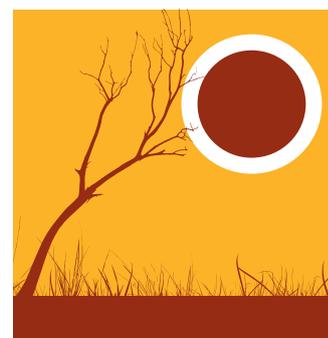


# Managing drought, fire and flood

A guide for NSW primary producers

First edition, December 2023



## Acknowledgements

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## Managing drought, fire and flood First edition

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This guide reflects the unique pressures placed on NSW producers before, during and after drought, fire and flood. It includes strategies and actions that farmers can consider to make informed decisions both for their business, and the wellbeing of them and the people around them.

It also includes information on relevant resources from the NSW Department of Primary Industries (NSW DPI) and Local Land Services (LLS), practical information on feeding livestock, farm management and sustainable practices around soils, pastures, cropping and natural resources.

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# Understanding seasonal conditions and climate information for NSW



Surrounded by large oceans, Australia has one of the most variable rainfall patterns on Earth. The frequency and volume of rainfall received underpins the success of our agricultural systems. However, rainfall is not the only contributing climate factor to agricultural production: temperature, humidity, frost, and wind also play their part, as does the timing of extreme weather events in the production cycle.

In this chapter, learn about:

- the use of Global and Regional Climate Drivers in seasonal outlooks
- how to read and understand/interpret short-term weather forecasts
- monitoring of seasonal conditions in NSW.

# The use of global and regional climate drivers in seasonal outlooks

Global Climate Drivers (Figure 1) influence Regional Climate Drivers (Figure 2) which interact with the regional landscape to deliver the weather at that location. Global Climate Drivers include El Niño and La Niña. East coast lows and blocking highs are examples of Regional Climate Drivers.

Understanding Global and Regional Climate Drivers and their influence on Australian weather improves our ability to interpret climate and weather forecasts. This allows us to make informed and more appropriate on-ground short-term operational and long-term tactical management decisions in our agricultural production systems.

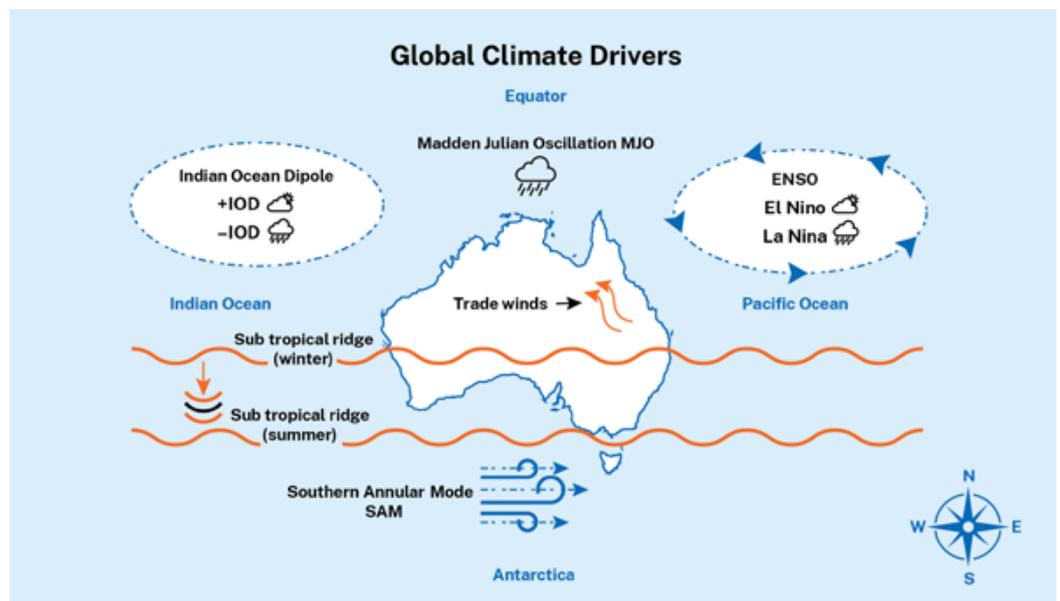


Figure 1. Global Climate Drivers (adapted from the Australian Bureau of Meteorology).

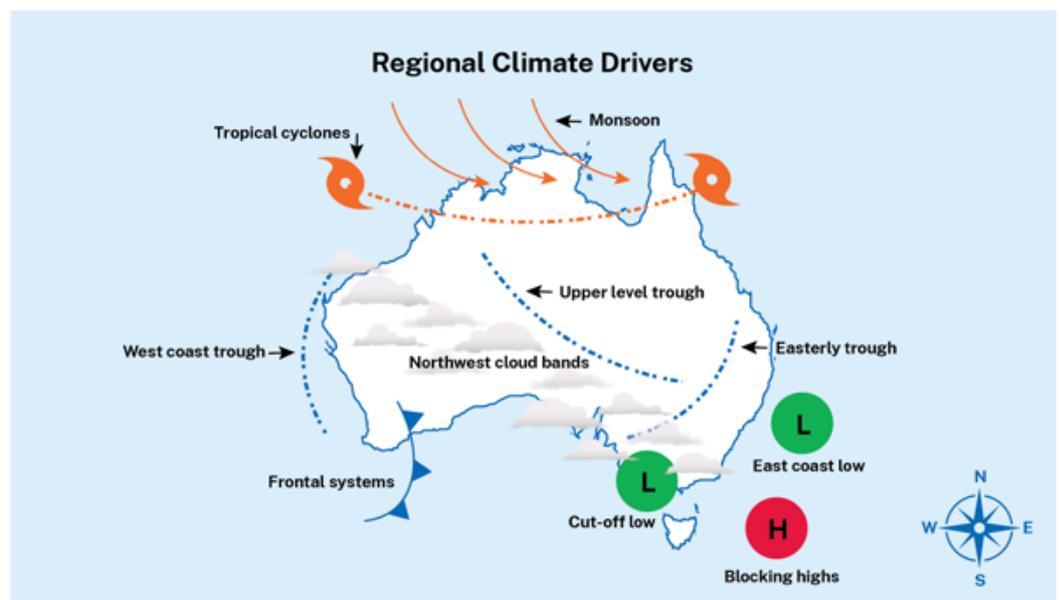
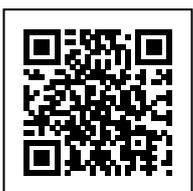


Figure 2. Regional Climate Drivers that influence weather in south-eastern Australia (adapted from the Australian Bureau of Meteorology).



1



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Seasonal forecasts and outlooks are produced by The Bureau of Meteorology and other third-party services. The outlooks are derived based upon the interactions of global and regional climate drivers. These interactions vary depending on the time of year and can affect both our short and long-term forecasts.

Detailed descriptions and videos explaining climate drivers can be found on the [Bureau of Meteorology website](#)<sup>1</sup>, and by watching [NSW DPI Climate Dog animations](#)<sup>2</sup>

## Global Climate Drivers

There are five key global climate drivers that influence the weather in south-eastern Australia. These are the El Niño-Southern Oscillation, the Indian Ocean Dipole, the Southern Annular Mode, the Madden-Julian Oscillation and the Sub-tropical Ridge. See Figure 1 for more information.

### El Niño-Southern Oscillation (ENSO)

ENSO is the change between El Niño and La Niña conditions based on sea surface temperatures (SSTs) in the equatorial Pacific Ocean, from east of the International Date Line across to the west coast of South America.

ENSO has a significant impact on the amount of cloud and strength of winds across the Pacific Ocean, which in turn influences the amount of rainfall received in south-eastern Australia during winter and spring.

There are three distinct phases of ENSO.

1. **El Niño:** reduces the chance of rain over south-eastern Australia during winter and spring. An El Niño event and a positive IOD further reduces the chance of rainfall. There is also an increased risk of fire danger in south-east Australia.
2. **La Niña:** increases the chance of rain over south-eastern Australia during winter and spring. A La Niña event and a negative IOD further increases the chance of rainfall.
3. **Neutral ENSO:** has no influence over the likelihood of rainfall in south-eastern Australia.

It is important to note that although El Niños are generally associated with drier conditions and La Niñas with wetter conditions, an El Niño event does not always lead to drought and a La Niña event will not always lead to very wet or flooded conditions for south-eastern Australia. This is because ENSO interacts with other climate drivers.

**TIP:** If you find it hard to remember whether La Niña or El Niño are more likely to bring rain, the word association that La Niña and rain contain the letter 'A' might help, where El Niño and drought contain the letter 'O'.



## Indian Ocean Dipole (IOD)

The difference between surface sea temperature (SST) of the tropical western and eastern Indian Ocean is known as the Indian Ocean Dipole (IOD). This SST temperature differential can influence temperature and rainfall in Australia. Its impact in south-eastern Australia is generally between June and November, before fading with the onset of the tropical monsoon season.

The IOD has three phases.

1. **Neutral:** occurs when sea temperatures in north-west Australia are warm but close to normal across the tropical Indian Ocean. This phase has minimal influence on the Australian climate.
2. **Positive:** occurs when there is cooler than normal water in the eastern Indian Ocean and warmer than normal water in the western parts of the tropical Indian Ocean. This phase can result in higher-than-normal temperatures and less rainfall in other parts of Australia (including south-eastern Australia) in winter and spring.
3. **Negative:** occurs when there is warmer than normal water in the eastern Indian Ocean and cooler than normal water in the western tropical Indian Ocean. This phase can result in an increased chance of above average winter and spring rain across western and southern Australia. However, the effect can vary greatly by region.

For further information visit the [Bureau of Meteorology website](#)<sup>1</sup>.

There is a strong interaction between IOD and ENSO. For eastern Australia, the wettest winter/spring periods occur when there is a negative IOD and negative ENSO (La Niña). Drought years are generally when there is a combination of a positive IOD and positive ENSO (El Niño).

## Southern Annular Mode (SAM)

The Southern Annular Mode (SAM) refers to the north/south movement of strong westerly winds in the mid to higher latitudes of the southern hemisphere. SAM brings storm systems and cold fronts that move from west to east. SAM affects southern Australian coastal regions and inland areas of Queensland and New South Wales throughout the year.

SAM has three phases, neutral, positive, and negative and the effect of SAM on rainfall varies greatly on season and region. A positive SAM pushes the Westerly winds towards Antarctica while a negative SAM expands the Westerly winds towards Australia.

The phases of SAM have different influences on rainfall, depending on the season:

- **In summer**, a positive SAM increases the possibility of rainfall in south-eastern NSW while a negative SAM decreases the chance of rain.
- **In winter**, a positive SAM increases the chance of rainfall in parts of coastal and central NSW. A negative SAM in winter generally decreases the chance of rainfall.
- Generally, for many parts of New South Wales, a positive SAM in winter or summer will result in a higher chance of rain.
- A neutral SAM has little influence on Australia's rainfall and temperature.



1



## Madden-Julian Oscillation (MJO)

The Madden-Julian Oscillation (MJO) impacts the timing and intensity of the monsoon troughs. Circulating the globe from west to east in the tropical atmosphere, the MJO can enhance or suppress summer rainfall over northern Australia for weeks or months. This can indirectly impact rainfall in parts of southern Australia.

While the westerly wind patterns are favourable for widespread rainfall, it can trigger a positive ENSO (El Niño).

## Subtropical ridge

The subtropical ridge plays an important part in the seasonal variation of Australian weather. It brings dry and stable conditions to large parts of Australia however its influence is determined by its location.

During summer and early autumn, the subtropical ridge is generally located to the south of Australia. This brings high pressure systems associated with stable dry conditions, which generally move eastwards along the ridge. The southern movement permits the monsoon troughs to move over northern Australia.

As the colder seasons develop, the subtropical ridge moves northward, remaining over Australia until late spring. When the ridge is at its northern-most position (southern Australian winter), northern Australia experiences fine conditions, whilst southern Australia is more affected by rain bearing frontal systems.

## Regional climate drivers

These are climate drivers that are shorter in duration than the global climate drivers, but still influence Australian weather. Three Regional Climate Drivers of specific relevance to NSW are east coast lows, blocking highs and the northwest cloud band (Figure 2).

Other regional climate drivers like monsoons, tropical cyclones and depressions generally impact the weather in northern Australia. However, depending on the global driver at play in the region, their influence can drift further south.

## East coast low phenomena

Forming at any time of year, these short-lived phenomena are most common in autumn and winter with a maximum frequency in June. East coast lows can bring heavy rainfall and strong and gusty winds to parts of south-eastern Australia.

## Blocking highs

Blocking high pressure systems disrupt the west to east flow of low pressure systems across southern Australia. They can remain near stationary for an extended time. The outcomes are complex and vary by region.

Areas under the influence of a blocking high could experience dry and stable conditions, while areas to the west of the high could experience wet conditions as the approaching frontal systems become very slow moving.

## Northwest cloud band

A northwest cloud band is an extensive layer of cloud which can stretch from northwest to southeast Australia bringing heavy rain to these areas.

- Generally occurring between March and October, with the highest frequency between April and September, northwest cloud bands can last from between a few days to a week.
- Northwest cloud bands can also interact with cold fronts and cut-off lows over south-eastern Australia to produce very heavy rainfall.

For further information on climate drivers visit the [Bureau of Meteorology website](#)<sup>1</sup>.



1



# How to read and understand a rainfall forecast

Weather apps linked to weather stations from The Bureau of Meteorology or other third parties provide a summary of current and forecast temperature, rainfall, wind and other weather conditions. These may be displayed hourly or daily but it is important to correctly interpret the information provided, especially in relation to rainfall.

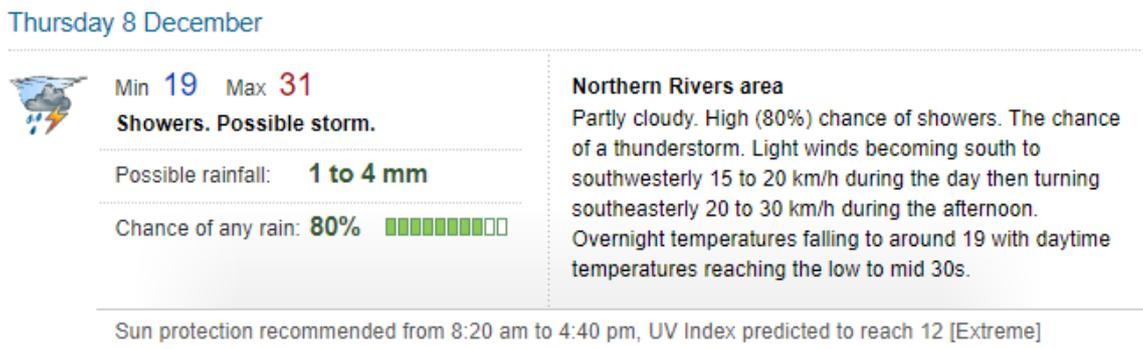


Figure 3. The Bureau of Meteorology weather app illustrating a typical rainfall forecast

## The chance versus the possibility of rain

Figure 3 is a screenshot from The Bureau of Meteorology website illustrating a typical rainfall forecast.

To correctly interpret the rainfall forecast you can break the information into two parts:

1. Chance of rain
  - The chance of rain relates to the percentage value.
  - In this example there is an 80% chance of rain. This means that there is an 80% chance of receiving any rain (above 0.2mm).
2. Possible rainfall amount
  - Possible amount of rain relates to the millimetre values
  - Each value has a different likelihood (or chance of occurring) assigned to it
  - In this example there is a 75% chance of at least 1mm or rain, and a 25% chance of above 4mm of rain.

Note: the first value will always be a 75% chance of receiving this amount of rainfall, there will always be between 75% and 25% chance of receiving an amount of rain between the two values and a 25% chance of receiving above the second value.

If there is showery weather or when thunderstorms are expected, the difference between the two figures will be larger.

# Monitoring of seasonal conditions in NSW

## NSW State Seasonal Update

NSW DPI has been reporting on seasonal conditions in the [NSW State Seasonal Update](#)<sup>1</sup> since 2013. The State Seasonal Update is published monthly providing:

- Information on NSW seasonal conditions over the past month
- A regional breakdown of conditions for each NSW Local Land Service region
- A NSW seasonal outlook for the coming three months

This information is provided to help farmers and government alike, understand, prepare and respond to both current and forecast seasonal conditions.

## NSW Combined Drought Indicator

A key feature of the NSW State Seasonal Update is information on the categories of drought currently experienced in NSW, which is calculated from the NSW DPI Enhanced Drought Information System (EDIS).

EDIS was developed in 2015 and officially launched in 2018 and continues to provide valuable information on drought risk awareness in NSW, emphasising:

- drought preparedness
- improving confidence in drought monitoring and
- early warning for NSW.

A key output from EDIS is the NSW DPI Combined Drought Indicator (CDI). The CDI integrates meteorological, hydrological and agronomic definitions of drought using indexes for rainfall, soil water and plant growth. Used together, these indices classify the five categories of drought: Non-Drought, Recovery, Drought Affected (weakening or intensifying), Drought and Intense Drought.

The definitions for each of these categories and associated management responses are provided in Table 2.

The CDI is publicly accessible on the [DPI website](#)<sup>2</sup>. The interactive map provides a snapshot of current conditions across NSW. It is important to recognise that the CDI map provides an aggregated 'on-average' view of NSW and that on-ground conditions can be different to those displayed on the map.



1



2



Table 2. CDI Category Table

CDI Phase	Technical definition	Description - typical field conditions	Farmer Response	Advisory Response
Non-drought	All indicators greater than the 50th percentile	Production is not limited by climatic conditions.	<ul style="list-style-type: none"> <li>• Prepare for dry periods</li> <li>• Manage risks, spread investments, long term planning</li> <li>• Build fodder reserves</li> <li>• Build financial reserves</li> <li>• Invest in water infrastructure</li> <li>• Update plant and equipment</li> <li>• Expand into more property</li> <li>• Change enterprise</li> </ul>	<ul style="list-style-type: none"> <li>• Encourage preparation plans</li> <li>• Assist long term planning</li> <li>• Undertake education and extension</li> <li>• Support succession planning</li> <li>• Assist with debt reduction</li> </ul>
Recovery	All indicators are greater than the 30th percentile AND any indicator is less than the 50th percentile AND the previous category is Drought Affected	Production is occurring but would be considered 'below average'. Full production recovery may not have occurred if this area has experienced drought conditions over the past six months.	<ul style="list-style-type: none"> <li>• Plan, rebuild and expand</li> <li>• Restock, increase breeding, restructure the herd</li> <li>• Undertake fodder, pasture and grain cropping, including opportunity cropping</li> <li>• Strengthen and expand water storage</li> <li>• Fire risk planning</li> </ul>	<ul style="list-style-type: none"> <li>• Organise recovery workshops Look at finance/enterprise mix</li> <li>• Encourage long term planning</li> <li>• Assist with budgeting and finance</li> </ul>
Drought Affected (weakening)	Any indicator is less than the 30th percentile AND Positive 5-month Rainfall Index trend (DDI>0.4)	Production conditions are getting tighter, but there have been some falls of rain over the past month. It is rare to enter the Recovery phase from the Non-Drought category; Usually there is a quick (1-2 week) transition into Drought Affected or Drought. When indicators are close to the Drought threshold drought conditions are severe.	<ul style="list-style-type: none"> <li>• Update Plans, monitor and wait</li> <li>• Arrange necessary finance planning</li> <li>• Undertake short term trading and agistment</li> <li>• Talk to other farmers and network</li> <li>• Engage with support workers and advisors about management decisions</li> </ul>	<ul style="list-style-type: none"> <li>• Target areas that may soon need help</li> <li>• Report local conditions and actions to government and policy makers</li> <li>• Monitor conditions and forecasts</li> </ul>
Drought Affected (intensifying)	Any indicator is less than the 30th percentile AND Negative 5-month Rainfall Index trend (DDI ≤ 0.4)	Conditions are deteriorating; production is beginning to get tighter. Ground cover may be modest, but growth is moderate to low for the time of year. When indicators are close to the Drought threshold drought conditions are severe.	<ul style="list-style-type: none"> <li>• Sell surplus stock</li> <li>• Manage crop inputs</li> <li>• Assess fodder reserves</li> <li>• Assess fodder costs</li> <li>• Fine tune drought plan</li> <li>• Monitor conditions and forecasts</li> </ul>	<ul style="list-style-type: none"> <li>• Re-establish 'networks'</li> <li>• Touch base with farmers</li> <li>• Monitor conditions and forecasts</li> <li>• Monitor mental health</li> <li>• Report local conditions and actions to government and policy makers</li> </ul>
Drought	Any indicator is less than the 5th percentile	Conditions may be very dry, or agronomic production is tight (low soil moisture or plant growth). It is possible to be in Drought when there has been some modest growth, or a few falls of rain.	<ul style="list-style-type: none"> <li>• Destock</li> <li>• Retain breeding stock if possible</li> <li>• Hand feed core breeders</li> <li>• Cart water</li> <li>• Use Farm Management Deposits</li> <li>• Organise bank debt mediation</li> <li>• Engage with support services</li> <li>• Undertake fire risk planning</li> </ul>	<ul style="list-style-type: none"> <li>• Target areas that need support</li> <li>• Monitor mental health</li> <li>• Link service providers and landholders</li> <li>• Organise drought concessions</li> <li>• Organise budgets for short term-funding</li> <li>• Monitor financial resources</li> <li>• Report local drought duration to government and policy makers</li> </ul>
Intense Drought	All indicators are less than the 5th percentile	Ground cover is very low, soil moisture stores are exhausted, and rainfall has been minimal over the past 6-12 months.	<ul style="list-style-type: none"> <li>• Continue managing to conditions</li> </ul>	<ul style="list-style-type: none"> <li>• Continue to seek assistance and advice</li> </ul>

# Understanding how the CDI category changes over time

The CDI and the underlying indices that determine the CDI (rainfall, soil moisture, plant growth indices) change over time depending on seasonal conditions. These changes are provided publicly on the NSW DPI website and are available for every parish in NSW.

An example of the information available is shown in Figure 4. The chart shows how the underlying indices, blue (rainfall), red (soil water) and yellow (plant growth) lines change over time (September 2016 to July 2023 for this example).

The coloured bar at the bottom (above the dates) displays which CDI category was current at the time.

Tracking the trend of these indicators over time can assist in making management decisions related to changes in seasonal conditions. This should be done considering local conditions and include other sources of information and advice.

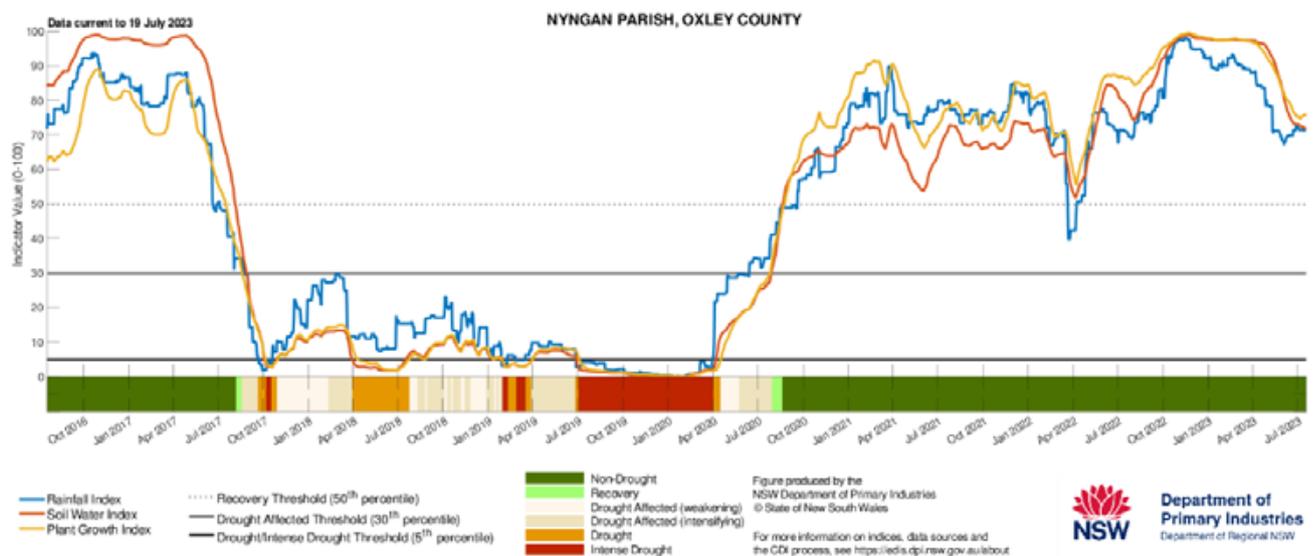


Figure 4. The combined drought indicator (CDI) time-series chart for Nyngan Parish, in Oxley County (September 2016-July 2023).

