Managing a fiery change

Complex issues are leading to major changes in the way CALM protects forest areas and local communities from the ravages of summer wildfires. Rick Sneeuwjagt and Nigel Higgs explain how the Department is meeting the challenge.

By Rick Sneeuwjagt and Nigel Higgs

Each year, the south-west forests produce big quantities of leaf litter, bark and twigs that dry out and form potential fuel for summer wildfires. If build-up of these fuels is not regularly reduced, our hot, dry and windy summers will turn the forests into a vast arena ready for conflagration. This was shown in the horrendous fires in the summer of 1960–61 that destroyed Dwellingup, Karridale and other forest settlements.

The key to reducing this build-up of fuel is fire itself: low intensity, slow moving fires that create a mosaic of burned and unburned areas of forest. Burned buffers are used to protect towns, settlements, farms, plantations, camp sites, fire-vulnerable plants and habitats and fire-sensitive forest regeneration from wildfires. The aim is to maintain this system of protective buffers by regular fuel reduction burns, carried out to a prescription for the area.

To maintain adequate protection for life, property and other values in the south-west, between 220,000 and 240,000 hectares of forest needs to be 'prescribed burned' each year.

MANAGING SMOKE

The weather conditions that are normally suitable for safe fuel-reduction burning in the south-west forests are frequently the same that lead to smoke being blown by southerly winds into the Perth metropolitan area. This smoke can become trapped below a blanket of warmer air (known as an inversion) for several hours.

To help overcome smoke impacts, the Department of Conservation and Land Management (CALM), in consultation with other agencies, has developed and applied a decision support system that assists in forecasting the way in which smoke may impact on the metropolitan area. While it relies heavily on accurate weather forecasts—for up to four days ahead—the reliability and performance of these forecasts and the efficiency of the system have improved markedly in the past five years, largely as a result of on-going research into the factors that influence smoke transport and build-up.

The decision support system has reduced the number of incidents each year in which smoke from CALM burns has resulted in haze in the Perth metropolitan area. For example, in the past five years, the annual number of instances of reduced visibility has fallen from about eight to 10 incidents to just two or three.

An analysis of Department of Environment Protection data since November 1994 reveals that no smoke from CALM prescribed burns has exceeded the new National Environmental Protection Measure standard for fine particulates (PM10) at any of the air quality monitoring stations in Perth. The data show that the standard has been exceeded on several occasions in winter due to domestic wood stoves and in mid-summer as a result of wildfires and vehicle emissions. But the limits have not been exceeded in spring and autumn, when CALM's main

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Low intensity patchy fires protect valuable native forests from wildfires and have little impact on native animals.
Photo – Jiri Lochman

Left: Shredding bark contributes significantly to fuel build-up. It is a major source of fire spotting, which can occur several kilometres ahead of the main headfire.
Photo – Jay Sarson/Lochman Transparencies

planned burning in the south-west forests is undertaken.

Photochemical smog also impacts the Perth metropolitan area. It is a pollution cocktail caused by the reaction of nitrogen oxides (NO_x) and reactive organic compounds in the presence of heat and sunlight. Studies indicate that air temperatures higher than 30°C, and full sunlight are important ingredients to the generation of photochemical smog. Thus, this phenomenon tends to be a summer problem, and rarely occurs in spring and autumn when most planned burning is carried out. However, summer bushfire smoke can result in significant photochemical smog events, especially when the reactive organic compounds in bushfire smoke react with vehicle and industrial emissions on hot, sunny days.

As many of Perth's high photochemical events are triggered by smoke from summer bushfires, there is a real concern that these pollution events will increase because of bigger and more intense wildfires if the fuel build-up in the forest is not managed.

OPERATIONAL FACTORS

The mixed karri-jarrah-marri-tingle forests of the southern forest regions dry out at different rates and therefore burn at different times. So that these mixed forest areas are burnt at prescribed fire intensities and fire spread rates, they need several lightings. Each ignition is targeted to burn a mosaic of each major vegetation type as the fuel moisture dries out. Once such an area is lit on the first occasion, it is important for the security of the burn and the safety of the adjoining values that subsequent ignitions are undertaken as soon as each fuel type becomes available. If this is not done, there is a serious risk that the smouldering fires within the burn will become fierce, uncontrollable fires should severe fire weather occur before they are completed.

