

Implications of Longitudinal Studies of Bushfire Preparedness for planning Community Safety Programs in Northern NSW

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Abstract

Fire Agencies throughout Australia have in recent years dramatically increased their focus on community safety as a core business. Previous research has indicated that the only truly effective mechanism for reducing the impact of bushfire on the broader community is to actively engage residents in programs that promote self-sufficiency with regard to bushfire safety. To gauge the effectiveness of such programs a longitudinal bushfire preparedness study, over the years 2001 – 2005, was conducted by the NSW Rural Fire Service in 11 locations across northern NSW, using facilitator implemented face to face resident surveys. The results from both surveys are presented in this paper with a discussion of geographical and settlement type variations in preparedness. Correlation of the differences in elements of preparedness has significant implications for community engagement program design and community education strategy development. A clear link has been found between community perception of bushfire risk and the undertaking of actions to increase preparedness. These results have provided the impetus for a change in approach to community education within the Northern region of NSW and have identified a justification for further research into long term behaviour change as a result of bushfire education.

Introduction

The New South Wales Rural Fire Service (NSWRFS) has a dedicated community education section (part of a broader Community Safety Directorate) that develops a wide variety of programs that aim to empower local residents, (e.g. Street FireWise, FireWise Groups, Farm FireWise etc.).

There have been many studies that have evaluated the response of communities to bushfire events (e.g. Odgers & Rhodes 2002) and the effectiveness of community based fire prevention programs (e.g. Rohrmann 1999), but very few aimed at identifying the current level of preparedness so that individual communities can have community education programs tailored to their specific needs.

In late 2000 the NSWRFS Northern Region commissioned a survey of 203 residents to establish an indication of preparedness (the 2001 survey) followed by a further survey of 235 residents in 2005 (the 2005 survey). A preparedness index was developed from the collated responses with geographical differences, longitudinal changes and variations in elements of preparedness analysed. The implication of these findings for the delivery of community education programs is then discussed.

Method

The 2001 and 2005 surveys were designed so that the data gathered was binary, (Yes / No responses), allowing for simple analysis and easy comparison, and were conducted using an interview style with trained volunteer community education facilitators ‘ground truthing’ the responses, thus ensuring a reliable data set. Questions in both surveys covered areas such as general bushfire knowledge, household preparation (including developing a bushfire survival plan), involvement with the Rural Fire Service, responsibility for fire safety and in 2005 previous exposure to RFS education programs.

Site Selection

In 2000 NSW was divided into 8 regions, with the initial (2001) survey conducted in Northern Region: comprising 19 Rural Fire Districts covering an area of 56,520 square kilometres. In 2001 there was realignment across the state to produce 4 regions; subsequently the 2005 survey was conducted in Region North comprising 37 Rural Fire districts covering an area of 150,710 square kilometres.

In 2001 there were 11 locations surveyed, and in 2005, 16 locations, all having an overall risk rating of extreme or major as identified in the relevant District Bush Fire Risk Management Plan(s) which use a risk rating system as defined in the NSW Bush Fire Coordinating Committee Guidelines for Bush Fire Risk Management Planning (1998).

Both the old Northern Region and the current Region North represent diverse geographical environments with a range of settlement types. To provide the best regional indicator, locations were chosen on a Geographic (Coastal, Rural, Bushland) / Settlement Type (Urban Interface, Village, Rural Residential, Multiple Occupancy) matrix as presented in Table 1.

Table 1: Locations surveyed (* indicates surveyed in 2001 and italics indicates locations surveyed in both 2001 and 2005)

Settlement Type	Geographic Community			
		Coastal	Rural	Bushland
	Urban Interface	Hyland Park* Koala Beach	Moore Creek	Coonabarabran
	Village	<i>Minnie Water</i>	<i>Torrington</i> <i>Wardell</i>	Upper Orara Hanging Rock
	Rural Residential		<i>Gungurru</i> Narrabri Invergowrie Scone	<i>Rileys Hill</i> <i>Ewingar</i> <i>Kalang</i> Temagog
	Multiple Occupancy			Blackhorse Creek* Tunttable Falls* Main Arm*

Analysis

Initially percentage trends for individual questions were analysed and a gap analysis undertaken. Locality specific issues arose from this analysis and were communicated to responsible Rural Fire Service personnel who then incorporated the findings into their annual community education strategies, however this type of data, while important at a micro-level has little relevance for strategic directions in community education and consequently will not be discussed any further.

