



Natural and Human-influenced Wildfire: A Review of Their Causes, Impacts and Prevention Strategies

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Abstract

Wildfires have emerged as one of the most devastating environmental hazards worldwide, increasing in frequency and intensity, driven by climate change and anthropogenic activities. Given the growing environmental, social, and economic impacts of wildfires, this review employed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) framework to examine wildfire hazards, their causal factors, associated risks, and preventive strategies. Evidence from the reports of the Food and Agriculture Organization, the Intergovernmental Panel on Climate Change (IPCC), and peer-reviewed literature revealed that while some wildfires are triggered by natural factors such as lightning strikes and extreme heat, the majority are directly or indirectly linked to human activities, including deforestation, agricultural burning, industrial operations, and environmental mismanagement. The review identified that the environmental, health, social, and economic consequences of wildfires include biodiversity loss, air pollution, food insecurity, population displacement, and infrastructure damage. Findings further indicate that effective wildfire management requires coordinated actions among governments, local communities, environmental agencies, and technological monitoring systems. Integrated Fire Management (IFM) emerged as a sustainable holistic framework for wildfire prevention, preparedness, suppression, recovery, and ecosystem restoration. The review concludes that strengthening climate adaptation measures, environmental education, and policy enforcement is essential for reducing wildfire risks and enhancing resilience to future climate-related disasters.

Keywords: Climate Change, Integrated Fire Management, Environmental Hazards, Disaster Risk Reduction, Sustainable Forest Management

INTRODUCTION

The Food and Agriculture Organization (FAO) reported that climate-related disasters are increasing significantly worldwide (FAO, 2023). Although some of these disasters occurred naturally, human activities have intensified their frequency and severity. Activities such as deforestation, environmental pollution, fossil fuel combustion, bush burning, poor waste disposal, and industrial emissions greatly contribute to climate change (IPCC, 2022; UNFCCC, 2023). Consequently, climate-related disasters can be described as human-influenced natural disasters, whereby human actions amplify naturally occurring hazards (FAO, 2024). These disasters increasingly affect agriculture, food production, human health, environmental sustainability, and economic development, particularly in developing countries where agriculture is a major source of livelihood (Ortiz-Bobea *et al.*, 2021). According to Okoro *et al.* (2024), wildfires are uncontrolled fires that spread rapidly through forests, grasslands, and bushes.

Their occurrence has become more frequent globally due to climate change, human activities, and rising temperatures. Wildfires destroy ecosystems, threaten human lives, and cause severe economic and environmental losses. To show how threatening the wildfires had become, the FAO, on its Instagram account (accessed on 11 May, 2026) posted and commented on the issues of wildfires, which some members of the Environmental Health Officers' Association of Nigeria (EHOAN) proactively worked on through a round table dialogue at the Fountain University, Osogbo, Osun State, Nigeria to discuss the issue to relevant stakeholders. The study was therefore aimed at documenting the Natural and Human-

influenced Wildfire: A review of their causes, impacts and prevention strategies.

METHODOLOGY

This EHOAN study adopted the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) Framework (Tricco *et al.*, 2018) to identify, select, and synthesize the literature on wildfire hazards, impacts, and prevention strategies. The PRISMA-ScR approach was chosen because it provides a structured method for mapping evidence across broad, interdisciplinary topics.

Search Strategy

A comprehensive literature search was conducted using electronic databases, including Google Scholar, Scopus, Web of Science, ScienceDirect, PubMed, and official publications from the Intergovernmental Panel on Climate Change (IPCC), the United Nations Framework Convention on Climate Change (UNFCCC), and the World Meteorological Organization (WMO), as well as the Instagram account on 11 May 2026 as the benchmark. However, the following keywords and search strings were used:

- wildfire and climate change
- forest fire risk factors
- integrated fire management
- wildfire prevention strategies
- wildfire health impacts
- wildfire environmental consequences
- climate-related disasters and agriculture

Eligibility Criteria

1. Inclusion Criteria

- Peer-reviewed journal articles.
- Reports published by recognized international organizations.
- Studies published between 2020 and 2026.
- Publications written in English.

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- Studies focusing on wildfire causes, impacts, management, strategies, and climate change relationships.

2. Exclusion Criteria

- Non-English publications.
- Opinion articles without empirical evidence.
- Duplicate publications.
- Studies unrelated to wildfire hazards or climate-related disasters.

