BURNING in SPRING

Study Tour of Western Australia
November 2005

Fuel reduction burning in Western Australia
Exchange between Department of Conservation and Land Management (CALM) and Department of Sustainability and Environment (DSE)

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INTRODUCTION

A review of the operations of the Fires and Emergency Branch (FEM) was undertaken by Stuart Ellis during 2005. In his advice to the Secretary, he has recommended that the Department of Sustainability and Environment (DSE) investigate how it can achieve greater prescribed burning in spring. In response to this recommendation, FEM has instigated the study tour to Western Australia which will be hosted by its Department of Conservation and Land Management (CALM).

The following is an extract from the Ellis report:

The Victorian Bushfire Inquiry (VBI) raised the issue of the "plausibility of burning in Spring". In investigating the Wilson's Promontory fire of 2005, the Office of the Emergency Services Commissioner (OESC) has identified that fatigue late in the fire season may be an issue, leading to patrolling after prescribed burning not being undertaken to the same extent that patrolling is completed after a wildfire. In 2003/04, 5% in area and 20% in number of prescribed burns conducted in Victoria were completed in the spring. In 2004/05 this increased to 7%, a 40% increase.

Limitations exist to conducting prescribed burning in spring in Victoria due to:
-· increased moisture
-· less predictable weather
-· the certainty of drier weather coming into summer.
- physical impediments, particularly topography.

However, it appears there is an opportunity to increase the burning in spring – perhaps to 15 or 20% of the total area burnt, thereby reducing the pressure in autumn to complete nearly all of the prescribed burning program. The VBI refers to as few as 10 days a year being suitable for prescribed burning due to weather conditions. This further highlights the benefits of burning in spring as well as autumn.

Interviews were conducted with staff and specific 'experts' (Kevin Tolhurst, Gordon Friend) on the opportunity for greater prescribed burning in spring. There is greater opportunity to burn in late spring in Victoria and this needs to be considered against the risk of less predictable weather. Suggestions were made that this period is best suited for small Zone 1 and 2 burns. Resources required for Zone 1 and 2 burns may be considerable therefore, focussing on these areas in spring will free up resources for larger burns in autumn. The motivation needs to come from within the Fire Program and may not be achievable in 2005. Forcing the issue in the short term would be counter productive.

In the final analysis, what is sought is greater burning in spring to reduce the concentration of burning in autumn, spreading the load across a longer period when hopefully more suitable days will be available.

The Ellis report recommendation has been accepted that the FEM Branch examine how greater prescribed burning in spring can be achieved and report back to the Secretary.

The Acting Director Emergency Management initiated a study team of Victorian firefighters to participate in the Western Australian 2005 Spring Prescribed Burning program. The Terms of Reference were:

1. To examine the Department of Conservation and Land Management (CALM) Spring burning program and report on possibilities to increase spring burning in Victoria
2. To participate in the CALM program and seek opportunities for transfer of knowledge to the Victorian program; and
3. To investigate the possibilities / benefits of a continuous exchange of personnel from both agencies

The study team participated in the WA burning program from 7th to the 25th November 2005. Team members participated in 15 burns across 7 Districts within 3 Regions of southwest Western Australia. CALM had completed 30,000ha at 7th November and 90,000ha by the 25th November, providing team members with excellent opportunities to observe and participate in their spring burning program.

STUDY TOUR FINDINGS

Objective 1 Spring Burning in Victoria

The forests of south western Western Australia that were observed have several similarities to parts of Victoria. The WA forest structure, topography and climatic influences appeared extremely favourable to spring burning. Burning observed by the study team occurred largely in forests of relatively uniform floristics and structure, on relatively flat terrain and under relatively stable climatic conditions.

The forests of WA can be grouped in to three broad categories; heath and heathy woodland, Eucalypt forest with a low understorey (Northern Jarrah), and Eucalypt forest with a medium understorey (Southern Jarrah). Much of the burning observed was in heath and Northern Jarrah forests. In the heath areas all of the vegetation was removed during the burning operation, this is consistent with Victoria. Where the heath areas were extensive, burning of the heath sometimes occurred in advance of burning the eucalypt forest, this also occurs in Victoria. Burning under Jarrah began as soon as the fuels were dry enough to carry fire, this often was only the road edges exposed to extra drying through increased sunlight and wind, and this also meant that the edges could be established under very mild fire behaviour. Resources were then committed to returning to the site on further occasions to repeat ignition as other elements of the fuel profile became available (dried out) until such time as the objective of 60 – 90 % of the area was burnt. On one occasion this required 8 ignition events, four of which involved aerial ignition. By burning under such mild conditions, CALM are able to minimise scorch and protect critical elements within the burn through fuel moisture differentials, for example riparian vegetation.

CALM manages fire behaviour using the same key principles as Victoria; fuel available for burning (fuel weight), fuel dryness (Surface Moisture Content), Drought Index (Soil Dryness Index), temperature, humidity and wind. CALM use their manual (Forest Fire Behaviour Tables for WA (1998) Sneeuwjagt RJ and Peet GB.) nicknamed the Red Book to undertake a desk top calculation of the likely fire behaviour at the burn site (Fire Danger Index is measured as a Rate of Spread), and light a test fire to validate Rate of Spread (ROS). CALM were not seen to validate fuel moisture content in the field (using a Wiltronics meter) as a routine practice.

Finding 1
Instigate spring burning to develop a diversity of fire regimes.

Finding 2
Implement spring burning through a staged process with trials in forest types of similar characteristics to WA, relatively uniform vegetation, relatively flat terrain and relatively low fuel hazard.

Model of Cover for Prevention (Prescribed Burning)

The issue that made the strongest impression on the study team was the level of commitment made by CALM to their burning program. This stems from core organisational policy where the prescribed burning program is paramount to the success of their wildfire control processes.

CALM build their organisational priorities and resourcing around a fire prevention program that involves both spring and autumn burning. As a result their Model of Cover is based more around their need for resources to meet prevention programs rather than suppression programs. Having the resources available for the burning program in spring and autumn automatically means that they are available for the summer suppression period. It has the added benefit of giving their staff the opportunity to build skills and awareness leading up to the summer, rather than recruiting at the last minute.

Finding 3
Model of Fire Cover in Victoria be based on a combination of Prevention and Response

Finding 4
That the 9 month fixed term seasonal fire contracts include a fixed start and finish time.

Finding 5
Implement aircraft to assist with patrol and security of prescribed burns

Finding 6
Increase aircraft availability through extended period (spring), to provide increased ignition capacity, and increased mapping capacity

Finding 7
Increase vehicle fleet capacity to facilitate increased burning. (eg. Mid range tankers, convert station wagons to trays for Slip on Units)

Recommendation
That the Model of Fire Cover review for 2007/08 considers the people and vehicle requirements for a program that includes increased spring burning.

Coordinated Resources at State, Regional and District levels

CALM operate a District structure with all staff within a District reporting to the District Manager. There were noted advantages to District staff being coordinated at District level. Staff support was enhanced by each business having responsibility for some burns, this led staff to support each other as they could see their burn might be next and they will need support in return, a cooperative scheme.

Finding 8
Single Coordinator / Duty Officer at District level with authority to direct resources to burning (single focus).

Finding 9
Each business (especially land managers) to actively contribute resources to burn programs in each District.

Finding 10
Increased resources allocated at District level to facilitate FOPS and Burn Plans.

Finding 11
Manage burning program through a tenure blind process, across land tenures and across Districts / Regions.

Objective 2 Transfer of Knowledge

There were many aspects of the WA program that relate to the overall annual burning program within Victoria, not just the spring component.

Science and Monitoring (Adaptive Management)

CALM uses science to underpin all of its burning. This scientific knowledge has been accumulated through a long history of research linked to management. They regularly refer to their process of adaptive management, using the ongoing burning operations to validate and improve available research information. This can be described simply as applied research, rather than pure research.

The CALM science relates to fire protection and management, and equally importantly to the nature conservation values applicable to public land. Much of their internal and external support is derived from the strong nature conservation research and management rather than the fire management outcomes. People in general demonstrated a positive response to managing public land for native animals and plants, and CALM uses a number of its high profile mammals to demonstrate the benefits and ongoing value of their burning program. For example, burning of senescent gully vegetation to renew habitat of the endangered Quokka. People were apprehensive when they were informed that public land had to be burnt (interpret sacrificed) to meet the protection needs of adjacent landowners. Whilst burning for protection reasons was acknowledged and tolerated, burning to promote wildlife was actively promoted and supported, community support was noticeable.