A preparedness index was developed to enable longitudinal comparisons within the different geographic communities, settlement types and across the Region as well as direct comparison of preparedness levels within the 7 locations surveyed twice. Four key elements of preparedness: Risk Perception, Bushfire Knowledge, Planning and Actions were established by a weighting of responses to relevant questions with each element proportionally weighted in the overall index. The weightings were established by surveying 120 community education practitioners at a conference in 2005. This index is similar to one established by Rhodes and Reinholdt in 1999 as quoted in Rhodes (2003) that had five dimensions, only excluding psychological readiness as no data was available from the surveys conducted. In NSW post fire studies have used preparedness indices in previously (Odgers and Rhodes 2002), but they have not informed community engagement strategy development as is the aim of this study.

A quantitative analysis of the preparedness index was undertaken to investigate longitudinal trends. Initially the paired data sets (2001 and 2005) in all possible categories were tested for normality using the Kolmogorov-Smirnov goodness of fit test for a normal distribution. The hypothesis that the preparedness was greater in 2005 than 2001 was then tested. Trends across elements of preparedness were then evaluated by considering profiles for different geographic communities and settlement types.

Results and Discussion

All the possible data sets represent non-normal distributions when analysed by the Kolmogorov-Smirnov goodness of fit test necessitating a non-parametric approach to hypothesis testing. Dallal (2000) suggests using a Wilcoxon rank-sum test to provide simple comparison of the two independent data sets and this was applied to all possible pairings of the 2001 and 2005 data at a significance level of $\alpha = 0.05$ with results presented in Table 2.

Overall results indicating a significant increase in bushfire preparedness across all data sets in Region North are a likely reflection of in the increased focus on community engagement programs that has resulted from the introduction of local, (in a Rural Fire District / Zone /Team), community safety officers since 2002. This decentralisation of community safety responsibility has resulted in an increasing effort from volunteer community education facilitators and more opportunities for programs that promote bushfire self –sufficiency through actively engaging residents. Odgers and Rhodes (2002) discovered a similar correlation between increased preparedness and active engagement with fire authorities in their post 2001-02 wildfire study.

Table 2: Wilcoxon rank sum test results for all categories

Data Set	μ_{2001}	μ_{2005}	Test Result
All	6.98	7.54	$\mu_{2005} > \mu_{2001}$ at $\alpha = 0.05$
Coastal	7.58	8.05	$\mu_{2005} > \mu_{2001}$ at $\alpha = 0.05$
Rural	6.78	7.30	$\mu_{2005} = \mu_{2001}$ at $\alpha = 0.05$
Bushland	6.85	7.57	$\mu_{2005} > \mu_{2001}$ at $\alpha = 0.05$
Urban Interface	7.12	7.67	$\mu_{2005} = \mu_{2001}$ at $\alpha = 0.05$
Rural Residential	6.93	7.36	$\mu_{2005} > \mu_{2001}$ at $\alpha = 0.05$
Village	7.05	7.71	$\mu_{2005} = \mu_{2001}$ at $\alpha = 0.05$

Despite an influx of new residents, the ‘sea change’ phenomena, into the coastal areas there has been a significant increase in preparedness. These areas have been the focus of considerable amounts of community engagement work as a result of an increase in volunteer facilitator numbers and several significant bushfire events. The converse is true for the rural areas surveyed with no statistically significant increase, potentially as a result of the transient nature of the population and no significant fire events in the period leading to a very low perception of risk. Bushland areas experienced the largest increase in preparedness and are characterised by the presence of many serious fires during the survey period and large numbers of community engagement programs.

A more detailed analysis of settlement type variations in preparedness produce similar results, with Rural Residential areas having a significant increase, having been the target for many community engagement programs and experiencing several major fires over the survey period. The urban interface areas surveyed have low risk perception and have not experienced any major fires, and subsequently have not experienced any significant increase in preparedness. Villages surveyed have transient populations and have experienced very little fire activity during the survey period resulting in no significant increase in preparedness.

This analysis of variations across different settlement types and geographic communities has identified several similarities that appear to govern preparedness levels. Low risk perception is linked to a lack of significant fire activity over the survey period and exacerbated by a transient population (a stable population would have memories of historical fire events and a more likely to personalise the potential bushfire risk) both leading to no significant increase in bushfire preparedness. This supports and expands the scope of the findings of Bibby (2003) who identified “the importance of people’s perception of risk in their approach to fire preparedness”, and Reinhold et al. (1999) who placed risk perception as a fundamental part of their wildfire reaction model and discuss its interaction with previous wildfire experience, by investigating these trends in pre-wildfire circumstances. Increases in preparedness resulted from greater focus on community engagement programs and a recent fire history linked with a more stable population.

Seven locations were surveyed in both 2001 and 2005 with the hypothesis testing results presented in Table 3.

