SYMPOSIUM

Fire In South-Western Australian Ecosystems: Impacts and Management

16, 17 AND 18 APRIL 2002

THE WA TURF CLUB FUNCTION CENTRE,
70 GRANDSTAND RD, ASCOT WA

Program and Abstracts

Government of Western Australia

DEPARTMENT OF Conservation AND LAND MANAGEMENT
Conserving the nature of WA

Scope

The south-west of WA is recognized internationally as a hotspot of biodiversity and one of the most fire prone regions in the world. This symposium will collate and disseminate current knowledge of fire ecology and provide a forum for presenting a range of views on fire management. The symposium will be informative to anyone interested in fire ecology and fire management. Authors of technical papers are recognised experts in their particular field and include local, interstate and overseas scientists. An international science publisher will publish the peer-reviewed technical papers as a book. The Department of Conservation & Land Management will publish other papers in a separate unrefereed volume.

Program

DAY ONE – Tuesday 16th April 2002

Registration: 8.00 am

Chair: **Dr Neil Burrows**

Time: 8.50 am
Welcome and Introduction, **Hon Dr Judy Edwards MLA**, Minister for the Environment and Heritage, Government of Western Australia

Time: 9.00 am
Title: An evolutionary and hotspot perspective on south-west Australian landscapes, biodiversity and fire
Presenter: **Dr Stephen Hopper**, Botanical Gardens and Parks Authority

Time: 9.35 am
Title: Current theories about disturbance and species diversity
Presenter: **Dr Michael Huston**, Oak Ridge National Laboratory, USA

Morning Tea: 10.10 to 10.40 am

Time: 10.40 am
Title: The fire history of south- west Australia to 1830
Presenter: **Professor John Dodson**, University of Western Australia

Time: 11.15 am
Title: Fire environment of the Mediterranean south-west of Western Australia
Presenter: **Dr Lachlan McCaw**, Department of Conservation & Land Management

Time: 11.50 am
Title: Australian landscape burning: a continental and evolutionary perspective
Presenter: **Dr David Bowman,** Northern Territory University

Lunch — 12.25 to 1.25 pm

Chair: **Dr Libby Mattiske**

Time: 1.25 pm
Title: Aboriginal fire regimes in south-west Western Australia: evidence from historical documents
Presenter: **Dr Ian Abbott**, Department of Conservation & Land Management

Time: 2.00 pm
Title: Believing the balga: a new method for gauging the fire history of vegetation using grasstrees

Presenter: **Professor Byron Lamont**, Jennifer Eldridge, Dylan Korczynskyj, Wendy I. Colangelo, Carrie Fordham, Emily Clements and Roy Wittkuhn, Curtin University, Western Australia

Time: 2.35 pm
Title: Development of a scientific understanding of fire behaviour and use in the south-west of Western Australia
Authors: **Phil Cheney,** CSIRO, ACT, Dr Lachlan McCaw, and Rick Sneeuwjagt**,** Department of Conservation & Land Management

Afternoon Tea: 3.10 to 3.40 pm

Time: 3.40 pm
Title: Fire and nutrients in south-west forests
Authors: **Professor Mark Adams** and Dr Pauline Grierson University of Western Australia, and Chantal Burrows, Geraldton

Time: 4.15 pm
Title: Smoke and heat as drivers of recruitment of Western Australian plants
Authors: **Dr Kingsley Dixon,** Botanical Gardens and Parks Authority

DAY TWO – Wednesday 17th April 2002

Registration: 8.30 am

Chair: **Dr Kevin Tolhurst**

Time: 9.00 am
Title: Fire in the shrub-dominated vegetation types of South Western Australia
Authors: **Angas Hopkins** and Dr Lachlan McCaw Department of Conservation & Land Management

Time: 9.35 am
Title: Fire and plants in south-west forests: a review of knowledge
Author**:** **Dr Neil Burrows**, Department of Conservation & Land Management and Dr Grant Wardell**-**Johnson, University of Queensland, QLD

Morning Tea: 10.10 to 10.40 am

Time: 10.40 am
Title: The response of fungi to fire in jarrah (*Eucalyptus marginata*) and karri (*Eucalyptus diversicolor*) forests of South-Western Australia
Authors: **Dr Richard Robinson,** Department of Conservation & Land Management and Dr Neale Bougher**,** CSIRO Western Australia

Time: 11.15 am
Title: Fire and invertebrates in south-west Australia
Authors: **Paul Van Heurck and** Dr Ian Abbott**,** Department of Conservation & Land Management

Time: 11.50 am
Title: The impact of fire upon frogs and reptiles in South-Western Australia
Authors: Dr Mike Bamford**,** Consultant and **Dr Dale Roberts,** University of Western Australia

Lunch: 12.25 to 1.25 pm

Chair: **Dr David Bowman**

Time: 1.25 pm
Title: Fire and birds
Authors: **Dr Allan Burbidge**, Department of Conservation & Land Management

Time: 2.00 pm
Title: Relationships between mammals and fire in South-Western Australian ecosystems: what we know and what we need to know
Authors: **Dr Gordon Friend**, Dept of Natural Resources & Environment, Victoria and Adrian Wayne, Department of Conservation & Land Management

Time: 2.35 pm
Title: Fire and organic substrates: soil structure, water quality and biodiversity
Authors: **Associate Professor Pierre Horwitz,** Bea Sommer and Simon Judd**,** Edith Cowan University

Afternoon Tea: 3.10 to 3.40 pm

Time: 3.40 pm
Title: Fire as a determinant of rarity in the South-Western Australian global biodiversity hotspot
Presenter: **Dr Colin Yates,** Dr Ian Abbott and Dr David Coates, Department of Conservation & Land Management, Dr Stephen Hopper, Botanic Gardens and Parks Authority

Time: 4.15 pm
Title: How fire regimes might interact with other forms of ecosystem disturbance and modification.
Presenter: **Professor Richard Hobbs**, Murdoch University

DAY THREE – Thursday 18th April 2002

Registration: 8.00 am

Chair: **Richard McKellar**

Time: 8.30 am - Introduction
Presenter: **Sam Williams** – Noongar Elder

Time: 8.45 am
Title: Aboriginal usage of fire—an indigenous perspective
Presenter: **Glen Kelly**, WA Aboriginal Native Title Working Group

