Planned Burning Manual

Guidelines to enable safe and effective planned burning on private land

NRM North
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All photos have been taken by Jon Marsden-Smedley, Leanne Sherriff or Bronnie Grieve, except where otherwise stated.

Disclaimer

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Cover photograph: Planned burning project pilot farmer, John Atkinson, during the planned burn at his property in May 2013.

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1 Background

Fire should not be regarded as unnatural or catastrophic, but rather as a recurring aspect of the Australian environment. Fire has shaped the character of the Australian landscape for millions of years[1]. Many vegetation types require periodic fire to maintain ecological values, and many plant and animal species have evolved strategies to cope with fire. Fire can be used as a land management tool to achieve many positive land management outcomes (e.g. fuel reduction, regeneration, weed management). However, not all fires are desirable. Fires may occur under conditions that threaten human life and property, may be too frequent, too intense, cause temporary reductions to air quality and/or disruptions to the community.

Planned burning is an important tool for minimising adverse impacts from wildfire but is not a cure for all fire management problems. Other tools can also be used to achieve the same objectives (e.g. slashing, crash grazing etc.). While planned burning is a useful tool it needs experience, knowledge and risk management strategies to use it well.

The aim of this Planned Burning Manual is to assist landholders with planning fire management strategies for their property, and then implementing these strategies. This will enable strategic reduction of hazards and improved ecological management, including excluding fire from areas where it is not desirable.

This manual is divided into 2 sections:

1. Planning for fire management
2. Implementing planned burns

The Fire Management Planning process is a series of steps to compile the information required to plan fire management at a property scale. It uses maps and tables to summarise the information required to understand fire management on the property and to identify the goals for managing different areas of the property with respect to fire (e.g. fire exclusion, fuel reduction, regeneration, etc.). The key actions required for fire management are then able to be identified.

Planned burning and fire management is a complex science. Technical information is therefore included in the first section of the manual. This information will help in understanding some of the terminology and issues to consider in implementing the Fire Management Plan (i.e. in conducting burns). This information includes legal responsibilities when performing planned burning, fire risk assessment, effectiveness of planned burning, ignition methods, lighting patterns, control lines and test fires.

This manual aims to minimise the risk of adverse outcomes from planned burning whilst ensuring that the burning is performed safely and meets fire management objectives. However, if the land manager is inexperienced with fire, engaging an expert to assist in the development of the Fire Management Plan is worth considering. Even land managers more experienced with fire may benefit from an outside perspective.

[1] Hotspots Fire Project. Managing fire on your property: a booklet for landholders in the Namoi region Feb 2012

Figure 1: Only 5 weeks after burning in May 2013, new green shoots are already emerging in this dry woodland

2 Planning for fire management

2.1 Mapping

The first step in the fire management planning process is to produce detailed property maps which summarise the information required for safe and effective fire planning. Much of the mapping will be able to be done as a desktop exercise using existing information, although it will be necessary to ground truth some elements (e.g. fuel hazard rating, condition of tracks, suitability of proposed fire breaks, etc.).

The map scale used will depend on the size of the property being managed and the degree of complexity (vegetation types, topography, etc.) in the areas to be burnt. In most situations, map scale should be between about 1:5,000 and 1:25,000.

Where a property is of a size and/or complexity that it needs to be divided into several maps, it will also be necessary to include an overview map detailing how the different sub-maps fit together.

All maps will need to have a clear legend which includes a title summarising the map's content, identification of the layers displayed on the map, scale, datum and zone (where possible the Grid Datum of Australia 1994 should be used, e.g. GDA94/55) and map production date. The maps also need to have grid identification numbers so that position data from GPS units and/or topographic maps can be incorporated.

The series of maps needed are:

- base map;
- property fire map.

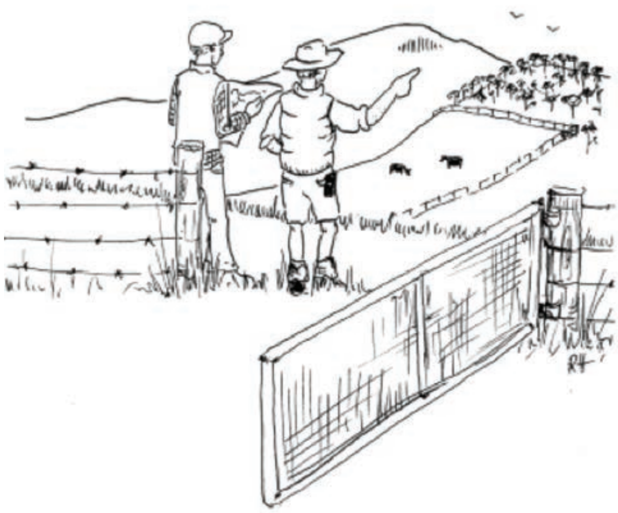


Figure 2: Planning for fire management on your property enables fire to be used as a tool where appropriate and also enables preparations to be made in the event of a wildfire.

2.1.1 Base map

The aim of the base map is to show the key features on a property which are relevant to fire management (e.g. slope/aspect, type of vegetation, assets to protect, etc.). If a property already has a Property Management Plan (PMP) in place, the farm layout map and environmental/biodiversity map created as part of this process will contain the majority of the necessary information.

As a minimum, the base map should include:

- recent aerial photograph as underlay;
- farm boundary;
- paddock boundaries and fence lines;
- assets and infrastructure, such as houses, sheds, barns, pump sheds;
- roads and tracks;
- pasture or crop zones, native bush (e.g. TASVEG community type);
- forestry areas;
- conservation areas;
- power lines;
- contour lines;
- rivers, creeks, drainage lines and dams;
- shelterbelts/windbreaks.

The base map should also include (if known):

- threatened species locations, such as eagle nests, threatened vegetation communities, etc.;
- weeds and/or disease infested areas (e.g. Phytophthora).

2.1.2 Fire information

The aim of the fire map is to use and build on the information included in the base map to display specific information relevant to fire management, including:

- fire exclusion areas (i.e. areas from which fire is to be excluded) and fire management areas (i.e. areas in which fire can be used as a tool);
- proposed fire boundaries;
- roads and tracks, including public access roads and farm tracks;
- water filling points, such as creeks, dams, pumps, hydrants.

2.1.3 Planned burning blocks

Once all of the information in 2.1.1 and 2.1.2 is mapped, then it will be possible to identify planned burning blocks, using the fire boundaries, roads and tracks etc. identified in the steps above. It is important to use numbers and/or names to identify the different blocks. It may be that as the proposed planned burning blocks are drawn in, that new boundaries will need to be included, or changes to other mapping layers may be necessary. Development of the map will be an evolving process, and may also change the fire action plan when developed. In developing the plan and identifying blocks to be burnt, it is critical that thought be given to whether the boundaries are adequate for planned burning given the vegetation type, topography etc. (refer to section 3.6).

2.2 Developing the fire action plan

The Fire Action Plan (Section 2.3) is a table which is used to summarise the characteristics of the areas identified during the mapping (Section 2.1), and identify management actions which can be used to achieve the goals for managing fire on each of the different fire management zones on the property. This action plan can be used to guide the scheduling of planned burns and other actions to manage fire on the property.

2.2.1 Goals for fire management

Based on the information collated during the mapping process it will be important to identify the goals for the use of planned burns in each of the blocks identified. These may include (but not necessarily be limited to):

- actively work to exclude fire;
- management of fuel hazards;
- ecological management;
- promotion of green-pick and/or management of woody thickening;
- weed management;
- stock safety zones.

During all planned burning operations, the overall objectives for performing the burning will need to focus on:

- conducting the burn safely;
- minimising escapes on to neighbouring properties.

The goals for the different blocks identified may need to be adjusted after ground truthing areas. In some cases the blocks themselves may need redefining.

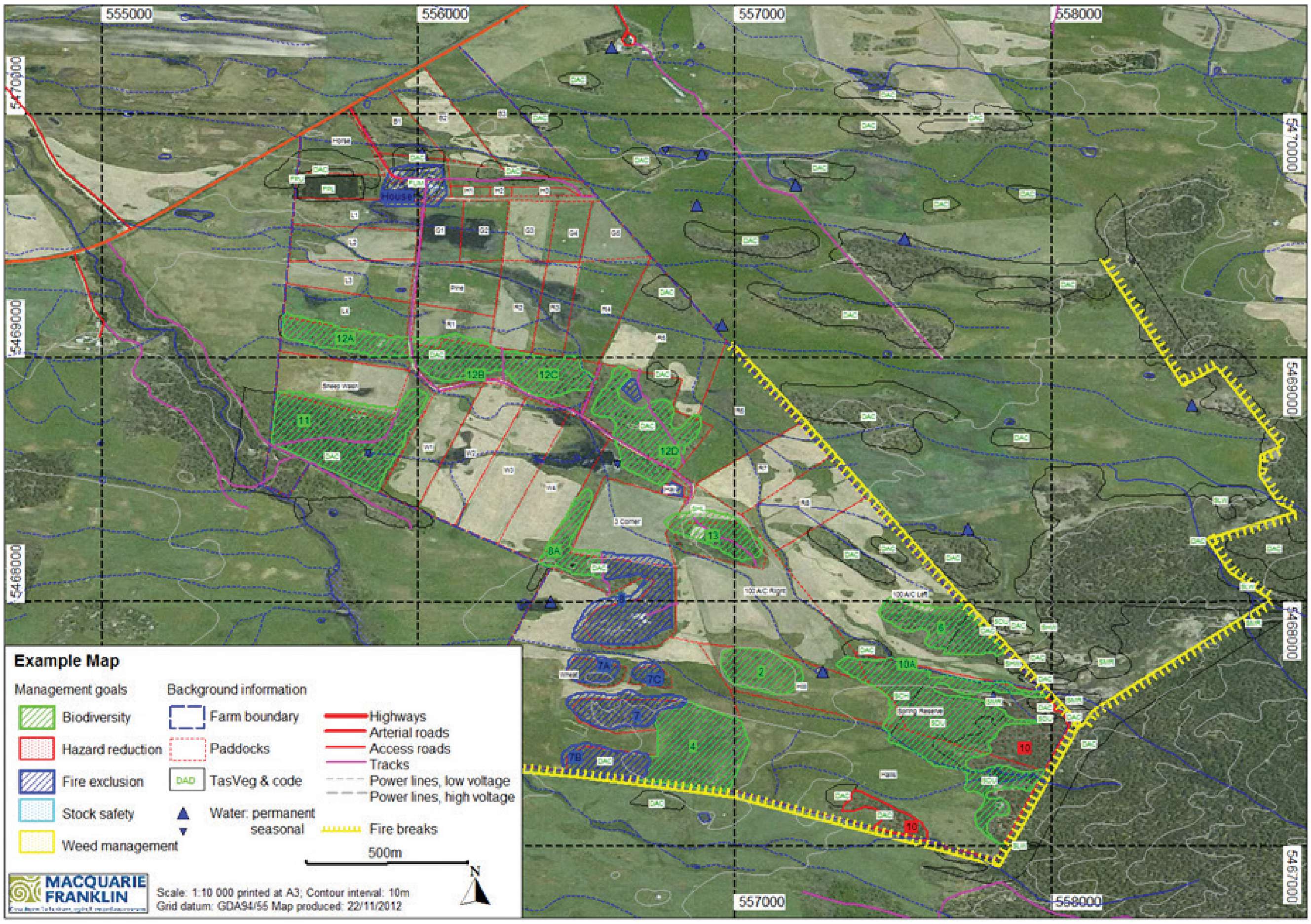


Figure 3: An example fire management map.

2.2.2 Description of planned burning blocks

The description of the planned burning blocks in the fire action table should include the following information:

- TASVEG community (and note if it is a threatened community, fire sensitive community, etc.);
- any relevant management information (e.g. grazing regime, whether it is fenced or not, etc.);
- presence of any threatened species (and note their sensitivity to fire);
- is the patch under a conservation covenant;
- any other relevant information (e.g. variation in vegetation type, weed status, etc).

2.2.3 Years since last fire

If known, the time (years) since the last fire should be recorded in the fire action table.

2.2.4 Fuel hazard rating

The level of fuel hazard should be assessed in the areas where planned burning is being considered and, if appropriate, in fire exclusion areas (e.g. if these fire exclusion areas are adjacent to assets). This should be done using the guide published by the Department of Sustainability and Environment, Victoria (summarised in Section 3.4 of this manual).

Figure 4: Banskia fruit opened by fire - the seed has been released onto the open ground, ready to germinate.

Figure 5: This ash bed will provide a perfect site for eucalypt seed to grow – note the branches covered in capsules which have been obtained from a nearby tree and scattered over the ash bed.

2.2.5 Actions

These are actions which are required to meet the goals of fire management taking into account the specific characteristics of the block in question. They may include actions as well as timing – e.g. preparing/maintaining fire breaks, recommended time to conduct a burn, etc.

