PRAGMATIC WILDFIRE PROTECTION PLANNING AT THE URBAN INTERFACE AVAILABLE FROM THREE MAJOR STUDIES IN NSW, AUSTRALIA

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Abstract
Many wildfire threat models exist today. Some are well used in the scientific community, few may have the capacity to be understood and applied by laypersons. Three major studies in three different cities in NSW, Australia are used to show how assessment of wildfire risk at the urban interface can provide practical outcomes in a cost effective manner using GIS and other planning tools.

The studies covered 644 kilometres of wildfire-prone urban interface. They provided valuable and practical information, understood and subsequently used by politicians, bureaucrats and fire management practitioners. Whilst the projects involved landscape-wide GIS studies, comprehensive stakeholder consultation and on-the-ground pilot studies produced detailed prescriptions for subsequent risk reduction work. On ground work that has been largely implemented for two of the three studies.

The studies combined good science, legislation, planning and GIS technology to provide pragmatic outcomes that included: a polygon identifying the size of asset protection zone (APZ) required; building construction standards, quantification of environmental impacts; cost estimates for implementation; clarification of the residual risk; and a program and priority for implementation.

The true test of any such planning is its application. These studies provide some of the most comprehensive tried, tested and implemented wildfire risk reduction plans for the urban interface in NSW. All that is required now is a wildfire, but we are not in a hurry.

Introduction
Three major studies of the wildfire risk at the urban interface have been completed since 1999 in three cites within NSW, Australia. In 1999, a wildfire protection strategy was prepared for 170 kilometres of urban interface on the southern side of the Blue Mountains City; in 2003, the first of three stages in a Wildfire Asset Protection Zone Risk Management Study was completed for a 282 kilometre urban interface in Wollongong City; and in 2005, Stages 1 and 2 of a Wildfire Risk Assessment and Mitigation Plan for Council Managed Lands was completed for 190 kilometres of urban interface in Baulkham Hills Shire in Sydney.

What may be different about these three wildfire threat studies is that they involve relatively large areas, focus exclusively on the urban bushland interface and were specifically required to produce outcomes that could be implemented soon afterwards, in the most part by organisations that at the time had limited wildfire protection expertise. An outline of processes followed, indicative results and lessons learned are provided. Implementation of the recommendations from all three studies has occurred to some extent.

Of the many wildfire risk assessment models published in recent years, some have been theoretical (Shields and Tolhurst 2003, Bradstock 2003), while others have focussed on broad areas beyond the interface (Ohlson *et al* 2003). While each of the three studies identified in this paper allowed for some innovation, each study was required to follow a contract brief issued by the local council. In each case the ‘bottom-line’ requirement was the production of a report within a budget that council could implement, local fire authorities were happy with and local residents were either consulted on, or could within reason, understand. Compared to the other risk studies cited, a very different, pragmatic, immediately applicable outcome was required.

Methodology in each study

Blue Mountains City (1999)

Conducted over two years this study involved extensive consultation. During the data collection phase, two meetings were held with executive from local fire and emergency authorities, two large meetings with local firefighters, one with local conservation groups, and another with local Councillors. Media releases were issued, and about an hour was spent with at least four residents in four pilot study areas. A public discussion paper was released.
Qualitative techniques were used to evaluate wildfire risk. A GIS database was used to capture and analyse data over the 170 km interface; data included slope, aspect, vegetation, fire history, history of damage, built and environmental assets, potential fire intensity, likely frequency of weather conditions at which uncontrollable fire intensities can be expected, length of interface in each brigade area/township and a general comment on the current vulnerability of buildings.

Seven major risk reduction strategy options were analysed, including a do nothing option. Recommendations involving a combination of five protection strategies were presented with details on how each could be implemented and appropriate standards to be achieved. Indicative costing was provided and a risk reduction program methodology was tested at four pilot study areas.

Wollongong City (2003)

There were two major stages to this study. In stage 1, a GIS model was used to predict the width of APZ required over the 282 kilometre interface and expert opinion used to prioritise segments of the interface for implementation. A suite of potential wildfire risk reduction principles were identified and along with the APZ model was ground-truthed or tested at seven pilot study sites. As with the Blue Mountains study, extensive consultation with stakeholders and the community were integral to the process. Stage 2 involved detailed design for implementation of the prioritised segments of the interface, including environmental review, and documentation of required works ready for contractors to implement.

Baulkham Hills Shire (2005)

This study also involved two major stages, with extensive field investigation of the wildfire risk in stage 1. Data obtained were analysed along with GIS modeling, aerial photograph interpretation, and wildfire risk reduction investigation around the perimeter of hundreds of relatively small bushland reserves.

