A DEFENSIBLE COMMUNITY?

A Retrospective Study of Montecito Fire Protection District's Wildland Fire Program during the 2017 Thomas Fire

October 23, 2018

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Executive Summary

The Thomas Fire, now the second largest wildfire in California history, burned into the community of Montecito on December 16, 2017 having already destroyed more than 1,000 structures in Ventura and Santa Barbara counties. With the fire burning under strong Sundowner winds, firefighters had anticipated significant structure losses across the northern reaches of the community. However, as the winds abated in the late afternoon of the 16th only seven primary residences were destroyed by the fire and another 40 additional structures and outbuildings were damaged or destroyed. Hundreds of structures were successfully protected by the fire suppression resources assigned to the community. While any structure loss is devastating to the families involved and to the firefighters assigned to protect them, the level of damage associated with the Thomas Fire in Montecito was significantly less than was modeled in the 2016 Montecito Community Wildfire Protection Plan (CWPP) or that firefighters anticipated or that occurred in either of the 2008 Tea and 2009 Jesusita fires. Over 100 homes were lost in Montecito during the 2008 Tea Fire and thousands of people were evacuated during both the 2008 Tea and 2009 Jesusita fires.

The objective of this document is to review the actions of the Montecito Fire Protection District (District) in the years leading up to the fire as well as actions that took place under the guidance of the Incident Management Team prior to and during December 16th to better understand how these actions influenced the positive outcomes associated with the defense of Montecito. While assessing the District's wildfire program, this report also provides recommendations as to how the District might build on these past successes given the new environmental conditions that the Thomas Fire and ensuing debris flow have created across the community.

Montecito's wildland fire program has spent the last 20 years developing a set of systems to combat the threat of wildfire. These systems include implementing new stringent building codes and architectural guidelines, creating a hazardous fuel treatment network across the northern portion of the community, developing a pre-attack plan to disseminate critical fire ground information to mutual aid resources, developing partnerships within the community and with adjacent agencies, and building a community education program that facilitates a positive working relationship with the community. These systems were successfully deployed to support structure defense actions by the more than 500 firefighters assigned to Montecito the morning of December 16th. In part, due to the effectiveness of the systems, only minimal structure loss and damage occurred, but most importantly, no lives were lost or serious injuries occurred prior to and during the fire fight.

A post-fire assessment found that the seven primary residences destroyed during the Thomas Fire lacked defensible space, lacked safe access due to narrow roads or no turnarounds for fire apparatus, were constructed of flammable construction materials, or were situated where gaps existed in the fuel treatment network.

The Thomas Fire demonstrated how proactive actions implemented by the District in the past 20 years contributed to the successful defense of the community during the Thomas Fire. Post-fire, Montecito still has unburned fuel in smaller enclaves within the community and within the 2008 Tea and 2009 Jesusita burn scars. These areas still have the potential to support smaller, more localized wildfires. Given the favorable climatic conditions of the Central Coast, over the next 10-20 years vegetation in the

footprint of the Thomas Fire will be able to support wildfire again. There is much opportunity for the District to use the Thomas Fire burned area to continue to expand and improve upon the existing fuel treatment network. Treating vegetation as it regrows will be less labor intensive and less costly than in the past. Leveraging community partnerships, improving the use of technology to support fire operations, modifying defensible space fire codes, and continuing the wildland fire safety education of the community are critical steps for the District in the upcoming years as they prepare for the inevitable next wildfire.

Introduction

In an effort to assess how well the District's wildland fire program performed during the Thomas Fire, Chief Chip Hickman and the District's Board of Directors hired Geo Elements, LLC to assist in the development of a retrospective study of the Thomas Fire and its impacts on the community of Montecito. The District's desire was to identify the strengths and weaknesses of current programs in protecting life safety and residences, identify what actions can be taken to improve these programs, and to build upon program successes. The findings of this study will support future actions as the District improves the wildfire program while enhancing the protection of its residents.

The objectives of this report are:

1. Assess the effectiveness of the 2016 CWPP
    a. Fire behavior
    b. Fuel treatments
2. Evaluate fire effects
3. Evaluate fuel treatment effectiveness
4. Analyze structure loss and damage
5. Compare previous Montecito fires to the Thomas fire
6. Discuss areas of success and needs for improvement

Methods

Both social and physical data were used in an attempt to understand how the pre-fire actions of the District influenced the impacts of the Thomas Fire on the community. The following methods were used in this analysis:

- Interviews

  A structured set of interview questions were developed that focused on pre-fire preparedness, fire operational activities, and post-fire observations. Answers were aggregated to identify common themes and observations from those interviewed.

  Geo Elements staff conducted interviews with 11 firefighters (identified in the appendix) who either work for the District or who were assigned to the Thomas Fire on December 16, 2017 when the fire burned into Montecito. These firefighters were able to observe fire activity and suppression actions as the fire moved into the community.

- Geospatial Analysis

  A geospatial database was developed to assess the locations of:

    a. All structures within the District that were impacted by the Thomas Fire.

b. All known pre-fire fuel reduction and fire prevention activities completed by the District, United States Forest Service - Los Padres National Forest, Santa Barbara County Fire Department (SBC), Carpinteria-Summerland Fire Protection District, and local residents.

c. Fire behavior associated with the Thomas Fire.

d. Relationships and common denominators to understand patterns of damage and impacts across the District.

The following datasets were used to validate insights from the fire personnel interviewed:

- Updated Thomas Fire perimeter for Montecito that reflects a more accurate fire perimeter. This updated map was developed by Rob Hazard (SBC), Kerry Kellogg (District), and Maeve Juarez (District)
- CAL FIRE Thomas Fire Incident Inspection Report (geospatial dataset and report on structures damaged or destroyed in the Thomas Fire)
- Montecito Fire Protection District damage assessment (geospatial dataset and photos of structures in Montecito damaged or destroyed in the Thomas Fire)
- Parcel data from Santa Barbara County Assessor's Office
- Individual structure polygons from the District's Geographic Information Systems (GIS) contractor
- Individual driveways from the District's GIS contractor

Additionally, Geo Elements staff delineated defensible space and areas of modified fuels for all properties within 400m (0.25 miles) of the updated Thomas Fire perimeter using the high-resolution satellite imagery available in Google Earth's timeline function taken on August 2017, four months before the Thomas Fire. Specifically, each parcel was evaluated for areas where a reduction in fire behavior could be anticipated based on fuel treatment actions or the presence of non-flammable modifications to the landscape. These coarsely digitized areas were interpreted as areas where there would be a reduction in fire behavior as compared to the surrounding native vegetation. These included areas where the native shrubland had been type-converted to grasslands, areas where vegetation had been thinned or removed entirely breaking up the fuel continuity, extensive pavement surfaces, irrigated lawns, large-scale irrigated landscaping, orchards, and other surfaces that were considered to be non-flammable.

Additionally, evidence of suppression actions including hand lines and fire retardant that were visible in a December 19, 2017 satellite image were digitized. The hand line locations were corroborated by one of the interviewees. All fire retardant was applied, either by aircraft or applied manually by ground equipment, prior to the fire entering Montecito on December 16th, as air operations were effectively grounded on the 16th due to high winds.

For structures damaged or destroyed during the fire, high-resolution satellite imagery pre- and post-Thomas Fire (August 2017, December 2017, and January 2018) was used to describe the degree of structure damage and evidence of fire behavior adjacent to the structures. In addition to describing pre-fire fuels, imagery was interpreted to describe whether shrub and tree crowns and other landscaping were still green, scorched (brown) or consumed (black) post-fire. The evidence used to describe fire behavior adjacent to structures was based on the level of consumption noted between pre- and post-Thomas Fire imagery. Dr. Crystal Kolden conducted all image analysis to limit inter-observer variability.

Access to the structures was described based on the calculated distance from a main road (primarily the high road system on the northern portion of the District) using both a Santa Barbara County road/transportation GIS layer and an individual driveway and structure layer from the District GIS contractor.

Review of Existing Data

Geo Elements staff reviewed existing published reports and documents from the District, United States Forest Service, CAL FIRE, and Santa Barbara County Fire Department.

The Community of Montecito

As described in the 2016 CWPP, Montecito is located approximately 90 miles northwest of the City of Los Angeles in an unincorporated area of southeast Santa Barbara County. The District covers approximately 21.7 square miles and borders the Santa Ynez Mountain Range and Los Padres National Forest to the north, the City of Santa Barbara to the west, Carpinteria-Summerland to the east, and the Pacific Ocean to the south (See Figure 1).

Although Montecito is not an incorporated town or city, the United States Census Bureau identifies it as a census-designated place. In 2013, the estimated population of Montecito was 8,965 individuals that resided in approximately 4,198 housing units that include small condominiums, modest homes of various styles, and size up to very large estates (U.S. Census Bureau, http://factfinder.census.gov, 07 August 2018).

Montecito is a community dominated by residential development on large lots with substantial natural and ornamental landscaping vegetation. The greatest densities of residences (defined here as habitable structures) are in areas south of Highway 192 east of Hot Springs Road and west of Sheffield Drive and north of Highway 101. Irrigated landscapes exist most frequently south of East Valley Road, while natural vegetation becomes more dominant within the community as it transitions north onto the lower slopes of the Santa Ynez Mountains. The Montecito Community Plan (MCP) states, "To maintain the semi-rural character of Montecito, the natural landscape must continue to be the dominant feature of the community." (County of Santa Barbara Planning and Development, 1995). The retention of the natural landscape within the community leads to an intermix of flammable vegetation and structures within the community.

The MCP also identifies Environmentally Sensitive Habitats within the District including Riparian Woodland Corridors, Monarch Butterfly Roost Sites, Sensitive Native Flora, and Coastal Sage-Scrub. Theses habitats support vegetative conditions, which under certain environmental conditions, will support wildfire spread.

The Montecito Architectural Guidelines and Development Standards (MAGDS), adopted in 1995 and updated in 2018, assist property-owners, architects, developers and builders in "designing projects that will be harmonious with the existing character of Montecito and includes guidance for access roads, brush removal, and landscaping related to wildfire".

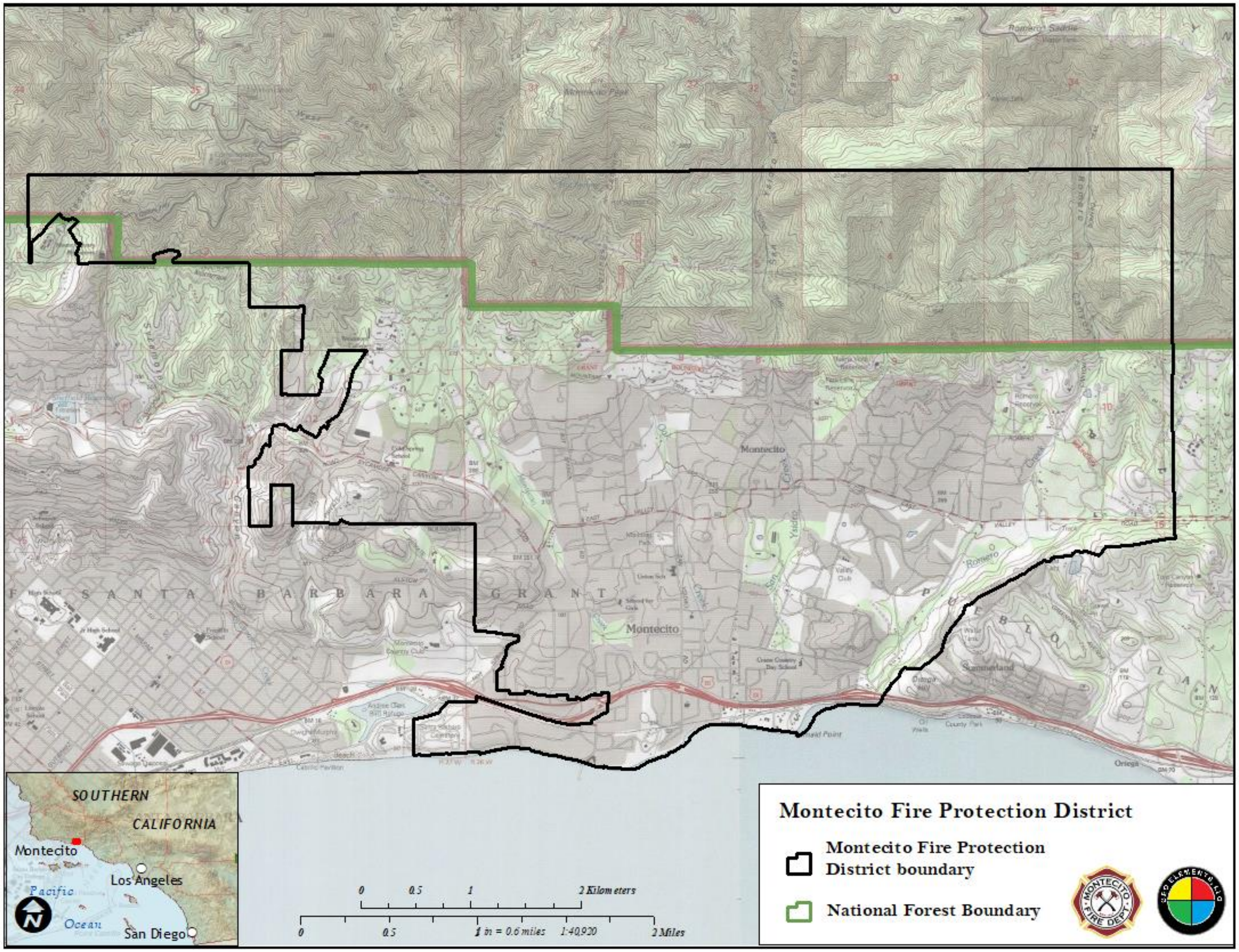


Figure 1 Project Boundary Map

The goals of MAGDS include: 1) To preserve, protect and enhance the existing semi-rural environment of Montecito; 2) To enhance the quality of the built environment by encouraging high standards in architectural and landscape design; 3) To ensure neighborhood compatibility of all projects; 4) To respect public views of the hillsides and the ocean and to be considerate of private views; 5) To ensure that architecture and landscaping respect the privacy of immediate neighbors; 6) To ensure that grading and development are appropriate to the site and that long term visible scarring of the landscape is avoided where possible; 7) To maintain the semi-rural character of the roads and lanes; and 8) To preserve and protect native and biologically and aesthetically valuable nonnative vegetation or to ensure adequate and appropriate replacement for vegetation loss. Throughout the document, the guidelines address the need for property-owners to follow fire codes and utilize fire-resistant landscape vegetation. It also includes the requirement for screening structures, walls, and fences with vegetation. Throughout most of the community, large hedges or vegetation (native and non-native) line the road system.

History of Montecito's Wildland Fire Program Policy and Actions

On June 27, 1990, the Painted Cave Fire started in Santa Barbara's front country destroying 673 residences and killing one civilian (Santa Barbara County Unit Fire Plan, 2017) with property losses estimated at 290 million dollars. Later that same year, the Tunnel Fire in Oakland, California killed 25 people and injured 150 others while destroying 2,843 single-family dwellings and 437 apartment and condominium units. Economic losses were estimated at $1.5 billion (https://en.wikipedia.org/wiki/Oakland_firestorm_of_1991). The cost, property damage, and public safety hazard of fires like these provided an incentive for fire departments in Santa Barbara's front country to address the wildfire threat in their communities.

In 1991, District staff and local fire officials created a *High Fire Hazard Area Map* and a community education pamphlet to begin the process of informing residents of Santa Barbara County on wildland fire safety issues and defensible space requirements. More stringent building code standards and defensible space standards were adopted for these *High Fire Hazard Areas* and represents an initial step to enhance public safety and structure defense within the wildland urban interface.

In 1994, under the leadership of Chief Herbert McElwee and with the support of the District Board, the District created a temporary Wildland Fire Specialist position to lead a hazardous fuels mitigation program. Although the District had a hazard abatement enforcement program in place, the emphasis of the Wildland Fire Specialist was to focus on developing more personal relationships with property-owners in the community and to develop strategies to address the wildfire hazard and risk issues. Chief McElwee set the foundation for this new position by identifying four major objectives:

1. Reduce hazardous fuels along roadsides on private property through partnerships and supporting neighborhood cleanup days that included free chipping for property-owners.
2. Enhance wildfire safety education for the community, develop one-on-one relationships with property-owners, conduct defensible space surveys, and enforce compliance with fire codes.
3. Develop partnerships within the community and neighboring jurisdictions to address wildfire hazards and risk.
4. Mitigate fire risk and hazards in the more remote areas of the District.

Based on a suggestion from Chief McElwee, the Santa Barbara Fire Safe Council was organized in 1997. The Council was tasked with serving as a liaison between the communities and fire officials as strategies were developed to address the threat of wildfire in the wildland urban interface areas of the County.

As part of this strategy, Chief McElwee authorized the District's 1998 Feasibility Study and Environmental Impact Report. These documents provided guidelines for hazardous fuel mitigation work in the District. Due to the workload identified in the Feasibility Study, the Wildland Fire Specialist position was made permanent full-time in 1999. The study also prompted then Fire Chief Ron McClain to increase the budget for hazardous fuels mitigation, necessitating the need for an additional part-time Wildland Fire Specialist to facilitate the increased workload.

In 2014, the District hired Citygate Associates to conduct an updated community risk assessment. Citygate was also tasked with evaluating the District's fire station placement plan, standards of response coverage, and assess the District's headquarters and support functions. The Wildland Risk portion of the Hazard Mitigation analysis recommended that the District "maintain existing vegetation reduction projects" while also "aggressively seeking" opportunities to expand the vegetation management program.

In order to address the needs of the hazardous fuel reduction program, in the spring of 2015, Fire Chief Chip Hickman authorized the development of a Community Wildfire Protection Plan (CWPP). The CWPP updated the 1998 Feasibility Study and brought the District into alignment with the requirements of the 2003 Healthy Forests Restoration Act. Completed in February 2016, the CWPP provided guidance and established priorities for the vegetation management program. As a result of the workload identified in the CWPP, the District Board upgraded the part-time Wildland Fire Specialist position to full-time status.

Over the last 20 years, growth of the Wildland Fire and Vegetation Management programs has resulted in increased budgets leading to the completion of more fuel treatments District-wide. Fluctuation in the annual program budget during "tight years" has challenged the District. Efforts to supplement department dollars with grant funds have proved frustrating and time-consuming, since writing grant proposals and administering grants often required District staff to focus efforts on these tasks rather than working with community members and local cooperators.

The following table displays the expenditures for Montecito's fuel treatments from 1999 through 2017.

Table 1 Budget for Montecito Wildfire Fire Program Fuel Treatments from 1999 to 2017

Fiscal Year	Budget
1999	$17,758
2000	$9,084
2001	$25,806
2002	$38,734
2003	$39,677
2004	$39,864
2005	$79,888
2006	$62,603
2007	$95,085

2008	$124,858
2009	$97,993
2010	$130,091
2011	$131,941
2012	$108,278
2013	$66,267
2014	$87,420
2015	$77,863
2016	$128,963
2017	$272,553
Total Dollars Spent	**$1,634,726**
The budgets do not include salary, benefits, or administrative costs.	

