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Management burning of invasive native scrub: techniques

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Vast areas of the rangelands of western New South Wales are suffering from the encroachment of unpalatable invasive native scrub (INS). Encroachment is continuing, and unless it is stopped by changes in management, the density of woody weeds will increase and landholders will suffer declining productivity.

Encroachment by INS reduces the landholders' income by lowering carrying capacity, reducing the reproductive performance of livestock and increasing the cost of managing livestock.

Dense stands of INS also reduce habitat diversity. INS favours certain fauna species such as insectivorous birds, but the decline of grass-timber mosaics affects a range of wildlife. Established INS can also lead to the decline of perennial groundcover and soil erosion. Uncontrolled grazing pressure from feral, native and domestic animals worsens these effects by reducing pasture vigour.

Research by the CSIRO, NSW Agriculture & Fisheries and the Soil Conservation Service of New South Wales demonstrated that management burning

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effectively manages INS. With fire, landholders can reduce the number of woody weeds and seedlings in a paddock and reverse the encroachment process.

The role of management burning is discussed in Primefact 852 *Management burning of invasive native scrub: principles.*

This fact sheet discusses how to conduct management burns that have been tried and found successful.

The techniques may be considered conservative, but they are recommended in the interest of safety because management burning is a new technology for most landholders. Landholders can modify the techniques to suit their individual situation after gaining sufficient experience with management burning.

TERMINOLOGY

Several terms relating to management burning are referred to in this fact sheet. Familiarity with these terms is necessary when you are making decisions on the use and control of management burning.

Air temperature – the temperature of the air, measured in the shade, and expressed in degrees Celsius

Back-burn – a fire burning against the wind

Curing rate – the percentage of grass fuel that is dead

Fire intensity – the amount of heat generated by the fire

Fuel loads – the amount of dry flammable fuel per hectare, expressed as tonnes or kilograms per hectare

Headfire – a fire burning with the wind

Rate of spread – the rate at which a fire moves over the ground

Relative humidity – the moisture content of the air

Scorch height – the height at which the heat generated by the fire will kill the leaves of woody weeds

Wind speed – the average speed of the wind

WHAT IS A MANAGEMENT BURN?

A management burn is planned, controlled and conducted to achieve a management objective; and it does not go beyond the desired area. A management burn is not a wildfire. A wildfire is a fire without a management objective and is usually out of control and can generally damage life and property.

PLANNING MANAGEMENT BURNS

Thorough planning is the key to a successful management burn.

The most important factor to consider when introducing management burning onto a property is how the burning program will fit into the overall management plan for that property. Successful pastoral management must include livestock and

Figure 1. An ideal situation for a management burn – many young shrubs, some older shrubs and a very good fuel load to carry the fire.

the plants they depend on. Management burning is one technique for managing these plants.

When considering a management burn, remember it is more likely to be successful if carried out early in the process of encroachment by invasive native scrub when more fuel is likely to be present (Figure 6). Further information on pasture management can be obtained from the DPI publication, *The glove box guide: Tactical Grazing Management for the semi-arid woodlands*.

Planning for burns must include all the factors which will ensure success. Amongst these factors are the following.

Fuel

The aim of management burning is to kill as many woody weeds and seedlings as possible, and every leaf on the bush must be scorched to give a maximum death rate. Thus the fire must be intense enough to achieve this objective without running the risk of burning outside the planned area.

Scorch height, however, is not the same as flame height. Leaves will be scorched to above the flame height by the radiant heat of the fire.

A successful burn across the desired area will be enhanced if there is a continuous layer of fuel over the paddock (Figure 1).

Experience has shown that grass makes the best fuel. Generally 900 to 1200 kg/ha of dry grass growing up to 30 cm high will ensure an adequate scorch height of invasive native scrub up to 3 m high. However, in semi-arid woodlands most grass grows in tussocks (clumps) and these must be close enough together, or have enough litter between them to ensure that the fire will carry across the paddock.

Fuel levels need only be sufficient to give the desired scorch height and allow for prompt and effective lighting up.

