Lab Report
Final Project Draft 1
GIS 5571

Title: **Growth Patterns in Southern California's Wildfire Zones**
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Author: Kyle Smith
Date: 11/5/24

Project Repository: Github
Time Spent: 5 Hours (for Draft 1)

Abstract

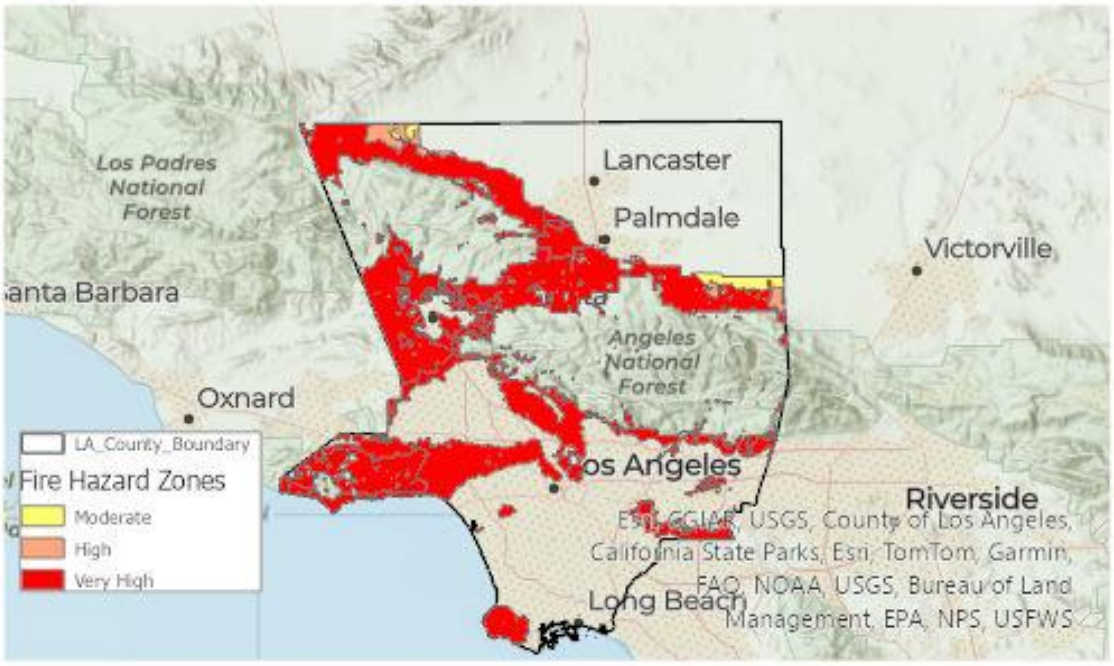
This project analyzes residential development growth in fire-prone areas of Los Angeles County, CA. I will identify patterns in recent expansion of residential land uses within wildfire hazard severity zones, defined by Cal Fire. Using historic fire perimeter and land use maps from 2012, 2016, and 2019, I will perform spatial analyses to detect trends over time. A Python ETL workflow using ArcPy in ArcGIS Pro will be used, as will analytical spatial functions such as clipping and merging datasets, creating buffer zones, and performing hot spot and local indicator analyses to detect development patterns in high-risk areas. Normalization and weight assignment will standardize fire risk evaluation. Sensitivity analysis will be used to assesses impact - hopefully producing conclusions on where residential growth meets elevated wildfire risks. These results may inform planning and policy in Southern California.

