

Fire Risk in Santa Barbara County

Miles Schneider, Lukas Lescano, Jaypheth Eichman, Kai Labson

Introduction

Objective:

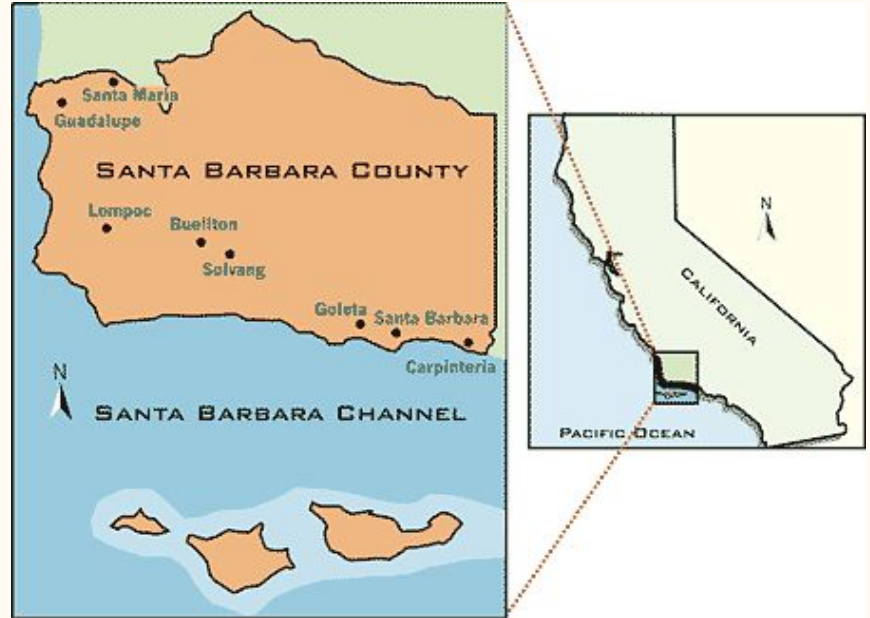
Create a fire risk model for Santa Barbara County

Motivation:

Historical destructive fires (1990-2025)

Importance:

Understanding fire risk can improve preparedness and save lives



Data Sets/Resources

Fire Perimeters: California Fire Perimeters (all); CA Dept. of Forestry and Fire Protection.

- Source: CalFire eGIS Resources.
- Link: <https://gis.data.ca.gov/datasets/CALFIRE-Forestry::california-fire-perimeters-all>

Vegetation: California Vegetation - WHR13 Types; CA Dept. of Forestry and Fire Protection.

- Source: CalFire eGIS Resources.
- Link: <https://data.ca.gov/dataset/california-vegetation-whr13-types>

Wind: Average maximum wind speed

- Source: ClimateEngine.
- Link: <https://app.climateengine.org/climateEngine>

Precipitation: Normal 30YR precipitation, Prism

- Source: Oregon State University.
- Link: <https://prism.oregonstate.edu/>

Roads: TIGER/Line Shapefile, Current, County, Santa Barbara County, CA, All Roads

- Source: Data.gov
- Link: <https://catalog.data.gov/dataset/tiger-line-shapefile-current-county-santa-barbara-county-ca-all-roads>

Fire Stations: Santa Barbara County Fire Stations

- Source: ArcGIS Online, Santa Barbara County Fire
- Link: <https://www.arcgis.com/home/item.html?id=025ce8415f54459282f68ddefbef2eaf>

County Perimeters:

- Source: [Data.gov](https://data.gov)
- Link: <https://catalog.data.gov/dataset/tiger-line-shapefile-2019-county-santa-barbara-county-ca-topological-faces-polygons-with-all-ge>

Vegetation: Methodology/Analysis

Layers used:

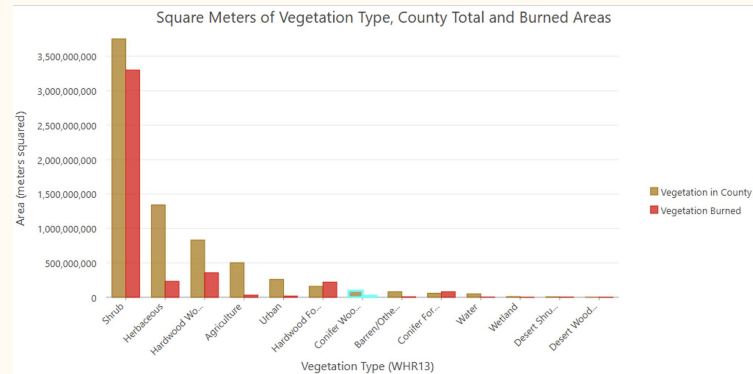
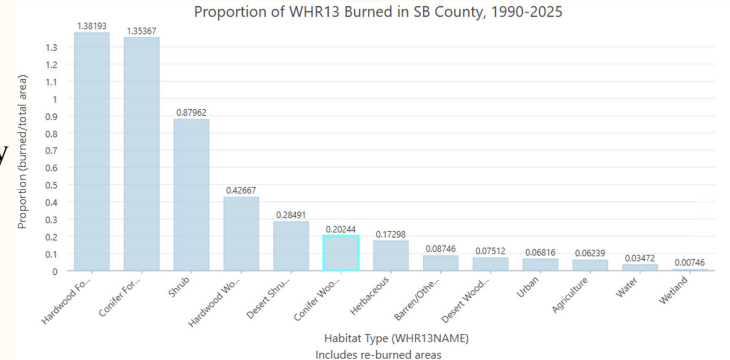
- CA Fire Perimeters (1990-2025)
- WHR13 Vegetation Raster (converted to vector)
 - different options; moderate option balancing diversity and simplicity
- CA County Boundaries

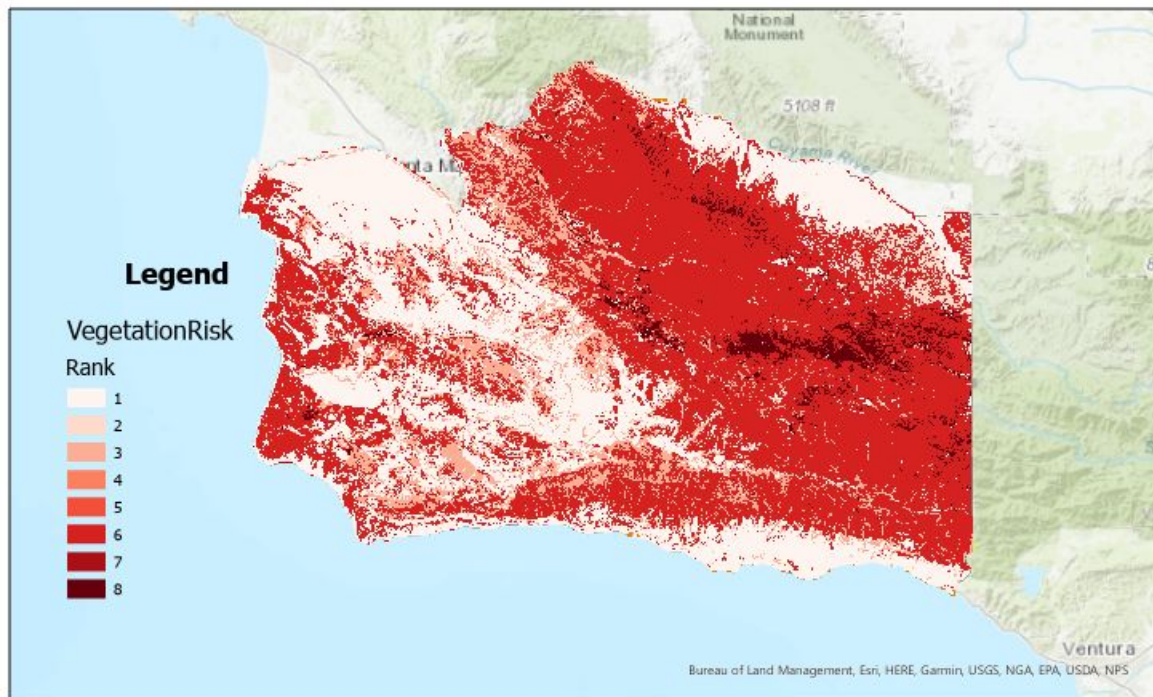
Process:

1. Intersect fire and vegetation (SB County)
2. Summarize statistics of shape area by WHR13NAME in burned zones and county-wide
3. Disproportionately burned veg. types used as proxy for risk
4. Join proportion table to WHR13 layer to visualize risk

Output:

- Vegetation map with risk (proxy) visualized
- Tables

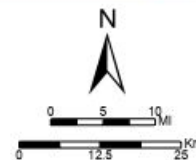




Vegetation Risk

Coordinate System: NAD 1983 California Teale Albers

2025



Fire Response Time Analysis

Data:

- TIGER/Line Road Network
- Fire Stations

Service Area Analysis Methods:

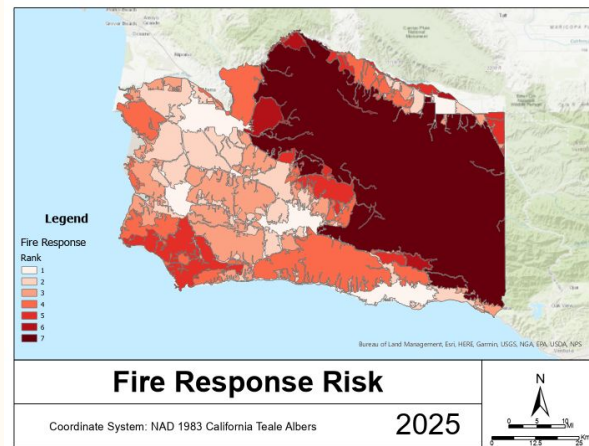
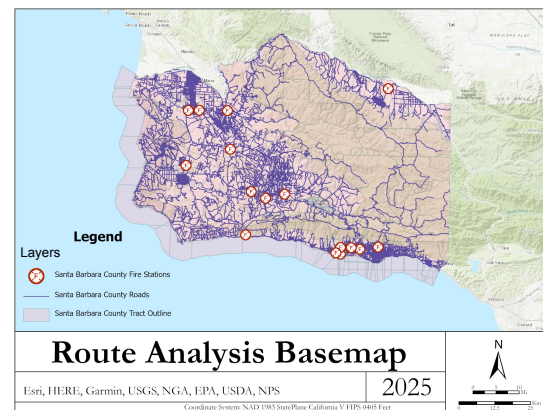
- Created and assigned the **cost structure** as **time** that was measured in minutes
- Calculated **road-based service areas** using Network Analyst
- Generated response time polygons at cutoffs(min):
 - 0, 10, 20, 30, 50, 75, 100, 150