RESULTS AND DISCUSSION

The Wildfires: Natural Disaster or Human Influence

The wildfire crisis discussed by the Food and Agriculture Organization (FAO) of the United Nations in the video reviewed for this study, is both a natural disaster and a human-influenced hazard. Wildfires may occur naturally through lightning, volcanic eruptions, or extreme heat. According to Balch *et al.* (2017), humans are responsible for approximately 90% of global wildfires through activities such as bush burning, deforestation, unattended campfires, and agricultural land clearing. Historically, natural fires contributed positively to ecological balance by clearing dead vegetation, recycling nutrients, and supporting biodiversity renewal in some ecosystems (Bowman *et al.*, 2009). Furthermore, anthropogenic climate change has intensified droughts, rising temperatures, and dry vegetation conditions, thereby increasing wildfire susceptibility worldwide (Jolly *et al.*, 2015).

Wildfires are among the most destructive environmental disasters affecting ecosystems and human societies globally. According to the Food and Agriculture Organization of the United Nations Instagram account accessed on 11 May 2026, wildfires have increased both intensity and frequency due to climate change, poor land-use practices, and increasing human activities. Firefighting operations are highly dangerous, expensive, and sometimes ineffective, especially under extreme weather conditions. Consequently, the FAO advocates

Study Selection

Retrieved articles were screened based on title, abstract, and full-text review. Relevant studies meeting the inclusion criteria were selected for data extraction and thematic analysis. The findings were narratively synthesized and organized into thematic categories, including causal agents, risks (wreaked havoc), and preventive measures.

an approach known as Integrated Fire Management (IFM), which combines prevention, preparedness, suppression, recovery, and sustainable land management strategies to reduce the impacts of wildfires. Although wildfires may arise naturally, most of the reviewed studies indicated that most fire outbreaks are directly or indirectly linked to human activities. Therefore, the FAO recognizes wildfire as a socio-environmental hazard resulting from the interaction between natural processes and human influence. This dual nature makes Integrated Fire Management necessary as the problem cannot be addressed solely through firefighting efforts.

Causal Agents (i.e., the Hazards)

Wildfire hazards are factors or agents that can ignite and spread fires. According to the Food and Agriculture Organization, major climate-related hazards include drought, floods, heatwaves, storms, wildfires, pest infestations, and land degradation (FAO, 2023). Empirical studies have identified multiple categories of causal agents associated with fire incidents.

1. **Climate Change and Extreme Temperature:** Climate change increases global temperatures, reduces soil moisture, and prolongs drought periods. Under these conditions, dry vegetation becomes highly combustible under these conditions. Abatzoglou and Williams (2016) found that climate change contributed significantly to increased forest fire activity in many regions worldwide.

2. **Drought:** Drought occurs when there is little or no rainfall for an extended period, leading to reduced crop yield, water scarcity, and livestock mortality (IPCC, 2022). Flooding, caused by heavy rainfall and poor drainage systems, destroys farmland, infrastructure, and water sources (FAO, 2023).
3. **Heatwaves:** Heatwaves are increasing due to global warming and adversely affect crops, livestock, and human health (WMO & FAO, 2026). Wildfires also occur under extreme heat and dry conditions, leading to loss of biodiversity and agricultural land (IPCC, 2022).
4. **Lightning Strike:** Lightning is one of the major primary natural ignition sources of wildfires, especially in remote forests and mountainous regions. Dry thunderstorms frequently ignite vegetation during hot and dry seasons.
5. **Pest and Disease Outbreaks:** Pest and disease outbreaks such as desert locust invasions are becoming more frequent due to changing climatic conditions and can severely affect food production (FAO, 2022). Land degradation, including soil erosion and desertification, further reduces agricultural productivity (Wang et al., 2024).
6. **Agricultural and Bush Burning:** Farmers often use fire for land clearing, hunting, and weed control. When uncontrolled, these fires spread rapidly into nearby forests and settlements, causing extensive damage.
7. **Industrial and urban activities:** such as oil exploration, mining activities, electrical faults, machinery sparks, and pipeline explosions can contribute to fire outbreaks, especially in industrial environments.
8. **Windstorms:** Strong winds intensify wildfire spread by carrying embers over long distances and increasing oxygen supply to flames.
9. **Deforestation and Land Degradation:** Deforestation leaves behind dry biomass such as leaves, branches, and stumps that easily catch fire. Poor land management also contributes to fuel accumulation in forests. Most of the hazards are strongly linked to human activities such as deforestation, pollution, urbanization, and poor environmental management (UNFCCC, 2023).
10. **Human Negligence:** Human negligence remains a major cause of wildfire outbreaks worldwide. Carelessly discarded cigarette butts, unattended campfires, fireworks, and intentional acts of arson are significant sources of fire ignition.
11. **Chemical Agents:** Chemical agents also constitute significant fire hazards. George and Renjith (2021), in a systematic review of Bayesian network applications in risk assessment, reported that toxic gas releases, flammable solvent vapours, and reactive chemical mixtures are causal agents in over 60% of major industrial accidents when coupled with ventilation failures. In addition, in infrastructure operations, Peng et al. (2025) employed hierarchical causal modelling on 132 bridge accident cases and identified 19 distinct risk factors, classifying geological instability and meteorological extremes as primary causal agents. The authors emphasized that "indirect causes eventually lead to the actual cause of the impairment, which is called the causal agent or proximate stressor" (Peng et al., 2025, p. 4); this distinction is critical: a poorly trained worker (indirect cause) may fail to lock out equipment, but the causal agent is the energized machine that directly induces injury.

