

Bushfires: are we doing enough to reduce the human impact?

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Physical and psychological health effects in the community

The recent devastating bushfires near Sydney in Australia are a reminder of the potentially serious human health consequences of this type of environmental disaster. There is a considerable research literature documenting the effects of fighting bushfires, such as an increase in airway responsiveness among firefighters,¹ but less attention has been paid to the health effects, both physical and psychological, on the communities in the area of bushfires. Evidence is accumulating from studies related to a series of severe bushfires over the past 20 years throughout the southern parts of Australia and in several other countries.

Bushfire is not a new phenomenon and is part of the natural ecology. In many countries, such as Australia, bushfire has been a necessary part of the life cycle for several native trees and plants, some of which have characteristics which promote the spread of fire, such as loose, flammable bark, and combustible oils in their green leaves. The Eucalypt in Australia is a good example. Bushfires also occur regularly in many other areas of the world, the most recent examples being the major series of European fires in the summer of 2000,² and the 1997 bushfires in Southeast Asia, which burnt an estimated 5.3 million hectares.³ What is new over the past century, is the establishment of human communities in the bush settings where these fires occur. This can lead to greater fuel levels in the bush, increasing both the frequency of bushfires and the at-risk population when fires do occur.

The 2001/2002 series of bushfires in Australia has been particularly widespread and prolonged. Over a two week period, it involved at least 100 separate fires, many of which were started by arson, mainly by juvenile offenders. An area of about 600 000 hectares, more than twice the area of Luxembourg, was affected. The total fire perimeter of about 3300 km burnt to the western outskirts of Sydney. Over 150 homes were fully or partially destroyed along with at least 200 other buildings, although it has been estimated that more than 12 000 homes were saved. Almost 25% of the Blue Mountains World Heritage Area was affected. Many thousands of people were

evacuated from their homes, but remarkably, no lives were lost. While serious, this outcome compares favourably with the impact of the "Ash Wednesday" fires in Victoria and South Australia in 1983, where 72 lives were lost and 2000 homes destroyed, and the "Black Friday" bushfires in Victoria in 1939, ironically on Friday 13, when 71 people were killed and 2000 hectares burnt.

"Air pollution can travel long distances"

Apart from the immediate effects of burns and smoke inhalation, bushfire affected communities can suffer other health consequences. Smoke from bushfires can cause serious air pollution, including high levels of particulate matter less than 10 μm (PM_{10}).^{3,4} Other pollutants, such as sulphur dioxide or ozone, are usually not increased to the same degree as particulate. This air pollution can travel long distances, depending on the prevailing winds. The recent television footage of the Sydney Harbour Bridge being engulfed in a thick haze, although many miles from the fires, was a powerful image of how widespread and severe air pollution from bushfires can be.

Several researchers have investigated the respiratory effects of air pollution from bushfires on the general population. There was a small increase in hospital emergency room visits for exacerbations of asthma or chronic obstructive pulmonary disease following the 1987 Californian bushfires in the USA, but no increase in hospital admissions.⁵ Researchers reported a similar pattern in Singapore following the 1997 forest fires of Southeast Asia: emergency room attendances for respiratory disorders rose by about 30%, but there was no increase in hospital admissions.⁶ In a prospective study during the 1994 Sydney bushfires, there was no relation between the increased PM_{10} levels and evening peak expiratory flow rate in children, despite PM_{10} levels of up to 210 $\mu\text{g}/\text{m}^3$, seven times the usual level for that time of year.⁴ Any adverse impact on community respiratory morbidity associated with bushfires seems likely to be

mainly short term, but this can still be an important public health problem if the exposed population is large.

Increased PM_{10} levels, from sources other than bushfires, have been shown to be associated with small, but consistent, increases in total mortality from respiratory and cardiac conditions in several studies.⁷ A study of mortality in Singapore during the Indonesian bushfires did not find increased mortality, despite particulate levels being substantially raised.⁶ This may be explained by differences in the particle size distribution during this particular bushfire. This apparent anomaly requires further research.

Psychological problems following bushfires is likely to be an important public health issue. A longitudinal study of psychological health in 469 firefighters was conducted in Australia following the Ash Wednesday bushfires in 1983.⁸ The firefighters reported delayed onset or chronic forms of psychological morbidity more commonly than acute problems. In this study pre-exposure variables were more important determinants than the stress of the bushfire itself.

The psychological problems in affected communities following a major bushfire have also been studied. The main effects appear to be delayed, developing when people have a chance to stop and reflect on their experience, and the link with the bushfire may not be fully appreciated.⁹ A prospective study of 1526 people who had experienced losses in the 1983 Ash Wednesday bushfires found that after 12 months, 42% were defined as a potential psychiatric case using the General Health Questionnaire, about double the expected community prevalence.¹⁰ Twenty months after the fires, this prevalence was found to be 23% in a group who suffered major loss, suggesting improvement over time, even in people who suffer losses during a bushfire. In another study, a range of stress related medical conditions were more commonly reported in the months following a bushfire, but these tended to resolve within 12 months.¹¹

"Economic costs are considerable"

Less obviously, human health may be at risk in the aftermath of a bushfire through effects on the drinking water supply. A recent study showed that erosion resulting from a drop in vegetation as a result of the bushfire caused an increase in sediment concentration in drinking water in the runoff area.¹² However, lead was the only metal in excess of current drinking water guidelines.