Figure 6: The level of fuel hazard should be assessed in the areas where planned burning is proposed.

2.3 Fire action plan template

Patch ID	Goals for fire management	Description	Years since last fire	Fuel hazard rating	Actions	Timing
X		• TASVEG type • Understorey type • Management info (e.g. grazed, fenced, etc) • Threatened species • Conservation covenant • Any other relevant detail		• Surface: • Near-surface: • Elevated: • Bark: • Overall:		

2.4 Ecological considerations

2.4.1 Vegetation reproductive strategies.

Many Australian plant species have developed reproductive strategies in close association with fire. Since fire is such a powerful disturbance force, changes in fire patterns can quickly influence which species (and reproductive strategies) will persist in an area and which won't.

Scientists describe two broad post-fire regeneration strategies are of particular relevance to land managers. These are obligate seeding species and resprouting species.

When obligate species are exposed to fire, all, or almost all mature plants are often killed. These species can persist however, by regenerating from seed (they're obliged to regenerate from seed if they are to survive in an area). This seed may be stored in the soil, on the plant or brought in from nearby unburnt patches of vegetation by wind, water, birds or animals.

Resprouters are able to resprout after fire from woody underground lignotubers or buds protected underneath their bark (epicormic buds). Many landholders may be familiar with the behaviour of these plants (most eucalypts are a good example). Some resprouters can tolerate frequent fire, and some can live for a long time without fire. However, it is important to note that even resprouter populations may have their vigour reduced by very frequent fire or by fire exclusion, and may rely on seed to ensure healthy, diverse gene pools.

Not surprisingly, in the absence of fire, those plants which come to dominate the landscape often include shrubs which are able to regenerate without fire and other long-lived plant species. These plants tend to competitively exclude the smaller, short-lived species from available light and space. A fire can help to open up the canopy so that light can once again reach the forest floor, triggering resprouting, germination, and plant growth in many species.[2]

2.4.2 Mosaic burning

Mosaics are all about maintaining different parts of the landscape at different stages of post-fire development. Creating these 'patchworks' of different fire ages in time and space has ecological advantages over 'burning the whole place at once'. These patches can be burnt in different seasons, as different sized fires and/or with different intensities. Unburnt patches can act as animal refuges during the fire and provide food and shelter once the fire has passed. They also provide a base for some plant species to slowly recolonise burnt areas as these recover. Burnt patches may reduce the speed and intensity of unplanned fires and can provide boundaries for later planned burns.

Consider how you can break up your property or specific bush blocks so that you can burn smaller areas at a time, utilising natural fire breaks where possible (e.g. previously burnt patches, gullies, rocky areas etc.). Or you might be able to better achieve a mosaic effect by working together with your neighbours - a great idea for smaller properties or larger properties which lack the resources to manage numerous areas differently. Even within a single vegetation type, it is a good idea to vary fire frequency over time and space to allow for the full range of species[2].

2.4.3 Frequency and intensity of burning

The frequency (time interval between burns) and intensity of fires can have very profound impacts on the ecology of an area. Different vegetation communities can tolerate/ be benefited by different fire frequencies and intensities. Typical frequencies which are suitable for different vegetation communities are outlined in table 1, below.

Table 1: Recommended burn intervals to achieve different management objectives in different vegetation communities

Vegetation community	Ecological management burn interval (years)	Hazard reduction burn interval (years)
Dry forest	20	5 – 7
Heathland, dry scrub	10 – 20	5 - 10
Buttongrass moorland	20 – 30	5 - 10
Native grassland	5 - 20	2 - 5

Often fire frequencies required to meet fuel reduction goals are much shorter than desirable ecologically (for example, the understorey of a eucalypt woodland can easily become bracken dominated with very few other plants in that vegetation type able to tolerate the high frequency of fires) . An informed decision should be made on whether the ecological impacts of too frequent burning are acceptable when balanced against the need for fuel reduction.

[2] Hotspots Fire Project (2011) Managing fire on your property. Preparing a fire management plan. Version 3 – July 2011 New South Wales

2.4.4 Threatened plants and animals

While planned burning can have very positive ecological benefits, species which are listed as threatened have very little "room to move" – they typically have low numbers of individuals and few populations and so potential impacts of fire on them requires special consideration. For this reason, thorough preparation of the Fire Management Plan should take into consideration any potential impacts of the proposed planned burning program on threatened species. In some cases the actions recommended in the plan may need to be modified or adapted so that threatened species are not negatively impacted. Where this is done a threatened species permit (issued by the Department of Primary Industries, Parks, Water and Environment (DPIPWE)) will not usually be required. However, you must apply for a permit if you know that in conducting a burn as described in your plan you will be destroying or killing a quantifiable number of threatened species.

If you have any existing vegetation covenants in place (usually through the Private Land Conservation Program (PLCP), DPIPWE) on a block you plan to burn, you are required by law to obtain their permission. This can be done by contacting your local stewardship officer or PLCP on 1300 368 550. This permission will usually be given using the fire management plan as the guide and is likely to only be needed once, unless the fire management plan changes.

Ensure you allow sufficient amount of time to obtain any permits or permissions before you plan to do your first burn.

2.4.4.1 Where to find information about TASVEG communities and threatened species

Information about threatened species or threatened vegetation communities on your property can be found by generating a Natural Values Atlas report (NVA) from www.naturalvaluesatlas.tas.gov.au. Registering for this service is free and you will need to enter the latitude and longitude of your property. The NVA report will generate a list of known threatened TASVEG communities, plants and animals reported within 500m and 5km of the site. Location of and further information about threatened plant and animal species can also be searched for at www.threatenedspecieslink.tas.gov.au. Contact the Threatened Species Section at DPIPWE for more information. Below are some key threatened animal species that may be found on private land.

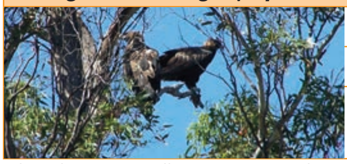
Wedge-tailed eagle *(Aquila audax fleayi)*		
	Status	endangered (TSPA) Endangered (EPBC)
	Habitat	Nests in old growth trees in native forests away from disturbance.
	Fire prescription	Do not disturb known nests from July/August to January/February and avoid burning within 1km of known nests if a spring burn is necessary.

Photo by Emma Williams, NRM North.

Spotted-tailed quoll *(Dasyurus maculatus subsp. maculatus)*		
	Status	rare (TSPA) Vulnerable (EPBC)
	Habitat	Most common in cool temperate rainforest, wet sclerophyll forest and coastal scrub along the north and west coasts.
	Fire prescription	No high intensity burns in spring. Use mosaic burns where possible.

Photo by S. Bryant.

Tasmanian devil *(Sarcophilus harrisii)*		
	Status	endangered (TSPA) Endangered (EPBC)
	Habitat	Coastal heath, open dry sclerophyll forest, and mixed sclerophyll-rainforest. Den habitats are well-drained areas with burrowable soil or the potential for sheltered overhangs, especially cliffs, rocky outcrops, knolls, caves and earth banks.
	Fire prescription	High intensity spring burns should be avoided in areas of den habitat especially if these areas are rare in the landscape. Use mosaic burns where possible.

Photo by Darran Leal.

Eastern-barred bandicoot *(Perameles gunnii gunnii)*		
	Status	Vulnerable (EPBC)
	Habitat	Mosaic of open grasslands with woodlands for shelter.
	Fire prescription	No high intensity burns in spring. Use mosaic burns where possible.

Photo by Hans and Annie Wapstra.

New Holland mouse *(Pseudomys novaehollandiae)*

Status	endangered (TSPA)
Habitat	Open heathlands, open woodlands with a heathland understorey, and vegetated sand dunes.
Fire prescription	Mosaic burns are recommended.

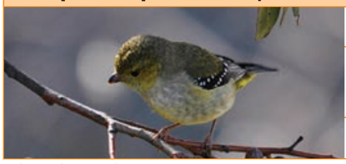
Photo by Hans and Annie Wapstra.

Swift parrot *(Lathamus discolour)*

Status	endangered (TSPA), Endangered (EPBC)
Habitat	Near the coast in dry forests on upper slopes and ridge tops. Nest inside hollow tree branches or trunks and mainly feed on the nectar of blue gum *(Eucalyptus globulus)* or swamp gum *(Eucalyptus ovata)* flowers. Their breeding range is restricted to the east coast of Tasmania where blue gums occur.
Fire prescription	Mosaic burns and should be low intensity to protect old growth trees

Photo by Mick Brown.

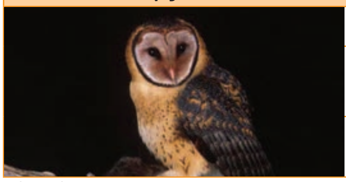
40 spotted pardalote *(Pardalotus quadragintus)*



Status	endangered (TSPA), Endangered (EPBC)
Habitat	Dry eucalypt forests and woodlands only where white gum (*Eucalyptus viminalis*) occur.
Fire prescription	No high intensity burns in spring and mosaic burn where possible.

Photo by Mick Brown.

Masked owl *(Tyto novaehollandiae subsp. castanops)*



Status	endangered (TSPA)
Habitat	Diverse range of forests and woodlands, particularly when these habitats adjoin areas of open or cleared land.
Fire prescription	Burns should be low intensity to protect old growth trees.

Photo by B. Brown.

Tussock skink *(Pseudemoia pagenstecheri)*

Status	vulnerable (TSPA)
Habitat	Occurs in grassland and grassy woodland habitats at a range of elevations.
Fire prescription	mosaic low intensity burn where possible

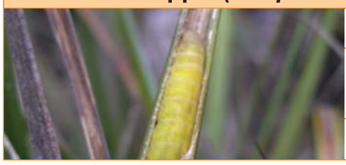
Photo by Hans and Annie Wapstra.

Ptunarra brown butterfly *(Oreixencia ptunarra)*

Status	vulnerable (TSPA)
Habitat	Ranges from Poa tussock grassland to *Hakea microcarpa* grassy shrubland to grassy open Eucalyptus woodland.
Fire prescription	Mosaic low intensity burns where possible.

(Male pictured) Photo by Mark Wapstra.

Chaostola skipper *(Antipodia chaostola leucophaea)*



Status	endangered (TSPS), Endangered (EPBC)
Habitat	Dry open eucalypt forest containing Gahnia radula in eastern and coastal Tasmania up to 600 m altitude.
Fire prescription	Avoid burning in spring and mosaic burn where possible.

Photo by Phil Bell, DPIPWE.

White-bellied sea eagle *(Haliaeetus leucogaster)*

Status	vulnerable (TSPA)
Habitat	Nest and forage mainly near the coast but will also live near large rivers and lakes inland, often moving on a seasonal basis. Nests in old growth trees.
Fire prescription	Do not disturb known nests from July/August to January/February and avoid burning within 1km of known nests if a spring burn is necessary.

Photo by Emma Williams, NRM North.

3 Implementing the burn

3.1 Background

The success of planned burning involves balancing a wide range of factors, some of which increase the level of fire behaviour and some of which decrease it. How these different factors are managed will determine the success or failure of a burn. Getting the balance right will maximise the probability that the fire will burn at the targeted level of intensity and its control will be within the available resources. Key factors include the level of fuel hazard, the intensity at which fires are lit and the relative balance between head, flank and back fires. These factors interact strongly with weather conditions to influence fire behaviour.

Having an understanding of all factors is critical to ensuring that planned burns are successful and safe.

***For example**, if fires are performed with all of the parameters at low levels (i.e. low wind speeds, low levels of fuel hazard and high fuel moistures) then fires will frequently fail to sustain, or if they do sustain then the fire will be too patchy to be effective at reducing fuel hazards or enhancing species regeneration. Conversely, if fires are performed with all of the parameters at high levels (i.e. high wind speeds, high levels of fuel hazard and low fuel moistures) then it will be very hard or impossible to control the fire and escapes are likely.*

The following section explains all of the factors relevant to fire behaviour and gives examples of how they interact. It then explains how to use these factors to successfully plan and implement your burn.

Figure 7: Having an understanding of all factors is critical to ensuring that planned burns are successful and safe.

3.2 Describing fire behaviour

The main influences on fire behaviour are wind speed, fuel characteristics and fuel moisture. The relative importance of these factors varies at different wind speeds. At low to moderate wind speeds (i.e. <25 km/h) wind speed and fuel characteristics have similar levels of influence on fire behaviour while at higher wind speeds, wind becomes the dominant factor.

The rate of fire spread is normally estimated from its average spread rate, once minor variation resulting from wind gusts, fuel characteristics and/or topography have been accounted for. Flames are normally described from the average vertical height of the flame above the ground surface. Fire intensity is estimated using the fuel's energy content, load and the rate of fire spread.

