The Argument for Investments in Disaster Response to Combat Climate Change

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Introduction

Due to rising sea levels and extreme temperatures, climate change has led to an increased frequency of natural disasters. After adjusting for inflation, the U.S. experienced more than twice the number of billion-dollar disasters during the 2010s than the 2000s decade: 119 versus 59. Though society may be past the point of fully preventing these occurrences, we can still adapt quickly to prevent unnecessary expenses and loss of life due to climate-related disasters. We propose a framework focusing UAV market opportunities in the search and rescue (S&R) and agriculture sectors, illustrate why each investment is profitable, and demonstrate how each use case positively affects climate change. We discuss the benefits of UAVs for wildfire prevention, surveillance, and rescue operations, and the use of UAVs in drought-prone and agricultural settings.

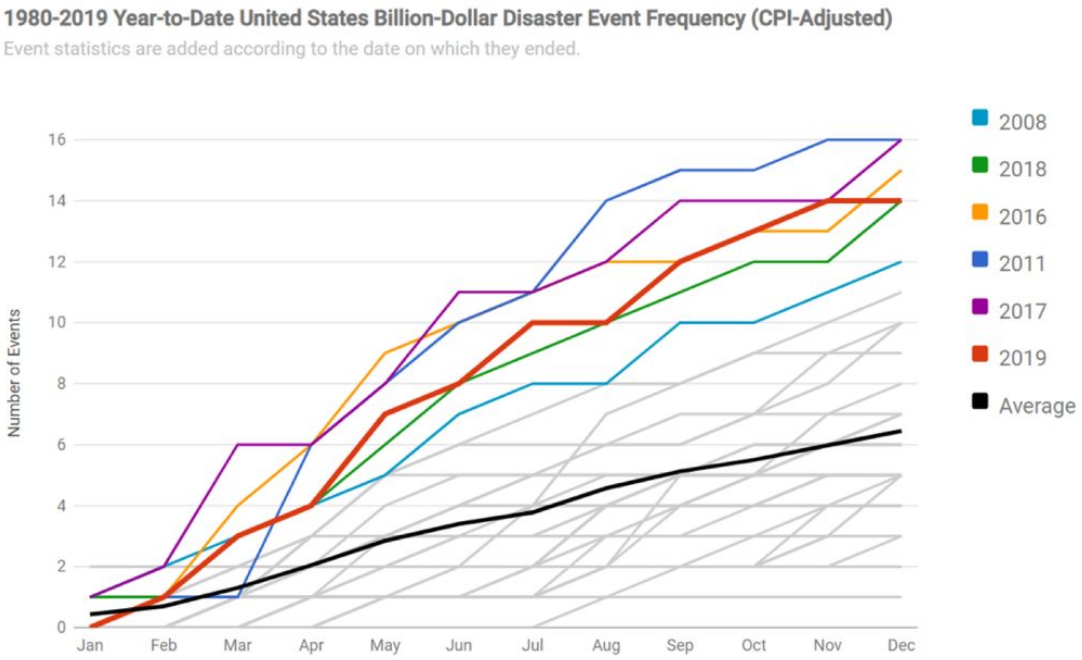

Figure 1: Tracking the Frequency of CPI-adjusted $1B Climate Disasters Over Time[3]

Background: Wildfires

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[3] The High Cost of Drought

The number of wildfires globally has been increasing as well, with dire consequences for the people living in those communities, their local economies, and the surrounding wildlife.

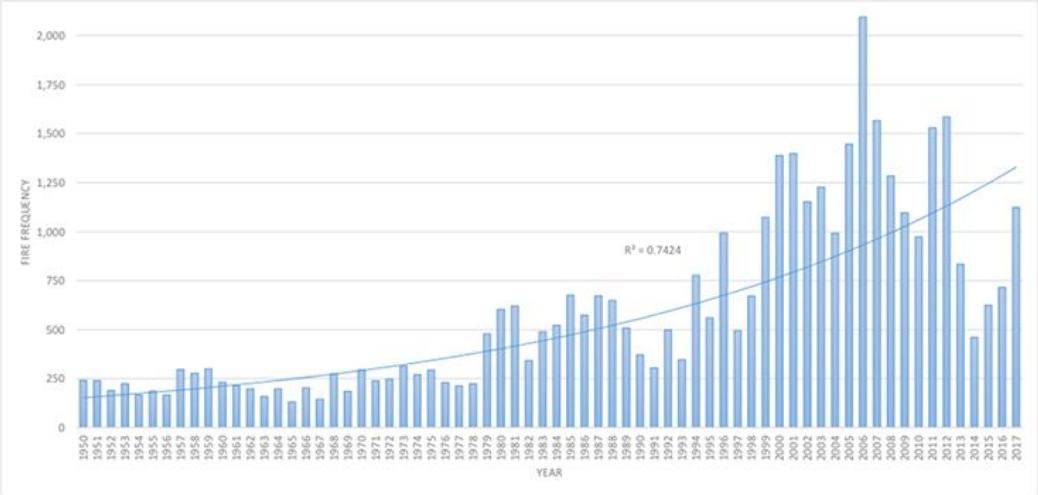

Figure 2: Number of Fires in the Western US, 1950-2017[4]