Problem Statement

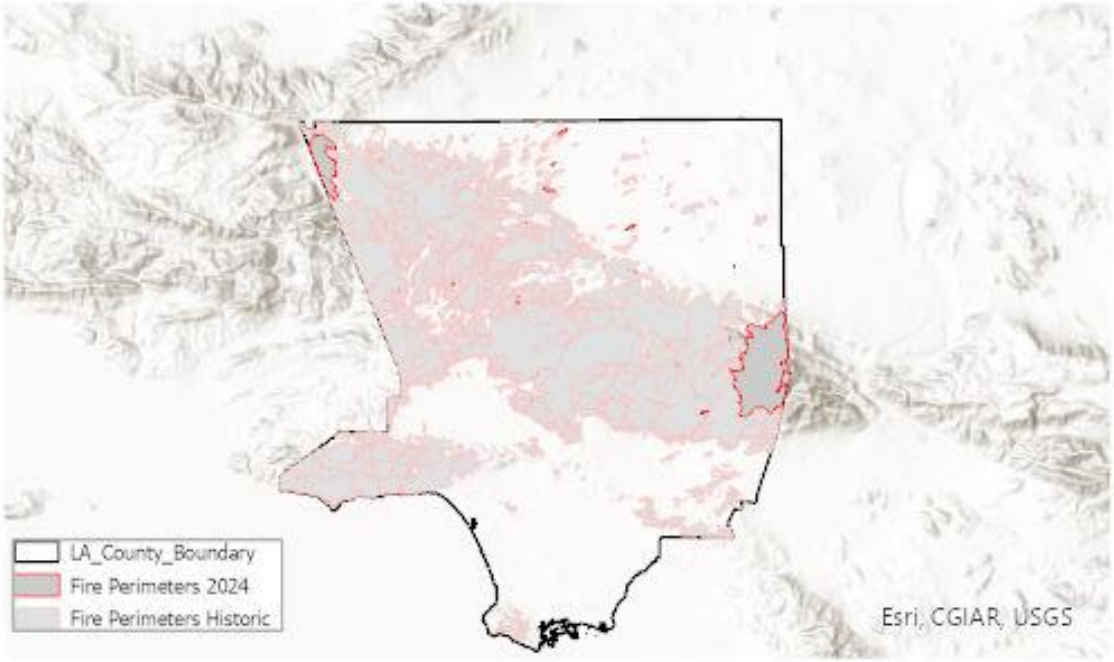
Southern California faces an increasing demand for new housing units while developable areas are limited by geography and other factors. This pressure often pushes new residential developments into areas with a high wildfire risk, such as previously undeveloped areas in the foothills, mountains and canyons. This project will use spatial analysis to find residential patterns in high-risk fire areas.

Project Area: Los Angeles County

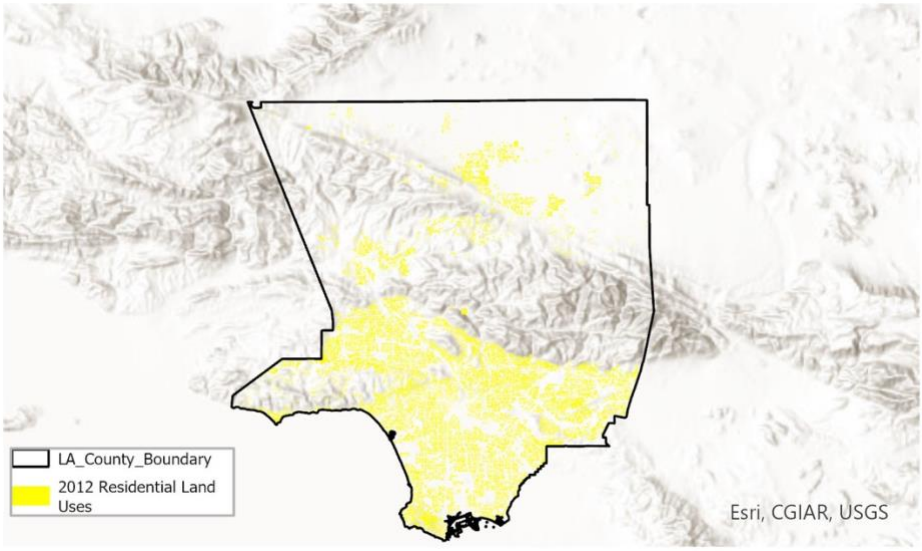
Fire Hazard Zones: Very High, High, Moderate (CA Dept Forestry & Fire)