The main parts of a fire are the head fire, flank fire and back fire (Figure 8). The head fire is the fastest moving and most intense part of the fire and burns with the wind and/or up slope. The flank fire is intermediate in its rate of spread and intensity and burns at right angles to the wind and/or across the slope. The back fire is the least intense part of the fire and burns back into the wind and/or down slope. The ratio between the head flank and back fires is dependent on the vegetation type, wind speed and slope.

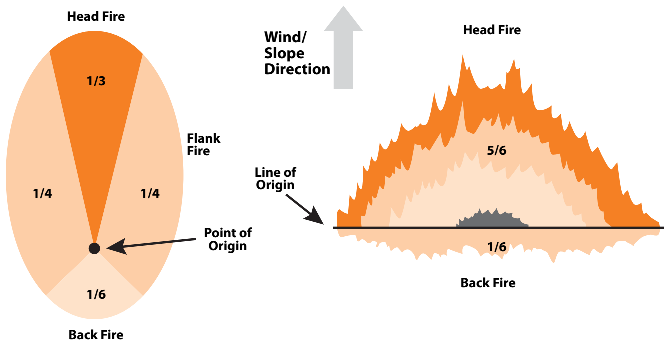


Figure 8: Parts of a fire. Figure copied from Kevin G. Tolhurst KG and Cheney NP 1999. Synopsis of the knowledge used in prescribed burning in Victoria. Department of Natural Resources and Environment, Victoria.

Fire behaviour can also be estimated from the Fire Danger Rating which integrates the influences of fuel, site factors and weather on fire behaviour, into an index of fire behaviour and suppression difficulty. The main aim of Fire Danger Rating is to provide a description of fire suppression difficulty. It was first developed by Luke (1953) and has since been amended to its current form. The Fire Danger Rating system consists of a numerical value and a rating class and is described in Table 1.

Table 2: Fire Danger Rating system (adapted from Luke 1953)

Rating class	Value	Description
low	0 - 5	fire control relatively easy
moderate	6 - 11	direct attack on fires possible if well resourced
high	12 - 24	fire control difficult and frequently fails
very high	25 - 49	fire control very difficult
severe	50 -74	fire control unlikely to be feasible or safe
extreme	75 - 99	fire control not feasible or safe
catastrophic	100+	very high level threats to life and property

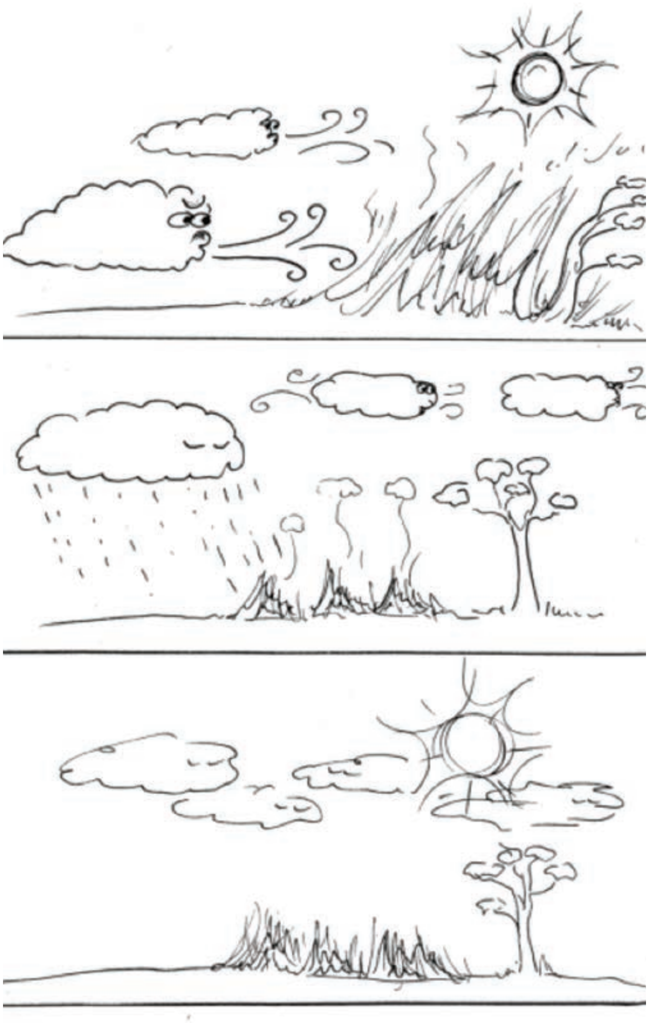


Figure 9: Wind, humidity and rainfall are very influential in fire behaviour.

3.3 Understanding the weather

The major weather factors directly influencing fire behaviour are: wind speed, humidity, rainfall and atmospheric stability. These factors have major influences on fuel moisture, which is another key influence on fire behaviour. Further detail about each of these factors is described below.

3.3.1 Wind speed

The major issue related to wind speed is the difficulty of measuring wind. This issue can be addressed by using the Beaufort wind scale (Table 2).

Table 3: Beaufort wind scale

Category		Speed (km/h)	Description
0	calm	<1	smoke rises vertically
1	light air	1-5	smoke drifts slowly, slight leaf movements
2	light breeze	6-10	wind felt on face, leaves rustle
3	light wind	11-20	leaves and small twigs move
4	moderate wind	21-30	dust raised, small branches moved
5	fresh wind	31-40	small trees sway
6	strong wind	41-50	large branches moved, wires whistle
7	near gale	51-60	large trees sway
8	gale	61-75	twigs and small branches broken off
9	full gale	75-90	large branches broken off
10	storm	91-115	trees uprooted, severe building structural damage

Daily changes in wind direction can be used during planned burning. Many of these wind direction changes are predictable, especially under stable atmospheric conditions. For example, the time and strength of sea breezes and/or katabatic/anabatic winds can be used during planned burning to burn off firelines during the day and then have the fire burn back onto recently burnt areas in the evening and overnight. However, if these wind direction changes are not accounted for they can cause major problems.

3.3.2 Humidity

The moisture content (humidity) of the atmosphere is normally described using relative humidity (RH) and the dew point temperature.

Humidity influences fire behaviour in several ways. RH is a major driver of fuel moisture, particularly when it falls below about 30%. At low humidity embers tend to stay alight for extended periods resulting in increased potential for spot fires. In addition, humidity has a major influence directly on fire behaviour. When the air temperature falls to the dew point temperature and forms dew, there is typically a rapid increase in the fuel moisture content and a corresponding decrease in the level of fire behaviour.

3.3.3 Temperature

Other than through its influence on the saturation vapour pressure, air temperature has only very minor influences on fire behaviour. Temperature does, however, have major influences on fire crew fatigue and the risk of dehydration, and the ability of fire crews to manage fires.

3.3.4 Rainfall

Rainfall influences fuel moisture and hence fire dynamics both through the amount of rain and the period of time since the rain stopped. The affect of rainfall on fire behaviour is normally assessed using the soil dryness index (SDI) and the drought factor (DF). The SDI provides an estimate of the longer term influences on coarse fuel moisture and the flammability of different vegetation types. The DF provides an estimate of short term influences on fuel moisture by predicting the proportion of the fine dead fuel available for burning.

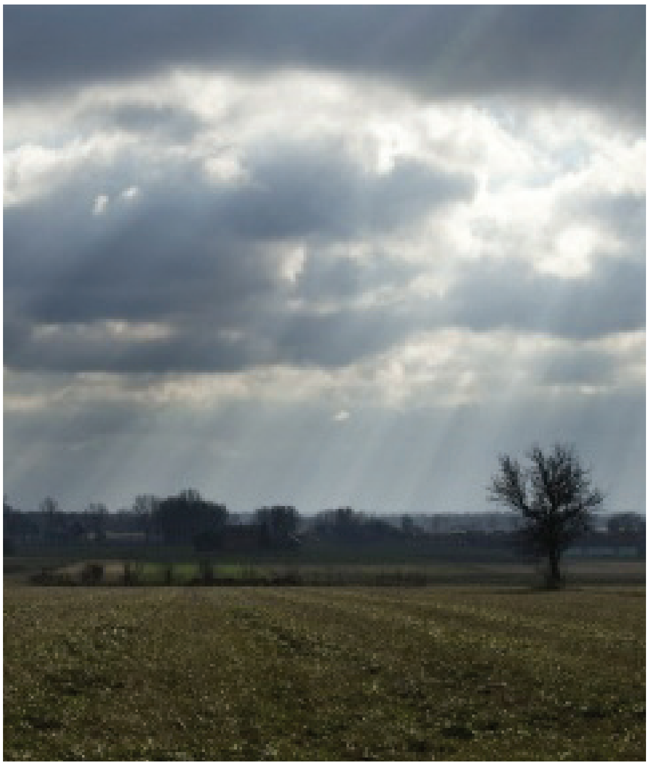


Figure 10: Rainfall influences fuel moisture and hence fire dynamics

Figure 11: Unstable atmosphere, note the clouds which are "boiling" upwards

3.3.5 Atmospheric stability

The stability of the atmosphere, and the presence or absence of inversion layers, has a major influence on fire weather and fire behaviour. This is mainly due to the likelihood that air from different heights will mix down to the ground surface and/or whether fires will form large convection columns.

A stable atmosphere (Figure 12) will reduce the fire's ventilation rate, trap smoke close to the ground surface and reduce solar heating. This will tend to result in decreased wind speeds, higher humidity and lower temperatures.

An unstable atmosphere (Figure 11) will increase the fire's ventilation rate, allow smoke to dissipate and increase solar heating. This will tend to result in increased wind speeds, lower humidity and higher temperatures. Usually when fires burn under unstable atmospheric conditions they have higher fire spread rates, flame heights and intensity along with more erratic fire behaviour.

Surface inversions typically form overnight at the ground surface due to cooling at the ground surface and result in a pool of cool to cold air beneath warmer air higher up. These inversions de-couple the atmosphere resulting in low wind speeds and high humidity at the ground surface. Surface inversions normally break down mid morning as a result of the ground warming (this breakdown may be delayed under cloudy conditions and/or when the atmosphere is smoky). Surface inversions are of major assistance during planned burning due to their influence on overnight fire behaviour, and their ability to increase the probability that fires will reduce to low fire behaviour levels and/or self-extinguish overnight.

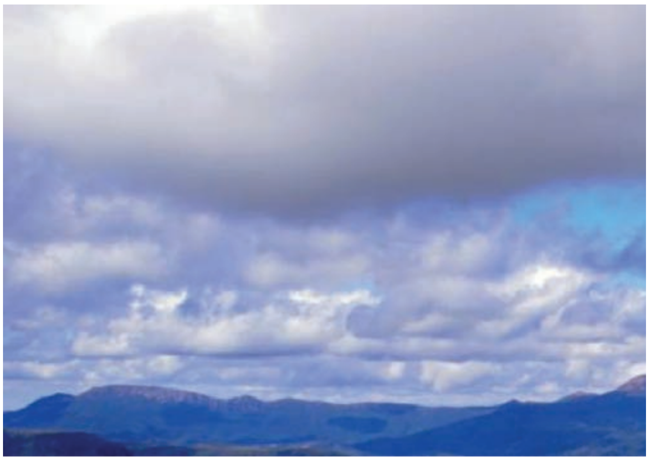


Figure 12: Stable atmosphere, note the flat, long clouds

3.3.6 Fuel moisture

The main influences on fuel moisture are:

- relative humidity (RH);
- Drought Factor (DF);
- Soil Dryness Index (SDI);
- wind speed;
- cloud type and cover;
- temperature.

The amount of moisture in dead fuel has a major influence on fire behaviour. The impact of fuel moisture can vary substantially depending on vegetation type. For example, fires in eucalypt forests will normally only sustain burning when the dead fuel moisture is below about 20%, but may burn uncontrollably when the dead fuel moisture falls below about 10%. In grasslands, fires will usually only sustain burning when the dead fuel moisture is below about 20 to 24%. In gorse, fires will typically sustain when the dead fuel moisture is below about 35%.

This means that if you are performing a burn in a highly flammable vegetation type such as gorse, provided the gorse's dead fuel moisture is above about 25%, it is possible to safely burn the gorse whilst having surrounding areas non-flammable.

Changes in fuel moisture may also occur within a vegetation type as a result of changes in aspect and/or slope. For example, gullies or south facing slopes may be shaded and/or have denser vegetation resulting in their having higher dead fuel moistures than flat areas, ridges and north facing slopes. These areas with higher fuel moistures therefore have the potential to act as boundaries. It may also be possible to perform two stage burns, where the drier ridges and north facing slopes are burnt at moister times of the year and then gullies or south facing slopes are burnt when conditions are drier, using the recently burnt ridges and north facing slopes as boundaries. This system has the advantage that the most flammable parts of the vegetation are burnt under low risk conditions.

Within a fuel layer, there is often variation in the dead fuel moisture between the exposed upper parts of the layer versus the shaded lower parts. For example, if only the fuels on the top of the layer are dry enough to burn then fires will typically burn as slow moving low intensity fires. However, if all of the fuel layer is dry enough to burn, the fire's rate of spread and intensity is likely to be much higher.

