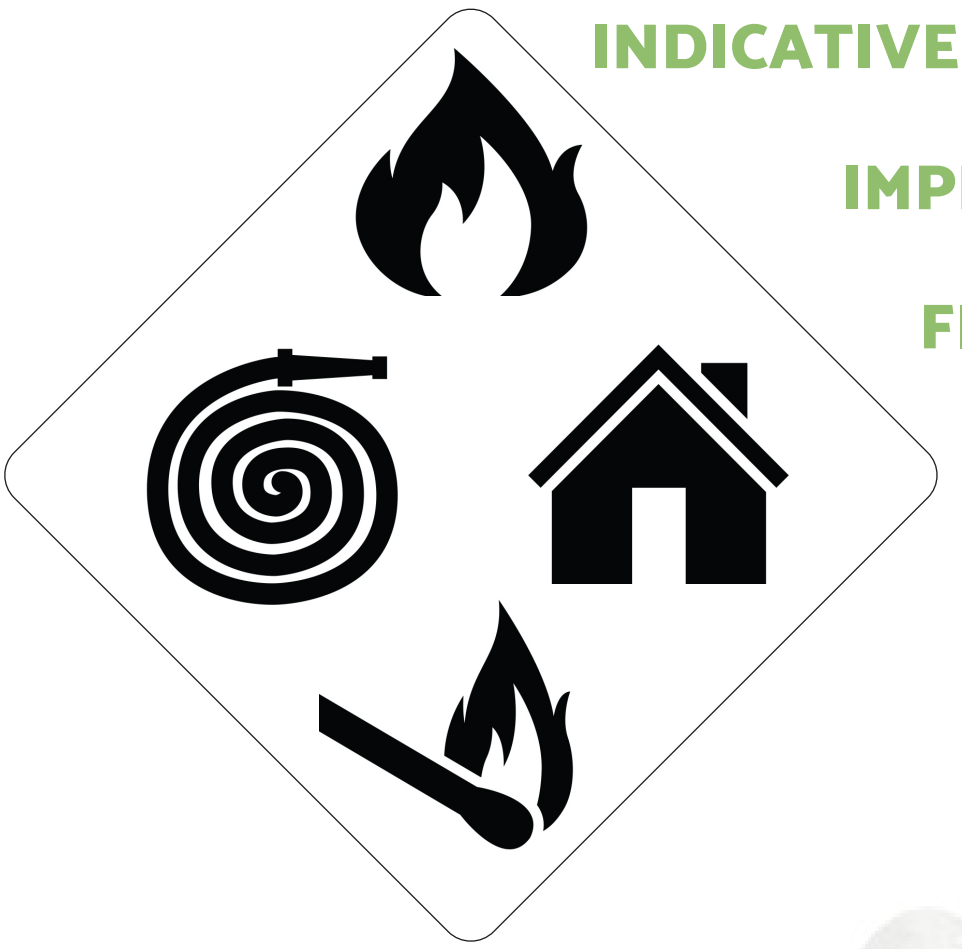
FOREST

QUICK GUIDE

UNDERSTANDING THE FIRE BEHAVIOUR INDEX

v. 2022_6

Australian
Fire Danger
Rating System



INDICATIVE FIRE BEHAVIOUR AND FIRE WEATHER

IMPLICATIONS FOR PRESCRIBED BURNING

FIRE SUPPRESSION AND CONTAINMENT

POTENTIAL FOR IMPACT

FOREST FUELS
IN THE AUSTRALIAN FIRE DANGER RATING SYSTEM

In the Australian Fire Danger Rating System (AFDRS), fuel types have been grouped by application of the most relevant fire spread model. Forest fuels within the system include the wide variety of dry and wet eucalypt forests that are found in Australia including temperate woodlands where litter and/or shrub fuels dominate the understorey as well as hardwood plantations.

DRY EUCALYPT FOREST FUEL STRUCTURE

These forests comprise of a broad mix of genera but are typically dominated by eucalypts. The open canopy nature of dry eucalypt forests often allows for the development of an understorey layer of dominated trees, shrubs and/or herbaceous vegetation that provide vertical fuel continuity.

Understorey fuels responsible for fire propagation are typically leaf litter, twigs and bark, and the finer components of the understorey herbaceous and shrub layer, which can vary from dense to almost absent depending on site conditions and time since last fire. Coarse woody debris represents the bulk of the available biomass but are mostly consumed after the passage of the flame front. In eucalypt fuel complexes the presence of tree species with fibrous bark is a key factor driving fire propagation, namely through prolific spotting that occurs under very dry and windy conditions. Candlebark and ribbon gums species contribute with aerodynamically optimum firebrands that can cause long distance spotting up to tens of kilometers, although it is virtually impossible to accurately quantify these distances. The relatively open nature of these forests means that understorey dead fuels dry rapidly, often within a few days of rain, and are available to sustain fire propagation over a number of months each fire season.

WET EUCALYPT FOREST FUEL STRUCTURE

At maturity wet eucalypt forests are 30 to 50 m tall and present a multi-storey structure, with the dominant overstorey layer cover varying between 30 and 70%. A well-developed understorey stratum might include a layer of sub-dominant and suppressed trees and tall shrubs. The lower section of this layer might have a well-developed shrub layer. Surface fuel quantities are characteristically higher in these forests than observed in dry eucalypt forests, and a well-developed duff layer is often present.

