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## Welcome from Editor

It is my pleasure to bring to you the compiled papers from the Science Day of the AFAC and Bushfire CRC Annual Conference, held in the Sydney Convention Centre on the 1<sup>st</sup> of September 2011.

These papers were anonymously referred. I would like to express my gratitude to all the referees who agreed to take on this task diligently. I would also like to extend my gratitude to all those involved in the organising, and conducting of the Science Day.

The range of papers spans many different disciplines, and really reflects the breadth of the work being undertaken, The Science Day ran four streams covering Fire behaviour and weather; Operations; Land Management and Social Science. Not all papers presented are included in these proceedings as some authors opted to not supply full papers.

The full presentations from the Science Day and the posters from the Bushfire CRC are available on the Bushfire CRC website [www.bushfirecrc.com](http://www.bushfirecrc.com).

**Richard Thornton**

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### Disclaimer:

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# The Complex Network within Bushfire Investigation Strategy

**An international comparative analysis of internal and external dynamics between post-bushfire investigative departments**

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## **Abstract.**

Worldwide, almost 90% of all bushfires can be attributed to human action either unintentional or malicious. In this light, it is evident that all bushfires should be investigated to some level, not just for reconstructing the event of bushfire itself, but also for planning an appropriate bushfire protection strategy through policy and program development.

Unfortunately 40% of all fires attended across Australia do not have a cause assigned by the responding fire and police agencies. This situation is similar to many other jurisdictions around the world.

The investigation of the origin and cause of major fires is a complex procedure undertaken jointly by fire and police agencies and often involving personnel from other organizations such as forensic science and insurance companies.

Given that bushfire has become a devastating global dilemma the opportunity to collaborate with investigators from other jurisdictions in the sharing of data and investigation techniques provides an important opportunity to pool expertise and collective understanding. Unfortunately there is very little evidence of collaboration at either the national- or international-level. Furthermore, even in those cases where state-level collaborations on these events have been developed, it is usually based on informal structures comprising an exchange of information and ideas, rather than a formal system constituted by a sharing of knowledge. Thus, identifying and understanding the opportunities for inter-organizational collaboration, and above all, the likely communicational impediments, represents a key step to improve the integration and application of efficient forensic investigation activities by fire and police agencies.

## Introduction

The incidence and impact of bushfires in Australia and globally has increased over the past several decades to the point that these blazes are affecting approximately 350 million hectares of land a year (FAO 2010) with incalculable costs in terms of lives, nature and properties.

According to the Centre of Fire Statistics (CTIF) at the beginning of the 21st century, the population of the Earth was 6.3 billion, who annually experienced a reported 7 - 8 million fires with 70.000 –80.000 fire deaths and 500.000 –800.000 fire injuries (CTIF 2006).

In this scenario, the population of Europe is 700 million, who annually experience a reported 2 -2.5 million fires with 20.000 –25.000 fire deaths and 250.000 –500.000 fire injuries. In the table below we can see that the European countries most affected by bushfires are in the south of the continent.

**Table 1: Bushfires in Europe (2000-2008)**

COUNTRY	NUMBER	AREA (HA)
Bulgaria	709	15.944
Croatia	4.800	46.926
Czech Republic	933	356
Estonia	143	995
Finland	837	616
France	4.362	22.935
Germany	942	430
Greece	1.765	50.782
Hungary	382	1.889
<b>Italy</b>	7.463	<b>85.047</b>
Latvia	875	1.007
Lithuania	699	367
Poland	10.371	7.566
<b>Portugal</b>	24.819	<b>157.066</b>
Romania	272	1.449
Slovakia	433	570
<b>Spain</b>	18.664	<b>125.687</b>
Sweden	5.290	2.662
Switzerland	62	216
Turkey	2.128	11.067

Source: EFFIS (*European Forest Fire Information System*)

So it is not a mere coincidence the fact that Italy, Spain and Portugal, along with Greece and France, have participated in the European project denominated FIRE 5 (Force d'Intervention Rapide Europeenne 5) to become "experts" in the process of exchanging of information, experiences, knowledge.

In the Southern hemisphere, Australia is also one of the most fire-prone countries on Earth.

Each year 'disaster-level' bushfires (where the total insurance cost of the event was more than \$10 million) cost Australia an average of \$77 million. "In Australia more people were

injured by bushfires than all other disasters combined, creating 48 per cent of the total death and injury cost from natural hazards” (AIC 2004).

Therefore, the management of bushfires represents an extremely significant issue that has social, criminological and environmental consequences. The need to recognise and to actively manage bushfires is an unavoidable step in planning an appropriate bushfire management strategy through policy and program development.

