IBHS RESEARCH

2025 LA County Wildfires

Early Insights

Insurance Institute for Business & Home Safety

January 16, 2025

Why it Matters

The Palisades and Eaton Fires led to catastrophic conflagration in Los Angeles County as strong Santa Ana winds fueled **uncontrollable structure-to-structure fire spread**. Each of these fires quickly consumed thousands of structures placing them among California's four most destructive fires, according to CAL FIRE.[1]

Dig Deeper: Historically, wildfire-driven suburban conflagrations follow **humans, drought, and wind**. These wildfires ignited just outside of suburban Los Angeles communities that were experiencing a flash drought and a volatile Santa Ana wind event. In **a textbook-worst case conflagration scenario**, the wind vector aligned with the orientation of major roads, which allowed the fire to rapidly spread through connective fuels—like privacy hedges and combustible fences—across the community overwhelming suppression resources.

From *The Return of Conflagration in Our Built Environment* (Giammanco et al., 2023)

"Wildfire, spreading under high wind conditions through volatile fuels, presents a different challenge relative to urban fires. The wildfire environment can stretch emergency response capabilities in a situation that is already challenging in its dynamic nature and scale. The combination of an active wildfire and a built environment conflagration can be too dangerous for direct fire suppression tactics, especially in such situations where weather conditions are so extreme that aerial fire suppression resources cannot be used in coordination with ground resources. Fire can spread uncontrolled both through the suburban and wildland environments. To slow fire spread neighborhoods must function as fuel breaks rather than fuel sources. Primarily, they must resist ember attacks as wildfire approaches. Then the structures and the space between must also serve to break the chain of fire spread through flame contact and radiant heat. Unfortunately, the lessons of past conflagrations in urban settings have not been applied to our residential neighborhoods in materials and design."

Weather

Flash Drought

In the five weeks leading up to the fires, a flash drought took hold in the region. No drought conditions were observed in LA County on December 3, 2024, but by January 7, 2025, 59.57% of LA County—including the area impacted by the Palisades and Eaton Fires—were experiencing D2 **severe drought conditions**. The rest of the county was experiencing D1 moderate drought conditions.

The rainy season for Los Angeles runs from November through March when average monthly rainfall totals more than one inch (Table 1). However, with a dry start to the rainy season, Los Angeles at LAX **measured only 0.03 inches of rain since November 1**.

Table 1. *Mean monthly precipitation for Los Angeles Airport (LAX) with a period of record since 1944.*

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Rainfall (in.)	2.61	2.62	1.88	0.71	0.19	0.04	0.02	0.09	0.16	0.36	1.29	1.94

[1] https://34c031f8-c9fd-4018-8c5a-4159cdff6b0d-cdn-endpoint.azureedge.net/-/media/calfire-website/our-impact/fire-statistics/top-20-destructive-ca-wildfires.pdf?rev=968bc973969441b1ae1306d970491c22&hash=21495EF4AD5394167B4BA02F2DB68C35

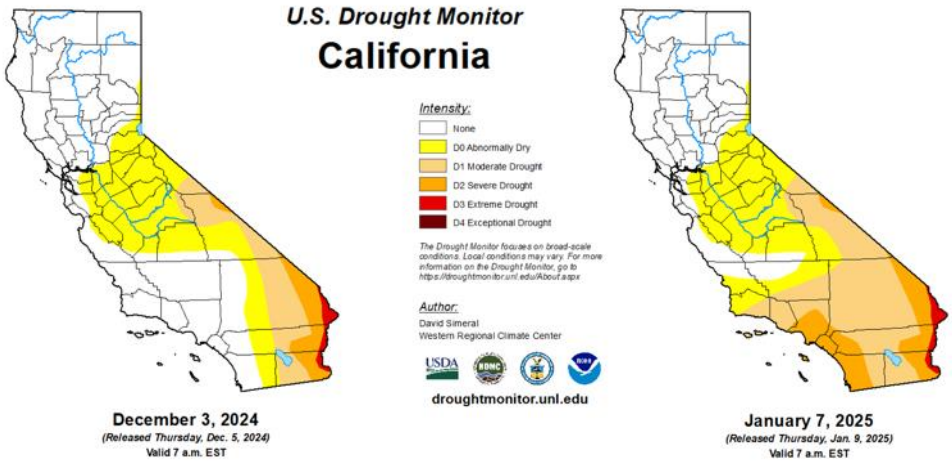

Figure 1. *US Drought Monitor shows the rapid onset of drought conditions in Southern California in the 5 weeks leading up to the fires due to the dry start to the rainy season.*

By January 7, 2025, more than 5.8 million people were living in areas classified as severe drought in LA County.

