

The Prevention of Bushfire Arson through Target Hardening

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An analysis of the Queensland Department of Primary Industries & Fisheries (Forestry) (DPI&F (Forestry)) Wildfire Data Base indicates that, in comparison to all other DPI&F (Forestry) districts the Beerburrum forestry district is a significant 'hot spot' of bushfire arson activity.

A situational crime prevention paradigm was used to analyse the Beerburrum forestry district to determine the environmental factors that resulted in this district becoming a 'hot spot' of bushfire arson activity. This analysis found that factors such as proximity to population centres, extensive road networks and low levels of staff 'guardianship' contributed to the genesis of the Beerburrum bushfire arson 'hot spot'.

The paper argues that situational crime prevention techniques, such as the use of prescribed burns (to reduce 'payoffs' to arsonists), can be used to target harden discrete geographical bushfire arson 'hot spots', such as Beerburrum, making bushfire arson more difficult, less rewarding and excusable to potential arsonists.

Introduction

'Many approaches to preventing structural arson involve 'target hardening', or taking measures such as securing buildings that may deter a would-be arsonist by making the crime harder to commit. In the case of bushfires, where target hardening is not a viable option and most other approaches recommended for structural protection do not apply, behaviour-based prevention is likely to be the best tool available' (Willis 2004, pp. 121).

The above passage encapsulates two significant problems in developing Australian bushfire arson prevention strategies. The first is that most of our information on bushfire arson is primarily derived from urban arson research in the United Kingdom and United States of America. The second is that much of the current research into the prevention of bushfire arson is focused on offender typologies and treatment programmes for individuals who are persistent fire setters or are at risk of becoming deliberate fire setters. As a result, situational crime prevention strategies, of which target hardening is but one method, are generally dismissed in favour of behaviour based prevention strategies.

This paper challenges that view. Utilising data derived from the Queensland Department of Primary Industries (Forestry) (DPI&F (Forestry)) Wildfire Data Base, it will demonstrate that forests are not homogenous entities the sheer size of which

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precludes the implementation of situational crime prevention techniques. Rather, an analysis of DPI&F's Wildfire Data Base indicates that, due to a range of environmental factors, much of the arson occurring in Queensland forests is located in discrete 'arson hot spots'. This study will argue that situational crime prevention techniques, such as target hardening and crime prevention through environmental design (CPTED), can be applied to these forest 'arson hot spots' to prevent or mitigate the effects of bushfire arson.

Situational Crime Prevention

Situational methods should not be rejected as irrelevant to the prevention and mitigation of bushfire arson. Rather, situational crime prevention methods can offer forest managers important insights into the causes of bushfire arson and provide practical, targeted responses to address the actions of bushfire arsonists, the effectiveness of which can then be evaluated through follow-up research and monitoring.

Situational crime prevention seeks to analyse the circumstances 'giving rise to specific kinds of crime and introduces discrete managerial and environmental change to reduce the opportunity for those crimes to occur' (Clarke 1997, p.2).

It incorporates two key methodologies: a systems approach to reduction and a problem solving process to inform strategy development. The former aims to develop strategies that address the criminogenic side-effects of the physical environment that facilitate criminal activity (Tilly 2005).

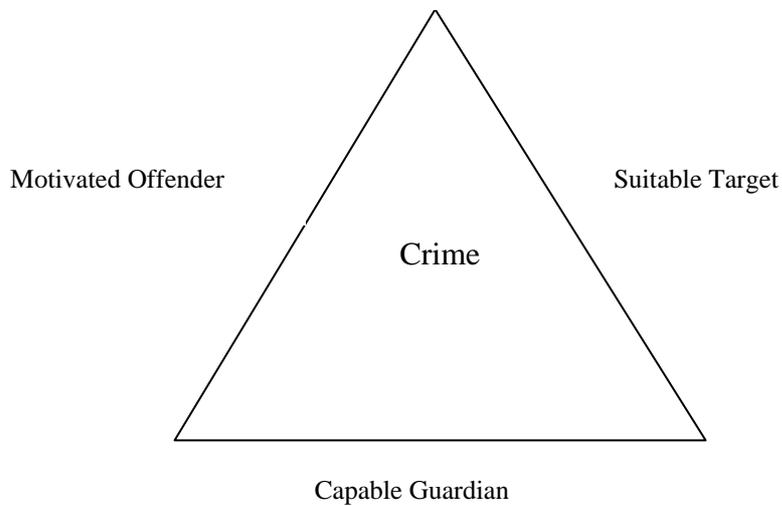
Situational crime prevention is underpinned by the assumption that a person who commits a crime has weighed up the risks and benefits of the situation and has made a rational choice to commit that criminal act. This observation is particularly important in the context of bushfire arson, given that the typology developed from Willis's (2004) review of bushfire arsonist motives clearly indicates that the majority of bushfire arsonists do have rational motives for committing the offence.

The Routine Activity Theory of crime also underpins situational crime prevention, directing its attention, not at the 'characteristics of offenders' but 'upon the circumstances in which they carry out predatory criminal acts' (Cohen and Felson 1979, p. 588).

The theory posits that 'most criminal acts require convergence in space and time of *likely offenders, suitable targets* and the *absence of capable guardians* against

crime' (Cohen and Felson 1979, p. 588). These three factors have become known as the crime triangle (Clarke and Eck 2003) (see Figure 1).

Figure 1: The Crime Triangle



The Routine Activity Theory explains how legitimate patterns of work and recreation can result in increased opportunities for illegal activities, while Rational Choice Theory identifies the factors which 'encourage' offenders to take advantage of those opportunities (Clarke 1999).

