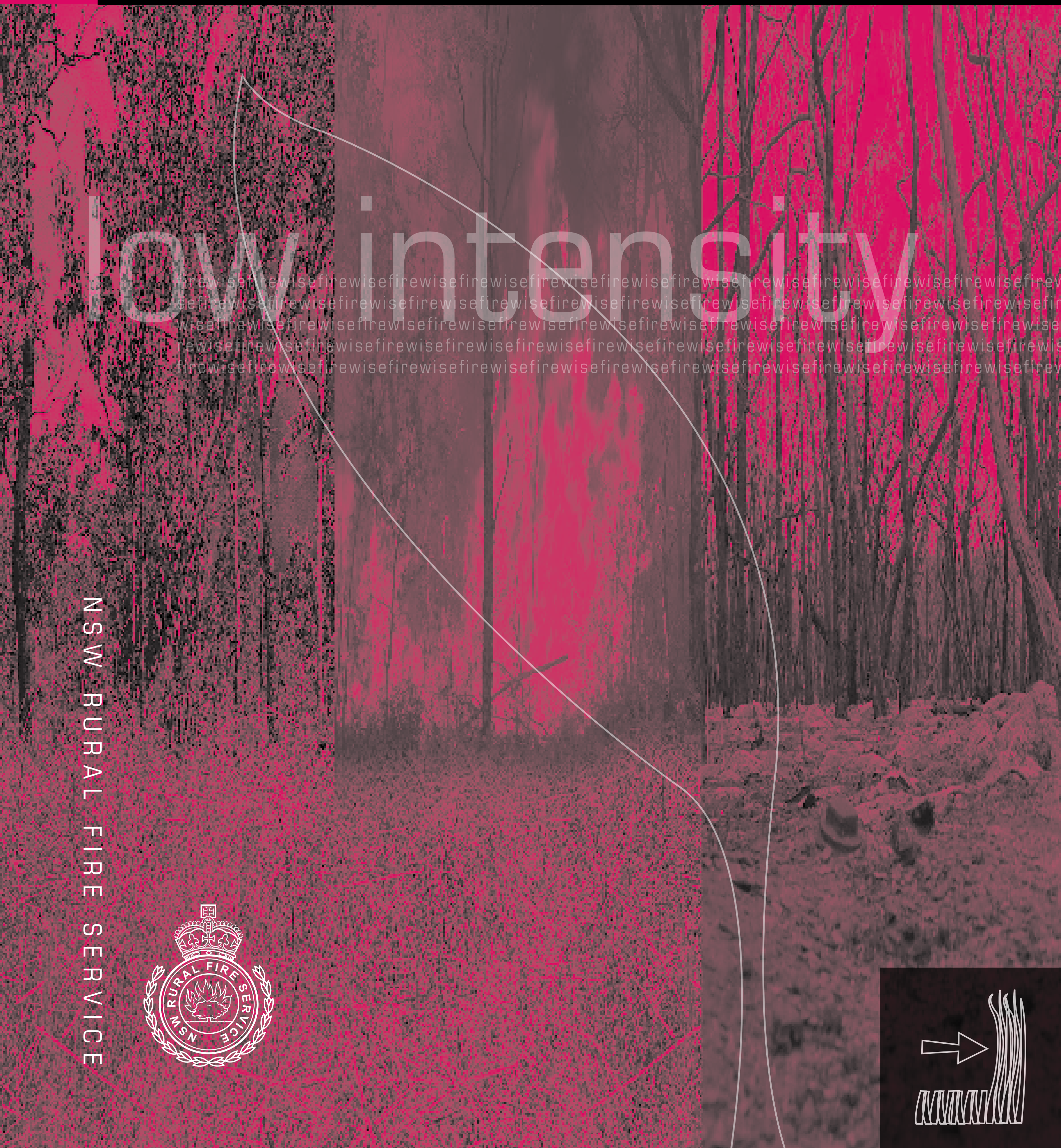
standards

for low intensity bush fire hazard reduction burning (for private landholders)



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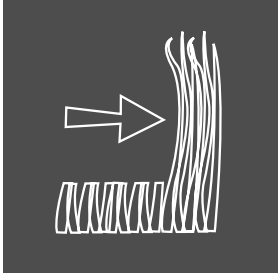


INTRODUCTION

This document explains the best way to carry out low intensity bush fire hazard reduction burning. While most of the information outlined here relates to dry open Eucalypt forest, it can also be applied to any bush fire hazard reduction burning once you have assessed the fuel load and weather conditions.

Before you start any hazard reduction burning, you need to ensure that you have the required environmental approvals. In many cases your local NSW Rural Fire Service (RFS) Fire Control Centre will be able to issue you with a Bush Fire Hazard Reduction Certificate (which provides most of the necessary approvals) or advise you on how to obtain other approvals.

You may also be required to obtain a Fire Permit (fire safety approval) before you conduct any burning.

Burning of vegetation can potentially be hazardous. **Ultimately you are responsible for any fire you light and if it escapes you may be liable for the damage it causes.** Before you start you should be confident that you can carry out the burn. In some cases it may be safer and more practical for you to rake up the material and conduct a pile burn or request assistance from your local Rural Fire Brigade.