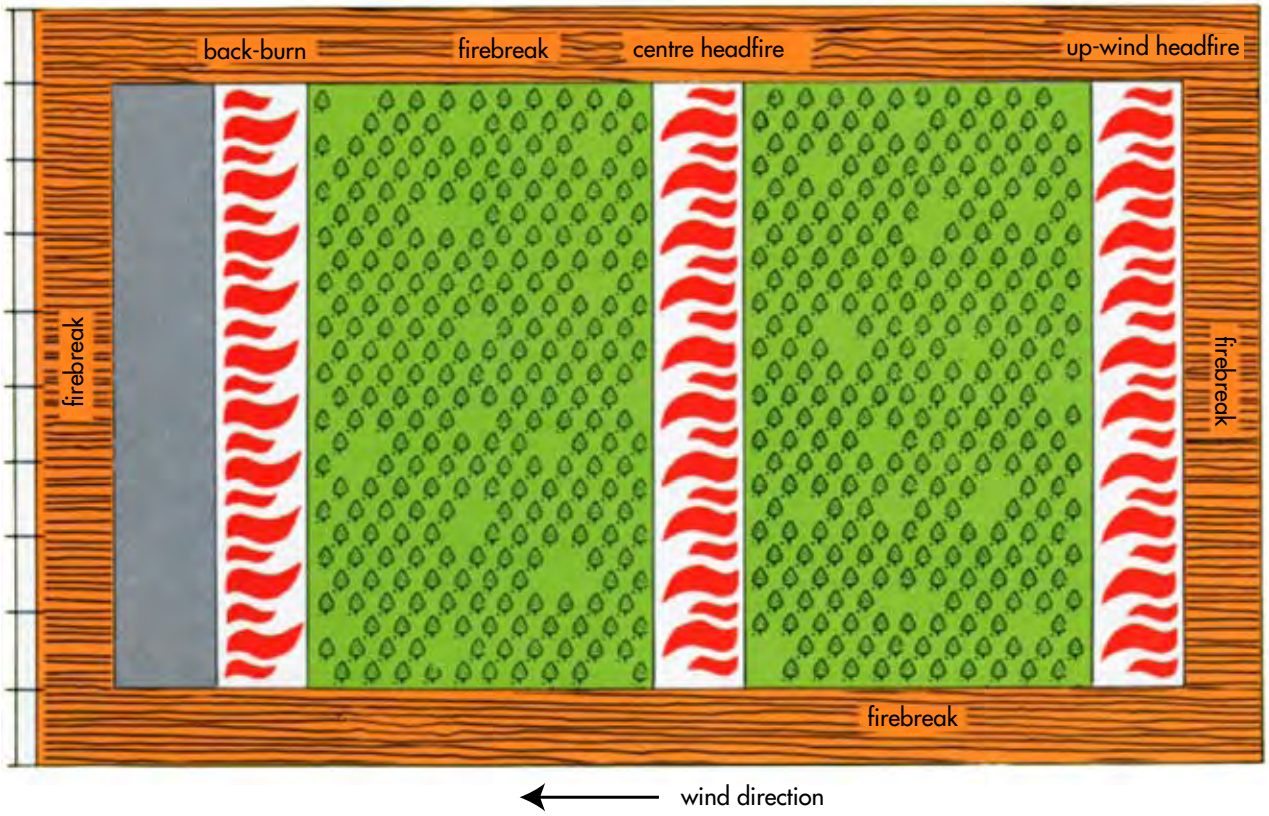
What size area to burn?

Before deciding how much area to burn, consider the following three important points.

1. Air temperature and humidity. These factors significantly affect fire intensity and rate of spread. Fire intensity will be lower early in the morning or late in the afternoon when air temperature is lower and humidity is higher. If fire intensity is low the required scorch height may not be achieved. Also the rate of spread of the fire will be best when the intensity is greatest.

   Thus the area to be burnt must be equal to or smaller than the area which the fire would burn across during that period of the day when fire intensity would be highest. If the area to be burnt is greater than this, there will be areas

Figure 2. Burning a 3000 ha paddock using two headfire fronts.