Santa Ana Wind

With an offshore area of high pressure setup to the northwest of the region and an area of low pressure to the southwest, a tight pressure gradient initiated strong offshore flow across the California coast. As those winds flowed through the mountains of Southern California, the air compressed, warmed, and dried as it descended the terrain creating the Santa Ana winds.

Forecasts from the National Weather Service in Los Angeles highlighted the extreme setup for the wind and fire weather conditions. On January 7, a "Particularly Dangerous Situation" Red Flag Warning detailed the potential for rapid fire spread, extreme fire behavior, and long-range spotting. The extreme wind conditions included the potential for a "life-threatening and destructive windstorm." Gusts reached as high as 100 mph fueling fire spread and hampering fire-fighting efforts, particularly grounding aerial firefighting support. Additionally, winds downed trees in the county.

Table 2. *Select wind reports in Los Angeles County from the National Weather Service Los Angeles preliminary local storm reports. All times PST.*

Time	Location	Wind Gust	Observing Site	Lat, Lon
January 7, 2025				
10:50 a.m.	8 S Agua Dulce	86 mph	Mesonet station SE678 Magic Mtn Truck Trl (SCE)	34.39N, 118.34W
6:58 p.m.	2 E Altadena	85 mph	Mesonet station HNGC1 Henniger Flats RAWS	34.20N, 118.09W
8:30 p.m.	2 WNW Burbank	84 mph	ASOS station KBUR	34.20N, 118.37W
9:30 p.m.	4 NNE Mount Wilson	81 mph	Mesonet station 099SE Barley Flats Rd (SCE)	34.27N, 118.05W
9:37 p.m.	7 SSW Woodland Hills	98 mph	Mesonet station DW2363 Saddle Peak (SCE)	34.08N, 118.63W
9:40 p.m.	7 SSW Woodland Hills	82 mph	Mesonet station 548SE Backbone Trail (SCE)	34.08N, 118.65W
9:56 p.m.	8 SSW Woodland Hills	83 mph	Mesonet station MBUC1 Malibu Hills RAWS	34.06N, 118.65W
10:20 p.m.	4 NW Altadena	99 mph	Mesonet station 149SE Mt Lukens Truck Trail (SCE)	34.23N, 118.19W
11:56 p.m.	8 SSW Woodland Hills	86 mph	Mesonet station MBUC1 Malibu Hills RAWS	34.06N, 118.65W
January 8, 2025				
2:30 a.m.	8 S Agua Dulce	90 mph	Mesonet station SE678 Magic Mtn Truck Trl (SCE)	34.39N, 118.34W
4:58 a.m.	2 E Altadena	90 mph	Mesonet station HNGC1 Henniger Flats RAWS	34.20N, 118.09W
5:00 a.m.	4 NW Altadena	100 mph	Mesonet station 149SE Lukens Truck Trail (SCE)	34.23N, 118.19W
5:04 a.m.	6 NE Pyramid Lake	81 mph	ASOS station KSDB	34.75N, 118.72W
5:30 a.m.	1 NNW Chatsworth	86 mph	Mesonet station SE712 Browns Cyn (SCE)	34.29N, 118.60W
7:30 a.m.	8 SSW Woodland Hills	85 mph	Mesonet station 751SE SCE Rambla Pacifico	34.06N, 118.65W
7:30 a.m.	8 SSW Woodland Hills	80 mph	Mesonet station SE003 Saddle Peak (SCE)	34.08N, 118.66W
7:37 a.m.	7 SSW Woodland Hills	89 mph	Mesonet station DW2363 Saddle Peak	34.08N, 118.63W
7:47 a.m.	7 SSW Woodland Hills	87 mph	Mesonet station DW2363 Saddle Peak	34.08N, 118.63W
8:40 a.m.	8 S Agua Dulce	81 mph	Mesonet station SE678 Magic Truck Trl (SCE)	34.39N, 118.34W
10:20 a.m.	8 S Agua Dulce	85 mph	Mesonet station SE678 Magic Truck Trl (SCE)	34.39N, 118.34W

Palisades Fire

- The Palisades Fire ignited Tuesday, January 7, 2025, around 10:30 a.m. local time southeast of Palisades Drive, near the Pacific Palisades and Topanga area of Los Angeles County. As of Wednesday, January 15, the fire consumed more than 5,000 structures, burned more than 23,000 acres, and claimed eight lives.[1]
- The Van Nuys Automated Surface Observing Station (ASOS) sits north of the Palisades and likely provided the best representation of general wind conditions during the Palisades Fire. The observing site recorded a peak 5-second gust of 66.7 mph with winds consistently out of the north, which directed the general flow parallel to the canyon features.
- Dry air present in the region as the fires unfolded led to only single-digit dew points. January 8–10, fuel moisture in Topanga, as measured at the RAWS site, averaged 4.64%.

