

The self defence alternative in the fight against severe bushfires

Part 1 Policies and outcomes (Fire agency approach vs. self defence)

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Abstract

This paper arose out of concern for the high damage toll in severe bushfires. It explores the theory that the property protection components of the current fire agency policy model are inadequate in severe bushfires and are incapable of reducing the high damage toll.

The property protection issue is examined from two perspectives. The fire agency policy model is a top-down model whose aim is community-wide protection and the self defence system is a bottom-up model whose aim is to deliver individual property protection. Both approaches are compared to defined benchmarks. The property defence benchmark is used to determine if all threat issues are covered and the self-empowerment benchmark is used to determine if the property owner is empowered to self-protect with confidence.

The analysis finds the fire agency policy model falls short in the criteria of both benchmarks. Its key deficiencies include incomplete identification of threats, inadequate guidance concerning threat management, and failure to empower the property owner to self-protect.

The analysis finds that the self-defence system meets all criteria of both benchmarks.

It concluded that reduction in the damage toll cannot occur using the property protection components of the fire agency policy model but must rely on improved suppression response. Implementation of the self defence system is capable of reducing the damage toll on individual properties and in neighbourhoods. An additional benefit may be reduced fire agency costs and suppression costs in those areas.

Introduction

This paper arises from the following question: Why is the damage toll still so high in severe bushfires in Australia in the 21st century?

The following figures indicate the recent bushfire damage toll is substantial. They show part of the toll from six severe bushfires in Australia since 2001: 9 deaths / 73 houses, 109 houses, 6 deaths / 84 houses, 41 houses, 4 deaths / 484 houses, 3 deaths / 48 houses (from O'Bryan, 2006a). Is the toll too high? It can be argued that the toll is too high if any of these losses were avoidable. An underlying inference of this paper is that with the correct fire protection approach, the toll would have been lower.

Because fire agencies are the dominant influence in all matters bushfire, the damage toll in severe bushfires can be seen as a reasonable indicator of fire agency performance, which in turn is a manifestation of the fire agency policy model. Therefore, if the toll is higher than desirable, the fire agency policy model must be somehow at fault.

In simple terms, the fire agency policy model can be described as a mix of fire suppression and fire protection components. Fire agencies acknowledge that in severe bushfires suppression resources are thinly stretched, eg, "Residents must keep in mind that in a major bushfire, CFA will not be able to provide assistance to every home" (CFA 2004). Therefore, the following analysis will assume that suppression resources will not arrive at a property when they are needed. This means the only strategies remaining to protect the resident are the agency's fire protection components. This analysis will also assume that a resident has no source of property protection knowledge or skill other than fire agency pronouncements. This leads to the hypothesis of this paper that the property protection component of the fire agency policy model is inadequate for severe bushfires and is incapable of reducing it the damage toll.

This paper is the first of a two part study. Part 1 examines the content and effectiveness of both approaches - the fire agency policy model and the self defence system. Part 2 (O'Bryan, 2006b) examines the quality of science behind both and their respective performance outcomes.

Comparison Methodology

Two fire protection approaches will be presented for comparison, both at different ends of the spectrum to highlight the range of possibilities. The traditional fire agency policy model is a top-down or community-wide approach and the self defence system is a bottom-up or property-centric approach which focuses on individual property protection.

To ascertain the adequacy of a given fire protection approach, each will be assessed against two benchmarks. If it fails to meet the benchmark criteria on a given property, protection will be regarded as inadequate and the property will be deemed to be vulnerable to and sustain damage in a severe bushfire. Conversely, if it meets the criteria on a given property, protection will be regarded as adequate, it will not be damaged in a severe bushfire, and therefore the damage toll will be reduced. By extension, if either approach is applied to ten properties, the respective damage toll will either tally up to ten, or be reduced by ten. The benchmarks are the property defence benchmark and the self-empowerment benchmark.

The fire protection approaches

Fire agency policy model

The current fire agency policy model delivers a specific range of policies and strategies whose objective is to minimise bushfire damage within their jurisdiction and within budgetary constraints. This is a logical and responsible approach to spending public funds. The key elements of their charter can be characterised as follows:

- **Suppression:** Fire agencies provide fire fighting resources to defend the community and they ensure that adequate infrastructure and regulations are in place to facilitate fire suppression.
- **Protection:** They provide the public with advice and regulations about personal and property protection.