Existing Emergency Preparedness Programs and Community Education

Since 1994, the District has assembled a range of programs that facilitate wildfire preparedness and education, including the 1998 Feasibility Study, 2016 Montecito CWPP, Ready! Set! Go! Plan, Fire Danger Rating, District Signage Program, Wildland Fire Initial Attack Plan, Montecito Emergency Response and Recovery Group (MERRAG), and Reverse 911. The District also maintains an online survey to provide the community with an opportunity to offer feedback on the District's performance.

Santa Barbara County and regional emergency preparedness and wildfire education programs, such as the Santa Barbara County Office of Emergency Management (OEM), American Red Cross, Santa Barbara Amateur Radio Emergency Service (ARES), Equine Evacuation, Santa Barbara Humane Society, and Volunteer Organizations Active in Disasters (VOAD) also serve the local community.

In 2014, Citygate Associates as part of their Standard of Service assessment conducted an Internet-based community survey regarding fire service. Their report recognized the District as having an active outreach and community education program with approximately 72.6 % of survey respondents having had direct contact with the District. The District received a rating of excellent from 74% of respondents in regards to public education while 24% gave a rating of above average. Additionally, 83% of those respondents rated MERRAG as excellent. The vast majority of those that responded rated the District's performance in public education in schools as excellent.

The survey respondents felt that the abatement of hazardous fuels was above average and personal inspection by the Wildland Fire Specialists of the vegetation ordinance was excellent. Additionally, Citygate's report included a comments section where respondents gave the District a number of very positive comments about their community education program and the personal relationships they felt with the District.

A participant in a public meeting following the 2008 Tea Fire stated that she had done everything that a Wildland Fire Specialist suggested during his "Defensible Space Survey", including evacuation planning, and that she was safe and her property was undamaged because of interaction with District staff.

Structures

Data does not exist on the construction material used on all buildings in Montecito, but structures in the community range from historic and legacy buildings constructed prior to modern building and fire codes to new structures built under current codes. The CWPP offered structure hardening recommendations that served as guidelines to property-owners on how they might increase the potential survivability of their property during a wildfire. It's unknown if property-owners initiated any structure hardening activities based on these recommendations prior to the Thomas Fire.

Most housing in Montecito consists of single-family residences on lots that vary widely in size but are more tightly spaced in areas south of Highway 192. Increased lot sizes are found as one moves uphill from the village core, with most properties in the northern reaches of the community adjacent to the wildlands including both a main residence and a guest house, in addition to outbuildings, pool houses, and gated driveways (See Figure 2).

Structures north of State Highway 192 (East Valley and Sycamore Canyon roads) and the eastern portion of the District (east of Romero Canyon Road and Lilac and Mariposa Lanes) are closest in proximity to the wildland vegetation of the Santa Ynez Mountains. Many properties have access and egress issues related to narrow winding roads and driveways, slope, topography, gates, bridges, or roadways fringed with heavy concentrations of wildland and landscaping vegetation. These issues have the potential to limit the type of fire apparatus that can safely engage in structure protection during wildland fires. The high road system consisting of Bella Vista Drive, Park Lane, East Mountain Drive, and West Mountain Drive, is the first road system where larger fire apparatus can engage in structure defense operations. Structures located north of this road system are at the greatest risk from wildfire due to long or narrow driveways that limit access or safe operational space for firefighters.

The Wildfire Environment – pre-Thomas Fire

The following describes the wildland fire environment prior to the 2017 Thomas Fire.

Weather

Situated in the coastal zone, the Pacific Ocean greatly influences weather conditions in Montecito. Fog is common on the lower slopes of the District throughout the spring and early summer, lessening in depth and duration in late summer and fall.

August is the warmest month of the year with an average maximum temperature of 74°Fahrenheit (F), although extremely hot temperatures can occur. The Montecito Remote Automated Weather Station (RAWS) recorded a record temperature of 112°F in September 2012.

The annual average precipitation in the District is 20.04 inches with the majority of the precipitation occurring between November and April. February is historically the wettest month of the year with rainfall averaging 4.44 inches (Santa Barbara County Flood Control District, 2015).

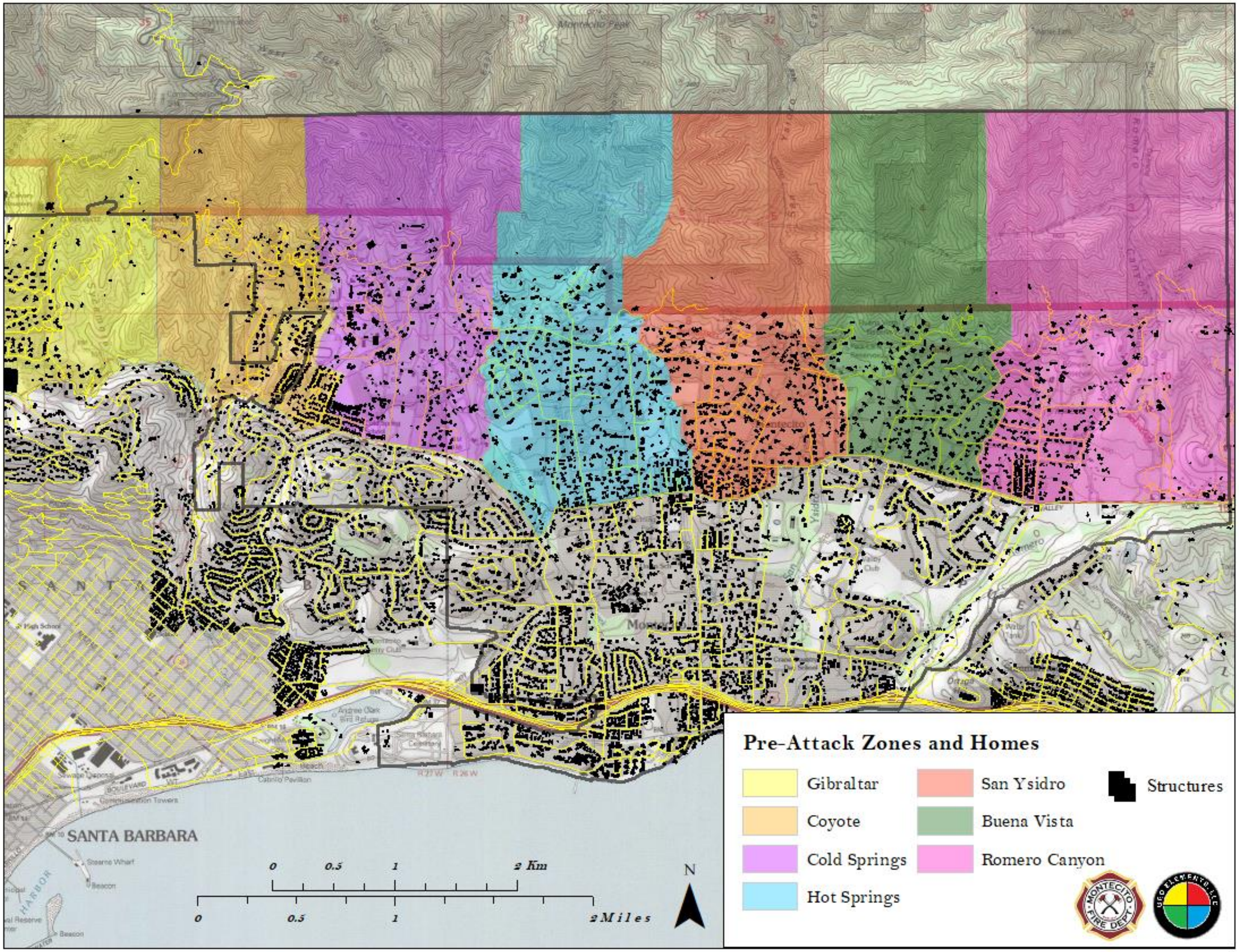


Figure 2 Pre-Attack Zones and Homes Map

Based on 18 years of wind records from the Montecito RAWS, the mean average wind speed is 4.3 miles per hour (mph) from the south/southwest. However, it is Sundowner wind events that drive large wildfire development along this portion of the Central Coast. Sundowner winds are a significant weather pattern in the Santa Barbara Front and are associated with elevated temperatures and decreased relative humidity. As these winds move downhill from the Santa Ynez Mountains, they heat through compression and are channeled along the ridgetops and through the drainages that bisect the District. Data from the 2008 Tea Fire indicate a six-hour period where wind speeds averaged in excess of 45 mph, with gusts to 72 mph.

Topography

The landscape rises dramatically from sea level along the coast to approximately 3,800 feet in the Santa Ynez Mountain Range above Montecito. Covering approximately 9.3 square miles, the District sits along the east-west trending segment of the California coastline on a low elevation alluvial coastal plain. The coastal plain is relatively flat within the southern portion of the community, but gains elevation rapidly as the Santa Ynez Mountains begin to rise towards the Los Padres National Forest. Slopes north of East Mountain Drive and Bella Vista Road in the Los Padres National Forest routinely exceed 80%.

Five major north-south trending canyons (e.g., Rattlesnake/Sycamore, Cold Spring, Hot Springs, San Ysidro, and Romero) originate from the Santa Ynez Mountains and bisect the community. These drainages descend sharply from the ridgetop before flattening as they pass through the developed portions of the community. The drainages help define the natural environment of the community but can also channel and accelerate offshore winds.

Dominated by a cool, moist climate, the southerly aspect that dominates the community helps support the rapid growth of native vegetation. Little difference can be noted between the fuels on north or south facing slopes as the marine climate overpowers the influence of aspect on fuel characteristics.

Vegetation/Fuels

The slopes above the community consisted of 53-year old mature chaparral with some grasslands and oak woodlands under management of the Los Padres National Forest. Riparian areas consisted of deciduous and evergreen vegetation. The northwestern portion of the District that burned in the 2008 Tea Fire was significantly different, consisting of 10-year old re-sprouting chaparral.

The northern portion within the District boundary primarily consisted of mature stands of chaparral fuels intermixed with residential development on large lots with a substantial mix of natural and ornamental landscaping vegetation. As the community descends south towards the coast, the density of structures increases with some areas intermingling with wildland enclaves and vacant parcels.

Fire Ecology in the Area of Interest

The following was taken from the 2016 CWPP to describe fire ecology prior to the Thomas Fire. Chaparral covered approximately 35% of the District described as a mosaic of grasslands, shrublands, and woodlands that includes a range of native chaparral vegetation such as manzanita, Ceanothus, mountain-mahogany, flannel bush, Christmas berry, cherry, oak, coffeeberry, chamise, sumac, and sugar bush.

These species are adapted to regenerate after a fire through various means of post fire reproduction, such as:

- obligate seeders – mature plants are killed by fire and populations regenerate from seedlings that germinate the following winter or spring
- sprouters – shrubs that are top-killed by fire resprout vigorously from root crown or burl
- combination seeders and sprouters – regenerate from seedlings and resprout from root crowns or burls
- fire followers – annual and perennial herbaceous species dominate an area during the first year or two after a fire but decline within 2 – 5 years as shrub cover increases. They drop seeds that lay in wait to the next wildfire event to regenerate

These chaparral species are adapted for seasonal and larger episodic droughts with characteristics such as small evergreen resin and/or waxy leaves, leaves that roll when dry, leaves or needles with fine hairs, and older leaves that drop in the summer months.

Recent research suggests that larger widespread fire events occurring now have been occurring for at least 300 to 400 years. The smaller, more localized fires were more numerous and frequent in the past and have been nearly eliminated from the modern fire regime (Lombardo, 2012).

Fire frequency in the chaparral plant community is highest in the summer; however, the majority of the acres burned occur in the fall. The last significant wildfire activity in the chaparral plant community that surrounds Montecito occurred during the 2008 Tea Fire.

Oak woodlands encompass approximately 18% of the District including stringers of woodland areas running through the District in riparian areas. These unique environmental features occur along canyons and major drainages within intermittent streams or at the bottom of steep drainages such as Hot Springs, San Ysidro, and Romero canyons.

Under more moderate weather conditions, these riparian corridors can be partial barriers to wildfire spread due to the cooler, shaded environment produced by the overstory of coast live oak trees. The shaded conditions help to keep fuel moisture higher and fuel temperature lower than the surrounding area(s). However, under downslope wind events, such as Sundowner winds, these riparian corridors can act as a wick to bring fire from the wildlands down into more developed neighborhoods in the District. Dead material and dried herbaceous fuel within these woodlands can aid in fire spread under moderate to strong Sundowner weather conditions.

Under typical weather conditions, fire severity is often lower in oak woodlands. Most commonly, wildfire scorches riparian plants or the outermost portions of the tree canopies burn during wildfire. Oak, sycamore, and willow trees are all strong sprouters and, if fire severity is low, the vegetative structure of the riparian area can quickly recover after fire. In rare cases, entire trees can die. While some tree species can recover by sprouting, years are required to restore the pre-fire woodland canopy cover.

Wildlife depends on vegetation such as chaparral and oak woodlands for food and shelter, therefore wildfire affects their distribution by altering the structure of vegetation and availability of many foods. During a wildfire, larger mammals and bird species can move quickly away from the fire and some smaller mammals and reptiles can take refuge in burrows underground, but species that cannot leave or find protection die in a wildfire.

Unburned areas or islands within a wildfire perimeter and unburned edges of wildfires create areas of dispersal for animal populations that can travel back into burned areas as they recover. The continued existence of wildlife after a fire within and adjacent to Montecito is determined by the habitat created and vegetation recovery post fire.

Pre-Thomas Fire Fuel Treatments

The focus of the District's vegetation management program is to protect life safety[1] and prevent community losses during a wildfire through the increased efficiency of firefighting resources. This program balances the need for wildfire hazard mitigation and structure hardening with requirements to maintain the semi-rural setting of Montecito through the protection of the biological and vegetative diversity of the community.

Montecito's vegetation management program follows the recommendations of the 1998 Montecito Community Fire Feasibility Report and the 2016 Montecito CWPP. These documents identified and prioritized fuel treatments in the community and include projects that address roadside fuel treatments and the enhancement of defensible space around structures.

The District provides leadership in projects involving public and private partnerships on private lands including roadside fuel treatments while some property-owners initiate and implement fuel treatment projects on their own lands without the District directly facilitating the work. These projects form a network of fuel treatments primarily across the northern portion of Montecito, many of which were completed prior to the Thomas Fire. Adjacent jurisdictions have also completed fuel treatment projects that reduced the level of wildfire hazard at a landscape level. These treatments included work performed by Santa Barbara City in the vicinity of Skofield Park and Las Canoas Road, and projects led by the Carpinteria-Summerland Fire Protection District in the vicinity of Ladera and Viola Lanes (See Figure 3).

Thomas Fire Chronology

Prior to the Thomas Fire, southern California had been in the midst of a severe drought that began late in 2011. However, during the winter of 2016-2017 Montecito received 31.02 inches of rain or 115% of normal precipitation. This heavy precipitation led to a robust grass crop with heavier than normal amounts of light, flashy fuels. While the winter of 2016-2017 helped to temporarily relieve the drought, its effects were still present with an increased volume of dead vegetation due to chaparral die back across the landscape.

Unfortunately, the winter precipitation abruptly ended by the beginning of March 2017. Grasses quickly cured and, as is normal in southern California, woody live fuels began to gradually dry through the summer and fall months. By September 15th, live fuel moistures across the Los Padres National Forest were approaching critically low levels.

[1] Life safety considers both the life and physical well-being of all people in a community.

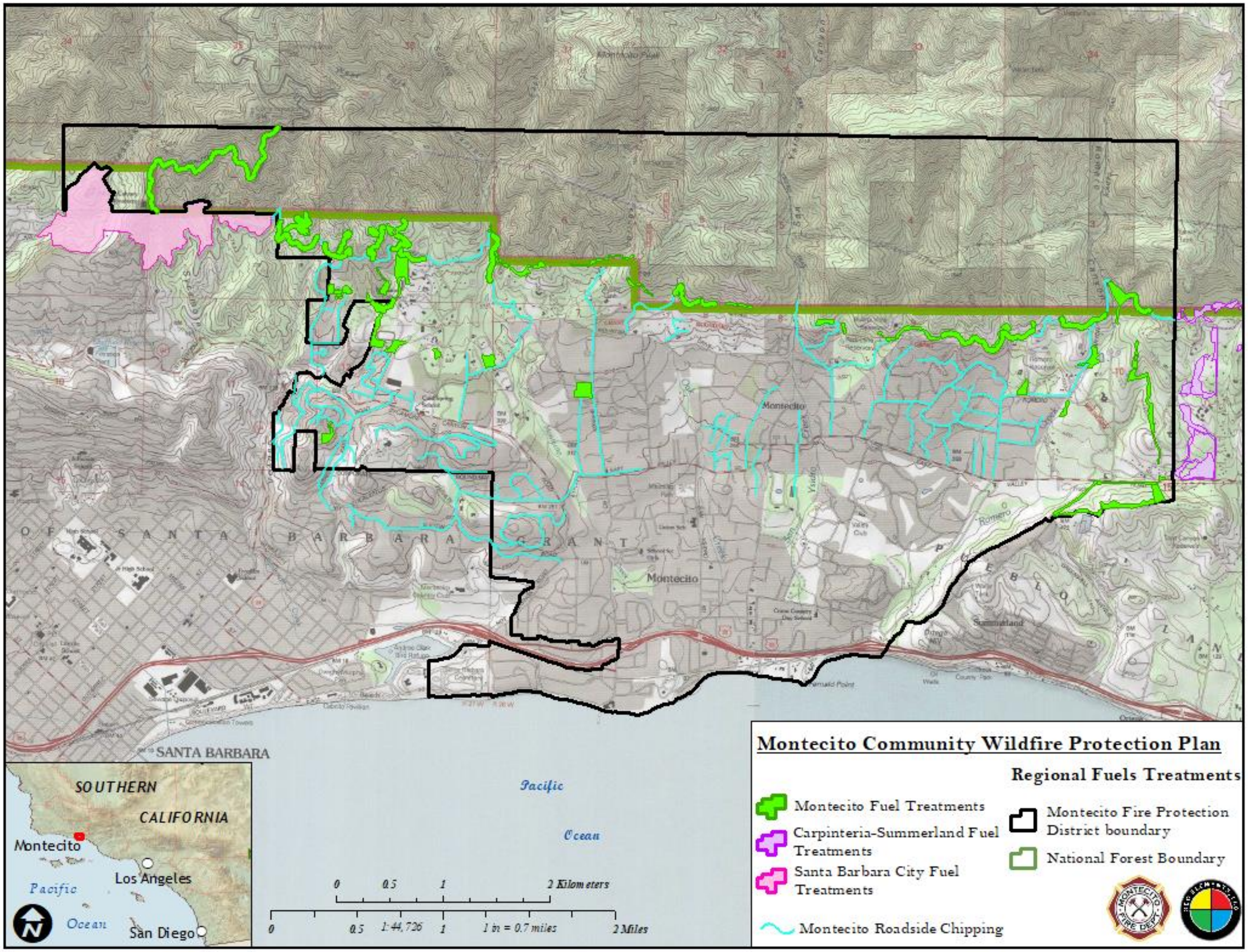


Figure 3 Pre-Thomas Fire Fuel Reduction Map

While winter precipitation typically returns in October and November with most areas seeing some appreciable rainfall by Thanksgiving, little to no precipitation occurred during the fall of 2017. By early December, fuel conditions in southern California included abundant cured fine grasses, live fuels approaching critically low moisture levels, and an increased dead fuel loading. These conditions can support large fire growth, especially when accompanied by Red Flag weather conditions.

