Peshtigo Revisited

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One of the effects of climate change is a decrease in rainfall in the American Southwest including California. In the last year, there were the usual number of rainstorms but instead of dropping two to four inches of rain each, they dropped less than 1/4 inch. The brush lands are dry and frequent fires are forecast.

Underwriting and casualty actuarial managers must adopt a new algorithm to provide adequate forecasting of the effect of climate change on brush fire losses. Usually we use incurred loss data to determine our estimates of loss frequency and severity. This has been compared to driving a car by looking out the back window. If there are no fundamental changes that would affect loss frequency and severity, historical data will work quite well. If the climate is warming, then the assumption that the past is prologue may not hold.

We have some early warning signs. Brush fire loss severity is up. Today's fires are five times as large as those in the 1980s.1 Projection of that growth rate out another ten years produces huge numbers. An Arizona brush fire just killed 19 out of 20 men of a Hotshot fire fighting crew. That is the worst loss of firefighters' lives in a brush fire in many decades. Such a loss of life among firefighting personnel is unacceptable. Perhaps we should take it as a wake-up call to review our assumptions about woodland fire.

Brush fires impact fire insurance underwriting and actuarial calculations on two levels. First, the probability of loss of individual dwellings must be considered. This impacts line underwriting and pricing. Second, the estimation of the probable maximum loss from a brush fire related catastrophe is critical. Reinsurance treaties must be reviewed to ascertain that they can respond to the greatest foreseeable catastrophe. A number of the elements comprising maximum probable loss are increasing. On the one hand, population shifts are increasing the number of homes particularly in the Southwest that are located in that urban/forest zone that is especially exposed to brush fire.

In addition, with climate change, loss probabilities for both individual risks and aggregate books of business will increase. The amount of the increase is difficult to ascertain. Climate change can increase temperatures, drying out brush and making fires more likely. Another effect of climate change is disruption of long term rainfall patterns. Such disruptions may bring additional rainfall to one area and drought to another. From the standpoint of brush fire underwriting, increasing temperature and drought adds up to a bad day at the office. The problem facing the fire actuary is that these increases are almost

1 "Scientists losing fight to predict wildfire behavior," *Los Angeles Times,* July 4, 2013, pp. A1 - A15.

certain to represent a sharp change from existing estimates. The growth in loss estimates may be exponential. The jump in loss severity will be particularly difficult to measure. The new distributions may not fit conventional mean/variance models but more closely resemble chaos.

How bad can it get? There are some who feel that if something has happened in the past, it can happen again. Yogi Berra would refer to this as deja vu again. The Great Fire in Peshtigo happened. Can it happen again? A review of that fire is in order when considering probable maximum loss.

On October 8, 1871, the entire Middle West was blanketed by an enormous windstorm. For those who spend their lives fighting brush fires, wind is the dreaded enemy. There were two momentous events at that time and due to a clever reporter one of them got all the publicity.

The first event was a fire in Chicago. It burned a great many buildings. This fire became famous, because of a fable made up by a reporter. He reported that Mrs. O'Leary's cow kicked a lantern over on to some straw, starting the fire that ate Chicago. Current thinking among historians is that the Chicago fire was a brush fire that burned into the city. When you look at the weather maps for that date, the brush fire is a very likely possibility.

There was another fire on October 8, 1871 but it occurred in a more remote area. Destruction was so complete and total, it took awhile for the news to get out to the rest of the world. Most of the world had not heard of the village of Peshtigo, Wisconsin. This fire is a catastrophe where dry statistics can never tell the story, but the insurance industry runs on numbers. The population of Peshtigo was about 1,500. It is estimated that the brush fire killed 800 of those residents. The total loss of life including the surrounding Sugarbush area was between 1,200 and 2,400.2

Can this happen again? The newspaper accounts of the day refer to a "tornado" devastating Peshtigo and accompanying the fire. It is likely they were referring to the fire storm that great fires can create. Over a certain size, a fire creates its own wind sweeping everything before it. Then, what is the likelihood that a fire storm will sweep into a rural community trapping the residents? Many feel this is unlikely considering the modern communication systems such as reverse 911 calling. Communication is not the entire answer.

During the Tea Fire in Santa Barbara, California, in April of 2009, my wife and I were responding to a reverse 911 evacuation order. We took both our cars, and our two cats with no time to grab anything else. As we drove down Tunnel Road, moving down the mountain above the city, I watched 100 foot high flames in the next canyon two miles away. The flames were being driven by a north wind so the flames were moving south, as we were. The problem is that the evacuation route was overloaded with traffic and we were bumper to bumper moving at about 3 miles an hour. A brush fire can travel at 15

[2] Deanne C. Hipke, "The Great Peshtigo Fire of 1871" (website)**,** www.peshtigofire.info.

miles an hour.3 (If you want to outrun one, plan on doing a sub four minute mile). If the wind had shifted to the east, it would have taken about 8 minutes for those flames to reach the string of cars caught in traffic on Tunnel Road. A wind shift would have turned Tunnel Road into a car wrapped shish kabob. The reverse 911 calls had triggered a massive simultaneous evacuation in Mission Canyon overwhelming the roads. Most of the fatalities in the Oakland Hills Fire died in their cars.

Just as climate change is making the urban/forest interface more dangerous, suburban expansion is making it more popular for new building. Urban planners tend to focus on the large rectangles of space when making zoning and population density rules. They should be focusing on the lines joining those spaces, the road infrastructure. Population density should be confined to the maximum number who can be safely evacuated in the face of a brush fire. During the seemingly endless time it took for the bumper to bumper traffic to move out of the forest, it became clear to me that Mission Canyon, in the hills above Santa Barbara was over-populated. Fortunately, the wind stayed in the north and we escaped. How likely was an east wind in that situation? It was forecast but it did not occur until later that evening.

Later that evening, as we sat in the yacht club trying not to look out the window at the fire roaring through the forest, I felt the wind shift to the east. It closed the distance to Tunnel Road to about a mile. Suddenly I started grinning. The wind had shifted to the south. Mission Canyon was spared from this fire that burned out a monastery with its northern movement.

It is this element of capriciousness that makes brush fire prediction so difficult. While reverse 911 phone systems can alert the residents to the outbreak of a fire, evacuation is dependent on an adequate road system. After a particular fire is out, it is difficult to keep urban planners aware of the critical link that evacuation routes provide.

The maze of jurisdictions that control evacuation route construction is formidable. State, city and county boundaries weave their way around the territories adjacent of the federally governed national forests. It would take a brilliant conductor to get that array of competing interests to dance to the fire evacuation tune. In Santa Barbara, for example, the county is aware of the problem and working to mitigate it. They are powerless when the City of Santa Barbara, with different priorities, constructs "traffic calming" schemes such as bulbous sidewalks that have the effect of narrowing streets, which are important evacuation routes.

Another Peshtigo tragedy could occur as a result of converging forces. First, new building moves more and more homes and people into the urban/forest zone. Second, climate change makes major forest fires more likely by higher temperatures and droughts that dry out the forest vegetation. Third, urban planners fail to recognize the need to keep the population in the urban/forest interface, particularly box canyons such as Mission Canyon, down to the number that can be evacuated. If our

[3] Stephen J. Payne, *Fire in America***,** p. 422, University of Washington Press, 1997.

luck runs out and these all converge then insurance executives will need adequate catastrophe reinsurance in more lines than just property fire. A large death toll will affect third party liability, workers compensation and life insurance.