FIRE IN ECOSYSTEMS OF SOUTH-WEST WESTERN AUSTRALIA: IMPACTS AND MANAGEMENT

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VOLUME 2

COMMUNITY PERSPECTIVES ABOUT FIRE

GOVERNMENT OF WESTERN AUSTRALIA
DEPARTMENT OF Conservation AND LAND MANAGEMENT
Conserving the nature of WA

Foreword

A symposium on the theme "Fire in Ecosystems of South-West Western Australia: Impacts and Management" was held in Perth on 16-18 April 2002. About 350 people representing a broad cross section of the community attended the Symposium. Refereed technical papers have been published in a separate volume by Backhuys Publishers, PO Box 321, 2300 AH Leiden, Netherlands or online at www.backhuys.com. Unrefereed papers presented at the symposium are contained in this volume.

Disclaimer

None of the articles included here have been peer-reviewed. The articles have not been edited by the Department of Conservation and Land Management. The opinions expressed are those of the contributors, and do not necessarily represent the policy of the Department of Conservation and Land Management.

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Aboriginal usage of fire – an indigenous perspective

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Abstract (No copy of the full paper was provided by the author)

While much has been said of Nyungar burning in the South West and while we have seen the development of several empirical models aimed at studying the effects and frequency of Nyungar burning, Nyungars themselves have had little opportunity to provide input into the ongoing debate of fire in the South West.

It is poorly acknowledged that there is still a significant amount of living knowledge on the subject of fire and fire use within the Aboriginal community of the South West. In this presentation, a Nyungar perspective on South West landscapes will be given, and the living knowledge of fire that exists within the South West Aboriginal community will be discussed, along with its potential for modern application. Included in this will be discussion on "naturalness" and examples of land degradation, vegetation and community change that have occurred as a direct result of land management practice moving away from a Nyungar fire regime. Also essential is an exploration of what it is that we might wish to achieve from our land management today, and how Nyungar knowledge and Nyungar people need to be incorporated into this.

Fire and Australian Society

David Horton

Writer and Consultant

When I was a young fellow growing up in the suburbs of Perth a book was published, in September 1950, which was to be one of the first of the blockbuster 'popular science' books. It was 'Worlds in Collision' by Immanuel Velikovsky. It was reprinted a staggering 13 times over the next ten years selling many tens of thousands of copies, and author and title were household names in the 1950s.

The book was nonsense. Velikovsky's theory was that the planets had moved around the solar system in a kind of celestial game of snooker, and the collisions between them, and the after effects, could explain all the history of climate and geology of the planet, and the evolution of organisms, and all human development. The collisions and their effects had continued not only through the last few hundred thousand years but into historical times.

The book was based on an obsessive belief in the theory and a willingness to force every piece of information the author could find, every reference to the heavens in ancient texts, into the mould of his vision. If you know the truth, really know the truth about the past, all evidence must accord with that truth.

The acceptance of the book by the general public was understandable - a claim to explain everything about the past all wrapped up in a simple theory is enormously appealing. Why though wasn't Velikovsky's book immediately discredited by the scientists of the day? Because a cosmologist reading it would say - 'well, the cosmology is of course complete rubbish but the geology looks very interesting'. A geologist would say, 'well the geology is nonsense, but gee there are some interesting ideas about biology here', an historian would say, 'well of course his reading of history is insane, but this stuff about planetary movement is really intriguing'. And so on.

Because the book combined material from many disciplines, no one was game to tackle it. Real scientists tend to feel a bit constrained about intruding into other disciplines, and they may give the book the benefit of the doubt, assuming the areas they don't have expertise in are ok. This lack of analysis by scientists didn't matter much for 'Worlds in Collision'. Like the 60s blockbuster 'Chariots of the Gods' it was pretty harmless fun, with no implications for human activity in the real world.

In the last few decades a view of the Australian past has been popularised which, not just implicitly, but explicitly, has very serious outcomes in the real world. It is a view which combines interpretation of evidence from a number of different disciplines, it has been very popularly received by the general public and supported by the media and by political interests with particular agendas, and it has led to the justification of some behaviours and attitudes, and ever increasing demands for action of certain kinds.

The ideas about Aboriginal use of fire and the effects of such use preceded the evidence for them. In the last 30 years data from disciplines including archaeology, ethnography, biology, geomorphology, anthropology, palynology and history have been used by some people not to evaluate the validity of those ideas but to demonstrate their truth. The greater the popularity of the ideas, and the more they became a source of support for vested interests, the less critical has been the examination of the data. The media has played a major role, giving great publicity to the latest claims of proof, and no publicity to the voices of criticism.

Generally, combining data from a number of different fields and using them to investigate a single idea would be seen as a strength. In the firestick farming case it has proved a weakness - practitioners in each discipline have assumed that they can build on the work of the other disciplines and that any doubts that they might have are cancelled out because of the assumed strength of the combined evidence from all the disciplines.

There is also an assumption that if there are many separate pieces of evidence, even if some are wrong, some must be right. But the case is a house of cards, and as soon as you start, without preconceptions, picking away at the evidence in any of the disciplines, the whole lot comes tumbling down.

The idea that has been dubbed 'fire stick farming' was from the start that most dangerous thing, the unfalsifiable hypothesis. This was made explicit by Rhys Jones who said that every change in the environment in the past was to be considered the result of human activity unless it could be demonstrated not to be.

So, high levels of charcoal in a swamp deposit? Fire stick farming. Low levels? Fire stick farming. Historic evidence of scorched tree trunks? Fire stick farming. No scorched trunks? Fire stick farming. Historic reports of many fires? Fire stick farming. Few reports of fires? Fire stick farming.

This monolithic interpretation of evidence extends to the model itself. The model demands that fire stick farming, in contrast to fires in recent times, was conducted in cool seasons when the conditions were such as to allow little gentle fires to run very slowly and quietly. Hence Aborigines would have burnt the bush in Spring or Autumn with moisture in the ground and vegetation, and little wind. In fact historic reports show the majority of fires burning in Summer. In Sylvia Hallam's work for example, of about 100 references to fire she records, 63 are in the months of December to March. Of the other 35 or so 13 are not references to bushfires, and in 14 it is unclear when the fire had actually been burning. In very few of those 35 is it clear that a fire had been caused by Aborigines. Attempts had to be made to discourage Aboriginal use of fire in the summer. Another report suggests fires being set on very windy days. The reason? Aborigines knew that on windy days the flames would be kept low!

Because we have here not a theory derived from the evidence, but evidence derived as a result of belief in a theory, there are a number of fundamental misunderstandings about the nature of that evidence. I don't have time to do more than pull away a few of the cards here.

Fire has probably been fundamental to all human societies. The ideas of a hearth as a focal point for the family, of fire to keep wild animals or bad spirits away, fire to illuminate ceremonies or story telling, fire to cook food or keep warm, are all universal and of great antiquity. Consequently ideas about how humans learnt to make and harness fire is a common feature in mythology around the world. That these things are also true for Aboriginal societies provides no support for the fire stick farming hypothesis and is simply irrelevant.

The general failure of observers in the past to distinguish in their reports between the smoke from campfires and the smoke from bushfires, is a major problem in ethnographic interpretation. Or, if it is a bushfire, to distinguish between a fire caused by lightning strike and one lit by humans. Or, if lit by humans, to distinguish between a fire set for the purpose of habitat modification and fires escaped from hunting trips and other such uses. The fact that in the early days of European exploration of Australia observations of campfires were used by Europeans as an indication of both human presence and human numbers means that frequent reports of fire mean very little in the context of fire use for other purposes.

Similarly the early reports of occasional landscapes described as 'park-like', so important in the fire-stick farming idea, have no bearing on it. Early European observers of Australia knew that Aborigines didn't practise agriculture. Here was the only continent on which no one practised agriculture. This being the case, the early observers knew that what they would be seeing as they explored was a wilderness of forests with thick undergrowth. There was no other alternative possible, if people didn't clear land it was wilderness. They were therefore surprised, and found it noteworthy, when they came across areas that had less undergrowth and apparently more widely spaced trees. Such reports were therefore accentuated (and the normal landscape ignored), and accentuated too because the colonists were farmers and were looking for areas to pasture sheep and grow crops. Observers had no way of knowing that variations in soils, topography and climate could cause significant variations in Australia without human intervention. Nor did they usually know whether a fire might have influenced the landscape some years before, nor, if it had, how that fire had started. It is far less excusable for writers 200 years later to also expect to see thick forest everywhere and to ignore all the descriptions of non-parklike conditions.

A proposition designed to bolster this idea that Aborigines had turned the Australian landscape into a park is that some areas have 'reverted' to thick wilderness when Aboriginal use of fire stopped. There is a lack of knowledge about European use of fire in the early nineteenth century, a failure to recognise that the effects of domestic and feral animals and plants and land clearance and fire suppression attempts also need to be disentangled, and 200 years of climatic change analysed, before there can be any attempt to see the presence and absence of Aboriginal fire, as a simple cause and effect experiment related to floristic change, even supposing that a postulated change in some area, and its timing, is itself well documented.

There is a lack of understanding that whether or not human use of fire can effect vegetation change, it is undoubtedly true that vegetation change as a result of climatic change will cause a change in fire regimes. Confusion of cause and effect is often a problem in science when trying to unravel historical events.
There is a propensity to take not just observations by early nineteenth century observers at face value, without any attempt to establish what they could have observed and what they actually were observing and whether they had an agenda which influenced what was reported, but also their theories about what was going on. There is an amazing trust in the observations and ideas of untrained observers, writing long before the development of modern science or anthropology, and who were dealing with a complex society which is only now, after some 50 years of sophisticated observations, beginning to be understood.

There is a clear and irreconcilable conflict between two different models of fire stick farming, and between these models and anything actually observed in the nineteenth century. Norman Tindale said (a view later repeated by Rhys Jones) - 'Man, setting fire to large areas of his territory ... probably has had a significant hand in the moulding of the present configuration of parts of Australia. Indeed much of the grassland of Australia could have been brought into being as a result of his exploitation. Some of the post-climax rain forests may have been destroyed in favour of invading sclerophyll, as the effects of his firestick were added to the effects of changing climate in Early Recent times... Perhaps it is correct to assume that man has had such a profound effect on the distribution of forest and grassland that true primeval forest may be far less common in Australia than is generally realised'. Conversely other authors have suggested that burning of small patches over long periods with small fires, exercising a level of control and an appreciation of long term consequences impossible for us to achieve, maintained a so called mosaic environment in an overall constant state for 50,000 years.

There needs to be a motive for the level of activity proposed under either model, and in spite of strenuous efforts no valid motive has yet been suggested. If the idea was to increase kangaroo numbers (when Rhys Jones called it 'firestick farming' he actually meant 'kangaroo farming', the firestick being the tool, the kangaroos being the animal farmed) for Aboriginal use it was a dismal failure. The presence of kangaroos in the food refuse in archaeological sites is always unusual. In fact you can turn the question round and ask why you would try to increase the availability of something that was an insignificant element of the diet. The question becomes even more pointed if you realise that the animals which did form the bulk of the meat diet were small marsupials and placentals and reptiles that would have been disadvantaged by a program of burning which aimed to reduce leaf litter, old trees, logs, large grass tussocks, in woodlands and forests. Incidentally, the suggested motive of getting rid of what commercial TV now calls creepy-crawlies, and at least one nineteenth century observation that fire did achieve this, is, if you wanted to take such observations at face value, an indication that fire stick farming was damaging to biodiversity. Talking about the casual use of fire in hunting, or for seeing at night, or escaped campfires, is a description of alternative causes of bushfires, not of fire-stick farming.

William Robertson, Doctor of Divinity, said in the 1770s, in the interval between James Cook and Arthur Phillip - 'In other parts of the globe, man, in his rudest state, appears as lord of the creation, giving law to various tribes of animals which he has tamed and reduced to subjection ... This command over the inferior creatures is one of the noblest prerogatives of man, and among the greatest efforts of his wisdom and power. Without this, his dominion is incomplete'. The good doctor was writing about America, but he represented the climate of opinion which saw the colonisation of Australia, and which has continued to colour the approach to the environment today.

James Cook had said of Australia - 'We are to consider that we see this country in the pure state of nature, the Industry of man has had nothing to do with any part of it ' the Aborigines 'have no fixed

habitations but move about from place to place like Wild Beasts in search of food, and I believe depend wholly upon the success of the present day for their subsistence'. Such views of the Aboriginal economy had important political implications both then (Australia was to be occupied by virtue of it being a terra nullius - the country was not being "used" and was therefore available for vacant occupation) and now.

This belief that the potential of the continent was wasted by its indigenous inhabitants was based on the idea that the Australian landscape had been unaffected by human activity until 1788, and that Aborigines were merely 'intelligent parasites' upon the land. It was a curious phrase, and the analogy it invoked with, say, lice or tapeworms was not only insulting, but put in place quite the wrong image of economy and society. But this was a belief with strong political approval because it reinforced the idea of terra nullius. If you didn't farm the land you didn't deserve to keep it.

The politics of the situation crystallised when anthropologists and archaeologists, on the side of the angels in the fight for Land Rights for Aboriginal people, began to see Australian hunter-gathering as a form of farming, and the Australian landscape as a managed landscape. That is, the form of management may not have been clear to European eyes, and the resulting landscapes not obviously man made, but they were as much an artefact as the rolling parklands of, say, the Duke of Bedford.

A people who had nurtured the land in this way could no longer be ignored as rightful claimants to the land, with a title in land use as valid as that of any Queensland grazier or Victorian wheat farmer. It was a view of a new reality eventually to be confirmed by the High Court. This new orthodoxy, success crowned by Mabo, has proved to be as hard to shake as the old orthodoxy, rooted in terra nullius, had been.

Political alliances changed as the implications of these new views about Aboriginal manipulation of the environment became apparent. If it was true, as Norman Tindale believed, that there wasn't a single habitat in Australia that hadn't been created by Aborigines, then the question by Rhys Jones as to what we wanted to preserve, the environment of 200 years ago, or one of, say, 70,000 years ago, was a good one. If the answer, as Jones pointed out, was 200 years ago, then we would need to use fires as Aborigines had done. That is, if the Australian environment was an artefact of human behaviour, there was no reason why it couldn't be manipulated by farmers, cattlemen and foresters. In the last few years Flannery has popularised the ideas of Tindale, Hallam and Jones. - 'there is no Australian wilderness, and no national park that can exist in its pre-1788 form without the ongoing input of people'. The campaign to change public opinion has focused on apparent changes to the environment caused by cessation of burning, the risk to property caused by bush fires (and the need for controlled burning), changes to vegetation (and the need for forestry practices to rectify things).
A concept that Aboriginal burning practices may have kept woodlands relatively open, and that therefore a particular spot of ground may (or may not) have more trees now if it has not been burnt than it would have had 200 years ago, has been extended into the ludicrous suggestion that there are more 'trees' in Australia now than there were 200 years ago. Farmers seize on this to justify continued large scale land clearing.

The popularisation of a set of particular interpretations of archaeological and ethnographic records, and of hypotheses derived from them, has been both presented, and received by media, politicians, and some scientists, and consequently by the public at large, not as interpretation and hypothesis but as fact. People who, in relation to all other aspects of human endeavour, would hold Aboriginal society, culture and people in total contempt, amazingly profess to find, when it comes to interaction with the environment with fire, that what they have been told was the Aboriginal way is the best way.

At the time of Native Title, Mabo, Wik, ten point plans, stolen generations, apologies and preambles, there was a large part of the population delighted to hear that Aborigines not only hadn't owned the land or been custodians of it, but had caused massive damage, extinctions, vegetation destruction, even, god help us, climatic change - a holocaust - and it was up to us to put things right. Aborigines constantly find themselves in no win situations in white Australia and here was another case of damned if you do and damned if you don't. If you didn't manage the environment you are freeloaders who didn't deserve to keep the land, if you did manage it you are incompetent primitive vandals.

There is perhaps an even more fundamental level at which the fire stick farming hypothesis is striking a chord and becoming an alibi. The recent Regional Forest Agreement legislation, pushed by the

representatives of both big business and union interests in parliament, is the result ultimately of a shared belief with the Doctor of Divinity William Robertson, that humans have a noble prerogative to be 'lords of creation'. Anything in the environment, whether a tree, a grassland, a river or oil on the Barrier Reef, which is not exploited to the maximum possible extent for the economic benefit of the exploiters, is wasted.

This links to another campaign. In NSW at Christmas, almost as the first arsonist was striking the first match, the campaign against the existence of National Parks, against the conservation activities of the NPWS, against any concept of wilderness areas and publicly owned land, flared up again like the flame on the match. There are it seems a number of people to whom the idea of public land strikes at the core of capitalism, and the idea of natural areas strikes at 10,000 years of human heritage in agriculture and forestry. There is to be no land which is not managed to make a profit.

Such people stare over the fence into National Parks, their angry faces on, demanding to know why this wasted land is being managed by greenies, and not by people from the real world who know that you need to thin trees, build tourist facilities, bring in sheep and cattle, encourage four wheel drives and motor bikes, and drop incendiary capsules and poison baits from the air. Hearing first about fire stick farming, and then that there is no such thing as wilderness in Australia, but it was all created by Aborigines, has played into the hands of these people.

This is all pretty heady stuff - ideas and metaphors about the past (stylistic devices in archaeological writing, the stuff, normally, of just tea room and seminar room debate) are being used to determine the place of Aborigines in society and perhaps even more frighteningly to determine environmental policy for the future.

The fire stick farming hypothesis fell onto fertile ground among some in the scientific community too. The reasons for this are also complex but involve the idea that the biological sciences in Australia should take more notice of indigenous knowledge about the environment.
Here was an ideal case - the anthropologists were saying, and, presumably, had good reasons for doing so, that Aborigines had used fire to modify the Australian environment. If this sounded odd as an economic and environmental strategy well, then, ecologists knew nothing of anthropology and its methods and would have to take it on trust. If the anthropologists thought it was okay then it must be.

What they didn't realise was that most anthropologists know little or nothing about ecology. Many anthropologists and archaeologists picked up on the idea with approval not only because of their philosophical predisposition to believe that Aborigines were active and not passive environmental agents, and their political views in support of Land Rights, but because it was a simple and elegant idea expounded with passion and conviction, and it therefore must be right. Besides that there seemed to be ecologists in favour of it.

The ecologists in turn could not fail to be influenced by an idea praised in the media and promoted in a book that sold many thousands of copies. So a general climate was created across the disciplines involved that firestick farming was not just an hypothesis but a fact, and a fact operating for 50,000 years, and therefore of critical importance in any investigations of prehistory and ecology.

Two further observations

For the last couple of hundred years sheep farmers in the uplands of Wales have been burning their pastures annually in the belief that in doing so they were reducing woody shrubs and encouraging palatable grasses. It has been realised lately that, combined with overgrazing and other activities, this fire stick farming was causing environmental problems. In my area of NSW every year farmers also burn pastures and the stubble from crops as they do all over Australia. If asked why they would probably say 'Well, the Aborigines did this and it's good for the environment'. I don't know how many Australian farmers have Welsh ancestors, but it would be an odd chain of idea development if the activities of Welsh shepherds 200 years ago had reached their descendants (and other farmers) not directly, but after being filtered through a hypothesis about Aboriginal behaviour.

This conference is focused on forests, and the conservation battlegrounds both here and in the east are also focused on fire use in forests. It is curious then that if you read Sylvia Hallam's book, a book

in which every camp fire, every burnt piece of land, every observation and theory by a settler, is seen as support for the fire stick farming hypothesis, there is no record of the use of fire in forest by Aborigines. As is often the case with fire stick farming, people see in the mirror what they expect to see, and they have assumed as a matter of course that the model, and the evidence for it, extends into the forests ..... Not the case.

I have no doubt that Aborigines were keen observers of their environment. How could they not be? They undoubtedly knew that there was succession after fire, and that different aspects of that succession offered different opportunities for resource exploitation. They also had no reason to worry about fire unless caught in it - no permanent housing, no railways, factories, domestic livestock, farm sheds, no reason to worry about damage to artefacts difficult or expensive to replace. A casual attitude was possible because the effects were understood and there was nothing to fear. In Australia in 2002 we know that bushfires can result from lightning, arson, or accident. My view is that the same was true 200 years and more ago.

I have no doubt that the great majority of people who are promoting the idea that we should take lessons from what they believe was the pattern of Aboriginal fire use in the past genuinely have the best interests of the environment, and Aborigines, at heart. But fire stick farming makes for strange bedfellows, and conservationists might be uneasily looking over their shoulders at some of the other groups who are, uniquely for once apparently on the side of conservation, promoting the same idea.

Conservationists should not assume that fire stick farming is a done deal. They should ask hard questions about both the logic of the hypothesis and the data on which it is based. If they have concerns about the current use of fire in forests, and its long term effects, they should ask hard questions about those matters, and no longer accept that the answer 'But Aborigines did it like this' closes off the debate.

There are also people who are promoting the idea of control burning who do not have the interests of the environment at heart. They have always believed the environment should be dominated and managed, and burnt constantly and frequently. It is not that the fire stick farming hypothesis generated these ideas, but that they seized upon the hypothesis in order to legitimise intentions which have long been there.

Fire stick farming is not an alibi or a prescription or a cover for extensive control burning. If you want to burn parts of the forest to protect property then let us take as our null hypothesis that 'control burning' will damage the environment and you should be required to demonstrate that in each proposal this is not the case. If you take the reverse hypothesis, assume that fire does not cause damage unless proved otherwise, and burn the extent of country with the frequency that is being promoted, then you will, in a very short time, cause damage, probably irreversible, that Aboriginal people managed to avoid causing in 50,000 years.

Scientists should analyse their data relating to fire ecology and see what it tells them. The data should not be analysed on the basis of what people believe Aboriginal people might or might not have done in the past. A similar mistake is to assume that we know that Australian organisms are 'adapted' to frequent fire and interpret accordingly. Theories in this critically important area must arise from the data, not be imposed upon the data.

Fire and the law

Sandra Boulter

Solicitor, The Environmental Defender's Office (Inc)

The Environmental Defender's Office WA (Inc)[1] (the EDO) is a non profit independent community legal centre specialising in public interest environmental law. The aim of the EDO is to inform and advise individuals and environmental groups about the operation and implementation of laws and policies pertaining to environmental protection and biodiversity conservation in Western Australia.

Australian law

In this paper[2] I will introduce the law relating to burning, by providing a synopsis of the general legal framework which underpins fire control and practice in the south west of Western Australia. I will then address issues of terminology, regulation and policy implementation employed in respect of burning practices in Western Australia.

Australia has developed an adversarial system of law based on the English system[3] which arrived along with the C18th English settlers[4]. Our law is made up of international law[5], common law, statutes, subsidiary legislation, policies and administrative guidelines. Customary Aboriginal law[6] and its interrelationship with English based Australian law[7] is an ongoing (sometimes contentious) issue of integration. All of these areas of law contribute to the legal framework embracing fire in Western Australia.

Fire issues span all levels of government, and many government agencies and land tenures. It is important that the debate about the management of fire is not confined to four year electoral terms or to the present owners and occupiers of the various land tenures. It is salient at this point to remember the special difficulties government agencies have in Western Australia in managing the responsibility for fire control on a third of our continent for a small population with limited resources.

When we ask, Who is responsible for the control of wildfire? and Who can authorise pre-emptive burning in Western Australia? there is no simple answer.

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[1] The EDO is funded by the Commonwealth and State governments and by charitable grants, sales of publications, donations and membership fees. The objectives of the EDO include the facilitation of effective community participation in environmental decision making. The EDO has published two texts: *A Guide to Environmental Law Western Australia* and *The Law of Landcare Western Australia 2002*, 2nd edition; and a number of fact sheets.

[2] This paper is for general information purposes only and is not legal advice. Important legal details have been omitted to provide an overview of the law. If you require legal advice relating to specific circumstances you should contact the EDO or your own solicitor. The views expressed in this paper are those of the author, and do not necessarily represent those of the EDO. Acknowledgment is made of reference to the paper by M Bennett Solicitor EDO WA (Inc) *Pre-emptive Burning* 1996 unpublished, and for the helpful comments from Alex Gardner Senior Lecturer of the University of Western Australia, Ian Bowden of FESA, Beth Schultz and Graham Rundle, and for the assistance in research for the paper by the EDO student volunteers.

[3] There are other systems of law which include for example an Inquisitorial system.

[4] 1829. For a history of the development of the law in WA see E Russell, *A History of the Law in Western Australia and its Development from 1829 – 1979* UWA Press, 1980.

[5] Treaties and International Conventions create international legal obligations but do not create legal rights and obligations in our domestic law. International law will not be addressed in this paper.

[6] The issues of Aboriginal customary/traditional practices in respect of burning have much greater impact on the lands in the north of our State, and have been addressed in my paper, *Burning Issues in the East Kimberley* presented to the Fire Forum held at *El Questro* in May 2001.

[7] For example see the draft policy published by CALM in August 2000 on the involvement of traditional owners in the management of CALM lands, *Aboriginal Involvement in Nature Conservation and Land Management.*

Fire and the common law

1. *Introduction*

Common law principles apply to everyone (including the Crown) unless expressly excluded by an Act of parliament. Common law is often referred to as judge-made law and generally has been made in the following way. In the absence of a written law, a court will determine a matter by looking at the established principles of common law,[8] custom, tradition and modern convention.

2. *Some common law principles*

The common law principles most relevant to the management of fire are:

- Negligence;[9]
- Trespass;[10]
- Nuisance.[11]; and
- Occupier's liability.[12]

The liability, of an owner (or occupier) arising from damage caused by the escape of fire from his or her land may be found in the common law principles of trespass, nuisance, negligence or occupier's liability. These principles may have been modified by statute.

3. *Negligent fire management*

The common law principle of negligence provides that if all the elements of negligence are made out in a particular case, a person is entitled to claim compensation for damage caused by that negligence. Case law records examples of civil[13] liability for negligent fire management which have been decided before the courts and include:

- lighting a fire in an inappropriate manner or place;[14]
- failing to watch a fire;[15]

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[8] Past cases published in law reports, which may be referred to as a precedent, or a case authority.

[9] The common law principle of *negligence* comprises the elements of a duty of care, a breach of the requisite standard of care, the type (not amount) of damage which was a foreseeable consequence of the breach, and the damage was caused by the breach: see *Donoghue v Stevenson* [1932] AC 562 ; *Jaensch v Coffey* (1984) 155 CLR 549. Negligent acts can occur in circumstances of an action, manufacture, contract, driving, advice or opinion in a business context, and by mis-statement.

[10] *Trespass* to land is described as the intentional or negligent act of an individual which directly interferes with another individual's exclusive possession of land without lawful justification. To make out *trespass* there must be direct physical invasion of private land and the invasion must be intentional. Neither damage nor unreasonableness is required to be made out to establish *trespass*. A related principle is the common law principle of *Trespass ab initio*. This principle applies to a person who enters another's premises under statutory authority and abuses that authority by committing an unlawful act outside the scope of that authority, to say that the whole of his or her entry becomes unlawful or trespassory from the beginning: see *The Six Carpenter's Case* (1610) 8 Rep 146a; 77 ER 695. However, the continuing existence of this doctrine has been doubted, see *Baker v R* (1983) 153 CLR 338; 47 ALR 1.

[11] *Nuisance* is an interference with a public or private interest, see *Halsey v Esso Petroleum* [1961] 1 WLR 683. The elements required to succeed in a private *nuisance* action are that there must be physical injury to land or to a person's use and enjoyment of the land, the interference causing the injury must be unreasonable, and the damage caused must have been foreseeable. Only a person in actual possession of the land can make claim in *nuisance*. Where the *nuisance* interferes with a right enjoyed by the public at large it is a public nuisance. Private individuals can take an action in public *nuisance* even if they have no interest in the land the subject of the interference, so long as they have suffered injury over and above the public at large. An activity or state of affairs that causes damage to land, might be emissions of airborne pollution or by unreasonably interfering with the use or enjoyment of land, see *Hargrave v Goldman* (1963) 110 CLR 40 at 60); or with the health, safety, comfort or convenience of the public at large, for example by smoke or fire. Also see Halsbury's Laws of Australia 330 – 400; and *Burnie Port Authority v General Jones Pty Ltd* (1994) 68 ALJR 331.

[12] Common law *occupier's liability* can be described as the raft of common law legal responsibilities of an occupier of land towards visitors who have lawfully or unlawfully entered occupied land and suffered injury during the course of their visit. Early common law principles created special obligations of an *occupier* which differed depending on the class of entrant on their land, for example between trespassers, invitees or licensees. These old common law distinctions have merged into the general common law principle of the *occupier's duty of care* to all classes of entrants, see *Australian Safeway Stores Pty Ltd v Zaluzna* (1987) 162 CLR 469. In WA there is the *Occupier's Liability Act 1985*, which in part replaces the common law. *Occupier* is defined for the purpose of this Act to be any person occupying or having control of the land or other premises (premises include any fixed or moveable structures including vessel, vehicle or aircraft): see section 2. The *Occupier's Liability Act 1985* binds the Crown: see section 3.

[13] As opposed to criminal liability.

[14] *Mullholland v Baker* [1939] 2 All ER 253; *Pickin v Hesk* [1954] 4 DLR 90.

[15] *Bugge v Brown* (1919) 26 CLR 110; *Wise Bros v Commissioner of Railways* (1947) 75 CLR 59.

- failing to prevent a fire getting out of control;[16]
- failing to contain a fire even where there is no responsibility for the fire, such as following a lightning strike or the spreading of a fire lit by a trespasser;[17] and
- creating a situation conducive to spontaneous combustion.[18]

It is important to remember that mere compliance with legislation, for example with a permit issued under the Bush Fires Act 1954, will generally not of itself be a complete defence to a civil claim for damages caused by the escape of that fire.[19] Furthermore, a person held liable for the actual damage caused by fire, may also be liable for consequential expenses reasonably incurred in respect of that fire.[20]

4. Fire management and government agencies

It is understandable that government agencies might be concerned to prevent personal injury or property damage from wildfire, and forestall any liability of the agency arising from a negligent failure to undertake a pre-emptive burn. Protection of life and property is not a specific function of the Department of Conservation and Land Management (CALM) under the Conservation and Land Management Act (1984) (the CALM Act), nor is it a specific function of management plans authorised by the CALM Act.[21] However, the common law principles described above apply to any occupier of land unless excluded by statute.

