

UPDATED

Fire Regimes in the Santa Ana Mountains and Laguna Coast

Synthesizing 105 Years of Fire Data (1914 to 2019)



Canyon 2 Fire (2017)



Silverado Fire (2014)

MELANIE SCHLOTTERBECK



Friends of Harbors, Beaches and Parks

Friends of Harbors, Beaches and Parks (FHBP) is a non-profit organization founded in 1997. FHBP's mission is "to promote, protect, and enhance the harbors, beaches, parks, trails, open spaces, natural preserves, and historic sites in Orange County."

Since 2000, FHBP has united conservation and community voices throughout Orange County through its Green Vision Project. Currently more than 80 organizations support the effort to increase the funding for parks, water quality, and open spaces in the region. One of the first tasks of the Coalition was to map conservation target lands. Known as the Green Vision Map, this map lays out the knowledge and efforts of the Coalition to preserve important landscapes.

The next major accomplishment of the Coalition was negotiating a comprehensive mitigation program. The Orange County Transportation Authority's Renewed Measure M includes approximately \$243.5 million (in 2005 dollars) or 5% of the freeway program to mitigate habitat impacts from freeway projects. The measure included funds to acquire, restore, and manage lands. With this funding, important acquisitions have begun to fill in the gaps in conservation in the County.

In 2011, FHBP published the General Plan Resource Directory to promote sustainable policies. The Healthy Communities Toolkit was later published in 2013 as a follow up to provide details on conservation and financing tools available to jurisdictions. Working with the Cities of Stanton, Garden Grove, and Westminster an analysis of parks in each city occurred and was captured in our Park Study in 2016. In 2019, the efficacy of mitigation measures was the focus for research through funding from The Henry W. and Ellen R. Warne Family Endowment Fund of the Orange County Community Foundation.

While it is important to conserve important landscapes, fires that burn too frequently are changing the natural resource values of those natural lands and making them more prone to burn in the future. To understand the fire regimes for previously unstudied areas, FHBP launched a Fire and Water Quality Study to determine the baseline conditions and the change in fire frequency between 1914 and 2014, as well as make recommendations on fire prevention.

The original study was released in 2015 covering 1914 to 2014. This update includes data from 2014 through 2019. The health of our natural lands is directly linked to fire frequency. This report completes the last two areas of Orange County in need of study and updates the data sets used to determine fire hotspots.

To Get a Copy of This Study

This Updated Fire Study can be downloaded for free from Friends of Harbors, Beaches and Parks website at: www.FHBP.org.

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Abstract

This study is an update to the August 2015 report released entitled: “Understanding Fire Regimes in the Santa Ana Mountains and Laguna Coast.” Earlier fire studies conducted in 2009 and 2012/2019 by the Irvine Ranch Conservancy and Hills For Everyone, respectively, provided in-depth information about the Irvine Ranch lands and Chino Hills State Park, but these studies excluded two significant fire impacted areas in Orange County: the Santa Ana Mountains and Laguna Coast. Friends of Harbors, Beaches and Parks (FHBP) thought it important to add to the repository of information about wildfires and ignition points by reviewing more than 100 years of fire data in these two additional and complementary areas. Wildfires have a significant role in an ecosystem, however, the acres burned and frequency of fires has increased because of human activity. This report outlines the findings for both the Santa Ana Mountains and Laguna Coast with data between 1914 and 2019.



Introduction

In August of 2015, Friends of Harbors, Beaches and Parks (FHBP) completed a 100-year study of wildland fires that burned in and around the Santa Ana Mountains and the Laguna Coast. This analysis was undertaken to understand the fire causes, locations, and how these fires were impacting the natural lands and nearby residences. Initially, the report spanned 1914 to 2014 with enough data to display 160 fires in the Santa Ana Mountains and 22 in the Laguna Coast. Recently, FHBP expanded the research to include fires between 2014 and 2019. These six additional years added 58 more wildland fires in the mountains and 25 more along the coast. It appears that most of the new fires were small in size, extinguished quickly, and occurred on “normal” temperature and wind days. A few fires in the update did not meet this norm and ravaged both the wildlands and homes in the region, most notably, the 2018 Holy Fire near the Trabuco Canyon area and two Canyon Fires near the northern edge of the Santa Ana Mountains in 2017. The continued goal is to reduce fire ignitions ultimately saving lives, homes, and natural resources by understanding why and where wildland fires start.

The Original Study

Similar to the fire study efforts led by the Irvine Ranch Conservancy and Hills For Everyone, this study by FHBP attempts to analyze where and why wildland fires are starting in the Santa Ana Mountains and Laguna Coast. Details about our approach are included in the next section. We focused on a time period of 2014 to 2019, but for our analysis we compared it to the original study.

Using the available data, the original study included these four goals:

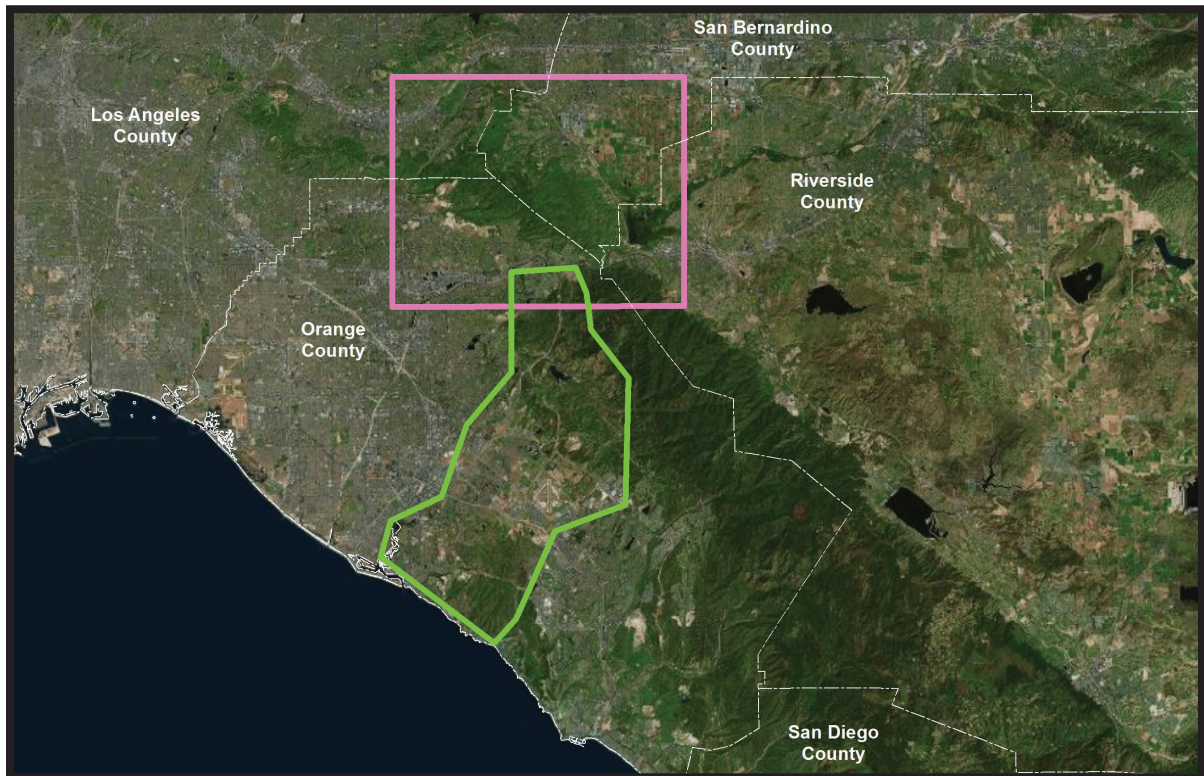
1. Document the fire perimeters, points of origin, causes, and weather conditions for each fire that burned within the two Study Areas (Santa Ana Mountains and Laguna Coast);
2. Analyze the results of the research and determine any fire-prone areas that needed particular attention;
3. Determine how fires impact the watershed and water quality (post-burn); and
4. Provide general recommendations for residents and agencies to reduce the number of fires and impacts associated with wildland fires, and concurrently protect homes, people, and parkland from unnaturally frequent fires.

This updated study is focused only on fire information (goals 1, 2, and 4) and avoids any water quality related research (goal 3).



Mystic Hills in Laguna Beach after the 1993 fire.

PROVIDED BY GENE FELDER



Map 1. The Irvine Ranch Conservancy Study Area is shown in as a green polygon, while the pink polygon is the Hills For Everyone Study Area.

Important terms are used throughout this report and their meanings are useful to understand:

- **Cause:** The confirmed or unconfirmed source of the wildland fire's ignition.
- **Fire Perimeter:** The farthest geographical extent, also known as the outer boundary, of a fire. *Note: Not all areas within the perimeter necessarily burned.*
- **Fire Frequency:** The number of times a specific geographic region has burned. This is similar to how population density is displayed: the darker the color, the more frequently the area has burned.
- **Natural Fire Regime:** The general classification of the role fire would play in the natural environment in the absence of modern human intervention.
- **Point of Origin (Ignition):** The approximate or exact location where the wildland fire ignited within the Study Area.
- **Study Area:** The geographic bounds of this study, which generally encompasses publicly protected natural lands with some overlap of private lands.
- **Wildland-Urban Interface (WUI):** The boundary between developed regions and the natural wildland areas.

The original research resulted in the digital history for each Study Area. Data from the Santa Ana Mountains were available for 160 individual fires that burned between 1914 and 2014, including 142 fire perimeters and 38 fire ignitions. Only one fire was natural (caused by

lightning); the remainder were human caused.