During the last week of November 2017, a persistent high-pressure system stalled over the Great Basin and brought unseasonably high temperatures with low relative humidity, and northeast Santa Ana winds to southern California. On December 1, 2017, the Oxnard National Weather Service Office issued a Fire Weather Watch for the Ventura and Santa Barbara areas, which was upgraded to a Red Flag Warning for Saturday December 2nd. This Warning extended through Thursday December 7th for areas within the counties of Santa Barbara, San Bernardino, Riverside, and San Diego. With this developing weather event, conditions were primed for explosive fire growth.

On December 4, 2017 at 6:35 p.m., a fire was reported just east of Steckel Park in Ventura County north of Santa Paula and south of Thomas Aquinas College. Under Red Flag Warning conditions, the Thomas Fire spread rapidly into the communities of Upper Ojai, Santa Paula, and Ventura. Weather conditions recorded at the Wiley Ridge Remote Automated Weather Station (RAWS), located east of the community of Fillmore, indicated that strong winds had developed in the Santa Clara River drainage between the communities of Santa Clarita and Ventura. The average wind speed recorded on December 4th at this RAWS for 6:00 p.m. was 34 miles per hour (mph) with gusts up to 51 mph. Relative humidity was measured at 11%. These strong winds and low humidity contributed to the explosive fire behavior and widespread ember cast reported by initial attack firefighters.

On December 9th, firefighters began to re-open the Camino Cielo Fuelbreak that runs along the Santa Ynez Mountains ridgeline. Work to re-open the Windy Gap Fuelbreak started on December 10th, a lateral fuelbreak that runs south along a lateral ridge east of Painted Cave. Firefighters have historically used dozers on these fuelbreaks as tactical opportunities for fighting wildfires in the area.

By December 11, 2017, incident managers of the Thomas Fire had created the *Santa Barbara Zone* of the fire and had begun staffing areas called Divisions[2] within the community of Montecito. The fire's progress somewhat slowed from December 11th through the 13th; however, opportunities for firefighters to directly engage the fire were limited. Initially, engine strike teams were placed in Montecito during a three day period to become familiar with the road systems and structure access.

By December 15th, more than 130 engines and 30 crews had been assigned to Montecito. Work assignments identified for the fire resources included "construct and improve fireline" and "prepare for structure defense". These work assignments translated on the ground into brush clearing around structures, building fireline across the upper end of the community in an attempt to isolate structures on the high road system from the approaching fire, and establishing hose lays in and around structures for use during structure defense.

[2] Divisions are used to divide an incident into geographical areas of operation. Divisions are established when the number of resources exceeds the span-of-control of the operations chief.

Some suppression actions could be spatially documented from the Incident Action Plan and from high-resolution satellite imagery acquired on December 19th. By December 15th, indirect dozer line had been completed above Montecito, along the Camino Cielo Fuelbreak from Romero Saddle west to Paradise Canyon Road near Highway 154. Additionally, at least 7 miles of retardant line had been laid and over ¼ mile of hand line had been constructed in preparation for the fire moving towards Montecito (See Figure 4).

Structure defense preparation started in Montecito on December 11th with a plan to use the east/west high road system to hold fire above the community and to utilize the 2008 Tea Fire and 2009 Jesusita Fire areas as control features on the western end of Montecito. By December 13th, the fire was positioned above the community of Montecito in the vicinity of Romero Canyon and had touched portions of the upper road systems in the community along Bella Vista Road. During the interviews with Geo Elements, firefighters stated that they anticipated high structures losses in the event of a Sundowner wind.

On Thursday, December 14, 2017 at 12:10 p.m., the CAL FIRE Director confirmed a firefighter fatality has occurred earlier that morning. Engineer Cory Iverson, 32, died while fighting the Thomas Fire above the community of Fillmore in Ventura County. The fire had expanded further to 249,500 acres.

By December 15th, the fire had grown to 259,000 acres and containment had increased to 40%. Another round of strong offshore winds were in the forecast for the morning of December 16th. By the evening of December 15th, the fire had pushed west into the area above Bella Vista Drive on the eastern end of Montecito. Fire behavior was described by interviewees as backing downhill with relatively moderate flame lengths and minimal spotting. That evening the fire burned up to and around the edge of several residences and properties on Bella Vista Drive.

December 16th – As predicted, the Sundowner winds developed around 6:00 a.m., increasing fire behavior significantly in the Santa Barbara Front Country (See Figures 5 and 6). The winds created a fundamental shift in fire behavior, where what previously had been a lower intensity backing fire now became a wind driven fire spreading downslope with higher-intensity and with greater spotting distances.

This transition in fire behavior was estimated by firefighters to have occurred in the drainages just east of Park Lane Reservoir, around the area of the Buena Vista trail. The fire made a southward push into the community of Montecito destroying seven primary residences and damaging or destroying 40 additional structures and outbuildings, even as a large number of firefighting resources were prepositioned in anticipation of this wind event. The fire extended its growth into the community in the north/south-oriented drainages of Romero, San Ysidro, and Hot Springs canyons and spotted into the Parma Park and other downwind areas. The majority of the fire was held above the high road system with a few slop-overs, and several small spot fires between the main front and Highway 192 in the Montecito Creek area. Spot fires did occur within the community as some of these fires were obscured from the view of firefighters by large hedges, fences, and screening vegetation.

As the fire advanced, the voluntary evacuation zone in Santa Barbara County was extended to include portions of Highway 154 and the community of Painted Cave while crews continued to hold the Camino Cielo Fuelbreak above Montecito preventing the fire from establishing itself along Gibraltar Road. By the end of the burning period, the fire had spread into the 2008 Tea Fire and 2009 Jesusita Fire footprints

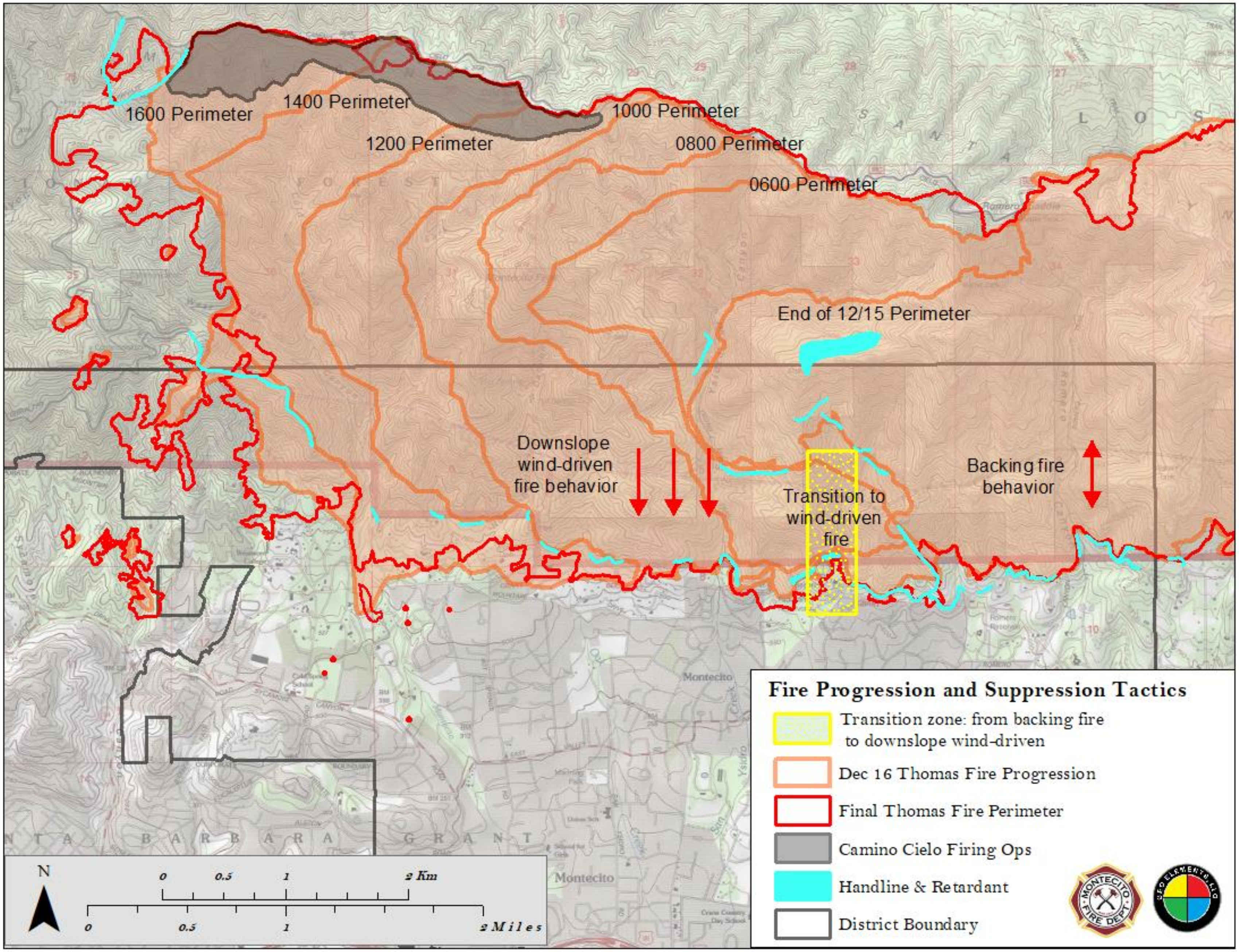


Figure 4 Fire Suppression & Suppression Tactics Map

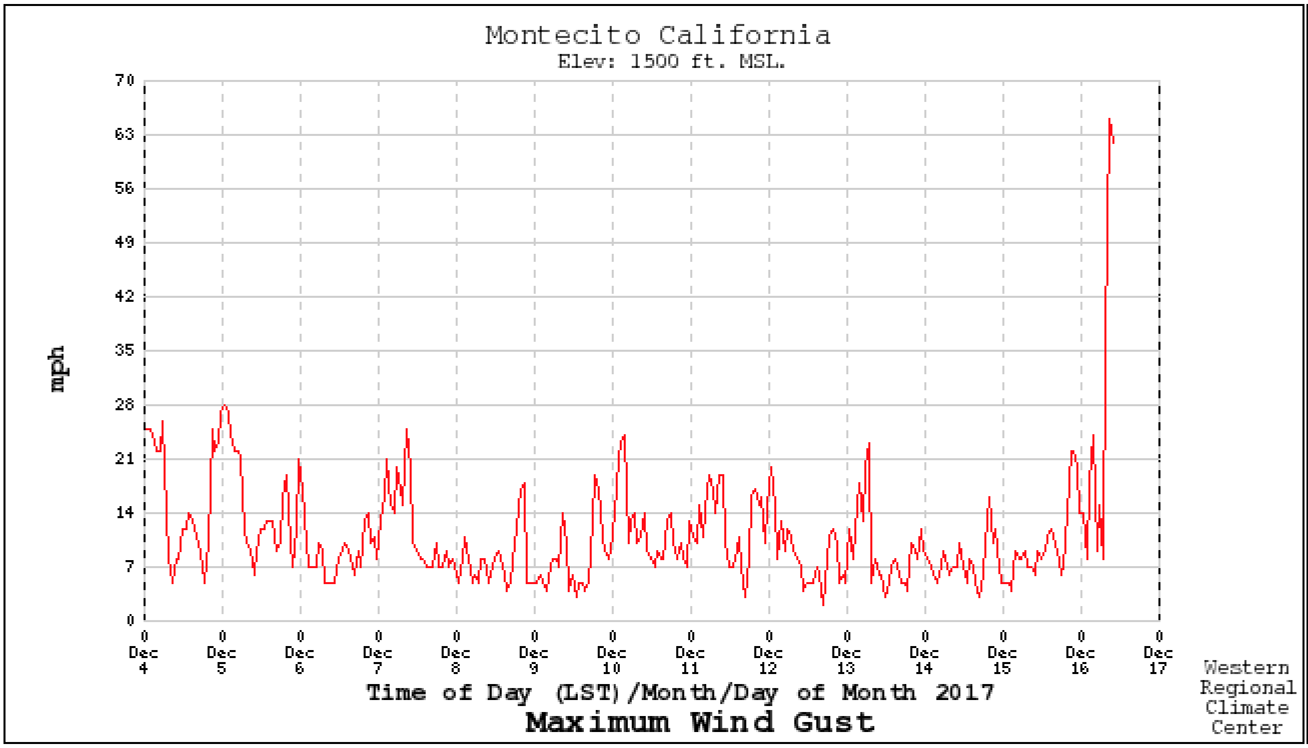


Figure 5 Maximum wind gust

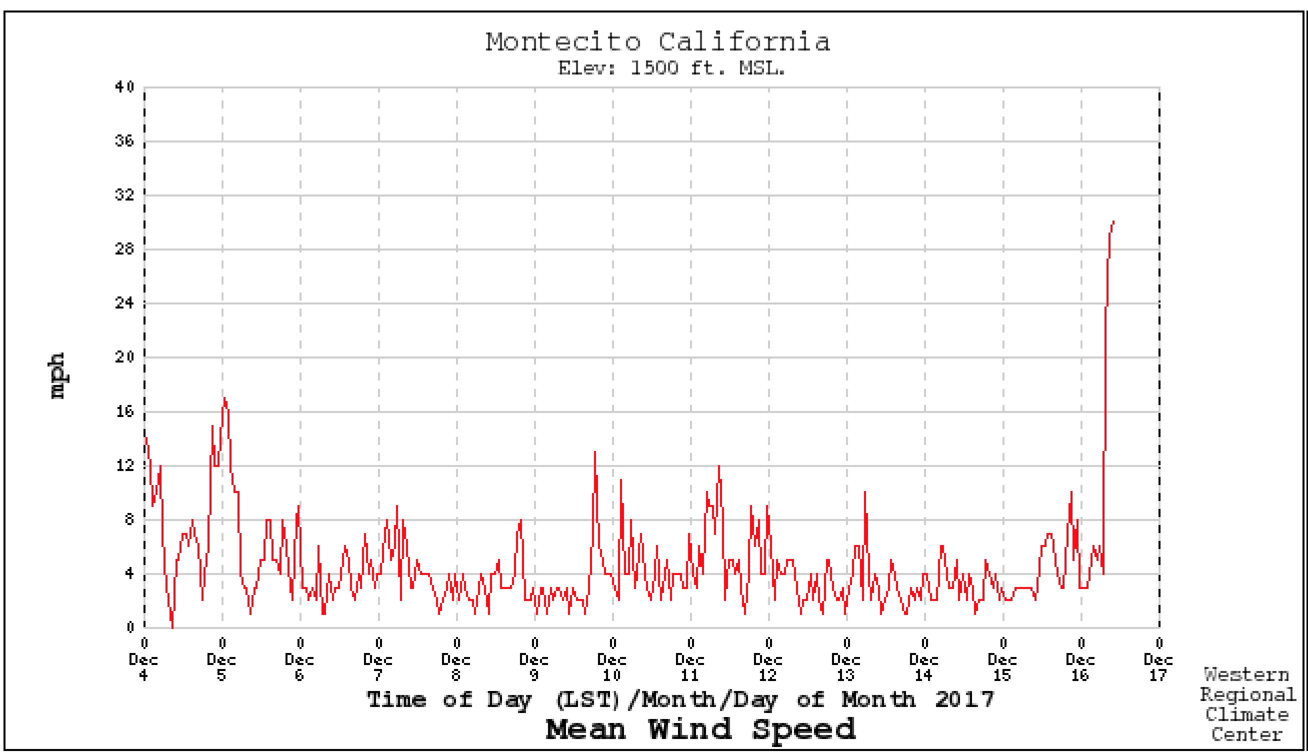


Figure 6 Mean wind speed

where the reduced fuel loads significantly moderated fire behavior, thereby allowing ground resources to successfully protect structures along the western portion of Montecito. Infrared imagery showed only scattered heat from spot fires that did ignite within the 2008 Tea and 2009 Jesusita fires' burn areas. By 6:00 p.m., the fire had burned an estimated 267,500 acres and was 40% contained.

On December 17th, the Thomas Fire expanded to 270,000 acres, was 45% contained and had reached the burn scars from the 2008 Tea and the 2009 Jesusita fires. Weakening offshore winds in the evening allowed firefighters to make progress in containing the fire, decreasing the threat to structures in Montecito and Santa Barbara. Firefighters successfully held the Camino Cielo Fuelbreak above the community and prevented the fire from expanding into Gibraltar Canyon.

After December 17th, fire activity decreased significantly with the majority of the fire's growth associated with firing operations deep in the Los Padres National Forest. On January 12, 2018, the fire was declared 100% contained.

During the Thomas Fire, southern California experienced the longest Santa Ana event in the last 70 years in an area that has been burned repeatedly by Santa Ana fires, and burned into a region where there were no prior Santa Ana fires. Southern California experienced the longest sustained number of consecutive Red Flag Warning days at 12 days.

Over the course of 39 days, the Thomas Fire became the largest wildfire in modern California history burning a total of 281,893 acres, destroying at least 1,063 structures while damaging 280 others (as of August 2018, it is now the second largest fire). The fire became the eighth most destructive wildfire in state history (the 2018 Mendocino Complex Fire has replaced the Thomas Fire as number seven) causing over $2 billion (2018 USD) in damages, including more than $230 million in suppression costs (Kolden and Abatzoglou 2018). See Figure 7 for the fire progression map of the Thomas Fire.

