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Retrofitting for wildfire resilience: What is the cost?

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ABSTRACT

Wildfires impact upon populations where development has occurred within or adjacent to natural vegetation. Even with extensive management interventions in the landscape, wildfires will continue to impact upon some properties. Residents in wildfire prone areas need to prepare themselves and their properties. Studies have found cost is one of the main reasons there is a generally low level of preparation by residents. In this study, we quantify the cost for residents to prepare themselves and retrofit their property for wildfire in an intermix and interface community. We combine this with semi-structured interviews to identify limitations to preparedness and willingness to contribute to a shared cost scheme with local government. Wide variation in the level of preparedness was found for the five case study homes in the intermix area and the five in the interface area with intermix houses being better prepared than those at the interface. All buildings were found not to comply with any building standards for wildfire resilience, despite most being considered to have the highest level of wildfire exposure. The total up-fronts cost to prepare residents and their homes ranged from approximately $8500 to $47,000 with an average of $24,600. Based on these figures, the financial investment required was significantly higher than residents felt they were able to cover. Ultimately, the choice to live in a wildfire-prone area will always involve the acceptance of some risk, regardless of the construction of the property and preparedness of the household.

1. Introduction

Wildfires impact predominantly on communities where homes are built adjacent to, or amongst, areas that contain "wildland fuels" [1]. These areas are referred to as the wildland-urban interface (WUI) [2,3], urban-bush interface [4] and peri-urban landscapes [5,6]. Populations at the WUI are increasing, driven by urban expansion, economic and lifestyle reasons [6,7], resulting in social and environmental change. Globally, the expansion of populations into these areas is increasing the risk to human populations from wildfire [8].

Fire management agencies try to reduce the likelihood of WUI disaster through both reactive and preventative approaches. The primary reactive approach is active fire suppression, which attempts to stop fires that have started in wildland areas before they impact WUI communities [9–11]. Associated with suppression is the evacuation of residents when the fires threaten property [12–14]. A range of preventative treatments exist, the most common of which are fuel treatments that aim to reduce fuel loads in an attempt to improve the likelihood of suppression and thereby reduce the intensity of fires reaching the WUI [9,11,15,16].

Less attention has been given to community engagement to encourage householders to prepare themselves and their property for potential wildfire. When exposed to wildfires, well-prepared properties and residents can significantly reduce the risk of loss of life and property [17–21]. Until recently there has been considerable debate over exactly what it means for residents to be prepared [22–29]. Recent research in this area has defined three key components of preparedness: a) the condition and maintenance of the house and grounds, b) defensive equipment, and c) the personal capacity of the homeowners [30].

Residents who are present during the passage of the main fire front will be required to seek shelter within the house. It is therefore important that houses are built to a suitable construction standard to survive the impact of the main fire front [30]. Globally, there are few

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construction standards for houses that may be exposed to wildfires. One of the most comprehensive is the Australian Standard *AS3959 - Construction of Buildings in Bushfire-prone Areas* [31], which was developed in 1991 with substantial revisions in 1999 and 2009. AS3959 prescribes the minimum level of construction required for new houses as well as extensions in order to better withstand the effects of the expected exposure from a wildfire. However, concerns have been raised about the efficacy of the standard and we refer readers to Leonard (2009) [32] for a complete analysis.

The majority of dwellings in wildfire-prone areas in Australia pre-date these regulations and are therefore not built to standard. Retrofitting houses to an upgraded construction standard may provide a cost-effective and sustainable mechanism to reduce the vulnerability of existing communities to wildfire. Guides have been prepared for householders who wish to voluntarily retrofit their house to improve their wildfire protection (e.g. *A Guide to Retrofit your Home for Better Protection from a Bushfire* by the Victorian Country Fire Authority) (http://www.cfa.vic.gov.au/fm_files/attachments/plan_and_prepare/bushfire_home_retrofit.pdf Accessed December 2015) or *Best Practice Guide to Bushfire Protection: Upgrading of Existing Buildings* by the NSW Rural Fire Service (http://www.rfs.nsw.gov.au/__data/assets/pdf_file/0018/4365/Building-Best-Practice-Guide.pdf Accessed December 2015). However, little work to date has explored methods to actively encourage the wholesale retrofit of high-risk homes and neighbourhoods. This is despite research having shown that reducing house ignitions in the WUI reduces the overall fire risk in the entire WUI landscape, thus heightening the probability of life protection and property survival [33].

Costs of retrofitting or preparing a property are currently the responsibility of the homeowner. There are a range of reasons that residents don't prepare adequately for wildfire including assessing the risk to too low to justify preparation [34–36] or the belief that they will be adequately protected by insurance or fire agencies [37–39]. Several studies have found that financial and time costs are two of the key barriers to preparedness actions being undertaken [34,40,41]. One possible mechanism to overcome this involves cost-sharing schemes with organisations and authorities whose interests are served by increasing the resilience of the WUI to wildfire attacks. For these organisations, the appeal of such schemes hinges on the balance between the cost of retrofitting and preparing WUI houses and the costs associated with protecting WUI communities through suppression activities and hazard reduction [42]. In cases where this balance favours building retrofits, it would be in the interests of fire management agencies to subsidise such retrofits. In the USA, cost sharing programs for wildfire risk mitigation activities have been utilised in many at-risk communities [43]. Cost sharing was found to encourage participation where barriers related to financial and time costs [44]. However, cost sharing did not appear to overcome resistance to mitigation that was related to concern about visual impact or doubts about the effectiveness of mitigation actions.

Here we examine whether it may be economically and socially feasible to harden the Wildland Urban Interface against wildfires in order to reduce risk to people and property. To address this, we undertook surveys of people and property in interface areas in south-eastern Australia. Firstly, we identified actions required to adequately prepare dwelling for wildfire using the definitions outlined in Penman *et al.* [30]. Secondly, we asssessed the modifications required to retrofit the buildings to match the Australian Building Standard *AS3959-Construction of Buildings in Bushfire Prone Areas*. These approaches allowed us to identify inadequacies in preparation and construction, and estimate the cost to harden the interface through preparation and retrofitting. Finally, we undertook semi-structured interviews with residents to explore the extent to which they were willing to contribute to the costs of preparedness and retrofitting to harden the interface.

Fig. 1. Map of study areas: Durren Durren (Group 1) and Toukley/Noraville (Group 2) in Wyong Shire Council, NSW.