A Bushfire Risk Evaluation Procedure (BREP) was developed and consisted of the ‘House Ignition Likelihood Index’ (HILI) devised by Tolhurst and Howlett (2003) used to calculate an index or rating of relative risk based primarily on measurable parameters. It was used to calculate the individual and combined effect of the surface, elevated and bark fuels on ember attack, radiation and convective load, and flame contact, and enabled a ranking of segments of the interface according to building ignition potential. Segments of the interface were prioritised for risk reduction works by modifying the HILI score for each interface segment with a house density score to recognise the increased potential risk associated with larger number of people and buildings.

Two GIS models were used in the second stage to provide detailed information on the expected size of APZ and an estimate on the cost to establish and maintain these APZs. Environmental data captured from GIS helped quantify the potential effects of establishing the APZs.

Results and Discussion

Being a study ultimately requiring on-ground works, it is pleasing to report that on-ground works have resulted in all three study areas albeit with mixed success.

Blue Mountains City (1999)

The study outcomes guided some fire fighting operations during the major wildfire in 2001/2002. Whilst the study results were not designed for implementation during a wildfire emergency, fire authorities and land managers took advantage of an indicatively mapped ‘interface control line’ to establish a line from where property defence and wildfire control could be launched. In the months following the crisis, other aspects of our carefully prepared study were implemented retrospectively on the disturbed sites.

Unfortunately however, the Blue Mountains City study as a whole has not been implemented and recent enquiries indicate the study report has been mislaid and many staff potentially responsible for its implementation have moved through the organisation since its release in 1999. A sad, but we believe, all too common outcome for wildfire risk planning studies. Considerable effort was invested to obtain support for implementation of the study with extensive consultation with fire authorities, public land managers, private property owners and politicians, an investment that will likely be required again sometime in the future.

A summary of the five components of the protection strategies detailed in the Blue Mountains City study are shown in Table 1. Whilst none of these components are new in wildfire protection planning, in this instance concepts were translated into on-ground priorities and detailed prescriptions for implementation over a 170 km interface.

Table 1. Five components of the Blue Mountains City wildfire protection strategy (BES 1999)

Strategy Priority	Description of strategy component
1	a. All buildings at the southern interface to establish appropriate asset protection zones, and b. All buildings at the interface to be protected against burning debris by applying appropriate components of Australian Standard 3959.
2	Establish an interface control line as part of, or in conjunction with, the asset protection zones for buildings.
3	Establish strategic fuel management zones between the interface control line and an outer management line.
4	Establish in key locations auxiliary management lines between the interface control line and outer management line.
5	Establish an outer management line at the outer limit of the strategic fuel management zone and/or establish an outer line potentially suitable for control of at least low to moderate intensity fire.

Wollongong City (2003)

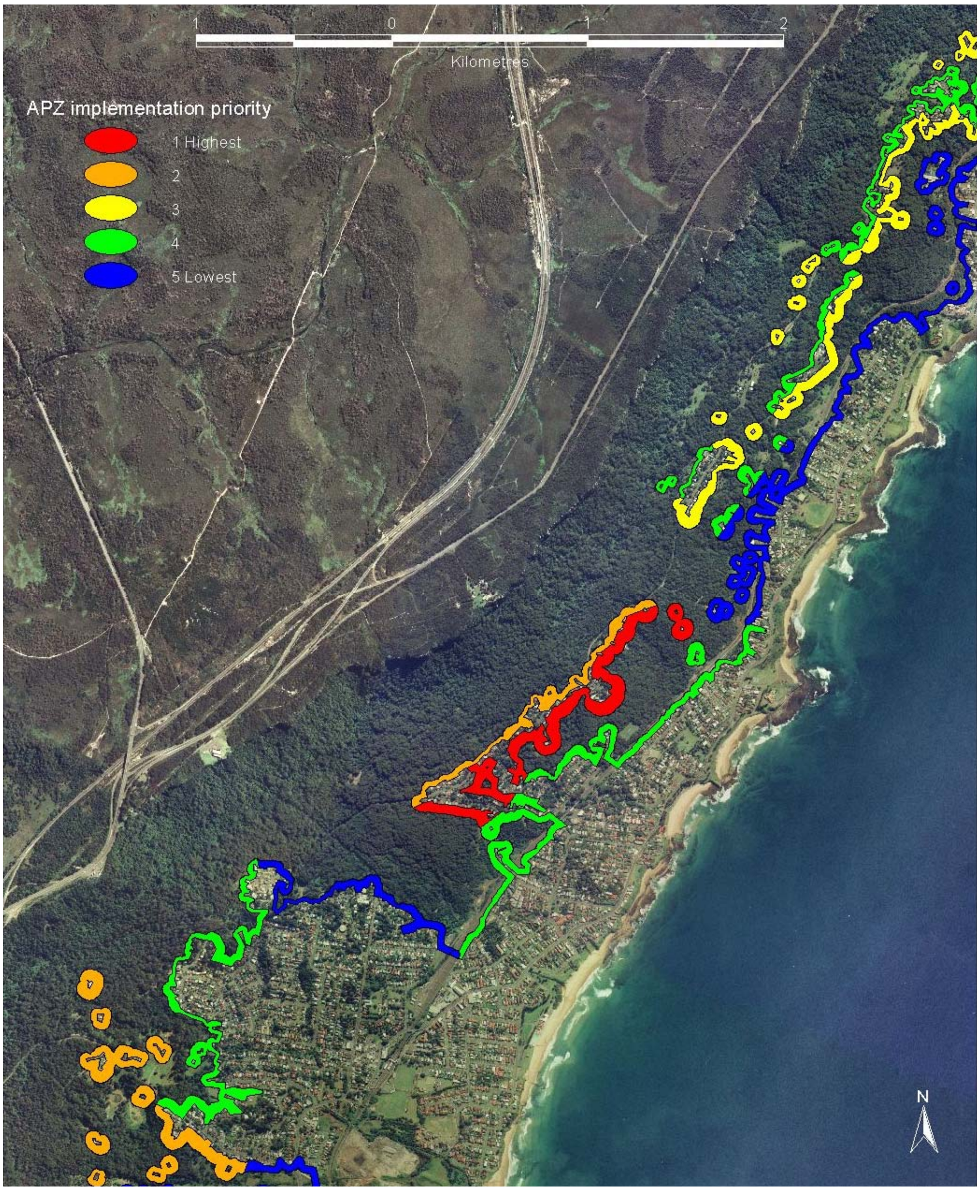
On-ground results from this study are extremely encouraging. Large parts of the council owned or managed portions of this 282 km interface now have a higher standard of wildfire protection with a site specific implementation of city-wide strategies now achieved. All of the highest priority interface areas (*i.e.* those with greatest risk) have had fuel management works carried out within the identified APZ, and works at a selection of second highest priority sites have begun. In addition the Council has secured funding for two part time Bushfire Education and Liaison Officers to work along side the Bushfire Management Officer in implementing the studies.

