A DISCUSSION OF THE CURRENT STATE OF WILDLAND FIREFIGHTING IN THE UNITED STATES

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Introduction

A multitude of large wildfires have been witnessed just in the past few years. The Australian bush fires lasted for almost a year. According to the Center for Disaster Philanthropy, record breaking temperatures and fire sizes were recorded in multiple areas of Australia - with over 46 million acres of land burned just during the 2019-2020 wildfire (*2019-2020 Australian Bushfires*, 2020). The Amazon rainforest wildfires lasted for almost a year as well, which were largely caused by recent deforestation efforts. However, in the United States, it seems as if every year a new wildfire in California takes over headlines in the news. Wildfires in this area have not only been occurring at an increasing rate, but they also have started to affect civilian lifestyle as they are starting to spread more than they used to. The civilian death rate has increased just in the past few years, and, according to a UCSB Emlab study, the estimated value of structure losses have skyrocketed in this same time span as well (*Long-term trends in wildfire damages in California*, 2019).

Wildfires are getting larger and more intense each year, and it is almost as if these reasons are infinite. It is difficult to pick one factor of wildfires and place all the blame there. It is evident there needs to be a complete overhaul on how the politics of wildfires are approached and how wildland firefighting needs to change, regardless of what reason people believe. To revamp the firefighting process to better cater to the more intense wildfires occurring today, there are both technological and social problems that must be addressed. The intention of this research will be to figure out how the current firefighting system in place is flawed and to look into the disruptions of the sociotechnical system of wildland firefighting. I will be addressing the social issue of the more intense fires in recent years by applying actor-network theory, as I will

study the entirety of the firefighting system in place in the United States, more specifically California, and what has gone wrong with it in the past few decades.

Context & Literature

Being from California, having the occasional wildfires in my area was something I had grown up with. Trees on Mount Diablo, a mountain seen as the centerpiece of my town, seemed to never get a break from wildfires. We were surrounded with trees burned to crisps on road trips and hikes on the mountain, and would have the occasional ashes from the mountain rained onto us under a yellow-tinted sky during recess. Having to evacuate our home gave a sensation of uncertainty to me. I was young when I lived in California and I didn't know exactly what was going on, but I never learned about the actual effects these fires caused until I got older.

The literature to be conducted for this research paper will mainly vary from documentation and interviews related to forest fires and wildland firefighting. This includes federal laws regarding the reasons for environmental damages, rules for wildland firefighting, and interviews and discussions with government officials. These sources will help me better understand the current state of wildland firefighting, compare and analyze existing statistics, and aid me through the process of carrying out Actor-Network Theory.

Changes in Wildfires & Climate

There has been a massive increase in the occurrence of wildfires, as they are getting larger and more intense each year (NASA, 2021). Many regions have experienced droughts in recent years, largely being due to the ongoing increase in temperature throughout the world. These areas become so dry that it is not only easy to start a wildfire, but it gives the fires the ability to easily spread and become harder to put out (Center for Climate and Energy Solutions,

2021). It is important to define the reasons behind why and how the size, longevity, and intensity of fires are increasing.

Wildfires are part of nature's cycle – the combination of fuel, oxygen, and heat is all it takes to get one started (*Elements of fire*, 2021). Copious amounts of fuel (trees, bushes, and other plants) in a forest give fires the opportunity to largely spread, therefore, turning them into a wildfire. However, their increase in size and intensity is not as natural. Part of this is due to climate change – which is the reason why droughts have been more consistent in some areas of the world, and why temperatures have been increasing. Factors such as these make the air dryer, which makes plants (such as trees and bushes) more prone to being easy fuel for a wildfire. Another part of this is due to improper management of past wildfires. It took some time before people realized extinguishing wildfires actually increases fuel in an area, making it easier for a catastrophic wildfire to occur (*Suppression, 2015)*.