Figure 4 can be interpreted as follows.

- The region (Nyngan parish in this example) transitioned into the Drought Affected category in September 2017.
- Although there was some rainfall in late October 2017, it was not effective, and the area remained in the Drought Affected category.
- The region transitioned into the Drought category in late May 2018.
- By October 2019, the region had transitioned into the Intense Drought category.
- Tough on-ground conditions were experienced, and the region remained in Drought until June 2020.
- There was an improvement in conditions from approximately April 2020 onwards. This was initially a result of effective rainfall in the region, which led to improvements in the agronomic indicators (plant growth and soil water).
- The region transitioned into the Non-Drought category by October 2020.

When interpreting the chart, it is important to note:

- The CDI and its individual rainfall, soil moisture and plant growth metrics are leading biophysical indicators of drought. While in this example, the CDI may point to a strengthening recovery and transition out of biophysical drought in July 2020, production and economic responses lag behind the CDI.
- The information provided in the map is aggregated to a parish level and provides a regional assessment of conditions. Variability within and between farms is possible and this may not be reflected in the CDI map.

**This information should only be used as a guide and users are advised to utilise a wide range of information and obtain professional advice when making risk management, agronomic and financial decisions for their property.**



## Farming forecaster

Farming Forecaster is an advanced risk management tool that utilises cutting-edge technology to offer a predictive outlook of pasture availability and expected livestock performance for the upcoming 3–4 months. It leverages real-time data, including soil moisture readings at various depths and two distinct climatology systems for pasture forecasts: historical weather data spanning 30 years and 33 runs of projected weather data for the next 4 months.

With a current coverage of over 100 sites encompassing approximately 4 million hectares of grazing land, the platform enables producers to assess the impact of rainfall events and shifts in weather patterns on soil moisture, projected pasture growth, and animal performance across five different risk profiles.

Moreover, Farming Forecaster<sup>1</sup> contributes to enhanced grazing management and environmental benefits such as improved ground cover, reduced soil erosion, enhanced water quality, increased plant production, greater species diversity, lower weed densities, and improved soil structure and nutrient cycling.

Farming Forecaster is complementary to the Combined Drought Indicator as Local Land Services staff use both systems to generate specific producer advice and communications products.

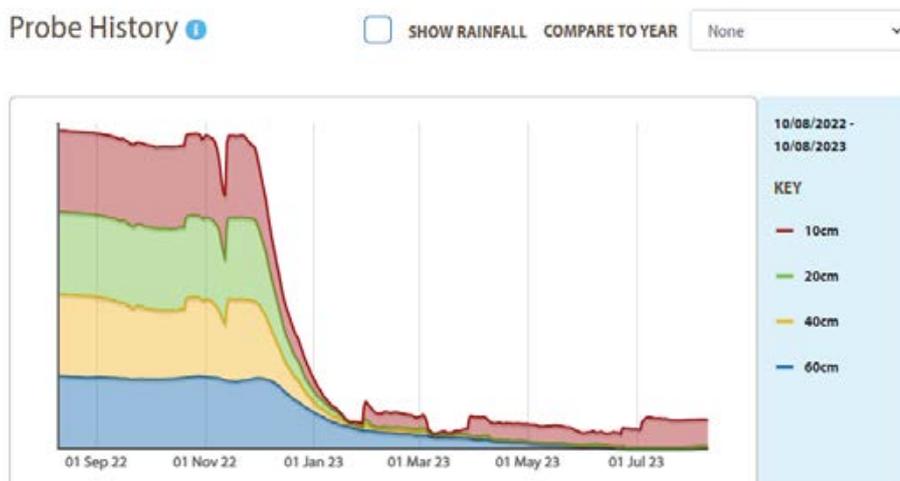


Figure 5. An example of the soil moisture data from a soil probe in the Farming Forecaster network.



1



# More information



1

- Read more on NSW DPI's [seasonal conditions monitoring program](#)<sup>1</sup> visit the DPI website.
- Subscribe to the monthly [State Seasonal Update](#)<sup>2</sup>.
- Visit the [Combined Drought Indicator interactive map](#)<sup>3</sup>.
- Contact a NSW DPI seasonal conditions staff member via email [seasonal.conditions@dpi.nsw.gov.au](mailto:seasonal.conditions@dpi.nsw.gov.au)
- To find out more about the climate drivers that influence Australia's weather, visit the [Bureau of Meteorology website](#)<sup>4</sup>.
- Provide feedback via our [survey](#)<sup>5</sup> to tell us what is important to you as DPI continues to improve the Seasonal Conditions monitoring program.



2



3



4



5





# Farm Tracker Mobile Application

Seasonal Conditions Monitoring Program

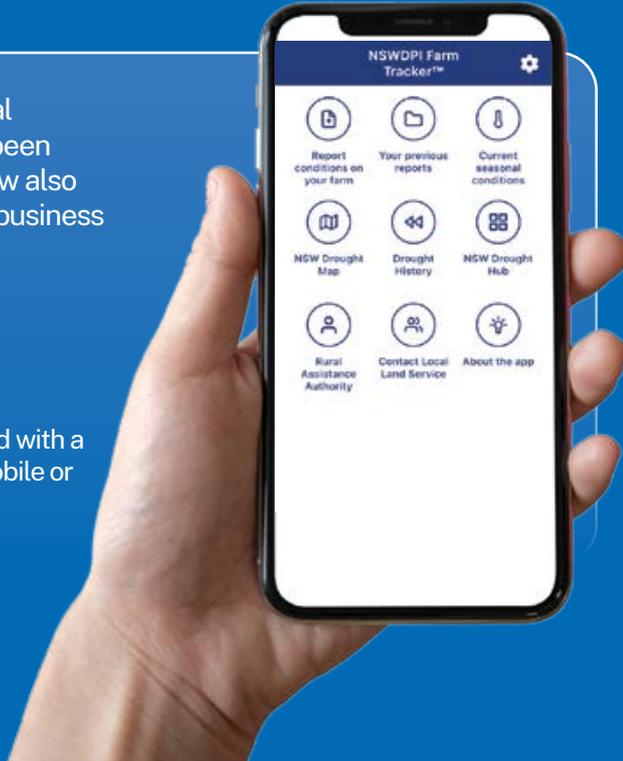
Farm Tracker is a simple tool you can use to help monitor seasonal conditions on your property. An upgraded version of the app has been released that now allows you to not only record conditions, but now also links users with other resources that may be useful to help make business decisions.

Farm Tracker allows you to:

- Complete a simple crop, pasture or animal survey
- Keep and manage a photo diary of your farm so you can monitor the same paddock over many years
- Reports can be completed in a few minutes and they are synchronised with a personal database as well as the statewide database when within mobile or wi-fi range.

The app connects you to other useful Government services like:

- The NSW Combined Drought Indicator map
- The monthly NSW State Seasonal Update
- NSW DroughtHub
- Local Land Services
- Rural Assistance Authority





# Seasonal Conditions Monitoring Program



## State Seasonal Update: Conditions & Outlook

The **State Seasonal Update** is produced monthly and is the official point of reference of seasonal conditions across NSW for producers, government, stakeholders and the public.

## Combined Drought Indicator: Latest NSW Drought Maps

Is an interactive tool that provides a snapshot of current seasonal conditions for NSW, factoring in rainfall, soil moisture and pasture/crop growth indices.



## Seasonal Conditions Information Portal

Uses a technology that allows fast, stable transfer of data and information direct from the EDIS system to your computer. The portal contains several downloadable features from the **NSW Combined Drought Indicator**.

## Farm Tracker Mobile Application

Farm Tracker is a tool you can use to record seasonal conditions. You can:

1. Complete a simple crop, pasture or animal survey
2. Keep and manage a photo diary of your farm
3. Monitor the same paddock over many years



## Have your say

Complete this survey and tell us what is important to you as DPI continues to improve our Seasonal Conditions monitoring program. Eg. improved local accuracy of data and climate networks, better ways of communicating, or strengthening linkages to drought management and relief measures.

**Department of  
Primary Industries**

[www.dpi.nsw.gov.au](http://www.dpi.nsw.gov.au)





# Planning for drought, flood and fire

When planning for a drought, fire or flood event, a positive approach to the problem, a clear understanding of your objectives and a careful evaluation of alternative courses of action are essential.

In this chapter, learn about:

- planning tools and resources
- strategies for the livestock producer
- developing an action plan.



# Decision time



## Consider

- Pasture and livestock management
- Selling
- Trading
- Agistment
- Production and financial resources
- Market price movement
- Farm recovery
- Stock welfare

# Planning

It is important to have a plan, act early, review and then plan again, revising the plan as each step is implemented.

You should be realistic in your assessment of the situation and not underestimate the resource (capital, fodder and management), personal and family cost to implement a particular course of action.

Where to start?

1

## Check the most limiting farm resources:

- mental and physical energy to do the continuous tasks required
- available funds
- stock and domestic water available
- feed reserves (paddock and stored) available
- surface/subsoil moisture for crop leaf and root growth
- available livestock fat reserves stored enabling controlled weight loss
- machinery service requirements – breakdowns cost time, money and frustration.

2

## Set action strategies considering:

- the breakeven position of each strategy
- windows of opportunity to adopt management practices that will be profitable during an event
- your available resources and the implications (such as for animal welfare, ground cover, chemical residue) of carrying out each strategy
- when situations are changing, conditional and timely fallback options.

### 3

## Monitor and review performance position and outlook by:

- using your established network to stay informed about key factors that affect your strategies
- being proactive about the decisions made
- being prepared for change
- remembering that the impact falls very heavily not only on the decision makers but also on the whole farm family and employees.

To make good decisions during an event it is necessary to assemble as much information as you can on the factors that will influence your decisions. Information on 'what to do?' comes from:

- past dry spells, drought, fire and flood experiences
- your established rural network
- past trends and current predictions
- decision support tools to inform potential strategies.

The degree of planning depends on your level of risk and how you assess your past, current and future climate, pastures, crops, livestock and business situations.

A whole-farm plan approach is required. Targeted action strategies can be implemented, including fallback options, forward contracts, etc. to ensure that the farm business and its goals are achieved.

# Developing an action plan

## Reminders

When a drought, fire or flood event is in its early stages it is important to remember:

- make decisions early and review them regularly
- set a timetable and keep to it as closely as possible
- graze paddocks with poor water first
- continue routine procedures for maintaining animal health, particularly drenching against worms
- wean calves – feeding cows with calves is expensive
- consider changing from hay to grain – cost hay against grain
- conduct pregnancy tests – why feed non-productive animals?
- fat score your stock to prioritise feeding and identify saleable animals
- livestock are not always expensive and unprocurable at the end of an event
- assess the dentition and structural soundness of your stock and cull accordingly.

## Plan your strategies early

Plan your strategies early to ensure the economic survival of your business.

Stock prices, feed costs, availability of feed, and interest rates vary, but here are some shared lessons across all events:

- The best decisions are logical, well-considered and not based on emotion. Seek skilled help when necessary.
- One reason given for retaining livestock is that the stock on hand are thought to be of superior quality and that replacing them at reasonable cost won't be possible. Except for seedstock animals, this is rarely the case.
- Sometimes there can be unexpected opportunities to make income during events such as lot feeding.
- The producers who do best during events are those with sound management and financial plans.

## Be ready

Every event is different. Be ready to:

- buy or lease land instead of buying feed
- replace old animals with younger ones
- change breeds or enterprise mix (for example from weaners to feeder steer production).

A single trading decision at the right time could contribute more to your viability than a lengthy feeding program. Your ability to take advantage of opportunities depends on maintaining stock in saleable condition.

# Act quickly to reduce risk

The higher the risk of a major crash in the market, the more important it is to take action early. Dollars earned from selling culled animals while the market is still strong will give you greater flexibility if conditions deteriorate.

Factors affecting risk include:

- national population of livestock including feedlots
- domestic and export market demand for beef/sheepmeat
- extent and severity of drought-affected areas
- likelihood of rain and the potential to grow feed at various times of year
- adequacy of regional, state and national feed supplies.

## Assess your position

Think about the risk and consider the questions below.

### Stock

For each class of stock, what is the:

- Rate of weight loss?
- Ongoing feed requirements and costs?

### Injuries and disease

- What should be culled?

### Finance

- What are my stock worth on the market and what are the market prospects?
- Are there other trading opportunities? For example, selling cows and buying yearlings or sheep?
- What is it costing to feed my stock per head per month?
- What can I afford to spend on maintaining my stock?
- Are there taxation considerations?

### Feed

- What feed do I have? Is it suitable?
- If I need to buy feed, what is the price and availability?
- Is it worthwhile selling conserved fodder such as hay and buying another type of feed such as grain?
- Will reserves be adequate to cover increased seasonal needs such as at calving or in winter?
- Have I allowed for full feeding or only supplementary feeding?
- What are the prospects for agistment or leasing?

## Review your progress regularly

The extra worry caused by an event, especially when you are preoccupied with feeding regimes, makes it hard to think logically about the big decisions. However, it is vital to take time to review what is happening, to monitor the changing situation for stock, feed or agistment, and to plan the next step in your management program.

You should review progress regularly, ideally once a month. Planning helps you to feel more in control and able to anticipate each major crisis.

Sometimes it is beneficial to have help with your assessment. Your local LLS team can help you assess your options.

## Develop skills for assessing pasture

It is a good idea to develop skills for assessing pasture quantity and quality. Good management relies on matching animal requirements with available pasture. Degradation of pasture leads to future income reduction and soil loss.

## Make sound livestock decisions

Early in drought, fire and flood events you should:

- reduce grazing pressure by selling, agisting, culling or lot feeding stock – this is the most effective way of staying viable and reducing costs
- maintain a positive cash flow by selling some stock
- keep your options open
- concentrate on the animals that have the potential to earn the most money – your enterprise is then more likely to stay productive.

Draw up a timetable with progressive deadlines for taking action, such as seeking agistment, selling stock, or starting to feed.

It is common to feed stock during dry spells and seasonal feed shortages. However, full feeding can be expensive, laborious, depressing and frustrating. Make sure you consider how to reduce or eliminate feeding wherever possible.

# Tools and resources to help you plan for a drought, fire or flood

NSW DPI's Drought and Supplementary Feed Calculator app, Grazfeed, Farmtracker and StockPlan can help producers, professionals and industry to plan ahead.



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StockPlan can help cattle and sheep producers to explore management options during a feed deficit. These tools help producers to make management decisions that minimise the environmental and financial impacts of climate variability. Contact your region's Local Land Services office to find out if a StockPlan workshop is running near you.

Other helpful resources include:

## Early warning via



2

Region Selector - [PastureForecasting \(farmingforecaster.com.au\)](http://farmingforecaster.com.au)<sup>1</sup>

Department of Primary Industries - [Enhanced Drought Information Systems Web Portal](#)<sup>2</sup>

## Drought planning



3

[Local Land Services' drought plan template](#)<sup>3</sup> (Appendix) is a good resource to help you understand your current situation and what critical decisions you may need to make to prepare for drought.

## Fire planning



4

NSW RFS has a [Farm Fire Plan](#)<sup>4</sup> that includes the 5 top actions to make your property safer and templates for you to create your own plan.

## Flood planning



5

[Local Land Service's Farm flood readiness kit](#)<sup>5</sup> includes a flood readiness checklist and a flood plan template.





## Taking care of yourself when times are tough

# 3

During times of adversity there are often things out of our control. It's OK to feel worried, uneasy or angry when times are tough but it's important to take care of your mental health and wellbeing and to seek help if you need it. Maintaining positive mental health can play an important role in individual, business and community resilience and recovery, so it's important to look after your social and mental wellbeing.

In this chapter:

- source tips for looking after yourself and others
- utilise support to make decisions.



## Tips for looking after yourself and others

Doing things every day to take care of yourself is important. It will help you to deal with stress, make clear decisions and support loved ones. It's important to:

- maintain social networks and speak openly with friends and family about what you're going through
- maintain routines with good diet, exercise, quality sleep and sufficient rest
- have down time to remove yourself from the stresses of the farm
- focus on the things you can control
- seek information from reliable sources to ensure you're well informed
- remember that challenging times will pass
- get help early. It can make a difference to how you feel in the long run.

## Signs that someone might be struggling

When someone is under prolonged stress, they may have difficulty making decisions regarding their finances, production or relationships. If you or someone you know is showing signs of being stressed or not coping, it's important to talk about it and seek or offer help as soon as possible. Common signs of stress or emerging mental illness include:

- changes in mood such as anger, irritability, low mood, or excessive worry
- loss of concentration or interest in usual activities
- physical health concerns such as low energy, aches, and pains
- relationship issues
- changed sleeping or eating habits
- increased use or reliance on alcohol or drugs to cope.

Trust your instinct. If someone doesn't seem their best self, check in with them.

# How are you going?



WELL

UNWELL

How are you feeling?

Self-aware & calm

Irritable or impatient

Angry or frustrated

Aggressive, out of control

What's your stress level?

Coping well

Worried or nervous

Very nervous, panicky

Really anxious, panic attacks

What's your outlook?

Positive

Overwhelmed

Feeling hopeless

Depressed or suicidal thoughts

How are you working?

Motivated & kicking goals

Putting things off, forgetting stuff

Unmotivated, not working well

Can't get anything done

How are you sleeping?

Sleeping normally

Trouble sleeping

Restless, disturbed sleep

Sleeping too much or too little

What's your energy level?

Energetic

Low energy levels

Tired

No energy & feeling unwell

What's your activity level?

Keeping active

Not doing as much as usual

Not enjoying activities

Avoiding activities

How social are you?

Feeling connected

Withdrawal from social activity

Annoyed with everyone

Avoiding people, isolated

# What can you do?

Keep it up!

Ask for support, try not to judge yourself

See your GP

Seek help now

Talk to friends and family

Don't put it off, act now

Help is available

Do something you enjoy

Contact Community Health or your EAP

Lifeline 13 11 14  
NSW Mental Health Line  
1800 011 511  
Beyond Blue 1300 224 636

# Worried about someone?

Start a conversation with them in a comfortable place and talk about what you have noticed and why you are concerned.

You don't need to fix their problems: you're there to listen to their concerns and reassure them help is available.

It's important to follow up and maintain connection with the person. This may include continuing to check in and encouraging them to seek help, helping them to find appropriate services, or checking in with how they went in seeking help.

If you're providing help to someone, it's also important to acknowledge how you are feeling and to seek support if you need it.

## Tips for decision-making

We make hundreds of decisions each day. Sometimes, we have to make tough decisions under pressure, which can be stressful. There are things we can do to reduce stress and help us make decisions.

**Describe and prioritise:** Think about the decision and how important it is. Spend more time making the important decisions and less time on others. If you are feeling overwhelmed by a decision, try breaking it down into smaller parts. You might find it easier to make a series of small decisions.

**Know your timeframe:** Think about how much time you have to make the decision and what information you need. Remember, delaying or avoiding a decision is choosing not to act.

**Ask others for advice:** It can be helpful to talk about your options with family and friends or a professional. They may have a different perspective or information and knowledge to assist you.

**Consider your options:** Think about the options and the benefits and results of each.

**Take action and evaluate:** It's important to evaluate the decision implemented and to be flexible if things change. It can help to monitor the situation and to reassess as circumstances change. Don't be too hard on yourself, sometimes our original decision might not end up being the best outcome, but was the best at the time.

**Increase your capacity for decision making:** Managing stress and looking after our health can help us make better decisions. Getting enough sleep, having a healthy lifestyle, socialising and taking time out to do things you enjoy can help you think better.

If you're having trouble making decisions and find that it's affecting your day-to-day life, it might be time to talk to a mental health professional. They can help you with more strategies.

# let's talk decision making



We make hundreds of decisions each day. Sometimes, we have to make tough decisions under pressure, and the decision itself can cause stress. When this happens, there are things we can do to minimise stress and help us in the decision-making process.



## Tips for making a decision

**Describe and prioritise:** Think about the decision and how important it is. Aim to spend more time making the important decisions and less time on others. If you are feeling overwhelmed by a decision, try breaking it down into smaller parts. You might find it easier to make a series of small decisions.

**Know your timeframe:** Think about the amount of time you have to make the decision and what information you need. Remember, delaying or avoiding a decision is choosing not to act.

**Ask others for advice:** It can be helpful to talk about your options with family and friends or a professional. They may have a different perspective or have information and knowledge to assist you.

**Consider your options:** Think about the possible options and consider the benefits and results of each.

**Take action and evaluate:** It's important to evaluate the decision and to be flexible if things change. It can help to monitor the situation and to reassess down the track. Sometimes our original decision might not have been the most beneficial. Remember, the decision made was the best at the time with the information at hand.

**Increase your capacity for decision making:** Managing stress and looking after our health can help to clear the mind, in turn supporting decision making. Activities like getting enough sleep, having a healthy lifestyle, socialising and taking time out to do things you enjoy can help to think clearer.

If you are having trouble making decisions and find that it is affecting your day-to-day life, it might be time to talk to a mental health professional. They can help guide you through the process and give you some more strategies.

## Want help but don't know where to start?

Head to [www.ramhp.com.au](http://www.ramhp.com.au) and type in your postcode to find your local RAMHP Coordinator. They can provide you with local advice about mental health professionals and services in your area.

**If you or someone else is in immediate danger call 000  
or go to your nearest hospital emergency department.**



# Decision making tool

What is the decision I need to make?

How important is this decision?

MINOR



LIFE CHANGING

When do I need to make this decision by?

What information do I need to make this decision?

Who will I talk to about my decision?

Think about the possible options and consider the benefits and results of each.

Option A:

Benefits...

Results...

Option B:

Benefits...

Results...

Option C:

Benefits...

Results...

How did my decision go?



## Looking after your business

Effective planning enables businesses to better manage and bounce back from adverse events. You are not guaranteed financial or farm assistance when events occur. By planning ahead, you can help manage the financial impact, reduce loss and damage, and improve resilience so you can get back to business.

In this chapter:

- source advice on the right people to talk to at the right time.

# 4

Having a drought, fire or flood plan will help you in making well considered decisions. It will also help your business to rebound and rebuild. In preparing, managing and recovering from adverse events, it is important to have a plan, act early, review and then plan again, revising the plan as each step is implemented.

Farmers who have been through these conditions before have provided the following advice when planning:

- take the time to make plans and act quickly and decisively – it's never too early
- do simple budgets for various stock feeding, emergency transport, agistment and selling options
- prepare cash flow budgets for 2 to 3 years
- protect your important business plans, documents and information and ensure you can access them when you can't access the premises.
- review decisions regularly
- look for opportunities
- remain positive
- plan a holiday where possible – taking time for you and your family is important
- seek advice.

## Who should I talk to?

There is no 'right way' of getting ready for drought, fire or floods, and every event or disaster is different. There are people and organisations who can help you plan and talk to you confidentially about your options. They can help you action your plan as conditions dry and to recover sooner as things improve.

You can talk to your **financial planner and accountant** about:

- preparing and reviewing your farm business plan
- planning for your family's financial needs and goals over the short, medium and long term
- responding to future challenges and opportunities
- reviewing your taxation and business structure
- managing pricing, costs, products, risk and alternate income sources
- the future of your business, including exit strategies and succession planning
- financial skills training
- referrals to specialist business advisers for complex matters
- accessing government drought support and complying with relevant obligations.

You can talk to your **bank** about:

- your financial position
- funding activities and assets to help you withstand drought, fire or floods
- using a Farm Management Deposit account to smooth out cashflows and build up reserves
- deferring scheduled loan or credit card payments
- waiving fees and charges, including break costs on early access to term deposits
- consolidating debt to help make repayments more manageable
- restructuring your existing loans

- obtaining extra finance to help cover cash flow shortages
- increasing emergency credit card limits
- supported exit strategies and succession planning.

You can talk to **Local Land Services** or **your agronomist** about:

- reviewing your farm's exposure and vulnerability to drought, fire or floods
- applying what you learned during the last event
- testing and improving soil fertility, retaining moisture and managing or limiting erosion
- riverbank regeneration and planting advice
- using water more efficiently and catchment advice
- increasing on-farm storage options
- changing cropping practices
- changing grazing practices to protect pastures
- sustainable and innovative on-farm practices
- easing pest, weed and disease pressures.

