Wildfire Detection in California and Monitoring Using Satellite Remote Sensing

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Abstract

California is popular for its famous celebrities and luxurious lifestyles, but not many people pay attention to the fact that California faces environmental issues, such as wildfires. Over 90 percent of wildfires are caused by humans (e.g. cutting down trees, which fall on power lines and can turn into a massive conflagration). Our research project consists of focusing on wildfires that have occurred in California over the past 5 years. Using satellite remote sensing, wildfires were observed through satellite images from (http://activefiremaps.fs.fed.us/) and maps were created using ArcGIS software to pinpoint what was burned or damaged by a wildfire. A visualization of the fires was made in ArcGIS and the data was cross-checked with statistics from the California Department of Forestry and Fire Protection (CAL FIRE). Hence, fire assessment can be improved by providing more accurate analyses of the damages from these wildfires. Trends shown in the data help identify several wildfire factors, like the common cause and extent of destruction. Using satellite remote sensing and Geographic Information Systems (GIS), wildfires can be easily studied and tracked. The movement of fire can be traced over its duration to see the common path it takes. Common indicators of the start of a wildfire can also be identified, as well as the specific areas that are prone to having them. By taking into account all of these aspects, tracking wildfires can be made more accurate and wildfire prevention made easier.

Objectives

Our main goal was to observe wildfires that occurred throughout California for the past 5 years and visualize fire movement. We calculated the total amount of acres burned to determine the severity of the wildfires in the county it occurred in. We chose 5 specific conflagrations that caused structural damages and even human deaths. The fires that we focused on were the following: Bull (2010), Eagle (2011), Rush (2012), Rim (2013), and
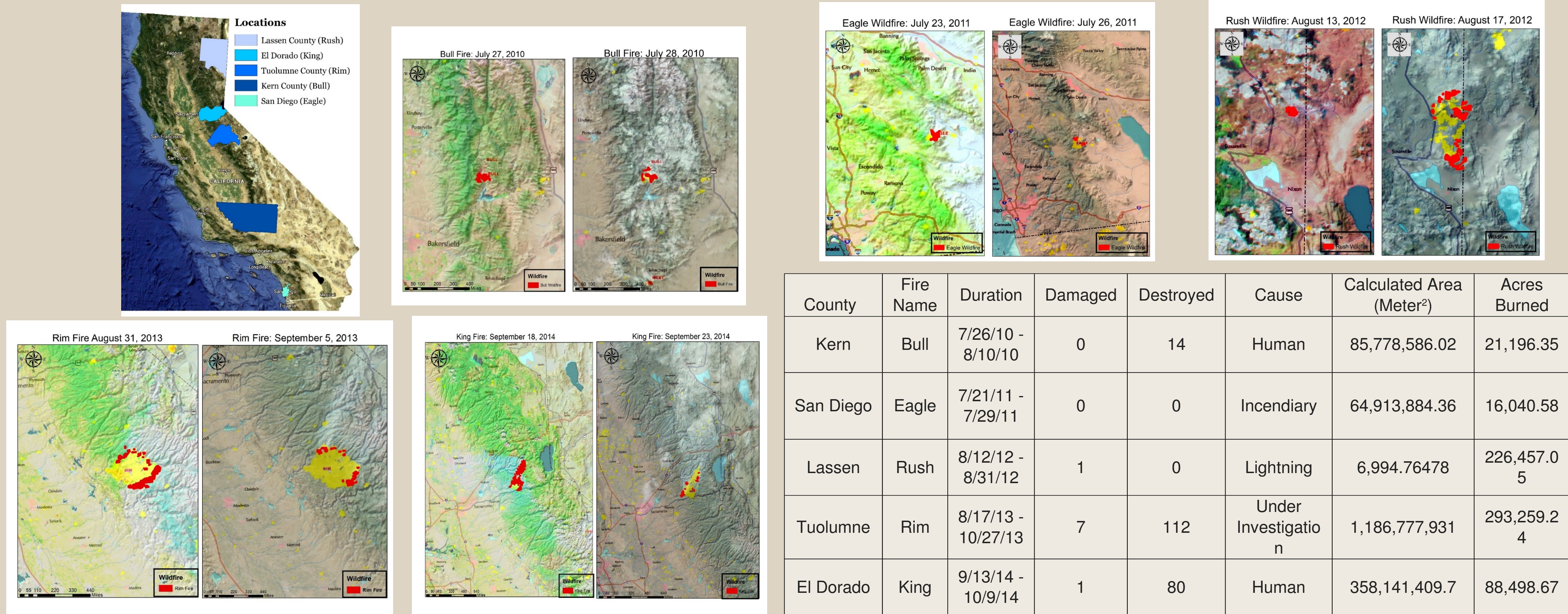
Methodology

➤ The firemaps were created with ArcGIS using ArcGIS software. Fire detection maps and MODIS satellite images were acquired from the USDA Forest Service Remote Sensing Applications Center website.
➤ The GeoTiff format of the satellite images were uploaded to ArcGIS and overlapped with the fire detection map to locate the exact fires. Polygons were then drawn over the area of the actively burning fire at that time according to the map.
➤ The satellite images allowed us to calculate the total amount of area burned in square meters, which was later converted to total acres burned.
➤ The fires had varying lifetimes, therefore we decided to pick two days over the duration of the fire and map them to show the change in movement and size of the fires. The yellow part on the maps represented the total area burned throughout the duration of the fire

Gather satellite images & fire maps

Georeference images and draw polygons over the fires

Calculate total burned area from polygons

Results

County	Fire Name	Duration	Damaged	Destroyed	Cause	Calculated Area (Meter²)	Acres Burned
Kern	Bull	7/26/10 - 8/10/10	0	14	Human	85,778,586.02	21,196.35
San Diego	Eagle	7/21/11 - 7/29/11	0	0	Incendiary	64,913,884.36	16,040.58
Lassen	Rush	8/12/12 - 8/31/12	1	0	Lightning	6,994.76478	226,457.05
Tuolumne	Rim	8/17/13 - 10/27/13	7	112	Under Investigation	1,186,777,931	293,259.24
El Dorado	King	9/13/14 - 10/9/14	1	80	Human	358,141,409.7	88,498.67

Conclusion

•These five wildfires burned many acres of land affecting the people around them as well as the county itself.
•Satellite remote sensing can be used to detect wildfires before they destroy and affect not only property but the environment as well.
•We can apply GIS software to detect and track wildfires in order to monitor their paths and growth.
•Since more than 90 percent of wildfires are caused by humans, we should take into consideration our place in preserving the ecosystem.
  If we monitor wildfires, we can possibly prevent massive conflagrations that are harmful to humans and the environment. This study made us aware of the potential threats we impose upon the environment.

Acknowledgements