Finding 12
Implement scientific and adaptive management as the primary drivers for ecological management

Finding 13
Develop Principles for ecological management (vice Neil Burrows)

Finding 14
Better communication of current knowledge - Reinforce work being done on ecological burning by such people as Dr Kevin Tolhurst and Gordon Friend

Finding 15
Investigate ecological impacts of a range of burning regimes (eg CALM rotation of spring, spring, autumn, rest)

Finding 16
Investigate spring burning for threatened species management, habitat and threatened species protection

Finding 17
An ecological or land manger representative be present at all burns to monitor non operational factors (eg are prescriptions meeting land management objectives?)

Finding 18
Increase ecological knowledge through better information obtained through systematic pre and post burn monitoring

Finding 19
Facilitate improved links between scientific researchers and burning operations to energise adaptive management

Finding 20
Train and reward field staff to assist with pre and post burn monitoring (Certificate IV – Natural Resource Management Modules)

Finding 21
Investigate fire intensity mosaic mapping for Victorian vegetation types.

Finding 22
Training in weather interpretation and operating of weather instruments.

Integrated People

CALM staff at all locations were committed to the burning program, partly due to the culture of the organisation, but more importantly because staff saw positive outcomes for overall land management objectives.

Fire is the only cost effective method of manipulating vegetation at the landscape level to meet nature conservation (flora and fauna) outcomes.

Maintaining broad staff support for the burning program was strongly linked to the science and monitoring process. Staff were dependant on the pre and post burn monitoring data to justify and validate the burning program and prescriptions. It was nature conservation outcomes that staff cited as the primary driver for their commitment to the burning program.

Finding 23
Prescribed burning be included with Response in all Position Descriptions in DSE

Finding 24
New recruits (base grade) have project role which includes active fire roles within 1st and 2nd years

Finding 25
Further strengthen mentoring processes to accelerate development of staff's burning skills (AWU, VPS VF & PV)

Finding 26
Reinforce 'Ellis' recommendation around rewards and recognition and identifiable brand

Finding 27
Department publicly support staff in the execution of the burning program recognising it is a risky business

Business Responsibility and Planning for Individual Burns

CALM have strengthened staff commitment and a culture of burning by aligning each burn to a land management objective.

Each burn may have a number of objectives including protection. When a burn has its primary objective as nature conservation, the nature conservation directorate at State level funds the burn and Nature Conservation staff at District level undertake the burn planning and usually the role of Burn Officer in Charge. Where the burn has protection as the primary objective, the asset manager funds and takes responsibility for the funding, planning and execution of the burn. CALM are still responsible for fire protection on softwood plantations managed by the Forests Products Commission.

CALM have a very extensive planning process for each individual burn that is paper based. The benefit of the CALM process at present is that all values are considered in detail, and approval for the burn occurs at all levels from District to State.

Finding 28
Flora and Fauna and other values groups (AAV) to advise on preferred outcomes for all areas available for burning

Finding 29
All departmental data sets be accessible live for fire planning eg: Threatened species/ AAV/ biosites/ WUP/TRP.

Community Engagement

CALM are actively involved in community engagement and many of the processes observed were the same as in Victoria. The most noticeable differences were the commitment of senior staff to lead community meetings, and the extent to which CALM promotes burning through all of its public messages especially at recreation sites.

Finding 30
Community meetings are professionally facilitated (eg: CALM use District/ Regional Manager).

Finding 31
Information boards at Visitor Facilities to include fire messages (eg: ecological, prescribed burning) other than response.

Objective 3 Ongoing Staff Exchange

Members of the Study Team found this opportunity immensely informative in relation to the prescribed fire and wildfire activities undertaken within Victoria. The Western Australian system for detecting and managing fires is very similar to Victoria, perhaps the most similar of all Australian states.

All of the CALM staff were keen to work with the tour party, and many expressed an interest to observe our activities in order to better understand their own fire environment. The study team believe there are benefits to be obtained from ongoing exchange between Victoria and Western Australia.

Western Australia recently experienced a large wildfire which committed all of their level 3 response capability. Victoria has experienced this also, and the time lag to activate resources from another State or country can be quite long when time is critical. Agreements for resource exchange now exist between a number of national and international parties, these need to be used on a relatively regular basis to ensure they remain valid, and operate efficiently when interstate assistance is required at short notice.

Finding 32
Invite WA experts in fire intensity mapping to visit Victoria.

Finding 33
Invite WA operational staff to participate in Victoria's autumn burning program.

DISCUSSION

DSE can undertake additional prescribed burning in spring. This needs to be achieved within a risk management context looking at weather, topography, fuel hazard levels and available resources.

CALM has a well established culture around burning in spring, their business management and staff expectations reflect the priority given to resourcing burning in spring. Western Australia has very distinct topography advantages, and observed weather was noticeably more favourable than Victoria. CALM has invested in physical resources including equipment and road networks to facilitate efficient and effective spring burning.

CALM maintains both staff and community support for their program as it is linked to both protection of community and assets, and biodiversity and ecological outcomes for public land. Much of the burning program is now driven by the need to maintain healthy ecosystems for the benefit of native flora and fauna, and CALM uses a number of high profile species to showcase and market their program and success.

CALM has invested in ensuring the science associated with burning and biodiversity supports and drives the burning program. Much of their community support is linked to this public recognition of the science being used to manage the burning program. CALM acknowledges that they are still learning, and apply adaptive management regimes to facilitate both the science and operations associated with burning.

Planning for prescribed burning in Western Australia is complex at the individual burn plan but increasingly simple as it is coordinated at District, Region and ultimately State level. The underlying intent is that burning will proceed, and that staff need to plan well ahead to ensure all pre burn works are completed. CALM facilitates this through a master burn planning process where each winter and summer the overall program for the next six seasons (i.e. Autumn, Spring, Autumn, Spring, Autumn, Spring) is reviewed and priorities determined. In general, burns in the first four seasons are approved at all levels, and ready subject to completion of pre burn works. Burns in seasons five and six are planned and being examined for final detail.

Tour members found this study tour to be very informative and all returned with a positive attitude and renewed energy to support and improve the overall burning program in Victoria. There were a number of aspects of how CALM operates as an agency and how it manages its burning program that the team were not able to fully explore. Ongoing exchange with Western Australia is considered beneficial for both agencies as we face similar challenges in managing public land for all of its values.

Part 1 Organisational Capability

Staff involvement/ integration/accountability

CALM's head office, in fire management, has few resources for policy and planning. CALM is more focused on service delivery from the Regions and Districts. This is quite different to the Victorian DSE situation although the SW Region of Victoria has developed a service delivery model that bares some similarity to the CALM model. It enables easier access to staff for prescribed burning. The fleet of vehicles are better equipped for burning. Regions and Districts have Managers who are responsible for the overall service delivery, and who promote an integrated approach to land management across functions. This is particularly the case in the delivery of the prescribed burning program where all staff have a role within the program, be it in planning, operations or support.

During the master planning process the District Manager chairs a meeting with staff from all businesses. The businesses provide the majority of the direction for the burning program and are responsible for the development of the burn plan following this process.

Equipment

CALM's equipment is designed for prescribed burning not for fire suppression, as is the case in Victoria.

- CALM use 2 tankers as their primary response vehicles a Isuzu 550 single cabin and 750 twin cabin with 2700L water carrying capacity.
- A variety of slip-on type vehicles are used which include 420L and 600L units. These are mounted to twin and single cabin Rodeos, Hilux, Patrols etc. They don't carry much in the way of chainsaws or hand tools on these vehicles.
- Fixed wing "American Scouts" (owned by CALM) are used for aerial reconnaissance of burns and fires.
- Wheeled loaders with a blade and forks (similar to rubber tyred dozer)
- D6 Dozers and floats (some areas have contract machines on full time standby during the summer period).

Model of Fire Cover Implications:

CALM's resource levels are based on prescribed burning targets as compared to the model of fire cover used in Victoria which is based on fire suppression needs. They employ seasonal staff for 9 months with fixed start and finish dates. This enables staff to plan around these time periods for works programs and training. This optimises the level of staff and equipment to prepare, conduct and ongoing patrol of burns. In Victoria we quickly run short of equipment to patrol and continue ignition.

Technology

CALM use the Red Book to monitor fuel moisture levels, they extrapolate fuel moisture in the field based on weather records monitored at the local office. CALM at one time converted the Red Book to a computer program but found some staff then lost the ‘understanding’ of what they were doing and just relied on the ‘answer’ from the computer. As a result they have returned to using the manual calculation process using the book, this has enabled new staff to understand the monitoring of fuels from first principles. A number of offices had recently received a Wiltronics Fuel Moisture Meter, and whilst they were awaiting final advice on calibration of the meter for Jarrah fuels, it did provide an excellent tool for monitoring fuel moisture under field conditions. CALM staff were not observed to use the Wiltronics, relying on their traditional methods of oven dried samples and test burns in the field.

