Fire Management Branch
Dept. of Conservation and Environment
ISBN 0-7306-2654-7

Eucalypt Bark Hazard Guide

RESEARCH REPORT No. 32

A A G WILSON

MAY 1992

Copyright

A Victorian Government Publication.

Published by the Department of Conservation and Environment, 240 Victoria Parade, East Melbourne, Victoria, 3002, Australia, to whom all enquiries should be directed.

About this guide ...

"Spotting" in eucalypt forests commonly determines success or failure in controlling wildfires or managing prescribed burns. Spotting potential depends substantially on the surface texture and condition of eucalypt bark.

This guide has two purposes, and is presented in two parts:

Part 1

Purpose

To show how to assess bark hazard, to help ensure that:

- Strategy of wildfire control will be effective (in terms of method of attack, suitability of planned or existing control lines, and adequacy of resources)
- Conduct of prescribed burning or back-burning will be effective (in terms of actions to ensure that spotting does not breach control lines)
- Safety of fire control personnel will not be threatened, and
- Sites that require fuel reduction are identified correctly.

Audience

- Supervisors of fire control operations or prescribed burns, and
- Personnel who participate in the scheduling of fuel reduction burns.

Part 2

Purpose

To outline the technical details involved, eg:

- The spotting process and the factors that affect it
- The technical basis of the bark hazard classification
- The reduction of bark hazard by fuel reduction burning, and
- The application of the classification in fire planning.

Audience

- Fire specialists such as planners, managers and researchers, and
- People who seek a greater understanding of spotting, or who wish to scrutinize the basis of the classification.

Part 1 - Assessing bark hazard

The recommended method of assessing bark hazard is to match the appearance of the larger trees (especially those with diameter greater than 30-40 cm, if present) to one of the four hazard categories that are described and illustrated in the following pages. The procedure should be tailored to the assessment circumstances and purpose:

While evaluating strategies for using wildfire control lines,
Assess the trees on both sides of the control line, within a few kilometers (for indirect attack) and especially within a few hundred metres (for both direct and indirect attack).

While ensuring that a prescribed burn or back-burn does not breach a control line, or identifying situations that may be dangerous to fire control personnel,
Assess the trees with 50 metres of both sides of the control line, especially adjacent to the control line and along parts of the control line that may be downwind or uphill of the fire.

While determining whether fuel reduction is needed,
Assess the whole area and take note of variation between different parts of the area.

While conducting fire behaviour research,
Formalize the process by establishing transects and assessing the trees within 10-20 metres of each sampling point.

Four categories of bark hazard

Moderate hazard

Very little bark is available to allow spotting to occur.

This category is characterised by:

- fibrous and stringybark eucalypts where the bark is well charred and tightly held on the whole trunk,
- eucalypts with very tight, platy or fibrous bark, such as ironbarks and Grey box,
- gum-barked eucalypts which do not produce long ribbons of bark. Examples include Red Gum, Snow Gum, Yellow Gum and Swamp Gum.

Fires with a flame height of 0.5 m will not "climb" these trees, and so spotting generally does not cause a problem.

Spotting should not defeat the Reference Initial Attack of wildfires up to a Forest Fire Danger Index of 50.

Moderate Hazard: charred stringybark (above and below)

High hazard

A limited amount of bark is available to cause spotting.

This category has a wide range and is characterized by:

- stringybark eucalypts where most of the bark is black (especially on the lower part of the trunks) and where few pieces of bark are loosely attached to the trunks;
- eucalypts with tight, fibrous bark which has not been burnt for many years. Examples include box, peppermint and bloodwood species;
- gum-barked eucalypts which shed long ribbons of bark but which typically have a smooth trunk down to ground level. Key examples are Manna Gum and Candlebark.

Fires with a flame height of 0.5 m will "climb" *some* of these trees and cause sporadic spotting.

Spotting will defeat the Reference First Attack of wildfires when the Forest Fire Danger Index is in the range 24 to 50.

High Hazard: stringybark (above) and peppermint (below)

Very High hazard

Significant amounts of bark are available to cause spotting.

This category is characterized by:

- stringybark eucalypts where less than 50% of the surface area of the trees is black, where the upper parts of the tree trunks may not be black at all, and where significant amounts of bark are loosely held;
- mallee eucalypts where strips of bark are suspended above the ground;
- eucalypts with loose, fibrous or platy bark. Examples include Mahogany, Mountain Ash, Gippsland Grey Box and Silvertop;
- gum barked eucalypts which produce long ribbons of bark and which typically have loose, fibrous or platy bark on the lower trunk, which have not been burnt for many years. The main example is the rough-barked variant of Manna Gum.

Fires with a flame height of 0.5 m will "climb" *most* of these trees (especially those with a diameter greater than 40cm) and cause significant spotting.

Spotting will defeat the Reference First Attack of wildfires when the Forest Fire Danger Index is in the range 12 to 24.

Very High Hazard: stringybark (above) and mallee (below)

Extreme hazard

Huge amounts of bark are available to cause spotting.