You can talk to **Local Land Services** or **your livestock consultant** about:

- reviewing your farm's exposure and vulnerability to drought, fire or floods
- applying what you learned during the last event
- managing seasonal conditions
- assessing availability and quality of feed and water supplies
- improving herd/flock fertility or breeding condition
- using feeds more efficiently and livestock nutrition
- changing grazing or confinement feeding practices
- easing pest and disease pressures.

You can talk to your **farm legal specialist** about:

- business structuring, planning and risk management to prepare for drought, fire or floods
- taxation and farm financial transactions
- managing disputes with lenders or financial hardship related to your business
- representation in farm debt mediations as well as other debt negotiations.

Your **agriculture industry organisation/representatives** can help you with:

- information about how other farmers are preparing for drought, fire or floods
- available drought support and tools
- any problems accessing help
- ways to reduce your costs or protect your assets
- business literacy and skills development training
- mental health information and strategies.

You can talk to your local **Rural Research and Development Corporation** about how:

- to reduce adverse event impacts on your business
- to make your farm business more productive, profitable and sustainable.

Your **local community** and **charities** can help you:

- stay connected socially, through community groups and events
- learn from others in similar circumstances
- with tips and tools to cope with stress
- with financial assistance
- with low-cost counselling and/or other services.

Your **local government** may be able to:

- refer you to other resources and programs
- provide hardship assistance such as waiving penalties or offering instalment plans.

Invest time in a little soul searching, speaking to trusted friends and advisers. Ask yourself is farming still what you really want to do with your life or is it time to consider other options? This is possibly the most important decision for you and your family, so give it the energy it deserves. Farming is tough, both physically and psychologically, more so in drought and during fire and flood events. How are you really travelling health wise, physically and mentally?



Visit [www.droughthub.nsw.gov.au](http://www.droughthub.nsw.gov.au)<sup>1</sup> for resources to help you manage your business during drought events.



Visit [www.nsw.gov.au/emergency/floods](http://www.nsw.gov.au/emergency/floods)<sup>2</sup> for information and support in relation to floods.



Visit [www.nsw.gov.au/emergency/bushfire](http://www.nsw.gov.au/emergency/bushfire)<sup>3</sup> for information on government programs, services and resources to help bushfire-affected communities.



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# Support for farm businesses



## Farm Business Resilience Program (FBRP)

The FBRP provides support to farmers to help improve their farm business acumen and achieve their business goals. It offers business coaching, farm tours and workshops, and helps farm businesses develop a drought plan.

Designed for all enterprises large and small, it is ideal for farmers, farm managers, and their employees, who are looking to upskill and learn about risk management, how to adapt to a changing climate, and improve the economic, environmental, and social resilience of their business.

For more information, contact [farmbusiness@dpi.nsw.gov.au](mailto:farmbusiness@dpi.nsw.gov.au) or visit [www.droughthub.nsw.gov.au](http://www.droughthub.nsw.gov.au)

## Local Land Services (LLS)

Local Land Services is the NSW Government's 'boots on the ground' agency that works with land managers and the community to improve primary production within healthy landscapes. They provide in the paddock, face-to-face assistance to land managers in a range of areas including agricultural production, animal health, pest and weed management, biosecurity and environmental threats. Call 1300 795 299 or visit [www.lls.nsw.gov.au](http://www.lls.nsw.gov.au)



## Rural Financial Counselling Service (RFCS)

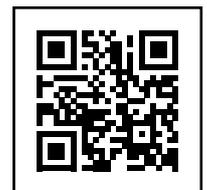
The RFCS provides free, confidential and impartial rural financial counselling to eligible primary producers, fishers and small rural businesses who are experiencing, or at risk of financial hardship.

A rural financial counsellor can help you:

- understand your financial position
- understand the benefits and drawbacks of different options to manage financial issues
- develop budgets and cash flows
- negotiate with creditors
- access dispute resolution services
- understand your rights and access broader professional advice and support
- access government and community grants, programs or schemes.

Visit [www.rfcsnsw.com.au](http://www.rfcsnsw.com.au)<sup>2</sup> to find your nearest rural financial counsellor, or call based on your region:

- Northern region 1800 344 090
- Southern region 1800 319 458
- Central region 1800 319 458



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## The Rural Assistance Authority (RAA)

The RAA administers a range of assistance schemes including:

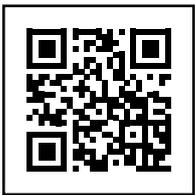
- low interest loans – funding by a loan to meet the costs of carrying out permanent capital works that will have significant beneficial impact on the land, long-term profitability of the business and address adverse seasonal conditions.
- natural disaster assistance programs for primary producers
- farm debt mediation.

For details of current RAA programs or more information, phone 1800 678 593 or visit [www.raa.nsw.gov.au](http://www.raa.nsw.gov.au)<sup>1</sup>

## Office of the NSW Small Business Commissioner

Business Connect is an advisory program for small businesses in NSW, including agribusinesses.

Phone 1300 134 359 to make an appointment with your nearest advisor. Or visit [business-connect-register.industry.nsw.gov.au](http://business-connect-register.industry.nsw.gov.au)<sup>2</sup> to find an advisor.



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Australian Government

## Commonwealth

### Regional Investment Corporation (RIC)

The Australian Government offers a number of concessional loan products to eligible farm and farm-related businesses.

For information about the loans and eligibility requirements phone the RIC on 1800 875 675 or visit [www.ric.gov.au](http://www.ric.gov.au)<sup>3</sup>.

If you have an existing Commonwealth concessional loan, the Rural Assistance Authority (RAA) will continue to administer this loan. Phone 1800 678 593 if you have any questions about your existing loan.

## Farm Household Allowance (FHA)

The Australian Government provides assistance to farmers and their families experiencing financial hardship. Qualification is based on multiple measures, including an income and an asset test. When both members of the couple are paid, FHA can provide more than \$30,000 into the household over the course of a year. Up to \$100,000 current loss of the farm can be offset against any other income. Each person also has access to \$10,000 to spend on professional advice and training.

More information: Farmer assistance line on 132 316 or visit [www.servicesaustralia.gov.au/farm-household-allowance](http://www.servicesaustralia.gov.au/farm-household-allowance)<sup>1</sup>

## Farm Management Deposit Scheme

Farm Management Deposits (FMD) can help eligible primary producers set aside income in good years that they can draw on when they need it.

Income deposited into an FMD account is tax deductible in the financial year the deposit is made. It becomes taxable income in the financial year in which it is withdrawn.

FMD are useful for:

- smoothing fluctuating income
- offering possible tax benefits
- maximising profits
- strengthening financial sustainability
- restocking or replanting when conditions improve
- building up cash reserves.

For more information, visit [www.ato.gov.au/business/primary-producers/managing-varying-income/farm-management-deposits-scheme/](http://www.ato.gov.au/business/primary-producers/managing-varying-income/farm-management-deposits-scheme/)<sup>2</sup> or contact the ATO on 13 28 66.

## Australian Government Disaster Support

Help is available for people directly affected by a natural disaster in NSW, such as fires, storms or floods. You may be eligible for Australian Government disaster support – visit Services Australia's website for more information:

[www.servicesaustralia.gov.au/new-south-wales-natural-disaster-support](http://www.servicesaustralia.gov.au/new-south-wales-natural-disaster-support)<sup>3</sup>



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# Australian Taxation Office (ATO)

## Primary producer concessions

Primary producers generally run a business of plant or animal cultivation, fishing or pearling, or tree farming or felling. Primary producers are provided with special tax concessions including:

- tax averaging to even out income and tax payable over a maximum of five years to allow for fluctuations in prices and production.
- spreading or deferring profits from the forced disposal or death of livestock
- accelerated depreciation for fencing, dams, pumps, silos, bins, landcare operations and carbon sink forests.

For more information on these and other primary producer concessions, talk to your accountant or visit the ATO at [www.ato.gov.au/Business/Primary-producers](http://www.ato.gov.au/Business/Primary-producers)<sup>1</sup>

The ATO also has a range of options for farmers experiencing financial hardship such as deferred payment plans.

For more information, visit [www.ato.gov.au/general/support-in-difficult-times](http://www.ato.gov.au/general/support-in-difficult-times)<sup>2</sup> or call 1800 806 218.

## Tax treatment of forced livestock sales due to pasture and fodder loss

### The five years following a forced livestock sale

If you are obliged to sell livestock because of the destruction of pastures or fodder through drought, flood or fire, you can elect to spread over five years the profit on the livestock sale. This means that one-fifth of the profit would be included in your gross income for the year of the sale of the livestock, and one-fifth would be included in the gross income for each of the following four years. To take advantage of this concession, you are required to declare that the sale was genuinely occasioned by the loss or destruction of pastures or fodder because of drought, flood or fire. You must also demonstrate that the main part of the proceeds of the sale will be used to purchase replacement livestock or will be used in the maintenance of breeding stock for the purpose of restocking.

You may elect to have the profit on a forced livestock sale excluded from your assessable income for the year in which it was derived, and applied to reduce the cost of stock acquired during that year (or any of the five years after the sale) to replace the stock disposed of. Where replacement stock are bred instead of purchased, you may elect to include in your assessable income, over the same period, appropriate instalments of the profit on the forced sale (as described above).

If, at the end of the fifth year from the year in which the forced sale occurred, any part of the profit on the disposal has not been applied in reducing the cost of new stock purchased, or has not otherwise been included in assessable income, the amount that has not been applied will be included in your assessable income for that fifth year.

Where you are eligible to elect to spread your income, you may become ineligible if you:

- become bankrupt, insolvent or die
- permanently depart Australia
- cease to carry on the primary production business to which the election relates.



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# Industry

## Dairy Australia

Dairy Australia has resources, tools and activities to help dairy farmers during adverse events. For more information, contact Dairy Australia on 1800 270 778 or visit:

- Dairy NSW: [www.dairyaustralia.com.au/dairynsw](http://www.dairyaustralia.com.au/dairynsw)<sup>1</sup>
- Murray Dairy: [www.murraydairy.com.au](http://www.murraydairy.com.au)<sup>2</sup>
- Sub-tropical: [www.dairyaustralia.com.au/about-dairy-australia/dairy-regionsubtropical](http://www.dairyaustralia.com.au/about-dairy-australia/dairy-regionsubtropical)<sup>3</sup>

## Australian Pork Limited (APL)

APL is a producer-owned organisation supporting the Australian pork industry. For more information, contact APL on 1800 789 099 or visit [www.australianpork.com.au](http://www.australianpork.com.au)<sup>4</sup>

## Meat and Livestock Australia (MLA)

MLA fosters the long-term prosperity of the Australian red meat and livestock industry. MLA is a service provider to the red meat industry, not an industry representative body or lobby group.

Support information is available from MLA's Dealing with natural disasters page at [www.mla.com.au/research-and-development/dealing-with-natural-disasters](http://www.mla.com.au/research-and-development/dealing-with-natural-disasters)<sup>5</sup>

## NSW Farmers

NSW Farmers is a membership organisation representing farmers across NSW. NSW Farmers speaks up on key issues that affect farming businesses including biosecurity, the environment, water and animal welfare. As well as advocating for farmers on issues that shape agriculture and regional areas, they provide direct business support and advice to their members.

For information phone 02 9478 1000 or visit [www.nswfarmers.org.au](http://www.nswfarmers.org.au)<sup>6</sup>

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# Animal welfare and management

All producers in NSW should plan for seasonal fluctuations and times when feed and water will run short. Ensure that plans consider adjusting stocking rates and/or supplementary feeding of livestock.

In this chapter, learn about:

- what's required of you to maintain the welfare of your livestock
- preventing livestock health problems
- livestock illnesses during extreme events
- welfare scoring and transport of stock
- animal management strategies
- humane euthanasia.



# Animal welfare

The welfare of animals is always important. While livestock in good health will be more productive and valuable through tough times, you also have a legal and moral obligation to make good decisions to protect the welfare of your stock during drought, flood and fire. Sometimes you may need to make tough decisions. Early intervention will ensure the best possible animal welfare outcomes. If you have drought, fire or flood-affected stock, you must make humane and reasonable decisions.

## Act early

- You must act early while stock are still fit and strong. Think about the right time to destock, agist or move stock. When times are tough, remember: “feed well or sell, and sell when well”.
- If you are considering destocking, everyone involved in the movement of stock, from assembling livestock to handling them at their final destination, must adhere to the Prevention of Cruelty to Animals (Land Transport of Livestock) Standards No 2.
- For more information on whether animals are fit for transport, download MLA’s [Is the animal fit to load guide](#)<sup>1</sup>
- NSW DPI’s manual [Welfare scoring nutritionally deprived beef cattle, dairy cattle and their crosses, sheep and horses](#)<sup>2</sup> is a helpful guide to assessing animal welfare.
- Another very helpful guide is the [Glovebox guide: biosecurity, Emergency Animal Diseases and preparing livestock for transport](#)<sup>3</sup>. Hard copies are available from your LLS office.



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## Relieve animal suffering

If stock are suffering, you must immediately feed appropriately, or, if they are still able to be transported, send them to agistment or directly to a processor. If they are not fit for transport, and you are unable to feed them, you must ensure they are humanely destroyed. It is not an option to “just let nature take its course”.



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# NSW welfare regulation

In NSW, animal welfare is governed by the *Prevention of Cruelty to Animals Act 1979* (the Act) and associated regulations.

The Act states that:

*'A person in charge of an animal shall not fail to provide the animal with food, drink or shelter, or any of them, which, in each case, is proper and sufficient and which it is reasonably practicable in the circumstances for the person to provide.'*

The health and welfare of your livestock and other farm animals is your responsibility. If you make decisions early, you will help ensure good animal welfare and compliance with the Act. The enforcement agencies of the Act include RSPCA NSW, NSW Police and Animal Welfare League NSW. Penalties can apply if you do not provide for the welfare of your animals.

If there are ongoing animal welfare concerns, the Act allows an enforcement agency to request the formation of a Stock Welfare Panel. Stock Welfare Panels work with stock owners to improve animal welfare outcomes. Following advice from the Panel, NSW DPI may issue written instructions (an official warning notice) for the care of animals, which must be completed within a set timeframe. The Panel monitors, assesses and reports on compliance. If the owner or person in charge of the stock does not comply, NSW DPI may issue an order to seize and dispose of the stock by way of sale or otherwise.

NSW Codes of Practice and Standards & Guidelines relevant to livestock management are prescribed under the Act. Some of these are mandatory (i.e. failing to comply is an offence) and some are voluntary, but compliance may be used as evidence in a court of law.

Mandatory:

- [Prevention of Cruelty to Animals \(Land Transport of Livestock\) Standards 2013<sup>1</sup>](#)
- NSW Code of Practice - [Commercial Pig Production<sup>2</sup>](#)

Voluntary/evidentiary:

- [Australian Animal Welfare Standards and Guidelines for Sheep<sup>3</sup>](#)
- [Australian Animal Welfare Standards and Guidelines for Cattle<sup>4</sup>](#)
- [Welfare scoring nutritionally deprived beef cattle, dairy cattle and their crosses, sheep and horses<sup>5</sup>](#)
- [Model Code of Practice for the Welfare of Animals: Animals at Saleyards<sup>6</sup>](#)

More information on animal welfare can be found at [www.dpi.nsw.gov.au/animalwelfare<sup>7</sup>](http://www.dpi.nsw.gov.au/animalwelfare)

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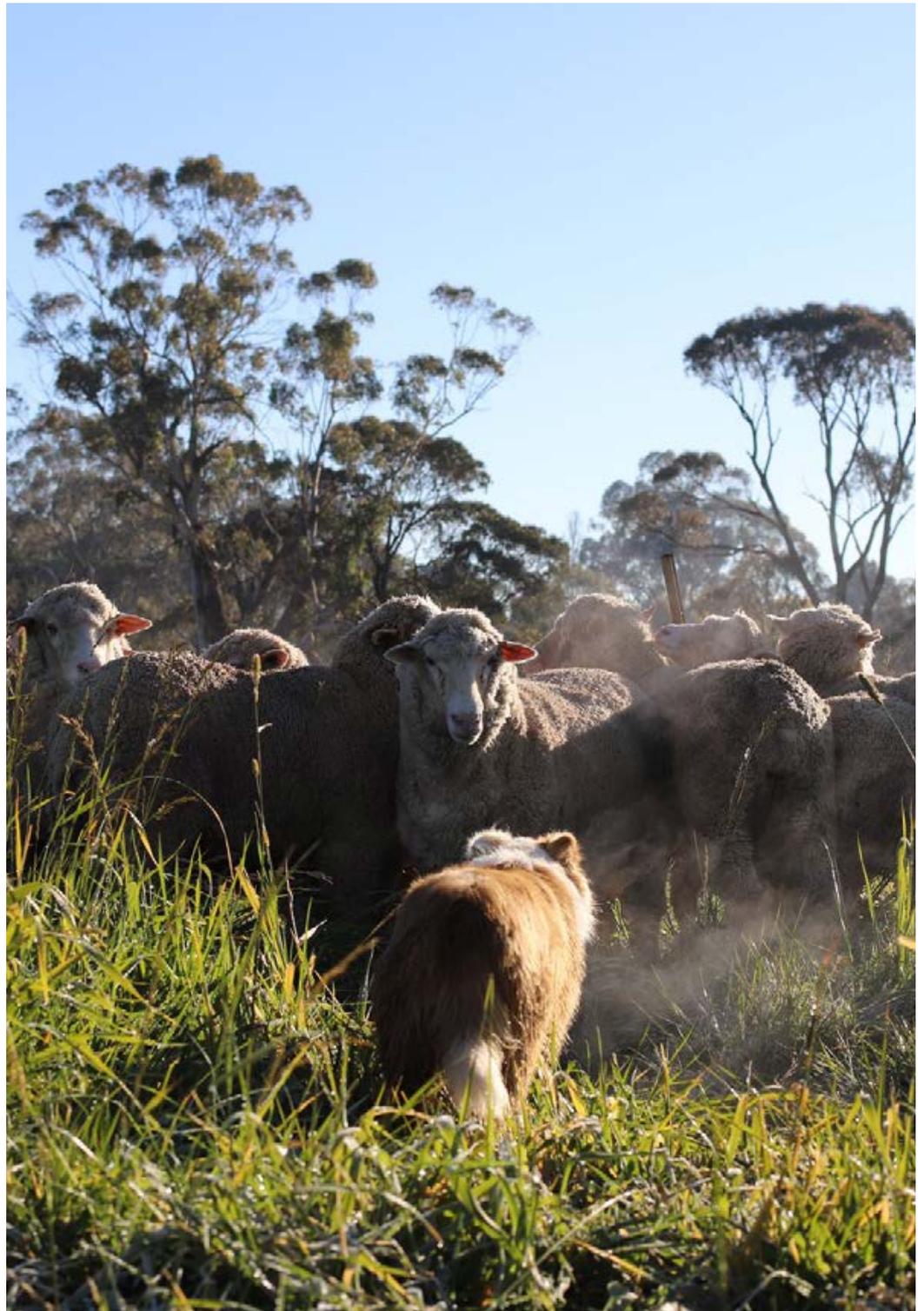
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## Managing biosecurity risks in feed and fodder

Buying in hay and grain for drought feeding exposes your farm and the community to biosecurity risks. It is important to restrict where stock are fed. Choose paddocks that are easy to quarantine and manage if unwanted pests, disease or weeds are introduced. Always find out where your feed and fodder has come from and what it is made up of/where it was grown so that you can manage any potential biosecurity risks.

Check feed and fodder is allowed into NSW. Some fodder movements are restricted to protect the biosecurity of our land, water, food and fibre production. Check whether the fodder you are receiving is legal and whether certification is needed by visiting [www.dpi.nsw.gov.au/biosecurity/feed-and-fodder](http://www.dpi.nsw.gov.au/biosecurity/feed-and-fodder)<sup>1</sup>.



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# Preventing animal health problems

It is important to have a plan to reduce the risk of animal health problems and to act early. If you don't have enough feed to feed all animals appropriately, you should sell some stock. This may enable you to afford to provide proper and sufficient feed to keep the rest of your stock healthy, saleable, and depending on their class, fertile.

**Remember:**  
**“feed well or sell, and sell when well”**



It is a mistake to keep too many stock and 'half feed' them. This will result in welfare compromised stock, and losses through reduced fertility, malnutrition (vitamin and mineral deficiencies etc.), metabolic disturbances (especially in pregnant stock), and eventually starvation. You have options when you have healthy animals in reasonable condition.

## Preventative herd health programs

Food and water of adequate quality and quantity are the most important ingredients in keeping an animal healthy.

However, other factors will affect an animal's susceptibility to disease during tough times including:

- condition of different classes of stock when drought sets in
- stage of pregnancy or lactation
- presence of any disease
- immunity levels to common diseases either through vaccination or previous exposure
- internal parasite burdens (e.g. worms, fluke) and external parasite burdens (e.g. lice, buffalo flies, blowflies)
- increased spreading of viruses and bacteria at crowd feeding and watering points
- increased exposure to various diseases from other species crowded at diminishing water sources
- higher stress levels from unaccustomed close interaction and confinement with other cattle and/or humans
- digestive upsets from new feeds such as grain and pelleted feed, which can predispose stock to diseases such as pulpy kidney
- ingesting poisonous plants or too much indigestible roughage or grain.

# Beef cattle health

Herd health programs that are recommended in good times are essential during tough times including:

- 5-in-1 vaccination to prevent clostridial diseases, which are far more likely to occur when there are sudden changes in feed type, quality or quantity
- leptospirosis vaccination (or 7-in-1 instead of 5-in-1)
- lice treatment in cooler months
- drench for internal parasites (including fluke in fluke areas), especially young stock (if retained) and bulls.

For more information, consult your Local Land Services District veterinarian or your private veterinarian.

## Water management

You should consider how much water you have and its quality before you hand feed cattle. Is the water supply good enough to assemble large numbers of cattle in one place? Will it be easier to feed near the best water supply or improve the water supply at the most convenient feeding location? If water is running out, it may be better to sell all, or at least some, stock.

For more information, refer to the [Feeding livestock chapter](#).

## Feeding stock

When there is not enough pasture, cattle should be confined and fed. Confined cattle need significantly less energy for maintenance than those that are left in the paddock to wander in search of feed. Pasture should be left in a condition where it can recover quickly when the drought breaks.

Note: Any change in feed (especially grain) should be introduced gradually. Failure to do this is one of the major causes of illness and death in livestock during tough times.

For more information, refer to the [Feeding livestock chapter](#).

## Recognising sick cattle

When cattle are being hand fed daily, you should take the time to observe normal behaviour so that it will be easier to recognise when there is a problem.

It is a good idea to take note of:

### Normal parameters:

- respiratory rate in resting cattle in cold and hot weather
- how much faster they breathe when they are put up the race
- how obvious or slight the normal respiratory movements are
- how much mucus the average animal has in its nostrils
- normal behaviour, head position, whether ears droop etc.

## Abnormal signs include:

- animals that stand apart, especially if depressed, ears drooped
- animals that do not eat
- fullness in flanks – bloat
- reluctance to move or get up when others do
- swelling of the legs, lame animals, or those standing oddly, for example leaning back, or shifting weight from one foot to another
- animals that seem restless or irritable, swishing the tail or kicking at the belly
- excess salivation, shivering, panting.

The normal temperature for adult cattle is around 38°C. If you suspect that an animal is ill, take its temperature and call a veterinarian if the temperature is abnormally high or low.

Look at the consistency of the dung, particularly while introducing grain to the ration. Pale pasty dung or diarrhoea may indicate feed problems or gut infections.

It is also important to detect any animals that are being bullied or not eating the ration. You may need to remove these cattle and feed them separately.

## Feed-related illnesses

### Malnutrition and starvation

Malnutrition due to lack of energy and/or protein is the most common disease during drought unless you take active steps to prevent it. Animals under your control are your responsibility. It is an offence under the Prevention of Cruelty to Animals Act 1979 to fail to provide proper and sufficient feed and water. If you cannot afford to feed or agist animals, they should be sold or humanely destroyed.

Stock should not be allowed to fall below condition score 2. Remember: “feed well or sell, and sell when well”. Refer to information on [transporting nutritionally deprived livestock](#)<sup>1</sup>.

### Metabolic disease

**Cause:** Metabolic disease occurs when energy intake does not keep pace with energy demand. Even fat cows can die if they lose weight too rapidly. Pregnancy toxaemia can develop when the increasing energy demands of pregnancy are far greater than energy intake. This is more likely to occur in fat females than thin ones, especially (but not only) in those carrying twins. Because twins are far more common in sheep, most sheep producers will be aware of this condition, but it can also occur in cows when feed is inadequate.