There is a need for staff involved in burning to understand the basic principles, and whilst there are a number of aids and electronic tools that make this easier, understanding the basic principles is essential to safe operations and control of the fire.

Part 2 Community Engagement

CALM has had a consistently large and highly visible prescribed burning program over the last 15years. The community recognise this as a necessary land management activity. During our time at WA our team attended a number of burns and the community appeared to be supportive of the burning program particularly in regional locations.

During the master planning process CALM run a series of public meetings prior to spring and autumn to engage key stakeholders (through invitation). These meetings are also open to the public. CALM also uses these meetings to make presentations on initiatives, monitoring results and issues of interest. District or Regional Managers facilitate the meetings because they are a step removed from the planning process. This allows for a more objective presentation and discussion. The managers have well developed engagement skills. Once the plan is finalised it is available for the public to view at all CALM offices.

The majority of CALM staff are committed to the prescribed burning particularly during the planning process. Staff, irrespective of their discipline, have become ambassadors of the prescribed burning program because of this involvement.

CALM, in particular the Science Division has been working closely with local University's to promote prescribed burning and other key land management practices. This has proved to be a successful partnership with CALM benefiting through the interest generated in the graduate recruitment program.

CALM's prescribed burning program is primarily driven by ecological objectives. A broad range of information is available to the public on the knowledge that underpins these objectives in the form of pamphlets, posters and flyers. Another initiative used by CALM is information boards located at visitor facilities throughout their parks and reserves, with key fire messages. Satellite mapping of burn intensity has been a useful tool for interpretation. The best example of this we saw was a poster showing wildfire running into a prescribe burn.

Part 3 Ecological Burning

Overview

The southwest of Western Australia is internationally recognised as one of the World's biodiversity hotspots. Research also suggests that the region has a long history of very frequent fire, both through lightning strikes and aboriginal use of fire. Historically fires would have occurred over an extended period, covering spring, summer, and autumn.

A primary driver for CALM's prescribed burning program is the planned use of fire to achieve nature conservation outcomes. Prescribed burns may have a number of objectives, with biodiversity management outcomes often a primary objective. Even where prescribed burns are undertaken with a primary objective of asset protection they will generally also have prescribed nature conservation outcomes as secondary objectives.

CALM undertake a considerable amount of prescribed burning in parks and forests during spring. Whilst the favourable weather and fuel conditions documented elsewhere in this report are a major reason for this, spring burning is also undertaken to achieve desired land management objectives, including nature conservation outcomes.

Rarely does a burn prescription require a 100% burn across the targeted area. With the emphasis on nature conservation objectives and achieving ecologically sustainable outcomes, the burn prescriptions will usually specify a minimum of 60-70% burnt in order to achieve fire protection outcomes, with a maximum of 70-90% burnt to achieve nature conservation outcomes. Such a prescription allows for numerous unburnt patches to remain within the burn site.

Figure 1. Fine scale mosaic of burnt/unburnt patches resulting from a low intensity spring prescribed burn.

A major benefit of prescribed burning in spring, with mild weather and higher fuel moisture levels, is the reduction in flame and scorch heights, fire intensities and rates of fire spread. This not only increases patchiness of burnt/unburnt areas but also produces a 'fine grain mosaic' of differing fire intensities/severities within the burn area. Burning at this time of year under these conditions allows the protection of some vegetation types and habitat, through the use of fuel moisture differentials.

Figure. 2. Spot lighting in a spring prescribed burn in Jarrah forest.

The mapping of all prescribed burns and wildfires to determine the 'fine grain mosaic' of burnt/unburnt patchiness and fire severity helps to determine whether burn prescriptions and fire protection and nature conservation outcomes are being met.

Prescribed burn frequency in Western Australia is high. This is primarily due to the evidence for a historically high fire frequency. This also allows for a high level of asset protection, due to frequent fuel reduction. Relatively frequent fire also allows for increased patch mosaics and other nature conservation objectives to be met. Fire in long-unburnt areas with significant fuel accumulation will produce an area with almost 100% burnt, and little patchiness, particularly in the case of wildfire or an autumn burn in drier fuels.

Nature Conservation and Fire Management

A considerable proportion of CALM's workforce is employed in the Nature Conservation business, and these staff are closely involved with fire management. This occurs both as operational prescribed burning and firefighting, and in the planning and monitoring process for the use of fire in biodiversity management.

CALM's Nature Conservation staff are heavily involved in the entire prescribed burning program. Burns may be proposed by Nature Conservation staff for biodiversity management. Burn prescriptions are often authored by Nature Conservation staff, particularly for those planned burns which have nature conservation management outcomes as the primary objective.

Regardless of whether burn objectives are for biodiversity management, asset protection, silvicultural, or a combination of objectives, all burn prescriptions include a report on nature conservation issues. These reports are prepared by Nature Conservation staff and, due to their knowledge and involvement in fire operations, are usually practical in nature and any recommendations to adapt prescriptions for nature conservation outcomes are workable in terms of on-ground fire management. Nature Conservation reports will often contain specific biodiversity management issues, such as threatened species or habitat requirements, and also general nature conservation recommendations, such as the need to identify hollows and habitat trees and initiating 'pre-burn mop-up' to prevent fire impacting on these items.

In addition to their involvement in the burn prescription planning process, CALM Nature Conservation staff are heavily involved in fire operations. At one particular burn, which had the primary objective of asset protection and secondary nature conservation objectives (particularly Quokka habitat management), five Sector Commanders were utilised. Three of these were Nature Conservation staff, one Parks and Visitor Services staff, and one fire management staff.

A further example of the importance placed on nature conservation in the fire management program was the deployment of two Nature Conservation staff as observers at the above burn. The observers participated in the pre-burn briefing and discussed lighting patterns with regard to Quokka habitat and dispersal routes. A Quokka sighting pro-forma was handed out to all crews deployed at the burn, and sightings recorded and reported back to Nature Conservation observers, who were present throughout the burn.

Adaptive Management and Ecological Burning

Adaptive management is a widely used and accepted process for public land and fire management in Western Australia. Monitoring by CALM's Nature Conservation and other staff, and strategic applied research undertaken by researchers from CALM's large Science Division and external collaborators continues to build a body of knowledge which provides the basis for fire management and nature conservation directions and activities. The monitoring and applied research validates existing fire management practices and provides the basis for a continuos improvement process in public land management. Fire managers are keen for research to be undertaken and encourage close links between science and practice. The adaptive management process strengthens the links between science, nature conservation and fire, and fire management has evolved from primarily the need to manage fuels, to the need to manage biodiversity.

Pre- and post- fire monitoring is critical to the adaptive management process, and in many cases works crew members are trained to participate in monitoring and the use of databases, in addition to Nature Conservation staff. Monitoring activities include information gathering on fire behaviour, fire effects, vital attributes, habitat and threatened species.

Part of the ecological requirements for flora and fauna is a diversity of fire regimes to maintain habitat and biodiversity. Aspects of fire regimes include fire intensity, frequency, season, and extent and patchiness. Using scientifically-based adaptive management, CALM's burning program for individual blocks involves a combination of spring and autumn burning to achieve a diversity of fire regimes. One of the strategies is a long-term program involving a series of burns with differing seasons and intensities, for example: spring, spring, autumn, unburnt.

Creating a landscape-scale mosaic of age-classes within vegetation types and habitats is an important aspect of biodiversity conservation. Prescribed burning is used in both spring and autumn to achieve this. Low intensity, patchy spring burns are particularly favoured in more fire-sensitive vegetation (for example, granite outcrops) to create a mosaic of age classes, and to prevent large scale, high intensity wildfires creating single-aged vegetation.

Multiple ignition events within a block are often used to achieve the desired outcomes, particularly where several vegetation and fuel types are present, and/or where there are specific vegetation or habitat requirements. On occasions, a prescribed burn within a block may be carried out with multiple ignitions over several seasons to meet several nature conservation outcomes, giving a diversity of seasons, intensities, and patchiness.