CONTENTS

The rate at which dead surface fuels dry is restricted by the dense understorey, and so fuels tend to be wetter in these forests than in adjacent dry eucalypt forests. Surface fuels may not dry out until mid-summer, and in the most sheltered locations may only become available to burn following extended drought. However, under these conditions very large quantities of organic material will be available for combustion. The tall and dense stand structure will also limit wind penetration into the lower understorey space.

Common wet eucalypt forests are karri forests in southern Western Australia, mountain ash forests in Victoria and Tasmania, and blackbutt in New South Wales.

FOR MORE INFORMATION ON FUELS REFER TO:
***A GUIDE TO RATE OF FIRE SPREAD MODELS FOR AUSTRALIAN VEGETATION* (2015 EDITION)**

FIRE SPREAD
IN FOREST FUELS

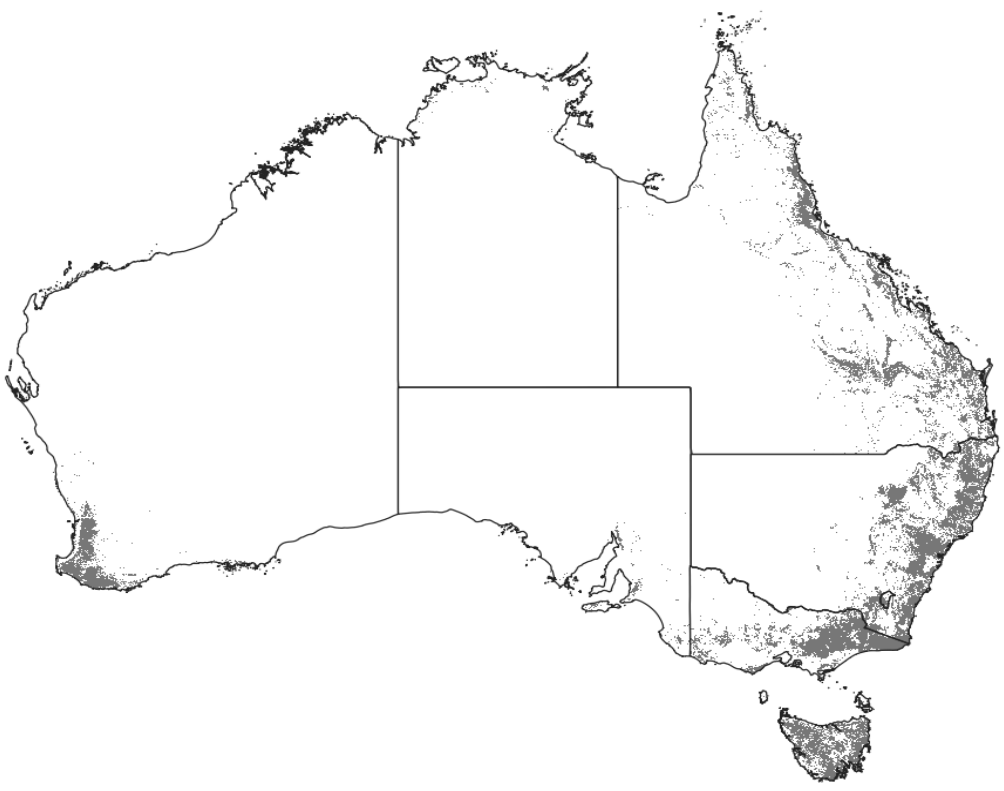
Rate of fire spread is the foundation variable for all calculations in the Australian Fire Danger Rating System. In Forest fuels the *Dry Eucalypt Forest Fire Model* (DEFFM or 'Vesta') is applied to determine the rate of fire spread.

BACKGROUND

The *Dry Eucalypt Forest Fire Model* was a result of research from Project Vesta which aimed to investigate the behaviour of moderate to high-intensity fires in dry eucalypt forest under conditions of moderate to high forest fire danger associated with dry summer conditions.

The Project was conducted in south-western Western Australia during the summers of 1998, 1999 and 2001 at two sites in eucalypt forest comprised of jarrah and marri. The sites were selected to be representative of most dry eucalypt forests found around the country.

WHERE IS THE MODEL APPLIED?