Figure 13: Within a fuel layer, there is often variation in the dead fuel moisture between the exposed upper parts of the layer versus the shaded lower parts.

A simple way of testing fuel moistures in the field is using the single leaf test. This test involves selecting a single piece of fuel, say a dead leaf or piece of bark, and seeing at what angle it will sustain burning. If it sustains burning when pointing straight up, the fuels will probably be too dry for planned burning. If it only sustains burning when pointing straight down, then the fuels are probably too wet to get an adequate burn (refer to Figure 14). The single leaf test can be used to estimate the moisture of different locations, such as gullies versus ridges, or different parts of the fuel layer, such as fuels that are exposed on the top versus those which are shaded on the lower part of the layer.

The single leaf test must be performed with care in order to ensure that the fuels tested are representative of the planned burn area. It is also critical that the single leaf test is not conducted too long prior to the burn as fuels may dry out further after testing.

Single leaf test	
 wet	**Leaf will not burn, even if pointed straight down** • fuel too wet to burn block • if from boundary, then boundary is too wet to carry fire
 moist	**Leaf burns only if pointed straight down** • if from top of fuel array, fuel too wet, do not burn
 borderline	**Leaf burns if angled down at 45˚ but not if level** • if from bottom of fuel array, fuel moisture may be ok • if from top of fuel array, fire will burn at low intensity • will require wind and/or slope to carry fire **Leaf burns if level but not if angled upwards at 45˚** • if from bottom of fuel array, fuel moisture ok • if from top of fuel array, fire will burn at moderate intensity
 dry	**Leaf burns if angled upwards at 45˚but not if vertical** • if from bottom of fuel array, too dry to perform burn • if from top of fuel array, fire will burn at high intensity • wind speed and/or slope needs to be minimised
 too dry	**Leaf burns if angled vertically upwards** • fuel too dry, do not burn

Figure 14: single leaf test for fuel moisture (copied from FT2005 prescribed burning - low intensity. Fire Management Branch, Forestry Tasmania, Hobart.).

Figure 15: In general, a stable high pressure system is ideal for burning.

3.3.7 Soil Dryness Index and Drought Factor

SDI estimates the amount of rainfall required to saturate the soil profile and includes estimates of the effective rainfall once the affects of vegetation interception, runoff and evapotranspiration are taken into account. Although the SDI provides reliable information on heavy fuel moisture, it needs to be used with caution and supported by information from the planned burn site. The best way to check the SDI is to go out to the burn site just prior to the burn and check the moisture by testing the moisture under logs and in the flammable fuels.

DF combines the effects of recent rainfall and the days since rain with the longer term soil moisture conditions predicted by the SDI to estimate the fine fuel moisture. The DF estimates the proportion of the surface fuel that is dry enough to burn, and varies between 0 (all of the surface fuel is too wet to burn) and 10 (all of the surface fuel is dry enough to burn).

The major factors affecting SDI and DF are:

- rainfall intensity and duration;
- the time since the rain fell;
- vegetation type;
- temperature.

3.3.8 Using the weather to plan your burn

Forecasts for these weather parameters are available from the Tasmania Fire Service website (http://www.fire.tas.gov.au/Show?pageId=colFireDangerRating) with additional weather information being available from the Bureau of Meteorology website (http://www.bom.gov.au/tas) or by phone on (03) 6221 2054. Various rural weather sites also contain suitable weather information (e.g. http://www.farmonlineweather.com.au/, http://www.eldersweather.com.au, etc).

It is important to consider the weather prescription that is needed to achieve your burn (e.g. wind speed and direction, humidity, time since last rain event, temperature), and study the weather forecasts with the prescription in mind. In general, a stable high pressure system is ideal for burning and the location of the high relative to your location will effect wind direction and speed. A key thing to look for is the forecast reliability (i.e. does the forecast for any given day change much over the forecast period?).

As well as monitoring the weather in the lead up to the burn, it is also a good idea to note the forecast weather system in the days after (e.g. if it is a larger high intensity burn, you may want to burn at a time when suitable burning conditions are followed by rainfall).

3.4 Fuel hazard rating

This Planned Burning Manual classifies fuel characteristics according to their fuel hazard and not fuel load. Studies have shown that fuel hazard is better correlated with fire behaviour than fuel load (t/ha).

Fuels are divided into four fuel hazard layers: surface fuels; near-surface fuels; elevated fuels and bark fuels (Figure 16). The fuel hazard assessment system developed by the Victorian Department of Sustainability and Environment (Hines et al. 2010) is used in this manual.

Each of these fuel hazard layers are assessed on a five point scale (i.e. low, moderate, high, very high or extreme) based on their fuel type, structure and continuity. In general, where fuels are being managed for asset protection, the aim is to normally ensure the level of fuel hazard is low or moderate.

Surface fuel layer

The surface fuel layer is comprised of: dead grass; leaves; bark; and twigs; usually in contact or close to contact with the soil surface. Surface fuels typically contain the majority of the fuel load and often have elevated fuel moistures and relatively low aeration.

Near-surface fuel layer

The near-surface fuel layer consists of live and dead fuels above the surface fuel layer. In some sites, the surface and near-surface fuel stratums intergrade with no clear break between them. Near-surface fuels are typically about 10 to 30 centimetres deep, but may be as high as one metre in some situations. Near-surface fuels consist of fine fuel including: suspended bark; leaf litter; low shrubs; bracken; tussock grasses; and sedges and rushes.

Elevated fuel layer

The elevated fuel layer consists of shrubs and tall bracken. They are typically about one to two metres tall, but may be 8 to 10 metres tall in wet eucalypt forests.

Bark

The main bark types are: gum barks; platy barks; and stringybarks. Gum bark (also known as candle or smooth barks) have long, coiled bark strips which may burn for extended periods and be lofted by the fire, resulting in the potential to cause long distance spotting (i.e. >2km). Platy bark (i.e. the bark tends to form small "plates") from peppermints, ironbarks and pines is characterised by layers of dead bark which can flake off and cause short range spotting (i.e. up to about 2km). Stringybarks form fibrous wads which can be removed by fire and can result in large numbers of short to medium range spotting.

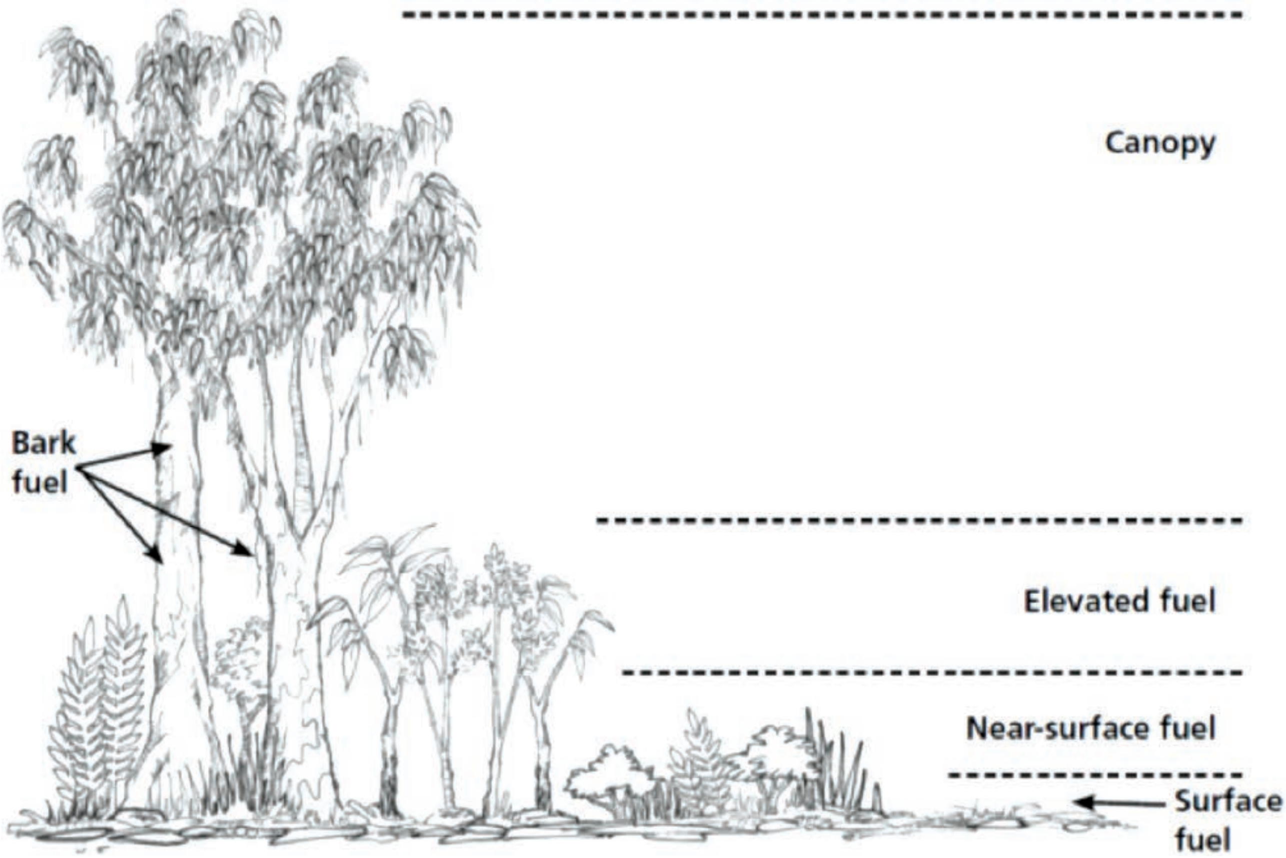


Figure 16: Fuel hazard layers (copied from Hines et al. 2010)

Overall fuel hazard

The influences of these four fuel stratums can be combined using the overall fuel hazard score. The usual method for doing this is to calculate the overall fuel hazard score then combine it with the level of fire danger to predict the ability of fire crews to manage fires.

Figure 17: Gorse is highly flammable and burns very intensely

3.5 Vegetation types suitable for planned burning

The guidelines for conducting planned burning in different vegetation types have been summarised in Table 3.

Table 4: Planned burning characteristics of different vegetation types suitable for planned burning

Vegetation type	**Typical burning objectives**	**Critical burning factors to consider**
Dry eucalyptus forest	• Fuel hazard reduction • Ecological management	Surface, near-surface, elevated and bark fuel hazard ratings must be reduced to low to moderate, requiring fires to be conducted with flame heights of two to four meters.
Heathlands, dry scrub and wet scrub	• Fuel hazard reduction • Ecological management	The tight threshold between sustaining and non-sustaining fires can result in minor increases in wind speed and/or slope, along with decreases in fuel moisture rapidly transforming low intensity fires that required intensive lighting, into high intensity fires.
Buttongrass moorlands	• Fuel hazard reduction • Ecological management	Moorlands are highly flammable and will burn when other vegetation types are too wet to sustain burning. However, this also means that when conditions are dry and/or windy, buttongrass moorlands will burn with high rates of spread and intensity. When surrounding vegetation is too wet to burn, buttongrass moorlands may be burnt with moderate wind speeds resulting in high intensity fast moving fires. However, when the surrounding vegetation is dry enough to burn, fires must be performed under more restrictive conditions and utilise mineral earth fire breaks
Native grasslands	• Green pick • Ecological management (to maintain species and structural diversity).	The critical factors controlling fire behaviour are fuel moisture, fuel load and continuity, curing (i.e. percentage of dead fuel) and wind speed.
Woody weeds (e.g. gorse, broom, Spanish heath & blackberry	• Control of weeds through integrated pre and post-fire treatments.	These guidelines are mainly intended for gorse fire management - other weed species are less flammable than gorse. Fire is a major issue in areas dominated by gorse due to its ability to sustain burning over a wide range of conditions, and its rapid post-fire regeneration. Therefore, integrated pre and post-fire treatments are essential. Treatment effectiveness can be enhanced by pre-burning herbicide spraying, scrub rolling and/or slashing to maximise burn intensity, and biomass consumption (to kill shallowly buried seeds and/or enhance seedling germination of deeper buried seeds) and improve post-fire access for follow-up treatments. Pre-burn treatment can also be used to broaden the burning window by increasing the weed's flammability and allowing the fire to be performed under higher fuel moisture conditions, reducing the risk of fires spreading to other vegetation types.