The Conservation Commission, the Forest Products Commission and CALM[22] arguably may be described as occupiers[23] of land vested in the Conservation Commission.[24] The common law and statutory liability of the Crown in respect of damage, injury or loss suffered by a person on or from a cause emanating from unmanaged reserves or unallocated Crown land has been limited by statute to that which is the direct consequence[25] of an act or activity of the Crown.[26] The same limitation applies to management authorities in respect of managed unimproved reserves and is further limited to an action that is otherwise than in accordance with its management order.[27]

5. Liability and policy implementation

A discretionary decision following a particular policy[28] not to carry out a particular pre-emptive burn[29] is unlikely, without more, to lead to a successful claim in negligence against the government agency or a local government making that decision. The law of negligence distinguishes between a mistake in making a policy, and a mistake in implementing a policy at the operational level.

This is so because our courts have held that governments must be free to govern.[30] Governments and their agents make policy decisions which involve the balancing of environmental, financial, economic, social, and political factors. This approach is reflected in judicial decisions which have held that public authorities are not under a duty of care in relation to policy decisions. Thus, a decision to follow a

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[16] Ibid.

[17] *Goldman v Hargrave* [1967] 1 AC 645 (P.C.); 115 CLR 458.

[18] *Vaughan v Menlove* (1837) 3 Bing NC 468; 132 ER 490. See J G Fleming, *The Law of Torts* The Law Book Company Limited 8th edn 1992 chapter 17, pages 349 – 352.

[19] Halsbury's Laws of Australia 330 – 400; and see *Roberts v Webb* (1887) 21 SALR 96; *Hazelwood v Webber* (1934) 52 CLR 268.

[20] *NZ Forest Products v O'Sullivan* [1974] 2 NZLR 80.

[21] Part V.

[22] *Conservation and Land Management Act 1984* sections 26 AA, & 20(3)(b).

[23] An 'occupier' is a person in actual possession of or taking up a place in an area. 'Occupation' encompasses a degree of control, see *Donaldson v Bottroff* [1965] SASR 145 which is not necessarily ownership, see *Bulong v Cohn* [1901] 3 WALR 74. An occupier is to be contrasted with an invitee or entrant by contractual right. Under the *Occupier's Liability Act 1985* an occupier is defined to mean a person occupying or having the control of land or other premises. "Premises" is defined to include any fixed or moveable structure including a vessel, vehicle or aircraft.

[24] The *Conservation and Land Management Act 1984* section 19(1)(a).

[25] The common law is broader, that is that damage was a foreseeable consequence of an action.

[26] *Land Administration Act 1997* section 264 (2) and the Crown in this section means a State agency or State instrumentality or an officer or employee of the Crown or of a State agency or State instrumentality, see section 264(4).

[27] A management order is an order made under section 46(1) or 59(4) of the *Land Administration Act 1997*, and is not a management plan.

[28] For example see a forest management plan.

[29] For example a policy that a less intensive hazard reduction burning program be pursued.

[30] *Sutherland Shire Council v Heyman* (1985) 157 CLR 424; and *Parramatta City Council v Lutz* (1998) 12 NSWLR 293; and *Murphy v Brentwood District Council* [1991] 1 AC 398.

policy is unlikely to found a successful action in negligence because a duty of care is an essential element of a successful common law claim for damages in negligence or some other tort.

On the other hand, mistakes at the operational level in implementing a policy might provide a basis for a claim for damages in negligence.

Examples of negligent operational mistakes might be:

- a failure to undertake a fuel reduction burn contrary to policy;
- a failure to control an authorised pre-emptive burn even if it is undertaken pursuant to a particular policy; or
- a rigid implementation of policy in circumstances where the policy is not apt.

Thus an action implementing a policy taking into account the full range of considerations, including public safety, risk to property and the impact on biodiversity, is unlikely to provide a foundation for a successful claim in negligence, unless the decision is then implemented in a negligent way.[31]

This analysis indicates that:

- a perceived threat of legal action (for example arising from property damage) for not undertaking a pre-emptive burn, may not be a valid reason for a government agency to ignore or not give appropriate weight to other statutory considerations (such as land degradation and biodiversity impacts)[32] of such a burn proposed to be undertaken or not undertaken, according to a policy; and
- it is in the interests of local government authorities and relevant government agencies to have approved policies on pre-emptive burning, since these might provide a successful defence in a civil action for damages perceived to have been caused by some action or omission of the material agency.
- In some matters that come before the courts a negligent action, undertaken by an employee or contractor, is well beyond the scope of the authorised activity. Such actions have been described as off on a frolic of their own and have led to personal liability for the consequences of a negligent action.[33]

Fire and statutory regulation

1. Statutes

Statutory law establishes and regulates the operation of our various levels of government and government agencies. A statute[34] is a written law made by an Act of Parliament to pass a Bill.[35] Statutes cover specific areas of law. Statutes prevail over the common law and can limit or modify common law rights.[36] For example, the liability of the Crown and management authorities responsible for management of Crown land is limited by the provisions of the Land Administration Act 1997.[37]

Statutes may impose restrictions on our activities, create obligations or provide sanctions against certain actions.

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[31] See *Sutherland Shire Council v Heyman* (1985) 157 CLR 424; *Parramatta City Council v Lutz* 1(1988) 12 NSWLR 293; *Murphy v Brentwood District Council* [1991] 1 AC 398.

[32] See the Executive Summary of the Progress Report on Environmental Performance and mid-term Report on Compliance: Forest Management Plan 1994 – 2003: EPA Bulletin 912 November 1998.

[33] An employee *off on a frolic of his or her own* negates the vicarious responsibility of his or her employer for damages arising from that unauthorised action, see *Whitfied v Turner* (1920) 28 CLR 977but see *Burnie Port Authority v General Jones Pty Ltd* (1994) 68 ALJR 331; 179 CLR 520 which held that in certain circumstances an owner has a non-delegable duty of care. Also see the *Pyrenees Shire Council v Day* 192 CLR 330 about the liability of government agencies for failure to follow up on a statutory notice to reduce a fire risk.

[34] Often referred to as an 'Act'.

[35] A Bill is the draft of a statute. The Bill progresses through the Parliament. When the Bill is passed by both houses parliament it is referred to as an Act of Parliament. The Act becomes operative on the date as proclaimed and recorded in the Government Gazette. The date of the Act may not be indicative of the contemporary relevance of the Act because it may have been amended numerous times since it was passed by the Act of Parliament.

[36] *British Railways Board v Pickin* [1974] AC 765 at 789, 793, 798.

[37] *Land Administration Act 1997* section 264.

When there are a number of statutes regulating one particular activity, the principles of statutory interpretation apply to determine which statute will prevail in the face of inconsistent provisions. Some of these principles include:

- the Crown is presumed to not be bound by a statute;
- where Acts are not inconsistent both will operate and a number of approvals might be required;
- a later Act will prevail over an earlier Act; and
- a more specific Act will prevail over a general Act.

2. Subsidiary legislation

A statute may authorise a certain person or body to make subsidiary legislation, which are often known as regulations.[38] Subsidiary legislation is binding like a statute.

3. Policies, management plans, memoranda of understanding and administrative guidelines

3.1 Policies

There are two types of regulatory decisions that a government agency might make.

First a statute might require an agency to make a decision as to whether a person has undertaken an action prohibited by the statute. There is no discretion in such a decision. Either the proposed action is prohibited or it is not.

The other type of decision requires an exercise of discretion, for example to grant or refuse a particular permit. When a government or its agent wishes to guide or influence the way discretionary decisions are made, they may develop policies or administrative guidelines for that purpose.

One of the questions I am often asked is: How can the provisions of a policy be enforced? The short answer is that generally speaking,[39] a policy is not enforceable but the appropriate consideration of the policy by the material decision maker may be enforceable. Policies and administrative guidelines are developed to guide (but not predetermine) a decision based on the exercise of the discretion of the decision maker.[40] The weight (or importance) to be given to a particular policy varies.

Legislative policy, (a policy adopted under an Act or subsidiary legislation) carries the greatest weight. An example of such legislative policies is a State Planning Policy (SPP) made under section 5AA of the Town Planning and Development Act 1928. The new Agricultural and Rural Land Use Statement of Planning Policy gazetted 12 March 2002 (the ARLUSPP) is a section 5AA SPP. The ARLUSPP describes related policies to include Policy DC 3.7 Fire Planning, and the policy Planning for Bush Fire Protection [41] published in December 2001 as a joint policy of the Department of Planning and Infrastructure and FESA.[42]

Other government policies (of progressively less weight) include cabinet endorsed, State government agency endorsed,[43] local government endorsed and local government ad hoc policies.

It may be possible to amend legislation (or subsidiary legislation) to make certain provisions of a particular policy enforceable. So, for example, a forest management plan, might require notification of

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[38] See for example the *Conservation and Land Management Regulations 1992* which regulate camping and commerce undertaken on CALM managed lands; or the *Wildlife Conservation Regulations 1970* which regulate the taking of fauna and flora, and activities on nature reserves and wildlife sanctuaries.

[39] However, see Environmental Protection Policies made under the *Environmental Protection Act 1986* ("EPP") which are binding on the world at large. EPPs could also be described as subsidiary legislation because they are enforceable and unfortunately the existence of such 'policies' leads to confusion about the role of policies generally.

[40] French and Drummond JJ in *Minister for Immigration, Local Government & Ethnic Affairs v Gray* (1994) 50 FCR 189 at 208.

[41] This policy is described as a protection planning tool that has been prepared by FESA in close consultation with the Department of Planning and Infrastructure (DPI). The main focus of the document is bush fire protection within new land development in bushfire prone areas and to provide a benchmark for bush fire prevention planning within existing communities. The policy at page 4 requires it to be read in conjunction with the *Policy No. DC 3.7 Fire Management* of the DPI. The policy also provides that building fire safety matters should be informed by the *Australian Standard for the Construction of Buildings in Bushfire-Prone Areas* (Australian Standard 3959). Local governments are encouraged to adopt this policy: see page 3.

[42] Fire and Emergency Services Authority of Western Australia.

[43] For example the *Fire Management Policy Statement 19* published by CALM in May1987.

the local government by the proponent of each pre-emptive burning proposal proposed to be undertaken according to that policy, which then must be recorded on a register held by the local government. An amendment to the relevant town planning scheme could require that implementation of such a proposal requires prior approval from that local government.

Policies do not always state the authority under which they are made or describe their legal effect. Such clarification is essential for the effective implementation, acceptance and efficacy of the policy.

3.2 Management plans

The enforceability of a management plan is in the main prescribed by its statutory foundation, that is by the legal nature of the plan.

Management plans should be clear, precise and unambiguous in their drafting because they can:[44]

- state the objectives of the administration of the statute under which they are made;
- state the policy basis for decision making;
- identify the decision making process and those responsible for making and implementing decisions;
- identify matters which can be taken into account in the decision making process;
- be an aid to decision making;
- set out and clarify constraints on and opportunities for the decision maker;
- communicate management issues to other stakeholders;
- promote equity;
- reduce the likelihood of arbitrariness and caprice;
- promote transparent decision making and accountability;
- provide information about how decisions will be made; and
- provide a defence to a particular claim against a person implementing a plan.

The fact that fire management and pre-emptive burning practices set out in a management plan are not binding on the authority authorised to administer it without more, means that departure from the plan can also be contemplated if there are factors against it. What is helpful in such circumstances is identification in a management plan of the criteria for departure from a plan, say for example when there in an extreme seasonal variation.

An example of a management plan is a forest management plan[45] made pursuant to Part V of the CALM Act.[46]

In regard to State forest management plans,[47] it has been held that,

> "…. (the CALM Act) may impose legally binding duties on the Executive Director of CALM to manage State forests in accordance with the relevant management plans, but subject to acting in good faith, and in accordance with directions from the Minister, the Executive Director has a wide discretion as to the manner in which he discharges his duties (in relation to a management plan)..." [48]

Even if an action under a forest management plan is a violation of policies and strategies in the forest management plan, this not enough to render that action invalid unless the action was in violation of a fundamental principle of the management plan.[49] However, it is important to remember that the

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[44] Water Resources Law and Management in Western Australia Centre for Commercial and Resources Law 1996, University of Western Australia and Murdoch University, *Legislative Requirements for an Effective Regional Water Resources Planning and Management Framework*, Ventriss, H. 119, at 121.

[45] The Forest Products Commission (FPC) created under the *Forest Products Act 2000* (FP Act) provides that the FPC must give due regard to an FMP when developing its Strategic Management Plan, see section 22 of the FP Act. The FPC is under a duty to act in accordance with its strategic development plan and its statement of corporate intent: see the FP Act section 11; forest products contracts must be in accordance with a material forest management plan: see the FP Act section 58; an FPC production contract expires when the management plan expires: see the FP Act section 58; notwithstanding any contractual term to the contrary: the FP Act see section 61.

[46] *Conservation and Land Management Act 1984.*

[47] *Conservation and Land Management Act 1984* Part V.

[48] Templeman, J in *Bridgetown/Greenbushes Friends of the Forest Inc. v Executive Director of the Department of Conservation and Land Management and Ors* (1997) 94 LGERA 380, at 428; 18 WAR 126.

[49] Scott, J in *Bridgetown/Greenbushes Friends of the Forest Inc. v Executive Director of the Department of Conservation and Land Management and Ors* (1997) 18 WAR 126, at page 154.

ministerial environmental conditions on a forest management plan are binding.[50]

3.3 Memoranda of understanding
A memorandum of understanding (MOU) may be entered into between government agencies to streamline the way the agencies process certain proposals that come before them. An MOU cannot alter or amend the effect of legislation without more, it is unlikely to be binding on the signatories to it nor is it likely to be enforceable by third parties.

3.4 Administrative guidelines
Administrative guidelines are published by an agency of government to describe how one or more of the functions of that agency will be administered. An example of Administrative Guidelines are those published by the Environmental Protection Authority for the process of environmental impact assessment under the Environmental Protection Act 1986.

4. Offence provisions
Statutes may make some actions punishable by a fine or imprisonment.[51] Specific persons may be nominated to prosecute certain offences and provide such a person with discretion not to prosecute.[52] The government (through a Ministerial direction) or an agency (through a policy) may develop a policy about prosecutions generally.

Where a restriction on private prosecution is not expressed in an Act, it is likely that the common law principle, which entitles private persons to take a prosecution, will prevail.

Fire and the Crown

The Crown includes Ministers and State government agencies, but not local governments.[53]

Common law principles bind the Crown.[54] Statutes are presumed not to bind the Crown and do not unless there is an express or implied provision in a particular statute to the contrary.[55] Even if there is a provision in a statute that the Crown is bound by it, this may not be the last word if there is an overriding Act such as a State Agreement Act.[56] The Mining Act 1978 and State Agreement Acts prevail over the CALM Act to the extent of any inconsistency.

So for example the Conservation and Land Management Act 1984 and the Fire and Emergency

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[50] Templeman, J in *Bridgetown/Greenbushes Friends of the Forest Inc. v Executive Director of the Department of Conservation and Land Management and Ors* (1997) 18 WAR 126, at 175.

[51] For some offence provisions see the *Environmental Protection Act 1985* numerous sections; the *Wildlife Conservation Act 1950 sections* 16, 16A, 17, 17A, 18, 26, the CALM Act sections 103, 109, 110, 114; the *Land Administration Act* sections 99, 130, 199, 267,269; the *Country Areas Water Supply Act* sections 12B, 12C, 45, 46, 82, 111, 113; the *Soil and Land Conservation Act 1977* sections 21, 22, 28, 35, 42.

[52] For example a prosecution under the *Wildlife Conservation Act 1950* can only be authorized by the Executive Director of CALM, see section 26(3) of that Act.

[53] One exception to this rule is the Bradken doctrine. Crown immunity may extend to other agencies which do not enjoy Crown immunity through the Bradken doctrine, or where an agency is subject to Ministerial direction: see *Soil Conservation Authority v Read* [1979] VR 557.

[54] The *Crown Suits Act 1947* overturned the common law principle of immunity of the Crown.

[55] The legal test of whether or not a statute binds the Crown depends on whether it was enacted prior to *Province of Bombay v Bombay Municipal* Council [1947] AC 58; between the *Bombay* case and *Bropho v Western Australia* (1990) 171 CLR 1; or after *Bropho*. For statutes in the middle period the Crown is not bound unless by express words or necessary implication. The rule is not so inflexible in the other periods If an Act is not stated to bind the Crown, then it is presumed that the Crown is not bound unless this presumption may be rebutted by judicial interpretation of the provisions of the material Act, see *Bropho v Western Australia* (1990) 171 CLR 1. For example under the *Forest Products Act 2000* (FP Act) any employee of the Forest Products Commission (FPC) is protected from liability that might have been incurred in good faith implementing actions authorized by the FPC but the Crown and the FPC are stated not to be exempt for liability for an action of that employee: see the FP Act section 67(1): see *Bridgetown/Greenbushes Friends of the Forest Inc. v Executive Director of the Department of Conservation and Land Management and Ors* (1997) 18 WAR 126.

[56] State Agreement Acts have been a tool often used by successive Western Australian governments for example, to avoid the provisions of certain Acts applying to the Crown, private persons or companies when large infrastructure agreements are made. There are a number State Agreement Acts operating in the south west of WA which relate to mining and to plantation forestry operations. State Agreement Acts which were enacted prior to 1 January 1972 (before enactment of the first *Environmental Protection Act 1971*) may prevail over the *Environmental Protection Act 1986*: the EP Act section 5.

Services Authority of Western Australia Act 1998 are not stated to bind the Crown so one looks to the provisions of the Acts to find that CALM, its employees and agents are bound by the requirements of the CALM Act to manage land in a certain way but they are not bound by the Fire and Emergency Services Authority of Western Australia Act 1998 and vice versa; but both CALM and FESA are bound by the provisions of the Environmental Protection Act 1986 and the Land Administration Act 1997 because these latter Acts are stated to bind the Crown.

The other important distinction between the Crown and other parties is in respect of civil liability for certain acts. The time[57] in which a complainant has to commence an action against the Crown, is generally much shorter than it would be against another party,[58] unless special leave or consent to commence litigation is granted by the Court. Furthermore, there is a statutory obligation to provide prior notice of the action to the Crown.

Fire management of general application

1. Introduction

The control of wildfire[59] and pre-emptive burning is critical to the good management of land in Western Australia. Fire occurs over a variety of land tenures and for a number of different reasons. Sources of wildfire include weather events; conservation, agricultural, horticulture and industrial practices; rubbish and hazardous waste disposal; criminal negligence or arson;[60] the activities of government agencies; local government; companies; private persons such as campers and tourists; and traditional owners. Accordingly, the management of fire is ranges across many statutes, regulations and policies. Non-neutral terminology can colour issues, cause unnecessary conflict, or create false expectations and understandings.

- Bushfire or wildfire?
- Fuel reduction or hazard reduction?
- Prescribed, controlled or pre-emptive burn?
- Disturbance or destruction?[61]

Where there is any doubt about a term, it should be defined for the purpose for which it is used,[62] especially in any Act or regulation that creates authority, duties or obligations of State government agencies, companies or individuals.

The source of the powers and functions of government departments may be found in the Act that creates the department[63], the Acts which the department administers[64] and any delegated authority under various Acts[65]. Furthermore, the common law applies to government department officers unless it has been modified by statute.

Some statutes regulate specific entities or specific land tenures. Other statutes can regulate the impact of wildfire and burning practices on a variety of land tenures in Western Australia. The four examples of general application to burning practices I have examined are statutes relating to

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[57] Generally referred to as the limitation period. For example, in respect of negligence, the limitation period generally commences to run after the damage is known or ought reasonable have been known to have occurred.

[58] The *Crown Suits Act 1947* section 6; and see the *Limitation Act 1935* section 47A.

[59] The impact of fire on land in WA has been documented by a number of sources including by satellite imagery. DOLA and the CSIRO have undertaken a fire history of WA and have been mapping hot spots daily for six years. Records, photographs and satellite surveys of these records and other information are available for inspection at the DOLA/CSIRO.

[60] Fire caused by arson or criminally negligent acts are criminal offences and will not be addressed in this paper. An analysis of arson is to be found in the combined discussion paper published in 1999 by the Arson Taskforce comprising the State government, the WA Police Service, the Fire and Rescue Service and the Department of CALM, *Flame Out: Combating Deliberate Fire Lighting in Western Australia.*

[61] D Mercer *A Question of Balance* 1995 2nd edn The Federation Press page 98.

[62] See for example the broad definition of *take* under the *Wildlife Conservation Act 1950.*

[63] Government departments are generally created under section 35 of the *Public Sector Management Act 1994.* Such departments are generally not separate legal entities which can sue or be sued.

[64] See for example the powers and obligations of the Department of CALM under the *Conservation and Land Management Act 1984.*

[65] See for example the powers and functions of the Minister for Lands are delegated to various officers of the Department of Land Administration (DOLA).

environmental impact, taking flora and fauna, clearing generally and clearing in a water catchment.

2. Fire and environmental impact

The Environmental Protection Act 1986 (WA) establishes a system for assessing the environmental impact of certain proposals. The Crown is bound by the Act.[66] The Act prevails over every other State act to the extent of any inconsistency, except a State Agreement Act signed before 1 January 1971[67] or an order by the Minister for the Environment approved by the Governor.[68]

Any person may refer, to the Environmental Protection Authority (the EPA), a proposal to burn which will, if implemented, have a significant effect on the environment.[69] The EPA, on advice from the Department of Environmental Protection (the DEP), will decide whether the proposal should be assessed and if so, determine the appropriate level of assessment. Thus, a particular proposal to undertake pre-emptive burning could be referred to and assessed by the EPA, if it is likely to have a significant effect on the environment.[70]

In the past the EPA has assessed State forest management plans (FMP). These plans may provide for certain burning regimes. The EPA has formed the view[71] that any specific burning proposal undertaken pursuant to an assessed management plan cannot be assessed because of the prohibition in the Act against assessing the same proposal twice.[72] If a proposed burn is not consistent with an assessed management plan, it is arguable that at least such a proposal should be assessed as a different proposal. Nevertheless, this situation results in the somewhat bizarre situation where a small proposed pre-emptive burn on private property requires referral to the EPA but a large scale burn proposed to be undertaken on reserved Crown land in the area the subject of an assessed FMP (in a way not contemplated by the assessed FMP) may not be.

It is salient to note here that the Environmental Protection Authority (the EPA) has concluded (at least in relation to State forests and timber reserves) that publicly acceptable methods of pre-emptive burning should be developed which are aimed at achieving the multiple objectives of human safety

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[66] *Environmental Protection Act 1986* section 4.
[67] *Environmental Protection Act 1986* section 5.
[68] *Environmental Protection Act 1986* section 6.
[69] *Environmental Protection Act 1986* section 38(1).
[70] There are other adverse environmental effects from pre-emptive burning, including as follows:

- The smoke levels in urban areas caused by pre-emptive burns may be of concern. The Conservation Commission's fire management objectives should include avoidance of air pollution in urban areas. The CEO of the Department of Environmental Protection has broad powers in relation to pollution. Smoke resulting from pre-emptive burning can fall within the definition of *pollution* under the *Environmental Protection Act* 1986 section 3. That definition is extremely broad, and includes alteration to the environment to its degradation. The Supreme Court qualified the definition of *pollution* to require that to be *pollution*, the alteration of the environment must be harmful or potentially harmful to the health, welfare, safety or property of human beings or harmful or potentially harmful to animals or plants Even with this qualification, the production of large quantities of smoke through burning operations may fall within the definition of *pollution*: see D Mercer *A Question of Balance* 1995 2nd edn the Federation Press, page 202.
- A further environmental impact of forest fires is the contribution to atmospheric warming by the production of significant amounts of carbon dioxide.

[71] However, see *Re Environmental Protection Authority; Ex parte Sandbourne Holdings Pty Ltd &* Anor [2002] WASCA 75; and Edo News, Newsletter of the Environmental Defender's Office (WA) Inc Vol.9 No.2 July 2002. Furthermore, this is unlikely to be crucial once the *Environmental Protection Amendment Bill 2002* tabled in the WA parliament 27 June 2002 is enacted.

[72] Under the *Environmental Protection Act 1986* a *proposal* can only be assessed once, unless it is significantly different from the initial proposal. Under proposed amendments to the EP Act (supra no.71) there will be a new class of proposal called a strategic proposal. If implemented this will mean that a proponent can refer a strategic plan for assessment and conditions imposed on that plan can be imposed on significant proposals that form part of that strategic plan. If a significant proposal is different from that contemplated by the strategic plan, it may be separately assessed. Proposed amendments to the EP Act have introduced environmental harm offences, which extend to the removal of indigenous vegetation by burning, see supra no.71.

and protection of the timber resource, and the protection of sensitive species and ecosystems.[73]

The Environmental Protection and Biodiversity Conservation Act 1999 (Cth) (the EPBC Act) applies in Western Australia. The flora and fauna provisions of the EPBC Act bind the Crown. The likely triggers under the EPBC Act in respect of burning in the south - west of Western Australia include possible threats to threatened species and ecological communities.

In areas of Western Australia covered by the Regional Forests Agreement[74] the State and Commonwealth governments have agreed to the requirements for ecologically sustainable forest management. [75] In respect of reserves identified under the CAR[76] reserve system, the parties have agreed that the EPBC Act; actions under the Wildlife Conservation Act 1950 (WA) and the then Endangered Species Protection Act 1992 (Cth);[77] and the Western Australian forest management system provide for the protection of rare or threatened flora and fauna species and ecological communities.[78] Where species restricted to Western Australia are listed under both Acts, any new or revised recovery plan must be jointly prepared and funded by the parties to the Regional Forest Agreement.

3. Fire, flora and fauna

The Wildlife Conservation Act 1950 (WA) ("the WC Act")[79] is the primary statute for the protection and preservation of native flora and fauna in Western Australia. The Conservation Commission is responsible for the conservation and protection of flora and fauna[80] throughout Western Australia through the agency of CALM and its Executive Director.[81] The WC Act does not bind the Crown with respect to fauna,[82] but it binds the Crown in respect of taking rare or endangered flora.

The WC Act prohibits the taking of rare or endangered flora, and fauna declared to be protected.[83] Taking under the WC Act is defined broadly[84] and there is little doubt that this includes taking by fire.[85] Accordingly, statutory authorities enjoying Crown immunity and proposing pre-emptive burning activities require a licence to take declared flora[86] but are not a licence to take fauna.

Local governments do not enjoy Crown immunity and would require a licence to take protected fauna, or rare or endangered flora by pre-emptive burning.

Together with the management of nature reserves[87] and wildlife sanctuaries[88] on Crown land, the

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[73] In the Executive Summary of the Progress Report on Environmental Performance and mid-term Report on Compliance: Forest Management Plans 1994 – 2003, *EPA Bulletin* 912, November 1998 at page ii, clause 6.

[74] The Bill enacting the Regional Forest Agreement as an Act of Federal Parliament passed through the Senate on 21 March 2002. This Act received royal assent on 5 April 2002.

[75] RFA at paras 40 – 55.

[76] The CAR system is an acronym for Comprehensive, Adequate and Representative as applied to the Conservation Reserve System for WA forests.

[77] This Act has been repealed in favor of the *Environmental Protection Biodiversity Conservation Act 1999(Cth).*

[78] RFA agreement clause 56.

[79] It has been proposed to replace the WC Act with State biodiversity conservation legislation but there is as yet no such Bill before State parliament.

[80] *Conservation and Land Management Act 1984* sections 19(1)(c)(iii), 56(1)(d) and 55(1)(g).

[81] *Wildlife Conservation Act* section 7; and the *Conservation and Land Management Act 1984* section 33 (1)(d).

[82] *Bridgetown-Greenbushes Friends of the Forest v the Conservation Commission* Supreme Court of WA, (1997) 18 WAR 102.

[83] Declared by the Minister for the Environment. All native fauna are declared to be protected in WA, unless otherwise gazetted.

[84] *"to take"* in relation to any fauna, includes to kill or capture any fauna by any means or to disturb or molest any fauna by any means or to use any method whatsoever to hunt or kill any fauna whether this results in killing or capturing any fauna or not; and also includes every attempt to take fauna and every act of assistance to another person to take fauna and derivatives and inflections have corresponding meaning;
"to take" in relation to any flora includes to gather, pluck, cut, pull up, destroy, dig up, remove or injure the flora or to cause or permit the same to be done by any means;
see the *Wildlife Conservation Act 1950* section 6.

[85] *Corkhill v Forestry Commission (NSW)* (1991) 73 LGRA 126; and *Forestry Commission (NSW)* (1991) v *Corkhill* (1991) 73 LGRA 247.

[86] By the written approval of the Minister for the Environment or her delegate.

[87] Declared under the *Wildlife Conservation Act 1950.*

[88] Declared under the *Wildlife Conservation Act 1950.*

Executive Director of CALM can enter agreements for the management of private land as a nature reserve or for some other public purpose, provided the affected local government has prior notice.[89]

On private land:

- the fauna provisions of the WC Act apply;
- protected flora can be taken by burning undertaken by the owner or occupier or by some other person with the permission of the owner or occupier; and
- flora which is declared rare, extinct or otherwise in need of special protection cannot be taken without the permission of the Minister for the Environment.[90]

4. Fire and soil and land conservation

The Soil and Land Conservation Act 1945 and the Soil and Land Conservation Regulations 1992 limit a landowner's common law right to clear his or her land. This Act is not expressed to bind the Crown. However, in applying the principles of statutory interpretation, it is arguable that although the Crown may not be bound by the requirement to lodge a notice of intention to clear land, it may be bound by certain other provisions of the Act.[91]

Burning can be said to effect clearing[92] for the purpose of this Act. However, it is important to recognize that for provisions in respect of the notice of intention to clear to apply, the clearing by burning must effect land degradation[93] that is detrimental to the present or future use of the land.[94] Whether land degradation and change of use includes biodiversity loss is unclear but it is my opinion that law reform should be implemented to include biodiversity loss as a certain trigger of the requirement to lodge a Notice of Intention to Clear and that the provision should clearly bind the Crown.[95]

4.1 The Commissioner of Soil and Land Conservation

The Commissioner of Soil and Land Conservation[96] has functions which include the:

- prevention and mitigation of land degradation;[97] and
- supervision of land vested in and managed by public authorities,[98]
- which accordingly provides a role in the management of burning practices of private landowners and government agencies which might cause land degradation.