Data from the Laguna Coast were available for 22 individual fires that burned between 1914 and 2014, including 21 fire perimeters and 8 fire ignitions. No fire was naturally caused by lightning; all were caused by human activities.

Fire Science

As a reminder from the previous study, fire science has found the natural fire regime for Southern California's chaparral and coastal sage scrub is between 30 and 150 years. This means that in order to allow the plants adequate time to regenerate, resprout, and store enough energy to grow and reproduce again fires happening more frequently than 30 to 150 years disrupts this cycle and has negative impacts on the plant communities. In short, the more frequently a fire burns a specific geography, the less chance these plant communities can adequately recover.

When the plants cannot recover quickly, opportunistic non-native plants are likely to replace native plant communities. These invasive plants are often non-native grasses—which grow faster, dry out earlier, and spread fire faster. Non-natives tend to exacerbate the fire cycle. With this in mind, and with the records available from California Department of Forestry and Fire Protection (CalFire), Orange County Fire Authority (OCFA), and the Laguna Beach Fire Department, FHBP was able to analyze the fire regime (both natural and human-caused) for fires in the Santa Ana Mountains and Laguna Coast now spanning 105 years.

Going back to 1914, it seems only one recorded natural (non-human caused) fire occurred in the two Study Areas. The cause was a lightning strike in the Santa Ana Mountains in 2009. This fire burned 142 acres. This single ignition by lightning fits with the natural fire regime for this area. The balance of the fires was most likely caused, accidentally or intentionally, by humans. We know this because our region does not generally experience weather patterns that produce lightning strikes. In addition, a fairly significant portion of the fires can be directly attributed to human activity (cars, arson, camping, shooting, machinery, etc.).



CHAY PETERSON

The Santa Ana Mountains have dense chaparral throughout the Trabuco District.

Information Sources & Analysis

The digital data for this study were obtained from three sources. First, data were obtained for free through the CalFire's Fire and Resource Assistance Program (FRAP), which has online digital data sets (called shapefiles). Second, data were provided by OCFA via a Public Records Act Request. The data obtained from OCFA also came in the form of shapefiles. Finally, an Excel spreadsheet with geolocation points or addresses was provided by Laguna Beach Fire Department. However, only 12 of the 21 fire ignitions provided by the Department could be used. Nine of the ignition locations had too generalized an address to include, were not near the wildland areas, or were outside the Study Area. In one instance, a newspaper confirmed the exact date of a wildfire in the Santa Ana Mountains from the original study, but otherwise newspapers were not relied on for data.



The 2017 Canyon 2 Fire gets a phoschek drop by aircraft.

FHBP used the ArcMap 10.1, a geographic information system (GIS) program, to assimilate the fire data. To enable wide distribution, the files were exported from ArcMap for use in Google Earth. These datasets are available for download by the public on the FHBP website: www.FHBP.org.

Through this research, FHBP was able to piece together a digital dataset that outlines where known fires burned, and, in some cases why the fires started. Not all fires that burned in the Study Areas

were formally documented. The fire agencies did not fully record all fires. Because of missing information, those incidents were not included. Nonetheless, the historic record of digital data that now exists as result of this study is more comprehensive than it was prior. This study assembles data from more and different sources and makes a more complete repository of information spanning a longer time frame than was previously available.

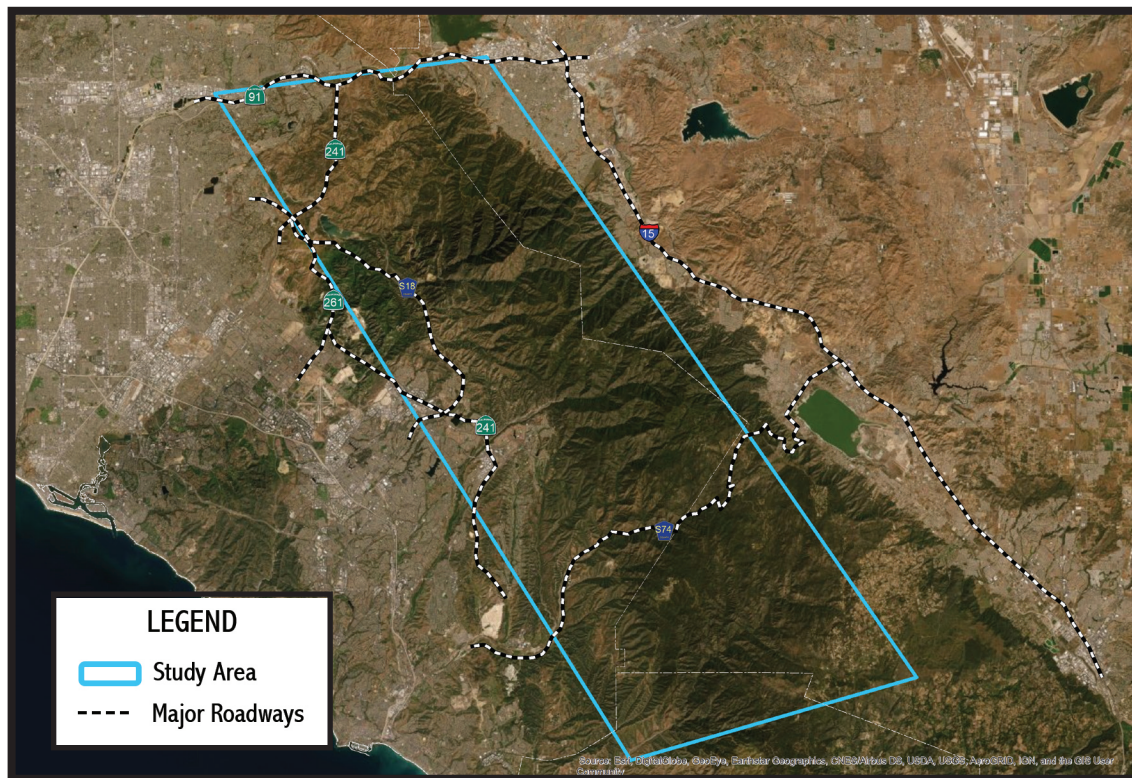
The emergence of public safety apps allowed FHBP to compare “on the ground” reports and look for additional data elsewhere (such as PulsePoint) that did not exist with the previous iteration of the study. However, these sources were not validated for reliability, and consequently, no new fires from these sources were included in the study.



Santa Ana Mountains

Study Area

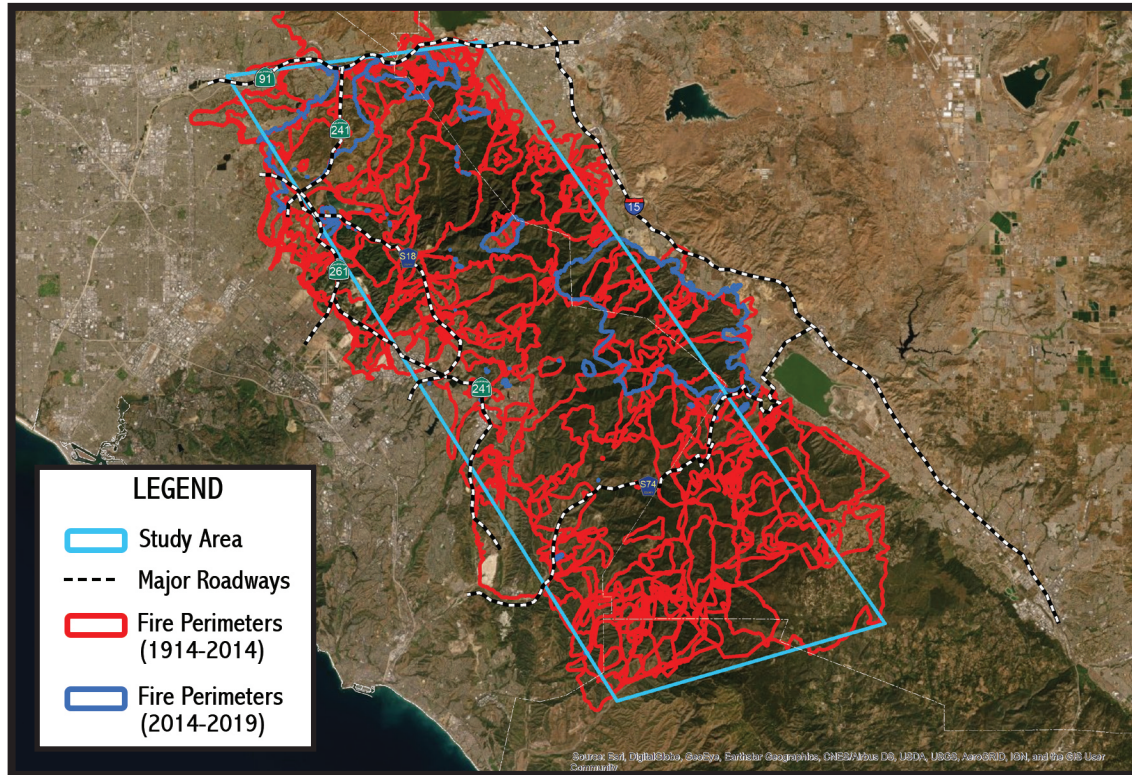
The geography in this Study Area generally included the Trabuco District of the Cleveland National Forest and portions of Orange County and Riverside County foothills. Several smaller privately protected areas were included, such as Audubon California's Starr Ranch Sanctuary and the publicly protected Orange County Transportation Authority's Trabuco Canyon and Silverado Canyon Preserves. The entire Study Area includes the forest and the foothills totaling about 235,000 acres. The Study Area is generally bounded by the 91 Freeway on the north, the 15 Freeway on the east, the San Diego/Orange County line on the south, and the edge of the foothills on the west.