CALM, through their Science Division, have developed Adaptive Fire Management Guidelines for improving the use of fire for nature conservation. An example of this is 'Adaptive Fire Management: Interim Guidelines for Forest Populations of Quokka (*Setonix brachyurus*)' (Burrows and Liddelow 2004). Habitat for Quokka populations, particularly riparian gully vegetation, takes about five years post-fire to become suitable, but senesces and declines after 20-25 years, needing regeneration by the use of fire. Adaptive fire management uses prescriptions which will limit fire effects in healthy habitat (for example, spring burning to take advantage of moisture differentials, and lighting patterns which limit fire spread and intensity in gullies), but encourage fire in senescing vegetation (for example, autumn burning in drier fuels, or different lighting patterns to put more fire into gullies). The Quokka is considered to be one of the 'fire regime specific taxa', and it is suggested that managing the landscape with a fire regime that is appropriate for Quokka is likely to be suitable for other organisms (Burrows and Liddelow 2004). This is the same concept as Victoria's 'key fire response species'.

In addition to burning directly for nature conservation, CALM also burn indirectly for nature conservation in a form of 'asset protection', with the asset being threatened species or ecological communities. An example of this is the burning of blocks of vegetation around the perimeter of a swamp reserve, in a mosaic pattern, for the protection of the endangered Western Swamp Tortoise. By burning around the perimeter of the reserve, the risk of a large wildfire burning through the entire reserve

and threatening the critically endangered species is reduced. Research has determined that the Tortoise aestivates in burrows away from the core swamp over summer. Therefore, using the adaptive management process, fire is applied in the surrounding vegetation in spring prior to the dispersal of the threatened species from the swamp.

Figure. 3. Burning vegetation in spring to protect Western Swamp Tortoise habitat from wildfire.

A further example of adaptive management and fire is the issue of fire management in fragmented reserves. These reserves will senesce and decline over time, but applying suitable fire regimes is often problematic due to their small size and isolation. These fragmented reserves are being classified and clustered by bioregion/vegetation type and by size class. A representative sample of reserves from each cluster is selected and fire applied. The results of fire are monitored and, through adaptive management, improved fire regimes can be applied to the fragmented reserves.

There are a number of blocks to which fire is applied with the primary objective of research. The adaptive management process recognises that the level of knowledge in land management is not perfect and, in addition to ongoing monitoring and research of other prescribed burns, much knowledge can be gained and applied through the use of specific research blocks.

Fire management and nature conservation are also linked through the ‘Western Shield’ program, an integrated ongoing hand and aerial-baiting program for foxes, feral cats, and feral pigs. Baiting is undertaken post-burn and post-wildfire and continues on a regular basis for at least a year. Research suggests that predation has a far more significant impact on native fauna than fire.

Overall, there exists a very close working relationship between nature conservation and fire management. There is both a very good understanding of fire management within the Nature Conservation division, and a very good understanding of nature conservation issues by fire management staff.

Political and corporate support exists for the prescribed burning program and its close association with nature conservation management. There is general acceptance in the community for prescribed burning for nature conservation outcomes, with the debate having shifted from 'whether to use fire' to 'how to use fire'. Public understanding of the use of fire in biodiversity management is enhanced through the dissemination of information on fire ecology science and practice via publications such as CALM's *Landscope* periodical, and the publication of a major book reviewing the current knowledge of fire in Western Australian ecosystems (Abbott and Burrows 2003).

It was stated by CALM staff that fire is an integral part of the environment of Western Australia and ecosystems are fire-maintained and, as such, the precautionary principle should be "fire is a natural part of the environment", and not burning is likely to have long-term detrimental effects on species and ecosystems.

Figure 4**.** Demonstration of the principle ***"Fire diversity conserves biodiversity"*** (Burrows 2005).

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Part 4 Planning

Master Burn Planning (MBP)

CALM has introduced a Master Burn Planning process for all prescribed burns that it undertakes. Proposed burns may be planned up to eight years in advance, a period which allows CALM staff to plan for the needs of other forest activities such as tourism, commercial operations and habitat regeneration. The Master Burn Planning process involves burn program development right through to burn prescription implementation. The Master Burn Planning cycle involves a wide cross section of CALM staff engaged in internal meetings held twice per year following the spring burning period and following the autumn burning period. The meetings are workshop style, organised on a regional basis and attended by the Regional Manager and District Managers, Regional Leaders and District Leaders for Nature Conservation, Parks and Visitor Services, Sustainable Forest Management as well as District and Regional Fire Coordinators and Fire Management Services representatives. (Tillman 2005)

Key objectives for the meetings to achieve are to

- confirm burn programs for the forthcoming season (spring/autumn)
- develop an issues statement for each of the burns listed in the forward program
- develop an indicative program for six or more seasons in advance, and
- collectively use the knowledge of all those present in developing the forward look program and the required prescriptions.

In developing the program a meeting agenda is set that covers the following issues:

- prescribed burning achievements from the previous season
- any areas burnt by wildfires
- the requirement to provide strategic protection to community values within the CALM region
- the requirements for achieving biodiversity conservation objectives
- how to try and minimize the potential impact of large scale wildfire by the strategic "breaking" of fire runs
- existing requirements under formal area management plans
- Indigenous Cultural Heritage site information
- established regeneration areas
- non indigenous cultural heritage information (eg Big Tree Register) (Tillman 2005)

Each burn plan that is prepared needs to have clear objectives that are to be SMART **S**pecific; **M**easurable; **A**chievable; **R**ealistic and **T**ime bound.

Burns generally have multiple objectives although one objective may be the main trigger for conducting the burn.

CALM proposes as a Key Strategic Direction – "Managing landscapes and ecosystems (integrating off-reserve and on-reserve conservation including abatement of landscape scale threatening processes)" (*Towards a Biodiversity Conservation Strategy for Western Australia* – Government of Western Australia December 2004)

In developing prescribed burn plans two objectives are usually featured –protection objectives and biodiversity management objectives.

In the Master Burn Planning process the meeting considers nature conservation values and issues including:

- presence of threatened species and threatened ecological communities
- inter-fire period and seasonality
- fire sensitive ecosystems
- poorly conserved and or extensively cleared vegetation types
- nature conservation management considerations (including weeds, pigs, fox baiting programs, Western Shield monitoring sites)
- conceptual burn strategy formulation (Tillman 2005)

In developing detailed prescriptions the following aspects are considered:

- **Threatened species and communities aspects** include the percentage representation of populations within and outside of burns, fire sensitivity, biology life cycle and reproduction aspects including vital attributes. They also include any specific fire requirements referred to in recovery plans. The need for pre-burn field monitoring and survey for new populations dependent on the adequacy and currency of information, requirements for post fire monitoring and the species' status ranking.
- **Fire sensitive ecosystems** include areas such as granite outcrops, mountain tops, riparian habitats, wetlands and fringing vegetation, organic soils and peat swamps, caves and limestone karst features. As well **Salinity Risk Areas** where maintenance of maximum vegetation cover is important, and there is a seasonal preference for autumn burning. *Phytophthora cinnamomi* infected areas where water runoff needs to be minimised.
- **Poorly conserved and or extensively cleared vegetation types** covers the Regional Forest Agreement and other vegetation data analysis, old growth forest types, species richness and other diversity mapping including short range endemic species.
- Examples of **management considerations** include flora permit-holders blocks, feral animals and weeds, implications and possible detrimental impacts, including the need for pre and or post fire control. The use of chemicals especially in riparian zones and the protection of scientific plots, pitfall grids, site markers and exclusion plots. Water monitoring using piezometers and the need for pre post burn recording.
- **Strategy formulation** includes disturbance mitigation strategies regarding disease, sensitive soils, the protection of adjoining high biodiversity values outside of burn (in case of escape) achieved by providing additional resources to conduct the burn. Sufficient water levels (eg: over peat swamps) to achieve the required moisture differentials and determining the season of burning and frequency as related to regeneration requirements (Tillman 2005).

Box 1. An example of a prescription
Overview of issues for burn WLP_ 302 (Walpole – Frankland District)

Banksia verticillata -- Hot burn mid - late autumn, seed to stimulate natural regeneration, seed distribution post burn
Reedia spathacea - protect peat substrate
Bristlebird -- Patchy / mosaic burn and exclusion of section of suitable habitat to provide buffer
Geophytes (*Microtis* and *Caladenia*) burn above ground summer and early autumn (Or when above ground parts are absent)
Granite Outcrop - Nil action.
Wetlands & Peat - burn while moist
General fauna - Mosaic at all scales of burn.
Quokka – modify riparian lighting strategy
Other Points To Consider: Dieback, Management access, Bibbulmun Track, campsites, weeds, post burn feral animal invasion (Bidwell 2005)

Presentation of Issues

All issues are well documented and presented in tabular form making them easy to read and reference. The issues table is provided to all Master Burn Planning meeting nominees. Issues for contentious burns are highlighted in the table by use of a yellow background. Information is also provided in the form of GIS mapping with different layers. The layers include fire history, burn achievements, fire run potential (burns greater than eight years old), projected immediate burn program, sensitivities (flora, fauna, indigenous heritage and regeneration areas) and a forward projection taking into account all of the above.

