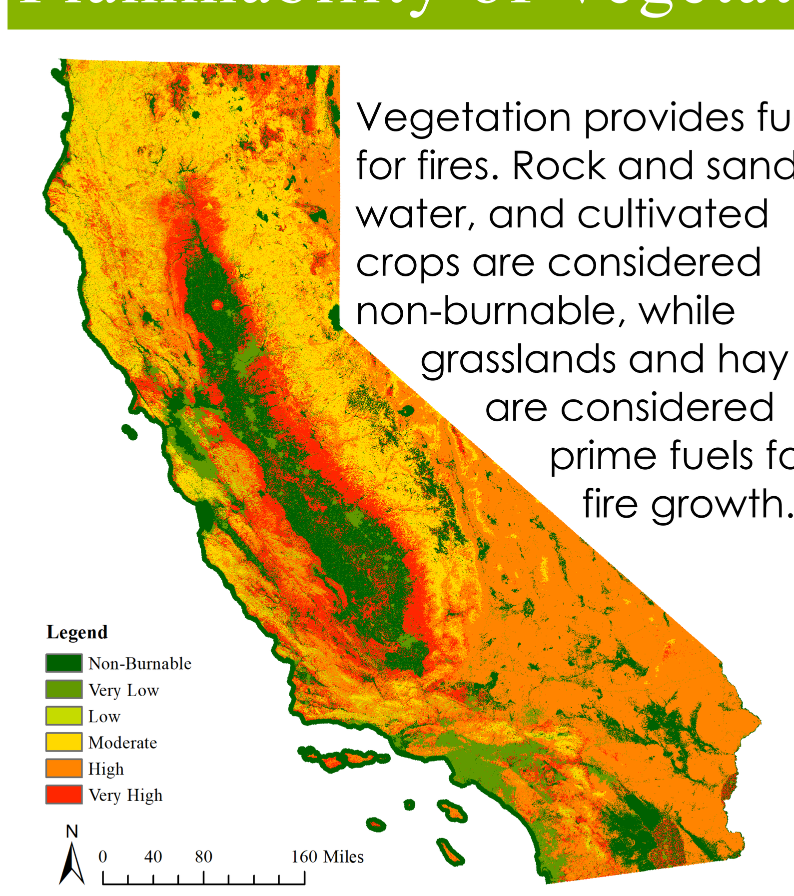
Since fires burn faster in drier climates because of the lack of moisture, areas that are experiencing severe and extreme droughts are more likely to experience severe fires.

Slope



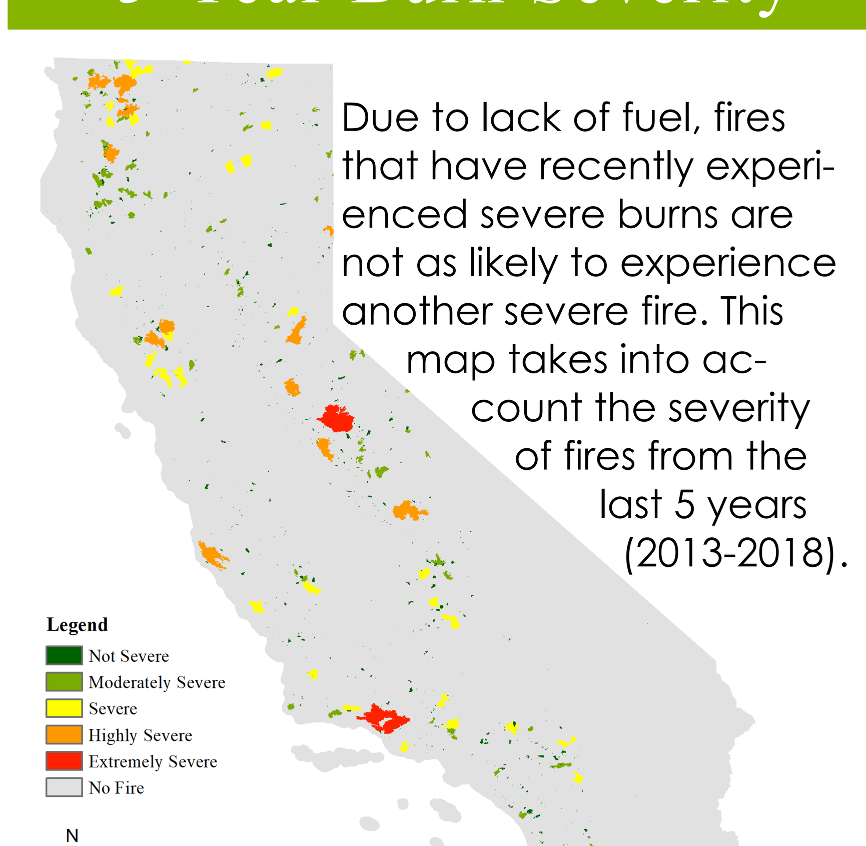
Since fires burn faster uphill, slope is a crucial factor in spreadability. Areas with a steeper slopes often have more severe burns.

Flammability of Vegetation



Vegetation provides fuel for fires. Rock and sand, water, and cultivated crops are considered non-burnable, while grasslands and hay are considered prime fuels for fire growth.

5-Year Burn Severity



Due to lack of fuel, fires that have recently experienced severe burns are not as likely to experience another severe fire. This map takes into account the severity of fires from the last 5 years (2013-2018).

Cartographer: Isabel Falls
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Data Sources: CAL Fire, ESRI, NLCD Land Use (2011), Tufts GIS (2008), United States Drought Monitor (2018)
Additional Research: CAL Fire
Projection: WGS_1984_California_Teale_Albers_FtUS

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