It's easy to blame climate change when considering why the conditions of wildfires are getting significantly worse in the past decade. As mentioned earlier, California has been a host area of multiple large wildfires per year - which rate does not seem like it will slow down anytime soon. Higher temperatures in California have been encouraging a drier climate. Specifically in Southern California, the average temperature has increased 3 degrees in the past century (*State Key Findings*, 2021). By the end of the 21st century, we are expected to see a 5.6 to 8.8 degree increase in temperature as well (*State Key Findings*, 2021). University of California, San Diego researchers also state that "if emissions continue at current rates, Fresno will likely suffer 43 extreme heat days per year between 2050 and 2099; 10 times more than its yearly average between 1961 and 2005" – which is an extremely concerning increase (Scripps Institution of Oceanography, 2022). Higher temperature means the rate of water evaporating into

the air is increasing, which takes it away from soils and surface water. This makes the environment and air drier, as less humidity in the air results in less precipitation. This gives environmental objects the ability to be used as fuels during fires. Another environmental issue that is often overlooked is the past methods for wildland firefighting. Stanford University Law School professor Buzz Thomphson puts this scenario simply in an interview on SiriusXM, that the idea to suppress wildfires as soon as possible was the "answer" to fires in the 20th century. However, this led up to "a huge buildup in the fuels", which contributed to the fires being significantly worse in the 21st century.

As a result of these environmental issues, more changes in environmental policy need to be implemented. A lot of the existing climate issues exist right now due to little action being done as well. California is and has been seen as a "leader" in terms of progression of the environment's state, as in many states within the United States use California's environmental laws as a baseline due to its emphasis on climate control. However, there has not been a single law regarding climate control passed in the state since 2018 (Safo, 2021). This caused them to receive a "D" grade in environmental progress and solutions by a large conservation group, EnviroVoters: making it their worst personal grade ever. Although it may be evident that the clear problem here is no laws being passed, there is an ethical issue under the fact that politicians are seemingly working for their own benefit. Steve Bennett, a member of the Climate Action Caucus, states "Politicians don't get popular by asking people to make sacrifices today to solve the problems that come 15 or 20 years down the road" – as it is something that will not help them for their personal gain (Potter, 2022). Lobbying is also an immense problem within this situation, as oil companies tend to lobby for politicians and regulators, especially in more recent years.

Firefighting Methods

It's surprising but the way people used to fight fires has a great impact on the state of wildland firefighting today. Natural wildfires have been around for thousands of years, and due to the consistent risks wildfires pose, firefighting methods have forever existed. If anything, wildfires are good for the environment; they provide return of nutrients to soil, restore habitat diversity, and promote germination of certain types of plant species (*Suppression, 2015)*. However, the risk of allowing fires to exist can have detriments to human life and civilization, so it is important to "draw the line" of when to interact with a wildfire. Although natural wildfires have benefits, there is a large risk of surrounding civilizations facing destruction due to a wildfire. Because of how complex this is, it is important to have the right technology to fight fires correctly – at least to our current knowledge.

Aerial firefighting technology is a topic that still requires a lot of exploration. Since its introduction to wildland firefighting in 1957, only a little more than 50 years after the first successful aircraft flight, it has seen many developments to help innovate wildland firefighting techniques and experiences (Wyckoff, 2007). Especially with the increased wildfire intensity and size in recent years, modern wildland firefighting would absolutely not be possible without the use of aircraft.

The use of aircraft in wildland firefighting has a large variety. Some aircraft, such as large Airtankers and VLATs (Very Large Airtankers), carry thousands of gallons of fire retardant, laying it out around a fire to contain it from spreading any further. Others, such as water scoopers, tend to directly fight fires above the ground and can immediately refill their tanks by scooping water from a nearby water source. The tactics performed by aerial firefighters can be extremely beneficial in doing a lot of tasks to aid ground firefighters.

However, due to recent increases of intensity and size of wildfires, the aircraft used for modern wildland firefighting cannot keep up. This primarily is because there is not an existing aircraft in the world designed solely for aerial firefighting. The majority of aircraft used for modern wildfires tend to be modified commercial or military airframes with external or internal additions to its original design that create inefficiencies. This makes the firefighting process harder than it should be. For example, the DC-10 aircraft is a passenger aircraft. However, this same aircraft has been modified to be capable of carrying 9,400 gallons of payload (such as water or fire retardant) to be used towards fighting wildfires (Geographic Area Coordination Center, 2009). An attached tank has been added to the bottom of this plane to give the aircraft a way to unload the payload through a controllable slit. However, this attachment increases the overall drag on the aircraft, which creates stability issues throughout the aircraft, making flying the aircraft difficult. Flying an aircraft while coordinating with firefighters for aerial firefighting is already hard enough on its own. These stability issues just make the pilot's job much harder.. This poses a large problem in wildland firefighting methods and will be something taken into consideration to recognize where the large problems in wildland firefighting are. A new aircraft solely meant for aerial firefighting could be designed, but, for some reason, this is not heavily prioritized.