G.R. SAWTELL

Figure 3. A well-constructed firebreak, three grader blades wide. The trash windrow was turned into the break on the last pass of the grader to leave a clean edge to burn off when lighting the burn.

where woody weeds and seedlings are not completely destroyed due to lower fire intensity and the resulting lower scorch height. Type of fuel is also an important factor in determining the rate of spread.

Rate of spread is a very important factor to consider when you are deciding the size of the area to burn.

2. Manageable area. The area to be burnt must be of the size that can be managed by the labour and equipment available. Be particularly cautious when there are large fuel loads, even with small areas.

   Generally up to 2000 ha can be effectively burnt in one day at peak burning time. Up to 3000 ha can be burnt in one day by using two headfire fronts (Figure 2). In this situation the paddock is split in two and the up-wind headfire burns into the back of the headfire that was lit across the centre of the paddock. This centre headfire then burns into the downwind back-burn.

3. Post-burn management. After the burn it is extremely important to let the regenerating or germinating perennial grasses establish successfully. It is this grass which will compete with the seedlings of woody weeds for moisture. In healthy stands of perennial grass, seedlings of woody weeds cannot survive normal to dry summers of the first or second season after they germinate. Grazing management is very important after the burn to let these grasses re-establish. As it is difficult and expensive to control livestock in sections of existing paddocks, management burns must usually be planned for whole paddocks.

When to burn

Management burns are best carried out in autumn and spring when conditions are warm enough to give the necessary fire intensity without a risk of the fire escaping. However, there can be no hard and fast rule on when to burn. Some situations, such as burning densely encroached land, may require higher fire intensity.

Precautions are essential to ensure a safe management burn under the prevailing conditions.

A permit to burn must be obtained from the local Rural Fire Service (RFS) Brigade Captain before starting any burn during a prescribed fire danger period.

To conduct a cool season burn to eliminate INS seedlings, conditions should be in the range of:

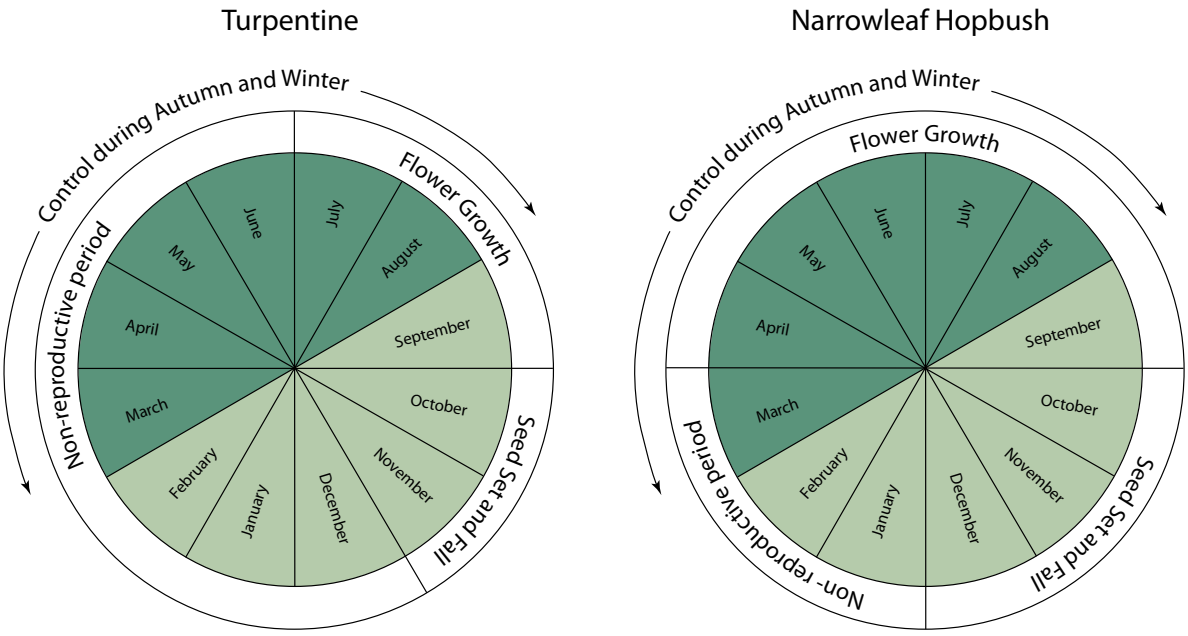
- fuel loads of approximately 1200 kg/ha with sufficient ground cover to carry the fire
- air temperature in the range of 25–30 degrees