Over the past 10 years (FY2008-FY2017), Congress has appropriated an average of $3.72B annually to fighting wildfires, with $4.18B combined to both the Forest Service and DOI in FY2017.

Market Opportunity: Fire Surveillance

Global temperature highs have been increasing, and as a result, fire seasons around the world have extended in calendar time and have caused more damage. Governments stand to benefit from contracting with private companies and buying autonomous surveillance vehicles to quickly chart wildfire growth and find people and animals who may be trapped inside the fires.

[4] Six trends to know about fire season in the western U.S

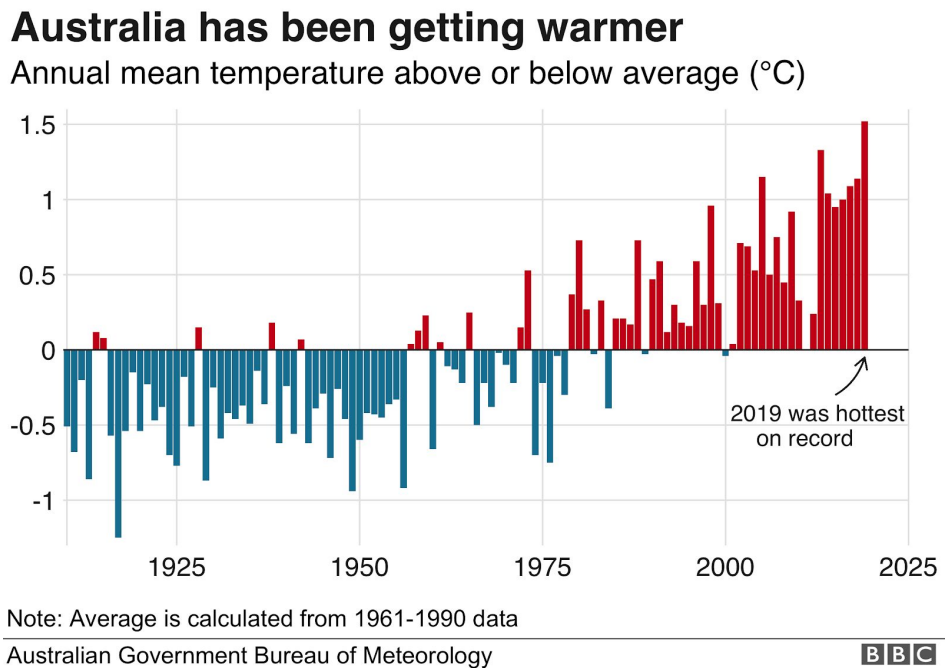

Figure 3: Annual mean temperature compared to average in Australia

The Australian wildfires early in 2020 resulted in the loss of approximately $100B accounting for the loss of life, property, and biodiversity.[5] Of that, the resources and manpower needed to put out the fire cost about $9.3B.[6] In total, 46.05 million acres of land burned.[7] Current fire surveillance is done by flying planes from the National Infrared Operations Program (NIROPS), which cost $1500/hour to rent.[8] For a single plane, full surveillance of the area mapped out by the fire would take approximately two days of nonstop flight. Thus, a fleet of four planes with each flying for about twelve hours could quickly and safely map the fire within a reasonable time frame. The crew needed to run the NIROPS plane costs $5000/day, giving the infrared planes a total daily cost of $164,000. A fleet of UAVs equipped with thermal imaging capabilities, CO2 sensors, and strong networking capabilities, with a unit cost of $40,000 per drone[9] could quickly cut costs for first responders. The use of CO2 sensors in particular would replace the man-hours required on the ground searching for people who may have been trapped by the fire. In addition, a surveillance UAV above could utilize its infrared cameras to map a safe path of exit out of a dangerous region of the fire for first responders trapped inside[10].

