COLORADO FOREST RESTORATION INSTITUTE
COLORADO STATE UNIVERSITY

School of Environment, Society & Sustainability
University of Utah

Is This Structure Defensible?

Understanding Wildland Firefighters' Perceptions of Structure Defensibility

Firefighters use structure triage to focus their limited time and resources on saving as many structures as possible during a fire. During structure triage, trained personnel use guidelines that account for firefighter safety, fire behavior, tactical considerations, and the structure's features to systematically categorize structures based on their perceived defensibility (Figure 1). Firefighters prioritize structures that are perceived as more likely to be successfully defended against damage or loss, while avoiding efforts on those less prepared to withstand fire. This brief summarizes a recent study that assessed factors driving perceived defensibility through the lens of wildland firefighters to learn more about how they evaluate the risks associated with different structures. It provides insight into structure defensibility in action, and the factors that firefighters may consider when they engage a fire near structures.

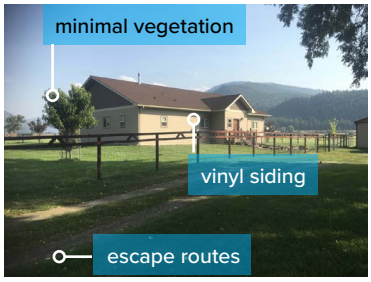
Assessing Structure Defensibility

Structures are more likely to be considered defensible if they have a low risk of ignition—like those that are built with fire-resistant materials or are an adequate distance from nearby vegetation (Figure 1). Structures with a lower risk of ignition and deemed safe for firefighters are prioritized for defense, as they require fewer resources and less time to protect.

A structure's immediate surroundings are a key factor in determining its defensibility. However, the broader landscape also plays a significant role. Recent research highlights that while the area directly around a structure is critical, it is not the sole factor influencing defensibility. Taking a wider spatial perspective can provide additional insight into perceived structure defensibility (Figure 2). Utilizing a dataset of over 30,000 on-the-ground structure triage assessments to inform a machine learning model, this study identified crucial factors for structure defensibility:

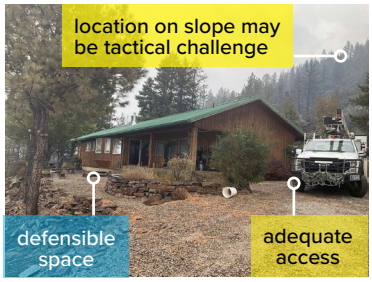
Assessing Structure Defensibility

Defensibility indicates whether a structure can be safely and successfully defended against damage or loss due to fire. Typically, firefighters prioritize more defensible structures because they can be protected using fewer resources and less time.



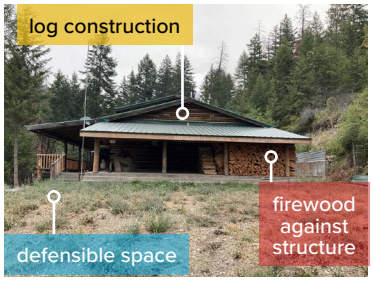
Stand Alone

Needs no additional work to be defended against fire.



Prep and Hold

Requires minimal intervention and is safe for crews to protect as flames approach.



Prep and Leave

Unlikely to survive fire without mitigation. Crews mitigate if possible, retreat as flames approach, and return after.

Rescue Drive-By

Unsafe for firefighters to work at, and no amount of mitigation measures can ensure survival.

More Defensible
Low Risk of Ignition

Less Defensible
High Risk of Ignition

Figure 1. During structure triage, firefighters conduct on-the-ground visual assessments and define structures according to the four defensibility categories pictured based on safety, fire behavior, and the probability of success. This includes evaluating escape routes and safety zones where a threatened firefighter can find refuge from dangerous fire conditions, and the Home Ignition Zone (HIZ), including structure building materials and design (e.g., roofing and siding, vents, decks, windows, and eaves) and the immediate surroundings within 100 feet (e.g., available fuels, vegetation management, and topography) (Butler & Cohen, 1998; Cohen, 2008; Campbell et al., 2019, 2022).

- Identified safety zone for firefighters to retreat to if needed: nearby safety zones were the most important variable driving perceived defensibility, which implies firefighters were considering their own safety over all other factors.
- Structures were much more likely to be deemed non -defensible if there was no defensible space.
- Access to structure: structures were deemed more defensible when they were accessible for firefighters and engines (e.g., roads clear of vegetation, unlocked gates, turnaround areas) and/or were nearer to highways and interstates.
- Slope: structures in areas with shallow slopes were more likely to be categorized as defensible.
- A lower percentage of shrub cover, particularly at a landscape scale, increased the likelihood of structures being classified as defensible.