Time: 9.15 am
Title: Australia's burning bush
Presenter: **Professor Stephen Pyne**, Arizona State University, USA

Time: 9.45 am
Title: Fire and human societies
Presenter: **Dr David Horton**, Consultant

Morning Tea: 10.15 to 10.45 am

Time: 10.45 am
Title: Fire and the law
Presenter: **Sandy Boulter,** Environmental Defender's Office

Time: 11.15 am
Title: Fire and risk management
Presenter: **Dr Ray Steedman**, Marine and Environmental Consultant

Lunch: 11.45 to 12.45 pm

Chair: **Dr Stephen Hopper**

Time: 12.45 pm
Title: Regional planning and bushfires
Presenter**:** **Mick McCarthy,** Shire of Mundaring

Time: 1.15 pm
Title: Approaches to community safety and bushfires in south-Western Australia
Presenter: **Drew Haswell**, Department of Conservation & Land Management, and Naomi Brown, Fire & Emergency Services Authority

Time: 1.45 pm
Title: Bushfire threat and community perception
Presenter: **Dr Peta Odgers**, Fire & Emergency Services Authority

Time: 2.15 pm
Title: Bushfire threat to home owners
Presenter: **Klaus Braun**, Consultant

Afternoon Tea: 2.45 to 3.15 pm

Time: 3.15 pm
Title: Bushfire smoke and human health
Presenter: **Dr Andrea Hinwood** , Department of Environment, Water and Catchment Protection

Time: 3.45 pm
Title: Global warming and bushfires
Presenter: **Professor Ian Noble,** Carbon Accounting CRC, and Richard McKellar, Department of Conservation & Land Management

4.15 –5.35 pm OPEN FORUM : FIRE IN THE 21ST CENTURY

Chair: **Dr John Bailey**

Perspectives on Fire Management

Time: 4.15 pm
Title: Fire, prescribed burning and the conquest of nature
Presenter: **Peter Robertson**, WA Forest Alliance / Conservation Council of WA

Time: 4.25 pm
Title: The role of fire in forest management in Western Australia
Presenter: **Don Spriggins,** Institute of Foresters of Australia, WA Division

Time: 4.35 pm
Open discussion

Time: 5.20 pm
Panel Summary

Time: 5.35 pm
Close

Panel:

DR JOHN BAILEY	-	CONSERVATION COMMISSION OF WA
BERNARD BOWEN	-	ENVIRONMENTAL PROTECTION AUTHORITY
NICK DEVINE	-	FIRE AND EMERGENCY SERVICES AUTHORITY
DR STEPHEN HOPPER	-	BOTANIC GARDENS & PARKS AUTHORITY
DARRYL PEARCE	-	SOUTH WEST ABORIGINAL LAND AND SEA COUNCIL
KEIRAN MCNAMARA	-	DEPARTMENT OF CONSERVATION & LAND MANAGEMENT
PETER ROBERTSON	-	WA FOREST ALLIANCE / CONSERVATION COUNCIL OF WA
DON SPRIGGINS	-	INSTITUTE OF FORESTERS OF AUSTRALIA WA DIVISION

Abstracts
Tuesday 16th April 2002

An evolutionary and historical perspective on south-west Australian landscapes, biodiversity and fire

Dr Stephen Hopper
Botanical Gardens and Parks Authority, Western Australia

Abstract

The distinguishing historical hallmark of south-west Australia's globally significant, highly endemic biota has been its evolutionary response to 250 million years of uninterrupted terrestrial life on predominantly old, flat, weathered, nutrient-deficient landscapes. The fossil record and contemporary molecular phylogenetics show that both fire-adapted and fire-evading plants have pedigrees ranging from remarkably old to relatively recent. The hypothesis that fire has played a major role in plant speciation remains speculative. Because the south-west has such unusual landscapes and unique biodiversity, there is an accentuated need for the development of locally appropriate approaches to nature conservation and fire management. Three hypotheses stand out from this evolutionary and historical analysis – (i) major soil disturbance through glaciation last occurred in the south-west 250 million years ago – much of the present biota consequently has not evolved with nor adapted to rapid topsoil removal, so we need to be very cautious with the use of bulldozers in fire operations, and protect topsoil wherever possible; (ii) unprecedented turnover of plant species over short distances across south-western landscapes has existed throughout the Cainozoic, with fire-adapted and fire-evading flowering plants intermixed in complex mosaics from the mid-late Cretaceous – we should expect different responses and biodiversity outcomes over short distances from the same fire regime; (iii) present landscapes and biodiversity have been so altered by European landuse, dieback disease and weed invasion in many districts of the south-west that new approaches to fire management are needed – the Aboriginal way of local people managing fire as a special privilege at district level has much to commend it. Some other hypotheses are also explored briefly.

Use of fire can continue to improve if we retain a focus on persistent long-term learning, applying adaptive management that is purposeful, information-rich and information-sensitive, inclusive and flexible. Examples of adaptive management improving biodiversity conservation in the south-west include the protection from prescribed burns of young karri regrowth and of fire refuges such as granite outcrops in southern forests, the abandonment of prescribed burns in favour of other control strategies in urban reserves infested by veld grass, and the move from bulldozing firebreaks to slashing or chaining buffer strips in southern mallee-heaths.

Current theories about disturbance and species diversity

Dr Michael Huston
Oak Ridge National Laboratory, Oak Ridge, USA

Abstract

It is widely recognized that disturbances that kill organisms can actually increase species diversity under some circumstances. The "Intermediate Disturbance Hypothesis" describes the observation that diversity can be reduced by disturbances that are too frequent (or intense), and also by too low a frequency of disturbance, so diversity is highest at 'intermediate" frequencies of disturbance. A major difficulty with this hypothesis is how to independently determine the intermediate frequency, without simply choosing the frequency associated with the highest diversity. An alternative hypothesis evaluates disturbance dynamics in relation to the growth rates of the organisms that experience the mortality. This hypothesis predicts that diversity is not necessarily highest at some intermediate level of disturbance, but may be highest at the extremes. Specifically, where populations grow slowly, even low frequencies of mortality can cause local extinctions and a reduction in species diversity. In contrast, under productive conditions where population growth rates are high, increasing the frequency or intensity of disturbance increases diversity by preventing the most competitive species from eliminating other poorer competitors. This reversal of the effects of disturbance on diversity between productive and unproductive environments was recently confirmed in an extensive review of grazing experiments. This study found that diversity (of planktonic algae and terrestrial plants) decreased with increasing intensity of grazing in all studies conducted under nutrient-poor conditions, while diversity increased in most studies conducted under nutrient-rich conditions.