Final statistics for the Thomas Fire include:

- Acres Burned: 281,893
- Fatalities: 1 civilian in car crash during evacuation; 1 firefighter – both in Ventura County
- Total Structures Damaged: 280
- Total Structures Destroyed: 1,063 (including 7 primary dwelling units and 7 additional dwelling units in Montecito)
- Maximum Number of Personnel Assigned: 8,529
- People Evacuated: 103,253

Subsequent Debris Flow

On January 9, 2018 at 3:30 a.m., the barren slopes directly above Montecito on the Santa Ynez Mountains received approximately 0.54 inch (13.7 mm) of rain in 5 minutes. The precipitation quickly exceeded the infiltration capacity of the hydrophobic soils, and the rainfall concentrated into drainages and creeks, carrying large quantities of sediment and boulders into Montecito. The volume of the debris flows, which was calculated by United States Geological Survey as a once-in-two hundred year-event, exceeded the debris basin capacity of the affected drainages and soils, rocks, and boulders spilled out of the drainage channels and into the upland areas and neighborhoods. The high-force debris and mudflows resulted

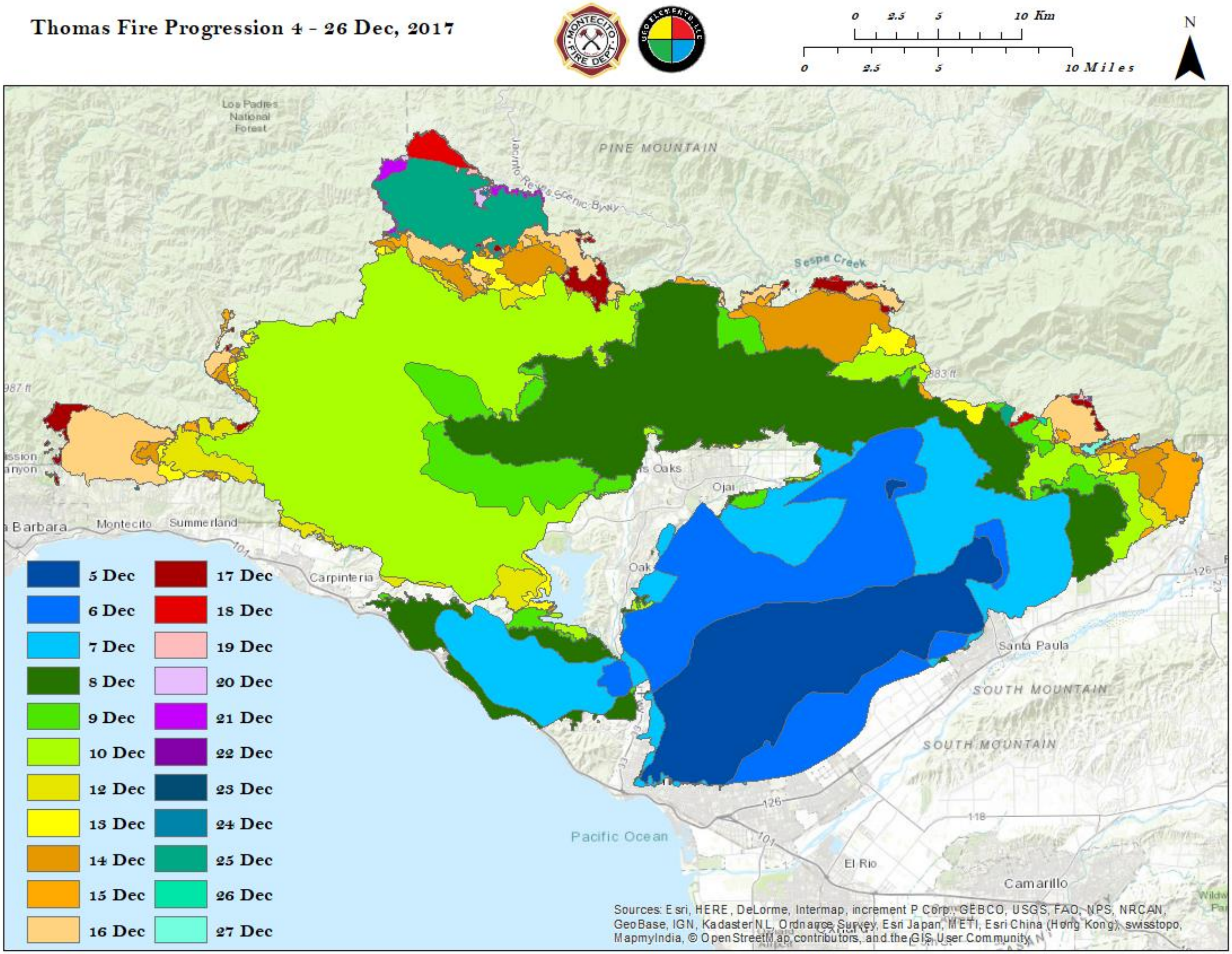


Figure 7 Thomas Fire Progression Map

In 23 fatalities (21 confirmed, 2 missing and presumed dead), 163 residents injured, and over 400 structures damaged or destroyed. The estimated economic impacts of the fire and flood to Santa Barbara County exceeded half a billion dollars.

The Aftermath of the Thomas Fire

The following describes the results with discussion of the analysis.

Structures Destroyed or Damaged by the Thomas Fire

Both the 2016 CWPP Fire Run Damage Assessment and firefighters anticipated that structure losses could be significant. During interviews, firefighters shared that they anticipated significant structures losses in the community and were surprised as to "why loss was so low" and why "structure counts weren't in the hundreds" and that they didn't feel "confident loss would be low". One firefighter was asked by a fire chief "what was the estimated structure loss" after the fire burned into Montecito on December 16th and he responded, "a high number".

Another firefighter thought that vegetative screening required in the Montecito Community Plan may have carried fire down Ashley Road and several others stated that the height of the screening obscured the view of spot fires from firefighters. By the time the spot fires were detected, more time and fire apparatus were required to extinguish these fires.

A few interviewees noted that many assigned units were initially uncomfortable going up the long driveways and lanes commonly found off of the primary travel routes due to lack of a safe operational space and an adequate escape route. This fear was abated when they saw the District's *Wildland Fire Initial Attack Plan* and understood the level of fuels reduction work that had been completed across the District. The availability of local intelligence and personnel to share local knowledge is consistent with the development of *slides* or *mental maps* that allow personnel to rapidly understand an area and feel comfortable enough to engage the fire, despite having a limited time to prepare for the fire's arrival.

Interviews conducted with District staff and firefighters assigned to the Thomas Fire, along with geospatial analysis, reveals further insights into the number of residences that survived undamaged under extreme burning conditions. Interviewees made it clear that the pre-attack planning, including the availability of paper and digital maps facilitated the development of solid situational awareness. Having pre-attack plans that identified structure locations, roads, hydrants, gates and gate codes and potential control features was critical to non-local firefighters becoming familiar with the operational area. The availability of the District's staff to share local knowledge was vital to both individual structure defense and fire managers.

Structure Assessment

Part of the challenge of assessing structure damage is the wide range of structure types found across the District. Geo Elements staff used two separate data sources to construct a general damage assessment of all structures, and a more detailed damage assessment of residences damaged or destroyed by the fire. District personnel conducted a damage survey using the Fulcrum Natural Hazard application, which included 40 properties. CAL FIRE conducted an independent structure assessment across the entire Thomas Fire that found 20 residences damaged and 13 residences destroyed within the

District, but CAL FIRE did not distinguish between primary residences and guest houses or outbuildings that were permitted as habitable. Additionally, there were errors in the CAL FIRE dataset based on data surveys done by District personnel (i.e., property was identified as damaged by CAL FIRE but no damage was found by the District). As these two datasets overlapped but were not equivalent, it required aggregating and characterizing the data as primary residences (primary dwelling units), secondary residences such as a guest house (permitted as an additional dwelling unit), and other outbuildings and structures (e.g., pool house, barn).

Geo Elements staff confirmed seven primary dwelling units (PDUs) destroyed, seven additional dwelling units (ADUs) destroyed, and 37 total addresses with some level of damage or destruction (many addresses had more than one structure damaged), including destroyed outbuildings and trailers, and damage to gates, burned landscaping, and other structures (See Figure 8 and tables 2 and 3). Additionally, the roof of one of the holding reservoirs for the Montecito Water District was destroyed. While damage was quantified as percent damaged in six classes (1 - 9%, 10 - 25%, 26 - 50%, 51 - 75%, 76 - 99%, and 100% destroyed), nearly all of the damaged structures in Montecito fell into the two categories at the extremes: 1 - 9% and 100% destroyed.

Because so few PDUs were destroyed by the Thomas Fire in Montecito, it is difficult to summarize *common denominators* as to why these structures were lost, and impossible to conduct a significant statistical analysis of structures loss. However, the destroyed PDUs and ADUs generally were associated with one or more of three primary factors. First and most important based on our interviews, properties that were inaccessible and unsafe for firefighters to defend were at greater risk of being destroyed. All but one of the destroyed PDUs was located above the east-west high road system, and all were located up long, winding driveways away from the main roads, with no large turnaround areas for fire apparatus. This lack of access and safe operational space allowed spot fires on or adjacent to a structure to spread, eventually destroying the structure. Had fire apparatus been able to safely establish defensive positions or access these locations following the passage of the primary fire front, it is conceivable that the structures would have been saved or damage to the structure minimized.

Secondly, these PDUs and ADUs all had a receptive fuel somewhere immediately adjacent to or as part of the structure. While several of the affected properties had some level of vegetation clearance, none of them met the California Public Resource Code 4291 defensible space standards, which stipulates there is no flammable vegetation or landscaping material within 30 feet of the home's exterior. At most properties, there were trees or bushes adjacent to the structure, a wooden attachment (deck, fence) attached to a structure, or exterior flammable material leaning up against the structure.

Finally, it is also notable that two of the PDUs and three of the ADUs destroyed were located below a gap in the Montecito fuel treatment network, just west of Hot Springs Road. This gap was identified by the District's Wildland Fire Specialist as a potential point of weakness in the fuel treatment network prior to the Thomas Fire. Unfortunately, this gap aligned with the primary fire front as it moved into the community on December 16th. All five of these destroyed PDUs and ADUs were surrounded by dense vegetation, with trees overhanging the driveway and homes, and it is likely that these structures were exposed to substantial ember wash, intense heat, and direct flame impingement.

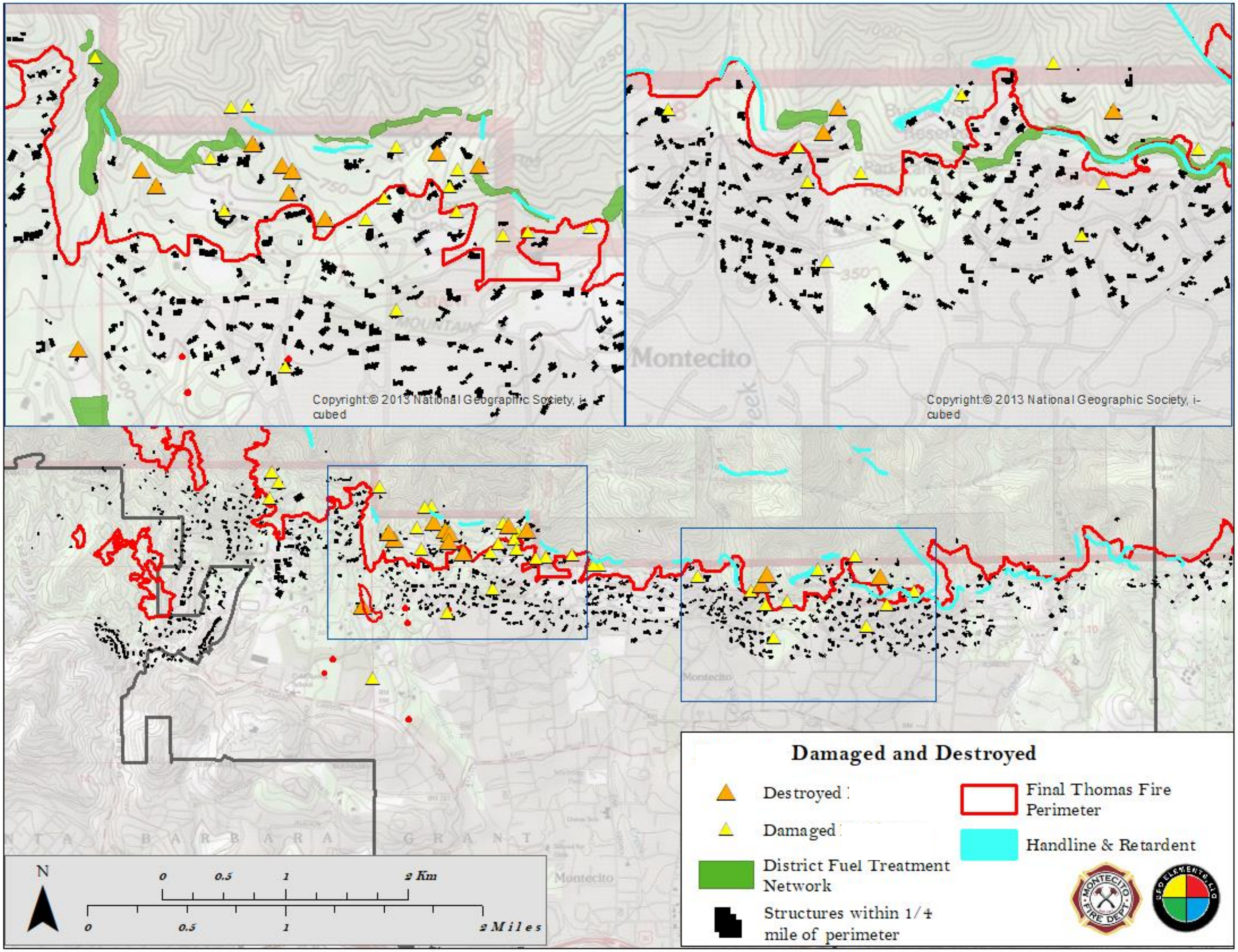


Figure 8 PDUs and ADUs Damaged and Destroyed Map

In contrast to the destroyed PDUs and ADUs, most of the damaged PDUs and ADUs were located at addresses where at least some hazard reduction efforts had been undertaken or where the property-owner had developed defensible space. Several properties were accessible and safe for firefighters to engage in structure defense or fire following tactics.

Nearly all damaged PDUs and ADUs experienced only minimal (1 - 9%) damaged. Damage was variable, but most frequently consisted of an ember ignition in vegetation adjacent to a structure or gate, and some charring, melting, and minimal combustion of the structure. Several outbuildings were destroyed or damaged, but it is notable that most of these structures are not generally built to the same codes as the PDUs. That the outbuildings were destroyed or damaged and the PDU was, in most cases, not damaged is evidence of the effectiveness of the California fire codes and speaks to the importance of adequate access for fire apparatus and defensible space in structure survivability during wildfires.

Finally, it is worth noting that many PDUs and ADUs near the fire front were not destroyed or damaged, despite the despite the heavy ember cast and long-range spotting distances observed by firefighters. The furthest known spot fire from the main fire perimeter was over ¾ mile downslope, and multiple spot fires were mapped ¼ - ½ mile from the main fire front. Spatial analysis was used to identify all structures within ¼ mile of the main fire perimeter that were also within the boundaries of the District. Thirty-seven addresses within the District had structures identified as being damaged or destroyed, while approximately 430 properties were undamaged (1 – 2% destroyed depending on how addresses are categorized). This suggests a 92% success rate for structure defense with only 1-2% of all structures identified destroyed by the fire.

Primary Dwelling Units Destroyed and Damaged

Table 2 summarizes PDUs damaged or destroyed (destroyed PDUs are highlighted in bold font). To identify individual PDUs, this report uses street names, the year the original home was built at the address as identified by the Santa Barbara County Assessor, the damage level identified by the District or CAL FIRE, if the property had defensible space as determined from satellite data, and a brief description of the damage and contributing factors of this damage.

Table 2 Summary of PDUs Damaged or Destroyed Inside the Thomas Fire Perimeter

Location	Type*	Year Built^	Damage Level (%)	Defensible Space	Notes
Park Hill Lane	**PDU**	**2007**	**100**	**Some**	**Had decent clearance, but riparian area with dense vegetation was directly adjacent to the property. This prevented the property-owner from doing any clearance to the east. No turnaround area for fire apparatus making it inaccessible/unsafe for fire following tactics.**

Park Hill Lane	**PDU**	**1965**	**100**	**No**	**Vegetation around PDU, dense vegetation in drainage, no turnaround for fire apparatus made it inaccessible/unsafe for fire following tactics.**
Park Lane	**PDU**	**1988**	**100**	**Some**	**Good clearance with irrigated vegetation adjacent to the structure; likely window or door left open to embers. No turnaround for fire apparatus to safely employ fire following tactics.**
Hot Springs Lane	**PDU**	**1984**	**100**	**Yes**	**Had good clearance, but a courtyard with flammable materials in center of structure; likely facilitated ember ignition. Unsafe access for fire following.**
East Mountain Drive	**PDU**	**1902**	**100**	**No**	**Old structure, lots of materials around exterior, per property-owner. Some understory thinning, but unsafe or inaccessible for fire following. Both the PDU and ADU were destroyed.**
East Mountain Drive	**PDU**	**1993**	**100**	**No**	**No fuels reduction on or above the property, gap in Montecito fuel treatment network. Unsafe access for fire following. Both the PDU and ADU were destroyed.**
East Mountain Drive	**PDU**	**1984**	**100**	**No**	**No fuels reduction on or above the property, gap in Montecito fuel treatment network. Unsafe access for fire following. Both the PDU and ADU were destroyed.**
Oak Creek Canyon	PDU	2008	10-25	Some	Some clearing, but dense vegetation was adjacent to PDU. Ember caught in roof tiles burned into attic, water damage from sprinklers.
Park Lane	PDU	1989	10-25	Some	Good clearance, but with trees still overhanging PDU. Hole in roof, likely due to ember caught in tiles.
Oak Creek Canyon	PDU	2008	1-9	Yes	Good defensible space. Minor superficial damage to a wall from a burned cypress tree planted next to it.
Park Lane	PDU	2001	1-9	Yes	PDU had good defensible space on all sides. Damage unknown (assessed by CAL FIRE).

East Mountain Drive	PDU	1991	1-9	Some	Minor damage to PDU and ADU. Some thinning. Active fire suppression from a Branch officer during fire fight.
Riven Rock Road	PDU	1995	1-9	No	Assume ember ignition damage since the property is >¼ mile from main fire perimeter. No additional info.
Knollwood Drive	PDU	1949	1-9	Some	Several tall trees overhanging the PDU. Damage to roof-mounted solar panels.
Hot Springs Lane	PDU	2008	1-9	Some	Good clearance around the property. Slight scorching of exterior wall from a bush or shrub that burned.

Details on Primary Dwelling Units Destroyed

The following provides details on the properties where PDUs were destroyed. For some of these addresses, ADUs or outbuildings were also destroyed or damaged. Yellow lines visible on the satellite imagery approximate the property boundary lines; these lines are not 100% accurate due to the lack of full terrain correction in Google Earth.

Park Hill Lane – The PDU was 100% destroyed as was an adjacent PDU on Park Hill Lane. The PDU was built under current fire codes in 2007 with non-combustible roof and siding material. The PDU was physically located on the nose of a ridge.

The property-owners had developed good defensible space by clearing vegetation on north and west side of PDU out to 30m (100-feet uphill and on contour); however, the PDU sits only about 18m (60 feet) from the edge of a parcel to the east (downhill side), and no vegetation clearing had occurred on this side of the PDU prior to the fire.

