Data Science for Climate Change Management with Focus on Drought and Wildfire in California

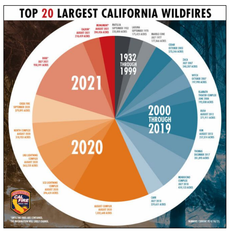
Team Members: Mazel Fernandez, Rayan Hyder, Victor Raj, Jennifer Serrano-Perez, Funing Yang
Faculty Advisor: Mohammad Pourhomayoun
Liaison: NASA & City of Los Angeles
Department of Computer Science
College of Engineering, Computer Science, and Technology
California State University, Los Angeles

Background/Objectives

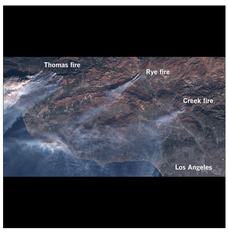
Wildfires have impacted thousands of Californians throughout the past decades. Fires have become more vicious and difficult to put out due to climate change. The evacuation also has issues - an investigation found that only 22% of high-risk communities have evacuation plans.

Economically, California spends an estimated $2.5 billion a year on CAL Fire firefighting, and farmworkers in Northern California in 2020 were estimated to have lost an average of $5,500 in wages due to fires.

Our team's goal is to create a **user-friendly dashboard with data analytics models** to help understand the cause and effect of wildfires, thus bringing more awareness to fire readiness, and other factors such as climate change.



Top 20 Wildfires in California



Major Wildfires - ESA Sentinel 2 satellite imagery from Dec. 8, 2017



Santa Rosa fires , before and after, wildfires now and then, forest fire damage - California Watch, Oct 10, 2017

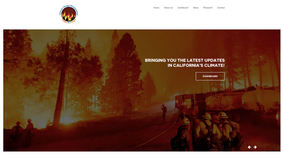


The Creek Fire jumped CA-168 on Tuesday, Sept. 8, 2020 in Fresno County, CA. Kent Nishimura / Los Angeles Times via Getty Images

Dashboard/Results

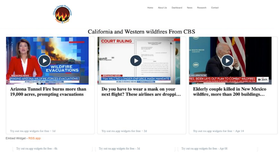
We have developed a Website "Wildfire Watchers" that is to be utilized as a "dashboard" for conducting this research. Which will briefly introduce the topic of our research and the visualization of the correlations from analysis of the maps.

Homepage



The Home page will introduce various aspect of a typical wildfire webpage. It will include the information, sponsors, team, research and other navigation.

News/Headlines



This page gives a headline on wildfire news in california by the CBS. Clicking on the selected item will redirect to their designated webpage.

Dashboard



This is the Extended Dashboard page which is accessed via the home page. This encompasses the various maps like wind, temperature and wildfire etc. It also include some correlations and a snap of research section.

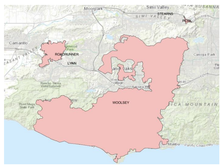
Research



This is the Research page that will show the correlations of the maps in more depth. The maps are next to the descriptions allowing the user to grasp the cause and effect in a simple manner.

Analysis

Show the cause and effects of wildfires. The following images are of the ***Woolsey fire*** that lasted November 8–21, 2018 caused by electrical and communication equipment owned by Southern California Edison. The cause for its spread may have been due to these factors: **vegetation, temperature, soil moisture, wind speed, and precipitation levels.**



Vegetation



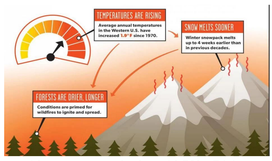
Vegetation **BEFORE** the Woolsey Fire, notice the greenery + some dry areas. Dry areas are very flammable, which results in high wildfire hazard.



Vegetation **AFTER** the Woolsey Fire, red shows heavily burned areas

Temperature





It was a sunny day when the Woolsey fire began with temperature in the mid 70's. Rising temperatures can be an indicator of climate change and can evaporate moisture from the ground, which dries soil, and makes vegetation more flammable.

Soil Moisture



This is what **normal** soil moisture should look like (should look more green/dense).

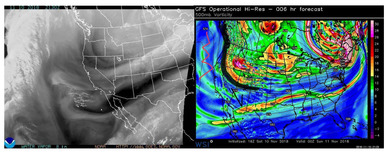


Based on the legend (middle image), the–100 cm soil moisture percentile data has shown to be a utility for drought monitoring.



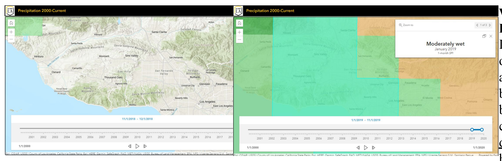
This is the soil moisture level **DURING** the Woolsey Fire. Soil is more dry which is the impact that wildfires leave that can lead to drought.

Wind



The driving force of the **Woolsey Fire** has been extreme wind—gusts of up to 60 miles per hour, perhaps even 70 in the hills of Southern California—blowing through the state. Wind further desiccates already dry vegetation and pushes the fires along with incredible speed.

Precipitation



DURING the Woolsey Fire, precipitation was very **low** in the area of the fire. Decreased precipitation is a significant factor that influences wildfires.

AFTER the Woolsey Fire, shown above is a noticeable increase of precipitation in the area which produced larger plume size on the coast affected by the fire, and caused spikes in the levels of both coliform bacteria and enterococcus.

WHY IS THIS IMPORTANT? Increased levels of precipitation after fires can be dangerous because they can lead to debris flow hazards, increase of bacteria, and negatively impact water quality in the area.

Conclusion

The **goal** of this project was to understand the cause and effect of wildfires and what parameters are related to wildfire & drought (vegetation, soil moisture, temperature, wind speed, and precipitation) in California with the usage of data science techniques.

We obtained this goal by creating a **Dashboard** Website that displayed our maps/research pertaining to wildfire data. We used ArcGIS to showcase data analytics model provided by NASA and did our own extensive research to find the commonalities/ trends with the given visuals.

Tools & Technologies

HTML CSS JS ArcGIS Pro GitHub