Pregnancy toxaemia is a form of ketosis, in which the breakdown products of fat, called ketone bodies, build up in the brain and become toxic.

**Symptoms:** Toxaemic animals may have an altered temperament. Some may show signs of aggression. They do not respond normally to handling or herding. They may seem more stubborn or “stupid”, and can be very difficult to muster. If not treated quickly, these animals will start to refuse feed, go down and die.



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**Treatment:** Cows with pregnancy toxæmia or ketosis can be drenched with glucose or commercial preparations containing propylene glycol such as Ketol® or Ceton®. Even with veterinary intervention, this process is difficult to reverse, and often the animal dies or must be euthanised.

**Control and prevention:** Separate pregnant and lactating animals and feed them more. All animals should have access to adequate roughage, especially in cold weather and if lactating. Roughage generates more heat internally and improves milk quality and production.

## Mineral deficiencies and imbalances

Mineral deficiencies may occur if a balanced ration is not fed.

### Hypocalcaemia

**Cause:** Hypocalcaemia is a *metabolic disease* caused by a low blood calcium level. The most common mistake is to feed cottonseed or grain, which are high in phosphorus, without adding calcium (garden lime). The calcium to phosphorus ratio should be about 2:1. Lime at a rate of 1 to 2% must be added to all grain supplements, including cottonseed. If the ration is not balanced, pregnant cows may go down, primarily due to low calcium in their blood.

**Treatment:** An animal that seemed fine one day may be found down the next, unable to rise. If these animals are suffering only from a calcium phosphorus imbalance, they will often get up immediately if calcium is given subcutaneously, or directly into the vein. Intravenous administration should only be done by a veterinarian as too much calcium too rapidly will cause death. If they are also in negative energy balance – that is, losing weight, then treatment is less likely to be successful, as the cow is likely to have other metabolic problems.

Calcium is also involved in muscle contraction, so low blood calcium may also contribute to the increased incidence of vaginal prolapses.

### Hypomagnesaemia

**Cause: Hypomagnesaemia** (low blood magnesium) is more common in cold conditions, when lush growth occurs in spring. It can also occur in the ‘green drought’ stage of a drought, after rain showers have resulted in the growth of short green pick, if this is the main source of feed. New growth is very high in potassium, which competes with other minerals like calcium and magnesium for absorption in the gut and hypomagnesaemia can occur.

**Symptoms:** This condition causes cattle to develop twitches or muscle tremors. They may become more excitable and aggressive, and usually die quite quickly from convulsions.

**Treatment:** Cattle on short green pick should be supplemented with hay. Causmag® at about 60 g/cow/day can be mixed into a slurry and poured over the hay to help prevent further problems.

**Control and prevention:** If possible, cattle should be confined, and hand fed until pasture is adequate to sustain them. They frequently burn more energy than they can consume if allowed to wander in search of short green pick.

## Reduced fertility

To maintain cow fertility, wean calves that are more than 8 weeks old and feed them separately. Supplementary feeding of cows to produce adequate milk for feeding calves is not an efficient use of feed. If cows are dried off and fed, it is easier to keep them in good condition to become pregnant next season. It makes no sense to feed a cow if she then fails to conceive at the next joining.

If feed supplies are limited, allow well-conditioned mature cows to lose some weight prior to joining, but feed them over the joining period so that they gain weight. Heifers must reach a critical mating weight of around 280 kg prior to joining and continue to gain weight over the joining period.

A bull's fertility and its ability to work will be affected if it is allowed to slip into poor condition. Semen quality is determined around 2 months before use, so it is essential that bulls are in good condition well before the start of mating.

## Acidosis (grain poisoning)

**Cause:** Eating too much 'concentrate' (grain or pellets) too quickly can result in an excessive build-up of lactic acid in the rumen. Even though this is commonly referred to as grain poisoning, as pellets are usually 90% grain, it can also cause acidosis. Any factor that causes variation in intake (e.g. inclement weather, or palatability of feed) or changes in the availability of the carbohydrate (e.g. a change in grain type, or how finely the grain is ground) may cause digestive upsets at any time, not just in the period of grain introduction. Be aware of hammer or roller mill changes. Be on the lookout for dominant stock that may push others out of the way and consume far more than their ration.

**Symptoms:** Affected animals show obvious signs of discomfort and are usually disinclined to move. They may kick at their belly or grind their teeth. Bloating is sometimes apparent, and scouring (light coloured, smelly faeces) is usual. Acute cases show staggering and appear blind and 'drunk'. Death can occur 12 to 72 hours after the onset of symptoms.

**Treatment:** If treated early, mild cases often respond to an oral drench of sodium bicarbonate (often found in the pantry as bi-carb soda or baking soda): 125 g in ~400 mls of water, given 2 to 3 times daily until symptoms resolve. Do not overdose as causing the rumen contents to become alkaline can lead to problems too. Remove access to concentrate, provide hay, and contact your veterinarian for treatment advice.

**Control and prevention:** If trailing out, make sure delivery of the concentrate is in an even line rather than a large amount in a pile. The ration must be consistent from day to day, particularly if there is no access to other feed. Introduce a change of feed slowly. 'Shandy' the old batch of grain with the new, even when the 2 batches of grain are the same type. Manufacturers sometimes change the type of grain used in pellets, so some of the old batch should be mixed with the new batch, gradually increasing the proportion of the new feed, to reduce the chance of upsets. Additives such as sodium bentonite and virginiamycin (Eskalin®) can also be used to reduce the risk.

## Bloat

**Cause:** Bloat occurs when gas accumulates in the rumen and is unable to escape. Legume roughages and very fine particles of shattered grain predispose cattle to gas formation.

**Symptoms:** Cattle with bloat may display the following signs:

- distended left abdomen
- no longer grazing
- a reluctance to move
- appear distressed – vocalise, eyes bulging
- strain to urinate and defecate
- rapid breathing – mouth may be open with tongue protruding
- staggering.

**Treatment:** Drench the affected animals with at least half a cup of oil (peanut, paraffin or linseed) or use proprietary formulations of bloat oil as per the instructions provided. Call a veterinarian for severe cases – the animal may need to have a stomach tube passed or ‘tapping’ of the left flank with a trocar and cannula.

**Control and prevention:** Chronic, persistent cases may require an anti-bloat agent to be mixed in with the feed. Access to fibrous, stinky lower-quality roughage will help to reduce bloat. Reduce the amount of legume roughage if bloat is a problem. Wetting the grain before processing can also help.

## Clostridial diseases

**Cause:** Spores of clostridial bacteria (such as those that cause pulpy kidney, blackleg and tetanus) are present in soil, and are ingested or can contaminate wounds when dust is stirred up, or when animals ingest soil when grazing close to the ground. Disease is most common in young animals in good condition.

**Symptoms:** Pulpy kidney usually occurs following an intestinal upset either at the sudden introduction of feed changes, usually grain, or when the drought breaks and animals are turned onto lush green pick.

**Treatment and prevention:** All stock should be fully vaccinated with 5-in-1 vaccine to prevent all clostridial diseases.

## Laminitis (Founder)

**Cause:** Laminitis is caused by incorrect ration formulations – too much grain, or too low a protein level can contribute.

**Symptoms:** Laminitis is characterised by lameness, often in all 4 feet. Digestive upsets result in the release of toxins that affect the circulation, especially in the feet, and there is heat and pain in the coronary band of the hoof. The animal may lean back to take the weight off the front feet, so that feet are forward of vertical. If the animal is forced to move, its gait will be shuffling and stumbling.

**Treatment:** Mild cases often recover without treatment if the ration is corrected. More severe cases require urgent veterinary attention. The condition may become chronic in animals that adapt poorly to grain, and you may need to sell these animals or feed them a much higher proportion of roughage.

## Urea poisoning

**Cause:** It is possible for excess urea to be consumed when there is inadequate mixing of feed or roller drum mixes, allowing pockets to accumulate, or when rain forms pools of water with a high nitrogen content in troughs or around blocks. Blocks left out in the rain may also soften sufficiently so that they can be eaten in chunks rather than licked.

**Symptoms:** Severe abdominal pain, shivering, bloat and salivation may be seen 20 to 30 minutes after feeding the ration, or after rain if blocks have been left out in the weather.

**Treatment:** If poisoning is detected early, drench immediately with 4 L of vinegar to reduce absorption of urea. Call a vet urgently, as surgery may be necessary to empty the rumen. Further treatment could be drenching with 0.5 L water: 0.5 L vinegar:1 kg sugar/molasses if poisoning is not severe. Treatment is often not successful if the condition is too advanced when an animal is found. These animals should be humanely destroyed.

**Control and prevention:** A maximum of 1% urea in the ration is recommended.

## Urinary calculi (bladder stones)

**Cause:** Bladder stones are usually only a problem in steers when stones block the urethra and prevent urination. Factors that predispose stock to stone formation include the high phosphorus levels in grain, too much sodium bicarbonate in the diet (used to help prevent acidosis), and reduced water intake due to poor water quality. Vitamin A deficiency is also a cause of bladder stones in cattle that have been on dry feed for prolonged periods.

**Symptoms:** Signs of bladder stones are usually only apparent when the urethra is blocked. Watch cattle for straining, dribbling of blood-stained urine, kicking at the belly or twitching of the penis. If the bladder ruptures, there is temporary relief, then depression, loss of appetite, peritonitis and death. Another possibility is that the urethra may rupture at the bend near the scrotum (sigmoid flexure), in which case the underline will fill up with fluid ('water belly').

**Treatment:** Usually, emergency slaughter is the only option. If the bladder has ruptured, the animal will be condemned.

**Control and prevention:** The addition of about 1% limestone to the diet will balance the excessive phosphorus levels present in high-grain diets.

## Vitamin A deficiency

**Cause:** Vitamin A deficiency usually occurs after animals have been without green feed for more than 6 months. In a drought situation, deficiency is unlikely in animals still in the paddock with access to green pick from occasional rain showers, or if trees such as Kurrajong are being lopped to feed them. Sheep are less likely to develop a deficiency because they can graze green pick much closer to the ground.

However, vitamin A deficiency may occur in young cattle being lot fed, especially if they were born into drought and have eaten very little green feed. Deficiency may affect growth rates of young stock prior to other signs becoming apparent.

**Symptoms:** Vitamin A deficiency may also cause lameness, swelling of the hind legs (especially hocks), increased respiratory rate, panting, drooling, and elevated rectal temperatures. Vision may be impaired, especially in low light ('night blindness'). To check for this, walk through your cattle at dusk and try to sneak up on some.

**Treatment:** Affected cattle should be injected with Vitamin A. Treatment should be administered in consultation with your veterinarian.

**Control and prevention:** Vitamin A deficiency mostly occurs in hot weather and affected animals are more susceptible to heat stress. Vitamin A deficient cows can have abnormal calves, so it is a good idea to supplement cows if you have decided to re-breed stock. To prevent vitamin A deficiency, give vitamin ADE injections or add green chop to the feed if stock have had 2 to 3 months with no access to green feed.

## Plant poisoning

**Cause:** Hungry animals will look for any green pick and may eat plants including shrubs and trees that they would normally avoid. Poisonings are common when stock are sent on agistment and consume plants they are not familiar with, or when stock are weaned early and placed into a paddock with plants they are not familiar with. Short regrowth of many plants normally eaten (e.g. sorghum and oats) may contain levels of nitrate or cyanide that are toxic to hungry animals.

**Symptoms:** Symptoms vary depending on the toxin involved. Nitrate and cyanide (prussic acid) poisoning cause acute respiratory distress and sudden death. Other poisons may cause nervous signs, staggering gait, or diarrhoea. Mouldy feed can cause digestive upsets and precipitate abortions.

**Treatment:** Call your vet to all suspected poisonings. If you suspect nitrate or cyanide poisoning, do not attempt to move animals that are in severe respiratory distress.

**Control and prevention:** Check any proposed agistment paddock for any unusual plants, especially if the plants are still green. It is a good idea to fill animals up on hay before releasing them into a paddock of regrowth.

## Other diseases

If animals are confined in yards or small paddocks, any disease-causing organisms or parasites that are often present in low numbers without causing problems will become more concentrated. There is an increased risk of spread of disease or parasitism.

The use of feed troughs will minimise this contamination. If troughs are not used, feeding points should be changed at frequent intervals, where possible.

## Diarrhoea

**Cause:** These diseases are more common in calves, but can also occur in older animals, especially if they are stressed and in poor condition.

**Symptoms:** Symptoms of these diseases vary:

- Salmonellosis causes a high fever and depression. It may also cause 'joint ill', and therefore lameness, in young calves. There is usually, but not always, bloody diarrhoea.
- Coccidiosis can also cause bloody diarrhoea and animals can become weak and uncoordinated.
- With *E. coli* scours, the diarrhoea is pale, profuse and watery, and death is usually due to dehydration.

**Treatment:** Correcting the ration formulation will cure many cases of mild diarrhoea. If the problem is more severe, the likely causes are bacterial infections including infections by coccidia, salmonella, *E. coli*. Call your vet if you suspect any of these diseases. Fluid replacement is the most crucial treatment for salmonellosis and

*E. coli* infection, although antibiotics are often given at the same time. Coccidiosis is usually treated with sulfonamides.

The ionophore group of growth promotants (eg Bovatec®) help control coccidiosis. Since their widespread use in feedlots, coccidiosis is much less common.

## Bovine respiratory disease

**Cause:** A range of bacteria and viruses can contribute to respiratory disease. Problems are more likely to arise in animals from cumulative stress factors such as saleyards, transport, mixing with unfamiliar animals and poor animal handling. Dry dusty conditions are also predisposing factors.

**Symptoms:** Depending on the severity of the illness, animals may be off their feed, or have nasal discharge, fever, depression, coughing and laboured breathing.

**Treatment:** Call your vet if there are any signs of respiratory disease. Viruses do not respond to antibiotics, but viral infections are often followed by secondary bacterial infections, so it is usual to treat with broad-spectrum antibiotics such as tetracyclines.

**Control and prevention:** Vaccinations are available to help prevent infection.

## Pinkeye (infectious keratoconjunctivitis)

**Cause:** The bacterium responsible for pinkeye, *Moraxella bovis*, is spread by dust and flies so it can be a major problem when animals are confined. Any eye damage, for example from grazing among thistles, will predispose an animal to infection.

**Symptoms:** The first sign is tears running down the face, followed by the classic inflamed pink eye. In severe cases, an abscess forms in the centre of the cornea, which may burst leading to the loss of the eyeball.

**Treatment:** Antibiotics are the preferred treatment. Patches glued over the eye will speed recovery and will also prevent flies spreading the disease more widely. However, if animals are not severely affected, it may be better not to treat them. Stressing the group by putting animals through a race to treat them, and stirring up dust that might possibly spread the condition, may worsen the situation.

**Control and prevention:** A preventative vaccine is available, which must be given before high-risk periods.

# Parasites in drought

## Worms and fluke

**Cause:** Worm infestations are more likely to cause problems in young cattle and recently calved cows. Adult cattle are normally fairly resistant to the effects of worm infestation, but stress can increase susceptibility in animals that are in poor condition. Usually, mixed infestations occur, but the small brown stomach worm (*Ostertagia ostertagi*) can cause severe disease. Bulls can be susceptible to ostertagia infection.

Fluke can be more of a problem in dry times. Stock that congregate in damp areas that supply the last of the green pick are exposed to the snail that is the intermediate host for fluke.

Crowding around feeding sites will increase contamination, but while the weather remains dry and vegetation is lacking, egg survival is likely to be poor. Parasitism is less likely if animals are confined to yards with troughs. Worms may be more of a problem when the drought breaks, or when cattle are sent away on agistment to areas that have had good rain.

**Symptoms:** Signs of worms and/or fluke include scouring, loss of appetite, anaemia and ill-thrift, with submandibular oedema ('bottle jaw') in more severe cases.

**Treatment:** Try to identify the parasites if possible. In fluke areas, faecal tests will differentiate between fluke and worm infestations. A fluke drench must be used in the case of fluke. If worms are the cause, it is important to use a drench that is effective against the dormant larval stages of ostertagia.

## Lice

**Cause:** Cattle seem to be more susceptible to a build-up of lice if they are in poor condition, especially in cold weather.

**Symptoms:** Cattle infected with lice will often scratch on sharp objects, and this can cause wounds that will make animals more susceptible to infection by clostridial bacteria. Cattle can damage equipment, especially feed and water troughs, making repairs necessary when you have more important things to do.

**Treatment:** Consider treating hand-fed cattle for lice before it becomes a problem, especially if winter is approaching. All animals should be treated at the same time. If the preparation used does not have a sustained action, and does not kill eggs, re-treatment is necessary after about 14 days. This time interval is crucial, as it kills lice at the immature nymph stage before they can lay eggs and continue the cycle.

More information is available at: [www.dpi.nsw.gov.au/animals-and-livestock](http://www.dpi.nsw.gov.au/animals-and-livestock)<sup>1</sup>

## Managing the risk of Bovine Johne's disease (BJD)

**Cause:** Johne's disease in cattle is a chronic and contagious bacterial disease.

**Symptoms:** Signs of Johne's disease include persistent diarrhoea, progressive weight loss and emaciation/wasting and ultimately death.

**Treatment:** There is no treatment for BJD. The disease is usually spread by movement of infected cattle. Increased stock movements from property to property during droughts can increase the risk.

**Control and prevention:** Previous legislative controls on cattle movements were abolished in July 2016. A new industry framework recognises the role producers have in the management of diseases on their property. The on-farm risk-based approach to biosecurity allows producers to choose management decisions that meet their own productivity and profitability goals.

More information is available at [www.dpi.nsw.gov.au/bjd](http://www.dpi.nsw.gov.au/bjd)<sup>2</sup>.



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# Sheep health

There are a number of conditions that occur more commonly when drought-feeding, especially when sheep are congregated on small areas. Some of these conditions and prevention and control recommendations are discussed below. Many diseases in sheep are orally transmitted including salmonellosis, worms, coccidiosis, and Johne's disease. The spread of these diseases can be minimised by avoiding faecal contamination of feed and by regularly changing the areas in a paddock where sheep are fed.

## Affecting all ages

### Acidosis (grain poisoning)

**Cause:** Grains are highly fermentable carbohydrate-rich foods. Eating too much of grain changes the microbe population in the rumen, which leads to the formation of large amounts of lactic acid that causes this condition. See [Primefact 330 Grain poisoning of cattle and sheep](#)<sup>1</sup>.

The condition commonly occurs when:

- sheep are first given access to grain
- there is a sudden increase in the amount of grain being fed
- too much grain is fed
- there is a change in the type of grain or concentrate being fed or even the same grain type but from differing sources.

**Symptoms:** Vary from mild to acute, depending on amount of grain and previous experience with grain. In milder cases, sheep are depressed, anorexic (do not feed) and ataxic (unstable on feet). In severe cases, there is scouring, abdominal pain, acute lameness with heat and pain around coronet (laminitis), apparent blindness, recumbency and death.

**Treatment:** Based on neutralising the excessive ruminal lactic acid. Treat with 60 g Causmag (magnesium oxide) or 15 g sodium bicarbonate in 250mls of water as a drench for each sheep. Affected sheep should be given roughage such as hay until recovered.

If a small number of sheep are affected, it may be possible to draft off the affected sheep from a large mob. Valuable stock should receive veterinary treatment.

**Control and prevention:** Follow guides for introducing sheep to grain. The first day of a feeding program commences when sheep start to eat the grain when fed. Do not allow a build-up of grain in the paddock.

When changing feeds, there should be a gradual changeover. If changing from wheat to oats or oats to barley, mix the new feed into the old feed over at least 4 feeds before the old feed cuts out. Add 2% sodium bentonite to grain rations. This will help reduce the risk of poisoning during grain introduction.



## Enterotoxaemia (pulpy kidney)

**Cause:** Pulpy kidney is an acute toxaemia caused when clostridial bacteria normally present in the gut multiply and produce a toxin. It can build up when there is a sudden change to the diet such as when sheep are fed grain, or moved onto lush, rapidly growing pasture or cereal crops.

**Clinical signs:** Usually sudden death, with rapid decomposition of the carcass, purple discolouration of skin, wool is easily plucked.

**Control and prevention:** All stock should be given a clostridial booster vaccination before feeding. If sheep have not been vaccinated, a full vaccination program should be implemented.

## Worm infestations

Sheep in drought-feeding situations can be more susceptible to internal parasites. Sheep that are stressed for any reason can also lose their immunity and may show the effects of worm infestation – e.g. stress through lactation.

**Cause:** The worms commonly involved are brown stomach worm and black scour worm. Where sheep congregate in wet damp areas or after rain, barber's pole worm, and *Nematodirus* (thin-necked intestinal worm) may also cause problems.

**Clinical signs:** One or more of these signs may be present: ill-thrift, anaemia, exercise intolerance, and scouring. If sheep are scouring, it may not be worms so it is important to determine the cause of the scouring before reaching for a drench gun. Check using a WormTest.

**Treatment:** When worms are confirmed, drench the sheep with an effective drench.

**Control and prevention:** Ensure that the sheep are on an effective worm control program (for example Wormboss). If sheep are not on a program, do a WormTest, then drench them if necessary with an effective drench before they are put into a feedlot, or before they are put into small yards or paddocks.

## Liver fluke

**Cause:** This is more common in dry times when sheep graze the wet fluke-prone areas.

**Clinical signs:** Chronic fluke results in anaemia and ill-thrift. Severely affected sheep can develop bottle jaw. It can be confused with barber's pole worm. Acute fluke infestations often cause sudden death in sheep. Sheep with liver fluke are more prone to black disease in areas where it occurs but this can be prevented by a clostridial vaccination program using a multi-valent vaccine.

**Treatment:** Sheep should be treated with a triclabendazole drench (e.g. Fasinex®, Flukare®), which will remove both mature and immature fluke.

**Control and prevention:** Prevent sheep from gaining access to fluke-prone areas in drought times, particularly when they are being hand fed. For a list of drenches for sheep worms including liver fluke, see [Primefact 152 Anthelmintics \(drenches\) for sheep, goats and alpacas](#)<sup>1</sup>.



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## Sheep lice

**Cause:** Most transmission occurs when sheep make direct contact with each other. This is more common in a drought feeding situation because there is more:

- close contact between sheep during yarding and handfeeding
- movement of sheep between mobs and between paddocks
- likelihood of tender wool and the clinical effects are more marked when sheep rub or bite.

**Treatment:** This depends on the length of wool on the sheep and the previous history. Seek advice on the most effective treatment. ([See Primefact 483 Sheep lice!](#))

## Plant poisoning

**Cause:** Hungry sheep gaining access to feed containing toxins – for example, when sheep are changed from a bare paddock to a paddock with some regrowth. Often plants not normally considered toxic may be eaten in excessive amounts and can cause mortalities. In drought situations, hungry sheep will eat plants that are not normally eaten.

**Clinical signs:** This depends on the toxins involved. Nitrate and cyanide poisoning will cause sudden death. Other plants may cause scouring and nervous signs including staggers and ataxia.

**Treatment:** This depends on the plant species involved. Seek veterinary advice if plant poisoning is suspected.

**Control and prevention:** Prevent hungry stock having access to toxic plants. Ensure sheep have a full stomach before they are moved out of a bare paddock.

## Urea poisoning

**Cause:** ingestion of excess amounts of urea in blocks, in mixed feed, or when sheep drink pools of water on the top of urea blocks after rain.

**Clinical signs:** Abdominal pain, nervous signs including excess salivation and sudden death.

**Treatment:** Not usually successful.

**Control and prevention:** Ensure that urea is mixed thoroughly with feed when used as a supplement. Keep blocks out of the rain in sheltered areas.



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## Salmonellosis

**Cause:** Faecal contamination of feed and water supplies with *Salmonella* organisms. It is often associated with stress and with sheep in areas that are wet and muddy following heavy rain or from overflowing water troughs. Coccidiosis, which may result in scouring and dysentery, can also occur under these conditions.

**Clinical signs:** Fever, scouring and sudden death.

**Treatment:** This requires antibiotic treatment. Seek advice from your veterinarian.

**Control and prevention:** Prevent faecal contamination of feed and water. Do not keep sheep that are under stress in wet, muddy areas. Withhold affected sheep from slaughter until outbreak is controlled.