Deploying UAVs to survey the area would allow first responders to focus on more efficiently extinguishing the fire. In Australia, there were 3700 firefighters on the ground at any moment[11]

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[5] Australia wildfire damages and losses to exceed $100 billion
[6] Estimating the Cost of Fire in Australia: now and in 2020
[7] At Least 24 People and Millions of Animals Have Been Killed by Australia's Bushfires.
[8] How much is this IR Flight Going to Cost?
[9] How Fire Departments Use Drones To Save Lives - Skyfire
[10] Drones are fighting wildfires in some very surprising ways
[11] https://www.bbc.com/news/world-australia-51008051

paid an hourly wage of $36/hour, with a net daily labor cost of approximately $133,000 and a total labor cost across 72 days of about $9.5MM. In addition to the firefighters, there were more than 3000 army, navy, and air force personnel present to assist with cleanup and search and rescue. In total, the manpower to put out the fire cost about $20MM. Utilizing UAV surveillance would have allowed each individual first responder on the ground to work more efficiently, saving time, money, and lives.

Market Opportunity: Preventative Surveillance

Given the vast economic impact of wildfires, companies that can secure contracts *surveilling* fire-prone regions could save governments billions of dollars. In California, much of the forest land is at risk for wildfires, and the number of acres burning in wildfires each year is increasing, as shown in this graph of the number of millions of acres burned in California between 1980-2019:

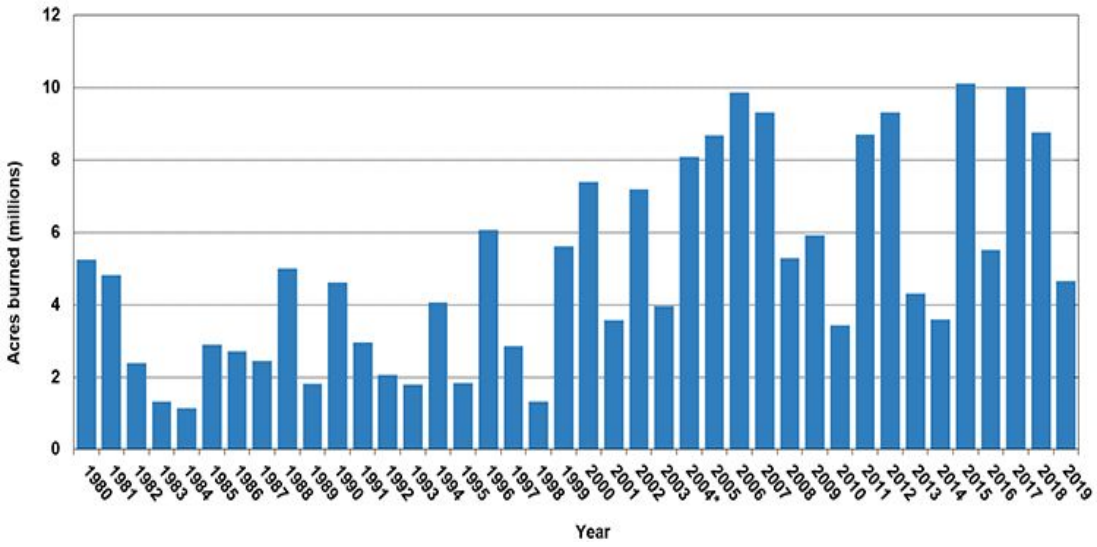

Figure 4: Acres burned in California, 1980-2019

These drones could also be used for surveillance to identify the causes of wildfires and prevent their spread. Daily patrol flights by UAVs that can autonomously takeoff and land at charging stations, and an asset management system that combines the data collected by each UAV to identify potential fire starting locations could help first responders quickly track down sources of fires.

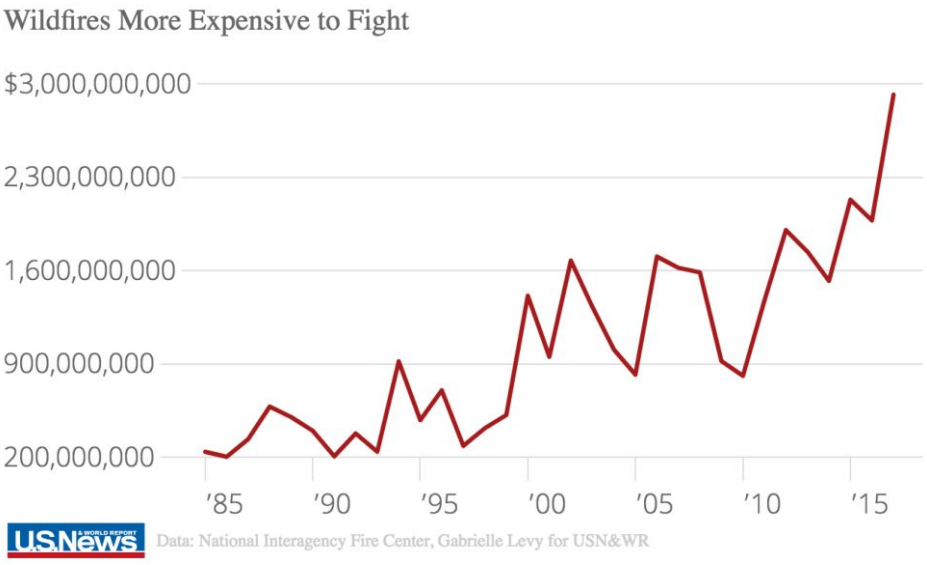

Figure 5: Cost of Firefighting in the US, 1985-2015[12]

The DOI established a contract for a "call as needed" fire surveillance system with four different drone companies for $17MM. We believe that private companies can provide a holistic software system to monitor a variety of autonomous agents in the field, create maps and analyses of the fire-affected regions, and quickly notify first responders about potential fires during short patrol flights.

Background: Drought

Another major source of avoidable economic loss can be found in the agriculture sector. Due in part to rising temperatures, the annual losses associated with drought amount to $9B.[13] Early detection of droughts can mitigate fire and famine, and in turn, can protect ecosystems and limit food insecurity.

Figure 6: Drought Prevalence Estimates as of July 2020[14]

[12] Wildfires Are Getting Worse, And More Costly, Every Year
[13] DROUGHT: Monitoring Economic, Environmental, and Social Impacts
[14] US Drought Portal (drought.gov)

Market Opportunity: Combining UAS and Meteorological Surveillance

Deploying low-flying unmanned aircraft systems (UAS) for precise soil moisture data could be invaluable in the fight against drought. Today, autonomous soil moisture monitoring can be paired with traditional meteorological satellites to predict and prevent drought. Project Drought is a prime example, as it uses the pairing of UAS and satellites to quantify drought risk.[15] Leveraging a UAV strategy that complements meteorology could provide critical insights in years to come. The agriculture sector in developing economies lost $96 billion between 2005-2015. Within these countries, drought was a leading cause of crop loss: 83% of all droughts led to economic loss, and the total amount lost was $29B.[16] Given that agriculture is a stronghold in many developing economies, partnering with governments or large agricultural businesses to deploy UAV technology in farming communities could be crucial to a country's long term health and growth.

Conclusion

Surveillance systems will help first responders and farming communities quickly adapt to wildfires and widespread drought. In addition, UAV technology can also be pivoted for surveillance use of indoor/outdoor vertical farms in cities, and can also be used to monitor wildlife populations in forests and fire-prone regions around the world. An investment in robotics and UAV companies focused in these sectors could lead to large returns and critical assistance in mitigating the current consequences of climate crisis as well as providing preventative measures to slow its effects.

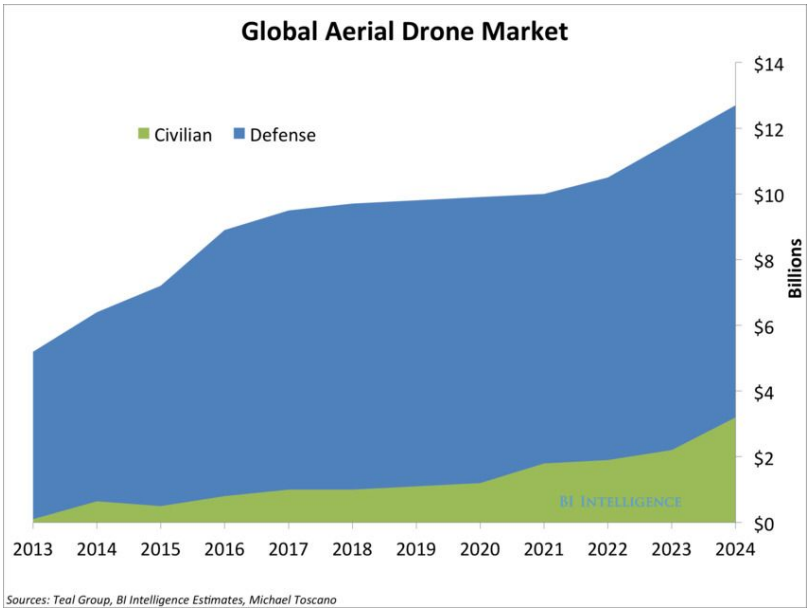

Figure 7: Trends in the Global Aerial Drone Market[17]

[15] Project Drought
[16] Disasters causing billions in agricultural losses, with drought leading the way
[17] This is how drones could help to fight climate change