Both grazing by herbivores and fires are disturbances that kill all or part of plants, and can thus be expected to have the same general effects on species diversity. In addition to the effects of nutrient availability and other factors that affect growth rates, differences in size, growth rates, and other properties of plants have a major effect on which species are affected by any particular disturbance. In any environment, the effects of disturbances on different types of plants is quite predictable, and any disturbance regime is likely to increase the diversity of some types of plants, and decrease the diversity of other types.

The fire history of south-west Australia to 1830

Presenter: Professor John Dodson
University of Western Australia, Western Australia

Abstract

Charcoal in sedimentary deposits is common in late Tertiary and Quaternary deposits in Australia well before Aboriginal people entered the continent. A Pliocene lake deposit 200km north of Perth contains charcoal indicating wildfire was present in the south-west by that time and that climate is a controlling factor in providing conditions under which fire can establish. Superimposed on the 'natural' fire regime, anthropogenic fire was imposed after Aboriginal people entered the continent in the late Pleistocene, and in areas of the south-west that Aboriginals habitually occupied, had a controlling effect on the vegetation composition and structure. Aboriginal fire intervals appeared to be much shorter than those in areas not occupied by them or used as a food source, and many were in the range of one to ten years. In contrast, southern forest regions of the south-west, which were not used by Aboriginals had major fires at much longer intervals. Similarly, analysis of core charcoal from a south coast estuary in the semi-arid area of Fitzgerald River National Park, which was not occupied by Aboriginals in historic times, indicates intervals between major fires were in the range of 30 to 100+ years.

Fire environment of the Mediterranean south-west of Western Australia

Dr Lachlan McCaw
Department of Conservation and Land Management, Western Australia

Abstract

The south-west of Western Australia spans the zone of latitude from 27-35 degrees south of the equator, and experiences a range of Mediterranean-type climates characterised by winter rainfall maxima and extended periods of summer drought. The reliability of the summer drought is such that the region experiences conditions conducive to the ignition and spread of bushfires every year, unlike comparable latitudes in south-eastern Australia where summer rainfall may in some years greatly reduce the likelihood of extensive fires in the landscape. Factors that exert a significant influence on the fire environment of the region include coastal sea-breezes, pre-frontal troughs, and the periodic incursion of tropical cyclones below latitude 30 degrees south. The generally subdued topography limits the extent to which elevation, aspect and orographic factors influence the fire environment. Lightning storms are a regular event during the spring and summer months and are responsible for igniting many fires. Fires may burn for months at a time in areas remote from settled agricultural and urbanised lands, and have the potential to burn large areas (>100 000 ha) during periods of severe fire weather. Similar events of sustained fire activity are also likely to have occurred in forested landscape of the higher rainfall zone prior to the advent of systematic fire management. Over the last three decades there has been a sustained decline in rainfall over most of the south-west, primarily in the early months of the cool season (May-July). This has had the effect of prolonging the fire season, sometimes by several months.

Australian landscape burning: a continental and evolutionary perspective

Dr David Bowman
Northern Territory University, NT

Abstract

Since flammable vegetation all but replaced the rainforests that dominated Australia prior to the drying-out of the continent some 15 million years ago, most landscapes have been repeatedly burnt and will continue to be burnt. From this geological perspective, fire is a predictable 'tide' that washes over the landscape, driven by implacable environmental forces - Australia has long been the most fire prone continent on Earth. It is therefore not surprising that a large proportion of the unique Australian biota is not only tolerant of recurrent fires but is apparently highly fire-adapted. Aboriginal people played an important part in the making of flammable Australia. However, contrary to some popular ideas, they did not trigger the relentless fire cycle. The incessant burning of landscapes throughout Australia by traditional Aborigines arose because the hunter-gatherers themselves could not stop the wildfires. Rather, they learnt over some 40-60,000 years to use fire to control wildfire to their economic advantage. This has been aptly described as 'fire-stick farming'. The breakdown of this system of fire management following European settlement represents an ecological and evolutionary event that, while being different in character, is of the same significance as the commencement of the intervention by Aboriginal people. The abundance and range (and indeed the very survival) of some plant and animal species has changed (and is continuing to change) in response to altered fire regimes in tracts of native vegetation. The changes are compounded by the introduction of exotic plants and animals. The great challenge for settler Australians is to learn how to sustainably manage a flammable land by slowing the rate of change and creating new ecological equilibria. Understanding past and present Aboriginal fire usage is a key step in this adaptive process.

Aboriginal fire regimes in south-west Western Australia: evidence from historical documents

Dr Ian Abbott
Department of Conservation and Land Management, Western Australia

Abstract

Historical documents for the period 1696-1890 likely to provide firsthand information about Aboriginal usage of fire were reviewed. Empirical data were extracted and classified according to their relevance to season, frequency, scale, and intensity of Aboriginal burning. In coastal and forested parts of the south-west of Western Australia, most fires were set by Aborigines in summer (December-March). On suitable days many ignitions could occur and fires could be large, resulting in burnt patches in the order of tens and hundreds of hectares. Trees could be scorched to c. 15 m. In the drier inland, most fires were recorded in October and November. Coastal plain woodlands and grassy woodlands inland had fire return intervals of 2-4 years. Fire in Karri forest and kwongan appears to have been less frequent and more localized, so that much of those landscapes remained unburned for longer than 4 years. These conclusions accord with those from experimental studies of fire behaviour and ecological research.

Several misconceptions in the literature about fire regimes, based mainly on inferences from information about vegetation, are clarified. Knowledge about Aboriginal burning derived from early visitors and colonial records can inform current fire management so as to maximize the conservation of biodiversity.

