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Several Effective Solutions to California Fire

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Abstract

With the intensification of the greenhouse effect and the global warming of temperature, California fires are more and more frequent. However, if we want to fundamentally solve the problem, we need to try to solve the greenhouse effect and eliminate greenhouse gases. But it is difficult to solve the greenhouse effect. Therefore, this paper tries to use other methods and means to slow down the frequency of fire and reduce the harm caused by fire. By tracing the source of fires in California for many years, this paper finds out the human causes behind most of the fires in California, including burning debris, human activities and old wires. And in the article, the reasons are analyzed one by one to find a one-to-one appropriate solution, including actively burning some combustibles to generate a controllable fire, unmanned aerial vehicle fire extinguishing, etc. To minimize the threat to people's safety and property loss caused by California fire.

Keywords

Wildfire, Greenhouse Effect, UAV

1. Introduction

Millions of people are threatened by climate change in this era. One day in early September 2020, people in California woke up from the dim morning light and found that they seemed to sleep to the end of the world. The red orange sky was against the distant fire and smoke. At this moment, the people of California once again felt the fear of being dominated by mountain fires.

2. Combating Wildfires in California: Tracing the Causes and Proposing Solutions

Why say "again"? Because mountain fires are no stranger to California. Since 2016, California has experienced an average of more than 7000 wildfires a year, burning an average of 1.2 million acres a year, equivalent to burning four New York. In this era of rapid climate change, countless California fires caused by climate change are threatening the lives of millions of people in California. Higher carbon dioxide levels provide an excellent breeding ground for fires. The annual increase of carbon dioxide leads to the gradual rise of temperature and the continuous decline of precipitation. This has led to a drier and drier climate in California, which has prolonged the fire season in California. At the same time, a dry climate will turn dead trees into more flammable fuels. Although fires in California have been common in the past, in recent years, the number of man-made fires (including the impact of greenhouse effect and man-made arson) has been twice that of naturally formed fires, and the harm of man-made fires is more serious [1].

If we want to solve this problem perfectly, it is essential to solve the greenhouse effect, but it is too difficult to solve the greenhouse effect because it involves many countries and people all over the world. Therefore, it is unrealistic to completely solve the greenhouse effect. At the same time, because the fire in California is a period with deep historical origins, fires often occurred as early as the Native Americans, so just solving the greenhouse effect can not completely eliminate the occurrence of fires [2]. Therefore, we need to trace back to the source, find the causes of the California fire, and start from these causes, try to put forward several methods that are conducive to reducing the number of California fires or reducing the harm of California fires.