A major aspect of situational crime prevention is developing an understanding of the environmental/situational factors that facilitate the convergence of likely offenders and suitable targets in the absence of capable guardians. These convergences can result in the development of 'hot spots' of geographically concentrated criminal activity. Three types of 'hot spots' and their associated causal mechanisms have been identified by Brantingham and Brantingham (1995, cited in Clarke and Eck 2003):

- Crime generators: places to which large numbers of people are attracted for reasons unrelated to criminal motivation. Providing opportunities for offenders and targets to come together in time and place produces crime or disorder.
- Crime attractors: places affording criminal opportunities that are well known to offenders. People with criminal motivation are drawn to such locales. In the short run, offenders may come from outside the area but over longer time periods and under some circumstances, offenders may relocate to these areas.
- Crime enablers: occur when there is little regulation of behaviour at places: rules of conduct are absent or not enforced.... Crime enablers also occur with the erosion of guardianship and handling.

Crime Pattern Theory is another place-based perspective to be considered when examining factors that result in the convergence of a motivated offender and a victim/target in the absence of a capable guardian. It is argued (Brantingham and Brantingham 1995, cited by Clarke and Eck 2003) that potential offenders, when searching for crime opportunities, tend to do so along the familiar pathways that they take from home to work to recreation. Offenders may not deviate far from these paths, usually operating in defined zones with which they are familiar. Road or rail networks traversed by offenders can be a significant factor in facilitating criminogenic activity and their proximity to crime 'hot spots' is relevant to prevention.

The second methodology underpinning situational crime prevention consists of a problem solving process, which is a key component of any situational project (Clarke 1999). It involves the employment of a standard methodology based on the action research paradigm to develop and test situational crime prevention strategies (Clarke and Eck 2003; Laycock 2005; Tilly 2005). This methodology is commonly known by the acronym SARA, which stands for Scanning–Analysis–Response–Assessment, and involves the in-depth analysis of the crime problem being explored. This analysis must have consideration for the environmental and operational context in which particular problems occur. Using the problem solving methodology in conjunction with Felson's crime triangle is regarded as a key component of ensuring that the strategies selected are applicable to the problems being addressed (Laycock 2005, p. 676). Hence, the environmental context and the way in which it generates, enables and attracts crime and creates 'hot spots', is important in understanding and preventing the occurrence of crime in particular locations.

Methodology

Data Collection

This study utilises the DPI&F (Forestry) Wildfire Data Base as its source of empirical data. This database contains a record of all wildfire activity occurring within DPI&F (Forestry) areas throughout Queensland since 1922 (see Appendix A for a map of DPI Forestry Districts).

As part of DPI&F (Forestry) management practices, all wildfires occurring within their forestry districts are investigated by forestry workers trained in the gathering, analysis and recording of wildfire event evidence.

Forestry workers investigating these events determine if the wildfire is the result of natural/accidental causes or has been deliberately set. Accidental fire classifications include:

- Act of God (i.e. lightning strike);
- All Reasonable Care Taken, Unlucky Accident;
- Carelessness;
- Gross Negligence;
- Reasonably Foreseeable Event Due to Stupidity/Incompetence; and
- Unknown not Suspected.

Deliberately set wildfire classifications include:

- Mischief Making;
- Malicious Incendiarism;
- Illegal Hazard Reduction;
- Torching Stolen Car; and
- Unknown But Suspected

‘Mischief Making’ can be roughly defined as fires resulting from ‘kids’ playing with matches and petty vandalism, while ‘Malicious Incendiarism’ is determined after the Fire Investigator has found evidence of incendiary devices or accelerants. ‘Illegal Hazard Reduction’ stems from illegally set ‘burn off’ type fires on private properties that have spread onto forestry property. The ‘Torching Stolen Car’ category applies to wildfires resulting from the destruction of abandoned or stolen vehicles. ‘Unknown but Suspected’ applies to fires where the investigator, having eliminated all other factors, concludes that the only feasible explanation for the wildfire was that it had been deliberately set.

Data Analysis

Data utilised in this study is based on a relatively recent subset of the DPI&F (Forestry) Wildfire Data Base derived from all wildfire events occurring in all DPI&F (Forestry) districts from January 1990 to March 2005. (The final wildfire event recorded at the time of commencing this study was 09/03/2005). This data subset details aspects of 1,988 individual wildfire events occurring in the DPI&F (Forestry) districts of Beerburrum, Maryborough, Dalby, Yarraman, Rockhampton, Roma, Imbil, Monto, Ingham and Atherton.

In order to facilitate analysis, the extracted data were first aggregated into their various ‘Districts’ (i.e. Atherton, Beerburrum). The ‘district aggregated’ wildfire data were then sorted into the various ‘cause’ classifications, as determined by the investigators (i.e. Malicious Incendiarism, Act of God etc).

The data were then examined to provide a comparison of the rates at which intentionally and accidentally set wildfire events occurred across all DPI&F (Forestry) districts since 1990. Following this, the data were then analysed to provide a comparison of the rates at which the incidence of intentionally and accidentally set wildfire events occurred within each DPI&F (Forestry) district.

Key Findings

Analysis of the DPI&F (Forestry) Wildfire Data Base

An analysis of the DPI&F (Forestry) Wildfire Data Base reveals that the rate at which intentionally lit wildfires occur is not uniform across all DPI&F (Forestry) districts. Table 1 and Figure 2 show that the Beerburrum district has experienced significantly greater numbers of intentionally set wildfires. Of the 977 intentionally set wildfires recorded across all forestry districts, Beerburrum experienced 633 or 64.8 per cent of all intentionally lit wildfires. In comparison, the next highest district, Maryborough, recorded 135 or 13.8 per cent. The other Forestry districts of Dalby (30 or 3.1%), Yarraman (49 or 5.0%), Rockhampton (35 or 3.6%), Roma (19 or 1.9%), Imbil (19 or 1.9%), Monto (10 or 1.0%), Ingham (32 or 3.3%) and Atherton (15 or 1.5%) all experienced significantly lower numbers of intentionally set wildfires.