Map 2. The Santa Ana Mountains Study Area is shown in blue with major highways labeled.

Fire Perimeters

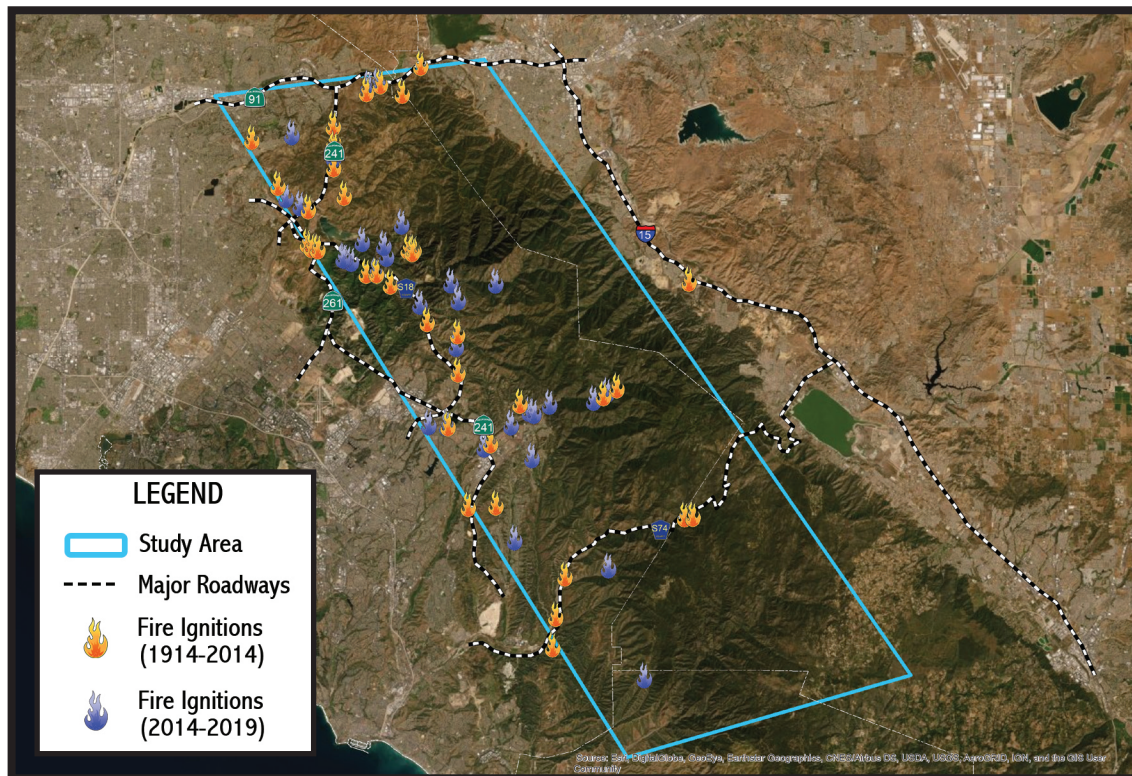
In the first report, FHBP was able to assemble 142 separate fire perimeters with 20 of those fires having known points of origin. In the update, there are 41 new fire perimeters with 16 known points of origin. Thus, there are now 183 documented fire perimeters.



Map 3. The previous study and current study's known fire perimeters. New additions are in blue.

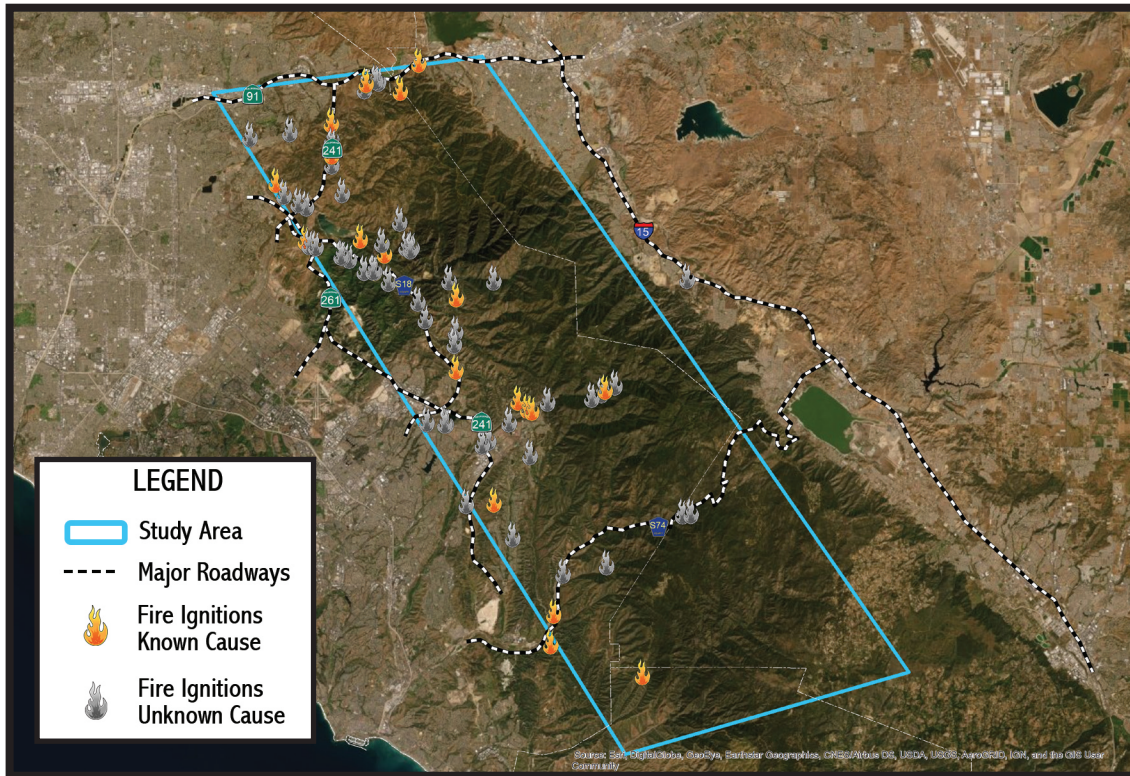
Fire Ignitions

In the first report, FHBP was able to assemble 38 separate fire ignition locations with 20 of those fires having known perimeters. In the update, there are 32 new fire ignitions with 16 known perimeters. Thus, there are now 70 documented fire ignitions. Roadways seem to have the largest documented ignition locations.



Map 4. The previous study and current study's documented fire ignitions. New additions are in blue. (Note: The ignition point by the 15 freeway burned into the Study Area, so it was included in the study.)

In reviewing the data on the Santa Ana Mountains and looking only at points of origin, we found 21 fires had a known cause, while 49 had an unknown cause.



Map 5. All fire ignitions from 1914 to 2019 with known causes as orange flames, unknown as grey flames. (Note: The ignition point by the 15 freeway burned into the Study Area, so it was included in the study.)

To provide a more comprehensive view, the table below includes known and unknown causes of wildland fires using data from both the fire perimeter and point of origin layers.

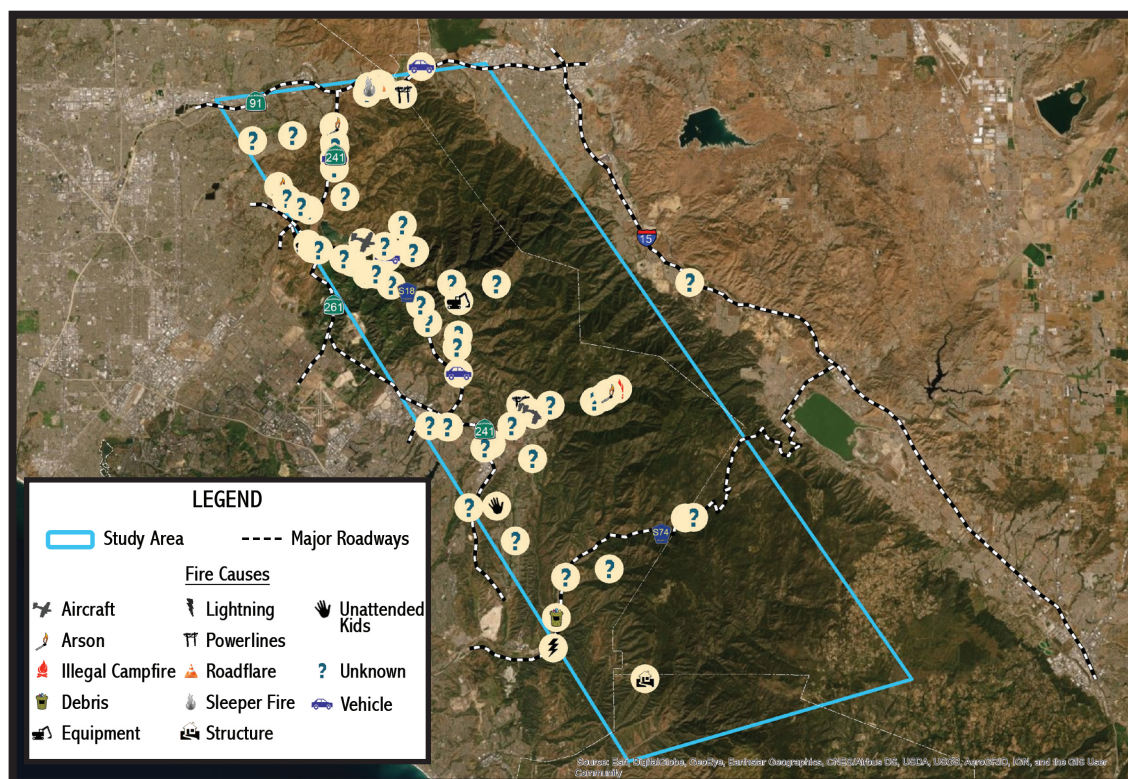
Table 1. The causes of fires burning in the Santa Ana Mountains.

