

Exploring The Cause And Consequences Of Repeated Fire Outbreaks In Monrovia, Liberia

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Abstract

Fire outbreaks pose significant threats to communities worldwide, causing loss of life, property damage, and environmental degradation. This paper explores the causes and consequences of repeated fire outbreaks in Monrovia, Liberia, drawing insights from global incidents such as the Grenfell Tower fire in London and the Camp Fire in Paradise, California. By analyzing specific incidents and case studies, the study highlights the multifaceted nature of fire outbreaks, including factors such as human error, electrical faults, and environmental vulnerabilities. It underscores the importance of proactive measures, such as regular inspections, adherence to safety protocols, and strengthening regulations, in mitigating fire risks and enhancing fire safety. Additionally, the paper emphasizes the critical role of community involvement, accessible emergency services, and education in enhancing resilience and mitigating the impact of fire emergencies. The findings underscore the necessity for integrated approaches involving stakeholders at various levels to address fire risks and enhance community resilience.

Keywords: Fire outbreaks, causes, consequences, Monrovia, Liberia

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Introduction

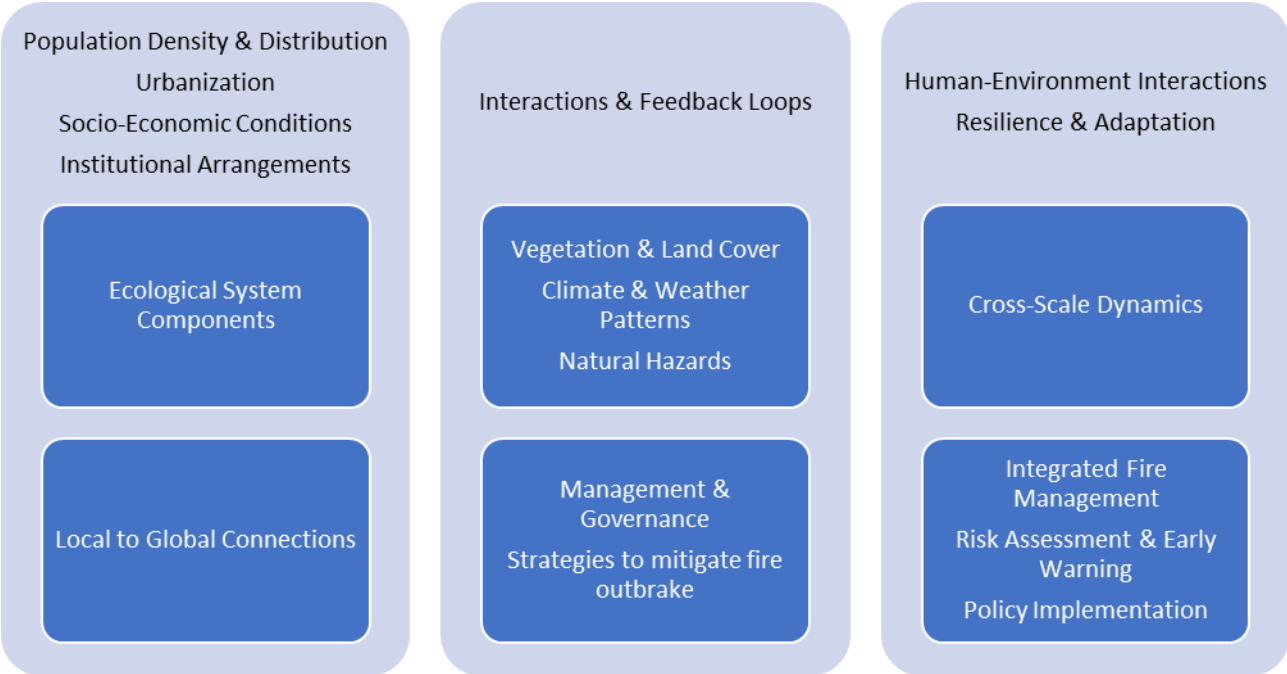
Fire outbreaks could occur due to a variety of reasons, such as electrical faults, human error, or natural disasters. One specific incident that highlighted the dangers of fire outbreaks was the devastating fire that occurred at the Grenfell Tower in London in 2017. The fire had been sparked by a faulty refrigerator on the fourth floor of the building and had quickly spread due to the building's flammable exterior cladding. The incident had resulted in the loss of 72 lives and had raised serious concerns about building safety regulations. Another notable incident that had exemplified the causes of fire outbreaks was the Camp Fire that had swept through Paradise, California in 2018. The fire had been ignited by a faulty power line and had been exacerbated by strong winds and dry conditions.