Government departments and public authorities are authorised to cooperate with the Commissioner to carry out the purposes of the Soil and Land Conservation Act.[99] The Commissioner may advise any government department or public authority as to the care and use of any Crown lands, in any case where the Commissioner considers that land degradation issues are raised by particular burning practices.[100]

A memorandum of understanding has been entered into by a number of agencies to coordinate the exercise of their respective powers in respect of the protection of remnant vegetation on rural zoned land in southern Western Australia.[101]

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[89] *Conservation and Land Management Act 1984* section 16.
[90] *Wildlife Conservation Act 1950* section 23F.
[91] For example by a Soil Conservation Notice made under section 32.
[92] *Soil and Land Conservation (Clearing Control) Regulations* 1991, regulation 2,
"to clear" under these regulations in relation to any land means to cut down, destroy or otherwise damage trees, shrubs, grass or other plants on that land but does not include the cutting of trees for firewood or posts for timber.
[93] By the use of the word *includes* in the definition of *land degradation* it is arguable that *land degradation* has a wider ambit than that described in the section: see Bennett MB & Clement JP *The Law of Landcare in Western Australia* 2nd ed page 94 at footnote 9.
[94] *Soil and Land Conservation act 1945* section 4.
[95] See now the proposed changes to the *Environmental Protection Act 1986* see supra no. 71.
[96] *Soil and Land Conservation Act 1945* section 7(1).
[97] Defined to include soil erosion and the removal or deterioration of natural or introduced vegetation that may be detrimental to the present or future use of the land: the *Soil and Land Conservation Act 1945* section 4.
[98] *Soil and Land Conservation Act 1945* sections 14(h) and 17.
[99] *Soil and Land Conservation Act 1945* section 18(b).
[100] *Soil and Land Conservation Act 1945* section 19(1).
[101] These include the Commissioner of Soil and Land Conservation, the Environmental Protection Authority, the Water and Rivers Commission and the Departments of Environmental Protection, Agriculture, CALM, and was signed in 1997.

4.2 Soil Conservation Notice

Under the Soil and Land Conservation Act, to clear[102] in relation to land means to cut down, destroy or otherwise damage trees, shrubs, grass or other plants on that land.[103] An occupier or owner of land or a third party[104] (but arguably not the Crown unless it is an owner of land) which proposes to clear more than one hectare of land (where that clearing will result in a change of use of the land) must give a Notice of Intention to clear land, to the Commissioner of Soil and Land Conservation at least 90 days before the clearing.[105] Where the clearing is for a firebreak,[106] there may be an exemption from lodging a Notice of Intention to Clear.

A Soil Conservation Notice (Notice) can be imposed (on any owner or occupier or any other person and may therefore include the Crown)[107] on any person who is causing or is liable to cause land degradation, to compel that person to take adequate precautions to prevent soil erosion or destruction of vegetation.[108] The Notice can direct that the owner or occupier refrain from or undertake certain activities.[109] It can reasonably be said that this includes prohibition against clearing effected by fire.[110]

4.3 Soil Conservation Reserves

Crown land or private land may be compulsorily acquired, on the recommendation of the Minister, as a Soil Conservation Reserve.[111] These Reserves are placed under the control and care of the Minister for Agriculture to conserve the land and soil of the Reserve and prevent injury to other land.

It is an offence to light a fire in a Soil Conservation Reserve without the consent of the Minister.[112] The maximum fine for this offence is $2,000.00[113] but a further penalty equal to the market value of any damage done is recoverable as a fine.[114] The declaration of a Soil Conservation Reserve is seen as a serious step, and I understand that only four such Reserves have been declared.

4.4 Land Conservation Districts

Any part of the State can be declared a Land Conservation District (LCD).[115] In LCD areas, the WA Governor is authorised to make regulations for a variety of purposes, including prohibition against certain burning practices, clearing or changes in the use of the land.[116] To date, only one LCD

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[102] This would include by burning.

[103] *Soil and Land Conservation Regulations 1992* regulation 2.

[104] Under the *Soil and Land Conservation Act 1945* section 4 defines *owner* and *occupier* for the purpose of that Act, thereby modifying the common law definition as follows:

"Occupier", in relation to land, means the person by whom or on whose behalf the land is actually occupied, or, if there is no such person, the person entitled to possession, and includes a person who, under a licence or concession relating to specified land vested in the Crown, has the right to take a profit à prendre in respect of the land.

"Owner" in relation to land, includes every person who jointly or severally whether at law or in equity —

(a) is entitled to the land for an estate of freehold in possession; or

(b) is a person to whom the Crown has lawfully contracted to transfer the fee simple under the Land Administration Act 1997, or any other Act relating to the alienation of lands of the Crown; or

(c) is entitled to receive or is in receipt of, or if the land were let to a tenant would be entitled to receive the rents and profits thereof whether as beneficial owner, trustee, or mortgagee; or

(d) is the holder of any lease granted under the *Land Administration Act 1997*, or any other Act relating to the disposition of lands of the Crown.

[105] *Soil and Land Conservation Regulations 1992* regulations4 (1) and 4(3)(a).

[106] Firebreak is not defined and should be to avoid any possible use of this provision to effect land clearing.

[107] However a government entity maybe exempt from complying with a soil conservation notice if to do so would cause a substantial interference with the lawful operations: section 3 of the *Soil and Land Conservation Act* and the Schedule which lists Acts supplementary to the Act.

[108] *Soil and Land Conservation Act 1945* section 32(1), and also see the LA Act section112 for the effect of a Soil Conservation Notice.

[109] *Soil and Land Conservation Act 1945* section 32(2).

[110] The Commissioner of Soil and Land Conservation has adopted the view that he will not require notice for public works in certain circumstances.

[111] *Soil and Land Conservation Act 1945* section 26.

[112] *Soil and Land Conservation Act 1945* section 28(1)(a).

[113] *Soil and Land Conservation Act 1945* section 28.

[114] *Soil and Land Conservation Act 1945* section 28(2).

[115] Also referred to as a Soil Conservation District, and see *Soil and Land Conservation Act 1945* section 22 (1)(a).

[116] *Soil and Land Conservation Act 1945* section 22 (2)(a),(b) & (c).

committee has sought and obtained such regulations.[117]

4.5 Other Acts

In respect of the interrelationship with other Acts, the Soil and Land Conservation Act has a special provision. The Act is to be read in conjunction with and supplements Acts listed in the Schedule to the Act. The Schedule includes the Bush Fires Act 1954 and the Environmental Protection Act 1971 [118] but not the Conservation and Land Management Act.[119] The Schedule has modified the common law principles of statutory interpretation. It appears that:

- the Soil and Land Conservation Act prevails over the Bush Fires Act and the Environmental Protection Act to the extent of any inconsistency, unless the operation of Soil and Land Conservation Act substantially interferes with the operation of the provisions of those Acts listed in the Schedule [120], in which case those Acts prevail; and
- the Conservation and Land Management Act [121] does not appear in the Schedule so it appears on ordinary principles of statutory interpretation that it would prevail over the Soil and Land Conservation Act to the extent of any inconsistency, although the position is certainly unclear.

Fire and water catchments

The Water and Rivers Commission:

- holds parcels of land in freehold title;
- has vested in it Crown Reserves[122] the larger of which are primarily major active water supply catchments; or
- small reserves for uses of little relevance today.[123]

The Water and Rivers Commission is authorised to establish by-laws to control land management practices that might affect water quality in any of the catchments under the Country Areas Water Supply Act 1947, the Metropolitan Water Supply, Sewerage and Drainage Act 1909 and the Rights in Water and Irrigation Act.

The primary protection of water resources in the south - west of Western Australia is found in the Country Areas Water Supply Act 1947. The Act is not stated to bind the Crown. There are at least 45 surface water catchments in the south - west of WA and there are 9 major storage reservoirs.[124] Six surface water catchments[125] have been declared to be controlled catchments under the Act. A person may not clear[126] (including by burning) more than 2,000 square metres of native or non-native vegetation (not under cultivation) from land without a licence from the Water and Rivers Commission.[127]

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[117] Soil *and Land Conservation (Clearing Control) Regulation 1991 Part 2 - Bruce Rock* which prohibit the clearing of remnant native vegetation, which would include by burning.

[118] Also included in the Schedule are the *Closer Settlement Act 1927*; *Country Areas Water Supply Act 1947*; *Forests Act 1918*; *Land Administration Act 1997*; *Land Drainage Act 1925*; *Local Government Act 1995*; *Local Government (Miscellaneous Provisions) Act 1960*; *Main Roads Act 1930*; *Mining Act 1978*; *Petroleum Act 1967*; *Rights in Water and Irrigation Act 1914*; *Sandalwood Act 1929*; *Stock (Identification and Movement) Act 1970*; *Town Planning and Development Act 1928*.

[119] *Soil and Land Conservation Act 1945* section 3; and see the Schedule to the Act.

[120] The *Environmental Protection Act 1986* replaced the earlier *Environmental Protection Act 1971*. It is not clear how one should interpret the fact that the old Act remains in the Schedule as there have been other additions and changes to the Schedule since 1986. For example the *Land Administration Act 1997* has replaced the *Land Act* that it repealed.

[121] However, the *Forests Act 1918* does appear in the Schedule but this Act was replaced by the *CALM Act* and by leaving the *Forests Act 1918* in the Schedule (when it might have been removed) might lead to the conclusion by a court that the *Soil and Land Conservation Act 1945* prevails over the CALM Act, unless the there is substantial interference with the CALM Act.

[122] Changes to tenure or purpose of these reserves are administered by DOLA.

[123] For example water, for travellers and stock.

[124] See the discussion paper in January 2002: *A new forest management plan for Western Australia* published by CALM, at page 16.

[125] These include the catchment areas of the Wellington Dam, Mundaring Weir, Denmark River, Kent River, Warren River and the Harris River Dam.

[126] *Country Areas Water Supply Act 1947* section 12AA: in respect of controlled catchments, this Act defines "to clear" to mean to cause or permit the indigenous undergrowth, bush, or trees on the land to be removed or destroyed, or so damaged as to eventually be destroyed, or to cause the removal from the land of vegetation not under cultivation.

[127] *Country Areas Water Supply Act 1947* section 12B.

Any action by any person (which arguably includes burning vegetation) that diminishes the quality of water in any water catchment is an offence under the Metropolitan Water Supply, Sewerage and Drainage Act 1909.[128] This Act is not stated to bind the Crown.

Management areas can be declared over watercourses and wetlands under the Waterways Conservation Act 1976.[129] The Act binds the Crown.[130] There are five such areas in the State.[131] The powers of the Water and Rivers Commission and its management authorities apply to public and private (with the consent of the owner) lands and to Crown land under the control of the Commission.[132] It is an offence to disturb the bed, banks or foreshores of any waters in such a way as to endanger the stability of the banks, foreshores or vegetation by the Waterways Conservation Regulations 1987.[133]

It is an offence to damage or clear native vegetation around a wetland registered [134] under the South West Agricultural Zone Wetlands Environmental Protection Policy.[135] These wetlands can be registered on private land with the consent of the owner, on Crown land with the consent of the management authority or on unallocated Crown land on a motion of the EPA.

The importance of water catchment areas is recognised in the CALM Act.[136] CALM has the function of protecting the quantity and quality of water on lands vested in the Conservation Commission[137] and to prepare policies accordingly.[138]

A management plan under the CALM Act that includes a public water supply catchment must be prepared by the Conservation Commission jointly[139] with the Water and Rivers Commission and any other relevant water utility.[140] Water catchment areas must be identified in a management plan.[141] A management plan that includes a water catchment area requires the approval of the Minister for Water Resources as well as the Minister for the Environment.[142] Where there is such a management plan in place, protection of water resources must be undertaken in accordance with a material management plan,[143] and in so far as land that is in a public water catchment, undertaken by the Conservation Commission[144] or if undertaken by CALM, jointly[145] with the Water and Rivers Commission and any relevant water utility.

Water allocation plans prepared by the Water and Rivers Commission and source protection plans prepared by the Water Corporation include objectives that CALM must take into account in preparing its forest management plans.[146]

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[128] *Metropolitan Water Supply, Sewerage and Drainage Act 1909* section 16(c).
[129] *Waterways Conservation Act 1976* section 10.
[130] *Waterways Conservation Act 1976* section 6.
[131] Peel/Harvey Estuaries; Leschenault and associated rivers; Albany Harbour and associated rivers; Avon River; and Wilson and associated rivers.
[132] *Waterways Conservation Act* 197 section 25(2)(a).
[133] *Waterways Conservation Regulations 1987* regulation 8(f).
[134] There is one such registered wetland, being Lake Monjingup in the Shire of Esperance.
[135] See the Environmental Protection Policy (EPP) published by the EPA pursuant to the *Environmental Protection Act 1986* Part 111, the *South West Agricultural Wetlands Policy*. It covers land between Geraldton and Esperance that is not part of the Swan Coastal Plain, which has its own EPP, the *Swan Coastal Plain Lakes Policy*.
[136] For example, see the *Conservation and Land Management Act* section 55(1a)(d).
[137] *Conservation and Land Management Act* section 33(1)(dc).
[138] *Conservation and Land Management Act* section 33(1)(dd).
[139] Under amendments to the *Conservation and Land Management Act* presently before State Parliament, management plans will be prepared by the Conservation Commission only through the Department of CALM in **consultation** with the Water and Rivers Commission: see *Conservation and Land Management Amendment Bill 2002*.
[140] *Conservation and Land Management Act* section 54(3)((a)(iii).
[141] *Conservation and Land Management Act* section 55(1a)(d).
[142] *Conservation and Land Management Act* section 60(2d).
[143] *Conservation and Land Management Act* section 33(4).
[144] *Conservation and Land Management Act* section 53(3)(a): will be repealed by the *Conservation and Land Management Amendment Bill 2002*.
[145] *Conservation and Land Management Act* section 54(3)(a)(iii): *acting jointly* will be amended to *in consultation:* see *Conservation and Land Management Amendment Bill 2002*.
see *Conservation and Land Management Amendment Bill 2002*.
[146] The discussion paper at page 12.

The exercise of the powers of the Executive Director of CALM in Part VIII Division 1[147] and Division 2[148] and of the CALM Act in respect of permits, leases, contracts and licences in State forests, timber reserves, certain Crown land and other land must be consistent with the Country Areas Water Supply Act 1947 and the Metropolitan Water Supply Sewerage and Drainage Act 1909.

Fire and regional parks

Regional parks are large areas of land identified by the planning process to require special protection. Regional parks may include a variety of tenures including private land and Crown reserves. CALM prepares management plans for regional parks on behalf of the Department of Planning and Infrastructure. Examples of regional parks include the Swan Coastal Plain Regional Park and the Peel Regional Park.

Management plans for regional parks may address issues of wildfire control and pre-emptive burning. The responsibility for the management of wildfires can be confusing especially where there are mixed land tenures and different owners or occupiers of those land tenures, as there are in regional parks. Management plans can be helpful in describing the responsibilities of each owner and occupier of land in respect of the control of wildfire and pre-emptive burning practices.

Fire on Crown land

1. General
The Land Administration Act 1997 (the LA Act) regulates the control and management of, transfer of interests in and activities on Crown land in Western Australia. Crown land comprises approximately 90% of Western Australian land. The LA Act binds the Crown.[149]

Under the LA Act the Minister is authorised to delegate the powers under the LA Act to certain authorised individuals,[150] for example to the Departments[151] of Land Administration (DOLA) and CALM. DOLA administers the LA Act.

2. Policies and Land Act management plans
A LA Act management plan is a statutory policy authorised by the LA Act.[152] It may or may not be binding on the management authority responsible for its implementation[153] but it will not create obligations on the world at large without more.

The Memorandum of Understanding signed between CALM and the Forest Production Commission[154] is in effect an agreed policy. It is unlikely to be binding on or enforceable by the parties to it without more, let alone the world at large.

3. Unallocated unreserved Crown land
The Minister for Lands is responsible for Crown lands,[155] and is authorised to delegate this responsibility.[156] Unallocated Crown land is managed by DOLA. It is an offence to clear Crown land without the permission of the Minister for Lands.[157] CALM may be authorised by the Minister to

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[147] *Conservation and Land Management Act* section 87A (1)(d).
[148] Permits, licences, contracts and leases on Crown land which is not a timber reserve, State forest or certain other land.
[149] *Land Administration Act 1997* section 4.
[150] *Land Administration Act 1997* section 18. The classes of pre-scribed persons to whom the Minister may delegate powers under the LA Act is provided under the *Land Administration Regulations 1998* regulations 3A and 3B.
[151] Departments created under the *Public Sector Management Act 1994* section 35.
[152] *Land Administration Act 1997* section 49.
[153] The requirement of the statute under which it is made, the wording of the plan, and the objects of the plan will all play a role in determining the justiciability of a decision affected by a management plan.
[154] See the *Conservation and Land Management Act 1984* section 33(1)(bb) and the *Forest Products Act 2000* section 10(l).
[155] *Land Administration Act 1977* section 10(1)(a).
[156] *Land Administration Act 1977* section 9.
[157] *Land Administration Act 1977* section 267(2)(c); see also the amendments to the *Environmental Protection Act 1986* supra no.71.

manage unvested reserved Crown land.[158] There is lack of clarity as to the roles of DOLA and FESA in respect of the wildfire prevention and pre-emptive burning on unallocated Crown land.[159]

An owner or occupier of land[160] that is adjacent to unoccupied Crown land can make a firebreak on that Crown land, and on obtaining a permit,[161] burn the bush which is on the firebreak and the shared boundary of his or her land (but not more than 3 metres in width and not more than 200 metres from the shared boundary).[162] If an agency such as CALM has satisfied FESA that there is a sufficient management plan in respect of such land, this right may be removed by a public notice to that effect published in the Government Gazette.[163] A bush fire control officer is authorised to burn a firebreak on Crown land (which is not State forest) to abate a fire hazard, if the hazard cannot otherwise reasonably be abated,[164] without a permit but subject to restricted times.[165]

4. Crown reserves

4.1 General

There is no limit on the number and type of reserves over land that can be created under the LA Act. An agency responsible for the care, control and management of a reserve[166] can draft a management plan for amongst other things the prevention, control and extinguishment of bush fires in the reserve, subject to the approval by FESA.[167] Once a plan is approved, the powers in relation to burning on a Crown reserve might still be varied or cancelled for that reserve by notice published in the Government Gazette.[168]

Certain Crown lands are vested in the Conservation Commission[169] for management. The Conservation Commission is subject to the direction and control by the Minister for the Environment. Land must be managed according to any management plans as approved by the Conservation Commission[170] and the Minister for the Environment.[171]

The Conservation and Land Management Act 1985 (CALM Act) provides for the use, protection and management of certain public lands and waters and their flora and fauna, the establishment of management authorities for that purpose, and any incidental or connected purposes.[172] The CALM Act is not stated to generally bind the Crown, although Part VII of the Act in respect of the control and eradication of forest diseases does bind the Crown.[173] This is important because the control of wildfire and pre-emptive burning regimes can effect the spread of forest diseases.

Under the CALM Act it is an offence to set fire to bush or grass on any land that is contiguous with a State forest or timber reserve,[174] without notice to a forest officer[175] unless it is a fire for camping or cooking permitted under the Bush Fires Act 1954.[176] It is unlawful to light or leave a fire within or within eight kilometres of a boundary of land to which the CALM Act applies or CALM managed land.[177] A CALM forest officer can enter CALM land which is under permit, lease, licence or contract to some other person, to prevent or suppress fire;[178] or call on anyone working or residing within 8kms of a fire

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[158] *Conservation and Land Management Act 1984* sections 33(1)(a), and 5(h), 5(g) & 7(4).
[159] See the application of the *Bush Fires Act 1954* section 34(1)(a).
[160] For example a leaseholder on Crown land.
[161] *Bush Fires Act 1954* section 34(1)(b).
[162] *Bush Fires Act 1954* section 34(1)(a).
[163] *Bush Fires Act 1954* section 34(1a).
[164] *Bush Fires Act 1954* section 34(1)(c).
[165] *Bush Fires Act 1954* sections 17 and 18.
[166] For example a *nature reserve* created under the *Wildlife Conservation Act 1950*, vested in the Conservation Commission and managed by CALM.
[167] *Land Administration Act* 1997 section 49; and the *Bush Fires Act 1954* sections 7 and 34(1a)(a)
[168] *Bush Fires Act 1954* section 34(1a)(b).
[169] Established under the *Conservation and Land Management Act 1984.*
[170] *Conservation and Land Management Act 1984* section 4.
[171] *Conservation and Land Management Act 1984* section 60.
[172] See the long title to the *Conservation and Land Management Act 1984.*
[173] *Conservation and Land Management Act 1984* section 80.
[174] *Conservation and Land Management Act 1984* section 105.
[175] Appointed under the *Conservation and Land Management Act 1984* sections 3 and 45.
[176] *Bush Fires Act 1954* section 25(1)(a).
[177] *Conservation and Land Management Act 1984* section 104.
[178] *Conservation and Land Management Act 1984* section 120.

occurring on land adjacent to any State forest or timber reserve.[179] CALM has published policies relating to fire.[180]

4.2 Reserved Crown land not vested in the Conservation Commission and without a management plan

Unvested reserved Crown land is land which has been set aside by the Minister for Lands for a specific purpose but not vested in a management authority. Such land may be placed under the management of CALM even if the land is not vested in the Conservation Commission.[181] Unless the Minister has created an instrument in writing authorising an agency or person to burn on unvested reserved land, no one has statutory authority to undertake pre-emptive burning on that land without more.

4.3 Reserved Crown Land vested in the Conservation Commission under the CALM Act but without a management plan

In the absence of a management plan, a national park or conservation park[182] vested in the Conservation Commission, must be managed in such a manner that only compatible operations are undertaken.[183] Compatible operations [184] are defined to mean necessary operations which are approved by the Minister as being in her or his opinion compatible with the purposes for which the land is managed under the CALM Act. Necessary operations means those operations that are necessary for the preservation or protection of persons, property, land, waters, flora or fauna.[185]

Before the Minister approves any proposed necessary operation (including a pre-emptive burn) in the absence of management plan, the Executive Director of CALM must, in the manner specified in the CALM Act publicly advertise the proposal.[186] An opportunity must be given to the public to make written submissions on any such operation, as if the proposal were a proposed management plan.[187] Subject to these conditions, the Minister may approve the proposal, with or without modifications, and may attach conditions to his or her approval.[188] The Minister may at any time revoke or amend the conditions of her approval.[189]

A Conservation Zone[190] without a management plan must be managed according to management plan objectives.[191]

4.4 Reserved Crown Land vested in the Conservation Commission and having a management plan

Management plans are in effect statutory policies, the development of which are detailed in Part V of the CALM Act. Management plans have been held not to bind CALM in so far as the detail of their implementation,[192] notwithstanding the provision in the CALM Act that land must be management in accordance with an approved management plan.[193]

Management plans may contain plans for wildfire control including pre-emptive burning regimes. Under a management plan, CALM officers may be authorised to undertake pre-emptive burning to implement that management plan.

4.5 State forest and timber reserves

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[179] *Conservation and Land Management Act 1984* section 113.
[180] For example, the Fire Management Policy No 19 produced in May 1987 to guide protection of the community and prevention of environmental harm from wildfire (objective 2.1) and for using fire as a management tool; and the CALM departmental guidelines *Fire as a sivicultural tool in the Jarrah forest* 1997.
[181] *Conservation and Land Management Act 1984* section 33(2)(b).
[182] National Parks and Conservation Parks are created under the Land *Act 1933* or *Land Administration Act 1997*. Can only be cancelled by approval of both Houses of Parliament.
[183] Within the meaning of section 33A (2), *Conservation and Land Management Act 1984* section 33(3)(b)(ii).
[184] *Conservation and Land Management Act 1984* section 33A.
[185] *Conservation and Land Management Act 1984* section 33A (1).
[186] *Conservation and Land Management Act 1984* section 57.
[187] *Conservation and Land Management Act 1984* section 58.
[188] *Conservation and Land Management Act 1984* section 33A (4).
[189] *Conservation and Land Management Act 1984* section 33A (5).
[190] *Conservation and Land Management Act* section 62.
[191] *Conservation and Land Management Act 1984* sections 33(3)(b)(iii) and 56.
[192] *Bridgetown-Greenbushes Friends of the Forest v the Conservation Commission* (1997)18 WAR 126.
[193] *Conservation and Land Management Act 1984* section 33(3)(a).

The Executive Director of CALM owns some land in freehold title. Most of this land[194] is managed by CALM as if it were State forest, although it is not bound by any management plans in respect of such land without more.

State forests and timber reserves[195] are vested in the Conservation Commission.[196] The purpose and area of State forests can only be amended with the approval of both houses of State parliament.[197] State forests and timber reserve must be managed in accordance with a management plan.[198] If there is no management plan these reserves must be managed in accordance with the provisions for a management plan.[199] The current forest management plan (FMP) contains fire protection strategies which include requirements as to:

- fire management and burning programs based on wildfire threat analysis;
- taking into account threatened species in fire programs;
- research; and
- minimisation of smoke impacts on urban areas.[200]

The EPA has assessed recent forest management plans. The Minister for the Environment set binding environmental conditions on the 1987 Forest Management Plan (FMP). These same conditions applied to the 1994 FMP in so far as they were consistent with the 1994 FMP. The Ministerial Conditions are binding on CALM and the Forest Products Commission. CALM is required to inform the public about its fire management in State forests and timber reserves each year in its annual report.[201] The annual report must include but is not limited to the following:

- occurrences and causes of wildfires;
- the purpose of all burns;
- areas burned under different regimes of season and periodicity;
- escapes; and
- the contribution of prescribed burning to reducing wildfire.

Furthermore under the RFA Agreement 1999,[202] it was agreed between the parties to the RFA that:

- fire management plans would be established in consultation with local government, the bushfires brigade and landholders within the plan area;[203] and
- annual and medium term fire management plans would be made publicly available.

A new FMP is being developed and the first stage of that process is through the document, "A new Forest Management Plan for WA: Discussion Paper January 2002". The new FMP will apply to State forests and timber reserves vested in the Conservation Commission and will describe burning regimes for the management of the land for logging and the conservation of biodiversity applicable to State forests and timber reserves.[204]

One issue that has been raised with me is that under the previous arrangements for wildfire control CALM machinery was made available for fire fighting as were a number of CALM officers and field

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[194] *Conservation and Land Management Act 1984* section 131.
[195] Timber reserves have been created under section 25 of the *Forests Act 1918,* the *Conservation and Land Management Act 1984* section 10 and the *Land Act 1933* (now repealed in favour of the *Land Administration Act 1997*). Timber reserves created under the Forests Act or the CALM Act can be cancelled by the Governor on the recommendation of the Minister for the Environment according to section 10(1)(b) of the CALM Act. Timber reserves created under the *Land Act 1933* require the approval of both Houses of Parliament.
[196] *Conservation and Land Management Act 1984* section 19(1)(a).
[197] *Conservation and Land Management Act 1984* section 9, and the Forest Management Plan 1994 – 2003.
[198] *Conservation and Land Management Act 1984* section 33(3)(a).
[199] *Conservation and Land Management Act 1984* sections 33(3)(b)(iii) and 56.
[200] Forest Management Plan 1994 – 2003: Fire Protection Strategies at page 28.
[201] Forest Management Plan 1994 – 2003: environmental condition 15-2.
[202] Now enacted in the *Regional Forest Agreement Act 2002 (Cth)* which received royal assent 5 April 2002.
[203] See the CALM response to the Progress Report on Environmental Performance and mid-term Report on Compliance: Forest Management Plan 1994 – 2003: EPA Bulletin 912 November 1998, at Appendix 2, page 8 as to the obligations to prepare master burn plans and wildfire threat analysis.
[204] The principles in respect of burning suggested for this new FMP are identified at Appendix 5.14 of the Discussion Paper.

staff who fulfilled a secondary role as fire fighter. CALM still has a fire fighting role but much of the equipment now belongs to the Forest Products Commission (FPC) and many former CALM field staff are employed by the FPC. An arrangement between these separate entities may have been entered into but if not, may need clarification.

4.6 Nature reserves and wildlife sanctuaries
Nature reserves[205] and wildlife sanctuaries are created under the Wildlife Conservation Act 1950 and vested in the Conservation Commission for management by CALM.
If there is a management plan[206] for a nature reserve or wildlife sanctuary,[207] CALM is required to manage the nature reserve or wildlife sanctuary according to that plan.[208]

Under the Wildlife Conservation Regulations 1970, pre-emptive burning is prohibited in a nature reserve (or wildlife sanctuary) without the authority of the Executive Director of CALM.[209] This authority can only be given if the proposal complies with an approved management plan or in the absence of a plan only if it is a necessary operation.