Cause	1914-2014 Fires	2014-2019 Fires	Total Fires	Acreage Burned
Aircraft	1	3	4	12*
Arson	10	1	11	56,329
Campfire	3	0	3	94
Debris	3	0	3	133
Equipment	3	2	5	702
Firearms	1	0	1	69,445
Lightning	1	0	1	142
Powerlines	2	0	2	2,234*
Prescribed Burn	0	4	4	2
Road Flare	0	1	1	2,661
Sleeper Fire	1	1	2	19,807
Structure	0	1	1	0*
Unattended Kids	3	0	3	200
Unknown	128	43	171	490,202*
Vehicle	4	2	6	30,690*
TOTAL:	160	58	218	672,711*

*Data on some fire acreages are missing, so this number is higher than shown.



This same information is displayed in the map below with each icon representing the cause.

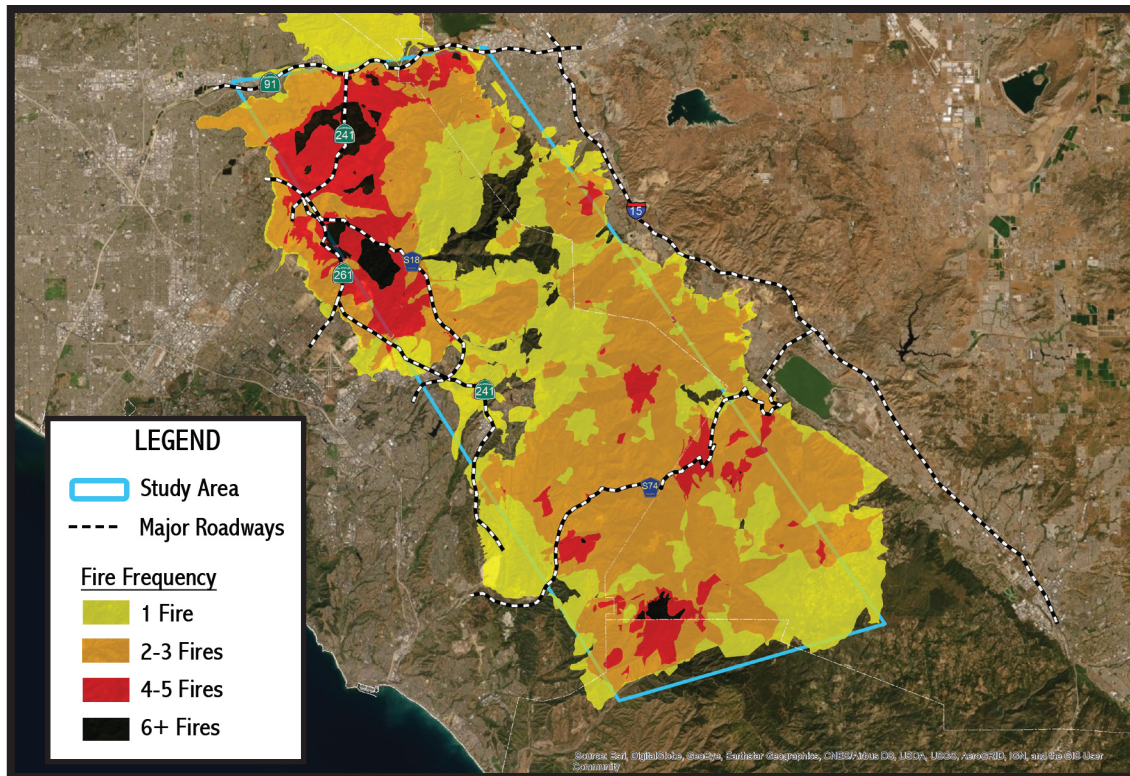


Map 6. All fire ignitions from 1914 to 2019 with causes displayed as an icon. (Note: The ignition point by the 15 freeway burned into the Study Area, so it was included in the study.)

Fire Frequency

In the original study, the data indicated four areas in the Santa Ana Mountains that have burned frequently—three of them along roads: the 241 Toll Road, Santiago Canyon Road, and Ortega Highway (Highway 74). There is one exception to this. The fourth is a small area of land within the Trabuco District’s San Mateo Wilderness which has an extensive fire history, but has limited access due to its remote location.

All of the fire causes in the San Mateo Wilderness are unknown, except one, which was caused by discharging a firearm. Even with the addition of the 2014-2019 data, no new causes were able to be confirmed for that geography.



Map 7. The fire frequency for the Santa Ana Mountains. Darker areas have burned more frequently.

Later in this report, FHBP will provide general recommendations to reduce the fire frequency in these known hotspots.

Fire & Weather

Under normal circumstances, the prevailing wind for Orange County is a westerly onshore flow. This is when most fires occur. However, the most devastating fires burn when the Santa Ana winds (which come from the north and east) occur. These winds bring hot and dry conditions to the region—exacerbating the fires burning under these windy conditions.

Research by the US Geological Survey indicates that 97% of fires, are contained shortly after they start. It is the fires in the 3% category that we should be worried about because they get out of hand quickly and spread at an alarming rate.

FHBP included in this study some research on weather patterns and seasonality of fires. The Weather Underground and the Old Farmer's Almanac websites were used to collect the data, using Silverado, CA or Trabuco Canyon, CA as the nearest location for the Santa Ana Mountains. Per our previous study, accurate weather data were not available prior to 1977. This time data on the relative humidity and wind direction were not consistently available. Consequently, this latter information was not included in this updated table.

Table 2. The weather averages for fires in the Santa Ana Mountains.

Weather Features on Fire Days	1914-2014 Fires	2014-2019 Fires	Average of All Fires
Average Temperature was:	83 °F (61 fires)	85.4 °F (58 fires)	84.2 °F (119 fires)
Average Relative Humidity was:	53% (35 fires)	n/a	n/a
Average Wind Speed was:	6 mph (35 fires)	6.2 mph (58 fires)	6.1 mph (93 fires)
Average Wind Gusts were:	27 mph (29 fires)	25 mph (58 fires)	26 mph (87 fires)
Wind Direction was: (The direction the wind originates from) (Data was available for 36 fires)	North (N, NE, NW)	4	n/a
	East (E, ENE, ESE)	8	n/a
	S (S, SE, SW)	2	n/a
	West (W, WNW, WSW)	21	n/a

Clearly most of the newly added fires are beginning under normal heat days (average 85.4 °) with relatively low wind speeds (average 6.2 mph). From our previous research, the predominant wind direction during wildfires was west, which is consistent with the typical onshore flow.

Fire & Seasonal Patterns

Most fires occur in the hotter months (July, August, and September). These months had more than 20 fires each. June was added to the list in this iteration of the study since it had a higher number of fires igniting (more than 20). Though no month is free from fires, a clear correlation exists between fire occurrence and summer months. Further, fire size (largest acreage) is confirmed to occur during Santa Ana wind events. October and November had consistently more acreage burned than the summer months, again indicating the Santa Ana Winds played a role in the fire's spread and consumed acreage. The average fire size for October and November is 10,511 and 7,493 acres, respectively. There appears to be one anomaly—a large fire (69,000+ acres) in December 1958 where high winds drove a rapid spread. Most December fires average 668 acres.



Table 3. Fire statistics by month for the Santa Ana Mountains including fire perimeters and ignitions.

Month	Known Fires	Total Acreage Burned	Average Acreage Burned
January	6	1,202*	300** (4 fires)
February	4	27,410	6,853 (4 fires)
March	2	1,618*	1,618** (1 fire)
April	3	less than one*	less than one** (1 fire)
May	9	6,415	712
June	28	17,983*	749** (24 fires)
July	34	21,298*	789** (27 fires)
August	23	42,751*	2,375 (18 fires)
September	22	19,469*	1,025** (19 fires)
October	17	178,696*	12,764** (14 fires)
November	14	104,904*	8,742** (12 fires)
December	7	73,454	10,493*** (7 fires)
Unknown	49	177,512	3,623
TOTAL:	164	672,712*	4,170** (189 fires)

* indicates some acreages are unknown and therefore the number is actually higher than shown.

** indicates acreages were averaged only where known fire acreages existed; if a fire acreage was unknown the fire was left out of the average.