For details of the restrictions on lighting fires, fire permits and notifications, see the NSW RFS document *Before You Light That Fire*. For information on pile burns see the NSW RFS document *Standards for Pile Burning*.

BUSH FIRE HAZARD REDUCTION BURNING

The objective of a low intensity bush fire hazard reduction burn is to reduce the fuel load (vegetation) and therefore minimise the potential impacts of a bush fire on life, property and the environment.

The characteristics of a low intensity burn include:

- **Low flame heights** - Flame heights should average about one metre, but may be higher in patches of heavy or elevated fuels.
- **Low scorch height** - Scorch height should average less than five metres. Scorch height is the height to which tree leaves are killed from the heat of the fire.
- **Slow rate of spread** - The fire should spread only at a slow walking pace.

In carrying out a burn, you need to consider:

1. the fuel load and structure
2. the effects on the environment and community
3. the specific zone objectives
4. if there are adequate control lines
5. the season and weather conditions
6. the topography and fire behaviour
7. what lighting patterns to use
8. conducting a test burn
9. what safety measures may be needed
10. mopping up afterwards
11. if you need to report the results.

In some cases (for example, if a bush fire hazard reduction burn is intended to cover many hectares) a detailed, written burn plan may be required. If in doubt, you should contact your local RFS Fire Control Centre.

STEP 1. CONSIDER BUSH FIRE FUEL LOAD AND STRUCTURE

Bush fire fuel is vegetation that will burn. The most hazardous fuels are fine fuels that will burn during the intense initial passage of the fire front. Fine fuels include the dead or dry leaf litter, grass, twigs (less than 6 mm in diameter) and bark that gathers on the ground or is suspended in the shrub layer of a bushland area.

The rate of spread and behaviour of a fire is affected by both:

- **Fuel load** - the quantity (usually expressed in tonnes per hectare) of fine fuel. More fuel will give a hotter fire.
- **Fuel structure** – the arrangement of shrubs and litter fuels. Fire will spread more easily through a continuous fuel layer. Shrubs, loose bark and vines provide a ladder for fire to climb into trees.

The objective of hazard reduction is to reduce, but not totally remove, the amount of fine fuel and to modify the fuel structure. With low fine fuel loads, a fire is difficult to light or sustain (like lighting a log fire without small kindling). With less suspended fine fuel, a fire is less likely to spread into the tree canopy.

Before conducting a hazard reduction burn, consider how the fuel load will affect the fire behaviour, and whether you are capable of controlling it. In areas of high fine fuel loads, a fire will be easy to light and you will need to be sure that you have the necessary people and equipment to control the fire and maintain a low intensity. As a rule of thumb, on flat ground, doubling the fuel load will double the forward rate of spread of the fire.

For more information about fuel assessment techniques, contact your local RFS Fire Control Centre.

STEP 2. CONSIDER THE EFFECTS ON ENVIRONMENT AND COMMUNITY

In some cases the area that you want to burn may have particular environmental values. To minimise possible environmental damage you need to comply with any conditions listed on your Hazard Reduction Certificate.

These conditions will take into account environmental factors such as:

- the presence of threatened species or endangered ecological communities;
- the risk of soil erosion;
- fire history and minimum fire frequency intervals for specific vegetation types;
- the location of waterbodies and waterside vegetation; and
- the effect of smoke on the local community.

The conditions on your Certificate may include measures to protect biodiversity by limiting the frequency of burns, or excluding fire from specific areas. Failure to comply with the conditions will result in fines if damage is done to the environment.

Riverside or creek (riparian) vegetation is sensitive to fire and is important for maintaining water quality and aquatic habitat. Every effort should be made to keep fire out of these areas.

Ensuring that fires are of low intensity will protect tree canopies and any tree-dwelling animals such as koalas. Low intensity fires are often also patchy, which reduces the potential for soil erosion if significant rain falls after the burn.

Weather conditions may limit smoke dispersal, causing it to linger in the area, so it is important to consider if smoke-sensitive areas such as roads, schools, hospitals, neighbours with health concerns or nursing homes are nearby. Make sure you discuss your plans with any neighbours and occupiers of properties that may be affected by the burn.

At least 24 hours (unless otherwise specified in your fire permit) before burning, you must notify any adjoining neighbours. The smoke produced from hazard reduction burning has the potential to impact upon other people. Your neighbours may be exposed to smoke and may need to make preparations to avoid any negative impacts.

Fires near roads may produce smoke that could be a traffic hazard. There are some cases where smoke from fires has caused serious accidents. The local traffic authority (generally RMS or Council) should be contacted at least two weeks prior to a planned burn. They will determine the best way to manage the effects of smoke on traffic. Road safety measures such as signage or traffic flow controls may be required.

It is also important to consider the location of powerlines as large amounts of smoke and heat may create electrical arcs (electricity conduction between wires), damage the lines or interrupt electricity supply.

To minimise the impact of smoke, burning should be restricted to daylight hours whenever possible.