Believing the balga: a new method for gauging the fire history of vegetation using grasstrees

Presenter: Professor Byron Lamont
Curtin University, Western Australia

Abstract

Removing leafblades and charcoal from the persistent leafbases surrounding the stem of grasstrees (balgas) reveals alternating bands of cream and brown tissues interrupted by black bands at variable intervals. We show that these colour differences have a chemical basis. Not only are leaves produced throughout the year, the cream bases are formed in spring-summer while the brown bases are formed in autumn-winter. As these are associated with seasonal or fire events experienced by the plant, the colour bands provide an accurate and convenient (non-destructive) method for determining fire history of grasstrees and thus of the surrounding vegetation. Leafbase thicknesses tend to remain constant along the length of plants, and agree with other evidence indicating that the overall growth rate of *X. preissii* remains stable with time. Variation in leafbase thickness and number can also be used to identify the seasonal bands. We found no evidence that fire susceptibility of grasstrees is dependent on their height but it may depend on their location in the landscape.

Application of the method showed marked changes in the fire regime of southwestern Australia over the last 200 years. The results confirm the anecdotal evidence of frequent and widespread fires at the time of European settlement, and imply a remarkable level of tolerance by the extant biota to environmental fluctuations associated with changing fire patterns. The results provide an empirical basis for identifying the extremes within which an optimal fire regime for conserving biodiversity should be sought. Whether we should seek to restore the fire regime apparently prevailing in the 18th and 19th centuries is less clear. The technique holds great promise for dealing directly with the controversy about the frequency of fires prior to European settlement of southern Australia. It should now be applied on grasstrees throughout Australia to see if they hold equal promise for determining their recent environmental history.

Development of a scientific understanding of fire behaviour and use in the south-west of Western Australia

Presenter: Phil Cheney
CSIRO, Australian Capital Territory

Abstract

From the inception of regulated forestry practice in the south-west of Western Australia, the threat of wildfire demanded a better knowledge of the fire environment and fire behaviour. The first focus for research was into fire danger rating followed by work to quantify and predict the behaviour of low-intensity fires from fuel and weather variables. The Dwellingup fires of 1961 clearly demonstrated the efficacy of fuel reduction against wildfires and the south-west forests became the focus for the development of sophisticated prescribed burning guides for a range of vegetation types and forest management practices. Later, the efficient and extensive fuel management programs that were put in place by operational foresters enabled fire scientists to carry out experiments on fires that were of a scale and intensity that were equivalent to wildfires burning under conditions of high to very high fire danger. These experiments produced guidelines for wild fire suppression and firefighter safety that were adopted across Australia. They also demonstrated fundamental gaps in our understanding of the behaviour of high-intensity fires. Recently, a series of unique fire behaviour experiments were conducted that have yielded such important insights into the fire behaviour associated with firefighter entrapment that the findings were immediately incorporated into firefighter training both in Australia and overseas. Organisational factors that have contributed to progress of bushfire science in Western Australia include a commitment to applied research, continuity of expertise, and effective collaboration with national and international research groups. The development of scientific understanding of fire behaviour has been both driven and facilitated by the practical need to use fire in the forest and has placed Australian scientists in the vanguard of the science.

Fire and nutrients in south-west forests

Presenter: Professor Mark Adams
University of Western Australia

Abstract

Building on past work that identified the south-west forests as more dependent than most eucalypt forests on biological and biochemical processes to supply nutrients, we focus here on the interaction of fire and these processes. We draw on studies from both jarrah and karri forests and from studies that use a range of approaches to highlight spatial and temporal variability as the key to understanding how we might achieve ecologically sustainable *fire* management. Our research suggests that spatial variability in studied processes is linked to the spatial distribution of net primary productivity and is probably predictable on that basis. Similarly, seasonal variability is clearly controlled by climate and must be incorporated into criteria and indicators used to assess the effects of fire on soil and vegetation properties. Annual turnover of pools of inorganic and organic forms of major nutrients are sufficient to account to nutrient requirements of forests and can be measured. Nutrient availability is strongly modified by fire although effects are short-lived relative to the life of the forest. Indirect effects of fire regime on species composition also modify the processes that dictate nutrient availability and thus the patterns thereof. On-going research focused on the use of new isotopic and spectroscopic techniques has much to offer managers seeking indicators of ESFM.

Smoke and heat as drivers of recruitment of Western Australian plants

Dr Kingsley Dixon
Botanical Gardens and Parks Authority, Western Australia

Abstract

Smoke and smoke-like analogues play a key role in the release of deep seed dormancy for a wide variety of geosporous (and some bradysporous) Australian plant species. Whereas heat and ash was previously thought to be the primary cues for release of dormancy and subsequent germination, smoke, either as an applied aerosol to unburnt bushland soil containing geosporous species seeds or seeds buried in soil in germination traps, is a key agent for promoting germination.

In the case of bushland sites, application of smoke increased germination 42 (*Banksia* woodland) to 48-fold (Jarrah-tuart woodland) greater than the control. In 37 species intensively examined in *Banksia* woodland, only three cases (in weedy annuals, some legumes, *Hibbertia amplexicaulis*) showed a more promotive effect of the heat/ash of the wildfire than smoke applied to adjacent unburnt vegetation. The action of smoke in releasing dormancy is complex and varies between species – in some cases involving permeation of lipoidal deposits in the sub-testa to denaturing of inhibitor compounds in the seed endosperm and/or embryo.

The active principle in smoke is water soluble, acts at extremely low concentrations (nanograms) and is deposited in the soil surface following fire. Rainfall solubilises the germination-active chemical species transmitting the chemicals to the soil seed bank in the first 25-50mm of precipitation. Smoke is therefore a reliable and precise measure of the action of fire in the landscape in terms of geosporous species. Detailed studies have been concluded which indicate that smoke provides a valuable tool for auditing of the soil seed bank of many important understorey species, particularly fire-sensitive (seeder) species.
In addition, smoke can act as a surrogate of fire for understanding the dynamics of season of fire on recruitment and survival of species. Importantly, germinant number diversity and survival have now been shown to be intimately linked to the season of smoke (aka fire) application.

