CWPP Components associated with Structures

Section 1.0 Introduction

Section 2.0 Community Overview

Excerpt -

Structures

WUI fire disasters typically do not occur under 90th percentile weather patterns when local fire protection resources have a greater probability of containing a wildfire and limit the fire's interaction with the WUI. WUI fire disasters are most commonly associated with extreme fire behavior conditions that account for the one to three percent of the wildfires that escape control by initial attack resources (2000, JP Menakis et al). There's a misconception by many that direct flame impingent to a structure during a high intensity fire is the primary cause of structure damage or loss. This is not always the case as ember cast and localized spot fires adjacent to vulnerable structure. Given the combination of extreme fuels, weather, and topography, the size, burning intensity, and proximity of wildfire to residential development determine the initial extent and intensity of WUI ignition exposure, primarily from firebrands (Calkin, et al, 2104). Low intensity fires within residential developments can destroy structures that are highly ignitable while structures with low ignitibility can survive high intensity fires (Cohen, 2010).

According to the National Interagency Fire Center (NIFC), the average structure loss in the United States since 1999 caused by wildfire is estimated at almost 2,600 structures per year with a little more than half of these losses being primary residences (NICC, www.predictiveservices.nifc.gov/intelligence/intelligence.htm). The NFPA reports that a total of 4,312 structures nationally were destroyed by wildfires in 2016, including more than 3,000 homes and more than 70 commercial buildings. In 2016, California lost 754 residences and 12 commercial structures in wildfires (NFPA, https://community.nfpa.org/community/fire-break/blog/2012/10/01/more-than-2600-structures-lost-per-year-due-to-wildfirem, accessed March 20, 2017).

There are numerous pathways for wildfire to ignite structures. These pathways depend on a variety of characteristics found in the WUI, including:

- adjacent wildland open space covered in wildland vegetation/fuel
- community characteristics such as housing density, zoning, separation distance, and physical barriers
- structure composition including exterior structure construction material, structure design, site location (e.g., mid-slope, hilltop), flammable structure extensions (e.g., wood decks, wood patios), structure maintenance, and heat sources (e.g., landscaping, flammable exposures) within 100-200 feet

The Santa Barbara Front has experienced significant property losses during interface fires. The 1990 Painted Cave Fire was the first WUI fire studied by researchers to better understand the cause of structure loss. Jack Cohen, a Forest Service researcher, determined that whether a structure is

damaged or destroyed depends primarily on exterior construction material, a structure's design, housing density, placement relative to nearby homes, geographic location, and whether the home has adequate defensible space (Cohen, 2000).

Subsequent research has shown that the primary reason for structure loss during a wildfire is the ignitability of a structure itself, with burning embers as the primary source of structure ignition in the WUI. These burning embers provide an ignition source to vulnerable structures, wood exposures, and nearby vegetation and debris which then ignite structures through radiant heat or direct flame impingement (Quarles, 2012).

A study of the 2007 wildfires in San Diego County indicated that 13% of the homes within the fire perimeters were destroyed. Those homes built under building codes enacted in 2001 had a loss rate of 4%, while homes built under codes modified in 2004 had a loss rate of only 2%.

WUI fires can spread firefighting resources thin and not every structure will have fire equipment pre-positioned in their driveway. In a rapidly developing WUI fire, common to the Santa Barbara area, firefighting capacity is often out paced by fire spread. The ability of a structure to withstand the passage of the fire can be correlated to the quality of the defensible space surrounding the structure and structural hardening work completed by property-owners long before the fire starts.

As firefighters arrive at the scene of a WUI fire, they perform "structure triage" to determine whether they can safely engage in structure protection activities. Structure triage is a dynamic process and a change in the fire environment can quickly alter the defensibility of a given structure. As an example, a change in fire behavior may dictate that firefighter life safety is jeopardized requiring he firefighters to disengage from structure protection activities.

Structure Triage
The process of inspecting and classifying structures according to whether their defendable or not, whether risks to firefighters' life safety can be mitigated, and continual assessment of changes in the fire environment that may dictate a need to disengage.