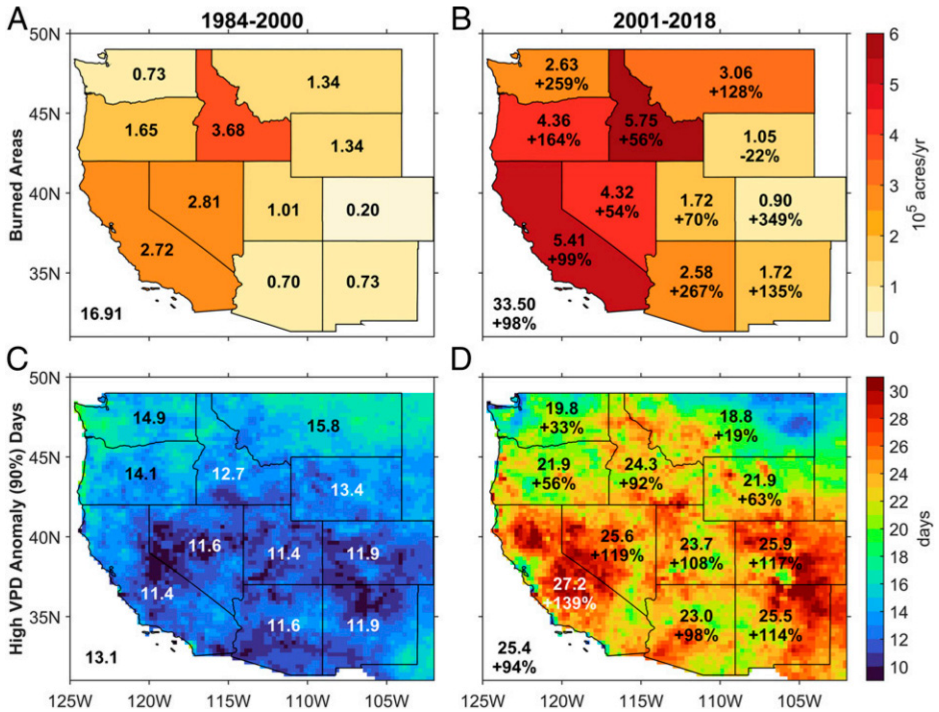

Figure 1. The Burned Areas of California Fires is Increasing/pnas.org.

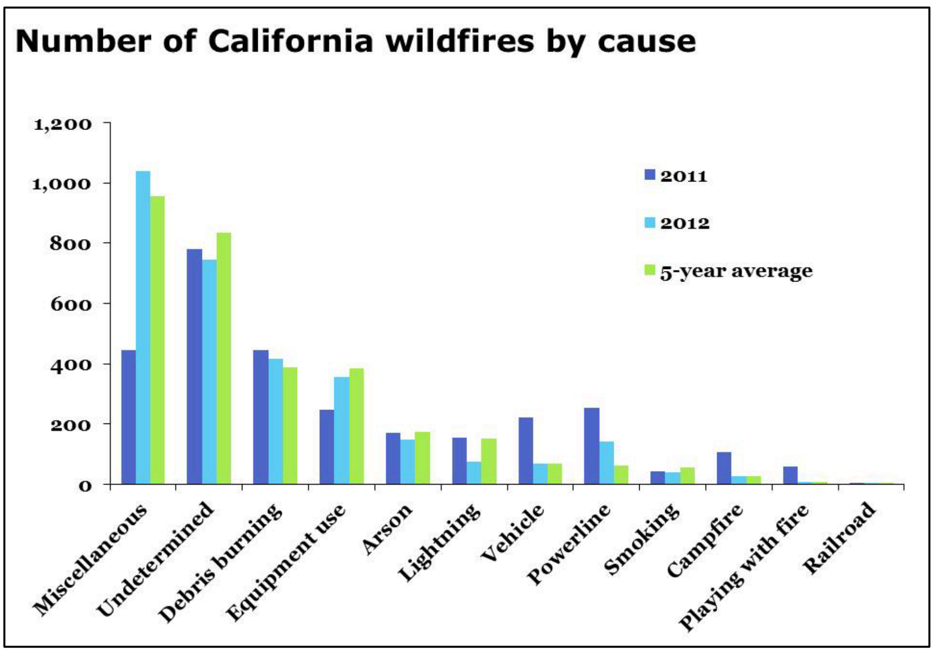

Figure 2. Main fire causes/citf.org.

2.1 Tracing the Causes of California's Wildfires

For California's wildfires, it is not hard to find the reasons cause those terrible fires: burning debris and human activities, and old wires. And most importantly, dead trees and weeds produced by climate change have become the perfect fuel. Burning debris: one of the most common causes of wildfires is the embers produced by burning debris. The wind can carry these embers for up to seven miles without extinguishing them. Human Activity: Such as driving cars, pulling trailers, having a gender reveal party, or doing yard maintenance. Electrical Power: Fallen power lines are the third most common cause of wildfires in California and were the cause of the deadliest fire in history—the Camp Fire [3].

Figure 3. Hill Fire was caused by Human Activity/nbclosangeles.com.

2.2 Proposing Solutions: "Attacking Fire with Fire"

Then, let's analyze these reasons and corresponding solutions one by one.

First, the forest area is huge: according to the data of 2016, [4] California's forest area is only second to Texas and Alaska in the United States, with about 33 million acres, accounting for one third of the whole state. Second, California's arid climate conditions have turned these trees into a good fuel for mountain fires. Over the past 10 years, California has been more or less dry [5]. In such a dry state, even the occasional showers have even played a counterproductive role - the rainfall of northern California in 2017 and southern California this year in the rainy season at the beginning of the year reached the historical average or even higher level, making the local plants recover and grow again. However, by the time of summer drought and monsoon, these lush plants become more fuel after drying up.