The rapid spread of the fire had destroyed over 18,000 structures and had claimed the lives of 85 individuals. This incident had underscored the role that environmental factors and infrastructure vulnerabilities could play in the occurrence and severity of fire outbreaks. In addition to these specific incidents, it had been important to recognize the role of human error in causing fire outbreaks (Evan et al., 2019). For example, careless smoking, improper disposal of flammable materials, and negligence in following fire safety protocols could all have contributed to the ignition and spread of fires. By analyzing specific incidents and their causes, we could have better understood the factors that contributed to fire outbreaks and could have implemented measures to prevent future tragedies (Bishop & Drysdale, 1989).

Fire outbreaks were a common and dangerous occurrence that could have devastating consequences (Lilley, 2013). Understanding the causes of these outbreaks was crucial in order to prevent them from happening in the first place. Fire outbreaks could occur in various settings, including homes, workplaces, and natural environments, and could be caused by a range of factors (Bishop & Drysdale, 1989). One of the main causes of fire outbreaks was human error. This could include careless behavior, such as leaving a stove unattended while cooking or smoking near flammable materials. Electrical faults were another common cause of fires, particularly in older buildings or those with faulty wiring (Adekunle et al., 2016). Additionally, arson could also be a factor in fire outbreaks, whether intentional or accidental.

The aim of this research was to identify the causes of fire outbreaks in the city of Monrovia, Liberia, that were creating chaotic situations for constructed buildings without proper fire safety standards, leading to the rapid spread of fires in densely populated areas. This research adopted the Social-Ecological Systems (SES) framework of (Schlüter et al., 2014). The SES framework was well-suited for studying complex interactions between human societies and their environments, which was highly relevant in the context of understanding fire outbreaks in urban settings like Monrovia. This framework emphasized the interconnectedness of social, economic, and ecological factors in shaping environmental outcomes, making it suitable for analyzing the multifaceted causes and consequences of fire incidents. SES theory allowed researchers to explore how factors such as urbanization, land-use patterns, infrastructure development, socio-economic

conditions, and institutional arrangements influenced fire risk and resilience in Monrovia. By adopting an SES perspective, researchers could gain a holistic understanding of the underlying dynamics driving fire outbreaks and identify opportunities for effective intervention and management strategies that considered both social and ecological dimensions.



This diagram illustrated the various components of the SES framework for understanding fire outbreaks in Monrovia, including social system components, ecological system components, interactions and feedback loops, cross-scale dynamics, and management and governance strategies. Each component interacted with others, highlighting the interconnectedness and complexity of the system.

Many residents in the city of Monrovia lived in densely populated areas with inadequate infrastructure, such as narrow alleyways and makeshift structures. These conditions made it difficult for firefighters to access and extinguish fires quickly, leading to greater damage and loss of life. Additionally, informal settlements often lacked proper electrical wiring and cooking facilities, increasing the risk of electrical fires and accidents. A third factor that contributed to fire outbreaks in Monrovia was the lack of fire safety education and awareness among the population. Many residents might not have had access to information on fire prevention strategies or might not have understood the risks associated with certain behaviors, such as leaving cooking unattended or using faulty electrical appliances. Without proper education and awareness, individuals were less likely to take precautions to prevent fires or respond effectively in the event of a fire outbreak. Increasing fire safety education and training programs in Monrovia could have helped reduce the frequency and severity of fire incidents in the city.