Prescription preparation and signing

The Prescribing officer gathers and summarises base information from data sets, the GIS system and where possible adopts standard protocols. The District leaders assisted by Nature Conservation team provide recommendations and strategies in the development of the prescriptions. Nature Conservation staff conduct desktop investigations accessing available data and where necessary conduct field assessments to obtain the necessary information. Pre and Post burn monitoring is routine. The Nature Conservation Team prepares a report on the burn including strategies and their recommendations. The Nature Conservation Report format, content and resource commitments are refined and approved in consultation with the NC Regional leader. Fire Coordinators, Prescribing Officers and Output Leaders work through issues utilizing collected data and responses together as a working group. Fire Coordinators develop and implement the consultation plan for the burn program (see chapter on Community Engagement).

The Master Burn Planning Group reconvenes for the signing of prescriptions, review of the issues list and a presentation of the Nature Conservation Assessment of the burns.

Monitoring

As part of the Master Burn Planning process each of the Burn Prescribing Officers and the Nature Conservation team undertake post-burn monitoring.

Burn monitoring methods include:

- Flora and Fauna surveys – population estimates, nest-box surveys, quadrat, plot monitoring and transect data (Nature Conservation)
- Feral animal and weed surveys – sand pads, transect counts, (Nature Conservation)
- Photo Point monitoring – vegetation structure(Nature Conservation)
- Aerial photography (Fire Management Services)
- Satellite remote sensing imagery – classification of biomass changes after burn, fire intensity, burn severity, percentage of biomass changes after a burn (Fire Management Services).

Master Burn Planning Tool

CALM Fire Management Services have developed an ArcView based mapping tool. This tool enables links back to previous Master Burn Plan cycles and ensures there is a flow through of data previously collected. This tool is used to validate achievements from previous seasons, carries over uncompleted burns, creates the new burn program, enables the assessment of the new program against sensitive sites and checks fuel age data.

The new burn program can be produced as an MS-excel format table and a broad scale map can be produced as an Adobe pdf file.

References

Tillman 2005. Personal Communication. Study Tour. November 2005.
Government of Western Australia (2004) Towards a Biodiversity Conservation Strategy for Western Australia. December 2004
Bidwell 2005. Personal Communication. Study Tour. November 2005.

Part 5 Operations

CALM operations for prescribed burning structure is based on the AIIMS, (Australian Interagency Incident Management System) and ICS (Incident Command System). CALM's Model of Fire Cover for resourcing is based on prescribed burning, as CALM undertakes prescribed burning for nine months of the year. Fire prevention and suppression on public land in Western Australia is delivered by CALM's Regional Services (Division), via Fire Management Services (Branch).

CALM are resourced both in staff and equipment to a level which enables the prescribed burning program to achieve desired outcomes. All staff are involved with burning as it is part of their job description, this encompasses staff at all levels, especially in the Regions from on ground operations and support roles.

CALM usually have two conference calls per day linked to Regions and Districts and initiated by the State Operations Officer or his delegate. The conference call is a standing number and can be accessed by any staff from a mobile phone at any time. The purpose of the conference is to plan, discuss and outcomes of previous day burns and what prescribed burning will be undertaken, based on mainly weather and smoke factors. Smoke around Perth and the outer urban does cause CALM problems, to the extent that burning would be postponed if smoke drift affects the city's community. CALM have been working hard to get their message across in the media, as well as education into why prescribed burning is important. The outcome is to ensure weather conditions are suitable and that resourcing of staff and equipment are available for the day's program. The burning operation is based on the prescribed burn plan (see planning). This plan sets the guidelines and framework to undertake burning.

The Operations structure is the same as Victoria with a District Duty Officer within an Office to coordinate and support the Burn OIC (Officer in Charge). The Burn OIC is one of their more experienced staff and usually will have a mentoring role to skill up less experienced staff

Staff Resources

CALM have two main awards, AWU and Public Servants.

AWU

CALM are well staffed, with up to 30 full time AWU field staff at most Districts and work centres throughout the South West. They are funded through various programs, especially Nature Conservation for the monitoring of flora and fauna in the field. CALM do employ additional staff for wildfire response, this is mainly a couple at each work centre, as their full time employees make up the bulk of their operational response staff. CALM is working towards an improved career structure for the AWU based on competency, skill and experience. Award rates in their current structure are higher than what Victoria's AWU receive.

Public Servants

Similar to Victoria, however all staff have a fire role built into their job description. CALM employ staff across all businesses, however one of the main employment functions is Nature Conservation. They are employed for native flora and fauna protection, with a large emphasis on habitat protection using of prescribe fire. They are involved throughout the burn process with the planning, operation (burn OIC and sector commanders) and monitoring of the burn. Staff are expected to undertake a fire role in both suppression and prevention. CALM are able to direct staff though a District model of reporting, which increases resource capacity especially for prescribed burning.

Equipment

CALM seem to be well resourced with a variety of fire fighting equipment. There main mode of fire fighting is using a mid range Isuzu tanker with 2,700 litres of water, these tankers are in a standard single cab and double cab configuration, most Districts and work centres have up to 12 of these units, and are used as their daily work vehicle. Some Districts are supplied with the 750 series 4,000 litre Isuzu tanker with a removable tank which can be replaced with a tipper body when not required for fire operations.

CALM has a range of small slip on vehicles, these are mainly Toyota Land Cruisers and Nissan Patrols fitted with heavier rear springs and with 600 litre units on the rear tray. They use Toyota Hilux with 400litre slip on units. Command vehicles are Toyota station wagons

Due to logging industry scaling down and less logging equipment to access for fire suppression, CALM have purchased additional large bulldozers with floats and prime movers, so that CALM isn't reliant on private contractors for initial wildfire suppression. They also contract private dozers on a needs basis.

They have a number of wheel loaders which have been adapted with a log grab. This machine is used to quickly attended problem areas on the fire line with less impact on the environment, it is able to pick up logs and place them without heaping, such as a dozer would, and is able to push over problem trees a lot easier due to the reach of the lifting tynes.

Aircraft

In addition to their detection towers, CALM own and operate a number of small observation aircraft that are used primarily for inspection of prescribed burns and assist in wildfire detection. They have aircraft that cost around $250,000 and an annual operating budget of $750,000. They are used within defined circuits mainly in the South West area of the state.

CALM contract in helicopter services for aerial incendiary operations and for wildfire suppression.

The use of foam in their contract fire bombers is the preferred method of their aerial bombing, however this year CALM are working on developing mobile phoschek retardant trailers. DSE have been assisting with design, set up and equipment.

Before the Burn

Based on burn prescription, numerous works are conducted prior to burn. Signage is placed on entry points to indicate that the area is to be burnt. Staff use the Red Book which indicates levels of forest fuels and fuel moisture and fire rates of spread in those fuel types, based on the main fuel types in the south west. The 'Wiltronics fuel moisture meter' has only been used over the last 12 months and is gaining support from staff. Written notification is sent to neighbouring land holders and is followed up with an onsite visit. Other agencies are notified such as police, local fire brigades, ambulance, shire offices.

Day of the Burn

Briefing is based on SMEACS format with usually 2 defined outcomes

Up to 70% of area to be burnt for asset protection
No more than 90% of area burnt for flora and fauna

The Burn is broken into sectors mainly for edge lighting, patrolling and looking out for hop overs (spot overs). The approved burn plan is on site, with burn pattern and maps are handed out to indicate burning pattern.

A test burn is conducted to check Rate of Spread, burning intensity and wind direction.

Approval to ignite the burn must be confirmed with the District Duty Officer immediately prior to ignition. This is a quality control measure that ensures all pre burn tasks have been completed, and that there is no higher priority requirement for resources (wildfires or other burns).

Staff are required to walk the road edge and in at least 40metres to ensure that any potential dangerous trees are assessed and are treated. This is part of their public safety while burning program and is due to an incident a couple of years ago, where a person was killed by a burnt tree which had fallen across the road. This process is labour intensive, and is usually undertaken by 2 staff walking each section and the Burn OIC has to sign off (document) the area is safe.

As part of the CALM AWU agreement, a condition of prescribed burning is that crews are required to have a nightly meal at 6.00pm or later by negotiation with the Burn OIC. In addition on weekends, CALM supply all lunches to all staff.

