FIRE AS A LAND MANAGEMENT TOOL:

Crop residue or stubble burns

Introduction

Fire is a valuable land management tool, but its use does come with some risk. Knowledge of how to use fire safely will reduce the risk to life, property and the environment.

While Fire and Emergency New Zealand provides advice and guidance to help ensure controlled burns are completed safely, the person who lights a fire is responsible for ensuring the fire remains safe and is completely extinguished.

Purpose of this guide

The purpose of the guide is to help farmers or other people who may be considering a crop residue or stubble burn:

- safely use crop residue or stubble burns as a land management tool
- plan and carry out safe crop residue or stubble burns that achieve the desired result.

If you have any comments or feedback on this guide, please email wildfire@fireandemergency.nz

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Key stages

There are five key stages to work through when using fire as a land management tool.

Safety of personnel is the highest priority at vegetation fires, and must be considered at every stage of the process.

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1. Check → 2. Plan → 3. Prepare → 4. Do → 5. Post-burn

1. Check

When planning to use fire as a land management tool, the first stage is to check and comply with the legal and administrative requirements of the area where you want to have the burn.

You must do the following:

a. Fire season status and permitting requirements

Before you light a fire in open air, you need to find out:

- what the current fire season status is for your area, and
- whether you need a fire permit.

Check the fire season status and permitting requirements in your region using the checkitsalright.nz website.

Even with a valid fire permit you are still responsible for the safety of the fire.

b. Territorial authority and regional council requirements

Check with your local territorial authority and regional council about any other restrictions or rules for burning in open air. These could include:

- resource consents for discharge to air and emissions or clearing of vegetation
- smoke management plans
- traffic management plans
- any other relevant bylaws.

c. Advice from Fire and Emergency New Zealand

Contact Fire and Emergency so we know what you are intending and we can provide advice. Even if your burn is in an open fire season, there are still risks when lighting a fire and we are here to help.

Fire and Emergency can provide free advice to help you achieve the result you want safely. Receiving advice does not take away your responsibility for the fire, but use of our expertise can minimise your risk and the adverse consequences of your burn.

Contact details for your local Fire and Emergency office are available on the fireandemergency.nz website.

d. Insurance

Check with your insurance company exactly what your insurance covers:

- **Insurance of property for loss and replacement from fire:** For your house, household effects, other buildings, vehicles, plant and machinery, forests and crops.
- **Public liability insurance:** To cover the cost of damage and loss to a third party from any fire that escapes from your property and damages other party's property.

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2. Plan

Planning is the most important stage when using fire as a land management tool. A good plan will help you to achieve your burn objectives, prevent the escape of your fire, and keep everyone and the environment safe.

a. Safety

Safety of personnel is paramount when using fire as a land management tool. It is crucial that everyone involved has the right skills and understands how the burn will be conducted.

Personal protective clothing is a must. Wear wool or cotton clothing. Do not wear synthetic materials as these can melt and cause severe injuries. Create layers of clothing without tucking in, e.g. trouser legs over boots to prevent embers catching in clothing.

Consider the number of resources required for the safe ignition and supervision of the fire during the burn, to watch and patrol for any escapes or spot fires. Also consider if you have the resources to deal with an escape, and if more are needed where they will come from.

As the person responsible for the burn, you are ultimately responsible for the safety of everyone present. Anyone not involved with the burn must not be allowed on the land to be burnt, and the surrounding area. Restrict access at locations accessible by the public.

LACES

LACES is an internationally recognised safety system used by firefighters at vegetation fires to protect themselves from being trapped by fires and other fire hazards.

Lookouts

Lookouts should be in a position from which they can see the fire line, the fire itself, and the crews that are working the line. They should be able to recognise and anticipate dangerous situations, and must report changes immediately. The size and complexity of the fire may require more than one lookout. They need to be experienced, and able to recognise dangerous situations.

Awareness and anchor points

Lookouts should watch for changes in the fire's location and behaviour. They should know the plan, so that they can relate it to what they see the crews and the fire are doing. Lookouts should also track the weather by taking readings at regular intervals and watching the sky for tell-tale signs of changes. Everyone must be able to understand what the lookouts are trying to report, however situational awareness is the responsibility of everyone on the fire.

An anchor point is a point to start construction of a fire line that minimises the likelihood of being outflanked by a fire. An example of an anchor point could be a river, road, location without fuels, or using a second crew to produce a line in the opposite direction.