Table 5: Planned burning guidelines for different vegetation communities

Parameter	**Units**	**Dry eucalypt forest**	**Heathland / dry scrub**	**Button grass moorland -scrub boundary**	**Button grass moorland -mineral earth boundary**	**Native grassland**	**Woody weeds**
Wind speed at 10 m	km/h	<30					
Wind speed at 2 m	km/h		5 - 20	≤20	≤10	≤20	≤20
Relative humidity	%	40 - 80	40 - 80	40 - 90	40 - 90	40 - 80	50 - 85
Soil Dryness Index		<125		≤10	≤20		≤20
Temperature	˚C	10 - 25	10 - 25	10 - 25	10 - 25	10 - 25	10 - 25
Curing	%					>60	
Days since rain >2 mm				2 - 10	4 - 10	2 - 10	
Fire Danger Rating*		≤10	≤20	≤10	≤5	≤5	≤10
Fire frequency recommended for fuel hazard management	years	4 - 10	5 - 10	5 - 10			

*Note: dry eucalypt forests use Forest Fire Danger Rating; heathlands, dry scrub, and woody weeds use Scrub Fire Danger Rating; buttongrass moorlands use Moorland Fire Danger Rating; native grasslands use Grass Fire Danger Rating; where there is missing data in Table 4 it means that the indicated parameter is not used in that vegetation type (e.g. the SDI is not used in heathlands and dry scrub).

3.6 Control lines

The control lines used during planned burning will depend on whether any pre-existing firebreaks exist, the characteristics of the burning block, fuel moisture in the area being burnt and in surrounding vegetation, level of fuel hazard and the prevailing weather conditions, available resources to manage the burn, and the potential consequences should the fire escape the control lines. The main types of control lines used are tracks, roads, rivers, fuel reduced areas and surrounding vegetation which is too wet to burn. Where surrounding vegetation is being used to control fires, its Soil Dryness Index must be such that the surface and near-surface fuels are damp and non-flammable.

Figure 18: Slashed boundary. While this is not a particularly secure boundary provided the moisture levels of the cut vegetation are relatively high and it is patrolled it can be effective for lighting off under mild burn conditions.

Figure 19: This is a well maintained secure boundary. However, note the vegetation growing against the fence (including gorse) which means that it will need to be patrolled during burning.

Figure 20: The adjacent green paddock is being used as a boundary in this burn. It is not a particularly secure boundary in terms of protection for the fences, but it is being patrolled by a tanker unit.

Figure 21: While this narrow farm is suitable for a planned burn under mild conditions, the overhanging trees and litter spread across the farm track mean it is not secure and must be patrolled during the burn.

In general, the width of fire break required for planned burning is about twice the expected flame height. For wildfire control, the increased risk of spotfires means that fire breaks need to be about 5 times the expected flame height. This means that fire breaks need to be about 4 to 6 m wide for planned burns and about 50 to 75 m wide for wildfires.

The mechanisms through which fires cross control lines are mainly via direct flame contact across the track, spot fires and to a lesser extent radiant heat igniting fuels on the unburnt side of the control line. Where planned burning is performed using narrow four-wheel drive tracks or handlines, the upper fire intensity limit should be about a flame height of about 1 to 2 m.

When considering the type of boundary that will be used for your burn it is important to take into account the potential impacts that ploughing or clearing a fire break may have on the health of adjacent native vegetation (e.g. potential for weed invasion or spread of diseases such as phytophthora), and whether less high impact boundaries could be effective control lines and used instead. If ploughing or clearing are necessary then ensure that equipment is cleaned down before starting work to minimise the risk of bringing weeds or disease into the area (this rule should apply to all equipment used prior to and at the burn, including slashers, vehicles, etc.).

It is critical that thought is given to control lines well before the day of the burn arrives, as good boundaries reduce the amount of labour and equipment required to safely manage the burn. Any boundary preparation (e.g. slashing, ploughing) should be done well in advance of the burn.

3.7 Resourcing the burn

The resources required to safely manage a planned burn will vary depending on the size, weather conditions and nature of the burn. Resources include both labour (people) and equipment. In general, private landholders do not have ready access to large amounts of labour, and people experienced and trained in planned burning are rare. The Tasmanian Fire Service volunteer rural brigades may be available to assist and resource planned burns if they have the capacity. However, as this will vary depending on the brigade and the time of year, the availability of local brigades shouldn't be taken as a given when planning burns. The best point of contact should TFS support be required is the TFS district officer for your area - their contact details can be obtained by contacting your regional office (South, North or North West). Contact details are available on the TFS website (http://www.fire.tas.gov.au). For private landholders who have limited resources, as a general rule it is likely to be better to conduct burns that are low intensity and planned to self-extinguish, rather than high intensity burns which need to be actively extinguished. Low intensity burns will require less labour resources to safely manage.

There is basic equipment which landholders planning burns should have access to, as it will increase the likelihood that the burn can be safely managed and kept under control. The basic equipment recommended includes:

- Driptorches - fueled by 1 part petrol and 3 parts diesel.
- 400 - 1200L tanker mounted on a trailer or on a ute/tractor. Before burning it is important all water tanks are filled ready to go and pumps are tested.
- Fire fighting foam - applied at about 0.1% foam concentrate to water using either a hose applicator or at the fire pump using a specialist foam injector system. It is not recommended that foam concentrate be added to water tanks since even slight agitation (e.g. as a vehicle drives along a track) will result in the creation of foam which cannot be pumped from the tank.
- Mobile phones (and phone numbers) to communicate with other members of the team (in some areas UHF radio may be more reliable).
- Access to current weather information via internet/phone.
- Tractor with slasher/discs/loaders/etc (optional) (these can be most valuable for preparing firebreaks prior to the burn).
- Beaters/hessian bags.
- Knapsacks (e.g. collapsible knapsacks).
- Hand tools such as rakes, hoes and/or chainsaws.
- Suitable clothing (refer to the next section).

Figure 22: Use of fire fighting foam to reduce the amount of water needed in burning in a fire break

3.7.1 Personal clothing and equipment

Essential

- Cotton, wool and/or specialist fire clothing (e.g. fire retardant overalls) (no clothing made out of synthetic materials).
- Leather boots.
- Food and drinking water.

Highly recommended

- Leather gloves.
- Goggles - without air breather holes so that smoke is kept out (these are available from retailers of safety clothing).
- Dust masks (e.g. masks suitable for welding are best).
- Hard hats (if burning areas with trees, these are essential).

Figure 23: Note safety clothing – hard hat, goggles, leather gloves, leather boots, cotton and wool clothing and armed with a drip torch and mobile phone.

3.8 Safety and risk management

This section covers both the safety of the people running and assisting with the burn, and managing the risks of negative impacts (e.g. fire escapes or smoke nuisance).

3.8.1 Smoke management

It is important to be aware that burns can be a significant contributor to episodes of air pollution. Smoke in sufficient concentrations can lead to exacerbation of asthma and other health conditions, even from short, episodic exposures. It can also have negative impacts on some crops (for example wine grapes).

Smoke is an inevitable consequence of conducting planned burns, which are a legitimate land management practice. However, smoke produced from your burn is your responsibility, and management of a burn should be done in such a way so as to avoid or minimise impacts from smoke. For example, use weather forecasts to predict where smoke will travel, modify prescriptions to prevent smouldering, or conduct the burn at a time when the impact will not occur. Further detail on managing smoke is available in the State Fire Management Council's Position Paper - Management of Smoke arising from Prescribed Burning of Vegetation.

3.8.2 Pre-burn planning

There should be a clearly identified "burn boss" who is in charge of the burn. This person would normally be the landholder, but in some cases they may nominate another person (e.g. local fire brigade chief).

There are a few key tasks which must be done as part of the preparation on the day of the burn:

- Neighbours must be notified of the burn.
- Fuel moisture assessment (either using the single leaf test or a test burn or both).
- Appropriate weather resources must be consulted (e.g. BOM and TFS websites).
- Property maps which show key features such as water fill points, roads and tracks and gates are available to draw the burn plan on.

Based on the information above, the fire ignition plan can then be developed and drawn onto the map, after first taking time to assess the **prevailing conditions** and to develop the burn plan based on these (NOT the forecast conditions). This should take into account what the conditions are likely to be later in the day (for example if a sea breeze is known to come in between 3 and 4pm most days factor this into the planning). Burns should be planned to minimise the risk of high concentrations of smoke in neighbouring communities, for example, when weather conditions predict poor smoke dispersal, burns should be limited or postponed.

The Tasmania Fire Service Burn Implementation Plan (Appendix 1) should be completed prior to every burn, even if the burn is not being done within the permit period. This will

Figure 24: Be aware of how smoke from your burn is likely to behave and what potential impacts this may have on neighbours when planning your burn

Be aware that where dense smoke is produced under powerlines; it can cause arcing

help to ensure the parameters used to conduct the burn are appropriate, and will clearly demonstrate that due care has been taken in planning the burn.

It is also possible to register a burn with the TFS outside the permit period – this ensures that if the fire is reported by a member of the community, TFS are already aware of it and it doesn't result in a brigade call out.

Either use the plan diagram in the TFS Burn Implementation Plan (Appendix 1) or your own map of the site to mark out the lighting plan. This should clearly show ignition lines or points (Section 3.9), safety zones, water fill points, crew locations etc. (Figure 27).

As a courtesy you should notify your neighbours of the burn, especially those who may be impacted by, or see, smoke. This should be undertaken twice: during the planning phase in case your neighbours have any issues with the burn (e.g. in case they plan to have dry stubble adjacent to your burn block or have smoke sensitive crops); and then just prior to the burn being performed.

3.8.3 Risk management

Key risks posed by planned burns are fire escapes and smoke nuisance (Figure 25). It is important to perform a risk assessment on the burn prior to going ahead with it. The aim of doing a risk assessment is to enable assessment of the

Figure 25: Key risks posed by planned burns are fire escapes and smoke nuisance.

Contact 1800 000 699 to register a burn. *You will need to provide your name, grid reference/property address, contact phone number.*

[4] AS/NZS 2009. Australian and New Zealand Standard: AS/NZS ISO 31000, Risk management – Principles and guidelines. Standards Australia, Sydney, Australia and Standards New Zealand, Wellington, New Zealand

relative risk levels of various aspects of the burn, and to have contingency plans in place before the burn is lit. When planned burns are conducted, compromises may need to be made as to how the burn is going to be undertaken. However, by quantifying the relative risk of different potential outcomes and identifying which factors have the greatest influence on the level of fire risk, balanced assessments can be made. Performing a risk assessment minimises the risk of negative impacts and maximises the probability of completing the burn successfully and achieving your objectives.

The Australian and New Zealand risk management standard (AS/NZS 2009[4]) can be used to guide assessments of the level of risk. This system defines risk as the likelihood that an event will occur multiplied by its consequence (Table 6).

Table 6: Risk matrix used to guide fire risk assessments

Consequences	**Likelihood**					
	1	**2**	**3**	**4**	**5**	**6**
	Practically impossible	**Conceivable**	**Remotely possible**	**Unusual but possible**	**Quite possible**	**Almost certain**
1 Moderate	Noticeable	Low	Low	Low	Moderate	Significant
2 Important	Low	Low	Moderate	Moderate	Significant	High
3 Serious	Low	Moderate	Significant	High	High	High
4 Very serious	Moderate	Significant	High	High	Extreme	Extreme
5 Disaster	Significant	High	High	Extreme	Extreme	Extreme
6 Catastrophic	High	High	Extreme	Extreme	Extreme	Extreme

Derived from Australian and New Zealand risk management standard AS/NZS 2009

Example 1: *If a burn is adjacent to a vineyard the likelihood of smoke impacting on grapes is almost certain and the consequence to the winery would be serious resulting in a high risk rating. These impacts can be reduced by burning in spring when the vines are not carrying ripe fruit, reducing the likelihood to practically impossible, consequence to moderate and the risk rating to noticeable.*

Example 2: *If a burn is adjacent to a road, which is up-wind of the planned burn there is still a chance that the wind could change direction and impact visibility for traffic on the road. In this example, the likelihood of a change of wind direction and impacts on traffic is remotely possible and the consequences would be serious resulting in a significant risk rating. These impacts can be reduced by monitoring for any changes in wind direction, and if this occurred by placing warning signs and advising traffic to slow down.*

A risk assessment template is included in Appendix 2, along with a completed example. This risk assessment should be completed prior to the planned burn so that the major risk factors can be addressed and the risks posed by the burn minimised.

The attention to safety required during the burn is summarised by the acronym LACES – this is explained in Figure 26. Be aware of this when preparing the burn plan, completing the risk assessment, taking the pre-burn briefing, and throughout the burn.