A No Burn Notice, which may prevent hazard reduction burning, is issued on days of predicted high air pollution. Your local RFS will advise you of pollution concerns or lighting bans when you notify them 24 hours (unless otherwise specified in your fire permit) before your burn. Notification is a requirement of your approval, and ensures that people who may be affected by smoke or embers are aware of the activity and don't mistakenly report the activity as a bush fire.

STEP 3. DETERMINE SPECIFIC ZONE OBJECTIVES

Local Bush Fire Risk Management Plans (prepared by local fire authorities and land management agencies) divide the landscape into four zones: Land Management Zones, Strategic Fire Advantage Zones, Asset Protection Zones and Fire Exclusion Zones. The specific objectives of your burn will depend on the zone in which the work is being conducted. The zone in which your burn is planned will be identified on your Bush Fire Hazard Reduction Certificate.

The following are examples of objectives for each zone:

ZONE	OBJECTIVES
Asset Protection Zone (APZ)	• reduce fine fuel load and structure to a level that provides a safe 'defensible space' around an asset; • reduce fine fuels within the zone to prevent a ground fire reaching the asset; and • reduce vertical structure of the fine fuels by reducing shrub fuels.
Strategic Fire Advantage Zone (SFAZ)	• reduce fine fuel load and structure to a level that provides firefighters with an area in which they have a high probability of success in containing bush fires burning within, or into, the area • reduce fine fuels by approximately 50-80% within area; and • reduce vertical structure of the fine fuels by reducing shrub fuels.
Land Management Zone (LMZ)	• provide a mosaic of areas with varying fuel load structures; • maintain or enhance biodiversity; and • provide fuel reduced areas in which firefighting suppression efforts are safer and have greater chance of success.
Fire Exclusion Zone (FEZ)	• protect fire sensitive areas such as rainforest, cultural sites, plantations and commercial crops.

STEP 4. ENSURE THAT THERE ARE ADEQUATE FIRE BREAKS AND CONTROL LINES

When planning your hazard reduction burn, it is important to think about the need for well-placed control lines and fire breaks. A control line is a planned, defined perimeter used to stop the fire escaping from the designated burn area. Control lines may be a combination of roads, earth breaks (hand or machine constructed), streams, areas that are already bare of fuels (rock shelves, green crop areas or recently burnt) or cleared land.

You must establish if further work is required to make existing control lines suitable (i.e. they may require cutting back or grading). Alternately you may be required to create a control line. If doing so, be sure to take into consideration any environmental impacts that may result, particularly soil erosion. These impacts will be considered in your Bush Fire Hazard Reduction Certificate.

Constructing a Control Line

To construct a control line, determine the best place for the line and clear all leaf litter and other fuel (down to mineral earth) to at least one metre wide. Control lines work best when as straight as possible, but need to be directed around trees. Try to place the control line where vegetation has already been disturbed.

Control lines that run parallel to a water body must not be constructed within the riparian vegetation. Riparian vegetation is the vegetation immediately adjacent to a waterway. It helps to protect the waterway from erosion or runoff. Control lines constructed across waterways pose a high erosion risk to these waterways. Substantial fines may apply if done incorrectly.

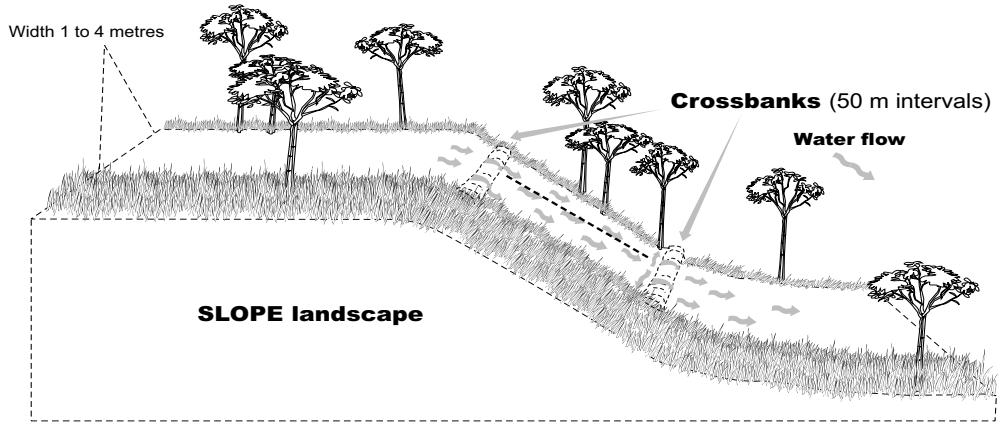
If you are intending to construct a control line, contact your local NSW RFS Fire Control Centre for advice. Your Bush Fire Hazard Reduction Certificate will specify the buffer distances required around waterways.

Rake the accumulated litter into the area on the side of the trail that will be burned, and spread the litter out over a wide area. Clear around the base of trees for approximately one metre and also around any large logs lying on the ground close to the control line. This will prevent the fire travelling up the trees (particularly trees with a rough bark surface or with hollows at the base). If possible, leave large logs unburned as they may remain alight for a long time after the burn is completed and pose to be a bushfire ignition source.