By delving into the root causes of these outbreaks, the study could inform targeted strategies for mitigating fire risk, enhancing emergency response capabilities, and fostering community resilience. This research held the potential to improve public safety and well-being in Monrovia by identifying vulnerabilities and implementing measures to

reduce the impact of fire disasters. Additionally, insights gained from the study could inform urban development and planning processes, promote sustainable environmental management practices, and contribute to evidence-based policy formulation and implementation. Ultimately, the study served as a valuable resource for knowledge sharing and capacity-building initiatives aimed at empowering local stakeholders to collaboratively address the challenges posed by repeated fire outbreaks in Monrovia.

Research Methodology

To delve deeply into the causes and consequences of recurrent fire outbreaks in Monrovia, a qualitative study was undertaken, employing interviews and focus group discussions. Semi-structured interviews were conducted with various stakeholders, including fire victims, community members, and representatives from the Fire Services Agency, to glean firsthand insights into the factors contributing to the repeated incidents of fire in the city.

Qualitative data was gathered through interviews and focus group discussions involving key stakeholders, including fire victims, representatives from fire services agencies, and community members. This process aimed to identify the underlying causes of fire outbreaks in the city.

The data were analyzed using patterns, themes, and critical issues to discern the underlying problems associated with the recurrent fire outbreaks in Monrovia.

Result and Discussion

Result

Table 1. Causes of Fire Outbreaks

Theme1: Causes of Fire Outbreaks	Analysis of Specific Incidents and Case Studies	Key Insights	Lessons Learned
Electrical faults	Examining the Grenfell Tower fire in London	Importance of proper building wiring and maintenance	Need for regular electrical inspections and maintenance (Baharuddin et al., 2014).
Human error	Analyzing the Camp Fire in Paradise, California	Negligence in following fire safety protocols	Importance of adherence to fire safety guidelines and procedures (Team,2015).
Infrastructure vulnerabilities	Reviewing fire outbreaks in informal settlements	Impact of inadequate building codes and enforcement	Importance of strengthening building regulations and oversight (Steininger& Pommeranz, 2016).
Environmental factors	Studying fire outbreaks during dry seasons	Exacerbation of fire risk by dry conditions	Need for proactive measures to mitigate environmental risks, such as controlled burns and

According to the table 1. The analysis of specific incidents and case studies reveals various causes of fire outbreaks and underscores the importance of proactive measures, such as regular inspections, adherence to safety protocols, strengthening regulations, and environmental management, in mitigating fire risks and enhancing fire safety.

Table 2. Impact and Consequences Analysis

Theme2: Impact and Consequences Analysis	Examination of Long-Term Effects	Key Insights	Lessons Learned
Evaluation of direct impacts such as loss of life and property damage	Study of socio-economic repercussions on affected communities	Understanding the magnitude of loss and damage caused by fire outbreaks	Importance of comprehensive risk assessment and mitigation strategies (Dawson et al.,1982).
Analysis of indirect consequences including economic impact and environmental degradation	Investigation into psychological effects and trauma	Recognizing the lasting impact on communities beyond immediate aftermath	Need for holistic support and recovery efforts for affected communities (Disaster Technical Assistance Center (DTAC), 2022).

According to the table.2 The examination of long-term effects and key insights underscores the substantial impact of fire outbreaks on communities and the importance of comprehensive risk assessment, mitigation strategies, and holistic support in mitigating the consequences and aiding in recovery efforts.

Table 3. Evaluation of Community Awareness

Theme3: Evaluation of Community Awareness	Assessment of Existing Measures	Key Insights	Lessons Learned
Assessing the level of awareness regarding fire emergencies within the community	Evaluating effectiveness of fire prevention and mitigation measures	Importance of community involvement and engagement in fire safety efforts	Importance of proactive community engagement in fire prevention (Oloke et al.,2021)
Understanding community preparedness measures and response protocols	Examining adequacy of firefighting infrastructure and emergency services	Need for accessible and effective emergency services	Necessity for continuous improvement of emergency response infrastructure (Turay & Gbetuwa,2022).

Emphasis on proactive measures to prevent future disasters and promote resilience	Reviewing impact of public education campaigns on fire safety	Role of education and awareness in enhancing community resilience	Education on public fire safety campaigns (Slavkovikj et al.,2014)
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According to the table 3, The evaluation of community awareness and key insights emphasizes the critical role of community involvement, accessible emergency services, and education in enhancing resilience and mitigating the impact of fire emergencies.