Abstracts
Wednesday 17th April 2002

Fire in the shrub-dominated vegetation types of South Western Australia

Presenter: Angas Hopkins
Department of Conservation and Land Management, Western Australia

Abstract

A wide variety of shrub-dominated vegetation types occur in the South West Botanical Province and adjacent bioregions. Collectively they are know as kwongan, and include vegetation types such as heath, thicket and mallee heath. These vegetation types form an important component of the vegetation mosaics that occur throughout the Province, and they are predominant in the two sandplain Bioregions: Geraldton Sandplains and Esperance Sandplains. It is estimated that they covered 10 million hectares in the Province at the time of European settlement, of which about 4 million hectares remain. The shrub-dominated vegetation types are particularly important because of their contribution to floristic richness, endemism and diversity characteristics of the South West.

Within the South West, with its fire bioclimate, shrub-dominated vegetation types are very prone to fire because of their fuel characteristics: living foliage is highly flammable, aerated and is generally within 1m of the litter bed and so susceptible to ignition from any ground fire source.

This paper brings together the results of studies on fire in shrub-dominated vegetation types throughout the South West. These studies have examined effects of fire on individual species and communities, and modes and patterns of regeneration, reproductive biology of plant species present in the communities including time to reproductive maturity, species richness trends, and rates of fuel accumulation. The shrub-dominated vegetation types contain species that are killed by a single fire and must regenerate from seed (seed regenerators), as well as species that have some capacity to regenerate from stored buds in stem or root tissue (resprouters). Proportions of seeders:resprouters vary throughout the region, from 10:90 through to 50:50. Seeders with on-plant storage of seed are estimated to take from 4 years up to 10 years to begin replenishing the seed stores – this may translate into a minimum between-fire interval of 12-30 years. Studies of fuel loadings and fire behaviour show that the shrub-dominated vegetation types are capable of carrying fire well before this time. This situation creates a management dilemma as fire protection objectives and conservation objectives are not easily met on the same area.

Fire and plants in south-west forests: a review of knowledge

Presenter: Dr Neil Burrows
Department of Conservation and Land Management, Western Australia

Abstract

Evolution is evident in the interactions of fire and plants in forest ecosystems of south-western Australia. These seemingly muted landscapes belie a remarkable heterogeneity of floristic assemblages across spatial and temporal scales. Plant species and communities have developed a wide range of adaptive traits that are characteristic of these communities. For many species, reproduction and regeneration are cued or enhanced by fire and for many plant communities, fire at particular spatial and temporal scales is necessary for the maintenance of floristic and structural diversity. Two comparative studies investigating the relationships between plants and fire revealed complex interactions. Long term (>30 years) monitoring in jarrah forest near Manjimup, has shown that no fire regime is optimal for all plant species at this site. A sustained regime of frequent burning (at 3-4 year intervals) has resulted in a significant reduction in the abundance of two key obligate seed species. These species have also declined significantly in the long unburnt sites, but may persist as seed stored in the soil. This study also demonstrates the overriding importance of site over fire in determining floristic pattern. In addition, the number of fires at this site has been more influential on determining floristic patterns than the time since fire. A comparative space-for-time study focusing on a single community type in karri forest reveals interactions between different contemporary agents of disturbance: fire and logging. This study also reveals the importance of site above fire in influencing species composition. Response of species and communities to fire regimes varies across south-western forested ecosystems reflecting climate and landform. This variation has been crucial in the persistence of a diverse array of relictual species and refugial habitat. Several relictual endemic taxa are consequently confined to more mesic or less flammable sites particularly in riparian systems, broad valley floors, wetlands and granite outcrops. These communities are less subject to frequent fires than surrounding landscapes. Generally, plant communities on drier, more flammable sites display a greater resilience to fire than those on less flammable sites. These complexities indicate that an understanding of species and community responses to fire requires an understanding of patterns and process at various spatial and temporal scales. We conclude by considering the necessity of implementing fire regimes that focus on achieving biodiversity conservation outcomes.

The response of fungi to fire in jarrah (*Eucalyptus marginata*) and karri (*Eucalyptus diversicolor*) forests of South-Western Australia

Presenter: Dr Richard Robinson
Department of Conservation and Land Management, Western Australia

Abstract

Fungi are arguably one of the most important forest organisms. They play key roles in decomposition and nutrient cycling, enhance soil structure and nutrient uptake by plants and provide a food source for several species of native mammals. Fire impacts significantly on the physical environment in which fungi persist. When studying fungi in relation to fire, two aspects are distinguishable (1) the flush of post-fire fungi soon after fire, and (2) fungi which appear later but can also occur outside recently burnt areas or on sites of various fire age. The former group is referred to as "pyrophilous' or 'anthracophilous' fungi. Within a day or two of a fire in eucalypt forest, several species of wood decay fungi fruit from subterranean sclerotia. Alkaline conditions provided by the ash-bed effect allow a specialist suite of ascomycete fungi to fruit prolifically in the first autumn and spring. As soil conditions revert and litter builds up the pyrophilous species change and are then gradually replaced by species more commonly found in unburnt forest. Mycorrhizal fungi that inhabit the litter and organic soil layer are significantly affected by fire. Long-unburnt sites have a higher number of mycorrhizal roots than recently burnt or frequently burnt sites. Species diversity is comparable between long-unburnt and frequently burnt sites but species composition differs. Fire thus favours some fungal species but has a negative effect on others. Spatial and temporal separation of fires of differing intensity can increase habitat diversity and managers should aim for a mosaic of fire ages and intensities within forest stands and across larger regions in order to maximise or maintain fungal diversity.

Fire and invertebrates in South-west Australia

Presenter: Paul Van Heurck
Department of Conservation and Land Management, Western Australia

Abstract

The impact of fire on the invertebrates in southwest Western Australia was first studied in 1955, following a major shift in fire policy from fire exclusion to frequent, prescribed burning in forests. This paper reviews all fire impact studies up to 2000. Most of the studies before 1993 studied broad taxa (orders or families) and thus were not highly informative about biodiversity conservation.

At landscape scales, invertebrate biodiversity is greatest where habitat heterogeneity (represented by a wide range of post-fire successional stages in the vegetation) is maximized. No single habitat type in a particular landscape will include every invertebrate species in the landscape, as some species are rare without frequent fire and others are rare if fire is frequent.