The PDU sits next to a steep draw with dense fuels pre-Thomas Fire (see images below). An interviewee indicated that the fire moved down into this draw and generated substantial fire intensity in the heavy fuels. Several interviewees stated that Park Hill Lane was not a road where they felt safe conducting firefighting operations. Park Hill Lane is a narrow, winding dead end street that lacked an adequate turn around area for fire apparatus at its upper end. It is likely this PDU had either direct flame impingement from the vegetation on the east side or ember impingement on the east side. The property-owner could not improve defensible space to the east due to a riparian area (See following page for images).

Park Hill Lane - pre-Thomas Fire (Source: Google Earth)

Park Hill Lane - post-Thomas Fire (Source: Google Earth)

Park Hill Lane – This PDU was built in 1965 and was built with non-combustible roof and siding material and had dual-pane windows. There was considerable green vegetation around the PDU pre-fire with imagery showing that this vegetation was immediately adjacent to the PDU. No evidence of hazard reduction clearing is discernable from the imagery. This location is a candidate for ember ignition as the source of its damage. Firefighters were unable to conduct fire following structure defense operations due to unsafe nature of Park Hill Lane.

Park Hill Lane - pre-Thomas Fire (Source: Google Earth)

Park Hill Lane - post-Thomas Fire (Source: Google Earth)

Park Lane – Built in 1998, the PDU was destroyed in the fire. No information on the type of construction material used at this property is available. Interviewees indicated that the backing fire affected this location, so it is unlikely that severe fire behavior contributed to the loss of the PDU. The property-owner had cleared substantial vegetation on all sides of the structure, up to about 60m (200 feet) on the downhill/east side; however, substantial green vegetation was retained directly adjacent to the PDU. This structure most potentially ignited from ember cast, and firefighters speculate that the property-owners likely left a window or garage door open allowing embers to enter the structure. The vegetation on the west side of the PDU did not burn and remained green while it appears that the vegetation on the east side of the structure burned due to the structure burning. The PDU was located toward the end of a long, narrow drive and lacked an adequate turn around for fire apparatus.

Park Lane - pre-Thomas Fire (Source: Google Earth)

Park Lane - post-Thomas Fire (Source: Google Earth)

Hot Springs Lane – Built in 1984, the PDU was destroyed. No information on construction materials is available. The PDU was located at the end of a long and winding driveway that lacked an adequate turnaround for fire apparatus. Property-owners had cleared substantial vegetation away from the structure, approximately 30m (98 feet) on three sides (north, west, and south) but only 5-10m (16-33 feet) on the east side due to property line constraints. Aerial imagery indicates that the pentagon shaped structure had a courtyard in the center of the building. In the aerial photo, vegetation is visible within the courtyard. Much of the cleared area around the structure had been type converted to grass with several large trees/shrubs retained, including some vegetation immediately adjacent to the structure. The high fuel density immediately adjacent to the east could have produced considerable fire intensity and ember cast. Two scenarios are probable regarding the destruction of this structure; ignition occurred in the courtyard from embers or the ignition of the structure is a result of fire in the vegetation immediately adjacent to the east of the PDU.

Hot Springs Lane - PDU destroyed

Hot Springs Lane - PDU destroyed

Hot Springs Lane - pre-Thomas Fire (Source: Google Earth)

Hot Springs Lane - post-Thomas Fire (Source: Google Earth)

East Mountain Drive – Both the PDU and ADU were destroyed. Built in 1902, the PDU was primarily wood construction with a Spanish tile roof. The property had extensive fuels reduction done upslope of PDU pre-fire; however, there was considerable vegetation remaining immediately adjacent to PDU. Many trees around the PDU and ADU survived the fire, suggesting ember ignition in building materials. The property-owner indicated that there was substantial debris around the structures, which was currently being used as a rental property. The property had poor access and no turnarounds for fire apparatus.

East Mountain Drive – PDU and ADU destroyed

East Mountain Drive – pre -Thomas Fire (Source: Google Earth)

East Mountain Drive - post-Thomas Fire (Source: Google Earth)

East Mountain Drive – Built in 1993 of unknown materials, both the PDU and ADU were destroyed. Based on visual assessment, the structures had Spanish tile roof. This property had been identified by District staff as a structure at risk as geographically; it straddled a drainage and was in close proximity of untreated fuel along the north edge of Montecito. Some fuel treatment had been occurred pre-fire in the vicinity of an old trail; however, considerable vegetation remained before the fire with little discernable defensible space. The property also had poor road access with no turn around location for fire apparatus.

East Mountain Drive – PDU and ADU were destroyed

East Mountain Drive post-Thomas Fire

East Mountain Drive - pre-Thomas Fire (Source: Google Earth)

East Mountain Drive - post-Thomas Fire (Source: Google Earth)

East Mountain Drive – Both the PDU and ADU were destroyed. The original structure built in 1984, did not show evidence of having been updated since the original construction. Prior to the fire, heavy vegetation surrounded both structures with no evidence of defensible space. Topographically, the structures were located on a bench above an adjacent drainage. Significant tree scorch and tree mortality is evident in the post fire imagery. This suggests that direct flame impingement from an intense surface fire combined with poor access for fire apparatus likely lead to the loss of the PDU and ADU.

East Mountain Drive - pre-Thomas Fire (Source: Google Earth)

East Mountain Drive - post-Thomas Fire (Source: Google Earth)

Additional Dwelling Units and Outbuildings Destroyed and Damaged

Table 3 summarizes ADUs damaged or destroyed and other non-habitable structures. To identify individual ADUs, this report uses street names, the year that the original home was built at the address as identified by the Santa Barbara County Assessor (i.e., not necessarily the year the damaged or destroyed structure was built), the damage level for the address, whether the property had defensible space, and a brief description of the damage and factors contributing fire effects.

*Table 3 Summary of Additional Dwelling Units (*ADUs) and Outbuildings (*Other) Damaged or Destroyed. ^Year Built = year the PDU was constructed per Santa Barbara County Assessor. Rows with bold font are destroyed structures.*

Location	Type*	Year Built ^	Damage Level (%)	Defensible Space	Notes
Hot Springs Lane	**ADU**	**1987**	**100**	**No**	**PDU has defensible space, but the destroyed ADU did not. Heavy vegetation. Unsafe access for fire following.**
Hot Springs Lane	**ADU**	**1989**	**100**	**Yes**	**Pool house; had some vegetation growing on the structure, suggesting ember intrusion and ignition. Unsafe access for fire following due to long driveway.**
East Mountain Drive	**ADU**	**1974**	**100**	**No**	**Dense vegetation with no defensible space.**
East Mountain Drive	**ADU**	**1902**	**100**	**No**	**Old structure, lots of materials around exterior, per property-owner. Some understory thinning, but unsafe/inaccessible for fire following. Both the PDU and ADU were destroyed.**
East Mountain Drive	**ADU**	**1993**	**100**	**No**	**No fuels reduction on or above the property, weak point in Montecito fuel treatment network. Unsafe access for fire following. Both the PDU and ADU were destroyed.**
East Mountain Drive	**ADU**	**1984**	**100**	**No**	**No fuels reduction on or above the property, weak point in Montecito fuel treatment network. Unsafe access for fire following. Both the PDU and ADU were destroyed.**
Ashley Road	**ADU**	**1900**	**100**	**Yes**	**ADU with no code updates, adjacent to drainage where fire spotted, likely ember ignition of either structure itself or materials on deck.**
Park Hill Lane	ADU	1959	26-50	Some	Property had good clearance, especially around PDU. Guest house damaged due to combustible materials and dense vegetation adjacent.

Oak Creek Canyon	ADU	2001	10-25	Some	ADU damaged. It sat in dense vegetation at bottom of hill away from PDU; no clearance.
East Mountain Drive	ADU	1991	1-9	Some	Minor damage to PDU and ADU. Some thinning. Active fire suppression from a Branch officer during fire fight.
East Mountain Drive	Other	2011	1-9	Yes	Good clearance; storage shed and travel trailer destroyed.
East Mountain Drive	Other	2014	1-9	Yes	Minor damage to roof of non-habitable detached garage. Good defensible space.
Knollwood Drive	Other	1928	1-9	Yes	Relatively good clearance around structure, but pockets of dense vegetation still stood across the property. Tennis court fence, rain gutters, and a window damaged.
East Mountain Drive	Other	2016	1-9	Some	Outbuilding destroyed and damage to the property gate. Good clearance across the property.
East Mountain Drive	Other	2003	1-9	Some	Detached garage damaged, total loss. No clearance on north side of the property; burned at high severity.
Hot Springs Lane	Other	1989	1-9	Some	Hot tub and pergola destroyed; they were surrounded by dense vegetation. Some clearing, but trees overhanging and adjacent to the structure.
Hot Springs Road	Unknown	1999	1-9	Some	Some clearance, but still high-density fuel. Damage unknown, assessed by CAL FIRE.
Hot Springs Road	Other	1978	1-9	Some	Some clearance, but dense vegetation around the structure and across much of the property. Outbuilding on the driveway destroyed.
Oak Creek Canyon	Other	1950	1-9	Some	Motorhome on the property was destroyed. Some clearance, but pockets of dense vegetation remained.
Park Hill Lane	Other	1998	1-9	Some	Damage to pool cabana and fencing due to adjacent dense vegetation.
East Mountain Drive	Other	1967	1-9	No	Horse stable destroyed. No clearance (property sits in riparian drainage/ESHA).
East Mountain Drive	ADU, Other	1939	1-9	No	Guest cottage and greenhouse destroyed. Not fire resistant, heavily vegetated property with little clearance.
Hot Springs Road	Other	2001	1-9	Some	Some clearance. Damage limited to pergola.

East Mountain Drive	Other	1990	1-9	No	Entry gate and driveway damaged. Dense vegetation with little clearance.
Oak Springs Lane	Other	1990	1-9	No	Pergola destroyed, gate damaged. No clearance and dense landscaping vegetation.
East Mountain Drive	Other	2000	1-9	No	Outbuilding at gate destroyed. Dense vegetation, very little clearance.

Details on Additional Dwelling Units Destroyed

The following provides details on the properties where ADUs were destroyed. Three destroyed ADUs on East Mountain Drive were on properties where the PDU was also destroyed and are addressed in the previous section. Yellow lines are visible on the satellite imagery and approximate the property boundary lines; these lines are not 100% accurate due to the lack of full terrain correction in Google Earth. These images are included to illustrate that for many properties, good defensible space saved the PDU, but the ADU often lacked defensible space and was more vulnerable to the fire.

Hot Springs Road – The PDU was undamaged by the Thomas Fire while the ADU (guest house) was destroyed. Interviewees also noted that a bridge and a pump house were destroyed by the fire. Imagery indicates little or no defensible space around the ADU with heavy fuels located in the drainage below the structures. Evidence suggests a high intensity fire developed adjacent to ADU as the vegetation was completely consumed in the fire. Visual evidence suggests that direct flame impingement teamed with poor access and no turnaround areas for fire apparatus contributed to the destruction of this ADU.

Hot Springs Road - pre-Thomas Fire (Source: Google Earth)

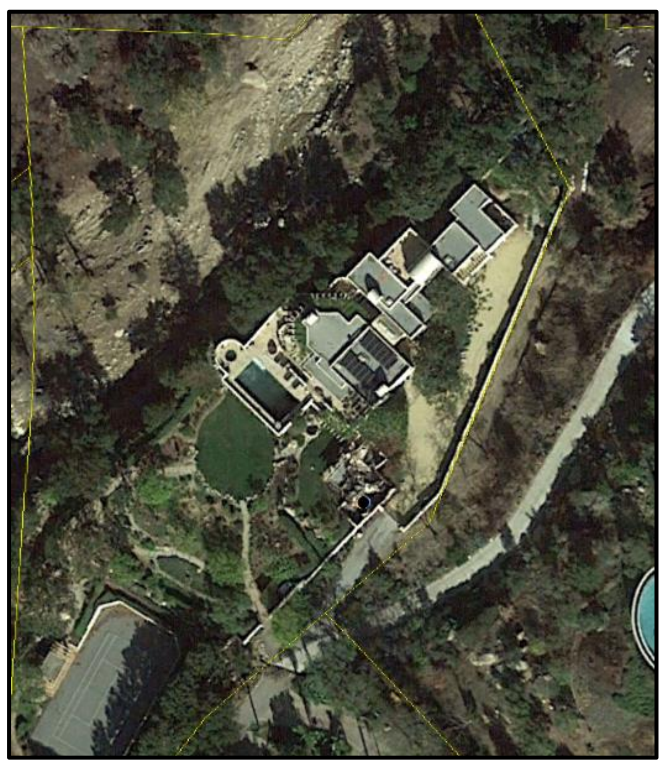
Hot Springs Road - post-Thomas Fire (Source: Google Earth)

Hot Springs Lane – Built in 1989, the PDU was undamaged in the fire while the attached pool house was destroyed. Construction material consisted of a non-combustible siding and roof and dual-pane windows. The structure did have flammable structural component attached. Some defensible space is identifiable on the southwest side of the ADU, and it appears that the property-owner had thinned the brush up to the property line on the northwest side of the property. Considerable vegetation (shrubs and trees) remained immediately adjacent to the ADU but most vegetation adjacent to the destroyed structure was green after the fire suggesting that this was an ember ignition.

Hot Springs Lane - ADU was destroyed but the PDU survived

Hot Springs Lane - ADU was destroyed but the PDU survived

Hot Springs Lane - pre-Thomas Fire (Source: Google Earth)



Hot Springs Lane - post-Thomas Fire (Source: Google Earth)

East Mountain Drive – The ADU was destroyed while no damage occurred to the PDU. Parcel data indicates the ADU was built in 1974 (likely had been a PDU). Immediately adjacent to the Thomas Fire perimeter, the fire was stopped between the ADU and PDU. Pre-fire imagery indicates that there was no defensible space, with an approximately 80% cover of dense vegetation around the ADU and PDU and on the property as a whole. This vegetative cover included mature oak and eucalyptus trees. The amount of green vegetation associated with this property post-fire suggests either ember ignition or impingement of the flaming front.

East Mountain Drive - pre-Thomas Fire (Source: Google Earth)

East Mountain Drive - post-Thomas Fire (Source: Google Earth)

Ashley Road - ADU was destroyed. This does not appear to be the PDU on the property but may have been the original homestead. This structure was built in 1900 and had a combustible roof, single-pane windows, non-combustible exterior siding (stucco or concrete), a wood deck, and unscreened vents. ADU was on flat ground and had less than 5m (16 feet) of defensible space. The ADU sat next to the Cold Spring Creek drainage with considerable riparian vegetation on the eastern side of the ADU and with a driveway separating the ADU from the vegetation. This ADU was likely ignited by embers, as photos show the wooden deck and fence partially consumed and a space underneath the deck. Debris build-up under a deck is common and ignitions from embers can easily occur in this debris. Additionally, there is evidence of debris on the deck that could have easily ignited and then supported ignition of the doors and/or entry through a broken window from fire intensity igniting burnable material within the ADU.

Ashley Road - post-Thomas Fire (Source: Google Earth)

Ashley Road – Pre-Thomas Fire on left and Post-Thomas Fire on right (Source: Google Earth)

The Fire Environment

Most elements of the fire environment described in the Montecito CWPP have not changed as a result of the Thomas Fire; however, the following describes those elements that were affected by the fire and subsequent debris flow.

Fuels

The Thomas Fire has significantly altered the fuel component of the fire environment, particularly north of Bella Vista Drive, Park Lane, and East Mountain Drive. The change is most discernable on the east side of the community where an absence of recent wildfires provided a continuous mature chaparral fuel bed to support fire spread. As the Thomas Fire spread west within the community, it interacted with both the 2008 Tea and 2009 Jesusita fire scars where a younger, less dense fuel bed acted as an inhibitor to fire spread. Firefighters who were actively engaged in suppression actions on the December 16th and 17th, 2017 stated that fire intensity immediately decreased as the main fire burned into these younger fuels and that spot fires within the recent burn areas did not actively spread.

Very little of the Thomas Fire spread south of Bella Vista Drive and East Mountain Drive and the impacts of the January 2018 debris flow had a larger effect on the fuels south of these roads than did the fire. Major drainages had the entire vegetation component scoured out or covered in debris. Narrow incised drainages, such as Romero and Hot Springs canyons, which once supported dense riparian vegetation, are now largely void of vegetation. The burned areas not heavily impacted by the ensuing flood will likely regenerate, but rates of regeneration and species composition are highly dependent upon several uncertain factors. While chaparral generally follows a well-documented post-fire recovery trajectory, wherein re-sprouting occurs rapidly post-fire and cover generally exceeds 80% within 10 years, the Thomas Fire was unprecedented in its timing, its size, and the observed post-fire effects. The lack of re-sprout four months post-fire suggests that the regeneration process may be slower or altered due to the fire intensity, drought stress pre-fire, post-fire erosion levels, or other factors. Regeneration is also dependent upon future weather, and climate change research suggests that even more extreme conditions, including drought, erratic precipitation patterns, and heat waves are likely to occur, any of which would further inhibit regeneration processes. Additionally, if invasive grasses are able to capitalize on this and establish in areas that were previously chaparral, this will fundamentally alter the fuels and the fire regime and facilitate greater probability of sooner-than-expected and more frequent fire.

It is also important to note that while the Thomas Fire consumed vegetation above the high road system, much of the District was not impacted and fuels in the more developed areas in the community remain available to burn. This is particularly important where one or more properties contribute to a dense pocket of fuel within the community, as an ignition in one of those areas could support a localized fire with the potential to impact dozens of PDUs and ADUs or more. This scenario was observed in July 2018 to the west of Montecito, when the Holiday Fire was ignited by a structure fire in a rural subdivision above Goleta. The fire consumed 28 structures, 13 of which were considered primary residences, while only burning 113 acres.

Finally, riparian fuels do not follow the same recovery trajectory that upslope chaparral areas do, and will likely take significantly longer to regenerate, particularly given the post-fire debris flow. As the debris flow removed trees to their roots, filled the stream channels, and left broad alluvial plains of uncompacted silt along drainages, it is hypothesized that there will be a significant lag in regeneration of riparian vegetation, and that continued erosion of the uncompacted alluvium over the next several years will facilitate multiple re-colonization events before riparian vegetation is able to fully establish.

Topography

Within the community, the erosion and debris flow event substantially altered topography in the riparian areas, while areas outside of this remain relatively unchanged. Above the high road system, which runs along the upper edge of the alluvial fans that underlie Montecito, channels were widened and incised in some locations by the magnitude of the debris flow. In contrast, below the high road system, the sediment dispersion along the drainages left an alluvial plain of uncompacted sediments that has raised the elevation of those areas by up to 10-15 feet in some locations. It is unknown how this will change with both debris removal efforts and further erosion in the coming years.