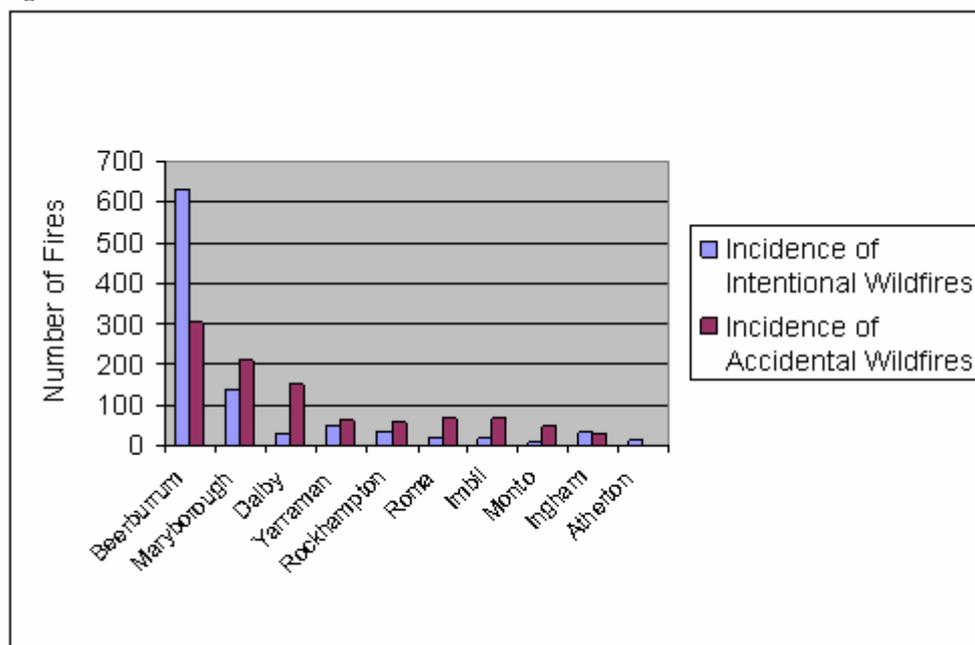
Table 1 Comparison of the incidence of intentional and accidental wildfire incidents across all DPI&F (Forestry) districts from 1990 to March 2005.

District	Incidence of Intentional Wildfires		Incidence of Accidental Wildfires	
	No.	%	Number	%
Beerburrum	633	64.8	305	30.2
Maryborough	135	13.8	211	20.8
Dalby	30	3.1	153	15.1
Yarraman	49	5.0	62	6.1
Rockhampton	35	3.6	61	6.0
Roma	19	1.9	69	6.8
Imbil	19	1.9	70	6.9
Monto	10	1.0	51	5.0
Ingham	32	3.3	27	2.7
Atherton	15	1.5	2	0.2
Total	977	100.0	1,011	100.0

Source: Department of Primary Industries and Fisheries (Forestry) Wildfire Records.

Note: values shown in parenthesis are the rates of wildfire occurrence expressed as a percentage of the total wildfire events across all DPI&F (Forestry) districts.

Figure 2. Intentional and Accidental Wildfire Events in Each DPI&F



Forestry District

Source: Department of Primary Industries and Fisheries (Forestry) Wildfire Records.

When the relative distribution of intentional and accidental wildfires within each district are analysed (see Table 2), three districts - Beerburrum, Ingham and Atherton - recorded a greater percentage of intentionally set wildfires than accidentally occurring wildfires within their forestry districts.

Table 2 Comparison of the incidence of intentional and accidental wildfire incidents within each DPI&F (Forestry) district from 1990 to March 2005

District	Incidence of Intentional Wildfires	Incidence of Accidental Wildfires	Total
Beerburrum	633 (67.5%)	305 (32.5%)	938 (100.0%)
Maryborough	135 (39.0%)	211 (61.0%)	346 (100.0%)
Dalby	30 (16.4%)	153 (83.6%)	183 (100.0%)
Yarraman	49 (44.1%)	62 (55.9%)	111 (100.0%)
Rockhampton	35 (36.5%)	61 (63.5%)	96 (100.0%)
Roma	19 (21.6%)	69 (78.4%)	88 (100.0%)
Imbil	19 (21.4%)	70 (78.6%)	89 (100.0%)
Monto	10 (16.4%)	51 (83.6%)	61 (100.0%)
Ingham	32 (54.2%)	27 (45.8%)	59 (100.0%)
Atherton	15 (88.2%)	2 (11.8%)	17 (100.0%)

Source: Department of Primary Industries and Fisheries (Forestry) Wildfire Records.

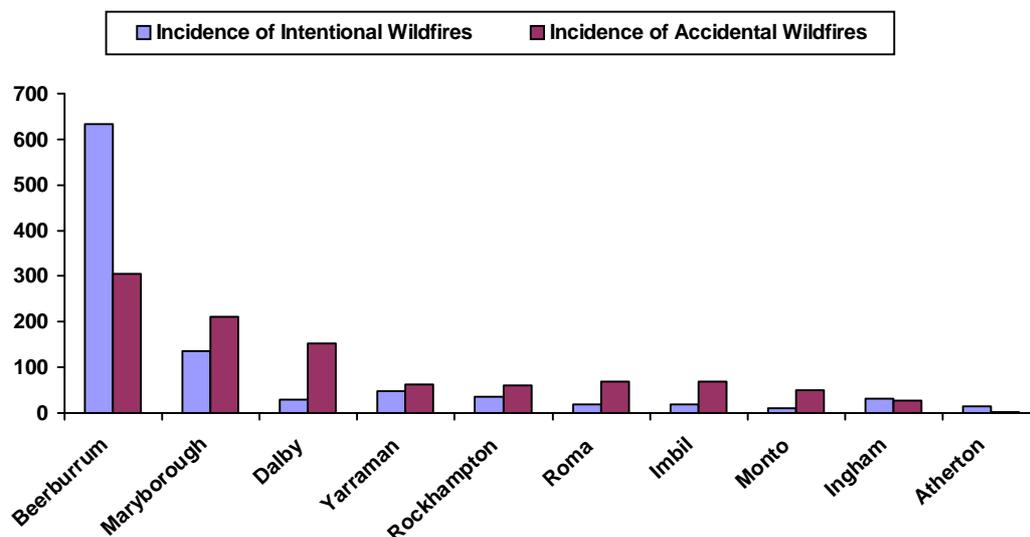
Note: values shown in parenthesis are the rates of wildfire occurrence expressed as a percentage of the total wildfire events across all DPI&F (Forestry) districts.