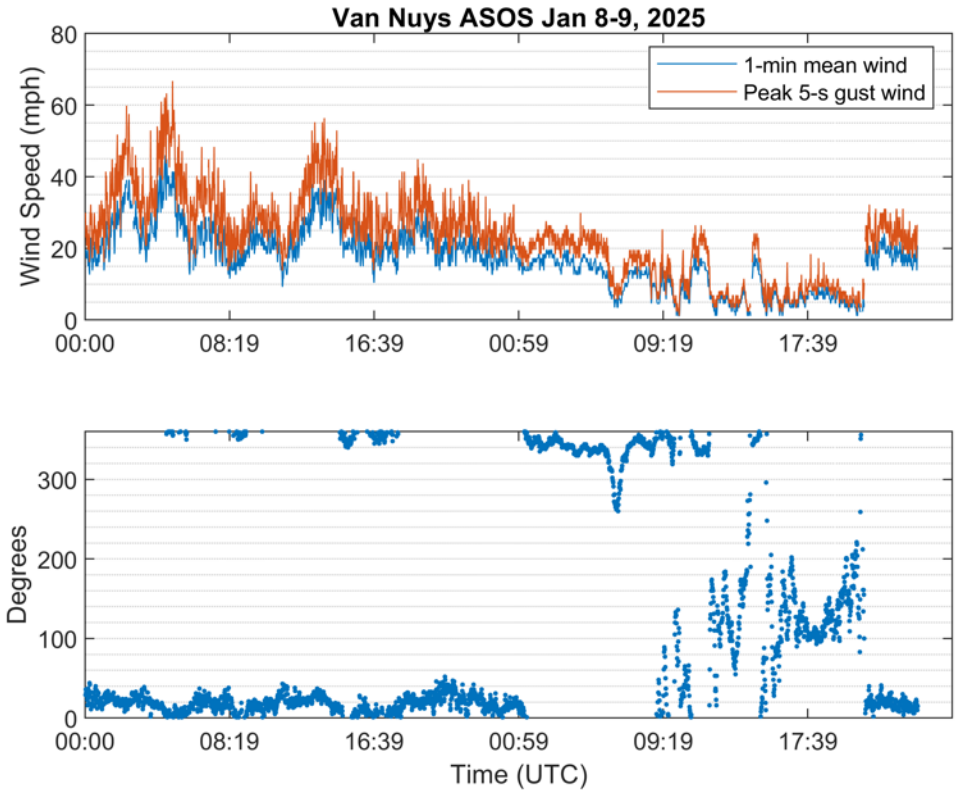

Figure 2. *Time history of mean wind and peak gust wind speeds (top) and mean wind direction (bottom) for January 8-9, 2025, from the Van Nuys National Weather Service Automated Surface Observing Station (ASOS).*

Fire Evolution

Ignition

- The Palisades Fire started behind homes on Piedra Morada Drive in The Summit neighborhood (Figure 3) and made its initial spread southeast through a small canyon, becoming a discrete conflagration. While the official **cause of the fire remains under investigation**, residents of Piedra Morada Drive reported the first signs of the fire beyond their backyards near Skull Rock.[2]

[2] https://www.nbcnews.com/news/us-news/pacific-palisades-highlands-fire-first-hours-rcna187156

- Approximately one hour after ignition, two homes on Lachman Lane near Fire Road in Pacific Palisades were actively involved in fire—south of the initial ignition following the wind vector. **Spot fires** continued the spread to Palisades Drive, Coastline Drive, and the Getty Villa area around midday.

Rapid Spread

- By that evening, the fire grew to 1,260 acres with the western flank located near Brentwood and Bel Air. Reports noted intense fire in the terrain on either side of Ridgeview Country Estates north of Sunset Blvd.
- **Significant wind-driven ignitions** led to streaks of conflagration in the Pacific Palisades neighborhood as aerial firefighting resources were grounded due to the wind around 8 p.m. local time. **Discrete ember ignitions transitioned into a built environment conflagration** near the intersection of Glenhaven Drive and Lachman Lane on the north side of Pacific Palisades.

