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Risk Frontiers

An Examination of Fire Deaths During the Last 100 Years:

Implications for the 'Stay or Go' Policy and the Insurance Industry

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Introduction

This article introduces work in progress which will examine the Risk Frontiers fire death database for fatality trends and relevance for the 'Stay or Go' policy and the insurance industry.

The safest option when threatened by a bushfire is to evacuate well in advance. However, for a number of reasons relating to public perceptions and behaviours in the face of risk, information and resources available to the emergency services and the unpredictability of fire behaviour, evacuation often occurs as the fire front arrives and becomes a physical threat (Handmer and Tibbits, 2005). Evacuating at this time is considered the worst possible outcome as people become disorientated whilst driving or running through intense radiant heat and smoke.

Although it had been previously recognised (see Handmer and Tibbits, 2005), the overwhelming evidence for safely remaining in and defending a property rather than a last-minute evacuation, came from analysis of the Ash Wednesday fires in 1983. These fires resulted in 83 deaths and the destruction of 2300 properties across Victoria and South Australia. Surveys following these fires identified that the presence of residents able and willing to defend their home from ember attack increased the probability of property survivability by 90% (Wilson and Ferguson, 1984).

The benefit of this approach in terms of reducing casualties is reinforced by the chilling statistic that twice as many deaths occurred in vehicles and out in the open rather than in homes (*ibid*).

The Australasian Fire Authorities Council (AFAC) has therefore developed a position which proposes that communities at risk from bushfires should be allowed and encouraged to take responsibility for their own safety. Using the maxim "*houses protect people and people protect houses"* the AFAC suggests that where people have adequately prepared themselves, their houses and property, they should remain with their homes during bushfires (Gledhill, 2003). This is now commonly referred to as the 'Stay and Defend or Go Early' policy.

Problems and issues

Indefensible

In certain situations, such as during extreme winds and where houses are adjacent to steep sided gullies of dense fuel load, properties may not be defensible. In these circumstances evacuation is by far the safest option.

When to go?

Although the AFAC position suggests that if evacuation is the preferred option it should be carried out early, recent research suggests some ambiguity in the public's interpretation of this advice. The adoption of a 'wait and see' strategy may increase risk for those who do not carry out timely evacuations, and who find themselves ill prepared and with limited options. The implication is that a lack of preparation can lead to poor judgement and actions that may endanger lives.

As part of ongoing research between Risk Frontiers and the Bushfire Cooperative Research Centre, information on fire fatality trends is being used to help identify the most vulnerable groups and behaviours.

The Risk Frontiers database

To date, no detailed quantitative analysis of the circumstances of Australian bushfire related civilian deaths exists. As part of a larger project of Australian natural hazards, Risk Frontiers has created a database which utilises historical spatial and temporal fatality trends as reported through printed media over the last 100 years. The fire death database contains details regarding dates, locations and circumstances of fatalities and the age, gender and occupation of the deceased. The newspaper data has been augmented, triangulated and validated where possible using scientific and government reports, Australian Bureau of Statistics data and historical accounts. To further validate the data, a selection of death certificates and Coroner's reports will also be examined and compared to the death reports.

Questions

Analysis of the data aims to answer a number of important questions relating to the nature of Australian fire deaths. Such questions regard age, gender, location and occupational trends; the relationship between deaths amongst children and the elderly and their propensity to evacuate; the circumstances of the fire deaths (whether inside the home or outside) and; whether deaths occurred whilst defending the home or evacuating.

It is anticipated that this work will help the emergency services and the insurance industry identify and better target the vulnerable in order to improve risk communication and policy and to reduce property damage and the loss of life.

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This Issue

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Pound for Pound: Tropical Cyclones and Climate Change

If 2004 was impressive with four hurricanes hitting Florida, a record typhoon season in Japan (10 landfalls) and Hurricane Catarina in the South Atlantic, the 2005 North Atlantic hurricane season proved even better with records tumbling faster than buildings: largest number of named storms (27); largest number of hurricanes (14); Wilma, the most intense storm on record; and Katrina, the most costly storm with over U.S.$125 billion in economic losses and an estimated U.S.$60 billion in insured losses.

So what is to blame for all this? If we were to suppose that global warming is responsible, a good place to begin is to look for trends in tropical cyclones themselves. And for scientists there is no better time than on the back of seasons such as 2004 and 2005.

In 2005 two important papers were published reporting a strengthening in tropical cyclones around the world. Emanuel (2005) described an increase in the intensity of hurricanes in the North Atlantic and North Pacific, and Webster et al. (2005) found an increase in the proportion of the strongest storms since 1970. These two papers sparked replies from Landsea (2005) and Chan (2006) and an ongoing debate with expert tropical cyclone and climate scientists trading blow for blow in a classic heavyweight bout. The referee's decision is still pending.