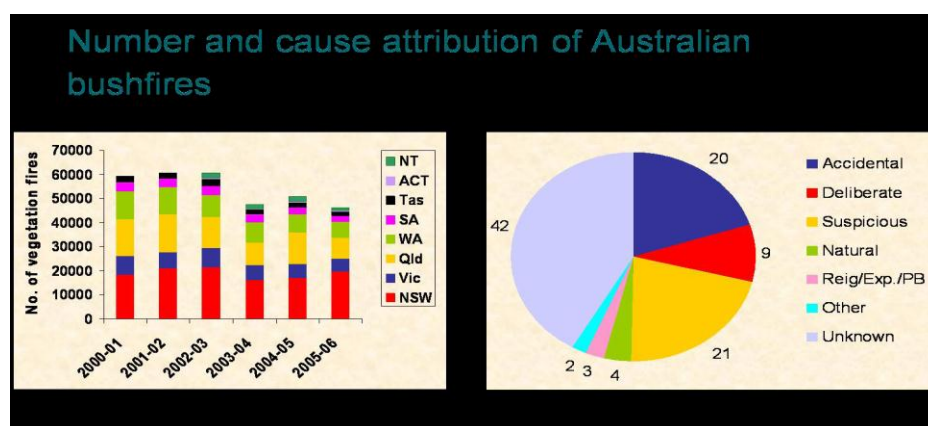
## Context

The forensic investigation of fire is a particularly demanding area of expertise in which managing uncertainty is a relevant element (Biedermann *et al.* 2004). In particular, *the attribution of the causes of fire and, more specifically, the motivations of any individuals involved is a key factor.*

In 2007 the Australian Institute of Criminology completed the classification of the numbers and causes of bushfires in Australia. The final pie graph (Fig. 1) is based on an analysis of nearly 300,000 records from 18 fire agencies over five years, from 2000 to 2006. Nonetheless, the scenario seems to be characterized by a lack of clearness concerning the major causes behind bushfires. As can be seen in Figure 1, the majority of bushfires (42%) does not present a clear cause attribution and are, therefore, defined as ‘Unknown’. The second largest group, representing 21% of all causes, has been classified as ‘Suspicious’. This means that it will be necessary a further investigation carried out by police agencies in order to understand if the fire was ignited either in a deliberate or accidental way. In both cases, it is likely related to human action; these constitute 50% of all bushfire causes. The natural causes represent just the 4% of the total of causes.

**Fig. 1:** Proportion of vegetation fires in Australia by assigned cause

Past data collection in Australia



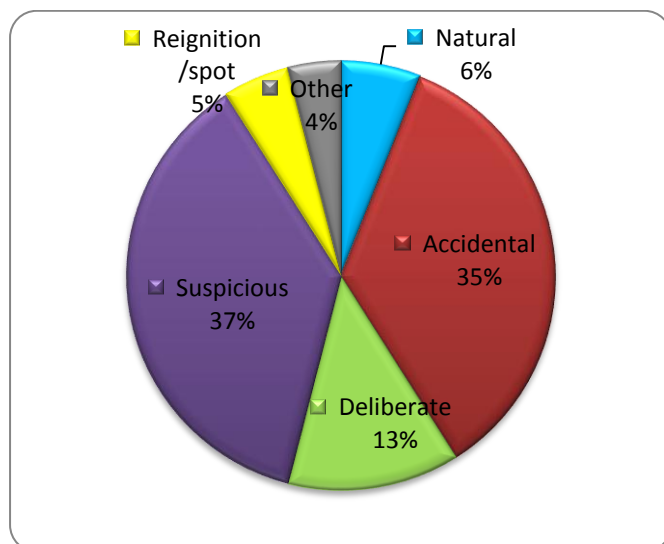
Source: Productivity Commission 2007 (AIC Computer File - Combined Australian fire agencies)

This same classification was rewritten according to the new system of attribution compiled a few years later as shown in figure 2. So, in 2009, the situation appears dramatically changed. Indeed, while both pie graphs show a similar number of ‘Natural’ (6%) and ‘Other’ (4%) causes of fires, in Figure 2 the group “Unknown” has disappeared. Thus, the major

cause is now 'Suspicious' (37%), immediately followed by "Accidental" (35%). If we add 13% "deliberate", 85% of all bushfires are caused by human action – see above.