Therefore, if we want to solve the problem of fire, we must try to trace back to the source and eradicate the fire from the source. Many experts in California and even the United States have put forward many constructive suggestions. One of the most interesting is to try to "attack fire with fire", and create a controllable fire by actively burning some combustibles. "A lot of forests - it's five times too dense," said Malcom north, an ecologist at the Pacific Southwest Research Station of the forest service. Many scientists are studying ways to keep western forests healthy. Researchers suggest that the state should burn about one million acres of land each year. This way not only clears out the dead plants and thick underbrush that fuel many severe wildfires, it also restores a natural process that once kept forests healthy and resilient. Prescription burns are effective. For example, last year's Creek fire exploded in parts of the Sierra Nevada. However, in 2019, the last year for which data are available, only about 118000 acres of land in the state were deliberately burned [6]. This can be tricky because all fires, whether natural or intentional, are inherently dangerous and smoky. Even so, experts say the benefits far outweigh the risks [7].

In fact, this method has a long history. Long ago, Native Americans managed California through this method, and they always lived in peace with the fire. "Fire is an eternal companion, a universal catalyst and technology," said Stephen Pyne, an emeritus professor, writer and fire historian at Arizona State University [8]. Yosemite itself is often burned to clear shrubs, open pastures, provide nutritious feed for deer, and support the growth of forest food crops to feed and sustain the once large and prosperous indigenous population. Anthropologists have identified at least 70 different fire uses among indigenous and indigenous peoples, including clearing travel routes, long-distance signals, reducing pest populations such as rodents and insects, and hunting.

3. Government Efforts and Challenges

In fact, government departments are also working in this direction. They have also issued relevant policies and instruments to support the early burning of excess weeds and shrubs [9]. However, there are many reasons for the poor effect, including the weak implementation of the government and the difficulty of implementing the measures. For preventive incineration, relevant departments need to conduct exploration in advance, identify high-risk areas, formulate corresponding strategies (burn all, burn key nodes, or burn out a large section of isolation belt), and then wait until the weather is favorable (the application for permission is approved, the firefighters are present, and the weather conditions are suitable) before preventive incineration can be really carried out (Ehlers 10). This makes it very difficult to actually complete preventive incineration, and relevant government agencies have not simplified corresponding procedures and permits so far.

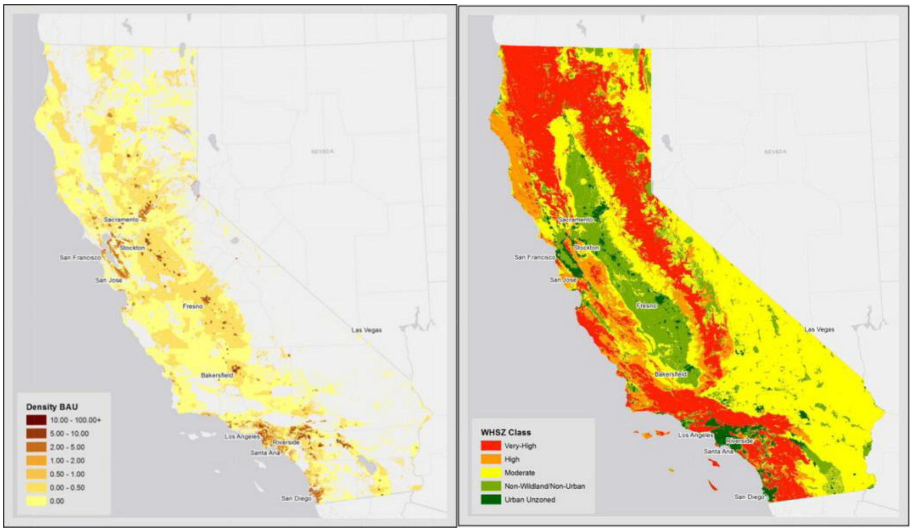

Figure 4. Distribution of High-risk Mountain Fires in California/vox.com.

