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An Evaluation of CFA's Approach to Dealing with the Bushfire Risk

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Abstract

This report, prepared for the Country Fire Authority (CFA), provides a historical evaluation of the CFA, with an emphasis on analyzing community safety programs. Working with information collected from interviews and literature, the research describes significant fire events since 1983, and the effects of community programs. Overall, the CFA's community safety approach has effectively increased community preparedness and led to a reduction of bushfire damage throughout the state of Victoria.

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Executive Summary

The purpose of this project was to provide the Country Fire Authority (CFA) of Victoria, Australia with an evaluation of the nature and scope of the changes made since the Ash Wednesday fires of 1983. The report focused on the CFA's approach to dealing with the bushfire risk, with particular attention to their community safety approach.

The CFA is one of the world's largest volunteer based, emergency service organizations, with approximately 58,000 volunteers throughout the state of Victoria. The CFA is responsible for the prevention and suppression of fires in order to minimize the resulting damage. The organization protects the majority of the state of Victoria, including residential communities, grasslands and forests and excluding only the metropolitan area of Melbourne and state owned forest land.

Background information was collected regarding analogous organizations and media campaigns located in the United States and the CFA's community safety programs. A literature review was also completed, collecting CFA publications and resources from American agencies that act to control bushfires. Several evaluation studies on the CFA were also collected and examined before arrival in Australia.

This report concentrates on the changes made by the CFA since the Ash Wednesday fires. During the summer of 1982-1983, the state of Victoria had experienced months of drought conditions, creating a high bushfire risk. On February 16, 1983 (Ash Wednesday), a series of fires set the state of Victoria ablaze. When the fires were extinguished, forty seven people had lost their lives, 2,090 structures were destroyed and over 200,000 hectares (over six 600,000 acres) were burnt in the state of Victoria alone; making the Ash Wednesday fires one of the worst series of fires in Victorian history.

The severity of the destruction of Ash Wednesday prompted changes within the CFA and these changes form the basis of this report. Changes in the structure of the CFA, the adoption of the community safety approach and the implementation of community education programs are all effects of the fires of 1983. The evolution and effectiveness of these changes are the focus of this report.

The community safety approach was adopted by the CFA after the Ash Wednesday fires. The approach aims to educate the public about the bushfire risk and teach them the appropriate steps that they need to take in order to increase their safety of the community in the event of a fire. The implementation of community programs, such as Community Fireguard and Bushfire Blitz, are methods used by the CFA to reach the community and distribute bushfire safety information.

A major source of data for this report came from interviews. Interviews were conducted with CFA personnel and volunteers, Community Fireguard facilitators, members of the media and a professor at the University of Melbourne who had completed relevant research. The interviews provided information on significant fire events, community programs, changes in the CFA since 1983 and studies recently completed on the CFA.

An additional source of information was the Annual Reports produced each year by the CFA. The reports provided information on community programs and data regarding major fire events. Data that were not found in the Annual Reports were acquired from Post Incident Analysis (PIA) reports on the major fires. The reports presented fire damage statistics and detailed maps outlining the affected regions.

In order to organize all the variables affecting a bushfire, models were created. The models presented the logical connections between the variables. They were later used to compile all the presented information and formulate conclusions. After

construction of the models, it was evident that the complexities of the variables involved with a fire make it difficult to identify the effects of a change in a single variable (success of a community program).

To control this problem, a series of comparisons were completed with significant fire events of the past twenty years. Fires that burned similar areas (geographically) and those that had similar Fire Danger Index (FDI) values were compared. An additional comparison was performed between the fires of 1983 and 2003. These comparisons formed a timeframe between the fires and the community programs implemented in that timeframe were identified. The fire damage data from the first fire was compared to that of the second fire in an effort to identify if a reduction in damage had occurred as a result of the implementation of the programs.

In order to compare fires that burned similar areas and had similar FDI values, two parameters were created. The first being the alpha (α) value, which is the percentage of fatalities per total population of the areas affected by a fire. This measure was calculated by dividing the number of fatalities by the total population for a given area. The second parameter was the beta (β) value, which is the percentage of dwellings destroyed out of the total number of threatened dwellings. The β value was found by divided the number of destroyed dwellings by the total number of threatened dwellings in a given fire area. These two values form the basis of the comparison.

Through the comparison of significant fire events, the effectiveness of community programs was addressed. A reduction of fire damage after a program's implementation suggested an increase in public education, thus a success in the program itself. An increase in fire damage suggested the opposite.

The completed interviews provided extensive qualitative data relating to the effectiveness of the CFA's community safety programs. The personnel interviewed

work directly in the management and operation of these programs. They provided accounts of the successes and failures of the programs. These accounts all exhibited a strong agreement with one another in that all confirmed a belief in the success of the community programs. This agreement supports the idea that these descriptions were indeed a useful measure of program success.

After completion of the data collection and analysis, conclusions on the effectiveness of community programs were formulated. This comparison is difficult because no two fires burned in exactly the same way. However, the data showed a decrease in fire damage over the past twenty years, suggesting that public preparedness had increased. The increase in education suggested that the implemented community programs have been successful.

The qualitative data further supported the effectiveness of the community safety programs, particularly Community Fireguard and Bushfire Blitz. In all interviews, the perceived strengths of the programs far outweighed the weaknesses. The stated weaknesses suggest changes that may lead to future improvement of these programs rather than cast doubt on their overall effectiveness.

Since many of the programs run in tandem and supplement each other, it was not possible to determine the effectiveness of a single program. It was possible to conclude that as a whole, the programs appeared to be successful in reducing the damage caused by bushfires.

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1 Introduction

Regions all over the world experience the damaging affects of bushfires.[1] Areas in Canada, China, Russia, Australia and the United States have had substantial destruction to land and structures due to bushfires (Pyne World Fire 37). In particular, bushfires have affected the lives of many Australians and become a seasonal occurrence. The Country Fire Authority (CFA) of Victoria is one of the world's largest emergency service organizations with thousands of volunteers dedicated to protecting the state of Victoria from the catastrophic damage caused by bushfires (see Appendix A for more information regarding the CFA.).

The Ash Wednesday bushfires of 1983 were among the most damaging and devastating fires in the history of Victoria. During the past twenty years, the state of Victoria has experienced several major fires, but none have matched the intensity and destructive nature of the fires of 1983 (Pyne Burning Bush 412). The Ash Wednesday bushfires served as an indication to the CFA that changes were needed in order to prevent such an event from occurring again.

In response to the Ash Wednesday fires, the CFA made changes in its programs pertaining to the bushfire risk in Victoria. The CFA now concentrates more on prevention and preparedness instead of focusing on the fire response tactics as it did in the early 1980's.

The fires of the 2003 season in the northeastern region of Victoria have provided a test of the changes made by the CFA since Ash Wednesday. A trip to the

[1] Bushfire is an Australian term meaning a large, uncontrolled fire located in the rural and semi-rural areas of Australia. The bush is an area of low lying scrubs and relatively flat land, occupied by various types of vegetation and located between the outskirts of the major metropolitan areas of Australia and the Outback (desert land located in the center of Australia). The bushfire term is synonymous with the American term of forest fire or wildfire. For the purposes of generality and uniformity, this paper will use the term bushfire to describe uncontrolled fires in both countries.

town of Omeo, a town directly affected by the 2003 fires, provided the authors with a first hand account of the destructive nature and devastation the fires had on the region. Reading reports and seeing photographs can only provide the accounts of those writing the reports or taking the photos. By witnessing the destruction first hand, it has reinforced how severe the fires were and the need for community education programs in order to save the lives and property of the general public.

The goal of this project was to evaluate the changes made by the CFA concerning the bushfire risk. The project identified bushfire education programs that have been implemented by the CFA since 1983. A timeline was constructed, identifying major fires and the changes that resulted from the fires. One major aspect of the project was the evaluation of the CFA's community safety approach. In determining how past program changes have affected its success, the CFA will be able to make informed decisions regarding future bushfire programs and policies.

Completion of the project produced the following:

- a collection of literature that document the changes made by the CFA in its approach to bushfire risk,
- a report detailing program changes made by the CFA with a concentration on the community safety approach,
- newly developed measurement parameters for comparing the impact of different fires,
- a presentation package that can be used to inform both the CFA and outside organizations of the changes of the past twenty years.

The complete prevention of bushfires is impossible, but actions can be taken to help ensure that the destruction of Ash Wednesday is not repeated. The goal of the CFA is to reduce the damage and destruction caused by bushfires in the state of

Victoria. This reduction in devastation is controlled by the programs that the CFA implements throughout Victoria. The success of these programs is the driving force in the reduction of damage and is the key topic analyzed in this report.

2 Background and Literature Review

2.1 Background

The bushfire threat in Australia is a serious problem and one that jeopardizes the lives of thousands of residents. The policies and programs implemented by national and state governments as well as those of fire protection organizations, like the CFA, help to reduce this risk and prevent substantial damage and loss of life. The use of relevant studies and resources are integral in answering the questions raised in this report. The following section explores these resources to provide necessary background information.

2.1.1 Ash Wednesday Fire

2.1.1.1 History

The Australian state of Victoria is more susceptible to bushfires than any other disaster. Long periods of drought make the land a prime target for the production of bushfires and make it among the most fire-prone areas in the world (Oliver 1). The Australian calendar is marked with historical dates known for their bushfires, including, Black Friday, Black Sunday, Ash Wednesday, Black Thursday, Black Tuesday and Red Tuesday. Stephen Pyne, a fire historian and professor at Arizona State University, compares Australia to Antarctica, in that Antarctica is as much of a land of ice as Australia is a land of fire (World Fire 30).

Scientists can spot weather patterns that may produce some natural disasters, such as a prolonged drought season that may produce bushfires, or extended periods of rain that may cause flooding to occur. The Ash Wednesday fires were not a surprise. Local authorities knew of the possible outbreak, but predicting and suppressing a bushfire are two different things.

The weather patterns over southeastern Australia in the summer of 1982-1983 were consistent with those that had produced severe bushfires in the past. By February 16, 1983, a ten-month long drought had its grip on the Australian state of Victoria. Oliver, Britton and James, all specialists in the field of disaster studies, (Oliver and Britton are from the Centre of Disaster Studies of Australia and James is from the Department of Civil and Systems Engineering) maintain the fire authorities, including the Country Fire Authority (CFA) were aware of the severe risk of bushfires in the state of Victoria in the summer of 1983. The rainfall for the summer was much lower than normal and over ninety five percent of the state of Victoria was experiencing drought conditions (Oliver 6).

According to a case study done by the Australian Bureau of Meteorology, the weather on one particular day does not create the potential for a bushfire, instead it depends more on weather conditions over weeks and months. Extended periods of drought, like those seen leading up to and through the Ash Wednesday fires, elevate the risk of a severe bushfires outbreak (Colls, sec. 1).

As the drought continued, the lack of rain began to take its toll on the soil. The earth and fine fuels covering the ground became extremely dry creating the perfect conditions for bushfire ignition. Oliver, Britton and James state that Victoria had experienced several hot days, and it was only a matter of time before serious fires would ignite. The summer of 1983 was the hottest and driest in Melbourne's recent history, with only 0.6mm of rainfall compared to the normal 49.1 mm, producing prime conditions for bushfires (Oliver 7).

Local authorities, including the CFA and the Forest Commission saw the possibilities of the severe bushfires in November of 1982 and set policies into place to protect the state of Victoria against a series of bushfires. Oliver, Britton and James

list several different actions taken in response to the fire risk. The CFA enacted a fire ban on 25 November to help reduce the number of accidental fires and the government approved the training of six hundred men as fire fighters. The United States loaned the Modular Airborne Fire Fighting System (MAFFS) to Victoria. In addition, the Forest Commission arranged for agricultural aircraft to be on stand-by as needed to drop fire retardants and to use the aircraft as fire scouting vehicles for surveillance. Arrangements were also made to have equipment, such as bulldozers, on stand-by to aid in the fire suppression if needed (Oliver 7-8).

The drought conditions, combined with the gusty winds began the chain of fires that would ignite what would later be known as the Ash Wednesday fires. Trevor Code, a resident of Victoria at the time of the Ash Wednesday fires, recalls that due to the scale and intensity of the fires, it seemed that the entire state of Victoria was engulfed in flames. Code remembers the sky "glowing orange" because of the intensity and size of the fires (Code).

According to the CFA, there were several sources of the fires ignition, including the clashing of power lines, tree limbs blown down on power lines, human action, and several cases where the source of the fire was unknown (CFA Ash Wednesday sec1). As the fires burned, the wind added a new element to the problem. The wind would spread embers to new locations, igniting the flammable ground, causing "spot fires." These spot fires combined into a large fire, and fed the ever-growing series of fires that destroyed all the land in it path.

The wind also affected the fire in another fashion. The wind would change the direction the fire was traveling. The ever changing wind directions, combined with the intensity of the fire, the flammability of the ground and the varying terrain, from

the mountains to the rural bush, made fighting the fires that much more overwhelming.

Figure 1 - Map of Ash Wednesday fires located in Victoria

(CFA Ash Wednesday sec. 1)

In technical terms, bushfires can be described based on their radiant heat output for a given length of fire front. Measurements of energy output at the areas of maximum fire intensity are usually measured in units of kW/m (Boura 4). A maximum intensity of 4,000 kW/m occurs when forested land is burned or 10,000 kW/m occurs when open grasslands are burned. In order to develop a perspective on some recent significant bushfires, the Dandenongs fires in 1997 reached a maximum intensity of 30,000 kW/m while the Ash Wednesday fires of 1983 exceeded 100,000 kW/m in some locations (Boura 4). Once the intensity of a fire has reached this threshold, standard suppression techniques involving a direct attack on the fire front cannot extinguish the flames. Such unusually large fires cause a majority of all bushfire damage in Victoria (Boura 4).

The intensity and scale of the fires was tremendous, and called for an enormous amount of resources. According to the Victorian Department of Natural

Resources & Environment, "Over 16,000 firefighters attended the Ash Wednesday fires including park and forest firefighters and Country Fire Authority volunteers. Also involved and assisting in fire control efforts were 1,000 police, 500 defense force personnel and many local residents. A variety of equipment, including 400 vehicles (fire-trucks, water tankers and bulldozers), 11 helicopters and 14 fixed wing aircraft were used to fight the fires" (NRE sec1).

The CFA mentions that the majority of the fires were controlled on Ash Wednesday, some taking only a few hours to manage. Accessibility to the fires played a large role in how quickly the fires were controlled. In some cases, response time was slowed by a lack of paved roads or any roads at all, and rocky or mountainous terrain, which made transporting the fire vehicles to the fire more difficult.

The devastation from the fires of the summer of 1983 was enormous and it was the responsibility of the government to put policies in place to help prevent such devastation from occurring again. The complete prevention of bushfires is impossible, but actions can be taken to help ensure that the destruction of Ash Wednesday is not repeated.

An understanding of the history of Ash Wednesday is particularly important to appreciate the size and destruction of the fires. The destruction caused by the Ash Wednesday fires served as an indicator to the CFA and other organizations that changes must be made in order to prevent such an event from occurring again. Without this understanding, the programs put into place as a result cannot be appreciated. The Ash Wednesday fires set the stage for future bushfire programs and form the basis of comparison in this report.

2.1.1.2 Lessons Learned

Ash Wednesday provided a much-needed test of the CFA. After the fires dissipated, numerous investigations were performed on the deaths in the community and the performance of the fire organizations. These investigations consisted of evidence given from almost five hundred witnesses that included by-standers, volunteers, and staff (Murray 244). One of the major questions in the inquiries was why there was no advanced notice for those living in Macedon, a small town located on the outskirts of Melbourne. There were horror stories of people on the phone awaiting fire warnings for evacuation orders, just seconds from the path of the fire. The coroner blamed the seven deaths in the Macedon area on the late evacuation and poor communication between the different organizations working to control the fires (Murray 245). A statement from John Nicholson, a CFA regional officer, indicated that he thought the fires would lose their speed, and not spread as far as Macedon (Murray 245-246). Many other officials believed this as well and thus concentrated on areas they perceived to be in greater danger.

Many of the decisions made at the time of Ash Wednesday were spontaneous. The CFA worked with the Forest Commission and Melbourne & Metropolitan Board of Works to reduce fire damage. There was insufficient coordination between the three organizations, which increased the time needed to control the fires (Murray 249).

One of the changes implemented by CFA after Ash Wednesday was to examine the equipment that failed during the fires. All the trucks used on Ash Wednesday were powered by petrol, and many of them stalled due to vapor blocks in the fuel lines, caused by the petrol vaporizing in the excessive heat. CFA has now modified its trucks to reduce the vaporization in fuel lines, and all new trucks are now diesel. They have also added reflector strips and heat shields to their trucks for easier

sighting, and less heat impact on the firefighters. Because many of the hoses used on the fires of Ash Wednesday failed due to grit blockages, they have investigated new hose nozzles (Murray 251-252).

The lessons learned from the Ash Wednesday fires provided the turning point in the CFA's attitude toward community awareness. It explains the basis for the new interest in their community safety approach.

2.1.2 Community Fireguard Program

As a result of the major fire events that occurred over the years the CFA concentrated more on the community safety approach. The Community Fireguard program constitutes a major part of the CFA's fire safety effort. It addresses the need to educate the public so that people are capable of taking responsibility for their own safety and that of their property during a bushfire. This is necessary because CFA fire crews must focus on controlling the fire front rather than protecting individual homes. The CFA created the Community Fireguard program during the 1993-1994 bushfire season. The program strives not only to educate participants but also to create actual behavioral changes in their communities' approaches toward bushfire mitigation (Boura Community Fireguard 6).