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Communications

The person in charge of the fire, crew leaders, and lookouts should have a quick, reliable, and tested way to communicate with others. This may be by direct radio contact, mobile phones, or through a lookout or other relay point. If you plan on using the radio system or mobile phones, have an alternative way to communicate in case the radios or mobile phones fail for any reason. Establish regular reporting times. The communications link down to the individual may be by word of mouth. It can be very noisy at the fire, so the distance between individuals may have to be shortened to ensure adequate communication.

Escape routes

Have at least two planned routes of escape. If your primary route is cut off, know what you are going to do. Every person must know the plan, and what is expected of them. Everyone must also know what will trigger a move to the safety zone. Escape routes should not be measured in distance, but in time to get to safety.

Safety zones

Safety zones are places of refuge; places you can be assured of your safety. Their size is dictated by the fuel, terrain, weather conditions, and worst-case fire behaviour. Some commonly used safety zones include “the black” or burned area, natural features like green meadows, clearings constructed as part of line construction, clear cut blocks, etc. Safety zones should NOT be downwind from the fire; in chimneys, saddles or narrow gullies; in locations that require steep uphill escape routes; or be located near heavy fuel concentrations. The time to get to the safety zone is also critical.

b. Weather

Weather is an important factor to consider when planning your burn. It can change very quickly with the potential to catch you out.

Element	Description
Air temperature	Fuels in a warm environment are pre-heated by the air temperature and the sunlight, drying it out and making ignition easier. Ambient air temperature is measured in °C.
Relative humidity	This is the amount of moisture in the air. When relative humidity is low, fuels dry and ignite easier. Embers remain hot longer and travel further, increasing the risk of spot fires. Wet fuels lose moisture to dry air (i.e. on sunny days). Relative humidity is measured as a percentage.
Wind speed	Wind helps dry out fuels, it directly affects the speed at which a fire spreads and direction the fire will travel. Wind is the element that catches people out the most when they are using fire. Wind speed is recorded in km/hr.
Rainfall	Fuels absorb moisture in continuous rain or high humidity. In short periods of heavy rain, water tends to run off and not be absorbed by fuels. Precipitation is measured in mm.

Technical weather information can be obtained from the fireweather.niwa.co.nz website.

c. Time of day

Weather pattern is important when deciding what time of day to start burning.

New Zealand wind tends to change direction before 1pm with the majority increasing in force during the morning, reaching a maximum sometime after midday. The change in force is at times quite sudden.

You need to be familiar with your local and regional weather patterns. Fire generally burns quickly during mid-afternoon when relative humidity is low and the temperature is higher. In some environments, winds shift or increase during the day. Examples of this are:

- coastal areas – the onshore coastal breezes arrive most afternoons
- hilly or mountainous areas – cool winds push down valley systems in the evening.

You must only light-up during daylight hours.

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d. Resources

Think about the resources you will require for preparation, lighting-up and fire suppression. The amount required depends on the size and complexity of the fire.

You will need the following resources, depending on the size of your burn:

- communications equipment for all personnel – radios and/or mobile phones
- lighting-up equipment – e.g. lighters, gas torch, drip torch
- hand tools for firefighting – e.g. shovels, grubbers, beaters
- ground firefighting – e.g. water carriers, hoses
- clean water supply of at least 1,000 litres with a mounted pump and at least 20m length of hose of a minimum 18mm but preferably 25 to 41mm diameter with an adjustable nozzle. You will also need drinking water for all personnel to prevent dehydration.
- first aid kit
- other resources – e.g. tractors with discs, grubbers or maxi till, vehicles, personnel transport.

e. Personnel

Your personnel must have the skills, competency and personal protective equipment to carry out the burn. Determine the numbers required, considering the size of the burn, in particular:

- the length of the burn perimeter
- the light-up pattern and length of any lines to be lit
- be guided by advice from Fire and Emergency.

All personnel need to be in constant contact with at least one other person during the burn. Whenever they are working near the fire, they need to be within line-of-sight of a buddy.

The rule for the buddy system is that you work as a pair – entering, working and leaving the burn off area together.

The purpose of the buddy system is that you look out for one another, maintain contact all the time and if that contact is lost, the buddy must take immediate action to re-establish contact or call for help.

For most crop residue or stubble burns, two to three people are sufficient.

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f. Communications

Communications are critical in every planned burn. It is vital that all personnel involved have visual and vocal contact with at least one, preferably two, other members. One person must be in charge for the entire burn.