Forty seven manageable sized interface segments were identified and prioritised for protection works, with a cost estimate for construction and maintenance provided for each. Estimates of $5 million (in 2003) were identified for the APZ construction with more than $6 million for maintenance for the subsequent four years. Cost estimates were not provided for construction of the additional trails and tracks (interface control lines), but estimates of cost per kilometre were provided.

Six percent of the modelled APZ was identified as having high/very high risk of slope instability; 9% involved slopes $>18^0$; 4.1% contained Endangered Ecological Communities; at least 5% had mapped weeds and exotics; and 1,026 ha of APZ was estimated as being required, 136 ha of which was on Council land, 19 ha on National Parks and Wildlife Service land and 871 ha was in private ownership. A summary is posted on the council website for stakeholder information <http://www.wollongong.nsw.gov.au/EnvironmentDevelopment/OurNaturalResources/Index_661.htm>.

Figure 1 shows a small part of the modelled APZ outcomes in Wollongong City as prioritised segments for implementation.

Figure 1: Modelled APZ and implementation priority for part of the Wollongong City study.



Baulkham Hills Shire (2005)

Results included an Implementation Priority Score (IPS), provided by a combined House Ignition Likelihood Index (HILI) score, house density score and expert adjustment; a House Ignition Likelihood Index (HILI); and a Reserve Implementation Priority Score (RIPS). The Implementation Priority Score (IPS) identified priority APZ works which are now underway.

Five levels of implementation priority were identified, with the priority one areas representing 38 kilometres of interface and priority two areas, 36 kilometres. Approximately 42% of the 190 km interface was rated as having an extreme House Ignition Likelihood Index (Tolhurst & Hollett 2003).

Another risk assessment procedure (adapted from Australian/New Zealand Standard for Risk Management (AS/NZ 4360:1995)), provided an estimate of the total dollar value of wildfire risk to Council.

Conclusions

GIS maps, quantified risk estimates, and prioritised and costed implementation programs have proven extremely valuable in communicating wildfire risk study outcomes and we believe these are a significant reason for successful political and stakeholder support of the recommendations in all three studies.

The successful on-going implementation of the Wollongong City and Baulkham Hills Shire studies can also, in part, be attributed to the way study funds were sought, with a large part of the commitment to the implementation of study outcomes made prior to the commencement of the first stage. Our Blue Mountains wildfire risk study and many others undertaken by the authors, but not mentioned here, suggest that major wildfire risk studies must be implemented soon after completion to be effective. It is at this time that considerable political and stakeholder momentum is available and this is often required for reliable implementation of recommendations associated with large scale projects such as the three studies discussed in this paper.

Multi-stage wildfire risk studies such as that in Wollongong City and Baulkham Hills offer advantages in that the first stage can quantify the problem, prioritise and cost strategies; with subsequent stages designing detailed strategies to achieve work on the ground. The first stage is aimed at management and council and raises awareness, identifies responsibilities, and provides an implementation cost against a dollar value of risk to council. Multi-stage studies such as these help ensure scare wildfire protection dollars go to well thought out priority areas, instead of where the community ‘noise’ is loudest.

References

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