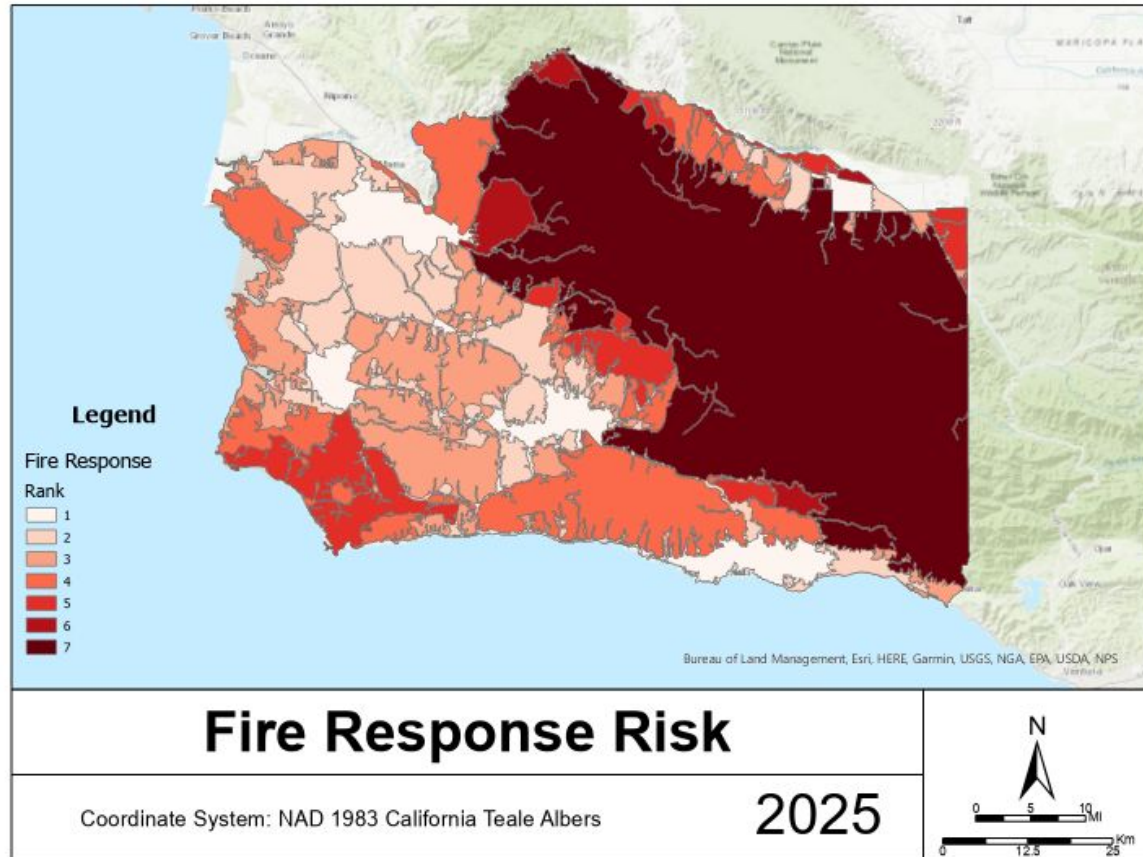
Processing:

- Converted **service areas** to **polygons**
- Removed overlaps to keep only shortest response time
- Assigned a **risk rank**:
 - Lower time (0-10) = lower risk(Number 1)
 - Higher time (100-150) = higher risk(Number 7)

Output:

- Final raster/polygon layer representing **fire response accessibility risk**





Methodology/Analysis

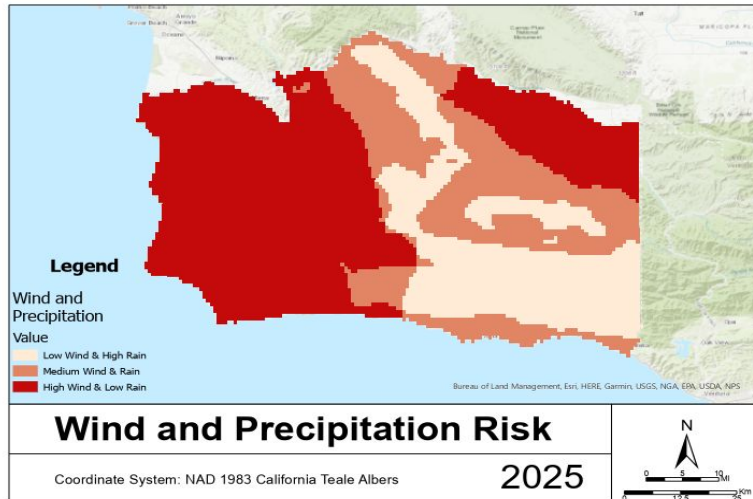
Wind and Precipitation

Collecting Data

- Dataset for wind speed must average maximum wind speed as this is more helpful for locating areas of greater risk of fire spreading
- Precipitation is the average rain over a 30yr period