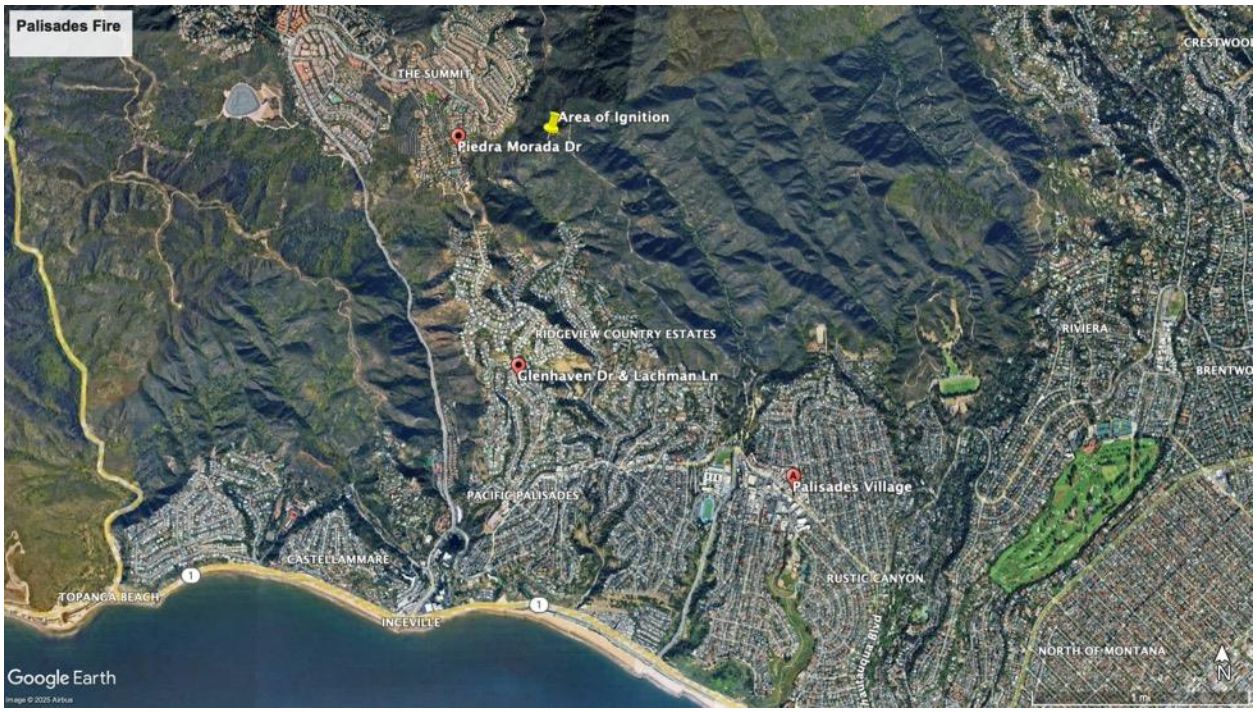

***Figure 3**. The area of Palisades Fire ignition marked by the yellow pin based on the CAL FIRE estimate as of January 15.*

Conflagration

- With winds gusting above 60 mph overnight, the **rapid fire growth and structure-to-structure fire spread** occurred within the first 24 hours of ignition. These wind speeds likely **maximized ember ignition** potential.
- The **swath of conflagration** through Palisades Village—generally the oldest neighborhood and with the densest construction—resembles observations from the Lahaina Fire (2023) with evidence of fire following the slope down to the ocean while **spreading through homes and connective fuels**. Most homes connected to adjacent structures by connective fuels on at least three of their four sides through vegetation and combustible structures like wood fences.
- While the fire continues to burn through wildland fuels as of this writing, the large-scale conflagration phase ended by late Wednesday, January 8. A distinct boundary of ignited structures on the east side of Pacific Palisades likely indicates fire suppression activities.
- Based on news coverage and aerial imagery, little survived the fire, particularly in Palisades Village, indicating **a high-intensity wildfire** like the Camp Fire (2018) and the Lahaina Fire (2023).