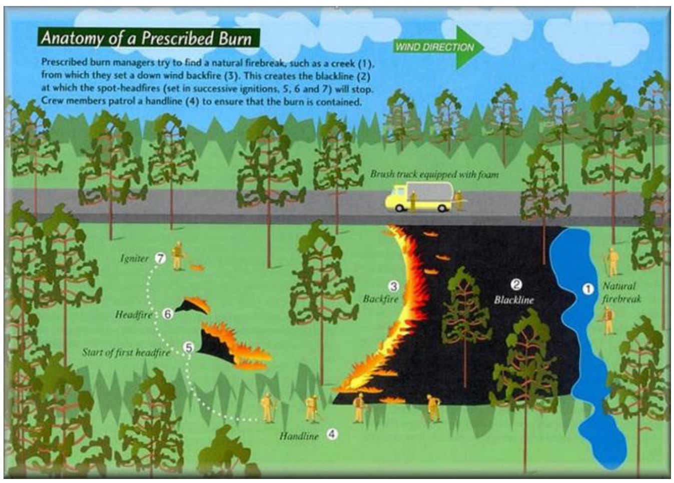

Figure 5. How to Carry Out Preventive Incineration/wildfire today.com.

You have to do it no matter how hard it is? If you ask the relevant government agencies why they haven't done it (or why they haven't done enough), there are basically two answers. The first is the budget. To put it bluntly, there is no money. It is reported that the federal government has reduced funding for the forestry sector, making the already stretched fire prevention work more difficult. I found the 2021 budget formulated by the federal government, which is $209.4 million less than that in 2020 [11]. This makes the work of selective early combustion more difficult.

4. UAVs for Early Detection and Control

Since it is difficult to reduce fuel reserves, it was suggested that the fire could be quickly detected and solved in the early stage. Therefore, some companies and organizations have proposed to control the fire in a small scale by satellite positioning and controlling the rapid response of UAVs. Among them, researchers from Dept. of electrical engineering and computer science, University of Central Florida have developed a relatively complete fire extinguishing system through UAV. They use opencv (a function library developed by Intel for visual recognition) on the UAV to judge whether there is a fire in real time. If the visual recognition of the UAV confirms that there is a fire, the loaded fire extinguishing substances will be sprinkled on the UAV for fire extinguishing. At the same time, it can communicate with the ground units and inform the fire brigade to put out the fire in time. They call this UAV FXUAV.

This method has been very perfect, but I feel there are some problems. The first reason is that the real-time positioning function of satellites is not perfect, which may be due to the lack of visual recognition of satellites. At the same time, they are identified through the camera on the FXUAV, so the scope is not wide enough. If you want to cover the whole forest and maintain 24-hour real-time monitoring, the number of UAVs required will be very large, and the human and material resources required to operate these UAVs at the same time will be very large.

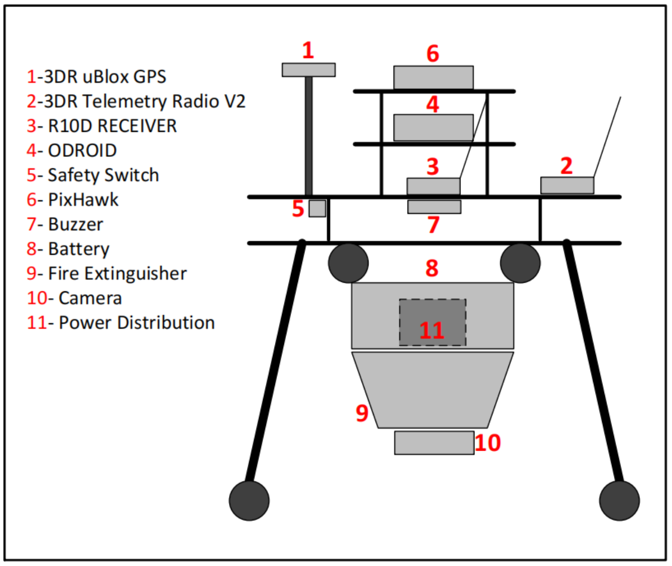

Figure 6. Structure of FXUAV.

5. Addressing High-Voltage Wire Risks

And because of the existence of mountain fires in California, they often develop very fast and on a very large scale. Therefore, the smaller FXUAV UAV is difficult to play a very key role in it, but it is sufficient as a preventive function. In mountain fires of this scale in California, large aircraft such as tanker are more often the main force.