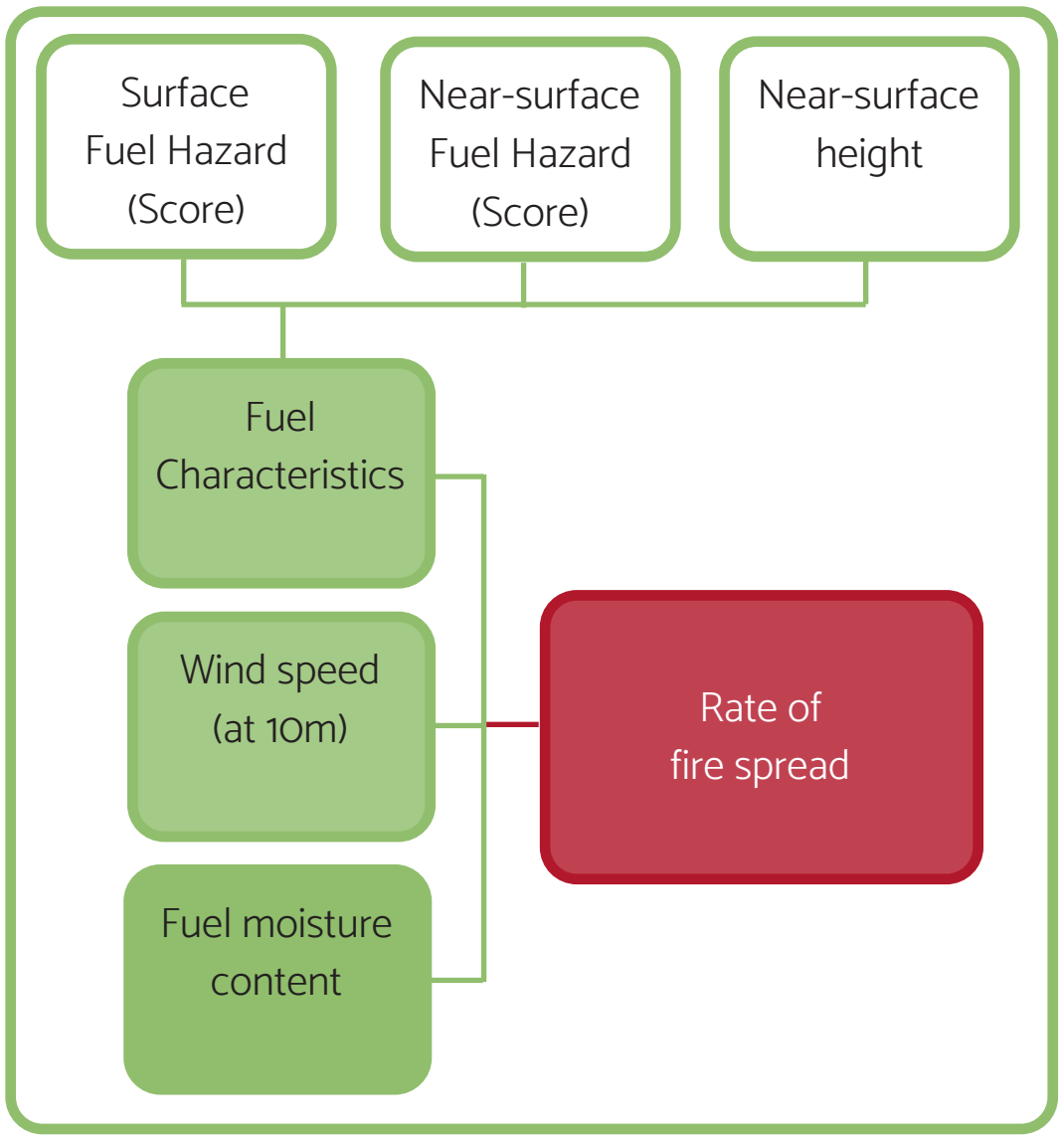


The DEFFM is applied to all dry and wet forest fuel types in Australia with the largest aggregations generally occurring in areas where average rainfall typically exceeds 500 mm annually, mostly on the east coast but also in the southwest of Western Australia.

HOW IS THE MODEL APPLIED?

The DEFFM was developed for dry summer conditions when dangerous wildfires occur. To apply the model more broadly across the full range of conditions and limitations in potential fuel availability, the AFDRS modifies the amount of fuel available based on a function of the drought factor (DF). In dry forests this is a steady linear relationship (where the amount of fuel available to burn increasing consistently as the DF increases from 0 to 10), while in wet forests, the AFDRS assumes no fuel is available to burn while

WHAT ARE THE MAIN INPUTS?



Rate of fire spread in Forests is calculated as a function of the surface and near-surface fuel characteristics, 10 m open wind speed and fine fuel moisture content.

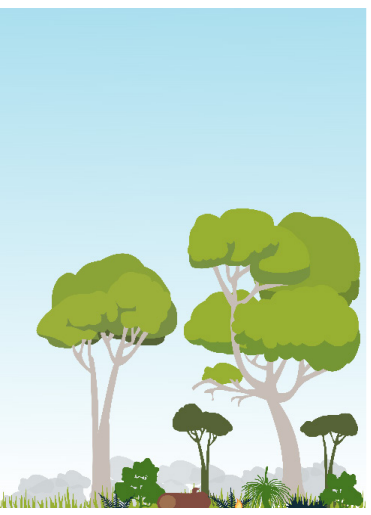
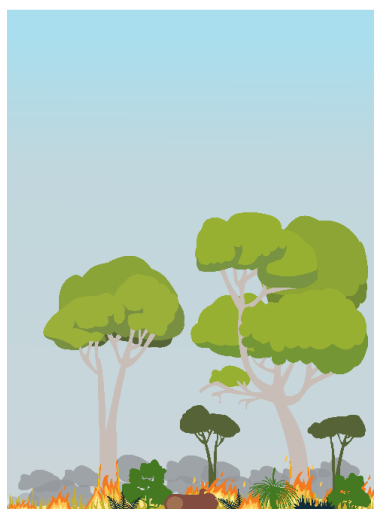
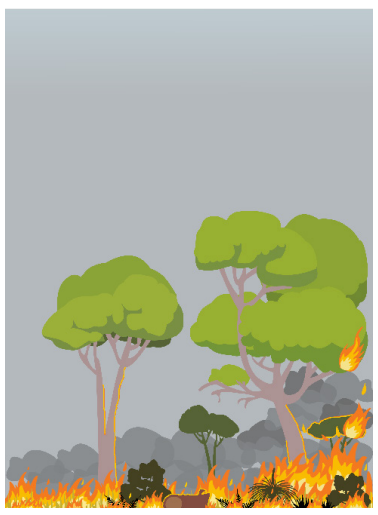
The fuel hazard scores are a numeric value from 0.0 to 4.0 based on visual assessment of per cent cover and fuel hazard of different fuel strata. The scores represent a subjective assessment of the flammability of each strata based on the morphological development of vegetation, bulk density, continuity, accumulation of litter fuel and type of bark.