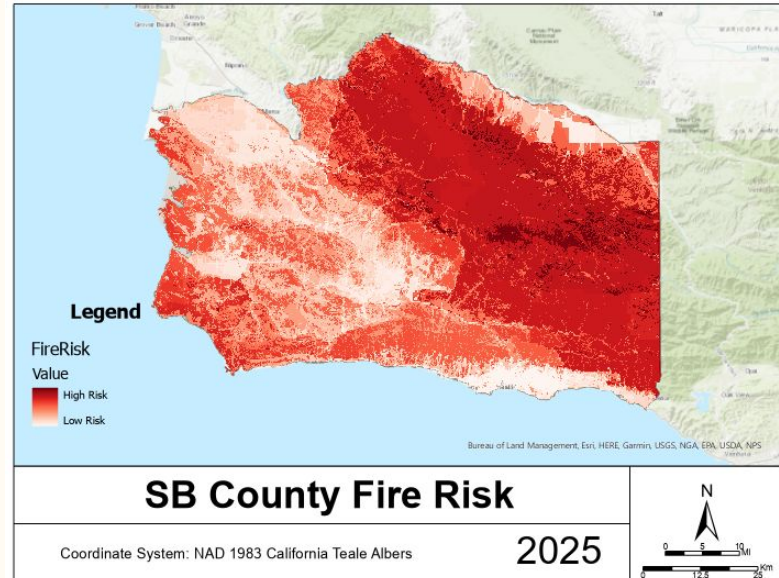
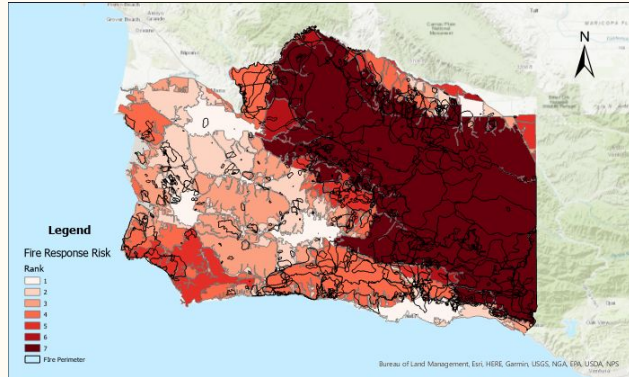
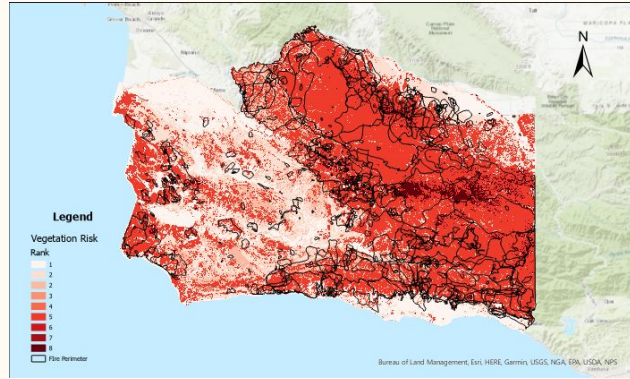
Process and Goal

- Standardize the raster data projection and cell size, as well as clip to the Santa Barbara area
- Reclassify both datasets and assign numerical values to each (larger numbers for higher wind speed and larger numbers for lower amounts of rain)
- Use raster calculator to get a map of areas with low precipitation and high wind speed
- Output map: Areas with the highest risk of fire spreading in Santa Barbara county



Results

- The 3 processed map layers were combined to create our final fire risk map
- Layer weights were determined by overlaying historic fire burn perimeters over our processed map layers



Lessons Learned

- Data sets from different sources can have compatibility issues
- Intersecting layers has consequences on how you perform data analysis.
 - example: intersecting each fire with vegetation types duplicates fire area data, no longer accurate
- Average maximum wind speed was difficult to find with high spatial resolution

Extension

- Expanding the project to include all of California
- Including topographic data and ignition point data
- Analyzing the statistical significance of how well the fire perimeters match up with each layer