It's essential to communicate any changes to the fire to all personnel on site to ensure safety of the resources and surrounding public and to be able to respond to break-outs or spot fires outside the burn perimeter.

g. Effective stubble burning light-up patterns

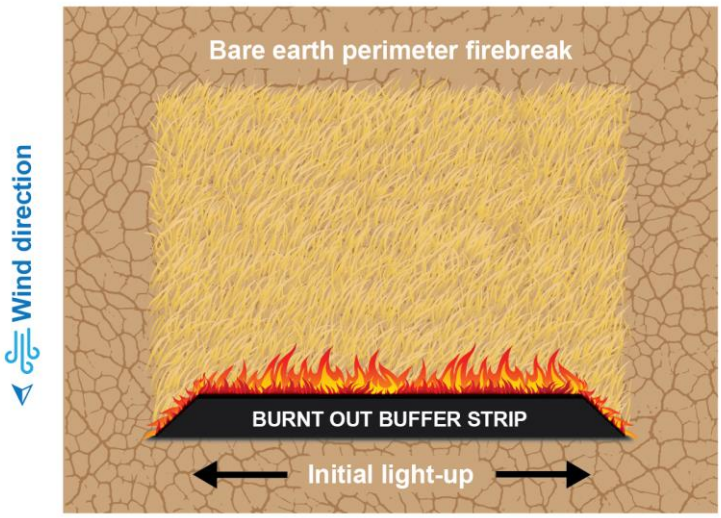
To achieve a clean stubble burn where no patches of stubble are missed or the fire moves too quickly to burn stubble fully, use the wind and firebreaks to control the spread of fire. By burning in to the wind you retain control of the fire while also creating a consistent, clean burn. This also widens your firebreaks reducing the risk of the fire breaking out.

Be aware that a fire with a high intensity may cause extreme fire behaviours such as spot fires or fire whirls.

Ring burning

The ideal method for lighting-up a paddock is to increase the width of the downwind and flanking firebreaks by burning out an area against them, before lighting-up the whole paddock from across the upwind firebreak. Steps are as follows:

1. Create a backing fire along the downwind firebreak, creating a buffer strip up to 200m.



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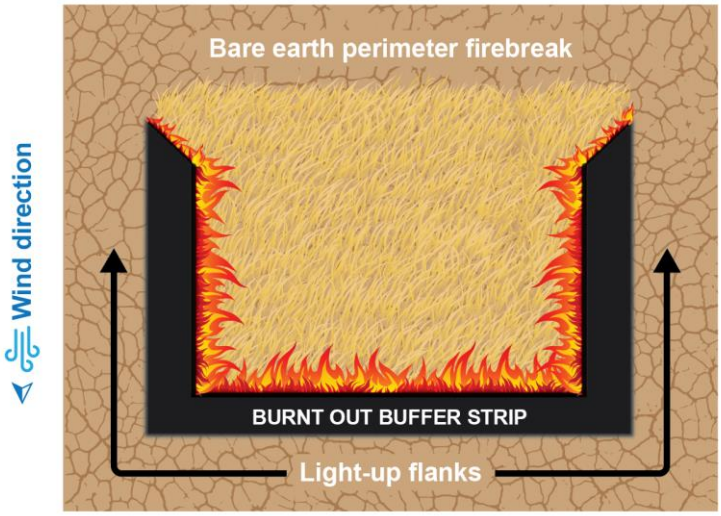
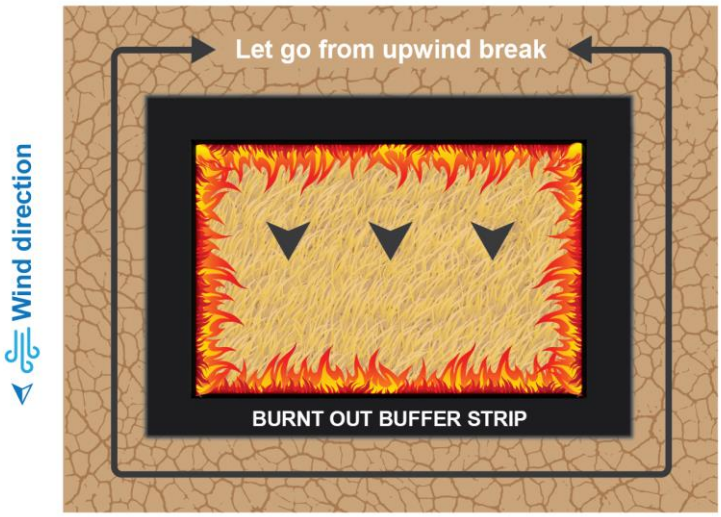
2. Light-up along the flanking firebreaks.