In the absence of a management plan, CALM is required to manage land and the associated flora and fauna in nature reserves (and wildlife sanctuaries) in such a manner that only necessary operations are undertaken.[210] Necessary operations are operations which are necessary for the preservation or protection of persons, property, land, waters, flora or fauna;[211] for the purpose for which the land was reserved; or for which the care, control and management of the land was placed with CALM.[212]

So, protecting human safety and property from wildfire by pre-emptive burning is within the ambit of necessary operations under the CALM Act.[213]

Fire management on local government managed land including on private land

1. Introduction
Local governments are responsible for fire protection in all areas of Western Australia within their districts except for the Conservation Commission estate, other CALM managed lands and gazetted fire districts: [214]see the Bush Fires Act 1954; the Local Government Act 1995; the Town Planning and Development Act 1928; local, district and region planning schemes; and local laws.

Generally local government areas are divided unto zones which may have different fire control requirements. Local governments issue fire prevention plans, fire break notices, fire response plans, fire equipment strategies and planned fire permits. Local governments are required to notify CALM if they are conducting a pre-emptive burn within 3kms of a conservation reserve of national park.

2. Fire management and FESA
The Fire and Emergency Service (FESA) was established 1 January 1999 following the gazettal of the Fire and Emergency Services Authority of Western Australia Act.[215] FESA administers the Fire and Emergency Services Authority of Western Australia Act 1998, the Bush Fires Act 1954[216] and the Fire

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[205] Nature Reserves are created for the purpose of conservation of flora and fauna. Changes to Class A (declared under the *Land Administration Act 1997)* nature reserves require approval of both Houses of Parliament. Nature Reserves which are not Class A may be cancelled or amended by the Minister for Lands.
[206] See Part V of the *Conservation and Land Management Act 1984.*
[207] Note that a *wildlife sanctuary* is a *nature reserve* for the purpose of the *Conservation and Land Management Act 1984* and the *Wildlife Conservation Act 1950*: see section 3 of the CALM Act and section 6 of the WC Act, including on private land: see section 16 of the CALM Act.
[208] *Conservation and Land Management Act 1984* section33 (3)(a).
[209] *Wildlife Conservation Regulations 1970* regulation 46.
[210] *Conservation and Land Management Act 1984* sections 33(3)(b)(i), and 33A(1).
[211] *Conservation and Land Management Act 1984* section 33A (1).
[212] *Conservation and Land Management Act 1984* section 56(1)(e).
[213] *Conservation and Land Management Act 1984* section 33A(1).
[214] See the *Fire and Emergency Services Authority of Western Australia Act 1998* under which FESA operates. FESA is responsible for gazetted fire districts.
[215] *Bush Fires Act 1954* section 7; and the *Fire and Emergency Services Authority of Western Australia Act 1998* section 4.
[216] See prescribed functions under the *Bush Fires Act 1954* section 10.

Brigades Act 1942.[217]

FESA[218] is authorised to act in conjunction with a person, local government, government department or other agency or instrumentality of the State or Commonwealth.[219] These entities are relieved of civil liability for anything done in good faith in the performance of a function under the emergency services Acts.[220]

FESA's functions[221] relate to the provision and management of emergency services.[222] FESA administers the Bush Fire Service,[223] the Fire and Rescue Service and the State Emergency Service.[224] FESA is an agent of the Crown and enjoys Crown Immunity.[225] FESA advises the Minister on policies[226] and develops plans for the coordination of emergency services.[227]

The Fire Services Division of FESA is responsible for fire control. This is done through the Fire and Rescue Service[228] in gazetted fire districts[229] and through the Bush Fire Service under the control of local government[230] for areas that are not within gazetted fire districts,[231] with infrastructure provided under the Bush Fires Act 1954 and the Fire Brigades Act 1942.[232]

The Minister is authorised [233] to declare prohibited burning times.[234] However, FESA may suspend the operation of this prohibition as it determines to be necessary.[235] FESA may authorise a person to regulate, permit or define the class of burning which can be carried out during the period of suspension.[236] FESA may declare restricted burning times[237] which means that fires cannot be lit except in accordance with a permit in writing[238] from a bush fire control officer or the local government delegate.[239]

3. Fire management and local government

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[217] For FESA's functions under the *Fire Brigades Act 1942*, see Part VI of the *Fire Brigades Act 1942*.

[218] FESA is answerable to the Minister for Emergency Services in respect of its functions under the FESA Act, while local government is answerable to the Minister for Local Government in respect of its functions under the *Bush Fires Act 1954*.

[219] *Fire and Emergency Services Authority of Western Australia Act 1998* section 12(f).

[220] *Fire and Emergency Services Act 1998* section 37(1) & (3).

[221] FESA has the functions of —

(a)advising the Minister on all aspects of policy in relation to emergency services;

(b)developing plans for, and providing advice on, the management and use of emergency services; and

(c)undertaking, coordinating, managing and providing practical and financial assistance to activities and projects relating to emergency services.

[222] *Fire and Emergency Services Act 1998* sections 11 and 13.

[223] A semi operational part of the Fire Services Division of FESA which operates outside gazetted Fire Districts.

[224] *Fire and Emergency Services Act 1998* section 13.

[225] *Fire and Emergency Services Act 1998* section 5.

[226] See for example the Standing Orders and Administrative Procedures and Standing Operating Instructions introduced in 2000 – 2001 to guide operational and administrative functions of FESA.

[227] *Fire and Emergency Services Act 1998* section 11.

[228] Approximately 850 career fire fighters and 2,500 volunteer fire fighters from 130 urban areas.

[229] Primarily in the Perth metropolitan area and major regional centres. Gazetted fire districts are staffed by permanent or volunteer staff. Where centres are managed by volunteers, FESA staff have a role in coordinating fire services. Local government is primarily responsible for fire prevention rather than fire fighting in gazetted fire districts.

[230] The *Fire and Emergency Services Legislation Amendment Bill 2002* is before parliament to amend a number of Acts, but a significant change will authorize local governments to delegate their fire control responsibilities to a FESA officer in certain circumstances.

[231] Gazetted fire districts are prescribed in Schedule 2 to the *Fire Brigades Act 1942*. In areas that are not gazetted fire districts, the local government is responsible for fire fighting and fire prevention. Local government is assisted by (but cannot be directed by) professional bush fire liaison officers appointed under the *Bush Fires Act 1954* sections 13 and 14.

[232] Approximately 700 Bush Fire Brigades.

[233] By a declaration published in the *Government Gazette, Bush Fires Act 1954* section 17.

[234] For example in the Bridgetown-Greenbushes local government district restricted burning times are between 2 November – 26 April and prohibited burning times are between 15 December – 14 March.

[235] See the *Bush Fires Act 1954* section 17(4): The local government cannot issue a permit to burn in a prohibited burning time, but FESA may suspend the operation of the prohibited time by a written notice. Local government can vary restricted burning times: see the *Bush Fires Act 1954* sections 17 and 18.

[236] *Bush Fires Act 1954* section 17(5).

[237] By a notice published in the Government Gazette.

[238] Regulation of permits is found under the *Bush Fires Regulations 1954*.

[239] Or the CEO of the local government if there is no bush fire control officer, see the *Bush Fires Act 1954* section 18(6).

3.1 Local Government Act 1995
The Local Government Act 1995 prescribes the functions and powers of local government. It does not generally bind the Crown.[240]

A local government is authorised to make local laws[241] and these laws may relate to fire management.[242] Local laws do not operate to the extent that they are inconsistent with the Act or any other written law.[243] Local laws may prescribe fines for up to $5,000 for offences under the local laws.[244]

The area in which a local government has control and in which its town planning scheme(s) and local laws apply is any part of the State as approved by the Governor and any part of another district by agreement with that other district.[245] The local government may perform its functions on land outside of its authorised district with the consent of the owner, occupier or manager of the land.[246] The local government is authorised to give notices in respect of certain things to any owners or occupiers of land.[247]

3.2 Bush Fires Act 1954
Legislation to control wildfires has been in place in Western Australia for over 140 years. Ordinance 15 of 1847 put in place penalties for anyone wilfully or carelessly setting fire to grass, stubble, scrub or other natural vegetation between September and April. I note with historical interest that the penalty was a fine of up to 50 pounds, unless you were an aboriginal native or a boy under 16, in which case the penalty was up to 50 lashes. This ordinance preceded a series of Bush Fires Acts, leading to the enactment of the Bush Fires Act 1954 in force today (as amended).[248]

The Bush Fires Act 1954 does not bind the Crown. This means that its provisions do not bind CALM or DOLA without more,[249] but they do bind local government, companies and individuals. Bush for the purpose of the Bush Fires Act, includes trees, bushes, plants, stubble, scrub and undergrowth, alive or dead, severed or not severed.[250] Occupier is defined for the purpose of the Act.[251]

The Bush Fires Act 1954 is primarily responsible for regulating the response to wildfire that threatens human health and private property on private land or land under the control of local government which is not in a gazetted fire district,[252] but not land degradation or loss of flora and fauna caused by fire. The Act does authorise certain activities on certain Crown lands to protect private property.[253]

Fire under this Act is controlled by:
- Bush fire brigade officers appointed by local government to manage smaller fires or assist at larger wildfires;[254]
- Bush fire liaison officers appointed by FESA who provide advice and may be called on to assist at larger wildfires;[255]

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[240] *Local Government Act 1995* section 3.3.
[241] *Local Government Act 1995* section 3.5(1); the *Bush Fires Act 1954* sections 20(3) and 62.
[242] See for example the Shire of Williams *Firebreaks Local Law* as amended in 2001.
[243] *Local Government Act 1995* section 3.7.
[244] *Local Government Act 1995* section 3.10.
[245] *Local Government Act 1995* section 3.19.
[246] *Local Government Act 1995* section 3.20.
[247] *Local Government Act 1995* section 3.25.
[248] The *Bush Fires Act 1954* has numerous provisions all of which cannot be explored in this paper. Any State Act or regulation may be purchased from the State Government Printer at 10 William Street Perth.
[249] However, see the *Bush Fires Act 1954* section 33(1) if DOLA or CALM is an occupier for the purpose of the Act.
[250] *Bush Fires Act 1954* section 7.
[251] *Bush Fires Act 1954* section 7: *Occupier* is a person residing on the land or having charge or control of it, whether the person is the owner or tenant or a bailiff, servant, caretaker, or other person residing or having charge or control of the land and includes a person who as mortgagee in possession has possession of the land, while the land is unoccupied, and also a person who has the charge or control of 2 or more separate parcels of land, although the person resides on only one of the parcels.
[252] See the long title to the *Bush Fires Act 1954.*
[253] *Bush Fires Act 1954* section 34(1)(a). See also certain sections of the *Bush Fires Act* which would bind CALM if it is an owner or occupier of land: see section 33(3).
[254] *Bush Fires Act 1954* section 7.
[255] *Bush Fires Act 1954* section 12.

- Bush fire control officers who are the firefighters appointed by local government:[256] These officers have a number of powers.[257] They can issue permits to burn subject to certain fire weather restrictions.[258] Where a bush fire is burning in or on forest land, or in or on Crown lands, a forest officer present at the fire has the powers and authorities conferred by the Bush Fires Act 1954 ;[259]
- Fire weather officers [260] who are appointed by local government and categorise determine fire risk times such as extreme and high; and
- Forest officers[261] who can act as bush fire control officers in certain circumstances.[262]

The Bush Fires Act authorises local government to appoint bush fire officers to undertake a number of functions under the Act.[263] The local government is authorised to take such measures as appear to it to be necessary or expedient for preventing the outbreak of bush fires[264] including a notice to the owner or occupier to make a firebreak [265] or abate a fire risk.[266] The nature of a firebreak in each particular circumstance is not generally defined and this leaves the various firebreak provisions open to abuse in respect of unnecessary clearing of native vegetation.

Bush fire officers [267]are authorised to enter land the subject of a valid notice which has not been complied with to undertake the works that the notice requires to be done.[268]

The responsibility for extinguishing wildfires in local government areas that are not gazetted fire districts rests with local government and bush fires brigades.[269]

Other rights and obligations under the Bush Fires Act include:

- the duty of occupiers of rural land to use all means possible to extinguish fires burning on their land during fire danger periods[270] (while it is not an offence to fail to comply with this obligation, a breach of this duty could give rise to a claim for civil damages);
- the duty of occupiers of any land to extinguish bush fires occurring on their land;[271]
- the duty of occupiers of land to notify the outbreak of fire during fire danger periods;[272]
- the duty of occupiers of rural land to report the existence and location of a fire which cannot be extinguished, if practicable means of communication are available;[273] and
- the right of local government to require an occupier of land to clear a firebreak.[274]

Local governments may issue permits to burn in controlled burn times.[275] A permit to burn is not

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[256] *Bush Fires Act 1954* section 38.
[257] *Bush Fires Act 1954* section 39.
[258] *Bush Fires Act 1954* section 38(6)(h)&(i).
[259] *Bush Fires Act 1954* section 39(2)(a).
[260] *Bush Fires Act 1954* section 38(6)(c).
[261] An enforcement officer of the Department of CALM appointed under the *Conservation and Land Management Act 1984* sections 3 and 45(1)(b).
[262] For example *Bush Fires Act 1954* sections 39(2), 46 and 56.
[263] *Bush Fires Act 1954* section 38(4)(a).
[264] Subject to other provisions of the *Bush Fires Act 1954* and subject to directions from the local authority
[265] The width of firebreaks is generally not stated in the *Bush Fires Act 1954* but:

1. Three able bodied persons must be in attendance of a fire lit in restricted times until there is no smoldering or burning within 30 metres of a firebreak: see regulation 15B of the *Bush Fires Regulations 1954.*
2. When burning *proclaimed plants* a firebreak must be 6 metres: see regulation 33 of the *Bush Fires Regulations 1954.*
3. A firebreak to the satisfaction of the local government must be made around an airstrip: regulation 39B(2) of the *Bush Fires Regulations 1954.*
4. A place where welding or cutting operations take place must have 5 metre wide firebreak: see 39C(d) of the *Bush Fires Regulations 1954.*
5. The form for a permit to burn clover in prohibited times under regulation 18 requires a firebreak of 3 metres: see the Standard Form at the appendix to the *Bush Fires Regulations 1954.*

[266] *Bush Fires Act 1954* section 33(1).
[267] In certain circumstances FESA can take over this role: see the *Bush Fires Act 1954* section 35.
[268] *Bush Fires Act 1954* section 33(4)(a).
[269] *Bush Fires Act 1954* Part IV.
[270] *Bush Fire Act 1954*, section 28.
[271] *Bush Fires Act 1954* section 28.
[272] *Bush Fire Act 1954*, section 28.
[273] *Bush Fire Act 1954*, section 28(1).
[274] *Bush Fires Act 1954* section 33.

necessarily a defence to the charge of lighting a fire.[276] The local government is not required to consider the biodiversity loss associated with a pre-emptive burn[277] of native vegetation when considering an application for a permit to burn. It would be helpful in terms of biodiversity conservation if there were certain well defined clearing principles to which the local government must have due regard when considering an application for a permit to burn.

3.3 Town Planning and Development Act 1928
The Town Planning and Development Act 1928 regulates the subdivision and development of land. This Act binds the Crown unless stated otherwise.[278]

Conditions can be applied by the Western Australian Planning Commission to an approval by the Commission of an application to it for a grant of subdivision of land. The subdivision approval conditions may, for example, include a condition that a bush fire management plan be prepared to protect subdivided land from wildfire or neighbouring land from the escape of fire from the subdivided land.

The Commission is authorised to determine the conditions of a subdivision and may depart from the recommendation of the relevant agency or local government. The Commission is not required under the Town Planning and Development Act to implement a recommendation of FESA or CALM even if such a recommendation is made a condition of the subdivision decision. This is because the Commission is the agency responsible for deciding that subdivision conditions have been satisfied and is empowered to do so notwithstanding that the conditions have not been satisfied.

The Town Planning and Development Act 1928 also authorises the making of Interim Development Orders, town planning schemes or district planning schemes for the regulation of development on subdivided lots. Development decisions are made by local government after subdivision decisions are made. The local government can require bushfire protection conditions in respect of building types, building envelopes and the like. If the protection mechanisms are only included in a management plan or a policy they are unlikely to be enforceable without more.

The Commission and the Bush Fire Service have produced a joint publication the Bush Fire Survival Manual 2nd edn March 1998.

3.4 Town planning schemes
Each local government area may be subject to one or more town planning schemes and may also be subject to a region planning scheme.[279] These schemes control development in the scheme area. Development can be defined to include clearing by certain types of burning, which would in turn require development approval by the Shire. Scheme can require certain fire prevention measures as part of a development approval.

Conclusion

The interlocking provisions of the various statutes that form the framework for fire management on the variety of land tenures in Western Australia are complex and fraught with difficulties of interpretation and application both for fire fighting and fire prevention. I have nursed patients with horrific burns in my past occupation as a nurse. I have stood in the face of bush fires and been pleased to leave it to others. It must make the burden on those people with the responsibility for wildfire management, and biodiversity protection and preservation so much more onerous where their powers, roles, duties and obligations are not abundantly clear to all concerned.[280] Where this is so, it can reasonably be said that law reform and administrative guidelines should be high on the State government agenda.

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[275] *Bush Fires Act 1954* Division 5.
[276] *McCutcheon v Bateman*, unreported decision of the Supreme Court of WA, Appeal number 171 of 1985, delivered 8 November 1985, Pidgeon, J.
[277] Unless the protection provisions under the *Wildlife Conservation Act* or the *Environmental Protection and Biodiversity Conservation Act 1999 (Cth)* are triggered.
[278] *Town Planning and Development Act 1928* section 35.
[279] Peel Region Scheme may be introduced into parliament at the end of 2002.
[280] Angie Lyndon cartoonist provided her work pro bono: phone 9336 7517.

APPENDIX 1: Application of the law

Entities bound by which law	Crown (DOLA, CALM, Water and Rivers Commission, Western Australian Planning Commission)	Local government	Owner or occupier of private land	State Agreement Act parties
Common Law	*	*	*	*
EPBC Act	Yes	Yes	Yes	Yes
Regional Forests Agreement Bill 2002 once operative	Yes	Yes	Yes	Yes
Environmental Protection Act 1986	Yes	Yes	Yes	*
Environmental Protection Policy	Yes	Yes	Yes	*
Conservation and Land Management Act 1984	Crown is bound by the forest diseases Part. Otherwise the Crown is not bound, except CALM which is generally bound by the provisions of the Act			
Land Administration Act 1997	Yes	Yes	Yes	*
Unallocated Crown land – not managed	Yes, and require permission of Minister for Lands to burn unless a bush fire control officer making a firebreak if not in restricted time.	Adjacent owner or occupier may burn firebreak with permit	Adjacent owner or occupier may burn firebreak with permit	*
Unallocated Crown land with management plan	Yes, and burn according to management plan, all other things being equal.	Yes	Yes	*
Reserved Crown land not vested in CALM	Yes, no burning without permission of Minister for Lands	Yes, and no burning without permission of Minister for Lands	Yes, and no burning without permission of Minister for Lands	*
Crown land reserves vested in CALM without management plan.	The Crown is not bound but the Department of CALM is. Only permitted burning is a necessary operation under the CALM Act, which is an operation necessary for the protection of person, property, land, waters, flora or fauna which operation must first have been advertised.	Yes	Yes	*
State forest and timber reserves vested in the Conservation Commission	The Crown is not bound but the Department of CALM is. Burn generally according to management plan. Must comply with Ministerial conditions on plan.	Yes	Yes	*
Soil and Land Conservation Act 1945	The Crown is not expressly bound but may be in part. The Crown is obliged to	Yes	Yes	*

	cooperate with the Commissioner for Soil and Land Conservation.			
Soil and Land Conservation Act 1945 Notice of Intention to clear	Unlikely	Yes	Yes	*
Soil and Land Conservation Act 1945 Soil Conservation Notice & Soil Conservation Reserve	Possibly	Yes	Yes	*
Soil and Land Conservation Act 1945 Land Conservation District Regulations	Possibly	Yes	Yes	*
Country Areas Water Supply Act 1947	No	Yes	Yes	*
Country Areas Water Supply Act 1947: Declared catchment	No	Yes	Yes	*
Metropolitan Sewerage and Water Supply Act 1909	No	Yes	Yes	*
Waterways Conservation Act 1976 and Regulations 1987	Yes	Yes	Yes	*
Local Government Act 1995	No	Yes	Yes	*
Bush Fires Act 1954	No	Yes	Yes	*
Fire Brigades Act 1942	No	Yes	Yes	*
Fire and Emergency Services Authority of Western Australia Act 1998	No but FESA is by specific provisions.	Yes	Yes	*
Town Planning and Development Act 1928	Yes, unless otherwise provided.	Yes	Yes	*
Town or region planning schemes	Yes, but not in respect of subdivision applications.	Yes, but not with schemes outside district where these seek to operate within district unless by agreement.	Yes	*

* Bound unless expressly or impliedly excluded or qualified by statute, but where the Crown is a party to a State Agreement Act it is likely to enjoy the Crown immunities it otherwise has.

Fire and risk management

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Abstract (No copy of the full paper was provided by the author)

Wild fire threat analysis and management system and its application to public lands of South Western Australia managed by CALM is well established. The system has proven effective in complex situations where often competing management issues of human safety, property protection, economic resources and ecological values arise. Recently CALM has extended the wild fire management techniques to include a qualitative risk analysis of these values.

However there is considerable diversity of opinion on identification, measurement and regulation of risk of natural hazards, such as wild fire, and the idea that risk management has no single meaning is presented. The view that assessment and management cannot be separated; as assessment is in involved in frequency and magnitudes, while management deals with legal, political, cost and administrative objectives. Examples are given where the fire risk may be influenced by organisation management, competing land use, behavioural response and safety-environment trade-off. Consideration is given to the absence of wild fire related standards and that the lack of standards makes the actual performance of new wild fire risk management systems difficult to assess and thus may limit liability.

With better field measurements and increasing knowledge about fire transport processes in natural systems, systematic methods of quantifying risks can in principle be made. Some specialised ideas taken from offshore oil engineering risk management systems are considered as a possible basis to quantify wild fire risk.

Regional planning and bushfires

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Overview

The Shire of Mundaring is a characterised by a diverse range of land uses from Residential through to Special Rural and General Rural areas, with extensive areas of National Parks, Regional Parks, State Forest, bushland reserves and water catchment areas.

This diverse environment has required the Shire to approach fire planning from both a regional perspective and by focusing on individual land parcels.

A regional approach to fire management is difficult to achieve in an area such as the Shire of Mundaring due to the multiplicity of land managers (CALM, Water Corporation, DOLA, WAPC, Education) and the varying objectives and standards for fire protection adopted by these organisations.

The Shire's influence in regards to a regional response to fire management is mainly in the areas of education and community liaison and the coordination of activities to achieve required standards and comply with relevant regulations.

The Shires Regional fire management and planning process is facilitated by the Shire's Chief Fire Control Officer, who is employed as the Fire Management Officer with support provided by FESA.

The Chief Fire Control Officers key role focuses on:

- Providing advice on fire management measures required during subdivisions, through conditions on Outline Development Plans, Structure Plans and development applications;
- coordinating the activities of the Volunteer Bush Fire Brigades (VBFB) to ensure effective communication links and training are available to the volunteers involved in planning and implementing fire control measures;
- preparing and distributing educational material to the community on minimising fire risk and the existing fire control laws that Council has in place.

Fire planning and management is best addressed at the early stage of the development approvals process and needs to be balanced against potentially conflicting interests such as bushland protection. Like many Local Governments, development applications submitted to the Shire are assessed by a multi-disciplinary team consisting of Planning, Health, Building, Engineering, Environmental and other staff.

In some cases it is necessary for environmental issues, such as bushland protection, to be a secondary consideration to fire management requirements. This is particularly evident when implementing fire management provisions required by legislation or necessary to protect life and property. Strategic firebreaks are becoming common in larger scale developments, however these strategic measures do not negate the need for property specific fire protection measures required by law. It is important that all staff involved in the development approvals process understands fire management legislation and that adequate training is undertaken in this regard.

The Shire considers that protecting regional and state assets (such as communications, power, road and water supply infrastructure) and ensuring that bush fire prevention, preparedness and protection needs to occur at the smallest common denominator (i.e. individual properties).

This means that individual landholders are responsible for ensuring the risk of fire is minimised on

each lot. By undertaking this property specific approach to fire prevention, should one segment fail, the whole community is not put at risk. This is particularly relevant if a strategic firebreak is breached and there are inadequate property level fire management measures in place.

By relying on individual property owners to ensure fire preparedness, the Shire has needed to be flexible in the type of firebreak that it considers acceptable. Individuals seeking to preserve vegetation on their land (which is also the aim of the Shire) are not required to have earthen firebreaks and may choose a range of alternatives identified in various publications.

Additionally, the Shire encourages landholders to protect vegetation through constructing firebreaks around significant vegetation or trees. Minimising the size of building envelopes, appropriately locating access driveways and encouraging the retention of native vegetation on lots can lead to an increased risk of fire. While encouraging the protection of vegetation, the Shire must always ensure each of the lots has appropriate fire prevention measures in place in accordance with regulations.

Officers of the Shire can assess individual properties for compliance with the legislation and advise of appropriate actions required. Assessing all properties is resource intensive activity, which highlights the importance of liaison, training and education components of fire preparedness are best approached from a regional basis.

The Shire of Mundaring is also investigating the establishment of strategic "low hazard buffer zones" or belts using previously burnt areas as a foundation. It was identified that areas subject to previous fires contained low fuel loads and were a suitable safe area to base bushfire response activities. From this, the concept evolved into the establishment of extensive buffers in high fire risk areas comprised of Shire controlled land, State Forest and private properties. Clearly, further progress of this initiative would be subject to the effective coordination of various stakeholders and cooperation with private landowners in designated buffer areas.

This paper is discussed under the following key headings and expands on issues raised in the overview.

- Existing Approach
- Difficulties in Regional Fire Planning
- Role of the Shire
- Fire and Subdivisions
- Property Specific controls
- Fire Management and Bushland Protection
- Education, Liaison and Coordination
- Firebreaks and Firebreak Alternatives
- Protecting Assets
- Compliance
- Low Hazard "Safe" Zones
- Rural/Urban Bushfire Threat Analysis
- Conclusions

Existing approach

The diverse range of land uses and environmental landscapes in the Shire of Mundaring require variable methods to manage fire risk and undertake fire management planning.

The fire management approach utilised by the Shire of Mundaring incorporates both regional strategies and property specific activities.

The regional approach focuses on the key areas of education, community liaison and the application of standards and regulations. Education needs to link with larger education initiatives undertaken by organisations such as Fire and Rescue Authority (FESA), the Department of Conservation and Land Management (CALM) and the Department of Environmental Protection (DEP).

This ensures that a common message is being promoted with regard to fire regulations, safety, fire

risk, landowner responsibilities, government standards and the impacts of fire on air quality. This cooperative approach also enables the Local Government to effectively undertake community liaison at the local level, whilst bring in to the process communicating the larger, more strategic approaches being implemented at the State Government level.

From this common understanding, it is possible to engage the community as a united force that covers the regulatory requirements, whilst offering local information to assist with property level fire management.

Difficulties in regional fire planning

There is a range of factors that creates difficulties in achieving a regional approach to fire planning in the Shire of Mundaring.

The multiplicity of landowners (and land managers in the case of Crown land) has logistical implications in terms of communication, education and the application of fire management regulations and standards. This is compounded by the fact that there are diverse land uses throughout the Shire that require different approaches for fire management, depending upon the density of dwellings, objectives of land managers (conservation, water protection, education, public purpose, unallocated crown land) and available resources for fire management.

In addition to the above issues, varying forecasting districts (and operational responsibilities) related to fire management for factors such as weather, fire risk, air quality and emergency response create a communication and coordination difficulties in achieving a regional approach to fire planning.

Weather forecasts form the principal basis by which response preparedness is established and the context in which fire restrictions are applied. FESA's Perth North Region bush fire responsibility covers the Local Government areas of Gingin, Chittering, Wanneroo, Swan and Mundaring. The weather forecast zones in this region alone include the Metropolitan forecast, Metro Hills, Lower West Coastal and Lower West Inland.

Based on these zones, it is possible to have a "Very High" fire danger rating in the adjacent Local Government (City of Swan) and a "High" fire danger rating in the Shire of Mundaring. This is difficult to predict or rationalize and may be due to the influence of the sea breeze on the coastal plain and other factors. It would mean for instance that you could have a solid fuel barbecue next to John Forrest National Park in the Shire of Mundaring, but be unable to undertake this activity a matter of metres away as in a resident in the City of Swan.

The region also includes great variation in population density, town planning schemes, and geographical diversity.

Regionalising fire safety initiatives becomes difficult in these circumstances, and until recently, has been left entirely at the local level, which has evolved significant diversity in these approaches.

A group known as the Darling Scarp Fire Safety group has been established and may overcome some of the issues related to local variations for the Perth Hills area. This group is made up of Local Government representatives from City of Swan, Shire of Mundaring, Shire of Kalamunda, City of Gosnells and the City of Armadale and is facilitated by FESA. Each of these municipalities has the associated wildfire risks created by the rural/urban interface along the Darling Scarp.

This group approach provides the opportunity for the implementation of common tools and establishes a regional and strategic context from the basis of a common threat. Given that the risks are treated at a local level, it is indicated that that Regional Fire Planning is really only effective in the areas of education, liaison and coordination toward the achievement of required standards.

Role of the Shire

The role of the Shire in regards to fire management is coordinated by the Chief Bush Fire Control

Officer, with input from other Shire service area officers as required and depending upon the issue.

Education and community liaison and the preparation and distribution of information is a major activity aimed at ensuring that landowners meet their statutory obligations and Council policy in regards to fire management.

Providing advice to landowners, proponents and developers on fire management requirements also provides the opportunity for the Shire to have a positive influence at the planning stage of subdivisions and developments.

Fire and subdivisions

It is important for fire management to be considered during development, particularly early in the subdivision process. The Shire of Mundaring has formed a multi-disciplinary team of officers known as the Development Promotions Unit (DPU), which provides advice on development applications and subdivision proposals. The DPU consider and discuss all relevant issues related to planning applications lodged with the Shire, including fire management aspects. The DPU comprises of officers from Planning, Environmental, Building, Engineering, Rangers, Community and Health Services and it is generally the officers involved in the DPU that provide advice to the Chief Bush Fire Control Officer upon request.