Fireguard facilitators seek to create strong ties of cooperation and coordination within the community. Groups might engage in community property preparation in order to share labor and help less able members of the neighborhood. The creation of phone trees allows rapid dissemination of information such as bushfire warnings to all residents. Residents identify safe properties and community areas, which will provide shelter from the fire and serve as gathering points. Perhaps most importantly, the Community Fireguard program creates a close interaction between the residents and the local fire service. The fire service can rapidly deliver its analysis of the situation

to all residents by utilizing multiple forms of media and interpersonal communication. A common example of this would be the development of community phone trees for contacting residents (Boura Community Fireguard 9-10).

Community Fireguard groups are often established by small community groups. In the wake of a large bushfire, the extensive media coverage often spawns an interest in fire safety and risk mitigation. Members of the community might take action by requesting that a Fireguard group be established (Boura Community Fireguard 6). The CFA's Bushfire Blitz program increases bushfire safety interest with its street corner meetings and street walks designed to provide interactive education and planning (Blitz 1). Occasionally existing community action groups will create a Fireguard group as a subdivision within their organization (Boura Community Fireguard 6). However they form, Community Fireguard groups all function in relatively the same manner to fulfill their goals.

Fireguard groups motivate residents and give them a sense of community responsibility and empowerment. A CFA trained facilitator directs each group and attempts to acknowledge and employ any of the group members' prior knowledge. Rather than simply distributing information or lecturing, the facilitator allows the group to formulate its own solutions under his or her expert guidance. Meetings are generally very informal and often occur in group members' homes. This allows group members to relax and feel comfortable as they interact with the facilitator. The informal group meetings and team problem solving activities also aim to create social ties within the group which will increase the likelihood that members will remain involved after the training (Boura Community Fireguard 7-8).

One major goal of Community Fireguard training is that each family should create a detailed plan of action to ensure its safety in the event of a bushfire (Boura

Community Fireguard 9). This should occur prior to the beginning of the bushfire season so that a response can begin immediately following a bushfire warning. Residents tailor each plan to the needs and abilities of their particular family, but all effective plans will include some common elements. The family should be made aware of the extent of protection offered by the fire service (Boura Community Fireguard 9). As part of their fire safety preparation, family members should be taught what to expect during a bushfire. They should be prepared to protect themselves from the dangers of radiant heat, smoke and burning embers, and to work in cooperation with the fire crews (Boura Community Fireguard 9; Terwilliger and Waggoner 60).

Often, especially in high-risk communities the fire crews must concentrate on attacking the perimeter of fire front and may not have the resources to defend individual homes (Terwilliger and Waggoner 60). Crews also cannot remain in an area long enough to ensure that all smoldering embers have been extinguished (Boura Community Fireguard 9). The residents can most efficiently accomplish this task.

If an evacuation becomes necessary, a household should be aware of applicable laws and the distances and road types that may be involved in travel to a safe location. Two lane roads are particularly important as they allow passage of emergency vehicles during evacuation (Terwilliger and Waggoner 59). Any decision to evacuate should be made well in advance of the fire's approach. The emergency vehicles will need clear roadways to combat the fire front effectively. The decision to stay should be based on the safety of the property (Boura Community Fireguard 9).

Home safety evaluations are an integral part of the Fireguard program. They incorporate a number of different factors and many of the risks can be minimized through some labor on the part of the homeowner. By reducing the risk, the property

can be made safe enough to allow residents to remain and seek shelter during a fire rather than needing to evacuate (Boura Community Fireguard 9).

The home and any other structures on the property should be inspected to see that their outer surfaces are primarily noncombustible. Noncombustible roofing such as asphalt or metal should be used. This is particularly important to protect the home from falling embers in the wake of the fire. Fire resistant siding materials should be employed such as stucco, concrete block, or aluminum. Any openings such as eaves vents, or porches should be enclosed and only metal screens should be used (Terwilliger and Waggoner 59).

Structures on a property should not be situated so closely to each other that if one were compromised by fire, it would spread to the others. The property surrounding the structure should be kept clear of woodpiles, yard debris or potentially flammable vegetation for a distance of nine meters (thirty feet) depending on local zoning regulations (Terwilliger and Waggoner 58). Seasonal changes in the moisture content of certain plants should also be taken into account (Terwilliger and Waggoner 59). Fuel breaks should be created on the property to slow or stop a fire's progress. Ideally, fuel breaks should be in shaded locations and clear of any combustibles. They should also be wide enough that the fire cannot jump across them (Terwilliger and Waggoner 59). The property should also be inspected for crown closure. The crown, or tops of trees and other vegetation, creates an elevated fuel bed which can cause the fire to spread, and greatly enhances its intensity. A crown fire is also much more difficult to suppress (Terwilliger and Waggoner 59).

When considered together, these factors describe the general safety of a property. Fuel location and quantity, coupled with the local topography and wind patterns, can dictate the movements and intensity of a fire on a given property.

Details of home construction can make it less likely to be compromised by fire. This can both reduce the extent of property damage and make the house a useful refuge as the fire front passes. If the property is deemed "safe to stay" (Terwilliger and Waggoner 59), the family can remain there and assist fire crews in "mopping up" (Terwilliger and Waggoner 60) smoldering embers behind the front. In this way, the properly prepared family can save their own lives and prevent destruction of their property, and is the main goal of the Community Fireguard program.

2.1.3 Bushfire Blitz

Operation Bushfire Blitz was first launched in the summer of 1997 in response to the El Niño weather pattern, which was affecting southeastern Australia at the time, creating extremely dry weather conditions conducive to bushfires. The threat of catastrophic fires combined with the need to reach a broader range of citizens caused the CFA to develop the Bushfire Blitz program (Rhodes Blitz 37).

The main goal of the program was to reach people in the community that lived in high fire risk areas and did not have extensive bushfire knowledge. The high-risk communities were determined using Geographic Information Systems (GIS) technology to map the fire danger in various regions (Rhodes Blitz 38). Using this information, a trained presenter would host meetings on local street corners in the identified neighborhoods to convey important information on bushfire safety. The presenter would encourage the residents to develop and implement plans of action to undertake in the event of a bushfire (CFA Annual Report 1997-1998 14); much like the way a Community Fireguard facilitator does.

The reason for conducting the Bushfire Blitz meetings on local street corners is to make it relatively convenient and comfortable for the residents to attend, which should in turn increase the attendance and effectiveness of each meeting. The

presenters are encouraged to use the local surroundings to help the residents visualize the information that is being presented and answer their questions as well (Rhodes Blitz 39).

Bushfire Blitz has also been involved in delivering bushfire safety messages to ethnic communities. In 1999-2000, over 140 meetings took place in non-English speaking communities, which is extremely important because bushfires are affecting these groups as well (CFA Annual Report 1999-2000 18).

Both the Bushfire Blitz and Community Fireguard programs provide an interesting, interactive way to deliver important bushfire information to the community. Each program also involves a CFA trained professional to distribute this information. However, there are many differences as well, the Community Fireguard program concentrates on specific neighborhoods and has a relatively high cost, while Bushfire Blitz reaches a much larger number of people at a lower cost (Rhodes Blitz 37). In addition, Bushfire Blitz has helped to supplement the Community Fireguard program by increasing awareness and inspiring the public to take the time to create Fireguard groups (Rhodes Blitz 37-38).

The Bushfire Blitz program is also involved in a media campaign that originated in 1997. The campaign involved ABC Radio and allowed callers to phone in using a toll free number, to ask CFA-trained professionals bushfire related questions. This allowed the public to get answers to their specific questions and to help further raise bushfire awareness (CFA Annual Report 1999-2000 18).

Community Fireguard and Bushfire Blitz are two major CFA operated community education programs. These programs and others, combined with different media campaigns have reached many members of the community over the years. They are working to increase the level of community preparedness and knowledge of

bushfire safety. This allows members of the community to take responsibility for their own safety and the protection of their property.

2.1.4 Model of Fire Cover

In 2001, the CFA wrote a proposal in response to the Discussion Paper by the Office of the Emergency Services Commissioner (OESC) about the development of a Model of Fire Cover for Victoria. The Model of Fire Cover is a plan to coordinate efforts of fire agencies in Victoria. The CFA's proposal further explains the benefits of all the fire agencies coming together to work as one. These agencies include the Metropolitan Fire and Emergency Services Board (MFESB) and the Department of Natural Resources and Environment (DNRE), as well as the CFA (CFA Model 2).

At this point in time, there is no means of organizing the efforts of all the Fire Protection organizations, and providing a meaningful comparison of productivity. Each agency has to follow certain government regulations (Australian/New Zealand Risk Management Standard, AS/NZS 4360: 1999), but each agency has its own procedures in order to follow these regulations. The CFA supports Model of Fire Cover and states that it "...provides an opportunity for all fire agencies to align their policies and strategic objectives and to develop meaningful measures of the efficiency and effectiveness of fire agencies in meeting objectives and the fulfilling of community expectations for its safety and well-being"(CFA Model 2).

One of the major problems with evaluating the fire agencies is that the fire investigations involve data that has no pertinence to an individual fire. It is difficult to evaluate the success of an agency compared to earlier investigations because the data collected from one fire may not pertain to the newest fire. Often, much of the data analyzed in the investigations consists of the agencies' own reports of the fire. This data could include the preparation, amount of equipment employed in

suppression of the fire. The CFA plans to examine the results of fires to use as a comparison for success. There are several independent variables to look at when comparing different organizations' efforts on prevention. Nevertheless, looking at the end effects would eliminate some of those variables, and would focus more on the effectiveness of the organization (CFA Model 6).

The CFA wants to create more regulations on land-use and amount of fuels in an area. This will help to regulate the variables consisting of housing materials and landscaping and improve fire safety. The CFA would like to expand the fire awareness programs in both the educational and community areas. Increased awareness would enable the citizens to take responsibility for their personal safety. This is will increase the effectiveness of the volunteer fire brigades by allowing them to concentrate on controlling the fire front (CFA Model 12).

Another important issue facing the CFA is the need for a better relationship with other fire agencies in order to provide better overall protection. The Model of Fire Cover will provide this connection between agencies, and create a safer and more educated Victoria (CFA Model 12). This proposal demonstrates the CFA's goals and highlights some factors that will be important in an evaluation.

2.2 Literature Review

In order to understand the proposed research questions, a theoretical framework must be created. Previous studies in the field of bushfire management provide the basis for this theory. Studies that evaluate fire protection organizations are of particular interest to this report and may provide useful assessment tools needed for this report.

2.2.1 Comparable International Strategies

An investigation was conducted into U.S. fire organizations to make comparisons with the CFA. By examining the strategies employed by organizations in the United States, a different perspective of the CFA's activities can be gained. Similarities between the two countries in terms of community safety programs can be used as evidence in the evaluation of the CFA's effectiveness.

2.2.1.1 US 10 year Fire Plan

Over the last decade or so there has been a steady increase in the magnitude and strength of bushfires in the United States. The National Fire Plan (NFP) reports that in 2000 approximately 8.4 million acres were burned, this is more then twice the national average of the past ten years (Comprehensive Strategy 6). Because of this, the Secretaries of Agriculture and the Department of the Interior collaborated with the Western Governors' Association, National Association of State Foresters, National Association of Counties, and the Intertribal Timber Council to create a 10-year plan that will reduce the risk and damage cause by bushfires (National Fire Plan Comprehensive Strategy 9).

The plan's main goals are to improve fire prevention and suppression techniques, reduce hazardous fuels that exist in high-risk areas, restore areas that were affected by bushfire, and encourage community involvement (National Fire Plan Comprehensive Strategy 1). Combining the efforts of all levels, whether local or national, is the main strategy for accomplishing these goals (National Fire Plan Comprehensive Strategy 9).

In order to implement this 10-year plan, specific tasks were assigned to the various organizations involved, and progress will be gauged by using a variety of measures that correspond to each goal. The first goal, improve fire prevention and

suppression, will use civilian and firefighter deaths, firefighter injury time off, acres burned by bushfire, percent of fires controlled, number of structures destroyed and the percent of burnable acres in both federal and state management plans to measure success or failure (National Fire Plan Implementation Plan 10). The second goal, which is to reduce the hazardous fuels, will use such measures as how many acres were correctly treated and the number of acres that were treated per million dollars investment (National Fire Plan Implementation Plan 12). The next goal is to restore effected areas using such measurements as the number of acres that were treated and moved to a new condition class, and the percent of acres that are being treated because they were burned by bushfires (National Fire Plan Implementation Plan 14). The final goal, to involve the community, will use measures such as the percent of communities with a current fire management plan or risk analysis, and the percent of the communities that have fire programs available (National Fire Plan Implementation Plan 15).

Many fire protection organizations have always worked toward the same goal, but have not coordinated their efforts. The implementation plan will strengthen bushfire suppression and prevention efforts within the United States by increasing cooperation between these agencies. It will increase the efficiency of local and federal agencies and better prepare communities to manage the risk. Although the population in high bushfire risk areas is increasing, plans such as this one can help save lives and property.

2.2.1.2 USDA Forest Service

The United States Department of Agriculture includes a forestry department that oversees the public forests and grassland. Congress formed the Forest Service in 1905 in order to provide quality water and timber for the nation. Today the Forest

Service manages these natural resources, working more on replenishing and maintaining the public forests, containing approximately 77.3 million hectares.

Concerning bushfires, the USDA follows the National Fire ten-year plan, which is similar to that of the AS/NZS 4360: 1999 regulations followed by the CFA. The USDA Forest Service uses prescribed burning to help prevent bushfires through fuel reduction. The USDA also works with Firewise, Smokey Bear, and other community programs to educate the public more on bushfire safety. In connection to public safety, it publishes many articles on fire safety and prevention (About Us).

Due to the fires in Colorado in the 1970s, the USDA formed a group that would coordinate fire agencies' actions to provide a better "fire cover" for the U.S. The National Wildfire Coordinating Group (NWCG) consists of the Bureau of Land Management, the National Park Service, The Bureau of Indian Affairs, and the Fish and Wildlife Service, all of which are departments of the USDA Forest Service. Its main purpose is to coordinate programs of bushfire agencies so that the agencies are working together. It provides standards for training, equipment, qualifications, and other specific functions. The NWCG is broken down into thirteen large "working teams" that includes a wild land fire education working team. This team can be hired out by agencies to come on site and improve safety awareness programs. The team will use the local resources including newspapers, handouts and media to spread the word of bushfire safety. It will train the agency's personnel in community leadership, and make further recommendations to help improve the community awareness (NWCG Organization).

2.2.1.3 Smokey Bear

The Smokey Bear campaign was launched in 1944 using a cartoon bear to help make people more aware of the danger of bushfires in the United States

(SmokeyBear.com, sec. 2). His now famous phrase "Remember... Only You Can Prevent Forest Fires" was introduced in 1947 (About.com, par. 10). A survey of schoolchildren in the United States and some foreign countries was conducted. The children were given the first part of a slogan and then asked to complete the phrase. More children were able to complete Smokey Bear's slogan than any other slogan that was studied (SmokeyBear.org, par. 6).

The Smokey Bear campaign in the U.S. has been well received by the community. Public awareness of Smokey Bear is very high, ranking him among such icons as Mickey Mouse and Santa Claus (About.com, par. 7). The use of Smokey Bear has proven to be a successful approach in educating the community about the bushfire risk. Advertisements involving a readily recognizable cartoon figure and memorable slogan have been shown to be effective methods for the dissemination of public safety information (About.com, par. 7).

The Smokey Bear campaign was ranked twenty sixth on "Advertising Ages Top 100 Campaigns of the Century" in 1999 (About.com, par. 3). In the ten year span from 1990 to 2000, the Smokey Bear campaign has received more than $481 million in donated advertising time and air space (About.com, par. 3). Smokey Bear has been the longest running public service advertising (PSA) campaign in history lasting more than fifty eight years (About.com, par. 3). Not only has it been a very popular campaign but it has also been effective. The amount of acres burned annually has been reduced by more than twenty two million acres since the campaign's launch in 1944 (Ad Council, par. 1). However, the devastating fire season in the United States in 2000 led to a slight change in the Smokey Bear message. The slogan was changed from "Only You Can Prevent Forest Fires" to "Only You Can Prevent Wildfires" (Ad

Council, par. 1). This change reflects the fact that forest fires are not just burning the forest but are also reaching communities.

2.2.1.4 Firewise

The Firewise program (community workshops) was formed in 1999 by the National Wildlife/Urban Interface Fire Working Team (Trembly 84). It operates in the United States under the National Fire Protection Association. It is government funded and has partnerships with national businesses and associations (Trembly 86). Firewise is a public education program that fulfils many of the same functions as the CFA's Community Fireguard program.

Firewise currently operates on a national scale. It seeks to bring together homeowners, builders, fire department personnel and community leaders to encourage cooperative fire safety practices. Participants gather for a two and a half day workshop in which they learn how to manage the bushfire risk in their community. They work in teams to create bushfire mitigation solutions for their communities. As they create these plans, they learn about fire risk evaluation, fire-safe construction and landscaping, community involvement plans, and education of other community members about fire prevention practices (Trembly 84). By involving members from all facets of the community, the Firewise program seeks to create fire mitigation plans to which the whole community will adhere (Trembly 84).

During its operation, the Firewise program has educated one thousand participants from eighty seven different high-risk communities located in forty seven states (Trembly 84). These participants also often educate other members of their communities as a part of their Firewise solutions. For example, in the Perry Park Ranch Metro District of Larkspur Colorado, the Firewise team published biweekly articles in the local newspaper in order to inform residents of the proposed plan.

In order to measure their success, they conducted a survey of five hundred households both before and after the advertisements. Before the articles, only 25% of the families responded and only 30% indicated that they were knowledgeable about the fire risk. After the newspaper articles had been published, 90% of households responded to the survey and 80% indicated some knowledge of the fire risk (Trembly 85). This appears to indicate that the local newspaper articles served to increase greatly the community's awareness of the bushfire risk. The team also sought to convince homeowners to clear a "defensible space" about their homes free of vegetation, yard debris and other combustibles (Trembly 85). Such a space slows the approach of a fire front and helps to prevent ignition of the structure. This type of preparation allows the house to be used as a shelter during a fire and provides an alternative to evacuation.

2.2.2 Relevant Studies

The best way to prepare for the future is to learn from the past. Reports and studies conducted on previous events and programs provided a valuable resource in which proposals and suggestions for the future can be based. This building process eliminates the repetition of damaging mistakes and allows the formation of a sound procedure for the future. Two studies that do just that include a case study into the deaths of Ash Wednesday and community involvement studies by Dr. Bernd Rohrmann. An understanding of the findings of these studies provides the necessary background information as well as suggestions that will aid in the conclusion section of this report.

2.2.2.1 Case Studies of the Ash Wednesday Deaths in Victoria

During the Ash Wednesday fires of 1983 that ravaged southeast Australia there were forty seven deaths in the state of Victoria alone (Krusel and Petris 8). Of the forty seven victims, there were thirty four civilian fatalities (Krusel and Petris 3), and of these victims there were thirteen that knew of the impending danger of a fire and did not choose an effective survival method (Krusel and Petris 7). With some basic knowledge of fire survival techniques, these people may not have perished.

One common reason that people died in the bushfires was that they chose to evacuate too late. Although evacuation is a good survival technique when done early, it is a very dangerous strategy when residents wait until it is too late to abandon their homes (Krusel and Petris 7).

Five victims chose to leave their homes late using a vehicle (Krusel and Petris 7). This is not an effective method for evacuation because the driver often does not know which road to use to move safely away from the fires. In fact, the driver could be driving into the fire itself. In addition, survivors recall experiencing disorientation due to the extreme heat and the smoke obscuring their view of the road (Krusel and Petris 7). A late evacuation is not a satisfactory survival method; instead of evacuation, these victims should have sought shelter in their homes. Besides the hazards of driving itself, houses provide much better protection from radiant heat when compared to vehicles (Krusel and Petris 7).

Another five victims died in close proximity to their homes. These people were aware of the dangerous fires, but were not aware that wind changes can cause a fire to flare up and quickly consume land that seemed safe (Krusel and Petris 8). The victims most likely believed that they were out of harm's way. If they had chosen to

stay in their homes or evacuate early, their chance of survival would have greatly increased. In fact, in some cases the victims' homes survived the fires.

Some people deliberately entered the fire area. They were well aware of the danger, but they entered despite the danger to take photographs. Two of the thirteen victims died in this fashion, after sudden wind changes caused the fire to shift direction (Krusel and Petris 8).

The final person in this group died inside his house. The events surrounding his death are rather unclear, but investigators believe that he died because police ordered him not to use any more water, because of the limited water supply (Krusel and Petris 9).

The rest of the civilian deaths that occurred in Victoria occurred because people were either unaware of the imminent danger of the bushfires in sufficient time to choose an appropriate survival plan, or were physically unable to employ an effective method for survival (Krusel and Petris 11-12).

While the CFA and other fire organizations try to help everyone, it is not always possible to do so. Especially as the urban/rural interface continues to grow, it becomes more difficult to supply everyone with individual care. Therefore, it is extremely important that people are educated in ways to survive bushfires. In addition, people need to understand that although the situation appears safe, sudden wind changes can rapidly endanger them. A good example of this is the fact that forty six of the forty seven deaths in the state of Victoria occurred as a direct cause of the wind change (Krusel and Petris 8).

It is important to understand how people reacted to the bushfires and evaluate exactly what the public needs to know in order to implement a successful survival strategy. People should be aware of the hazards of a late evacuation and that

sheltering in a home provides better protection from the radiant heat of a bushfire. An assessment of the public's knowledge of how to react properly during a bushfire should be a guiding factor for any community safety program.

2.2.2.2 Risk Communication Studies

In a study published in *The Australian Journal of Disaster Management* in 2000, also written by Dr. Bernd Rohrmann, the effectiveness of bushfire preparedness programs in Australia was assessed. The study, *Critical Assessment of Information on Bushfire Preparedness for Residents*, used surveys, focus groups and expert analysis to study how effective different types of publications were in educating and preparing the public about bushfire risk. Dr. Rohrmann also conducted an evaluation of the Community Fireguard program which is discussed in the effectiveness of the program in increasing the public's awareness of the bushfire risk (for a detailed description of the program, see section 5.3).

Dr. Rohrmann studied several forms of bushfire related publications, including leaflets, brochures, books, slides, posters, and videos. The study suggests that in order for the education program to be successful, the information must be presented in an effective and useful manner. The publications must be appealing to the public and contain information relative to all audiences, because the involvement and interest of the public is critical to the success of the program (Rohrmann Preparedness for Residents).

The medium either used to present the material, electronically through videos or written in books and leaflets, was studied. The study found that, although it was preferred, the use of colors over the use of professional drawings and charts did not change the public's understanding. The value of the publications is dependant on the relationship between the bushfire prevention organizations and the public. The study

suggests that simply distributing the material is not useful unless there is some interaction between the public and the bushfire organizations. The use of different forms of publication over another is determined by the context in which it will be applied (Rohrmann Preparedness for Residents). For example, a resident more at risk of being effected by a bushfire may find a comprehensive book more useful than a leaflet in protecting his home from being damaged by fire.

The study also suggests that future research will examine the use of more technologically advanced methods of communicating the bushfire information. Future methods include the use of the World Wide Web, CD-ROMs and other computer based techniques (Rohrmann Preparedness for Residents).

In order to make recommendations for future programs, the necessary background information must be understood. The studies by Dr. Rohrmann and those regarding Ash Wednesday fires combined with information compiled from analogous U.S. organizations and the CFA provide the necessary background information for this report. A better understanding of the background and literature review sections aid in the analysis and conclusion portions of the report.

3 Methodology

In the twenty years since the Ash Wednesday fires, the CFA has implemented a number of programs that attempt to reduce the occurrence of bushfires and the extent of bushfire damage in Victoria. The CFA has also conducted significant research and undergone some structural changes to its overall organization. In order to guide further program implementation decisions, these changes need to be evaluated. Recommendations based on research findings should be applied to the operation of the CFA. Programs, which do not significantly reduce the number or the severity of bushfires, should be modified. Instead, resources should be directed toward those programs that have proved most effective in reducing the damage caused by bushfires.

First, a historic review of the CFA during the past twenty years was conducted. This history included major fire events, important research results, structural reorganizations within the agency and major program implementations. It focused on the increased concentration on community safety and preparedness.

Due to the complex nature of the environment in which these programs operate, there are many factors influencing their success. To facilitate visualization of the logical connections between contributing variables, models were created. These models organized the variables and directed the evaluation of changes within the CFA. The evaluation included a qualitative analysis of interview data in order to assess the effectiveness of the community safety programs. In addition to interview data, different media outlets, including Victorian newspapers and publications, were contacted and analyzed for relevant information pertaining to the CFA.

In support of this analysis, a quantitative evaluation of the fire damage resulting from major bushfires was conducted to identify any reduction in fire damage

occurring after the implementation of these programs. Statistics regarding the formation of Community Fireguard groups were analyzed as an indicator of program growth and the effectiveness of the program in distributing its message to the public.

3.1 Models of Variables

In an effort to present the variables relevant to this evaluation, a list was constructed and the models seen in Figure 2 and Figure 3 were created. The main purpose of the models was to organize the extensive list of relevant variables and to show connections between these variables. Gaining a better understanding of the relations between the variables involved allowed appropriate comparisons and statistical analyses to be conducted.

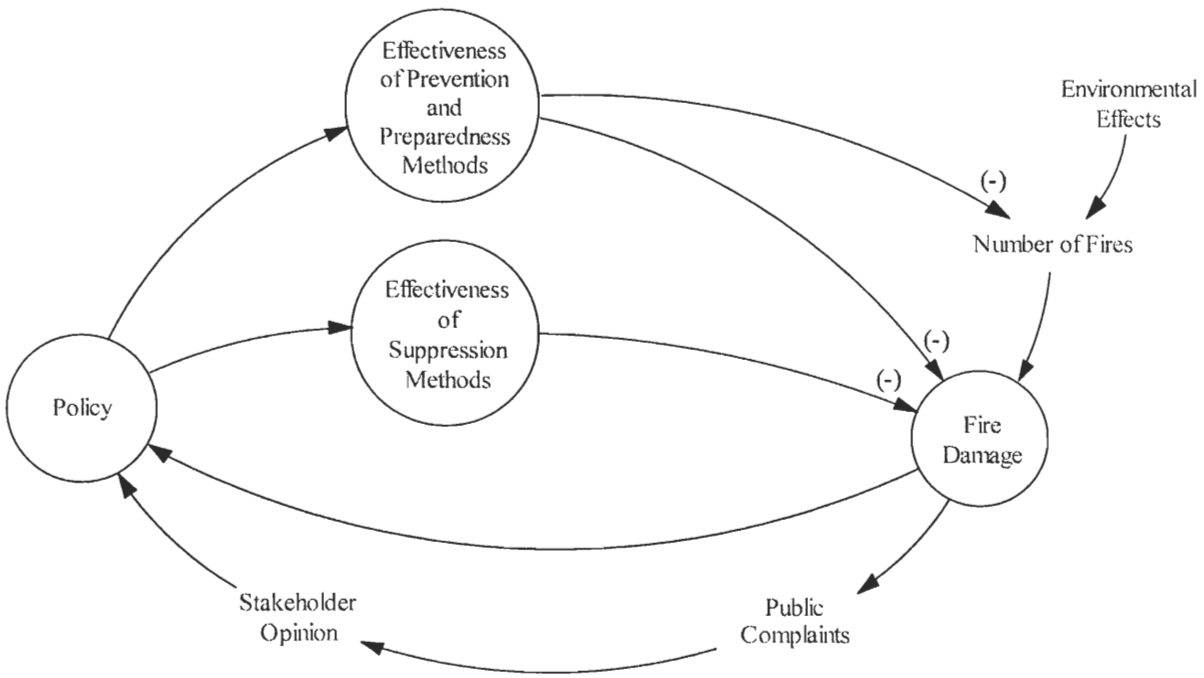

Figure 2 - Condensed Model of Variables

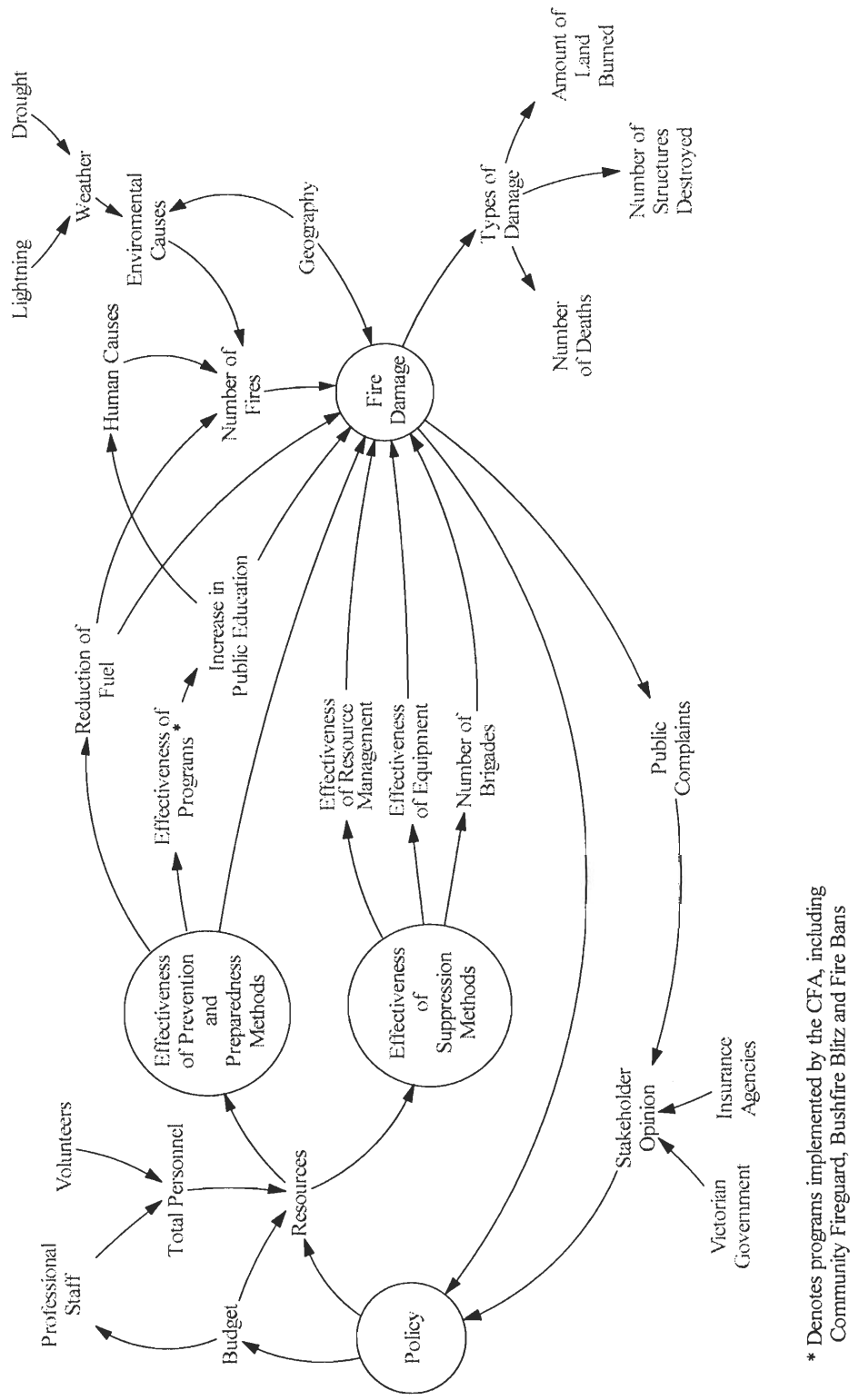

Figure 3 - Expanded Model of Variables

The causal loop in Figure 2 shows the connection between the broad categories of dependant and independent variables and Figure 3 shows the specific

variables included in each broad topic. This project concentrates on the community safety programs implemented by the CFA. The goal of bushfire safety programs is to reduce the bushfire risk and the damage caused by the fires. This is done through effective bushfire suppression, preparedness and prevention methods. The effectiveness of these methods is dependent on the amount of available resources, the greater amount of available resources, the more effective the prevention and suppression methods can be.

The more effective the prevention, preparedness and suppression methods are, the smaller the amount of damage caused by bushfires. Prevention and preparedness methods include school education and youth development programs, the Community Fireguard and Bushfire Blitz programs, and the reduction of fuels available for the fires. The more effective the CFA can be in educating the public and in reducing the amount of fuel, the less likely a fire will start and by limiting the number of fires, the CFA can reduce the possibility of fire damage. The education of the public is important in order to limit the number of fires and to help prevent damage and deaths from occurring as a result. One intervening variable that arises is the environmental causes of bushfires, including prolonged periods of drought and lightning strikes.

The suppression branch of the model includes the effectiveness of the equipment and the number of brigades available to fight the fires. More advanced equipment and greater equipment availability increases the likelihood that fires will be controlled. Effectively training the personnel to use the equipment is another variable and by increasing the skills of the personnel, it becomes more likely that the fire will be controlled in a timely fashion.

All these factors affect the amount of fire damage. The various types of damage include the number of human fatalities, the area of land burned and the

number of structures destroyed by the fire. If the amount of damage is large, the public becomes more aware of the bushfire problem and applies pressure on the stakeholders, in this case the CFA, insurance agencies and the Victorian government. The public begins to ask that new policies and programs be implemented and new regulations be put into place to prevent such a large amount of damage from occurring again.

The implementation and adjustment of programs is an on-going procedure. The effectiveness of the programs is seen in the reduction of fire damage and as a result of the reduction in fire damage, no program changes may be required. On the other hand, if fire damage increases, this serves as an indicator that the programs are not sufficiently effective and new changes must be made. By using this model to examine the fire damage statistics over the past twenty years and the changes that have attempted to control that damage, this report can evaluate the success of the community safety programs. This model also allows information from interviews to be utilized in assessing the effectiveness of these programs.

3.2 Data Collection

The models provided the variables and classifications needed to evaluate the effectiveness of the community safety programs. The majority of the data available regarding the fire events and changes within the CFA during the past twenty years was qualitative in nature. Recently, more quantitative measurement programs have been implemented but remained in their initial stages.

In order to find values for the variables needed to evaluate the programs, a wide array of materials and interviews were utilized. Annual reports, fire investigations, coroner's reports, and documents on community programs were collected to gather the available statistical information. The CFA's GIS services were utilized to obtain

census data of population and housing for the areas affected by major fires. The population and number of dwellings for all collection districts, which overlapped the fire areas were summed according to the census of 1996. Data published by the Department of Infrastructure (Towns in Time) was then used to determine the percent by which populations had grown or decreased in each affected area between the year of the fire and the 1996 census. The population and number of dwellings were then adjusted by adding or subtracting this amount as appropriate.

Recent articles published in *The Age* were reviewed as an example of the possibility for interaction between media coverage and the CFA's community safety programs. Interviews were conducted with CFA personnel in the Community Safety Directorate, the GIS services, and the media/publicity department. Interviews were also conducted with area managers of Gippsland where the fires of 2003 burned. These interviews provided further descriptions of significant events as well as explanations of the expected program outcomes and qualitative descriptions of the successes and failures of the programs.

3.3 Data Analysis

A timeline was created to identify the major events during the last twenty years. These events included significant fires, community programs, research, and the organizational structure changes. Significant fires were defined as any fire in which considerable fire damage occurred or important research was conducted because of the fires. Significant fires were compared to each other in respect to their location, Fire Danger Index and fire damage data and were identified through expert interviews and CFA annual reports. The fire damage data included area burned, structures destroyed, and human fatalities.

After all data was collected, parallels between fires with similar characteristics were examined. Programs that had not been implemented during an earlier fire but were active during a later fire were identified. The reports of fire damage and community preparedness for the two fires were then compared in order to determine the effectiveness of the program changes.

These similar fires were also compared in terms of the extent of the damage they caused. The number of human fatalities and the number of dwellings destroyed were compared as ratios incorporating relevant census data. This accounted for differences in the population or number of dwellings threatened by each fire.

Statistics related to the number of Community Fireguard groups formed in each year were used to indicate the effectiveness of the program in distributing its message and information to the community. The number of people reached by a program provides a useful indication of the potential of that program to educate a population.

4 Data

4.1 History

The history section presents the data in an organized manner to describe how programs have developed over the past twenty years and how programs have been affected by significant fire events. In order organize the evaluation of the community safety programs; a timeline was formed. This timeline included the significant fires from Ash Wednesday in 1983 to the 2003 fires of northeastern Victoria, the programs implemented in between those fires, and structural changes in respect to the Community Safety Directorate. A description of each significant event follows the timeline, which explains a given event along with the contribution it has made towards community preparedness. In respect to the community safety programs, a matrix was formed to describe a program specifically, which allows for an easy reference and means of comparison. This portion of data defined the basis for the evaluation and was necessary to layout before further analysis could be conducted.

4.1.1 Timeline

A timeline was created to provide a clear visual representation of major fires, structural changes, relevant research, and program implementations, which shaped the CFA's history during the past twenty years. This timeline was built upon information from CFA annual reports, interview data, and fire investigation reports. It supplies the basis for what will be analyzed in the evaluation of the Community Safety Directorate's programs.

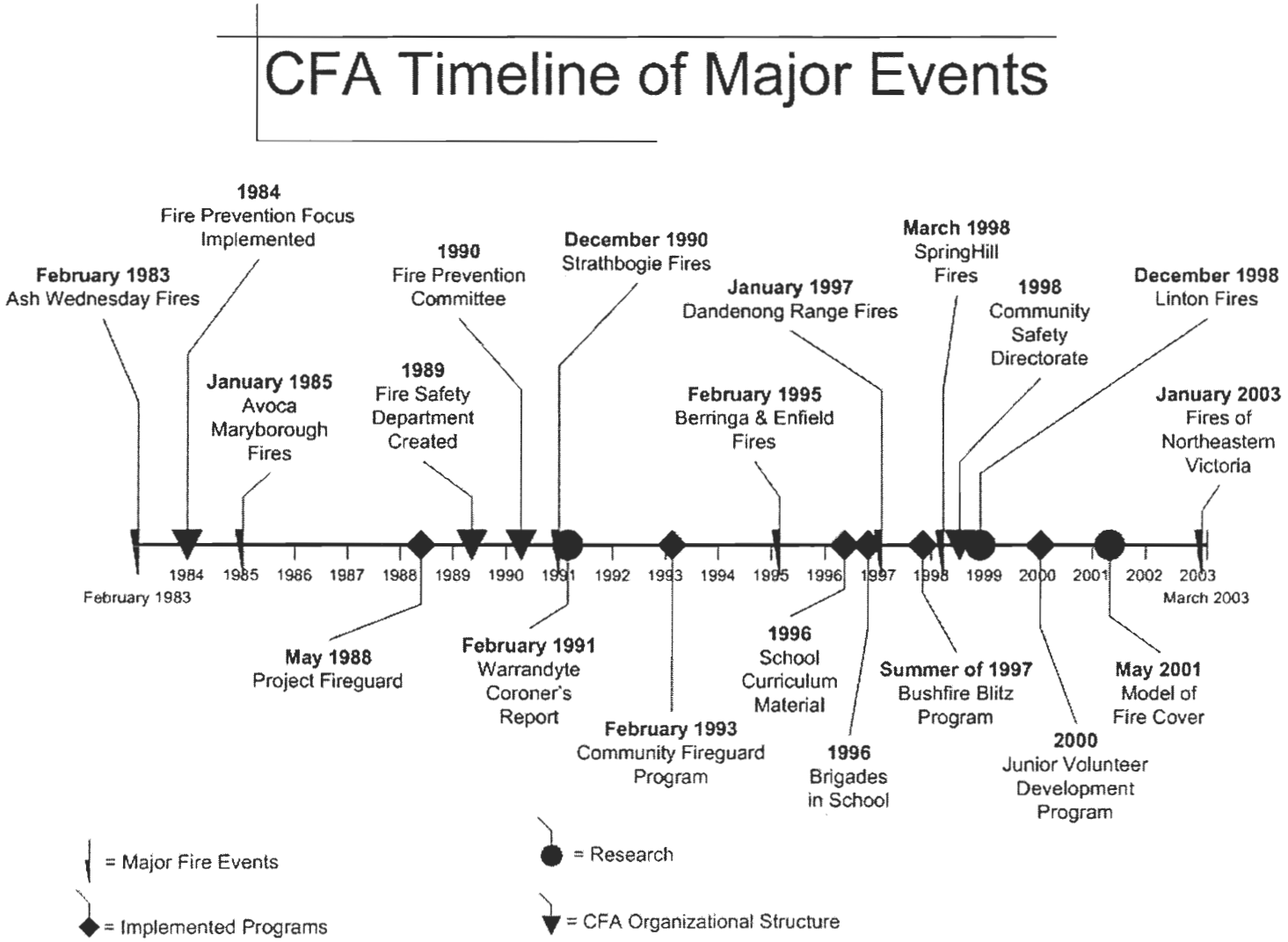

Figure 4 - Timeline of CFA activity 1983 - 2003

4.1.2 Historical Narrative

The timeline alone does not provide sufficient historical information. A description of the last twenty years is necessary to completely understand and evaluate certain aspects of the CFA. The following table refers to the fires that have taken place over the past twenty years, the areas that were affected and the reasoning behind the significance of the fires. The importance is based upon fire reports and interview data and will be used in the analysis of community programs.

Major Fire Events

As stated in the background section (see section 2.1), the Ash Wednesday fires (16 February 1983) were some of the most destructive fires in Victorian history in respect to number of fatalities, area burned, and fire intensity. It provided the highlighted the need for a better community preparedness plan. The proximity to Melbourne provided enough threat to the urban areas to seek out help from the CFA and gather media attention on the severity of bushfire damage (Boura). Ian Symons, manager of the Gippsland area, mentioned a grassland fire in 1977 where two fire fighters perished, but it did not receive the attention paid to Ash Wednesday (Symons). The fires of 1983 still remain embedded in the minds of many in the community today, a constant reminder of the ferocity of Ash Wednesday.

Two years later, the fires of 14 January 1985 occurred in four different areas of central Victoria and were significant in the respect that there were six fatalities and a total area burned of more than 60,000 hectares (CFA Report on 14th January 1985 26). The proximity of these fires to the Ash Wednesday fires was another reminder that the community needed to be prepared in terms of bushfire survival.

The fires on 27 December 1990 in the Strathbogie Ranges consisted of three different fires and burned more than 25,000 hectares in a variety of topographies,

which caused some difficulties in relaying information and suppressing the fires. One volunteer fire fighter died during the mop-up of the fires. One of the major advances in this fire was the increase in knowledge of the homeowners on protecting their homes. As stated in the fire investigation report the lack of structural damage could be "...indicated by the confident approach displayed by landowners ...who had stayed to defend their properties. Given the size and intensity of the fires it can safely be assumed that this attitude clearly led to saving all but 16 houses in the fire areas" (CFA Report on 27th December 1990 18).

On 25 February 1995, a significant fire broke out in the Berringa-Enfield area, in proximity to the 1985 fires. The total area burned was approximately 11,000 hectares with zero deaths. This was the first fire to test the newly developed Community Fireguard groups. The South Dereel Community Fireguard Group had been running for roughly nine months and had prepared months in advance for a bushfire and even though they were not hit directly, they "felt confident in their ability to save their homes and their lives" (CFA Berringa-Enfield Fire 5.3.4.2). The report mentioned that of the households examined, all had some form of fuel management in place (CFA Berringa-Enfield Fire 5.2-5.3).

The fires on 20-21 January 1997 in the Dandenong region burned approximately 2,600 hectares and there were three fatalities in Ferny Creek. Although the fire was significantly smaller then the other fires mentioned it sparked additional community interest. Again, the proximity to Melbourne heightened the media's involvement and in some cases there were incorrect messages being relayed to the community (CFA Review of 20 & 21 January 1997 Fire Prevention). In an interview with John Schauble, a journalist of *The Age* and CFA volunteer, it was stated that each year a third of the population is new to the Dandenong region and do

not understand the bushfire risk involved in living in such an area (Schauble interview). One interesting fact to note was that there were no active Community Fireguard groups in the Ferny Creek fire area, however where Community Fireguard groups were located, significant knowledge was gained and utilized (CFA Review of 20 & 21 January 1997 Ferny Creek).

The Springhill fire of 22 March 1998 was a relatively small fire that burned approximately 2,800 hectares. The fires took place in areas close to those affected by the 1985 and 1995 fires, making it useful for comparison (Krusel). There was a newly formed communication between the CFA and the NRE (Natural Resources and Environment), which helped to control the fire in a timely fashion (CFA Spring Hill, sect. I).

The fires in northeastern Victoria occurred from January to February 2003 and provide a means to conclude the past twenty years. Since the investigations into the fire were still ongoing at the time of this report, much data was still unavailable. At this time, the fires are known to have burnt an approximate total of 1 million hectares with zero casualties.

Research

The investigations after two fires in the last twenty years did not have as much fire damage as the above fires but raised some important issues. In February of 1991, a coroner's report was completed on the Warrandyte fires that provided insightful recommendations on safety and preparedness. It stressed the lack of preparedness many of the community had in terms of bushfire survival and the need for the CFA to take action. In 1998, the Linton fires occurred and killed five firefighters in a tanker burn over. The investigation report filed afterwards stressed the need for better

protection in terms of clothing, equipment, and communications for volunteer firefighters (CFA Linton Fires).

As stated before in the background section (see section 2.1), the Model of Fire Cover is a policy that strives to bring structure and organization to the state of Victoria in terms of the three different fire fighting agencies (CFA, Department of Sustainability and Environment, and Metropolitan Fire Brigade). The policy is still in its research stage in determining how to develop standards to compare and evaluate the act of fire fighting.

Implemented Programs

The programs have been a result of the CFA's concentration on community preparedness. The Community Fireguard and Bushfire Blitz programs are some of the most well known community safety programs. Often they work together to educate the community. As stated in the background section, the Community Fireguard program was implemented on the ten year anniversary of Ash Wednesday with the goal of educating the community in bushfire safety and preparedness. Bushfire Blitz was implemented in 1997 in direct response to a dry season, resulting from the El Niño weather pattern (Rhodes). It was to be incorporated into the summer campaign to provide neighborhood meetings and activities with a brief overview of bushfire safety and home survival (Wolf).

The summer campaign itself starts before the bushfire season and is used to prepare for the coming bushfire season. Each year there is a new campaign that focuses on one component of community safety. This message is then displayed on billboards, TV commercials, newspapers, and broadcasted on radio stations. The CFA has a number of pamphlets that are distributed to the public on bushfire behavior and safety. These pamphlets are normally revised after a five-year cycle (Tindall).

Living in the Bush was an exception in that it was published to coincide with the initiation of Bushfire Blitz in 1997 instead of being published as part of the five year cycle of media campaigns.

There are two types of school educational programs currently in place: the Brigades in School and School Curriculum Material programs. The CFA's Brigades in Schools program was implemented in 1996 to teach schoolchildren general fire safety, including bushfire information. The School Curriculum Material is two sets of resources given to teachers so that they can incorporate it into their teaching plans. This program started in 1988 as Project Fireguard but then was revised in 1996 to the Fire Safe Program and then renamed to the School Curriculum Material. The Junior Fire Safe program is for children in grades P-2, and involves personal safety. The Fire Safe targets grades 3-6 and develops more overall fire safety knowledge, including bushfire safety information.

The Land Use Planning program is a set of regulations used to control where one can build a house and certain parameters that need to be implemented. These rules help regulate the amount of fires caused by excessive fuels and reduce the number structures destroyed due to bushfires by targeting areas with high bushfire risk (Krusel). The program aims to reduce fire damage through regulating where homes are constructed and attempt to reduce the number of dwellings in an area that has a particularly high bushfire risk associated with it. The program also works with contractors to reduce the amount of flammable material used in the construction of homes.

The Junior Volunteer Developmental Program (JVDP) delivers activities for youths to promote bushfire responsibility and could be measured by the number of activities provided by brigades each year. Like the majority of the programs used by

the CFA, the goal is to promote bushfire awareness and seek to lower the amount of fire damage.

CFA Organizational Structure

In order for the community safety approach to grow to the extent it has, certain structural changes occurred in order to provide the funding and personnel required to focus on the community. The figure (Figure 5 - Organizational Structure of the CFA) below shows the organizational structure of the CFA at the time of this report. As seen in the timeline (see section 4.1.1), there were several changes that occurred after the Ash Wednesday fires that all focused on fire prevention and preparedness in respect to the community. One of the main changes that occurred in the past twenty years was the creation of a separate Community Safety Directorate. At the time of the Ash Wednesday fires, the community safety activities were part of the Operations Directorate under fire protection and research with a total of six personnel. With a director of community safety, the CFA has a team of forty four personnel that focus on how to better educate the community on bushfire risk to ultimately reduce the fire damage.

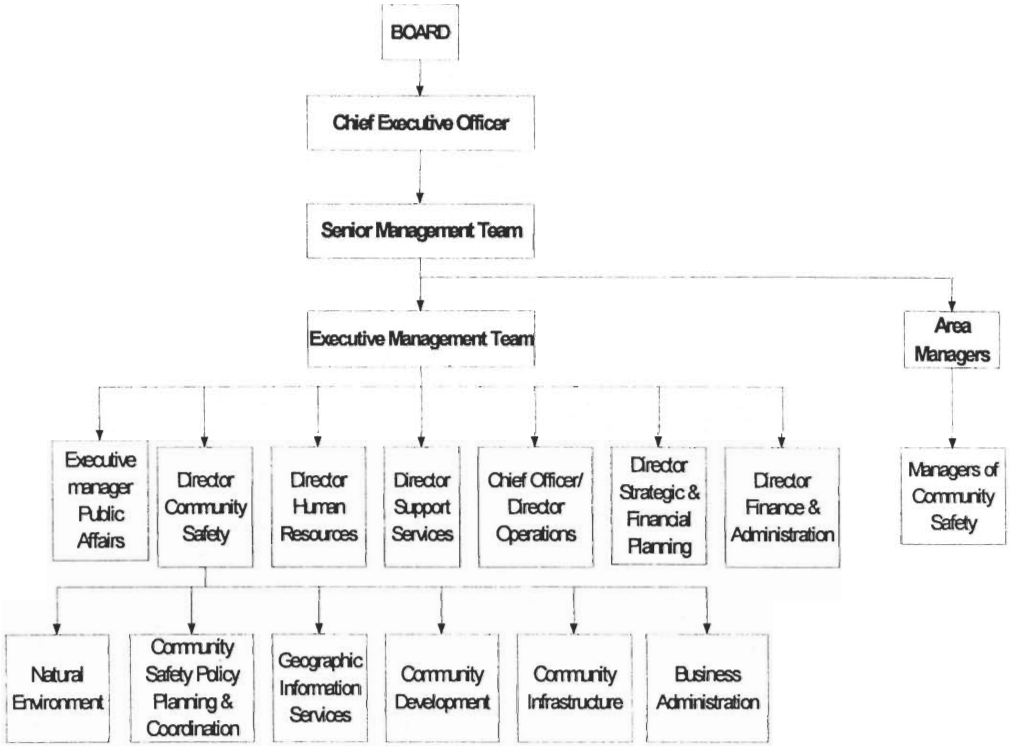

Figure 5 - Organizational Structure of the CFA

4.1.3 Program Matrix

In order to determine the effectiveness of a given program, the CFA has created a logic matrix for each program. This matrix provides a list of expected outcomes and performance measurements to assess the results. A hierarchy of outcomes is used to determine the extent of increased public awareness starting from the basics of what can be measured. The logic behind this hierarchy is that as more resources are allocated to a given program, more people will become involved, and more education in bushfire safety will be provided to increase community awareness (CFA Logic Matrix-CF). A condensed form of this matrix was created to identify factors that contribute to the success or failure of a program.

Program	Target Audience	Performance Measurement	Outcomes
Community Fireguard	High Risk areas	# of groups	Self-reliance, bushfire strategies
Brigades in School	Primary school: (grades P-6)	# of schools # of sessions	Increase fire safety knowledge
School Curriculum Materials	Junior Fire Safe: (grades P-2) Fire Safe: (grades 3-6)	# of schools # of resources	Increase fire safety knowledge as part of school curriculum
Summer Campaign	Specific to campaign	# of meetings/ activities	Increase bushfire awareness/ prevention
Land Use Planning	Residents in interface	# of meetings	Deliver planning provisions to communities
JVDP	Youth	# of activities	Increase fire safety and responsibility

Table 1 - General Program Matrix

With these programs currently running in tandem, an evaluation of individual programs was difficult. If performance measures were tabulated over the course of the program, starting with its implementation, a more effective analysis would have been completed. In regards to this, a general evaluation was performed on the overall effectiveness of all programs working together to reduce the amount of fire damage.

Community Fireguard works to produce self-reliant groups educated on bushfire survival in high-risk areas of Victoria. Since it is relatively impossible to quantify the amount of knowledge gained by an individual, the number of groups formed was analyzed to determine the effectiveness of the program in distributing information. Brigades in School and School Curriculum Materials seek to deliver adequate fire safety knowledge to schoolchildren. In order to measure the effectiveness of these programs, the number of schools involved helps to show the amount of knowledge being delivered to children. By reaching more children through these programs, the higher the chances the children retain the presented information.

In regards to the Bushfire Blitz program, the major program of the Summer Campaign, it was rather difficult to separate out the individual activities. The number of Bushfire Blitz meetings preformed each year was used to measure the success or failure of the program. As more people were reached through the program, the chances of information retention increased throughout the entire population.

It is impossible to separate the individual programs, because each program operates in conjunction with the others. The hierarchy of outcomes provided a possible solution to this problem. Although this process was not perfect it did allow for a general program evaluation.

4.2 Statistics

In order to provide quantitative support for the results of the qualitative analysis, various statistics were collected. These include fire damage statistics to be used in a comparison of the results of fires before and after the implementation of significant programs. Statistics regarding the activity of the Community Fireguard program were also collected to describe the evolution of this program and its response to fire events. The analysis of these statistics formed an important component of the evaluation of the CFA's bushfire safety programs during the past twenty years.

4.2.1 Fire Statistics Table

Fire	Population	Dwellings
February 16, 1983 Ash Wednesday	31,119	14,042
Dandenong components	13,998	1,620
January 14, 1985	13,908	3,767
December 27, 1990	1,755	1,398
February 25, 1995	2,201	858
January 20, 1997	8,038	4,210
Dandenong components	5,903	2,405
March 22, 1998	2,574	940
January – February 2003	17,973	5,984

Table 2 - Census Data

Fire	Cities	Area (ha)	Deaths	Houses	FDI
February 16, 1983	Beaconsfield Upper/Belgrave Heights	9,200	21	238 (other buildings)	-
	Cockatoo	1,800	6	307 (other buildings)	-
	Monivae	3,181	0	3	-
	Branxholme	200	1	1	-
	East Trentham/Mt. Macedon	29,500	7	628	-
	Otways	41,000	3	729	103
	Warburton	40,000	0	27	-
	Cudgee/Ballangeich	50,000	9	157	-
January 14, 1985	Maryborough/Avoca	51,000	1	76	60-90
	Little River	8,700	2	6	40-90
December 27, 1990	Strathbogie	25,000	1	16	-
February 25, 1995	Berringa/Enfield	11,000	0	10	61
January 20, 1997	Kalorama	30	0	2	37
	Ferny Creak	140	3	33	50
	Upwey	208	0	5	40
	Creswick	1,919	0	0	55
	Mt. Martha	36	0	0	46
	Langwarrin	60	0	0	32
	Arthur's Seat	111	0	0	71
	Heathcote	231	0	0	37
March 22, 1998	Spring Hill	2,800	0	11	75
January - February 2003	Gippsland	1,126,229	0	41	-

Table 3 - Fire Data

The Census Data table (Table 2 - Census Data) provides a description of the number of people affected by each fire. The population and number of dwellings for

the area are presented in order to determine the number of people who lived in the fire area and the number of dwellings that were threatened (Commonwealth Census 1996). This data was used to compare the damage from each fire relative to the number of people and amount of property at risk.

The Fire Data table (Table 3 - Fire Data) describes the area burnt by each fire, the number of human fatalities, and the number of houses destroyed. This data provides a quantitative description of the damage from each fire. Such a description allowed the comparison of the damage caused during each fire event.

The Fire Danger Index (FDI) describes the conditions involved in the ignition of each significant bushfire. It provided a description of the environmental conditions preceding the ignition, including such factors as air temperature, relative humidity, average wind speed and the extent of drought conditions (Luke and McArthur 114). This data allowed comparison of fires that occurred under similar environmental conditions.

4.2.2 Program Statistics Table

Year	Number of Community Fireguard groups
1992/1993	3
1993/1994	18
1994/1995	76
1995/1996	104
1996/1997	156
1997/1998	421
1998/1999	608
1999/2000	701
2000/2001	857
2001/2002	938

Table 4 - Community Fireguard Group Formation

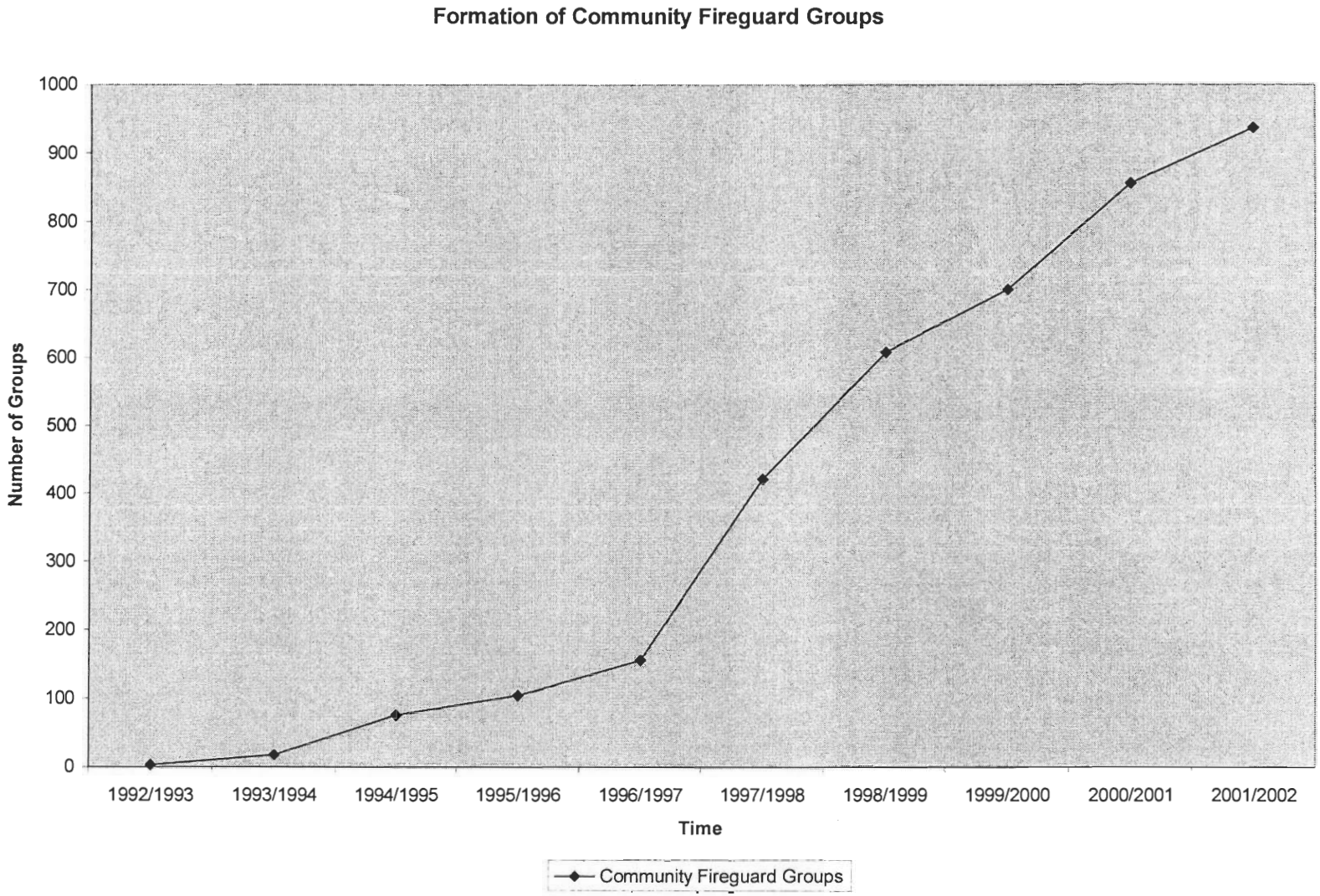

Figure 6 - Plot of Community Fireguard Group Formation

The Community Fireguard group formation data provides an indication of the effectiveness of the program at reaching residents in bushfire-prone areas. The above table (Table 4 - Community Fireguard Group Formation) presents the number of Community Fireguard groups active in each year from the programs inception until the 2002 fire season. Figure 6 provides a useful graphical representation of this data. This shows the growth of the program over the past ten years.

4.3 Previous Evaluation of Community Fireguard

Beginning in 1996, Dr. Bernd Rohrmann of the University of Melbourne's Psychology department conducted a longitudinal study of the CFA's Community Fireguard program (Rohrmann Community-based). The study sought to evaluate the CFA's bushfire preparedness program in terms of their impact upon both the community and CFA personnel. It employed personal interviews using a standardized questionnaire (Rohrmann Community-based). The questionnaire involved multiple items targeting each individual measurement (Rohrmann Community-based). Aside from demographic information, these measurements included; the residents' awareness of the bushfire risk, level of previous knowledge regarding bushfire safety, expectations of the CFA in the event of a bushfire, extent of involvement in the Community Fireguard group, intention to participate in the future, and a general evaluation of program activities, materials and staff. The researchers interviewed one hundred ten residents who were previously involved in the Community Fireguard Program as well as one hundred twenty six residents from high-risk areas that had no Community Fireguard groups.

In the second part of the study, researchers contacted twenty one residents from the original sample who had been involved in the new community fireguard

groups and thirty six who had not. Researchers then repeated the interviews with this sample. As part of a sub-study, researchers also interviewed thirty residents exposed to the bushfires in 1997 and twenty CFA Community Fireguard personnel (Rohrmann Community-based). This type of study is useful in an evaluation of the CFA's programs, because it provides a quantitative measurement of actual knowledge.

4.4 Interview Summary

The data that were collected were predominately qualitative in nature. The primary source for this qualitative data was information collected through expert interviews. Interviews were conducted with CFA personnel and volunteers, media outlets and a researcher involved in the field of program evaluation. The following section is dedicated to summarizing the conducted interviews and provides a synopsis of the information that was gained. For a detailed description of all interviews see Appendix B.

4.4.1 Community Safety Interviews

This project concentrated on the community safety approach applied by the CFA, thus it was logical to conduct interviews with members of the Community Safety Directorate. Alan Rhodes, the Director of Community Safety, provided information on the CFA's history and community programs and highlighted major fire events over the past twenty years. Dr. Noreen Krusel, the Manager of Natural Environment, supplied information pertaining to the Land Use Planning program, as well as information about her role in the 2003 fires. Jon Boura, the Manager of Policy Planning and Coordination, provided information on the changes made in the CFA since 1983 and suggested the use of anecdotal information as a means to evaluate community programs. Penny Wolf, the Manager of Community Development,

provided information regarding the various community programs implemented by the CFA, as well as information about the brochures and publications used by the CFA. Kay Hawkins, the Youth Program Director and a Community Fireguard Facilitator, discussed information on Community Fireguard and some strengths and weaknesses of the program.

4.4.2 Geographic Information Systems (GIS) Interviews

Interviews were conducted with Mark Garvey and Ron Shamir, both members of the CFA's GIS services. Mark Garvey, the Manager of GIS, provided access to the GIS database for the retrieval of electronic maps, census data and fire statistics. Ron Shamir, a GIS Analyst, presented the modeling aspect of GIS as is relates to community safety and some basic information on the science of bushfires.

4.4.3 Gippsland Area Interviews

Interviews were conducted with Ian Symons and Murray Ravenhall, both members of the CFA in the Gippsland region. Ian Symons, the Gippsland Area Manager, supplied information pertaining to his experience with the CFA over the past thirty years and his role as an area manager. Murray Ravenhall, the Community Safety Manager for the Gippsland region, provided a wealth of information about the Community Fireguard program, the implementation of the various community programs and the recent developments in community safety as a product of the 2003 fires.

4.4.4 Media Relations Interviews

In order to get a view of the CFA from the public's perspective, interviews were conducted with John Tindall and John Schauble. John Tindall, the Manager of Communications Services of the CFA, provided insight in the media campaigns and

the use of CFA publications in the community programs. John Schauble, a journalist for *The Age* and CFA volunteer, presented his experience with the CFA and the evolution of the Community Safety Directorate over the years he has been involved.

4.4.5 University of Melbourne Interview

An interview was conducted with Dr. Bernd Rohrmann of the University of Melbourne's Psychology Department to discuss the findings of his studies conducted on the CFA. The studies of interest to this report are those that evaluate the CFA's approach to educating the public and broadcasting the messages of the CFA. The interview discussed some of the major findings of his evaluations, including the evidence of success in educating the public through the Community Fireguard program.

5 Analysis

5.1 Fire Comparison

A list of major fires was constructed (see section 4.1.2) based on the information collected through the interview process (see section 4.4 and Appendix B). Using certain characteristics of the fires, a series of comparable fires were examined in an effort to form conclusions about the success of community programs. The characteristics used to compare fires include; Fire Danger Index (FDI) value and the geographic location of areas affected by the fire events. Additionally the fires of 1983 and 2003 were compared, because they formed the beginning and end points of this analysis.

Upon completion of the data collection process, these fire characteristics were compared to identify fires with similar features. This established some time frames, with the earlier fire forming the starting point and the more recent fire creating the end point. After the time frame was established, the fire safety programs implemented between the two fire events were identified. Based on the fire damage, structures destroyed and fatalities, the success of the programs implemented in the time frame were evaluated. For example, a decrease in lives lost or structures destroyed may indicate that a program was successful in educating the public, and ultimately in reducing the fire damage. The following sections detail the analysis of the identified major fire events and the data collected for each conflagration.

Due to the fact that this report concentrates on evaluating the performance of community programs, the population of an area must be taken into account. Fires that affect a large number of people generate the interest of everyone involve, including the media (Symons). As the number of people affected by fire increases, the possibility of personal property (structures and land) being destroyed along with the

chances for loss of life both increase. Since population plays a key role in the risks associated with a fire and the possibility of fire damage, it was incorporated in this evaluation.

The fires compared in this analysis often occurred on vastly different scales in terms of the number of residents and dwellings that were threatened. In order to compensate for this effect, appropriate ratios were developed. The first ratio, alpha (α), is a percentage of the total population that lost their lives in the fire. This value was determined by dividing the number of human fatalities from a fire by the total population of the fire area as obtained from the census data (see Table 2). The ratio was then converted to a percentage and reported in the analysis. It did not factor in firefighter deaths, because the concentration of this project was on the community safety approach. The second ratio, beta (β), is the percentage of total threatened dwellings that were destroyed by the fire. This value was obtained by dividing the total number of houses destroyed by the fire by the total number of dwellings in the area as reported in the census (see Table 2) and then converted the result into a percentage.

5.1.1 Geographic Comparison

Fires which burned in the same geographic region would have encountered similar fuel types, fuel loading patterns, types of vegetation, local weather patterns and population density and therefore provide a useful means of comparison. This helps eliminate inconsistencies in the data due to these factors because fires in similar geographical settings are likely to witness little or no variation over the relatively short time period (the twenty years since 1983).

One factor that affects the spread of a fire is the slope or geography of the land. The steeper the landscape is, the faster the fire can spread uphill. This is due

the fire heating and drying the land above it, creating the dry fuel the fire needs to grow (Symons). Analyzing fires with similar landscapes eliminates the need to factor in this variable.

Another factor that affects the spread of fire and ultimately its size is the type of vegetation in which the fires burn. Different materials burn at different rates; the same is true for vegetation. The available fuel in the Australian forest is different then that found in the forest of North America, as the eucalyptus plants of Australia burn differently than the leaves of maple trees found in North America (Garvey interview). This phenomenon provides a logical means of comparison.

Another variable that can affect the spread of a fire is the climate and weather patterns of the region. Obviously the drier the climate, the drier the available fuel will be, thus increasing the possibility of ignition. The weather patterns and climate conditions in the studied areas have not had noticeable changes during the relatively small time period that this report concentrates on (Garvey interview). Changes in climate require extended periods of time, much longer than the period studied in this report, in order to produce a noticeable change.

5.1.1.1 Ash Wednesday (Dandenong) '83 and Dandenong '97 Fires

A general comparison of the 1983 Ash Wednesday fires to the significant fires that occurred on 20 and 21 January 1997 in Victoria was completed because the two fires occurred before and after the CFA's adoption of the community safety approach.

Date of Fire	Area (ha)	Deaths	Structures	Actual Population	α Value	Number of Dwellings	β Value
1983 February 16th	210,000	33	2,090	31,119	0.11%	14,042	15%
1997 January 20-21st	2,737	3	40	8,038	0.037%	4,210	0.95%

Table 5 - 1983 and 1997 Fire Comparison

Ash Wednesday did have a higher α value (0.11% compared to 0.037%), although the 1983 fires did cover a much larger area, much of which was far removed from the

Dandenong Mountain Range. To better interpret the results of these two different fires, the portion of the 1983 and 1997 fires that occurred in the Dandenongs was compared. As seen in the chart the α and β value is still higher for the Ash Wednesday portion of the Dandenongs.

Location	Area (ha)	Deaths	Structures	Actual Population	α Value	Number of Dwellings	β Value
1983 Dandenong	11,000	14	545	13,998	0.10%	1,620	10%
1997 Dandenong	364	3	40	5,903	0.05%	2,405	2.2%

Table 6 - Dandenong 1983, 1997 Fire Comparison

5.1.1.2 Comparison of 1985, 1995 and 1998 Fires.

The fires of 1985, the 1995 Berringa/Enfield fires and the 1998 Springhill fires all occurred in neighboring towns. The fires also provided a substantial amount of time between them in order to observe changes in community preparedness.

Location	Area (ha)	Deaths	Houses Destroyed	Actual Population	α Value	Number of Dwellings	β Value
1985 January 14th	61,560	3	95	13,908	0.022%	3,767	2.5%
1995 Berringa/Enfield	11,000	0	10	2,201	0%	858	1.2%
1998 Spring Hill	2,800	0	11	2,574	0%	940	1.2%

Table 7 - 1985, 1995 and 1998 Fire Comparison

The α values for the two most recent fires (1995 and 1998) were 0%, since there were no fatalities in either of these fires. The α value for the 1985 fires however, was 0.022%. The more recent fires did not burn as much land or destroy as many homes. The β value for the 1985 fires was 2.5%, but the β value for both 1995 and 1998 was 1.2%.

5.1.2 Fire Danger Index Comparison

The January 14, 1985 fires and the January 20, 1997 fires had similar FDI ranges. Other fires also had comparable FDI values, but had either already been compared or were not spaced far enough apart to demonstrate an accurate measurement of changes in community preparedness.

Date of Fire	FDI	Area (ha)	Deaths	Structures	Actual Population	α Value	Number of Dwellings	β Value
1985 January 14th	40-90	61,560	3	95	13,908	0.022%	3,767	2.5%
1997 January 20th	32-71	2,737	3	40	8,038	0.037%	2,405	0.95%

Table 8 - 1985 and 1997 FDI Comparison

The 1985 fires have a slightly lower α value, 0.022%, when compared to the 1997 fires, 0.037%. This could be explained by the very small number of people that were involved in the 1997 fires. However, the β value is 0.95% for the 1997 fires, compared to 2.5% for the 1985 fires. This shows that although the 1997 fires burned a smaller area of land, the fires took place in a more populated area.

5.1.3 Ash Wednesday 1983 and Northeastern 2003 Fires

In order to examine the changes over the last twenty years a comparison between the Ash Wednesday fires and the 2003 fires was completed. This comparison was done because the events occurred on opposite ends of the timeline (see section 4.1.1) and therefore allow a means for evaluation of all the community safety programs that have been implemented over the past twenty years.

Fire	Area (ha)	Deaths	Structures	Population	α Value	Number of Dwellings	β Value
1983 Ash Wednesday	210,000	34	2,090	31,119	0.11%	14,042	15%
2003 NE Fires	1,126,229	0	41	19,001	0%	5,984	0.69%

Table 9 - Comparison of 1983 and 2003 fires

The Ash Wednesday fires did have a considerably higher α value (0.11%) when compared to the recent fires that did not include any fatalities. The β value for Ash Wednesday was also much higher with an α value of 15% compared to the extremely low value of 0.69%. These comparisons of relative fire damage (α and β) were later utilized to evaluate the effectiveness of the CFA's programs in reducing fire damage.

5.2 Analysis of Program Data

The data regarding the number of Community Fireguard groups registered each year (see section 4.2.2) indicates a constant increase in the number of active groups. Table 10 presents the number of new groups that were formed in each year that the program has been in operation. While the extent of increase varies from year to year, there has been a general increase in the number of new groups. It becomes clear when examining the plot of this data (

Figure 7 - Plot of New CF Group Formation) that in certain years, the number of newly registered groups was considerably higher than would be expected from the general trend. This occurred during the 1997/1998 fire season and again to a lesser extent during the 2000/2001 fire season.

Year	Number of New Community Fireguard Groups Formed
1992/1993	3
1993/1994	15
1994/1995	58
1995/1996	28
1996/1997	52
1997/1998	265
1998/1999	187
1999/2000	93
2000/2001	156
2001/2002	81

Table 10 - New Community Fireguard Groups

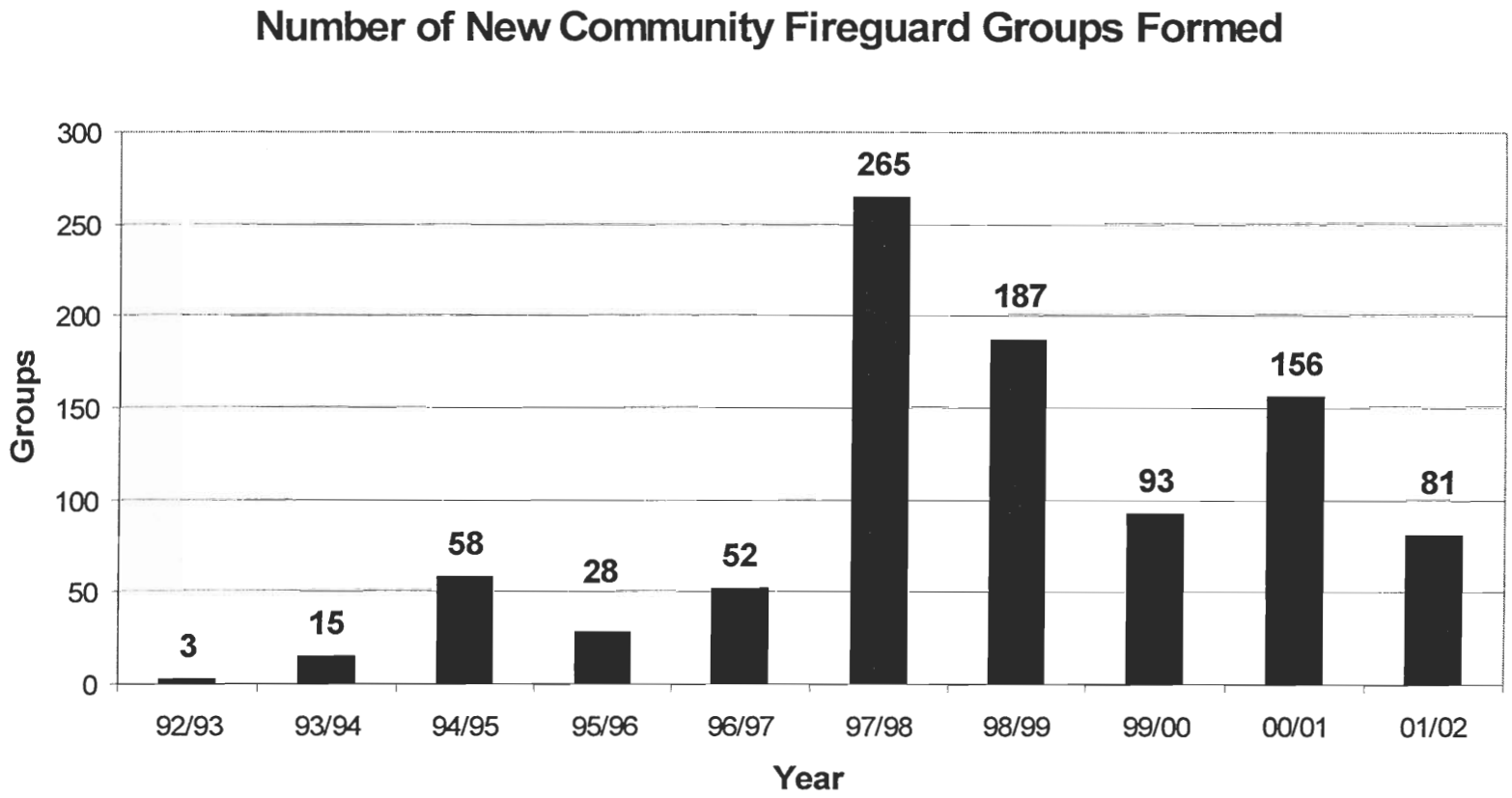

Figure 7 - Plot of New CF Group Formation

5.3 Previous Evaluation of Community Fireguard

Dr. Rohrmann's study (see section 4.3) found that residents in general were aware of the bushfire safety risk and demonstrated a moderate level of bushfire safety knowledge. Residents tended to read applicable printed materials and seek more information. After participation in the Community Fireguard program, the residents were less inclined to obtain new information. As a whole, participants attributed more of the responsibility for their own bushfire safety to themselves and their communities after participation in the program, rather than to the CFA. Most participants also indicated that they would seek further Community Fireguard involvement, though participation tended to decrease as the requisite effort increased (Rohrmann Community-based).

The sub-study involving CFA personnel also provided some useful results. The CFA personnel tended to describe the residents as less knowledgeable about bushfire safety and less prepared for a bushfire than did the residents in their self-assessments. CFA personnel showed strong support for the Community Fireguard Program. They particularly noted that active guidance from trained professionals was needed to start Community Fireguard groups and cause residents to begin to take responsibility for their own bushfire safety (Rohrmann Community-based).

5.4 Qualitative Analysis of Interview Data

Interviews have provided expert opinions and background information necessary for qualitative evaluation of the various programs that have developed over the past twenty years. Due to the difficult nature of reporting on bushfires, interviews have formed the basis for the data portion of this report. The qualitative information collected from interviews was imperative to this report since it provided expert

opinion of community programs and a description of the changes made by the CFA since Ash Wednesday. What follows is the qualitative analysis of the information and data collected during the interview process (for specific interviews, see section 4.4).

5.4.1 Content Analysis of Expert Interviews

Community Fireguard was the most frequently discussed program during interviews. It was often the first program mentioned when the topic of community safety was presented. The interviews showed that many feel the program has been successful in educating the public, thus helping to reduce the fire damage, specifically the number of fatalities and the loss of personal property (Boura, Hawkins, Ravenhall, Rhodes, Schauble, Symons, Wolf). The Community Fireguard program has also been successful in limiting the amount of dependence the public has on the CFA for overall protection (Ravenhall). The resources of the CFA, geography of the land and the shear size of the fire do not allow the CFA to be "superman in yellow overalls" (Garvey) for this reason it is crucial for programs such as Community Fireguard to be implemented.

Another program that was often mentioned was Bushfire Blitz. Due to the informal nature of the program, it is able to reach a large number of people. It has been successful in increasing the public awareness of the bushfire risk and contributing to the formation of Community Fireguard groups (Hawkins).

In recent years, the collaboration between the Community Safety and Media directorates of the CFA has reached out to the public in more effective ways than ever before (Tindall). The use of newspapers, magazines, radio, television and the internet has allowed the CFA to reach more members of the general public. In return, the media has been able to announce fire warning to affected areas and publicize restrictions put into place by the CFA. During the 1997 fires, the Australian

Broadcasting Corporation (ABC) was used in a call-in program for residents to contact the bushfire experts (Rhodes). In the 2003 fires, *The Age* printed a weeklong series of articles about the bushfire risk and the correct measures for protecting one's home from the devastation of a bushfire (Schauble). Media campaigns like these have enabled the CFA to reach more members of the public and spread bushfire preparedness messages that went unnoticed twenty years ago (Tindall).

The majority of interviews have supported the idea that the community safety programs have been successful in educating the public. In particular, Ian Symons, the manager of the Gippsland area for the CFA, went as far as to say that he feels the reduction in fire damage of the recent 2003 fire was "definitely" a direct result of the success of the community safety programs.

A wealth of information has been gained through the interview process. The interviews provided information to fill gaps in the collected data. Although the use of numerical data may be desired, the value of expert interviews cannot be overlooked and they have provided valuable information necessary for a thorough evaluation.

5.4.2 Anecdotal Evidence

During the interview process, a suggestion was made to incorporate anecdotal evidence to support the conclusions (Boura interview). Anecdotal evidence consisting of stories about the people involved with bushfire as opposed to raw data collected from a fire. Although there are thousands of stories printed in newspapers around Australia about bushfires, stories pertaining to evidence of an increase in bushfire education were of particular interest to this evaluation. Most notable were the stories of the 2003 fire season and the fires around Anglers Rest.

The newspapers of New South Wales (NSW) printed photos of residents on rooftops watering down their homes to protect them from the advancing flames of

bushfires. Photos were also printed in Victorian newspapers of residents doing the same thing, but with one noticeable difference. Residents in NSW were wearing clothing that had little protection from the advancing flames while the Victorian residents were dressing in appropriate protective clothing (Ravenhall). This difference of clothing shows a greater understanding of the risk involved in protecting one's home from a bushfire, something that would have been taught at a Community Fireguard or Bushfire Blitz meeting (Ravenhall).

Another source of anecdotal information supporting the increase in public education was the stories from the Anglers Rest area during the 2003 fire season. Anglers Rest is an area north of Omeo and a region directly impacted by the bushfires of the recent season. The Community Fireguard groups in the Anglers Rest area were well aware of the advancing flames traveling down from NSW and were prepared. They took the appropriate precautionary measures to ensure their homes would be safe from the fires. After the bushfires were extinguished, the residents of Anglers Rest were all able to defend their homes successfully, despite the intense fire activity. Armed with the information gained from community programs and warnings produced by the CFA, the residents were able to save themselves and their property (Ravenhall). It is stories like these that show a strong relationship between the implementation of community programs and an increase in public knowledge.

6 Conclusions

6.1 Discussion of Model

The models mentioned previously (see section 3.1) were used to present the conclusions in an organized manner and show how effective the community safety approach has been over the last twenty years. In order to evaluate the CFA's success, the effectiveness of prevention and preparedness methods was analyzed. Similar fires were compared in order to identify any differences in the fire damage that has been caused by different fires over the last twenty years.

6.1.1 Fire Comparison Discussion

The Dandenong regions of the 1983 and 1997 fires provided relevant evidence to support the model in terms of reducing the amount of fire damage. There was a decrease in the α and β values from 1983 to 1997 (section 5.1.1.1). Many community safety programs were implemented between these two fires, most notably the Community Fireguard program in 1993. Since the main goal of the community safety programs is to educate the community to allow them to protect their homes and themselves, this measurement indicated that the community was better prepared to handle the bushfires in 1997.

There are, however, some issues with this analysis, which must be addressed. The 1983 Dandenong fires took place in one day and burned approximately three times as much area as the Dandenong fires of 1997. Another issue is the difference in the Fire Danger Index values between the two fires. The Dandenong portion of the 1983 fires had a maximum FDI greater than one hundred, while the 1997 Dandenong fires had a maximum FDI of approximately seventy. Though these fires occurred in a similar area, these variations limit the utility of this comparison.

The fire comparison between the three fires, 14 January 1985, Berringa/Enfield 1995 and Spring Hill 1998, provided supporting evidence that the community education programs have been effective. The α and β values (section 5.1.1.2) decreased in the 1995 and 1998 fires as compared to the values of the 1985 fires. In the ten years between the 1985 and 1995 fires, Project Fireguard and the Community Fireguard program were implemented. Between the 1995 and 1998 fires, the Bushfire Blitz program was launched. The problems existent in the previous comparison were also evident in this comparison. The 1985 fires covered a larger area and affected more people than either the 1995 or the 1998 fires. Despite these limitations, the figures indicate that there was a reduction in fire damage between 1985 and 1998, supporting the idea that the community programs have been effective.

The Fire Danger Index comparison was conducted between the 1985 and 1997 fires. The α value increased slightly from 1985 to 1997, which does not directly support the model in this case. The β values decreased from 1985 to 1997 supporting the model. This could be an effect of implementing community safety programs, such as Community Fireguard, which began in 1993, that educated the public on how to make their houses bushfire safe.

The final bushfire comparison was conducted using the two endpoints of the timeline (section 5.1.3), Ash Wednesday and the 2003 Northeast fires. The comparison was conducted in order to view any significant changes in the α and β values that have occurred over the past twenty years. The α and β values decreased during this time period. These decreases all occurred after the implementation of the community safety programs, showing that as a whole the programs have been effective.

Relating the comparison of the fires over the years (section 5.1) to the model of variables (section 3.1), the increase of prevention and preparedness activities should decrease fire damage. Figure 8 - Major Fires α Value Chart 9 display the downward trend in the α and β values of the major fire events analyzed in this report. This is particularly evident during the last ten years. The CFA has increased public education and this has helped to reduce fire damage as shown by the overall reduction in the α and β values.

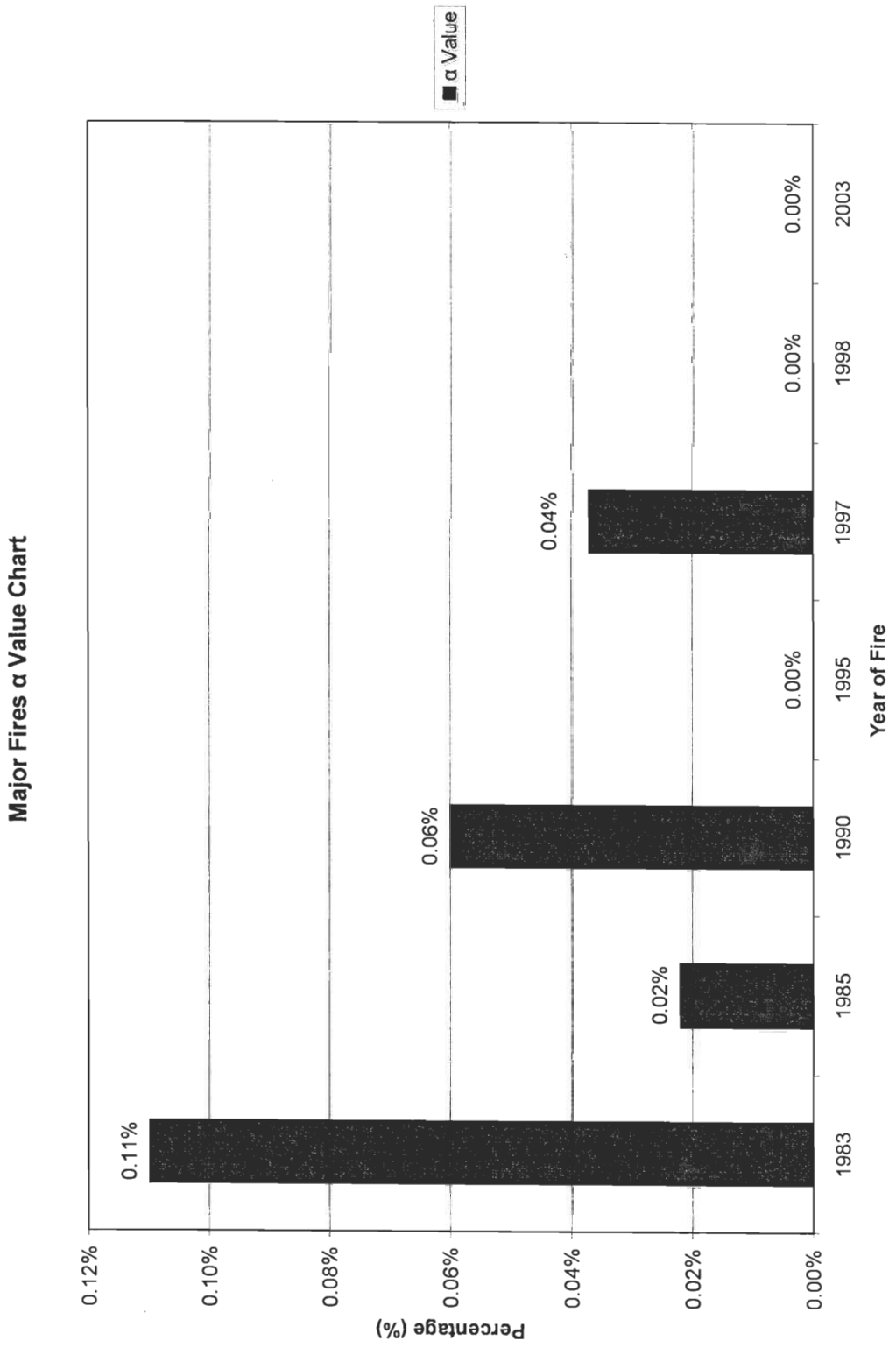

Figure 8 - Major Fires α Value Chart

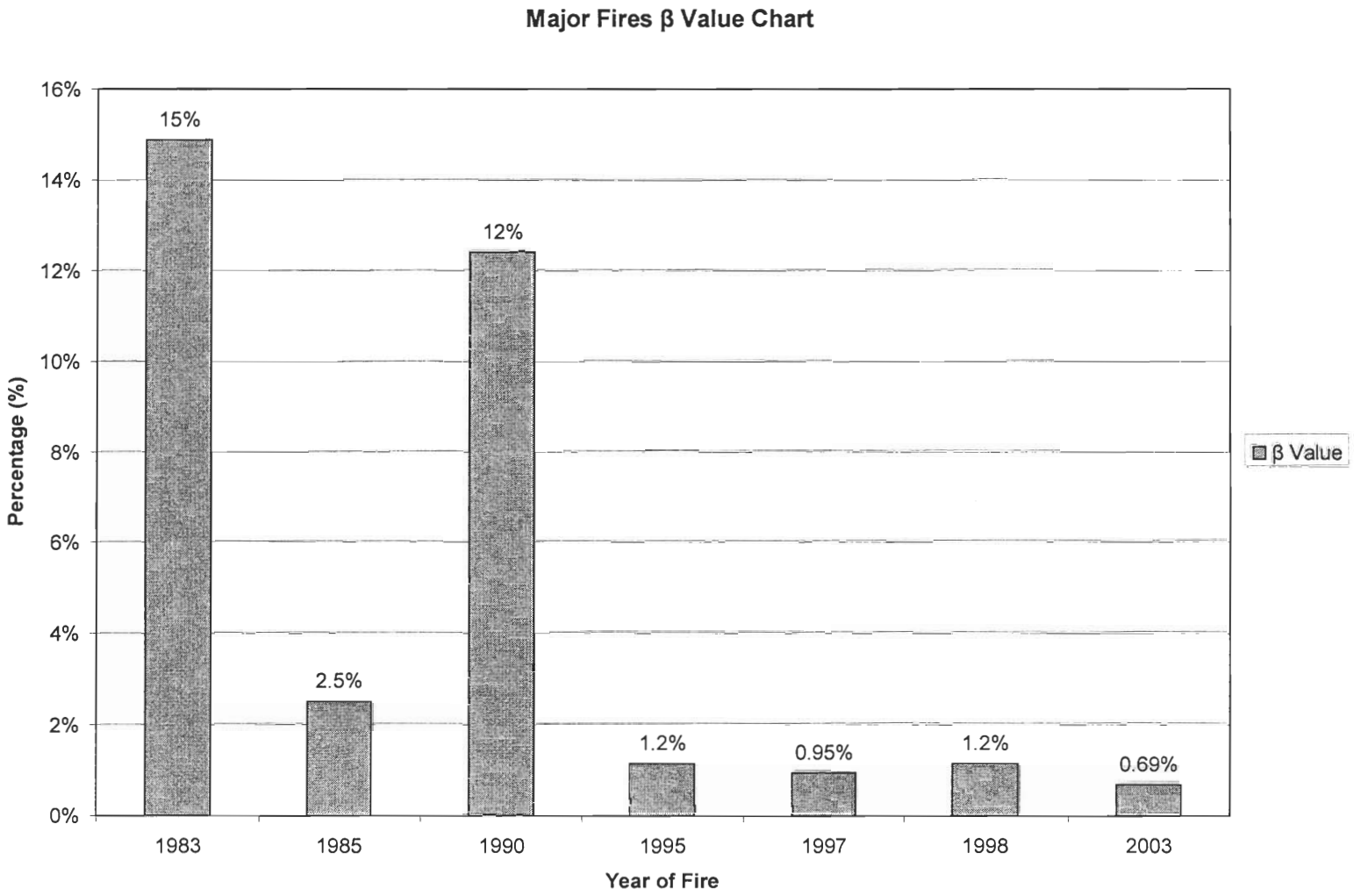

Figure 9 - Major Fires β Value Chart

The comparison of fires is not a completely effective way to evaluate the community safety programs. The geographical comparison (section 5.1.1) did not factor in intervening variables such as wind changes, extreme drought and fuel loads that can elevate the intensity and destructive nature of a fire. In terms of the Fire Danger Index comparison (section 5.1.2) no information on topography was taken into account. An important factor to consider is that each fire is different and each person reacts differently to a fire. A person can be taught all the tools of survival and still make a split second decision that could cause death or loss of property. Despite these limitations, the fire comparisons provide a useful method for quantitative evaluation of the reduction in fire damage.

6.1.2 Program Statistics Discussion

In respect to evaluating the effectiveness of community safety programs, the hierarchy of outcomes used in the Program Logic Matrix is not a direct, conclusive relationship between the allocated resources and the overall decrease in fire damage. However, in terms of a general understanding on the effectiveness of a program the matrix provides the needed steps in order to achieve the desired outcome.

The statistical data regarding the rate of Community Fireguard group formation does not directly measure the effectiveness of the program's goal to reduce fire damage. However, the increasing group formation provided a positive indication that the program was effective at distributing this message. This is a key component of community education. As more people are exposed to the bushfire safety message, there is a greater likelihood that it will affect their behavior. As outlined in the expanded model (see Figure 3), the increase in education tends to decrease the number of fires caused by human carelessness and in doing so reduces the amount of fire damage. The education of residents also reduces fire damage through increased

community preparedness. This preparedness makes homes and other structures more likely to survive a bushfire and therefore reduces the resultant damage. This reduction of fire damage is a key final goal of any bushfire safety program.

The two seasons in which there was a significant increase in Community Fireguard groups formed provide a significant point for analysis. In the 1997-1998 fire season, the increased group formation can be seen as an effect of the recently concluded Dandenong fires. Such a fire event heightens the public interest in bushfire safety. This season also marked the initiation of the Bushfire Blitz program. This campaign suggests that participants may want to form Community Fireguard groups in their neighborhoods in order to obtain more information and create a better prepared community. In the 2001-2002 fire season, fires in the Sydney area received extensive media attention and were the most likely explanation for increased group formation in that season. The increase in the 1997-1998 season was the greater of the two, which seems to support the idea that the Bushfire Blitz program was another effective way in creating an interest in bushfire safety.

The school and youth educational programs can be evaluated in terms of the increase of schools and brigades involved in the different programs. When reading the annual reports after the implementation of the Brigades in School program in 1997, there was written evidence in the increase of participants. In the marked year of 1999-2000, it was noted that Brigades in School was being delivered to most of the state schools (Annual Report 1999-2000 12). The Youth Development program shows the same sort of written evidence of an increase in the number of brigades offering activities for the program. In the 1998-1999 year, the "Bushfire Action" summer campaign involved 148 brigades and included multiple youth development activities (Annual Report 1998-1999 17).

One concern is that the community as a whole is not homogeneous. The reaction of one participant will not necessarily be the same as another. Participants have their own values and circumstances that will affect the overall effectiveness of a program. As stated before, the matrix provides a general procedure to evaluate a program, but in order to gain a more conclusive evaluation a "two-way communication" (Petris 24) between the community and the CFA needs to be included. A communication will allow the CFA to take into account personal feedback and a better idea of what the community is lacking and find ways to educate in those areas lacking.

6.2 Previous Evaluation of Community Fireguard Discussion

The study conducted by Dr. Bernd Rohrmann on the Community Fireguard program sought to analyze the effectiveness of the Community Fireguard program using various surveys and open-ended questions. Due to time constraints and limited resources, further surveys could not be conducted for this research project. Instead, the basic conclusions of Dr. Rohrmann's research have been incorporated and provided a useful indication of program effectiveness. As discussed in the interview summary (see section 4.4), some methodological problems existed which prevented the evaluation from forming definitive conclusions. However, the conclusions that were reached agree with the results of other analyses within this report and as such provide further support.

The study concluded that the need for community preparedness programs and their capabilities to increase preparedness were evident. Community Fireguard received praise for the content and the way the program was delivered. The program helped the participants accept the responsibility for themselves and personal property, in the event of a bushfire with the knowledge that the CFA cannot always defend

individual houses. There was also an increase in bushfire preparedness, whether in perception of risk or overall knowledge of bushfire behavior (Rohrmann Community-based). These conclusions relate to the Model of Variables (section 3.1) in that the increase in bushfire education will in turn decrease the overall fire damage.

6.3 Qualitative Analysis of Interview Data Discussion

The qualitative analysis of interviews conducted with experts regarding the CFA's programs provides a powerful indication of the effectiveness of these programs. In every interview, it was indicated that these programs appear to be effectively spreading the CFA's bushfire safety message to the public. It was also indicated that the preparedness practices taught by these programs do indeed protect the home from a bushfire and that after proper preparation, remaining at home during a fire can greatly increase the chances of survival of both the structure and its residents. This can be seen in the model (see section 3.1) where the increase in effective preparedness methods can decrease the extent of fire damage. The agreement of expert opinions, while not entirely conclusive, provides significant support for the idea that these programs are achieving their desired outcomes.

7 Recommendations

Based on the research findings and problems that were encountered over the course of this project, recommendations for the future have been created and are presented here. These recommendations will first and foremost provide guidance for future improvement of the CFA's programs.

The primary obstacle faced in conducting this research was the lack of appropriate data collected concerning the performance of the CFA's programs and the lack of a standardized procedure for accessing this data. In order to allow for performance evaluation, each current program and any future programs should be accompanied by criteria for evaluation of its success. This should be based upon the stated program goals and include a list of data needed to verify completion of these outcomes. This data should be collected in a standardized format and stored in a central database. Such a system would allow for periodic reports of a program's status. W.H. Mason from the Tasmania Fire Service wrote a paper on the Community Fire Service in Australia and expressed the need of a long-term strategic plan that would analyze the program's priorities to the outcome evaluations. This type of ongoing evaluation system is necessary for efficiency in program development.

One particular component of this data collection system should include financial data. Data detailing the amount of funding spent to operate each program should be recorded in the same central database. This would allow the determination of the cost effectiveness of each program. Such a system would provide the CFA with a means of gaining the greatest possible benefit for its program expenditure.

The need to inform an endangered community of a bushfire's advance is an issue that needs to be addressed. This was particularly evident during the 2003 fires

of northeastern Victoria as increased warning before a fire's approach allowed extensive preparation of the threatened communities (Ravenhall). Many members of these communities were then able to remain and successfully protect their homes. The Community Fireguard groups and Bushfire Blitz meetings prepare the community for a bushfire event, but when a fire arises, much of the community is still in danger because they have no information on to the location, size, and direction of the fire front. In many cases, the media in some form of TV or radio broadcast provides the first warning of a bushfire (Boxelaar 24). The accuracy of these reports depends on how and when the information was gathered by the media.

In order to improve the accuracy and timeliness of fire information reports, it was recommended by Lucia Boxelaar and Samantha Reinholtd, authors of *Community Safety Research and Evaluation Report*, a community-based information system be incorporated into the operations' incident reporting system (Boxelaar 39). This would create more coordination between the Operations directorate dealing with the fire and the community safety directorate preparing the communities involved. It would significantly increase the accuracy of the fire information and could provide specific reports for different areas. A community phone tree could be included with this system (Ravenhall), as well as a public access to pertinent fire information on the CFA website.

8 Appendix A

History of the CFA

In 1939, the fires of "Black Friday" burnt approximately 1.5 million hectares (3.7 million acres) and killed more than seventy people in Victoria. The Royal Commission brought forth a plea to organize all the fire efforts in the Victoria area. These fires became a turning point of fire suppression efforts, and resulted in greater emphasis on public awareness and organization. In 1945, the Country Fire Authority (CFA) was formed by the Victorian government as a response to the destruction cause by the "Black Friday" fires of 1939. The CFA was created to regulate all fire brigades in the Victoria area, in hopes to prevent another disaster like that of "Black Friday." Once established, the Country Fire Authority produced a stronger and more organized method of fire suppression (CFA History of the CFA sec. 2).

The focus of the CFA is to coordinate the efforts of the volunteer brigades to improve organization and ultimately reduce destruction caused by bushfires. The general duty (mission statement) of the CFA stated in the Country Fire Authority Act of 1958 is as follows:

> "The duty of taking superintending and enforcing all necessary steps for the prevention and suppression of fires and for the protection of life and property in case of fire and the general control of all stations and of all brigades and of all groups of brigades shall, subject to the provisions of this Act, so far as relates to the country area of Victoria be vested in the Authority" (Country Fire Authority Act 1958).

Currently there exist approximately 1200 brigades in Victoria, which are divided into one hundred and forty three groups based on location. The one hundred and forty three groups make up the twenty different fire brigade regions of Victoria. These twenty groups are supervised by one officer who must report to the CEO in the CFA headquarters in Melbourne. This provides the structure needed to support the 63,000 volunteers of the CFA (CFA History of the CFA sec. 3). An understanding of the history and structure of the CFA is necessary to create an appropriate perspective for evaluation of its policies.

9 Appendix B

9.1 CFA Community Safety Interviews

Alan Rhodes

Name	Title/Position	Date of Interview	Location of Interview
Mr. Alan Rhodes	Director of the Community Safety Directorate	March 13, 2003	CFA Headquarters, Burwood East, Victoria

Upon arrival at the CFA, our first interview was conducted with Mr. Alan Rhodes, the current Director of Community Safety for the CFA. As the Director of Community Safety, Mr. Rhodes oversees programs and policies dealing with community education, risk management and media campaigns. The interview provided a list of contacts in each of the major community programs, including Community Fireguard and Bushfire Blitz. Mr. Rhodes also provided a list of sources for fire data and helped to construct a list of major fire events to be highlighted in this report. The list included the Maryborough/Avoca (1985), Strathbogie (1990), Berringa/Enfield (1995), Dandenong (1997), Linton (1998) and the 2003 fires. Reports for the majority of these major fires were provided by Mr. Rhodes.

The interview also incorporated a discussion about the most recent fires (2003) that burnt areas in the northeastern section of Victoria. The discussion highlighted the changes that have been made in the community approach towards major bushfire events, describing the need for the community to be less dependent on the CFA for support in the event of a bushfire. He mentioned the CFA currently stresses the importance of community preparedness, while in the past the CFA focused more on fire suppression.

Dr. Noreen Krusel

Name	Title/Position	Date of Interview	Location of Interview
Dr. Noreen Krusel	Manager of Natural Environment	March 21, 2003	CFA Headquarters, Burwood East, Victoria

Dr. Noreen Krusel, the Manager of Natural Environment, has experience in the areas of Land Use Planning and the effect fire has on the environment. Dr. Krusel explained the Land Use Planning program, detailing how the program establishes building regulations in areas of high bushfire risk. The program was launched in 1997 and well help in the reduction of the bushfire risk.