## Pink eye

**Cause:** A bacterial infection of the eye that is aggravated by the congregation of sheep in dusty areas, especially if flies are present.

**Treatment:** Antibiotic ointment in severe cases. Most sheep will recover if left alone but ensure that they have access to feed and water.

**Control and prevention:** Difficult in drought situations when sheep are in confined areas.

## Urinary calculi (bladder stones) in wethers and rams

**Cause:** The common cause is a limited water intake. This can occur as a result of faecal contamination of water, stagnant or brackish water, or high salt content in the water. Losses also occur when sheep are fed on grain rations without a calcium supplement.

**Clinical signs:** Often sudden death. When sheep are examined there is a grossly enlarged bladder caused by an obstruction.

**Treatment:** Not practical and rarely successful.

**Control and prevention:** Ensure that sheep have access to drinkable water supplies at all times. An increase in the salt content of the ration may help to increase the water intake of sheep. However, this will only work if the water is drinkable.

## Grass seed infestation of the gums

**Cause:** Feeding hay that contains a lot of mature grass seed.

**Clinical signs:** Sheep failing to eat, sometimes slobbering at the mouth. Examination of the mouth indicates masses of grass seed around the inside of the gums.

**Treatment:** Removal of the grass seed.

**Control and prevention:** Take care when feeding pasture hay heavily contaminated with grass seed.

# Affecting mainly young sheep

## Enterotoxaemia

This is more common in young stock and the same precautions described under 'Affecting all ages' (above) should be followed.

## Pneumonia

**Cause:** Bacterial infections aggravated by dry, dusty conditions. It is more common where lambs are being fed on dry, dusty feeds in troughs, especially finely hammer milled hay.

**Clinical signs:** Nasal discharge, coughing, ill-thrift and sudden death.

**Treatment:** In severe cases, antibiotic treatment can be used as advised by a veterinarian.

**Control and prevention:** Avoid feeding dry, dusty feeds. This may require some damping down of the feed in troughs.

## Vitamin A deficiency

**Cause:** Vitamin A deficiency can occur in lambs born to grain-fed or drought-fed ewes. Grain and most hays are low in Vitamin A. Lambs must be completely off green feed for some months before clinical signs will occur.

**Clinical signs:** Night blindness, eye discharges and ill-thrift.

**Treatment:** Vitamin A drench.

**Control and prevention:** Lambs off green feed or lucerne hay for 3 to 4 months may need a Vitamin A supplement. A single drench should give 6 months' protection.

## Vitamin E deficiency

**Cause:** Vitamin E deficiency is often associated with feeding weaners on hay or grain over extended periods, especially young weaners.

**Clinical signs:** Animals go down. They appear bright and alert but they are reluctant to stand. In other cases, there is sudden death. Examination of dead animals reveals pale muscles.

**Treatment:** When the diagnosis is confirmed, treat with an oral drench of water-soluble Vitamin E using a dose rate of 3000 iU per animal.

**Control and prevention:** Oral Vitamin E drenches every 6-8 after pasture senescence, until sheep graze green pastures again. Watch weaners and young sheep for signs suggesting Vitamin E deficiency and seek advice. Vitamin E deficiency can resemble white muscle disease due to selenium deficiency. However, selenium deficiency is very unlikely in a drought situation.

## Nematodirus infection (thin-necked intestinal worm)

**Cause:** A mass hatch of Nematodirus worm eggs after an autumn break when sheep graze on short green pick.

**Clinical signs:** Scouring, ill-thrift and weaner deaths. Clinical signs may occur before there is an increase in Nematodirus egg counts on WormTest.

**Treatment:** Drench with an effective drench.

**Control and prevention:** Difficult because of the long-term survival of the Nematodirus eggs and the mass hatch following the autumn break or rain after a prolonged dry spell.

## Coccidiosis

**Cause:** Stress and overstocking of lambs and weaners under moist conditions – such as muddy feeding and watering areas. Heavy pasture contamination and stress can lead to a build-up of infestations. The clinical effects are aggravated by concurrent worm infestations.

**Clinical signs:** Scouring with watery faeces that may contain blood, lack of appetite, dehydration, with anaemia and ill-thrift in some cases.

**Treatment:** Confirm diagnosis and seek a veterinarian's advice.

**Control and prevention:** Avoid placing lambs and weaners in situations where gross faecal contamination of feed will occur.

## Teeth abnormalities

**Cause:** Long-term feeding of weaners on grain without calcium supplementation.

**Clinical signs:** Dribbling from the mouth and abnormalities of the molar teeth.

**Control and prevention:** Ensure that young sheep on grain rations receive a calcium supplement of at least 1.5 per cent of their ration in ground limestone.

## Affecting adult sheep

### Periodontal disease

**Cause:** Often faulty molar dentition. The incisor teeth are not so important. The effect of molar teeth abnormalities may not become obvious until sheep are stressed in drought feeding situations.

**Clinical signs:** Ill-thrift, emaciation and sometimes a cud discharge from the mouth.

**Treatment:** There is no treatment. Remove affected animals from the flock.

**Control and prevention:** Cull old sheep early in the drought rather than hand feeding them.

## Johne's disease

**Cause:** A chronic bacterial infection of the intestines in sheep, which becomes more obvious when sheep are stressed.

**Clinical signs:** Wasting and ill-thrift in sheep 2 years of age and older, which will not respond to drenching or other treatments. Sheep die within 3 to 4 months of first showing signs of the disease. Diagnosis is on post-mortem.

**Treatment:** There is no treatment.

**Control and prevention:** If animals are at risk from the disease, vaccinate with Gudair®. This is a once in a lifetime vaccine that provides effective protection against infection. In areas where OJD is a threat, offer supplementary feeding in troughs and feeders to avoid ingestion of soil. The disease is notifiable so seek advice from your local veterinarian.

## Affecting pregnant ewes

### Pregnancy toxaemia

**Cause:** Poor nutrition in late pregnancy, especially in twin-bearing ewes. Outbreaks of pregnancy toxaemia are often brought on by stress.

**Clinical signs:** Affected animals are dull and listless and may appear blind and wander into objects. Animals eventually become recumbent and very depressed.

**Treatment:** Products such as Ceton®, Ketol®, Vytrate® or Lectade®. When cases occur, increase feeding levels.

**Control and prevention:** Ensure an adequate ration, especially for twin-bearing ewes. It is important that you differentiate pregnancy toxaemia from hypocalcaemia and polioencephalomalacia.

### Hypocalcaemia

**Cause:** A sudden fall in blood calcium levels in late pregnancy and early lactation.

**Clinical signs:** Often sheep are found down or may appear listless. They may show some nervous signs. Commonly occurs shortly after lambing.

**Treatment:** Intravenous or subcutaneous calcium borogluconate.

**Control and prevention:** Prevent sudden changes of diet or other forms of stress. Calcium supplementation of diets is only recommended when sheep are being hand fed on grain and concentrate diets over several months. Sheep can also develop hypocalcaemia when grazing short lush green feed immediately after a drought has broken. Grazing of high oxalate plants such as sorrel, oxalis or portulaca can also cause hypocalcaemia.

## Chronic copper poisoning

**Cause:** Long-term excessive intake of copper in the diet, or as a result of a build-up of copper associated with liver damage caused by grazing on Paterson's curse or heliotrope. Clinical disease is brought on by some form of stress for example, nutritional or lactation stress.

**Clinical signs:** Animals show severe jaundice.

**Treatment:** Including molybdenum in the diet will help control outbreaks. However, molybdenum should not be added to the rations of normal sheep as it may predispose them to copper deficiency.

**Control and prevention:** The disease can be prevented in susceptible groups of animals by incorporating molybdenum at certain times on the advice of your veterinarian.

## Toxoplasma abortion

**Cause:** Feeding of pregnant ewes on hay or grain contaminated with cat faeces.

**Clinical signs:** Abortion, dry ewes or the birth of small, weak lambs.

**Treatment:** There is no economic treatment once the outbreak commences.

**Control and prevention:** Ensure that pregnant ewes are fed on hay or grain that has not been contaminated by cat faeces. Silo-stored grain should be reserved for pregnant animals.

## Campylobacter abortion

**Cause:** Bacterial infection of sheep picked up by ingestion of the organism. Carrier animals excrete the organism in their faeces. Outbreaks occur when ewes in the last 2 months of pregnancy are hand fed on the ground under cool, moist conditions when the organism will survive on pasture.

**Clinical signs:** Abortion in the last 2 months of pregnancy.

**Treatment:** There is little value in treatment in most circumstances. Valuable animals might be treated with antibiotics on the advice of a veterinarian.

**Control and prevention:** Outbreaks occur as a result of faecal contamination of feed. When feeding pregnant ewes, care should be taken to reduce the degree of faecal contamination – especially when sheep are being hand fed under cool, moist conditions. This may be shortly after a drought breaks where hand feeding continues until pasture growth is established.

# Livestock health issues due to floods

There are many potential issues to consider in the aftermath of major flood events and periods of ongoing rainfall. Below are some of the main issues that may occur with increased frequency.

## Lameness

During floods, persistent wetting of the feet can lead to softening of the hooves and an increased risk of trauma such as bruising and penetration wounds. This can also lead to bacterial infections in the foot itself or the skin of the lower limbs.

## Internal parasites

Exposure and susceptibility to worm eggs and their larvae increases during floods. Barber's Pole, Ostertagia, Cooperia, lungworm and Liver Fluke can cause scours, loss of condition, and poor growth rates. Barber's Pole can also cause severe anaemia (pale mucous membranes such as gums, eyelids or vulva) while lungworm can cause respiratory disease and reduced production.

## Leptospirosis

Leptospirosis is caused by Leptospira bacteria, which favour warm, moist environments including water logged soil. Floods in warmer months are a particular risk. Infection is spread via urine, placental fluid and milk and is contracted through ingestion or contact with wounds or mucosal surfaces including the eyes, mouth and nasal cavity.

Leptospirosis is a zoonosis, which means that affected animals can spread the infection to humans. Leptospira infection in humans causes flu-like symptoms, which can become life threatening. Vaccinating cattle with 7-in-1 greatly reduces the risk of disease in cattle and the risk of exposure to humans.

## Botulism

Botulism is a clostridial disease that is a significant threat after a flood. It is caused by the ingestion of Botulinum toxin found in rotting plant and animal material where it is produced by the bacterium Clostridium botulinum. Bones, carcasses, rotting vegetation and silage can all pose a threat and the toxin can be ingested accidentally or, in the case of bone chewing, in an attempt to obtain phosphorous in times of deficiency. The toxin causes progressive paralysis that is usually fatal.

## Yersiniosis (Flood mud scours)

Flood mud scours is a bacterial infection that can occur when the weather is cool and a large amount of mud covers dry feed. Outbreaks are common after a flood in winter or early spring. The disease is usually seen in adult cattle and can cause significant numbers of deaths when an outbreak occurs. When found early, affected cattle can be depressed, off their feed, scouring and have a fever. Often, animals are simply found dead.

## Blackleg

Blackleg is a common clostridial disease seen in cattle in NSW coastal regions and is a higher risk during flood times because of increased numbers of infective spores in the environment. The disease usually causes sudden death in young cattle (usually between 4 months and 2 years of age). It occurs when bacterial spores from the environment enter the body via ingestion or wounds. Affected cattle may show lameness and depression but more often than not they are found dead.

## Three-day sickness

Also known as Bovine Ephemeral Fever, 'Three Day' is a viral disease of cattle that is spread by biting insects from animal to animal and can be prevalent after flood due to boggy ground and standing water. Infection causes fever, lethargy, muscle soreness and lameness, which can lead to recumbency. Most cattle recover uneventfully after approximately 3 days, hence the name.

You can take these steps to minimise the risk of these conditions:

- prevent access to animal carcasses
- provide access to clean, fresh drinking water
- move stock from pasture with heavy soil contamination
- test cattle for intestinal worms and fluke and treat if required
- ensure all 5-in-1 and 7-in-1 vaccines are up to date in cattle and 3-in-1 or 6-in-1 vaccines are up to date in sheep
- consider using a botulism vaccine
- Monitor paddocks for new weeds that may have come in with floods or feed.

If you have any concerns for the health and welfare of your stock please contact your LLS District Veterinarian or your private veterinarian.

For more information visit [www.lls.nsw.gov.au/floods](http://www.lls.nsw.gov.au/floods)<sup>1</sup>



# Livestock health issues due to fire

Livestock are often injured in bushfire and may be impacted in large numbers.

When assessing burnt livestock you should consider the immediate and long-term welfare of the animals, the severity of the burns or injuries, the impact of the injuries on the animals' productivity, the presence of infrastructure and the availability of feed and water.

The impact of the fire event may affect your ability to make decisions and manage affected livestock. You may not be able to make rational decisions, especially ones that relate to the condition of your stock in the long term. If you are considering treating any affected livestock, you must consider whether you have the capacity to assess the livestock, the infrastructure to do this, as well as the impact this will have on you and all those involved.

Seek veterinary assistance as soon as possible and be aware of the following options.

## Humane destruction

Any animal that is in a state considered 'cruel to be kept alive' requires humane euthanasia as soon as it is identified:

- animals that are down and unable to rise because of burn injuries
- severe burns to more than 10 to 15% of the body even if the animal is still standing. The skin may be splitting or sloughing away
- extensive damage to the legs and feet with swelling of the legs and the burnt skin having a dry and leathery appearance
- the hooves obviously starting to separate at the coronary band
- severe burns around the face and eyes so that the surface of the cornea is dry and damaged
- animals suffering from smoke or flame inhalation resulting in acute pneumonia with symptoms of laboured breathing, frothing at the nose and mouth and severe coughing.

## Salvage slaughter

Cattle that do not require immediate destruction and are assessed as suitable for transportation, may be considered for salvage slaughter at an abattoir or knackery. The welfare of the cattle must be protected before salvage slaughter is considered.

- Cows with moderate burns to vulvas, teats and udders, or bulls and steers with moderate injury to the prepuce or scrotum are best salvaged by slaughter.
- Where this is not a practical option, udders with burnt teats should be dried off and teats reinspected after 3 to 4 weeks to assess the function of the teat opening. This is particularly important in dairy cattle. Analgesia and antibiotics may be required but remember to consider withholding periods. Consult your veterinary practitioner.
- Cattle with mild hoof injuries such as exudate at the coronary band or minor splitting at the heel and only moderate lameness (lameness score 3 out of 5 or less) may also be considered for salvage slaughter.

Sheep that are moderately burnt will often survive for several days after the fire. They may be heavily singed on the wool with only minor burns to non-wool areas including the face, ears, lips, forelegs, teats, anus and between the legs. These animals must be monitored closely as the condition of even mildly burnt sheep can deteriorate rapidly.

### **Consider salvage slaughter for the following.**

- Animals that survive but where injuries will result in scarring that may prevent them fulfilling their intended purpose, such as breeding ewes and rams. Keep in mind when assessing sheep that bare areas with hardened, cracked skin usually have subcutaneous oedema and congestion, causing difficulty with skinning and can result in carcass condemnation.
- Unburnt sheep on farms with no feed left, although wool-type sheep may be better destroyed on-farm when prices are low or when abattoirs are distant or over-supplied.
- Any sheep being considered for salvage slaughter must be fit enough to be transported. They should be assessed by a veterinarian prior to transport, and only travel to the nearest available abattoir.

### **Keep and treat**

Animals with mild injuries may recover with good nursing care. If you are considering nursing injured animals, you must ensure that adequate facilities and resources are available including: clean and soft holding yards, feed and water, shade, and someone who can check and treat animals daily for at least 10 days. These animals will likely require antibiotic and pain relief medication.

- These animals have less than 10 to 15% of their body covered by moderately severe burns. It is usually the non-haired areas of the body that are most affected such as the prepuce, scrotum, vulva and anal region. Areas with moderate swelling and inflammation can be treated. If there is severe swelling with blanched or blackened areas, the animal should be euthanised.
- Nil severe separation of the hooves at the coronary band, although there may be some separation at the heels. These animals must be closely monitored as the extent of hoof damage may become more obvious in the following days
- The animals appear bright and alert, are able to eat and drink, and can move around with minimal lameness.
- Carefully examine the teats and udders of cows with calves at foot – burnt teats may mean that the cow will reject the young calf, which may die without intervention.
- Sheep will require regular inspection and treatment if there are signs of flystrike.

## Remember to consider their future potential to meet their intended purpose.

Many animals suffer burn injuries to their genital region, and although these injuries may not be life-threatening, the damage or scarring means they may no longer be fertile or able to rear their young.

Ewes/Cows/Heifers:

- Check for teat/vulval damage before joining/calving.

Rams/Bulls:

- Palpate scrotums for scarring and adhesions if burnt
- Check pizzles for damage/scarring
- Note: infertility from high heat events can last 6 weeks or more

## Factors affecting management in the immediate to mid-term

The effect of the fire on the environment and infrastructure may mean there is no remaining water and/or pasture, fences and yards no longer exist, stored feed is damaged or destroyed, and/or the vehicles to deliver that feed are no longer useable.

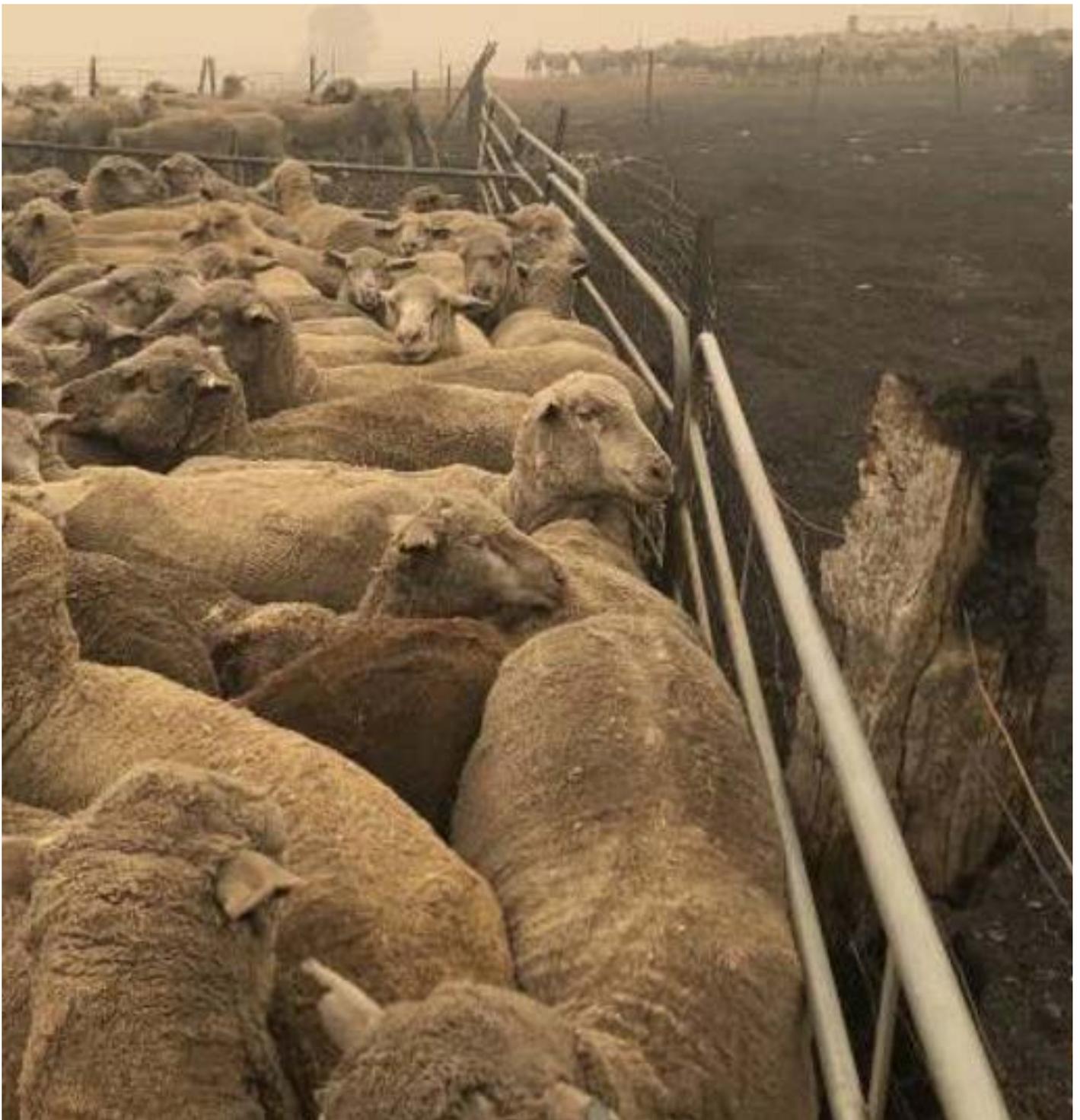
If you have any concerns for the health and welfare of your stock please contact your LLS District Veterinarian or your private veterinarian

For more information visit [www.dpi.nsw.gov.au/emergencies/bushfires!](http://www.dpi.nsw.gov.au/emergencies/bushfires!)



## Animals which appear normal

- These are animals that appear largely unaffected in the immediate aftermath of a fire.
- It should be noted that even with an initial conservative assessment some livestock may deteriorate later due to burn injuries that were not initially obvious. It is important that all burnt livestock are reassessed in at least 5 to 7 days after the fire and periodically after this.
- Particular attention should be paid to breathing difficulties caused by smoke inhalation, which may take some time to become evident, and increasing lameness caused by separation of hooves.
- Stock should be yarded where possible to ensure adequate inspection.



# Nutritionally deprived livestock – welfare scoring and transport

Livestock that have experienced extended periods of inadequate feed lose fat and muscle cover as these are mobilised to provide the body with the energy that is lacking from their diet.

The loss of fat and muscle is accompanied by predictable changes in behaviour as the animal adapts to the energy and protein restrictions imposed by dietary deficiencies.

These changes in both physical condition and behaviour form the basis of the Welfare Scoring system, as described in Welfare scoring nutritionally deprived beef cattle, dairy cattle and their crosses, sheep and horses at [www.dpi.nsw.gov.au/drytimeswelfare-scoring](http://www.dpi.nsw.gov.au/drytimeswelfare-scoring)<sup>1</sup>

The fat or body condition scoring system uses the physical appearance of the fat and muscle cover to differentiate between animals that are in appropriate condition from those that are at risk of poor welfare outcomes due to lack of fat and muscle.

## Beef cattle

Cattle are given a fat score using a scale of 1 to 6. A Fat Score 1 is the equivalent of between 50 to 80 kg live weight depending on frame size of the cattle.

A Fat Score 1 animal is an At Risk animal and at this point, intervention is required to improve the condition of the animal.

Beef cattle that fall below Fat Score 1 are described in terms that reflect their body condition. The term Welfare Score is used.

There are 3 Welfare Scores:

- High Risk 1
- High Risk 2
- Downer

There are transport recommendations for Fat Score 1 and each welfare score. If these are not adhered to, penalties may apply under POCTA.

Following is a summary of the Welfare scoring nutritionally deprived livestock publication.



1



## At Risk

### Transport recommendation:

Able to be transported to abattoir, saleyard or agistment with minimum time off feed



## Fat Score 1 – At Risk

### Appearance

- Backbone is easily seen but individual spines not prominent
- Short ribs are fairly sharp to the touch (identifiable)
- Tail head is prominent with no fat around it
- Area inside of pins is slightly sunken
- Hip bones and long ribs are obvious (prominent)
- Area between tail and pin bones is concave (sunken)
- Rump muscle is slightly concave and leg muscle beginning to waste
- Tail bones not identifiable
- Skin is pliable
- Dewlap has no fat.

### Behaviour

- Bright appearance/alert
- Mobile gait.

## High Risk 1

### Transport recommendation:

Transport to abattoir and agistment only. Unsuitable for sale through saleyards or transport over long distances



## High Risk 1

### Appearance

- Muscle depletion is now evident at the back and loin, and the hind leg muscles
- The rump muscle is concave
- Spines of the backbone are identifiable
- Short ribs all prominent and very sharp to touch
- Tail bones just identifiable
- Long ribs, pin bones and tailhead prominent
- Rump muscle concave, muscle wastage in loin and leg muscle evident
- The inside of the pins are sunken
- Stifle joint not identifiable
- Udder is beginning to shrink
- Slacker skin over hump (Bos indicus)
- Skin is less pliable.

### Behaviour

- Mobile but less energetic
- Grooming behaviour ceases
- Able to lie down/rise with ease
- Dung pats normal and cud chewing observable.

