The Fire Ecology of California

Fire is natural in California. Much as we take precautions like creating defensible space around our homes and planting a fire-resistant landscape, we can never guarantee that our homes will be entirely safe. An event like the Tubbs fire, which leaped over six lanes of freeway, is not going to be stopped by the right choice of plants or 30 to 100 feet of defensible space. While we can improve our odds with lesser fires, fire is intimately linked to the climate, topography, and plant communities of the state. All Californians, no matter how urban or protected they feel, should have emergency evacuation plans.

Central California has what's known as a Mediterranean climate, with cool, wet winters and hot, dry summers. The winter rains create lush growth, while the hot, dry summers make the growth into tinder. Because of the relatively scant rainfall, more vegetation is produced than can be completely decomposed, and fire takes up the gap in the natural cycle of decomposition. In the wild, it has tremendous regenerative power. In the city, where toxic household chemicals burn down with the plants, the destructive effects can be deadly.

Risk factors

Several factors influence when and where fires will strike, including topography, weather, and fuel buildup. South-facing slopes are hotter; north-facing slopes have denser vegetation. East-west canyon faces are particularly susceptible to wind-driven fires. Areas that were originally chaparral have more of a tendency to burn. Fuel buildup from years of fire suppression creates hotter, larger, more intense fires. But the two most significant factors are drought and high winds. Winds blowing from the Great Basin toward the ocean (variously called foehn winds, Diablo winds, or Santa Ana winds) tend to occur in autumn, and make October the most dangerous month.

In the past year, we had an exceptionally wet winter (with lots of new growth), followed by a very dry and exceptionally hot summer, creating ideal fire conditions when the foehn winds came. California's exploding population, in turn, has meant that lots of new development has spread into formerly wildland or chaparral areas, putting people at heightened risk of fire. Climate change has only exacerbated that risk (more on that later).

The California Indians lived here for thousands of years and understood the risk well, hence, they deliberately set fires. The natural outbreaks of fire they experienced were not nearly so severe as what we have now, thanks to their regular fire management practices. With the advent of Europeans and Americans came fire suppression efforts, which tended to increase the fuel load. Normally California forests would have open, park-like space between trees, but when fires are suppressed, trees that are fire-sensitive (such as white fir and gray pine) grow in the understory and create ladder fuels and overcrowded conditions that spread fire to the more fire-resistant trees. A comparison of satellite imagery and aerial photographs over 52 years showed the difference between Baja California just south of the border, where fires were not suppressed,

and the southern California area just north of the border. Ten times as many fires burned in Baja, but they were much smaller than the fires north of the border. They tended to be a mosaic of many small fires, constrained by previously burned areas.

The practice of controlled burns in wildland areas is a response to the failure of total fire suppression, and it needs to be supported by the public because it will save us from more devastating fires. Logging and thinning were considered as alternatives to burning, but research done after the Biscuit fire of 2002 showed that slash left from logging and thinning burned intensely and destroyed more trees, whereas the highest survival rate of trees happened where thinning was followed by burn treatments. Other research following the same fire showed that salvage logging activity reduced conifer recovery. Thinning and clearing of excess dry vegetation remain as viable solutions in urban and suburban areas.

Fire and Plant Communities

Fires regenerate California's native plant communities; they do not destroy them. Most native California trees are fire-adaptive in one way or another, and some of them are fire-dependent, i.e., they rely on occasional fires to regenerate, open their cones, or create viable conditions for their seeds. Different plant communities have different typical fire-return intervals.

Conifers differ greatly among species as to their susceptibility to fire: the most resistant are the giant Sequoias and coast redwoods, while gray pine (*Pinus sabiniana*) has been called the gasoline tree. Ponderosa and Jeffrey pines are highly fire-resistant; moderately resistant conifers include sugar pines, Douglas firs, white fir, and incense cedar. Among oaks, coast live oak, Engelman and valley oaks are very fire resistant, while Canyon live oak is fire sensitive. Seedling regeneration, particularly for deciduous oaks, has become uncommon in some areas because of fire suppression.

