LESSONS LEARNED FROM THE NOVEMBER 2008 WILDFIRES

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EDITOR'S NOTE: Strong winds, with near hurricane-force gusts, fanned three separate fires in Southern California last November, prompting the evacuation of more than 50,000 residents. When it was over, more than 43,000 acres had burned and more than 1,000 structures were destroyed. In this article, AIR Senior Research Scientist Tomas Girnius and Research Analyst Scott Stransky, both of whom were part of AIR's post-disaster survey team, discuss the team's findings.

By Dr. Tomas Girnius and Scott Stransky

INTRODUCTION

The 2008 wildfire season has wound down—having, thankfully, caused less insured damage than its 2007 predecessor. Nevertheless, it ended with the rapid succession of three catastrophic fires somewhat later in the season than is typical. While we should not extrapolate from just one year, it has been suggested by some that the concept of a wildfire season in California is disappearing, and that the threat is now year-round.

The three fires noted above and discussed in this article are the Tea Fire, the Sayre Fire, and the Freeway Complex Fire. We begin with an overview of the route taken by AIR's post-disaster survey team and some striking images from the three fires. Then, rather than focus in this article on observed damage patterns, as has been done in previous AIR Currents, we explore another objective of the survey—that is, to validate the fire perimeter information that is available for loss modeling purposes during the unfolding of the events. An important source for AIR of real-time perimeter information during wildfire fire events—information that is critical to producing reliable estimates of insured loss—is the Geospatial Multi-Agency Coordination Group, or GeoMAC (www.geomac.gov), a consortium of federal and state agencies. Finally, we touch briefly on the observed distribution of damage within the perimeters and note a cause of loss worthy of further investigation.

IMAGES FROM THE TEA, SAYRE AND FREEWAY COMPLEX FIRES

AIR's survey team arrived in California less than a week after the fires were contained and were granted uncustomary access to sealed-off neighborhoods that had suffered damage. The map below shows the area where the fires occurred, along with published GeoMAC perimeters.

Figure 1. Published perimeters of the Tea, Sayre and Freeway Complex Fires.

Tea Fire

The Tea Fire, which got its name from Montecito's historic "Tea House" near which it ignited, began on November 13. By the time it was over, some 1,900 acres and more than 200 houses had burned in and around Montecito in Santa Barbara County. The survey team visited most of the structures destroyed by the fire, and traced the perimeter clockwise to assess the accuracy of the reported GeoMAC perimeter.

Below are images taken by the AIR team at the site of the Tea Fire.

Figure 2. A completely burned house next to one totally untouched. Source: AIR

Figure 3. Brick chimneys are often the only surviving witnesses. Source: AIR

Figure 4. Total destruction. Source: AIR

Figure 5. One of the rare cases of "partial" damage. Source: AIR

Figure 6. Masonry survives even when nothing else does. Source: AIR

Figure 7a and b (inset). Surroundings completely burned, but brush setbacks and good construction won this particular battle. Source: AIR

Sayre Fire

At around 10:30 p.m. on November 14, a resident of Sayre Street in the Sylmar section of northern Los Angeles reported a fire that soon came to be known as the Sayre Fire. Over the course of the next week, the fire burned more than 11,000 acres and more than 500 structures.

The AIR survey team followed the entire length of the southern perimeter of the fire (along the wildland/urban interface), again both to examine damaged structures and to validate the perimeter. The team also traversed the northwestern part of the perimeter, to confirm some of the later updates from GeoMAC. We were able to verify, for example, that the fire did in fact jump California Route 14 toward the end of its spread.

The images below illustrate the devastation wrought by the Sayre Fire.

Figure 8. What was once a motorcycle parked at the Oakridge Mobile Home Park. Source: AIR

Figure 9. The Oakridge Mobile Home Park; nearly 500 out of 600 homes destroyed. Source: AIR

Figure 10. At the end of a cul-de-sac at the Sayre Fire perimeter. Source: AIR

Freeway Complex Fire

The Freeway Complex Fire ignited on November 15 along the 91 Freeway in Corona, California. On November 16, the smaller Landfill Fire in Brea merged with the Freeway Complex Fire. When it was over, more than 30,000 acres near the nexus of Orange, Riverside, Los Angeles, and San Bernardino Counties had burned, and some 300 homes were damaged or destroyed.