Consequences of Wildfires

Wildfires cause enormous environmental, social, health, and economic damage across affected regions. One major consequence is food insecurity, as destruction of crops and livestock leads to shortages, hunger, and malnutrition (FAO, 2023).

1. **Loss of Human Lives and Injuries:** Wildfires result in fatalities, burns, injuries, smoke inhalation, and displacement of communities. Firefighters are also exposed to occupational hazards, including heat stress and respiratory diseases.
2. **Destruction of Biodiversity:** Wildfires destroy wildlife habitats, kill

plant and animal species, and reduce ecosystem stability. Bowman et al. (2020) observed that severe fires threaten global biodiversity conservation efforts.

3. **Air Pollution and Health Problems:** Wildfire smoke contains particulate matter (PM_{2.5}), carbon monoxide, nitrogen oxides, and toxic gases that contribute to asthma, lung diseases, cardiovascular disorders, and premature deaths.
4. **Soil Erosion and Land Degradation:** Wildfires destroy vegetation cover and reduce agricultural productivity.
5. **Economic Losses:** Economic losses are also significant, as farmers incur investment losses and governments incur high costs for disaster response and recovery (Aragón et al., 2021). Governments spend billions of dollars annually on firefighting equipment, emergency response, rebuilding infrastructure, and healthcare services.
6. **Climate Change Acceleration:** Climate-related disasters further increase poverty and unemployment, particularly in rural communities dependent on agriculture (IPCC, 2022). Wildfires release large amounts of greenhouse gases, such as carbon dioxide and methane, into the atmosphere, thereby worsening global warming.
7. **Food and Water Insecurity:** The destruction of farmlands, livestock, forests, and watersheds affects food production and water quality for affected populations.
8. **Displacement and Migration:** Displacement and migration are common outcomes, as people are forced to leave their homes due to floods, droughts, and environmental degradation (UNFCCC, 2023). Environmental damage, including the destruction of forests and water bodies, worsens climate change and reduces ecosystem resilience (FAO, 2022).
9. **Health Challenges:** Health challenges also arise due to poor sanitation, lack of clean water, and increased exposure to disease during disasters (WMO & FAO, 2026). Additionally, infrastructure such as roads, schools, and hospitals is often damaged,

slowing national development (IPCC, 2022).

10. **Impact on Infrastructure::** Wildfires often damage roads, bridges, and utility systems, leading to widespread outages that affect hospitals, communication networks, and water supplies (Climate Central, 2024). Wildfires negatively affect socioeconomic development by causing loss of lives, destruction of property and infrastructure, disruption of livelihoods, reduced agricultural productivity, and increased healthcare and recovery costs. They also contribute to poverty, food insecurity, displacement, environmental degradation, and economic instability, thereby undermining community resilience and sustainable development (Farid et al., 2024; Kumar et al., 2025; Edgeley et al., 2025).

The Preventive Agents

Integrated Fire Management (IFM) is a holistic and sustainable strategy promoted by the Food and Agriculture Organization (FAO) to reduce wildfire risk. Several strategies can reduce the impact of climate-related disasters. One key approach recommended by FAO is climate-smart agriculture, which enhances productivity while promoting environmental sustainability (FAO, 2024). It involves governments, environmental agencies, local communities, researchers, and technological systems working together to prevent and control fires. Thus, the key preventive strategies include:

1. **Public Awareness and Environmental Education:** Public awareness and environmental education are crucial in promoting environmentally responsible behaviour. Additionally, investment in infrastructure, such as drainage systems, dams, irrigation facilities, and flood barriers, can reduce the impacts of disasters (FAO, 2022). Communities should be educated about safe fire practices, the dangers of bush burning, and emergency response procedures.
2. **Early Warning and Monitoring Systems:** Invest in technology (cameras, sensors, satellites, drones) and community reporting for rapid response. Satellites, drones, artificial intelligence, and remote sensing