This study provides an initial attempt to quantitatively describe how fire personnel make real-time decisions about structure triage and defensibility. The findings highlight the importance of landscape-scale variables, such as roads, vegetation, and slope, as well as local-scale factors like defensible space, accessibility to a property, and proximity to safety zones, in determining structure defensibility. Additionally, understanding firefighters' perceptions of structure defensibility during wildfire incidents could refine risk assessments and inform community planning. Communities could use these insights to enhance localized efforts and expand their focus beyond the Home Ignition Zone when planning targeted mitigation actions and evacuations in Community Wildfire Protection Plans.

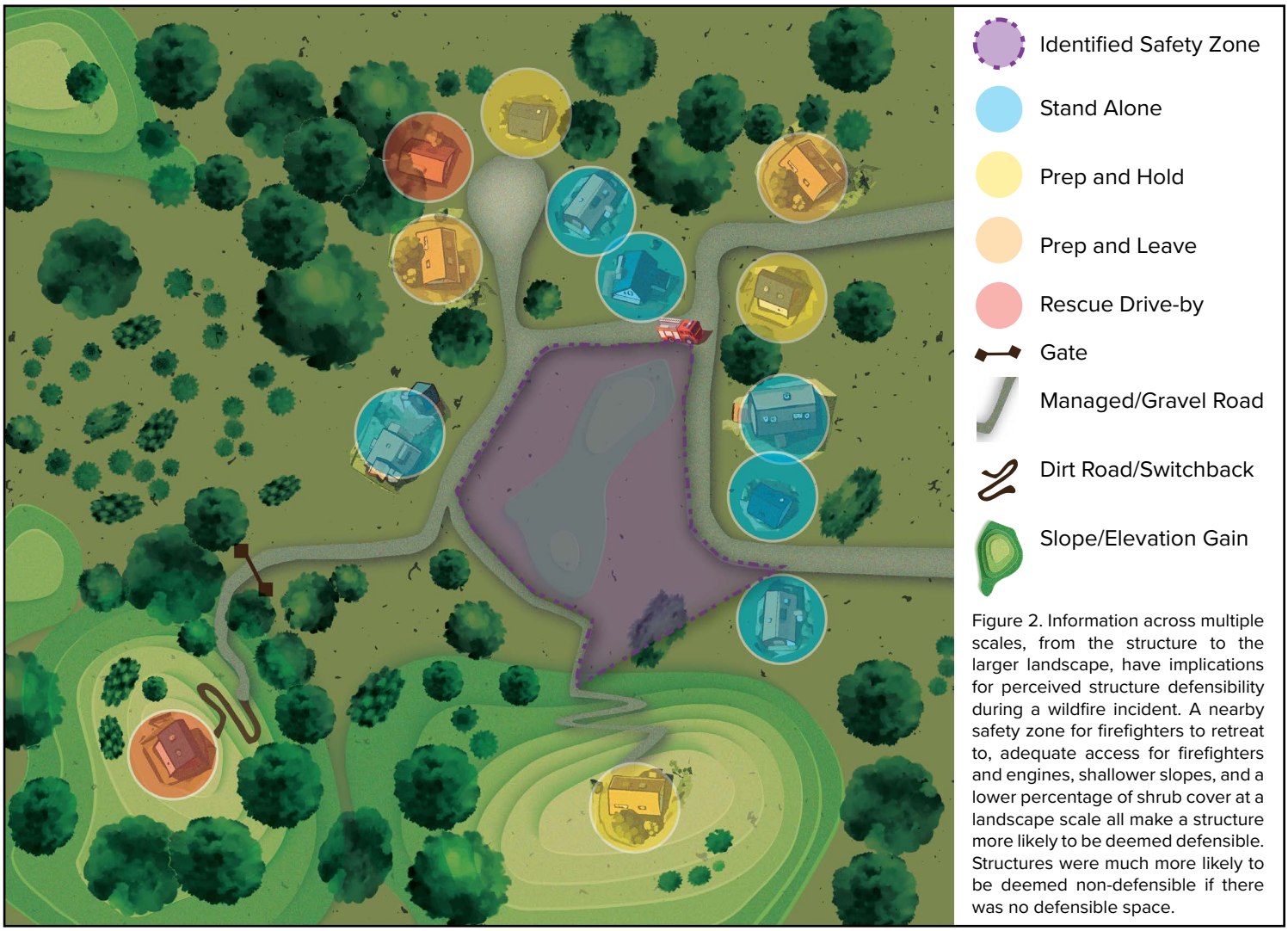


Figure 2. Information across multiple scales, from the structure to the larger landscape, have implications for perceived structure defensibility during a wildfire incident. A nearby safety zone for firefighters to retreat to, adequate access for firefighters and engines, shallower slopes, and a lower percentage of shrub cover at a landscape scale all make a structure more likely to be deemed defensible. Structures were much more likely to be deemed non-defensible if there was no defensible space.

Read the article

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