With a great diversity of invertebrate species and only rudimentary knowledge of their taxonomy and ecology, a precautionary approach to fire management across the landscapes of the southwest of Western Australia seems appropriate. Elements of this should include strategic planning at regional and landscape scales, greater variety in season of burning, size and frequency of planned fires, and more effective long-term monitoring of indicator and fire sensitive taxa. The impact of unplanned fires (wildfires) on invertebrate assemblages in particular needs to be further studied. Further surveys are needed to map and determine the bio-indicator potential of post-fire invertebrate species assemblages to monitor more efficiently forest ecosystem health and the restoration of threatened plant communities across the full continuum of disturbance.

The impact of fire upon frogs and reptiles in South-Western Australia

Presenter: Dr Dale Roberts
University of Western Australia

Abstract

The impacts of fire on frogs and reptiles are poorly known in most forest systems worldwide. The emergent patterns are: a) no impact b) complex interactions between topography, climate and disturbance events including fire c) predictable assemblage changes after fire in systems where there are associations between vegetation structure and occurrence of particular species. In south-western Australia there are few data sets directly assessing fire impacts. These are restricted to data on assemblage composition for frogs and reptiles in Banksia scrubs on sand plains and some experimental and observational data for frogs in the genera *Geocrinia* and *Spicospina*. Reptile and frog data from Banksia scrubs are strongly affected by the patchy distributions of species and local climate events. These data do not show any clear patterns. Experimental data for *Geocrinia* species suggest low intensity fires reduce adult population size by 30 - 50% but populations recover by 6 years after fire. *Spicospina* at some sites may currently require fire to promote breeding activity but other disturbance or succession regimes, e.g. grazing, long periods without burning, may promote similar outcomes. Many data sets word wide are poorly replicated and have low power to detect fire impacts so we should be cautious in assessing even the limited data available. Current assemblage structure in south-west forests may be dominated by fire tolerant species selected by repeated, recent burning. Reptile and frog assemblages also have a long term evolutionary history predating European and Aboriginal fire regimes which may have determined their responses to fire. Choosing a fire management regime will therefore be difficult but also dependent on what values, e.g. assemblage composition, species richness or preservation of endangered species, we wish to maximise by using that regime.

Fire and birds

Dr Allan Burbidge
Department of Conservation and Land Management, Western Australia

Abstract

The effects of fire on a bird community are difficult to predict, apparently varying with the fire intensity, season and extent, as well as the site itself (including its fire history) and climatic variation before and after a given fire. Each species responds differently to fire – some benefit from easier access to food supplies while others are disadvantaged through loss of habitat. Understanding the varying responses of bird species and communities is fundamental to managing avian biodiversity in a fire prone environment. Some rare species may have declined because of too frequent fire in the past, but the main threat to these species now is infrequent, widespread fire in fragmented habitat – the best management option for these species is a carefully planned regime of relatively small fires of moderate frequency, but further research is needed to provide prescriptions for individual species. There is an urgent need for long-term, well replicated and controlled studies on the response of bird species and communities to fires and fire regimes of varying characteristics. This will require public support and ongoing collaboration between scientists and land managers.

Relationships between mammals and fire in South-Western Australian ecosystems: what we know and what we need to know

Presenter: Dr Gordon Friend
East Melbourne, Victoria

Abstract

A brief overview is provided of past research and reviews addressing the relationships between fire and mammals in the forests, woodlands and shrublands of south-west Western Australia. Several frameworks and approaches used by various researchers to help understand Australian fire ecology are described in order to place current knowledge in perspective and to highlight gaps in understanding. Elements addressed in our review include the component characteristics of a disturbance such as fire (eg. scale, timing, frequency and season), patterns of post-fire succession for species and their abundances within a community, the use of species life histories and development of a "fire response index" to predict responses to fire, and the realisation that mammal responses are closely determined by vegetation density and structure rather than time-since-fire *per se*. To further illustrate fire responses, case histories are provided for a range of species representative of early, middle and late successional stages (*viz*. the introduced House Mouse *Mus musculus,* Ash-grey Mouse *Pseudomys albocinereus,* Little Long-tailed Dunnart *Sminthopsis dolichura,* Common Brushtail Possum *Trichosurus vulpecula,* Red-tailed Phascogale *Phascogale calura,* and Honey possum *Tarsipes rostratus)*. The relationship between fire and hollows, an important form of habitat to many mammals, is also examined.

The publication of past research, the elucidation of mechanisms and interactions between fire and ecological processes at the community level, and determining the relative importance of scale, patchiness and fire interval are proposed as the principal priorities for future fire ecology research efforts in the southwest. The setting of clear conservation objectives and implementation of an adaptive experimental approach to fire management are seen as the most efficient and effective means of achieving ecological sustainability in relation to fire.

Fire and organic substrates: soil structure, water quality and biodiversity

Presenter: Associate Professor Pierre Horwitz

Edith Cowan University, Western Australia

Abstract

This paper is based on two premises. Organic matter in soils will accumulate according to the moisture of the soil, the rate of litter fall and the type of fire regime experienced locally. The factors are inter-related too: coarse organic matter at the surface of soil can hold soil moisture for longer; the more moisture held the slower the decomposition; the more anaerobic it will become and the more likely it will be to accumulate as 'peat'. With more organic matter, surface moisture will increase, hence the likelihood that microclimates can influence, even 'edaphically' control, fires. The reverse holds too: the drier the soil the more prone it will become to fire and the loss of organics. Organic matter thereby influences fire regime by regulating soil moisture.

Secondly, in places where organic matter is likely to accumulate, like shaded areas, depressions or other cool, moist places, wetland characteristics follow. Water quality in such wetlands is influenced by stained, slightly acidic, stratified, dystrophic water. Organic rich wetlands have invertebrate and vertebrate animals, and vascular and non-vascular plants, which are unique to such places.

Our hypothesis is that these dynamic characteristics and states of organic rich wetlands can be disrupted by a changed fire regime. Under frequent hot fires, or any frequent regime designed to remove organic matter, fire can become a geomorphological agent, trigger the release of a pollutant, and present a threat to biodiversity. We support this hypothesis with evidence from recent work and in doing so construct a partial biogeography of south-western Australia.