Table 4. Review of Existing Regulations

Theme4: Review of Existing Regulations	Identification of Gaps	Key Insights	Lessons Learned
Examination of current fire safety regulations, building codes, and enforcement mechanisms in Monrovia	Identifying shortcomings and areas for improvement in policy frameworks related to fire prevention, emergency response, and urban planning	Understanding the strengths and weaknesses of existing regulatory frameworks	Importance of regularly updating and enforcing fire safety regulations (Khan and Ahmad, 2022)
Assessment of existing building codes pertaining to fire prevention.	Recognition of areas lacking in building codes related to fire prevention.	Recognizing the importance of robust policies in mitigating fire risks and promoting public safety	Need for comprehensive policies that address various aspects of fire prevention and emergency management (Thompson,2003).
Evaluation of enforcement mechanisms for fire safety measures.	Assessment of deficiencies in enforcement mechanisms for ensuring compliance with fire safety regulations.	Stressing the importance of collaboration between government agencies, stakeholders, and communities for effective policy implementation.	Collaboration between government agencies, stakeholders, and communities is essential for effective policy implementation (Firdausijah,2019).

According to the table 4, The review of existing regulations and identification of gaps emphasizes the importance of robust policies, regular updates, and collaboration for effective fire prevention and emergency management.

Discussion

Factors contributing to Fire Outbreaks in Monrovia, Liberia

Monrovia, Liberia, like many other urban areas, faced a number of factors that contributed to fire outbreaks in the city (Innis, 2023). One significant factor was the lack of proper building codes and regulations. Many buildings in Monrovia were constructed without adherence to safety standards, such as proper insulation and fire-resistant

materials. This increased the risk of fires spreading quickly and causing extensive damage. Additionally, the lack of enforcement of building codes meant that buildings might not have had proper fire exits or emergency procedures in place, further exacerbating the risk of fire outbreaks. Another factor that contributed to fire outbreaks in Monrovia was the prevalence of informal settlements and overcrowded living conditions.

Poor infrastructure and building materials

Lack of fire safety measures and emergency response capabilities

Fires were devastating disasters that posed a serious threat to both individuals and property (Bowman et al., 2009). One of the major causes of fire outbreaks was the lack of adequate fire safety measures and emergency response capabilities (Turay & Gbetuwa, 2022). When buildings and facilities were not equipped with proper fire safety equipment such as smoke detectors, fire extinguishers, and sprinkler systems, the risk of a fire breaking out and spreading uncontrollably increased (Vidaharan et al, 2018). Additionally, if individuals were not trained in fire safety protocols or if there was a lack of clear emergency response plans in place, the potential for a fire to cause significant damage and harm was heightened (Thompson, 2003). In many cases, buildings and establishments might have neglected to invest in fire safety measures due to budget constraints or a lack of awareness regarding the importance of such precautions (Vidaharan et al, 2018). However, the consequences of not prioritizing fire safety could have been catastrophic (Alao et al., 2021).

Without adequate measures in place to detect and suppress fires in their early stages, the likelihood of a small fire escalating into a large-scale inferno was much greater (Ponta & Maxsi, 2021). Furthermore, if there were no established emergency response protocols or if individuals were not properly trained on how to react in the event of a fire, the potential for injuries or fatalities increased significantly. It was essential for individuals, businesses, and organizations to recognize the importance of investing in fire safety measures and emergency response capabilities (Vidaharan et al, 2018). By implementing proper protocols, conducting regular fire drills, and ensuring that all occupants were educated on fire safety procedures, the risk of a fire outbreak could be significantly reduced (Thompson, 2003). Additionally, having well-maintained fire safety equipment and systems in place could help to prevent fires from spreading and causing extensive damage. Ultimately, by prioritizing fire safety, individuals could better protect themselves and others from the devastating effects of fire outbreaks.

Importance of understanding the causes

Poor infrastructure and building materials were significant contributors to fire outbreaks in both residential and commercial buildings (Cicco, 1984). He further mentioned that buildings that were not up to code or had deteriorating infrastructure were more susceptible to fires. This could include faulty wiring, old electrical systems, and inadequate fire safety measures. Additionally, buildings constructed with substandard materials such as flammable insulation or cheap wiring were at a higher risk of catching

fire easily (Cicco,1984). When proper building materials were not used during construction or renovations, the likelihood of a fire spreading quickly increased. Cheap materials could easily catch fire and spread flames rapidly throughout a building.