This category is characterized by stringybark eucalypts, including Alpine Ash, where the outer bark on the trees is attached weakly and shows minimal evidence of charring. Brushing against the trees will dislodge large flakes of bark.

Fires with a flame height of 0.5 m will "climb" virtually all these trees, and the bark sustains the flames easily, even when there is little heating from below. Strong updrafts during almost any fire are likely to dislodge numerous "firebrands".

The bark is the most significant part of the overall fuel hazard and spotting makes any fire in this forest difficult to control, regardless of the fire intensity.

Spotting will defeat the Reference First Attack of wildfires when the Forest Fire Danger Index is in the range 8 to 12.

Extreme Hazard: stringybark (above and below)

Part 2 - Technical details

Spotting and bark hazard

The following summary of the definitions and processes of "spotting" has been drawn from McArthur (1967), Cheney and Bary (1968) and Luke and McArthur (1978).

"Spotting" is a process whereby flames ignite loose pieces of bark, dead leaves and twigs, which are then blown ahead of the fire to ignite spot fires. Spotting can be "short distance" (up to 3km and especially within 100m of the fire front) and "long distance" (30km or more). Spotting from eucalypt trees can readily defeat direct attack and in eucalypt forests it commonly determines the success or failure of fire control.

Spotting activity increases as:
- relative humidity and fuel moisture contents decrease,
- wind speed increases,
- fire intensity increases,
- ground slope increases,
- fires encounter firebreaks (Cheney 1991),
- fires reach the top of a slope, or
- a strong convection column develops in association with particular wind profiles;

but the underlying determinant of spotting potential is the surface texture of eucalypt bark.

Bark hazard depends on:
- the tree species
- the time elapsed since previous fires, and
- the intensity of those previous fires.

The highest level of "short distance spotting" hazard is characterized by large accumulations of loosely-held "rough-bark", and is typical of stands of "stringybark" eucalypts which have not been burnt for many years.

The highest level of "long distance spotting" hazard is characterized by large amounts of "ribbon" bark that is suspended from tree trunks, branches or understorey vegetation, and is typical of some stands of "smooth"-barked eucalypts, especially where they grow on slopes greater than 10 to 15 degrees.

Basis of the hazard classification

In the absence of quantitative data the classification in this report has necessarily been refined by the perceptions of experienced fire personnel (see Acknowledgements), which include fire behaviour specialists, field fire managers and field fire practitioners. The collective experience of these personnel has a broad geographic base in Victoria and is further supported by some experience from other States.

The categories in this classification are based on the perceived impact of bark on the difficulty of first attack under a nominal set of reference conditions. The Reference First Attack is specified as being: direct attack by a 50 kW bulldozer (D3 class) and a small tanker (400 litre capacity) and crew, within 30 minutes of detection of a single fire burning on flat terrain with good access, when the Drought Factor (Luke and McArthur 1978) is 10 and the wind speed is 20 km/h.

The species names in this report are those used by Costermans (1973).

The use of this guide in combination with careful observations of bark and fire behaviour should provide the basis for future refinement of the classification.

Reducing bark hazard

Fire is the only feasible way of reducing levels of bark. A wildfire or fuel reduction burn can readily reduce the hazard by removing loosely-held bark and the shrub layer on which ribbon bark is often suspended.

Prescriptions for reducing levels of litter fuels may be inadequate for reducing levels of bark fuel, especially on the upper sections of individual stems: the flame height of low intensity fires may be too low for the flames to reach unburnt bark fuels above the level of charring from previous fires. In some cases specific prescriptions for reducing bark hazard may be needed.

Application in fire planning

Summary of DCE Burning Zones

Priority 1 zone - to provide the highest level of protection of life, property and public land values and assets. To be achieved by maintaining fine fuel quantities below 8 t/ha on up to 90% of the area.

Priority 2 zone - to provide a strategic corridor of sufficient width and continuity to provide a substantial barrier to the spread of wildfire, reduce fire intensity and damage, and provide a base for fire suppression. To be achieved by maintaining fine fuel quantities below 12 t/ha on up to 80% of the area.

Priority 3 zone - to provide for broad area protection where it is important to reduce severity of wildfire, to prevent destruction of natural and cultural values and to complement works in higher priority zones. To be achieved by maintaining fine fuel quantities below 12 t/ha on up to 50% of the area.

Interpreting bark and litter fuel levels

For a given Protection Priority Zone, the difficulty of fire control will be affected by both the level of surface fine fuel and the level of bark hazard. To meet the protection requirements outlined above, bark hazard must also be kept below acceptable levels.

One possible guideline for applying the bark hazard classification to the Protection Priority system may simply be along the following lines: "Very High and Extreme bark hazards in Priority 1, Priority 2 and Priority 3 zones, and High bark hazards in Priority 1 zones, are unacceptable".

An alternative guideline may be to evaluate litter and bark hazards jointly, using criteria such as those shown in Table 1. The figures in Table 1 suggest, for example, that Extreme levels of bark should be reduced even when litter levels are relatively low, to ensure that the prescribed levels of protection are achieved.