The scale of subdivisions undertaken in the Shire of Mundaring range from strata developments and two (2) lot subdivisions through to major subdivisions and townsite proposals. Education and an understanding of fire management through the multi-disciplinary and consultative approach undertaken in DPU ensures that officers are kept up to date on the latest fire management techniques and regulations. During the assessment of the subdivision applications and the setting of approval conditions, it is very common to be balancing issues of fire management and vegetation protection.

Some of the key fire management issues related to subdivisions are outlined below.

- *Strategic Firebreaks* – Need to be located in discussions with developer and integrated into the design of the subdivision. Long term management responsibilities should be negotiated early in the planning process. Property specific fire control measures (firebreaks, minimising fuel loads) still required at the individual lot level.
- *Conditions of Subdivision* – Need to include fire management requirements.
- *Access and Egress* – Needs to be considered at the design stage as appropriate access for fire management will have implications for road location and design, lot layout and lot yields.
- *Fuel Loads* – To be assessed as part of site evaluation, with information included in planning application. Management of fuel loads over time and the requirements for fuel reduction (controlled burns, slashing, herbicide application) to be resolved with consideration of proponent responsibilities, landowner responsibilities and Shire involvement.
- *Building Envelopes* – Located to minimise the removal and damage of vegetation (i.e. cleared areas wherever possible), recognising that tree preservation provisions are required in the Shire of Mundaring for lots greater than 4,000 m^2 in size.
- *Access to Water Supply* – Needs to consider hydrant and standpipe locations (in areas with access to mains water supply) or alternative water resources (dams, rivers etc). In the case of dams, negotiation with landowners may be required to secure access rights.
- *Firebreaks and Fire Access Tracks* – Generally required around the perimeter of individual property, however location can be modified to accommodate protection of vegetation and other natural features (eg rock outcrops, steep slopes) in consultation with Shire officers.

Property specific controls

Property specific fire controls are the primary basis for fire management in the community and represent the "lowest common denominator" approach. Fire preparedness is a critical aspect in reducing risk and enabling effective fire response. It is the responsibility of each and every landowner and land manager to ensure that their landholdings meet statutory fire regulations and that they have implemented adequate fire preparedness measures.

Fire control measures can be tailored to meet individual property needs and should be negotiated with the Chief Bush Fire Control Officer, who can consult with other Shire staff as required. This includes opportunities for alternative firebreaks and other property specific measures.

The costs of fire management are borne by all landowners, which is reasonable given that the landowners (or land managers) are responsible for fire management on their property. It is relevant to note that annually, Local Government and relevant State Government agencies direct significant resources toward community level fire management. This shared approach ensures that the risk to the community in terms of fire management is minimised and enables the formation of effective partnerships and working relationships for fire response, education and advice.

Fire management and bushland protection

When undertaking fire management planning, a balance needs to be achieved between fire management and bushland protection. The community is very aware of the need to protect remnant bushland and, in places like the Shire of Mundaring, the natural environment plays a strong part in the hills lifestyle.

Bushland has intrinsic value from many perspectives including landscape amenity, biodiversity, fauna habitat and ecosystem services. The sustainability of these important environmental values are the responsibility of today's landowners and land manages. The responsibility to protect these natural assets for future generations rests with us all, as members of the community and decision makers. It also needs to be recognised that bushland settings in close proximity to residences is the key factor associated with increased fire risk.

In cases where a practical balance between these sometimes competing demands may not be achievable, the fire management regulations generally take precedence over vegetation protection given the need to protect human life and property.

Some of the measures that the Shire of Mundaring put in place to protect remnant vegetation, either through statutory means or through an advocacy and education role, include:

The careful siting of firebreaks to avoid the removal of vegetation with conservation value;
Minimising the size of building envelopes, particularly in well vegetated areas;
Locating access ways and subdivision roads to cleared areas wherever possible; and
Encouraging landowners to clear only around buildings (noting required low fire hazard buffer distances) and to retain vegetation within building envelopes.

Education, liaison and coordination

The need to engage the support of the community as active partners in fire management is essential.

Education, liaison and the coordination of fire management activities is an important role played by the Shire of Mundaring as a Local government located in a one of the highest fire risk areas of the Perth Metropolitan area.
This education role draws on the expertise and resources of other agencies and organisations that contribute toward cooperative fire management.

The Volunteer Bush Fire Brigades (VBFB) are an essential link between the community and the Shire of Mundaring and undertakes an important role in education, liaison and coordination. There are ten (10) VBFB's operating in the Shire of Mundaring. In addition the Shire has established a VBFB Environmental Officers Group, which meets every two (2) months and involves a member of each VBFB with an interest in environmental issues.

The issues discussed at the VBFB Environmental Officers Group meetings are communicated back to the brigades with the aim of increasing the member's understanding of the potential environmental impacts associated with fire management. This is useful "internal" education activity that enables the

brigades to provide good environmental practice advice to the community as part of its annual fire compliance and education campaign.

Firebreaks and firebreak alternatives

Individual landholders are responsible for ensuring the risk of fire is minimized on each property. By undertaking this property specific approach to fire prevention, should one segment fail, the whole community is not put at risk.

Alternatively, if reliance is placed only on a strategic approach, should one segment fail (or be not properly maintained), a greater proportion of the community may be put at risk. This is particularly relevant in the context of strategic firebreaks and there is also associated with this, an inadequate level of individual property fire management in place because of the perceived inherent value of the strategic measures.

By relying on each of the individual property owners to ensure fire preparedness, the Shire has needed to be flexible in the type of firebreak that it considers acceptable.

The Shire also needs to ensure that, within this flexibility, the minimum provisions of the Bush Fires Act are adhered to. The application of the Bush Fires Act in this context is not a simple task, because this legislation is principally design for rural and agricultural areas, not the fringes of the Metropolitan area.

Individuals seeking to preserve vegetation on their land (which is also the aim of the Shire) are not required to have mineral earth firebreaks, provided other alternative measures are undertaken. For alternatives to be utilized, landholders must apply for firebreaks "of an alternative nature or in an alternative location" by the 15th of November each year. This allows evaluation of the alternatives in sufficient time for enhancement of the arrangements by the gazetted time, should the original proposal not be sufficient.

For instance, allowances may be made for residential properties based on the following:

- Property is less than 3,000 m^2;
- Substantially cleared of native vegetation;
- Contains a dwelling; and
- Grass is maintained on the property at 5 cm or less in lieu of a firebreak.

Other circumstances and/or methods of control that may be considered as an alternative to perimeter earthen firebreaks on larger lots (> 3,000m^2) include:

- Controlled burns;
- Appropriate chemical control of vegetation using herbicides;
- Grazing;
- Physical removal of fire hazard (fuel loads) and regular maintenance;
- Use of natural features (rock outcrops, low heath areas);
- Discreet zoning of vegetation type and cover; and
- The installation of irrigation systems.

These, and other alternatives, are identified in a number of publications such as:

- Shire of Mundaring Firebreak Notice (updated annually);
- FESA Bush Fire – Are You Prepared? Information Pamphlet; and
- FESA Bush Fire Survival Manual (2000)

For all properties in the Shire, other alternatives may also be considered, depending upon local factors and circumstances.

Protecting assets

The Shire of Mundaring considers that protecting regional, state and local assets and ensuring that bush fire (wildfire) prevention, preparedness and protection occurs at the smallest common denominator, i.e. individual properties. It is also considered that this is also the most appropriate and effective level from which to establish safe communities.

Assets such as communications, major roads, water supply, power distribution and educational facilities have policy for management established at a state or federal level. However, protection for these is often provided only as a coincidence of that lowest common denominator type of approach; and is not entirely within the realm of local government's scope to manage. Nor should local government manage these facilities when the organisation concerned has its own resources to implement management. It is simply a concept that each landholder provides for their own wildfire preparedness.

As an aside, it is interesting that a system such as the power distribution network (managed by a corporate body (Western Power) and is the primary source of income to that body), insists that its customers ensure the protection of the network. For example, tree pruning and vegetation management in the vicinity of the local systems. Most organisations and businesses do everything possible to ensure their income is protected and accept this responsibility.

Compliance

Officers of the Shire assess individual properties for compliance with the legislation and advise of appropriate actions required. Assessing properties is a resource intensive activity, which highlights the importance of liaison, training and educational components of fire preparedness in the regional approach.

In the Shire of Mundaring, some interesting statistics have arisen as a result of compliance activities as indicated below:

- The are approximately 13,500 rated properties in the Shire of Mundaring;
- Inspections are undertaken between 1 December and 8 March each year to determine compliance with fire regulations;
- In total, 4,033 properties (almost 1 in 3) were inspected during summer 2001/02;
- A further 259 properties were re-inspected in 2001/02 to check if recommended actions to comply with officer advice had been undertaken;
- 174 ten (10) day warning letters were issued requiring landowners to undertake immediate action; and
- 70 infringements were issues.

These figures indicate a high level of fire regulation compliance in the Shire of Mundaring, with only 1.3% being issued a warning letter and 0.5% non-compliance.

Low hazard "safe" zones

Not all fire events are planned. That is the nature of our environment and demographics combine to create an eventuality that fire will occur somewhere during the drier months of the year. However, as with planned burn events, wildfire or unplanned events also result in a reduced fuel loading. The Shire of Mundaring is investigating the strategic value of utilizing these reduced fuel areas by managing adjacent areas to compliment the areas that suffered the unplanned event.

It is interesting to note that at least anecdotally that many residents perceive the greatest threat to their welfare ("fire hazard") arises from publicly held naturally vegetated areas near them. Statistically though, by far the majority of fire incidents occur and are contained on private property.

The Glen Forrest fire on 31st of December 1999 originated on private property (not due to the negligence of the owner) and the intensity and rapid spread of the fire was difficult to contain. This was

especially due in the early stages because of the physical barriers established by property owners (fences, buildings etc), which restricted access to fire fighting crews.

The fire was contained because a sustained suppression effort could be mounted on the northern and southern flanks in the naturally vegetated areas. The head fire was also narrowed because of a protective burn undertaken by a resident on the northern flank some 18 months previously.

Cheney (Australasian Fire Authorities Council Conference, Sept 9 2000, Project Vesta Conclusions) suggests that by narrowing headfires, there is a greater chance of fire containment. This proved to be the case in this event. If effective individual property protection had been undertaken, the head fire would have been narrowed much earlier and it could be suggested that the fire could have been contained much earlier.

The vegetated areas that were burnt in Glen Forrest, should a similar event occur in this vicinity again, now have strategic value as fuel-reduced areas that can be utilized for future fire containment purposes. These areas can be viewed at "safe zones" as the fire history of the area is known and locations within the previously burnt area can used to launch and coordinate fire fighting efforts.

We should not be oblivious to the fact that intense fire events have the potential to occur frequently. New South Wales actually experienced significant fire events across the state in 1994, 1997 and from October 2001 through to the end of January 2002. It is understood that the Royal National Park was impacted in both 1997 and the most recent events. As such these large areas cannot alone be relied upon for their strategic value to community wildfire protection, it is vital that controlled burning (based on mosaic approach) and property specific fire management measures continue to be implemented.

It is unreasonable to continue to implement planned burns for the whole of the area defined by the Glen Forrest fire. Consequently some areas may have to be burnt a little sooner than a "normal" rotation. This will afford continuing protection whilst still buying time to manage the remaining areas into the future.

This cannot be achieved with Shire of Mundaring and volunteer resources alone. In this area in particular other organisations are also landholders in this locality.

Rural/urban bushfire threat analysis

Bushfire threat analysis aims to assist in identifying fire risk areas so that control measures and priorities can be determined to achieve effective fire management.

FESA have prepared a tool known as the Rural Urban Bush Fire Threat Analysis (RUBTA). The purpose of RUBTA as outlined in FESA's Community Safety directorate is as follows:

"to provide an analytical system that fire managers can use to quantify decisions associated with wildfire hazards, risks and values to determine the threat that a bush fire would pose".

It is expected that the rural urban bush fire threat analysis (RUBTA) tool will be applicable in situations where bushland and communities are located. This may include several streets in the metropolitan area, or a brigade zone or local government area. The expectation is that the hazards, risks and values analysed and the resultant threat determined by use of this manual can be applied with equal success in all areas.

This analysis tool is not designed to be applied in isolated areas that contain little or residential commercial development. In these isolated instances it is recommended that the CALM Wildfire Threat Analysis tool be used.

It is also acknowledged that the community needs should be considered in terms of:

- People (e.g. residences, employees/ers, visitors, patients and students);
- Property (e.g. houses, businesses, public buildings);
- Infrastructure/systems (e.g. utilities, transport, communications).

All of these are components of the "community" section of the threat analysis, but they are also significant components of the "risk" section.

It fills a role in each section because by having a community, it has people, and people start the majority of bush fires. Therefore people make up a large portion of the problem of the risk associated with bush fires.

Each component of the analysis tool is weighted so that the values of life and property take precedent over other values. The special environmental values are also weighted to ensure greater consideration is placed on these sections of the environment that warrant such consideration.

The total points allocation is 300. The RUBTA is designed to identify where a more significant potential problem may exist when compared with other areas after completing a threat analysis of the area.

Without going into the mechanics of the RUBTA and how it is applied, it is with tools such as these that community wide threats can be analysed. This is where the "regional" approach is brought into context. The RUBTA has been made available to the Chief Bush Fire Control Officers who now have a common tool to develop community safety standards.

Conclusions

The Shire of Mundaring is located in a region characterised by a range of land uses and forecasting districts.

Fire planning on a regional level is should not be about strategic firebreaks but one of communication, training, education and promotion.

Identifying hazards and determining adequate control measures (and designs) at the planning stage is an important function provided by the Shire to reduce fire threats associated with development.

Fire preparedness at a state and regional level is dependent on individual landholders ensuring their property has the appropriate fire control measures in place. This includes government agencies such as CALM, Water Corporation, Ministry for Planning, Department of Planning and Infrastructure and Department of Land Administration.

Fire preparedness at an individual property basis requires the Shire to be flexible in the types of fire controls available to landholders. The Shire seeks to protect vegetation while still ensuring the wider community is protected from the risks associated with uncontrolled fires.

The Shire of Mundaring is investigating ways to establish extensive low hazard buffers in high fire risk areas to establish "safe zones" and provide a base for launching a defence against wildfires threatening life and property.

A sustainable balance between fire control and bushland protection needs to be negotiated and achieved, taking into account legislation, local conditions and environmental values.

The Shire of Mundaring will continue to work with the community and in partnership with other organisations to ensure that fire management objectives that protect life and property, whilst preserving environmental values, are achieved.

Approaches to community safety and bushfires in southwestern Australia

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Abstract

Disaster prevention and mitigation management requires that communities have a significant and direct involvement in the planning of and response to emergencies. This requires heightened community awareness of the social and economic benefits of risk management through the development of strategic alliances, structured community consultation and genuine community ownership. The significance of community safety in emergency risk management is recognized nationally by Emergency Management Australia.

Models for community safety vary between the Australian States and Territories. One proposed model (Emergency Management Australia 1997) is based on developing partnerships for community centred safety management. Hill (1999) suggests that community safety be based on integrating the key elements of community characteristics, organisational knowledge, planning and program delivery, and continuous performance improvement.

Both models share concepts and principles, in that they (i) are community centred, (ii) require mutual obligations by all community sectors, (iii) improve the capacity of communities to deal with bushfires, and (iv) are promoted and coordinated by fire agencies. The programs are successful if they (i) have a shared community vision, (ii) form partnerships built on trust, (iii) share community responsibility for their own safety, and (iv) are implemented based on long-term sustainability.

Approaches to community safety in southwestern Western have been influenced by:

- key institutional drivers such as bushfire management following the passing of the Forest Act in 1918, the passing of the Bush Fires Act in 1954, the 1962 Royal Commission Inquiry into the Dwellingup fires, and the 1997 Day Report on fire hazards in the Darling escarpment;
- key systems drivers such as the introduction of planned burning in 1953, the development of risk management tools from 1991, and the introduction of an agreed emergency risk management approach in Western Australia in 1999; and
- key socio-political factors concerned with changing demographics between city and country, changing community attitudes about the use of planned fire and its impact on the environment, and an increasing focus of the importance of prevention and mitigation in emergency management.

This paper introduces a performance indicator framework for assessing effectiveness in meeting community safety objectives and the implementation of programs. It suggests that the thematic areas for the application and/or development of performance indicators be based on the Nationally agreed concepts for community safety, and that indicators for success be based on the Nationally agreed principles for community safety.

Introduction

Every year the community is reminded of Australia's vulnerability to a range of natural and technological hazards. The key to reducing these impacts is by preventing and mitigating the risks of disasters and emergencies through a system of partnerships between all levels of government, industry, commerce and the community. Self-help at the local community level is central to this approach.

Disaster prevention and mitigation management requires that communities have a significant and direct involvement in the planning of and response to emergencies. This requires heightened community awareness of the social and economic benefits of risk management through the development of strategic alliances, structured community consultation and genuine community ownership. The significance of community safety in emergency risk management is recognized nationally by Emergency Management Australia.

Models for community safety

Most community safety is event focused using tools such as mitigation and prevention, and is managed through legislation, and by central government agencies, regional assessment teams or through local governments. The need for a more strategic and holistic approach based on managing community safety outcomes and consequences is necessary.

One proposed model (Emergency Management Australia 1997) is based on developing partnerships for community centred safety management. Another model proposed by Hill (1999) suggests that community safety be based on integrating the key elements of community characteristics, organisational knowledge, planning and program delivery, and continuous performance improvement. Both models share the following concepts and principles which will be used in the discussion of this paper, to demonstrate how the effectiveness of community safety processes and outcomes in southwestern Australia can be measured.

Concepts

Community centred: Here the wider community actively participates in its own safety. The community takes a partner role in the development of processes, plans and actions. Partnerships are strong working relations. Partnerships between the community and organisations that have traditionally held responsibility for community safety are essential in any process that involves community centred approaches for safety management.

Mutual obligation: Community safety is sustained by a sense of mutual obligation between government, agencies, private sector companies and the community. Responsibilities should be well defined so that all the parties understand their role in improving community safety.

Community capacity: Improving the communities capacity for safety is achieved by developing specific safety attributes and behaviours including motivation, understanding, information, self reliance, sustainability, inter-dependence and empowerment.

Agency innovation: Improved performance of agencies who have responsibility to facilitate community safety requires that they use all the mechanisms available to them, that they are innovative, customer focused, flexible and community friendly.

Principles

Shared vision: Strategies and partnerships for community centred safety management need to be committed to a shared vision. This provides the basis and motivation for building cooperation, mutual understanding and agreement. The commitment is central to the partnership and underpins all other principles.

Inclusivity: Strategies and partnerships for community centred safety management need to be inclusive. This means that the partnership is built on an open relationship characterized by active involvement, effective communication, genuine collaboration and cooperation. Any processes developed need to be open and accessible to all members of the community.

Empowerment: Strategies and partnerships for community centred safety management need to be empowering. This means that partnerships share responsibility, support, resources and

encouragement to achieve mutual benefits. It implies harnessing the potential of the community and resources of existing safety management to create innovative and more comprehensive solutions.

Sustainable: Strategies and partnerships for community centred safety management need to be sustainable. This means that the partnership is established to derive and achieve long-term goals. The partnership and its processes should continue to evolve over time and remain responsive to the needs of the wider community.

Bushfires in southwestern Australia

Bushfire hazard in southwestern Australia is as severe as in any other part of the world because the region has extensive tall forests, which sheds tonnes of highly flammable material each year, as well as a Mediterranean climate. That climate produces three to six month drought every year with periods of high temperature and low humidity. The summer drought is also a period of frequent high winds generated by unstable frontal movements, deep coastal troughs and strong sea breezes.

Fire is a naturally occurring element of southwestern Australian ecosystems. To the vegetation and the native animals, it is simply a powerful disturbance factor from which, in time, natural systems recover. The plants and animals have evolved in the presence of regular fire occurrence and even depend on fire for regeneration, refuge, protection and reproduction.

Aboriginal people have used fire for more than 40,000 years for hunting, cooking and for clearing the country to enable easier access for hunting, as well as to stimulate regrowth of native grasses to attract grazing animals. Aborigines also used fire to create buffers to help protect them against the ravages of wildfires. Early European explorers and colonists often referred to the ever-present plumes and the Aborigines' extraordinary familiarity and dexterity at using fire in a wide range of circumstances.

Fire can also be an agent of death and destruction to human assets and values as large fires are extremely costly to the community. In southwestern Australia, communities are now embedded in a very fire prone environment. While natural fires in the past once ran their course until it rained, the creation of towns, settlements, community assets and infrastructures, farmlands and other commercial developments means that today's community requires protection against damaging summer wildfires.

Community safety – drivers for change

Early approaches in bushfire management
The early development of bushland fire policies and their implementation is summarised by McCaw and Burrows (1989). Although bushfire ordinances were passed in the mid 1800s, there was little attempt to tackle the fire problem in the southwest until after the passage of the Forests Act in 1918 and the establishment of the Forests Department in 1919.

From the very beginning, the development of bushland fire policies saw opposing forces in conflict over the deliberate use of fire. Many of the European-trained professional foresters who were appointed to the new Forests Department were opposed to planned burning. However field foresters with long experience in the Australian bush were in favour of it. During the 1920s and 1930s fire management involved:

- subdivision of the forest into areas which had been timber harvested and regenerated, and areas where timber harvesting had not yet occurred. The former were completely protected from fire. Some planned burning, mainly *firebreaks* (narrow strips of forest between two tracks), was undertaken in the remainder of the forest. However most of the unlogged forest simply burnt from time to time in wildfires;
- the development of a fire management infrastructure such as forest management headquarters, fire lookouts, communications systems, maps, roads, training and liaison with neighbours; and
- programs of public education, plus law enforcement aimed at reducing illegal or irresponsible fire

lighting.

The policy of restricting the use of broad scale planned burning and improved fire suppression saw heavy fuels accumulating in most forest areas by the 1940s. From the late 1930s onwards, fires had started to become very large and difficult to control. There were major fires in the jarrah forest in 1949/50 (Wallace 1965), and in the jarrah and the karri forests in 1937 and during the 1950/51 summer. In the long protected compartments fires became uncontrollable once they exceeded about a hectare in size, even under mild weather conditions. At about this time there were also massive fires in the southern forest national parks, notably the Walpole-Nornalup Park and adjoining areas, where whole hillsides of karri and tingle trees were killed. The remnants of these dead trees, and the regrowth forests which developed under them, can still be seen near Nornalup today.

In 1953 there was a change in Forests Department policy and broadscale planned burning for fuel reduction was introduced. Because of the massive fuels in most of the areas to be burnt, implementation of the policy was cautious and slow at first. Most of the initial burning in the northern jarrah forest was actually done in winter. There were also technical deficiencies, especially lack of fire behaviour information on which to base burning prescriptions, and a lack of trained staff to undertake the work. Little effective burning could be undertaken in the dense southern forests, principally because of lack of access and problems with predicting fire behaviour in complex karri and karri-tingle fuels.

Bush Fires Act
The Bush fires Act (1954) provided a legal model for the early development of fire prevention based community safety programs. While it sought to prescribe the management of fire hazards, and to set times of the year when it was prohibited, restricted and open to light fires, the provisions of the Act were delegated to local governments, and emphasized the responsibility of land occupiers to manage flammable hazards on their properties. In prescribing these arrangements the Bush Fires Act provided for the establishment of a State level Bush Fires Board with specific fire prevention functions; namely

- best means to be taken for preventing or extinguishing bush fires (s10[1][a]);
- carry out fire prevention measures as it considers necessary (s10[1][e]);
- carry out research in connection with fire prevention and control and matters pertaining to fire prevention and control (s10[1][f]; and
- conduct publicity campaigns for the purpose of improving fire prevention measures (s10[1][g].

Royal Commission Inquiry into the Dwellingup fires, and the adoption of planned burning
The culmination of early fire policies for West Australian forests came in the summer of 1960/61. Massive fires swept through the forests of the southwest. The town of Dwellingup was burnt, as were the smaller settlements of Holyoake, Nanga Brook and Karridale. There were serious losses of pasture, stock and fencing. Fortunately no one died in the fires, but many were injured, and the cost to the community was enormous.

The Dwellingup fires covered 146,200 hectares, destroyed 132 dwellings, a hospital, two sawmills, two service stations, three general stores, offices, outbuildings and 74 motor vehicles to a total value of $2 million. In the wake of the 1961 fires, a Royal Commission was held. The report of the Commission (Rodger, 1961) contains numerous recommendations concerning measures necessary to prevent and control bushfires. From the point of view of the then Forests Department, recommendation 20 was the most significant. It read:

"The Forests Department [is to] make every endeavour to improve and extend the practice of control burning to ensure that the forests receive the maximum protection practical consistent with silvicultural requirements. "

While this did not represent a redirection of policy for the southwest forests, it unambiguously endorsed the policy which had been adopted in 1953. The Royal Commission's recommendations were adopted in full by the Government of the day, and have not been rescinded over the intervening years. Today the planned burning approach is only one of the measures now employed in fire prevention in southwestern Australia. Other measures include:

- the development of prediction systems for fuel moisture content, fire behaviour and fire effects parameters;
- the introduction of spotter aircraft to augment and partly replace the fire detection system based on lookout towers;
- the development of inter-agency agreements for cooperative fire management with Shires, Bush Fire Brigades, the fire agencies and other organisations;
- formal and structured fire training systems for fire agency staff and volunteers;
- the development of structured and pre-planned fire command systems that ensures arrangements and procedures for responding to and coping with fire emergencies are integrated, effective, timely and appropriate;
- the development of Wildfire Threat Analysis as an objective way of identifying, ranking and mapping values to be protected so that priorities and procedures for fire prevention and fire suppression works can be agreed and implemented with the resources available;
- the identification of *strategic buffers* in southwestern Australia where fire protection takes priority over other landuses, and is integrated across tenures;
- the use of computers and *geographic information system* software for mapping, fire behaviour computation and for aiding decision-making and fire management planning;
- the introduction of an aerial suppression capability to rapidly contain small initiating wildfires particularly in rural/urban interface zones.

The Day Report
Following the spate of uncontrolled fires that burnt into parts of Sydney in 1994, the Government of Western Australia established a Working Group to assess bushfire risks in the urban rural interface of the Darling Range near Perth. The Group was chaired by John Day, Member of the Legislative Assembly, and member for Darling Range, and focused on the standards of fire prevention and operational preparedness, and on the vulnerability of the hills surrounding Perth to fire hazards.

The Day Report was released in 1994 and contained 58 recommendations, the first being to undertake a comprehensive bushfire threat analysis of the area. The Report also emphasized community ownership of bushfire risks, with a focus away from institutionalised protection, as provided by the Bush Fires Act, to a focus of fire agencies assisting communities increase their capacity to deal with bushfires. A need for landuse planning and controls on building design through the application of AS 3959 (Building in Bushfire Prone Areas), was also highlighted as critical to the prevention of human and property loss form bushfires.

The introduction of emergency risk management in Western Australia
In 1999 the State Emergency Management Advisory Committee adopted a system of emergency risk management in Western Australia based on National approaches for disaster mitigation and prevention. Key State principles included:

- that effective emergency risk management be outcome/consequence (and not event) focused and directed at reducing deaths and economic losses and maintaining community and business continuity;
- that emergency risk management priorities be focused on the "gap" between existing community safety programs and the achievement of agreed State emergency risk management goals, objectives and outcomes;
- that successful emergency management requires the determination of State risk management priorities. This requires wide community consultation so as to evaluate societies' risk thresholds and risk evaluation criteria and to establish points of weakness in the State's risk management processes;
- that outcome and consequence based emergency management require that communities have a significant and direct involvement in the planning of and response to emergencies. This requires heightened community awareness of the social and economic benefits of risk management through the development of strategic alliances, structured community consultation and genuine community ownership; and
- that successful emergency management require the development and management of shared risk, threat and vulnerability information.

The development of risk management tools
Community safety based on risk management processes requires decision support tools, judgment and communications, to predict potential impacts, and assist the development of safe, sustainable and prosperous communities. Common conventions define hazard as conditions that can lead to harm, risk as the probability of a hazard leading to harm, vulnerability as the degree of susceptibility to hazards and threat as the level of risk relative to hazard. Most information on the relationships and processes involved in understanding risk are spatial in nature and require *geographic information systems* to drive analysis and assessment.

The Department of Conservation and Land Management's Wildfire Threat Analysis (Muller and Vodopier 1994) formalizes the processes undertaken by experienced fire managers when considering the threat from and responses to forest fires. It was first introduced into Western Australia in the early 1990s. Wildfire Threat Analysis integrates the four main components that contribute to bushfire threat, namely: the values at risk; the probability of ignition; the rate of spread of wildfires; the capacity to mount a suppression operation. Currently, the Fire and Emergency Services Authority is trialing a Rural Urban Bushfire Threat Analysis to assist it and local governments take into account fire threats on private lands.

The management of risk must also address vulnerability to threats, so that community safety programs can be targeted at the most exposed sub-groups. Vulnerability to threats occur in five themes (Jones et. al. 1999), namely

- the community setting, such as the physical environment, climate, access, and local government administrative arrangements;
- community shelter, such as capacity to provide protection and refuge;
- community sustenance, particularly the effectiveness of lifeline support systems such as power supply, telecommunications and food and medical supplies;
- community security (health and welfare), such as the availability of hospitals, police and fire stations, and special provisions for the elderly and the young; and
- societal factors that deal with the capacity of communities to manage threats such as language, education and ethnicity.