This analysis is concerned with the property protection component of fire agency policy model, and will be represented by the policies and advice promoted by fire agencies in Australia's two most fire prone States, Victoria and NSW.

Application of this model to a property can be described as prescriptive, ie, residents follow instructions in leaflets that they assume to be based on good science and risk theory.

The self defence system

The self defence system (O'Bryan 2006a) is proposed as a means of providing effective protection to an object (an object includes a person, a building, a property or a neighbourhood) against damage, particularly in severe bushfires. The system derives from the following logic. There are essentially two damaging elements in an approaching bushfire - the moving flame and the embers. By keeping the moving flame at a safe distance from an object, full attention can be directed to the embers. To reduce the possibility of embers developing into a flame (moving or stationary) on and in the vicinity of the object, maintain an on-site suppression capability and eliminate potential flammable materials. Thus the self defence system has three components.

- 1 Exclusion of moving flame from nominated area.
- 2 On site suppression presence
- 3 Flame dimension management in strategic protection zones to prevent damage from flame contact or radiation.

(The strategic flame dimension model (O'Bryan, 2006a and 2006b) provides the underlying scientific framework for the self defence system)

Application of this system to a property can be described as self-determined, ie, residents undertake a training program to understand bushfire behaviour prediction and applied risk.

The benchmarks

Both benchmarks are intended to provide standards for damage prevention on a given property or group of properties. The emphasis on a property focused perspective is appropriate for a few reasons. It is at the individual property level where damage occurs,

where distress is endured most keenly and where residents can mount a defence from. Finally, there are political reasons. It is where influential stakeholders reside - these residents not only help to fund the fire agencies, but they are also frontline judges of agency performance.

Property defence benchmark

The criteria of this benchmark ensure protection of an object (a person, a building, a property or a neighbourhood) from bushfire damage. It derives from standard risk management models (eg, Australia / New Zealand Risk Management Standard (AS / NZS 4360: 1995), after Smith et al (1996) and Salter, 1998). The benchmark carries the expectations that (1) an object protected by all the criteria of this benchmark can expect to escape bushfire damage, and that (2) an object protected by less than all these criteria (or if they are implemented in part) cannot expect to be protected. The three criteria are:

- Identify all relevant threats
- Manage or reduce all threats
- Ensure the object is fortified or defended against threats

In effect, these criteria provide a qualitative assessment of the scope and content of a property protection model.

Self-empowerment benchmark

This benchmark provides a qualitative assessment of the degree of empowerment of an individual property owner. An individual is defined as feeling empowered with a new skill when trained in the right content and with teachable techniques so as to be confident about property self-protection. The answers to three key questions are used as indicators of individual empowerment.

- Does the model identify all reasonable threats relevant for the person's property?
- Is protection guidance comprehensive and applicable to any property?
- Is protection advice sound and realistic?

Comparisons Results

Comparison with the Property Defence Benchmark

Current fire agency policy model

- Threat identification

Fire agencies identify flame contact, radiation and ember attack as the causes of damage in bushfires. The bushfire is assumed to be a single fire front that approaches a property as a solid wall of flame, crosses over it and continues on its way (eg, CFA, 2002, RFS, 2001).

Comment: Fire agencies do not adequately address threat identification because of three serious omissions. First, the single fire front description fits low and moderate intensity fires, but is inadequate to deal with severe fires. Severe bushfires in mixed eucalypt forest / grassland landscapes commonly have multiple fronts (O'Bryan, 2005). Next, they fail to recognise stationary flames as a threat. Their literature quotes reports that most bushfire damage is caused by embers (eg, RFS, 2001), but does not appear to acknowledge the causal connection between embers and stationary flames. Finally, it omits the common scenario of the moving fire front that stops at a fuel free barrier where the barrage of live embers often causes considerable damage via stationary flames, eg, as observed recently in the Canberra 2003 bushfires at Duffy.

