

Understanding Fire Weather Improves Community Wildfire Protection Planning

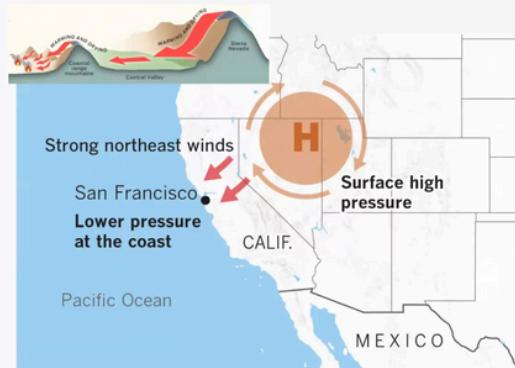
On a hot, dry afternoon in Marin, the difference between a small fire in the hills and a neighborhood-wide disaster often comes down to the wind. When strong winds sweep across the county, they dry out plants, carry embers far, and push flames faster than firefighters can stop them.



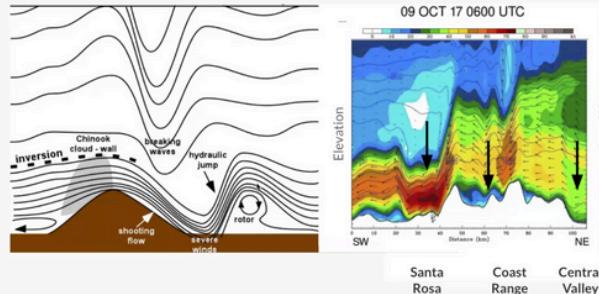
Funding for this project is provided by Measure C.

The 2025 Los Angeles fires and the 2023 Lahaina fire showed how changing weather patterns can make urban fires much worse. As part of the Community Wildfire Protection Plan (CWPP) update, Marin Wildfire studied past weather records, satellite data, and climate change predictions. The goal was to see if there are weather factors missing that could cause more dangerous fires in the next ten years.

The Marshall Fire, Lahaina Fire, Tubbs Fire, and Los Angeles Fires were all driven by mountain wave wind events which intensified the prevailing pressure-gradient driven winds.



Diablo / Foehn Winds
Wind events driven by large-scale pressure differences between high pressure in the Great Basin and low pressure off the coast of California. As air is pushed up and over the Sierra and Coast Ranges, it warms and dries, creating desiccating conditions in the Bay Area.



Mountain Waves

Mountain wave winds occur when stable, fast-moving air flows over a ridge and creates oscillating waves on the downwind side, resulting in localized, intense surface gusts and turbulence. Dry air aloft accelerates towards the ground, resulting in extreme winds and a sudden decrease in relative humidity. Areas downwind of steep gradients in terrain are most susceptible. Prevailing winds within 30 degrees of perpendicular to the ridgeline are most likely to create mountain waves.

From this study, the current Diablo Wind measurements will remain since they match what is seen today and what climate change models predict. A new model will also be added that looks at west-blowing winds with very dry vegetation and stronger wind speeds. These kinds of conditions have already been seen in Marin and are expected to happen more often in the future. Marin faces its own version of these threats. Two winds in particular — Diablo winds and West winds — are the most dangerous to our communities.

Marin's Most Dangerous Wind Patterns

Diablo Winds

- Strong winds that blow from the northeast towards the coast
- Hot, very dry, and often very fast
- Usually occur in the fall and winter
- Have fueled some of the most destructive fires in the Bay Area

West Winds

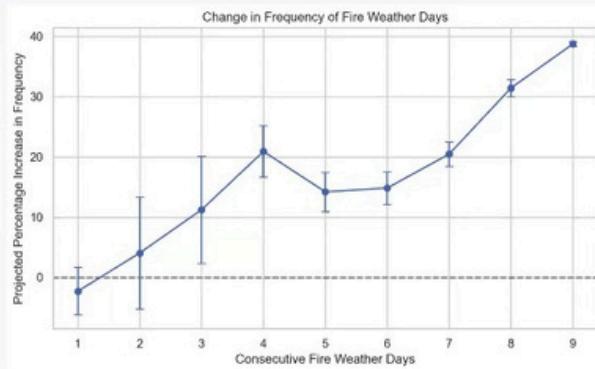
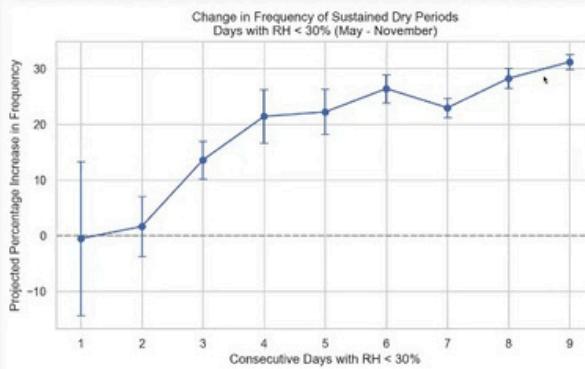
- Blow in from the ocean, but arrive unusually dry instead of cool and foggy
- Less frequent than Diablo winds
- Can spread flames quickly and shift the fire in dangerous and surprising ways

Key Takeaways for Marin Residents

Diablo winds create extreme fire danger almost every year. They often come in late fall, when the landscape is already very dry and vegetation is ready to burn. They are similar to the winds that fueled the major fires in Los Angeles earlier this year. When they blow, fires in Marin can grow quickly and put whole neighborhoods at risk.

Winds from the west are also a risk. In Marin, ocean breezes usually bring cool air and coastal fog. But in rare cases, instead of fog, these winds can be dry and very powerful, fueling dangerous fire spread. These conditions can drive fires in new directions and catch firefighters off guard.

Other winds in Marin: Other winds in Marin can spread fire too, but they are usually weaker and carry more moisture than Diablo or West winds. These fires will still burn, but won't move as fast or as fiercely. By preparing for the strongest winds, we are also ready for smaller events.



Fire Weather Likely to Last Longer

Models project that dry and windy conditions will be more sustained by the middle of the century. The likelihood of five or more days with RH < 30% is anticipated to increase by about 20%. The likelihood of seven or more consecutive dry and windy days will also increase by about 20%.

What Marin Residents Can Do

- Sign up for [Alert Marin](#)
- Respond to [Red Flag Days](#) by preparing the home and yard
- Make an [evacuation plan](#)
- Learn how to [evacuate safely downhill](#)
- Assemble a [go-kit](#)

Together We Are Ready

Fire departments in Marin plan and prepare for the toughest fire weather the county faces. Communities built to handle those conditions will also be resilient to less severe fires. By preparing for these winds, Marin is planning for the moments when wildfire risk is highest. If we are ready for the toughest days, our neighborhoods will be safer the rest of the year, too.

Got a question or comment send it to
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