Socio-political factors
Changing demographics between city and country, changing community attitudes about the use of planned fire, and an increasing awareness of the importance of prevention and mitigation in emergency management have been important factors influencing the development of community safety programs. Over the last decade the divide between urban and rural has become less clear due to the expansion of cities and people choosing to live in natural settings and commute to larger work centres. This has occurred despite the Victorian Ash Wednesday fires in 1983 and the Sydney fires in 1994. One interpretation is that communities are prepared to *trade* the threat of living in bushfire prone areas, for more nature based *lifestyle* alternatives. This cultural shift has meant that bushfire threats have impinged more heavily onto rural centres, and increase the need for community safety programs.

A second cultural change has seen the community become more concerned about the use of planned fire, and its environmental impact on native plant and animal species, ecosystems, and Perth's air quality. This has significantly reduced planned burning achievements, and accumulations of flammable fuels in parts of southwestern Australia are now equivalent to levels before the Dwellingup fire of 1961 (Department of Conservation and Land Management 2000). While the merits of this debate will not be argued here, it is noted that:

- the urban/rural interface is the most fire vulnerable part of the Australian environment due to the mixture of bushland, houses, people, paddocks and stock;
- in Western Australia there are many urban interface areas of concern, particularly the hills area east of Perth, the new suburbs north of Perth, the *hobby farm* and rural retreat areas along the Leeuwin-Naturaliste ridge, and similar areas in and around the karri forest and along, the south coast;
- the solution to the fire threat in these areas involves a package of strategies, including house design and protection measures, maintenance of fire breaks and clean areas around buildings, sprinkler systems, well trained and well disciplined householders, and the nearby presence of well equipped and highly readied fire suppression crews; and

- the effectiveness of the above strategies is dependent on the prevention of high intensity bushfires. Fuel reduction using planned fire is a central part of the overall strategy in preparing for bushfires at the urban/rural interface.

A third cultural change has seen an increase focus and priority given to emergency prevention, through a range of community safety programs. Comprehensive and integrated risk management lessens the impact of emergencies on community life, property, business continuity and the environment. They also bring about fundamental changes in community perceptions about emergencies. International experience has also shown economic benefits in the community safety approach, in that every dollar spent on emergency prevention and mitigation saves at least two dollars on responding to and recovering from disasters.

Reducing the impact of fires on the community requires parties to work together in partnership. Some of the key participants are community members facing the risk, community groups with specific interests in risk (eg. conservation groups, local governments), other land managers, government agencies, and fire services. Increasingly, partnerships between some or all of these groups are bringing about agreed and coordinated strategies.

An example of such a partnership is the joint five local government authority, Fire and Emergency Services Authority, Department of Conservation and Land Management group (The Darling Scarp Fire Safety Group) that functions to address fire risks in the Perth's Darling Escarpment. Traditionally, each local government authority would have developed its own plans for risk assessment, hazard reduction, and education. By working jointly they are able to be more strategic, and make more effective use of their community's limited resources.

A further example of partnerships is the work between the Fire and Emergency Services Authority and *friends* of particular bushland sites. Efforts have been made over the past three years for the two groups to work together in the planning of fire response strategies should they be necessary, taking into account environmental values and operational imperatives. While there are still disagreements and difficulties between the groups, both the relationship and outcomes for the bushland are steadily improving.

Community safety – responding to the drivers

In attempting to reduce the impact of bushfires on communities there are essentially three pathways to be taken either jointly or on their own.

Engineering: modifying the environment to reduce the number and effects of bushfire

Fuel reduction: The analysis of bushfire threats of the Darling Range between Mundaring and Dwellingup, as recommended in the Report of the Ministerial Review of the Fire Hazards in the Darling Escarpment (Day 1994), clearly indicated a high level of exposure and vulnerability of these communities to bushfires. Reductions of the level of flammable vegetation, achieved primarily through planned burning, is an effective strategy for reducing community impact from high intensity fires emanating from nearby natural areas carrying heavy vegetation. Since the Dwellingup fires in 1961 there have been numerous instances where rural and rural/urban interface communities have been saved from bushfires by the presence of strategically located fuel reduced burn buffers (Sneeuwjagt *pers comm* 2002).

Land use planning: The carefully planned use of the land prior to construction of developments is one of the most effective ways of reducing bushfire impacts. This requires an assessment of the suitability of the land for development and then the meeting of standards such as access, water supplies, and width of roads. In 2001, the Fire and Emergency Services Authority and the Department for Planning and Infrastructure developed and distributed a policy and guidelines for local government and planners of sub-developments in bushfire prone areas. The document is called Planning for Bushfire Protection and takes account of Australian Standard 3959 Building in Bushfire Prone Areas.

Fire prevention planning: Guidelines were developed by the Bushfire Service in 1998 as a model plan for bushfire prevention planning. They may be applied to small areas such as holiday camps and

to entire Shires. The Fire and Emergency Services Authority and the Urban Bushland Council have also developed a guide for landowners, fire officers and bushland friends groups involved in management planning in urban bushlands, on how to reduce the number and impact of fires in urban bushland.

Enforcement:
Enforcing compliance with legal requirements relating to bushfire
Bush Fires Act (1954): There is provision for financial penalties and/or imprisonment for contravention of a number of sections under the Bushfires Act (1954). These relate to prohibited burning times (s12), restricted burning times (s18), permit to burn requirements (s24B), the use of tractors or engines during prohibited burning times (s27), and disposal of burning cigarettes and matches (s32). The most serious offence within the Act is *the lighting or attempting to light a fire likely to injure or damage a person or property, whether the fire be caused or not.* This is an indictable offence that carries a penalty of $250,000 or 14 years imprisonment or both (s32).

Community participation in reporting deliberate firelighters: In an effort to combat the number of small but potentially dangerous bush and grass fires adjacent to houses and schools, householders and school populations in targeted areas are being encouraged to use the Police Crime Stoppers number to report suspicious activities. To date, two areas in Perth experiencing very high numbers of fires have been targeted at Forrestfield and Kwinana. Each area has received publicity, door knocks, shopping centre displays and school visits. This has been a joint effort by the Fire and Emergency Service Authority, local governments, bushfire volunteers and the Police Service. Reported fires in Forrestfield dropped significantly after the operation and the Police received a number of names to pursue.

Fire investigation: In Western Australian the investigation of the origin and cause of wildfires remains a primary tool for responding to the incidence of suspicious and deliberately lit fires. Fire investigation contributes to identifying causes that can lead to prevention or reduction in community losses, and assists in detection and apprehension of arsonists. No one agency can be responsible for wildfire investigation. The fire agencies and the Police have the responsibility for investigating the origin and cause of wildfires. Their joint work has led to a number of arrests and convictions of arson. Increased community awareness, is an essential strategy of the State Arson Strategy.

Education: Increasing the knowledge, understanding and skill of the community so that they can make informed choices about their situation

State Mitigation Committee: The State Mitigation Committee, Directors General and Chief Executive Officers from relevant Government Departments, are focused on coordinating a whole-of-Government approach to emergency mitigation, ensuring appropriate access to Commonwealth National Disaster Relief Funding, and the effective identification and implementation of mitigation strategies. The following outcomes have been agreed:

- developing a definition of mitigation that can be agreed by the three levels of government;
- determining the criteria for setting mitigation priorities;
- facilitating the development of databases to incorporate historical data, gathered from previous emergencies, and integrating the use of these databases into the strategic mitigation planning;
- promoting an emergency risk management methodology for use by local governments in the development of emergency risk management arrangements;
- develop local government authority and community awareness of the social and economic benefits of mitigation;
- coordinating mitigation strategies state wide providing for efficient use of resources and data;
- evaluating the appropriateness of existing Commonwealth and State programs to fund mitigation activities; and
- developing Commonwealth, State and local government funding criteria to support local governments undertake mitigation works.

Arson Task Force: In 1996 the Minister for Police and Emergency Services established an Arson Taskforce whose Terms of Reference included: developing strategies to combat arson; measuring the effectiveness of arson strategies and the achievement of objectives; coordinating the implementation of the arson strategy; liaison to maximize community and industry input and assistance. The

development of a comprehensive Arson Strategy has included:

- the preparation of the Position Paper "Arson: Context, Current Status and Prevention Strategies in Western Australia" (1997) that provided an analysis of the state of arson in Western Australia;
- the preparation of the Public Discussion Paper "Flame Out: Combating Deliberate Firelighting in Western Australia" (1999) that was released for public comment; and
- the holding of a State Arson Strategy Workshop (2000) to determine strategies, outcomes, targets, performance indicators and interagency collaboration on arson prevention.

Community involvement, with industry and government, is an essential element in the prevention of arson and the reduction of arson impacts. Strategies include (i) increasing community awareness on the causes, impacts and consequences of arson, and (ii) educating the community on potential solutions to reduce the incidence and impact of arson

Community awareness campaigns: Public awareness campaigns on the dangers of bushfires are held in southwest and northwest of Western Australia each year. In the southwest the *SummerSafe* campaign runs from November to March and focuses on community preparedness for bushfires. It targets those in the urban rural interface around Perth and in the southwest, and aims to raise the awareness of the dangers of bushfires, and provide information on actions that can be undertaken by householders, in the event of approaching fire. The campaigns are part of a strategy to ensure that people can make informed choices about the risks they face and how they can deal with them. They rely mainly on press releases as well as paid and opportunistic messages through the media. Additionally, places with public access are targeted for displays. Local governments authorities are often proactive in promoting fire safety through the distribution of information brochures to householders in fire risk areas both promoting fire safety and providing information on restricted and prohibited burning times and requirements for fire breaks.

Bushfire Ready Action Groups (BRAGs): Media campaigns alone are considered not enough to change community behaviour. At a more local and intensive level, community groups are supported to participate in *Bushfire Ready Action Groups*. In participating in these local groups, people learn and practice skills in preparing their properties and themselves while forming links with neighbours. In doing so, the members of the group become more reliant on themselves and each other than on emergency services.

Schools programs: Communities and fire services regard the early education of children on how to prevent and respond to both structure fires and bushfires as very important. Within Western Australia, children in primary schools have the opportunity to learn these things through the *Fire Inside Out* program which was distributed to all primary schools in 2001. A feature of the *Fire Inside Out* program is the emphasis on the consequences of fire in terms of loss, property damage, environmental damage, injury, death, legal issues and danger to firefighters. This mainstream program is supported by visits to schools by permanent and volunteer firefighters and in many areas, local government authority staff such as Rangers.

Juvenile firelighters: Many children become involved in deliberate firelighting activities for a wide variety of reasons. Some of these are anger, curiosity, revenge, boredom, and attention seeking. The Fire and Emergency Services Authority runs a program for such children aged between 4 and 16 years called the *Juvenile and Family Fire Awareness* (JAFFA) Program. The program is based on a comprehensive assessment of the child's needs followed by tailored education sessions or, if necessary, referral to a more appropriate agency. The program also deals with children who have a fascination or fear of fire. Approximately 120 children are referred to the program each year.

Discussion

Are these programs community centred; do they require mutual obligations by all sectors of the community; do they improve the capacity of communities to deal with bushfires; and are they promoted and coordinated by the fire agencies? Are they successful in that they require a shared community vision, form partnerships built on trust, share community responsibility for their own safety, and are the programs implement based on long-term sustainability?

These questions can only be properly answered by developing a framework of performance indicators that assess effectiveness in meeting community safety objectives, and continuous improvement in the implementation of programs. Performance measurement is a complex discipline, particularly where community values are involved. It has the following essential features:

- ξ performance indicators necessary to assess community safety management should be dynamic, strategic, and operate at various spatial and temporal levels. They may relate to assessments of program components, or relate to the quality of environmental, social and economic outputs and inputs resulting from the programs. The indicators must also take account of contextual factors, such as variations in the severity of fire seasons, which cannot be controlled by management intervention;
- ξ performance indicators should have a clearly defined purpose. Community safety programs should demonstrate the success, or otherwise, of the achievements of objectives, that plans are being implemented, and that effective management systems are in place. Indicators should be designed to measure the three elements of a management theme, namely (i) the condition of the community under consideration, (ii) the pressure(s) that might be affecting the community, and (iii) the response to those pressures by management; and
- ξ for any given purpose, criteria are necessary to select the most appropriate key performance indicator(s). Those used for community safety could relate to their capacity to represent community concerns, to operate at State, regional and local levels, and to contribute to the balanced provision of environmental and socio-economic benefits. For any given performance indicator, tests are then necessary to determine the extent to which the indicator can be implemented. This will include the availability of data for indicator reporting, its capacity to be measured, and the cost of implementation.

The concepts and principles for community safety described earlier in this paper are considered a suitable basis for assessing thematic areas for the application and/or development of performance indicators (Table 1).

Table 1: Thematic areas for the application and/or development of performance indicators

Criteria (Concept)	**Indicator success areas (Principles)**
Community centred	Partnerships; agreed processes for developing plans and actions; sustainability of partnerships
Mutual obligation	Defined functions, roles and responsibilities; strength of working relations
Community capacity	Awareness, education and information programs; changes in community attitudes and behaviours; self reliance
Agency innovation	Agency performance; community safety program development; customer focus

For the community centred theme, examples of performance indicators in Table 2 show condition, pressure and response measures. For example condition indicators measure the vital attribute of whether the success of community safety programs is rising or falling, pressure indicators measure the extent to which bushfire threats affect the level of community safety, and response indicators measure the extent to which management inputs are having a positive impact on community safety.

Table 2: Examples of performance indicators for community safety management

Issue	Condition indicator	Pressure indicator	Response indicator
Community safety theme: community centred			
Community safety by local governments	The status of local governments with community losses exceeding the State average.	The numbers of bushfires from human causes; the impact of bushfires	The extent to which local governments integrate community safety; the area of fuel reduction.

Conclusion

"Increasing a community's capacity to recover from, mitigate against, prevent, respond effectively / appropriately and minimise disruption for both individuals and groups within physical, psychological, social and financial contexts is the key component associated with a safer community" (Rhodes and Odgers 2001). For organisations this has implications for appropriate planning, suitable hazard management, communication of the risk and delivery of the information and resources that will enable communities in bushfire prone area to make informed choices about their safety. For individuals and communities there is an implication that safety is a shared responsibility requiring not just knowledge of the risk but action in mitigating against it.

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Bushfire threat and community perception

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Abstract

As was evidenced by the bushfires in New South Wales over the Christmas / New-Year period, the threat of bushfire within our community is both real and devastating. Unfortunately, though, the general perceptions of many people who live in bushfire prone areas is that they are simply not at risk. Research conducted in Carramar, a suburb approximately 30km north of the Perth CBD, found that for the most part residents felt as though they knew what to do in a fire and were adequately prepared. Each household which participated in the research, however, was also able to identify at least one other property which they felt was under prepared and at risk during a fire. Despite this confidence, Carramar residents also thought that it would be beneficial if a knowledgeable authority could visit their properties to provide advice and if the fire services could organise an annual meeting for residents to reinforce safety messages and provide information about what to do. While the focus of this paper will be on the outcomes of a qualitative study conducted in Carramar, Western Australia, data will also be drawn from similar studies conducted in Victoria (1995, 1997) as well as the initial results from the 2002 New South Wales Bushfire study. In particular, the current paper will explore the perceptions of communities in relation to the threat of bushfire, safety and organisations associated with preparing for and responding to bushfires.

Introduction

The risk of fire both in and to the community remains high despite advances in early warning systems, improved suppression systems, more advanced planning, increased knowledge and enhanced operational preparedness. Each year fire causes tens of millions of dollars damage to the Western Australian community and countless dollars damage to bushland areas and the environment, as well as resulting in hundreds of injuries and even death. As fire services have been put under increasing pressure to provide a better service with limited finances and scope to improve the effectiveness of operational strategies, they have also been forced to adopt a different approach to contribute to improved community safety levels (Odgers and Esmond, 2001).

In order to contribute to improved community safety levels, fire services throughout Australia have begun to adopt a Risk Management approach to their day-to-day business. A key component of this approach has been a shift in focus away from primarily suppression towards a stronger emphasis on prevention. Associated with this shift has been the development of closer affiliations with the community and an encouragement for the community to take greater responsibility for their own safety. Importantly, the community's participation in creating a safer community is vital (Odgers, 2000).

A safer community

The concept of a "Safer Community" is not exclusive to the fire services, but rather is a concept which is also embraced by a range of other sectors such as health, injury prevention, crime prevention and so on. Within each of these sectors, though, the notion of a safer community is largely the same, comprising similar philosophies, understandings, strategies and so on. Importantly, the key element associated with safer community relates to increasing the capacity of a community to recover from, mitigate against, prevent and respond appropriately to risks. By doing this the potential level of physical, psychological, social or financial disruption within the community is minimised (Rhodes & Odgers, 2002).

In order to increase a community's capacity to deal with risk, though, it is also important to increase a community's resource level, knowledge level and skills as well as the number and types of choices

they have in relation to their safety. No matter how much an organisation attempts to increase the resource, knowledge or skill levels of a community, however, if the community is not ready to use these resources, take on board the knowledge or accept the skills, then the capacity of the community to deal with risk will not change.

Two important aspects which organisations and groups must therefore take into consideration when trying to increase the capacity of communities are:

- The notion that people may consider their level of risk acceptable, and
- An individual's or community's perception of their own situation and therefore their readiness to change.

It should be noted, though, that an individual or community is not simply ready or not ready to change, but rather progressively become more ready and more likely to start to adopt new attitudes and behaviours in relation to any given risk. Encouraging people to change and adopt new ideas and behaviours is very complex and requires people to move through the various stages of understanding, acknowledging and assimilating risk before they are able to consider changing their behaviour. The effects of information received will therefore be dependent upon the stage an individual or community is at in relation to their "risk". By determining both the stage of readiness people are at and the level of risk they are prepared to accept, organisations can place themselves in the best possible position to effect social change (Rhodes & Odgers, 2002).

Importance of perception

People's perceptions have long been recognised as a key-influencing factor associated with the way in which they behave (Gale Encyclopaedia of Psychology, 2001). Whether associated with attaining a desired reputation, achieving financial status or simply in relation to a social situation, people will behave in a manner commensurate with their goals and perceptions, regardless of whether these perceptions are right or wrong, well founded or misconstrued. As such, peoples behaviour is only likely to change as they manage their reputation realign their goals or alter their perceptions about an issue or concept. People's behaviour in relation to safety is no different. It relies on the establishment of similar information sets, the development of goals and the moderating influence of perception. For example, an elderly person maybe prompted to install a home security system, after exposure to repeated media reports about the homes of senior citizens being broken into despite living in a suburb which has one of the lowest home invasion rates in the state. Their risk perception level in this instance is not so much based on fact, but rather the assimilation of the media information to their own age group and perceived vulnerability levels. Conversely, if someone does not perceive themselves to be at risk of a home invasion they are highly unlikely to install a home security system despite living in a suburb notorious for home break-ins.

Participation is fire safety activities is no different, with people only engaging in those activities which they believe are commensurate with their perceived level of fire risk. This notion is an important one for fire services to understand as it significantly contributes to explaining why it is that people do not become engaged in fire safety activities more readily. While the notions of apathy and laziness have long been held as reasonable explanations for why people do not become involved in fire safety, Western Australian research suggests that while these notions are certainly valid in a small minority of cases, more frequently it is simply a lack of perceived risk that leads to a lack of participation in fire safety activities (Odgers & Esmond, 2001).

Perhaps the most powerful aspect of perception in relation to safety relates to an individual's level of dis-ease. In a situation where a person is comfortable because they believe they can "handle" things, it is unlikely that they will be motivated to change their behaviour, particularly if a high cost (whether social, financial, effort, reputation, etc) is deemed to be associated with the change in behaviour. Alternatively, if an individual or their family is not comfortable or confident about their capacity to deal with "things" then they are more likely to be motivated to change their behaviour even if there is a cost associated with this change. Of course, the balance between cost and benefit is something that can only be determined by each individual and will ultimately influence their final decision in relation to the extent of behavioural change or the extent to which they participate in fire safety activities.

Unfortunately, the perceptions held by individuals, their preparedness to bear the costs associated with behavioural change, their readiness to change and their capacity to maintain this change are all individually and situationally specific. This means that organisations attempting to influence behavioural change will not succeed by simply using a broad-brush approach. Rather, behavioural change will generally only be evident when an individual is able to assimilate information to their / their family's situation. People, however, are never simply ready to change or not ready to change, but rather move through a continuum of gradually improved readiness. Increased knowledge, improved understanding, new skills and so on all assist in this process, although it is thought that the most important "mover" is that of assimilation – the recognition of the relevance to self. That is, "seeing as, is a necessary prerequisite for action" (Sherman, 1989, pp. 40). Although even this is sometimes not enough.

A bigger picture

The results of six separate research community based projects conducted in Western Australia (three), Victoria (two) and New South Wales (one) between 1994 and 2002 can be combined to help provide a clearer understanding of communities. In particular, by using this information, organisations can develop an idea of the way in which people perceive the risks associated with Bushfire, the roles of organisations in relation to Bushfire and the levels of preparedness achieved by the community. The following provides a synopsis of the findings of these works

Perception of risk

Research conducted in Western Australia during the year 2000 (Odgers & Esmond, 2001) specifically sort to understand why people accepted responsibility for their own safety while not being very vigilant about implementing safety practices (Odgers & Esmond, 1999). The results of this research showed that people generally perceived that they were not very susceptible or vulnerable to different risks. Further, people perceived that in the event that something did happen that their level of resilience (ability to cope with the fire) and recoverability would be relatively high, thereby ensuring that things would be "back to normal" fairly quickly. These findings not only reflected the findings of two community projects conducted in Victoria (Strahan Research, 1997), but were further supported by work carried out in Carramar, a small community approximately 30 kilometres north of the Perth CBD, in 2001 (Esmond & Odgers, 2001) and the NSW Bushfire Study, 2002 (Odgers & Rhodes, 2002).

Community members spoken to in the context of all of these research projects tended to respond in a similar fashion. The results of the 2000 Community Safety Survey conducted in Western Australia, though, was able to quantify the perceptions of people in relation to risk. In order to do this people were asked about 12 different "risky" situations that enabled a comparative analysis and an opportunity to understand the perception's people have of different risks relative to each other. As can be seen from Figure 1, people's perceptions vary from not really at risk to slightly at risk (It should be noted that the range on this scale is from 4 (not at all at risk) to – 4 (greatly at risk)).

As can be seen from Figure 1, people throughout Western Australia perceived the risk in relation to Bushfire to be less than home break-ins, road crashes, night time assaults, car theft, day time assaults and house fires. Conversely, peoples perceived bushfire risk level was greater than that of sever storms, cyclones, storm surge, floods and earthquakes. These results, however, are based on state wide responses. When examining this information more closely, it was found that the responses of people in different regions of Western Australia were quite different. For example, the perceptions of people who live in the Southwest / Great Southern Region of Western Australia are displayed in Figure 2.

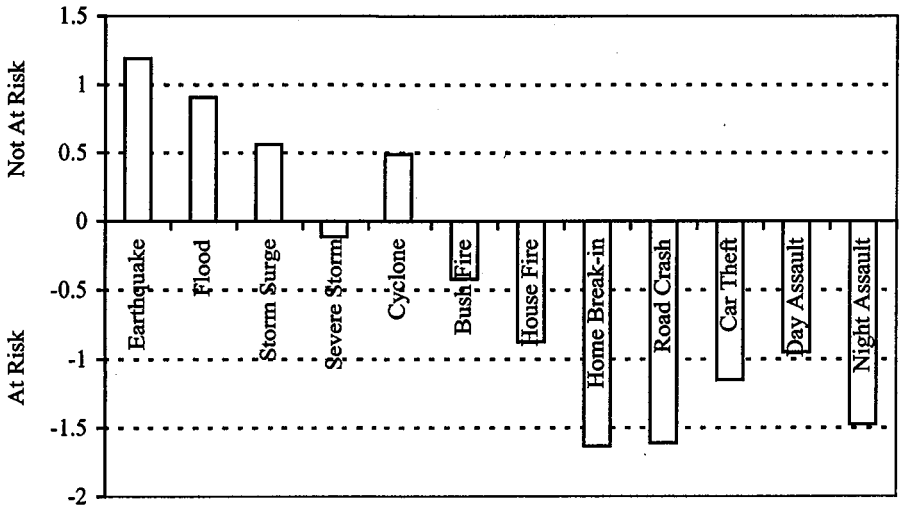

Figure 1: The perceived risk level of Western Australians.

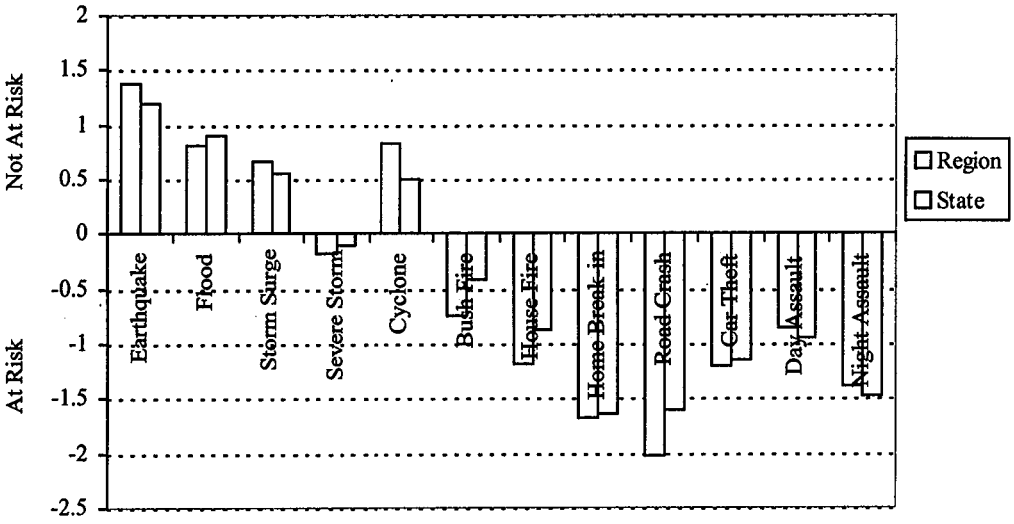

Figure 2: The perceived risk level of the South West / Great Southern Region.

As can be seen in Figure 2, the perceptions of risk for people from the Southwest / Great Southern Region differ to the state average. In particular, their perceptions of risk in relation to road accidents and bushfires are significantly greater than the state average. This perception of "at riskness" was subsequently transferred into actions, with people in the Southwest / Great Southern region reporting greater levels of participation in safety activities than the state average.

Perceptions of preparedness levels for bushfire

Despite perceiving to have relatively low risk levels in relation to bushfire, people involved in the five research projects indicated that they generally felt as though they were well prepared, organised and aware of what to do in a fire. In most instances, however, those involved in interviews were also able to identify at least one property where they did not feel as though people were prepared. Further, properties in Victoria and Western Australia which were examined for adequacy of preparedness measures were most commonly found to be under prepared. These findings therefore suggest that

many people may in fact be over estimating their efforts in relation to bushfires or simply over reporting their efforts in an effort to appear self-reliant.

In either instance, it is also interesting to note that residents in the Carramar study, the two Victorian studies and the NSW Bushfire study all indicated that they would like to have "experts" provide them with specific advice in relation to their property and how to better prepare it for a fire. In addition to this, residents also indicated that they would like for the fire service to run an "open day" each year just before the bushfire season so that bushfire safety measures, messages and strategies could be reinforced. These are both very "healthy" requests though as it indicates that residents while perhaps recognising their limitations are keen to take responsibility for their own safety and to do it in a manner that is commensurate with fire service guidelines.

A key factor that was continually identified by residents, especially those who had experienced a bushfire, related to the topic of evacuation. Residents who had been forcefully evacuated from their homes, or had witnessed forced evacuations, were adamant that people should be able to make their own decisions about whether to stay or go, especially if they had been involved with the fire service's bushfire preparedness strategies such as Bushfire Ready or Community Fireguard. Much of the frustration related firstly to the perceived contradiction between bushfire preparedness messages and operational actions, secondly, the perception that there was a lack of communication between fire services and police, and thirdly, that the police appeared to be under-trained in relation to bushfire / fire. This final aspect was associated with concern for the police and their safety as much as having them understand about the fire prevention strategies that residents had undertaken on their property and therefore the "unnecessariness" of evacuating them.

Within the context of the Carramar study residents were spoken to on two occasions (one week after the fire and five months after the fire). This allowed for an exploration of people's intentions and their subsequent actions in relation to their preparedness levels. Unfortunately, while the vast majority of people reported a week after the fire that they were going to increase their prevention measures (e.g., non-electric pumps, external sprinklers, etc.) five months later practically non of these strategies had been implemented. A number of reasons were cited for this lack of action with the most common being a lack of knowledge and a lack of time. Residents were, however, still keen to undertake some of the strategies and suggested that the local council could take a lead role in assisting residents. For example, residents saw non-electric pumps as important, but problematic, because people were unsure of what would be appropriate for their area or property. Residents therefore felt that the local council could act on their behalf and make recommendations as to what was appropriate. Bulk purchases could perhaps then be made and a regular "local area" maintenance program implemented. People were therefore indicating that they were prepared to pay for equipment and their maintenance, but lacked confidence to make the initial purchase. This is also reflective of people wanting to take ownership and responsibility for their own safety while acknowledging that they would be better placed to do this with assistance from "expert" agencies.

Perceptions of organisations

For the most part people appear not to understand the roles of organisations very well in relation to the prevention of fire, preparing for fire or responding to fire. This lack of understanding, along with preconceived ideas about what each organisation should or could be doing in relation to fire, may be the major contributing factors associated with the perceptions people have about how well organisations fulfil their different roles when it comes to fire. Unfortunately, in most instances, people were not particularly satisfied with the actions, or inaction, of local governments and police. Much of this dissatisfaction though appeared to be associated with residents feeling as though local governments in particular were generally not prepared to listen to residents, were unwilling to enforce regulations pertaining to fire safety and were often obstructive in relation to the clearing of tress from around homes. In one instance there was even a perception among residents that many households had been fined for clearing trees from around their house while in fact only one person had received a caution in 18 years.