Live Oak Ranch, before and after 2017 fire (Source: Corby Hines, Sonoma Land Trust)

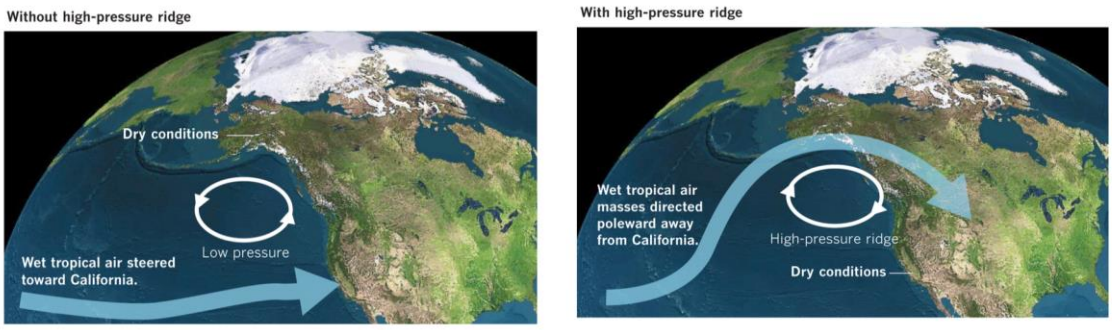
Almost 99% of the state's original grasslands are gone, replaced by exotic grasses mostly introduced for grazing animals. Native grasses are more fire-resistant, but after many wildfires,

grassland areas were reseeded with non-native grasses because they grow quickly. The long-run effect has been to make the reseeded areas more fire susceptible, while moving many native grasses into the endangered or threatened species categories. Widespread aerial reseeding is less common nowadays, but many people still believe that it helps to control erosion. In fact, grasses, even the non-native varieties, do not grow quickly enough to have much effect on runoff and erosion.

Chaparral shrublands are the most flammable of all vegetation types in the United States, and they are more common in California than any other vegetation type. Because of its fire susceptibility, there have been several efforts to turn chaparral areas into forest in the San Gabriel mountains; all of them have failed. After the 2009 Station Fire that torched 250 square miles of the San Gabriels, the Forest Service planted a million tree seedlings with plans to plant two million more. But only 25% of the seedlings survived their first year. The rough terrain, nutrient-poor soils and dry climate of chaparral areas insure that only chaparral plants will thrive there, but the plant community does have the ability to come back quickly. It can start resprouting ten days after a fire and within four years will have revegetated 50% of the burned area. The more long-term problem is that more and more people are moving into very fire-susceptible areas at the same time that government budgets for fire management are shrinking. Whatever else we try, we cannot change the underlying plant community over a large area by simply planting different plants.

Fires and Climate Change

An even more long-term and threatening problem is the effect of climate change on fire in California. Although exact cause-and-effect relationships cannot be known with certainty, trends can be predicted, and recent research points to alarming consequences for the future. The increase in heat is an established fact, as is the decline in snowmelt, and both are likely to increase the number and intensity of fires. There will be increasing variability between drought years and wet years, and that can lead to greater risk. More than a hundred million trees died during the recent five-year drought. Drought didn't directly kill all of them, but it weakened them to the point that they succumbed to beetle infestation. Old oak trees that have been standing since the 18th and 19th centuries near San Luis Obispo have been dying, according to a team of researchers from UC Berkeley. And in the Sierra, there has been a spike in the deaths of giant sequoias. If a comparable drought occurs before seedling trees have a chance to become adults, it could cause a landscape-scale change in the Sierra's ecosystem. Bill Stewart, a forestry specialist at UC Berkeley, says that, during this century, Northern California's landscape will begin to resemble that of Southern California. "It's like we're moving one or two counties south every decade."



(Source: Lawrence Livermore National Laboratory, Google Earth)

Scientists at Lawrence Livermore National Laboratory released a study in late November which finds that rapidly melting Arctic sea ice now threatens to decrease precipitation over California by as much as 15% within 20 to 30 years. This study, bolstered by others, connects the ice melt in the Arctic and the buildup of atmospheric ridges that block winter storms from reaching California.

In short, while we may prepare our own homes for fire as best we can, there are much larger factors at play than our own backyards. In one way or another, we will be learning to live with fire for a long time to come.

--Karen Guma, Master Gardener class of 2014

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*Books should be available at local libraries or can be found on-line.