Fire Effects of the Thomas Fire

The Thomas Fire was a highly anomalous wildfire, even within the context of the fire regimes of southern California. The Thomas Fire occurred much later in the year than large autumn wildfires normally do, igniting on December 4th and burning into the Montecito area between December 15th and 16th. Because of the prolonged, multi-year drought in the region, water-stressed riparian species had lower live fuel moistures and were more susceptible to combustion. Upland shrub species were also highly susceptible to fire, even those in relatively young age classes. Historically, regenerating chaparral has not been combustible until after 30-40 years post-fire, due to the need for dead fuel to begin accumulating on the ground and in the crown, but extensive portions of the Thomas Fire burned in vegetation that was only 10-20 years old.

Ecologically, these conditions produced more complete fire consumption across the landscape, and particularly affected Environmental Sensitive Habitat found in riparian areas. Above Montecito, large patches of vegetation were entirely consumed, even down to the roots. Riparian areas carried fire in both the surface litter, thus scorching the tree canopies, and crown fire ran into the canopies in several drainages. White ash was evident on the soil surface; this only occurs with very high intensity fire. Such high intensity fire alters soil properties, making soils hydrophobic.

Geo Elements visited the site four months post-fire in mid-April 2018. Geo Elements staff observed the following fire effects related to the Thomas Fire in the Montecito area:

1) While the chaparral ecosystem in the area is primarily comprised of rapid re-sprouters that are fire-adapted, there was minimal re-sprout occurring on the slopes above Montecito. This is unusual, particularly as the area had received winter rains and the timing was such that re-sprouting was anticipated. The team observed entire slope patches with no visible green vegetation and no blackened shrub stumps (See Figure 9). The leads to the conclusion that even the fire-adapted shrub species were so drought-stressed and so much of the area burned at such high severity (with such low soil moisture present) that the fire induced widespread mortality of plants.

Figure 9 Aerial view of a mid-slope location above Montecito where some of the most intense fire activity occurred.

2) Riparian zones were affected at a higher than expected rate. Scorching or full consumption of vegetation was observed across many of the upper elevation drainages, with slightly less scorching observed with decreased elevation (Figure 9 above). Unfortunately, due to the debris flow event, lower elevation riparian areas at the interface with Montecito (i.e., in the built zone) were generally 100% altered from the post-fire condition, often completely cleared of trees. However, it is possible that the debris flows were, in part, able to generate considerable velocity due to the lack of live trees in the lower drainage areas.
3) Eucalyptus is a non-native tree that is widely dispersed in the region, often planted intentionally in the past. While eucalyptus is often targeted as a highly flammable and fire-facilitating species, it was observed that on properties throughout Montecito where eucalyptus trees had been limbed and maintained, they did not carry fire and were generally resistant to bole scorch.
4) Cypress is another non-native tree that is widely used for landscaping and screening in the Montecito area. In contrast to the fire-resistance we observed in some eucalyptus, cypresses were consistently consumed throughout the impact area; often well away from the fire edge. This suggests that cypress were highly susceptible fuels to the ember showers observed during the Thomas Fire. Further, many of the damaged PDUs and ADUs had burned cypress trees as the source of the flame damage, suggesting that this species is a very poor choice for landscaping within the defensible space zone.

Figure 10 Cypress trees burned during Thomas Fire

5) By contrast to the areas above Montecito where high severity fire completely consumed all vegetation across large slope patches, areas where some fuel reduction had occurred prior to the Thomas Fire had lower severity fire effects. Across much of the uppermost built area of Montecito, both property-owners and the District had conducted thinning and fuel reduction activities (see Figure 11). Within treated areas, the research team observed a much higher rate of tree and shrub survival, as evidenced by unscorched crowns and new growth post-fire.

Figure 11 Looking west across the San Ysidro drainage to an area upslope of the San Ysidro Ranch. The right side of the photo shows where no thinning had occurred, and vegetation burned at high severity. By contrast, as the fire moved into the thinned area (left side of photo), the reduction of fuel reduced the intensity from a crown fire in the chaparral to a surface fire, reducing shrub scorch and mortality, thereby facilitating more rapid regeneration of understory grasses and robs due to the lower intensity.

6) Areas where vegetation had been thinned and/or converted to grass cover pre-fire were green with substantial new grass and other herbaceous growth four months post-fire. This in contrast to the more severely burned slopes where there are no discernable regeneration occurring as of April 2018 (See Figure 11 above).

Post-fire recovery

There has been considerable interest in the rate of post-fire vegetation regeneration in chaparral ecosystems, with variable lengths of time suggested until vegetation is no longer resistant to re-burning. Some earlier scientific literature suggested that chaparral species would resist fire until 30-40 years old. However, more recent observations suggest that either this earlier estimate was an underestimate, potentially based on a low number of fires observed) or that the fire return interval has actually decreased (i.e., vegetation is ready to burn again in a shorter time period) potentially associated with increased fire ignitions, invasive species, or climate change. Either way, Kolden and Abatzoglou (2018) reported that while the Thomas Fire burned predominantly in 31-40 year old vegetation, over a quarter of the fire (27%) burned in <30 year old vegetation (See Figures 12 and 13).

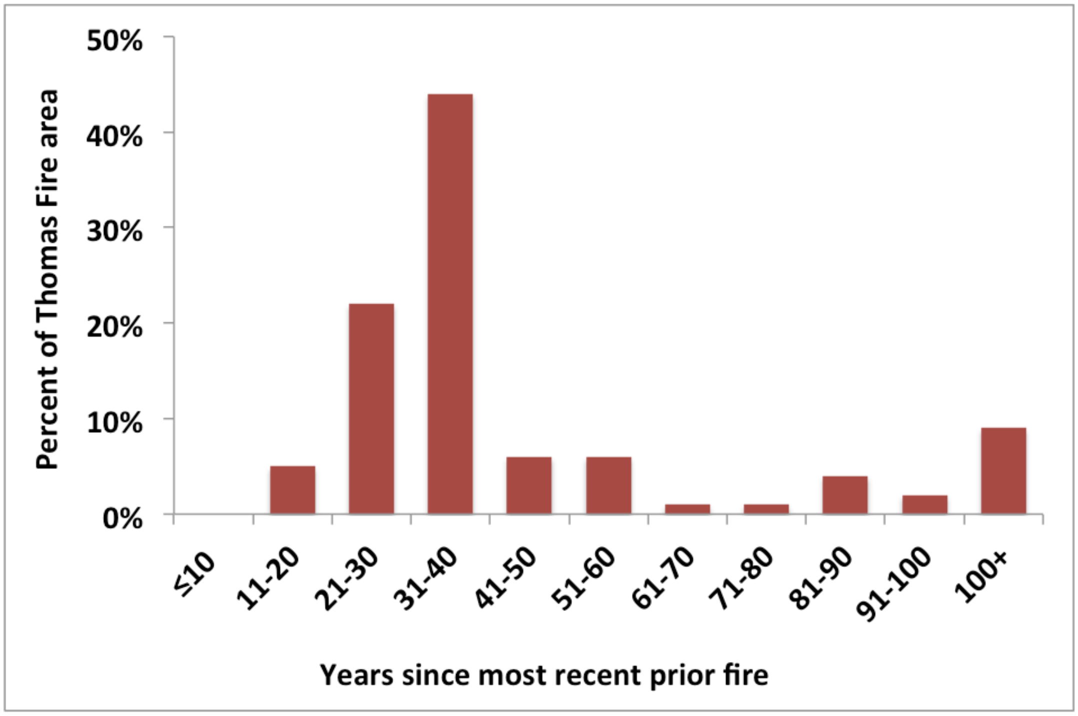


Figure 12 Portion of the Thomas Fire area that burned in each vegetative age (Kolden and Abatzoglou, 2018)

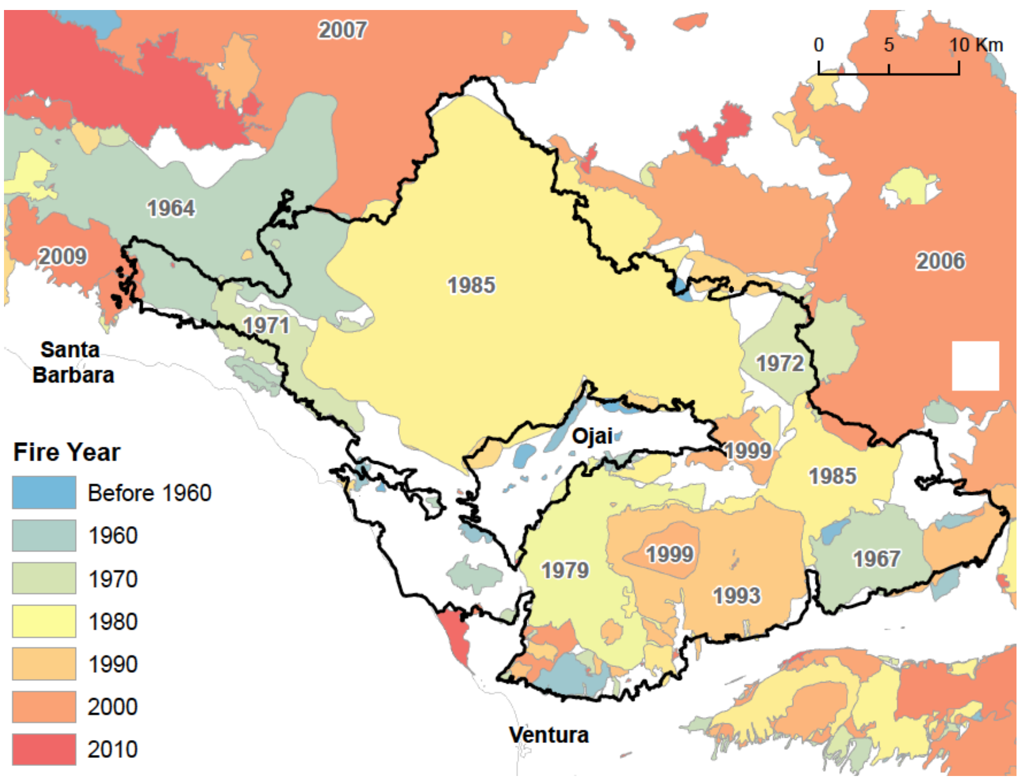


Figure 13 Prior fires with year that Thomas Fire Burned Over (Kolden and Abatzoglou, 2018)

Implications of Post-fire Recovery for Montecito

Anywhere on the District that is currently in grass, either through type conversion or temporarily converted following the Thomas Fire, has the potential to burn at any time of year in any given year due to annual climatic cycles in California. The Mediterranean climate produces annual grass growth in response to winter and spring rains and cooler temperatures, and rapid curing under summer drought and high temperatures. Oaks that have survived the Thomas Fire, particularly vigorous resprouters, typically regenerate rapidly and begin to rebuild flammable litter substrate within a few years. Similarly, chaparral species such as Manzanita and chamise should begin to resprout and potentially be available to re-burn in 10-15 years. By 20 years post-fire, any fire-resistant properties of early shrub growth will rapidly decline, and unmanaged shrub fields will be producing sufficient litter and dead material to support running shrub crown fire and active ember dispersal.

Environmentally Sensitive Habitat Areas (ESHAs)

ESHAs occur primarily in the riparian zones along the drainages that bisect the District. Burn severity mapping for the Thomas Fire and post-fire high-resolution satellite imagery indicate that the ESHAs burned predominantly at moderate to high severity, suggesting that habitat is likely compromised until sufficient regeneration and restoration occurs (See Figure 14).

Post Debris Flow

The Thomas Fire was a large-scale wildfire that dramatically altered the vegetation on the Santa Ynez Mountains that normally intercepts rainfall and facilitates infiltration, thereby reducing runoff. However, the Thomas Fire left the ground charred, barren, and unable to absorb water creating conditions disposed to potential flash flooding and mudflow. Typically, as rain falls on damaged soil, runoff can pick up soil, sediment, and woody debris carrying it into channels such as drainages or streambeds. Post-fire erosion rates are notoriously difficult to quantify but have been estimated at 50 - 100 times greater than for an unburned watershed (Radtke 1983) and flood risk remains significantly higher until vegetation is sufficiently regenerated. During the regeneration period (estimated at 5-10 years across most burned landscapes), there is ongoing elevated risk for flooding and debris flows, which is highly variable and predicated on the initial severity of the fire, the rate of vegetation regeneration, the soils and topography, and the intensity of a given precipitation event.

When addressing post-fire soil erosion mitigation activities, consider the impacts for the future wildfire threat similar to the use of shaded fuelbreaks. For example, a common erosion mitigation strategy is planting trees or woody shrubs across hillside slopes, as root systems can stabilize slopes over time. However, any such plantings should consider whether the species selected have fire-resistant characteristics, and whether the fire-resistant characteristics can feasibly be maintained over years to decades. Fire resistant characteristics include:

- High moisture content in leaves (these ignite and burn more slowly)
- Little or no seasonal accumulation of dead vegetation
- Open branching habits (they provide less fuel for fires)
- Fewer total branches and leaves (less fuel for fires)
- Slow-growing, so less pruning is required (to keep open structure as noted above)

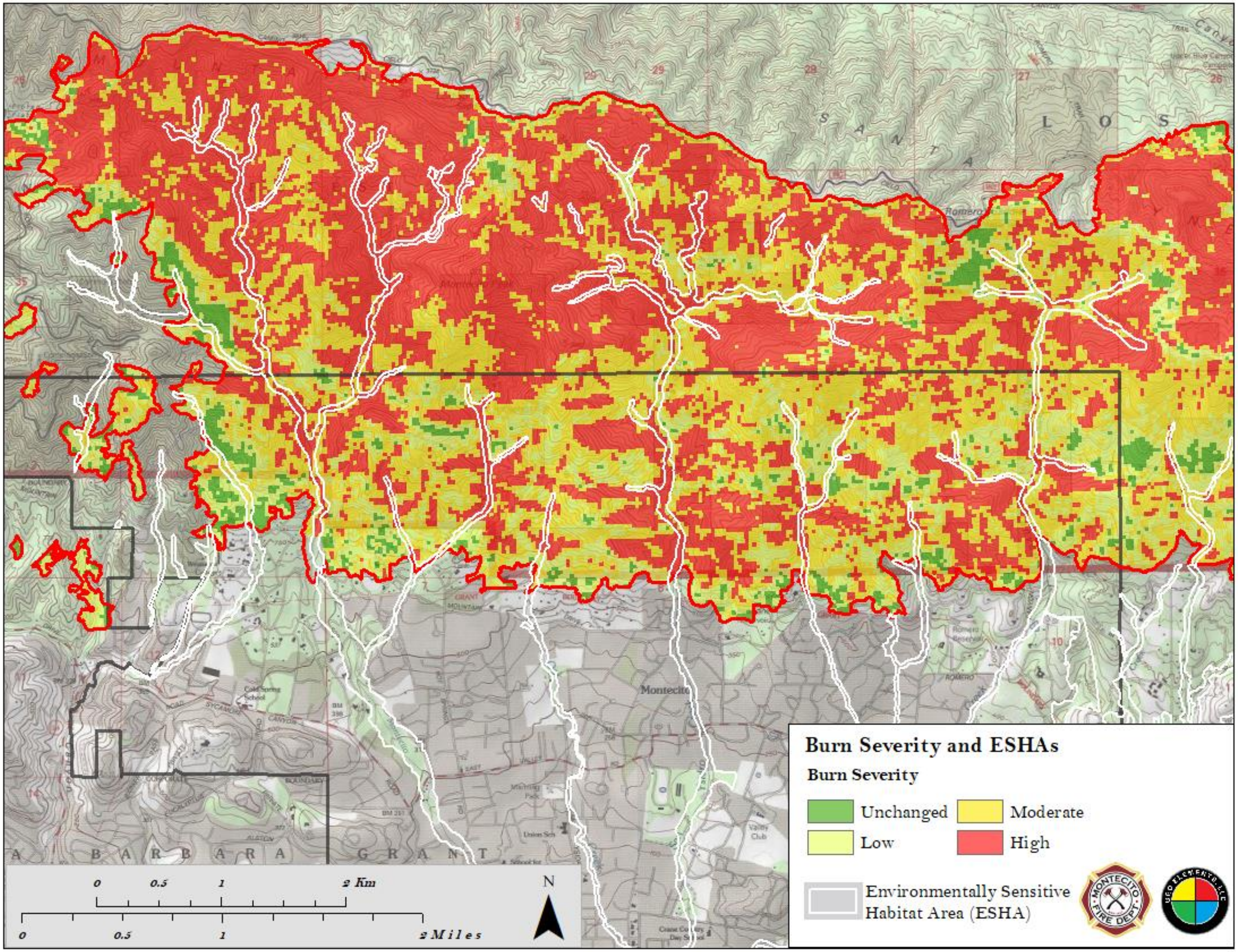


Figure 14 Burned area severity and ESHAs Map

- Non-resinous material on the plant (i.e. stems, leaves, or needles that are not resinous, (oily, or waxy). Cypress, junipers, pines, spruces, and firs are resinous and highly flammable

Given that the Santa Barbara Front will inevitably see more wildfire in the future, it will be critical to assess the trade-offs between short-term slope stabilization (on the order of 3-5 years) and long-term reduced wildfire potential in a future fire (on the order of 10-50 years).

Effectiveness of Montecito’s Wildland Program

The following describes the effectiveness of both the CWPP Wildfire Assessment and Fuel Treatments.

Review of the CWPP Wildfire Assessment

The wildfire assessment provided in the 2016 CWPP was generally valid concerning the potential impacts of a wind driven wildfire on the community of Montecito. The tools and methodologies utilized to evaluate fire potential were appropriate and provided fire managers insights into the possible impacts on the community. The 2016 assessment states, “the greatest wildfire threat to the community comes from the Los Padres National Forest and SRA lands in the Santa Ynez Mountains above Montecito”. This certainly proved true during the Thomas Fire.

Wind inputs used in the CWPP analysis were consistent with data reported from local RAWS. A 60-mph wind from the north was used to model fire behavior in the CWPP analysis. Sustained winds of 32-mph and gusts of 65-mph were observed at the Montecito #2 RAWS when Sundowner winds developed the morning of December 16th (See Figure 15).

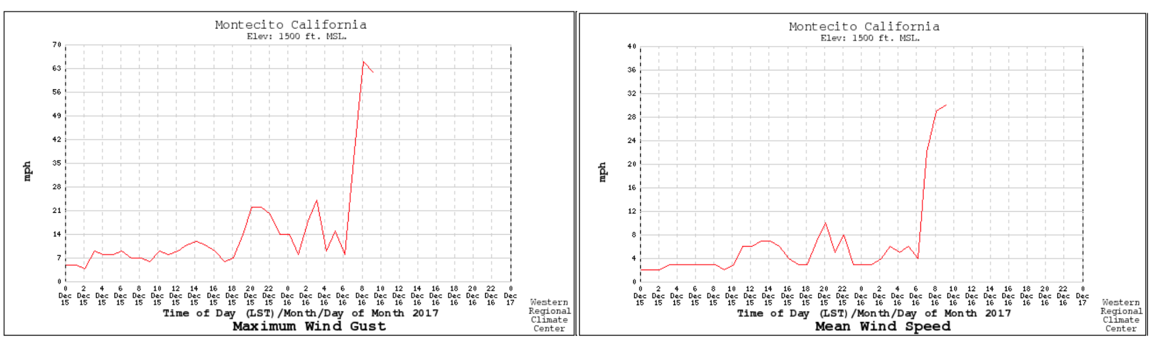


Figure 15 Sundowner winds maximum wind gust and mean wind speed

The fire intensity, as measured by flame length presented in the CWPP, represented real world conditions observed on the fireline. Flame lengths in excess of 20’ were common on the slopes north of East Mountain Drive and Bella Vista Road. In the CWPP, flame lengths were anticipated to decrease within the footprints of the 2008 Tea and 2009 Jesusita fires. This reduction in fire intensity was also verified by firefighters interviewed after the Thomas Fire.