WHAT IS THE MODEL SENSITIVE TO?

Fuel structure is incorporated into the model through descriptors of the surface (fuel hazard score, FHS) and near-surface (FHS and height) fuel layers. The surface FHS has a slightly higher effect on rate of fire spread than the near surface FHS. Variation of surface FHS from 1 to 4 will result in an approximate three-fold increase in the rate of fire spread. The same change in the near-surface FHS will result in a 2.3-fold increase in rate of spread. The model is also sensitive to the height of the near surface fuel layer. A doubling of the near surface height will result in a 65% increase in the rate of fire spread. Model sensitivity to the near-surface fuel height warrants special care in its estimation. Measurement errors in the definition of this layer can result in significant bias in the model output.

MORE DETAIL ON THE MODEL CAN BE FOUND IN: A GUIDE TO RATE OF FIRE SPREAD MODELS FOR AUSTRALIAN VEGETATION (2015 EDITION)

UNDERSTANDING THE
FIRE BEHAVIOUR INDEX
IN FOREST FUELS

Fire Behaviour Index 0-5	6-11	12-23	24-49	50-99	100+
					
No rating	**Moderate**	**High**	**Extreme**	**Catastrophic**	
fire behaviour Fires are likely to self-extinguish	fire behaviour Typical prescribed burning conditions Fires are likely to be mostly self-sustaining	suppression Fires typically suppressed with offensive fire management strategies (i.e. direct, parallel or indirect attack)	impact Increasing focus on defensive suppression strategies Transition to medium distance spotting Aerial suppression less likely to be effective at controlling fire	impact Increased likelihood of community loss and significant consequences Transition to long distance spotting	impact High probability of loss of life and property

A SCALE OF POTENTIAL FIRE DANGER

The Fire Behaviour Index (FBI) was developed to assist operational decision making, while the Fire Danger Ratings provide the broad categories needed to communicate fire danger to the community.

The FBI provides a scale of potential fire danger (should a fire start) based on the predicted rate of fire spread. In forest fuels, the rate of fire spread together with fuel load, are used to determine the fireline intensity and this value is used to categorise fire danger on the FBI scale.

TRANSITIONS AND CATEGORIES

The FBI is made up of step-ups or transitions, where an increase in category is triggered by a change in:

1. fire behaviour,
2. suppression response, or
3. potential impacts.

Each category is defined in terms of:

1. indicative fire behaviour and fire weather,
2. implications for prescribed burning,
3. fire suppression and containment, and
4. potential impacts.

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UNDERSTANDING THE FIRE BEHAVIOUR INDEX

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Fire Behaviour Index
0-5

- Mostly self-extinguishing, trouble-free fires.

INDICATIVE FIRE BEHAVIOUR AND FIRE WEATHER

Fire difficult to ignite and sustain.

Fires generally unlikely to spread and likely to self-extinguish.

- Rate of Spread: 0-40 m/hr
- Max. Flame Height: <1 m
- Spotting Potential: Potential for any spotting is very limited and likely <150 m

IMPLICATIONS FOR PRESCRIBED BURNING

Marginal prescribed burning conditions, even at peak of the day.

Opportunities may arise where burn objectives target very low intensity, particularly heavy or dry fuels.

FIRE SUPPRESSION AND CONTAINMENT

Fire control relatively simple.

Delayed containment possible with suitable conditions.

Head-fire readily suppressed with offensive, direct attack techniques.

Initial attack success is typically very high.

TIME TO 5 ha

11 hrs

Small fires that may be allowed to spread within an extended (time and area) containment objective.

CREDIBLE WORST CASE
MAX. POTENTIAL
in 4 hr (30 min)

AREA
<1.5 ha (<0.1 ha)

PERIMETER
<0.5 km (<0.1 km)

POTENTIAL FOR IMPACT

Community losses are unlikely.

CONDITIONS TO CONSIDER

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UNDERSTANDING THE FIRE BEHAVIOUR INDEX

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Fire Behaviour Index
6-11

- Typical prescribed burning conditions.
- Fires generally easy to suppress and contain.

INDICATIVE FIRE BEHAVIOUR AND FIRE WEATHER

Slow spreading fires, typically involving surface and near-surface fuels and sometimes bark and elevated fuels. Spotting is sporadic and limited to short-distances.

- Rate of Spread: 20-110 m/hr
- Max. Flame Height: <4 m
- Spotting Potential: Potential for spotting is limited with short distance spotting possible up to 400 m

IMPLICATIONS FOR PRESCRIBED BURNING

Typical prescribed burning conditions.

Simple burns with adequate resourcing.

Upper limit for private landholder burning provided adequate resourcing, training, necessary approvals and permits.

FIRE SUPPRESSION AND CONTAINMENT

Fire control mostly simple with sufficient resources and becoming more complex at higher intensities.

Offensive, direct attack techniques on head-fire or flanks largely successful in fire control.

Delayed containment sometimes possible with suitable conditions.

Fires may be allowed to spread within an extended (time and area) containment objective.

TIME TO 5 ha

4 hrs

CREDIBLE WORST CASE

MAX. POTENTIAL in 4 hr (30 min)

AREA

<10 ha (<0.2 ha)

PERIMETER

<1 km (<0.1 km)

POTENTIAL FOR IMPACT

Community losses are unlikely however unattended or poorly prepared houses and infrastructure may be at risk.