Table 3: Wilcoxon rank sum test results for all locations surveyed twice

Data Set	μ_{2001}	μ_{2005}	Test Result
Minnie Water	7.85	8.15	$\mu_{2005} > \mu_{2001}$ at $\alpha = 0.05$
Wardell	4.78	7.62	$\mu_{2005} > \mu_{2001}$ at $\alpha = 0.05$
Torrington	8.34	7.22	$\mu_{2005} < \mu_{2001}$ at $\alpha = 0.05$
Gungurru	7.21	6.88	$\mu_{2005} = \mu_{2001}$ at $\alpha = 0.05$
Rileys Hill	5.50	7.29	$\mu_{2005} > \mu_{2001}$ at $\alpha = 0.05$
Ewingar	8.06	7.43	$\mu_{2005} = \mu_{2001}$ at $\alpha = 0.05$
Kalang	7.05	7.93	$\mu_{2005} = \mu_{2001}$ at $\alpha = 0.05$ but $\mu_{2005} > \mu_{2001}$ at $\alpha = 0.0537$

These results provide further evidence for a trend towards increased preparedness in locations that have been a focus for community engagement programs, and no significant increase in locations that have low risk perception, transient populations and no recent fire history. Table 4. provides descriptions of specific issues in the locations surveyed in both 2001 and 2005 that supports this position.

Boura (1998) identifies a community education cycle that is mirrored by the key elements of the preparedness index: risk perception, bushfire knowledge, planning and actions. Trends across the preparedness profile for all sites

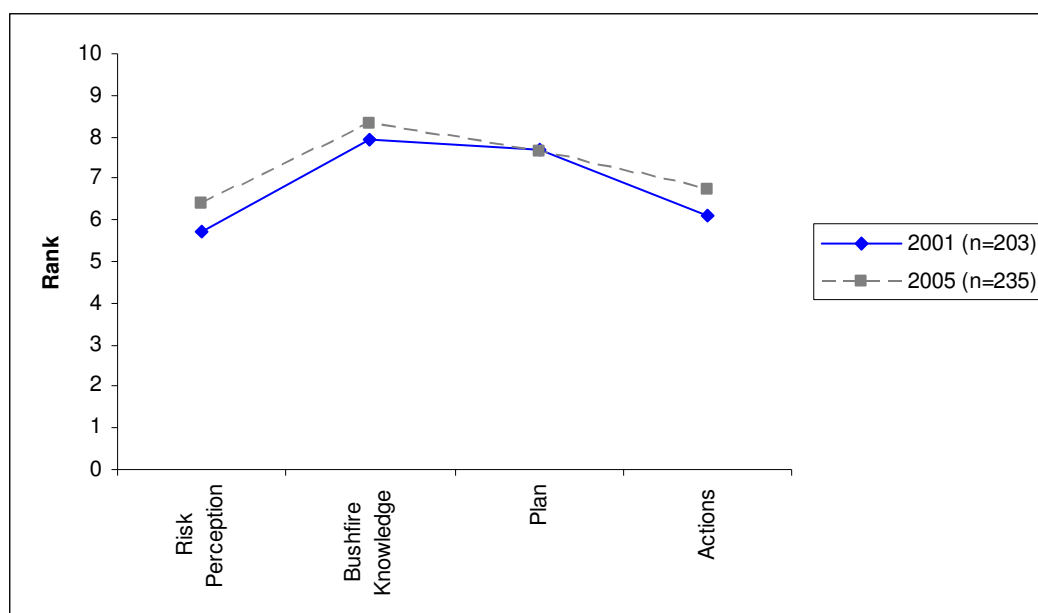
surveyed (both 2001 and 2005) supports the linkage between risk perception and level of preparedness, based on the concept that undertaking preparedness activities ('Actions') is a short term indicator of overall behaviour change. Figure 1 indicates increases between 2001 and 2005 in risk perception leading to increases in the undertaking of preparedness activities despite only a small rise in bushfire knowledge and no increase in the planning element. Investigation of profiles for all settlement types and geographic communities reinforces this link

Table 4: Specific issues relating to preparedness for locations surveyed twice

Data Set	Description
Minnie Water	Holiday Village that has very small permanent population. Has experienced some fire activity over the survey period and has been the focus of significant community safety engagement activities
Wardell	Experienced major fire in 2003 followed by a proactive approach by local brigade in engaging with the local community to encourage bushfire preparation.
Torrington	Previous survey was just after a major fire, no fires since – very transient population has had very little community engagement work.
Gungurru	New subdivision with transient population that has experienced no major fires
Rileys Hill	Focus of considerable amount of community engagement work, major fire event in 2003 with no losses due to work in 2002.
Ewingar	Very transient area with alternative lifestylers – has been focus for some community engagement work but difficulty in addressing local turnover
Kalang	Experienced fire over the survey period and has been the focus a large amounts of community engagement work.

between risk perception and actions and is supported by Odgers & Esmond (2001) quoted in Odgers and Rhodes (2002) p. 5 “it is low level of perceived risk that leads to a lack of participation in fire safety activities”.

