

Fire fighting cont... Most large plantation fires occur in drought conditions. In such conditions, ready access into the plantation or to adjacent land by earthmoving machinery will be necessary to allow effective mineral earth containment line construction before the onset of adverse weather. Planning of plantation access at the pre-establishment phase must take into account such considerations.

Key points for communities

The softwood plantation type, the fuel hazard, the terrain and the fire climate need to be considered in determining the fire risk posed by plantations to adjoining communities.

The locations and widths of fuel reduced buffers and firebreaks needed to provide an adequate

level of protection to plantations and adjoining communities assets will depend on the location of the plantation and the critical community or private assets with respect to slope and adjoining fuel type.

Neighbouring properties located within 500 metres downwind of a

softwood plantation wildfire may experience significant ember attack under conditions of Extreme Fire Danger. However, such properties should be able to be defended by properly equipped homeowners, if appropriate steps have been taken to reduce potential fuels surrounding buildings and other sensitive areas.

Protecting communities from wildfire

Regardless of how well the fuels are managed within the plantations, the fire risk will remain high if there is a build up fuels surrounding the plantations and within the communities. Thus, management of fuel within plantations and surroundings is arguably the most effective practical method of reducing the risk of property loss from wildfires.

There is a common public perception that pine plantations are a major fire hazard. Whilst it is true that softwood plantation can develop crown fires under high fire danger conditions, the spotting distances are relatively short (less than 500 metres) and much less than eucalypt forests fires that often spot several kilometres ahead of the main fire front. Whilst ember attack is recognised as a major source of residential structures catching alight during bushfires, it is not practical to establish plantation-dwelling separation distances based on possible ember attack ranges as these can be several hundred metres for pine plantations or several kilometres in the case of eucalypt forests.

Communities must recognise the need for effective fire protection actions in their own environment, to complement the fire protection measures undertaken in adjacent plantations, and the fire suppression resources provided by forest protection agencies. Effective partnerships between plantation owners, fire authorities and local communities are essential to ensure effective fire protection for the forest owner and the community.

Looking ahead...

The increase in Australia's softwood plantation area is expected to continue over the next two decades. This will see many plantations on cleared agricultural lands that have previously carried predominately grassy fuels. This growth in plantation cover is creating new fire management issues related to fire behaviour, fire suppression and firefighter safety. At the same time creation of such a high value asset brings with it new resources to protect from and suppress fires. The risks associated with fires burning into or out of softwood plantations can be minimised through adequate planning and implementation of fire protection measures. For this reason, there needs to be a continuing strong focus on strategic planning of softwood plantations that recognises the risk of wildfire to the plantation as well as its neighbours.

For more reading see the full report: *"Softwood Plantation Fires Synopsis"* compiled by the Forest Fire Management Group – a Sub Committee of Forestry and Forest Products Committee of Primary Industries Ministerial Council.



FOREST FIRE MANAGEMENT GROUP

Softwood Plantation Fire Synopsis

Softwood plantations play an important role in the economies of both Australia and New Zealand. The pine species used in these plantations are relatively sensitive to fire so effective fire management is an essential part of plantation management. This report summarises knowledge of how wildfires behave in softwood plantations, and of the land management actions that can be taken to protect these forests, their adjoining neighbours and communities, and the safety of firefighters.

Key findings

Wildfires of even moderate intensity will generally kill or severely damage the softwood plantation stands to the degree that salvage and/or re-establishment will be necessary.

Planning for the protection of softwood plantations from wildfire should commence prior to plantation establishment. This planning must include strategic protection factors such as plantation shape and size, access networks, fuel breaks, water supplies and proximity to other land uses and vegetation types.

Plantation management practices throughout the rotation in and adjacent to plantations should be linked with fire protection requirements where practicable. Fuel reduction or modification through

use of fire, pruning, thinning, grazing or crushing of fuels can significantly reduce the level of fire hazard in plantations.

Wildfires in softwood plantations generally have rates of forward spread that are equivalent to the rates of forward spread experienced in eucalypt forests under the same fire weather conditions. However, the potential for medium and long distance spotting is markedly lower in softwood plantations than in eucalypt forests.

At Extreme Forest Fire Danger levels, wildfires in softwood plantations will generally have rates of forward spread that are 30%-40% less than wildfires burning in grassland, heaths or other non-forest fuel types where prevailing winds

can impact directly on the flame zone.

Crown fire formation in softwood plantations can cause the rate of forward spread to increase by as much as two to three times. This sudden change in fire behaviour has significant implications for fire suppression operations, particularly in terms of firefighter safety.

As part of a broader risk management strategy, well maintained firebreak and access track networks are required to restrict initiating wildfires from spreading to and impacting on adjoining communities.

Plantations inevitably occur amongst other vegetation types and land uses so fire behaviour of plantation fires cannot be looked at in isolation.



This document summarises a report *"Softwood Plantation Fires Synopsis"* compiled by the Forest Fire Management Group – a Sub Committee of Forestry and Forest Products Committee of Primary Industries Ministerial Council.

Endorsed by Australasian Fire Authorities Council Ltd (AFAC).



Fire sensitivity of softwoods

Softwood plantations are fire sensitive. Of the major Australia and New Zealand species, *Pinus radiata* is the most sensitive to moderate and high intensity wildfire, while *P. pinaster*, *P. elliotii* and *P. caribaea* are more resistant to moderate fires.

Tree deaths and reduced growth by survivors are primarily caused through stem and crown damage, with the extent of crown scorch primarily determining the magnitude of impact. The length of time a fire burns in relatively dry heavy fuels or duff layers will also influence the amount of stem damage.

