

FIRE PROTECTION OF PLANTATIONS OF *P. RADIATA*

Notes for Meeting with Officers of State Forests of NSW, Bombala 1.8.96

Fire Behaviour

Although the fuels under pine plantations appear to be quite different to fuels under eucalypt forests, the primary factor determining the difference in fire behaviour is the extent of the gap between the surface fuel and the aerial fuels in the tree crowns.

In eucalypt forests this gap is created rapidly from a young age by the self-pruning habit of the eucalypts. In dense conifer forests, regenerated naturally, the gap develops through early suppression of lower limbs and subsequent breakage by weathering or decay while they are small. In un-managed conifer plantations this gap may develop more slowly as wider spacing allows larger branches to develop at low levels.

The McArthur fire behaviour guide for eucalypt fuel on the back of the forest fire danger meter appears to predict fire spread reasonably well for surface fires in pine plantations using a fuel load of 12.5 t ha^{-1} and up to a fire danger index of 25. When crown fires develop the fire spreads around 3 to 4 times faster than predicted by McArthur.

Fires in eucalypt forests, when fires are large and wind speeds are high, will also spread 3 to 4 times faster than predicted by McArthur.

Once a crown fire has developed the age of the stand, and therefore its height, appears to have little influence on the rate of spread.

The maximum recorded rate of spread of a crown fire in undulating terrain is around 12 km p/h at a FBI of 100 plus (Mt Muirhead fire SA - 16 February 1983).

Long-distance spotting from conifer forests is relatively rare and usually attributed to patches of eucalypt within the plantation.

Most spotting from pure conifer fires is less than 3 km. Very heavy short distance spotting can occur under low humidities where the primary firebrand are small flakes of radiata bark.

Flame heights from crown fires are commonly 3 to 4 times tree height. Extreme flashes have been observed up to 300 m.

The close packed nature of conifer crowns clearly illustrates surges in fire behaviour after the event in the form of crown fire streets.

Crown fire streets are caused primarily by fluctuations in wind direction or wind speed. There is little field evidence to suggest any peculiar atmospheric motion as suggested by horizontal role vortices.

The initiation of crown fires depends on the intensity of the surface fire I , the bulk density of the crown, the foliar moisture content, and the height to crown fuels.

Prescribed burning

Prescribed burning under *P. radiata* is possible but, in practice, the window of opportunity is very narrow.

Burning with a spreading surface fire is impractical unless a significant gap has developed between the surface fuels and the crown fuels.

Burning in fuels composed only of needle litter is easy and can be carried out under a relatively wide range of burning conditions.

Needle litter will burn at a higher moisture content than eucalypt litter. The moisture content of extinction for pine needles is around 25% compared with 18% for eucalypt litter.

It is very difficult to burn **green slash** without an unacceptably high level of total fuel consumption.

It is virtually impossible to burn **red slash** within stands without causing unacceptable levels of damage.

Grey slash can be burnt within pines but the window of opportunity is very narrow. This window is usually achieved between 1 and 3 days after rain and the burning must be timed to remove the needles suspended in the slash pile while the surface litter is moist to carry a fire.

Needles suspended in unpruned trees can be burnt during or soon after rain without damaging the tree but this is very difficult to do operationally without a dedicated crew and perfect timing.

Residual material from previous clearing operations complicate prescribed burning very much.

Fire effects

Tree death from scorch will usually result if:

- more than two thirds of the green crown is scorched; or
- the leading leader of the tree is scorched (even though much of the lower crown may remain green).

Low-intensity fires in litter and pruning slash less than 500 kW m^{-1} cause little butt damage in trees greater than 16 years old. Slash piles from thinning operations close to the tree or smouldering logs against the tree will usually cause quite severe butt damage.

Trees propagated from cuttings have much thinner bark near the ground than seedlings and are much more sensitive to fire damage.

Old log and branch material from thinning operations often burns out completely under summer conditions and can cause quite high scorch and tree death from a relatively low-intensity fires.

Once a tree is damaged by fire which induces resin flow this resin will be ignited by subsequent fires and the damage will be extended.

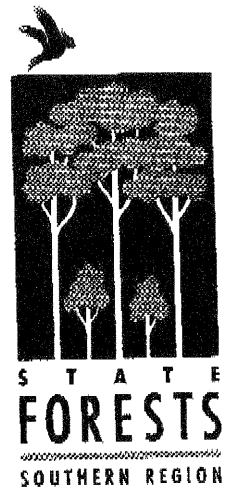
Burning under low temperatures (i.e. less than 10°C) will minimise scorch height and reduce the chances of igniting resin at prescribed fire intensities.

Removal of surface litter in pine plantations raises the soil PH and accelerates decomposition of the duff. Burning increases the proportion of nitrifying bacteria and fungi in the soil flora and the increased decomposition of the hyphal layer provides for better soil aeration and greater wet-ability.

- In the ACT 18 year old stands of *P. radiata* which had been prescribed burnt withstood the severe 1968 droughts much better than adjacent unburnt stands. There was far less drought die-back indicating improved soil moisture conditions.

FACSIMILE TRANSMISSION

To	CSIRO - Fire Behaviour & Management		
Attention	Jim Gould	Date	10/7/96
Your Fax	06 281 8348	No of Pages	1
From	General Manager / Operations Manager		
Subject	Fire Management	Reference	A591/GJG:DB



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Dear Jim . . .

In regard to fire management of our *P. radiata* plantations some questions spring to mind:

- Fire behaviour - pine fuels
- Fuel loads
- Effectiveness of fire breaks/design
- Fire behaviour - thinned versus unthinned
- Fire behaviour - pruned versus unpruned
- Effective strategies to control fire in pine
- Management of fuel in plantations

Is your Unit able to throw any light on these subjects ?

I hope to be in Batemans Bay on 25 July 1996 and could either talk then or you may care to give me a ring to discuss.

Regards

Graham Gray

STATE FORESTS OF NSW

BOMBALA DISTRICT



CSIRO FIRE BEHAVIOUR WORKSHOP AGENDA

*** Thursday - 1 August 1996 ***

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|------------|---|
| 8.00 am | Brief discussion of issues concerning Bombala District. |
| 8.30 am | Travel to Bondi State Forest. |
| 9.00 am | Stop on Buldah Road - Firebreak Compartments 220/221.
Discussion points: <ul style="list-style-type: none">* firebreaks and effectiveness.* management of stands - thinned v unthinned;
pruned v unpruned and fire behaviour. |
| 10.00 am | Morning Tea |
| 10.30 am | Stop on border at Buldah Road.
Discussion points: <ul style="list-style-type: none">* fuel reduction in adjacent native forest.* effectiveness of fuel reduction burning as a firebreak.* critical fuel loads. |
| 12.00 noon | Stop at Goldfields Lookout.
Discussion points: <ul style="list-style-type: none">* management of adjacent moist tablelands hardwood regeneration.* burning prescriptions for regeneration. |
| 1.00 pm | LUNCH |
| 2.00 pm | Stop along Wattle Scrub Road - Inspecting Reserves.
Discussion points: <ul style="list-style-type: none">* effect of reserves on fire behaviour.* management of hardwood reserves, fuel reduction burning and access. |
| 3.00 pm | Return to Office: Summing up of main discussion points. |