The wildfire data described above show that the Beerburrum district is a 'hot spot' of intentional wildfire activity, experiencing significantly elevated levels of arson in comparison to all other DPI&F (Forestry) districts with the exception of Atherton district. It should be noted that, while the Atherton district has experienced fewer intentional wildfires in comparison to the Beerburrum district (Atherton 15, Beerburrum 633), a higher proportion of fires in this area are attributed to intentional fire setting (88.2%) than in Beerburrum (67.5%). However, given the small numbers of recorded wildfires in the Atherton district, it is difficult to draw any concrete conclusions from these figures.

This study also focuses on the nature of the 'arson offence' by examining the frequency with which individual categories of intentionally lit wildfires occur. The aim of this analysis is to determine whether there are 'hot spots' of specific categories of intentional wildfire activity occurring within the various DPI&F (Forestry) districts. This knowledge is useful because it may help to develop crime prevention strategies targeting specific offences in discrete geographical locations.

Figure 3 provides a comparison of the incidence of intentional wildfire events across all DPI&F (Forestry) districts. 'Malicious Incendiarism', the most frequently occurring classification, accounted for 36.9 per cent of all intentional wildfire events. 'Unknown But Suspected', the next highest category, accounted for 34.3 per cent, while 'Torching Stolen Car' and 'Mischief Making' accounted for 19.8 and 5.0 per cent of all intentional wildfire events respectively. 'Illegal Hazard Reduction' was the least common category, accounting for 4.1 per cent of intentionally lit wildfires across all districts.

Figure 3 Intentional and Accidental Wildfire Events in Each DPI&F (Forestry) District.



Source: Department of Primary Industries and Fisheries (Forestry) Wildfire Records.

However, the data contained in Table 3, which compares the relative distribution of different types of intentionally set wildfire activity in each individual DPI&F (Forestry) district, indicates that some forest districts are experiencing markedly greater levels of certain intentional firesetting types.

Table 3 Comparison of the relative distribution of different types of intentional wildfire events in each DPI&F (Forestry) district, 1990 to March 2005

District	Malicious Incendiarism	Torching Stolen Car	Unknown But Suspected	Illegal Hazard Reduction	Mischief Making
Beerburrum	288 (45.5%)	187 (29.5%)	123 (19.4%)	11 (1.7%)	24 (3.8%)
Maryborough	17 (12.6%)	3 (2.2%)	98 (72.6%)	9 (6.7%)	8 (5.9%)
Dalby	7 (23.3%)	0 (0%)	16 (53.3%)	2 (6.7%)	5 (16.7%)
Yarraman	13 (26.5%)	0 (0%)	27 (55.1%)	3 (6.1%)	6 (12.2%)
Rockhampton	8 (22.9%)	1 (2.9%)	20 (57.1%)	3 (8.6%)	3 (8.6%)
Roma	0 (0%)	0 (0%)	11 (57.9%)	8 (42.1%)	0 (0%)
Imbil	6 (31.6%)	0 (0%)	9 (47.4%)	2 (10.5%)	2 (10.5%)
Monto	2 (20.0%)	0 (0%)	7 (70%)	0 (0%)	1 (10.0%)
Ingham	9 (28.1%)	0 (0%)	21 (65.6%)	2 (6.5%)	0 (0%)
Atherton	10 (66.7%)	2 (13.3%)	3 (20%)	0 (0%)	0 (0%)

Source: Department of Primary Industries and Fisheries (Forestry) Wildfire Records. Note values shown in parenthesis are the rates of intentional wildfire occurrence expressed as a percentage of the total wildfire events in each DPI&F (Forestry) district.

The data contained in Table 3 show that ‘Malicious Incendiarism’ was the most frequently occurring intentional wildfire type in the Beerburrum and Atherton Forestry Districts. Beerburrum recorded 288 ‘Malicious Incendiarism’ wildfires which was 45.5 per cent of all intentionally set wildfires in this district. Atherton also recorded a proportionately high number of ‘Malicious Incendiarism’ wildfires (66.7%). Districts such as Monto (20.0%), Rockhampton (22.9%), Dalby (23.3%), Yarraman (26.5%), Ingham (28.1%), Imbil (31.6%), Maryborough (12.6%) and Roma (0%) recorded proportionately few ‘Malicious Incendiarism’ fires within their individual districts.

‘Unknown But Suspected’ was the most frequently occurring intentional wildfire type in the districts of Imbil (47.4%), Dalby (53.3%), Yarraman (55.1%), Rockhampton (57.1%) and Roma (57.9%). However, in comparison, areas such as Beerburrum (19.4%) and Atherton (20.0%) recorded very low levels of “Unknown But Suspected” type wildfires.

It should be noted that overall, the occurrences within each district of wildfires resulting from ‘Illegal Hazard Reduction’ and ‘Mischief Making’ were relatively low.

