AIRCURRENTS

CALIFORNIA WILDFIRE: HOW LARGE CAN THE LOSSES BE?

08.2008

EDITOR'S NOTE: This year's California wildfire season has been an extremely active one. Early this summer, more than 2,000 fires were burning simultaneously as a result of lightning strikes. Fortunately, property losses have thus far been limited. But insured losses from wildfires in the U.S. are on the rise, and in this article Senior Research Scientist Dr. Tomas Girnius, along with AIR Research Analysts Tyler Hauteniemi and Scott Stransky, explore the potential for a confluence of conditions that could result in an extreme urban conflagration.

by: Dr. Tomas Girnius, Tyler Hauteniemi and Scott Stransky

INTRODUCTION

Wildfires are a common occurrence in California. On average, between 5 and 10 thousand wildfires are sparked throughout the state in any given year. Fortunately, few result in casualties or destroy property. This year is a good example. In terms of both the number of fires (more than 2,000 already) and the number of acres burned (nearly 1.2 million), 2008 is on record-setting course. Yet the total number of structures burned is just a few hundred.

While the societal costs of treasured natural resources like Big Sur going up in flames may be immeasurable, if we limit our bookkeeping to insured properties, the 2008 fire season has thus far been nothing out of the ordinary.

Last year was a very different story, and indeed insured losses from wildfires have shown a persistent upward trend. Just how large can the losses be? This article explores recent history, examines a few close calls and, finally, sets forth a plausible scenario for a major urban conflagration in California.

RECENT FIRE SIEGES

During the siege of last October, the Witch and Poomacha Fires alone (initially treated as separate events, but eventually merging) caused insured losses that ISO's Property Claims Services estimates at USD 1.3 billion. If one includes losses from other significant fires of the 2007 siege—particularly those from the Harris, Rice, Slide, and Grass Valley Fires—the total exceeds USD 2 billion.

When losses from all major historical wildfires are trended to current dollars, the Witch-Poomacha Fire falls into third place among all-time loss-causing California fires, behind only the Oakland Hills (1991) and Cedar (2003) Fires, but ahead of the Old Fire (2003).

Trended to current dollars, the Oakland Hills Fire caused an estimated USD 3 billion in damage. It reduced to scorched earth a relatively small (1,600 acres), but densely built-up area (2,900 homes destroyed). More impressively, it essentially did so in less than half a day. Prolonged antecedent drought and high wind speeds are common factors in virtually all catastrophic California wildfires, and Oakland Hills was no exception. The fire was preceded by 5-6 years of unprecedented drought and accompanied by extreme winds.

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The Cedar Fire burned approximately 280,000 acres and caused just over USD 1.3 billion in damage. Finally, the Old Fire, which burned in the foothills above San Bernardino, destroyed about 90,000 acres and caused about USD 1.2 billion in damage.

To put the historical wildfire record in perspective, it is notable that three of the top four individual loss-causing fires in California occurred within the last five years—and all fires causing losses in excess of half a billion dollars occurred in the last twenty.

Why have the losses from California wildfires increased so dramatically? Since 1940, the state's population has increased by between 4-5 million people per decade, on average, and with an estimated 37 million residents, it is currently the most populous state in the U.S. While the bulk of that population lives in large cities (Los Angeles, San Francisco, San Diego, etc.), many are choosing to make their homes in the vulnerable wildland-urban interface (WUI)—a region where undeveloped forests, grasslands and chaparral meets urban expansion. It is estimated that more than 5 million homes in California are located in the WUI—more than twice as many as in any other state.

SOME NEAR MISSES

While the losses from recent California wildfires are staggering, had conditions been only slightly different, they might have been much higher. If we consider the time-line of the Oakland Hills Fire, for example, one thing that stands out is that virtually all the destruction occurred within a period of just 10-12 hours—exactly the period coincident with elevated foehn winds (dry downslope winds that are called Santa Ana winds in Southern California and Diablo winds in Northern California). As long as the foehn winds are blowing, firefighters are unable to make progress. As soon as the winds die down, they are able to contain, and eventually control the fire.