FROM SEED TO WOODY WEED – THE ENCROACHMENT PROCESS

Seed production

Although some woody weeds (notably turpentine) sucker freely when damaged, widespread encroachment arises from seed germination. Results from a three year study undertaken by the NSW Soil Conservation Service in the late 1970s indicated that narrowleaf hopbush and turpentine show a regular annual timing of seed production.

Figure 4. Annual seed production cycles



Although the proportion of shrubs producing seed and the amount of seed produced by each shrub may vary from year to year, seed production always appears adequate. Even during their worst year of seeding, a quarter of the mature hopbush and almost half of the mature turpentine studied produced seed.

The minimum height at seeding is one metre for hopbush and 50 cm for turpentine (Figure 8).

- relative humidity in the range of 25–35%
- wind speed of approximately 15–25 km/h.

With a grass curing rate (dryness) of around 80%, this should give a rate of spread of about 0.8 km/h.

To conduct a hot burn to scorch and kill juvenile plants to one metre in height, conditions should be in the range of:

- fuel loads of approximately 1000 kg/ha with sufficient ground cover to carry the fire
- air temperature in the range of 30–35 degrees
- relative humidity in the range of 15–25%
- wind speed of approximately 20–25 km/h.

With a grass curing rate (dryness) of around 80% this should give a rate of spread of about 1.2 km/h.

The following conditions would be considered too extreme for management burning:

- fuel loads above 700 kg/ha
- air temperature above 35 degrees
- Relative humidity below 15%
- Wind speed above 30 km/h.

Plant species, fuel loads and curing rates along with wind speed, relative humidity and temperature can vary the rate of spread. Consider operating at the conservative end of the scale until you gain experience.

Firebreaks

The type of firebreaks necessary in a particular situation depends on many factors. These include the type of fuel, the expected fire intensity, the amount of dead plant material that has been deposited in the windrow of the firebreak by the grader, the amount of labour and equipment available on the day of the burn and the experience with management burning of the personnel involved.

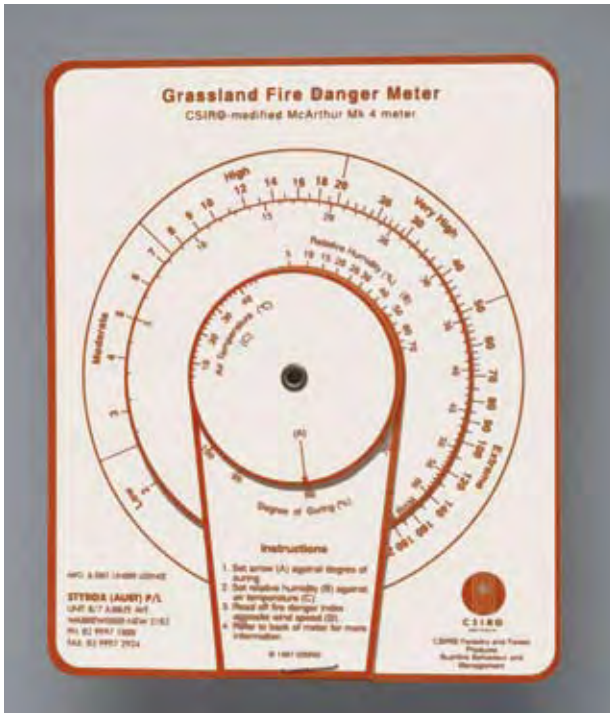


Figure 5. One of the McArthur Grassland Fire Danger Meters available to help landholders carry out management burns.

Figure 6. This area needs a management burn before plants mature and set seed.

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Figure 7. A well-equipped fire unit with a tank and reliable pump unit, hoses and adjustable nozzles, drip torches and UHF radio.