CONDITIONS TO CONSIDER

- Strong wind gusts

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Fire Behaviour Index
12-23

- Most bushfires occur in this category.
- Fires typically suppressed with direct, parallel or indirect attack.

INDICATIVE FIRE BEHAVIOUR AND FIRE WEATHER

Actively spreading fires typically involving surface, near-surface, elevated and bark fuel layers and occasionally canopy fuels. Low-moderate spotting frequency; isolated medium range spotting can occur.

- Rate of Spread: 60-600 m/hr
- Max. Flame Height: 2-8 m
- Spotting Potential: Short distance spotting occurring with increasing frequency with possible medium distance spotting up to 2 km

IMPLICATIONS FOR PRESCRIBED BURNING

Conditions may be suitable for more complex prescribed burning subject to adequate resourcing and well established boundaries/edges.

Prescribed burning may be conducted away from the peak of the day when conditions are optimal and lighting techniques are suitable to achieve prescribed burning objectives.

FIRE SUPPRESSION AND CONTAINMENT

Fires generally becoming more complex and require more resources to control.

Combinations of direct, indirect or parallel attack may be necessary for fire control.

TIME TO 5 ha

45 mins

CREDIBLE WORST CASE
MAX. POTENTIAL in 4 hr (30 min)

AREA

<300 ha (<5 ha)

PERIMETER

<6.5 km (1 km)

POTENTIAL FOR IMPACT

Unattended or poorly prepared houses and infrastructure may be at risk.

CONDITIONS TO CONSIDER

- C-Haines >95th percentile (approx. >10)
- Wind change forecast during the peak of the afternoon, potential conditions for 'dead man zone'
- Strong wind gusts

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UNDERSTANDING THE FIRE BEHAVIOUR INDEX

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Fire Behaviour Index
24-49

- Increasing focus on defensive suppression strategies.
- Initial attack success critical to prevent large fire development.

INDICATIVE FIRE BEHAVIOUR AND FIRE WEATHER

Rapidly spreading fires with potential for development into large burn areas within burning period. Fires typically involving most fuel layers. Short-range spotting is prevalent, with possibility of medium range and occasional long-range distance spotting.

- Rate of Spread: 0.3-1 km/hr
- Max. Flame Height: 7-14 m
- Spotting Potential: Short and medium distance spotting occurring with increasing frequency with possible long distance spotting up to 4 km

IMPLICATIONS FOR PRESCRIBED BURNING

Conditions are unlikely to be suitable for prescribed burning.

Potential fireline intensity and spotting activity pose a serious risk for burn escapes.

Fire intensity may be inconsistent with land management objectives.

FIRE SUPPRESSION AND CONTAINMENT

TIME TO 5 ha

25 mins

Both ground and aerial resources using offensive strategies likely to be unsuccessful during the peak of the day, with focus largely centred on the rear and flanks.

Suppression increasingly focused on defensive strategies.

Fire control is likely to be difficult and require increased resourcing.

Increased risk to firefighter safety.

CREDIBLE WORST CASE
MAX. POTENTIAL in 4 hr (30 min)

AREA
<1,000 ha (<16 ha)

PERIMETER
<11 km (1.5 km)

POTENTIAL FOR IMPACT

6 % of house loss has occurred under these conditions.

Increased potential for pasture/crop/stock losses as well as rural assets such as fencing, machinery and buildings.

CONDITIONS TO CONSIDER

- C-Haines >95th percentile (approx. >10)
- Wind change forecast during the peak of the afternoon, potential conditions for 'dead man zone'
- Strong wind gusts

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Fire Behaviour Index **50-100**

- High levels of threat to life/property.
- Conditions limit strategic suppression options.
- Elevated risk to firefigter safety.
- Initial attack success critical to prevent large fire development.

INDICATIVE FIRE BEHAVIOUR AND FIRE WEATHER

Fires likely to quickly transition to crowning. Possibility for fire behaviour to become erratic and plume driven. Strong convective column formation. Wind speed and direction likely to be erratic at times.

- Rate of Spread: 0.7-3 km/hr
- Max. Flame Height: 11 m - approx. double forest height
- Spotting Potential: High ember density in short and medium range with possible long distance spotting up to 12 km

IMPLICATIONS FOR PRESCRIBED BURNING

Conditions will be unsuitable for prescribed burning.

Potential fireline intensity and spotting activity pose a serious risk to firefighter safety and the community.

FIRE SUPPRESSION AND CONTAINMENT

TIME TO 5 ha

10 mins

Control of developed fires is extremely difficult and unlikely until conditions ease.

Suppression will be largely based on defensive strategies, ensuring firefighter and community preparedness and safety.

Offensive strategies could position crews in danger, however safe opportunities may exist for direct, indirect or parallel attack on the rear and flanks. Important initial attack opportunities may exist for new ignitions.

Conditions on the fireground are likely to be extremely windy and smoky limiting visibility and restricting aviation and access. Aerial resources are likely to be ineffective at holding fire. Increased risk to firefighter safety.

CREDIBLE WORST CASE

MAX. POTENTIAL in 4 hr (30 min)

AREA

<9,000 ha (<140 ha)

PERIMETER

<35 km (4.5 km)

POTENTIAL FOR IMPACT

24% of house loss has occurred under these conditions. Limited visibility due to smoke and dust. High risk to the community related to inappropriate pre-considered plans, inadequate sheltering. High likelihood of pasture/crop/stock loss together with loss of rural assets such as fencing, machinery and buildings.