## High Risk 2

### Appearance

- The animal is emaciated
- The spines of the backbone are individually identifiable – pointed to the touch
- The hips, pins, tailhead, long ribs and short ribs are individually identifiable
- Tail bones can be easily felt
- Inside of pins is deeply sunken to the bone
- Wasting in the leg muscles has occurred to the extent that stifle joint is identifiable
- Deeply concaved rump muscle between hooks and pins
- Skin is tight
- Udder is now shrunk and tucked up to the body
- Dewlap is a skinfold and the sternum identifiable
- Loose skin over the hump of Bos indicus and Bos indicus cross cattle
- Any dung will show evidence of poor rumen function e.g. undigested feed, mucous membrane, dirt, watery.

### Behaviour

- Dull appearance/no grooming behaviour
- Locomotion slow and unsteady gait, tend to drag hind feet
- Animal may ‘plait’ hind legs as they walk
- Cud chewing reduced
- Lie down/stand up is difficult.

## Downer

### Appearance

The animal meets all the descriptors for Welfare Score High Risk 2 in addition to the following:

- Immobile with zero flight distance despite attempted flight behaviour
- No response to any external stimuli
- Locomotion is difficult/unsteady gait, or not possible, ‘plaiting’ motion of hind legs, difficulty maintaining balance
- If lying down the animal is unlikely to stand without assistance because muscle strength is depleted
- ‘Paddle’ marks from feet movement/body or head movement where animal is sitting/lying
- Eyes are ‘tearing’, sunken and glazed
- Brown liquid faeces indicates no/limited rumen function.

## High Risk 2 Transport recommendation:

Not fit to travel, do not transport



## Downer Recommendation:

Seek veterinary advice for euthanasia decision



# Sheep

Sheep are given a fat score using a scale of 1 to 5. A Fat Score 1 animal is an At Risk animal and at this point, intervention is required to improve the condition of the animal.

Sheep that fall below Fat Score 1 are described in terms that reflect their body and behaviors. The term *Welfare Score* is used.

There are 2 Welfare Scores:

- High Risk
- Euthanase

There are transport recommendations for Fat Score 1 and both welfare scores. If these are not adhered to, penalties may apply under POCTA.

Below is a summary of Welfare scoring nutritionally deprived livestock from [www.dpi.nsw.gov.au/drytimeswelfaregrading](http://www.dpi.nsw.gov.au/drytimeswelfaregrading)<sup>1</sup>.

## At Risk Transport recommendation:

Able to be transported to saleyard, abattoir or agistment only with minimum time off feed.



## Fat score 1 - At Risk

### Physical features

- Individual ribs are easily felt, and fingers will fit easily between the ribs when palpated. No tissue can be felt sliding over the ribs. Depressions are quite obvious between the ribs and will be visibly prominent in animals with short wool
- Pin bones are prominent, and the loin muscle feels concave
- Spines of the backbone are easily felt individually
- Individual tail bones not identifiable
- Animal looks 'narrow' when viewed from behind.

### Behaviour

- Animal appears alert and mobile, will be attempting to eat grass, head to the ground
- Able to lie down and rise easily, normal gait
- Healthy appetite
- High lamb mortality if lambing or in early lactation.



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## High Risk

### Physical features

- Animal is emaciated. Inside of pins are sunken to the bone, concave rump muscle when viewed from behind. 'Tent' shaped from behind.
- Skin is very loose over the ribs and backbones. Wool may be dull and rough visually and to the touch. Wool likely to be tender.
- The actual spines of the backbone are easily identified, as are the hips, pins, tailhead and bones, long ribs and short ribs – pointed to the touch, no soft tissue between skin and bone. Point of shoulder will be prominent.
- Loin muscle and leg muscle extremely depleted
- Sunken or humped back, head lowered
- Any dung will show evidence of poor rumen function – rumen contractions are infrequent.

### Behaviour

- Dull, listless appearance
- May lag behind if the mob is driven
- Slow and unsteady gait, animal tends to drag hind feet, animal may sway when standing
- Great effort is required to lie down/stand up.

## Euthanase

### Physical features

Will possess physical characteristics of High Risk animals in addition to:

- Severe muscle depletion and nil or almost nil fat cover
- Immobility
- Faeces abnormal, indicating no/limited rumen function or 'hard' low moisture content faeces indicating dehydration and intake of high cellulose roughage (low digestibility).

### Behaviour

- Little response to any external stimuli
- No ability to walk
- Lying down, unlikely to stand
- 'Paddle' marks from feet movement/body or head movement where animal is sitting/lying
- Eyes are sunken and glazed – face muscles are depleted

## High Risk

### Transport recommendation:

Able to be transported to abattoir or agistment. Unsuitable for sale through saleyards or transport over long distance



## Euthanase

### Recommendation:

Seek veterinary advice for euthanase decision



# Humane Euthanasia

## Requirements for euthanasia

Livestock affected by natural disasters may need to be humanely destroyed due to welfare reasons. A person responsible for an animal that is suffering from severe distress, disease or injury that cannot be reasonably treated must ensure the animal is humanely destroyed at the first reasonable opportunity.

## General welfare considerations

- The terms 'euthanasia' and 'humane destruction' are both used to describe a method of inducing death that minimises the pain, fear and distress experienced by the animal involved.
- A critical factor in achieving this is to ensure that immediate unconsciousness occurs, followed by rapid death without the regaining of consciousness. Some methods of destruction achieve this more effectively than others.
- Choose a method of euthanasia appropriate to the size and species of the animal that kills it painlessly and rapidly.
- A person undertaking the destruction of an animal must have the relevant knowledge, skills, and experience, or be under the direct supervision of a person with the relevant knowledge, skills, and experience, to humanely destroy an animal.
- Animals should be handled quietly and calmly, taking care to avoid inadvertently subjecting them to unnecessary fear or pain.
- Ensure the animal is adequately restrained. Where livestock can walk without causing distress, they should be handled in a race or crush. Animals requiring emergency killing due to welfare considerations should be humanely destroyed without moving them further than necessary.
- Confirm death systematically every time, so that there is no doubt the animal is dead before leaving or disposing of it.
- The immediate collapse of an animal together with development of a fixed stare and cessation of breathing are a sufficient combination of signs to indicate that the method of destruction has been successful.

## Disposal

Advice should be sought from relevant authorities, such as the Environment Protection Authority (EPA) and Local Government regarding on or off-farm disposal. Consideration needs to be given to such issues as the number of carcasses involved, disease status, location of waterways, water tables, land use, erosion, and flood risks.

For more information on the humane destruction of cattle, sheep and other livestock species, please go to [www.dpi.nsw.gov.au/animals-and-livestock/animal-welfare/animal-care-and-welfare/livestock](http://www.dpi.nsw.gov.au/animals-and-livestock/animal-welfare/animal-care-and-welfare/livestock)<sup>1</sup>



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# Cattle

## Recommended methods of humane destruction:

- Cattle may be destroyed by firearm or captive bolt, (or by a veterinarian via lethal injection)
- Calves less than 24 hours old may be destroyed by firearms, captive bolt, blunt trauma, (or by a veterinarian via lethal injection)
- Blunt trauma should only be used when there is no other recommended option for humane destruction, can only be used on calves that are less than 24 hours old, and should be followed by bleeding-out or another technique while the animal is unconscious, to ensure death.

## Ammunition:

- Adult cattle, close range shooting: a rifle should deliver a minimum muzzle energy of a standard 0.22 magnum cartridge.
- Larger animals and bulls, particularly when paddock shooting: 0.30-calibre high-power cartridges are recommended.
- The .22 LR is not recommended for euthanasia of adult cattle because of poor penetration, deflection, and fragmentation of the bullet.
- Calves: a rifle should deliver at least at least the muzzle energy of a standard 0.22-long rifle cartridge. Soft nose or hollow point bullets are preferred over solid bullets.
- Shotguns loaded with birdshot or slugs are appropriate from a distance of 1 to 2 metres; greater distances lead to inaccurate shot placement. The preferred gauge for euthanasia of cattle is 12 gauge. Number 6 or larger birdshot or shotgun slugs are the best choices for euthanasia of cattle.

## Point of aim

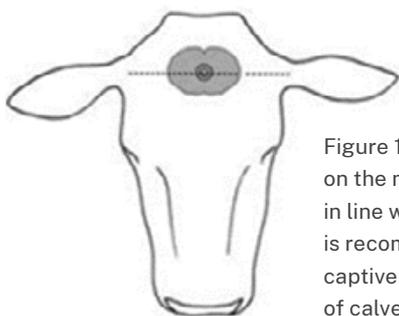


Figure 1: The Frontal position, on the midline of the skull and in line with the base of the ears is recommended for firearm, captive bolt and blunt trauma of calves.

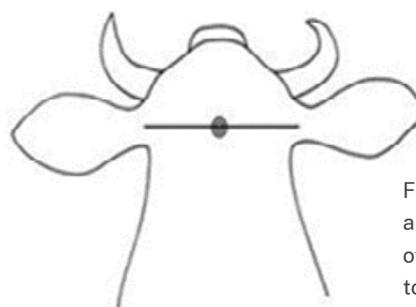


Figure 2: The Poll position is aimed just behind the base of the horns and directed towards the muzzle

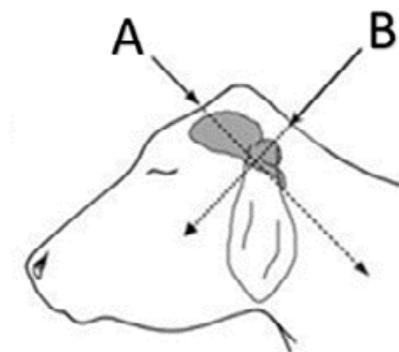


Figure 3: Side view showing positioning for Frontal (A) and Poll (B) positions.



Figure 4: The temporal position can be used for paddock shooting from a distance if necessary but should only be undertaken with solid nose bullets and heavy calibre firearms.

# Sheep

## Recommended methods of humane destruction:

- Sheep over six months old may be destroyed by firearm, captive bolt, or bleeding-out, (or by a veterinarian via lethal injection)
- Bleeding-out by neck cut to kill a conscious sheep can only be performed in an emergency situation when there is no firearm, captive bolt reasonably available.
- Lambs under 6 months old may be destroyed by firearm, captive bolt, bleeding-out or blunt trauma (or by a veterinarian via lethal injection).
- Blunt trauma should only be used when there is no other recommended option for humane destruction, can only be used on lambs that are less than 24 hours old, and should be followed by bleeding-out or another technique while unconscious to ensure death.
- Bleeding-out by neck cut to kill a conscious lamb can only be performed in an emergency when there is no firearm, captive bolt or lethal injection reasonably available.

## Ammunition

- A firearm should deliver at least the muzzle energy of a standard 0.22-long rifle cartridge for lambs.
- Firearms recommended for euthanasia of adult sheep include the .22 LR rifle and shotguns.
- Hollow-point bullets can be used to increase brain destruction and reduce the chance of ricochet although bullet fragmentation may substantially reduce the potential for brain destruction because of reduced penetration, particularly when used in large-horned adult rams.
- Shotguns or higher-calibre firearms loaded with solid-point bullets are preferred for large horned adult rams.

## Point of aim

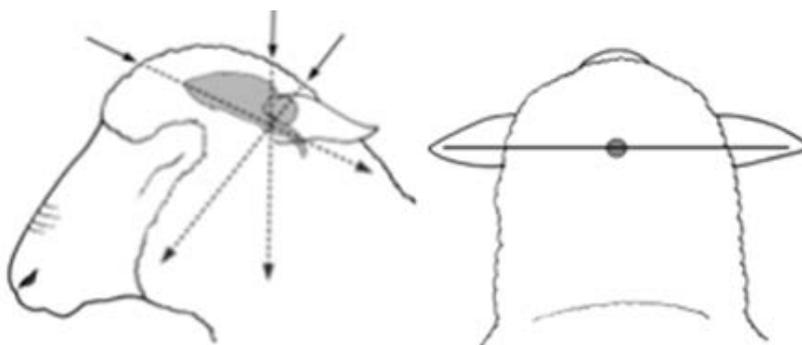


Figure 5: Anatomical landmarks for placement of shot in the poll position.

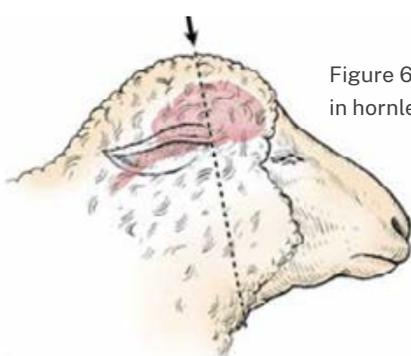


Figure 6: Poll position in hornless sheep.

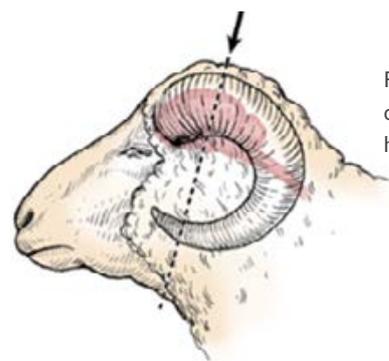


Figure 7: Poll position can also be used in horned sheep or rams.

# Drought, fire and flood animal management strategies

The objectives, or aims, of your drought, fire and flood event strategies, which must always take into account the welfare of stock, should be to ensure that the farm business survives and that the productive resources of the farm – the soil, the capital, and (if relevant) the genetic merit of livestock and crops – are managed to allow production to recommence as soon as possible after the event.

Objectives should be clearly defined both for the event period and for the post-event (recovery) period. Recovery from a significant event may take several years, particularly if debt levels rise substantially or if pastures or crops are depleted or have perished and require re-sowing.

Your objectives should be clear and, wherever possible, be stated in numbers, dates or dollars as benchmarks, or triggers for particular actions.

Write down your objectives and review them regularly. You can change your objectives as the situation dictates. Your objectives should not be ‘set in concrete’ – they are a guideline, not a boundary. If the situation requires that you change them, provided you have examined your options thoroughly, you should.

If you don’t review and change your objectives, there is a chance that recovery after the event may be extremely difficult. You may have to make a trade-off between short-term and long-term objectives. For example you may choose to incur greater costs during the event to reduce your costs or increase your enterprise’s chances of survival during the post-event recovery stage.

## Developing your strategies

Once you have clarified your objectives, choose the strategies that will help you meet them. You will need to cost strategies for events of various lengths; that is, you need to develop a ‘model’ of the event so that you can estimate the effectiveness of various strategies over time.

You will find that as the assumed period of an event varies, so does the likely cost of the different strategies. Similarly, varying the assumptions about the cost of restocking, or the current sale value of stock, dramatically affects the cost of various strategies.

In most cases, no single strategy will be sufficient. Each situation will require a unique set of strategies according to your physical, financial and managerial resources.

# The six most common strategies.

Consider which of these options to use, to what degree, and under what circumstances.

These strategies are most relevant for times of drought, but may also be used during flood and fire events. The degree of relevance will depend on the scale of the event.

## 1. Selling stock

The timing of selling and the condition of stock at sale is critical.

Selective reduction of stock numbers, or partial destocking early in an event is nearly always the best approach, especially with cattle. If stock are sold early, prices are generally better in a firm market and stock are more likely to be in reasonable condition. Selling stock also avoids feeding costs.

The question of which stock to sell involves knowing which are easier to handle during an event and which will be most productive or give the best returns afterwards.

Sheep, for example, have consistently given a higher percentage return to livestock capital invested than cattle. The longer the event lasts, the more effective this strategy of retaining sheep versus cattle will be for a mixed livestock enterprise to employ.

If the event is short, or confined to only a portion of the property in the case of fire or flood, and a small number of stock have been sold, the remaining stock will probably help compensate for these animals through increased performance per animal as a result of the reduced stocking rate. It may not be necessary to repurchase stock.

With a longer event, such as a prolonged drought, or an extensive fire or flood event, leading to a higher number of stock sold, it is generally preferable to purchase restocker animals at reasonable prices when conditions improve, rather than “hanging on” due to fear of stock not being available or only being available at significantly increased prices.

Livestock prices in the post-event phase do not necessarily rise dramatically. Do not fall into the trap of electing to “hang on” and not sell because you think you’ll never be able to buy back in.

Early sale of stock will also generate cash to bolster the farm’s equity position or generate interest, which will help longer-term business resilience and survival. This should almost always be the first measure taken in the early period of a drought.

As the drought progresses, stock should be sold on a class-by-class basis, including finished young stock, aged stock, castrated stock, replacement stock, until a nucleus of young, sound, breeding females is left. This class of stock is likely to be the most valuable and capable of the best production when the drought breaks.

Do not dismiss the option of full destocking. This may be done in a series of partial destocks, or may be the decision taken very early. Depending on the duration of the event or the scale of it, and factors other than the welfare of the stock, total destocking may be the best option for all involved.

Always make decisions in accordance with the underlying principle of “feed well or sell, and sell when well.”

## 2. Production feeding

Production feeding includes maintaining a level of production either by ensuring turn-off of finished stock at a time when quality slaughter stock are at a premium, or by maintaining the breeding flock/herd in the hope that conditions will improve to allow progeny to be finished normally.

### Option A – farm lot or confinement feeding

Farm lot feeding is an attractive option if there is a large gap between the price of store animals and that of finished animals, and the cost of ration ingredients is reasonable. It is important to consider animal breed, nutrition requirements, marketing, ration costs and any infrastructure requirements. Refer to [Primefact 554 Confinement feeding stock](#)<sup>1</sup>.

### Option B – maintaining performance of the breeding unit

Maintaining performance of the breeding unit assumes a short-term event and a market demand for the offspring in the future. It is more common in the cattle industry because the longer gestation period of cattle gives a greater chance of encountering a break in the event than is the case for sheep.

Production feeding of breeding females is costly and choosing this option when markets and seasonal conditions are erratic carries considerable risk.



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### 3. Maintenance feeding

Maintenance feeding is widely practiced especially with sheep because the wool they will grow generates income to help offset costs.

Decisions to feed are often based on the availability of fodder stored on the farm and cash reserves, rather than on a rational examination of costs and returns.

In a short event, maintenance feeding is likely to be a low-cost strategy. However, if the event is prolonged, maintenance feeding can be very expensive, particularly if continued to the point where resources are exhausted.

Before commencing feeding, stock numbers should be reduced as discussed earlier. Fat animals should be allowed to use some of their own body reserves before feeding commences. This reduces the feeding period and ensures the most efficient use of the feed.

### 4. Agistment

Agistment is widely used in regional droughts and more widely practiced with cattle than with sheep.

A written agreement is useful in formalising the duration, agistment costs, supplementary feed costs and other aspects of the arrangement.

Before dispatching your stock, it is important to understand the quality and quantity of feed available, management facilities available (eg yards) and the relevant residue, pest and disease status of the agisted property (particularly concerning organochlorines, along with ovine/bovine Johne's disease and virulent footrot).

**It is a legal requirement for sheep, cattle and goat owners to record livestock movements to and from agisted properties on the National Livestock identification System (NLIS) database.**



## 5. Trading in livestock

Many producers don't consider trading in livestock because of the loss of the genetic base built up over many years of a breeding program, and the risk of introducing disease. However, the market for livestock during an event can fluctuate widely and there is often an opportunity to buy a class of stock that is cheaper than another.

It may be possible to retain the same number of stock in terms of dry sheep equivalents and have much less capital tied up in livestock. The cash generated could be used to pay for feeding costs.

## 6. Humane destruction

Humane destruction of livestock may be necessary in times of drought, fire and flood when animals are not fit to be transported and there are very low livestock prices.

It is not acceptable to keep or sell an animal that is in distress due to being injured, diseased or because it has not been provided with adequate feed or water.

Under the *Prevention of Cruelty to Animals Act 1979*, penalties can be imposed on a person who fails to provide an animal with proper and sufficient food, drink or shelter, or veterinary treatment.

Humane destruction of an animal should be carried out to prevent suffering and distress, when it is cruel to keep an animal alive, or when an animal is considered to be unfit for transport. Humane destruction should only be carried out by skilled persons using appropriate methods. In making this assessment, you need to consider both animal and non-animal indicators that can affect survival.

Animal indicators include emaciated body condition, depression, loss of appetite, inability to rise, and the presence of disease. Non-animal indicators include the availability of feed and water and extremely hot or cold weather.

In some rare situations, where sale is not a viable option, it may be preferable to humanely destroy groups of animals before this 'point of no return'. Decreasing competition for feed will help the remaining animals to stay in better condition and be more productive after the drought whilst also maintaining ground cover. It will also reduce feeding costs.

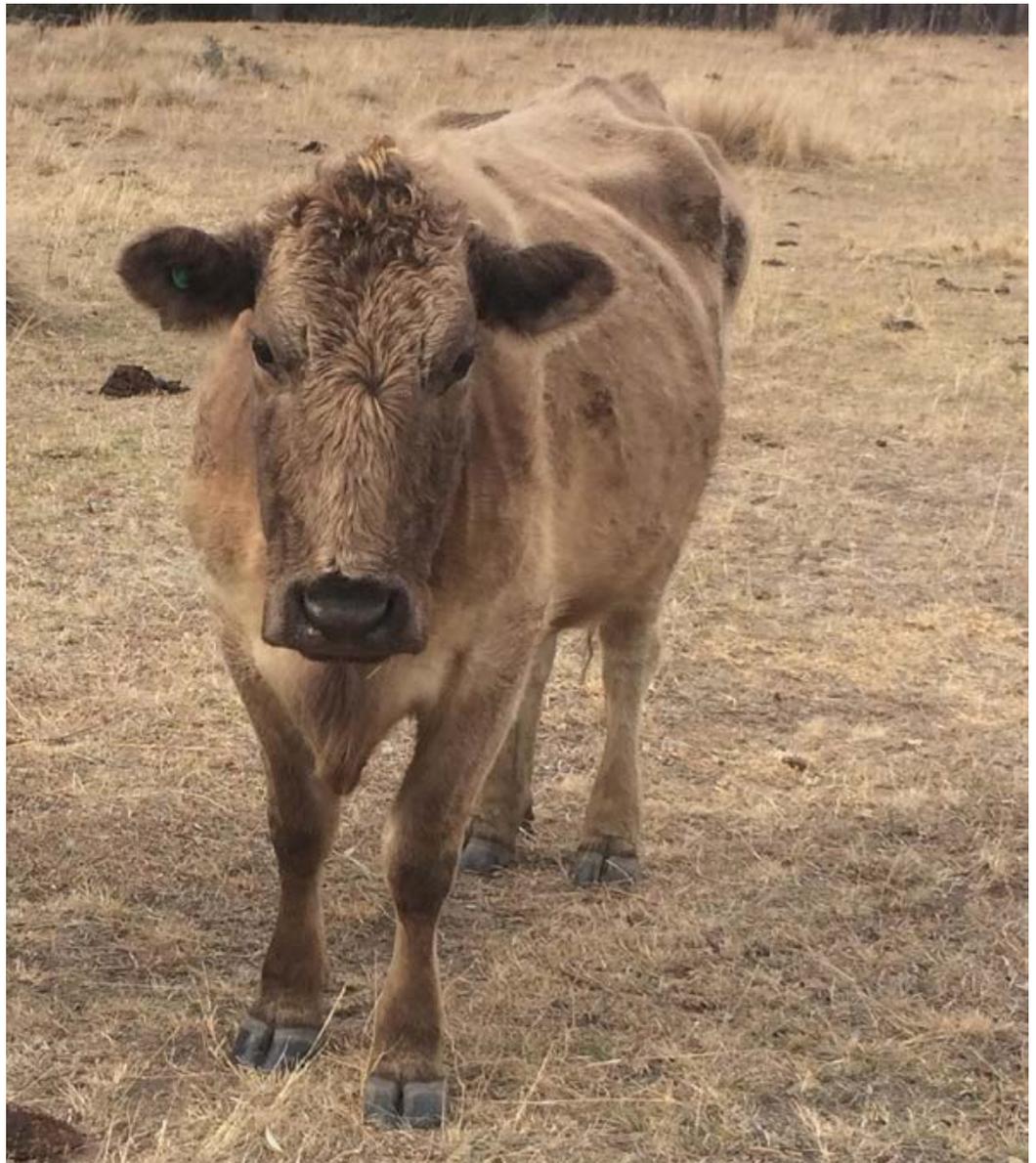
In deciding which groups of animals need to be humanely destroyed, you should consider the genetics required after the event and the underlying vulnerability of different animal classes.