Many of the frustrations experienced by residents following a bushfire may in fact be associated with a lack of clear understanding about the roles of organisations and the activities they undertake. Firebreaks for example, are generally perceived to be areas which will stop the fire. During a fire,

residents understandably then become angry when these firebreaks "don't work". Post fire debriefs, however, revealed that when residents understand that firebreaks are more adequately described as "access roads" they become less angry although insist on the terminology being changed to be more reflective of their purpose. Many residents, in fact, felt betrayed and let down by the local government who was seen as having ultimate responsibility for "firebreaks".

Despite the many different areas of concern, most residents unequivocally supported fire services and thanked them for their efforts. Fire services were, however, encouraged by the public to work more closely with the police so that they understood more about fire and how to behave during a fire. People felt that by doing this police officers would not be placed at the same level of risk that they currently were. Many other organisations were also praised for their efforts following and during a fire with most residents feeling very supported by groups such as the State Emergency Services, Salvation Army and essential service providers.

Conclusion

The results of research conducted in Western Australia, Victoria and New South Wales suggests that communities throughout Australia may be facing many similar issues in relation to bushfire. While disturbing, similar issues provide fire services with the opportunity to work collectively to identify appropriate strategies for assisting communities in their desires to become more self-reliant. An important aspect of this approach will be for fire services to work more closely with communities who are located in bushfire prone areas. In doing this, though, it will be essential for organisations to remain mindful of community perceptions, needs and assumptions and ensure that the most appropriate risk communication strategies possible are used.

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Bushfire threat to homeowners

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ICS Group

Abstract

"The fires ripped through houses and outbuildings alike", "thousands flee as fire rages out of control", and "the fires burned red-hot, leaping roads and destroying all in their paths" – these are just a few quotes from news stories covering the New South Wales bush fires of 2001/2002. Similar quotes can be found in news reports for other bush fire events. But does this media hype reflect the actual threat of bush fires to homeowners?

Research and inquiries into major fires, both in Australia and overseas, paint a different picture. The research found that many fatalities and injuries occurred as a result of residents being poorly informed about bush fire safety and that they often took inappropriate actions, which placed them at much greater risk in a bush fire. It was also found that houses were generally lost as a result of ember attack, and that houses often burned down either well before, or well after, the fire front passed through an area. Many homes could have been saved if the initial spot fires in and around these houses had been extinguished. As a result of this research clear information on the factors that lead to fatalities, injuries and building loss during bush fires is now available.

It is not only the media hype that can have an adverse influence on homeowners. The actions taken (or not taken) by fire and emergency services, during pre-planning, community safety programs, training and fire operations, can have a significant impact on the level of risk homeowners are exposed to in a bush fire.

This paper reviews research into fatalities and building losses during major bush fires, and provides an overview of programs, guidelines and regulations that are currently available to homeowners to minimise the impact of bush fires. Furthermore, the paper discusses the factors that reduce the threat of bush fires to homeowners, and those that increase the threat.

Introduction

Many myths and media hype surround bush fires, especially when they penetrate the urban interface. News reports often provide graphic pictures of mass evacuations, of people fleeing the fire front, of houses burning "at random" and of general mayhem. Rarely do these reports however focus on factual information.

Research into major bush fires paints a different picture. Most houses are lost as a result of ember attack some time before or after the fire front has passed. Many civilian deaths occurred when residents evacuated late, or were caught outside their homes. Often their houses survived the fire and would have provided adequate shelter from radiant heat if people had stayed.

Research into bush fires and losses has been undertaken in Australia for many decades. The first scientific study of bush fire damage to buildings was conducted after a fire at Beaumaris (Vic) in 1944 (Leonard, 1999). Many more studies have been undertaken since then, including the more prominent research into building damage and losses after the Ash Wednesday Fires of 1983 (SA and Vic) and the Sydney Fires of 1994.

The factors that contribute to building loss, injury or fatalities are now well understood. But more importantly, programs and measures have been developed which will increase the capacity of people and their homes to withstand a bush fire. Unfortunately, however, it appears that many residents, but also fire and emergency services personnel and government officials, base their decisions in relation to bush fire safety on the information they receive from media coverage of bush fire emergencies. This can significantly increase the risk to the community.

This paper reviews research into fatalities and building losses during major bush fires, and provides an overview of programs, guidelines and regulations that are currently available to homeowners to minimise the impact of bush fires. Furthermore, the paper discusses the factors that reduce the threat of bush fires to homeowners, and those that increase the threat.

Fire appliances

The traditional approach to reduce the threat from bush fires to homeowners is based on fire suppression. Governments maintain fire services that have the capacity to "fight" bush fires to protect the community. As a result, fire organisations have evolved who have access to modern four-wheel drive fire appliances, air tankers, communication networks, training and co-ordination facilities. During major bush fire emergencies, additional fire fighting resources from outside the area are called in, to support the overall fire fighting effort. During the Sydney fires of 2001/02, for example, fire fighting resources were assembled from all states, and two additional Ericson Skycrane helitankers were hired from America.

This approach appears to work well for the majority of bush fires. However, the traditional approach has significant limitations in a bush fire emergency that occurs under severe weather conditions (Petris, 1995). Where initial attempts to contain a fire under extreme fire weather conditions have failed, fire intensities develop that are well beyond the fire suppression capacity of modern ground and air based fire fighting resources. These fires can generally not be contained until weather conditions abate, or until fires burn into areas that have very limited bush fire fuels.

In forest fuels an indirect attack with earth moving machinery and appliances will generally fail once fire intensities reach 3,000kW/m (FESA, 2000). Luke and McArthur (1978) suggest a slightly higher intensity, 4,000kW/m, where a direct attack on a fire will become difficult. This difference becomes negligible when the intensity of bush fires that burn under severe fire weather conditions is taken into consideration. For example, head fire intensities in moderate fuels within a stunted jarrah forest were reported to have reached 20,000kW/m during the Mount Barker (WA) fire of December 2000 (Braun, 2002), and may have reached 100,000kW/m during the Ash Wednesday Fires of 1983 (NRE, 1999).

The notion that major conflagrations can generally not be contained by fire fighting resources is supported by fire officers, who reported that even if the available fire-fighting resources in areas such as Cockatoo, had been multiplied many times they would have been powerless to control the unstoppable fires (Miller et al, 1984). The community must also recognise that fire fighting resources may not be able to reach homes before a fire impacts on them, and that generally the number of houses that are threatened by a major fire is significantly higher than the number of fire appliances available. Additional and alternative ways of reducing fire threat to homeowners must therefore be sought to supplement the existing fire suppression resources that are available (Petris, 1995).

Fuel reduction burning

Fuel, hazard reduction, or prescribed burning has long been advocated to minimise the threat of bush fires to homeowners. In Western Australia, a comprehensive prescribed burning program is undertaken throughout the State's forests, nature reserves and national parks. The Department of Conservation and Land Management (CALM) reports that as a result of the burning program the average size of fires has declined, and major property losses, injuries and fatalities have been avoided (CALM, 1994). Similar reports have also been made in relation to fires in other states (Petris, 1995).

However, a number of studies and research papers do not support the above reports. Both Simmons (1988) and Bora (1994) observed that fuel loads can reach significant levels within 2-3 years after a fire. Even CALM's own research indicates that fuels accumulate to levels where head fires can not be successfully suppressed under average fire danger conditions, after only 5-7 years in jarrah and 6-8 year in karri forests (CALM, 1994). This leaves only a short period during which fuel reduction burning is effective. Furthermore, when this information is adjusted to take very high and extreme fire weather conditions into account, it could be argued that the time taken for fuels to accumulate to levels where fires can not be successfully controlled is much less.

There is additional evidence that fires burning under severe fire weather conditions will travel through recently burned bush areas, sometimes at high intensities. A number of houses were, for example, destroyed in December 1990, during a fire which burned under extreme fire weather conditions in the Brisbane Water National Park near Gosford (NSW). The fire travelled through a number of areas that had burnt less than 5 years prior to the wildfire, including the entire valley behind the town. The fire travelled downhill through the valley, which had been burned only 13 months before the wildfire (Bradstock, 1995).

Bradstock (1998) found that 95% of bush fires, which resulted in fatalities and significant building losses, occurred on days of very high and extreme fire danger. Under these conditions, he argued, fuel reduction burning had little or no impact on fire behaviour. Furthermore, Bradstock suggested that the risk from bush fires can not be significantly reduced though prescribed burning, even if it is undertaken at very frequent intervals.

The severity of wildfires burning under extreme fire weather conditions, through forests that had been hazard reduced, was also highlighted during the fires of 1961 in the south west of Western Australia. One of these fires impacted on Dwellingup, where 132 dwellings, a district hospital, 2 service stations, 3 general stores, offices, 2 saw mills and 74 vehicles were destroyed. These losses occurred despite that fact that most of the forests in the Dwellingup division had been controlled burnt in recent years, and the litter on various parts of the forest represented accumulations generally speaking, of from 0-8 years. During this fire, buildings were commencing to catch alight long before the advancing fire reached the outskirts [of the town of Dwellingup] (Rogers, 1961).

McArthur (1961) researched the Dwellingup fire and prepared a report for the Royal Commission. He found that on many occasions a head fire burned quite rapidly through forests that had only been burned in the previous spring. Although these fires burned at lower intensity, they frequently ... [spotted] ahead for some distance. He also states that it is obvious that recently control-burnt country will not stop the spread of a fire on a day of extreme fire danger ....

In more recent work, Jasper (1999) challenges the value of prescribed burns adjacent to urban developments in relation to life and property protection. Furthermore, James (1999) suggests that the results of his study indicate that prescribed burning was of limited effectiveness as a fire management strategy for the Blue Mountains.

The above reports indicate that prescribed burning alone is not sufficient to protect homes from bush fires. It is, however, acknowledged that hazard reduction burning can be a valid and effective strategy for strategic fire management and for conservation. It is important that the limitations of hazard reduction burning are recognised, and that residents in the urban interface are made aware that alternative fire protection measures are required to minimise the threat from bush fires, in addition to hazard reduction burning.

Building protection

Numerous myths surround the "destruction" of buildings in a bush fire. Many people believe that timber-clad houses can not be protected from wildfire, others believe that houses explode in the path of a fire. Very few people appear to be well informed about the different modes of fire attack. This, in turn, prevents them from taking appropriate steps to improve the resilience of a house in a bush fire emergency.

The first study into the resistance of buildings was undertaken by Barrow, after the Beaumaris (VIC) fire of 1944 (Leonard, 1999). This study identified that houses tended to burn down from the inside, and that house survival was dependent on its surroundings and the details of construction. Barrow found that fires generally started in roof spaces, in rooms or under the floors, and that burning embers and debris entered through windows, eaves and vents. Preventative measures were suggested, including enclosing under-floor spaces and eaves, covering openings with metal mesh, and removal of firewood, trees and shrubs from the walls. Today, similar recommendations are still made by fire services. Although the modes of wildfire attack on buildings are known, well over 4000 houses have been destroyed in bush fires since the Beaumaris fire of 1944 (Leonard, 1999).

More detailed studies into building losses were undertaken after the Hobart fires of 1967, the Ash Wednesday fires of 1983, the Sydney fires of 1994, and the Dandenong fires of 1997. These studies also concluded that the mechanisms for bush fire attack on buildings were embers and burning debris, radiant heat or direct flame contact, with the majority of houses being lost due to ember attack (Ramsay, 1986, 1995, Leonard, 1999). The notion that the majority of houses are ignited through ember attack is also supported by reports from the Dwellingup and Hobart fires (Petris, 1995). Furthermore, Ramsay (1986) was able to dispel the myth that houses exploded in the path of a fire, as evidence to support such claims was not found during the research into the Ash Wednesday Fires of 1983.

In a bush fire, embers and burning debris, together with leaves, can be piled up by the wind against combustible material on the outside of the building, or may enter the building through eaves, windows or other openings. This may start small spot fires which, if left unchecked, will develop to eventually involve the whole building.

Radiant heat from a bush fire may preheat combustible material in and around the building, which will increase the likelihood of material igniting from embers and small spot fires. Radiation from the bush fire, or another burning structure, may be sufficient to break windows. This in turn will allow embers and burning debris to enter the building to start spot fires inside the building. It is believed that unprotected, standard glass windows will break when radiant heat levels reach 14kW/m^2, which can be generated by a fire burning in heavy forest fuel under extreme fire danger conditions, at a distance of more than 50m from the building (pers. com. Dr Noreen Krusel CFA, and Neville McArthur, CSIRO). This highlights the importance of maintaining adequate separation distances between bush fire fuels and buildings.

Flame contact from the bush fire, other combustible material such as firewood stored adjacent to or under a building, but also from adjacent buildings, is a further mechanism for building loss in a bush fire. Flame contact from the bush fire may occur under extreme fire weather conditions, in heavy forest fuels where separation distances between the building and bush is less than 30-50m (pers. comm. Dr Noreen Crusel, CFA).

House to house ignition was a major factor in the loss of buildings during the Como/Jannali (NSW) fire of 1994, and it contributed to the loss of possibly 3 buildings during the Sydney 2001/02 fires (Ramsay, 1995a; pers. com. Neville McArthur, CSIRO).

In more recent times, damage caused by wind accompanying the fire was included as an additional mechanism for building loss (Ramsay, 1995b). It was found that burning debris and embers were able to enter a building through openings caused by wind damage.

The knowledge gained from research into building losses has lead to the contemporary approach that aims to integrate building design and construction features, building maintenance, landscaping and bush fire fuel modification around houses, as well as subdivision design and active defence. It has been recognised that it is generally not sufficient, nor practical, to only apply one single risk minimisation strategy on its own.

Recent work undertaken by the Australasian Fire Authorities Council, in conjunction with a number of fire services, has provided performance based models, which quantify the level of attack of a bush fire on a building, based on surrounding bush fire fuels. The results from an assessment of a building and its surrounds can be used to determine appropriate risk minimisation strategies around the home, to minimise the threat from bush fires. Programs have been developed which integrate the areas of subdivision planning, building design and construction, fuel modification, as well as bush fire safety education and awareness for homeowners. The latter includes the Community Fire Guard and Bush Fire Ready Action Group programs.

The myths that surrounds building losses in bush fires can easily be dispelled when factual information about these fires is assessed. For the Dwellingup (WA) fire of 1961, Rogers (1961) found that the ignition of buildings appeared to depend largely upon where burning brands lodged, and whether persons were present to extinguish it quickly. Investigations into the Western District (VIC) fires of 1977 and the Ash Wednesday Fires (SA, VIC) of 1983 found that very few attended houses were

destroyed and that the presence of people who were able to carry out firefighting activities had a marked effect on house survival (Leonard, 1999).

During the Como/Jannali (NSW) fire in 1994, one person was killed and over 100 structures were destroyed within one hour of extreme fire weather. The Como/Jannali fire burned through a reserve that was only 23 hectares. It started through spot fires from a fire that had burned on the opposite side of the Woronora River, some 750m away. It was reported that houses were igniting for more than two hours after the spot fires developed and much of the destruction in the Como/Jannali fire came from house to house ignition well after the bushland reserve was burnt out (Ramsay, 1995a).

A homeowner can significantly reduce the risk from bush fires by implementing a number of basic fire safety measures. Hazard separation, enclosing openings, general housekeeping, maintenance of a reliable water supply, and ensuring that well informed able bodied persons stay with the home to extinguish spot fires, are some of the fundamental fire safety measures that will reduce the wildfire risk to homes. It must however be recognised that the risk to homeowners will greatly increase if only partial attempts are made to comply with minimum fire safety measures. If, for example bush fire fuels are not adequately reduced around a building, or a reliable water supply is not maintained, the homeowner may not be able to defend the house, and may be exposed to significant risks from the fire.

Land use and town planning, as well as building design, construction and siting must be included in fire protection planning, to ensure that houses are not exposed to severe levels of bush fire attack, and to provide homeowners with the opportunity to implement minimum fire safety measures.

Stay or go – surviving a bushfire

News reports are filled with images of residents fleeing their homes as bush fires burn in the streets. Police and emergency services are seen driving down streets and ordering residents to evacuate. In some cases police officers use force to remove homeowners from the fire area, or to prevent them from returning to their houses. The situation is similar in many countries. In January 2002, the ABC reported that 7,000 residents were evacuated as a result of the Sussex Inlet Fire (NSW). In May 2000, the Associated Press reported that 11,000 people had been evacuated when fires roared into Los Alamos (New Mexico).

The number of deaths that were confirmed to have been caused by bush fires in Australia for the period from 1901 to 1994 is 471 (TFS, 1994). Little research has been undertaken to determine the circumstances that surrounded these deaths.

Krusel and Petris (1992) undertook a detailed study into civilian deaths during the 1983 Ash Wednesday bushfires, to assist with the development of strategies to minimise the future loss of life. The study found that bush fire victims could be placed into three categories:

Victims who recognise the real threat to their safety with enough time to save their lives, but chose ineffective strategies;
Victims who did not recognise the real threat to their safety in time to implement an effective survival strategy; and
Victims who were physically incapable of implementing an effective survival strategy.

In the Victorian Ash Wednesday fires of 1983, 47 people died. Only 7 of them died inside their homes, and all of them were over 50 years of age (Wilson, 1984). A number of victims who died inside their homes were incapacitated, and one victim had been instructed by police to turn off the water, which may have contributed to his death.

Many victims were trapped inside their cars when they attempted a late evacuation of the area. Some of them became disoriented in the smoke and drove off the road, where they were subsequently burned. A number of victims were also found with a high blood alcohol level which would have impeded their judgement.

Research into the Hobart fires of 1967 found that it is much safer to remain with a well prepared house

than it is to evacuate late. It was observed that the houses of about half the people who died when they tried to escape the fire, were not affected by the fires (Chambers, 1967). These houses would have provided more than adequate shelter to the occupants.

A Coronial Inquest into the death of three people, who died inside a house in the Dandenong Ranges fire in January 1999 (Coronial Services Centre), and a subsequent community risk management report (VRJ Risk Engineers, 1999) support the above. The Coroner found that the fire which destroyed the house probably came from early ember attack and developed to engulf [the house] after the fire front had passed. The victims took shelter in the garage of the house where they were not in a position to protect themselves and the house.

VRJ Risk Engineers found that even in the context of the above fatalities, there is a strong case for abandoning evacuation given the impracticalities of early evacuation, and the tendency to evacuate late. In the above case, the victims would not have had sufficient warning to leave the area safely. VRJ Risk Engineers believe there is little evidence to support any form of mass evacuation. Many other studies have also concluded that evacuation is a flawed strategy. The following levels of risk were assigned by VRJ Risk Engineers:

Strategy	Consequence	Level of risk
early evacuation	loss of life loss of homes	low extreme
late evacuation	loss of life loss of homes	extreme extreme
active defence	loss of life loss of homes	significant significant

Active defence has been identified as the most appropriate risk minimisation strategy. However, this strategy still carries a significant level of risk, which must be addressed by the fire and emergency services and the community. Active defence is only a viable option where residents are well prepared and well informed about bush fire safety, and have the capacity to actively defend, or protect their homes.

Arrangements must be in place at community level to ensure that residents who do not have the capacity to fend for themselves, or those whose houses can not be protected in a bush fire emergency, can seek shelter in adjoining homes, which are more suitable as a safe haven.

Homeowners must take responsibility for their own safety. In a major wildfire emergency, fire appliances may not be available to protect every home and warnings of a fire may not be available to allow for early evacuation. Fire intensities can be severe, even within a fire that has only burned through a small area, or a fire that burns through low bush fire fuels. Well prepared houses provide shelter to its occupants from radiant heat. In turn, occupants who remain with their homes may be able to extinguish spot fires, saving their homes.

Homeowners in the urban interface, or in rural areas who fail to prepare for bush fire long before a fire occurs will be exposed to significant risk. Late evacuation as a "last resort" will further increase the risk to an extreme level.

Fire and emergency services

Fire and emergency services can significantly reduce the threat of bush fires to homeowners. In most incidents fire services are able to suppress bush fires before they result in losses. However, on days of extreme fire danger fire intensities are often beyond the capacity of even well resourced fire services, and the traditional approach of fighting fires to protect the community is no longer adequate.

Most of the losses have occurred on days of severe fire danger, when fire services are unable to control a bush fire. In order to reduce the threat from wildfire to the community, fire and emergency services must expand their traditional response role and implement alternative risk management

strategies. Research into previous bush fire emergencies must form the basis of such work.

Over the last two decades fire and emergency services have introduced numerous programs to reduce the threat of bush fire to homeowners. Examples include community education and awareness programs such as Community Fire Guard (VIC) and Bush Fire Ready Action Groups (WA), the Bush Fire Blitz campaign (VIC), and the implementation of minimum performance criteria for building and subdivisions design (e.g. Australian Standard AS3959 Construction of buildings in bushfire-prone areas, Planning for Bush Fire Protection, 2001, NSW and WA). Where the implementation of fire mitigation measures has been successful, communities have a better capacity to protect themselves and their homes during a bush fire emergency.

However, the reality is somewhat different. During the Sydney fires of 2001/02 between 100-150 houses were lost, many of them were not even in a high or extreme bush fire hazard area. Furthermore, late evacuations were ordered and mass evacuations took place (ABC News reports Dec 2001 to Feb 2002). In many of these incidents the actions taken by the fire and emergency services contradict the messages provided by the services in community education and awareness campaigns, as well as the recommendations of Coronial Inquiries into previous major bush fire events, and the results from previous research.

Similarly, during the Mount Barker (WA) fire of December 2000, police and fire personnel ordered the evacuation of residents at a time when the fire burned through the town. People would have been quite safe in their homes, but were in many cases exposed to significant risks as they attempted to evacuate through roads which had intense fires burning alongside them.

Staff and patients in the Mount Barker hospital were also evacuated during the height of the fire, when the hospital filled with smoke from the bush fire. (It was later established that windows were left open and the ventilation system was still operating when smoke from the bush fire moved through the area.) Staff and patients were assembled outside the hospital where they waited, in smoke and showered by embers, for transport to another location. However, roads in and out of Mount Barker were affected by fire, which prevented the safe movement of patients to other hospitals. There was no significant threat from the bush fire as the hospital is located in an urban, low bush fire hazard area, and the building had a low risk of ember attack.

During this fire, roadblocks were established adjacent to heavy bush fire fuels, and in the path of the fire. Motorists were placed at extreme risk when the head fire impacted on the area (Braun, 2001).

In another incident in Glen Forrest (WA) in December 1999, an evacuation was ordered as the fire moved through the area. During a debrief it was reported that residents in shorts and T-shirts were leaving the area on foot, along roads where vegetation was on fire. A member of the local Community Fire Guard group, whose property was very well prepared for bush fire, was forcibly removed by police, and a quadriplegic was left inside a house with neither fire service personnel or a neighbour remaining with the property to extinguish spot fires.*

The above examples show that the threat to homeowners was significantly increased through the actions taken by fire and emergency services personnel. It is interesting to note that in Western Australia police are seeking to introduce legislation which allows them to forcibly remove people from their homes in the event of a bush fire. The Police Commissioner believes that police are in a better position to make a determination on whether residents should be allowed to remain in an area (The West Australian, 2002).

During the Cerro Grande Fire in New Mexico in 2000, a crew from local construction companies entered a neighbourhood that had been evacuated, on the outskirts of Los Alamos. The construction workers were able to extinguish spot fires on porches and around building, using garden hoses left behind by homeowners, as well as their own water carting trucks, as the fire burned into this suburb. Their actions saved all but one of the homes in this area (The Los Alamos Monitor Online, 18/03/2000). Had residents been allowed to stay behind, they may also have been able to save their homes.

There appears to be a significant gap between the actions fire and emergency services personnel take or the advice they provide, and the findings and recommendations from inquiries and research into

major bush fire emergencies. Fire and emergency services personnel may resist to accept these findings and recommendations, and may argue that their own practical experience is more valuable than the research (Murray, 1999).

To overcome this challenge, carefully researched information must be integrated into training programs for all fire and emergency services personnel, including senior officers and volunteer crews. This will ensure that these people will initiate appropriate actions during bush fire emergencies, and that they will provide good advice to homeowners, to reduce the risk of bush fires to the community.

Conclusion

Many myths and media hype surround the survival and loss of life and homes in bush fires. Extensive research has been undertaken since 1944, and the factors that contribute to the loss of life and houses in bush fires are well understood, today. However, it appears that homeowners, as well as fire and emergency services personnel, are often influenced by media reports and recommendations based on anecdotal evidence, rather than on factual information. As a result, effective mitigation strategies are not always applied, and homeowners are exposed to significant risks in a wildfire emergency.

The current strategies of fire suppression and hazard reduction burning appear to be effective during the majority of fires. However, significant losses have generally occurred on days of extreme fire danger, where fire suppression response and hazard reduction burning programs alone are insufficient to prevent losses. It is during these bush fire emergencies where it becomes paramount that homeowners take responsibility for their own safety and implement appropriate mitigation measures. Homeowners must be well informed about wildfire safety and must be prepared, well before an emergency occurs.

Research has shown that many people lost their lives or homes as a result of poorly informed decisions or inappropriate actions. In order to reduce the threat from bush fires, fire and emergency services must work with their communities to ensure that people and their houses have the capacity to withstand a severe bush fire, and that new subdivisions and homes are designed to comply with minimum fire safety measures. Furthermore, the services must provide training and awareness programs so that staff and volunteers, as well as homeowners, are well informed about bush fire safety and survival, and to ensure that their actions and decisions are based on well founded research rather than media hype and anecdotal evidence.

* Details on the Glen Forrest fire of December 1999 are based on unpublished information from an impact assessment the author undertook in 2000.

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Bushfire smoke and human health

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Abstract

Bushfire is known to be a significant source of smoke which is made up of particles and other air pollutants such as volatile organic compounds (VOCs). The relationship between particle concentrations and smoke and adverse human health outcomes has been well established in the scientific literature, with numerous countries reporting associations between particle concentrations and human health outcomes such as hospitalisations for respiratory diseases. Preliminary analysis of air quality and morbidity data for Perth show associations between particle concentrations and hospitalisations for respiratory diseases, cardiovascular diseases and asthma. The major source of air pollutants which may contribute to these associations in Perth are thought to be wood heater and motor vehicle emissions, however, questions have been raised as to the possible contribution of bushfire smoke to the results.

The relationship between specific bushfire smoke events and impacts on human health in the Australian context have not been clearly established, even though bushfire smoke, by virtue of its composition is likely to present a risk to human health via inhalation. Little data is available on the impact of smoke from planned burns or wildfire on human health in the Perth metropolitan area, and even less on the impact of smoke on rural populations. The low frequency and relatively short duration of such events combined with the difficulties in separating the impacts of other contributing pollutant sources, complicate any analysis. The public health risks associated with wildfires compared with prescribed burning also need to be assessed. These issues were identified during the development of the Perth Air Quality Management Plan (AQMP). The AQMP contains a number of actions which will address the specific issues outlined above.

Introduction

Bushfire is known to be a significant source of smoke which is made up of particles and other air pollutants such as volatile organic compounds (VOCs).

The relationship between bushfire smoke and impacts in the Australian context have not been clearly established. We do know that various components of bushfire smoke have been associated with adverse health effects. The non-lethal or non-injury related public health impacts of bushfire smoke have not been determined.

There are limitations with our ability to undertake hypothetical risk assessments as there is limited information on the composition of bushfire smoke, on actual exposures and health information and there are relatively few events with which to assess this information. To make matters more complex, actually obtaining the relevant information is difficult and costly. The issue is complicated by the broad range of burn scenarios, the complexity of vegetation, the variation in vegetation type and composition and the contribution of other factors like meteorology.

This paper attempts to outline these issues and the way forward to assessing the potential implications of bushfire smoke on the public in the Perth metropolitan area, the results of which may be able to be extrapolated to the rest of Western Australia.

Bushfire smoke: What are we concerned about in the smoke?

Bushfire smoke is comprised of gaseous and particulate components. Volatile organic compounds are emitted followed by other complex chemicals formed via reactions, heat and flames. Additional

transformations take place in the atmosphere. The resulting smoke is a complex chemical mixture (Beer and Meyer, 1999).

The components traditionally of concern with regard to bushfire smoke are particulates, carbon monoxide and oxides of nitrogen (Beer and Meyer, 1999; Environment Australia, 1999). More recently, VOCs, polycyclic aromatic hydrocarbons (PAHs) and dioxins have received more attention, although there is a scarcity of information.

The composition and concentration of the various components of bushfire smoke depend on many factors, the heat of the fire, what is being burnt, and meteorological conditions to mention a few parameters (Beer and Meyer, 1999).

Air quality data on pollutant levels in Perth

The Department of Environmental Protection (DEP) currently has a network of 10 ambient air quality monitoring stations which monitor air pollutants such as ozone (O_3), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), carbon monoxide (CO), particles with a diameter of up to 10µm (PM_{10}), particles with a diameter of up to 2.5µm ($PM_{2.5}$) and visibility reducing particles in the Perth metropolitan area. Figure 1 shows the locations of these sites.