**Fig. 2:** Proportion of vegetation fires in Australia by assigned cause

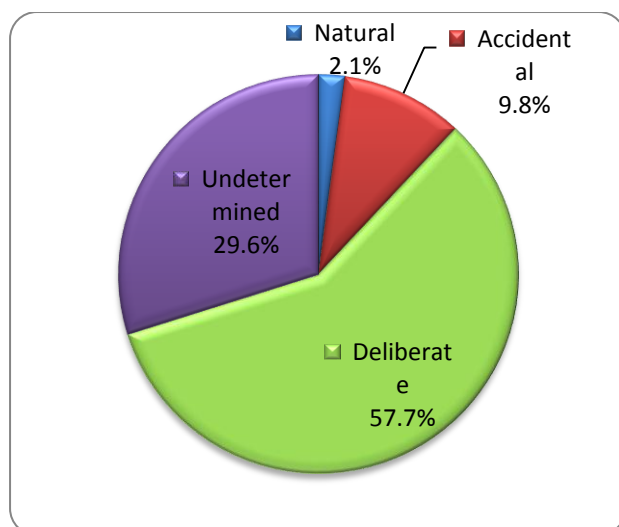
Current data collection in Australia



Source: Combined Australian fire agencies [computer data file], October 2009, AIC.

In terms of causes of fires, we can witness a very similar outcome in Italy. However proportions of attributions appear to be slightly different. As can be seen in Figure 3 (Italian Fire Brigade 2007), this is particularly true for 'Deliberate' fires which, with 58%, represent the major cause of all Italian fires. The second major group, representing almost 30%, corresponds to 'Undetermined' causes. Despite what has been said, however, the cause of the majority Italian fires is to be assigned to human actions (70% approximately). This statistic, indicating that human action is the major cause of fires, is what makes the phenomenon of bushfire a global issue. Even two so different countries, as Italy and Australia, have more similarities than it would appear.

**Fig. 3:** Proportion of fires in Italy by assigned cause



Source: Italian Fire Brigade - 2007

The crucial point is that more than half of all bushfire across Australia do not have a cause assigned or, at the best, they are defined as suspicious or uncertain by the responding fire and police agencies. As also noted by the Victorian Bushfires Royal Commission (2009) the extent and causes of this global dilemma are not well understood. The lack of reliable data of the reason and cause of a fire represents an impediment to the interpretative aspect of fire investigation which is important in order to have better targeted and informed programs (Drabsch 2003).

### The causes of bushfires

There has been much discussion on the causes that lead to fires, often with some degree of superficiality. For a long time this discussion has not gone beyond the attribution of fires to natural phenomena. In Australia, therefore, it has been thought that “lightning” would be the main reason for most bushfires (Bond and Keeley 2005; Darwin 1859; Johnson, Miller, Fogel, Magee, Gagan, and Chivas 1999; Bowman and Murphy 2011).

In Italy, self-ignition has been seen as the principal cause behind bushfires, even if it is a rather rare event (DeHaan 2002; Eric Stauffer 2005). The reality, however, is very different and complex and it certainly deserves a further examination. It now is known that almost 90% of all bushfires as well as structural fire can be attributed to humans, for actions that are either unintentional or malicious, while natural causes have less relevance (Provincia di Genova 2003; Willis 2004; Kapardis 1983; Bryant 2008).

Many of those people who cause fires do so for specific and well planned reasons. This is the case with arson which is further subdivided on the basis of the reason behind the act of crime (Rebekah Doley 2003). Fires, then, can be set for economic gain, to hide a crime, for revenge, as a political act, for actions of pyromaniacs or simply to attract attention. It is



precisely for these reasons that the Crime Classification Manual classifies arson among the three main violent crime typologies, alongside sexual violence and homicide (Douglas *et al.* 1997).

Many psychologists, psychotherapists and psychiatrists have worked on these complex and varied behavioral typologies without, however, managing to reach a well defined “fire setter’s syndrome”. Moreover, it has to be taken into consideration the fact that all causes and reasons behind an arson have been conducted in urban settings and, mostly, in Europe and the United States of America. Little attention has been paid to the motives of bushfire arsonists, especially in Australia.

Moving from this presumption, Willis (2004) has studied the incidence and motivations of deliberately lit bushfires in arson, identifying five major types with a range of sub-types.