Ignition Pattern

Burning pattern is spot ignition at spacing as per the burn prescription, but usually about 100 metre spacing this allows about a 3 hour junction zone and to a depth of 50 metres plus. The common idea of not putting in too much fire initially is that they can put in more fire later, if required. Generally crew do not undertake core lighting

(internal ignition) due the size of the area being burnt and the thickness of the understorey scrub. This task is undertaken by the incendiary helicopter, which is booked well in advance of the burn. On large burns an ignition officer will be appointed to ensure that ignition points are meeting up and sufficient depth is being achieved.

Communications

All communications are based on CALM's Communication Plan. CALM operate on VHF Simplex channels via repeaters across the state. Districts have predetermined channels.

They use a number base system for individual identification instead of names, for example Blackwood District in the South west area " Blackwood 3 to Blackwood 2". No "check system" to used is used to control radio traffic.

Inter agency incidents, communication is arranged via exchange of radios.

The use mobile phones and coverage is similar to that in Victoria

After the Burn

CALM are audited on prescribed burn mainly though Western Australia's Conservation Council. This body will organise external auditors to assess the planning process, operational procedures and practices, and whether objectives have been met. CALM will have internal District audits conducted as a routine process.

Burn outcomes are mapped by using satellite imagery. CALM use helicopters to map burnt area and confirm by ground checking.

CALM have a satellite imagery team based at Perth to download information from "Modis" (web based program which CALM pays for). With this information they can map burn areas and fire intensity. This information is used to calculate CALM burning targets and information for reporting. Depending on the burn prescription and the fuel moistures, District staff may undertake to prescribe burn a sensitive area over 3 burn periods (this is mainly undertaken for Nature Conservation protection values). This is where they use the helicopter and ground checking to confirm achieved outcomes.

As a follow up measure CALM's Western Shield program is actively used by applying 1080 poison baits to protect the native fauna from fox and cat predation within wildfire and prescribed burn areas. Results from follow up monitoring suggest that native wildlife numbers have increased in these areas due to the baiting program.

Key Messages

The findings and recommendations from this report will be included in the continuous improvement process of FEM. The findings should be considered by all DSE staff involved in the spring burning programs.

All members of the Team expressed a willingness to assist with implementation of any outcomes of this report. The communication of the results of this report may be in the form of regional information forums or workshops with key internal stakeholder groups and practitioners. The key messages for such communications are:

Spring Burning

- Yes it can be done
- It is high risk
- Trial on similar sites (topography, fuel arrangement, total fuel quantities)
- Patrol and mop up like wildfire (resources)
- Model of Cover for prevention and suppression

Accountability

- Not just Protection
- Land Manager / Biodiversity
- Science / Adaptive Management
- Executive Director as State Fire Coordinator

Staff Involvement

- All staff are committed
- Shared responsibility
- District Managed / Coordinated

Ecological Burning

- Driven by land manager / Nature Conservation (Flora and Fauna)
- Goal is overall biodiversity
- Focussed on key species
- Marketed using high profile species (Quokka)
- Fire is the only economically viable tool available for biodiversity management at the landscape scale

Community Engagement

- Facilitated by senior managers
- Focussed on key groups
- Taking science to the people

Planning

- Prescriptions for fire behaviour and land management outcomes
- Monitoring pre and post burn (Biodiversity)
- Report Hectares and Biodiversity outputs
- All data incorporated

Listed below are some other messages that may be used in implementing outcomes of this report.

IT WILL GET IN

Reference to fact that high intensity environmentally damaging wildfires will get into biological reserves if the surrounding forested areas are not treated to prevent the run of intense wildfires. Such intense wildfires by their nature do not allow for the creation of mosaics within the reserves. Recovery from severe wildfire may take geological timeframe, particularly if the wildfire is associated (before or after) with another stochastic event (flood, drought, plague).

BURNING ROTATION

Western Australia describes a standard burning rotation to meet biodiversity needs as spring, spring, autumn, rest, rest. This rotation is considered to create sufficient variability and mosaics within the landscape to provide the diversity needed for ecosystems to maintain their health.

PATROL BY AIR

Patrol by air not only detects any smoke, but also ensures critical evaluation of the significance and potential of any smoke detected. Aerial patrol can determine whether the smoke is located on the edge of the treated area or internally, whether the smoke is from burning material within the burnt (physically burnt) area, whether the burning material is adjacent to unburnt material within the treated area that has or has not potential to cause an escape, or whether the smoke is in fact an escape or other fire adjacent to the treated area.

STAFF CAN FULLY OCCUPY THEMSELVES ON LOWER RISK ACTIVITES

In a society and government agency that constantly talks about reducing risk, it is easy for staff to select tasks that are of lower risk, and fully dedicate their time and energies to these tasks.

FINE GRAIN MOSAIC

This concept has not been fully defined, the intent however is very clear. The philosophy is that the greater diversity within the burnt area than can be achieved through small or fine patches will provide the best diversity to meet ecological outcomes.

MOSAIC ACROSS THE LANDSCAPE

Land managers need to manage the entire land area under their control, creating a mosaic across this landscape is as important as creating a mosaic within the treated area.

FOX AND PREDATOR CONTROL

Within Western Australia they have clearly demonstrated that the impact of predation from the fox in particular strongly outweighs any impact fire has on faunal populations. For the habitat enhancement achieved through burning to be effective for fauna, it must be undertaken in conjunction with predator control

IGNITION PATTERN AND DURATION OF IGNITION

There is a direct correlation between the ignition pattern and time taken to ignite an area, and the fire intensity achieved. Where ignition points are close together or continuous (driptorch) fire intensity and scorch height will be higher than ignition points further apart. Western Australia calculate rate of spread for the day and adjust ignition spacing such that fires join (junction zone) after the hottest time of day or even after dark.

LEARN BY DOING / ADAPTIVE MANAGEMENT

Operationalise the research. Western Australia looked at the financial investment committed over the last decade and how this had translated into improved practices over their entire land management area. Their scientific resources are now clearly focussed on application of science in the field, the more traditional research is used in support. This could also be described as 'Applied' research, rather than the traditional 'Pure' research.

PATROL AND MOP UP LIKE WILDFIRE

For spring burning where the burn site needs to be secure for the entire summer, often under weather conditions far more severe than when the burn was ignited, it is necessary to take strong precautions to ensure the fire is extinguished. The best way to do this is to apply the same standards as for a wildfire.

FIRE IS THE ONLY TOOL FOR LANDSCAPE MANAGEMENT

Fire is currently the only economically viable tool available to land managers to modify the environment at the landscape scale on all land tenures to bring about changes in the environment for the benefit of biodiversity.

ACKNOWLEDGMENTS

Special thanks to Rick Sneeuwjagt, Manager Fire Services and his team at Kensington for their very friendly welcome and ongoing attention to our care and needs whilst in Western Australia.

Terry Maher and Murray Mitchell were tireless in their efforts to facilitate as many opportunities for us to observe, experience and participate in their burning program.

Anna MacDonald for her assistance with our arrangements and chasing up our smallest needs.

Dr Neil Burrows	Director, Science Division
Dr Lachie McCaw	Senior Research Scientist
Dr Li Shu	Research Scientist, Fire Management
Dr Fermena Metcalfe	Information and IT Coordinator
Alan Jones	Fleet and Fire Equipment Manager
Craig Carpenter	GIS Research Officer
Darren Wallace	GIS

Swan Region

Rob Towers	Regional Fire Coordinator

Perth Hills

Kevin Pollock	District Fire Coordinator
Stefan Dehaan	
Sam Herd	
Greg Standing	
Steve Thomas	
Nevin Wittbar	Forests Products Commission
Michael Lobb	Forests Products Commission

Swan Coastal District

Paul Brown	District Manager
Mike Cantelo	District Fire Coordinator
Brian Inglis	District Protection Officer
Lyndon Mutter	Nature Conservation Coordinator
Leigh Sage	Conservation Officer - rare flora
John Wheeler	Ranger - Yanchep National Park
Rod Martyn	Nature Conservation Officer
Owen Donovan	Sustainable Forest Management Officer

South Coast Region

John Tillman	Regional Fire Coordinator

Blackwood District

Greg Mair	District Manager
Brad Commins	Operations Manager
Don Boothey	District Works Coordinator
Rob Turner	District Fire Coordinator
Mick Zwart	Sustainable Forest Management Coordinator
Marika Maxwell	Nature Conservation Officer

Collie District

Drew Griffiths	District Manager
Peter Gibson	District Fire Coordinator
Tom Kenneally	Operations Officer Nature Conservation

Wheatbelt Region

Brett Beacham	**Regional Ecologist**

Warren Region

Peter Keppel	Regional Manager
Rod Simmonds	Regional Fire Coordinator

Donnelly District

Jeff Bennett	District Fire Coordinator
Ian Wilson	District Nature Conservation Coordinator
Dave Moon	District Recreation Planner

Frankland District

Peter Bidwell	District Manager
Donna Green	District Fire Coordinator
Ted Middleton	District Fire Ecologist
Ray Flanagan	

Gary Featherston of Forest Strategy Pty Ltd completed the final edits of the report to make it suitable for release.