3. Finally, light-up along the upwind firebreak to let the entire paddock go.



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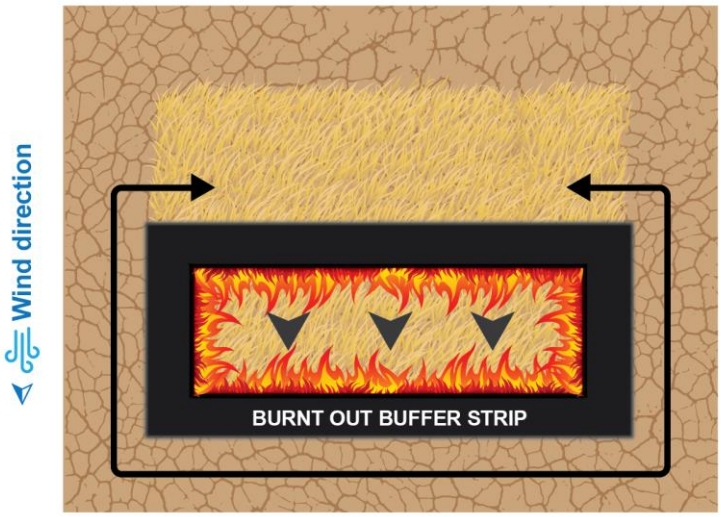
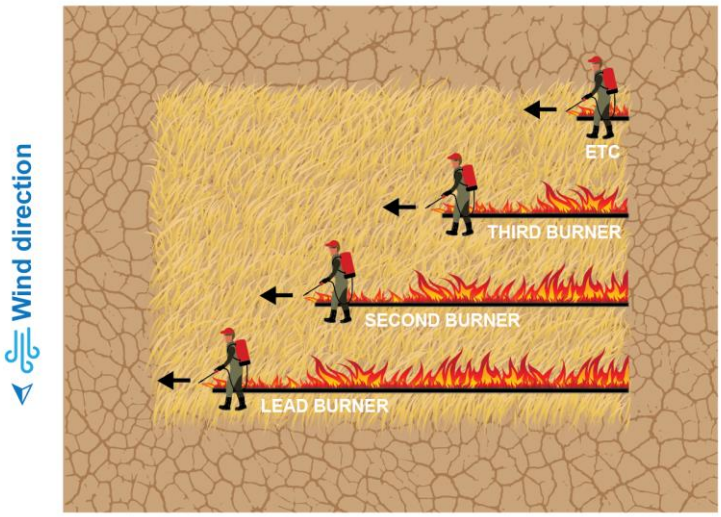
For larger paddocks, consider lighting half-way up the flanking firebreaks and then lighting across to reduce the amount of material burning at the same time.



Strip burning

If you have appropriate resources, strip burning may be appropriate. This involves setting fire to a narrow strip of fuel next to the downwind side of the burn, then setting successive strips upwind.



It's absolutely critical that personnel maintain watch on one another, and that they are staggered behind the lead person who has the strip closest to the firebreak, and that the lighters are staged successively deeper into the burn, so that no one person's light-up threatens the person in front of them.

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h. Additional regulatory requirements

There may be a number of regulatory requirements that your burn will need to conform with. Go to the checkitsalright.nz website to see what Fire and Emergency's rules are for your area. Check with your district and regional councils directly to see if there are any regulatory requirements that apply to your situation.

Prepare the plans and apply for any consents or other authorities that are required, for example:

- Resource consent for discharge to air.
- Traffic management plan approval if your fire is likely to create a smoke hazard for public road users, including setting out warning signs on the day of the burn.
- Apply for the fire permit, if required.

i. Managing the protection of adjacent values

Think about where you want to have the fire. If your burn is going to be on or near a boundary that is close to high-value commercial plantations, crops, areas of public conservation land or other farm infrastructure, you should advise your neighbours.

Also be aware of other national infrastructure utilities that are present:

- Mobile phone towers.
- Power lines – smoke across power lines can cause arcing which greatly increases the risk of escaped fires.
- Roads and other public access ways across your land or that may be close to your burn or affected by smoke drift.

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3. Prepare

Once the plans are in place, there are several preparation steps to perform before you can light-up.

a. Prepare the firebreak

A firebreak's main function is to break the continuity of the fuel to provide a barrier against the spread of fire.

Firebreaks also provide:

- a place to light-up from
- access for crew and equipment to deal with spot fires across the break
- a safety zone and escape route for the crews.

Create a bare earth perimeter at least 5m wide around the area to be burnt. The goal is to remove all flammable material from the firebreak. A single pass of a tined cultivator is not considered adequate firebreak protection.

Cultivation can be done by ploughing or by multiple passes with a maxi till or discs. Ensure the corners of your paddock have also been cleared. Closely mow the stubble and rake off all the combustible material into windrows inside the firebreak prior to cultivation, to leave only bare mineral earth.