The risk of escapes from partially completed mixed-forest burns can increase dramatically from late November to early January when the sudden onset of severe weather conditions involving strong, hot and dry north-east and north-west winds can occur. Although this risk is best minimised by restricting the number of 'live' and incomplete burns, it also means that very few planned fires can be carried out if weather conditions are also unsuitable for safe, low intensity burns and smoke dispersion.

The requirement to apply multiple ignitions to ensure the safety of burns will often override smoke management constraints, and thus there may be a risk of haze in the Perth metropolitan area from these follow-up ignitions.

THE IMPACT

Smoke management constraints on planned burning have become more severe in recent years due to the increasing demands for 'zero smoke tolerance' in Perth. The impact of this is that CALM achieved only half its planned burn program in 1998–99, and only about 65 per cent in 1997–98. The backlog in overdue burns has reached its highest level in the northern forests, where smoke impacts on Perth are likely to be greatest.

As at the start of the current burning season, approximately 70 per cent (490,000 ha) of the northern forests were carrying heavy fuel loads that will burn intensely and uncontrollably, even under mild summer conditions. The potential now exists for large conflagrations similar to the 1960–61 Dwellingup fire (150,000 ha) and with even greater potential to destroy local communities and forest values. The situation is only slightly better in the central and southern forest areas where approximately 65 per cent of all forests, including fire-sensitive regrowth stands, are carrying heavy fuel loads. Significantly, the area subjected to planned burns in the past two years is now below the average area that was

PLANNED FIRES

CALM uses fire in a planned and specific way to protect community assets and to ensure that the State's forests, parks and reserves are managed sustainably.

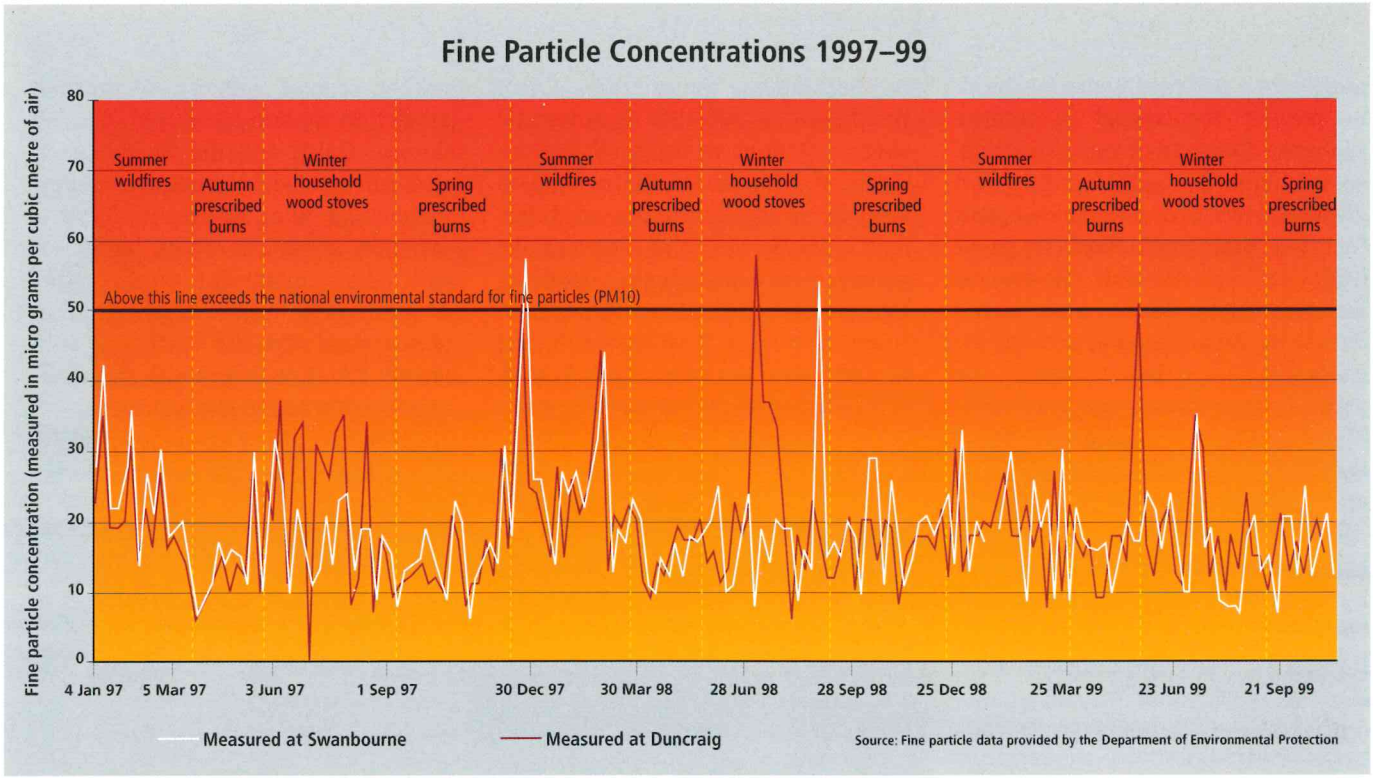
Fuel hazard reduction burns are located strategically within lands CALM manages and are aimed at protecting life, property, community assets and environmental values including fire-sensitive species. Forest fuels in these areas are reduced regularly so that wildfires can be readily suppressed on most summer days.