Ember exposure is difficult to verify, in part because there is no way to quantify the density of embers received in a given area. However, we can evaluate where damage was heaviest, particularly as it is assumed that most damage to structures was associated with ember ignitions, and all damage observed outside/south of the fire perimeter was ember-ignited. The ember exposure model from the CWPP predicted that the highest density of embers would be received in a few key areas given a north wind of 60-mph. For the eastern half of Montecito, the Sundowner wind was not a factor, with a backing fire dominating fire behavior as the Thomas Fire intersected Montecito. Across the western portion of the community, however, the model was very accurate in indicating where the highest damage levels would be. One of the predicted peak ember density locations was the area between the Cold Spring and Hot Springs drainages, which is also where the highest density of destroyed and damaged structures occurred (See Figure 16).

Spot fire distances were accurately estimated with the model indicating maximum spotting distances up to 0.8 miles. While interviews with most firefighters indicated observed spotting of less than 0.25 miles, the damage assessment indicates an underestimation bias. The further known and mapped spot was almost exactly 0.8 mi from the main fire perimeter. It is likely that additional long-range spots occurred but were not mapped or known due to minimal damage that was not reported.

The fire damage assessment of the CWPP was run for an ignition in the Hot Springs drainage and indicated that the fire would spread into the community through the major north-south oriented drainages with their origins in the Santa Ynez Mountain Range resulting in hundreds of structures lost. This projected fire spread was most pronounced in Cold Spring and Sycamore canyons. However, the model is run without any fire suppression operations and pre-fire fuel treatments as input. Firefighters that were interviewed corroborated the 2016 CWPP fire model predictions on fire behavior on the morning of December 16th. Firefighters also expected hundreds of residences would be lost based on their experience, this suggests that suppression actions and pre-fire fuels reduction not captured in the model were likely responsible for the reduced number of structures lost.

Effectiveness of Fuel Treatments

Fuel treatments reduce the amount of vegetation on the landscape, thereby reducing the intensity and severity of wildfires. As discussed earlier, the District has a long history of being proactive and recognizing the value of a comprehensive fuel treatment program. The 1998 Feasibility Study was the foundational document of the fuel treatment program and identified the areas north of Bella Vista and East Mountain drives as the priorities for treatment. These initial projects became a community network of fuel treatments that focused on creating a patchwork of treatments that connect property-owner developed defensible space with projects completed by the District. Additionally, roadside clearing and enhanced clearances adjacent to structures created a fire environment that allowed firefighters to engage safely in structure defensive actions during the Thomas Fire. Firefighters felt safer, therefore stayed to defend structures and suppress fires started due to burning embers. Without firefighters remaining in place, many more structures would have likely burned.

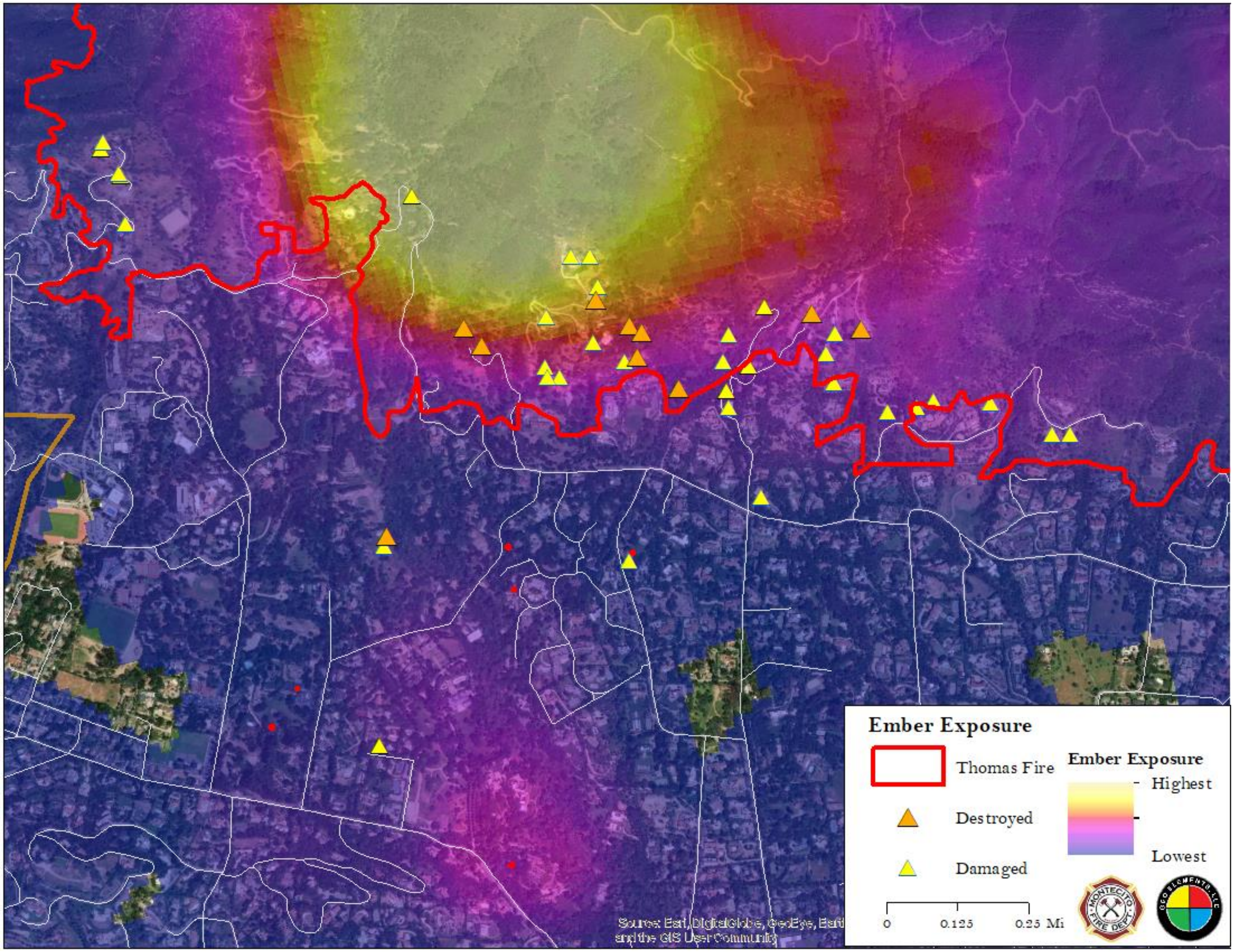


Figure 16 2016 CWPP Ember Exposure Zone Map

The District's Wildland Fire Program has developed an on-going public and private partnership of fuel treatments that focus on facilitating the safe evacuation of residents, providing ingress and egress for firefighting resources, and the protection of structures, infrastructure and natural resources. Fuel treatments included thinning, pruning, chipping, pile burning, and removal of both dead and live vegetation. The public/private partnership of fuel treatments has created a network across of the high roads in the community utilizing a series of roadside fuel treatments connected with fuel treatments on private lands. When Geo Elements digitized thinning and vegetation clearance work done by residents (often in partnership or facilitated by the District), it reveals a strong line of defense across much of the north portion of the District (Figure 17).

Additional review of aerial imagery by Geo Elements staff showed large areas of irrigated landscaped vegetation, property-owner initiated fuel treatments, and legacy vegetation type conversion that were not incorporated into the District's fuel treatment database. The review of imagery also identified areas of smaller vegetation where heavier chaparral either never existed or was type-converted in the past through farming and ranching practices.

These interconnected fuel treatments and irrigated landscapes resulted in a significant fuel modification mosaic that served to substantially reduce the intensity of the fire as it moved downhill and into Montecito during the Thomas Fire. It is speculated that this significantly reduced energy of the fire, and:

1) reduced the volume of ember cast ahead of the main fire front and subsequently reduced pre-heating and fuel volatilization
2) supported structure defense

The 2016 CWPP incorporated earlier studies and recommendations while continuing to promote community partnerships to meet the goal and objectives of the plan. While treatment priorities need to be revisited post Thomas Fire, the goals and objectives of the CWPP are still valid. Even as goals and objectives remain valid, fuel treatment guidelines are expected to change. Actions focused on reducing the continuity of chaparral vegetation as it regrows following the fire will become important to reduce the effort and cost required to maintain treatment areas over time.

Emergency Preparedness Programs and Community Education

After review, and from the perspective of the community and firefighters, Montecito's emergency preparedness and community education programs were highly successful prior to and during the Thomas Fire. These programs helped facilitate community protection, enhanced life safety for the public and animals during evacuation, provided safe operational space for firefighters defending structures from the fire, and provided valuable guidance for incoming firefighters. Specifically, the following programs stand out:

- *Ready! Set! Go! Plan*

  This plan provided valuable information to the community in structure hardening, defensible space, and preparation for evacuation.

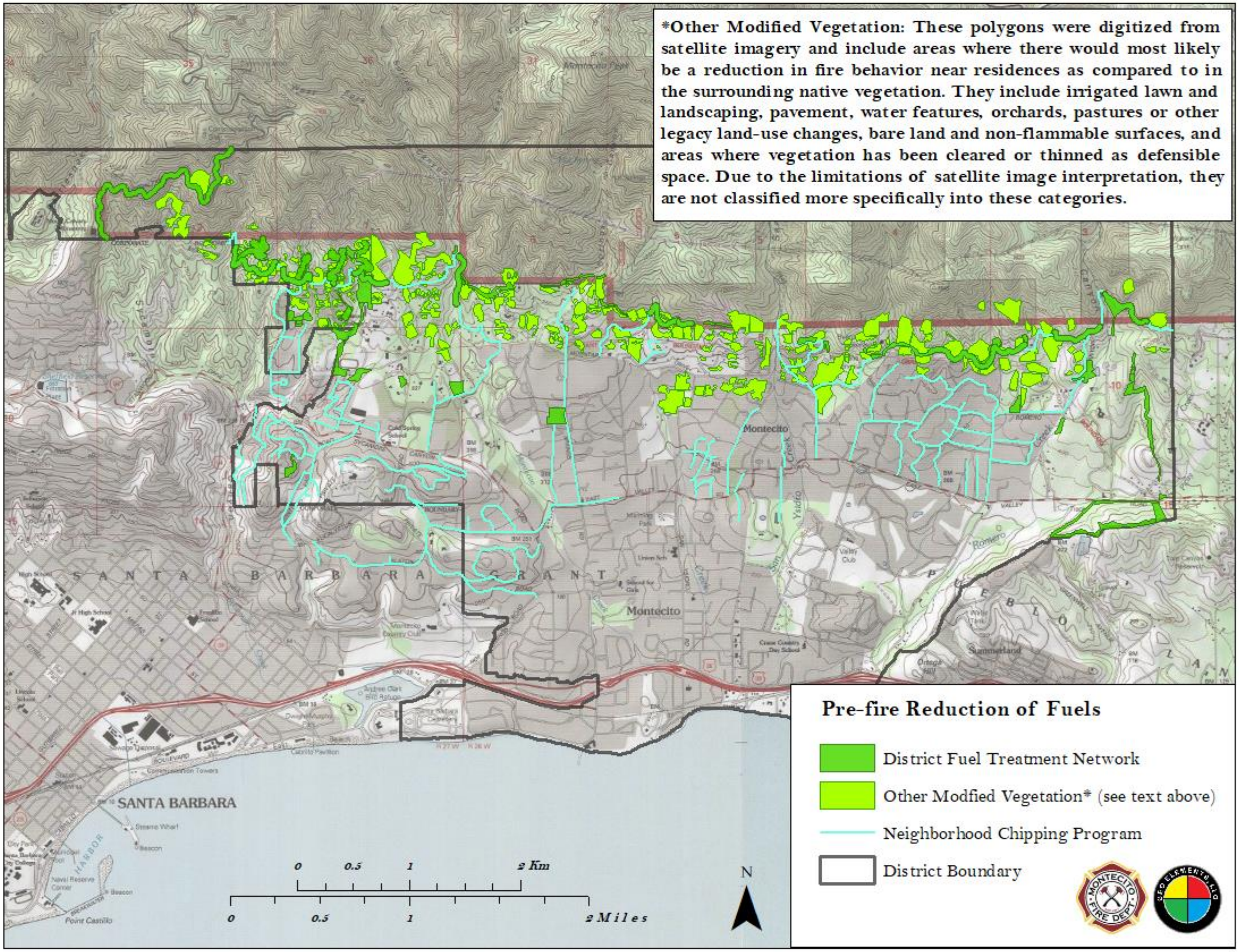


Figure 17 Modified Vegetation Map Pre-Thomas Fire Map

- *Wildland Fire Initial Attack Plan*

This operational plan was highly successful in providing guidance to incoming firefighters throughout Montecito's interaction with the Thomas Fire. Firefighters assigned to Montecito received this plan in both digital and paper form, which provided them information on how to locate values at risk and operational features, so they could formulate a plan to adequately prepare and defend structures and contain the fire. The network of fuel treatments was not included on the zone maps but was provided to some as a separate product.

- *Emergency Notification Systems*

These systems include Reverse 911, Everbridge Emergency Alerting System, Nixle, AM1610, use of local media outlets, and MERRAG. These critical information systems were used during the fire to relay fire information and facilitated a safe evacuation and re-population of the community.

- *Santa Barbara County Office of Emergency Management (OEM)*

OEM was responsible for the emergency planning and coordination of the Santa Barbara Operational Area throughout the Thomas Fire.

- *Voluntary Organizations Active in Disaster (VOAD)*

VOAD assisted through its members such as the American Red Cross, Disaster Relief, MERRAG, Smooth transportation, United Way, Santa Barbara Foodbank, and Easy Lift. The average sheltering operation for the Thomas Fire was three-to-five days for Montecito. (www.noozhawk.com/article/santa_barbara_county_nonprofits_voad_key_role_emergency_response_20180506).

- *American Red Cross*

The Red Cross opened a Thomas Fire recovery assistance center at UC Santa Barbara and provided overnight shelters at UC Santa Barbara, meals and snacks, hygiene items, comfort and an opportunity for those evacuated to connect with loved ones, health services, and get information.

- *MERRAG*

Provided public information and was set up on the South Village lawn. Armed with bulletin boards, maps and handouts, MERRAG staffed the site up until the area evacuations took place. They provided update fire information as the fire approached and vital pre-evacuation preparedness information. As the fire neared Montecito MERRAG helped staff the public information location with incident public information officers.

- *Santa Barbara County District Amateur Radio Emergency Services (ARES)*

The ARES members utilized amateur radio digital network (ARDN) MESH video network to live stream images from several sites. Members utilized Ham radio equipment (ADS-B receivers used to monitor air traffic) to help provide information to the public on the status of the Thomas Fire in areas of Carpinteria, Toro Canyon, and Santa Barbara. (www.arrl.org/news/amateur-radio-volunteers-active-in-latest-round-of-california-wildfires and www.arrl.org/news/thomas-fire-response-also-demonstrates-amateur-radio-s-social-media-value)

- *Equine Evacuation*

Although Montecito has very few large animals within the District, Equine Evacuation actively transported animals throughout the initial days of the Thomas Fire for both Santa Barbara and Ventura counties. Since Montecito had a long time to prepare, it's believed that animals within the community were transported well ahead of the Thomas Fire entering Montecito. Equine Evac is a well-established and respected organization in Santa Barbara County and plays a vital role when the need arises.

- *Santa Barbara County Animal Services and Humane Society*

It is unknown how many animals in Montecito were rescued but the Santa Barbara County Animal Services and the Santa Barbara Humane Society looked after a variety of animals including cows, donkeys, alpacas, goats, sheep, geese, ducks, an emu, and pigs. It's estimated that they helped 1,430 animals during the Thomas Fire (www.suzanneperkins.com/in-the-news/ways-to-support-disaster-relief-efforts-for-animals-in-santa-barbara-county).

A unique problem came up during evacuation in Montecito. The District became a "concierge service" for the community taking calls regarding pets (e.g., koi, exotic birds, tortoises, chickens) left behind during mandatory evacuations. Santa Barbara Humane Society relieved District staff by working with the Sheriff's office to coordinate care and feeding of those animals.

- *Montecito Fire Protection District Auxiliary*

This is a paid team of auxiliary members that support the Prevention Bureau throughout the year. The team was utilized in supporting MERRAG at the public information site, running errands for supplies, opening and locking community gates, and support for procuring meals for District staff assigned to stay on the District.

Evacuation of Montecito

With more than 10 days from the start of the Thomas Fire to the time that it burned into Montecito, the Santa Barbara County Sheriff's Department, Montecito Fire Protection District, and Incident Management Teams had ample time to coordinate a systematic evacuation of the community.

Evacuations orders were issued for Montecito on December 10, 2017 for areas north of Highway 192 and remained in effect until December 19th. An evacuation warning continued in place for areas north of Highway 192 until December 21st at 0900 hours when the community was able to repopulate (www.countyofsb.org/thomasfire.sbc#evacuations). Portions of the community south of Highway 192 were never covered by the mandatory evacuation order but were under a voluntary evacuation warning. Even as the fire burned into Montecito, the hard evacuation closure was only enforced for areas north of the highway.

Firefighters report that there was a high level of compliance with the evacuation order and that only a few residents were encountered following the issuance of the order. Using the District's Evacuation Map, incident managers and law enforcement personnel were able to clearly communicate to the public, which areas were under the evacuation order (See Figure 18). A web-based, interactive evacuation map was also available to the public to aid in communicating evacuation information.