While a consensus is yet to be reached on the tropical cyclone front, is there anything in the loss data, in particular our Australian loss data, to suggest that global warming may be contributing to increasing disaster losses? *A priori* Australia should be more sensitive than many other nations to changes in climate given meteorological hazards dominate the numbers of buildings destroyed over the last century. In particular, tropical cyclones have been most destructive, accounting for almost one third of buildings destroyed.

To compare losses in the Insurance Council of Australia Natural Disaster Event List requires an estimate of the current loss that would be sustained if each event were to reoccur today. An indexation methodology incorporating two surrogate factors to account for changes in population, inflation, and wealth since the date of the original event has been previously reported (see Risk Frontiers' March and June 2006 Quarterly Newsletters: www.riskfrontiers.com). The approach is based on changes in the number and nominal value of dwellings over time, where dwelling value excludes land value. Indexed tropical cyclone losses have been further adjusted, where appropriate, to account for better building standards in tropical cyclone-prone areas introduced in the early 1980's. The results suggest that the increasing trend in unadjusted losses is largely attributable to the societal factors above.

Unfortunately, Australia lacks sufficient tropical cyclone loss data to rigorously explore resulting trends in indexed losses. An alternative frequency-severity index utilising the entire tropical cyclone event set making landfall on the east coast of Australia since 1961 (near the beginning of the satellite era) was developed. This assumes a uniform exposure to overcome Australia's sparsely populated coastline. Again there are no clear signals attributable to global warming.

The results have implications for disaster reduction policies - mitigation versus adaption.

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Volcanoes – A Neglected Hazard?

Volcanoes provide many benefits - fertile soil, valuable minerals, water reservoirs, geothermal resources and tourism. However, they may also contribute to large losses of life and property, a possibility often overlooked by the insurance industry where volcanic risk is generally lumped in with earthquake and tsunami risk, without explicitly pricing this risk.

Volcanic hazards range from the gently flowing lava characteristic of effusive eruptions, like Kilauea volcano in Hawaii through to the explosive discharge (up to 250km/h) of pyroclastic flows at temperatures that can exceed 800 C, like those from Mt Pelée in 1902 that levelled the city of Saint-Pierre on the Caribbean island of Martinique, killing 27,000 people.

Explosive eruptions impart a much greater volcanic hazard and risk than their effusive counterparts and are characterised by widespread falls of tephra (volcanic ash), ballistics, pyroclastic flows and surges, rockfalls, noxious gases, and lahars (volcanic mudflows). Timescales vary from seconds to centuries.

At the start of the 21st century, it is estimated that some 500 million people were at risk from volcanic hazards. As with many other natural perils, increasing fatalities and property losses result not from increased volcanism, but from elevated population growth close to active volcanoes. Many of these active volcanoes near populated areas have not been sufficiently studied to assess the volcanic risk.

Risk Frontiers is currently ranking the global volcanic risks to urban areas according to explosivity and population within 200km. This work has begun with a review of Asian risks. Of the 25 highest ranking volcanoes that have erupted within the last 10,000 years with a Volcanic Explosivity Index (VEI) of 4 or above (termed "cataclysmic", e.g. Mt Pelee, 1902), 2 are located in the Philippines, 6 in Indonesia and a whopping 17 in Japan. This preliminary analysis neglects the many violent and dangerous volcanoes with longer return periods.

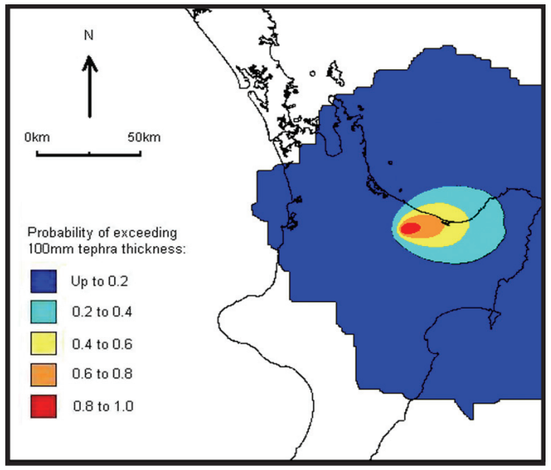
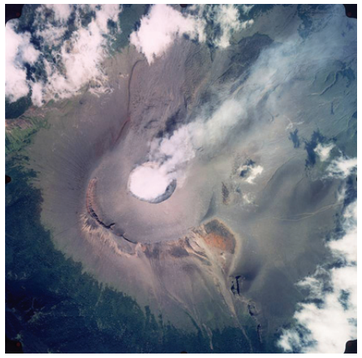


Figure 1: *Multiple phase tephra fall footprint established using ASHFALL (Hurst, 1994). An erupted volume of 5km³ is comparable to that erupted throughout the Vesuvius AD 79 or Pinatubo 1991 eruptions and is relatively modest for Okataina volcanic centre.*

Whilst volcanic eruptions are often un or under-rated, our studies are showing possible losses to be comparable to or greater than those anticipated for other more commonly modelled hazards, such as earthquake. Potentially long duration eruptions with time-varying hazard intensity and magnitude set volcanic eruptions aside from other natural hazards. This difference is seldom appreciated, even by those actively involved in assessing volcanic risk.