Spot fires generated from embers/firebrands are a function of three elements of the wildland fire environment: firebrand sources, transport mechanism, and a receptive fuelbed away from the main fire. Without all of these elements occurring within the fire environment, spot fires will not propagate and spread. A fire burning within or adjacent to the Planning Area has ready access to fuels that will support firebrand production and the convection column of a fire influenced by the prevailing winds provides the transport mechanism to a receptive fuelbed; however, the availability of a receptive fuelbed is highly variable. A receptive fuelbed is a fuel that will ignite and support the spread of a wildland fire when a firebrand lands on it. These receptive fuels can be native or ornamental vegetation, but also debris found in rain gutters and/or roof valleys or flammable roofing and/or deck materials.

Add Community Characteristics Section....in process

The potential for wildfires to threaten communities within and adjacent to the Planning Area can occur year round; however, the greatest likelihood for catastrophic wildfires primarily occurs in the summer and late fall. Those who live within the Planning Area should recognize the reality of the wildfire threat associated with living in the flammable landscape of Santa Barbara County and take actions which will enhance the ability of their residence to survive a wildfire without the intervention of ground or aerial firefighting equipment. During significant wildfire events there are simply not enough firefighters to protect every structure and structures should be able to stand on their own.

Section 3.0 Defining the Wildfire Problem

Section 4.0 Communities at Risk

Section 5.0 Wildfire Analyses

Excerpt in Section 5.0 -

Structure Vulnerability

Vulnerable parts of a structure that can contribute to ignition during a wildfire include:

- Roofing – Roof construction and maintenance has been a key factor in structure loss on many fires. It is not just the type of roofing material, but also the design, construction details, the condition of the material, and whether the roof is clear of burnable material (e.g., pine needles and other debris).
- Wood Decks – Decks act as a source of fuel that is attached or directly to structures. When ignited by wildfire the radiant and convective heat output can ignite structures. Many decks are adjacent to large windows or glass sliders where the heat from a deck fire can cause the glass to fail allowing the wildfire to enter a structure.
- Garages - Garages with gaps at the top, bottom and edges of doors can allow firebrands to enter, especially during windy conditions. Oftentimes garages contain flammable materials that can enhance ignition potential. Garages usually have vents at various locations, especially if they contain gas furnaces or hot water heaters. These vents can be entry points for embers.
- Siding - Flammable siding can provide a pathway for flames to reach vulnerable portions of a structure, such as the eaves or windows. Siding is not generally susceptible to ember cast and needs a source of ignition to support fire development. In many cases this ignition source includes vegetation (ornamental or native) immediately adjacent to the structure, wooden decks, and fences, sacked firewood or other flammable material in close proximity to a structure. These potential heat source provide the fire intensity that can ignite siding.
- Vents - Soffit vents in the eaves are an easy entry point for wind-driven burning embers during a wildfire. Attic fires are not easily detected from the outside and structures have been lost when fire personnel have left the scene unaware that a fire has ignited within the attic.

- Windows - Unprotected and inadequate windows can be another major entry point for fire. Windows broken by airborne materials or cracked by thermal expansion during a wildfire ignite materials in the structure through radiation, convection, and firebrands.
- Nooks and crannies - Little grooves, inside corners, and roof valleys all become areas where flammable debris can collected over time. Burning embers can land on this debris, igniting it.
- Crawlspace Vents – If not adequately screened, these areas, not just under a structure but also under decks and other attachments, are difficult to protect. Much like vents in the attic, firebrands enter these areas and flammable material underneath a structure can ignite.
- Wood Fences – Fences act as a fuel source that can carry fire to a structure. Fences when attached to homes present a threat to the structure.
- Flammable landscape vegetation and flammable items such as firewood or flammable debris piled in close proximity to the house can act as receptive fuels for firebrands and provide a heat source to transfer fire to the structure. Establishing quality defensible space which under normal conditions, creates a sufficient buffer to the spread of a wildfire is important to the overall survivability of a structure.

