

# Will my pasture recover from fire?

## How to assess burn intensity and pasture species survival

### The issue

In the aftermath of a fire, producers question whether their pastures have survived and will recover. Fires leave everything blackened, making it difficult to assess pasture survival.

### The impact

Pasture species may not survive hot or very hot burns. Having to resow pastures is expensive and can be risky. Where fires are cooler, many pasture species survive but pasture production can be reduced, impacting animal production.

### The opportunity

Many fires occur in summer and often well before the autumn break giving farmers time to assess what has survived and plan what paddocks may require resowing and strategies they can use to quickly return pasture productivity.



Plant survival after fire is influenced by both the intensity of the burn and the growth characteristics of each species. Plants that store seed underground or have growing points located below the soil surface are generally more resilient and better able to recover following a fire. In most cases, fire only affects plant material in the top 1–2 cm of soil, allowing deeper buds and seed reserves to remain protected and support regrowth.

## Paddock assessment

Pasture survival may vary across the farm and within paddocks because of differences in burn intensity and species adaptation. Therefore, paddocks of concern will need to be individually assessed and plans made.

Generally, there is no immediate rush to inspect areas post-fire as there can be some lag between the fire occurrence and the autumn break when growth re-starts. Watering up areas is a way to speed up this process see page 8 for more information. Assessments and watering up areas can commence after mid-February.

### The steps for paddock assessment are:

- Assess burn severity by inspecting plants and seeds for damage and signs of survival using Tables 1 and 2.
- Rate the likelihood of reduction in plant survival/content using the species by burn severity rating matrix in Table 3.
- Confirm the likelihood of damage by watering up areas.



## Burn intensity

The intensity, or how hot the fire is in a particular paddock has a major effect on the recovery of the pasture.

There are several factors that will influence burn intensity including:

- **Climatic conditions** on the day of the fire.
- **Fuel load** - high continuous fuel loads create hotter burns.
- **Fuel moisture content** – pastures containing green material burn less intensely.
- **Topography** – fires travelling up hills can burn more quickly and intensely than when moving down slopes.

There are three categories of burns that can be identified by considering these factors and assessing what was burnt during a fire and what was left.

They include:

**i) Cool-moderate**

**ii) Hot burn**

**iii) Very hot burn**

To help identify the burn intensity, use the observation checks in Table 1. Tick the descriptions which mostly apply to each observation. At the end of the checklist, the burn category with the most ticks will help best describe the intensity of your burn.

**Cool-moderate burn**



Recognisable plant material Cow pat intact  
Some charring

**Hot burn**



Cow pat - incomplete combustion (spongy rather than powdery when touched) Recognisable plant litter

**Table 1.** Paddock check list to help identify the burning intensity of the fire.

Observation	Cool-moderate burn	Hot burn	Very hot burn
<b>Fuel cover before fire occurrence</b>	Little dry grass cover before the fire < 3000 kg DM/ha.	Heavy plant cover, for example, lightly grazed pasture or crop stubble (dry 3 - 10 t DM/ha)	Intense fire emerges from bush areas onto pasture, where crops have not been harvested or there are very large stubble or litter loads (>10 t/ha), windrows or soils with a thick root mat.
<b>Amount of litter consumed</b>	Litter partially consumed. Small areas of unburnt pasture remaining.	Plant material is mainly burnt and only a small amount remains.	All plant material and seed is destroyed as the fire burns into the top organic matter layer of the soil.
<b>Appearance of litter on soil surface.</b>	Charred surface litter but still recognisable as grass or leaves.	The topsoil mostly appears charred and bare but with recognisable litter underneath.	Little to no effective ground cover with litter only ash or bare soil remaining.
<b>Colour and amount of ash</b>	Thin light layer of grey ash .	Medium layer of pale grey ash at soil surface.	Thick layer of whitish ash.

## Plant survival checks

Plant survival checks can be carried out at the same time as the assessment of the burn intensity. The likelihood of plant survival based on different pasture observations is shown in Table 2.

### Live plants

Live perennial grasses can be assessed using Pasture Paramedic kits and the summer assessment method. This involves **counting the number of live perennial grass plants** within a 0.1 m<sup>2</sup> area. Unburnt live plants are normally assessed by whether they remain anchored when gently pulled and twisted. However, burnt dead plants can remain anchored for up to 4 weeks post fire before roots have decayed enough to be easily pulled from the ground.

A more useful assessment will be to **visually inspect plants for green material**, checking remaining litter and within plant crowns. Live perennial grasses will send up green shoots in the weeks following fire, especially if rainfall occurs.

### Root damage & damage to crown

Where most plant matter has been burnt, dig up the base of phalaris and tall fescue plants, wash and **check for pinkish coloured live buds** which shoot to become new tillers.



### Seed

Search for **residual surface and buried seed** in the top 1 cm of the soil and check for **plump, undamaged seeds** contained in burrs or seedheads. If seed has been visually damaged by fire, low germination rates will occur, see image on page 7.