LACES

Firefighter

Lookouts	Everybody looks out for everybody else
Awareness	Everybody is aware of the current and anticipated behaviour of the fire and other incident hazards and precautions
Communications	Everybody speaks up about what is happening and their concerns at the incident and everybody listens
Escape Route	Everybody has an 'out' planned and agreed
Safety Refuge	Everybody helps everybody to survive. Everybody supports the decision to get clear of a hazard

Crew Leader

Lookouts	Assign a "lookout" to a safe vantage point in communication with crew leader
Awareness	Terrain, weather, fire behaviour, the task and nearby activities
Communications	Maintain suitable radio or other contact
Escape Route	Suitable escape route/s checked and known by all crew
Safety Refuge	Suitable, large enough, close enough and free of hazards

Figure 26: the LACES planned burning safety system (obtained from NSW Rural Fire Service pocket book)

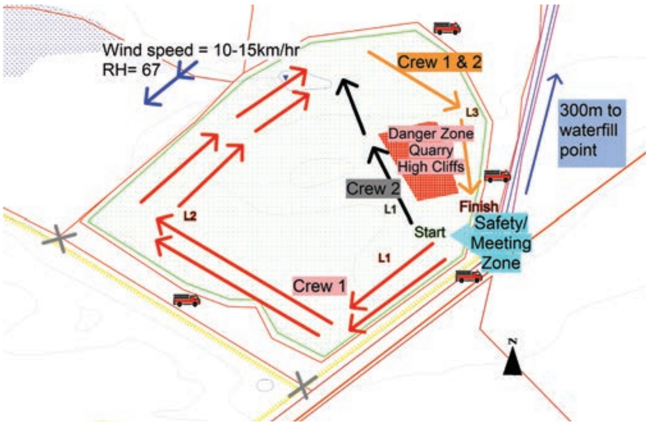


Figure 27: An example of a lighting plan

3.8.4 Pre-burn briefing

Prior to the burn a briefing should be held with all participants. The briefing should cover:

- Map of the site highlighting tracks and any access limitations (e.g. 4WD only, gates).
- The lighting technique to be used (shown on the map).
- How the burn is predicted to behave (including the predicted weather forecast).
- Key risks identified and how these are being addressed (i.e. what is the contingency plan if things don't go according to plan).
- Tasks for participants (i.e. so everyone involved is clear on their role).
- Escape routes and safety zones are clearly identified and explained.
- How communications will be managed during the burn (if mobile phone reception is reliable have a list of mobile phone numbers available, if not handheld or UHF radio frequencies). Radios are preferable to phones as everyone can hear what is going on.
- Participants are confident using the equipment they are assigned (especially pumps and hoses) (and pumps etc. have been tested prior to light up).
- Ideally participants should all be taken for a drive around the block, so that they can familiarise themselves with the terrain and escape routes.

Figure 28: The briefing should cover whether participants are confident using the equipment they are assigned.

3.9 Lighting the fire

The method used to light burns, and the location of the ignition points relative to the site's characteristics, will have a major influence on the rate of fire spread rate, fire intensity, spotting potential, fire control options and burn out time.

For example, if fires are lit with higher wind speeds, drier fuels, as head fires and/or closer ignition spacing then the time taken to burn out the block will be reduced, but the fire's rate of spread, intensity and spotting potential will also be increased which will make fire control more difficult and increase the risk of escapes.

The major factors to consider in lighting the burn are:

- the intensity of ignition spacing;
- length of fireline lit;
- orientation of ignition compared to site slope;
- orientation of ignition compared to wind direction;
- variation within the burn area in fuel type and fuel moisture.

3.9.1 Fuel type and moisture

Variation in fuel type, fuel moisture and the time of day that fires are lit can be used to influence fire behaviour and the location of control lines. In most sites, ridgelines and north-to-northwest facing slopes will have lower fuel moistures than gullies and south-to-southeast facing slopes. Hence, ridgelines and north-to-northwest facing slopes typically burn at higher intensities than gullies and south-to-southeast facing slopes.

For example, if planned burns are conducted when the fuel moisture in gullies and/or south-to-southeast facing slopes is too high to sustain burning, these south and southeast facing areas can be used as control lines resulting in fires only burning ridgelines, north and/or northwest facing sites. This in turn allows for the potential to safely burn the south and southeast facing sites under drier conditions than would be possible if the dry north and northwest facing slopes had not already been burnt.

The time of day fires are lit is also important. During the day, fuel moisture typically peaks at about dawn and is lowest in the mid-afternoon (Figure 29). Ideally, fires are lit once fuel moistures have bottomed for the day and are on the rise. If fires are lit too early in the day, the level of fire behaviour mid-afternoon may be too high for the available resources and/or the available control lines.

A good rule of thumb is to wait until early to mid-afternoon before lighting the fire so that the fire is burning during the time period when fuel moistures are rising, not falling.

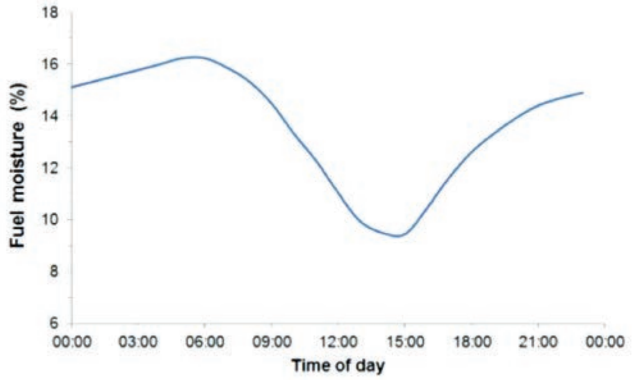


Figure 29: Relationship between time of day and fuel moisture under typical planned burning conditions.

The time of year has a major influence on fire behaviour. In late autumn or early spring fuel moistures tend to be higher than in early autumn or late spring. The prevailing conditions in the year that a burn is being planned are also important. During below average rainfall years it may be possible to perform burns in late autumn, winter and early spring (during such dry years it may be too dry to do safe planned burning in early to mid-autumn or in mid to late spring). Conversely, in above average rainfall seasons it may be too wet to conduct planned burning between mid-autumn and mid-spring.

3.9.2 Length of fireline

The length of active fireline has major influence on fire rate of spread, intensity and spotting. Fires burning with a fire line of less than 50m will tend to have lower rates of spread and intensity. This means that if the length of active fireline is kept short the resulting level of fire behaviour can also be kept low.

Figure 30: The length of active fireline has major influence on fire rate of spread, intensity and spotting.

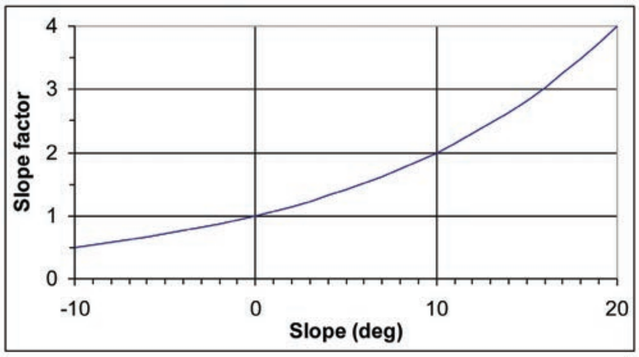


Figure 31: Relationship between slope and rate of fire spread[5]

3.9.3 Effect of slope

The level of fire behaviour is also strongly influenced by the orientation of the ignition line to the direction of the sites slope. For example, the rate of fire spread upslope approximately doubles for every 10° upslope and conversely, halves for every 10° down slope (Figure 31).

3.9.4 Effect of wind direction

The orientation of the fireline to the prevailing wind direction will determine whether the fire burns as a head, flank or back fire (refer to Section 3.2 for more information on the regions of a fire). A good rule of thumb is that flank and back fires typically burn with about 40% and 10% respectively of the head fire rate of spread.

3.9.5 Ignition method

When planned burns are lit, the main ignition method is hand lighting using drip torches. A major issue associated with planned burn ignition is balancing the intensity at which the burn is lit (e.g. the length of fireline lit and/or the number of ignition points) against the required level of fire behaviour. There is typically a time-lag between when fires are lit and the fire reaching its average level of fire behaviour and it is critical that fires are not over lit during this build-up period. If fires are lit too intensively or with too close a spacing there is a high potential for the fires to form junction zones, which can cause enhanced local wind speeds and increases in the rate of fire spread, intensity and potential for spot fires.

Where fires are lit as spot fires, the rate of fire spread and intensity will slowly increase as the fire gets larger, while if fires are lit as lines of fire then the fire will burn at its potential rate of spread and intensity from the time at which it is lit.

Figure 32: Lighting the fire off a fire break, with tanker following to "mop up".

[5] McArthur (1967); Noble et al. (1980)

3.9.6 Ignition pattern

The most common ignition patterns used during planned burning are:

- back fire ignition;
- flank fire ignition;
- head fire ignition;
- spot fire ignition and;
- perimeter fire ignition.

Back fire ignition

Fires are lit so that their direction of travel is into the prevailing wind and/or down slope, resulting in the rate of fire spread and intensity being kept to a minimum. This technique is normally used when fuels are relatively dry and/or weather conditions are such that head and/or flank fires would burn with excessive rates of fire spread, intensity, scorch and/ or spotting. The main aim of this lighting strategy is to keep the level of fire behaviour low. It can also be used to burn fire breaks.

Flank fire ignition

Fires are lit in lines parallel to the direction of fire spread and/ or straight up-down slopes, resulting in intermediate rates of fire spread and intensity.

Head fire ignition

Fires are lit in lines with the wind behind and/or straight across slopes, resulting in rate of fire spread and intensity being maximised. This technique is normally used when fuels are relatively moist and/or under mild weather conditions.

Spot fire ignition

Fires are lit as a series of independent spot fires. The aim is for the spots to join up in the cool of the evening and/or burn into less flammable fuels (e.g. gullies or south to southeast slopes), where they self-extinguish. The aim of this technique is normally to minimise fire junction zones and excessive levels of fire behaviour. However, if fuels are relatively moist and/or the weather conditions are mild, this technique can be used to intensively light up areas with the fire junction zones acting to increase the level of fire behaviour and reduce the burnout time.

Perimeter fire ignition

The block is lit normally as strips from pre-existing fire breaks (e.g. roads, tracks and/or rivers), and allowed to burn into the block.

Figure 33: Flank fire ignition

Figure 34: Spot fire ignition

Figure 35: Perimeter fire ignition

4 After the Burn

Landholders are strongly encouraged to monitor and review both immediate and long term outcomes from burning on their properties. Monitoring post-burn is also critical to prevent fire escapes, which can still be a risk after the burn.

Plan to check the burn for 2 days in the heat of the afternoon and then again on the next high fire danger day after the burn (the latter check is especially important if heavy fuels or log heaps have been burnt). Feeling the ground for warmth is a simple way of testing whether the fire is still smouldering or not. Patrol the burnt area the morning after the burn to check whether it has extinguished or not. If the fire is still actively burning, steps may need to be taken to make the fire as safe as possible. This might involve suppressing the fire's boundary if practical and/or re-lighting the fire's boundaries to bring the fire out to safe edges.

Great care should be taken when patrolling after the burn, as trees that may have burnt but still be standing may have been structurally weakened and there is a danger of trees/branches falling.

Figure 36: This tree was weakened by the fire and came down in high winds a few weeks later.

Heaps and stumps are high risk for fire escapes after the burn and should be checked regularly in the weeks after the burn to keep track of whether they are extinguished or not. Ideally heaps and heavy fuels should be rolled over using machinery to aerate them and burn them right through. During the period before heaps or heavy fuels are extinguished if there are any high fire danger days, monitor closely for smoke.

Figure 37: This log heap has been turned after the burn, most of the material has been burnt and the heap is extinguished.

The recording sheet for Landholders (Appendix 3) is recommended to be completed after each burn. Monitoring and recording may include:

- Recording specific details about the burn.
- Monitoring regeneration of vegetation (this may be achieved through setting up photo monitoring points).
- Monitoring establishment/regrowth of weeds.

Recording and monitoring of burn outcomes will enable informed decisions when planning and implementing future burns. Like all land management activities, the use of fire will give maximum benefits when the effect on the land is observed and responded to.

Where planned burns are conducted for weed management, it is essential for follow up control to occur in the months after the burn.

5 Wildfire

High fire danger days during the summer months are inevitable, but there are a few precautions that can be taken to reduce the risk of the severity of impacts from wildfire.

Before summer precautions include:

- General protection of house and assets (download the Bushfire Survival Plan from the TFS website www.fire.tas.gov.au).
- Graze paddocks near houses and sheds hard (or slash grass) so there is no long dry growth surrounding assets.
- Service any fire pumps and check tanks/trailers.
- Maintain fire breaks.

When high fire danger days are predicted additional precautions include:

- Monitor any smouldering heaps or stumps.
- Ensure tanks are full of water and ready to go.
- Relocate livestock if they are in a high risk area to a safer area (or open gates to enable them to move to safety if a fire threatens).
- Listen to the radio, refer to TFS website for updates of any wildfires.