Increased risk of long term economic and environmental impacts.

Strong winds are likely to impact infrastructure (e.g. power lines) with falling trees increasing the likelihood of new ignitions as well as causing road obstructions and power outages.

CONDITIONS TO CONSIDER

- C-Haines >95th percentile (approx. >10)
- Wind change forecast during the peak of the afternoon, potential conditions for 'dead man zone'

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Fire Behaviour Index **100+**

- High probability of loss of life and property.
- Elevated risk to firefighter safety.
- Initial attack success critical to prevent large fire development.
- Conditions limit strategic suppression options.
- Wind speed and limited visibility may ground some aviation resources.

INDICATIVE FIRE BEHAVIOUR AND FIRE WEATHER

Fires likely to quickly transition to crowning. Possibility for fire behaviour to become erratic and plume driven. Strong convective column formation. Wind speed and direction likely to be erratic at times.

- Rate of Spread: >2 km/hr can be expected and possibly >3 km/hr
- Max. Flame Height: >30 m (approx. double forest height)
- Spotting Potential: High ember density in short and medium range with possible long distance spotting occurring 20-30 km ahead of the main fire front

IMPLICATIONS FOR PRESCRIBED BURNING

Conditions will be unsuitable for prescribed burning.

Potential fireline intensity and spotting activity pose a serious risk to firefighter safety and the community.

FIRE SUPPRESSION AND CONTAINMENT

TIME TO 5 ha

<10 mins

Fire control of developed fires is extremely difficult and unlikely until conditions ease. Focus will be largely based on defensive strategies, ensuring firefighter and community preparedness and safety. Offensive strategies could position crews in danger, however safe opportunities may exist for direct, indirect or parallel attack on the rear and flanks. Important initial attack opportunities may exist for new ignitions. Conditions on the fireground are likely to be extremely windy and smoky, limiting visibility and restricting aviation operations. Conditions are likely to impact performance and effectiveness of aerial resources with a high probability that some aircraft will be unable to operate due to high winds and limited visibility. Systems such as communications, will be heavily challenged with a likelihood of difficulties and outages.

CREDIBLE WORST CASE

MAX. POTENTIAL in 4 hr (30 min)

AREA

>9,000 ha

(>140 ha)

PERIMETER

>35 km (>4.5 km)

POTENTIAL FOR IMPACT

70% of house loss has occurred under these conditions. Limited visibility due to smoke and dust. Very high risk to the community related to inappropriate pre-considered plans, inadequate sheltering. Extremely high likelihood of pasture/crop/stock loss together with loss of rural assets such as fencing, machinery and buildings. Very high risk of long term economic and environmental impacts.
Extremely strong winds are likely to impact infrastructure (e.g. power lines) and fall trees increasing the likelihood of new ignitions as well as obstructed roads and power outages.

CONDITIONS TO CONSIDER

- C-Haines >95th percentile (approx. >10)
- Wind change forecast during the peak of the afternoon, potential conditions for 'dead man zone'

INDICATIVE FIRE BEHAVIOUR AND FIRE WEATHER

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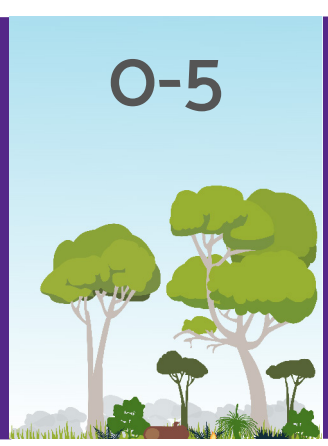
FIRE BEHAVIOUR INDEX

MAX FLAME HEIGHT <1 m	0-5 	**RATE OF SPREAD** 0-40 m/hr	Fire difficult to ignite and sustain. Fires generally unlikely to spread and likely to self-extinguish.	**SPOTTING POTENTIAL** Potential for any spotting is very limited and likely **<150 m**
<4 m	6-11 	20-110 m/hr	Slow spreading fires, typically involving surface and near-surface fuels and sometimes bark and elevated fuels. Spotting is sporadic and limited to short-distances.	Potential for spotting is limited with short distance spotting possible up to **400 m**
2-8 m	12-23 	60-600 m/hr	Actively spreading fires typically involving surface, near-surface, elevated and bark fuel layers and occasionally canopy fuels. Low-moderate spotting frequency; isolated medium range spotting can occur.	Short distance spotting occurring with increasing frequency with possible medium distance spotting up to **2 km**
7-14 m	24-49 	0.3-1 km/hr	Rapidly spreading fires with potential for development into large burn areas within burning period. Fires typically involving most fuel layers. Short-range spotting is prevalent, with possibility of medium range and occasional long-range distance spotting.	Short and medium distance spotting occurring with increasing frequency with possible long distance spotting up to **4 km**
11 m - approx. double forest	50-99 	0.7-3 km/hr	Fires likely to quickly transition to crowning. Possibility for fire behaviour to become erratic and plume driven. Strong convective column formation. Wind speed and direction likely to be erratic at times.	High ember density in short and medium range with possible long distance spotting up to **12 km**
>30 m (approx. double forest height)	100+ 	>2 km/hr can be expected, possibly >3 km/hr	Fires likely to quickly transition to crowning. Possibility for fire behaviour to become erratic and plume driven. Strong convective column formation. Wind speed and direction likely to be erratic at times.	High ember density in short and medium range with possible long distance spotting occurring **20-30 km** ahead of the main fire front

IMPLICATIONS FOR PRESCRIBED BURNING

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MARGINAL

0-5

Marginal prescribed burning conditions, even at peak of the day.

