EVALUATING THE EFFECTIVENESS OF THE COMMUNITY FIRE UNIT PROGRAM

STRATEGIC ANALYSIS OF COMMUNITY RISK REDUCTION

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ABSTRACT

The problem was that the effectiveness of the New South Wales Fire Brigade's Community Fire Unit program, initiated after the devastating 1994 wildfires in the state of New South Wales, Australia, had never been formally evaluated.

The purpose of the research was to determine on the basis of experiences during the wildland and interface fires of December 2001 and January 2002 whether the program had been successful and whether it could be improved. This was an action research project. The research questions were:

1. Were Community Fire Units in fire affected areas activated effectively during the wildfires of December 2001 and January 2002?
2. Were the units effective in assisting to save life and property during the fires, and did the units interact effectively with Fire Department operations?
3. Are there ways in which the program could be improved?

The procedures included distribution of a feedback instrument to members of the community in fire affected areas, interviewing fire service commanders who operated in those areas, interviewing members of Community Fire Units about their experiences and perceptions, and analysing historical data about fire losses for comparative purposes.

The results showed that Community Fire Units were effectively activated, contributed to significant savings of life and property, and complemented fire service operations. The research also showed that apart from direct fire attack and mop-up operations during fires, members of the units conducted pre-fire season preparation of defensible space near properties, preparation of homes for fire impact, and establishment of strong neighborhood networks that identified people in need of assistance, eg the elderly and disabled.

The recommendations based on this research were:

1. That the NSWFB continue to establish Community Fire Units in wildland interface areas.
2. That regular joint training exercises continue to be conducted involving local fire crews and Community Fire Unit members to ensure understanding and inter-operability during times of crisis.
3. That the role of Community Fire Units be extended to include an educative component aimed at improving the level of knowledge within fire-prone communities about survivability of themselves and their assets.
4. That the New South Wales Fire Brigade develop training programs and resources to support the enhanced Community Fire Unit Program.
5. That future studies be conducted to ascertain whether the enhanced Community Fire Unit program has resulted in increased levels of knowledge within the community about fire safety.

TABLE OF CONTENTS

INTRODUCTION

The problem was that the effectiveness of the New South Wales Fire Brigade's (NSWFB) Community Fire Unit (CFU) program, initiated after the devastating 1994 wildfires in the state of New South Wales (NSW), Australia had never been formally evaluated.

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BACKGROUND AND SIGNIFICANCE

The NSWFB is charged with saving life and property from fire in 187 towns and cities throughout the state of NSW in Australia, and from hazardous materials emergencies throughout the state. Additionally, it shares responsibility for technical rescue with other agencies. Services are provided from a network of 337 fire stations staffed by 3,038 career firefighters and 3,300 paid on-call ("retained") firefighters (New South Wales Fire Brigade [NSWFB], 2002c). Services provided include fire prevention, fire suppression, hazmat, technical rescue, urban search and rescue, and recovery operations following natural hazard events such as regular damaging storms. The NSWFB, like most other Australian fire

services, does not provide Emergency Medical Services (EMS) which are provided solely by the Ambulance Service of NSW, however the NSWFB is sometimes called upon to fulfil a first responder role when ambulance resources are delayed or unavailable.

While predominantly an urban fire service, the NSWFB is responsible for tens of thousands of acres of wildland, and thousands of miles of urban / wildland interface throughout the state. In rural, and many interface areas, the NSW Rural Fire Service (RFS) has volunteer fire brigades that operate four wheel drive water tankers and respond to wildland fires, sometimes operating within the jurisdiction, and under the control of, the NSWFB. The NSWFB has mutual aid agreements in place with the RFS which see the two services working together cooperatively on a routine basis to suppress interface fires (NSW Government, 1997).

In the past, NSW has experienced serious wildland and interface fires on a regular basis with significant losses of life and property. NSW has similar climatic and fuel conditions to some parts of Southern California in the United States of America. In recent times the interval between major fire events seems to have shortened. Major fires with significant loss of life and property have occurred in NSW in 1926/27; 1939; 1944; 1951/52; 1957; 1968; 1971/72; 1975; 1977; 1979; 1990; 1991; 1993/94; 1997; 2001/02 (Luke & McArthur, 1978; NSW Rural Fire Service [RFS], 2002; Webster, 2000.).

During the summer of 1993/1994, more than 2 million acres were burned, 206 homes were destroyed, and four people were killed in NSW (Sesta Publishing, 1994). In the summer of 2001/2002, 1.8 million acres were burned, 109 homes, 40 commercial buildings and 433 smaller out-buildings were destroyed (New South Wales Fire Brigade [NSWFB], 2002b). The 2001/2002 fires were fought by 29,000 firefighters from every Australian state, as well as New Zealand, using 1,695 fire units and 109 aircraft over a 21 day period (RFS, 2002).

Following the 1994 fires the NSWFB consulted fire-affected local communities to devise self-help strategies (NSWFB, 2002b). The outcome of the consultation was the Community Fire Unit (CFU) program. Prior to 1994, people in NSW only had ad hoc capabilities to protect themselves and their assets during major fires, and relied almost entirely on the fire services.

During fast-moving fires, firefighting units often cannot keep pace with fire fronts, and sometimes there are insufficient resources available to protect all assets that come under simultaneous threat (New South Wales Fire Brigade [NSWFB], 2002a). Many homes are lost due to ember attack subsequent to fire fronts moving through an area, due to an inability to provide fire apparatus at every location (New South Wales State Emergency Management Committee [SEMC], 2002). Houses are more likely to survive if able-bodied people remain in attendance to put out small fires after passage of the main fire front (Webster, 2000). A study by Melbourne University after the 1983 fires in the state of Victoria that destroyed 2,700 homes and killed 62 people concluded that while only 30% of unattended homes survived, this increased to 82% where one person remained in attendance, 90% where two people remained, and 100% where three or more remained (Wilson & Ferguson, 1984).