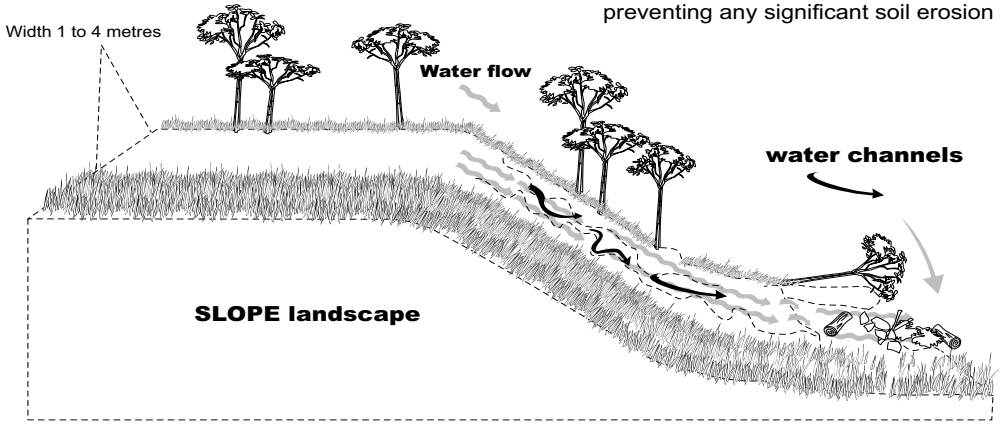
Control lines constructed down slopes (perpendicular to contours) require drainage structures to minimise water flow and subsequent soil erosion. There are many types of drainage structures, but the most simple to construct and possibly the most effective are crossbanks. Logs and other material may be used for smaller or narrower control lines.

Crossbanks are mounds of earth that act like speed humps to slow down and divert the flow of water. Crossbanks should divert water away from the control line and onto a stable surface such as a vegetated or non-erosive surface. It is important that water flow is not diverted directly into a water course.

Drainage structures should be placed so that potential water flow down a slope does not exceed 50 metres in distance.



Water flow (runoff) is diverted and slowed by a crossbank, preventing any significant soil erosion



Unmanaged water flow down a control line may cause significant soil erosion

Any control lines constructed for the purpose of a bush fire hazard reduction burn must be allowed to regenerate with natural vegetation following the burn. If you are constructing a control line intended for vehicular use, then the erosion control requirements will be more substantial. Contact your local NSW RFS Fire Control Cenre for advice.

The person responsible for bush fire hazard reduction work is responsible for its control. The law has severe penalties if a fire escapes its control lines onto your neighbour's property or into any environmentally sensitive location.

STEP 5. CREATE A BURN PLAN

You should create a basic map of your plan, even if it is a sketch. This should include the location of assets, existing and proposed control lines and the proposed burn area. This will help you show your intentions to others who are helping with the burn (for guidance with burn plans, contact your local RFS Fire Control Centre).

STEP 6. DETERMINE THE SEASON AND WEATHER CONDITIONS FOR A LOW INTENSITY BUSH FIRE HAZARD REDUCTION BURN

(a) Selecting the season

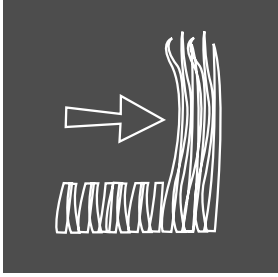
Selection of the right year and season to carry out hazard reduction burning is crucial to meet your fuel reduction and environmental goals, and minimise the potential for escape or re-ignition at a later date.

In southern NSW (generally from the Illawarra south) bush fire hazard reduction burning is typically conducted in autumn. Burning in late spring (after fuels have dried out sufficiently following winter rainfall) is usually avoided because there is potential for re-ignition in summer when rainfall is lowest and conditions are hot and dry. Spring burning in the south should only be carried out by, or with the assistance of, very experienced burning crews and should be avoided in years of below average rainfall.

In northern NSW (generally Sydney north, and more particularly north of the Hunter district) bush fire hazard reduction burning is generally conducted in early spring, when fuels have dried out during the usual dry winter. If fuels are sufficiently dry, a burn may also be conducted during autumn and winter. In most years, the onset of typical summer rainfall patterns reduces the potential for re-ignition during summer. Spring burning in years of below average rainfall should only be carried out by, or with the assistance of, very experienced burning crews.

(b) Selecting the appropriate day and time of the day

Fire behaviour is controlled by fuel and weather conditions. To minimise the risk of escape and to ensure calm fire behaviour, burning should be carried out when the weather conditions are suitable.



The four important weather elements for low intensity burning are:

(i) Temperature

Temperature affects the fire behaviour and moisture levels in the fuel. Ideally temperatures should be less than 25°C for low intensity burning. Temperatures are normally at a minimum early in the morning (3-4 am) and at a maximum early to mid-afternoon (2-3 pm).