### Watering up

Watering up small areas is a useful method which provides more confidence in survival of plants under hot burns. This factsheet lists the pasture species targets and densities required for resowing or manipulation.

**Table 2.** Likelihood of plant survival based on pasture observations.

Observations	High	Likely but significant impacts on density	Highly unlikely
<b>Presence of live plant material</b>	Green tillers or leaves obvious	Surviving plants may have 1 or 2 green tillers or a small trace of green leaf.	No presence of live green leaves or tillers.
<b>Root damage</b>	Roots remain largely unchanged and are well anchored	Roots near surface may be charred or scorched but largely unchanged.	Roots charred greater below the soil surface. Plants can be easily pulled from the ground.
<b>Appearance of seed</b>	Seed recognisable and intact	Few intact seeds observed on soil surface but seed observed below seed surface.	No seed observed on soil surface or at 1-2 cm.

## Impacts on pasture content

Plant survival and regeneration ability vary with species. Individual species responses to fires are outlined on page 6.

**Plant growth characteristics** that increase the likelihood of recovery following fire:

- Location of growing points are below ground.
- Plants with taproots, bulbs and well-developed root reserves.
- Dormancy at the time of fire, hence plants that have summer dormancy or are winter active.
- Hard seed producing plants that have established seed banks.

An estimate in reduction of plant content in relation to burn intensity based on results from past fires and knowledge of growth habits is shown in Table 3. Note the presence of dry annual species can increase the likelihood of summer fire damage to green plants such as lucerne.

Annual and perennial ryegrass pastures experiencing very hot burns are unlikely to survive and recover, while many other perennial species may experience approximately 50% plant loss. Many affected paddocks will require resowing.

Generally, cool-moderate burns have a high likelihood of plants surviving with pasture recovering to its original density in the following year with careful management.

Hot burns impact more on species survival and regeneration, with 20 to 90 % reduction expected depending on species adaptation. Watering up areas is useful in this scenario where there is uncertainty.

**Table 3.** Likelihood of reduction in plant content

Species	Cool to Moderate Burn	Hot Burn	Very Hot Burn
Phalaris and fescue (winter active)	0 %	20 %	50 %
Perennial ryegrass and cocksfoot	20 %	60 %	100 %
Tall wheatgrass and summer active tall fescue	10 %	30 %	80 %
Native grasses, kangaroo, weeping, red and windmill grass	10 %	30 %	80 %
Native grasses, spear grass and wire grass	0 %	20 %	50 %
Annual grasses	20 %	80 %	100 %
Lucerne and chicory	0 %	20 %	50 %

Species	Cool to Moderate Burn	Hot Burn	Very Hot Burn
White clover	20 %	60 %	100 %
Sub-clover subtypes <i>subterranean</i> and <i>yannicum</i>	10 %	30 %	80 %
Sub-clover sub-type <i>brachycalynium</i> , e.g. Antas	20 %	60 %	90 %
Aerial seeding, hard-seeded annual clovers, e.g. <i>balansa</i> , arrowleaf	20 %	80 %	100 %
Capeweed and erodium	20 %	80 %	100 %
Biannual/annual thistles – e.g. spear and slender	20 %	80 %	100 %

## Summarising assessments

A useful way to pull together the information to start planning is to list paddocks with their dominant species with the information collected from Tables 1, 2 and 3. An example is shown in Table 4. Once information is collected and summarised, it helps inform potential decisions.

**Table 4.** Paddock assessments.

Paddock name	Species grown in paddock	Burn severity rating (use Table 1)	Plant, seed, root assessment notes	Likelihood of reduction in plant content (use Table 3)	Results of watering up	Strategy
Flat	Balansa clover	Hot	No visible sign of surviving seed	90%	No evidence of balansa emerging.	Resow

## Pasture density

Pasture density is lower following fire and will have more impact on carrying capacity than the species that survived. Anticipating potential reductions in plant density helps feed planning and budgeting.

Annual grasses' contribution to feed and animal production is often undervalued. Annual grass weeds like annual ryegrass, barley grass, soft brome grass and silver grass can make up at least 20% composition of a pasture, providing high-quality early feed, and that feed supply will be dramatically reduced following fire.

The likely percentage reductions in content for different pasture species could be used from Table 3 to estimate likely food on offer for feed planning purposes, with the highest effects on density occurring in winter and tapering off in spring.

Table 5 shows an example of expected impacts from fire on a typical moderate rainfall, mixed annual and perennial grass sheep pasture (Ag Vic n.d.).

**Table 5.** Effect of fire on the carrying capacity of a typical western district sheep pasture.

Month	Carrying capacity (% of normal)
June	20%
July	30%
August	40%
September	50%
October	60%
November	70%
December	70%
January	70%
February	70%
March	70%

## Individual plant species response to fires

The impact on individual plant species and their potential recovery is described below.

