Appendix A Home Ignition Zone Recommendations

Purpose

The two most important recommendations in this report are;
1) for existing structures to implement defensible space techniques and be fire hardened to the greatest extent practical.
2) for ignition resistant construction and defensible landscaping to be incorporated into future development.

Structure hardening and ignition resistant plantings will be discussed later in this appendix, but first, we'll cover the basic practices involved in fuels management in the Home Ignition Zone. The defensible space concepts presented below can be applied to closely built groups of homes as well as individual homes built on larger lots with greater spacing. The authors and stakeholders of this report recognize the difficulty involved in coordinating large groups of homeowners and organizations such as HOAs; however, structure hardening and the creation of defensible spaces will produce the greatest benefits for the protection of life and the conservation of property from the effects of wildfire. For more information on broader community protection, please visit https://csfs.colostate.edu/wildfire-mitigation/ and https://fireadaptednetwork.org/ .

What is The Home Ignition Zone

There are primarily two factors that determine a home's ability to survive wildfire; the ignitability of the structure and the quality of the defensible space surrounding it. These two factors are combined in the Home Ignition Zone (HIZ) (See **Figure 1**), which takes into account both the structure itself and the space immediately surrounding it when designing actions to mitigate the effects of wildfire.

One of the greatest challenges to limiting the potential damage from interface fires in the more densely populated areas is the lack of defensible space. In neighborhoods where homes are too close to create adequate individual defensible spaces, cross-boundary cooperation will be necessary to execute the most effective treatments. Throughout the study area, land adjacent to homes is of varied ownership, and any fuels modifications extending beyond lot boundaries will require collaboration and perhaps special permission to implement. Homeowners need to be aware they cannot cut and dump behind their property to create defensible space.

Under extreme conditions, wildland ignitions could quickly involve homes located on the edge of natural fuels and spread through neighborhoods by house-to-house transmission. This type of fire spread is similar to the 2012 Waldo Canyon fire near Colorado Springs that destroyed 486 homes and claimed two lives. It is not possible to develop individual defensible space where structures are spaced close together on small lots; however, it is possible to create linked defensible space by building defensible perimeters around clusters of dwellings and replacing flammable native and ornamental plantings near and between structures with ignition resistant plantings (See **Figure 2**).

The following general information regarding creating defensible space has been adapted from information available on the Colorado State Forest Service (CSFS) website. The specific distances quoted below are guidelines, and depending on circumstances of fuels, topography, and ownership, these distances may need to be modified. For more information, please see the CSFS publication *Protecting Your Home from Wildfire: Fire 2020-1,* which is expected to be publicly available in May 2021.

Defensible space is defined as an area around a structure that has been modified to reduce fire hazards. Natural and manufactured fuels are treated, cleared, consolidated, or substituted with ignition-resistant landscaping to slow the spread and intensity of fire. The development of defensible space involves three zones in which different techniques are deployed. These zones should be developed for every structure on the property, including detached garages, storage sheds, barns, etc., as well as the home. The specific design depends on many factors, including, but not limited to, the size and shape of buildings, construction materials, topography, and vegetative type.

Zone 1 extends from zero to five feet from the structure. Zone 1 distance is measured from the outside edge of the eves, decks, or other attached projections.

- In general, nothing should be planted in the first five feet from the structure, and ground cover should be non-flammable such as gravel, cement, or flagstones.
- Any cuttings, mulch, or woody debris should be removed.
- Pine needles and any other flammable debris should be removed from any decks or projections and raked to a distance of five feet away from these. Raking this material more than five feet has not been shown to significantly reduce the likelihood of ignition and is not recommended.
- Any branches that overhang the roof or are within 10 feet of a chimney should be removed.

Zone 2 extends from five to 30 feet from the structure and is managed to reduce the intensity of approaching fire. Fuels management in this Zone consists of the following:

- Remove any stressed, diseased, dead, or dying trees or shrubs.
- Create at least 10 feet of crown spacing between an individual or small groups of trees. Groups of two or three trees may be left in some areas, but a spacing of 30 feet is recommended between such groupings.
- Remove ladder fuels and prune branches from tree trunks up to a height of 6-10 feet or 1/3 of the tree height, whichever is less. Limbs should be cut no less than ¼ inch from the trunk to preserve tree health.
- Keep shrubs at least 10 feet away from tree branches and leave a minimum distance of 2 ½ times the mature height between groups of shrubs.
- Clumps of shrubs should be reduced in diameter to no more than twice the mature height.
- Mow grasses to a maximum height of four inches. This is especially important in the fall when grasses have dried out.