A sobering thought in the context of the Oakland Hills Fire is that 10-12 hours is a fairly short foehn wind episode; they can easily last one or two days. Had the Diablo winds blown for a longer period in October of 1991, the loss of property could have been much, much greater.

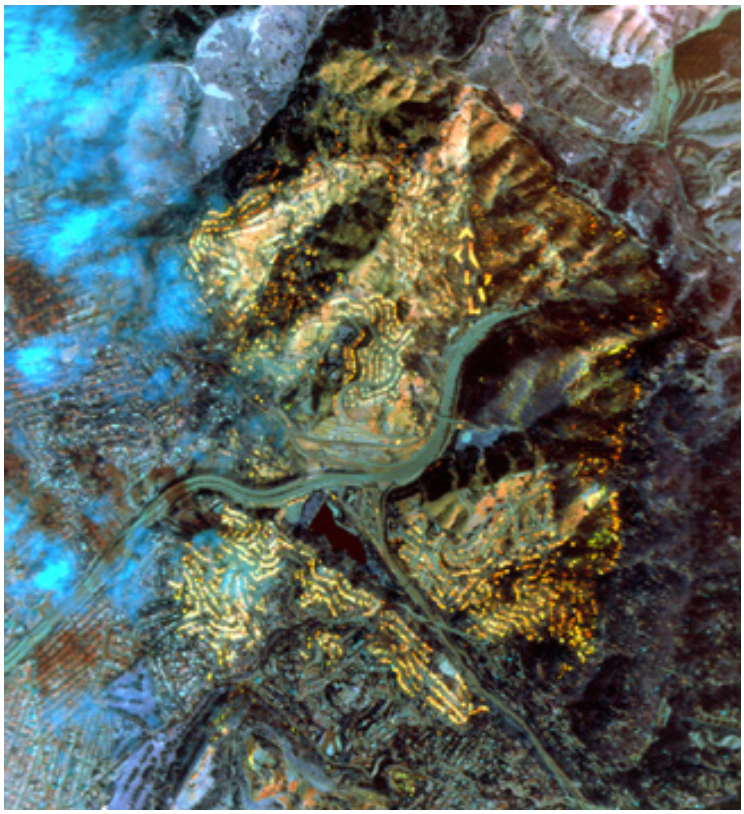

Figure 1 Satellite image of Oakland Hills fire, showing thousands of properties on fire simultaneously. Source: NASA.

Perhaps the closest California has come to an extreme urban conflagration was the Bel-Air Brentwood Fire of 1961. In early November 1961, Southern California was in the middle of a multi-year drought. There had been no fires in the area for many years, allowing the vegetation to overgrow—some chaparral in the area was 25 feet tall. The steep canyons and high ridges of the Santa Monica Mountains, along with their high-value homes, were primed for a wildfire.

Before dawn on November 6, the Santa Anas began to blow. By sunrise, sustained winds were 25 to 50 mph, with some reported gusts over 60 mph. Humidity was down to 4%. By 8:15 am, a report of a small fire was issued. Eleven minutes later, a "major emergency" was declared by an LA fire chief. Within minutes, the fire had spread uphill to Mulholland Drive, and 85% of LA's fire fighting staff and equipment was en route to the scene to help fight the fire.

When firefighters arrived, they were met with an unimaginable scene. Hundreds of houses were on fire. Flaming wood roofing material was flying through the air, sometimes traveling as much as a mile, igniting numerous small secondary fires.* Around noon, the fire jumped the San Diego Freeway and entered Brentwood.

By that time, the media was reporting extensively on the fire. Concerned residents throughout LA—even people many miles from danger—began turning on their garden hoses, filling their bathtubs, and wetting down their properties. Water consumption throughout LA was twice its normal level. Because of this excessive demand, many firefighters could not get the water pressure they needed to effectively fight the fire. Officials feared that the fire would burn all the way to the ocean given the winds and fuel load in the area. And they might have been correct had the Santa Ana winds continued.

The turning point came at 3 pm, less than seven hours after the fire began. The Santa Anas abruptly died down. Firefighters were able to begin to gain control of the fire. In the end, 505 structures were destroyed, representing slightly over 20% of the structures within the fire perimeter.