Additionally, poor infrastructure could lead to difficulties in controlling a fire once it had started, as weak structures could collapse or fail to contain the fire within certain areas. This could result in devastating consequences for both the occupants of the building and surrounding properties. To prevent fire outbreaks due to poor infrastructure and building materials, it was essential for building owners and managers to invest in regular inspections and maintenance of their properties (Waterfall, 1991). Upgrading outdated infrastructure, ensuring proper wiring and electrical systems, and using fire-resistant materials during construction could significantly reduce the risk of fires. Additionally, implementing and practicing fire safety protocols, such as installing smoke detectors and fire extinguishers, could help mitigate the impact of a fire outbreak. By taking proactive measures to address these issues, the likelihood of a fire breaking out due to poor infrastructure and building materials could be greatly reduced (Hamka et al., 2021).

One notable case study of a fire outbreak in Monrovia occurred in 2019 at the Paynesville City Corporation market. The fire started in the early hours of the morning and quickly spread throughout the market, destroying several stalls and goods in its path. The cause of the fire was determined to be an electrical fault in one of the stalls, highlighting the importance of regular maintenance and inspections of electrical systems to prevent such incidents. The lack of proper fire safety measures, such as fire extinguishers and fire alarms, also contributed to the rapid spread of the fire and the extensive damage it caused. Another case study of a fire outbreak in Monrovia took place in 2018 at the Duala Market. The fire broke out in the evening when the market was still crowded with vendors and customers, leading to a chaotic evacuation process and increasing the risk of injuries. The cause of the fire was suspected to be a cooking stove left unattended in one of the stalls, emphasizing the importance of proper safety protocols when using open flames in crowded spaces.

The lack of fire exits and clear evacuation routes in the market further exacerbated the situation, making it difficult for people to escape quickly and safely. A more recent case study of a fire outbreak in Monrovia occurred in 2020 at a residential building in the Sinkor area. The fire started in one of the apartments and quickly spread to the neighboring units, causing extensive damage to the building and displacing several families. The cause of the fire was determined to be a faulty gas stove in the kitchen, underscoring the importance of proper maintenance and usage of gas appliances to prevent fire incidents. The lack of smoke detectors and fire extinguishers in the building also hindered the residents' ability to contain the fire and evacuate safely, highlighting the need for improved fire safety measures in residential buildings across Monrovia.

Overcrowding in urban areas

Overcrowding in urban areas was a significant factor contributing to the increased risk of fire outbreaks. As urban populations continued to grow, cities became more

densely populated, leading to overcrowding in residential and commercial areas. This overcrowding resulted in buildings being constructed too close together, making it easier for fires to spread rapidly from one structure to another (Dewan et al., 2012). Additionally, overcrowded areas often lacked proper fire safety measures, such as sufficient fire exits, smoke alarms, and fire extinguishers, further increasing the likelihood of a fire outbreak (Hassanaian, 2008). Furthermore, overcrowding in urban areas also led to an increase in the use of flammable materials in construction. With limited space available for building, developers resorted to using cheaper, more flammable materials that did not meet proper fire safety standards.

These materials could easily catch fire and contribute to the rapid spread of flames throughout a crowded area. Inadequate building codes and regulations in overcrowded urban areas also exacerbated the risk of fire outbreaks, as structures might not have been built to withstand fire or might have lacked proper ventilation systems to prevent the buildup of flammable gases (Cicco, 1984). In conclusion, overcrowding in urban areas posed a serious threat when it came to fire outbreaks. It was essential for city planners, developers, and policymakers to prioritize fire safety measures in densely populated areas to prevent potential disasters. By implementing and enforcing strict building codes, ensuring proper spacing between structures, and promoting fire safety education, the risk of fire outbreaks in overcrowded urban areas could be minimized, ultimately creating safer environments for residents and businesses (Sadler et al., 2010).