Opportunities may arise where burn objectives target very low intensity, particularly heavy or dry fuels.

GENERALLY SUITABLE

6-11

Typical prescribed burning conditions.

Simple burns with adequate resourcing.

Upper limit for private landholder burning provided adequate resourcing, training, necessary approvals and permits.

MARGINAL

12-23

Conditions may be suitable for more complex prescribed burning subject to adequate resourcing and well established boundaries/edges.

Prescribed burning may be conducted away from the peak of the day when conditions are optimal and lighting techniques are suitable to achieve prescribed burning objectives.

GENERALLY UNSUITABLE

24-49

Conditions are unlikely to be suitable for prescribed burning.

Potential fireline intensity and spotting activity pose a serious risk for burn escapes.

Fire intensity may be inconsistent with land management objectives.

UNSUITABLE

50-99

Conditions will be unsuitable for prescribed burning.

Potential fireline intensity and spotting activity pose a serious risk to firefighter safety and the community.

UNSUITABLE

100+

Conditions will be unsuitable for prescribed burning.

Potential fireline intensity and spotting activity pose a serious risk to firefighter safety and the community.

FIRE SUPPRESSION AND CONTAINMENT

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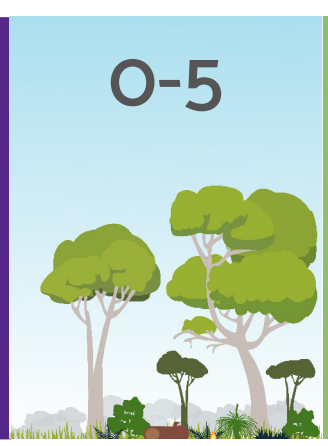
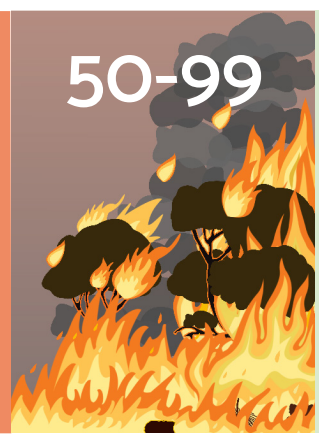
FIRE BEHAVIOUR INDEX			CREDIBLE WORST CASE
TIME TO 5 HA 11 hrs	0-5 	Fire control relatively simple. Delayed containment possible with suitable conditions. Head-fire readily suppressed with offensive, direct attack techniques. Initial attack success is typically very high. Small fires that may be allowed to spread within an extended (time and area) containment objective.	MAX. POTENTIAL in 4 hr (30 min) **AREA** <1.5 ha (<0.1 ha) **PERIMETER** <0.5 km (<0.1 km)
4 hrs	6-11 	Fire control mostly simple with sufficient resources and becoming more complex at higher intensities. Offensive, direct attack techniques on head-fire or flanks largely successful in fire control. Delayed containment sometimes possible with suitable conditions. Fires may be allowed to spread within an extended (time and area) containment objective.	**AREA** <10 ha (<0.2 ha) **PERIMETER** <1 km (<0.1 km)
45 mins	12-23 	Fires generally becoming more complex and require more resources to control. Combinations of direct, indirect or parallel attack may be necessary for fire control.	**AREA** <300 ha (<5 ha) **PERIMETER** <6.5 km (1 km)
25 mins	24-49 	Both ground and aerial resources using offensive strategies are likely to be unsuccessful during the peak of the day, with focus largely centred on the rear and flanks. Suppression increasingly focused on defensive strategies. Fire control is likely to be difficult and requires increased resourcing. Increased risk to firefighter safety.	**AREA** <1,000 ha (<16 ha) **PERIMETER** <11 km (1.5 km)
10 mins	50-99 	Control of developed fires is extremely difficult and unlikely until conditions ease. Suppression will be largely based on defensive strategies, ensuring firefighter and community preparedness and safety. Offensive strategies could position crews in danger, however safe opportunities may exist for direct, indirect or parallel attack on the rear and flanks. Important initial attack opportunities may exist for new ignitions. Conditions on the fireground are likely to be extremely windy and smoky limiting visibility and restricting aviation and access. Aerial resources are likely to be ineffective at holding fire. Increased risk to firefighter safety.	**AREA** <9,000 ha (<140 ha) **PERIMETER** <35 km (4.5 km)
<10 mins	100+ 	Fire control of developed fires is extremely difficult and unlikely until conditions ease. Focus will be largely based on defensive strategies, ensuring firefighter and community preparedness and safety. Offensive strategies could position crews in danger, however safe opportunities may exist for direct, indirect or parallel attack on the rear and flanks. Important initial attack opportunities may exist for new ignitions. Conditions on the fireground are likely to be extremely windy and smoky limiting visibility and restricting aviation and access. Conditions are likely to impact performance and effectiveness of aerial resources with a high probability that some aircraft will be unable to operate due to high winds and limited visibility. Systems such as communications, will be heavily challenged with a likelihood of difficulties and outages.	**AREA** >9,000 ha (>140 ha) **PERIMETER** >35 km (>4.5 km)