Groundwork also carries heavy importance in firefighting. It is fairly optimized as it is – the coordination and communication between firefighters are effective and the strategies are not problematic. To successfully control the spread of a fire, at least one of those three components must be removed. However, the large problems with ground firefighting are severely ethical, unlike aerial firefighting's technological problem.

Firefighting Ethics

Being a firefighter is extremely dangerous. Fighting a fire with the capability to destroy an entire forest is a task with a lot of risk. As expected, wildland firefighters are at large risk of direct injuries, or even death, due to the fire. Suffocation due to smoke and high degree burns are likely. Cardiovascular and heart diseases, and cancer, are also possible (Kardas-Nelson, 2020).

Ethical issues lay with this as well. The pay for being a wildland firefighter is atrocious, with a floor of $28,000 per year (Safo, 2021). For a job with such high risk, this pay is absolutely devastating. In an interview with former wildland firefighter Jonathon Golden, his base wage was only 18$ an hour when he quit, and had to work over 1,000 hours in overtime to make enough money just to support his family (Safo, 2021). Not only is the low pay unethical for these firefighters, but it is an extreme push to work elsewhere. There is no incentive to work a high-risk job for such little pay and inconsistent hours when there are other alternatives. Another ex-wildland firefighter, Aaron Humphrey, started to work for a gas and electric company after two decades in the wildland firefighting field, stating "getting a salary that I can live off of and not have to stress on overtime and being gone all the time" (Safo, 2021). Not only is it unethical to put people at high risk for little pay, but there is also the issue of hiring prospective firefighters who may be turned off by the low pay. Nobody is going to take a job like this.

Additionally, incarcerated firefighters also exist – prisoners who are working as firefighters below minimum wage (Lowe, 2021). It sounds like a great opportunity at front, but they make only $2 to $5 a day, with an additional $1 an hour when on the fire line (Sibilla, 2021). Although this is bad on its own, none of the prisoners working on the line while doing their time were even allowed to become full time firefighters after their release from prison until July 2021, when some exceptions were made to allow some ex-offenders get into the firefighting

workforce. Not only was it absurd to pay prisoners such a wage for a high risk job, but it also gives an idea of how high in demand this grueling task really is.

Methods & Analysis

This paper seeks to answer the question of how the sudden increase in intensity and size in wildfires can be determined, and to the question of what social and technical steps can be taken to reduce the alarming rate of growth in both areas of size and intensity. Climate change can be connected to many different issues, including government policy, ethical decisions by humans, and even the occurrence of natural climate change throughout long periods of known history. I argue that poor decisions made by both government and society have highly factored into the wildfire season getting significantly worse

Actor-Network Theory (ANT) is the framework that will make up the analysis conducted on the current state of wildland firefighting. This theory states social and technical actors can have connections to each other in a certain network. When using ANT, each actor gets equal treatment during analysis, meaning there is no priority for one actor over another in a network.

In this case, the network is the wildland firefighting system. ANT will study how the occurrence of more wildfires is due to global warming by connecting wildfires to natural, non-human actors. The two groups of actors will be human actors and non-human actors. The main groups of human actors consist of firefighters, engineers, the government and lawmakers, and regular civilians. The main groups of non-human actors consist of the forests, the environment, firefighting technology, and laws. ANT will be used to connect these different actors together within the same network, and then an evaluation can be made to determine which groups are at fault for the failure of the modern wildland firefighting system.

People

Likely the most crucial piece of the system of wildland firefighting are the firefighters. Even though they are the most important piece, it is clear that a large part of the problem in the system stems through the firefighters. As previously stated, the rapid increases in intensity and size of wildfires due to climate change with a poor salary gives little incentive for people to enter or stay in the wildland firefighting industry (Safo, 2021). Resorting to using prisoners to fight the wildfires also is a large indication there is a true shortage. The Biden Administration even announced a plan to boost wages to $15 an hour and to give seasonal workers opportunities to work all year (Wertz, 2021). However, many firefighters still feel this is too low due to the risk they put their lives on and the mental exhaustion it gives. It's fairly clear the problem with wages stems from governmental control. Because this is a federal job, the government has a lot of control over the wages of firefighters. Although $15 is an improvement, it still does not align with what many firefighters and firefighting supporters think the wage should be.