technologies help detect wildfires early and enable rapid response

3. **Controlled or Prescribed Burning:** Prescribed burning helps reduce excess vegetation fuel loads under controlled conditions, thereby minimizing severe wildfire outbreaks.
4. **Community-Based Fire Management:** Local communities play important roles in fire surveillance, reporting, and prevention activities.
5. **Enforcement of Environmental Policies:** Governments should enforce laws regulating deforestation, illegal bush burning, industrial safety compliance and unsafe waste disposal (UNFCCC, 2023).
6. **Governance, Policy, and Monitoring:** Develop national/regional IFM policies with dedicated funding. Monitor effectiveness using indicators (e.g., reduced large-fire acres, community preparedness scores) (European Forest Institute, 2026).
7. **Afforestation:** Afforestation plays a vital role in reducing soil erosion, improving environmental quality, and absorbing carbon dioxide (IPCC, 2022).
8. **Sustainable Forest Management:** Sustainable forest management includes forest thinning, firebreak construction, reforestation, and vegetation management, which help reduce wildfire risks.
9. **Climate Change Mitigation:** Reducing greenhouse gas emissions through the adoption of renewable energy and sustainable industrial practices remains a long-term solution to climate-related disasters (IPCC, 2022). Providing modern firefighting equipment, training, and occupational safety measures improves the effectiveness of emergency response.
10. **Ecosystem Restoration:** Restore degraded areas with fire-resilient species and structures that support natural fire regimes (frequent, low-intensity fires in many ecosystems).

THE PROFESSIONAL IMPLICATIONS

The findings of this review underscore critical implications for the practice of the Environmental Health Officers' Organization of Nigeria (EHOAN), particularly in wildfire response; these implications were discussed and summed to include heat stress, smoke inhalation, burns, physical injuries, and psychological challenges such as post-traumatic stress disorder (PTSD) as health risks for the responders, firefighters, forestry workers, and emergency personnel.

To safeguard occupational safety, EHOAN members and associate professionals must conduct thorough wildfire risk assessments, establish emergency preparedness and response plans, enforce the use of appropriate personal protective equipment during firefighting, implement safe evacuation procedures, and continuously monitor hazardous conditions throughout operations. Beyond immediate safety, EHOAN members and associate professionals play a vital role in environmental protection by preventing environmental degradation, promoting sustainable land management, monitoring air quality, and supporting ecosystem restoration following wildfires.

Regulatory compliance is equally essential, requiring organizations in wildfire-prone regions to adhere to standards on fire prevention, hazard communication, emergency response, and environmental impact management. Finally, the growing frequency of wildfires demands proactive risk management strategies that integrate climate-related hazards into organizational safety systems and business continuity planning, ensuring resilience in the face of escalating environmental challenges.

LIMITATIONS OF THE STUDY

Given that no single study can comprehensively address every aspect of a research problem, and that each contributes unique perspectives and evidence, this review has certain limitations that should be taken into account when interpreting the findings and considering their application in policy, practice, and future research:

1. The study relied primarily on secondary data obtained from published literature and institutional

- reports; therefore, no primary field data were collected.
2. The review was limited to English-language publications, which may have excluded relevant studies published in other languages.
 3. Differences in study methodologies, geographical coverage, and reporting standards among reviewed publications may affect comparability of findings.
 4. Some wildfire statistics and climate-related projections are subject to change as new scientific evidence emerges.
 5. The broad scope of the review prevented detailed examination of region-specific wildfire management practices and outcomes.
 6. Although efforts were made to include the most recent literature, some newly published studies may not have been captured during the review process.

Despite these limitations, the study provides a comprehensive overview of wildfire hazards, the havoc they wreak, and prevention strategies, offering valuable insights for policymakers, researchers, and EHOAN members and associate professionals.

RECOMMENDATIONS

Based on the reviewed literature, the following recommendations are proposed

1. Governments should institutionalize IFM policies that integrate prevention, preparedness, suppression, recovery, and ecosystem restoration.
2. Increase investment in satellite monitoring, drones, artificial intelligence, and remote sensing technologies for real-time wildfire detection.
3. Community awareness campaigns should be intensified to discourage unsafe bush burning and promote responsible land-use practices.
4. Adoption of renewable energy technologies and reduction of greenhouse gas emissions should be prioritized globally.
5. Enforcement of laws against illegal deforestation, uncontrolled agricultural burning, and industrial negligence should be improved.

6. Local communities should be actively involved in fire surveillance, reporting, preparedness, and recovery activities.
7. Provision of modern firefighting equipment, personnel training, and emergency response infrastructure should be expanded.
8. Reforestation, afforestation, fuel-load reduction, and ecosystem restoration programs should be implemented to enhance environmental resilience.
9. Wildfires present significant challenges for the EHOAN members and associate professionals responsible for protecting workers, communities, and the environment.

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