POTENTIAL FOR IMPACT

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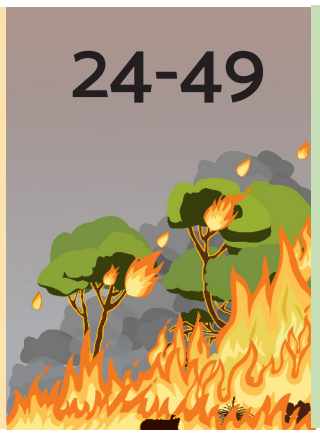
UNLIKELY	0-5 	Community losses are unlikely.
UNLIKELY	6-11 	Community losses are unlikely however unattended or poorly prepared houses and infrastructure may be at risk.
MINIMAL	12-23 	Unattended or poorly prepared houses and infrastructure may be at risk.
INCREASING	24-49 	6 % of house loss has occurred under these conditions. Increased potential for pasture/crop/stock losses as well as rural assets such as fencing, machinery and buildings.
HIGH	50-99 	24% of house loss has occurred under these conditions. Limited visibility due to smoke and dust. High risk to the community related to inappropriate pre-considered plans, inadequate sheltering. High likelihood of pasture/crop/stock loss together with loss of rural assets such as fencing, machinery and buildings. Increased risk of long term economic and environmental impacts. Strong winds are likely to impact infrastructure (e.g. power lines) and fall trees increasing the likelihood of new ignitions as well as obstructed roads and power outages.
VERY HIGH	100+ 	70% of house loss has occurred under these conditions. Limited visibility due to smoke and dust. Very high risk to the community related to inappropriate pre-considered plans, inadequate sheltering. Extremely high likelihood of pasture/crop/stock loss together with loss of rural assets such as fencing, machinery and buildings. Very high risk of long term economic and environmental impacts. Extremely strong winds are likely to impact infrastructure (e.g. power lines) with falling trees increasing the likelihood of new ignitions as well as road obstructions and power outages.

SUPPLEMENTARY INFORMATION FOR FOREST FUELS

To define each category against modelled outputs within the Fire Behaviour Index (FBI) scale, various methodologies and assumptions are applied. These are outlined below.

FLAME HEIGHT

Flame heights are based on McArthur's equation for flame height in Noble (1980).

RATE OF SPREAD

Rates of spread are back-calculated from FBI model outputs based on Byram's fireline intensity and a range of fuel load varying from 10-20 t/ha.

SPOTTING DISTANCE

Spotting distances are based on McArthur's equation for spotting distance in Noble (1980).

FIRE AREA AND PERIMETER

Potential fire area and perimeter are based on a 4-hour fire run under maximum fire danger with a range of length-breadth ratio as determined by wind speeds ranging from 10-40 km/hr (as per Cruz et al (2015)) and a fuel load varying from 10-20 t/ha.
The values assume no suppression.

FUEL LOAD

The lowest FBI category assumes that only 50% of the fuel load is available for burning, and this is represented in flame heights, rates of spread and potential fire size.

Forest FBI 6-23 assume an additional 3 t/ha is available (contributed by bark & elevated layers), and FBI above 50 assumes an additional 8 t/ha is available (contributed by bark, elevated and canopy fuel layers).

REFERENCE TIME TO 5 HA

Reference time to 5 ha is based on the shortest time for the category under following conditions: wind speed 25 km/hr, L:B ratio of 3:3 and a fuel load of 10 t/ha.

IMPACT RELATED THRESHOLDS AND DESCRIPTIONS

Impact related thresholds and descriptions have been based largely on the work of Kilinc et al (2013), Harris et al (2011) and Blanchi et al (2010).

PROJECT DOCUMENTATION

A comprehensive list of project documentation for the Australian Fire Danger Rating System is available via the AFAC website at: https://www.afac.com.au/initiative/afdrs/afdrs-publications.

SUPPORTING REFERENCES AND FURTHER READING

Blanchi, R., et al. (2010). Meteorological conditions and wildfire-related house loss in Australia. International Journal of Wildland Fire 19(7): 914-926.

Byram, G. M. (1959). Combustion of forest fuels. Forest Fire: Control and Use. K. P. Davis. New York, McGraw-Hill: 61-89.

Cruz, M. G., et al. (2015). A Guide to Rate of Fire Spread Models for Australian Vegetation. Melbourne, Victoria, CSIRO Land and Water Flagship, Canberra, ACT, and AFAC.

Harris, S., et al. (2011). Establishing a link between the power of fire and community loss: The first steps towards developing a bushfire severity scale. Melbourne, Victoria, Victorian Government Department of Sustainability and Environment.

Kilinc, M., et al. (2013). Project title: A scale for determining the destructive potential of bushfires. Milestone report for the period 2013. Technical Report 1. Monash University, Geography and Environmental Science and University of New South Wales, Canberra.

Noble, I. R., et al. (1980). McArthur's fire-danger meters expressed as equations. Australian Journal of Ecology 5: 201-203.

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afac

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PARTNER AGENCIES:

A.C.T. RURAL FIRE SERVICE

CFS

EMV EMERGENCY MANAGEMENT VICTORIA

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NORTHERN TERRITORY GOVERNMENT

QUEENSLAND FIRE AND EMERGENCY SERVICES

GOVERNMENT OF WESTERN AUSTRALIA
Department of Biodiversity, Conservation and Attractions

GOVERNMENT OF WESTERN AUSTRALIA
DFES
Department of Fire & Emergency Services

Tasmanian Government

Tasmania Fire Service

SUPPORTING BODIES:

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South Australian Fire and Emergency Services Commission

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Department for Environment and Water

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