(ii) Relative humidity

Relative humidity affects fire behaviour by altering fuel moisture levels. Relative humidity is usually highest overnight and lowest in the early afternoon. As a general rule, burning should only occur when the relative humidity is 50% and rising. Relative humidity forecasts and observations can be obtained from the Bureau of Meteorology website.

(iii) Wind speed and direction

Wind speed directly influences the rate of spread of the fire, thus increasing or decreasing the intensity of the burn. Wind speed usually strengthens mid-morning and reduces late evening. Low intensity burns are best carried out in wind conditions less than 15 km/h as measured in the open. The direction of the wind affects the direction in which the fire develops as well as how fast it progresses.

(iv) Atmospheric stability

To minimise the risk of escape, low intensity burning requires stable atmospheric conditions. Stable conditions are usually associated with a high-pressure system dominating the local weather pattern, with clear skies and light winds. Unfortunately a very stable atmosphere usually means that smoke will linger in the air. Rapid changes in atmospheric conditions such as unstable weather and high winds associated with the passage of a frontal system can affect the fire's behaviour.

In forest areas with deeply shaded fuels it may not be possible to burn successfully under the above weather conditions.

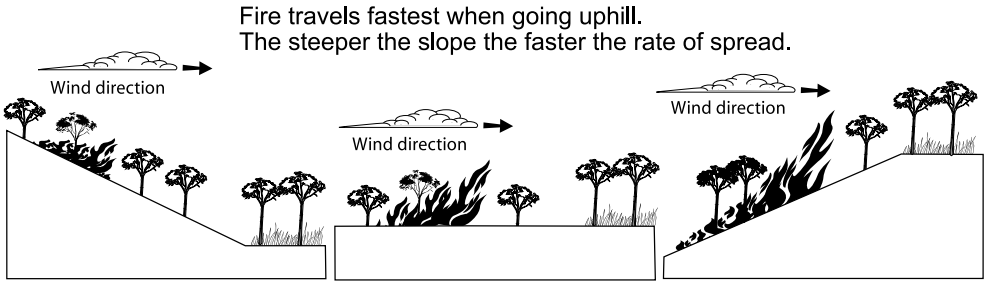
As an alternative, you may contact the local RFS Fire Control Centre to be given the Forest Fire Danger Index (FFDI) score and ways to measure your fuel load, to determine if the conditions are suitable to burn. An FFDI score is calculated based on all the weather elements and gives the best indication of potential fire behaviour. These scores are used for the fire danger signs. Low intensity burning should be performed when the FFDI is less than indicated in the table below.

Table 1 Forest Fire Danger Index limits for low intensity bush fire hazard reduction burning.

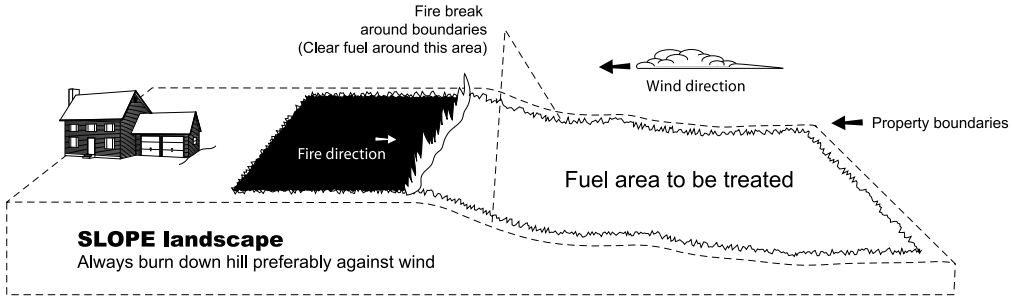
FUEL LOAD (t/ha)	FOREST FIRE DANGER INDEX (FFDI)						
	2	4	6	8	10	15	>15
5	burn	burn	burn	burn	burn	burn	don't
10	burn	burn	burn	burn	burn	don't	don't
15	burn	burn	burn	burn	don't	don't	don't
20	burn	burn	don't	don't	don't	don't	don't
>25	burn	don't	don't	don't	don't	don't	don't

STEP 7. CONSIDER TOPOGRAPHY AND FIRE BEHAVIOUR

- Fires burning on level ground will have a different intensity and rate of spread from a similar fire (under the same weather conditions) travelling up a slope or down a slope.
- On an uphill slope an increase of 10 degrees will cause a fire to double the rate of spread and therefore the speed of the fire. If the angle is increased to 20 degrees then the spread of the fire will be increased fourfold.
- On a downhill slope, the figures will be reversed which means the fire will travel slower. Generally fires lit for reducing a hazard should be lit at the top of a slope to burn downwards.



- The aspect or direction the fuel faces is of importance, as the fuel may be more moist on some aspects or drier on others. Generally, fuels facing west, northwest or north are exposed to longer periods of sun during the day and will be drier than those on other aspects. The dry fuels will burn more readily, increasing the potential for erratic fire behaviour.