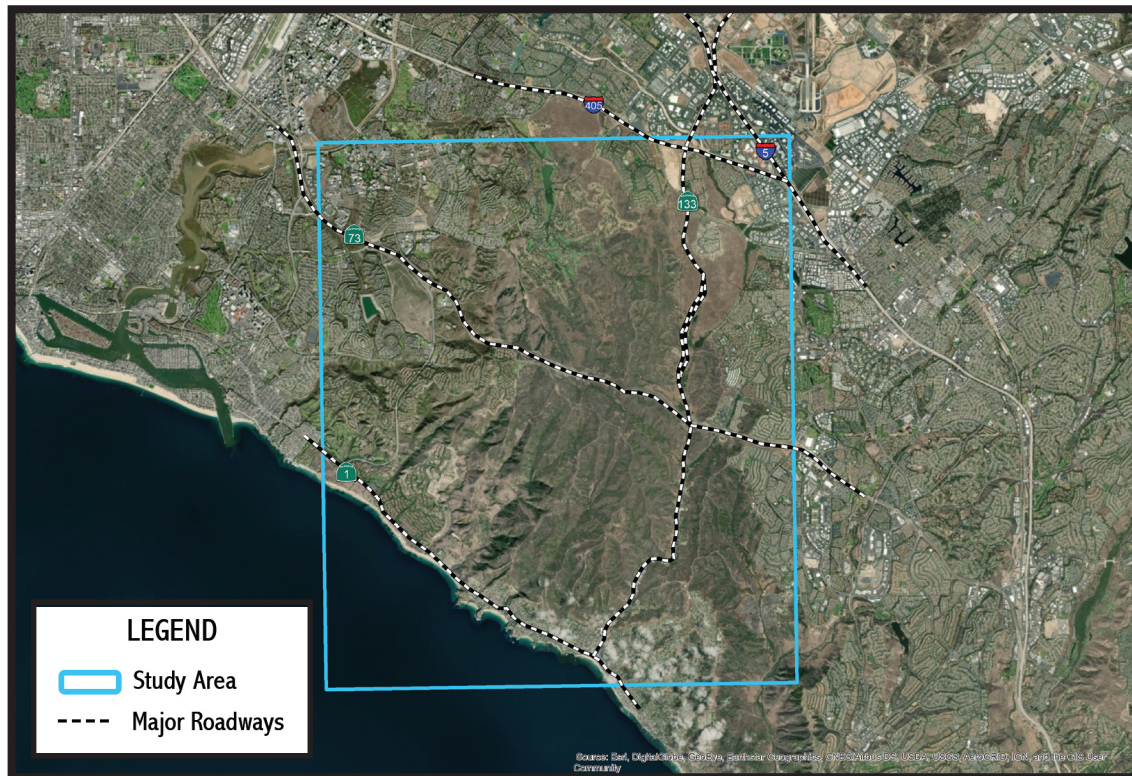
*** One Santa Ana wind driven fire in December 1958 significantly modified the acreage and average by burning 69,444 acres. Without this fire, the acreage burned would be 4,010 and the average for the six fires would be 668. This is more consistent with what we would expect in December.



Laguna Coast

Study Area

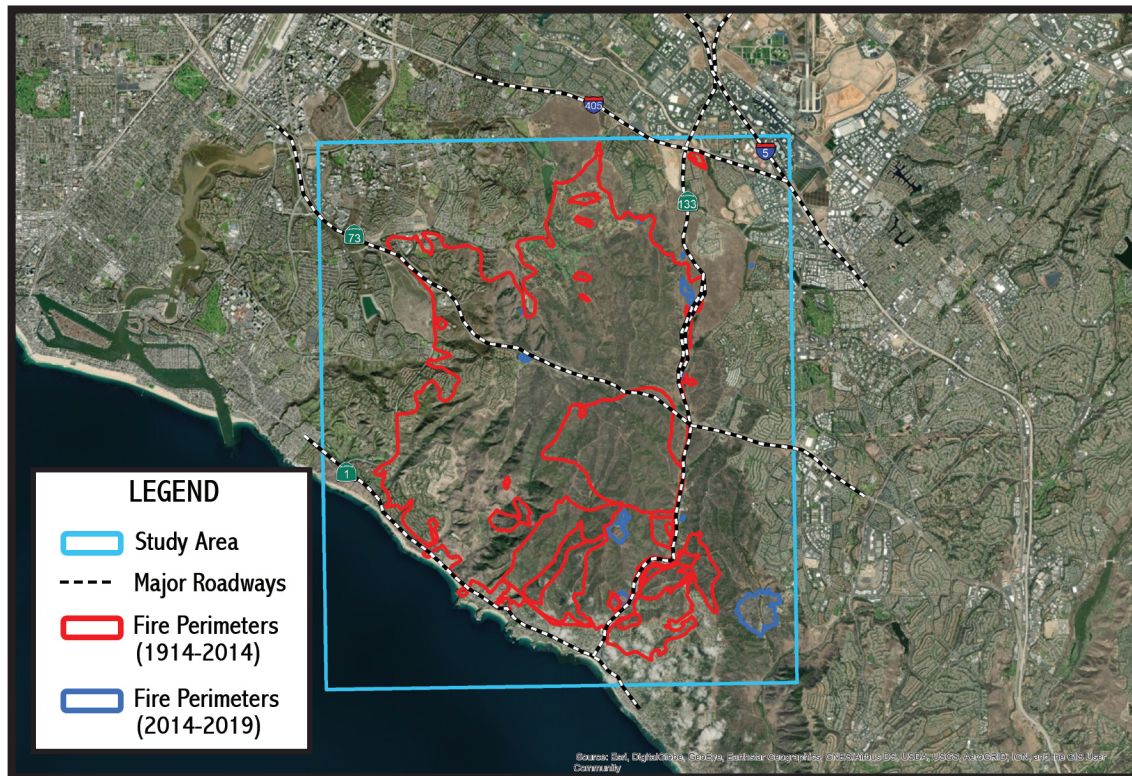
The geography in this Study Area generally included the 22,000 acres of protected lands in the Laguna Coast. It includes Crystal Cove State Park, Laguna Coast Wilderness Park, Aliso and Wood Canyons Wilderness Park and several smaller parks as well. The entire Study Area totals around 36,250 acres. It is generally bounded by the 405 Freeway on the north, the 133 Freeway on the east, the coast on the south, and the residential development of the Irvine Coast on the west.



Map 8. The Laguna Coast Study Area is shown in blue with major highways labeled.

Fire Perimeters

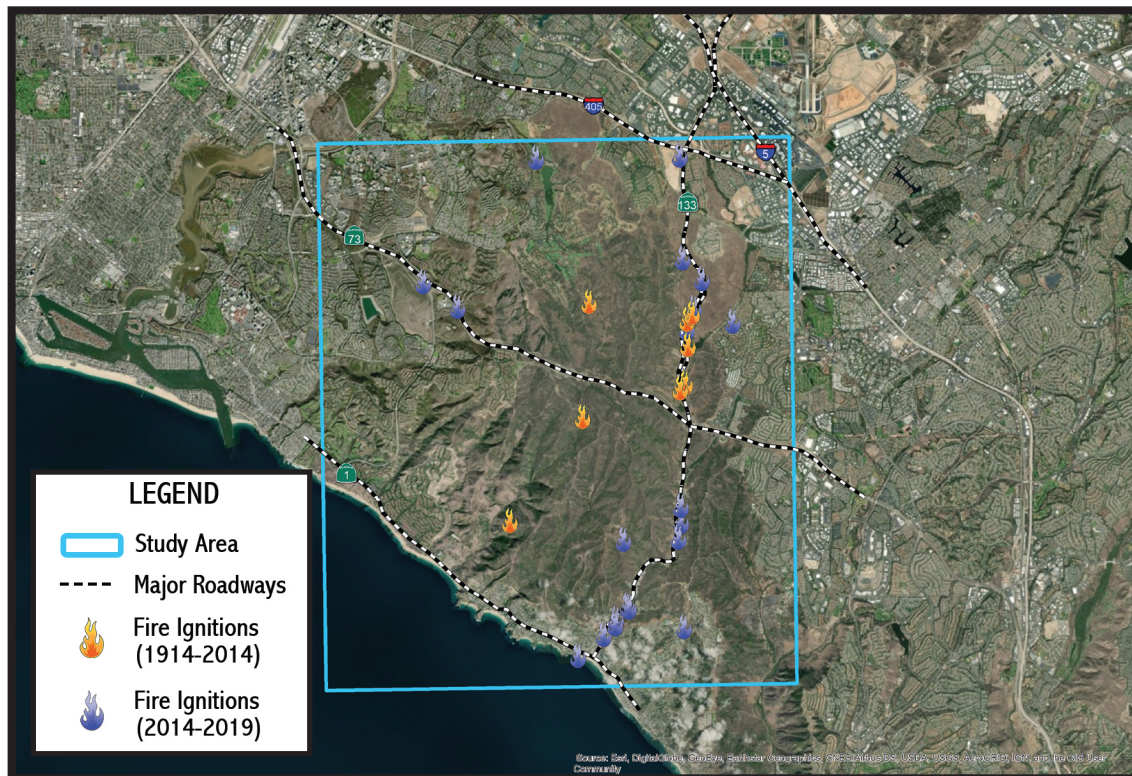
In the first report, FHBP assembled 21 separate fire perimeters with seven of those fires having known points of origin. In the update, there are 13 new fire perimeters with eight known points of origin. Thus, there are now 34 documented fire perimeters.



Map 9. The previous study and current study's known fire perimeters. New additions are in blue.