- Avoid heavy accumulations (known as jackpots) of fuels on the ground, including logs, slash, or mulch piles.

The distances given here are minimums and should be increased for slopes and dangerous terrain features. We strongly recommend a fire or forestry professional be consulted when planning defensible space in steep or complicated topography.

Zone 3 is designed to provide a gradual transition between Zone 2 and the natural vegetation condition of the surrounding lands. This zone extends from 30-100 feet from structures and is managed to promote vegetative health and limit fire behavior. Healthy forests usually contain various ages, heights, and species; however, reducing ladder fuels and maintaining or creating crown spacing should be primary concerns. Contacting the local CSFS office for guidance with Zone 3 management is highly recommended.

Remember creating defensible space is not a one-time job. Instead, defensible space must be maintained on an annual basis. A handy checklist of defensible space maintenance tasks is available from the CSFS website.

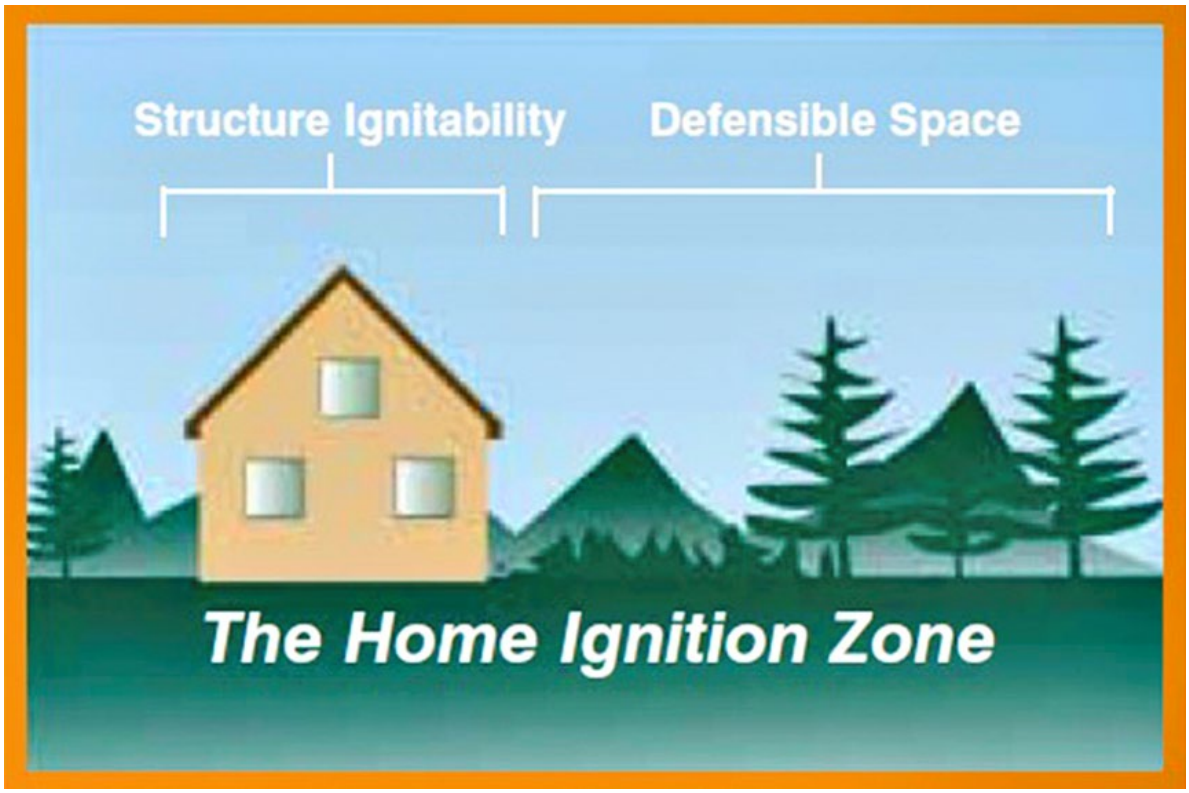

Figure 1 - The Home Ignition Zone

Figure 2: Linked defensible space example

○ Ignition-Resistant Landscaping

Ignition-resistant landscaping generally includes widely spaced trees, low-fuel volume shrubs, and herbaceous groundcover. Ignition-resistant, native re-vegetation should be considered at least as far as the 30-foot perimeter of Zone 2. In areas where it is practical and desirable, replanting with fire-wise species and implementing proper planting practices will provide the following benefits:

- Reduce the fire risk by limiting the ability of invasive and flammable species to return.
- Protect bare soils from erosion.
- Promote natural beauty and ecological stability without sacrificing adequate wildland fire protection.