Fire as a determinant of rarity in the South-Western Australian global biodiversity hotspot

Presenter: Dr Colin Yates
Department of Conservation and Land Management, Western Australia

Abstract

South-west Western Australia is one of 25 recently recognised global biodiversity hotspots primarily because of its rich flora of some 8000 taxa of which 75% are endemic. The region has had a Mediterranean climate possibly since the Oligocene onset of aridity and charcoal deposits indicate recurrent fire since at least the late Pliocene (2.6 Ma). The Cainozoic fossil record shows a correlated decline of fire sensitive rainforest to almost complete extirpation and replacement by sclerophyll vegetation. The south-west is characterized by a large number of rare species, especially of plants, presenting a significant opportunity to explore the relationship between fire and rarity. Current theory and empirical studies demonstrate that there are many causes of rarity. Thus sophisticated experimentation is required to distinguish the effects of fire from other causes. This is exemplified by non-sprouter plants with a short-lived seedbank; these are more vulnerable to fire regimes than sprouters but the same could be said for other disturbances such as drought, floods, grazing, frosts and severe windstorms. Few critical experiments discriminating between such multiple causes of rarity have been published.

An analysis of the life forms and fire response for the 327 rarest plant taxa in south-west Western Australia reveals that fire response is known or inferred for 209 taxa. Of these the greater proportion are non-sprouters and will have population dynamics that are particularly susceptible to fire regimes. This ratio is higher than found in most habitats where proportions of sprouters and non-sprouters have been measured.

Some interesting correlations between fire and rarity have emerged from descriptive studies of selected taxa and a limited number of habitats in south-west Western Australia eg. several palaeo-endemic plants and animals and some rare birds persist only in vegetation where fire is very infrequent whereas the greatest concentration of rare and neo-endemic plant species is in south-west kwongan and mallee, which experiences relatively infrequent fire. The proportion and/or dominance of fire sensitive non-sprouter plants are highest in habitats which provide fire refuges such as granite outcrops or offshore islands. These patterns may be a consequence of varying fire regimes but other explanations cannot be excluded based on available evidence. Experimental data are limited to testing the hypothesis that some rare plant species are fire opportunists that persist as seeds in the soil between fires. The relationship between fire and rarity is likely to be complex and we recommend further experimental studies to improve understanding of the significance of fire to management of rare species.

How fire regimes might interact with other forms of ecosystem disturbance and modification

Professor Richard Hobbs
Murdoch University, Western Australia

Abstract

Fire is only one of a number of agents which disturb and modify ecosystems. Disturbances are discrete events which result in damage to ecosystem components, and range from localized animal diggings to broad-scale damage by storms. Ecosystem modification can also result from human activities such as harvesting, clearing and mining, but also includes invasion by non-native plants and animals, disease, and grazing. The interactions between fire and other types of disturbance and modification have not been extensively studied in Australia. However, from the limited information available and from work elsewhere, it is clear that such interactions can be very important. Of particular concern is the interaction between fire and weed invasion, especially where a spiral of non-native grass invasion and increased fire frequency occurs. Systematic removal of the invasive grass species seems to be one of the few ways of reducing this problem. Ecosystem fragmentation can be shown to interact with fire regimes in a number of ways. Fire frequencies may increase at the edge of fragments, leading to increased degradation. Alternatively, isolated fragments may no longer be subject to the historical disturbance regime, or may have altered conditions meaning that post-disturbance recovery is impeded. Fire, grazing and climatic variability can interact in a variety of ways to determine the state of vegetation in any given area, and grazing can also determine post-fire regeneration success. Examples of these interactions are provided from southwestern Australia and elsewhere.

Abstracts
Thursday 18th April 2002

Introduction Day 3

Sam Williams
Noongar Elder, Albany, Western Australia

Biography

Sam Williams was born at the United Aborigine Mission, Gnowangerup. He moved with his family to the Tambellup district, and attended Tambellup State School passing 7 subjects at completion of year 10. Sam was also awarded Deputy head prefect during year 10.

Along side his father and brother, Sam worked on various farms around Tambellup district clearing new land, root picking, also as a shed hand on his dad's shearing team for a period for 3 years.

Sam then moved to Kellerberrin where he worked for a period of 4 years as a Clerical Assistant for the Native Welfare Department. His family then returned to Tambellup and commenced working with his eldest brother who operated a shearing team in the district.

Sam continued shearing for a period of 23 years before gaining employment as Community Development Officer for the then ' Western Australian Alcohol and Drug Authority' unit. Government cuts caused the closure of regional offices.

Sam remained in the field of addictions by transferring to Palmerston Association Inc. who were successful tenderers for continuation of the service in the great southern region.

Sam has been married for 34 years, a marriage that has produced 6 children and 10 grand children.

Aboriginal usage of fire – an indigenous perspective

Glen Kelly
WA Aboriginal Native Title Working Group

Abstract

While much has been said of Nyungar burning in the South West and while we have seen the development of several emprical models aimed at studying the effects and frequency of Nyungar burning, Nyungars themselves have had little opportunity to input 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 pespective 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 degredation, 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.

Australia's burning bush

Professor Stephen Pyne
Arizona State University, Arizona USA

Abstract

For more than 40,000 years Australian fire has been braided with the history of its human inhabitants. Its legacy of Aboriginal fire remains one of the distinctive features of the Australian scene - a Third Way between European conceptions of fire as a tool within a wholly domesticated landscape and American assumptions that the true fire is a naturally kindled one in wilderness. More recent developments follow three global trends: the competition between the combustion of fossil biomass and living biomass; the rise and decline of extensive public (crown) lands; and the peculiarities of a national fire culture. Within this international spectrum Australia is a firepower, distinctive for the breadth of its fire science, the extensiveness of its burning, and the success of its system of volunteer bushfire brigades.

Fire and human societies

Dr David Horton
Consultant, Australian Capital Territory

Abstract
There is a big conceptual gap between 'firestick farming' and understanding the effects of fire and taking advantage of those effects. We don't have to believe either that Aborigines were simply 'parasitic' or that they massively changed the whole Australian environment over a long period to suit their purposes. We can instead simply believe that Aborigines, like all human societies past and present, observed their environment and made use of it as best they could, and that they established social, cultural, religious and economic systems to enable them to do so.