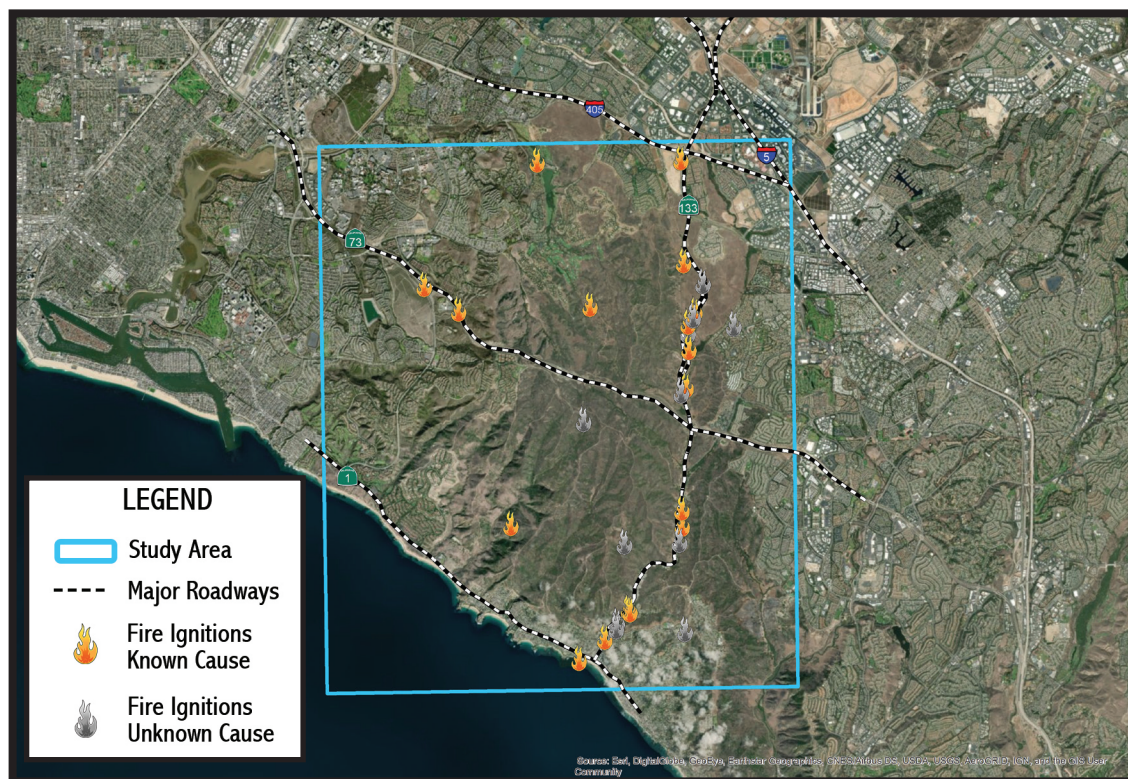
Fire Ignitions

In the first report, FHBP was able to assemble eight separate fire ignition locations with seven of those fires having known perimeters. In the update, there are 20 new fire ignitions with eight known perimeters. Thus, there are now 28 documented fire ignitions. Because of the data provided by the Laguna Beach Fire Department, much more information was available along Laguna Canyon Road, which appears to have the largest documented ignition locations.



Map 10. The previous study and current study's documented fire ignitions. New additions are in blue.

In reviewing only the ignition data along the Laguna Coast, we found 17 fires had a known cause, while 11 had an unknown cause.



Map 11. All fire ignitions from 1914 to 2019 with known causes as orange flames, unknown as grey flames.

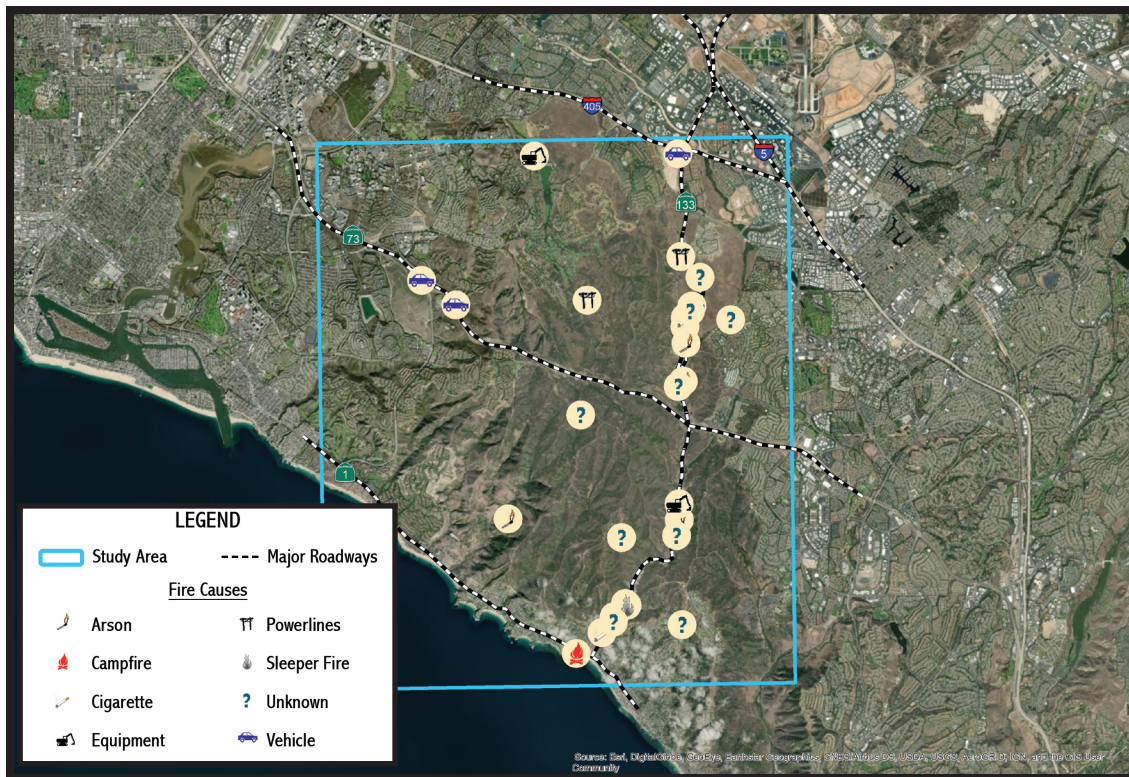
To provide a more comprehensive view, the table below includes known and unknown causes of wildland fires using data from the fire perimeter and point of origin layers.

Table 4. The causes of fires burning in the Laguna Coast.

Cause	1914-2014 Fires	2014-2019 Fires	Total Fires	Acreage Burned
Arson	3	1	4	14,435*
Campfire	0	1	1	0*
Cigarette	1	1	2	3*
Equipment	1	2	3	83*
Powerlines	3	2	5	48*
Sleeper Fire	0	1	1	0*
Unknown	14	13	27	3,697*
Vehicle	0	4	4	26*
TOTAL:	22	25	47	18,292*

*Data on some fire acreages are missing, so this number is higher than shown.

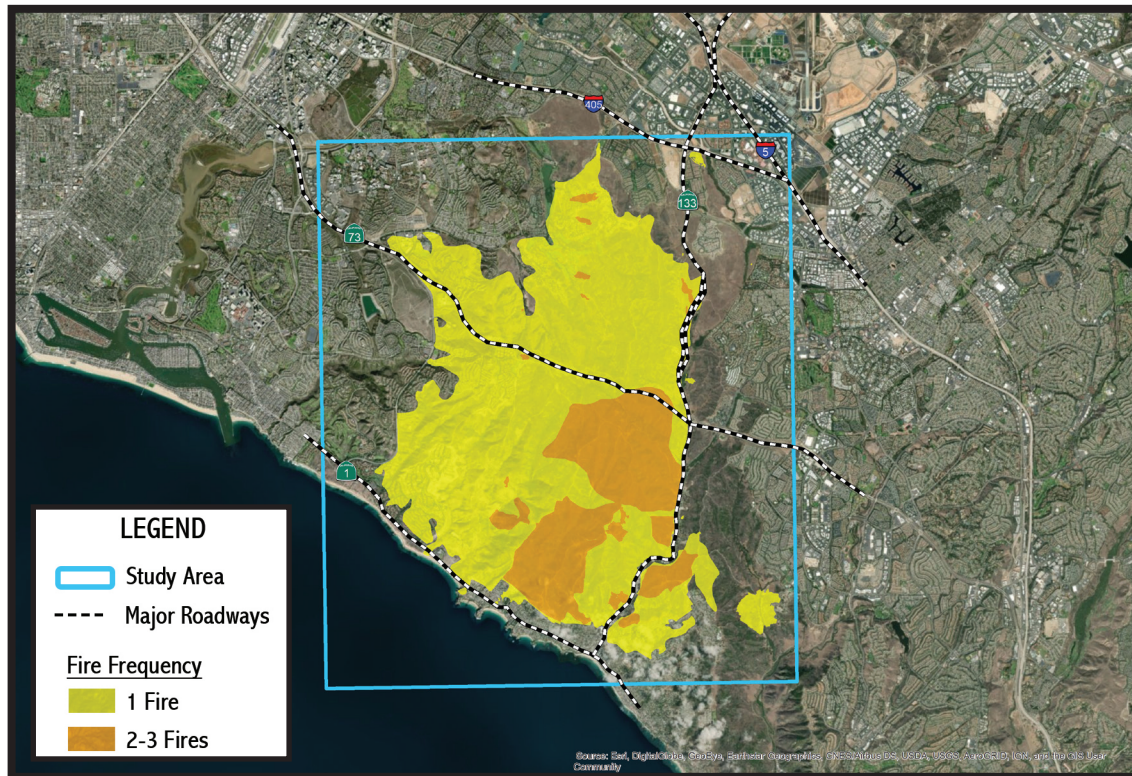
This same information is displayed in the map below with each icon representing the cause.