Fire Suppression

Several factors hampered fire suppression efforts, including:

- **A limited window of time to prevent conflagration**. High winds with gusts over 80 mph were ongoing at the time of ignition. These winds maximized short-range ember transport and resulted in extreme ember attack for the built environment almost immediately, limiting the window of opportunity to prevent the fire from becoming a conflagration.
- **Loss of aerial attack due to high winds**. While fire fighters utilized air resources during the first several hours of the fire, including a C-130 and several helicopters, all air resources were grounded due to high winds on the evening of Tuesday, January 7. Aerial operations were unable to resume until the morning of Wednesday, January 8. Additionally, a civilian drone struck a Super Scooper aircraft mid-flight during firefighting operations on Friday, January 10, putting a critical resource out of service.
- **An insufficient water supply due to the scale of the events**. Without the use of critical aerial firefighting resources, firefighters were left defending the community with ground resources only. This effort was significantly hampered when the municipal fire hydrant system, designed to fight one- or two-house fires at once—not hundreds of house fires simultaneously during a wildfire, lost pressure in the water supply system, particularly at elevated areas in the Palisades. Los Angeles Department of Water and Power Chief Executive Janisse Quinones told reporters in a press conference that the water system was pushed to the extreme after four times the normal demand for 15 consecutive hours.[3]
- **Extreme fire conditions overwhelming firefighting efforts**. Dry gusty winds fueled the fire spread, particularly as the wind direction paralleled the rows of homes pushing fire deeper into communities. During the first 24-hours of the Palisades Fire, three other wildfires ignited in the county—the Eaton, Hurst, and Woodley Fires. LA County Fire Chief Anthony Marrone acknowledged in a live press conference that morning that there was not enough manpower for an emergency of this scale.[4] Additionally, firefighting resources prioritize life safety over property preservation.
- **Evacuation traffic and abandoned vehicles blocking roads**. Residents trying to evacuate abandoned locked vehicles, which blocked roads, particularly Palisades Drive, that firefighters also needed to access the fire. With few roads in and out of these mountainside communities, ground resources used firefighting bull dozers to push vehicles out of the way, creating a pathway for fire engines.[5]

Figure 4. *Fences act as a connective fuel, providing the fire a pathway to spread. Image courtesy of CAL FIRE.*

[3] https://www.latimes.com/california/story/2025-01-08/lack-of-water-from-hydrants-in-palisades-fire-is-hampering-firefighters-caruso-says
[4] https://www.latimes.com/california/story/2025-01-08/l-a-officials-admit-firefighters-were-overwhelmed-by-deadly-firestorms
[5] https://www.npr.org/2025/01/09/nx-s1-5252742/wildfires-evacuation-lessons

***Figure 5**. Oblique aerial imagery shows residential homes in Pacific Palisades with a mean structure separation of approximately 14 feet. Image courtesy of EagleView.*

California classifies land for ***financial responsibility of fire suppression and prevention*** *into three categories: Federal Responsibility Area (FRA), State Responsibility Area (SRA), and Local Responsibility Area (LRA).*

Within the SRA and LRA, California also classifies the severity of the wildfire hazard present based on fuel loading, slope, fire weather, and other relevant factors into moderate, high, and very high ***Fire Hazard Severity Zones****. The zones identify where wildfire mitigation measures need to be taken like the California Building Code Chapter 7A and defensible space requirements. The SRA Fire Hazard Severity Zones were most recently updated on April 1, 2024, with the LRA Fire Hazard Severity Zones currently in the process of being updated.*

Building Stock

Building Codes

The area impacted by the Palisades Fire adopted the 2022 California Residential Code (CRC), 2022 California Energy Code (CEC), and 2022 California Building Code (CBC) with local LA County amendments.[6] These state codes are based on the 2021 International Building Code and 2021 International Residential Code (I-codes).

- The communities of Pacific Palisades and Malibu are classified as LRA, with the unincorporated areas impacted by the fire classified mostly as SRA with isolated pockets of FRA.
- Much of the Pacific Palisades and Malibu impacted by the fire are mapped as a very high Fire Hazard Severity Zone.
- Most of the **construction in these neighborhoods occurred in the 1950s**, prior to the development of California's Chapter 7A for building in wildfire prone areas.
- In the SRA and very high Fire Hazard Severity Zones of the LRA,
    - New construction—after July 1, 2008—must comply with Chapter 7A.
    - All properties must comply with California's defensible space requirements regardless of the year the structure was built.
- The Pacific Palisades was recommended as a very high Fire Hazard Severity Zone from 2007 to 2011.