As described in Section 2.0, structures within the Planning Area include a range of construction characteristics from fire-hardened stucco and clay/fiber cement/slate tile roofed structures (common in the lower foothills and structures constructed under fire codes) to highly susceptible wood siding and wood-shingle roofed residences found in older homes (pre-fire codes) and in many of the mountain communities. Combustible fuels in the form of native vegetation is prevalent in the mountain communities, while the abundant of ornamental vegetation and enclaves of native vegetation is associated with the residential areas of the lower foothills of the Planning Area.

Specific areas of concern for structures vulnerability include:

1. Wood shake residential roofs.
2. Wood exposures, on, attached or directly adjacent to homes, such as wood siding, decks, gazebos, weathered wood eaves and fascia boards, and poorly maintained wood fences.
3. Some homes do not have boxed in eaves.
4. Many homes appear to have ineffective attic screens. Substandard screens can allow burning embers to enter a structure, potentially causing ignitions in attics.
5. Poorly maintained ornamental and natural vegetation create localized fire hazards.
6. Homes with poorly maintained landscaping or rain gutters and roof valleys with flammable debris build up are at risk from burning embers generated during a wildfire.
7. Some of the community enclaves are tightly packed where strong winds and steep slopes can cause a wildfire to spread from structure to structure. Structure fires threaten adjacent structures and improvement with their long burning duration, extreme radiant and convective heat, and additional production of firebrands that are transported to other structures and fuel.

Structure ignition is a direct result of exposure to radiant and convective heat produced by the wildfire and burning embers.

Convective heat transfer: This consists of the transfer of heat by the movement of rising hot air or gasses. Convection is a primary mechanism for pre-heating adjacent fuels upslope from a wildfire and is also the primary mechanism associated with the transport of burning embers.

Many structures within the Planning Area are located near slopes exceeding 40% with inadequate structure hardening and defensible space to prevent the transfer of convective heat onto the structures.

Radiant heat transfer: Heat energy is released in all directions from a burning object. Exposed flammable structural elements can ignite by receiving enough radiant heat for a long enough duration to reach its ignition temperature. Burning structures can ignite other structures in close proximity moving a fire from structure to structure. The potential for ignition is greatly reduced if spacing between structure and fuel (wildland and urban) is increased.

Many structures in the Planning Area are not sufficiently hardened, have inadequate spacing between structures and/or lack defensible space, significantly increasing the likelihood of ignition through radiation.

Burning Embers: Burning embers include flammable material (wood shingles, tree bark, leaves) that detach from the main fire front and are carried by convection drafts and prevailing winds to receptive fuel causing spot fires. Wildfires can produce thousands of burning embers that can be carried very long distances by winds.

Receptive fuels adjacent to structures abound in the Planning Area and fire modelling suggests that under a 50 mph offshore wind, burning embers can be transported up to 1.2 miles ahead of the flaming front of the fire. With receptive fuels and long transport distances as known elements of the fire environment, managing defensible space and hardening structures against ember cast become important aspects of protecting communities against structure loss during widlfires.

Chapter 6.0 Action Plan

Excerpt.....

WORK IN PROGRESS

Structure Hardening

Structure Component	Structure Hardening Mitigation Action
Defensible Space	Clearance from all structures shall not be less than 100 feet using surface measurements. Within the 100-foot perimeter, all brush, flammable vegetation, or combustible growth shall be modified so that a wildfire burning under average weather conditions would be unlikely to ignite the structure. Follow Primary Zone guidelines in Tables (to be developed) for potential increase in distance. Select fire resistant plants and non-combustible hardscape for the landscaping. Plants located within this area should be kept healthy and maintained