Note that aged and unweaned animals and pregnant and lactating animals are more likely to be affected by the event.

In some situations, it may be advisable to destock and remove all stock from the property, for example if sheep are infected with virulent footrot. If animals with similar or better breeding are likely to be available after the drought, fire or flood, then all animals could be either sold for processing or humanely destroyed.

**Sheep infected with virulent footrot can only be transported under an individual biosecurity permit from the Local Land Services and must only be sold direct to slaughter.**

See the human euthanasia section earlier in this chapter, or contact a Local Land Services District Veterinarian or your local private veterinarian.



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People who experience distress associated with the humane destruction of livestock are advised to contact their local health services.

For more information on whether animals are fit for transport, please visit [www.dpi.nsw.gov.au/animalwelfare](http://www.dpi.nsw.gov.au/animalwelfare)<sup>1</sup>

The following resources are available for download:

- [The Glovebox Guide: biosecurity, emergency animal diseases and preparing livestock for transport](#)<sup>2</sup>. Hard copies of this resource may also be available at Local Land Services offices
- The [MLA Fit to Load Guide](#)<sup>3</sup>
- See other resources available on the [DPI website](#)<sup>4</sup>



Table 1. Advantages and disadvantages of the six most common strategies

Strategy	Advantages	Disadvantages
Selling some or all stock	<ul style="list-style-type: none"> <li>• No cash outlay is required (unless values are minimal)</li> <li>• Interest on proceeds of sale can be earned</li> <li>• Good prices are more likely if stock are sold early</li> <li>• Risk of damage to pastures is reduced. Improved performance of</li> <li>• remaining stock post-event may compensate for reduced numbers</li> <li>• Reduces labour input – time is available to pursue other activities</li> <li>• Can select culls to improve flock genetics.</li> </ul>	<ul style="list-style-type: none"> <li>• Stock may need to be repurchased after the event (prices could be high)</li> <li>• Income declines due to lost production</li> <li>• Breeding cycle may be disrupted</li> <li>• Stock may have to be sold at a substantial discount if held for too long</li> <li>• Taxation may be affected</li> <li>• Genetic material is lost if culling does not discriminate</li> </ul>
Production feeding	<ul style="list-style-type: none"> <li>• Throughput of stock is maintained</li> <li>• Livestock inventory can be maintained at high levels by purchasing more stock for feeding, reducing restocking problems</li> <li>• Cash flow is maintained</li> <li>• Lot feeding protects pastures</li> </ul>	<ul style="list-style-type: none"> <li>• Costs are high, while market prices are uncertain</li> <li>• High labour input is required</li> <li>• Feeding costs increase for pregnant and lactating cows, and as growing animals put on weight</li> </ul>
Maintenance feeding	<ul style="list-style-type: none"> <li>• Income may be earned from production of progeny and/or wool</li> <li>• Restocking costs are avoided</li> <li>• Maintenance of breeding cycle may be possible</li> </ul>	<ul style="list-style-type: none"> <li>• Costs are directly related to length of time for sufficient pasture to become available</li> <li>• Large financial reserves may be required for practical periods High labour input is required Performance levels are affected</li> <li>• Young stock do not perform well</li> </ul>
Agistment	<ul style="list-style-type: none"> <li>• Agistment may be cheaper than maintenance feeding per unit of food</li> <li>• provided, depending on transport costs and the duration of agistment</li> <li>• If good agistment is available, full production may continue</li> <li>• Damage to pastures is minimised</li> <li>• Breeding program can continue</li> </ul>	<ul style="list-style-type: none"> <li>• An event may affect agistment property</li> <li>• Stock must adapt to new area</li> <li>• Stock thefts may occur</li> <li>• Handling facilities and managerial control may be inadequate</li> <li>• Weeds and diseases may be introduced when stock are returned to original property</li> </ul>
Trading in livestock	<ul style="list-style-type: none"> <li>• Cash flow is provided for feeding and running costs so that total livestock numbers can be maintained</li> <li>• Can allow enterprise shift</li> </ul>	<ul style="list-style-type: none"> <li>• Weeds, diseases etc. may be introduced</li> <li>• Breeding cycle may be disrupted</li> <li>• Genetic base is lost</li> </ul>
Humane destruction	<ul style="list-style-type: none"> <li>• Prevents unacceptable suffering</li> <li>• Reduces stocking rates, enhancing chances for the remaining stock</li> <li>• Reduces hand feeding costs</li> <li>• May reduce the impact of, or eliminate, a disease, e.g. footrot</li> </ul>	<ul style="list-style-type: none"> <li>• Financial loss of stock value</li> <li>• Costs of slaughter and disposal and unpleasant task</li> <li>• Some risk to operator</li> <li>• Loss of genetics can occur if there is no selection</li> </ul>

# Summary

Recommended steps to prepare for drought, fire and flood:

- Start early to establish your short-term and long-term objectives
- Assemble facts and figures on all aspects of alternative strategies: feed costs, rainfall records (official records and local experience), climate forecasts, stock prices, agistment, support and subsidies
- Cost strategies for various lengths of events
- Select the strategies that best fit your situation and projections
- Write down your objectives and strategies, and whenever possible, set down numbers, dates or dollar figures as benchmarks or triggers for particular actions
- Review your strategies and adapt them if necessary.



**Remember:**  
“feed well or sell, and sell when well”





# Feeding livestock

Periods of tough times require producers to make important decisions that will have short-term and long-term impacts on a farming enterprise. Drought, fire and flood can be very difficult, but planning and management based on sound information will help producers through the experience.

In this chapter, learn about:

- supplementary and full feeding cattle
- supplementary and full feeding sheep
- feeding dairy cattle
- water requirements for sheep and cattle in emergencies
- the value and risk of feeding waste materials to stock.

## 6

# Supplementary feeding cattle

An effective supplementary feeding program supplies nutrients that are deficient in pasture, in a cost-effective manner. It therefore relies on the following components:

- identifying the limiting pasture components such as protein, energy, and minerals
- using supplements containing economical levels of those components
- matching the supplement with the class of stock being fed
- supplying appropriately, to minimise disruption to the animals' digestive system
- costing the whole program, considering alternative measures
- prioritising animals with the greatest needs
- monitoring animal health, feed consumption, liveweight, and fat scores.



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## Introduction

Poor quality dry feed is often abundant in the early stages of drought and also after some floods. Supplementary feeding at these times improves animal performance and increases the consumption of this available feed source by up to 15–25%, until pasture grows back, or full feeding is required.

Dry feed that has no green component will be most deficient in protein and possibly sulfur, while energy is only available in slowly digestible forms. At this point, the most effective supplement is one that provides non-protein nitrogen (a basic building block of protein) to rumen microbes, allowing them to digest the roughage more effectively.

Non-protein nitrogen is generally provided as urea. Historically, this was supplied by mixing with molasses, either directly mixed into pure molasses<sup>1</sup> or in diluted molasses mixes in roller drums<sup>2</sup>.

Molasses is an ideal supplement for low quality pasture because it has about 70% of the energy value of grains and can be mixed with urea or protein meals to provide protein. Where molasses is the main supplement ingredient, cattle usually regulate themselves to about 1kg per 100 kg of bodyweight per day. Roughage must be available to avoid molasses toxicity.

Increasing costs of supplying, transporting, and feeding out molasses has, however, meant that providing urea as part of a dry lick is generally more economical and convenient. There are a range of commercially available dry licks containing some combination of salt, urea, sulfate of ammonia, minerals, and a small amount of protein meal.

Salt is used as an attractant and so any cravings must be satisfied by feeding by itself for a week, before providing a urea based lick. Sulfate of ammonia has a bitter taste and is used to temper intake as well as providing sulfur.

Urea and sulfate of ammonia dissolve quickly in the rumen and any surplus nitrogen is excreted. To be effective, they must be constantly available and therefore must be covered or fed in perforated drums to prevent any rainwater pooling. For more information visit the Future Beef website<sup>3</sup> or listen to the FutureBeef podcast<sup>4</sup>. While providing nitrogen in the form of a urea based dry lick is the cheapest and most cost-effective form of supplementation, it is only able to slow weight loss or at best, result in modest liveweight gains (up to 100–200g/hd/d). To achieve this, intake



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rates of around 60g of urea per cow per day or 30g of urea per weaner per day are required (Table 1). Weaners, less than 250 kg, and poor stock should be supplied with true or bypass protein, rather than urea based supplements.

## Lick blocks

Commercial urea and protein blocks are convenient and can be used when there is abundant (over 2500 kg dry matter/ha), good quality, dry feed. However, they are more expensive than other options such as loose licks, pulse grains, and protein meals and low overall urea intake rates often limit their effectiveness. Water pooled on the top of lick blocks can also be toxic.

Dry licks containing urea must be covered or fed in porous drums to prevent rainwater pooling, as dissolved urea can be fatally toxic to stock. Adding some meal to the mix can help soak up small amounts of moisture. Photo: Todd Andrews.



Loose licks, protein meals and white cottonseed supplements stimulate roughage intake, but if there is insufficient pasture available (as shown here) then it must be provided in the form of hay, silage, or byproducts such as grape marc. Photo: Todd Andrews



Autumn floods in northern NSW left a bulk of dry feed. Supplementing stock grazing improved animal performance while also reducing the bulk of feed, allowing regrowth or winter pastures to be sown. Photo: Nathan Jennings.



Palm kernel meal (or palm kernel expellers, PKE) is lower in protein and less palatable than other protein meals, which helps to regulate initial intake. This large pile formed a crust after 1600mm rain over 6 months but was still suitable for feeding. Photo: Todd Andrews

## Protein meals, pulses and white cottonseed

As drought progresses, pasture protein and energy content continues to decline. As digestibility and palatability also declines, animals actually eat less of the poorer quality feed, exacerbating deficiencies in these key nutrients.

At this point, animals require supplementation with both protein and energy, and this can be achieved with concentrates such as protein meals (e.g. canola meal, palm kernel meal), distillers dried grain (DDG), pulse grains (e.g. lupins, faba beans, chickpeas) and white cottonseed. While more expensive than urea-based supplements, and with a lower return on investment, these supplements provide varying amounts of bypass protein plus energy, resulting in much better animal performance.

Protein meals are digested slowly, allowing cattle to use the protein efficiently over a longer period. As a result, twice-weekly feeding is as effective as daily feeding. Pulse grains are more readily degradable and should be fed every second or third day (Table 1). Because they contain low starch levels, acidosis cases are rare.

Protein meals supply most of their energy as oil, with animal performance often declining when they are fed at more than 30% of the overall diet. If additional energy is required, then cereal grains can be gradually mixed with these concentrates. At this point, the supplement is replacing the paddock feed which is only supplying dietary roughage rather than a large nutrient component.

White cottonseed is an excellent supplementary feed that is high in energy and protein but also provides fibre in the hulls and lint. It mixes well with grain and protein meals, but its high oil content may cause digestive upsets when daily intakes are high for extended periods, or when combined with roughages that are also high in oil such as grape marc or failed canola crop. Read the [NSW DPI Primefact White cottonseed - a supplementary cattle feed<sup>1</sup>](#) for further information.

Table 1. Supplementary feeding options for different stock classes

Pasture notes	Class of stock	Supplement	Feeding frequency
Plentiful dry feed <ul style="list-style-type: none"> <li>• Low protein and marginal digestibility limits pasture intake</li> <li>• Protein supplements increase pasture intake</li> </ul>	Cows and calves, dry adult stock	Urea/molasses mix or loose lick to supply 60g urea/cow/day or	Continuous access
		Pulse grains, 0.5–1.0 kg/cow/day or	Every second day
		Protein meals, DDG, cottonseed 0.5–1 kg/head/day	2–3 times/week
	Weaners	Molasses mixes or loose to supply 30g urea/hd/d, but high-protein grains or meals are preferred.	
Deteriorating dry feed <ul style="list-style-type: none"> <li>• Low pasture digestibility restrict intake</li> <li>• Feed energy/protein supplement mixes</li> <li>• Full hand feeding follows</li> </ul>	Cows and calves Dry stock	molasses/urea/protein meal or	Continuous access
		white cottonseed/DDG/pulses 2–3 kg/cow/day for lactating cows;, 1–2 kg/hd/day for dry cows	2–3 times/week



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**WARNING:** Cereal grains should be introduced gradually into a diet and fed daily, while stock cravings for salt should be satisfied before introducing urea. Lactating cows require at least 20% roughage (hay).

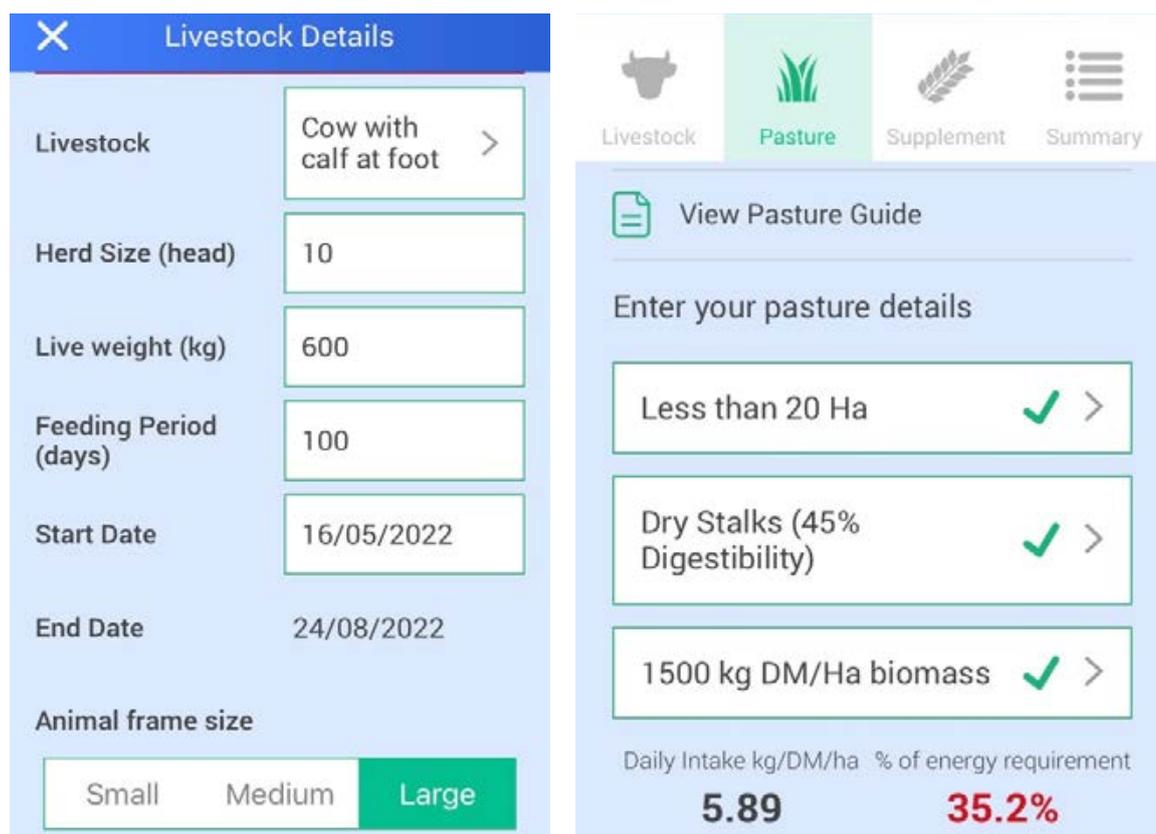
Cereal grains (such as oats and barley) and hay are generally not suitable as supplementary feeds because they act as a substitute for paddock feed rather than stimulating its utilisation. However, as conditions deteriorate, they are effective with supplying energy and roughage respectively, when a full ration is being fed.

## Drought and supplementary feed calculator

The DPI Drought and Supplementary Feed Calculator app is a free tool to assist sheep and cattle producers to develop feed rations during times of nutritional shortages. It allows users to compare the nutritional value from 71 different feed types, calculates the individual feed quantities and auger timings needed when making single and mixed rations, and calculates the nutritional requirements for different sized mobs and livestock classes.

It also estimates pasture quality and quantity using height, density and growth stage estimates. When the livestock class is added, the App indicates whether the available pasture is providing sufficient energy or whether a supplement is required.

Users can then choose from a range of supplements with estimated feed values or use a customised feed source. When recommended supplement amounts are combined with their price, the cost effectiveness of a range of products can be compared. The app can be downloaded on both Apple and Android devices. For more information on how to download and use the App, visit the [NSW DPI website](#)<sup>1</sup>.



The NSW DPI Drought and Supplementary Feed Calculator App allows users to estimate pasture availability and livestock weight gain and to choose from a range of suitable supplements to compare costs.



# Managing full hand feeding of beef cattle

## Introduction

Full hand feeding of cattle requires a large amount of feed, often including grain, which needs to be stored, handled and monitored regularly. While considerable up-front planning, infrastructure and labour is required, setting up a smaller, confined area where stock can be fed, watered, monitored, yarded, treated, and trucked will make full feeding a much simpler, convenient and more effective strategy.

## Feeding in a confined area

All livestock being fed should be confined to a small area or paddock for the following reasons:

- To limit pasture and soil degradation (i.e. groundcover loss) across the property. The area chosen for confinement feeding should ideally be arable and able to regenerate pasture quickly
- To allow livestock to be fed quickly and easily
- To allow stock health and performance to be easily monitored and treated, and animals culled when necessary
- To reduce livestock energy losses from animals having to walk large distances searching for food or water
- To prevent livestock from getting bogged in dams and eating poisonous weeds

For a comprehensive guide to confinement feeding of sheep and cattle refer to the [Local Land Services guide<sup>1</sup>](#) to confinement feeding, or refer to [Primefact 554 Confinement feeding stock<sup>2</sup>](#).



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Sometimes there is no option but to feed in a confined area. Dropping hay separately over larger areas allows all animals to eat without bullying. Photo: unknown source



# Parasites

Parasite burdens can be heavier when stock are immuno suppressed due to poor nutrition and close confinement. For example, bulls are highly susceptible to ostertagia (small brown worm) infestation, as are calves and young stock. Fluke treatments may also be required if relevant. Consider faecal testing for gastrointestinal worms and fluke to determine the level of burden and advise the type of treatment required. Consider fly control as a means of reducing pinkeye infection, particularly if feeding calves. Lice control may also be worthwhile, to prevent scratching on infrastructure such as fencing and troughs.

There is no evidence that either fast flowing or persistent flood water reduces worm burdens on pasture. Conversely, the impact of grazing flood affected pastures and standing in water can make cattle more susceptible to worm and fluke infection.

# Vaccinations

Vaccinate all stock, including bulls, with 5-in-1 (or 7-in-1) before feeding grain, hay, and silage, to protect against clostridial diseases. Others to consider include:

- vaccinating against botulism prior to feeding silage
- vaccinating against pinkeye and respiratory diseases prior to early weaning calves
- vaccinating to prevent, or cure, vibriosis if stock mix with neighbouring cattle during floods.

# Vitamins and minerals

Vitamin A, D, E treatments are essential for all cattle if they have not had access to green feed for an extended period and are required every 3 months. Cereal grain is low in calcium and sodium and so limestone (1% by weight) and salt (0.5% by weight) should be added to the ration when feeding a large portion of diet as grain over an extended period.

# Stock management

Stock should be dehorned as part of normal management. When being fed as part of a supplementary or full feeding program, polled or dehorned cattle are less aggressive at the feed trough, which means less troughing is required. If cattle have not been dehorned prior to feeding, consider delaying the operation to avoid the extra stress of dehorning.

# Heifers

If maiden heifers are kept, monitor their weight to ensure that they meet joining thresholds as well as assessing the likelihood that they will also reach adequate calving weights. Refer to [Primefact 'Calving two year old heifers'](#)<sup>1</sup> to rebuild herds' for relevant threshold weights for replacement heifers.



1



## Cows

Pregnancy test all joined cows. Sell any that are empty and identify those that have conceived late as the next priority to be sold. Pregnant cows need close supervision as calving during times of nutritional shortage can lead to a higher proportion of calving difficulties, retained afterbirths and metabolic disorders such as milk fever (calcium deficiency). Lactating cows require at least 20% dietary roughage (1–2 kg/hd/d) to produce adequate milk.

## Calves

The amount of energy required to feed a lactating cow with a calf is 30–40% higher than for a dry cow and weaned calf. It is therefore more economic to feed them as separate units, and so calves should be weaned as early as possible. This can be as early as 6 weeks of age with good nutrition and management, although fewer diseases and other issues might be encountered if calves are at least 80 kg liveweight.

Early weaning calves onto a limited ration of DDG pellets plus ad lib hay allows dry cows to be run on low quality pasture that would be unsuitable for lactating cows.

Photo: Todd Andrews



## Weaning management

Early weaning of calves requires care and planning to ensure a good outcome. They must be fed a ration that allows them to grow and as a general guide average daily gains of 0.2–0.3 kg/d are acceptable for calves from small-framed herds with lower growth potential, while 0.5–0.6 kg/d is required for larger framed calves with larger growth potential, such as Euro cross. Calves need more protein than older stock, which adds to costs, but overall need less feed than other classes of stock.

To minimise weaning stress, feed the calves with cows prior to weaning (until calves are eating a small amount themselves), allowing calves to familiarise themselves with feeding operations and adjust to a new diet. Creep feeding is a good option for older calves. Where space permits, allowing cows to be adjacent to the weaning yards also reduces separation anxiety.

Calves require roughage. A good quality grassy lucerne/pasture/cereal hay is preferable to prime lucerne, and these can be available ad lib for younger calves but as part of a restricted diet in older calves. As with all stock, grain must be introduced slowly to prevent acidosis and trough space must be adequate (30–40 cm/hd) to prevent gorging. Introducing grain to calves should be done at lower quantities than mature cattle, starting at approximately 250 g/hd/d. Where possible draft calves according to size and weight to prevent bullying but if this is not possible then more trough space is needed to ensure access for all animals.

## Calves 6–12 weeks

These calves need a diet with 16–18% crude protein and 12MJ ME/kg DM. This can be achieved by mixing around 30% distillers dried grain (DDG) pellets or treated pulse, for example lupins, with 70% rolled grain (wheat/barley/oats) or simply feeding a commercial calf pellet. Feed around 1–1.58 kg/hd/d. Observe calves at feeding and also weigh regularly to monitor weight gain and identify shy feeders or ill-health. Feed off the ground and remove any uneaten feed to help prevent coccidiosis.

## Calves over 12 weeks

While some protein meal or DDG will still be beneficial, these calves are more durable and can be fed a wider range of feeds such as 1% dietary urea, some white cottonseed and molasses.

## Calf health

Minimise all potential stressors by providing fresh, clean water at all times; shelter from cold winds; prevent worm, lice and pinkeye and avoid branding and marking until the calves leave the yards. Remove sick and scouring calves from the group and treat them immediately; young calves are particularly susceptible to coccidiosis.



The early stage of pinkeye, a disease spread by flies that can be a major problem in early weaned calves, with the potential to cause rapid weight loss and blindness. Vaccinate prior to weaning, limit dust, control flies and treat immediately. Photo: Todd Andrews

# Grain feeding

## Starting cattle on grain

Cattle should be introduced to grain and pelleted rations slowly and carefully, beginning with a base diet of hay if there is minimal pasture available. Diarrhoea is often the first sign of mild grain acidosis and if this is seen in a number of animals, the proportion of hay in the ration should be increased and grain reduced. Some grains, for example lupins, are safer to feed than others. Similarly, it is safer to feed oats, which have a higher fibre to starch ratio, than wheat.

Table 2: a possible introductory regime for grain feeding cattle in a paddock.

Day	Amount of hay	Cereal grain (kg/hd/day) for cattle
1-2	To requirements, then grain	0.5
3-4	Decrease hay fed	1
Day 5 onwards	Decrease hay fed	Increase by 500 g/day until required feeding level is reached

When changing between different types or even batches of grains, and especially when changing between batches of pellets, the new feed should be introduced by 'shandying' it with the old and gradually increasing the proportion of the new feed over at least seven days.

## Complete grain and roughage ration

When animals are introduced to a high-grain diet, they should begin on a ration consisting primarily of hay, with the percentage of grain being gradually increased over two to three weeks.



Assess the suitability of different feeds for stock. This very coarse hay is only useful as a roughage source, to be fed out with grain, pellets or other concentrate.

Photo: Todd Andrews

## Frequency of feeding

When cattle are on full drought grain rations, it is safest to feed daily. If being fed two or three times a week, be alert to the increased risk of grain poisoning. Where possible, feed at a regular time of the day to reduce digestive upsets.