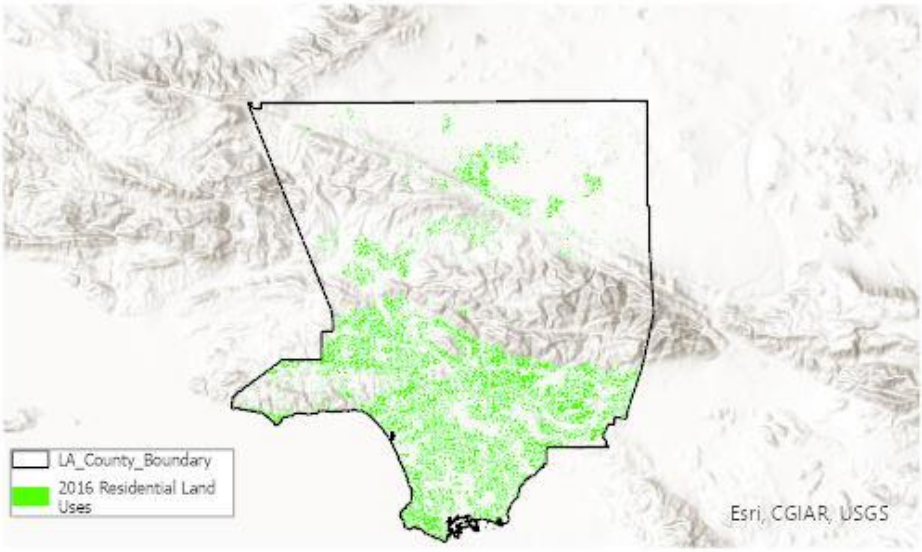
Fire Perimeters: Historic and Current Year (2024) (CA Dept Forestry & Fire)



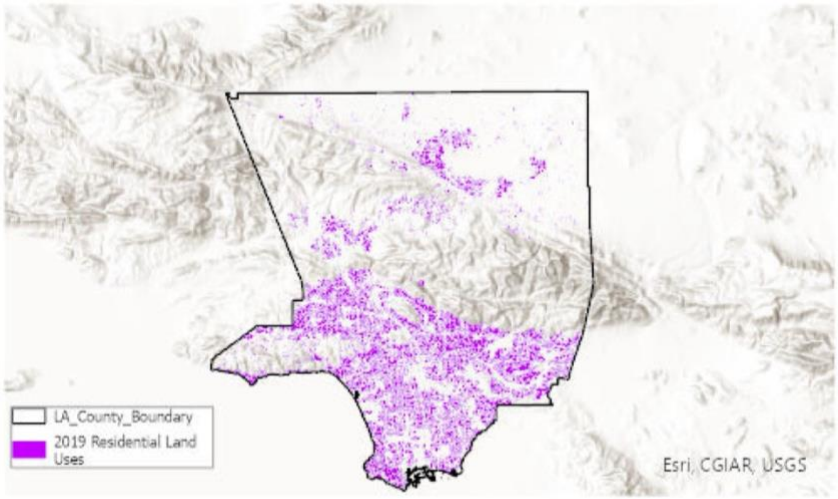
Residential Land Use Designations in 2012