The team circled the entire fire, focusing on areas of reported property loss. Beginning in Anaheim Hills, we studied damage patterns in a residential area just south of the 91 freeway and examined the destruction at the Cascade Apartment complex. From there, we drove through numerous residential areas in Yorba Linda that were untouched by fire, yet reported as being within the perimeter. As we came closer to the Chino Hills, entering the wildland/urban interface, the slope increased, and we began seeing damaged and destroyed properties. Working our way clockwise around the perimeter, we visited many neighborhoods in Yorba Linda. We then took the Carbon Canyon Road into Olinda Village, located in the center of the fire perimeter. Surprisingly, only one property—a wood frame residence—was destroyed in the village.

Some of the more striking images from the Freeway Complex Fire are shown below.

Figure 12. Numerous units destroyed at the Cascade Apartments. Source: AIR

Figure 13. A bit late, but heavy rains had been forecast; the sandbags were to protect against mudslides. Source: AIR

Figure 11. One winner and one loser in Anaheim. Source: AIR

Figure 14. On the perimeter. Source: AIR

WHERE'S THE PERIMETER?

Since the launch of the AIR Wildfire Model in 2006, AIR has performed a number of fire damage surveys in California. Certain damage patterns and damage mechanisms are seen repeatedly, and the AIR model's damage functions have been validated by the observed relative vulnerability of different construction types.

An additional objective of this survey was to assess the accuracy of the fire perimeters reported by GeoMAC throughout the course of the fires. Fire management officials use the information published by GeoMAC for resource allocation decisions. AIR relies on GeoMAC perimeters for real-time loss estimation. To estimate the perimeters, the GeoMAC consortium uses GPS data and infrared imagery from fixed wing and satellite platforms. The most common method for collecting GPS data involves flying helicopters along the perimeter of a still burning fire, as low to the ground as possible. As the pilot attempts to trace the perimeter, a GIS specialist with a handheld GPS unit takes readings. This lends considerable uncertainty to the reported perimeter. For example, some experienced pilots are able to make 90 degree turns, while others are understandably hesitant to fly into very thick smoke. It can also be hard to see through the smoke to determine how far the fire itself has actually progressed. The helicopter data is supplemented by MODIS satellite hotspot data and reports from fire crews on the ground to create the final reported perimeter.

It became evident during the AIR survey that the accuracy with which published perimeters matched actual perimeters on the ground varied considerably from location to location. The perimeter survey of the Tea Fire as reported by GeoMAC proved to be particularly reliable. In one location after another, as the team spot-checked reported perimeter coordinates against our handheld GPS units, charred ground and buildings could be seen on the inside, and unburned vegetation on the outside.

The reported perimeters for the Sayre and the Freeway Complex Fires were less reliable. As we traversed the southern boundary of the Sayre Fire, it became obvious that—at least in some neighborhoods—the fire's progress was stopped successfully while still in the wildlands (or reached one or two houses into the end of a dead end street), while the reported perimeter indicated penetration into housing developments tens or even hundreds of meters deep. Clearly, such discrepancies can impact post-mortem loss estimates.

The AIR model approximates the probability of damage (see the next section) based on event wind speed, topography, and the nature of fuels present, for any structure contained within the perimeter. By including houses that should not be within the reported perimeter, loss estimates are inflated. Conversely, losses may be underestimated if the reported perimeter fails to include some damaged exposure. It is near the perimeter that wildlands typically meet the urban environment, and therefore losses during a wildfire tend to cluster there. Consequently, inaccuracies in how the perimeter is reported can lead directly to uncertainties in estimated losses.