Attachment 1

Summary of Findings

1 Instigate Spring burning to develop a diversity of fire regimes.

2 Implement Spring burning through a staged process with trials in forest types of similar characteristics to WA, relatively uniform vegetation, relatively flat terrain and relatively low fuel hazard.

3 Model of Fire Cover in Victoria be based on a combination of Prevention and Response.

4 That the 9 month fixed term seasonal fire contracts include a fixed start and finish time.

5 Implement aircraft to assist with patrol and security of prescribed burns.

6 Increase aircraft availability through extended period (spring), to provide increased ignition capacity, and increased mapping capacity.

7 Increase vehicle fleet capacity to facilitate increased burning. (eg. Mid range tankers, station wagons changed over to trays for slip on units)

8 Single Coordinator / Duty Officer at District level with authority to direct resources to burning (single focus).

9 Each business (especially land managers) to actively contribute resources to burn programs in each District.

10 Increased resources allocated at District level to facilitate FOPS and Burn Plans.

11 Manage burning program through a tenure blind process, across land tenures and across Districts / Regions.

12 Implement scientific and adaptive management as the primary drivers for ecological management.

13 Develop Principles for ecological management (vice Neil Burrows).

14 Better communication of current knowledge - Reinforce work being done on ecological burning by such people as Dr Kevin Tolhurst and Gordon Friend.

15 Investigate ecological impacts of a range of burning regimes (eg WA rotation of spring, spring, autumn, rest).

16 Investigate Spring burning for threatened species management, habitat and threatened species protection.

17 An ecological or land manager representative be present at all burns to monitor non operational factors (eg are prescriptions meeting land management objectives?).

18 Increase ecological knowledge through better information obtained through systematic pre and post burn monitoring.

19 Facilitate improved links between scientific researchers and burning operations to energise adaptive management.

20 Train and reward field staff to assist with pre and post burn monitoring (Certificate IV – Natural Resource Management Modules).

21 Investigate fire intensity mosaic mapping for Victorian vegetation types.

22 Training in weather interpretation and operating of weather instruments.

23 Prescribed burning be included with Response in all Position Descriptions.

24 New recruits (base grade) have project role which includes active fire roles within 1st and 2nd years.

25 Further strengthen mentoring processes to accelerate development of staff's burning skills (AWU, VPS & PV).

26 Reinforce 'Ellis' around rewards and recognition and identifiable brand.

27 Department publicly support staff in the execution of the burning program recognising it is a risky business.

28 Flora and Fauna and other values groups (AAV) to advise on preferred outcomes for all areas available for burning.

29 All departmental data sets be accessible live for fire planning eg: Threatened species/ AAV/ biosites/ WUP/TRP.

30 Community meetings be professionally facilitated (eg: WA use District/ Regional Manager).

31 Information boards at Visitor Facilities to include fire messages (eg: ecological, prescribed burning) other than response.

32 Invite WA experts in fire intensity mapping to visit Victoria.

33 Invite WA operational staff to participate in Victoria's autumn burning program.

Recommendation

That the Model of Fire Cover review for 2007/08 considers the people and vehicle requirements for a program that includes increased spring burning.

Attachment 2

Study Tour Details

Tour Dates

Monday 7th to Friday 25th November 2005

Tour participants

Laurie Jeremiah	DSE Gippsland - Senior FMO - TEAM LEADER
John Van de Paverd	DSE PP - Regional Fire Prevention Coordinator
Ron Patterson	DSE NE - Works Coordinator Tallangatta
Terry Ouroumis	DSE NW - Forest Stewardship Officer
Andrew Arnold	DSE SW - Biodiversity Business and Project Manager
John Stoner	PV West Gippsland - Fire & Environment Program Officer

Tour Coordinators

Alen Slijepcevic	Coordinator Statewide Hazard Management and Prescribed Burning
David Tainsh	Manager Fire Gippsland & Convenor Prescribed Burning Committee

Tour Itinerary

Tour members arrived Perth Monday 7 November. Following a briefing in Kensington on Monday and Tuesday morning, team members broke in to pairs and proceeded to different Districts to observe local burning arrangements.

Team members met at the end of each week to discuss findings and arrange future deployments to maximise exposure to the opportunities available.

Team members returned to Perth on Wednesday 23 and joined Tour Coordinators to finalise observations and receive briefings from key leaders in the burning program.

Date	Location	Tour Members	Task	Contacts
7/11/05	Kensington	All	Induction to WA fire management	Terry Maher, Rick Sneeuwjagt, Murray Mitchell
8/11/05	Kensington	All (am only)	Induction cont.	Terry Maher, Rick Sneeuwjagt, Murray Mitchell
	Wanneroo	RP, JS	Swan Regional Office induction to the district and local issues. Swan Coastal District Office Induction to coastal environment	Rob Towers Brian Inglis
	Kirrup	LJ, AA	Southwest Region Headquarters and Blackwood District	John Tillman
	Mundaring	TO, JV	Travel and meet District staff	Kevin Pollock

Date	Location	Tour Members	Task	Contacts
9/11/05	Wanneroo	RP, JS	Teleconference Met with Nature Conservation staff Tour of Swan Coastal District - Coastal vegetation Fire tower Previous burns Proposed burns Yanchep National Park – previous wildfire Pine plantation burning	Brian Inglis Leigh Sage
	Kirrup	LJ,AA	Red Book, practical application Edge burning, Warner BB 217 next to highway Project Vesta fire research plots	John Tillman Mick Zwart
	Dwellingup	TO, JV	Plavins Silvicultural Burn DO 35 2056Ha harvested last year Edge burning on eastern boundary	Greg Standing Kevin Pollock
10/11/05	Wanneroo	RP, JS	Pine plantation tour Prescribed Burn – Breakwater Drive block Prescribed burn for asset protection UWA/FESA smoke mask research Met Regional Fire Coordinator	Owen Donovan Brian Inglis Mike Cantello
	Kirrup / Narrogin	LJ,AA	Edge and Core ignition Noggerup BB 225 Nature Conservation - Wheatbelt Region	Don Boothey Brett Beecham
	Mundaring	TO,JV	Julimar Burn HMDG 007 564 Ha Biodiversity burn, protection of Western Quoll Traffic management became an issue	Stefan Dehaan Sam Herd Wayne Rhodes Alan Rhodes Clinton Hull
11/11/05	Wanneroo	RP, JS	Met Director Regional Services & Regional Manager Met with Nature Conservation Coordinator Inspected previous days prescribed burn Prescribed Burn – Twin Swamps NR Biodiversity Management burn Western Swamp Tortoise habitat protection Lots of 'hopovers' (*Melaleuca* sp.)	Alan Walker & Alan Sands Lyndon Matter Rod Martyn
	Collie	LJ,AA	Bowelling Burn W 056 Edge burning and initial core ignition using rotary wing	Tom Kenneally Peter Gibson
	Mundaring	TO, JV	2nd day on Julimar burn. Aircraft unavailable – hand ignition used to ignite the middle of the burn Combination of strip and spot ignition (fuel dependant)	Stefan Dehaan Brad Walter Brad Hassen Warrick Treu Paul Dunsten Nevin Wittbar Michael Lobb
12/11/05	Perth	RP, JS, TO, JV	Discussion & Writing up notes Kings Park	
	Kirrup	LJ,AA	BS 049 Hopkins/McGregor Silvics and protection burn Edge and core ignition	Greg Mair Marika Maxwell
13/11/05	Rest day	RP, JS, TO, JV		
	Perth	LJ, AA	Travel from Kirrup to Perth	