Residential Land Use Designations in 2016



Residential Land Use Designations in 2019



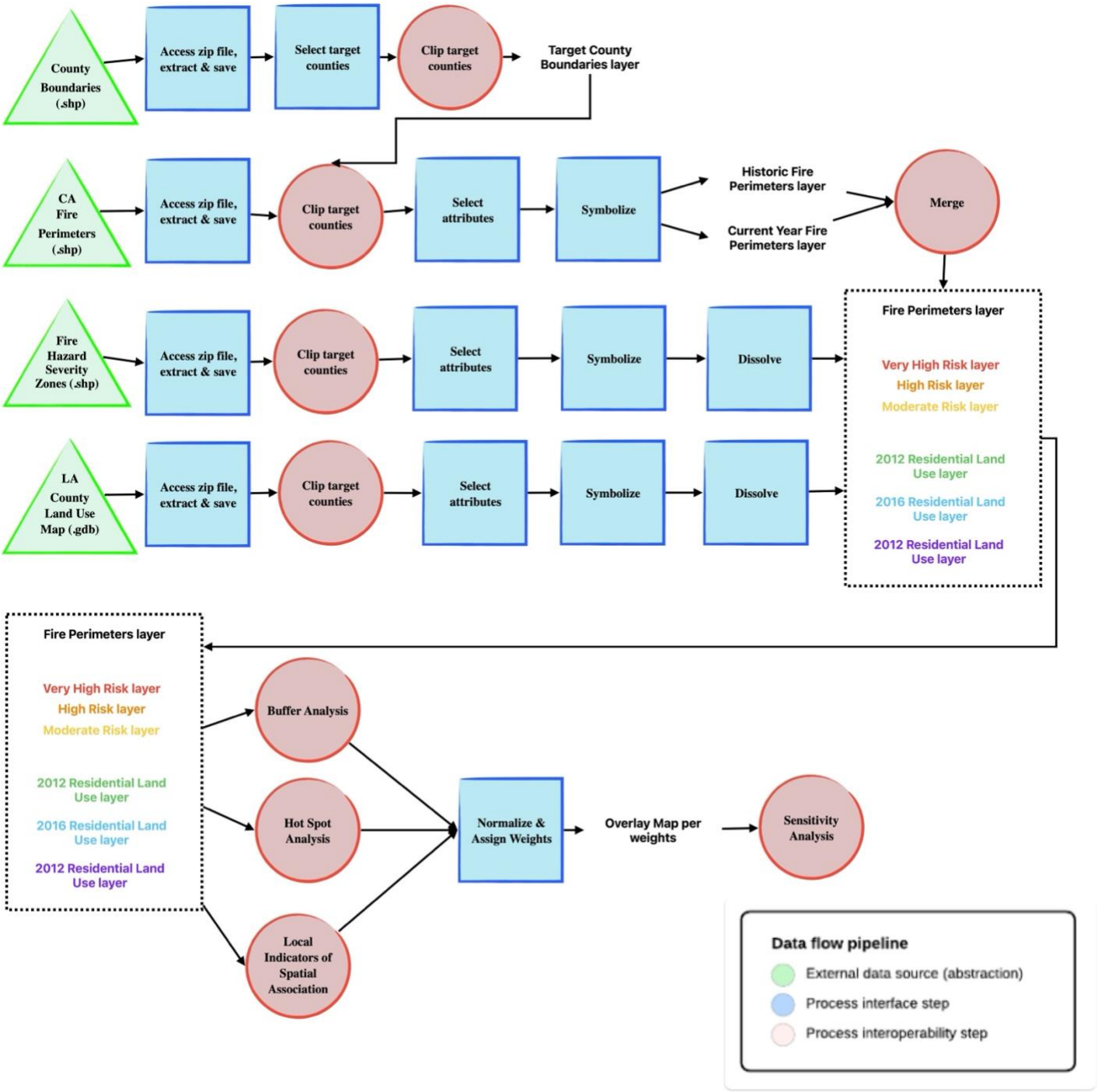
Requirement	Defined As	Spatial Data	Attribute Data	Dataset	Preparation
Los Angeles County Boundary Map	Define Project Area	Boundary		SCAG	Use for clipping
Land Use Map	Areas with residential land uses: • LU Class 1100 – 1150) • Vacant land (LU Classes 3000-3400, 1272, 1275, 1900) Los Angeles County: • 2012 • 2016 • 2019	Parcel and land use data	Land Use Class	Los Angeles County & SCAG Land Use Data 2012 2016 2019	Clip as needed
Fire Hazard Zone Map	Zones with high wildfire risk: - Very High - High - Moderate	Fire Hazard Severity Zones	Severity level	Cal Fire	Reproject to match SCAG
Fire Perimeters Map	Recent and Historic areas where wildland fires occurred	Fire Perimeters	Date, area affected	Cal Fire	Filter by time period
Pairwise Clip	Clip datasets to LA County Boundaries.	Boundary map		Created during analysis	Clip datasets to LA County Boundaries.
Merge	Combines fire perimeter maps	Polygons		Created during analysis	Combines fire perimeter maps
Buffer Analysis	Creates buffer zones around fire hazard zones & fire perimeters	Polygons		Created during analysis	500m, 1km buffer zones
Hot Spot Analysis	Show clusters of new development since 2012	Overlayed Development in Fire Zones	Cluster	Created during analysis	Show clusters of new development since 2012
Local Indicators of Spatial Analysis	Detect clusters and outliers of high-risk development areas.	Development and Fire Risk Overlay	Cluster	Created during analysis	Detect clusters and outliers of high-risk development areas.
Normalize & Assign Weights	Criteria normalized to a 0-1 scale	Criteria Layers for Fire and Development	Weights	Created during analysis	Criteria normalized to a 0-1 scale
Sensitivity Analysis	Evaluates how changes in criteria weights affect final outcomes.	Suitability Map, Criteria Layers	Weights	Created during analysis	Adjust weights and assess impact on results

Input Data

This project uses several datasets to assess residential growth patterns within fire-prone zones in Southern California. Key data sources include fire hazard severity zones and historical fire perimeter data from the California Department of Forestry, as well as land use and residential zoning data from the Southern California Association of Governments (SCAG). These datasets are clipped to the six-county SCAG region to focus on urbanized areas.