Map 12. All fire ignitions from 1914 to 2019 with causes displayed as an icon.

Fire Frequency

The data show no extreme hotspots (meaning six or more fires) in the Laguna Coast related to fire frequency. Based on the data in our possession, only a few areas have burned multiple times. Though fewer fires occurred in this Study Area, the similarity with the Santa Ana Mountains is that the location most likely to burn or have ignitions is along roadway edges.



Map 13. The fire frequency for the Santa Ana Mountains. Darker areas have burned more frequently.

General recommendations to reduce the fire frequency are provided toward the end of this report.

Fires & Weather

The onshore flow is even more prevalent along the coast. Again, Weather Underground and the Old Farmer's Almanac websites were used to collect data with Laguna Beach, CA being the nearest location for the Study Area. No weather data was available prior to 1977 and relative humidity and wind direction were excluded due to lack of data availability.

Table 5. The weather averages for fires in the Laguna Coast.

Weather Features on Fire Days	1914-2014 Fires	2014-2019 Fires	Average of All Fires
Average Temperature was:	84 °F (14 fires)	78.7 °F (25 fires)	81.4 °F (39 fires)
Average Relative Humidity was:	66% (4 fires)	n/a	n/a
Average Wind Speed was:	3 mph (4 fires)	5.88 mph (25 fires)	4.44 mph (29 fires)
Average Wind Gusts were:	22 mph (3 fires)	15.9 mph (25 fires)	19 mph (28 fires)
Wind Direction was: (The direction the wind originates from) (Data was available for 4 fires)	North (N, NE, NW)	1	n/a
	East (E, ENE, ESE)	0	n/a
	S (S, SE, SW)	0	n/a
	West (W, WNW, WSW)	3	n/a

Clearly, most of the newly added fires are beginning under normal heat day (average 78.7 °) with relatively low wind speeds (average 5.88 mph). From our previous study, the predominant wind direction during wildfires was west, which is consistent with the typical onshore flow. However, like the Santa Ana Mountains, we were unable to find information on relative humidity or wind direction and are using data from only four fires to determine this.



Fire & Seasonal Patterns

Similar to the results from the previous study, the Laguna Coast Study Area has more fires occur in August and September. This could be because coastal vegetation dries out later in the year due to the marine influence. October has the fires with the largest acreages, averaging 7,182 acres per fire. (Note: there are only two fires comprising this average).

Table 6. Fire statistics by month for the Laguna Coast includes fire perimeters and ignitions.

Month	Known Fires	Total Acreage Burned	Average Acreage Burned
January	1	less than one*	less than one** (1 fire)
February	2	11	5.5
March	3	3.5*	1.75** (2 fire)
April	2	less than one*	less than one** (1 fire)
May	5	13*	4.3** (3 fires)
June	5	306*	77** (4 fires)
July	5	189*	47** (4 fires)
August	7	128*	26** (5 fires)
September	8	2,002*	334** (6 fires)
October	2	14,365	7,183
November	4	1.7*	less than one** (2 fires)
December	2	552	276***
Unknown	1	720	720
TOTAL:	47	18,291*	867**

* indicates some acreages are unknown and therefore the number is actually higher than shown.

** indicates acreages were averaged only where known fire acreages existed; if a fire acreage was unknown the fire was left out of the average.

*** One fire in December 1979 significantly modified the acreage and average by burning 535 acres. The other December fire (2003) burned 18 acres, which is more consistent with what we would expect in December. Unfortunately, we only have the weather data for the 2003 fire and not the 1979 fire, which may have burned more land due to wind gusts.



Recommendations

The data demonstrate that there are four general “hotspots” in the Santa Ana Mountains Study Area that show a propensity to burn: along the 241 Toll Road, Santiago Canyon Road, and Ortega Highway (Highway 74), and within the San Mateo Wilderness at the Orange/San Diego County border. For the Laguna Coast Study Area, the ignition hotspots are along the Laguna Canyon Road. There were many more documented ignitions on the coastal side of the 73 Toll Road than in the previous study—likely due to the fact that the Laguna Beach Fire Department was able to contribute data to this study and had not been able to in the last study. The entire length of Laguna Canyon Road (State Route 133) is now an area of concern.

Because of this information, FHBP has provided several suggestions for possible adoption by the US Forest Service, State Parks, OC Parks, Irvine Ranch Conservancy, regional non-profits, Fire Safe Councils, cities, decision makers, and/or transportation and fire agencies. We acknowledge that these recommendations may require an increase in expense and/or staffing. As offered after the release of the last study, FHBP is able to provide outreach and education as well as information to the public and decision-makers that may provide the impetus for implementing some or all of these recommendations. Recurring firefighting costs and damage to the habitats and homes is likely to far outweigh implementation costs.

This section provides an overview of each recommendation from the original study and its status. In addition, FHBP has several new recommendations based on the new research. We remain willing to help develop the political will and partner on implementing these recommendations.



General Recommendations

The following recommendations came from the 2015 study and were general to the information gathered.

Original Recommendation	Action*	Status (2020)
To understand the details about wildland fires, fire agencies should determine, when possible, the exact cause and ignition location of a fire (arson, vehicle, fireworks, etc.).	Both Study Areas had a reduction in the number of “unknown” causes based on the fires for which data were available on.	Remains a recommendation.
Enforcement of existing fire rules and regulations is essential if fires are to be reduced.	<p>While fire agencies have developed brochures for fire prevention, to our knowledge the most effective education can be through local Fire Safe Councils.</p> <p>There is now better enforcement of the smoking ban (especially at Alta Laguna Park) by the City of Laguna Beach.</p> <p>To help prepare for the next big fire, the water district in Laguna Beach has doubled the reservoir capacity since the damaging Laguna Fire in 1993.</p> <p>It appears there is a problem with park-related land manager cooperation to ensure fuel modification in some areas near homes.</p>	In progress.

* FHBP is not claiming to have implemented these actions. We are simply reporting the known activities and status.



Original Recommendation	Action*	Status (2020)
<p>Continue or create volunteer FireWatch programs and staff them on high fire danger days at high fire frequency locations to reduce ignitions.</p>	<p>Irvine Ranch Conservancy FireWatch programs are operational and coordinate with the Fire Safe Council East Orange County Canyons (FSC-EOCC), OC Parks, the cities of Anaheim and Laguna Beach.</p> <p>The FSC-EOCC has a robust CanyonWatch program that covers all types of natural disasters and community assistance.</p> <p>In Laguna Beach, the FireWatch is run by the Greater Laguna Coast Fire Safe Council. Volunteers come out on red flag days and position themselves at key locations—especially park entrances. The City Fire Department upstuffs fire investigators to patrol on red flag days as well.</p> <p>Laguna Beach’s CERT (Community Emergency Response Team) members are also available to assist as well. The Fire Department does train the CERT team.</p> <p>The School District is patrolling area schools with parent volunteers, but this effort should be coordinated with other entities.</p>	<p>Implemented in some locations.</p> <p>Continues to be a recommendation.</p>

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Original Recommendation	Action*	Status (2020)
Educate homeowners and drivers, especially in the high fire frequency locations with the goal of fire reductions. For example, signage along roadways encouraging drivers to report suspicious behavior.	<p>Signage is placed at the entrance to Santiago Canyon Road.</p> <p>Laguna Canyon Road has signs that rotate messages in multiple locations.</p> <p>Laguna Beach is a no smoking city, which means no smoking in any public area.</p>	<p>Implemented in some locations.</p> <p>Remains a recommendation.</p>
Reduce fire frequency along roadways by reducing ignition opportunities. Brush clearance increases non-native plant growth and therefore increases fire ignition and spread. Weed mats have been successfully used along nearby Highway 71.	<p>Portions of the 91 Freeway have hardened edges with k-rail. And, efforts to add the additional k-rail remain. Brush is cleared along the toll roads. No weed mats have been used.</p> <p>Caltrans weed whips to remove high vegetation along Laguna Canyon Road. The City works with OCFA via a CalFire grant for the installation of a cactus strip to reduce roadside ignitions (between 405 Freeway and 73 Toll Road).</p>	Remains a recommendation.
Maintain buffers at the end of “chutes” (at the ends of canyons) by requiring homes to be clustered or moved beyond these areas as these homes are less defensible as the fires move up the canyon walls quickly.	<p>Very few developments are being proposed in the Canyons because of the land use plans (specific plans), cost, and lack of infrastructure.</p> <p>Laguna Canyon Road area has not seen many new additional homes since most of the land is protected.</p>	Remains a recommendation.