[6] https://pw.lacounty.gov/building-and-safety/general

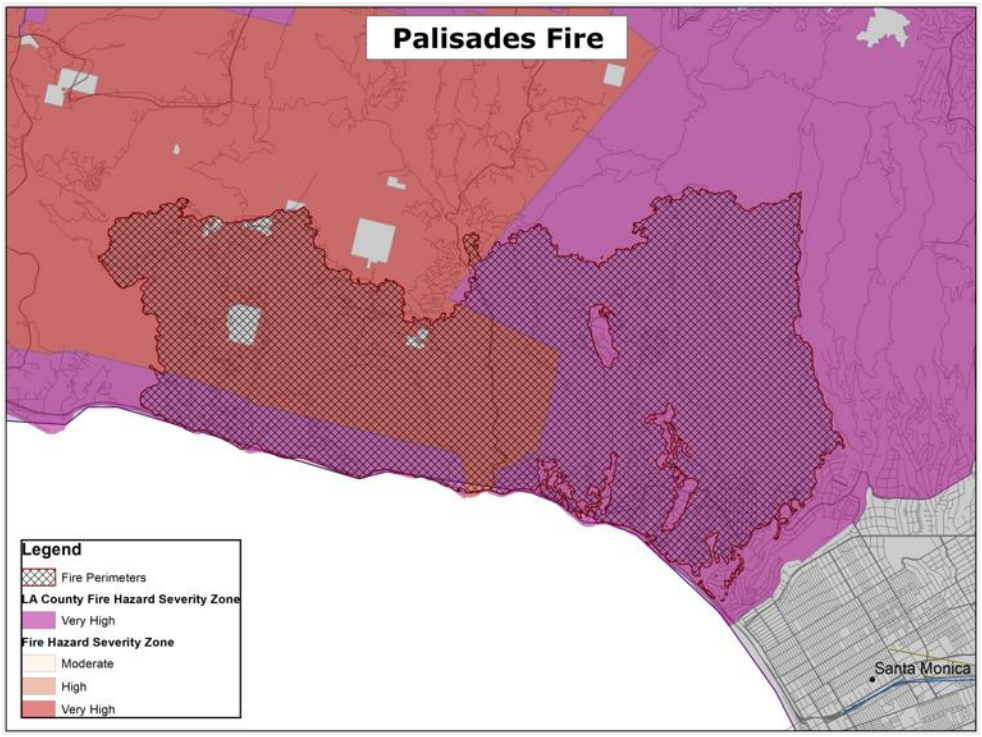

Figure 6. *Map showing the Palisades Fire perimeter (as of January 15) and the Fire Hazard Severity Zones.*

Community Characteristics

- Discrete ignitions occurred in areas with 30–70 ft structure separation. When fire reached the densely constructed areas in Pacific Palisades with **8–14 ft structure separation, conflagration took hold.**
- Connective fuels laced between these homes created **pathways for structure-to-structure fire spread**. Observed connective fuels included vehicles (Figure 7) and privacy hedges (Figure 8).

Figure 7. *Google Streetview imagery shows the prevalence of street parking in Pacific Palisades, which could allow vehicles to serve as connective fuels along roads. Image courtesy of CAL FIRE.*

Figure 8. *Dense vegetation including privacy hedges served as connective fuels between homes allowing the fire to spread from home to home. Image courtesy of CAL FIRE.*

- In and around Palisades Village where satellite data indicates some of the most extreme fire conditions occurred, the **structure separation distance of more than half the homes was less than 20 ft** and for 27% of homes was less than 10 ft.
- Roof covers in this area appear to be mostly noncombustible asphalt shingle, barrel tile, or flat tiles. However, **wind gusts were strong enough to damage roof covers** in the area, similar to observations following the Lahaina Fire (2023). The signficance of this vulnerability to potential roof system ignitions remains unclear.
- Unlike in the Tubbs Fire, commercial construction did not appear to act as a major fuel break. This is possibly due to tight spacing of commercial buildings that acted like residential construction, allowing fire to continue its rapid spread.

Eaton Fire

The Eaton Fire—initially called the Close Fire—ignited on Tuesday, January 7, 2025, at 6:18 p.m. local time near the intersection of Altadena Drive and Midwick Drive in the Altadena/Pasadena area of Los Angeles County. As of Wednesday, January 15, the fire has destroyed more than 7,000 structures, burned more than 14,000 acres, and claimed 16 lives.[1]

Fire Evolution

Ignition

- The Eaton Fire **ignited as the strongest of the Santa Ana winds occurred** (Table 2). Forty minutes after ignition, the Henniger Flats mesonet station two miles east of Altadena recorded an 85-mph wind gust. The Burbank ASOS station also gusted as high as 84 mph, which likely provides the best view of the winds in the Eaton Fire.
- The **cause of the fire remains under investigation**. Numerous media reports point to an electrical tower in Eaton Canyon as a possible cause of the fire, but these reports have not been substantiated by authorities at this time.[7]
- Structure ignitions around Eaton Canyon remained isolated and discrete. Structure separation in parts of this area was greater than 30 feet.