### Perennial grass species

Grasses with growing points below the soil surface like **phalaris** and **tall fescue** survive best. Phalaris is often burnt on roadsides in very high fuel loads, but survives. **Perennial ryegrass** and **cocksfoot** have growing points located at the base of the tiller (whitish area) just above the soil surface which can be damaged by fire. When the growing point is damaged, the plant dies.

If perennial ryegrass or cocksfoot has set seed before the fire and the burn is relatively cool, much of that seed can survive. These viable seeds can then germinate after the fire and establish new plants.

Young, newly sown perennial plants (less than six months old), along with older but weak plants that have not yet developed strong root systems or energy reserves, will experience stress after a fire. They are generally able to survive cool to moderate burns but will require a period of spelling to rebuild carbohydrate reserves. However, these plants are highly vulnerable to hot burns and are likely to be killed under those conditions.

Strong perennial pastures that had little or no weed burden before the fire are reported to have had few, if any, weed problems when recovering.

**Native grass** plants are well adapted to burning. Damage can be more severe on summer growing species that are actively growing at the time of fire such as kangaroo grass, red or red leg grass, weeping grass and windmill grass, especially if there are high amounts of dry fuel.

Native grasses, spear grass and wire grass have below-ground growing points and are therefore more tolerant.

## Annual grasses

There is a high likelihood of drastic reduction (50%-80%) in the annual grass component of pasture for three reasons.

1

Their seed remains on or very close to the soil surface and will be burnt in most circumstances.

2

Most annual grasses produce very little dormant seed that carries over to germinate in the following year. Usually, 80-90% of the seed produced in one season germinates the following autumn.

3

Remaining surface seed is exposed on the soil surface and can be vulnerable to wind removal or ant harvesting before the autumn break.

An expected reprieve in annual grasses can reduce their risks of competition if oversowing new pasture species. However, any surviving plants can go on to set massive number of seed and numbers can quickly increase in the following years.

## Annual clovers

**Subterranean clover** subspecies types, *subterranean*, also known as black-seeded and *yannicum* - white-seeded, actively bury their seed and therefore the soil cover should protect them in cool to moderate burns. The subspecies *brachycalycinum* sets more surface and residual seed than other subtypes and so is likely to have greater loss of seed e.g. cultivars Antas and Clare.

Where a strong sub-clover seedbank is present, it is generally expected to recover well after fire. Large fluctuations in day-night temperatures help break down hard-seededness, and the removal of pasture litter by fire can further stimulate germination by exposing the soil surface and creating more favourable temperature conditions. The timing of the autumn break and follow-up rainfall will also influence sub-clover recovery. Because soils without surface litter dry out more quickly, rainfall events greater than 20 mm may be needed to trigger germination, with additional rain required to support seedling survival. False breaks remain a risk under these conditions and can slow or reduce successful recovery.



Clover seeds on burnt ground

Hot burns will potentially result in lower plant numbers. Strategies should be undertaken aimed at encouraging seed set to replenish seedbanks.

For **aerial-seeding annual clovers** such as balansa, Persian, shaftal and arrowleaf clover, any recently set seed lying on the soil surface is likely to be burnt during a fire. However, both balansa and arrowleaf clover possess hard-seed characteristics that support recovery in the seasons following a burn. Arrowleaf clover also has the added advantage of a deep taproot, which can enable the plant to survive and potentially recover even when fire occurs during its growing period.

## Perennial Legumes

Established **lucerne** can survive even a very hot burn despite the tops of the crowns being burnt due to its good root reserves.

**White clover** is very similar to the survival of perennial ryegrass. The surface stolons (runners) of white clover can be destroyed in hot fires but it will largely survive cool-moderate burns. Seed is set on the surface and likely to be destroyed.

**Strawberry clover** has been observed to survive better than white clover, with only severe damage occurring in the very hot burns.

## Broadleaf and narrow-leaf weeds

Perennial weeds with well established, deep root systems, tap roots or bulbs survive fire very well. These include weeds such as flatweed, docks, sorrel and onion grass and they can recover quickly and thrive where pasture competition is limited.

Capeweed and erodium (corkscrew) are annual weeds which set seed on the soil surface and produce little dormant seed and are severely impacted in hot fires. However, because they set massive amounts of seed they are favored by the bare ground and can become dominant following cool to moderate fires.

Thistles have been reported to cause issues after fire because they produce dormant seeds and growth is also favoured by lack of pasture competition, e.g., spear thistle, slender thistle.

## References and more information

- [Agriculture Victoria. \(n.d.\) Pasture recovery after fire.](#)
- [DPI NSW. \(2020\). Pasture recovery after bushfires 3rd Edition. Tamworth.](#)
- [Southern Farming Systems. \(2026\). What will regrow? How to Water-Up and Assess Pasture Recovery Post Drought / Fire.](#)



Ag Vic - Pasture recovery after fire



DPI NSW - Pasture recovery after bushfires



SFS - What will regrow? How to water up post drought/fire

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