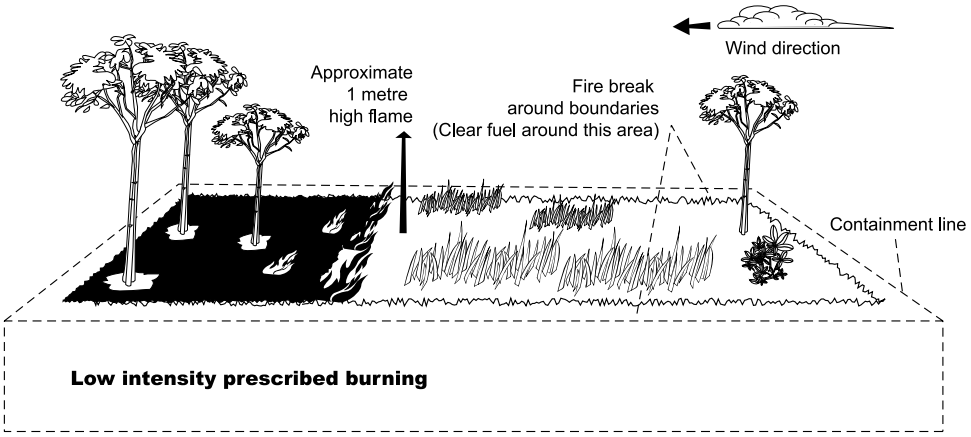
STEP 8. LIGHTING PATTERNS

Lighting patterns strongly influence the area that will burn and the flame height generated. Different lighting patterns can be used to achieve different burn coverage, inten sity and environmental controls.

The pattern of lighting a fire can also help to keep fire out of environmentally sensitive areas such as riparian vegetation (vegetation found along rivers, streams, lakes and wetlands).

Lighting patterns to minimise environmental impacts:

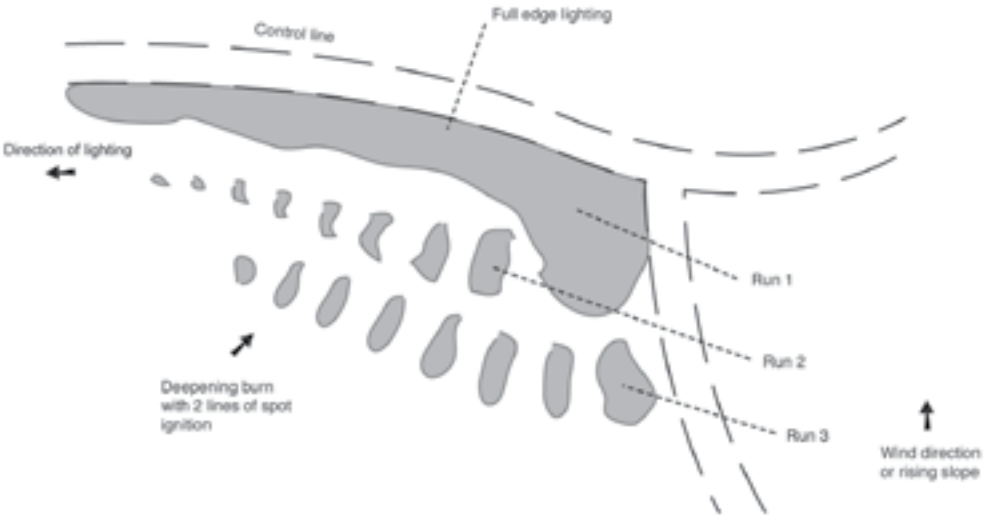
- Burn when the higher parts of the topography (ridges) are drier, and the lower parts (valleys and gullies) are moist. To assess the likelihood of gully fuels burning, prior to the burning day collect gully fuel litter in the afternoon and, in a cleared area (such as the centre of a track), attempt to burn it. If fuels burn easily then burning should be delayed until rain has fallen.



Low intensity prescribed burning

- Use spot fires as they burn slower and with less intensity than a line of fire. The figure below clearly illustrates the spot lighting method.
- To minimise fire burning through stream areas, use a widely spaced spot lighting pattern (10 to 20 metres between spots) in areas adjacent to the streams, and do not light directly within any riparian vegetation or within 20 metres of the stream.

Implementing a spot ignition burning pattern for a low intensity burn:



- Make certain that your lighting pattern ensures that no fires are lit downslope of other personnel working in the burn area.
- Ensure that all personnel are familiar with the burn plan and lighting pattern.

STEP 9. CONDUCT A TEST BURN

It is important to test that conditions are suitable before lighting your low intensity burn. There are two steps to conducting a test burn:

(a) Use the burning leaf method to determine the fuel moisture.

A sample leaf (dead) should be taken from above and below the surface of the litter layer. Sheltered from any wind, light the end of each leaf. The aim is to discover the angle at which a small flame either goes out or flares up. The diagram below provides a guide.

There should be a difference between the two leaves. If the subsurface leaves are not moister than the surface leaves, the burn should not proceed.

(b) Light a small test fire.

Leaf burns if held straight down or does not burn at all

- All fuels too wet if this leaf is in the area to be burnt.
- OK if only in wet area not to be burnt.

Leaf burns if angled downwards

- Fine fuels from this leaf's position will only burn if on a slope or in the wind.
- OK if the leaf was from the bottom of the litter in the burn area, or from a wet area not to be burnt.