[7] https://apnews.com/article/california-wildfires-eaton-cause-utility-fireworks-eb0f4f71e437f1ba692f929e9633c856

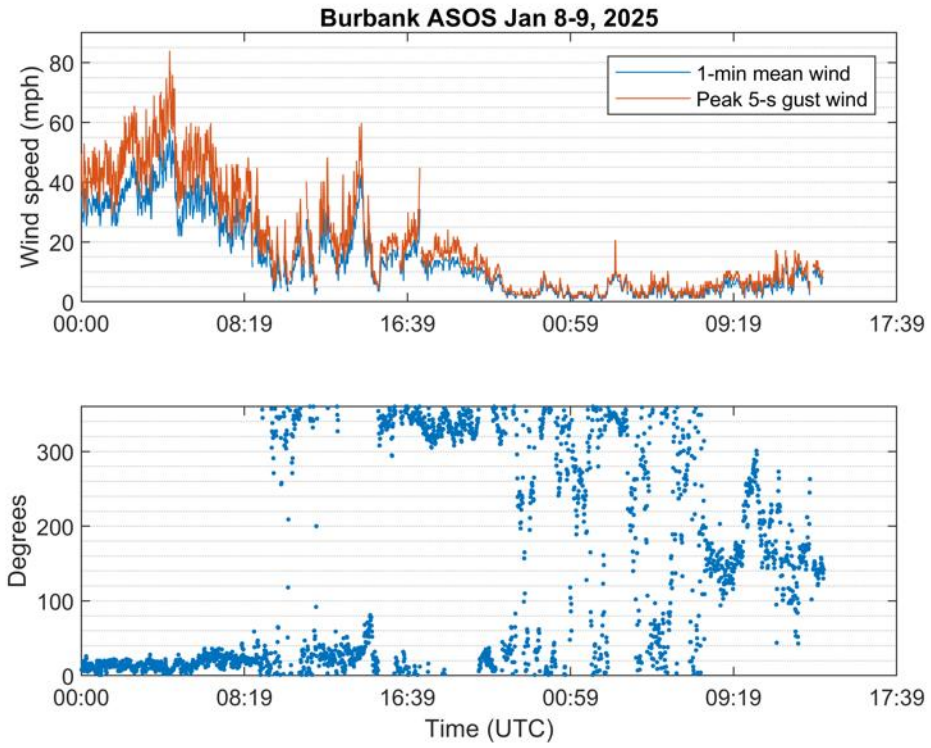

Figure 9. *Time history of mean wind and peak gust wind speeds (top) and mean wind direction (bottom) for January 8-9, 2025, from the Burbank National Weather Service Automated Surface Observing Station (ASOS).*

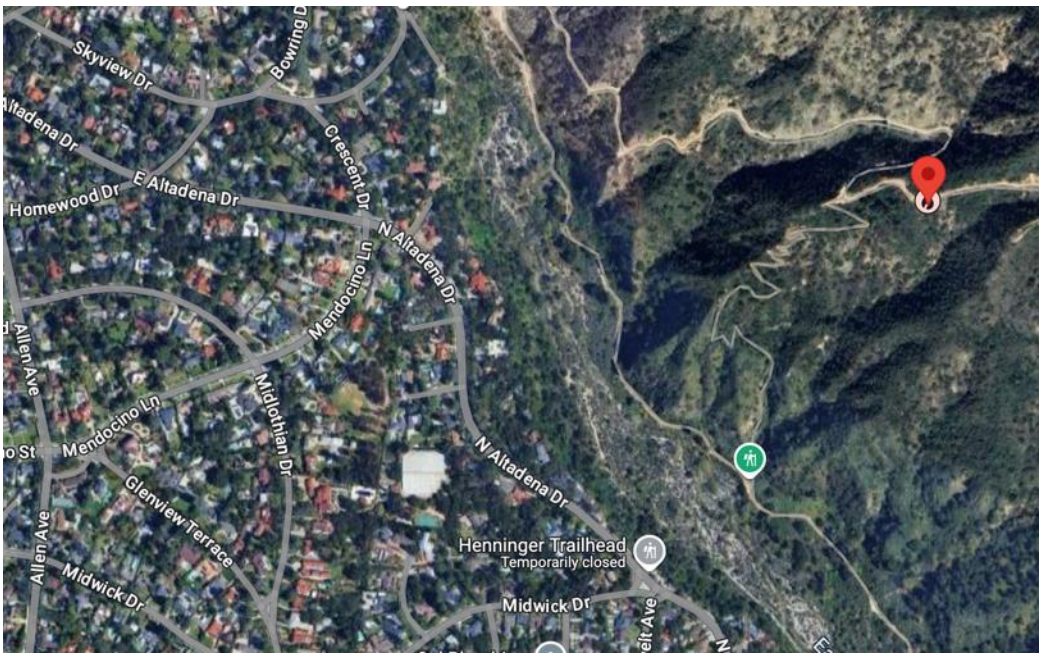

Figure 10. *Area of ignition in the Eaton Fire based on CAL FIRE data as of January 15.*