The figure below shows the Freeway Complex Fire scar, with the GeoMAC perimeter overlaid. Note that some areas within the southern part of the GeoMAC perimeter are actually unburned. However, in Anaheim Hills, between the Riverside Freeway and the Eastern Trans Corridor, homes even further south than the GeoMAC perimeter were destroyed. Optimally, the perimeter should have keyholes cut out for the completely unburned areas. Also note that Olinda Village (the unburned area east of Brea in the middle of the perimeter) had been a keyhole cutout in one version of GeoMAC perimeters (which are issued daily), but the next version included it in the burn area. During the survey of the village, we saw that only 1 home out of about 200 had burned.

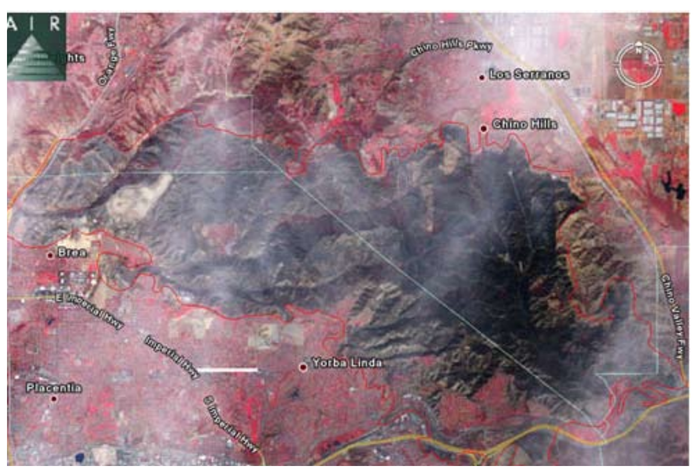

Figure 15. Burn scar from Freeway Complex Fire with GeoMAC perimeter overlaid.

VALIDATING DAMAGE FUNCTIONS

If losses resulting from smoke damage are excluded—a type of damage that is challenging to assess without access to the interiors of buildings—the team's observations validated the AIR Wildfire Model's ability to estimate how much damage is likely to occur given that a building sustained some damage—also referred to as the conditional damage ratio within a fire perimeter. If a house was burned at all, then in the vast majority of cases (roughly 90%) that house was a total loss, while in the few remaining cases (roughly 10%) the damage was typically quite minor—e.g., a window or a garage door destroyed. Our observations were in accord with the shape of the conditional damage distribution function employed by the AIR model. This was more or less uniformly the case in each of the three fires surveyed.

Estimating what fraction of buildings within a perimeter sustain some level of damage—that is, the unconditional damage ratio—proved to be more challenging. This is closely related to the problem of uncertainties in fire perimeters as reported by official agencies. Many neighborhoods within the reported perimeters, as mentioned earlier, had no visible damage whatsoever. In areas that clearly had some damage, we saw streets with widely varying damage ratios. For example, on Aviemore Drive in Yorba Linda, 6 homes in a row were destroyed. On the other hand, on nearby Rolling Hills Lane, there was only one total loss out of nearly three dozen homes.

WHERE THERE'S FIRE, THERE'S SMOKE

The comment in the previous section about excluding the impact of smoke damage deserves further scrutiny. The survey team visited the UCLA Olive View Medical center, while surveying the Sayre Fire. This complex of about 40 buildings is located in foothills and is partially within the reported perimeter. Although there was little visible damage to the buildings, the team members have received reports that most of the buildings suffered substantial smoke damage. Indeed, numerous other buildings we passed had no visible damage, yet their contents were in piles outside. Smoke damage is implicitly captured in the AIR model to the extent that it is reflected in claims data used to calibrate the model's damage functions.

CONCLUSION

The AIR team surveyed the three November fires in considerable detail. Damage patterns generally aligned well with expectations and the relative vulnerability of different construction types validated the AIR Wildfire Model's damage functions.

Of particular interest to the team was that officially reported perimeter coordinates varied in quality from fire to fire, due to the challenges discussed above of constructing such perimeters. This speaks to the always-present uncertainty involved in real-time loss estimation. The AIR Wildfire team is currently in contact with several governmental and private sector organizations, and is actively pursuing cooperative arrangements that would help us acquire more accurate real-time and post-mortem fire perimeters in the future.

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