Damage statistics on the Bel-Air Brentwood Fire include:

- 382 of the destroyed structures (more than 75%) had wood roofing
  - 30% of wood roofed buildings within the perimeter were destroyed
  - 12% of buildings with other roofing types inside the perimeter were destroyed
- Only 2.8% of homes were stilted and built on a steep slope, but 44.5% of them were destroyed, more than twice as many as the overall damage ratio.

Under slightly different conditions—namely a longer duration of Santa Ana winds and large, resource-consuming fires elsewhere in the state—the Bel-Air Brentwood Fire might have resulted in truly extreme losses. Were such a scenario to occur today, with today's property exposures, the losses could easily reach many billions of dollars.

Figure 2.Ridge-top destruction after the Bel-Air Brentwood Fire. Source: LA Fire Department.

JUST HOW LARGE CAN THE LOSSES BE?

The purpose of modeling is to anticipate the likelihood and severity of future events so companies can appropriately prepare for their financial impact. To that end, models incorporate catalogs that contain hundreds of thousands of potential future events capable of causing loss, including low-probability but entirely plausible events that may have no historical precedent—events for which there is a confluence of all the right conditions to produce extreme losses.

The AIR U.S. Wildfire Model includes many such scenarios. One is illustrated in Figure 3, which shows the perimeter of a simulated event in the AIR model's stochastic catalog. AIR estimates total property replacement value within the fire's footprint at more than USD 145 billion. The ignition for this simulated fire is in Griffith Park, located at the far eastern end of the Santa Monica Mountains, north of downtown Los Angeles. Fires have ignited in Griffith Park throughout recorded history. In fact, the most recent fire, albeit a small one, started on August 4th of this year.

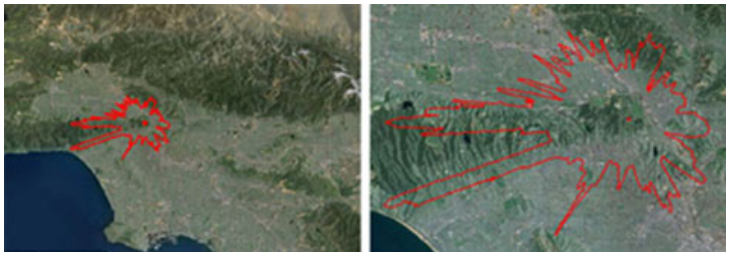

Figure 3. Perimeter of an Extreme Urban Conflagration Event in AIR's Stochastic Event Set Overlaid on Satellite Images

Our scenario fire ignites during a strong Santa Ana event, with winds predominantly from the east and north. As it spreads, it destroys high-value properties along Mulholland Drive and Sunset Boulevard. This fire is a true Urban Conflagration Event in the AIR model, which means that not only is the vegetation on the mountains consumed, but the homes themselves act as fuels. Firefighters do not have time to set up firebreaks around the initial perimeter, so it quickly grows out of control. Finally, in this scenario, multiple other fires are burning across the state, so resources are spread thin.

In the end, more than 50,000 acres are burned and insured losses exceed USD 20 billion. An extreme event? Yes—with an annual exceedance probability of less than 0.1%. A plausible scenario? Unfortunately, yes.

The trend toward increasing wildfire losses in California will continue as long as the growth in the number and value of properties in the WUI continues at its current pace. Exacerbating matters, fire suppression policies in such areas are aimed at extinguishing fires as quickly as possible, leading to the dangerous build-up of fuels. The result is a convergence of risk factors: an unprecedented accumulation of fuels in areas of increasing population and property.

It is not a question of whether a wildfire could transition to an extreme urban conflagration in California. It is rather a question of when.

SOME HELICOPTERS AND TANKER PLANES FLYING IN THE AREA REPORTED BURNING BRANDS AND EMBERS AT "CONSIDERABLE ALTITUDES". UPON LANDING, THEY HAD TO REMOVE CHARRED SHINGLES FROM THEIR COCKPITS.

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