Date	Location	Tour Members	Task	Contacts
14/11/05	Kirrup	RP, JS	Met District Fire Coordinator Induction to District Burn planning Operations Prescribed Burns – Jarrah/Marri forest Munro block Catterick block Aerial ignition Aircraft refuelling Met Parks & Visitor Services Coordinator	Rob Turner Don Boothey David Lathwell
	Mundaring	TO, JV	Lewis Block burn – flat rocks road, located 30km East of Pierce Airport. 5026ha Biodiversity burn – last burnt 1996 Aircraft burn cancelled due to strong winds Reconnaissance of burn - Wondoo woodland with pockets of Jarrah - Edged burnt in Autumn 2004	Stefan Dehaan
	Kensington, Wannaroo	LJ, AA	Swan Coast Regional Headquarters Wannaroo District, urban interface and nature conservation reserves surrounded by urban development.	Rob Towers Mike Cantelo Brian Inglis Paul Brown
15/11/05	Kirrup	RP, JS	Morning Planning meeting – District Fire Coordinator Duty Officer Meeting with Regional Fire Coordinator – Master Burn Planning Burn mosaic mapping Inter-fire periods Burn funding Nature Conservation reports for prescribed burns Prescribed burning and Quokka management Prescribed Burns – Munro Catterick	 Rob Turner Brad Commins John Tillman John Tillman / Don Boothey
	Collie		Noggerup Met Wellington District Fire Coordinator	Peter Gibson
	Mundaring	TO, JV	Tour with District Fire Coordinator Forest Urban Interface Previous fuel reduction burns Planned burns and issues High risk areas Public relations	Kevin Pollock
	Wannaroo, Yanchep	LJ AA	2005 wildfire impact on national Park and long unburnt Tuart Burning in coastal heathland Banksia Woodland unburnt 11 years Biodiversity conservation, Western Swamp Tortoise	John Wheeler Leigh Sage

Date	Location	Tour Members	Task	Contacts
16/11/05	Margaret River	RP, JS	Met Burn OIC & Mentor Prescribed Burn – Margaret River Jarrah/Marri/Karri forest Adjacent to township	Claire Forward & Mick Zwart
	Manjimup	LJ, AA, TO, JV	Warren Region Burn on Block system but fuels variable within. Likely to have prescribed fire running all through summer period Fire is not an impact in Old Growth Indigenous Partnerships Community consultation	Peter Keppel Rod Simmonds
17/11/05	Kirrup	RP, JS	Kirrup Office/Work Centre - Burn Prescriptions Planning meetings for next days burn PM Teleconference	Rob Turner / Don Boothey / Greg Mair / Brad Commins
	Manjimup	LJ, AA, TO, JV	Northern Jarrah, compare Spring burning to autumn burning, different plant response (heart leaf) 30 year old unburnt Karri Protection burning around CALM visitor sites Annual Nature Conservation Works Program	Rod Simmonds Ian Wilson
18/11/05	Kirrup	RP, JS	Prescribed Burn – Nelson block Protection & Quokka management Edge lighting Patrolling with Nature Conservation staff	Rob Turner Marika Maxwell / Caitlin Prowse
	Pemberton	LJ, AA, TO, JV	Karri forest Burning coastal heathlands Burning for conservation of Rare Flora	Jeff Bennet
19/11/05	Kirrup	RP, JS	Prescribed Burn – Nelson block cont. Core lighting Met Nature Conservation Coordinator	Rob Turner John Carter
	Manjimup	LJ, AA	Edge and Core Ignition DMJ 023 Northern Jarrah and heathland, some silvicultural areas	
	Manjimup	TO, JV		
20/11/05	Bridgetown	RP, JS	Discussion & writing up notes Rest of day off	
		LJ, AA, TO, JV	Rest Day	
21/11/05	Walpole	All	Presentation on Nature Conservation and Prescribed Burning Field trip – Valley of the Giants Tingle forest Prescribed burn – heathland/woodland	Peter Bidwell Donna Green Ted Middleton Peter Bidwell
22/11/05	Walpole - Perth	All	Depart Walpole and return to Perth	
23/11/05	Kensington	All	Meeting - Group Presentations – Fire Ecology	Neil Burrows & Lachie McCaw
24/11/05	Kensington	All	Meeting – Group Presentations – IT/GIS	Darren Wallace / Craig Thurley / Femina Metcalfe / Li Shu
25/11/05	Kensington	All		

Burns Visited during Tour

Burn Number	**Burn Name**	**Fuel Type**	**Size** (ha)	**District**
W 056	Bowelling	Northern Jarrah	5000	Wellington
BB 217	Warner	Northern Jarrah	204	Blackwood
BB 225	Noggerup	Northern Jarrah	827	Blackwood
BS 049	Hopkins McGregor	Northern Jarrah	4990	Blackwood
SWC 055	Breakwater drive	Coastal Heathland	138	Swan Coastal
	Twin Swamps NR	Swamp vegetation	30	Swan Coastal
BB 001	Catterick	Northern Jarrah	1179	Blackwood
BB 028	Munro	Northern Jarrah	1415	Blackwood
BB 107	Nelson	Northern Jarrah	1368	Blackwood
BS 268	Margaret River	Coastal Heathland / Jarrah	80	Blackwood
HMDG 007	Julimar	Northern Jarrah Wandoo	564	Perth Hills
HMDG 001	Lewis Block	Wondoo	5026	Perth Hills
DO 35	Plavins	Northern Jarrah	2056	Perth Hills
DMJ 005	Iffley	Southern Jarrah	4000	Donnelly
F 410	Giants Campsite	Southern Jarrah Karri	522	Frankland

Attachment 3

Contents of Western Australian Burn Plan

Extract from (Kerr BB029) Blackwood District, SW Region

PRESCRIBED FIRE PLAN
Sections:
Part A: Summary of the Burn, burn objectives, success criteria, monitoring requirements and the signatures of Departmental officers endorsing and approving the prescribed Fire Plan
Part B: The information that has been collected and collated to support the Prescribed Fire Plan.
Part C: The information needed to undertake the burn on the day of burn including all the checklists, prescription and action plan documents and maps
Part D: The post-burn assessments, audits and records.
Part E: Forms associated with various notifications required prior to lighting the burn

A) Purpose of burn:
Protection Burn
To provide strategic protection against damaging wildfire to adjoining Balingup town-site, private property and Balingup pine plantation.
Biodiversity Management Burn
To protect, maintain and enhance biodiversity values and ecological processes within the precinct of Kerr Block.
Success Criteria – Protection Success Criteria, Biodiversity Success Criteria
Monitoring Requirements – Protection Monitoring Requirements, Biodiversity Management Requirements
Prescribed Fire Plan Index
Stakeholder Issue List
Endorsements signatures of staff endorsing portfolio and fire management aspects
Approvals District and Regional Managers

B) Operational Map
Vegetation Stratification Map
Nature Conservation Values Map
Fuel Assessment Summary
Rating System for Prescribed Burning
***Phytophthora cinnamomi* Management Plan** (includes boundary interpretation map)

C) Aerial Burn Flight Plan Checklist
Pre-burn Checklist Part 1 : Environmental Issues Part 2 : People and Property
Operation Officer's Day of Burn Checklist
Fire Management Day of Burn Checklist (for Duty officer, Incident Controller and District Fire Coordinator)
Operation Checklist for Prescribed Burns involving Bibbulmun Tk & Munda Biddi Trail
Notifications
Burn Prescriptions
Sign Management Form and Sign Map

Prescribed Burning Communications Plan
SMEAC Briefing Checklist
Organisational Structure for the Burn
Sector Plan

D) Burn Records (first lighting, fire behaviour, weather observations)
Operational Diaries (Copies of Duty Officer, Incident Controller and Operations Officer Incident Management Diaries and Navigators Flight Log for each aerial operation)
Maps (annotated operational and aviation maps used during the burn with notes, maps created of the burnt and unburnt mosaic, patterns of crown scorch including information on how the map was made, satellite images of burnt and unburnt mosaic and/or indications of fire intensity are to be included in this record)
Post burn Checklist (roading rehabilitation, dieback, water points, weed survey, monitoring
Burn Evaluation (Assessment of outcomes against burn objectives and associated success criteria (Part A) including Community Protection Objectives, Biodiversity Conservation Objectives and Land Management Objectives)
Monitoring records Results of monitoring operations identified in (Part A) including Community Protection Monitoring Requirements, Biodiversity Conservation Monitoring Requirements and Land Management Monitoring Requirements

E) Stakeholder Notifications (Letters to community neighbours etc, Radio Station notifications)
Record of Notifications (listing of landholders, beekeepers etc)
Record of Public Consultation (listing of persons attending consultations)
File Notes on local residents meetings
Record of Discussion (eg. Discussion held between CALM Blackwood and Balingup Friends of the Forest)
Heritage Council of Western Australia (database search results showing listing of Heritage sites at Balingup)
Helicopter Landing Pad listing (landholder sites)