There are considerable economic costs to the community from bushfires. It has

been estimated that the damage bill for the 2000 expected insurance claims from the 2001/2002 fires in Australia will be more than A\$70 million, with at least as much again spent on fighting the fires. After the 1983 Ash Wednesday bushfires, a full economic assessment was undertaken.¹³ Including such costs as impact on state forests, bushfire mitigation methods, and medical treatment, the authors calculated the total cost to be around A\$400 million.

Despite the obvious negative effects on a community affected by bushfires, one positive aspect has recently received considerable publicity in Australia, where firefighting is undertaken by a large volunteer workforce. This comprises a broad cross section of the Australian community, from all walks of life, who train without remuneration and are prepared to be called on to fight fires at short notice, usually during the holiday season and often at great personal risk. During the 2001/2002 fires over 15 000 volunteers from around the country fought the fires. This traditional spirit of volunteerism has become a potent force in binding together the Australian community in the face of severe bushfires.

What is being done to minimise the human impact of bushfires? During the recent Australian bushfires, media attention focused on the use of high tech firefighting methods, such as huge helitankers, which can drop up to 9000 litres of water in seconds. Better methods of predicting the behaviour of bushfires have been developed, which assist in coordinating firefighting activities. Effective fire fighting is important, but does not negate the need for better planning and preparation. It is recommended that at least 100 m around a house should be cleared of potential forest fuel, but homeowners often ignore this advice in their desire for a "natural" bush setting. In the immediate aftermath of a bushfire, people are motivated to adequately prepare, but as time moves on complacency usually sets in, until the next conflagration occurs.

"Prescribed burning has an environmental impact"

One contentious issue is the use of prescribed burning to reduce natural fuel loads in the bush. There is conflict between those concerned about the ecological effects of prescribed burns and those bodies concerned with bushfire prevention. In Australia, such burns need approval, and often an environmental impact study has to be undertaken, which can take several weeks. Prescribed burning reduces fuel load around a property, and should reduce the intensity of a fire, making future bushfires more manageable. Prescribed burns do have environmental impacts, such as the generation of smoke, and may endanger some animal and plant species. Decision makers have to strike an appropriate balance between protecting people and their property and protecting environmental diversity.

There has been substantial progress in dealing with bushfires during the last century in Australia, and other countries.² Judge Leonard Stretton, who conducted the Royal Commission into the 1939 Black Friday Bushfires in Victoria said, about the death and destruction in one area: "The full story of the killing of this small community is one of unpreparedness, because of apathy and ignorance and perhaps of something worse." The "something worse" refers to arson as a cause of the fires, a problem which unfortunately is still with us. However, the recent bushfires in Australia, despite their magnitude, did not cause any acute loss of life and resulted in much less destruction to homes than in most previous bushfires. We seem to have heeded at least some of Judge Stretton's words. However, there is no room for complacency and bushfires continue to be a serious environmental hazard.

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REFERENCES

- 1 Liu D, Trager IB, Balmes JR, *et al*. The effect of smoke inhalation on lung function and airway responsiveness in wildland fire fighters. *Am Rev Respir Dis* 1992;**146**:1469–73.
- 2 Environment and Geo-Information Unit. *Forest fires in Southern Europe*. Report No. 1. Directorate-General Environment Civil Protection and Environmental Accidents of The European Commission; 2001. Available at <http://europa.eu.int/comm/environment/civil/prote/cpactiv/cpact06.htm>
- 3 Aditama TY. Impact to lung health of haze from forest fires: the Indonesian experience. *Respirology* 2000;**5**:169–74.
- 4 Jalaludin B, Smith M, O'Toole B, *et al*. Acute effects of bushfire on peak expiratory flow rates in children with wheeze: a time series analysis. *Aust N Z J Public Health* 2000;**24**:174–7.
- 5 Duclos P, Sanderson LM, Lipsett M. The 1987 forest fire disaster in California: assessment of emergency room visits. *Arch Environ Health* 1990;**45**:53–8.
- 6 Emmanuel SC. Impact to lung health of haze from forest fires: the Singapore experience. *Respirology* 2000;**5**:175–82.
- 7 Pope CA, Dockery DW, Schwartz J. Review of epidemiological evidence of health effects of air pollution. *Inhalation Toxicol* 1995;**7**:1–18.
- 8 McFarlane AC. The longitudinal course of posttraumatic morbidity: the range of outcomes and their predictors. *J Nerv Ment Dis* 1988;**176**:30–9.
- 9 McFarlane AC, Raphael B. Ash Wednesday: the effect of a fire. *Aust N Z J Psychiatry* 1984;**18**:341–51.
- 10 McFarlane AC, Clayer JR, Bookless CL. Psychiatric morbidity following a natural disaster: an Australian bushfire. *Soc Psychiatry Psychiatr Epidemiol* 1997;**32**:261–8.
- 11 Clayer JR, Bookless-Pratz C, Harris RL. Some health consequences of a natural disaster. *Med J Aust* 1985;**143**:182–4.
- 12 Meyer VF, Redente EF, Barbaric KA, *et al*. Ecosystem restoration: biosolids applications affect runoff water quality following forest fire. *J Environ Qual* 2001;**30**:1528–32.
- 13 Healey DT, Jarrett FG, McKay JM, eds. *The economics of bushfires: the South Australian experience*. Melbourne: Oxford University Press, 1985.