Galunggung (Indonesia) in eruption on 16th August, 1982. (J.P. Lockwood)



An aerial shot of Asama (Japan) degassing during the September 2004 eruption. (Asia Air Survey Co Ltd)

Fuji in a peaceful mood in June 2006 (S. Jenkins)

According to recent work at Risk Frontiers Galunggung, Asama and Fuji respectively pose the highest volcanic risks to urban areas in Asia.

Figure 1 shows the exceedence probability for the North Island of New Zealand of receiving in excess of 100mm ash fall (an approximate threshold for roof collapse) given an eruption at Okataina volcanic centre. Contours of conditional probability are plotted. Monte Carlo techniques were used to simulate outputs conditional upon a multiple explosive phase volcanic event with a total volume of 5km³. Volumes of 100km³ are possible from this volcanic centre.

To date, most modelling of volcanic eruptions assumes one instantaneous paroxysmal event. Given changing weather conditions, a drawn out eruption over time may lead to a significantly different hazard footprint. Trying to model such eruptions and losses more realistically is an ongoing task at Risk Frontiers.

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Risky Business

– Do Refined Risk Measures Require Government Insurance Programs?

There have been major advances in tools to differentiate risks in recent years. Genetic testing can identify people more likely to develop certain diseases. "Black Box" and GPS technology in vehicles allow motorists' driving habits to be precisely recorded. Sophisticated catastrophe models can estimate the likelihood a given structure will be destroyed by a cyclone, taking into account the unique construction characteristics of the building.

These technologies allow insurers to tailor premiums to individual risks in ways unimaginable a decade or two ago. Will this lead to greater availability of private sector coverage, or will it increase calls for government to provide insurance to high risk consumers in order to maintain "affordability"?

Free markets seek out the best information to measure and price for risk, constrained by the cost of collecting the requisite data and adjusting pricing or underwriting systems to use it. On one hand, improved risk measurement and pricing should prompt insurers to offer coverage to a wider spectrum of risks, as pooled pricing gives insurers an incentive to avoid high hazard risks. On the other hand, high risk consumers often resist moving away from a community average rate, perhaps by calling on their elected representatives to create a pool to "spread the risk".

Free markets have a very difficult time enforcing the subsidies required to make pooled rate schemes work. If Insurer A charges a pooled rate to risks of varying propensity for loss, Insurer B can undercut Insurer A's price for those less likely to generate losses, making the pooled rate unsustainable for Insurer A. Generally, government intervention is required for a pooled rate scheme to work, as only government has the sovereign authority to force some risks to pay more than the "fair" rate so that others may pay less.

Does a trend towards individualized rating violate the principle of risk pooling upon which the insurance system is based?

Many people confuse the notion of "risk pooling" with that of "pooled rating". There is nothing at all wrong with a system which collects an individualized premium from each risk, places the funds in a common pool, and indemnifies the member(s) of the pool which suffer losses. In fact, a key function of the insurance system is to increase economic efficiency by sending economic signals to consumers regarding the riskiness of their behavior.

The degree to which society requires that rates be pooled to advance various social objectives has a major influence on the degree of government involvement required in the system. For example, if private insurers can identify risks subject to a 20 year return time flood, the only way for a system to provide coverage at a 100 year rate is for a sovereign entity to compel that the subsidy be paid by forcing risks with little or no flood exposure to pay a surcharge.

When considering a subsidized scheme, public policy planners must carefully consider the effect of dampening economic signals to consumers on overall loss activity. In some cases, such as restricting genetic testing in health insurance, the effect may be minor, as people are not more likely to get sick because they are charged a pooled rate for a condition they cannot control. Alternatively, some schemes to subsidize property insurance in high risk areas may lead to excessive development, increasing overall losses to the system. This is precisely what has occurred in the United States, where subsidized pools offering below cost flood and cyclone coverage have directly contributed to reckless development and enormous losses in places like Florida.

Advances in risk measurement metrics will lead to increasing pressure for government intervention to make the system "fair". However, "fairness" requires consideration of more than just the effect on high risk consumers, particularly with regard to the effect of dampening economic signals which serve to discourage risky behavior.

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