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Original Recommendation	Action*	Status (2020)
Include portable signage for residents and commuters to be cautious, alert, and to report suspicious behavior.	<p>Signage is placed at the entrance to Santiago Canyon Road.</p> <p>Laguna Canyon Road has signs that rotate messages placed in several locations.</p>	<p>Implemented in some locations.</p> <p>Remains a recommendation.</p>
Where appropriate de-energize problem powerlines during extreme Santa Ana Wind conditions and when it doesn't inhibit firefighting and overall public safety.	<p>Both geographies are within the SoCal Edison Public Safety Power Shutoff Program territory.</p> <p>The FSC-EOCC has identified that battery back-ups are needed on the Verizon repeaters to maintain cell phone and internet connections for residents and public safety personnel. Not everyone has General Mobile Radio Service.</p> <p>Laguna Canyon only saw one notice from Edison, in 2019, about a possible loss of power. A key problem identified by Laguna Beach Fire Department with power loss is gated communities (which require electricity to open and close), consequently backup power is needed for those gates.</p> <p>Laguna Beach has an Emergency Coordinator position. It is currently vacant. This position is essential to coordinating with the community.</p>	<p>Implemented in some locations.</p>

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Original Recommendation	Action*	Status (2020)
Removal invasive exotic plants such as <i>Arundo donax</i> from the watershed.	<p>Restoration projects are occurring in some locations, but attacking <i>Arundo</i> takes multiple kill cycles and extensive funding. Additional locations have been identified by the FSC-EOCC in both Silverado and Modjeska Canyons.</p> <p>Some restoration projects have been funded in partnership with Laguna Canyon Foundation, the City of Laguna Beach and OC Parks—Aliso Creek being the location with the most robust fuel modification program.</p>	<p>Implemented in some locations.</p> <p>Remains a recommendation.</p>
Decision-makers should stop approving development projects in Very High and High Fire Hazard Severity Zones.	<p>Very few development projects have been proposed for the unprotected portions of the wildland areas of the Santa Ana Mountains. However, development remains a threat.</p> <p>Many of the natural lands in Laguna Coast are already protected, so few projects are proposed there.</p>	Remains a recommendation.

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Santa Ana Mountain Recommendations

The following recommendations came from the 2015 study and were specific to the Santa Ana Mountains.

Original Recommendation	Action*	Status (2020)
Focus fire reduction efforts along the hotspots areas.	It is unknown if the hotspot areas have been targeted for specific mitigation measures by fire agencies or FireWatch programs.	Remains a recommendation.
Harden the roadway edges along the 91, 241, 74, and Santiago Canyon Road. Hardening techniques can include vegetation removal, the addition of k-rail, and/or weed mats.	Portions of the 91 freeway have k-rail, efforts to add the remaining k-rail are underway. Brush is cleared along the toll roads. No weed mats have been used.	Implemented in some locations. Remains a recommendation.
Increase fire patrols or FireWatch presence on high fire danger days along the key roads.	FSC-EOCC has a robust radio network through its CanyonWatch program to report on issues, including all-natural disasters, not just wildfires.	In Progress. Remains a recommendation.
Work closely with residents to expand their understanding and personal responsibility to protect their property.	<p>The FSC-EOCC offers two brush clearance days in the Canyons (June/September). Silverado and Modjeska Canyons first received its FireWise certification five or six years ago.</p> <p>To aid emergency responders in finding streets/addresses, the FSC purchased and sells metal reflective street signs and address signs.</p> <p>Instead of Community Emergency Response Team (CERT) members OCFA created the Canyon Emergency Preparedness Academy (CEPA) for locals to become educated. Trainings are offered through this academy for the unincorporated areas.</p>	Implemented in some locations. Remains a recommendation.

* FHBP is not claiming to have implemented these actions. We are simply reporting the known activities and status.



Original Recommendation	Action*	Status (2020)
Stop approval of new houses at the Wildland-Urban Interface and in Very High or High Wildfire Hazard Severity Zones.	Very few developments are being proposed in the Canyons because of the cost, lack of infrastructure, and the development guidelines of the Canyon Specific Plans.	Remains a recommendation.
Continue to engage the Fire Safe Council to increase knowledge and understanding.	The FSC-EOCC has received multiple grants (Edison and CalFire) to remove dead and dying trees and provide defensible space. The FSC continually helps keep the communities informed.	In Progress.
Promote improved fire resistance and code upgrades for existing older canyon homes.	Continuing education for residents as to the basic improvements needed for homes, like boxed eaves, vegetation removal near the structure, and replacing sliders/windows appropriately.	Remains a recommendation.

* FHBP is not claiming to have implemented these actions. We are simply reporting the known activities and status.



Laguna Coast Recommendations

The following recommendations came from the 2015 study and were specific to the Laguna Coast.

Original Recommendation	Action*	Status (2020)
Focus fire reduction efforts along the hotspot areas.	<p>City is trying to reduce evacuation chokepoints by identifying areas where people will get trapped.</p> <p>The Coastal Development Permit for Laguna Beach includes a coordinated fuel modification program. This means the City would no longer be relying on emergency permits from the Coastal Commission.</p>	<p>In progress.</p> <p>Remains a recommendation.</p>
Harden the roadway edges along the 133 between the 405 and the 73. Hardening techniques can include vegetation removal, the addition of k-rail, and/or weed mats.	Efforts to reduce wildland fires along Laguna Canyon Road include the installation of a cactus barrier. It has been planned, but not yet implemented.	Remains a recommendation.
Utilize the parking areas and Nix Nature Center for information on fire prevention.	No information is being distributed that we are aware of.	Remains a recommendation.
Work closely with residents to expand their understanding and personal responsibility to protect their property.	The Greater Laguna Fire Safe Council assists with this effort.	<p>In Progress.</p> <p>Remains a recommendation.</p>
Consider creation of a FireWatch program in this area and/or a Fire Safe Council to engage residents.	The Greater Laguna Fire Safe Council has existed for more than a decade and continues to work with residents and the City to ensure fire preparedness.	In Progress.

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Original Recommendation	Action*	Status (2020)
Promote improved fire resistance and code upgrades for existing older hillside homes.	The City has enlisted the help of a home inspector to go house to house to help identify weaknesses in homes related to wildfires and ember intrusion.	Remains a recommendation.

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New Recommendations

New recommendations include the following:

- Fire agencies should support efforts by local park agencies to improve the WUI with fire-resistant native vegetation.
- Provide additional information, outreach, and education about the Edison Public Safety Power Shutoff program to ensure residents are able to effectively evacuate with the power off.
- Include information, examples, and demonstrate how to make your home fire-safe during safety related events like the National Night Out.
- Require mitigation and repair, when natural resources burn due to incompetence or negligence of an agency.
- The public should be advised not to smoke in high fire risk areas and reminded that discarding burning objects from vehicles is unlawful.
- Encourage transition to underground cabling for powerlines.

For the Santa Ana Mountains, specifically:

- Fire agencies and jurisdictions should aggressively pursue grants to retrofit older homes at the WUI.
- Consider insurance (or lack of it due to high premiums) implications and how that impacts homeowners in Very High or High Fire Hazard Severity Zones—as existing residents are having policies canceled, not renewed, and must rely on the state through its Fair Plan.

For the Laguna Coast, specifically:

- Regularly participate in the National Night Out event.
- Educate residents, businesses, and visitors along the fire-prone portions of Laguna Canyon Road to reduce ignitions.



Conclusions

This update provides new details about where, why, when, and how fires are starting in the Santa Ana Mountains and along the Laguna Coast. There are more fires burning in both areas—especially the Santa Ana Mountains—than would be seen during a natural fire regime. In the Santa Ana Mountains, there have been 218 fires in 105 years—thus significantly altering the natural fire regime of one fire every 30-150 years. The natural fire regime remains static with one lightning strike in 105 years. Consequently, humans have increased the frequency to more than two fires a year igniting in the Study Area.

FHBP recognizes that a sample size of one natural fire is not enough to draw firm conclusions. However, our local examples of natural fires indicate fewer acres burn (142 acres) compared with fires ignited by humans or human error (an average of 2,941 acres). Natural fires tend to ignite on ridge tops with a lightning strike. The fire then generally spreads downhill and does so more slowly allowing firefighters more time to attack the blaze. Human caused fires tend to start at a canyon bottom, where roads usually are, and race uphill.

It still appears access into the wildlands increases the fire ignitions. Many more fires start along roadways than in the actual wildlands. For the two locations studied, 25% more fires were added in the Santa Ana Mountains, and 53% along the coast. Tracking is better—as seen in the Laguna Beach example where the local fire department had information available to share.

Three large fires were documented in the newly added data for the Santa Ana Mountains between 2014 and 2019. These included the 2017 Canyon 1 (2,661 acres) and Canyon 2 (9,815 acres) Fires, and 2018 Holy Fire (22,885 acres). Subtracting these large wind-driven fires leaves 55 remaining fires. The average fire size for these examples was 1,825 acres per fire—only a fraction of the size of a wind-driven fire, but still a significant number.



BOB KANNE

The Canyon 1 Fire in 2017 burning towards Corona.

Again, only looking at the new data (2014-2019), the worst fire in Laguna burned 175 acres—one tenth the size of the average fire in the forest. This fire did not appear to have occurred during a true Santa Ana wind day, with a temperature of 76 degrees and wind gusts topping only 14 mph. When averaged, the remaining 24 new fires in the Laguna Coast Study Area were approximately 6.77 acres per fire—a much more manageable and easier fire to extinguish.

A key risk of excessive fires, particularly in the wildlands, is that the vegetation type converts into non-native grasslands, which by its nature is more flammable, easier to ignite, and spreads fire faster. The goal should continue to be reducing ignitions to keep people, property, and natural lands safe for future generations.

Acknowledgments

Melanie Schlotterbeck is a conservation advocate specializing in natural resource protection in and around Orange County. Ms. Schlotterbeck is a technical consultant for numerous conservation focused non-profits both locally and regionally, including FHBP. She has experience with GIS mapping, land conservation, research projects, and outreach. Some of her most recent efforts have led to the conservation of thousands of acres in and around Orange County. She earned her bachelor's degree in Environmental Geography and her Master of Science in Environmental Studies.

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This Study is available electronically as one way to reduce our impact on the environment.



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