- Management of threats

Flame management: Agencies claim to protect dwellings from direct flame contact and radiation from moving flame in adjacent vegetation (eg, RFS 2001).

Ember management: Agency focus for ember defence is on protecting building surfaces against the possibility of ember ignition (eg, RFS 2001).

Comment: There are three serious problems with fire agency advice and policies. Firstly, the protection zone widths are based on radiation calculations that use pre-determined (not actual) fuel loads (see O'Bryan 2006b). Secondly, flame within protection zones is overlooked as innocuous (see O'Bryan 2006b). Thirdly, they omit to recommend effective

management of ember attack, eg, the CFA's property fire plan has minimal reference to strategic management of flame or ember threats on a property (CFA 2004).

- Defend the object against threats

Remove the object

Evacuation is the traditional method for reducing injury to humans in a threatened neighbourhood. Evacuation can be compulsory or voluntary. Where evacuation is voluntary, fire agencies advise people to decide whether they will stay or go, but add if they decide to go, to leave early - well before the fire front arrives (eg, CFA 2004).

Comment: Whilst the evacuation policy may save lives, it is counter productive for the fire agency property protection objective. In the first place, the implicit consequence of evacuation is that property protection relies totally on fire agency resources on site because other potential manpower has been sent away, and secondly fire agencies have told property owners not to rely on their assistance. In regard to deciding to go early, agency guidance is vague, eg, "listen to ABC radio". Furthermore, "going early" can work well with foreknowledge, but the author is aware that sometimes the residents' first warning of an approaching severe fire can be embers landing in or near their property (eg, TV interviews with residents at Mt Eyre fires, 2005).

Isolate the object

Agencies have an advisory approach for existing dwellings and a regulatory approach for protection of new dwellings. The advisory approach focuses on fuel management. The regulatory approach applies only to bushfire prone areas, which are defined by proximity to standing vegetation (eg, CFA 2002, RFS 2001). Regulations focus on protecting buildings by design standards and by management of separation distance between adjacent vegetation of predetermined fuel loads. The protection zones aim at reducing rate of spread by reducing fuel loads.

Comment: The isolation requirement fails because it needs strategic fuel free areas, not fuel reduced areas. The belief that reducing fuel load slows the fire speed and this somehow this makes the building safer has no scientific support (see O'Bryan, 2006b).

Fireproof the object

Construction design standards apply to new developments in bushfire prone areas (CFA, 2002; RFS, 2001). They generally require the use of fire retardant materials and ember-proof screens in areas where embers may lodge and ignite the surface of the building.

Comment: Lack of guidance about fire retardant materials and ember controls on established properties is a serious omission because most properties in bushfire prone areas are established, not new.

Comparison with self defence system

- Threat identification

The system addresses moving flame, embers and stationary flame as they occur on or near a given site or asset. The system also accounts for flame contact and radiation caused by both moving and stationary flames. It can account for single and multiple front fires.

Comment: The system identifies and accounts for all significant threats.

- Management of threats

Flames: The system requires flame size management on a given site in the appropriate fuel bed layer, whether moving or stationary.

Embers: Ember attack is managed in the environs of the object by specifying flame height maxima (eg, zero or low) in designated zones.

Comment: Because the system deals with actual on-site fire behaviour, it therefore allows management of actual threat to an object by flame contact and radiation.

- Defend the object against threats

Remove the object

Evacuation of the site is not required where there are adequate protection zones.

Comment: These zones provide an on-site safety area for the extinguishment team to shelter in and subsequently deal with ember caused problems.

Isolate the object

The system ensures that objects are isolated by managing flame height in protection zones.

Comment: Flame height is relevant for managing potential flame contact and radiation.

Fireproof the object

Protection zones are located strategically to provide protection against flame contact and damaging radiation levels caused by either moving or stationary flames. A building can be further protected from ember attack by applying the principles of Australian Standard 3959, 1999 (Construction of buildings in bushfire prone areas).

Comment: Protection zones apply to all properties, new or established. The zones target flame size which is the direct cause of radiation and flame.

In summary, the foregoing comparison suggests that fire agency policy model falls well short of the requirements of the property defence benchmark. On the other hand, the self defence system appears to meet the requirements of the benchmark.