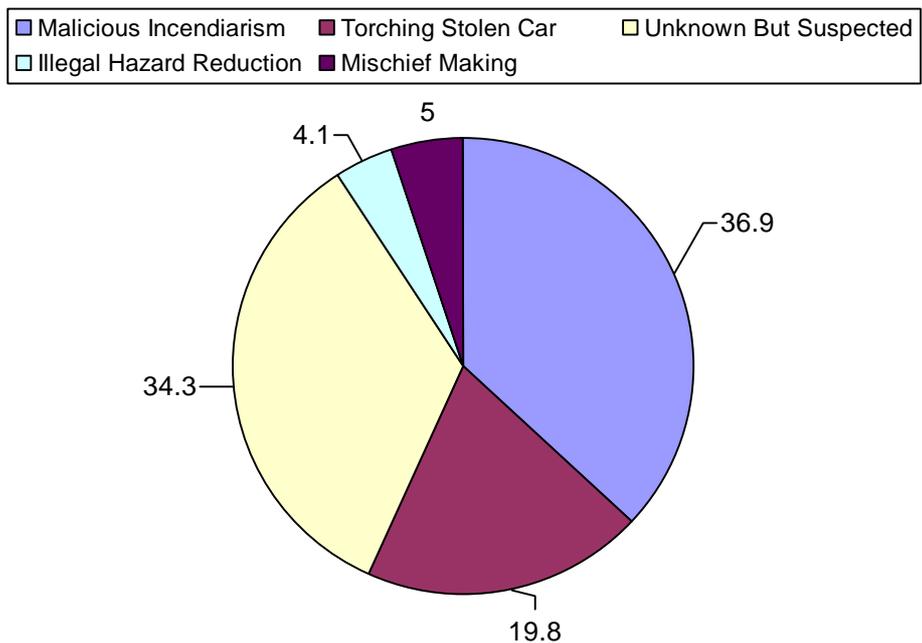
The exception to this was Roma where 'Illegal Hazard Reduction' type wildfires accounted for 42.1 per cent of all intentional wildfires in its forestry district.

'Torching Stolen Car', which in over all terms resulted in 19.1 per cent of all intentionally lit wildfires, occurred in four forestry districts - Rockhampton (1), Atherton (2), Maryborough (3) and Beerburrum (187) - with by far the largest number occurring in Beerburrum.

The data presented above indicate that the Beerburrum forestry district is a 'hot spot' of bushfire arson activity. Further, Figure 4 shows that this activity is marked by the high incidence of 'Malicious Incendiarism'. In contrast, it recorded relatively low numbers of 'Unknown But Suspected' wildfires. It should be remembered that for a fire to be classified as 'Malicious Incendiarism' there must usually be evidence of accelerant use. Therefore, it could be argued that this is very much a more planned, 'top end' arson attempt. The seemingly frequent use of accelerants to start a wildfire in Beerburrum could provide some explanation for the relatively low numbers of 'Unknown But Suspected' wildfires. Another possible explanation for the low numbers of 'Unknown But Suspected' wildfires occurring in Beerburrum, in comparison with other areas, are the methodologies used by fire investigators to determine wildfire causation. Subjective differences in fire cause interpretation by investigators may result in methodological inaccuracies occurring when comparing cross-jurisdictional data. This has been marked as an area of future research by this paper (see conclusion).

There were also highly elevated levels of 'Torch Stolen Car' in Beerburrum. In fact, this district accounted for 96.9 per cent of all such recorded incidents. In contrast, the Beerburrum forestry district recorded very low levels of 'Mischief Making' and 'Illegal Hazard Reduction' wildfires.

Figure 4 Comparison of the Incidence of Intentional Wildfire Events Across DPI&F (Forestry) Districts.



Source: Department of Primary Industries and Fisheries (Forestry) Wildfire Records.

Why is the Beerburrum Forestry District a 'Hot Spot' of Bushfire Arson?

The analysis of the DPI&F (Forestry) Wildfire Data Base has shown that the Beerburrum forestry district is a 'hotspot' of wildfire arson activity, experiencing elevated levels of 'Malicious Incendiarism' and 'Torch Stolen Car' wildfire events. The question is, as per the SARA methodology, why? What are the environmental/situational factors affecting Beerburrum that facilitate the convergence in time and space of likely offenders and suitable targets in the absence of capable guardians?

Beerburrum is a commercial plantation forest located within the highly populated coastal fringe of South East Queensland. It is bordered by Brisbane to the south, the Sunshine Coast to the north and with a number of significant population centres such as Caboolture and Petrie in close proximity along its length.

The Beerburrum district is a highly accessible forestry environment bisected by the Bruce Highway, Queensland's major 'high volume' North/South transportation corridor. There are a number of 'tourist drives' within the Beerburrum district linking the Bruce Highway to tourist attractions located in the 'heart' of the

Beerburrum forest district. There are also a number of popular scenic lookouts and picnic grounds located throughout the forestry district.

Beerburrum is a commercial forestry operation in which heavy machinery/transport are regularly engaged in the planting, maintenance and harvesting of timber. As a result, the forestry plantations are serviced through a forestry road system of well maintained dirt roads, many of which are accessible by conventional vehicles. This network of roads within the Beerburrum forest district is a popular recreational destination for motorists, horse riders, trail bike riders and bushwalkers. There are no requirements for recreational users to obtain permits to use these roads. Access to the forests is highly 'porous', with numerous entrances and exits from the Bruce Highway and other secondary public roads. There are no specific entrances into the forest through which access can be monitored or controlled. Nor is there any forestry staff specifically tasked with monitoring vehicles using the forestry road network.

Beerburrum forest's close proximity to major population centres, extensive commercial operations and high recreational usage means that large numbers of people are engaged in legitimate work and recreational activities within this district. Its extensive internal road network and ease of access, in combination with limited monitoring of activities within the forest, result in an absence of capable guardians. As predicted by Routine Activity Theory, these factors, when combined, facilitate the convergence in time and space of likely offenders, suitable targets in the absence of capable guardians and result in Beerburrum becoming a 'hot spot' of criminal activity. Indeed, it can be argued that the range of environmental factors which result in the Beerburrum forest district becoming a geographical 'hot spot' of bushfire arson, encompass aspects of all three 'hot spot' types described by Brantingham and Brantingham (1995, cited in Clarke and Eck 2003).