Dr. Krusel presented several alternative means in which to evaluate the success of the programs of the CFA. More ways in which to compare fires were also discussed, including the use of fatalities, fires with similar population densities and fires that occurred in the nearby geographical regions. Dr. Krusel suggested that the Spring Hill fires of 1998 and the Maryborough fires of 1985 were comparable, as well as the fires in the Dandenong Ranges in 1983 and 1997. However, it was suggested that due to the lack of consistent statistical information and the fact that no two fires are identical, a purely statistical approach should not be applied to this project.

Jon Boura

Name	Title/Position	Date of Interview	Location of Interview
Mr. Jon Boura	Manager of Policy Planning and Coordination	March 26, 2003	CFA Headquarters, Burwood East, Victoria

Jon Boura, the Manager of Policy Planning and Coordination, discussed some of the political changes that have occurred within the CFA since Ash Wednesday and the importance of anecdotal information to evaluate community safety programs in terms of their reduction in fire damage. In respect to the political aspect of bushfires, the further away the fires are from Melbourne the less media and political attention the fires will receive. The Ash Wednesday fires were extremely close to Melbourne and therefore forced the state government to recognize the need for changes to occur

in preparing the community. However, there were major fires before that received little attention because they were farther away from the city and did not endanger the urban settlements. In many incidences, it is the political issues that produce public outcry and assist to create changes in bushfire programs and strategies.

Mr. Boura stated that the Ash Wednesday fires confirmed what the CFA already knew, in that the community was poorly educated in bushfire risk. In order to evaluate the change in knowledge of the community, the input and outputs of the CFA need to be linked with the actual outcome. In order to do this, a risk assessment could be done every few years to discover the reduction in risk with the implementation of new services delivered. Since many facts concerning the bushfire risk in a particular area will be hard to collect, anecdotal data could be gathered from interviews and media coverage to provide enough evidence to support the conclusions.

Penny Wolf

Name	Title/Position	Location of Interview
Mrs. Penny Wolf	Manager of Community Development	CFA Headquarters, Burwood East, Victoria

Mrs. Penny Wolf is the Manager of Community Development and is responsible for the implementation and review of community programs geared to educate the public about bushfire safety. Since Mrs. Wolf was the main liaison for this project, she was contacted and interviewed (informally) several times throughout the course of the project.

Although no formal interviews were conducted with Mrs. Wolf, a wealth of information was gained through discussions with her. She supplied several brochures and publications on community programs, such as *Living in the Bush* and *Know You Total Fire Ban District*. She also provided people to contact in each of the main programs.

Kay Hawkins

Name	Title/Position	Date of Interview	Location of Interview
Mrs. Kay Hawkins	Youth Program Director & Community Fireguard Facilitator	April 14, 2003	CFA Headquarters, Burwood East, Victoria

An interview was conducted with Kay Hawkins, the Youth Programs Director and a Community Fireguard facilitator, to discuss her experiences with the Community Fireguard program. In addition to working as a facilitator in the area of Christmas Hills, Ms. Hawkins works to train new facilitators. She provided a useful insight into the philosophies that direct the Community Fireguard program. In 2001, a new training format was implemented. The facilitators now attend a three-day workshop and then a later two-day follow-up session, instead of a single two-day workshop used in the past. This allows time for the facilitators to apply and reflect on the new ideas presented and then return to discuss them further. New training techniques are applied to the facilitator training sessions, which apply the ORID (Objective, Reflective, Interpretive, Decisional) method. This method provides the framework for directing a discussion. It incorporates the ideas of the participants and therefore increases their feelings of ownership of the resulting plan. She noted that it was the reflective stage that was most often overlooked by facilitators and that this stage greatly reduces the group's assimilation of the ideas presented.

Ms. Hawkins discussed some of the strengths and weaknesses of the Community Fireguard program. She saw the main weakness in the confusion over the role of the facilitator. Some facilitators truly involve the group members encouraging them to generate their own ideas, and take an active role in the formulation of the group's bushfire safety plan. This is the goal of both the Community Fireguard and Bushfire Blitz programs. Other facilitators often tend to lecture to the groups. They present the same information repeatedly, but this process is not as effective in generating a behavioral change among the residents. A second weakness was the

lack of refresher training to keep current facilitators updated on new research and allow them to share new ideas. A major difficulty faced by the program is the retention of experienced facilitators who often move on to other paid positions or simply cannot continue to make the time commitment required. Many facilitators are employed on a casual basis or volunteer their services, making it difficult to track the costs associated with the program.

According to Ms. Hawkins, a major success of the programs is seen in the group dynamics that can develop. During the start-up phase, residents may hesitate to show their homes to neighbors, but after the initiation period, residents become more able to seek suggestions from the group. Often, in a successful group, the members build a strong trust and even begin to interact in a social context outside the group. Some groups may even continue to schedule meetings without the facilitator. In 2001, one group in Christmas Hills was able to save a house threatened by fire by putting the plan they developed at the Community Fireguard meetings into action.

9.2 Geographic Information System Interviews

Mark Garvey

Name	Title/Position	Date of Interview	Location of Interview
Mr. Mark Garvey	**Geographic Information Systems (GIS) Project Manager**	**April 3, 2003**	**CFA Headquarters, Burwood East, Victoria**

Mark Garvey, the GIS Project Manager, provided electronic maps for regions affected by major fire events, animations created by the GIS team, information on the science of fires and some preliminary statistical analysis he had completed on several fire events over the past thirty years.

Mr. Garvey explained the difficulty and time consuming process of measuring actual fuel loads of certain areas, thus the importance of the modeling aspect of the GIS team. Since the fuel load is difficult to measure, the geography of the land was suggested as a means of comparison. The slope of the landscape, as well as the

vegetation type, population density and weather patterns were discussed. The type of vegetation in an area is used in the modeling process and a suggested comparison. Different types of vegetation are more flammable than others, thus increasing or decreasing the rate of spread depending on flammability. It was mentioned that the oils found in plants in Australia are different from those in North America and thus have different fire properties.

Mr. Garvey identified several major milestones that have occurred during his tenure with the Authority. He mentioned the extreme operational activity of the CFA in the 1983 and 2003 fire seasons and the lack of activity between those two periods. Having worked in the Research and Development section of the CFA, he witnessed the shift towards a preparedness and prevention focus in the mid-1980s. Instead of the "superman in yellow overalls" motto, the CFA has since publicized the need for each citizen to be more actively involved, as the CFA has recognized that not every person can receive individual attention during a bushfire. It was realizations such as this one that produced programs like Community Fireguard and Bushfire Blitz.

It was also mentioned that the CFA very innovative fire service and specifically "the leader in fire service organizations in Australia." The CFA uses media to instill catch phrases into the minds of Victorian children and adults, something not done ten years ago, was also discussed.

Mr. Garvey also provided the resources to obtain the electronic maps (see maps section) of areas affected by the bushfires discussed in this report. He also provided the resources for much of the census data and information already complied by the GIS team.

Ron Shamir

Name	Title/Position	Date of Interview	Location of Interview
Mr. Ron Shamir	Geographic Information Systems (GIS) Analyst	March 20, 2003	CFA Headquarters, Burwood East, Victoria

Ron Shamir, a GIS (Geographic Information Systems) Analyst, provided a means of comparing fire intensities for a given fire and an up-to-date outlook on the role of GIS with respect to community safety principles. GIS has used its capabilities in modeling and graphics to provide effective visuals of high-risk areas and fire damage in past fires. The construction of fire intensity maps and other modeling techniques are topics that Mr. Shamir believes that will continue to bridge the gap between the Operations and Community Safety directorates.

The GIS department has shifted focus to more of a community safety role in the past few years. Instead of being solely a map producing department, the GIS team uses modeling techniques to determine areas of high fuel load and high-risk areas, in order to help community safety identify high bushfire risk areas and prioritize which regions should receive extra public education.

In direct respect to this project, it was recommended to apply regression modeling, using numbers from an incident database, to analyze the data. However, the database is relatively new and consistent data from the past three years is all that currently exists. With this in mind, it was recommended to look into spans of time, for example breaking the twenty years since Ash Wednesday into five or ten year segments for analysis. In addition, one characteristic that was suggested to use as a means of comparison was fire intensity. In order to find the fire intensity, heat yield, weight of fuel, and rate of spread (Fire Danger Index, fuel load) are taken into account. However, these values are often estimated, which makes accurate results difficult to obtain.

9.3 Gippsland Area Interviews

Ian Symons

Name	Title/Position	Date of Interview	Location of Interview
Mr. Ian Symons	Area Manager – Gippsland Area	April 1, 2003	Port of Sale Business Centre Sale, Victoria

Ian Symons, the Area Manager of the Gippsland region, supplied extensive information about the workings of the CFA over the past twenty years, his personal opinions on the success of the CFA, and the changes they has witnessed since Ash Wednesday. In respect to bushfires prior to 1983, Mr. Symons mentioned that there was a set of fires in 1977 that caused significant fire damage and two firefighter fatalities, but received little publicity. It was not until the Ash Wednesday fires, which were closer to Melbourne and forty-six people died in Victoria, that the media, government, and public were pressuring the CFA to promote community preparedness.

During the recent fires, the town of Omeo had fourteen days to prepare for the fires. This allowed a substantial amount of time to warn the community and prepare them for the upcoming fires. Mr. Symons stated that in the New South Wales fires there were pictures in newspapers of people up on the roofs of houses with t-shirts, shorts, and sandals trying to protect their homes from the incoming fires. While in the Victorian newspapers, the public seemed to be much more prepared, wearing appropriate clothing in order to protect them from the radiant heat. This preparedness included a Gippsland Information Line, where the community could call up and ask for updates in their area. The only problem was that the area was very large and the Information Line did not receive fire information for the entire region in a timely matter. Fuel management was another big focus during the 2003 fires, but caused continued conflict between the conservationists and those in favor of it. The Cooperative Research Centre (CRC), a federally government funded centre, has

started to focus more on fuel reduction, bushfire behavior, community behavior, and planning for the future.

In respect to the Community Fireguard groups in Gippsland, the facilitators use a House Survival Meter created by A.A.G. Wilson. It was used to show the percentage a house had on surviving a bushfire, using variables such as the amount of fuel around your home, the material your home is made of and the geography of your property. Another variable in the Meter was whether the homeowner stayed to protect the home or evacuated. The choice to stay would drastically increase the houses chance of survival if the necessary preparations were done before the fire hit.

The science of bushfires was also discussed. The geography of an area affects the rate of spread, which ultimately affects the amount of fire damage caused by a fire. The slope of the land affect the rate of spread by heating and drying the land ahead of the fire front, producing dry fuel that is conducive to fire. Since the geography of an area is an important factor in the spread of a fire, it was suggested to use as a means of comparison.

Murray Ravenhall

Name	Title/Position	Date of Interview	Location of Interview
Mr. Murray Ravenhall	**Community Safety Manager – Gippsland Area**	**March 31, 2003**	**Port of Sale Business Centre Sale, Victoria**

Murray Ravenhall, the Community Safety Manager for the Gippsland region, provided valuable information pertaining to the implementation of community safety programs and successful tactics used in the most recent fires (2003). Mr. Ravenhall mentioned the troubles in forming Community Fireguard groups due to the lack of resources for such a big area. At this point in time, there are thirty five groups in the area with an expectation of forming six more groups this coming year (2003).

Leading up to the recent fires, a new engagement plan was initiated. This plan included seventy "level one" community meetings that gave a briefing on the fires

and how to prepare for them. There were Bushfire Blitz meetings in the high-risk areas, as well as notices on bulletin boards on current bushfire news. Phone trees were put into place within communities and would be activated by CFA personnel if needed. Once the fires hit, the radio station (ABC) delivered new updates word-by-word from the CFA. There was a Community Information Unit that was established that had direct contact with the Fire Incident Control to get the necessary facts to the community. "Level two" meetings were called into place to inform the community that the fire was going to pass through them, and to either go home and protect their home or evacuate immediately. This engagement plan proved to be very successful in informing the community of the bushfire risk.

In looking toward the future, Mr. Ravenhall stated the need for a better warning system to alert the community and disseminate information regarding an approaching fire. During the recent fires, the CFA was fortunate in that they had plenty of preparation time. Often, however, this is not the case. In order to cope with this, better cooperation between the Community Safety and Operations directorates of the CFA is necessary to facilitate this rapid response.

9.4 Media Relation Interviews

John Tindall

Name	Title/Position	Date of Interview	Location of Interview
Mr. John Tindall	Manager of Communications Services	March 20, 2003	CFA Headquarters, Burwood East, Victoria

John Tindall, Manager of Communications Services, discussed the CFA's role in media relations over the last twenty years, detailing the change towards community preparedness. The public relations department has changed its role in the past years, moving from a broad range of campaign activities to more of publications/media relations focus. The pamphlets are updated on a five-year cycle and are developing a

greater focus on the community being self-sufficient and staying home to protect their property. One pamphlet, *Living in the Bush*, was produced to coincide with the implementation of the Bushfire Blitz program and has proved very useful in informing the community about bushfire behavior.

One of the major milestones in media relations was the change of control of the summer/winter campaign from the public relations department to the community safety department. This change in control allowed for better communication between the two departments.

Another key point is the developing relationship between the media and the CFA. In years past, there was the idea that the media was the enemy, and little communication existed between them. In recent years, more cooperation has occurred with training sessions being conducted for the media about safe on site operation during a bushfire. The CFA personnel are now trained to interact with the media. Both members of the media and personnel of the CFA take part in training seminars aimed to educate those involved on the communication aspect of bushfire reporting and communicating with the public.

John Schauble

Name	Title/Position	Date of Interview	Location of Interview
Mr. John Schauble	Writer for *The Age* & CFA Volunteer	March 28, 2003	Sassafras-Ferny Creek Fire Brigade, Ferny Creek, Victoria

John Schauble, a journalist for *The Age* and CFA volunteer, offered a different perspective on the public knowledge of bushfire risk, and the steps taken to increase this knowledge. Mr. Schauble acknowledged the initiative taken by *The Age* during mid-December this past year to print a weeklong series of articles on bushfire safety. He discussed the advances made through training sessions given to journalists on actual bushfire behavior as well as personal safety on the fire front, to ensure safe and accurate reporting during bushfire events. He also mentioned the tendency of the fire

service to compare each fire season to the 1983 Ash Wednesday season. It was suggested that this often unfounded comparison has dampened the public's attention to the seriousness of bushfires, creating a sense that the fires will never again be as severe as in 1983.

As a CFA volunteer, Mr. Schauble has been working in the Sassafras Fire station in Ferny Creek, an area affected by the 1997 fires. In this area, the population is steadily increasing due to urban sprawl, and about 1/3 of the population is new each year. This creates the issue of how to educate residents effectively when 2/3 of the community already has heard the media campaigns, and 1/3 has limited bushfire knowledge. He mentioned how the pamphlets are becoming outdated and that the Sassafras-Ferny Creek brigade produced their own pamphlet to distribute specific information regarding its area. It was stressed that the key point in educating the community is to be proficient at presenting. He recommended incorporating outside participants such as educators to speak to the community, instead of firefighters who may not always be experienced public speakers. In relation to this recommendation, he noticed that as a Fireguard facilitator, he initiated a number of group formations and kept them going, but when he left to go on sabbatical for a few years, he noticed many of the groups were no longer were active upon his return. This kind of evidence emphasizes the need for an active facilitator that communicates well to the groups to keep them interested and active.

9.5 *University of Melbourne Interview*

Dr. Bernd Rohrmann

Name	Title/Position	Date of Interview	Location of Interview
Dr. Bernd Rohrmann	Associate Professor of Psychology	March 24, 2003	University of Melbourne Melbourne, Victoria

Dr. Bernd Rohrmann is an associate professor at the University of Melbourne and has conducted several studies involving bushfire preparedness. He provided background information on his studies including individual survey statistics and an explanation of some problems with his evaluation of Community Fireguard. This evaluation was funded by Australian research grants, the CFA and the University of Melbourne. The study commenced in 1993, just after the initiation of the Community Fireguard program.

This evaluation sought to measure the change in bushfire preparedness of participants in the Community Fireguard program based on their interview responses. The lack of resources forced the use of a small sample size, which limited the significance of the results. This was particularly true in the later interviews where members of the first group were no longer available, further reducing the sample size. The bushfires in the Sydney area in November of 1997 brought heightened media attention to the issue and this influx of information served to educate the general public about bushfire safety. This reduced the apparent effectiveness of the program by decreasing the difference in bushfire education between the Community Fireguard sample and the control sample. Both samples experienced an increase in bushfire preparedness and a decrease in their reliance on the CFA for protection.

Some psychological effects also contribute to the lack of convincing results. The members of the Community Fireguard groups exhibit self selection in that only those residents who are most motivated and likely already the most prepared tend to request Fireguard group formation. The ceiling effect is also a concern when

examining these results. The same amount of information will create a greater increase in knowledge among a group who are mostly unprepared (the control sample) as compared to a more prepared group (the Community Fireguard sample). Therefore, with the introduction of the media reports on bushfire preparedness, the non-Fireguard sample exhibited a similar increase in knowledge when compared to the Fireguard sample.

The results of the study, while not conclusive, do provide some support for the effectiveness of the Community Fireguard program. When analyzed in terms of the psychological effects it appears likely that the program does indeed lead to an increase in bushfire preparedness among residents. This conclusion also agreed with the philosophies upon which Community Fireguard was based and therefore seemed reasonable on an intellectual level.

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