## Digestibility of grains

Grains are more digestible if rolled or coarsely crushed, but greater care is required as the increased availability of starches and the potential for livestock to gorge can lead to digestive upsets and acidosis.

Most grains give satisfactory results if fed whole. While there are some losses while the rumen adjusts to grain feeding (3–4 weeks), the amount of whole grain being undigested varies from about 5% in oats and corn up to about 25% in sorghum.

## Depraved appetite

Bark chewing, hair licking and dung eating can occur when cattle are on grain survival rations. These habits do not pose a health problem. However bone chewing can result in deaths from botulism. Although grain is generally high in phosphorus and low in calcium, supplements that supply both, such as mono- and dicalcium phosphate, will reduce this behaviour.

## Shy feeders

About 10–15% of stock will not settle down to grain feeding. Shy feeders are best removed from the mob and either fed diets containing some roughage or sold.



Feeding cottonseed in a tyre (rather than a trough) allows greater access as well as reducing wastage.

Photo: Todd Andrews

## Troughing

Feed grain in a trough, where possible, to reduce wastage but also minimise health and residue risks from dust and potential dung and soil consumption. Troughing does not need to be elaborate. Many cheap, temporary methods are satisfactory including:

- bush timber or railway sleepers placed on the ground 40 cm apart with corrugated iron used as the troughing
- 200 litre drums split down the middle
- tractor tyres (ensure they are not steel belted) cut in half with a chainsaw.
- Provide sufficiently sized troughs to allow stock to eat together. Allow 30 cm of trough length per head for weaners, 40–45 cm for yearlings and 60 cm for adult stock. To reduce bullying, several troughs spread apart are better than one long trough. Round feeders allow better stock access than others.
- Note that feeding twice the daily amounts every second day can improve feed access for the mob as dominant animals feed and then move away.
- Where no troughing is available, place the grain in dumps of about 20 kg each, rather than trailing as for sheep. Dumps are not as efficient as troughs with an expected wastage of 6–8% and a higher risk of sand impaction.



Cattle troughs can be made from bush logs and corrugated iron as part of drought or other emergency feeding plans. Ensure adequate trough space to allow all animals to feed, especially when feeding limited rations. Photo: Todd Andrews

# Full hand feeding cattle

## Introduction

Full hand feeding is required when there is not enough pasture for livestock maintenance or when further grazing may irreversibly damage pastures. This may result from any number of emergency situations, including extended drought, severe flooding and widespread bushfire. While the time required to reach the decision to fully hand feed stock is very different from the slow buildup of drought compared to the rapid onset of fire or flood devastation, it still requires significant planning and careful execution. The most convenient arrangement is to have a designated feeding area where stock will be confined and fed a full and complete ration. For a comprehensive guide to Confinement feeding sheep and cattle follow download it from the [LLS website](#)<sup>1</sup> or refer to the NSW DPI [Primefact 554 Confinement feeding stock](#)<sup>2</sup>.

Before commencing a full feeding program, it is worthwhile to consider the:

- probability of growing feed in the foreseeable future, i.e. the likely feeding time frame
- quantity of feed required for full feeding
- resources required (finance for feed, labour and other ongoing costs) and the facilities or equipment required
- potential benefit of feeding certain classes of stock

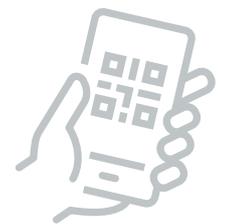
Feeding programs can be costed on a monthly basis, bearing in mind that there may be a considerable lag time for abattoir killspace. Reassess stock feeding numbers to stretch available funds where required, noting that feeding requirements and therefore costs increase during periods of production stress such as pregnancy and lactation.



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Although convenient and fairly safe, feeding hay as a full ration is usually expensive on an energy basis and can also be wasteful if fed on the ground during drought. Stock should not be fed immediately above dams as manure and other runoff can lead to fouling or blue green algae blooms.  
Photo: Todd Andrews

# Energy requirements for maintenance

Once full hand feeding commences, available energy is generally the most limiting factor in diets. Animals need energy (measured in megajoules, MJ) for all body functions and these requirements are assessed as 'megajoules of metabolisable energy' (MJ ME). Energy in feed is assessed as 'megajoules of metabolisable energy per kilogram of dry matter' (MJ ME/kg DM or M/D).

A drought feeding ration must provide sufficient metabolisable energy otherwise weight loss is inevitable. The energy requirements of cattle depend on:

- liveweight and desired growth rate (kg/d)
- pregnancy/ lactation status
- weather conditions.

## Calculating the feed requirement for maintenance

The NSW DPI Drought and Supplementary Feed Calculator (DASFC) estimates the amount of feed required (both dry matter and 'as fed') for different classes of cattle by using average feed testing values for a large range of potential ration components. Alternatively, users can input values for their own feeds. The DASFC is covered earlier in this chapter.

The following steps provide a guide to manually estimating feed requirements, once the energy content of the feeds is known. Average values for a range of feeds are listed in the Drought and Supplementary Feed Calculator, although a feed analysis is recommended wherever possible, as there can be considerable variation. Feed quality service testing is available through NSW DPI, visit [www.dpi.nsw.gov.au](http://www.dpi.nsw.gov.au)<sup>1</sup> for more information.



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Feeding hay to cattle after fires and floods is the most practical option. Account for losses due to trampling and muddy ground when estimating amounts required.

Photo: Nathan Jennings



Once the energy content of the feed is known, the amount of dry matter required to maintain dry stock can be estimated. Where more than one feed is being fed, the following procedure is used to calculate the energy content of the mixed ration. It is this number which is then used in Figure 2.

## Example

A ration contains 80% wheat (12.9 M/D) and 20% clover hay (8.9 M/D). The overall energy content of the feed is calculated as follows:

$$\text{Energy content} = \frac{(80 \times 12.9) + (20 \times 8.9)}{100} = 12.1 \text{ M/D}$$

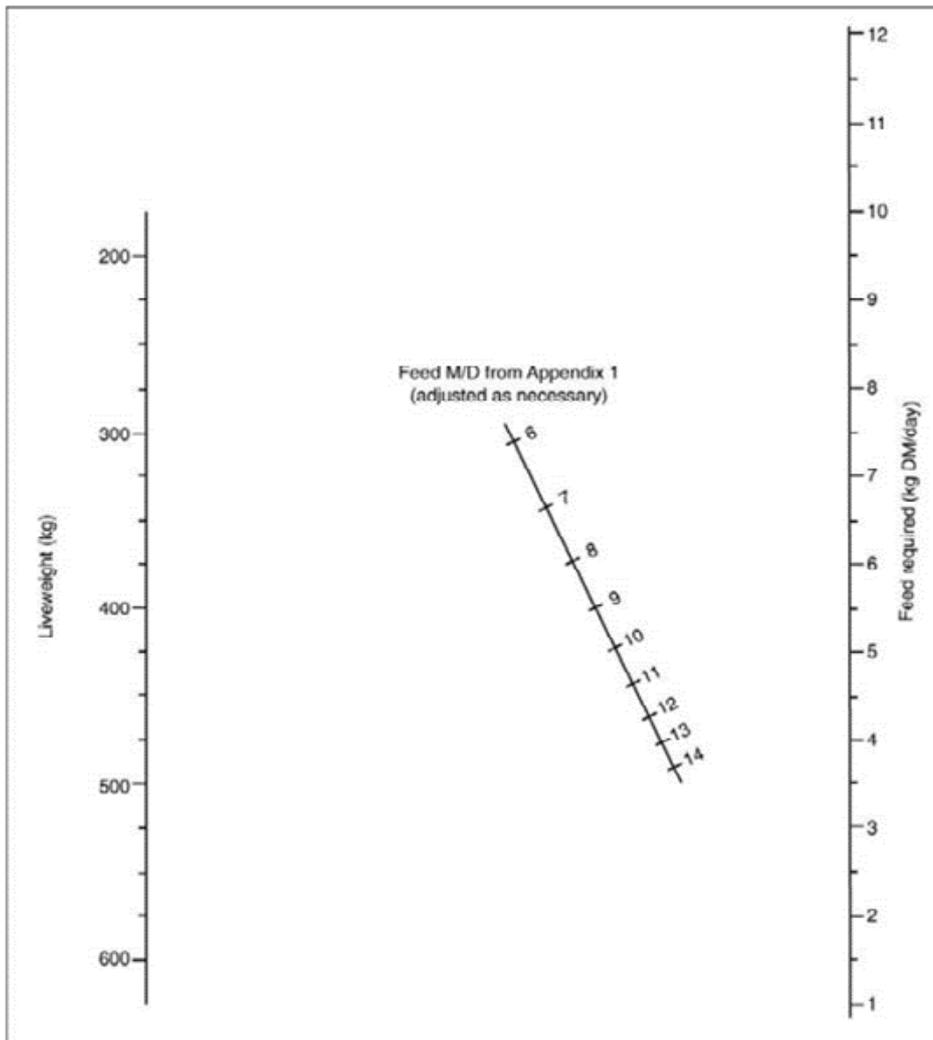


Figure 2. The feed required (in dry matter) to maintain dry cattle can be calculated from their liveweight and from the energy contained in the feed (metabolisable energy/kg dry matter or M/D). Refer to the text to adjust these amounts for pregnancy, lactation and cold stress. The 'as fed' amounts must also account for the moisture content of the ration.

## Calculating the 'as fed' amount

The calculation in the previous section assumes the feed is 100% dry matter. All feeds contain some moisture, and this needs to be accounted for when determining actual amounts to feed but is also important in comparing the cost of different feeds, including transport.

To determine the amount of a particular fodder or ration to feed, multiply the amount of feed dry matter required (Fig 2), multiply it by 100, and then divide this by the dry matter percentage. This is commonly known as the 'as fed' amount.

### Example

6.5 kg of dry matter/d is required, where the dry matter percentage is 90%:

'As fed' amount =  $6.5 \times 100 \div 90 = 7.2$  kg

To adjust the amount of feed as fed, follow these steps. Hay and grain is around 90% DM, while silage varies between 30–55% and should be tested.

## Adjusting and finalising the ration

### Step 1. Ration for dry beast

Using animal liveweight (kg) and feed energy content (M/D), place a ruler on Figure 2 to estimate the 'Feed required' from the right-hand side. Then adjust for dry matter content to calculate the 'as fed' quantity.

### Step 2. Allowance for pregnant and lactating cows

Using Figure 2, first calculate the feed requirements for maintaining a non-pregnant cow. Then increase this by the percentage factor given below to determine the corrected amount of feed required by a pregnant or lactating cow:

- Cow 6 months pregnant: add 20%
- Cow 8 months pregnant: add 40%
- Cow with calf at foot: add 60%

### Step 3. Allowance for cold stress

During cold, bleak weather, increase the rations for all classes of stock by 20%. The extra feed should be provided as hay.

## Feeding for survival

Cattle can become emaciated after extended drought or after standing in floodwaters for some time. High quality feed is required otherwise stock can die. Feeding grain for survival is a good option in drought as it involves gradual introduction of grain. In this case the success of feeding depends on starting well before cattle fat scores/condition scores fall to their critical levels (see Chapter 5 Animal welfare and management).

It will generally be necessary to feed hay or silage after floods or bushfires as there is no time for a gradual introduction of grain and stock may be located where there is no feeding infrastructure. Good quality grassy hay will be the most suitable feed, especially if stock have been without feed for some time, as it can supply some energy but will not contain too much legume that can cause bloat or other problems.



## Suitability of various feeds

### Grains

Grain is usually the most economical feed when full hand feeding is required. Wheat, barley, oats, rice, corn and sorghum are energy-rich feeds with similar nutritive values. They contain sufficient protein to meet the requirements of adult stock and are all suitable for drought feeding. Sorghum should be cracked or otherwise treated to enable adequate digestion. Oats and corn can be fed whole although there will be undigested grain in the first few weeks of feeding as the rumen adjusts.

Grains are low in calcium, so 1.5% limestone (superfine grade) by weight must be fed with all grain diets. Grain introduced too rapidly or eaten in excess can cause sickness and death.

### Prepared feeds

Cattle and sheep nuts vary in quality between manufacturers and even between batches. Their energy value is generally slightly lower than that of grain. They are a convenient but expensive form of energy and can cause digestive upsets similar to those caused by grain. When introducing and using prepared feeds, use the same precautions as for grain.

High protein nuts/pellets generally supply protein in some combination of true protein and urea. They are convenient to use and should be compared to other sources using a feed cost calculator.

White cottonseed is an excellent supplement when dry paddock feed is available and can then form the basis for a full ration when combined with grain and roughage. Feeding in numerous small piles allows access for all stock if feeding a limited ration.

Photo: Todd Andrews

## Hay

Hay is a necessary part of a full feeding ration fodder for:

- introducing stock to grain
- feeding during periods of cold stress
- feeding lactating cows
- production feeding, that is when large amounts of grain or other concentrate is fed.

Lucerne, good pasture, and cereal hays are adequate for maintaining stock. The energy in 3kg of these hays is roughly equivalent to the energy in 2kg of grain. Lucerne and clover hays are high in protein, calcium and vitamin A, and are particularly suited to young and lactating stock.

Poorer quality hay and straw barely meet stock maintenance requirements with 2 kg equivalent to 1kg grain. The fibrous nature of these feeds will limit the amount stock can eat, due to poor digestibility and increased gut-fill. They are usually low in protein and energy and are not suitable for young or lactating stock without the addition of grain or other concentrates.



Lactating cows require roughage, in this case grape marc being fed in piles. These calves could be weaned to reduce feed costs with wastage managed by feeding in tractor tyres. Photo: Todd Andrews

## Estimating hay quality

Break open a bale or dig into the bale to get a representative sample. Hay with a sweet and pleasant smell is likely of higher quality than hay with little or no smell. Hay that smells earthy or like dirt is generally very poor quality.

Good quality hay should be green and leafy rather than yellow or brown. Note that some clover or other legume hays can cure to quite a dark colour. Coarse, “stemmy” hay will have lower digestibility.

Hay containing seed heads indicates that it has been cut late and will be of lower quality; this includes cereal hay, where overall quality will be lower despite the presence of some grain. Cereal hay containing seedheads is susceptible to vermin infestation, while wheaten and barley hay may also contain awns which can further reduce its acceptability to stock.

A sample of the hay should be easy to break apart and should not hurt your hands when squeezed. If it does, it has been cut late and will have lower digestibility. If this is the case, check if leaves fall off the stems easily as this can further reduce overall quality and are wasted during feeding.

There should be no visible mould (white or dark, matted patches in the hay) or other foreign material such as soil and sticks. When opening hay, look for dust as this can reduce palatability or may indicate the paddock was flooded at some point.

Be aware of weed seed. Where possible, confirm where hay was made and if weeds were present. While it is generally difficult to find weed seeds in hay, if there are unusual or unfamiliar plants in the bale and they have flowers or seed heads, then it is likely to contain seed. In this case, feed out in locations that can be monitored post drought.

**Be aware of other biosecurity considerations** such as red imported fire ant (RIFA) in hay from South East Queensland (check the map of the RIFA quarantine zone) and lupin anthracnose for grain grown in Western Australia or South Australia.

[www.dpi.nsw.gov.au/rifa1](http://www.dpi.nsw.gov.au/rifa1)

[www.dpi.nsw.gov.au/lupin-anthraxnose2](http://www.dpi.nsw.gov.au/lupin-anthraxnose2)



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Note that appearance is not always a reliable indicator of nutritive value. Grass hays that appear similar can vary widely in protein content, by up to two to three times. Feed tests provide a solid basis to determine hay quality and, in turn, what other supplements are required to formulate a suitable ration.

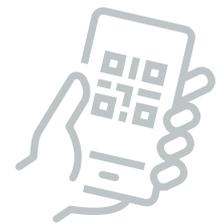
## Silage

Silage is suitable for cattle and can be self-fed or fed daily as a restricted ration. If feeding weekly, silage should be fed in dumps rather than trails. Most types of silage are comparable in energy value on a dry matter basis if baled at a suitable growth stage, but lucerne silage and clover silage have a higher crude protein and lower fibre content, making the feed value greater than that of other types of silage such as wheat or sorghum.

The feed value of wet silage is variable because of differences in palatability and moisture content. Although the crude protein of silage is similar or higher than hay produced from the same material, its degraded nature means it is used less efficiently, especially by sheep.

Silage is expensive to transport for feed as it is low in dry matter and round bales are irregularly shaped for stacking. Spoilage to the perimeter of the bale represents a large percentage of wastage in the bale.

Photo: Todd Andrews



The dry matter of most silage varies between around 30–35% for fine chop pit silage and from 45% to 55% for baled silage. The risk of poor fermentation and subsequent low intake due to palatability is unlikely at these DM percentages. To calculate the amount of silage to feed, see the section ‘Calculating the ‘as fed’ amount’.

Poorly preserved silages can reduce intake and subsequent production, even if ME and protein content are sufficient. Testing silage for pH and ammonia-N can indicate silage fermentation quality. Ensuring adequate pH (pH 4.5 or less) also reduces the risk of botulism. Consider vaccination against botulism prior to feeding out silage.

## Irrigated feed

Stock may be given daily access to irrigated fodder crops, as follows (assuming no limit to availability and quality):

- Weaners and yearlings 2 hr/day
- Adult dry stock 1 hr/day
- Breeders, late pregnancy 2 hr/day
- Breeders, lactating 3 hr/day.

Table 3. Feed requirements ‘as fed’ (kg/head/day) for full hand feeding of cattle.

Stock class	Liveweight (kg)	Grain* 12MJ ME	Hay 8.5MJ ME	Pit silage 35%DM 8.5MJ ME	Bale silage 45%DM 10MJ ME	Grain:hay 50:50	Grain:hay 80:20
Young stock gaining 0.2kg/d	200	3	5	13	8	4	3.5
	250	3.5	6	15	9.5	4.7	4
	300	4	7	17	11	5.5	4.5
	350	4.5	7.5	19	12	6	5
	400	5	>9MJ ME required		13	6.5	5.5
Dry stock at maintenance	450	4.5	7.5	18	12	6	5
	500	5	8	19.5	13	6.5	5.5
	550	5.5	8.5	21	14	7	6
8 month pregnant cow (no gain)	500	7	8	19	18	9	8
	550	7.5	8	20	19	9.5	8.5
	600	8	Not achievable >9MJ ME required 21		20	10	9
	650	8.5			10.7	9.5	
Lactating cow (no gain) with calf	500	Not suitable 20% roughage required	Not achievable >10MJ ME required to maintain cow weight		25	12	10.5
	550				12	11	
	600				13	11.5	
	650				14	12	

\* Calculations are for crushed grain. Feeding whole grain can increase the amounts required. Increase all amounts by 20% in cold weather, using hay where possible.

# Supplementary feeding sheep

The aim of supplementary feeding sheep is generally to maintain weight in dry sheep; meet the requirements of late pregnancy and lactating ewes; and to grow lambs and weaners sufficiently to survive and avoid permanent checks. Targets for sheep will be based on required production, welfare and cash flow considerations; these will guide decisions on which sheep will be fed and how much.

Supplementary feeding options include grain, hay and silage when there is limited pasture or poor quality dry feed lacking in energy or protein. This may be due to drought or flood events.

As well as meeting the nutritional requirements of different physiological classes of sheep, supplementary feeding aims to:

- reduce grazing pressure on newly established pastures or those approaching minimum ground cover thresholds
- improve utilisation of existing dry pasture
- maintain or improve meat or wool production to achieve targets.

An effective supplementary feeding program supplies those nutrients that are deficient in pasture, in a cost-effective way. It therefore relies on the following components:

- identifying the limiting pasture components such as protein, energy, and minerals
- using supplements containing economical levels of those components
- matching the supplement with the class of stock being fed
- supplying appropriately, to minimise disruption to the animals' digestive system
- costing the whole program, considering alternative measures
- prioritising animals with the greatest needs
- monitoring animal health, feed consumption, liveweight and fat/condition scores.



Supplementary feeding ewes with twins increases lamb survival and growth, especially when grazing low quality stubbles containing little or no grain. Photo: Tracy Lamb

# Energy

Energy is the most important requirement for all livestock and is the most common limitation during a drought or any feed-limited situation. An animal's requirement for energy is measured in megajoules (MJ) and expressed as metabolisable energy (ME) and varies depending on the weight, growth rate, breed (dorpers and other shedding breeds require less energy), wool length, weather conditions and pregnancy status. Even at the supplementary feeding stage, it is important to identify those ewes having twins as they will need more energy.

# Protein supplements

Sheep are able to selectively graze small amounts of green matter in a pasture but can also access other protein rich sources such as legume seeds/burr, other seeds and browse shrubs. As a result, they are able to access sufficient dietary protein from a drought affected pasture much longer than cattle. However, when available protein sources are exhausted, sheep can respond to both non protein nitrogen and true protein supplements. At this point it is likely that available pasture has been depleted to such an extent that producers could consider confinement feeding. Refer to [Confinement Feeding Sheep and Cattle<sup>1</sup>](#) for a comprehensive guide or refer to [Primefact 554 Confinement feeding stock<sup>2</sup>](#).

# Minerals

Late pregnant and lactating ewes are particularly prone to calcium deficiency and this should be provided as lime when feeding grain. There are specific mineral deficiencies within some areas of NSW, depending on soil type and pasture/fodders available – seek local veterinary advice.



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A barley and lupin mix is an ideal mix of energy and protein for sheep with a separate loose lick to supply calcium and other minerals.

Photo: Geoff Duddy



# Types of supplementary feed

Selecting what supplements to feed involves:

- estimating the energy and protein requirements of each class of sheep
- assessing what and how much can be met from pasture and/or crop residues (and for how long)
- calculating which available fodders are suitable, lowest cost and practical to feed
- assessing other needs, for example, calcium and fibre.

## Cereal grains

Cereal grains generally form the basis of a ration or supplement because they are high in energy and are usually readily available. Most cereal grains have an energy level of 10–13 megajoules per kilogram of dry matter (MJ/kgDM) and contain 5–15% crude protein. Grains are low in calcium, so 1.5% limestone (superfine grade) by weight must be fed with all-grain diets. Grain introduced too rapidly or eaten in excess can cause sickness and death.

## Lupins/faba beans

The high protein and energy levels in pulse grains make them an ideal supplementary feed. Their high fibre content and low starch levels make them extremely safe to feed to ruminants without the risk of acidosis. Lupins can be fed whole or cracked, but not ground, as this increases the risk of grain poisoning. Lupins are low in sulfur which can upset its balance with nitrogen and so a supplement containing sulfate/sulfur, for example, gypsum, can be added to the diet. Faba beans are harder than lupins and so cracking, plus the addition of molasses, maybe required to get stock started. Once feeding begins, they can be fed whole to sheep.

Faba beans are generally lower in protein and also have a lower bypass protein number (25% vs 10%) than lupins and so lupins are more suitable for early weaned lambs. Both of these pulses are better cracked or tempered for cattle.

## White cottonseed

White cottonseed is an excellent supplementary feed that is high in energy and protein but also provides fibre in the hulls and lint. It mixes well with grain and protein meals, but its high oil content may cause digestive upsets when daily intakes are high for extended periods, or when combined with roughages that are also high in oil such as grape marc or failed canola crop.

## Pellets

Pellets are an alternative to grain when supplementary feeding. Generally, greater care needs to be taken when feeding pellets as they convey a higher risk of acidosis as a result of the manufacturing process. Change between batches gradually by shandying components, as grain sources and other ingredients can change. Be cautious and check the ingredients if feeding cattle pellets to sheep and vice versa. Cattle pellets frequently contain higher concentrations of some additives or elements that can cause health issues or death in sheep. For example, copper rates within cattle pellets are usually higher than sheep requirements and may cause copper poisoning if fed to sheep.

## Silage

Silage is generally of a greater nutritive value than hay because it is made at an earlier stage of plant growth when energy and protein are at higher levels. Grass-based silage will maintain sheep but generally not provide an adequate diet for animal production. Silage made from a mixture of cereal and legume crops will contain more nutrients and so may support production without additional grain. Silage is used successfully for all classes of sheep and for a broad range of production levels. Chop length of silage is important—if the chop length is too long, the sheep intake will be significantly reduced. Chop length is less important if round bale silage is offered as a whole bale. Use precision chop harvesting equipment when making silage for sheep.

## Hay

Hay for sheep can be made from cereals, legumes or from pastures of grass and clover mix. