The Enduring Threats of California Wildfires: How Construction Companies Must Adapt

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California wildfires are among the most pervasive and commonly occurring natural threats to the state. Especially considering the incremental increase in frequency and destruction of wildfires, there is a crucial need for modernized policies aimed at both preventative measures as well as viable responses. My project will analyze how the exponentially growing prominence of California wildfires has affected the landscape of the construction business, revealing the need for modernized protocols that could aid in prevention. These factors include the full scope of short and long term economic damages inflicted by wildfires, fluctuations in labor and material prices, and resulting disruptions in project deadlines. Additionally, this paper will analyze the cost benefit of existing fire-retardant materials already implemented in the construction industry. Through meticulous analysis of these factors, this paper will propose considerations that both government agencies and construction companies in California should adapt in order to preemptively mitigate the detrimental consequences posed by fires.

Key Words: Wildfires, Prevention, Building Materials, Fire Regulations, Risk Assessment

Introduction

Construction businesses around the world are accustomed to catering to their surrounding environment to both plan and execute successful projects. This innately includes any individual or combination of environmental factors specific to the region that can hinder or redirect construction projects of any scale or scope. As wildfires cause immediate and long-term consequences on communities, California local and state budgets are commonly stressed by restoration projects. This is especially crucial when assessing the economic impacts that result both ecologically as well in physical damage, restoration projects, and from disruption of businesses and services. In California specifically, the construction industry must factor in the range of natural occurrences prevalent throughout the state into their building plans, design processes as well as structural integrity.

The commonality of California wildfires has forced the construction industry to both take every precaution both during construction projects as well as pivot in the extreme case of their destruction. This is easily evidenced by the growth in development of fire-retardant materials commonly utilized. Additionally, the devastation of California wildfires tends to affect low-income areas throughout the state most, causing extreme disruption within affordable housing projects, urban infrastructure, and key municipal services. Understanding the inevitability of wildfires in the California construction industry is essential to plan for shifts in labor and capital prices, resource allocation, and ultimately how project management must be adaptable to the threats and consequences posed by fires.

Background

Although wildfires have always been a concern in California, they have increased dramatically over the last decade both in regularity and destruction. This trend has been especially evident in 2020, which has seen significantly more fire damage than the preceding five years.

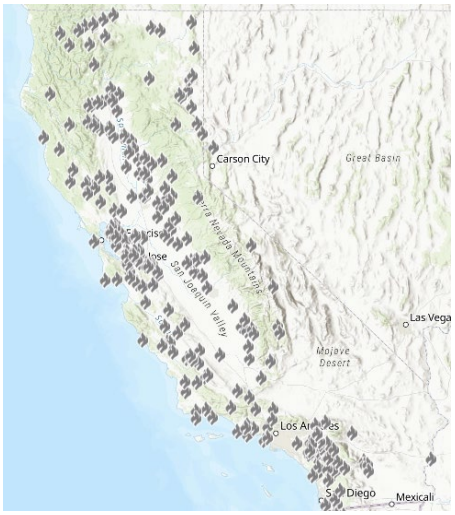

Figure 1: 2019 California Wildfires

According to Cal Fire, in 2019, California has experienced some 7,860 wildfire incidents, burning 253,321 acres or nearly 395 square miles (Ochi 2020).

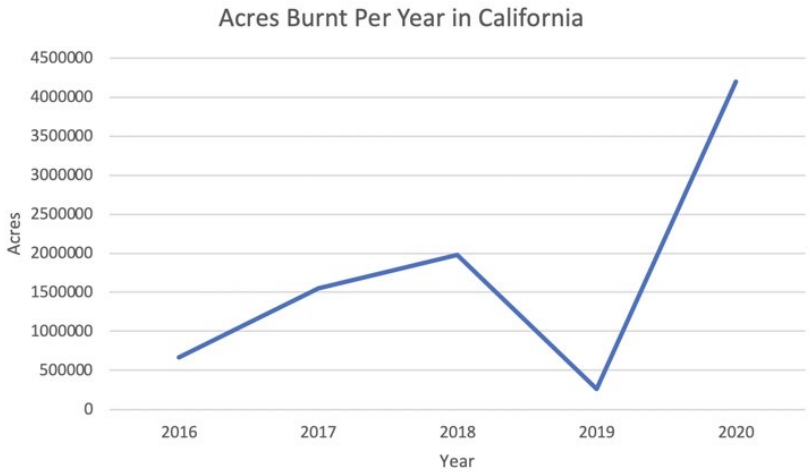

Figure 2: California Wildfires per Acreage Burnt

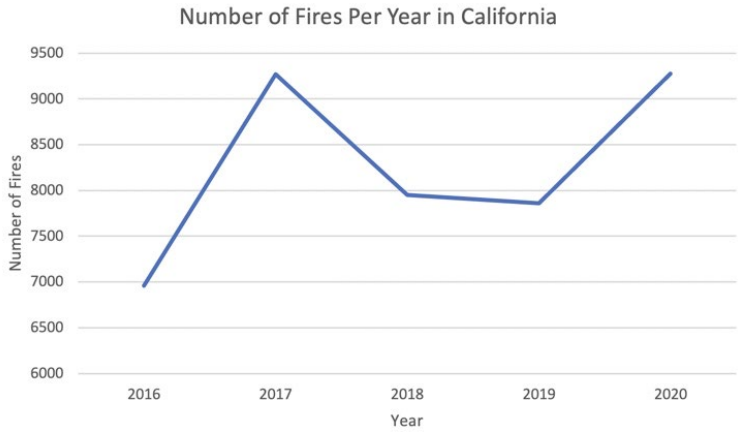

Figure 3: California Wildfires per Annual Fires

However, in 2020, wildfires have increased exponentially in terms of frequency and territorial damage. Per the figures above, California has been afflicted by 9,279 fires that have resulted in 4,197,682 acres of damage, which exceeds the total damage of the last three years combined. Additionally, 2020 hosted five out of six of the largest fires to occur in California since 1932 (Entcheva 2020). This alarming upswing in wildfires seen this year brings urgency to the issue of how the state and construction companies need to prepare to respond.

There are several factors that need to be considered when assessing the root causes of increasingly destructive wildfires. California has experienced more extreme environmental changes from drier and warmer weather, which has resulted in other unpredictable natural occurrences like droughts, storms, and wind patterns. Many fuel management regulations like logging and controlled burn regulations, while well intended, have had an adverse effect on fire prevention (Netburn 2019). By taking significant measures to prevent naturally occurring wildfires, many areas of California consequently went extended periods without naturally occurring fires, which ultimately contributed to a more combustive and unpredictable fuel source. Additionally, factors like population growth in traditionally uninhabited rural areas prone to fires have risen substantially in recent years, putting these populations and their infrastructure at higher risk. The culmination of these elements have made wildfires an unavoidable consequence that the state and all affected industries must take necessary precautions to mitigate.

When looking at the process of constructing homes or any structure, in any area, there are preliminary design and feasibility aspects to factor into planning. Owners and architects must take into account the wide range of elements, for example, location, temperature, and possible natural events, that can change how they design the structure. This can be seen in the design of homes in places like Kansas where reinforced basements are used as shelters from tornadoes (Lordson 2020). In areas at high risk for earthquakes, there are strict structural building codes in order to maintain safety standards that mitigate seismic instability. These are all ways that regulatory agencies ensure the safety of occupants. In California where an earthquake is just one of the risk factors, builders must take mudslides, issues with coastal erosion, and fire into account collectively.

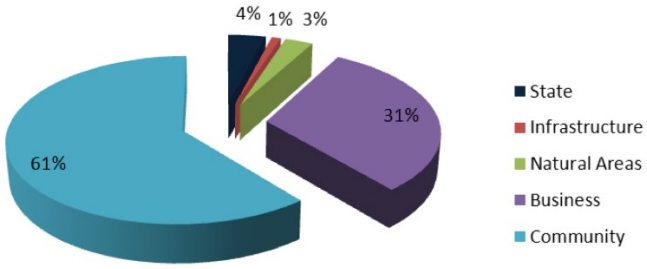

Figure 4: Economic Damage by Fires per Sector

The economic impact of wildfires on a given community must be gauged on multiple levels. First, communities are subject to the costs of initial damage and the lasting consequence if certain industries or infrastructure suffer long-term damage that renders them unusable. Immediate damage is assessed first, typically involving residential destruction or infrastructure with high consumer use, like transportation or utility distribution. Depending on the size and territory of the fire, the long-term economic impact can be exponentially more costly. For example, the long-term cost of damaged water systems, transportation networks, or natural habitats affect state budget resources far more than structure fires. This was seen in the 1998 wildfires that burned through nearly 500,000 acres in eastern California, including 337 homes, cost nearly $880 million dollars (Diaz 2018).

Cost Type	Total Estimated Cost	Cost Per Acre	Percent Total
Timber	$605	$1,212	69%
Fire Suppression	$100	$200	11%
Disaster Relief	$25	$50	3%
Property Losses	$12	$24	1%
Tourism	$138	$276	16%
TOTAL	**$880**		

Figure 5: Estimated Fire Cost Losses per Acre in California

This speaks to the consequential damage and costs associated with wildfire damage to community infrastructure, like highways, power generators, and water supply networks. Given the necessity of these community services, they require immediate attention from the varied organizations and state departments responsible for them, which also incurs large costs. Furthermore, when assessing the impact on the corporate sector of a given community, fires can impact businesses and their productivity in more ways than damaging their facilities (Diaz 2018). The residual effect typically will cause long-term dips in worker productivity, shipping delays, and slowed project management. While the ultimate commercial impact is contingent on the scale and type of businesses affected, these costs are still imperative factors in assessing the overall community losses incurred.

In context, the economic impact of fires within California are as vast and wide-ranging as the diverse landscape of the state. Although the majority of wildfires occur in my rural territories of California, the continuous urban development throughout the state conveys the prominence of economic devastation detailed above. Furthermore, wildfires have also been consistently emerging in more metropolitan and residential areas, like Santa Barbara County, Orange County, San Diego, and the Bay Area. Urban devastation throughout California not only impacts the cities' core municipal and civilian services, but they suffer the economic losses from the loss of tourism, recreational centers, and commercial businesses. These fiscal losses in California can be quantified on an aggregate scale by a study conducted by the Southern Fire Exchange, which found that every acre in California burned equated to roughly $6,516 in damages (Diaz 2018).

Literature Review

For my research I have combined qualitative and quantitative data with an emphasis on key industry reports from both fire agencies and construction firms. By assessing data from annual reports detailing varying metrics of wildfires in California, like annual number of fires, acreage burned, and high-risk areas, I will extrapolate what policies could be most effective in mitigating proper responses. These reports will also include environmental and ecological data that can evaluate how these factors are affecting wildfires to date as well as forecasting their impact in the future.

To analyze the economic impact of wildfires throughout California, I have collected data and insights from several reports that examine varying fiscal consequences posed by wildfires. These reports account for much more complex considerations than the immediate costs associated with direct damage control. They extend economic analysis into urban development, community impact, business disruption, and environmental costs associated with disturbed ecosystems. By presenting a full view of short- and long-term costs caused by wildfires, I have been able to comprehensively propose adequate industry and localized standards and code reforms.

In terms of the construction industry and business development perspective, I have collected data through researching and analyzing deviations in labor and material prices. This data was consolidated through both published pricing indexes as well as information collected from companies willing to share changes in pricing for their own bidding. I have also pulled from several news articles with pertinent information regarding how the large-scale wildfires of 2020 have affected labor divisions, project deadlines, and construction companies.

I have both compiled data tables and extracted information to create graphical representations of key information discussed in my analysis. This Information has been gathered from data banks and research articles. I have also compiled resources published on similar topics that provide relevant context. The knowledge collected through this supplemental research will give me supporting data, which will also allow my paper to resonate with a broader audience.

Analysis

In order to address the inevitability of wildfire destruction, California has already implemented specific codes and developed use of preventative materials used in their construction. When enacting these codes, many factors must be taken into account, one of the most important being to examine is the cost impact. With the current trend of large wildland-urban development alongside

the recent years of longer lasting and more destructive fires, homeowners and communities are at a higher risk in California than ever.

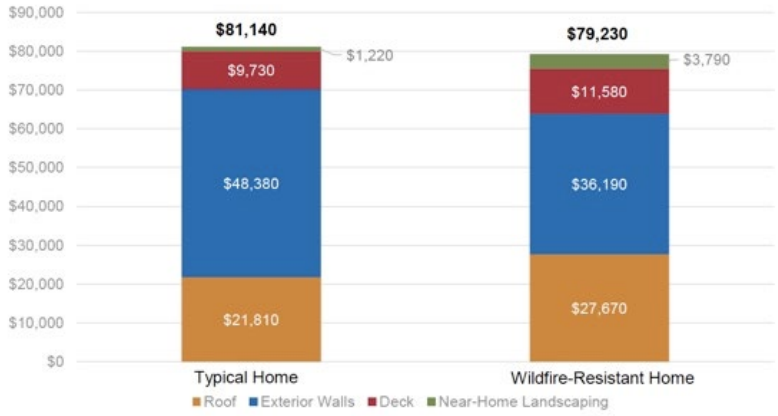

Figure 6: Cost Analysis of Fire-Retardant Materials

Due to these events, companies like Headwater Economics have compiled research on the factors that determine the survivability of a structure. Through this research, done both in laboratories and the field, it can be concluded that using safer materials and ensuring a controlled area around your property can be the most cost-effective ways to protect builders and homeowners. This study also found that the cost impact from building with fire resistant materials is about two percent less than traditional building methods. The largest cost savings element found was switching to a fibrous cement siding in lieu of typical wood siding. This may affect certain design limitations on construction projects, but when looking to build in a high-risk area, these materials may be an easy change to mitigate homeowners' risks (Cohen 2013).

To further understand the cost, impacts builders have to take a categorical look at the different pieces of building a new home. First, they must look at the most exposed feature, the roof. The roof can be the most vulnerable part of the structure due to the large amount of exposed surface area and the likelihood of overgrown vegetation being ignition points for the roof. Though the cost of retrofitting or installing a fire-resistant roof may cost up to 25% more, the lifespan and maintenance costs of these materials make up for some of the overall cost (Quarles 2018).

While the price of fire-resistant materials exhibits few disparities from traditional materials, the price of construction labor indicates the opposite. The price of labor has shown strong variation both in base rates as well as for fire reconstruction projects. A study conducted by the Association of General Contractors draws immediate attention to the already shrinking number of skilled laborers nationwide (Tau 2018). This trend has been amplified in locations where wildfires are common due to the higher wages involved with fire damage reconstruction created by demand. Accordingly, this demand and resulting higher wages in surrounding areas pulls workers away from other projects in California, disrupting project deadlines and slowing their completion. The greatest impact has been seen in finding skilled laborers, like carpenters, plumbers, insulation installers, and bricklayers. For example, in high-risk areas of northern California, 80% of construction companies reported difficulty maintaining craft worker positions. This is expected because these are major trades needed in both residential and commercial construction. However, the high volatility of labor costs consequently leaves firms often subject to improper cost estimations or delayed project deadlines.

Currently, many builders do not have specific strategies to properly plan and execute constructing buildings in these high-risk areas, though they may be required to follow stricter building codes to protect occupants. California also does not enforce statewide construction codes to prepare for fires since areas are impacted so disparately. This makes developing in these areas a higher risk to develop both for owners and builders. In some cases, fire breaks are utilized around a development during construction for the protection of the project from wildfires and the surrounding area from fires that may be started on a construction site. Construction site fires are a common cause of wildfires: more than 4,8000 fires (Appel 2013) are started a year on a construction site. These fires can quickly spread, as seen on the California Polytechnic State University campus in spring of 2018 when a metal grinder sent sparks onto dry brush, igniting a hillside fire that required evacuations.

Potential Improvements

To ensure that communities are safe and protected cities, counties, and states must introduce structured measures and building codes. Due to California's vastly diverse areas, these codes are hard to enforce when looking at the state as a hole. Instead, these new regulations need to be locally developed, strictly enforced, and revamped to address increasingly devastating fire seasons. They should be recognized in tandem within larger bureaucracy of regional and state regulations.

It is imperative to take the cost of these regulations into account from the builder’s point of view. These costs will differ region to region based on what the risks in that area is, the availability of materials and the knowledge of the contractor. For example, fire risks in rural areas of California are greater than in many coastal communities. If a development was built in a rural area with densely packed vegetation, a fire break around the property surrounding it would be needed. Conversely in a coastal community where the landscape is more developed there would be less of a risk and therefore would require less in terms of fire-resistant development.

Therefore, some uniform standards construction companies should agree to include: mandatory use of fire retardant materials in high risk areas, required fire inspections performed on sites, and developing provisions that reduce exposure to heat or embers from nearby landscaping elements. They should also be required to submit detailed reports regarding a structure’s ignition zone to account for the various combustible elements within a 100 feet circumference.

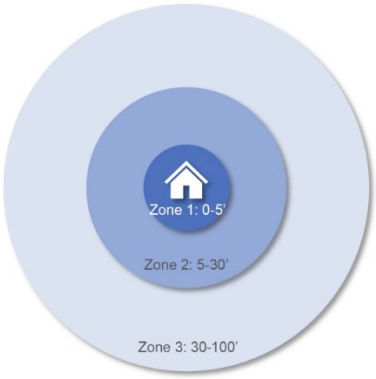

Figure 7: Structure Ignition Zone

Despite these geographical differences, it is critical for the government agencies to assist these individual communities to create and enforce these codes in order to protect both growing communities and the surrounding environment. By preventing wildfires in accordance with these localized factors, communities avoid long term damage that leaves areas struggling to recover.

Conclusion

The construction industry has the unique challenge of building in an unpredictable environment that must be balanced between development and the safety of the communities. In California, builders must be proactively aware of looming disasters that have devastated the state in recent years. These factors include the catastrophic fire seasons that have become more common and impactful. In order to mitigate these eminent risks, owners and contractors must work together in the design, building and occupation of the project. When designing new buildings, governing bodies must enact design requirements and codes that lower the risk to all surrounding areas. These codes also must lay out materials that are fire resistant or materials that resist ignition. While constructing the project builders need to be required to follow all safety measures that are put in to ensure safety for the workers as well as the surrounding area. This includes any precautionary measures as well as having reactionary steps in case an issue arises. Ultimately, standardized codes and enforced building procedures on both the bureaucratic and construction company sides will result in less fluctuations in materials and labor prices that cause extreme disruption throughout the industry. Once a project is completed, it is the responsibility of the owner to maintain a safe property free of fire hazards.

Future Research

Though California has the highest average number of fires and acres burned each year, it is important to also assess trends across the country. This paper is restricted to talking about the impacts and solutions found in California. The findings and research from this paper can be expanded to evaluate different areas to better understand their greatest risks and how they are best mitigated. This can include examining codes used in other high-risk areas that may have a lower number of fires. It would also be beneficial to compare labor indexes of these areas to see how they trend during fire seasons. Additionally, assessing material pricing records from areas outside of California that are at high fire risk could help understand and prepare for fire seasons more accurately.

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