The Beerburrum forest district acts as a crime generator. High recreational usage of forest facilities, combined with regular commercial forestry activities, result in significant numbers of people accessing the forest, thus increasing opportunities for illegal activity.

The Beerburrum forest district also acts as a crime attractor. Its extensive and easily accessible internal road network provides ample opportunities for the dumping, stripping and torching of stolen vehicles. Further, given the long history of these types of offences occurring in this district, there can be little doubt that this area has become a 'location of choice' for criminals engaged in this type of activity. The Beerburrum forest district is also a convenient and easily accessible source of combustible material for bushfire arsonists. Given the long history of bushfire arson and associated dumping, consideration should be given to the possibility that, as

argued by Brantingham and Brantingham (1995, cited in Clarke and Eck 2003), some offenders may be specifically drawn to the area because of the opportunities it provides further to facilitate their offending behaviours.

The Beerburrum forest district can also be classed as a crime enabler because of the lack of resources available to regulate behaviour within the district. Therefore, guardianship of the district is low and is being eroded by poor place management practices.

The proposition that Beerburrum is a 'hot spot' of bushfire activity due to environmental factors such as the road networks is further supported by the crime pattern theory of Brantingham and Brantingham (1995, cited by Clarke and Eck 2003; also see Brantingham and Brantingham 1993). The high volumes of traffic flowing along the Bruce Highway and the high recreational/commercial use of forest road networks provide potential offenders with numerous familiar pathways from home to work to recreation. Therefore, these road networks need to be considered a significant factor in facilitating criminogenic activity within the Beerburrum district. Indeed, there can be little doubt that these road networks facilitate the dumping and subsequent torching of stolen cars.

Implications for Policy

Prevention and Mitigation of Bushfire Arson through Target Hardening

This paper has provided clear evidence that bushfire arson is a significant problem in the Beerburrum forest district. Extensive road and trail networks in this area that provide access to forestry workers and outdoor recreation enthusiasts also provide opportunities for potential offenders. Given that the chances of being detected are minimal due to the lack of capable guardians within the forest, and that the potential 'payoffs' to arsonists are large, it is not surprising that the rate of bushfire arson in the Beerburrum District is high.

A key argument of this study is that situational crime prevention techniques can be utilised to 'target harden' certain high value commercial forest types, such as the Beerburrum pine plantations, mitigating the effects of bushfire arson and perhaps preventing its commission in the first instance. The core situational strategy required to reduce the incidence of bushfire arson is conceptually simple; reduce the rewards/payoffs to the potential arsonists while increasing the risks of being caught.

Reducing Rewards and Increasing Effort

To reduce the rewards of arson, we need to first reduce the forest's fuel load. Prescribed burning is the most environmentally and economically effective method of fuel reduction (House of Representatives 2003, p. 88). This reduction in fuel load through prescribed burning serves a number of purposes:

1. It increases the effort required by the arsonist to start a fire, due to the lack of fuel accelerants probably required to get a fire started.
2. It reduces rewards to arsonist. If the arsonist does successfully start a fire, the chances of it actually spreading over any significant area are significantly reduced due to a lack of fuel.
3. It increases risks to the arsonist. As the amount of effort and time needed by the arsonist to successfully start a fire increases, so too do the chances of detection by forestry staff or through chance observation by legitimate forest users. Furthermore, the use of accelerants leaves forensic evidence at the crime scene which can lead to detection.

Another forest management practice that could be utilised to target harden forests against the effects of arsonists is the construction of fire trails. While fire trails may not prevent arsonists from setting wildfires, a properly designed and maintained fire trail system can reduce the payoffs to arsonists by restricting the spread of wildfires and by providing rapid access for firefighters. A CPTED approach to the construction of fire trail/firebreaks could include:

1. Access control to reduce the opportunity for crime by denying access to potential targets while creating a heightened perception of risk in offenders; recreational forest users need access to Beerburum in order to conduct their lawful activities. However, it may be possible to restrict the areas accessible to them by limiting the number of access points to the forest through the use of locked gates, accessible only by forestry workers. This would serve to establish specific 'territories' for recreational users, increasing their 'sense of ownership' and 'notions of propriety concern' for the area occupied (Cozens et al. 2005, p. 331). Indeed, a CPTED analysis may determine that, at times of high fire danger, these territories may be further restricted to aid surveillance or closed off completely for the duration of the high-risk period.
2. Improve levels of natural surveillance; construction of fire trails/firebreaks that remove sharp curves and blind corners resulting in long wide straight sections of road would improve levels of natural surveillance, thereby increasing the risk to arsonists of being observed by forestry workers or other legitimate forest users.

In *A Nation Charred*, a report on the Canberra bushfires (House of Representatives 2003, p. 20), it was argued that some forest managers neglected their responsibility for managing the bushfire threat, shifting this responsibility to reactive agencies such as rural bushfire authorities. The failure of forest authorities to develop rapid-fire response strategies has resulted in a greater payoff to bushfire arsonists, as fires have a greater chance of spreading beyond their initial ignition point.

Increasing Risks

Utilising situational crime prevention techniques to improve the levels of formal (i.e. by forestry workers, police etc) and informal (i.e. by recreational users) surveillance within these forestry districts may assist in increasing the risks of detection for bushfire arsonists.