Ecological management burns use fire in a specific way that maintains and enhances the ecological processes on which native plants and animals depend. An example is using planned fires to regenerate thickets that grow along streamlines in the Perup Nature Reserve east of Manjimup. These thickets are valuable habitat for a range of native mammals, several of which are on the threatened species list.

Regeneration burns are used to create nutrient-rich ashbeds in the karri forest that enable seedlings to grow vigorously after harvesting. Similar burns are used in the jarrah forest to stimulate the regrowth of jarrah from underground lignotubers.

Young jarrah regrowth emerges through gaps in the forest canopy following carefully prescribed silvicultural burning.

Photo – Chris Garnett/CALM



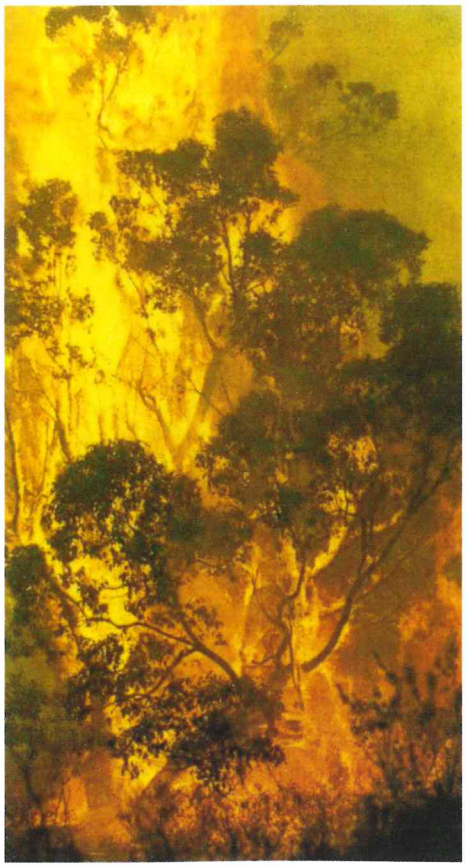
burnt by the Forests Department before the summer of 1960–61.

FIRE SAFETY

The intensity of a bushfire—its 'killing power'—is directly related to the amount of fuel available to burn. Fires burning in south-west forests become uncontrollable in summer whenever fuel loads are more than eight tonnes per hectare in jarrah forests or 18 tonnes per hectare in karri forests. This may occur between five and 12 years since the previous burn, depending on the forest type.

If fuel loads are maintained below these critical levels, there are relatively few days each summer when fire intensities exceed limits at which ground forces cannot suppress fires safely. On the other hand, if jarrah fuels accumulate to 15–20 tonnes per hectare, uncontrollable fires can occur on about 130 days each year.

Most importantly, fuel-reduced areas provide safer working conditions and refuges for firefighters. Without such low-fuel areas, the risk to the lives of firefighters increases dramatically. CALM has a proud record of fire fighter safety in the forest regions since the advent of broadscale planned burning. Unlike some other Eastern Australian States and USA experiences, there have been no CALM firefighters killed by bushfires in the past 40 years. Many of them have taken advantage of previously burned areas to ensure their safety in potentially dangerous situations.