#	Title	Purpose in Analysis	Link to Source
1	Los Angeles County Boundary Map	Define Project Area	SCAG
2	Land Use Map	Areas with residential land uses: • LU Class 1100 – 1150) • Vacant land (LU Classes 3000-3400, 1272, 1275, 1900) Los Angeles County: • 2012 • 2016 • 2019	Los Angeles County & SCAG Land Use Data 2012 2016 2019
3	Fire Hazard Zone Map	Zones with high wildfire risk: - Very High - High - Moderate	Cal Fire
4	Fire Perimeters Map	Recent and Historic areas where wildland fires occurred	Cal Fire: Historic 2024

Methods



Results

I suspect that final results will show incremental growth has occurred in the last 12 years within fire severity zones. White this has implications for public safety, it also plays a role in exacerbating the housing crisis in Southern California. This can have implications for regional planning, such as forcing density elsewhere.

I will be expanding on the Results Section.

Results Verification

I will use cross-referencing methods and Sensitivity Analysis to demonstrate the final uncertainties of the model and discuss its accuracy with other published data.

Discussion and Conclusion

I will have more to say here, but a discussion surrounding the importance of balancing housing demand with wildfire risk will be important to mention here, as well as in the public sphere. Further, the greater California housing crisis can be put in to greater context here, as can the increasing wildfire risk due to climate change.

References

(So Far)

California State Geoportal. (n.d.). *County Boundary - Los Angeles*. Retrieved November 2, 2024, from https://geohub.lacity.org/datasets/county-boundary/about

California State Geoportal. (n.d.). *2016 Land Use Information for Los Angeles County (SCAG)*. Retrieved November 2, 2024, from https://gisdata-scag.opendata.arcgis.com/datasets/SCAG::2016-land-use-information-for-los-angeles-county/about

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California State Geoportal. (n.d.). *California GIS Map for Land Use and Environmental Features*. Retrieved November 2, 2024, from https://gis.data.ca.gov/maps/c3c10388e3b24cec8a954ba10458039d/about

Lab Report – Draft 1 – Supplement
Kyle Smith
Growth Patterns in Southern California's Wildfire Zones

Kyle Smith - Final Project - Draft 1.docx
GitHub

I wanted to add some more info as to the methods / analysis section before the Draft 1 deadline … This is a result of peer feedback plus some work I have done since submitting Draft 1 for peer review.

Buffer / Overlay / Temporal Analysis:
I plan to create a 1-mile buffer around all fire zones in LA County, covering zones of any severity (moderate, high, and very high). This buffer will be overlaid with residential land use data for 2012, 2016, and 2019, allowing an analysis of residential density near fire-prone areas over time. Within the buffer, residential land use density will be weighted (1, 2, or 3) to reflect different levels of residential intensity. With regard to the residential areas outside of a fire zone but within the 1-mile buffer, I expect this to be a significant density. I want to analyze this area by isolating the buffer area outside the fire zones. The residential changes in this this "outer buffer" area over the 12 years can be shown, and it might make sense for this area to be weighted 0.5 (or 0?). The idea is that this buffered overlay will serve as an "inverse" to the existing fire zones, effectively mapping areas where residential density patterns may be influenced by proximity to fire zones. By examining how this "inverse" overlay has changed over the three time points, I aim to draw conclusions about the intensification or reduction of residential density in and near fire zones over 12 years.

Hot spot analysis:
A hot spot analysis will be conducted to identify statistically significant clusters of residential land use within fire zones. By mapping "hot spots" and "cold spots" within these zones, I can track changes over time, and providing discussion as to shifting residential land use patterns in fire-prone areas. This analysis will also hopefully be a valuable visual representation.

Additional Analysis:
In addition to the buffer and hot spot analyses, I am planning on using additional tools such as ***Local Indicators of Spatial Association*** to further identify clusters and outliers; and what specific areas are showing an intensification of residential uses.

Multi-Criteria Decision Analysis **(MCDA),** normalizing and weighting factors such as residential density, fire zone severity, and proximity to historical fire perimeters to show a comprehensive risk map should be an effective step.

And Finally, I do plan on doing a ***sensitivity analysis*** to provide some conclusions as to the effectiveness of the data.

Other possible analyses which I considered and could be used, although I need to consider time and the scope of this assignment:

-*time series analysis* will measure the rate of residential growth within fire zones
-*proximity analysis* could show how close developments are to current and historic fire perimeters,
-perhaps a *density analysis* to compare residential density changes inside and outside the fire zones.