Figure 38: High fire danger days during the summer months are inevitable

6 References and further reading

Planned burning, smoke, fuel assessments and fire risk

Marsden-Smedley JB 2009. Planned burning in Tasmania: operational guidelines and review of current knowledge. Parks and Wildlife Service, Forestry Tasmania and Tasmania Fire Service, Hobart, Tasmania. Available from: http://www.parks.tas.gov.au/index.aspx?base=15944

Marsden-Smedley JB 2011. Planned burning in Tasmania I: review of current knowledge. TasForests 19: 86-108. Available from: http://www.forestrytas.com.au/publications/tasforests/tasforests-vol-19

Marsden-Smedley JB and Whight S 2011. Planned burning in Tasmania II: fire risk assessment and the development of a standardised Burn Risk Assessment Tool (BRAT). TasForests 19:109-121. Available from: http://www.forestrytas.com.au/publications/tasforests/tasforests-vol-19

Marsden-Smedley JB 2011. Planned burning in Tasmania III: revised guidelines for conducting planned burning. TasForests 19: 122-134. Available from: http://www.forestrytas.com.au/publications/tasforests/tasforests-vol-19

Hotspots fire project 2011. Managing fire on your property: preparing a fire management plan, version 3. NSW Rural Fire Service and Nature Conservation Council of NSW. Available from: http://hotspotsfireproject.org.au/

State Fire Management Council 2012. Position Paper - Management of Smoke arising from Prescribed Burning of Vegetation. Available from: http://www.sfmc.tas.gov.au/document-library

Wine Tasmania website has useful information on reducing the impacts of smoke on vineyards: http://winetasmania.com.au/industry/technical_information/vineyard_management

Vegetation and fuel type

Harris S and Kitchener A 2005. From Forest to Fjaeldmark: Descriptions of Tasmania's Vegetation. Biodiversity Conservation Branch, Department of Primary Industries and Water, Hobart, Tasmania. Available from: http://www.dpiw.tas.gov.au/inter.nsf/WebPages/LJEM-6K2749?open

Hines F, Tolhurst KG, Wilson AAG and McCarthy GJ 2010. Overall fuel hazard guide. 4th edition. Report 82, Fire Management Branch, Department of Sustainability and Environment, Melbourne, Victoria. Available from: http://www.dse.vic.gov.au/fire-and-other-emergencies/publications-and-research/fire-research-reports/research-report-no.-82-overall-fuel-hazard-assessment-guide

Pyrke A and Marsden-Smedley JB 2005. Fire-attributes categories, fire sensitivity, and flammability of Tasmanian vegetation communities. TasForests 16: 35-46. Available from: http://www.forestrytas.com.au/publications/tasforests/tasforests-vol-16

Additional background information and resources

South East Queensland Fire and Biodiversity Consortium. Available from: http://www.fireandbiodiversity.org.au/

Hotspots fire project 2011. Managing fire on your property: preparing a fire management plan, version 3. NSW Rural Fire Service and Nature Conservation Council of NSW. Available from: http://hotspotsfireproject.org.au/

Useful websites and phone numbers

Private Land Conservation Program (PLCP), DPIPWE)
Phone 1300 368 550

Tasmania Fire Service
www.fire.tas.gov.au

State Fire Management Council
www.sfmc.tas.gov.au

Tasmania Fire Service (weather parameters)
www.fire.tas.gov.au/Show?pageId=colFireDangerRating

Bureau of Meteorology
www.bom.gov.au/tas
Phone 03 6221 2054

Various rural weather sites
www.farmonlineweather.com.au
www.eldersweather.com.au

To register a burn
1800 000 699

Appendix 1 - Tasmania Fire Service planned burning form

The operational burn plans are based on the Tasmania Fire Service planned burning form required to be completed when applying for a fire permit during the permit period. Completing this form is strongly recommended prior to conducting a planned burn even outside of the permit period. It ensures all of the factors such as ignition method, control lines, weather etc have all been considered prior to actually conducting the burn.

Please note that this TFS permit is a separate permit to that required for threatened species.

To register a burn outside the permit period contact 1800 000 699.

TASMANIA FIRE SERVICE
BURNING PLAN

PERMIT NO ISSUED: …………..

A PERMIT HOLDERS DETAILS

Given Name: ______________________ Surname: ______________________

Street/Road Number/Name: ______________________

Suburb/Town/Location: ______________________

Postcode: ______________ State: TAS Contact Phone No/s: ______________________

B LOCATION OF PLANNED BURN

Is the location of planned fire same as on permit holders details? Yes / No *(If No complete details below)*

Street/Road Number/Name: ______________________

Suburb/Town/Location: ______________________

or

Map Sheet Name: ______________ Scale: ______________ Grid Reference: ______________

C DESCRIPTION OF AREA

Vegetation Type/s: Bush Scrub Grass Slash Logheaps

Years Since Last Burn: ______________ Size of Area to be Burnt (Ha): ______________

Topography – Predominant Aspects: North East South West

– Predominant Slope: Flat Undulating Moderate Steep

Boundaries/Control Lines: Roads Tracks Raked Lines Stream/Water Course

Green Crop Cleared/Ploughed Ground Recent Burnt Area

What needs to be done to ensure Control Lines are secure: ______________________

____

____

What is the most vulnerable edge: ______________________

D WEATHER

Temperature should not exceed 20°. Relative humidity should be above 40%.

Wind speed must be less than 15kph. Wind direction **must not be from**: ______________

Nearest Fire Weather Station______________ Forecast Fire Danger Rating (Day of Burn) ______________

Next Three Days	Day 1	Day 2	Day 3
Fire Danger Rating			

E PERSONNEL and RESOURCES

Number of personnel to be on site: ______________________

Name of person in charge: ______________________

Firefighting equipment on site: ______________________

____

Firefighting equipment available at short notice: ______________________

____

F LIGHTING TECHNIQUE

How many people will be physically lighting fire: ______________________

How long will it take to light fire: ______________________

What is the most suitable time of day to light fire: ______________________

How long will the fire burn for: ______________________

Describe the sequence of lighting: (For example southern boundary 1st, once secure spot lighting down slope/upwind etc.):

____

____

____

G PATROL / MOP UP / EXTINGUISH

Number of personnel available to patrol and extinguish perimeter and hot spots within 100 metres of perimeter over the next three days: ____________________

What firefighting equipment will be available for this purpose: ____________________

____

H RISKS

Identify any assets which may be at risk as a result of the planned burn: ____________________

____

I ESCAPES

If the fire escapes or the fire activity is such it appears likely to escape, list your actions: ____________________

____

____

____

J PERMIT HOLDER'S OBLIGATIONS

This plan forms the primary conditions of your fire permit, it is not valid until approved by the Fire Permit Officer and has the permit number written in the top right hand corner of the front page. This plan must be retained by you and you must be able to produce this plan and your fire permit upon the request of an authorised officer at any time during the duration of the fire. Failure to retain this plan will be deemed to be a breach of the conditions of permit. A copy of the plan must be provided for the permit officer.

Upon the declaration of a Total Fire Ban your permit is revoked. If your fire is alight you must take immediate steps to stop it spreading and extinguish it.

If you need help dial 000 and ask for the Fire Service

K ADDITIONAL INFORMATION

FIRE WEATHER INFORMATION

Listed below are the Fire Weather Forecast Station for which the Bureau of Meteorology issues detailed fire weather forecasts and fire weather outlooks. The information for the fire weather station nearest the planned burn area is available from a number of sources.

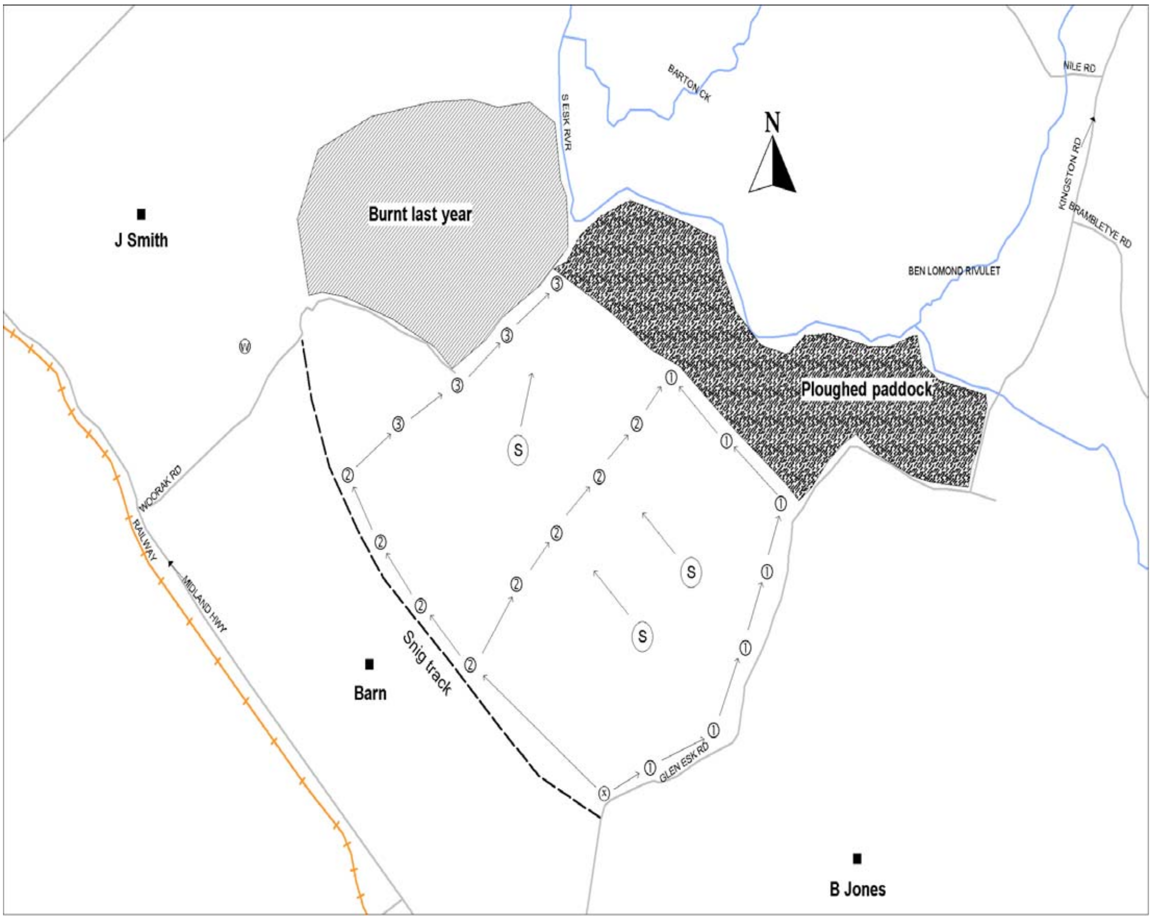
Weather by Fax (Bureau of Meteorology) and which can be accessed by Fax Machine
Fire Weather Forecast for next day/or on the day of the planned burn — Phone: 1902 935 803
Fire Weather Outlook for the next three days — Phone: 1902 935 804

Bureau of Meteorology Ph: (03)62212000 and ask for the Fire Danger Rating for a specific station.

State Fire Management Council Web Site http://www.sfmc.tas.gov.au/part_a/intro_weather_map.htm and follow the link to Fire Danger Index Forecasts and outlooks.

Fire Weather Forecast Stations
Bushy Park, Devonport, Dover, Fingal, Flinders Is Airport, Friendly Beaches, Geeveston, Hobart Airport, Hobart City, King Is Airport, Launceston Airport, Launceston City, Liawenee, Luncheon Hill, Marrawah, Maydena, Moogara, Mt Wellington, Ouse, Palmers Lookout, Scotts Peak, Scottsdale, Smithton, St Helens, Strahan Airport, Tarraleah, Tunnack.