#### 1 - Bushfires lit to create excitement or relieve boredom

Vandalism (by individuals or groups)

Stimulation (the author is interested in doing something ‘really’ extraordinary and exciting)

Activity (an attempt to generate activity and relieve boredom)

#### 2 - Bushfires lit for recognition and attention

Heroism (through reporting the fire and helping the fire services during the suppressions activity, it is possible for the arsonist to become an ‘hero’)

Pleading (it is defined and thought as a ‘cry for help’)

#### 3 - Bushfires lit for a specific purpose or gain

Anger (intended as a form of revenge or protest)

Pragmatic (a practical activity that leads to an uncontrolled bushfire, e.g. land clearing)

Material (e.g. firefighters seeking to obtain overtime)

Altruistic (e.g. gain funding for small rural fire services)

#### 4 - Bushfires lit without motive

Psychiatric (psychological or psychiatric impulses derived from mental disabilities)

Children (simply driven by curiosity, as a private form of experimentation)

#### 5 - Bushfires lit with mixed motives

Multiple (different reasons at the same time)

Researchers agree on the four main reasons: for curiosity (Fineman 1995; Kolko and Kazdin 1991; Vreeland and Waller 1980); by crisis, when the behavior represents a mean to

communicate stress or the efforts to seek a relief to their own tensions (Fineman 1995; Koike and Kazdin 1991); delinquent, when the use of fire becomes a mean of rebellion against the authority (Sakheim and Osborn 1994; Koike and Kazdin 1989a); and pathological when we are dealing with those who have psychiatric disorders (Rice and Harris 1991; Fineman 1995).

In conclusion, it can be said that there will always be fire-setting acts differentiated in function, modality and significance (Laxenaire and kuntzburger 2001).

For this reason, data on these aspects are of priority to understand specific reasons and causes for these events. Large intense bushfires are undoubtedly terrifying and can be lethal. Nonetheless, these human-caused fires are potentially preventable rightly because they are caused by humans (Willis 2005).

## **The project**

The most challenging aspect in ensuring an effective investigation is that there are many factors need to be considered often by more than one agency (Webster 2008). The need to collect more data over a much larger area and, above all, in a coordinated and efficient manner is seen as a 'key need'. Indeed, improved quality data capture will help increase our understanding of wildfires. In other words, to improve efficacy and efficiency in understanding and predicting the complex interactions of fire management, data collection and fire investigation knowledge should be better developed and, above all, shared across agencies and state boundaries (Lewis, symposium 2010). This approach constitutes the most suitable basis for an integrated and strategic fire investigation program.

Undoubtedly, investigating the reasons and causes of major fires is a complex procedure recognized as a joint undertaking between fire officers, police officers, crime investigation personnel, forensic scientists and representatives from insurance and other emergency service organizations. In Australia, fire agencies and police have separate and complementary roles in the investigation process (AIC 2006). The initial decision as to whether a bushfire is investigated as arson rests with the firefighters who attend the fire; if the fire investigator suspects the fire was deliberately lit they will then refer the matter to the police for a criminal investigation. It is clear, at this stage, that a strong relationship between police and fire agencies, including well understood protocols of responsibility and efficient information sharing, can increase capacities for the successful investigation and prosecution of bushfire arson.

The root of this assumption is the observation that agencies cannot provide effective investigation activity in isolation, as affirmed also by Dwyer and Esnouf (2008), particularly in a complex system, such as bushfire. The best way to guarantee a safe and secure environment for everyone is to share knowledge and form collaborations between all stakeholders in this field, at both national and international levels. The Council of Australian Governments (COAG) has highlighted that cooperation and information sharing between bushfire agencies and police services are key elements within a bushfire reduction strategy (Ellis *et al.* 2004).

The same necessity has been also confirmed and underlined by several organizations and researchers both in Australia and globally. For example, Tomkins clearly showed the desire

for cooperation between different policing institutions (Tomkins 2005). Similarly, an innovative project was delivered in UK with the purpose of sharing “Best Practice in Arson Prevention and Investigation” by creating a European network. This network developed Fire Investigation Training Modules, to be utilised by all European countries (Northumberland Gov. 2009). In this scenario, the strong commitment of both Bushfire Cooperative Research Centre and The Australasian Fire and Emergency Service Authorities Council on adopting a holistic and multidisciplinary approach of bushfire management across Australia is also well known.

Unfortunately, it is difficult to find evidence of national- and international-level collaboration-building efforts between and across sectors. Furthermore, even in those cases where state-level collaborations are present, what we can witness is, at maximum, an informal structure based on an exchange of information and ideas, rather than a formal system constituted by a real and sharing of knowledge. Identifying and understanding inter-organizational connections and dynamics, above all in terms of impediments, is a necessary step to improve the integration and application of efficient forensic investigation activities by fire and police agencies.

The *central questions* are:

- How do organizations deal with post bushfire investigation and what is their remit?
- What are the factors that enable or prevent effective collaboration within bushfire investigation?
- How does professional communication within and between organizations lead to a successful complex collaboration?
- How can organizations structure themselves to deal effectively with a post bushfire investigation? Is there an international dimension to such investigation actions?