Technology

The existing technology used for firefighting is not ineffective by any means, but the problem more so lies through the fact that wildfires are only getting stronger. Current ground firefighting methods are already fairly simple and fully optimized, and the only fixes that need to be made have to do with anything but the technology. However, aerial firefighting poses a large technological issue. Discussed earlier, firefighting aircraft used today are modifications of other commercial or military aircraft. Although sufficient, the limitations are more and more impactful the stronger the wildfires get. In the field of technology, it's clear the problem is it being outdated. However, finding a reason for this is a little more difficult.

Wildland firefighting's need for aerial technology has transitioned from modifications to existing aircraft to requiring specialized aircraft for these tasks. Firefighters can't do much about their technology being outdated, so the first group of people to consider are engineers, specifically, aircraft engineers. Because engineers work in collective groups, it usually doesn't make much sense to blame the engineers individually.

However, projects for advanced aerial firefighting aircraft are not even a high consideration at this point. Contractors are even having a hard time with manufacturing aircraft that have firefighting additions towards them, such as the modified DC-10 aircraft (Mak, 2021). Not only is there an absence in a specific aerial-firefighting aircraft, but there is also a large shortage in larger air tankers – which are a crucial part in aerial firefighting. Designing and contracting is a much more time-grueling task that will likely take years, with a lot of money and effort. Because wildfires are fought by government forces, it means the government also has the responsibility and capability to call for a new firefighting aircraft to be created or designed. Lack of a new aircraft to be created is the fault of the government not assigning anybody this work due to the limited budget in firefighting, but even the lack of manufacturing existing firefighting aircraft is also to their blame.

Climate Change

The increase in strength within wildfires would not really be anything to worry about if it weren't for climate change. It's a universal issue that the majority of people are aware of and there does not seem to be significant efforts by many major governmental powers to control this. However, before blaming all of climate change as a whole, it's important to recognize which specific parts of the climate are causing the fires.

In a scientific perspective, one of the reasons why fires are getting stronger is due to the drier climate (as mentioned earlier). The dry climate makes the fuels to be used for fires – such as trees and bushes – a lot drier, therefore, a lot easier to burn. Especially in areas that get less rain, it is easier for somewhere to be in the state of lack of humidity – in other words, drought. This is due partially to a lack of rainfall, but even that is due to a rise in temperatures.

This temperature rise and climate change are largely due to the lack of government action. It's easy to blame the government – specifically lawmakers and others who have a high position of power to make an influential change. That is not to say there has been no effort in making climate control laws, but the United States government has not been doing a good job with keeping up with progressive climate policies. For example, the Trump Administration rolled back on a total of 112 environmental protection rules, and would largely increase greenhouse gas emissions over the next decade (Popovich, 2021). In an interview, Senator Whitehouse also claimed a lot of the laws were being blocked due to the impact it would have on corporate money, which was largely a fault in the Republican party's decisions (Toomey, 2017). These are not the only instances of the government blocking or backing down on climate policies, but they do show how there are monetary priorities within the system that are prioritized – which is a huge problem.

Conclusion

There are a lot of apparent problems within the network of wildland firefighting, but that does also mean one solution may fix multiple problems. Fixing the problems of extreme climate change won't directly help the technology of aerial firefighting, but there wouldn't be aerial technological issues to begin with if temperatures weren't getting so high to make the wildfires worse. Fixing the wages for firefighters may not necessarily solve climate change, but it will

give more incentive for people to enter the firefighting industry, solving the problems of lack of workers and using prisoners to fight fires. The research found by applying actor-network theory pointed out the majority of the issues stemmed back to the United States government. Although a lot of the apparent problems were within other groups, it usually was not in control by those populations and instead was controlled by the higher powers.

For future studies and work, this analysis can help lead governmental figures and climate change activists towards the right directions to solve the question of what is wrong with the firefighting system currently in place. This was not the extent the analysis could have been conducted to either. This is an extensive problem which people spend years researching, and this is just a fraction of what can be done. However, a network analysis within the government is not possible without all the required resources, which can include interviews and opinions of people in the positions to vote for these policies – which can take a lifetime to obtain.

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