Moderate intensity wildfires will generally kill or so severely damage the plantation that salvage and/or re-establishment will be necessary. However, low intensity fires do not adversely affect the major softwood plantations species provided that large woody fuels such as ground logs and old stumps do not ignite and burn.

Fire behaviour

Fire behaviour in softwood plantations varies with the age of the stand and the effect of silvicultural operations upon fuel loads and distribution, and by the amount the pine plantation is interspersed amongst other vegetation types.

Rates of forward spread of wildfire in pine forests are similar to those encountered in eucalypt forest. In extreme conditions the rate of fire spread in plantations is 30-40% less than wildfires burning in grassland or scrub.

Generally speaking, the potential for medium and long distance spotting in softwood plantation fires is markedly reduced in comparison with eucalypt fires. Under Extreme Fire Danger conditions, when relative humidity is very low, mass short distance spotting by embers (at distances up to 200 metres) is a prominent feature of wildfires in softwood plantations. Softwood plantation wildfires do not normally spot beyond 500 metres, unlike eucalypt fires that can spot over long distances (up to 10-15 kilometres) under the same weather conditions.

The biggest danger in softwood plantation fires is the formation of crown fire particularly in unthinned stands. The crown fires can result in a rapid increase in the rate of forward spread and the fire intensity. This sudden change in fire behaviour can have serious implications for fire suppression and firefighter safety and should drive fire protection efforts.

Protecting plantations from fire

Planning for the protection of softwood plantations from wildfire should commence prior to establishment of the plantation. Planning and implementation of plantation silvicultural treatments throughout the rotation should be linked with fire protection requirements where possible. Fuel reduction burning, pruning, thinning, grazing and the crushing of slash can significantly reduce the level of hazard in and adjacent to plantations.

Historically, the vast majority of wildfires that have occurred in well-managed softwood plantations have been kept small due to good access for fire-fighters, good access to water supplies and a network of firebreaks and fuel reduced areas. This picture could change dramatically if emphasis on managing softwood plantation fire risk decreases, and the availability of skilled and well-equipped firefighters also diminishes.

Fuel characteristics:

The fuels that provide the energy flux that enables a fire to spread forward are generally those fuels consumed in the continuous flaming zone of a fire front. The amount of fine fuels in plantations, such as needle and twig litter less than 6 mm in diameter, is the major fuel variable in determining the fire hazard and behaviour of fires in plantations.

The level of the fine fuel hazard depends on the fuel moisture content, and the fuel parameters within the stand which includes the fuel structure, composition, continuity and load. The fuel parameters will change over time as a result of plantation treatments, fuel accumulation and fire management.

The rate of fuel accumulation and other in fuel changes structure are important in:

- Determining the fuel quantity and structure, and thus the potential rate of spread and intensity of bushfires at any time during the plantation rotations.
- Determining the changes in fuel quantity and structure over the rotation of plantation particularly following thinning, pruning and harvesting operations.
- Determining the degree of difficulty of suppression at different stages of fuel development in the plantation, and
- Determining the changes in bushfire threat and hazards of forest plantations in the region.

The space between the surface fuels and the base of the tree crown will influence the likelihood of crown fire formation, as will the spacing between tree crowns.

The level of fire protection measures undertaken or achieved in softwood plantations is a function of many things including the physical setting, climate, the age of the stand, funds

invested in protection by the owner, the regulatory environment, and actions occurring (or not occurring) on land adjacent to the plantation.



Key points for reducing risk

Site selection factors will have a significant influence on the fire risk profile and protection measures required. For example, plantations situated adjacent to and downwind (relative to the prevailing adverse fire weather direction) of large tracts of fire prone vegetation with difficult access will have a much higher risk profile and require greater protection measures than plantations located in less fire prone sites.

Fire breaks in or beside a plantation should be of sufficient width (e.g. 10 metres) to provide for rapid access by fire-fighting equipment whilst also meeting the firefighter safety requirements and suppression objectives (e.g. providing

containment lines from which to backburn safely from the plantation boundary to protect the plantation from approaching fires).

Access routes near, between and within compartments should be of sufficient width (e.g. 5-6 metres) and network spacing that allows fire suppression resources safe and expedient access into and out of the plantation and to fires for direct and parallel attack.

Wide firebreaks, and other large gaps in the plantation canopy, can create turbulent wind effects that may cause unexpectedly severe wildfire behaviour.

Compartment size and strategic perimeter and internal fire break dimensions should vary according to the risk of wildfire starting and spreading from plantations, and should consider the terrain other factors influencing the difficulty of suppression.

Strategic fuel modification programs based on thinning, pruning, prescribed fire and mechanical treatment or removal of fuels will significantly improve plantation protection. The location and extent of such treatments should be prioritised according to the ignition potential and the consequences on the plantation assets and adjoining community assets.

Fire fighting in softwood plantations

As with all wildfires, the capacity to mount an aggressive first attack in or close to the plantation will most often determine the outcome. If first attack fails, wildfires in softwood plantations will generally be more difficult to suppress than wildfires in grasslands.

Well-managed softwood plantations with good access and short turn around times to water points provide firefighters with best opportunity to safely and effectively attack and control wildfires even under high fire danger conditions. In most cases, 'wet' firefighting techniques involving the use of water and/or foam directly on the fire edge is an effective means of rapid control of initiating wildfires.

Fireline construction with heavy machines in young unthinned or unpruned plantation stands can be very difficult, and established roads and tracks will usually have to be used as control lines if direct attack fails. Smaller machines that can work between rows can increase suppression effectiveness.