Comparison with self-empowerment benchmark

Current fire agency policy model

- Does the model identify all reasonable threats relevant for an individual's property?

It does not mention strategies for the owner to deal with moving or stationary flame if it occurs on an individual property. It covers ember attack on buildings in new development sites, but omits ember attack on buildings in other areas and on the environs of a building.

Verdict: No

- Is protection guidance comprehensive and applicable to any property?

Guidance is qualitative. Fire agencies provide fuel management advice as a generalised list of hints and tips about property protection, but there is no specific advice for an individual property. For new development sites in designated bushfire prone areas, fire agencies require specific vegetation clearance standards. But there is no equivalent requirement or advice for established neighbourhoods.

Verdict: Partially

- Is protection advice sound and realistic?

Their guidance to a property owner is confusing. One agency provides general fuel management advice on surviving the passage of a fire front but then advises residents to evacuate if they do not feel confident to stay (eg, CFA, 2004). Another agency provides advice but then doubts its value in severe bushfires (RFS, 2001, Sect 6.1).

Verdict: No

In summary, the fire agency policy model gives vegetation clearance standards to property owners in new development areas and tips on how their house (and they) may survive in other areas. They are advised to evacuate if in doubt. They feel confused and therefore are not empowered to self-protect.

Self defence system

- Does the system identify all reasonable threats relevant for an individual's property?

It identifies the threats from both moving and stationary flame and empowers the individual with knowledge to quantify and manage flame height anywhere on the property.

Verdict: Yes

- Is protection guidance comprehensive and applicable to any property?

Guidance is quantitative. The property owner is empowered to assess fire behaviour accurately on all areas of the property and risk consequences thereof.

Verdict: Yes

- Is protection advice sound and realistic?

Because it arms the resident with adequate knowledge, the size and location of protection zones can be assigned with sound logic. This gives the property owner the confidence to manage flame or ember attack, to remain on site and to provide safe refuge.

Verdict: Yes

In summary, because the self defence system provides property owners with adequate information to apply and self-assess, they can feel empowered to self-protect with confidence.

Discussion

Are these benchmarks reasonable? From the point of view of the property owner who wants to avoid damage, they are reasonable because they specify criteria required for protection of a property from bushfire damage. However, they do set a higher standard than simply achieving a reduction in risk of damage or than the community-wide performance criteria that fire agencies seem to use.

Does the comparison produce a reasonable result? It can be argued that the benchmarks are biased towards the needs of individual property protection, and that therefore the self defence system is expected to win the comparison contest. The key issue in this paper, however, is to find a fire protection approach that will protect an individual property from damage in a severe bushfire. In reality, if the fire agency policy model or any other model produced this result for an individual property, it would also pass the test. Therefore, the comparison will always produce a reasonable result.

The assumptions seem to be reasonable. Attendance at an individual property by fire agencies cannot be expected in a severe bushfire because their attention is on preventing perimeter spread. People in bushfire areas seem to rely heavily on fire agencies as the source of advice about property protection.

The two fire protection approaches were compared on the basis that fire agency resources were not available during the bushfire. The fire agency policy model failed to meet the benchmark criteria, but the bushfire defence system did. This means that damage toll reduction by fire agency model must rely on improved suppression response, whereas the bushfire defence system can achieve damage toll reduction without reliance on fire agency suppression. This suggests two beneficial outcomes. Adoption of this system by a property or a neighbourhood will not only prevent bushfire damage in the next bushfire, but will free up fire agency resources for their attack on the bushfire perimeter. It is foreseeable that adoption by many neighbourhoods will lead to reduced damage toll, shared community responsibility, improved community knowledge base, reduced suppression costs in those areas and reduced demand on the fire agency resources.

Conclusion

This paper has provided evidence to support the hypothesis that the current fire agency policy model is inadequate in severe bushfires and is incapable of reducing the damage toll. It found evidence that the self defence system can protect a property from damage and will lead to reduction in the damage toll, not only on individual properties, but also in neighbourhoods. Its implementation is therefore recommended as a positive step to reduce the damage toll.

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