The NSWFB decision to commence the CFU program was based on the knowledge that house survivability has a direct correlation to the number of people who remain in attendance to protect it. The rationale was that if those who stayed behind were properly clothed, trained and equipped, the probability of house survival would be increased greatly (NSWFB, 2002b).

At present there are more than 180 CFUs established in areas of wildland / urban interface throughout the state, but predominantly in fire-prone areas around Sydney. Sydney

has a population of 4.2 million, and covers an area of more than 1,000 square miles with hilly terrain, eucalypt forest, brush and grassland interspersed with urban development.

Each CFU comprises between 12 and 20 local residents who receive firefighting and safety training at least four times each year from their local fire station crew (NSWFB, 2002b). Members are provided with distinctive blue fire-retardant treated overalls, helmets, boots, goggles and gloves. Each unit is allocated either a fixed cabinet or a light trailer equipped with a portable pump, hydrant gear, hoses, nozzles, and various firefighting tools. CFU members are taught how to prepare for fire impact, and to extinguish fires caused by ember attack before and after arrival of the fire front (NSWFB, 2002b). There is interest in the program by fire services in other Australian states and territories following media reports of its success in the 2001/2002 wildfires.

There has been no evaluation of the effectiveness of the CFU program, despite more than $A2 million being invested by the state government since its inception.

The study is important to the NSWFB for three reasons. Firstly, the NSWFB needs to be able to demonstrate to the State Government that its investment of more than $A2 million has been worthwhile and has led to measurable outcomes. Secondly, the NSWFB needs to be assured that continued investment in the program is an appropriate use of public funds. Lastly, the NSWFB needs to know on the basis of experience whether the program is operationally effective, and whether any improvements can be made.

At the time of writing (December 2002) NSW is suffering from unprecedented drought conditions and many major fires have already occurred. Since October 8, 2002, more than 100 structures have been destroyed, 3 lives lost, 1.7 million acres burned, and it is feared that fire losses could surpass those of summer 2001/2002. The prospect of increased fire

season frequency and consequential losses reinforces the need for proper evaluation of the CFU Program as a basis for future planning and risk management.

This Applied Research Project relates to Unit 9, Program Design, taught in the *Strategic Analysis of Community Risk Reduction* course in the National Fire Academy (NFA) Executive Fire Officer Program. The unit states that "The fire chief's role is to evaluate existing, modified, or newly developed programs to determine if they will accomplish those strategies" (National Fire Academy [NFA], 2002, p. SM 9-7). This project will evaluate an existing program to determine effectiveness, and whether improvements can be made.

LITERATURE REVIEW

The purpose of this literature review was to set the theoretical basis for the study and evaluation of the effectiveness of CFUs.

The first question to be addressed was, were Community Fire Units in fire affected areas activated effectively during the wildfires of December 2001 and January 2002?

The state of NSW was subjected, from early December 2001, to a sustained period of high temperatures, strong winds and low humidities, which continued almost unabated until rain fell in many areas on 7 January 2002. Extreme fire weather conditions on 16 consecutive days combined with significant fuel buildup in many areas of the state, a prolonged dry spell, and several dry thunderstorms contributed to the ignition and rapid spread of numerous fires in coastal regions (NSW Government, 2002).

Most parts of the state experienced temperatures over 100 degrees, relative humidity below 10%, and strong winds gusting to gale force on Christmas Day 2001 (NSWFB, 2002b). Major fires that had ignited during extreme conditions on the previous day as well as new fires caused by dry lightning storms early on Christmas Day became conflagrations, resulting

in the destruction of dozens of buildings. Apart from a general recall of off-duty professional firefighters and mobilization of thousands of volunteer firefighters, the NSWFB had alerted CFU Leaders throughout the state of the forecast conditions on the morning of 24 December 2001 (NSWFB, 2002a).

NSWFB Standard Operational Guidelines (SOGs) require that Station Commanders make personal contact with CFU Team Leaders within their station area on the evening preceding forecast extreme fire danger (NSW Fire Brigades [NSWFB], 1998). An operational readiness memorandum was published on both the 23 and 24 December 2001alerting NSWFB commanders to this requirement (Appendix A). Debriefs indicate that all CFUs were at a heightened level of readiness on 24 December 2001, with all Team Leaders having been informed of the forecast weather conditions and extreme fire danger (NSWFB, 2002a; personal communication; Station Officer T. Munsey, October 8, 2002).

Between 24 December 2001 and 7 January 2002 fires impacted on a number of areas where CFUs had been established (NSWFB, 2002b). All CFUs in these areas were staffed and ready for impact of the fires (NSWFB, 2002a).

On the basis of interviews, debrief records and media reports, it is concluded that existing NSWFB procedures to alert CFUs were effective. Current experience reinforces this view with many homes having recently been saved in interface fires around Sydney by the combined efforts of CFUs and fire services.

The second question to be addressed was, were the units effective in assisting to save life and property during the fires, and did the units interact effectively with Fire Department personnel?

There are numerous examples of the effectiveness of CFUs in protecting life and property during the fires of 1997 and 2001/2002 (NSWFB, 2002c). Two examples reported by the media demonstrate the effectiveness of CFUs.