If the land is well irrigated and green, a firebreak is not required.

b. Arrange the personnel

Ensure you have the personnel required available for the day of the burn. One person must be in charge for the entire burn with a chain of command or responsibility leading up to that person.

Make sure that everyone has access to the correct personal protective clothing:

- Natural fibre clothing, such as cotton or wool. Synthetic materials can melt and cause severe injuries.
- Fire resistant overalls are preferred to ensure that legs, arms and head are covered.
- Sturdy laced up leather boots.
- Heavy leather gloves to protect hands when working close to the fire.

c. Arrange the light-up and suppression resources

Ensure you have the resources that you identified during planning on hand including communications and lighting-up equipment, firefighting tools, clean water supply, first aid kit, and any other resources.

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4. Do

On the day of the burn, there are several tasks that must be performed, other than just lighting-up. Follow the standard and special conditions of the fire permit, if your burn requires one.

a. Check current fire season status

Go to the checkitsalright.nz website to check:

- the current fire season status
- the rules around the fire season status
- there are no temporary prohibitions in place
- that it's not a prohibited fire season.

The notification of a temporary prohibition or a prohibited fire season prevents the lighting of fires in the affected area and suspends all existing fire permits. It is possible to obtain permits for fires during a temporary prohibition or affected fire season, but applications must be assessed against special criteria.

b. Obtain the latest weather forecast

It is important to obtain the latest weather forecast for the area in the morning. You need a current and a long range forecast, obtained no more than 12 hours before light-up.

Do not light-up if:

- there are strong winds or when strong winds are predicted. Generally, fires should not be lit with a wind greater than 15km/h (observed if leaves and small twigs in motion). Your permit may specify a maximum wind speed.
- the wind is blowing towards adjacent forestry blocks, riverbeds, or other sensitive environments.
- smoke drift from the fire could cause nuisance to nearby towns, residences or compromise traffic safety on roads.

Continue monitoring the weather forecast during the day and change your plans to suit the weather.

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c. Notify of intent to burn

Notify the people you have identified during the planning phase that need to be aware of the burn, including all occupiers of adjoining land if the area to be burnt is near a boundary to a neighbouring property.

Follow the notification requirements in the traffic management plan, if one has been created.

d. Confirm safety considerations

Safety considerations should have already been determined during the planning and preparation phases. Confirm that these are still valid and are in place.

Establish LACES. See Safety earlier in this document.

e. Brief personnel on the fire plan including safety elements

A good briefing to all personnel helps avoid accidents. The briefing should cover:

- relevant details of the burn plan, including the light-up pattern
- what is required from the crew.

Briefing checklist

Ensure you have covered the following:

- ☐ buddy system – work in pairs
- ☐ locations of safety zones and escape routes
- ☐ how changes to the fire will be communicated
- ☐ communications equipment is operational
- ☐ personal safety equipment and clothing is worn correctly – don't tuck clothing in, but create layers, e.g. trouser legs over boots to prevent embers catching in clothing
- ☐ adequate drinking water on hand
- ☐ ask questions at any time if it is not clear
- ☐ keep a close eye on the fire and alert your crew leader to any changes or unexpected behaviour
- ☐ know your LACES

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f. Commence burning

- Only burn during daylight hours.
- Follow the pre-determined light-up pattern.

g. Supervise the fire at all times that it is actively burning

- Make the escape routes and safety zones known to all personnel
- Post lookouts where there is possible danger
- Be prepared to respond to changing weather conditions or fire behaviour and shut down the burn, if necessary
- Patrol and observe the adjoining land outside of the perimeter for spot fires
- Rapidly suppress any spot fires outside of the perimeter, if it is safe to do so
- Be aware of the risk of rabbits or hares running through the fire as they may set other vegetation alight
- Look out for fire whirls across the paddock as the fire dies down that could pick up sparks and embers and carry them across to unburnt areas
- In the event of a sudden flare up or flame across a break, lie flat on the ground rather than running
- Maintain patrols until the fire is out

Call 111 immediately if at any point you are concerned about a risk to people, property, or the environment.

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5. Post-burn

After a crop residue or stubble burn is complete, it is ideal to cultivate immediately afterwards. If this is not practical, then priority should be given to cultivating the firebreaks and adjacent burnt area to minimise the risk of re-ignition. When the cultivation is complete check the burn to ensure that the fire is completely out and cannot escape.

Further information

More information including tools and resources on how to safely use fire as a land management tool is available from:

- the Fire and Emergency website at fireandemergency.nz
- your local Rural Fire Officer
- the Fire and Emergency call centre 0800 FIRE INFO (0800 347 346).