Examples of fire-wise planting practices would be to space trees widely to interrupt the continuity of aerial fuels, plant low-fuel volume shrubs (usually no greater than 18 inches in height), and integrate decorative rocks and non-combustible natural features into the landscape architecture design. Deep watering trees through the summer and fall and during dry winters will keep trees alive and deter insects. Healthy, well-irrigated plants are less flammable, and irrigation systems can reduce the intensity and spread of surface fires.

Drought-resistant plants and irrigation systems should be utilized in newly planted areas. Existing native plants that are fire-adapted do not have to be replaced to reduce the fire risk; however, flammable species such as juniper should be avoided. Any retained natural vegetation needs to be maintained at a conservative fuel level and arrangement. Decorative rocks should be integrated into the design. Stone will help anchor and stabilize soil, create fuel breaks and

provide a natural look to the landscape. Emphasis should be placed on the use of Firewise species. A list of Firewise plants recommended by the CSFS can be found in their *Firewise Plant Materials* publication – http://extension.colostate.edu/topic-areas/natural-resources/Firewise-plant-materials-6-305/.

Careful planting of a Firewise landscape can provide open space and common areas with natural beauty and ecological stability without sacrificing adequate wildland fire protection.
To retain the health and vigor required to be fire-resistive, plants require maintenance. Maintenance of plant material is a critical factor in safeguarding these species' ignition-resistant qualities and continuing resistance to undesirable fire effects. On-going maintenance should include removing of dead material, weed control, cutting grasses to four inches or less, pruning trees and shrubs as necessary to prevent the buildup of ladder fuels, and removing surface fuel jackpots. Ladder fuels and fuel jackpots contribute to crown fire development and spotting during fires.

It is important to remember fire mitigation is not a one-time job. Defensible space should be maintained year-round, and reducing structural ignitibility is an ongoing process. The WMP should be reviewed and continuously updated to ensure the information regarding hazards and recommended solutions, and other important information presented there, stays current.

The Importance of Reducing Structural Ignitability and Individual Parcel Assessments

In their 2013 publication *How Risk Management Can Prevent Future Wildfire Disasters in the Wildland-Urban Interface,* David E. Calkin, Jack D. Cohen, Mark A. Finney, and Matthew P. Thompson come to the following conclusion:
"The demonstrated inability to suppress wildfires under extreme weather conditions and the fact that many homes are not destroyed when exposed to these wildfires indicates that reducing home ignition potential is key to effectively reducing home destruction. Because home ignitions are primarily determined by conditions on private property, the principal authority, and thus, primary responsibility for preventing WUI home destruction lies with homeowners rather than public land managers."[1]

As mentioned earlier, the HIZ is comprised of the structure itself and the area within the first 100 feet. Individual home hazard assessments can provide a road map for homeowners to reduce the ignition potential of the HIZ; however individual assessments rely heavily on the evaluation of conditions existing from the structure up to 100 feet out. As such, they are most effective when lot sizes are one acre or greater.

Homes in some of the residential hazard zones identified in this report, such as North Morrison, South Morrison, and Willow Springs to North Ranch, could receive the most benefit from parcel-level hazard assessments; however, in most of the WUI areas, homes are too close together and lots too small for individual parcel assessments to yield much actionable information. For that reason, we recommend individual parcel assessments focus on neighborhoods where the average lot size is one acre or larger. For the other communities of the study area, we recommend focusing on reducing HIZ ignition potential through linked defensible space and structure

[1] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3896199/

hardening tactics discussed below. In the neighborhoods where lots are large enough to benefit from parcel-level assessments, the data gathered should be integrated with data in the WMI (such as structural ignitability data not captured by NoHARM) to establish a framework for future damage assessment responsibilities and recovery efforts.

Structural Hardening Recommendations

NEW DEVELOPMENT

The best time to reduce the ignitibility of a home is before it's built. Therefore, we recommend during the planning stage questions such as these be addressed:

- Are there multiple access points, and would access be safe for responders and evacuees during fire conditions?
- Can the adjacent fuels be modified to create adequate defensible space for homes considering the fuel type and topography?
- What are the potential fire behavior and ember cast from fires approaching the development during typical fire and extreme weather conditions?
- Will complex forms or flammable materials in the architectural design trap heat and embers?
- Does the design of homes and neighborhoods include adequate turnarounds and access for apparatus and sufficient water for fire suppression?
- Are streets and home addresses visibly marked with consistent, reflective signage?

EXISTING COMMUNITIES

Although some of the factors impacting the survivability of structures are best addressed before the home is built, there are still steps that should be taken to improve the chances of survival for existing homes.