In order to avoid crowded areas, high-voltage wires are often laid in deep mountains and forests. However, it is precisely because of this geographical location that the wire fire has become one of the three major fire causes in California. There are many accidents in which wires fall to the ground due to strong wind or aging of wire pillars, resulting in fire. When people notice the branches, the wires may break, or when the trees are not scratched. In 2015, fires caused by wires and equipment in California were higher than any other cause. In New Mexico, wire fires set a state record. In 2016, a fire in Dayanshan National Park spread to Gatlinburg, killing 14 people. In the deep mountains, the wire brings hope to the people in the city. In a beautiful day, the power grid makes life easier. Even far from the center of the city, in the house on the side of the mountain and in a dry bush, the lights can still be seen flashing. However, the high-voltage wire hanging in the air not only brings hope, but also becomes a knife hanging over people's heads. Generally speaking, the wire will cause fire only when there is a problem on the ground. Even power companies agree. A study conducted by Edison Electric Institute in 2012 shows that underground lines encounter fewer problems in windy weather and are more beneficial to public safety [12].

But the economic problem is always the biggest problem. California has 330000 kilometers of wires, and the cost of laying underground lines is about $1 million / 1.6 kilometers, which is higher in mountainous areas. Laying wires underground can cost five to ten times more than laying wires overhead, which usually makes it logically or economically impractical to lay wires underground. In North Carolina, for example, plans to lay wires underground have been put on hold because electricity prices in affected areas may rise by 125% [13].

However, all this is not entirely controlled by the power company. California power company is not sure how many wires they have installed underground. This problem is regulated by the U.S. Power Commission in order to protect consumers, protect the environment and ensure that Californians have access to safe and reliable public infrastructure. The committee tries to balance risks and costs and limit the cost that power companies can spend laying wires underground. Therefore, it is impossible to completely eliminate the passage of high-voltage wires from overhead, but as a state government and federal government, it is essential to minimize the exposed wires and control the exposed wires to keep them under control.

6. The Role of PG&E in Wildfires

At this point, I have to talk about PG&E. Pacific Gas and Electric company, locally referred to as PG&E, is a public utility company in the United States that provides natural gas and power services in Northern California, from the California Oregon border to Bakersfield in the south central part, about two-thirds of the state.

In the past five years, PG&E has caused 31 wildfires, killed 113 Californians, burned nearly 1.5 million acres and destroyed nearly 24000 buildings. The utility company was blamed for some of the biggest fires in the state's history, including the Dixie fire in Northern California last summer, which burned more than 963000 acres and destroyed 1300 buildings [14].

PG&E has been charged with criminal charges, including four counts of involuntary manslaughter, because last year's deadly "Zogg Fire" killed four people and destroyed hundreds of buildings. The 31 charges charged PG&E with 11 felonies, multiple misdemeanors and enhanced charges related to "Zogg Fire" under California law.

The fire was triggered by a pine tree in contact with PG&E wires and burned more than 56000 acres in September 2020. In addition to killing four people, the fire also injured one person and destroyed 204 residential and commercial buildings [15]. PG&E, as a utility company, has both legal and regulatory obligations to reduce the risk of fire by removing dangerous trees from around the power line. These responsibilities are clearly stipulated in public resources and utility regulations," said Stephanie Bridget, district attorney of Shasta county [16]. Therefore, we can say that in order to reduce the occurrence of fire, in addition to the efforts of individuals and governments, all relevant companies also play an important and decisive role. PG&E, as an important utility company responsible for the management of two-thirds of California's power and high-voltage power lines, has repeatedly put the interests of the company and individuals above the safety of people's lives and property. Let the high-voltage wires be directly exposed to the dangerous environment, or ignore the maintenance of the high-voltage wires for many years, so that the people are directly exposed to the danger. Therefore, it is also very urgent to quickly rectify relevant companies. At the same time, it is also essential to strengthen the management and monitoring of high-voltage wires.

Figure 7. The Pole is On Fire/ltaaa.cn.

Figure 8. Kincade Fire by PG&E/Bloomberg quint.com.

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