



The 2023 Lahaina Conflagration

Executive Summary
September 2024

Characterized by dry, warm weather and persistent northeasterly trade winds from the North Pacific Ocean, summer in Hawaii often leads to conditions conducive to fire. The hot, arid climate on the rain-shadowed leeward side of the islands lowers the moisture content of fuels—particularly non-native grasses and short shrubs—making the area susceptible to rapid fire spread. In 2023, drought further amplified these dry summer conditions setting the stage for disaster.

On August 8, 2023, a grassfire outside Lahaina grew into the deadliest natural disaster in Hawaii's history and one of the top 10 deadliest US wildfires on record since 1871. This tragedy claimed 102 lives, and damaged or destroyed approximately 2,200 structures, with reconstruction costs estimated at \$5.5 billion. Elevated wind speeds coupled with the effects of fuel chemistry, density, and continuity—both at the community interface and within the community—resulted in conflagration in Lahaina.

As is typical of grass fires, the Lahaina Fire entered the community through continuous fuel paths and short-range spotting, first igniting homes on the periphery of the community. Once structural fuels ignited, mid- to long-range spotting created several fire fronts within the community which rapidly grew and merged.

Fanned by winds of 50 mph, the fire rapidly grew and ignited man-made fuels capable of sustaining longer periods of combustion. In densely built Lahaina, the wind-stretched flame lengths from man-made fuels—such as structural building components like fences, secondary buildings on parcels, abandoned vehicles, and burning homes—exceeded the separation distances between fuels. This led to rapid building-to-building fire spread through flame contact and radiative heat. The extreme thermal exposure generated by the fire, compounded by the additional stress from high winds, surpassed the tolerance limits of most building materials, including those that are compliant with fire resistant building codes.



After the 2023 Lahaina Conflagration, IBHS studied destroyed, partially damaged, and visibly undamaged structures to understand the pathways the fire took through the community leading to this devastation.

Following the fire, a team from the Insurance Institute for Business & Home Safety (IBHS) collected detailed data on the building materials used across Lahaina and the urban fuel surrounding these buildings to understand the conditions that contributed to the community conflagration. These data explain the relative importance of structure spacing, connective fuels, and building materials in fire spread into and through the built environment and demonstrate the critical need for a system of mitigations to reduce the intensity and likelihood of conflagration.

For communities surrounded by grassland, such as Lahaina, mitigations should be layered from the community down to the parcel by:

- *Establishing and maintaining fuel breaks around the community.* Given the lack of long-ranged spotting from grass fires, fuel breaks effectively reduce the rate and likelihood of fire spread into the community.
- *Constructing buildings at the periphery of the community with wholistic consideration of fire resistance against embers and flames,* such as the system of requirements in Wildfire Prepared Home Plus™. These homes serve as the first line of defense against spreading grassfires. At the heat and ember flux produced by grass fires, fire-resistant materials and designs can meaningfully reduce the vulnerability. By constructing homes with fire-resistant materials, the structures have a higher chance of survival and generate fewer embers, reducing the hazard on other homes within the community.
- *Maintaining—or even increasing—the structure separation distance for buildings within the community.* Additionally, utilizing noncombustible solid privacy fences like stone can mitigate exposure to other homes and compartmentalize fires if a home ignites.

- *Eliminating connective fuels between homes to reduce potential exposures and fire pathways.* The heat from a burning building is particularly intense for neighboring homes downwind, as the flames tend to lean and stretch in the direction of the prevailing wind. Yet, connective urban fuels can sustain a slow-moving fire allowing fire to propagate even upwind. This is especially important where increasing the distance between structures presents significant challenges.
- *Using fire-resistant materials and designs.* The complex nature of man-made fuels with differing and fluctuating heat release capacities, combined with variable wind velocities, leads to dynamic fire behavior where heating rates received at building claddings can change rapidly. While most building materials can be overwhelmed by an extreme thermal exposure, fire-resistant materials are designed to resist ignition under low to moderate thermal conditions. Because of special and temporal variations in fire intensity, a home could experience low to moderate fire conditions even in extreme fire conditions. If surrounding homes can withstand the peak thermal exposure, it can create clusters of unburned homes and even break the chain of conflagration.

Together, these actions across the community and individual parcels also improve the effectiveness of first responders' suppression efforts, as fewer building ignitions allows for concentrated efforts.