The role of embers in structure loss cannot be overstated. Embers are generated by burning materials and lofted by wind and convective heat ahead of the main fire front. Structures are vulnerable to ember penetration in numerous ways. Some of the more common areas are outlined below.

Roof: Several homes and outbuildings in the study area have highly flammable wood shake roofs. The roof of a structure has a significant impact on its ignitability and the likelihood of house-to-house spread. Class A roofing materials such as asphalt shingle, metal, and tile roofs are all considered ignition resistant. There are also many homes in the study area using wood for architectural features. We recommend that future use of any wood shingle be prohibited and non-flammable materials should be strongly encouraged when existing elements need repair or replacement.

Decks: There are quite a few homes with wooden decks and projections. According to CSFS, wooden decks are so combustible that "when a wildfire approaches, the deck often ignites before the fire reaches the house."[2] The shape of decks and outdoor stairs makes them excellent traps

[2] https://static.colostate.edu/client-files/csfs/pdfs/FIRE2012_1_DspaceQuickGuide.pdf, Page 4.

for heat and embers. Nothing flammable should ever be stored under decks or projections because of this.

We recommend that as wooden decks and projections found throughout the study area become in need of repair or replacement, non-flammable materials, such as plastic composites or aluminum decking should be strongly encouraged. The quality and number of choices for wood substitute building materials have grown exponentially in the last decade, and homeowners are no longer limited to materials with an inferior look and finish. In addition to reducing fire hazards, these materials usually require much less maintenance than wood. In areas where fire behavior predictions call for low to moderate intensities, it is helpful to isolate existing wooden decks from the energy of fires by building a non-combustible patio and wall below the deck to limit the heat trap effect. The best design is to enclose the deck completely to create a solid form.

WINDOWS quickly fail when exposed to the radiant heat of a wildfire. Once windows have failed, they provide a direct path for embers and heat to enter the home and ignite the inside. Although some of the newer homes in the study area have more heat resistive windows, such as low E Thermopane (double glazed) and tempered glass patio doors, most older homes are likely to have conventional single-pane window glass. This is especially true of homes that were built originally to be seasonal or vacation residences.

We recommend replacing single-pane windows with modern double-pane windows that will improve the resistance to breakage from heat exposure by up to double the exposure time.[3] Homes near heavy fuels should consider installing heavy, non-flammable window coverings that will afford the home some additional protection from embers in the event windows break. Homes in these areas should also consider replacing large windows (2 feet or more wide or tall) with smaller panes that are more likely to stay in place even if fractured by heat.

VENTS are another location where embers can enter the structure. Vents, especially vents on the downhill side of the home, should have flammable vegetation removed as per Zone 1 defensible space standards and be protected by non-flammable landscaping features such as stone or brick that will block the heat path of the fire. Vents in eves and soffits should be covered with a non-combustible mesh with openings 1/8” or smaller to slow the ingress of embers. Any open eves should be enclosed to prevent them from becoming a trap for heat and embers. When enclosing an open eve, a flat soffit is preferred over a sloping soffit to limit the heat trap effect.

PROPANE TANKS Any above-ground propane tank should be kept at least 30 feet from structures, and all flammable vegetation should be removed from within 10 feet of tanks, lines, and meters.

Historic fire events have proven that poor construction techniques and materials are linked directly to structure loss, reinforcing the message of the research quoted earlier in this appendix. The Insurance Institute for Business and Home Safety (IBHS) wildfire research center has

[3] https://static.colostate.edu/client-files/csfs/pdfs/firewise-construction2012.pdf, Page 30.

developed a video demonstrating how various home construction materials burn during an ember storm (https://www.youtube.com/watch?v=IvbNOPSYyss).

For more detailed information regarding structure hardening and construction method and material vulnerabilities, please see the CSFS publication *Firewise Construction: Site Design & Building Materials,* which can be downloaded from the CSFS website at https://csfs.colostate.edu/wildfire-mitigation/construction-design-materials/ and the following links:

- https://fireadapted.org/wp-content/uploads/2018/06/waldo-canyon-report.pdf (Lessons learned from the Waldo Canyon Fire)
- https://www.fema.gov/media-library-data/20130726-1652-20490-4085/fema_p_737.pdf (FEMA *Home Builder's Guide to Construction in Wildfire Zones*)
- https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=1141 National Fire Protection Association (NFPA) 1141, *Standard for Fire Protection Infrastructure for Land Development in Wildland, Rural, and Suburban Areas*.
- https://www.youtube.com/watch?v=vL_syp1ZScM *Your Home Can Survive a Wildfire* NFPA video presentation.

REFERENCES/CITATIONS