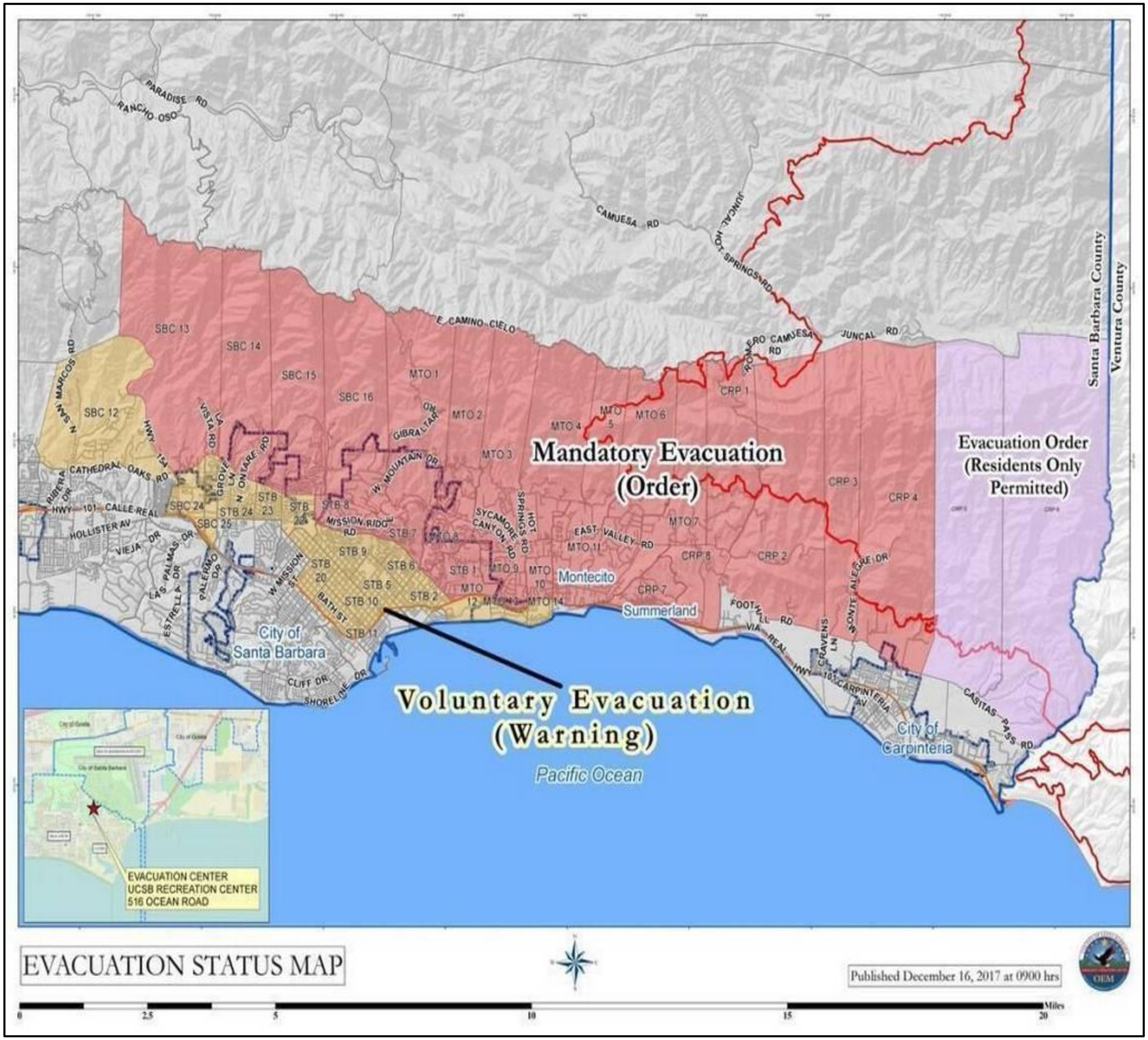


Figure 18 December 16, 2017 Evacuation Map - Santa Barbara County Office of Emergency Management

Beyond the human element, the Thomas Fire required the evacuation and care for thousands of animals. Santa Barbara County Animal Services and partners at the Santa Barbara Humane Society, Santa Barbara Equine Evacuation and Assistance, El Capitan Ranch, Earl Warren Showgrounds, Animal Shelters Assistance Program, Santa Maria Valley Humane Society and the Santa Barbara County Public Health Department coordinated this task. On December 21st, the Department of Health Services posted a formal request to owners of displaced animals to claim them from the various locations that provided temporary refuge during the fire.

While the evacuation of both humans and animals was well planned and executed, unique community specific concerns surfaced, including the care of expensive koi and their habitat, care of unique and valuable landscaping, and the loss of power an unattended valuable wine vaults. Specific information concerning these unique issues could be more fully developed and included in the District's Wildland Fire Initial Attack Plan.

Comparisons between the 2017 Thomas Fire and the 2008 Tea and 2009 Jesusita Fires

The Thomas Fire was similar in some key facets to the 2008 Tea and the 2009 Jesusita fires, but with starkly different outcomes in terms of structures lost and injuries to fire personnel and civilians. Because many of the changes made in the past to codes and fire management practices along the Santa Barbara Front and in Montecito specifically stem from these two earlier fires, it is valuable to compare the fires to identify if changes impacted fire outcomes.

Table 4 identifies similarities and differences between the Thomas, 2008 Tea, and 2009 Jesusita fires as derived from interviews and official reports.

Table 4 Summary of Fire Statistics

Fire Name	Date	Acres Burned (acres)	Structures Lost
Tea	November, 2008	1,940	210
Jesusita	May, 2009	8,733	80
Thomas	December, 2017	281,893	1,063

What were the similarities?

- Sundowner wind event with high 60+ mph winds.
- Firefighters experienced windy narrow roads and driveways with limited access for large fire apparatus. Gates and vegetative screening affected structure assessments during firefighter triage and spot fire detection.
- Fire behavior was extreme.
- Fuel moistures were critically low.

- California Public Resource Code relating to defensible space were in place.
- The Camino Cielo and Windy Gap fuelbreaks were re-opened as firebreaks giving firefighters tactical opportunities on the 2009 Jesusita Fire (these fuelbreaks were also used on the 1990 Paint Cave and 2008 Gap fires).

What were the differences?

Conditions

- Thomas and 2009 Jesusita fires were actively burning during the day, while the 2008 Tea Fire began at night and most structures were lost during the night.
- Montecito has increased the amount and interconnectedness of their fuel treatment networks since 2009.

Preparation

- Firefighting resources knew the Thomas Fire was coming and had ample time to prepare and become familiar with the structures, road systems, topography, fuels, and fuel treatments. There was little to no time to prepare structures prior to the fires arrival for the 2008 Tea and 2009 Jesusita fires.
- Evacuation of residents was completed prior to fire's arrival on the Thomas Fire. On the 2008 Tea and 2009 Jesusita fires evacuation of residents was occurring as firefighting resources were arriving creating congestion along roadways and making the evacuation priority over any suppression efforts.
- The District and property-owners had observed two large fires (2008 Tea and 2009 Jesusita fires) threaten their community. This served as an example to the community on what could be expected and how to prepare.
- The District's Fire Marshals and Wildland Fire Specialists have increased public awareness and education by building relationships and partnerships with individual property-owners and the community.
- Many of the fire resources involved in structure defense on the Thomas Fire had been assigned to other areas of the fire in previous days. This increased their tactical proficiency in defending structures.
- More firefighting resources were assigned to the protection of Montecito than were used in either the 2008 Tea or 2009 Jesusita fires. The 2008 Tea Fire was an initial attack fire with little ability to defend all threatened structures with the initial attack response. The 2009 Jesusita Fire was in the process of firefighting resource build-up when the loss of structures occurred.
- Fire suppression resources assigned to structure protection on the 2008 Tea and 2009 Jesusita fires had little time to survey or triage the areas and develop a resource deployment strategy.
- Firefighters on the Thomas Fire were able to use the 2008 Tea and 2009 Jesusita fires' burned areas as strategic locations where fire behavior was expected to decrease.

- Very Large Air Tankers (VLATs) were available to support Thomas Fire preparation. These aerial assets did not exist during the 2008 Tea and 2009 Jesusita fires.

Fuel treatments

- Existing fuel treatments combined with previous hardening of structures provided building blocks to begin work in preparation of the Thomas Fire entering Montecito.
- The adoption and enforcement of wildland urban interface structural codes improved the firefighter's ability to defend structures.
- Fuel treatments did not exist in the areas where structures were lost on the 2008 Tea and 2009 Jesusita fires.

Outcomes

- On the morning of December 16th, fire suppression resources were making a shift change making more fire suppression resources available on scene when the Thomas Fire made its push into Montecito.
- Structures burned during the initial attack phase or soon after on the 2008 Tea and 2009 Jesusita Fires.
- Personnel observed lighter fuels in the area of the 2008 Tea Fire which may have increased fire spread rates.
- Ingress and egress was not always adequate due to vegetation encroaching into roads and driveways. Narrow roads systems and driveways, and lack of adequate turnarounds existed on all three fires, but were much worse on the 2008 Tea and 2009 Jesusita fires. Roadside fuels reduction in Montecito prior to the Thomas Fire facilitated improved ingress and egress along the high road system.
- In most cases, inadequate safety zones were identified or travel times to a designated safety zone were unrealistic due to the narrow roads and congestion on the 2009 Jesusita Fire (Jesusita Burnover Report 2009).
- The decisions by firefighters during the 2009 Jesusita Fire to "hunker in" or stay and defend structures in untenable conditions led to a burnover and near misses.
- Adequate safety zones were nearly non-existent in the areas of Mission Canyon, Lauro Canyon, and Spyglass Ridge on the Jesusita Fire.
- Escape routes were compromised by the large numbers of Type I engines on a system of steep, narrow, winding roads funneling through a single outlet on the 2009 Jesusita Fire.

Key Findings

After this review of elements of Montecito's Wildland Fire Program, it can be stated that the program as implemented over the past 20-years contributed to the successful protection of structures and life safety during the Thomas Fire. The following are key findings of this review:

District Wildland Fire Program

The commitment by the District to develop and support a wildland fire program was key to the success in protecting the community. Key findings were:

- The ability of the District to provide resources and funding to lead and complete fuel treatment projects on private lands was key to saving residences and the community.
- It was anticipated by firefighters and fire modeling that the District had the potential to lose hundreds of structures during a wildfire. The investment of money and time by the District saved hundreds of homes and millions of dollars.
- The CWPP was effective in identifying fire behavior characteristics and addressed most challenges faced by firefighters.

Community Education and Emergency Preparedness

The value of one-on-one relationships and partnerships with property-owners and the community cannot be overstated. The partnerships established over the course of the past 20-years, contributed to the willingness of property-owners to develop adequate defensible space, take reasonable structure hardening actions, and also supported an orderly evacuation of the community when ordered to do so.

Key findings concerning education and preparedness include:

- Educating the public on the benefits of fuel treatments and structure hardening resulted in citizens completing work that aided in protecting life and property.
- Public education conducted by the District has helped the citizens to understand the need and cost of making their property more fire safe. Shared investment in fire safe projects helped to maintain these successful public/private partnerships.
- The District's Emergency Notification System worked well during the Thomas Fire.

Fuel Treatments

- The fuel treatment network helped facilitate the protection of life safety and residences under Sundowner wind conditions.
- Defensible space, appropriate landscaping, and fuel treatments provided opportunities where firefighters felt safe to stay and defend structures.
- Adequate clearance of roadside vegetation allowed fire apparatus safer access.
- Existing fuel treatments were used as anchor points to build check lines behind structures.
- The amount of time needed to complete fireline preparation was reduced due to previous fuels work.
- The fuel treatment network was used as an anchor to construct fireline directly along the fires edge above Bella Vista Drive.

- Fuel treatments and defensible space greater than 100-feet provided a larger buffer around values at risk, provided firefighters greater tactical opportunities, and enhanced life safety for evacuation of the public and for firefighters defending structures.
- Individual property-owners through hazardous fuel abatement work or the maintenance of fire-resistant landscaping not identified on the District's fuel treatment network contributed to the success of structure defense actions during the Thomas Fire.
- The District's fuel treatments served to substantially reduce the intensity of the fire as it moved into the community under Sundowner wind conditions. It is speculated that reducing fire intensity in the treatment areas:
    - minimized the threat of residence-to-residence combustion below Highway 192 (i.e., similar to what occurred on the 2017 Tubbs Fire in northern California)
    - reduced the volume of ember cast associated with the flaming front of the fire
    - allowed firefighters to safely engage in structure defense and employ fire following tactics where resources could not be safely pre-positioned at structures
- Actions taken by firefighters in preparation of the Thomas Fire's advance into the community helped in structure defense during the fire. The extent that these actions assisted in community protection cannot be fully understood as the scope and location of all the prep work cannot be spatially determined.
- Higher rates of tree and shrub survival occurred in areas where vegetation had been thinned.

Structure Hardening

- The District's adoption of wildland urban interface (WUI) codes made many newer structures more resistant to wildfire.
- All but one of the residences destroyed pre-dated the WUI fire codes. This structure was located near a heavy concentration of fuels and did not have adequate access for firefighters.

Wildland Fire Initial Attack Plan

- The Wildland Fire Initial Attack Plan provided critical information and situational awareness to incoming firefighters on access, evacuation routes, water sources, and structure locations. This Plan allowed firefighters to adequately prepare for structure defense and fire operations.
- The District should incorporate the fuel treatment spatial data into the existing Wildland Fire Initial Attack Plan, rather than providing this information separately as occurred during the Thomas Fire.

Evacuation

- Evacuation planning and implementation was successful during the Thomas Fire. The amount of lead-time allowed fire and law enforcement personnel to implement evacuation orders systematically.
- Completing evacuations prior to the arrival of the fire allowed firefighters and fire apparatus to move unimpeded through the community in preparation for the fire and during the fire fight.

- The length of time that property-owners were evacuated created a challenge for residents with concerns with exotic animals, valuable landscaping, and valuable wine collections. Specific information on how to address these unique issues could be developed and included in the District's Wildland Fire Initial Attack Plan.
- It was perceived that repopulation was delayed unnecessarily due to a perceived fire threat to the community by the Incident Management Team. Repopulation of the community after an evacuation should be based on actual conditions.

Challenges

- Gates were an issue for firefighters and apparatus. Gated driveways commonly have a *Knox Box* that allows firefighters to gain access, however codes to the gates or *Knox Boxes* were not always available to fire personnel assigned to the community.
- Narrow driveways and road systems without adequate turn arounds hindered the ability of large fire apparatus to access some structures.
- Firefighters observed spotting near structures but visibility to those spot fires was obscured due to the heights of vegetation and fences used as screening along the road system.
- Flammable vegetation and landscaping material were problematic at some structures. Residents should be encouraged to remove flammable material that have the potential to act a receptor for wind-blown embers or which ignite easily.

Technology

- It became apparent during the interviews that smart phones and tablets are an increasingly important tool in wildland firefighting. Not only are they used for direct communication but also to share and display digital information.

Opportunities for the Future

The following describes opportunities to build upon current programs now available to the District:

- Develop educational material based on lessons learned from the Thomas Fire. Consider using portions of the structure damage assessment of this report as an educational tool when working with property-owners on improving the wildfire resilience of their homes and property.
- Consider seeking new and innovative structure hardening elements to enhance structure defensibility.
- Consider seeking opportunities to develop a cost-share grant program to share the costs of structure hardening or replacing flammable vegetation with more fire-resistant vegetation.
- Recommend the District seek opportunities under Senate Analysis of SB 465 that expands the California Property Assessed Clean Energy (PACE) Program to include wildfire safety improvements (including structure hardening measures) for the District.
- Continue to educate the public and discourage the use of flammable landscape materials vegetation within 200-feet or more of a structure.

- Continue to promote FireWise concepts concerning structure hardening within the Home Ignition Zone.
- Since most of the wildland vegetation above Montecito was burned off during the Thomas Fire, now is the time to design projects that significantly limits regrowth and breaks up the continuity of chaparral within at least 300-feet along the upper perimeter of the District thereby reducing future wildfire intensities. These projects could serve as a buffer between the community and the wildland vegetation of the Los Padres National Forest, while also capturing more remote structures on private land within treated fuel beds.
- Consider all forms of treatments including limiting regrowth of chaparral adjacent to structures. Wider is better. Promoting the idea of type conversion (brush to grass) and the use of fire safe landscaping.
- Based on the fire behavior observed during the Thomas Fire and the need for greater safe operational space for life safety by firefighters, consider extending fire code defensible space to 200- feet utilizing the prescriptive guidelines in the 2016 CWPP.
- Support property-owner initiated fuel treatments and include such treatments within the database of the greater Montecito fuel treatment network.
- Work with property-owners to connect any gaps and widen the fuel treatment buffer north of East Mountain Drive/Bella Vista Drive. Continue filling in the blanks along the perimeter between wildland and urban.
- Consider establishing a program that recognizes property-owners implementation of fuel treatments and utilizing fire safe landscaping.
- Typically, one wildfire in the Santa Barbara Front Country threatens multiple jurisdictions simultaneously. Consider working with cooperators to establish a holistic approach to the wildfire threat by developing a comprehensive landscape level fuel treatment plan across the entire Santa Barbara Front Country.
- Consider working with a biologist to develop Best Management Practices in riparian areas and ESHAs to create more fire resilient habitat.
- Consider working with local cooperators to develop and enhance a fuel treatment system above the Santa Barbara Front, including expanding the existing Camino Cielo fuel treatment system and identifying lateral ridgelines where fuel treatment systems could be established.
- Consider developing a monitoring plan to track chaparral growth in recently burned areas. This information should inform the timing of maintenance treatments within the fuel treatment network of the community.
- Continue to encourage use of the *Knox Box* system with back-up power for gates throughout the community.
- Establish a mechanism to efficiently transfer digital information to handheld electronic devices during future incidents.

- Efforts to mitigate post-fire soil erosion should consider potential long-term impacts to the community related to wildfire. Considerations should include an increased fuel loading, the use of vegetation with fire resistant characteristics, fire safe design and spatial distribution of vegetation, water use in the drought-prone area, long-term maintenance of any planted vegetation (up to 50 years), and potential environmental impacts.

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Appendix

List of firefighters that were interviewed for this assessment.

Name of Interviewee	Rank and Title	Incident Position during the Thomas Fire
Joe Tieso	Santa Barbara County Fire Engine Captain	Division/Group Supervisor (OO)
Rob Hazard	Santa Barbara County Battalion Chief	Division/Group Supervisor (RR)
Kerry Kellogg	District Wildland Fire Specialist	Agency Representative
Travis Ederer	District Battalion Chief	Agency Representative
Tyler Gilliam	Santa Barbara County Captain/ Crew Superintendent	Foothill Division/Group Supervisor/Handcrew Superintendent
Al Gregson	District Fire Marshall	Agency Representative
Kevin Taylor	District Division Chief for Operations	Agency Representative
Maeve Juarez	District Wildland Fire Specialist	Agency Representative
Jay Walters	Special Ops Division Coordinator, Arizona State Forestry	Branch Director (XX)
Tod Patten	CAL FIRE – Battalion Chief	Branch Director (XXI)
Laurie Donnelly and Travis Craig	CAL FIRE – Battalion Chiefs	Strike Team Leader and Division/Group Supervisor (HH)
Jim Topoleski	Redlands Fire Department Battalion Chief	Branch Director (XX)
Tom Plymale	US Forest Service – Los Padres National Forest	Safety Officer (Branch X)
Brandon Paige	Santa Barbara City Fire Engine Captain	Division/Group Supervisor (KK)