## **Aims and approach**

The aim of the project is to identify strengths and weaknesses of knowledge sharing between bushfire investigative related agencies as well as their internal practices and procedures in undertaking bushfire investigation. This analysis will focus on the role of professional communication, seen as one of the most relevant facilitator in inter-organizational bushfire investigation activities.

The main issue seems to be the fact that despite the investigation of the causes of bushfires is a shared responsibility in Australia between fire and police services they take different paths. This difference could inhibit a joint approach. Some practical examples include police not attending suspicious fire reports or fire agencies not advising police of suspicious fires.

Some reasons for these different paths may include organisational vision which appears to strongly influence the level of commitment of agencies. The differing bushfire investigation

cultures of fire and police agencies in respect of thinking, approach, training and language can be perceived either as an inhibitor or as a strength for an effective inter-organizational collaboration (Mitchell 1999). To explore this, a symbolic-interpretive perspective will be adopted within the broader framework of organizational theory so to be able to analyze these complicated situations.

The research methodology, therefore, is guided by a philosophical approach in promoting understanding and cross-national learning rather than by a specific technique focused on obtaining precise measurement. To effectively address the complex nature of business communication to which this project aims, it will be utilized a qualitative case study approach that is international in its scope, cross-sector in its breadth, and multidisciplinary in its conceptualization. More specifically, it will be adopted an interpretative and social constructivist approach in order to satisfy the desire of working with a plurality of perspectives and of using participatory methods (Carey 1992).

It is necessary to keep in mind that those organizations who are involved in the post bushfire investigation such as police, fire services and state emergency services have a common organizational feature; they are primarily emergency service organizations. More specifically to the research project, five post bushfire investigation departments will be studied as five different case studies through interviews, focus groups and document analysis. These organizations will be: Victoria Police, Department of Sustainability and Environment (DSE) and Country Fire Authority (CFA) in Victoria; Anti-Forest Fire Investigative Unit (NIAB) and Fire Investigative Unit (NIA), in Italy.

Although Victoria and Italy may differ in many aspects regarding to bushfire investigation strategy including policy, procedures and even the organizations involved, they present some common characteristics. Indeed, both countries:

- have to deal with the same devastating dilemma and with the same degree of alarm;
- have more than one organization involved within the bushfire investigation network;
- are in the need of an efficient and efficacy extent of professional communication (intra and inter organization).

In addition to the main characteristic of the above mentioned agencies is that, as emergency organizations, all of them follow a military style structure, especially in terms of management and ranking system. In working with continuous improvisation and coping with a high degree of uncertainty after-action-reviews, lessons-learned and knowledge management become essential for the entire military and emergency organizational system (Rostis 2007).

In this light, organizational learning plays an important role in the creation of a 'culture of reliability', which is essential in order to operate in very dynamic and high risk environments (Argyris 1999). Activities that support this, such as expert meetings or management

development programs, lead to the creation, sharing and transfer of knowledge, are called organizational learning mechanisms.

Furthermore, organizational learning occurs within a dialectical process (Berends and Lammers 2006). This means that organizations are necessarily involved in continual transaction with their internal and external environments which are constantly changing both as a result of forces external to organization and as a result of organizational responses to their situations. The whole process of interaction, therefore, is strongly based on the concepts of interpersonal communication and information flow.

Yet, even if we deal with these communication obstacles through dialogue and enhanced understanding, this still does not mean that we have any level of conformity between bushfire stakeholders or that they can actually work together in a meaningful way. Indeed, learning requires common codes of communication and coordinated search procedures (Beyerlein, Beyerlein and Kennedy 2005).

## Conclusion

There is still a strong need to equip bushfire stakeholders with common terminology, data collection and information-sharing processes in order to assist the development of evidence-based prevention measures as well as to identify and share best-practice approaches (Royal Commission - Final Report 2009). To develop effective international policies, there is a requirement to coordinate the process of collecting and evaluating global bushfires data. This will represent a first step in order to improve the ways in which communication takes place within and between bushfire investigative departments. This project is based on the assumption that communication, conceptualized as a dynamic process, is the key factor in creating, sustaining, and transforming learning organizations.

From a holistic perspective, fire and police agencies can improve, by studying their structural and operative barriers, in the awareness of what are the major weaknesses in their own bushfire investigation and, by maximising communication and collaboration with other fire stakeholders, in the quality of their interconnections as well as of their knowledge.

This self-awareness can be seen as the basis for a better understanding, which is essential to provide these agencies with an appropriate level of power and knowledge, required in any process of growth. The final aim should be the building of reciprocal trust and lasting collaboration between different fire stakeholders. This can be reached through the establishing of an international network based on inter-agencies agreements, once the prime causes of the miscommunication and inadequate data collection are identified.

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