Figure 1: All Sites Preparedness Profiles



The final analysis undertaken used data gathered in 2005 regarding previous exposure to Rural Fire Service community engagement programs, with the goal of determining any correlation between program type and preparedness. Programs were divided into two main categories: passive programs (e.g. static displays, letterbox drops, television advertisements) and active programs (e.g. any program that involves face to face contact with a facilitator). Results indicate a slight positive correlation between passive programs and preparedness and a stronger positive correlation between active programs and preparedness (i.e. while attending passive programs will slightly increase preparedness, active programs will provide a greater increase).

Conclusion

An overall increase in preparedness across all sites surveyed justifies the increased focus on community engagement activities across NSW with the appointment and continued support of dedicated community safety officers in local areas. Furthermore it highlights the importance of recruiting and retaining volunteer community education facilitators as the delivery of active programs is highly labour intensive and not viable without volunteer support. The clear link between risk perception and preparedness (particularly preparedness activities) needs to be addressed in both strategic community safety engagement program development and in training programs for engagement practitioners.

Successful programs will only result from strong community involvement, with a focus on residents participating in risk identification and mitigation (Bibby 2003), these concepts are fundamental to the new community safety training packages currently being rolled out by the NSWRFs. Paton et al. (2005) discuss the concept of critical awareness (how much people think and talk about hazards) as a vital precursor variable in motivating people to prepare and that it needs to be combined with risk perception and hazard anxiety before people move to the next phase of preparedness. Combining this concept with the findings from the survey has brought about a change in direction for community engagement strategy development across NSWRFs Region North, with programs for the 2006-07 year focussing on a multi-faceted approach for specific locations incorporating hazard identification as a core outcome, subsequently encouraging communities to personalise the risk and consider mitigation options. This has been supported such initiatives as the development of village protection strategies as an appendix to current bushfire risk management plans and extensive community consultation in the revision of expired plans. Additionally the NSWRFs is actively seeking partnerships such as the Hotspots project, with Nature Conservation Council to broaden the scope of community engagement programs.

Transient communities pose an ongoing issue for maintaining adequate levels of bushfire preparedness. However organisations such as the NSWRFs are in a unique position to monitor these trends being an integral part of many local communities. This relationship is being utilised across NSWRFs Region North, through the establishment of volunteer community engagement practitioners in interested brigades and using these personnel to work with local residents.

This study has evaluated longitudinal preparedness in communities across NSWRFs Region North and identified a need for ongoing studies to monitor the implementation of engagement strategies based on the findings and implications as discussed in this paper.

References

- Bibby, A. (2003). Working towards Community Safety, *Asia Fire Pacific Magazine*. <http://www.apfmag.com/content/artic-fs.htm>
- Boura, J. (1998). Community Fireguard: Creating partnerships with the community, Country Fire Authority.
- Dallal, G.E. (2000). Nonparametric Statistics, <http://www.tufts.edu/~gdallal/npar.htm> (Accessed 9.11.2005)
- NSW Bushfire Coordinating Committee (1998). Bush Fire Risk Management Planning Package.
- Odgers, P. and Rhodes, A. (2002). Community Response to the New South Wales Bushfires 2001 – 2002. The Australasian Fire Authorities Council.
- Paton, D., Smith, L. and Johnston, D. (2005). When good intentions turn bad: promoting natural hazard preparedness, *The Australian Journal of Emergency Management* Vol. 20, No. 1., February 2005
- Reinholdt, S., Rhodes, A., and Scillio, M. (1999). Stay or Go: Understanding Community Responses to Emergencies, Country Fire Authority
- Rhodes, A. (2003). Understanding Community Preparedness and Response to Wildfire Risk, <http://unpan1.un.org/intradoc/groups/public/documents/APCITY/UNPAN019478.pdf> (Accessed 27.3.2006)
- Rohrmann, B. (1999). Community-Based Fire Preparedness Programs: An Empirical Evaluation, *Australasian Journal of Disaster & Trauma Studies* 99-1, <http://www.massey.ac.nz/~trauma/issues/1999-1/rohrmann.htm> (Accessed 27.3.2006)