As noted earlier, significant numbers of people utilise the Beerburrum forestry district for recreational purposes and still more people transit through Beerburrum on a range of business and recreational activities via the Bruce Highway. While these large flows of people help facilitate criminogenic activity, they can also be used to boost levels of informal surveillance within the forestry district. In an attempt to harness this resource, DPI&F (Forestry) have joined the Crime Stoppers Program and are encouraging people who use the Beerburrum plantations for recreational purposes to report suspicious activity anonymously via a 1800 number.

The effectiveness of this programme could possibly be improved by the erection of strategically placed signage advising people of the illegality and dangers of bushfire arson and requesting that people who observe suspicious activity within the forest contact Crime Stoppers via the 1800 number. By formally advising people of the illegality and dangers of bushfire arson, this strategy also seeks to reduce excuses for criminal activity by prompting the conscience of forest users to act in a lawful manner and report suspicious activity, thus facilitating compliance with the 'law'.

The benefits of such a programme are that:

1. The signage would serve as a prompt to legitimate forest users that they need to remain vigilant;
2. It would remove excuses for arson by advising people that committing arson in a forestry environment is a crime and a danger to life; and
3. It would help increase the perception by arsonists that they face possible detection via chance observation by recreational users and forestry staff.

While there is a degree of formal surveillance conducted within the forestry district, this is not a 'core' activity of forestry staff. However, during periods of high fire danger, Beerburrum forestry workers do actively patrol high risk areas.

To improve formal surveillance levels, DPI&F (Forestry) are experimenting with the installation of remote sensing video cameras (CCTV) in key forestry areas as a replacement for existing fire towers which are staffed only irregularly. While these are principally used for the early detection of fires, it is hoped that their presence will also discourage, or provide useful information about, deliberate firesetters.

Torching Stolen Car: a proposed prevention strategy

As discussed previously, 'Torching Stolen Car' wildfire events account for 29.5 per cent of all intentionally lit wildfires within the Beerburrum district. These wildfire events result from individuals deliberately setting fire to a stolen vehicle which then spreads to the forest. Some of these vehicles are set on fire at the time they are abandoned, possibly as an act of vandalism or to remove evidence. However, there is extensive anecdotal evidence derived from the author's informal discussions with forestry workers and local police officers, indicating that many of these vehicles sit abandoned for several days, often being stripped of parts before being set alight. These vehicles are often reported stolen to the police and their locations identified by forestry workers. However, possibly due to police resource limitations, these vehicles are rarely recovered before they are 'torched'. This situation is frustrating to forestry workers who see these abandoned vehicles slowly disintegrate before being set alight.

A proposed 'Torch Stolen Car' prevention strategy would be for DPI&F (Forestry) to use a recovery vehicle to remove these abandoned vehicles as soon as they are detected to a secure holding facility. This strategy utilises the situational crime prevention technique of 'target removal' which seeks to reduce criminal activity, in this case the 'torching' of abandoned vehicles, by removing the arsonist's potential target (see Clarke 1997, pp. 21-22).

The purpose of this strategy would be to reduce the amount of wildfires caused by the torching of abandoned vehicles and to help prevent further damage from occurring to those vehicles abandoned largely intact. There could be an element of the 'broken window theory' (Wilson and Kelling 1982) contributing to the number of vehicles being abandoned and 'torched' in this area. If potential offenders see that vehicles are being abandoned, stripped and torched over an extended period of time, it may suggest to them that this is 'safe' place for such activity to occur. The rapid

removal of abandoned vehicles by this proposed strategy may help to address these perceptions.

This paper has presented a number of wildfire management practices which can be classified as forestry-specific situational techniques that 'target harden' DPI&F (Forestry) districts like Beerburrum against bushfire arson. However, it needs to be recognised that not all forest tenures will benefit from the proposed methods. The strategy of reducing the incidence of torched stolen vehicles would only be of value in those specific environments subject to the dumping of stolen vehicles. Because native cypress forests are very fire sensitive and could be damaged by prescribed burns, fuel load reduction would not be appropriate to this forest type. This reinforces a key argument of situational prevention: that it is important to understand crime problems in context and fashion strategies based upon careful analysis. Therefore, an in-depth assessment, using the SARA methodology, would need to be employed to achieve maximum benefit from any situational crime prevention approach that aims to reduce the effects of bushfire arson in specific forest environments.

Conclusion

As stated previously, the majority of our information on bushfire arson has been derived through extrapolated research into urban arson in the UK and USA. In conjunction with a focus on behavioural measures as the primary method for preventing bushfire arson, this has resulted in situational prevention techniques being overlooked as a viable option for the prevention of bushfire arson.

This paper acknowledges behavioural measures as an important aspect of bushfire arson research and prevention. However, a significant shortcoming stemming from a 'behavioural only' approach is that little consideration has been given to environmental factors which may facilitate bushfire arson.

An analysis of the DPI&F (Forestry) Wildfire Data Base found significant evidence supporting the concept of bushfire arson 'hotspots'. The data analysis revealed that bushfire arson activity was concentrated in the 'hotspot' of Beerburrum which was marked by a high incidence of 'Malicious Incendiarism' and 'Torch Stolen Car' bushfire arson events.

An examination of the Beerburrum forest district environment revealed a number of factors serving as crime generators/enablers within the district. These factors can be briefly summarised as follows:

- Close proximity to high population centres resulting in large numbers of people accessing the forest, the routine activities of whom provide a 'cover' for those engaged in criminal activities;
- An extensive road/fire trail network traversing the forest, providing high levels of access for both legitimate and illicit forest users; and
- A lack of capable guardians to protect the forest, with minimal staff resources tasked with the enforcement of rules and regulations within the forest district.

Management practices, such as prescribed burns, constructing fire trails and developing integrated fire response strategies, were canvassed for preventing or mitigating the effects of bushfire arson. It is argued that these management practices are, in effect, forestry-specific, target hardening approaches which serve to increase the efforts required by arsonists to successfully start a fire while reducing 'psychological payoffs'. Situational crime prevention techniques, designed to increase risks to potential arsonists by improving the levels of formal surveillance by forestry authorities and informal surveillance by legitimate 'recreational' users, were also recommended as a viable additional approach.