Above: Australia has one of the strictest national standards for air quality. This graph shows the occasions on which the amount of smoke particles (commonly known as PM10) in the air exceeded the national standard. The readings were taken at the Department of Environment's monitoring stations in Swanbourne and Duncraig, two of Perth's coastal suburbs.

Left: Rapidly spreading fires are difficult to control, risk community assets and endanger the lives of fire fighters.
Photo – CALM

A SAFER COMMUNITY

Fuel reduction burning is a pivotal part of the overall strategy for minimising the damage that wildfires can inflict on townships, forest communities and the urban-rural interface. It is true that prevention measures such as house design, maintenance of clear areas and firebreaks around buildings, provision of sprinkler systems and fire equipment are important strategies for survival in fires in rural-urban areas. But only strategic fuel reduction burning in areas of heavy vegetation can prevent extensive, high intensity fires accompanied by burning embers, intense heat radiation and flames from assaulting local communities.

Alternatives to planned burning, which include mechanical and manual removal of fuels and vegetation, grazing and herbicide treatments, do not

provide for a sufficiently wide fuel break to prevent the spread of intense wildfires. The long-distance 'spotting' of wildfires—fireballs being blown great distances from a wildfire—means that low fuel zones need to be at least one kilometre wide. Mechanical fuel removal on such a scale is not only environmentally and ecologically unacceptable, but would be prohibitively expensive to maintain.

To help meet the challenges, CALM is developing and implementing a range of measures so that all suitable opportunities for safe and effective burning are used to achieve the planned burning target of around 220,000 hectares a year.

SMOKE AND WEATHER

Research into improved weather and smoke transport prediction systems has been among the priorities. CALM has funded a network of automatic weather stations in the south-west to enable the Bureau of Meteorology to base its weather forecasts on better data. CALM has also run smoke management workshops involving external agencies and Bureau research scientists. One such workshop, hosted by CALM and the Bureau last August, resulted in an agreed research program for the development of a Smoke Transport Prediction System, which will be coupled with a new weather prediction system developed by the Bureau. CALM and the Bureau have also participated in studies to better understand the nature of Perth's radiation inversions. These initiatives will be integrated into the Government's Air Quality and Management Plan for Perth and will provide CALM managers with improved tools for scheduling planned burns.

CALM is also helping coordinate this research at an Australia-wide level.

Right: CALM firefighters make safe live edges during planned burning.
Photo – Jiri Lochman

Below: Low instensity planned fire in the Blackwood River Estuary near Augusta safely removes ground fuels. Scorched lower shrub layers quickly re-establish from resprouting and seedling regeneration.
Photo – Bill Bachman

Left: Smoke from CALM planned burning near Pemberton is directed away from population centres by accurate forecasting and burn scheduling.
Photo – Dennis Sarson/Lochman Transparencies

Centre left: Low intensity planned burning in the jarrah forest consumes ground fuels and reduces the severity of subsequent wildfires.
Photo – Rick Sneeuwjagt/CALM

Below left: Native plants are well adapted to recover from wildfires. Here a banksia is respouting to replace its burnt canopy.
Photo – Bill Bachman

These efforts will help improve the current level of knowledge and understanding of complex weather processes that affect smoke transport and smoke accumulation.

CONCLUSION

These measures are being developed so that CALM and other fire authorities can maximise the few safe fuel hazard reduction opportunities that arise each burning season. However, it is inevitable that there will be occasions when there is short-term inconvenience caused by haze from prescribed burns. The real challenge is for the community and land managers to balance these occasions against the likelihood of more intense summer wildfires.

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A special edition of *LANDSCOPE—Fire: the Force of Life*—features eight articles on fire previously published. It is available from CALM for $6.95.

2001154-04-5M

Published by the Department of Conservation and Land Management.
Executive Editor: Ron Kawalilak. Editors: David Gough and Carolyn Thomson-Dans. Story Editors: Rick Sneeuwjagt and Nigel Higgs. Designer: Tiffany Aberin.

DEPARTMENT OF Conservation AND LAND MANAGEMENT