On 26 December 2001 an arsonist lit a fire in heavy eucalypt forest and brush near the township of Warrimoo, at the base of the Blue Mountains on the western outskirts of Sydney. Within minutes the fire crowned and spotted to immediately threaten properties. Firefighting resources were stretched to the limit with all local resources engaged at another major fire 5 miles away, that had destroyed property the previous day. Two engines were dispatched to Cross Street, Warrimoo, which is located at the top of a heavily wooded canyon, while a Strike Team was diverted to other nearby streets. The first arriving officer in Cross Street radioed for urgent assistance as spot fires were already threatening homes (personal communication; Captain W. Challinor, October 11, 2002). The officer noted that the local CFU had been activated, and that volunteers had lines of hose at work from hydrants and a portable pump set into a swimming pool. In addition to this, the CFU members had lined a number of small trailers with plastic and filled them with water (personal communications; CFU Team Leader R. Fitzpatrick 4 November 2002; Captain W. Challinor October 11, 2002). Soon after arrival of the first engine, a firestorm hit the area with estimated flame lengths estimated at 120 feet. At the same time, the water mains failed due to demands in numerous other streets that were being impacted simultaneously. Fire crews had to shelter in their engines, which sustained scorching and fire damage. CFU volunteers took refuge in homes as the firestorm passed. On emerging from their refuges, it was found that most of the 15 homes in the street were on fire, the majority having small fires in roof gutters. With no reticulated water available, firefighters and CFU volunteers used portable pumps and the thoughtfully placed water-filled trailers to douse the flames. Only six of the homes were destroyed, most of

which had well advanced roof fires that could not be readily suppressed with the limited water supplies (NSWFB, 2002b).

Fires in the same location in 1977 destroyed 49 homes, and in 1968 more than 100 were destroyed. The weather and fuel conditions on each occasion were similar, as were the fire intensities (Foster, 1976; Luke and McArthur, 1978; NSWFB, 2002a).

On 1 January 2002, a fire outbreak in Sydney's northern suburbs threatened hundreds of homes during weather conditions similar to those experienced on Christmas Day (NSW Government, 2002). Eighteen CFUs, together with more than 50 engines and 10 helicopters were engaged for the next two days in direct firefighting and property protection on ridges above a deep river valley with very heavy brush and eucalypt forest fuels (NSWFB, 2002a). The CFUs played a crucial role in protecting properties, and enabled engines to leave recently burned areas to concentrate on attacking the head of the fire (personal communication; Chief Superintendent R. Dobson, October 1, 2002). The CFUs suppressed small fires caused by ember attack.

Despite extreme fire behavior including spotting and flame lengths of 80 to 100', not one home was lost. This was partly attributed by the Incident Commander to the efforts of the CFUs, which enabled engines to stay ahead of the main front and protect life and property from the intense head fires (personal communication; Chief Superintendent R. Dobson, October 1, 2002). A fire in the same location in 1994 when there were no CFUs resulted in destruction of 17 homes and severe damage to 30 others (Sesta Publishing, 1994).

The NSW Parliament convened a Joint Select Committee to inquire into the fires in 2001/2002. The Committee's report specifically mentioned the contribution of CFUs recommending that the program be continued and extended if possible (NSW Government, 2002).

The third question to be addressed was, are there ways in which the program could be improved?

For the purposes of this applied research project, following the 2001/2002 wildfires, information was elicited from the community by means of a feedback instrument (Appendix C) to determine community knowledge of appropriate protective measures in the event of urban interface fires. Four hundred and twenty (420) copies of the feedback instrument were distributed by firefighters and CFU members in areas that had been impacted by the fires. An impressive return rate of 89% was achieved.

The questions were based on behaviors and knowledge which have been shown to play a large role in saving life and property during interface fires, and which form the basis of public education programs delivered by Australian fire services (NSW Government, 2002).

For example, studies of numerous wildfire deaths in Australia revealed that the majority occurred when people fled from fires either in vehicles or on foot (Foster, 1976; Luke & McArthur, 1978; Webster, 2000).

A properly prepared home can act as a safe refuge. There are numerous examples of houses catching fire during passage of a wildfire, yet providing shelter for occupants long enough to ensure survival (Webster, 2000). Luke and McArthur (1978) illustrate the dangers of late evacuation by relating a case study:

> *A party of seven women and children were advised to evacuate their homestead when the approach of the fire seemed imminent. They left in a car, but crashed in dense smoke after travelling about 300 metres. They were not injured in the crash but were soon overtaken by the fire. Their bodies were found outside the vehicle, but as it was amongst heavy fuel, remaining inside the car could not have saved them. Their safety could have been assured by staying at their house, for although it caught alight and*

> *eventually burnt down, the rate of burning was slow at first and the house could have been saved if able bodied persons had been present.* (p.232)

Similarly, motorists caught in a fire have a better chance of survival if they stay within the vehicle, yet the "fight or flight" reflex often results in people leaving their vehicles, and in many cases perishing as a result (Foster, 1976). Again, Luke and McArthur (1978) provide a graphic example:

> *On 8 January 1969 seventeen people died when they left their cars after traffic was halted on a four-lane expressway by a fast-moving grass fire at Lara, near Geelong in Victoria. Passengers who remained in their cars survived. The victims would probably also have been saved if they had not left their cars.* (P. 231)

Australian fire services do not support large-scale evacuation from wildfires, preferring instead that people shelter from the fire in their homes (if properly prepared with adequate defensible space), and stay to assist in putting out small fires after passage of the main fire front (NSW State Emergency Management Committee [SEMC], 2002; Webster, 2000).

The New South Wales State Bushfire Plan, a sub-plan to the State Disaster Plan states that:

> *Capable persons should not be evacuated from properly prepared dwellings likely to be affected by bushfire. A properly prepared dwelling can provide a refuge in which people are able to take shelter as the fire passes. In turn, people are most vulnerable when they are in the open or in vehicles travelling along roads that are being impacted by bushfires. Last minute evacuations should be avoided, particularly where local road, traffic conditions or visibility may hamper safe and swift evacuation.* (SEMC, 2002. P. 3)

The feedback instrument was developed to determine levels of knowledge about three key areas; firstly, knowledge about preparation of homes before fire impact, secondly, knowledge about evacuation and other options, and lastly, knowledge about what to do if caught in a vehicle while trying to escape a fire. Each of these areas has been shown to be critical to protection of life and property during fires (Foster, 1976; Luke & Macarthur, 1978; Webster, 2000; NSW Government, 2002). In addition to these issues, the feedback instrument included two questions about the CFU Program.

The major finding from the feedback instrument was that the majority of people (63.7%) living in urban interface areas have limited knowledge about how to protect themselves and their homes during fires. There was, however, a correlation between a higher level of community knowledge of safety factors, and areas where a CFU had been established (75.5%). Where a CFU had been established, there was a measurable improvement in the level of knowledge of residents, even if they were not members of the CFU. Further enquiries revealed that CFUs in those areas had taken on an educative role in addition to the intended fire suppression role (personal communication; Station Officer T Munsey, October 8, 2002; CFU Team Leader R. Fitzpatrick, November 4, 2002).

There was significant anecdotal evidence that in areas served by CFUs, homes are far better prepared for fire impact than in areas not served by a CFU (personal communication; Chief Superintendent R. Dobson, October 1, 2002; Captain W. Challinor, October 11, 2002). The effect of this is to maximize survivability of homes and residents during severe fire impact (NSW Government, 2002). As a result of the research, the NSWFB is considering extending the current role of CFUs to also encompass community education and neighborhood preparedness.

In summary, the literature review indicates that procedures to alert CFUs are effective, that the units contributed to the saving of life and property while complementing the work of firefighters, and there is an opportunity to enhance the role of CFUs by formally extending the program to include community preparedness and education.

PROCEDURES

The research procedures included distribution of a feedback instrument to more than 400 home-owners in interface areas, analysis of the findings of the feedback instrument, interviews with fire officers and CFU members, and research into recommended behaviors during wildfires.

Research questions (1) and (2) were answered by means of interviews with NSWFB commanders and CFU members, as well as accessing historical data on property losses. Question 3 was answered through analysis of answers to questions contained in the feedback instrument.

Research Methodology

Action research was used to develop a strategy to further improve the effectiveness of the Community Fire Unit program. The research involved establishing the effectiveness and current position in relation to the program, and on the basis of interviews and results from the feedback instrument, reaching conclusions upon which an action plan for improvement could be developed.

Assumptions and Limitations

It was assumed that the level of fire safety awareness within communities recently impacted by severe wildfires, which were targeted for distribution of the feedback instrument, would be as high or higher than that within the general community.

The results of the feedback instrument indicated that communities were more aware of fire safety guidelines in areas where CFUs are established, and it was assumed that this was in large part due to the efforts of CFU volunteers in educating their neighbors.

The literature search identified that in several areas where CFUs are established, property losses compared to previous wildfires in the same locations were significantly less. It was assumed on this basis and on the basis of interviews with fire officers that the reduced losses were in large part due to the efforts and operational integration of CFUs.

The research was limited by the sample size of 420 households, and 89% return rate in selected fire-impacted areas. It was assumed that the results were a fair reflection of levels of knowledge within the general community in fire-prone areas.

Action Research Steps

The National Fire Academy's student manual for *Executive Development* sets out steps to be taken in action research projects (NFA, 2001).

1) Recheck problem statement for clarity and comprehensiveness.

   The problem statement clearly articulates that a community self-help program is in place which anecdotally appears to be effective, however there has never been a formal evaluation to support this contention.

2) Establish a broad goal.

   The purpose of the research project was to evaluate the effectiveness of the CFU program, and to identify any opportunities for improvement.

3) Conduct a situational analysis to determine influencing factors and forces

   The analysis is detailed in the background and significance, literature review, and results sections of this paper. A basic force field analysis is as follows.

Assisting Forces	Resisting Forces
Community acceptance	Community apathy in some areas
Support by NSWFB firefighters	Resistance by RFS volunteer firefighters
Government funding support	Insufficient management and training resources
Media accolades to CFU volunteers	Jealousy by RFS volunteers
Union support	Concerns about volunteer safety
Community recognition of fire problem	
Executive level support	

4) Define and prioritize strategies

The strategy to increase the educative role of CFUs developed on the basis of the research will capitalize on the assisting forces and minimize or eliminate the resisting forces.

5) Set objectives

Specific, measurable objectives will be based upon attitudinal issues identified as a result of the feedback instrument. Future surveys will be conducted to measure changes in community knowledge.

6) Develop step by step action plans for accomplishing each objective

A service improvement strategy is attached at Appendix B. Success will depend largely upon the level of acceptance and buy-in by communities in interface areas, and funding support by government. Step by step action plans for each objective are beyond the scope of this paper.

7) Implement the plans

Implementation is beyond the scope of this research project. Implementation plans will require development of a business case to the NSW Government, marketing

plan to gin acceptance in targeted communities, and provision of sufficient financial and human resources to sustain the program.

8) Evaluate outcomes

Identified outcomes, objectives and action steps will be measured and evaluated for success. Some of the key success criteria will include changes in community knowledge and attitudes to wildfire, the number of communities that seek to participate in the CFU program, and over time, a reduction in loss of life and property in areas that participate in the program. Future surveys will be a key tool in quantifying, measuring, and evaluating outcomes.

Feedback Instrument

In order to determine levels of community knowledge and attitudes to wildfires, a feedback instrument was distributed in areas that had been impacted by the 2001/2002 fires.

The reason for this was the assumption that the level of community fire awareness would be higher in recently fire-impacted areas. The feedback instrument, a copy of which appears at Appendix C, was reviewed by the NSWFB's Manager Strategic Information Services, and Assistant Director Specialized Operations for clarity and acceptability, and approved for release (Personal communications; N. Nicolopoulos and J. Hamilton, August 5, 2002). The questions were developed on the basis of current and past Australian research that identified three main causes for fire loss and deaths: poorly prepared dwellings, poor decision-making with regard to the need to evacuate, and lack of knowledge about survival when caught in a vehicle by a fire.

The sample size was 420 households and a return rate of 89% (374) was achieved.

The data received was evaluated in its raw form and is shown in the 'Results' section.

Definition

Bushfire – a generic term used in Australia to describe fires in the outdoors involving grass, brush and forest, including urban / wildland interface fires.

RESULTS

The service improvement strategy resulting from this research is attached at Appendix B.

The research clearly identified that CFUs were effectively alerted and utilized during the 2001/2002 wildfires, that they integrated effectively with the established fire services, and that the program can be improved by increasing the community education role of the units in the local neighborhoods.

Answers to Research Questions

Research Question 1. It was found that CFUs were effectively alerted during the 2001/2002 wildfires. In all areas of fire impact fire services and respondents to the feedback instrument reported that CFUs were active before, during and after arrival of fire fronts. CFU members themselves expressed satisfaction with alerting procedures.

Research Question 2. It was found that the units were very effective in saving life and property during the wildfires, and that they integrated effectively with and complemented the operations of established fire services. Experienced commanders suggested that far greater losses were avoided because engine companies were able to "leap-frog" and keep ahead of the main fire fronts, as CFUs mopped up and contained minor fires after passage of the fire fronts. In the past this task would have fallen to engine companies, thus diverting critical resources from fire fronts.

Research Question 3. It was found that in some areas CFUs had gone beyond their intended role of protecting life and property, to conducting neighborhood awareness sessions

on the dangers of wildfire, and precautions required to protect life and property in interface areas. This proved to be very effective in assisting to lessen the impact of the fires on life and property. As a result, the CFU program will be enhanced to formally include an educative role in all areas in which CFUs are established.

Personal Interviews

A small number of personal interviews were conducted with key fire service personnel and CFU members to establish whether CFUs were effectively alerted, whether they integrated effectively with fire service operations, and perceptions about possible improvements to the program. A list of personnel interviewed appears at Appendix E.

Feedback Instrument

A copy of the letter accompanying the feedback instrument appears at Appendix D, and a copy of the feedback instrument at Appendix C. The results of the feedback instrument indicated that the majority of community members in interface areas lack sufficient knowledge about how to protect themselves and their assets from fire (63.7%). It further indicated that in areas where CFUs were established, the level of knowledge was greater than in other areas (75.5% of correct responses). This reinforced the information that CFUs were playing an educative, as well as a combat role in areas of interface fire hazard, and suggested that this was a successful strategy. The combination of findings suggested that fire service public education campaigns may be of limited effectiveness, however the uptake of messages appears to be enhanced in areas where community volunteers subscribe to the CFU program.

Detailed results

Raw Data

N = 420

Total responses = 374 (89% return rate)

Table 1 – breakdown of feedback instrument responses

Question Number	Correct answers (% of total responses)	Number of correct responses that also answered "yes" to questions 11 and / or 12
1	**171 (45.7%)**	**110 (64.3%)**
2	**118 (31.6%)**	**97 (82.2%)**
3	**91 (24.3%)**	**85 (93.4%)**
4	**261 (69.8%)**	**121 (46.4%)**
5	**95 (25.4%)**	**79 (83.2%)**
6	**95 (25.4%)**	**75 (78.9%)**
7	**109 (29.1%)**	**91 (83.5%)**
8	**105 (28.1%)**	**83 (79.0%)**
9	**163 (43.6%)**	**112 (68.7%)**
10	**151 (40.4%)**	**114 (75.5%)**

Average correct answers = 36.3%

Average number of correct answers where respondents were aware of the CFU Program, or where a CFU had been established in the locality = 75.5%

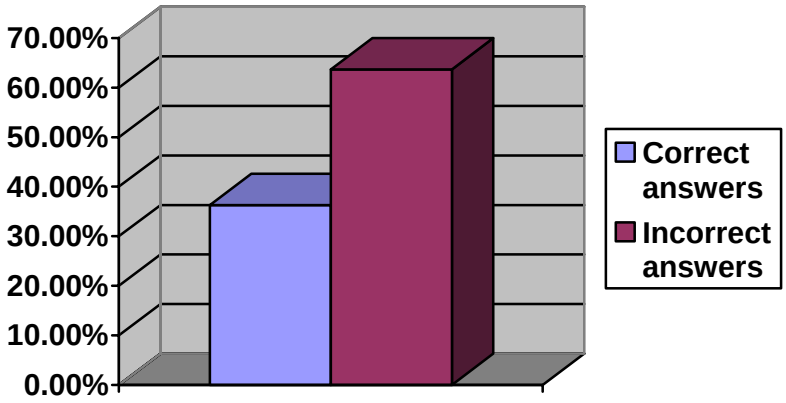
Analysis of Data

Analysis of the data showed a disturbingly low level of fire safety knowledge. This was even more disturbing given that the selected populations had been chosen because they were located in fire-prone areas, and also because they had recently experienced serious fires with property losses. Only 36.3% of respondents (on average) exhibited the desired level of

knowledge about fire behavior, preparation for fire impact, safety and survival, and evacuation.

A correlation was noticed between correct responses to respective questions, and affirmative responses to questions 11 and 12 regarding knowledge and establishment of CFUs. A correlation is a relationship between two variables (Render and Stair, 1997). The correlation averaged 75.5%, which was considered significant. The correlation suggested a possible connection between the CFU program and areas where a higher level of fire safety knowledge was exhibited within a community. Personal interviews established that in many areas where CFUs had been established, CFU members had, unbidden, performed an educative role within their respective communities. This would tend to explain the correlation.

Levels of fire safety knowledge



DISCUSSION

The purpose of the research was to identify whether the CFU program initiated by the NSWFB after the 1994 wildfires had been successful, and whether there were any opportunities for improvements to the program.

The literature review indicated that the program has been a success, as it can be shown that losses of life and property have decreased in comparison to previous fires in the same locations (Luke & McArthur, 1978; NSWFB, 2002a; NSW Government, 2002). The reduction may or may not be entirely due to the CFU program, however those fire officers and CFU members who were interviewed had a clear perception that the program was the principal reason that losses had been reduced in the areas of fire impact. There is no reason to doubt or discount these views. A variety of studies reinforce the perception, as it has been shown that house survivability is correlated to the number of people who remain in attendance to extinguish small fires after passage of the main fire front (Luke & McArthur, 1978; Webster, 2000; Wilson & Ferguson, 1984).

Part of the training and education that was provided to CFUs included advice on preparing homes for fire impact. The concept of 'defensible space', a term not widely used in Australia, was introduced and information provided on measures to increase house survivability (Teie, 1994). The main focus however was on basic firefighting techniques using equipment provided by the NSWFB, with the intention that CFUs' main role in the community would be supporting the fire services during major wildfires. Results from the feedback instrument showed clearly however that the units had extended beyond this to adopt an educative role in the surrounding community. Personal interviews confirmed this.

Experience during the 2001/2002 fires and the current fires have shown that this role probably contributed almost as much to community resilience and survivability as the direct firefighting role (personal communication; Chief Superintendent R. Dobson, October 1, 2002). Where in the past many homes would be found in an almost indefensible condition upon arrival of fire services, this is proving not to be the case in areas served by a CFU

(personal communications; Station Officer T. Munsey, October 8, 2002; Captain W. Challinor, October 11, 2002).

Another unintended, but positive outcome of the CFU Program is that thousands of CFU volunteers have become advocates and supporters of the NSWFB. This has translated into political support from local politicians, virtually assuring that the program remains resourced and funded. The Los Angeles City Fire Department apparently had a similar experience when the Community Emergency Response Team (CERT) concept was initiated (personal communication; Captain J. Featherstone, Los Angeles City Fire Department, November 6, 2002).

When the CFU program was initiated, firefighters and their union met it with a degree of skepticism. This seemed to change in December 1997 when a major wildfire on Sydney's southern outskirts destroyed ten homes. A newly installed CFU in a nearby street was able to save every home in their own, and adjoining streets, despite there being no fire service presence at the time of fire impact (NSWFB, 2002b). This event passed into CFU folklore, led to a huge increase in public interest in the program, and a high level of support and acceptance by firefighters and the union. During the 2001/2002 fires and the current fires, CFUs have been directly responsible for saving dozens of homes (NSWFB, 2002a; NSWFB, 2002b).

One problem being experienced is a level of unease evident within the ranks of the volunteer RFS. There are concerns that CFUs will detract from RFS efforts to recruit volunteers, and that CFUs are not adequately trained, equipped, or prepared for their role (personal communication; Station Officer T. Munsey, October 8, 2002). These issues have been addressed by means of strict "rules of engagement", and by ensuring that CFUs are not established in areas where a RFS unit is located (NSWFB, 1998). Given the demonstrated

success of the program, there is now evidence of support emerging within the ranks of the RFS, as it clearly does not pose a threat to that service (personal communication; Station Officer T. Munsey, October 8, 2002).

The feedback instrument showed a disturbing lack of knowledge of even the most basic fire safety rules within many communities in fire-prone areas. This indicates that public education campaigns by the fire services may not be reaching all of the intended targets, or perhaps they are not being delivered in an effective manner. Possible reasons for this include general community apathy, lack of attention, and a general disregard for fire safety messages due to a prevailing attitude that, "it will never happen to me".

The difference was substantial in areas covered by CFUs. It seems clear that in areas where residents take the decision to form a CFU and to work together to assure their collective safety, fire safety messages are both amplified and heeded. Interviews with CFU members suggest that formation of units has led to a stronger feeling of community, to the extent that: "I met people who had lived down the road for 10 years, yet until recently I didn't even know their names. We know we're all in this together." (Personal communication; CFU Team Leader R. Fitzpatrick, November 4, 2002). This increased community cohesion resulting from the CFU Program may contribute to the level of attention paid by community members to safety messages. In marketing terms this might be considered a function of the types of marketing "channels" used, considering their appropriateness, acceptance and credibility amongst the target population. It might be concluded that familiar faces are more credible in this respect.

It appears that the strength of the CFU Program is that it is based on self-help. While there is a general decline in volunteerism in the general community, the NSWFB has been overwhelmed by applications to establish CFUs (NSWFB, 2002c).

The literature review identified common themes of wildfire safety that underpin contemporary fire service education programs. These include the preparation and maintenance of defensible space, preparation of homes for fire impact, evacuation decisions and guidelines, survival when caught by a fire, and basic issues such as appropriate clothing (Foster, 1976; Luke & Macarthur, 1978; Webster, 2000). The feedback instrument and interviews identified a clear opportunity to improve the CFU program by using the inherent community links to relay and amplify critical fire safety messages. This was the key outcome of the research.

In an operational sense, interviews clearly suggested that due to effective operational integration of CFUs into firefighting operations, property savings were effected. At present training programs for CFUs only involve fire station staff at those stations with CFUs within their operational jurisdiction (NSWFB, 1998). Clearly, there is a need for interoperability between CFUs and the NSWFB in general. For this reason, it will be recommended that training exercises be extended to include fire stations that do not normally interact with CFUs.

Given the uptake and community acceptance of the CFU program, as well as the willingness of members to perform an educative role in their own communities, there are clear opportunities to extend its scope. The research identified that the program has been a resounding success, has had unintended but positive consequences that further enhance survivability of homes during wildfires, and that there are opportunities to improve the program. Most importantly, the research identified an alarming lack of fire safety knowledge on the part of at-risk communities. The improvement program will seek to address this gap, and measure effectiveness in the future.

RECOMMENDATIONS

1. That the NSWFB continue to establish Community Fire Units in wildland / urban interface areas.
2. That regular joint training exercises continue to be conducted involving local fire crews and CFU members to ensure understanding and inter-operability during times of crisis.
3. That the role of CFUs be extended to include an educative component aimed at improving the level of knowledge within fire-prone communities about survivability of themselves and their assets.
4. That the NSWFB develop training programs and resources to support the enhanced CFU Program.
5. That future surveys be conducted to ascertain whether the enhanced CFU program has resulted in increased levels of knowledge within the community about fire safety.

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APPENDIX A (Operational Readiness Memo)

NEW SOUTH WALES FIRE BRIGADES
MEMORANDUM

State Operations

To: All GSA stations, specialist operational and support areas

From: Major Incident Co-ordination Centre, Alexandria

Subject: Total Fire Ban / Bushfire Alert

File: CHO/01357

Date: 24 December 2001

The Weather Bureau has issued Fire Weather Warnings for Extreme Fire Danger in the Metropolitan, Hunter, Illawarra, Central Tablelands and several country Weather Districts for tomorrow, Christmas Day 2001. Accordingly, Total Fire Bans and a Bushfire Alert will remain in force in these areas.

In order to ensure maximum preparedness for the possibility of major bush and grass fires, the following actions will be carried out in the greater Sydney area:

1. The Major Incident Co-ordination Centre (MICC) will be partially activated from 0900 hours tomorrow.
2. All fire permits issued in the areas covered by bans are to be revoked, and no further permits are to be issued during the currency of the Total Fire Ban / Bushfire Alert.
3. All activities which could hinder immediate response by appliances will be re-scheduled to a later date.
4. Stations designated for Strike Teams will be advised of any pre-deployment details by 1000 hours, and at this stage will be pre-deployed *after 1230 hours*, fire conditions permitting.
5. All Station Commanders are to ensure that staff have proper personal protective equipment carried on appliances including sunscreen, that all bushfire fighting equipment is serviceable, and that drinking water containers are filled.
6. All Operational Commanders will monitor bushfire activity in their areas, and respond to incidents involving three (3) or more appliances.
7. Manager State Operations will identify two (2) Type 1 Incident Management Teams ready for deployment statewide.
8. Director Logistics Support, via Fleet Officer Operations, will advise the MICC by 0900 hours of the number of "under repair" pumpers, tankers and composites which could be made available for Strike Team deployment, and lead times (including stowage from emergency store).
9. Director Logistics Support will ensure that one bulk water tanker is filled and available for immediate response, with another available with 1 hour lead-time if required.
10. Station Commanders will advise Community Fire Unit Team Leaders of the Total Fire Ban and Bushfire Alert this evening. The Station Commander will advise the Operational / Zone Commander when they have done so, and the availability of team members the next day.

In addition to the above, DRCs Newcastle and Wollongong and ZC's W3 and N7 have local contingency plans in place for formation of Strike Teams should this become necessary.

The above instruction is to be conveyed to all on-duty personnel at stations / sections affected. It shall be strictly observed and acted upon immediately.

APPENDIX B (Service improvement strategy)

NEW SOUTH WALES FIRE BRIGADES

SUMMARY - COMMUNITY FIRE UNIT DEVELOPMENT STRATEGY

Background

The Community Fire Unit (CFU) Program was initiated following the devastating bushfires of December 1993 and January 1994 when 205 homes were destroyed and four people lost their lives.

A survey of community members in fire affected areas identified that:

- There was a high level of frustration due to the inability of fire services to cope with demand
- Some members of the community heeded fire service advice to stay at home to protect their assets, only to be thwarted in their efforts by failure of reticulated water supplies, and
- The message from those surveyed was loud and clear – "provide us the training and equipment to help ourselves during the inevitable periodic events when major fires will impact residential areas."

In the suburb of Lindfield in Sydney's northern suburbs in 1994, a NSW Fire Brigade (NSWFB) Hose Post, one of the few left over from a World War II program, enabled residents to save four homes using rudimentary firefighting equipment and training provided by their local fire station crew.

On the basis of this experience, the CFU Program was established. For a modest investment of around $12,000, a team of neighborhood volunteers could be trained and equipped to save their own homes before and after impact of a fire front. It was envisaged that the CFUs would complement the efforts of trained career firefighters from the NSWFB, and volunteer firefighters from the Rural Fire Service (RFS).

The program was established in 1995, with modest funding from within existing NSWFB budgets. Despite the humble beginnings, by December 1997, a moderately severe bushfire season, 47 new CFUs had been established in urban / wildland interface areas. In December 1997 a fast-moving fire impacted on a southern suburb of Sydney and destroyed ten homes. While this tragedy initially captured news headlines, what emerged as the main story later was the success of a newly commissioned CFU in saving a number of homes in nearby streets.

This success was duplicated during the devastating fires of December 2001 and January 2002. Dozens of homes in fire-impacted areas were saved as a result of the direct efforts of the CFUs. This contrasted with the experiences of 1994 in the same locations when many more homes were lost. For example, near Lane Cove National Park in Sydney's northern suburbs, 17 homes were destroyed and many more severely damaged in 1994. In January 2002, in the same location, no property damage or losses were sustained. The weather and fuel conditions in 2002 were as bad or worse than in 1994, with faster rates of fire spread. The fire service response was better coordinated, yet similar in magnitude. The main difference was that since 1994 fourteen new CFUs had been established in areas devastated by the 1994 fires. The CFUs handled mopping up and dealt with small fires caused by ember attack before, during and after passage of the main fire fronts. This enabled fire services to remain ahead of the main fire fronts and to knock down the intense head fires as they reached properties.

At present there are 187 CFUs throughout the state, with a total of 230 planned by the end of the 2002/2003 financial year. Community demand currently outstrips the ability to resource the program.

Experiences during the 2001 /2002 fires

In order to ascertain the effectiveness of community education efforts and the CFU program, feedback instruments were distributed in areas impacted by fire during the 2001/2002 fire season.

Collated results of the feedback instrument provided both worrying and encouraging information.

Most worrying was that soon after the fires, when community awareness could have been expected to be at its highest, the level of knowledge about what to do before, during and after fire impact was in fact quite limited. Basic knowledge about preparation of defensible space, preparation of homes for fire impact, personal behaviors including the decision to evacuate, were all found wanting.

Encouraging though was the finding that where CFUs had been established, levels of knowledge and preparation were superior. This was unexpected to a degree, as no additional information had been provided other than standard educative materials. It appears that the uptake of knowledge in areas served by a CFU was superior, and that CFU members undertook an educative role in addition to their voluntary operational roles.

Purpose of the strategy

The purpose of this strategy is to extend the role of CFUs in urban / wildland interface areas from solely fire suppression, to include an educative, community preparation role. This in turn will improve the resilience, survivability and cohesion of neighborhoods considered to be at risk from wildfires.

Responsibility

The Director State Operations will act as Executive Sponsor of the project.
The Manager, Bushfire / Natural Hazards Section within the State Operations Directorate will act as project manager.

Implementation plan

The Project Manager will, together with a project team selected for the purpose, develop an implementation plan for consideration by the Project Sponsor, including a comprehensive business case detailing funding requirements, justification, and a cost / benefit analysis.

Funding

Development of the implementation plan will be funded from existing resources within the State Operations Directorate. Further funding will be dependent upon approval by the Commissioner of the associated business case.

Deliverables

The implementation plan will address the following required outputs:

- A cost / benefit analysis of the proposed strategy
- Description of expected community outcomes, including quantification of expected tangible benefits, and description of intangibles
- Detailed action plans to address:
  - The need for comprehensive documentation to support the strategy
  - The need for "train the trainer" materials to support the program
  - The need for revised training materials for initial and ongoing CFU support
  - The need for clear written guidelines for CFU members in both the firefighting and educative roles
  - Whether there are any legal / liability issues to be considered in implementing and supporting the strategy
  - The need for ongoing measurement and evaluation of the strategy including its effectiveness and success in meeting desired outcomes.

Outcomes

The desired outcomes of the strategy are:

1. Extension of the existing roles of CFUs in their communities beyond fire suppression to include education about fire prevention and preparation,
2. Demonstrably safer communities confident in their abilities to withstand severe fire impact, and able to demonstrate comprehensive levels of knowledge about fire-safe behaviors.

Timeframe

The Project Manager is required to form a project team by 10 January 2003, to provide an initial progress report to the Project Sponsor by 31 January 2003, and to deliver a final project report by 28 February 2003.

Greg Mullins
Assistant Commissioner
Director State Operations

20 December 2002

APPENDIX C (Feedback instrument)

NEW SOUTH WALES BUSHFIRES – 2001/2002

Introduction

Thank you for providing feedback by completing the questions below. The information we gather will be used to target public education efforts so that we are providing information needed by the community to be safe before, during, and after bushfires. All of the information that you provide will be kept strictly confidential. If there are any questions that you do not want to answer, you are under no obligation to do so.

Instructions

The questions simply require a tick or cross in the appropriate box. When completed, please place the feedback form in the envelope provided. A member of the fire service will call to collect the completed survey, or if this is inconvenient, simply leave the envelope near the front door for collection.

	Yes	No
1. Houses explode when a fire front arrives		√
2. Most houses that burn down do so in the short period of time that it takes for the fire front to pass through		√
3. A wooden house can provide shelter from an intense fire	√	
4. Houses can be made safer if flammable materials are removed from around and underneath the house	√	
5. People should evacuate when a fire front approaches		√
6. People should stay to protect their home when a fire front approaches	√	
7. People should shelter in a house when the fire front passes, then emerge to put out small fires caused by embers	√	
8. Most houses burn down because of embers after the main fire front passes	√	
9. If caught by a fire when traveling, people should stop near a cleared area, cover exposed skin and stay inside the vehicle	√	
10. If caught by a fire when traveling, people should leave the car as the fuel tank may explode		√
11. Have you heard of the NSW Fire Brigade's Community Fire Unit Program?		
12. Is there a Community Fire Unit in your locality?		

√ **Indicates model "correct" answers.**

APPENDIX D (Letter accompanying feedback instrument)

2001 / 2002 BUSHFIRES

Dear Resident

The NSW Fire Brigade is collecting information on the effects of the recent bushfires in NSW. The information collected will be used to develop a greater understanding of the needs of communities in preparing for, and safely surviving, bushfire emergencies.

The accompanying questions will help to identify how much information about bushfires, such as the precautions that need to be taken, and actions to take during fires, members of the community are aware of. The information will help to identify any deficiencies so that the NSW Fire Brigade can develop programs to ensure that people like you who live in urban interface areas know exactly what to do before, during and after a fire.

The information you provide will be combined with information from other respondents, and no personal details will be kept. Your confidentiality is assured.

Thank you for your time and support. Should you have any queries regarding the project please contact the NSW Fire Brigade's Bushfire / Natural Hazards Section on (02) 9742 7348.

If you wish to obtain information on fire safety, please do not hesitate to visit or contact your local fire station.

Yours faithfully

Greg Mullins
Assistant Commissioner
Director State Operations

APPENDIX E (List of personnel interviewed)

Chief Superintendent Robert Dobson – Incident Commander, Lane Cove National Park Complex.

Captain James Featherstone – Los Angeles City Fire Department Training Division.

Captain Wayne Challinor – 48 Station Mortdale.

Station Officer Terry Munsey – Bushfire / Natural Hazards Officer

Mr Robert Fitzgerald – Team Leader, Cross Street Warrimoo Community Fire Unit.