'Torch Stolen Car' wildfire events were shown to be a particular problem in the Beerburrum district. To address this issue, a strategy of 'target removal' was recommended in which a recovery vehicle is utilised to rapidly remove abandoned vehicles to prevent them from being 'torched'.

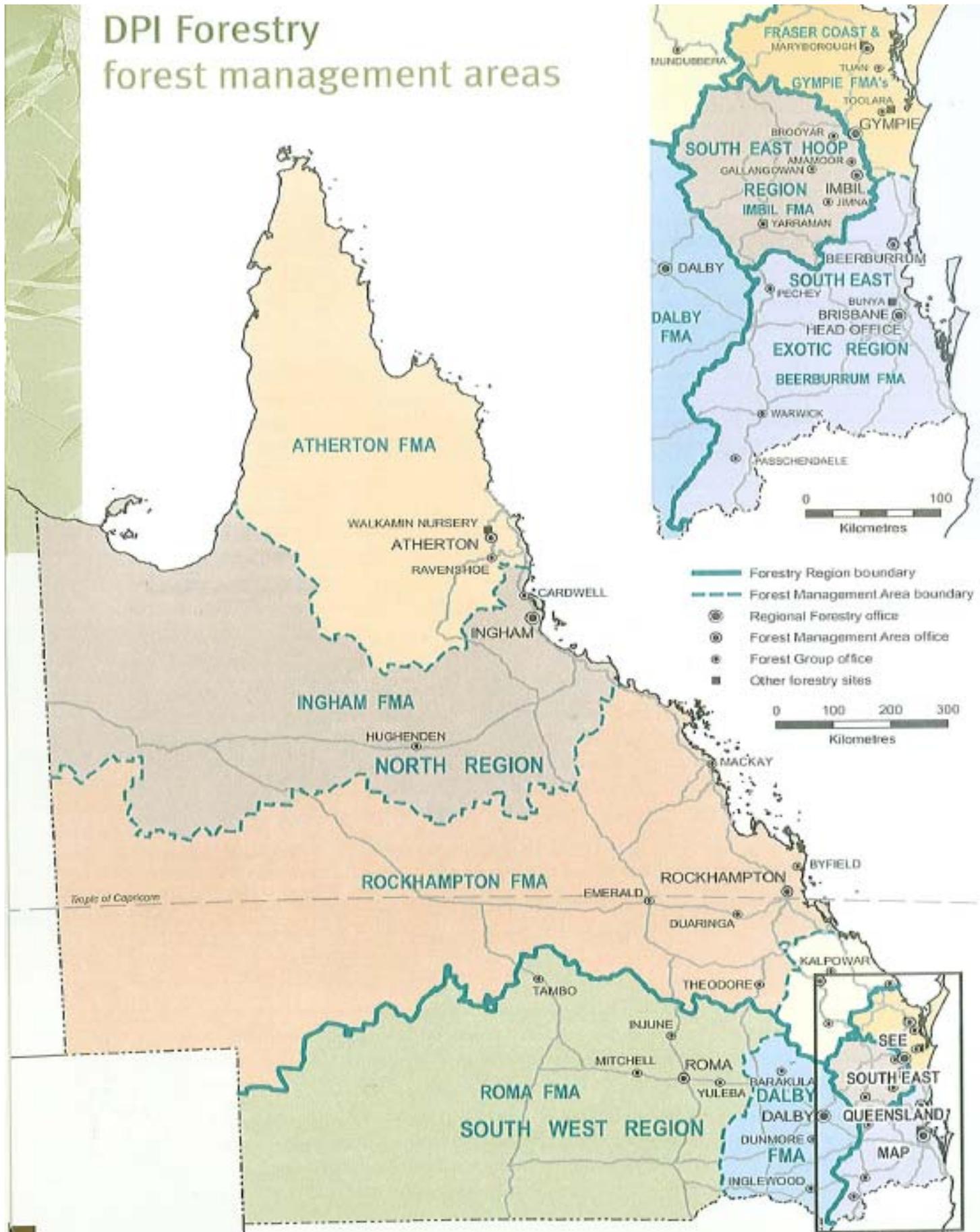
This study has demonstrated that situational crime prevention can play a significant role in the analysis, prevention and mitigation of bushfire arson. However, there exist some significant areas for further research. For example:

- The analysis of the DPI&F (Forestry) Wildfire Data Base has demonstrated the value of Willis's (2004) call for the mapping and analysis of all bushfire arson related data. A similar analysis of data from other jurisdictions may shed further light on locations that serve as bushfire arson 'hot spots' and help to identify viable opportunity reduction programmes.
- Research on offender decision-making processes and how opportunity influences their decision making strategies about committing arson could significantly assist in the development of viable opportunity reduction strategies (see Cornish and Clarke 1986).
- Research into the methodologies used by fire investigators to determine wildfire causation is needed to ensure the validity of data being gathered. Subjective differences in fire cause interpretation by investigators may result in methodological inaccuracies occurring when comparing cross-jurisdictional data. This paper calls for the

development of a nationally standardised process for the investigation and recording of bushfire data to improve data availability and validity.

Given the destructive potential of deliberately set wildfires, research into situational bushfire arson prevention strategies assumes an even greater significance. Behavioural methods addressing the social causes and psychological motives of bushfire arsonists are essentially reactive strategies. Treatment programmes can only be used on convicted arsonists after the commission of the offence. While behavioural programmes are important, proactive situational programmes that prevent and mitigate bushfire arson through decreasing rewards, increasing risks and removing excuses for deliberate firesetters are also critical, particularly when very few deliberate firesetters are actually caught.

Appendix A



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