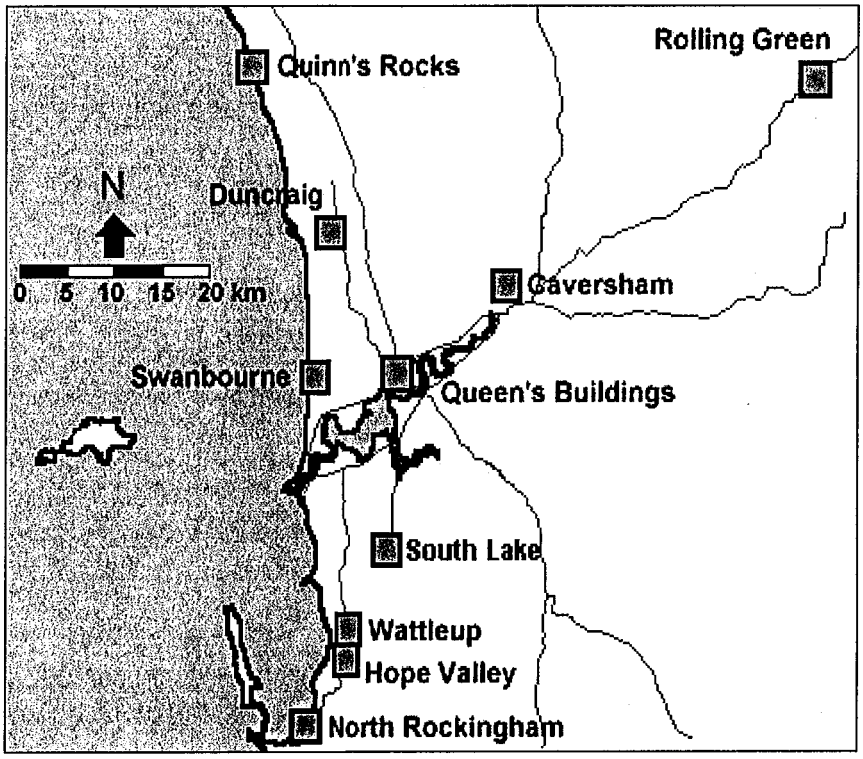

Figure 1 – A map showing the Perth air quality monitoring network.

In addition to the DEP network, the Kwinana Industries Council (KIC) maintains three air monitoring sites that measure SO_2 and/or PM_{10}. Weather conditions such as local wind speed and direction, relative humidity and temperature are also recorded at the DEP and KIC air monitoring sites. Of the 10 metropolitan sites operated by the DEP, seven monitor visibility, five monitor PM_{10} and two monitor $PM_{2.5}$. A list of stations and parameters measured is shown in Table 1.

Table 1 – Ambient air quality parameters measured at DEP monitoring stations in Perth

SITE	Parameter Measured								
	CO	NO_x	O_3	Lead	PM2.5	PM10	SO_2	TSP	Visibility
Abercrombie Road*							ι		
Caversham	ι	ι	ι		ι	ι			ι
Duncraig	ι	ι			ι	ι			ι
Fanstone Avenue*						ι	ι		
Hope Valley		ι					ι		ι
Miguel Road*							ι		
Queens Buildings	ι	ι		ι		ι		ι	ι
Quinns Rocks		ι	ι						ι
Rockingham		ι	ι				ι		
Rolling Green		ι	ι						
South Lake	ι	ι	ι			ι	ι		ι
Swanbourne		ι	ι			ι			ι
Wattleup							ι		

* KIC monitoring stations

Between January 1995 and December 2001, Perth experienced 519 site-days where there was at least one hour where visibility was less than 20 kilometres. Site-days are calculated by summing the number of days each site exceeded the visibility standard for at least one clock hour. Of these 519 site-days, 304 exceedence days were recorded at only one site, 39 exceedence days were recorded at two metropolitan sites, 16 exceedence days were recorded at three metropolitan sites, 11 exceedence days were recorded at four metropolitan sites and nine exceedence days were recorded at five metropolitan sites. Over the seven-month period October to April spanning the period January 1995 to December 2001 there were 158 site-days where there was at least one hour where visibility was less than 20 kilometres. Of these 158 site-days, 55 exceedence days were recorded at only one site, 13 exceedence days were recorded at two metropolitan sites, three exceedence days were recorded at three metropolitan sites, seven exceedence days were recorded at four metropolitan sites and eight exceedence days were recorded at five metropolitan sites. These exceedences are shown in Figure 2 where n is the number of days when there was an exceedence regardless of how many sites at which that exceedence occurred. The period October to April was chosen as the most likely period where the cause of poor visibility will be due to the prescribed burning of natural vegetation or from wildfires and not from domestic wood heating.

The relationship between components of bushfire smoke and human health

The most common health concerns with bushfire smoke are from the resultant particles. The relationship between particles and human health outcomes is well established. Increases in particle concentrations have been associated with increases in hospitalisations for respiratory diseases, including asthma and cardiovascular diseases(Voigt et al, 1998; Pope et al, 1991). Significant results have been observed for the elderly and the young (Schwartz, 1994; Ransom and Pope, 1992). Increased mortality has also been observed, increased emergency department attendance and changes in lung function (Morgan et al, 1998; Wordley et al, 1997). Most of the work on the health effects have been done using time series analysis which considers the daily change in particulate levels with daily hospitalisations or daily mortality. These studies use population level data from large urban centres usually impacted by motor vehicle smoke and wood heater smoke in winter.

In relation to the other compounds of interest, carbon monoxide has also been associated with hospitalisations and mortality but again the studies focus on urban centres. Carbon monoxide is a well known pollutant with well established health impacts from both toxicological and epidemiological studies.

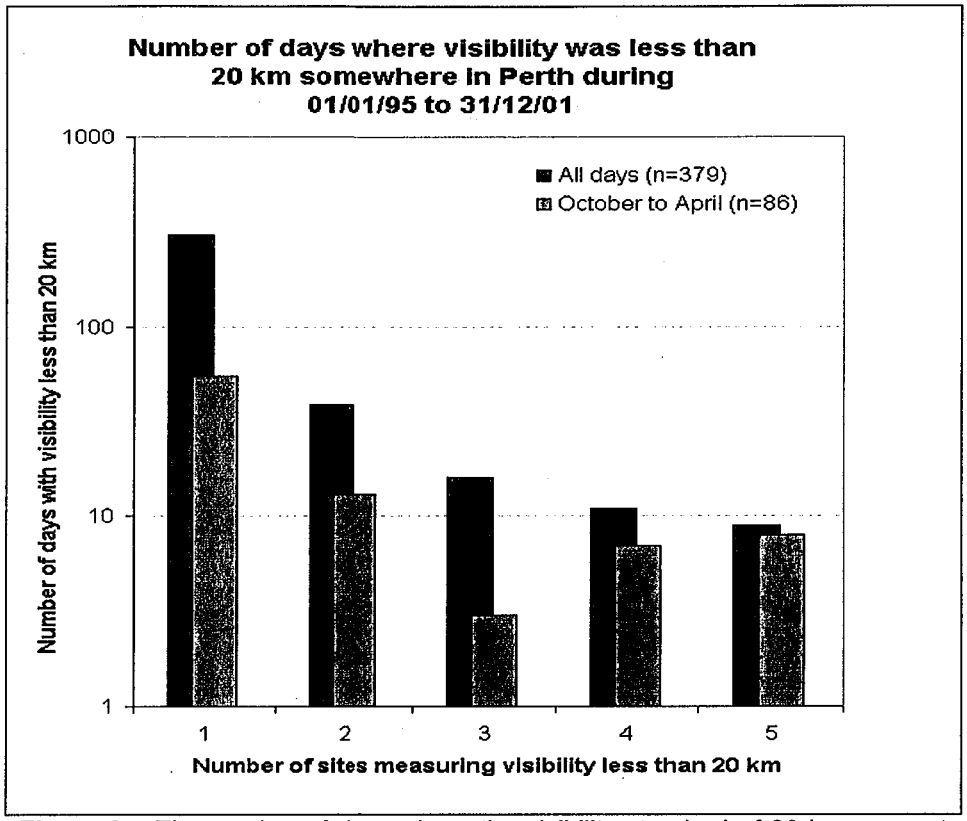

Figure 2 – The number of days where the visibility standard of 20 km was not met within the Perth region. (See text for explanation) – Note the graph is log-normal.

VOCs and PAHs have a range of impacts including long term impacts as determined by studies in the occupational setting. Information on these compounds and health impacts in the community setting, given the broad range of sources contributing these compounds to the airshed, needs further elucidation.

In Perth, a preliminary study of daily air pollution levels and hospitalisations and mortality for respiratory and cardiovascular diseases has commenced (DEP, 2000). The study is a case cross-over study of daily air pollution levels and daily mortality and hospitalisation between 1992 and 1997. The preliminary results show an increase in particle concentrations increases the risk of hospitalisations for asthma, cardiovascular disease, pneumonia and chronic obstructive pulmonary disease.

Long term impacts of air pollutants have been observed, notably lung cancer and cardiopulmonary mortality following exposure to fine particulate air pollution (Pope et al, 2002).

Bushfire smoke and health impacts

Most of the information on health impacts from bushfires is anecdotal. The most informative work reported on this issue in Australia, is in NSW where hospitalisations from the NSW 1994 fires were documented (Corbett, 1996). In the 1993/1994 fires, Sydney was ringed by fires with more than 25,000 people evacuated, 205 homes destroyed and 5 people lost their lives (Corbett, 1996). The bushfires resulted in eight consecutive days where particulate levels remained elevated, nitrogen dioxide levels were elevated initially and a small ozone event occurred at the end of the eight day period. Hospital attendance and admission records were examined for three large suburban hospitals for asthma. Other health outcomes were not examined.

The researchers did not find any significant increase in attendance at hospital for asthma, contrary to the results of studies investigating particle levels and hospitalisations. There are a number of possible reasons for this. One is the time period for investigating these data was too short, i.e. there was

insufficient power in the study to detect a significant increase in hospitalisation if one existed. Other reasons or rationale may include the composition of the smoke and the size range of the resultant particles. Further, people may have taken preventive measures and sought advice from their local doctor for example, rather than presenting to hospital.

What are we doing in Perth - The Perth AQMP

The Perth Air Quality Management Plan (AQMP) released in December 2000 was developed to ensure that clean air is achieved and maintained throughout the Perth metropolitan region over the next 30 years (DEP, 2000). The actions within the AQMP seek to achieve this by reducing the emission of those air pollutants that are causing occasional episodes of unacceptable air quality now, and by preventing the development of future air quality problems. The aim of the AQMP is to steadily improve Perth's air quality so that we have cleaner air to a level that is acceptable to the community.

The AQMP outlines 126 actions which target a range of areas including health research, bushfire emissions as well as the more traditional areas of motor vehicle emissions, land use transport and planning and monitoring.

The actions seek to address emissions from major sources and consider issues such as land use and transport planning that can influence emission levels. Actions also address research requirements, monitoring of air quality , assessment of health effects and community education.

While the AQMP details what actions are to occur, an Implementation Strategy has been developed to address how the actions will be implemented. The Implementation Strategy has been developed using a consultative process with the involvement of key stakeholders.

Health research
There are now numerous studies which have demonstrated a significant relationship between air pollutants and population level health outcomes. The emerging areas of research are the impacts of air pollutants on children and the long term health impacts of exposure to air pollutants. Aspects relating to the application of standards for the protection of public health also require further attention.

The AQMP initiatives support the investigation of public health impacts of air pollution, sources of air pollutants and their impacts on residents through the development of the Air Pollution and Health Network and associated research programs.

Program 1 of the Draft AQMP Implementation Strategy outlines research to investigate the relationship between daily air pollutant levels and mortality and hospitalisations for various disease categories between 1992 and 1997,the preliminary results of which have been outlined above.

Program 2 of the Draft AQMP Implementation Strategy aims to investigate the sources of air pollutants and their impact on residents by determining the potential health impacts of variations in Perth's daily air quality and Program 3 is the development of an Air Pollution and Health Network.

Smoke management

Planned burns are undertaken by various authorities and landholders to achieve land management objectives including reducing flammable vegetation and the associated risk of wildfire to people and property. A number of actions in the AQMP have been incorporated into Programs to address emissions from these activities. Program 4 of the Draft AQMP Implementation Strategy is specifically aimed at smoke management research. In particular it aims to examine smoke and weather modelling as an input to the burn decision process, and identify significant sources of smoke from outside the Perth metropolitan region and the comparative risk to safety and property from smoke and wildfire.

Smoke events can sometimes occur in the Perth region due to large and planned burns in the southwest of the State. Improved modelling capabilities to predict the impacts of such burns would improve the burn decision model currently in use.

This program will continue with studies of weather and smoke modelling as an input to the burn decision process and will quantify significant sources of smoke from outside the Perth metropolitan region. This program also incorporates assessment of the community health impacts of smoke from prescribed burning and wildfires and aims to undertake a comparative risk assessment of mortality and morbidity influenced by smoke from prescribed burning and wildfire. The objective of the program is to investigate comparative risk of health outcomes such as respiratory symptoms with risks to safety and property from smoke and wildfire.

These actions will be co-ordinated by DEP, CALM and BoM, with smoke plume modelling research currently being undertaken by the Australasian Fire Authorities Council.

Quantifying significant emission sources is on-going and is linked to future updates of the Perth Air Emissions Inventory (see DEP, 2002). Accordingly implementation of this action will occur before or as part of future inventory updates.

Concluding remarks

The relationship between specific bushfire smoke events and impacts on human health in the Australian context have not been clearly established, even though bushfire smoke, by virtue of its composition is likely to present a risk to human health via inhalation. Little data is available on the impact of smoke from planned burns or wildfire on human health in the Perth metropolitan area, and even less on the impact of smoke on rural populations. The low frequency and relatively short duration of such events combined with the difficulties in separating the impacts of other contributing pollutant sources, complicate any analysis. The public health risks associated with wildfires compared with prescribed burning also need to be assessed. These issues were identified during the development of the AQMP and will be addressed with the implementation of the AQMP.

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Global warming and bushfires

Ian Noble and Richard McKellar

Abstract (No copy of the full paper was provided by the authors)

Climate change is expected to lead to warmer, possibly drier and probably a more variable climate. Under these conditions fire regimes are expected to change, but the precise changes at particular localities are difficult to predict because the impacts of climate change depend on the delicate balance between increased precipitation and increased evaporative demand and on the way that fuel loads respond to the changing climate and fire regimes. However, fire authorities and land managers will need to be prepared for more frequent extreme fire danger conditions. Changing fire regimes will be yet another pressure on flora and fauna already threatened by intensification of human activity and climate change.

Fires are a major source of greenhouse gases to the atmosphere. Currently, the net contribution of fires and its variability on a year-by-year basis is largely ignored in accounting for greenhouse gas emissions. Accounting fully for fires will require not only monitoring emissions of CO_2 and non-CO_2 greenhouse gases during the fire, but also charcoal formation and fire stimulated regrowth. If accounting and compliance rules that require closer tracking were to be adopted they would add significant costs in measurement and additional, problematic factors for land managers to take into account.

Fire, prescribed burning and the conquest of nature

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In recent years there has been a vigorous campaign to increase the amount of pre-emptive ('prescribed', 'controlled', 'hazard reduction', 'fuel reduction') burning in WA. Recently this gained added impetus as a result of the emotive reporting of the NSW fires and some resentment of the WA government's decision to protect old growth forests from logging. However, rather than more burning, what WA really needs is a sophisticated fire management and protection policy which is effective and does the least harm.

Recent pre-emptive burning extent in south west WA

1992-93: 120,000 ha
1995-96: 200,000 ha
1997-98: 125,000 ha
2000-01: 80,000 ha [CALM Annual Reports]

"The greenies are stopping CALM burning."
According to the 2000-2001 CALM Annual Report, less prescribed burning was done last year because of: continuing reductions in burn size; the increasing complexity of burns; the need to protect increasing areas of fire sensitive forest regeneration; efforts to minimise smoke haze over Perth; and the risk of severe fire behaviour and possible escapes.

The pre-emptive burn 'target'
CALM still maintains an annual 'target' of 250,000 ha of pre-emptive burning in the South West. Not only is this target ecologically, financially and operationally unsustainable; the attempt to reach it involves considerable risk and damage while the consistent 'failure' to reach the target is then used by the proponents of more burning to claim that the community is in danger of "another Dwellingup". This is a no-win situation for the whole community.

Fire and science (1)
"Frequent fires can reduce the native fauna species diversity of an area and the habitat availability...There is increasing evidence in the [scientific] literature, and via personal communications from experts in their fields, that frequent fires have a disastrous effect on many species of flora and fauna and their habitat structure." [Kings Park Bushland Management Plan, 1995-2005]

"Species of fungi that require the conditions associated with a litter layer will not be favoured by a fire regime where the litter layer is frequently removed by burning." [EPA, 1992]

"What fire control and land management authorities describe as 'fuel' and a 'hazard', I prefer to think of as the food and the energy that keeps our ecosystems functioning." [Professor Harry Recher, Edith Cowan University]

This is just a small sample of the scientific research and expert opinion that contradict claims that frequent burning is harmless and effective (see over for more). Numerous peer-reviewed and published scientific papers setting out the risks and impacts of frequent repetitive burning are available from the WA Forest Alliance/Conservation Council office.

What scientific research indicates again and again is that many components of our natural environment are in fact fire sensitive, and not, as the proponents of more burning claim, uniformly adapted to frequent repetitive burning. If WA's environment was as fire-prone, as fire-adapted, and as frequently burnt as the proponents of more burning claim, there would no longer be any fire-sensitive species or ecological communities left: they would have been burnt into oblivion thousands of years

ago, and south west WA would be one vast, biologically simplified and homogenized environment. Attempts have also been made to construct a version of Aboriginal fire management in south west WA that justifies frequent repetitive burning. The proponents of more burning now claim that the Noongar people of south west WA burnt the entire jarrah forest (about four million hectares pre-European extent) every four years, which means a million hectares of burning per year. The only way such a massive annual burning program could have been achieved is by vast uncontrolled wildfires that would have destroyed wildlife, habitat, and everything else the Noongar people needed and valued.

The D'Entrecasteaux National Park fire
The 2002 wildfire in D'Entrecasteaux National Park has been used to target conservationists and promote more burning. In fact, as is so often the case, this fire could have been suppressed before it became a wildfire if appropriate resources had been used when the fire was first detected. A series of recent fires in conservation reserves seems to indicate a policy of allowing small fires to turn into wildfires, which are then used to justify more pre-emptive burning.

The Dwellingup wildfire – example of what?
The reason the infamous Dwellingup wildfire was so severe was not the lack of pre-emptive burning. The 1961 Royal Commission report says: "Statements that the Forests Department does not carry out controlled burning in the Dwellingup forests are entirely without justification. The Department has control burnt extensive areas each year for the last 40 years and more than ever at the present day." Rather, logging operations, which had opened up the forest canopy and created vast amounts of logging debris, were a major cause.

The NSW wildfires
Responding to the chorus of calls for more and bigger prescribed burns in NSW, Rural Fire Service Chief Commissioner Phil Koperberg warned:

"The previous practice of broad acre burns runs the risk of permanently changing the balance among the plants and animals which make our landscape unique and attract millions of tourists each year.... The prospect of regular, comprehensive prescribed burning to convert the entire 5.4 million hectares of national parks into a garden landscape is, however, out of the question...Strategic fuel reduction, not widespread burning, is central to protect lives and property." [Sydney Morning Herald, 7 January 2002; full article available from WAFA]

Fire and the greenhouse effect
"On the other side of the issue, fire has short-term potential feedback effect into the greenhouse effect. N. Burrows (pers comm.) has calculated that the present fuel reduction burning program throughout State forests produces annually about 46,000 tonnes of particulate matter and 4.14 million tonnes of CO_2."

> [Blyth, J., A.J. M. Hopkins, F.J. Bradshaw, "The greenhouse effect and Western Australian forests." CALM, unpublished, 1991.]

Not only does pre-emptive burning contribute to WA's massive annual greenhouse emissions, but the already apparent climate change occurring in the South West (e.g. the 20% decline in rainfall over the past 25 years) has significant implications for fire management, e.g. the ability of ecosystems to cope with burning. It is increasingly apparent that fire can no longer be considered in isolation. The cumulative impacts of, and interactions between, climate change, fire, pests and diseases (and a range of other factors) can no longer be ignored.

Facts about pre-emptive burning
There are five facts that must be explicitly taken into account in the formulation of fire policy:

- frequent burning does have harmful ecological impacts;
- doing less pre-emptive burning but targeting it more carefully will produce better results than increased broadscale burning;
- pre-emptive burning is of limited effectiveness under severe conditions, while other strategies may be more effective;
- CALM's risk assessment and fuel accumulation methodologies are crude and outdated;
- frequent burning can make us more vulnerable to fire, not less, by promoting fire-prone species

and conditions.

Fire policy is evolving
Traditionally, land and resource 'management' has meant high-impact intervention and heavy-handed manipulation of natural systems. This outdated approach is gradually being replaced by a new understanding of the values and sensitivities of natural systems. In the area of fire management there are moves to modify and modernise approaches to fire and pre-emptive burning by reducing and varying the size, intensity and frequency of burns and varying their season.

The government has promised a major public review of fire and fire management, to be conducted by the EPA in 2002.

A rational approach
Pre-emptive burning at the scale and frequency proposed by the proponents of more burning will impoverish our natural environment and leave our community just as, or even more, vulnerable to fire.

The rational response to fire risk is more investment in a sophisticated, multi-faceted approach to fire management and protection, which includes limited and carefully targeted pre-emptive burning, but does not rely upon it. We need four things:

- More focus on preventing fires, including arson. There is a risk that constant talk of the need for more burning, and of how much our environment likes fire, will encourage arson;
- More investment in our capacity to detect fires soon after they start, and our capacity to put fires out before they become wildfires. This means better aerial fire fighting capacity and also ground-based rapid response teams;
- More care in where we allow settlements to occur, discouraging building in areas at risk from wildfires. If people choose to live in such places they must accept the risk of wildfire;
- More focus on improved strategic firebreaks and buffers around vulnerable communities and assets, as opposed to frequent broadscale burning of remote bushland.

Fire and science (2)
"Detrimental fire regimes contributed to the extinction of two of the three bird species, and three of the four sub-species [including two WA sub-species: Rufous Bristlebird and Lewin's Rail] which have disappeared from Australia since European colonisation. Inappropriate fire management is now a factor in the threatened status of at least 51 nationally recognised threatened bird taxa.... Of the threatened [bird] species whose relationships with fire regime has been comparatively well documented, almost all show clear preference for much less frequent fire than that currently prevailing. The long-unburnt vegetation favoured by these species is becoming disappearingly rare, and will require concerted management effort to maintain or increase. Most fire-sensitive threatened birds have low reproductive output and limited dispersal ability. The persistence of these species is further jeopardized by habitat fragmentation, which accentuates the handicap of these traits for recolonisation following fire....[In temperate eucalypt forests] the most detailed long-term study suggests that frequent mild fires will lead to the decline and loss of some species which are now perceived as common and little affected by mild fires."

"Too frequent burning has endangered species such as Noisy Scrub-bird, Western Bristlebird, Malleefowl and Ground Parrot. The old growth (or mid to late seral) vegetation that these species require, or are most abundant in, is now becoming disappearingly rare.... The endangerment of so many species reliant on relatively old vegetation is a clear indication that land managers are generally burning far more extensively or frequently than prior to European settlement, or that fires now are generally more destructive. The very low fire frequency, or fire exclusion, required by many of these species (e.g. preferred intervals of at least 20 years for most threatened heathland birds, or at least 60 years for Malleefowl) will pose serious management problems...."

Woinarski J.C.Z., Fire and Australian Birds: A Review, in Australia's Biodiversity – Responses to Fire; Environment Australia Technical Paper No. 1, 1999, pp. 57, 83

"This research indicated that frequent burning resulted in a simplification of large-scale spatial patterning in the litter (fine -fuel) environment. The components (leaves, twigs, bark etc) that give the

leaf litter its physical structure changed with regard to their relative abundance and spatial distribution.... Top-soil moisture levels were, on average, 18% lower following 20 years of frequent burning.... These shifts in [invertebrate] community composition were substantial and suggested that the extensive and frequent application of fuel-reduction burning could result in a reduction in terrestrial invertebrate biodiversity at a regional scale, with this decrease potentially as high as 50%.... [T]here remains a need to establish secure refuges for species with specialist requirements and limited dispersal abilities, and provide links (i.e. corridors) between habitat patches to facilitate recolonisation.... Realistically, the conservation of biodiversity cannot be achieved without consideration of the important role that invertebrates play.... [S]ubstantial measured changes in the structure of invertebrate assemblages and the loss of species associated with the decomposer cycle implies frequent burning may be impacting upon nutrient cycling and transfer within these forests. If this is the case, it would have serious implications with regard to the maintenance of ecological sustainability."

York, A., Long-term effects of repeated prescribed burning on forest invertebrates: management implications for the conservation of biodiversity, in Australia's Biodiversity – Responses to Fire; Environment Australia Technical Paper No. 1, 1999, pp. 183-4

"Historically, many plant species have become locally extinct due to too-frequent fires. Typically, these species have fire-sensitive adults and rely on seed for their re-establishment after fire ("obligate seeder species"). Fire-sensitive species may become rare and become confined to "fire shadows" in the landscape.... Fires are easy to ignite and can spread widely. They can be a cheap management tool and a costly reality.... Examples of fire-induced local extinctions of native plants in Australia span the continent.... Leigh and Briggs (1992) list 19 species as being threatened with extinction at state or federal level due to the inappropriateness of current fire regimes."

Gill A.M. and Bradstock R., Extinction of biota by fires, in Conserving biodiversity: threats and solutions, Surrey Beatty & Sons, 1995, pp. 309-311.

The role of fire in forest management in Western Australia

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Fire has been a natural feature of Western Australian forests for many thousands of years. In fact, the bushfire hazard in the south-west of the state is one of the most severe in the world. The combination of a hot, dry Mediterranean climate and extensive, tall forests which shed large quantities of highly flammable material each year and sources of ignition such as lightning or humans, ensure that summer wildfires occur regularly. These forest fires can be intense and fast spreading, and can pose a serious threat to lives, properties, forest values and other community assets.

The coming of European settlers to Western Australia wrought great changes in fire regimes and led to the abandonment of the aboriginal burning patterns, which had developed over thousands of years. The early era of uncontrolled land clearing and timber harvesting up until the end of the First World War was characterized by destructive wildfires, which ravaged previously cutover forest and damaged young regrowth.

The terrible wildfires in the summer of 1961 ushered in a new era of forest fire management in the southwest. Foresters embarked upon a major program of rotational fuel reduction burning aimed at preventing forest fuels from accumulating to hazardous levels. Over the years techniques have been adapted to meet the requirements of changing land use objectives, in particular the desire to manage habitats and ecosystems for conservation objectives.

The IFA believe that the use of prescribed burning now has an essential place in contemporary forest management in Western Australia.

In addition to prescribed burning for fuel reduction, fire is used to remove debris after timber harvesting operations, to prepare receptive seed beds for new growth, to stimulate the germination of plant species and to provide specific habitats for certain animals.

Fuel reduction burning

The purpose of fuel reduction burning is to reduce the amount of fuel on the forest floor to levels where a summer bushfire will be slowed or stopped. Fuel reduction burning has to be applied to a substantial area of forest before it has a significant impact on slowing the spread and intensity of a wildfire. High value areas, such as forest settlements and townships need extra protection and burns around these areas are smaller.

Strategically located buffer zones provide the basis for effective control of large and intense wildfires in the SouthWest forests. This strategic approach means that less than 8 percent of the South-West forest areas are burnt by prescribed fires each year, and burn rotations vary from 6 to 15 years.
As a result of the fuel reduction burning program, Western Australia has had a good record in forest fire control. Since 1961 there have been no major property losses, few large fires, few injuries or deaths and many significant "saves" even under extreme conditions since that time. There have been many cases where prescribed burning played a crucial role in preventing wildfires from burning out rural communities (e.g., Manjimup 1978, Walpole 1987, and Augusta 1992) and large areas of native forest and plantation. By comparison, forest areas in the Eastern States where fuel reduction burning has not been as intense have all suffered major fires, eg Ash Wednesday (1983) and fires around Sydney in 1994 and 2002.

Regeneration after timber harvesting

Leaves, branches and unsaleable wood left behind after harvesting operations represent a barrier to young regrowth, and if left unburnt will pose an ongoing hazard for many years to come. Post-harvest burning provides an economical method of disposing of this debris and is preferable on environmental grounds to intensive mechanical site preparation, which may damage soil structure and inhibit regeneration of native understorey shrubs.

Post-harvest burning is also used to prepare receptive seedbeds necessary for the establishment of eucalypt seedlings, either by seedfall from retained seed trees or by planting seedlings raised in a nursery. Karri regeneration burns are typically of high intensity and are conducted under dry conditions in late summer and early autumn. Areas of jarrah forest that have been cut to establish a shelterwood are also burnt but at moderate intensity in late spring and autumn to encourage the establishment of seedlings.

Habitat management

The native plants and animals of the forest have evolved with fire, and are well adapted to surviving or regenerating even the most intense fires. Research has shown that the plant and animal species of the forest survive, or recover rapidly, sometimes within weeks. Some individuals may die, but they are replaced, either from seeds or rootstock, in the case of plants, or by young animals moving in from unburnt patches or surrounding forest.

Fire can be used deliberately to regenerate specific habitat. For example, some species of plants only germinate after a hot fire in summer or autumn. Alternatively, a fire regime can be designed specifically to protect some species. Burning early in spring ensures moist gullies remain unburnt and reduces the risk of them being burnt in a summer wildfire. Plant species diversity in the northern jarrah forest reaches a peak at about five years after fire.

Planning constraints

Prescribed burning operations are undertaken within a strict framework of legal, administrative and environmental constraints. Threatened fauna and flora must be considered and burn prescriptions are modified if there is a risk of permanent damage to wildlife communities. Fire is minimised around granite outcrops, peat swamps and other sites likely to contain fire sensitive species. Burning is also limited to only one side of main public roads to minimise the temporary aesthetic impacts.
Current situation – a potential disaster?

Since the mid-1980s there has been a steady decline in the area prescribed burnt in Western Australian forests each year. This has occurred for two main reasons:

(i) a lack of funds has meant that burning is being done more strategically, directed at protecting the highest value assets in the forest; and
(ii) because of imposition of restrictions on burning, most notably restrictions on smoke from burns entering the metropolitan area.

These restrictions severely limit the number of days in which burning can occur for forests within 150 kms of Perth.

Prescribed burning in the forest is also opposed by some environmentalists, in the belief that biodiversity suffers in its wake.

Less burning equates to more fuel in the forest and the IFA is concerned about the levels of fuel build-up. Members of the IFA fear that it will result in a substantial bushfire in south-west forests in the next few years, with possible loss of life and certain serious impacts on the forest, plants and animals and human assets in the region.