	frequently.
Addressing	Required minimum letter/number height of 3” for residential and minimum of 6” for commercial with additional posting for longer access routes
Roof	Replace wood-shake or shingle roofs with a Class-A fire-resistant type (e.g., composition, metal or tile). Openings in roofing materials, such as the open ends of barrel tiles, should be plugged to prevent ember entry and debris accumulation. Regardless of the type of roof, keep it free of bird’s nests, fallen leaves, needles and branches.
Chimneys	Chimney and stovepipe openings should be screened with an approved spark arrestor cap.
Eaves	Cover the underside of the eaves with a soffit, or boxing in the eaves, which will reduce the ember threat. Enclose eaves with fiber cement board or 5/8-inch-thick, high-grade plywood. If enclosing the eaves is not possible, fill gaps under open eaves with caulk.
Exterior Siding	Noncombustible siding materials (e.g., stucco, brick, cement board and steel) are better choices. If using noncombustible siding materials is not feasible, keep siding in good condition and replace materials in poor condition.
Windows and Skylights	Single-pane windows and large windows are particularly vulnerable. Recommend installing windows that are at least double-glazed and that utilize tempered glass for the exterior pane. The type of window frame (wood, aluminum or vinyl) is not as critical; however, vinyl frames can melt in extreme heat and should have metal reinforcements. Keep skylights free of leaves and other debris, and remove overhanging branches. If skylights are to be placed on steep pitched roofs that face large amounts of fuels in close proximity (e.g., a mature pine tree or another house), consider using flat ones constructed of double-pane glass.
Vents	All vent openings should be covered with 1/8-inch or smaller wire mesh. Another option is to install ember-resistant vents. Do not permanently cover vents, as they play a critical role in preventing wood rot.
Rain Gutters	Always keep rain gutters free of bird’s nests, leaves, needles and other debris. Check and clean them several times during the year.
Decks	Keep all deck materials in good condition. Consider using fire-resistant rated materials. Routinely remove combustible debris (pine needles, leaves, twigs and weeds) from the gaps between deck boards and under the deck. Enclosing the sides of the deck may reduce this type of maintenance. Do not store combustible materials under the deck.
Residential Fire Sprinkler Systems	Required in all new and two family dwellings and townhouses. Existing residents that increase/replace the gross floor area to 3,500 feet or more and the aggregate structural alteration is greater than 1,000 feet in gross floor area cumulatively dating back to 1991 are required to install an automatic fire sprinkler system. Annual maintenance service or inspection of these systems is strongly recommended to ensure operability.
Flammable Items	Keep the porch, deck and other areas of the home free of flammable materials (e.g., baskets, newspapers, pine needles and debris). Keep firewood stacked

at least 30-feet away.

Items to include/consider:

- SBCFD new database coming online 2017. See msg in dev team folder apr metg
- Include Berkeley's scorecard in appendix
- Firewise process for Firewise designation info
- Links to the FEMA pre-disaster grant program and the Big Bear re-roofing program - FEMA Grant Program: https://www.fema.gov/pre-disaster-mitigation-grant-program
- The Mountain Area Safety Taskforce re-roofing program: http://www.thinisin.org/shake/
- Human behaviors must be addressed (storage under decks, maintenance & woodpiles).
- The issue of fire prone landscaping is pervasive in the CWPP plan area, especially in the Foothill Community. Should be a major component of recommended action plans.
- Need to emphasize flammable ornamental vegetation See table on page 8 ("Some plants to avoid when landscaping in fire-prone areas"). Review list at http://www.cnps.org/cnps/publications/fremontia/Fremontia_Vol38-No2-3.pdf
- Look at Wildfire Pacific Guide for good info
- Improving your structure's wildfire resistance – identify DYI projects, both large and small, to improve a structure - a new roof, replace old windows or doors to improve energy efficiency, or need to rebuild a deck or porch. When repairing a roof, Fire Codes do require property-owners to replace wood shingle. Modification can make your home more aesthetically appealing, reduce energy bills, and add to its value while reducing the risk of wildfire damage.
- The best investment in a home is to replace a flammable roof. It is the greatest threat to a home. Replacing a roof is a major project, but it also yields major benefits. The roof should be a top priority. Research has shown that combustible roof coverings are the greatest threat to a building during a wildfire.