Impact on communities and infrastructure

Fires could have devastating impacts on communities and infrastructure, often causing widespread destruction and loss. When a fire broke out, it could spread quickly and uncontrollably, putting lives and property at risk (Cicco, 1984). Homes, businesses, and other buildings could be destroyed in a matter of minutes, leaving behind a trail of devastation and loss. In addition to the physical damage, fires could also have long-lasting emotional and psychological effects on those affected, as they might have struggled to rebuild their lives and cope with the trauma of the event (Cianconi et al., 2020). In communities affected by fire outbreaks, the impact could be far-reaching and profound. Displaced residents might have been left homeless and in need of emergency shelter, food, and other basic necessities. Schools, hospitals, and other essential services might have been disrupted or forced to close, further exacerbating the challenges faced by the community (Upadhyay et al., 2010).

The economic impact of a fire could also have been severe, as businesses might have been forced to shut down indefinitely, leading to job losses and financial hardship for residents (Nasi et al., 2002). Rebuilding and recovery efforts could have taken years, and some communities might have never fully recovered from the devastation caused by a fire (Celik, 2016). Infrastructure was also significantly impacted by fire outbreaks, as roads, bridges, and other essential structures might have been damaged or destroyed in the blaze. This could have made it difficult for emergency responders to access the affected area and provide assistance to those in need (Cicco, 1984). Power lines, water mains, and

other utilities might have also been compromised, further complicating the recovery process. The cost of repairing and rebuilding damaged infrastructure could have been substantial, placing a heavy burden on local governments and taxpayers. In some cases, the damage caused by a fire could have been so extensive that it took years to fully restore the affected area to its pre-fire condition.

The role of government, communities, and individuals in fire prevention efforts.

Fire outbreaks could have devastating consequences, leading to loss of lives, destruction of property, and environmental damage (Bowman et al., 2009). The role of government, communities, and individuals in fire prevention efforts was crucial to minimize the risk of fire outbreaks (Bishop & Drysdale, 1998). Government played a significant role in establishing and enforcing fire safety regulations and building codes to ensure that buildings were equipped with proper fire prevention measures such as fire alarms, sprinkler systems, and fire exits (Kodur et al., 2019). Additionally, government agencies were responsible for conducting fire safety inspections and providing training for firefighters to respond effectively to fire emergencies.

Communities also played a vital role in fire prevention efforts by promoting fire safety awareness and education (Wang et al., 2014). Community members could participate in fire drills, workshops, and training sessions to learn about fire prevention techniques and how to respond in case of a fire outbreak. By working together, communities could create a culture of fire safety and establish neighborhood watch programs to identify and report potential fire hazards. Moreover, communities could support local fire departments by volunteering, donating resources, and organizing fundraisers to ensure that firefighters had the necessary tools and equipment to combat fires effectively (Maye et al., 2020). Individuals had a responsibility to take proactive measures to prevent fire outbreaks in their homes and workplaces. Simple steps such as installing smoke alarms, keeping flammable materials away from heat sources, and practicing proper cooking and electrical safety could significantly reduce the risk of fire incidents. It was essential for individuals to be vigilant and report any potential fire hazards to authorities to prevent accidents from occurring. By taking personal responsibility for fire safety, individuals could contribute to the overall efforts of government and communities in preventing fire outbreaks and protecting lives and property (Hassanain & Al Ashwal, 2005).

Preventative Measures and Solutions

Preventative measures and solutions were crucial in reducing the risk of fire outbreaks (Addai et al.; 2016). One important measure of fire outbreak was to regularly inspect and maintain electrical systems and appliances. Faulty wiring and overloaded circuits were common causes of fires, so it was important to address any issues promptly. Another preventative measure was to keep flammable materials away from heat sources and to store them properly. This could help prevent accidental fires from occurring.

Furthermore, having a fire evacuation plan in place was essential for ensuring the safety of everyone in a building in the event of a fire (Aziz et al., 2019).