Table 1. Indicative planning tolerances, in terms of surface fine fuel loads (t/ha), for each combination of bark hazard category and Protection Priority Zone. For discussion purposes.

Protection Priority Zone	Bark Hazard			
	Moderate	High	Very High	Extreme
P1	8	6	4	2
P2 or P3	12	10	6	4

References

Cheney, NP (1991). The role of spot fires in the propagation of eucalypt forest fires. Abstracts of papers presented at the Australian Bushfire Conference, University of NSW, Canberra, 30 Sept. - 20 Oct. 1991. p 20.

Cheney, NP and Bary, GAV (1969). The propagation of mass conflagrations in a standing eucalypt forest by the spotting process. Paper A6, Vol 1, Panel N2, Working Group J, Mass Fire Symposium, 10-12 Feb 1969, Canberra. The Technical Co-operation Program, Defence Standards Laboratories, Maribyrnong. 18 pp.

Costermans, LF (1973). Trees of Victoria. 3rd Ed. Melbourne. 83 pp.

Department of Conservation, Forests and Lands (1989). Guidelines for the preparation of Regional Fire Protection Plans. Update May 1989. 95 pp.

Luke, RH and McArthur, AG (1978). Bushfires in Australia. AGPS Canberra. 359 pp.

McArthur, AG (1967). Fire behaviour in eucalypt forests. Leaflet No. 107, Forestry and Timber Bureau, Forest Research Institute, Commonwealth of Australia. 36 pp.

Acknowledgements

The importance of bark to fire hazard and difficulty of fire control has been impressed upon me mainly by Peter Billing, whose advice about this report has been extensive and crucial.

I am grateful for the expert assistance of: J Blain, P Billing, A Buckley, R Caddell, P Cheney, T Edgar, R Edwards, L Fogarty, G Larkins, L McCaw, J Nankervis, L Stevens, D Tainsh, G West and M Wouters.

List of reports in this series

1. A study of the distribution of aerially applied fire retardant in softwood plantations. R. Rawson 1977
2. Low intensity prescribed burning in three Pinus radiata stand types. D.S. Thomson 1978
3. Fuel properties before and after thinning in young Radiata Pine plantations. D.F. Williams 1978
4. Using fire to reduce fuel accumulations after first thinning in Radiata Pine plantations. P.R. Billing 1979
5. Some effects of low intensity burning on Radiata Pine. P.R. Billing 1979
6. A low intensity prescribed burning operation in a thinned Radiata Pine plantation. P.R. Billing 1980
7. Some aspects of the behaviour of the Caroline fire of February 1979. P.R. Billing 1980
8. Changes in understorey vegetation in Sherbrooke Forest following burning or slashing. R. Rawson, B. Rees 1981
9. Hazard reduction burning in the Big Desert. P. Billing 1981
10. The effectiveness of fuel-reduction burning: Five case histories. P.R. Billing 1981
11. A fire tornado in the Sunset Country January 1981. P. Billing, R. Rawson 1982
12. A summary of forest fire statistics, 1972-73 to 1980-81. R. Rawson, B. Rees 1982
13. Fuel moisture changes under Radiata Pine. M. Woodman 1982
14. Fuel reduction burning in Radiata Pine plantations. M. Woodman, R. Rawson 1982
15. Project MAFFS/HERCULES the Modular Airborne Fire Fighting System in Victoria. R. Rawson, B. Rees, E. Stuckey, D. Turner, C. Wood, M. Woodman 1982
16. Using fire to reduce aerial fuels in first thinned Radiata Pine. P.R. Billing, J.V. Bywater 1982
17. Fuel properties before and after second thinning in Radiata Pine. M. Woodman 1982
18. Retardant distributions from six agricultural aircraft. B. Rees 1983
19. The Bright plantation fire: November, 1982 N. Watson, G. Morgan, D. Rolland 1983
20. Otways Fire No. 22 - 1982/83: aspects of fire behaviour P. Billing 1983
21. Otways Fire No. 22 - 1982/83: A case study of plantation protection. P. Billing 1983
22. Forest Fire Statistics 1974-75 to 1983-84. B. Rees 1984
23. The Avoca fire 14 January 1985. P. Billing 1985
24. Fuel management in Radiata Pine following heavy first thinning. P. Norman 1985
25. Effectiveness of fuel-reduction burning. R. Rawson, P. Billing, B. Rees 1985
26. Operational aspects of the Infra- Red Line Scanner. P. Billing 1986
27. Heathcote fire: Bendigo Fire No. 38 - 1986-87. P. Billing 1987
28. Fire behaviour and fuel reduction burning - Bemm River wildfire, October 1988. A. Buckley 1990
29. Fire hazard and prescribed burning of thinning slash in eucalypt regrowth forest. A Buckley and N. Corkish 1991.
30. Monitoring the ecological effects of fire. Ed. by F. Hamilton 1987.
31. Assessing fire hazard on public land in Victoria: fire management needs, and practical research objectives. AAG Wilson 1992.