Leaf burns if level

- Fine fuels from this leaf's position will burn, but very slowly unless helped by wind, slope and fuel continuity.

Leaf can be angled upwards and still burns

- Fine fuels from this leaf position are dry enough to burn.
- OK if this leaf is from the top of the litter, risky if from the bottom.

Leaf burns if held straight up

- All fine fuels are very dry and flammable.
- Fire will spot if windy.
- DON'T BURN

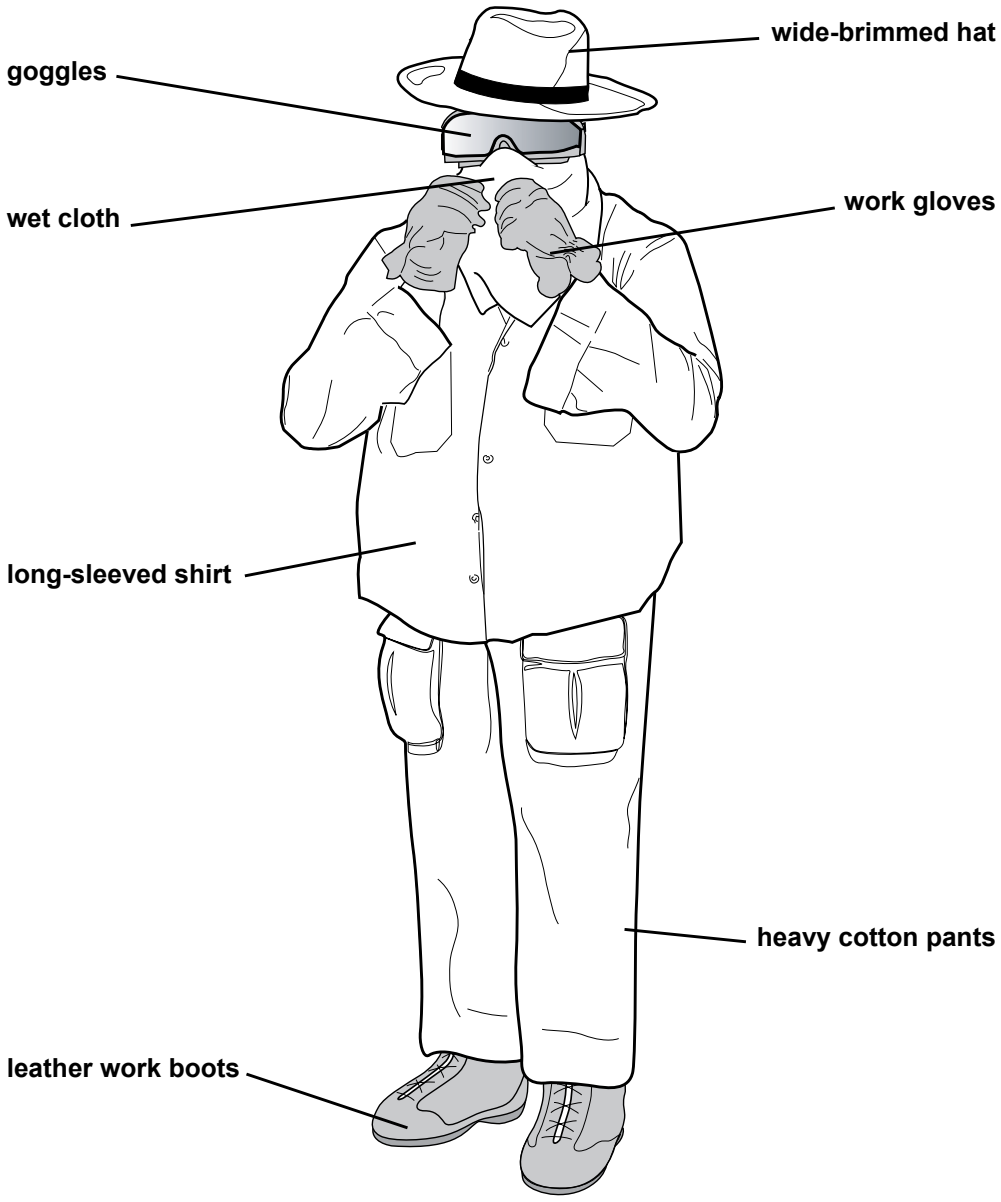
Having assessed that weather conditions are within a desirable range (Step 5), and with suppression equipment close at hand, light a test fire in a prepared area approximately five metres square on flat ground. Observe the test fire flame heights and rate of spread. If the height of flames burning in surface fuels consistently exceeds one metre, then the test fire should be immediately extinguished and your hazard reduction burn should be postponed.

STEP 10. ENSURE PERSONAL SAFETY CONSIDERATIONS ARE IMPLEMENTED

Your safety, and the safety of others assisting you during any hazard reduction burning is of utmost importance. You should discuss personal safety issues with your local RFS.