There is a big conceptual and real gap between 'the Australian environment can survive fire' and 'the Australian environment is dependent upon fire'. The gap is plugged by the professed belief of farmers, foresters and politicians that Aborigines made extensive use of fire and that as a consequence they maintained the environment and that the torch, flame burning brightly, has been passed to us to continue the 'maintenance'.

This belief has been fuelled by a misreading of archaeological and ethnographic evidence, and a confusion between hypothesis and fact. The enthusiastic acceptance of the firestick farming hypothesis, and its transfer to approaches to land clearance, forestry and farm management, and 'control burning', is the result of the political and social climate of the 90s and of the use that can be made of it by vested interests. The hypothesis has no basis in fact.

Whatever you believe about Aboriginal use of fire in the past, and whatever the truth of the matter, to act now to try to reproduce a hypothetical Aboriginal fire regime of some time in the past, in a time in which at best almost every aspect of the environment is different to its condition 200 years ago, and when every part of the environment all over Australia and most of the world is either already greatly damaged or under attack, would be to add a further destructive force which we can do without.

The best you could say about the reproduction of hypothetical past Aboriginal fire regimes is that if they did exist, and if you did manage to reproduce them, you might hypothetically benefit a few species while harming many others, might do a little fine tuning of some environmental attributes while damaging many others. But any such supposed benefit, however relevant it might have been say 30 - 40 years ago, is no longer of any relevance in the context of the environmental disaster with which we are now faced.

Fire and the law

Sandra Boulter
Environmental Defender's Office, Western Australia

Abstract

The Environmental Defender's Office is a non-profit community legal centre, which specialises in public interest environmental law. The aim of the Environmental Defender's Office is to inform and advise environmental groups and individuals about the operation and implementation of policies and laws pertaining to environmental protection and preservation.

In relation to fire, this paper addresses issues of terminology, regulation and policy implementation.

The terminology employed in describing certain burning activities may be emotive, or imply certain expectations or meanings that are not accurate. Should we speak of bushfire or wildfire?.. fuel reduction or hazard reduction?... a prescribed burn or a pre-emptive burn?

The many sources of planned and unplanned fire include traditional Aboriginal cultural activities; pastoral, agricultural, horticultural and conservation practices; development and clearing; storage and disposal of rubbish and hazardous goods, campfires and lightning strike. Fire risk activities might be undertaken by Aboriginal traditional owners, government agencies, local government, freehold landowners and occupiers, companies and corporations, picnickers, tourists or campers.

The legal rights and obligations, in respect of choosing and controlling a pre-emptive burn, may arise quite separately from the duties and obligations of the owners and occupiers of land to minimise the risk of or control an unplanned wildfire. This paper reviews those rights and obligations as they apply on the various land tenures, at common law or by statutory duties, rights and obligations.

The regulation of fire management through the common law and statutes is explored by a brief overview of the roles of FESA, the Department of CALM, local and State governments, the Environmental Protection Authority; and the Police service (in the case of arson, criminal negligence and the need for public safety); as they apply on Crown land (including reserves, pastoral leases, nature reserves and wildlife sanctuaries); on Soil Conservation Reserves and in Land Conservation Districts; and on private land.

The legal responsibility in respect of the liability of certain government agencies for the damage to human health, property, flora and fauna is explored in the paper by drawing the legal distinction between the various objectives of the material Acts, and between operational and policy decisions of government agencies.

Fire and risk management

Dr Ray Steedman
Marine and Environmental Consultant, Western Australia

Abstract

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 organization 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

Mick McCarthy
Shire of Mundaring, Western Australia

Abstract

Aims

1. To indicate that Regional Fire Planning is really only effective in the areas of education, liaison and coordination toward the achievement of required standards.
2. To show that fire management needs to be undertaken at the local level and is the responsibility of the landowners or managers.
3. Outline the issues involved in balancing fire management and vegetation preservation within the Shire.

Intent

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 focussing 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 to 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 management 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 fire management legislation is understood by all staff involved in the development approvals process 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 (ie individual properties).

This means that individual landholders are responsible for ensuring the risk of fire is minimised on each property. 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 a property can lead to an increased risk of fire. While encouraging the protection of vegetation, the Shire must always ensure each of property 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.

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 liaison, coordination, 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 management 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 threats 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 defense against wildfires threatening life and property.

Approaches to community safety and bushfires in south-western Australia

Presenter: Drew Haswell
Department of Conservation and Land Management, Western Australia

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 recognised 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, organizational 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 Forests Act in 1918, the introduction 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 continuous improvement in the implementation of programs. It suggests that the thematic areas for the application and/or development of performance indicators be based on the above concepts for community safety, and that indicators for success be based on the above principles for community safety.

Bushfire threat and community perception

Dr Peta Odgers
Fire and Emergency Services Authority, Western Australia

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 underprepared and at risk during a fire. Despite this confidence, Carramar residents also thought that it would be beneficial if a knowledgable 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.

Bushfire threat to home owners

Klaus Braun
ICS Group, Western Australia

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.

Bushfire smoke and human health

Dr Andrea Hinwood
Department of Environment, Water and Catchment Protection, Western Australia

Abstract

Bushfire is known to be a significant source of smoke which is made up of particles and other air pollutants such as 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. 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 contributor to these associations in Perth is 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 relationships 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 sources, complicate any analysis. The public health risks associated with wildfires compared with prescribed burning also needs to be assessed. These issues were identified during the development of the Perth Air Quality Management Plan (AQMP). The Perth AQMP contains a number of actions which will address the specific issues outlined above.

Global warming and bushfires

Presenter: Professor Ian Noble
Carbon Accounting CRC, Australian Capital Territory

Abstract

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.

Perspectives on Fire Management

Fire, prescribed burning and the conquest of nature

Peter Robertson
WA Forest Alliance / Conservation Council of WA www.wafa.org.au

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**:**

1. 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;
2. 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;
3. 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;
4. 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.

Perspectives on Fire Management

The role of fire in forest management in Western Australia

Don Spriggins
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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.

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