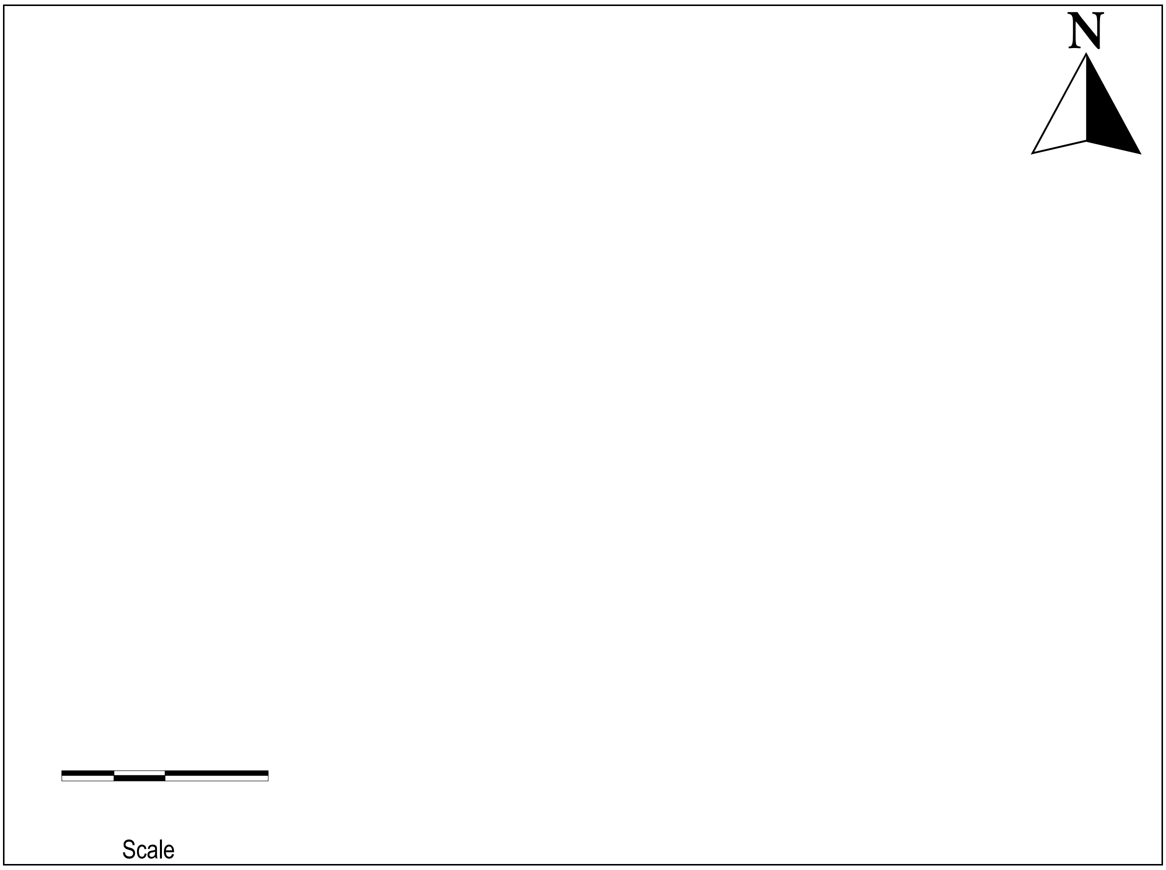
EXAMPLE OF PLAN OF BURNING AREA AND LIGHTING TECHNIQUE



LEGEND FOR BURNING PLAN

(W)	Water Point		Road
(X)	Start Point		Track
(S)→	Down Slope	XXXXXXXX>	Control Line
(T)	Tanker		Stream/Creek
■	Assets/Neighbours	①→①→	Lighting sequence & direction
		②→②→	Lighting sequence & direction

PLAN OF APPLICANTS BURNING AREA AND LIGHTING TECHNIQUE



SYMBOLS FOR BURNING PLAN

(W)	Water Point	———	Road
(X)	Start Point	- - - - - -	Track
(S)→	Down Slope	XXXXXXXX>	Control Line
(T)	Tanker	~~~	Stream/Creek
■	Assets/Neighbours	①→①→	Lighting sequence & direction
		②→②→	Lighting sequence & direction

This Plan Approved By: (PRINT)................................... (SIGNATURE) ....

Position: ……………………………………….……………… Date: …../…./….

Appendix 2 – Risk assessment template

Patch ID: ______________________________

Risk factor being assessed	**Likelihood of occurring**	**Consequence of occurring**	**Risk rating without controls**	**Actions to reduce risk**	**Modified risk rating**
•				• • • •	
•				• • • •	
•				• • • •	
•				• • • •	
•				• • • •	

Example Risk assessment

Patch ID: Block 2

Risk factor being assessed	Likelihood of occurring	Consequence of occurring	Risk rating without controls	Actions to reduce risk	Modified risk rating
• Fire spreads into neighbour's plantation	Unusual but possible (4)	Serious (3)	High	• Monitor wind for any change in direction and adapt burn plan if needed • Patrol fire breaks on southern boundary • Monitor plantation	Low
• Fire escapes into adjacent woodland & burns young tree regrowth	Unusual but possible (4)	Moderate (1)	Low	• Burn in a break to protect this area • Patrol the break	Noticeable
• Lighting crew could be trapped on hill in middle of the burn	Remotely possible (3)	Very serious (4)	High	• Ensure all crews are familiar with terrain & burn plan • All crews to have radio communications & communicate regularly • Ensure burn boss is designated and all personnel follow their instructions (unless instructed otherwise no one other than those allocated are to light any fires) • Any change in wind direction means crews stop and assess and await instruction	Low

Appendix 3 - Legal responsibilities of fire management

The major piece of Tasmanian legislation relevant to fire management on private land is the Fire Service Act 1979. This Act states that Tasmanian land owners and managers have a common law responsibility to take all reasonable steps to minimise the risk of fires originating on their property causing injury and/or damage to adjacent properties. The main priorities for fire management under the Fire Service Act 1979 are to:

1. protect human life;

2. minimise the risk of fires spreading to adjacent properties;

3. minimise the area burnt by wildfires.

The sections of the Fire Service Act 1979 relevant to this manual, are Sections 49, 56, 61, 62, 63, 64, 66, 67, 69, 70, 71 and 73. These sections of the Act are summarised below.

Section 49 states that officers authorised by the State Fire Commission (including those in the Tasmania Fire Service) are permitted to enter and inspect land for fire hazards, and if the officer deems it appropriate, require the level of fire hazard to be reduced.

Section 56 of the Fire Service Act 1979 states that authorised officers may require the construction of firebreaks aiming to reduce the spread of fires.

Section 61 states that State Fire Commission may declare a fire permit period for part or all of Tasmania. **Section 62** states that during the fire permit period authorised officers may take all necessary steps to reduce the danger of fire, and requisition resources for the purposes of fire-fighting operations. **Section 63** states that during a fire permit period, a person may not light or cause to be lit, a fire for the purposes of clearing vegetation without taking all reasonable precautions to prevent that fire from spreading to adjoining land. **Section 64** states that during the fire permit period the occupier of the land shall, immediately after becoming aware of a fire take diligent steps to extinguish a fire and/or to prevent it from spreading, and report the fire to the Tasmania Fire Service or the police. **Section 66** states that during the permit period fires may not be lit without a permit for the purposes of clearing vegetation and that an authorised officer can specify the permit conditions under which fires may be lit. In addition, **Section 66** also states that provided permit conditions are complied with, a permit holder is not liable for any loss should the fire escape. **Section 67** states that an authorised officer may revoke, suspend or vary the conditions under which a fire permit has been issued.

Section 69 of the Fire Service Act 1979 states that camp fires may be lit for the purposes of cooking, warmth and/or the burning of carcasses. **Section 69** also states that fires may not be lit in or on peat or humus, in marram grass or within 3 metres of any stump, log or standing tree, and that the fire will not be left unattended unless it has been completely extinguished. In addition, during the fire permit period, fires lit under this section of the act will have all flammable material within 3 metres of the fire removed.

Section 70 states that the State Fire Commission may declare a day of total fire ban over any part of Tasmania. During a day of total fire ban the Fire Service Act 1979 states that the State Fire Commission may specify fires that are not subject to the total fire ban, prohibit or restrict the use of specified machines or apparatus in the open and that all fire permits issued under Section 66 of the Fire Service Act 1979 will not be issued, or if issued, the permits are revoked. **Section 70** also states that an occupier of land on which a fire occurs on a day of total fire ban will immediately after becoming aware of a fire take diligent steps to extinguish the fire, to prevent it from spreading and report the fire to the Tasmania Fire Service or the police. **Section 71** states that during a day of total fire ban it is an offence to light, or cause to be lit, or maintain or use, a fire in the open air on any land for any purpose, unless that fire has been excluded from the ban and use any machine or apparatus prohibited under the declaration of a total fire ban. **Section 72** authorises officers of the Tasmanian Fire Service to take actions considered necessary or expedient to extinguish a fire or prevent it from spreading. **Section 73** authorises on a day of total fire ban any person who finds a fire burning within one and a half kilometres of their land to take any reasonable actions to extinguish the fire or preventing it from spreading. **Section 73** also requires any person intending to enter land for the purposes of extinguishing a fire to notify the Tasmania Fire Service that they intend to enter land for the purpose of extinguishing the fire (provided it is reasonably practicable for that notice to be given), and they must comply with any directions given by authorised officers of the Tasmania Fire Service.

Sections 200 and 201 of the Local Government Act 1993 are relevant to the issuing of fire abatement notices. Section 200 of the Act authorises local councils to issue fire abatement notices and Section 201 of the Act authorises the council to, if required, perform the fire risk abatement and if necessary recover the costs of performing the abatement from the land's owner or occupier.

The parts of the **Threatened Species Protection Act 1995** relevant to Fire Management Planning are **Sections 4, 5 and 51**, and **Schedules 1 and 3**. Schedule 1 aims to promote Tasmania's sustainable development of natural and physical resources and protection of native species. **Schedule 3** contains a list of Tasmanian threatened species. **Section 51** states that a person must not knowingly, without a permit, take or disturb any listed threatened species. **Section 3** defines "take" to include kill, injure, catch, damage, destroy and collect, meaning that a permit from the Department of Primary Industries, Parks, Water and the Environment may be required where a planned burn covers land containing listed threatened species. It is also important to note that landholders with a conservation covenant must receive written permission to undertake planned burns in covenants.

Additional and more detailed information regarding the legislation relating to fire in Tasmania is available from the Tasmanian legislation website (www.thelaw.tas.gov.au).

Appendix 4 – Post-burn monitoring template

<table>
<tr><td colspan="2">Date of burn:</td><td colspan="2">Time burn lit:</td></tr>
<tr><td colspan="2">Block ID/name:</td><td colspan="2">Vegetation type:
e.g. woodland with grassy understorey, heathland</td></tr>
<tr><td colspan="2">Actual wind speed:</td><td colspan="2">Actual wind direction:</td></tr>
<tr><td colspan="2">Actual temperature</td><td colspan="2">Actual humidity</td></tr>
<tr><td colspan="2">% block burnt</td><td colspan="2">Intensity of Burn:</td></tr>
<tr><td>What were the objectives of the burn?</td><td>List all the objectives here</td><td>How well did the burn meet objectives?</td><td>Against each objective note how well they were met (e.g. 100%, partially, etc.)</td></tr>
<tr><td>Any other comments?</td><td colspan="3">e.g.
What next?, Only X% burnt, will try again next year when fuels are drier. Were there enough resources? Anything you would change for future burns?
Any threatened species in the burn area? How have they been affected by the burn?</td></tr>
</table>

Photopoint ID		**Description:**	
Post ID (e.g. N, S, E or W)	**Easting:** **Northing:**	**Post ID** (e.g. N, S, E or W)	**Easting:** **Northing:**
Insert photo here Describe what the photo is of (e.g. looking south)		Insert photo here Describe what the photo is of (e.g. looking south)	
Photopoint ID		**Description:**	
Post ID (e.g. N, S, E or W)	**Easting:** **Northing:**	**Post ID** (e.g. N, S, E or W)	**Easting:** **Northing:**
Insert photo here Describe what the photo is of (e.g. looking south)		Insert photo here Describe what the photo is of (e.g. looking south)	

Planned Burning Checklist

In the lead up to the burn

1. If you have any threatened plants, animals or vegetation communities on areas to be burnt ensure you have the required permit from Department of Primary Industries, Parks, Water & Environment.
2. Ensure you have the appropriate permission from Private Land Conservation Program (DPIPWE) if the block you plan to burn has an existing covenant.
3. Do any heavy boundary preparations (e.g. slashing, ploughing).
4. Consider the resourcing required for your burn – if extra help is needed contact your TFS District Officer well in advance.
5. Watch the weather forecast for a period of stable high pressure systems and conditions that match the prescription for your burn (e.g. wind direction and speed, humidity, temperature, etc).
6. Do some single leaf tests to monitor fuel moistures in the lead up to your proposed burn date.
7. If you are receiving help from others keep them informed of the weather outlook and the likely date.
8. Inform your neighbours, and take into account any potential negative impacts for neighbours, especially smoke (be prepared to adjust your plan).
9. Check any equipment (pumps, tanks etc) to ensure they are working properly.
10. If within the permit period, obtain a fire permit from TFS.

On the day of the burn

11. Register the burn with TFS 1800 000 699.
12. Do some single leaf tests and/or a test burn to determine actual fuel moisture.
13. If the conditions are not as forecast, make a decision on whether it is safe to proceed with the burn or whether it should be called off.
14. Develop your burn plan – draw the lighting plan on a map and complete the TFS burn implementation plan (whether it is fire permit season or not).
15. Do a risk assessment.
16. Conduct a briefing with all helpers (i.e. assign tasks, explain burn plan, highlight any potential risks/hazards and safety zones/escape routes ensuring access is clear and any gates are open).

After the burn

17. Check the burn during the afternoon for 2 days after the burn and on the next high fire danger day after the burn.
18. Turn log heaps and heavy fuels so that they burn completely and do not smoulder.
19. Monitor to see if the burn has achieved what you aimed for (e.g. fuel reduction, regeneration, etc.).