Before lighting the burn, everyone involved should consider the following:

- Wear natural fabrics (e.g. cotton, denim or wool). Synthetic fabrics can melt or burn.
- A long-sleeved shirt made from thick cotton or wool is ideal to prevent burns to the upper body and arms (e.g. flannelette or cotton drill work shirt).
- Sturdy leather work boots along with a pair of woollen socks prevent burns to the feet.
- A pair of heavy cotton pants will shield your legs from the radiant heat emitted from the fire (e.g. denim jeans or oil-free overalls).
- By wearing a wide-brimmed hat you can stop embers from dropping onto your head or down the back of your shirt.
- Work gloves will protect your hands.
- A good pair of goggles will safeguard your eyes against any embers and debris that may be in the air.
- Cover your nose and mouth with a wet handkerchief or piece of cloth to prevent inhalation of smoke and embers.



Prior to burning:

- Drink plenty of water throughout the day to avoid dehydration.
- Ensure the area to be treated is clear of personnel before burning begins.
- Ensure that adequate resources are available to conduct the burn in the prevailing and expected conditions, and contain the burn to the planned area.
- Use the attached checklist to ensure you are adequately prepared to conduct the burn.

During the burn:

- Ensure the burn is monitored at appropriate times until the risk of the fire escaping the planned area, and/or trees falling across roads and trails has passed.
- Working arrangements should ensure that personnel are not working alone or out of sight of others.
- Ensure that any safety hazards are immediately reported to the person supervising the fire.

The highest risk of fire trapping people conducting a burn is when they are working within the burn area perimeter. Additional safety precautions need to be planned and implemented in such circumstances and all personnel briefed about the precautions.

STEP 11. MOP UP AND PATROL

When you have completed the burn make sure that any logs or trees that are still burning are properly extinguished. In large bush fire hazard reductions the perimeter should be extinguished to a depth of at least 10 metres from all fire edges.

You should be regularly patrolling the perimeter to ensure that there is no ignition from burning embers of unburnt areas outside the perimeter of the area being treated. Under drier conditions, the area may need patrolling for several days following the bush fire hazard reduction work.

STEP 12. REPORTING

Ensure that you report on the completion of works by returning the completion form from the Bush Fire Hazard Reduction Certificate to the address indicated on the Certificate.

CHECKLIST FOR LOW INTENSITY HAZARD REDUCTION BURNING

PRIOR TO BURNING MAKE SURE YOU HAVE:

- ☐ **Obtained an environmental approval such as a Bush Fire Hazard Reduction Certificate (See "Before You Light That Fire")**
- ☐ **Obtained a Fire Permit (See "Before You Light That Fire")**
- ☐ **Either :**
  - ○ Selected the appropriate season and weather conditions having considered:
    - Temperature
    - Relative humidity
    - Wind speed and direction
    - Atmospheric stability

  OR
  - ○ Contacted the RFS for a Forest Fire Danger Index (FFDI), determined your fuel load, then cross checked with Table 1 to determine whether the chosen day is suitable.
- ☐ **Made a map of burn site taking into consideration:**
  - ○ Location of assets and control lines
  - ○ Direction of fire travel
  - ○ Areas of dry and moist fuel loads
  - ○ Most appropriate lighting patterns
  - ○ Placement of personnel during burn
    - Safe escape routes
    - Safety zones
- ☐ **Established control lines around the burn area including:**
  - ○ Drainage structures if necessary
  - ○ Cleared areas under trees and around logs
- ☐ **Conducted a test burn**
- ☐ **Notified all necessary parties:**
  - ○ RFS (24 hours prior to burning, unless otherwise specified in your fire permit) or Fire and Rescue NSW
  - ○ Neighbours (24 hours prior to burning, unless otherwise specified in your fire permit)
  - ○ RMS (if traffic control is necessary)
  - ○ Council (roads)
  - ○ Network provider for power lines
- ☐ **Checked to ensure it is not a Total Fire Ban day (See "Before You Light That Fire")**
- ☐ **Ensured that all personnel are familiar with details of the burn plan and adequately prepared:**
  - ○ Appropriate experience
  - ○ Protective clothing
  - ○ Food and water
  - ○ Awareness of safe burning procedures and first aid
- ☐ **Considered emergency procedures:**
  - ○ Efficient communication system
  - ○ First Aid Kit

AT COMPLETION OF BURN MAKE SURE YOU HAVE:

- ☐ **Extinguished all necessary burning material**
- ☐ **Returned the completion form from the Bush Fire Hazard Reduction Certificate**

HOW CAN I FIND OUT MORE?

The following documents are available from your local Fire Control Centre and from the NSW RFS website at www.rfs.nsw.gov.au.

- Before You Light That Fire
- Standards for Low Intensity Bush Fire Hazard Reduction Burning
- Standards for Asset Protection Zones
- Standards for Pile Burning
- Application Instructions for a Bush Fire Hazard Reduction Certificate
- Standards for Windrow Burning

If you require any further information please contact:

- your local NSW Rural Fire Service Fire Control Centre. Location details are available on the RFS website or
- call the NSW RFS Enquiry Line 1800 679 737 (Monday to Friday, 9am to 5pm), or
- the NSW RFS website at www.rfs.nsw.gov.au.

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