When constructing firebreaks, it is important to guard against a build-up of excessive dead plant material in the graded windrow (Figure 3). If there is a build-up of plant materials such as dead shrubs, the burning leaves and embers may spot across the breaks during back-burning operations. If the windrow is to be turned into the paddock it is much safer to burn the windrows at night, well before the management burn. Preference would be to grade the windrow to the fence or away from the burn side.

In most situations, constructed breaks should be strengthened by back-burning on the burn day. Fire breaks can often be made by taking advantage of natural breaks such as clay pans, water courses or densely scrubbed areas without grass or ground fuel. Tidy breaks around fences protect them from fire and give better vehicle access for checking them and observing livestock.

In the Western Division there are guidelines for the construction of fire breaks. For further details please check with your local Catchment Management Authority (CMA) office.

Equipment

When conducting management burns it is essential to check that all equipment is fully serviceable. All machinery should be tested several days before the burn to allow time for repairs.

Each mobile unit should carry a water tank and pump and be equipped with a UHF radio (Figure 7). Each unit should be individually identified and carry a map of the burn area with clearly identifiable positions marked on it, particularly the points where water is available and safety zones. Remember, a visiting neighbour who is helping with the burn will not know the paddock as well as the owner does.

If possible, each watering point should have its own pump for filling the units' water tanks.

For a full list of equipment you may require, contact your local RFS Captain or major centre. Instruments to measure wind speed, temperature and relative humidity are necessary and may also be obtained from the RFS. These measurements, together with a Grassland Fire Danger Meter (Figure 5), can predict fire intensity and rate of spread. Knowledge of these factors is vital for making sound decisions on lighting and managing the burn.

A very useful piece of equipment at a management burn is a grader; this can be quickly brought in for assistance if necessary.

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Personnel can be correctly positioned around the burn area by using a system of numbered positions on the firebreaks.

Figure 8. This series of photographs show the results from a management burn to control encroaching INS seedlings. While they are less than 50 cm high, fire is an effective tool in limiting their establishment (Figure 4).

LIGHTING UP

The decision to light up can only be made on the day of the burn and must take into account wind speed and direction, fuel conditions, temperature, humidity, standard of fire breaks and available labour and equipment. A weather forecast for the burn day is also essential. Before lighting up, use a Grassland Fire Danger Meter to determine the expected fire intensity and rate of spread. If there is a risk of the expected fire intensity exceeding the capacity for the firebreaks prepared, do not light the fire. Other factors to consider include the following.

- Burn only on days with a steady, light to moderate wind. Strong gusty winds will cause erratic fire behaviour and can cause spotting over the breaks when back-burning.
- Humidity is important in determining the moisture content of the fuel. When humidity is high it may be difficult to achieve a burn, if the humidity is low the fire may become difficult to control.
- Use only drip torches for lighting the fire with a recommended mix of two parts diesel and one part petrol. Light all back-burns on foot using the most experienced personnel. Using burning tyres dragged behind motor bikes is very dangerous and is not recommended.
- When lighting the back-burn, concentrate fire units behind the lighters and have units constantly patrolling back along the break until the burn is secure.
- Do not let large trees along the edge of a fire break or back-burn catch fire, or it will be necessary to patrol this area constantly

throughout the following days to prevent the fire from escaping.

- The edge of the fire must be carefully patrolled until there is no risk of burning trees falling across the firebreak and until the perimeter is secure.

These points are only a guide to management burning for control of INS and seedlings. Obviously it is hard to write a recipe for management burning, as all situations are different. Landholders are encouraged to contact their RFS Brigade Captains for local information and to organise management burns on a community basis. This gives experience with management burning to all members of the community.

Adequate public liability insurance must also be obtained before conducting any management burns.

Management burning has been shown to be effective for the control of INS and seedlings on the rangelands of western New South Wales, and should be seriously considered as a management strategy by landholders.

FURTHER INFORMATION

For assistance with planning and conducting a management burn, please contact your local RFS or CMA office.

Under the Native Vegetation Act, burning is defined as clearing and a Property Vegetation Plan (PVP) will be required. Please contact your local Catchment Management Authority for further details.

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