This plan should have included designated escape routes, meeting points, and procedures for alerting authorities. Regular fire drills should have also been conducted to ensure that everyone knew what to do in case of a fire. Additionally, having functioning smoke detectors and fire extinguishers in place could help to quickly detect and extinguish small fires before they escalated. In addition to these preventative measures, it was important to educate individuals on fire safety practices. This included teaching people about the proper use of appliances, candles, and other heat sources. It was also important to educate individuals on the dangers of smoking indoors and the proper disposal of cigarettes. By taking proactive steps to prevent fires and educate people on fire safety, the risk of fire outbreaks could have been significantly reduced (Bishop & Drysdale, 1998).

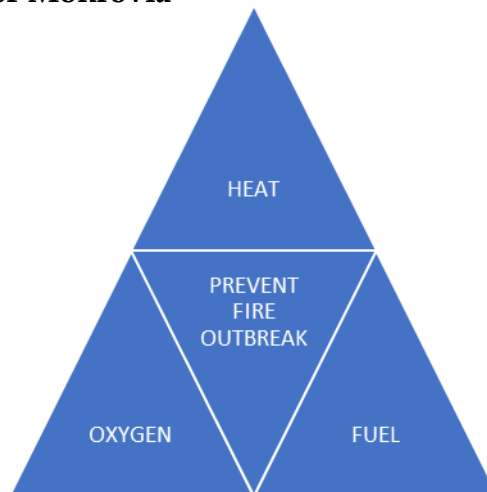
Strategies for reducing fire outbreaks in Monrovia

Monrovia, the capital city of Liberia, faced a significant risk of fire outbreaks due to a variety of factors. One of the main causes of fire outbreaks in Monrovia was the prevalence of informal settlements and overcrowded living conditions (Mensah, 2006). These densely populated areas often lacked proper infrastructure, making it easier for fires to spread quickly. Additionally, the lack of fire prevention measures and inadequate fire safety regulations contributed to the high number of fire incidents in the city. Furthermore, the use of open flames for cooking and heating in many households increased the risk of accidental fires (Mushi, 2016).

To reduce the frequency of fire outbreaks in Monrovia, it was essential to implement effective strategies. One key strategy was to improve fire safety regulations and enforcement in the city (Innis, 2023). This included ensuring that buildings met safety standards, conducting regular inspections, and providing training on fire prevention and response. Additionally, investing in firefighting equipment and training for firefighters could help improve the city's ability to respond quickly and effectively to fires. Another important strategy was to promote community awareness and education on fire safety practices, such as proper storage of flammable materials and the use of smoke detectors in homes (Kodur et al., 2019).

In addition to regulatory measures and community education, infrastructure improvements could also play a crucial role in reducing fire outbreaks in Monrovia. Investing in upgrading roads, water supply systems, and electricity networks could help prevent fires from spreading and make it easier for firefighters to access affected areas. Furthermore, establishing designated fire lanes and ensuring that buildings were constructed with fire-resistant materials could help contain fires and minimize their impact. By implementing a combination of these strategies, Monrovia could work towards reducing the risk of fire outbreaks and protecting the lives and property of its residents (Vaidogas & Šakėnaitė, 2011).

Fire Prevention Diagram of Monrovia



Understanding the interplay between heat, fuel, and oxygen, fire prevention measures can be implemented effectively. This may include measures such as implementing fire safety protocols, installing fire detection and suppression systems, conducting regular inspections and maintenance, providing employee training, and enforcing fire safety regulations.

Conclusion

The analysis of specific incidents and case studies reveals various causes of fire outbreaks and underscores the importance of proactive measures, such as regular inspections, adherence to safety protocols, strengthening regulations, and environmental management, in mitigating fire risks and enhancing fire safety. The examination of long-term effects and key insights underscores the substantial impact of fire outbreaks on communities and the importance of comprehensive risk assessment, mitigation strategies, and holistic support in mitigating the consequences and aiding in recovery efforts. The evaluation of community awareness and key insights emphasizes the critical role of community involvement, accessible emergency services, and education in enhancing resilience and mitigating the impact of fire emergencies. The review of existing regulations and identification of gaps emphasizes the importance of robust policies, regular updates, and collaboration for effective fire prevention and emergency management. Collectively, these findings highlight the multifaceted nature of fire safety and the necessity for integrated approaches involving stakeholders at various levels to address fire risks and enhance community resilience.

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