***Figure 11**. News coverage shows a pergola burning near a home in Altadena. Pergolas, like any combustible fuel element, can act as a connective fuel to spread fire in a community.*

Rapid Spread

- On the morning of Wednesday, January 8, **scattered ignitions in the built environment** caused the fire to rapidly spread west into wildland fuels and ignited numerous spot fires near Altadena and Pasadena.

Conflagration

- As the fire spread into Las Flores Canyon and E Loma Alta Drive, **tighter structure spacing with more connective fuels transitioned the fire into a conflagration**.
- Live news coverage on the morning of Wednesday, January 8, showed **ongoing structure-to-structure fire spread**, with the southwest head of the fire spreading into the neighborhoods of Altadena.
- **Connective fuels—including pergolas, sheds, and fallen trees**—allowed the fire to spread between homes, based on live news coverage.
- Later in the morning, dual polarimetric radar data of the fire plume showed **evidence of large particles or embers** being cast 1–3 miles downwind, indicating embers primarily from structural fuels were driving the fire spread.
- The fire grew to 10,600 acres with 1,000 structures destroyed by approximately 10:30 a.m. local time on Wednesday, January 8, and the fire remained at 0% containment as **air resources were grounded due to high winds.**
- By the afternoon, spot fires spread to the Sierra Madre and La Cañada neighborhoods located in the higher terrain above and north of Altadena and Pasadena.
- Fire growth slowed during the afternoon and evening as the wind event ended.

Figure 12. *Aerial imagery from Google near Las Flores Canyon and E Loma Alta Drive shows the tight spacing of homes and abundant connective fuels.*

Building Stock

Building Codes

The Eaton Fire impacted areas currently adopting the 2022 California Residential Code (CRC), 2022 California Energy Code (CEC), and 2022 California Building Code (CBC) with local LA County amendments. These state codes are based on the 2021 International Building Code and 2021 International Residential Code (I-codes).

- The communities of Altadena and Pasadena are classified as LRA, with the wildland areas north and north/east classified as FRA and SRA.
- The very high Fire Hazard Severity Zone includes the fringes of Altadena. However, the **conflagration extended deeper into the community** burning beyond the very high Fire Hazard Severity Zone.
- Like the Palisades Fire, the Eaton Fire impacted an area of dense construction predominately built in the 1950s or earlier. While some in-fill construction was built under the modern code environment, **most structures were built well before modern building codes** and the emergence of wildland urban interface codes, including the California Building Code Chapter 7A.
- In the SRA and LRA very high Fire Hazard Severity Zones,
    - New construction—after July 1, 2008—must comply with Chapter 7A.
    - All properties must meet California's defensible space requirements regardless of the year the structure was built.

Figure 13. *Map of the Eaton Fire perimeter (as of January 15) with the Fire Hazard Severity Zones.*

Community Characteristics

- On January 9, multispectral imagery showed isolated **streaks of possible conflagration** extending from the terrain south into Altadena. Elsewhere, traditional discrete ember-driven spot fire ignitions were evident.
- Initial satellite imagery appears to indicate that much of the ornamental vegetative connective fuels burned, but some native vegetation appears to have survived the fire, strikingly similar to what unfolded in the Fountain Grove neighborhood following the Tubbs Fire (2017).

Summary

Built environment conflagrations follow humans, drought, and wind. When these factors occur with a wildfire ignition, uncontrollable structure-to-structure fire spread occurs.

> **Humans:** More than 5.8 million people were living in areas classified as severe drought in LA County.
> **Drought:** With only 0.03 inches of rain to start the rainy season, LA County was in the midst of a flash drought.
> **Wind:** A well-forecast, volatile Santa Ana wind event produced 80–100 mph wind gusts across LA County January 7-8.

These three factors were present in LA County on January 7 and 8, 2025, when multiple wildfire ignitions occurred and resulted in conflagrations for the Pacific Palisades and Altadena communities. Areas of conflagration followed densely built communities with abundant connective fuels that created pathways for fire.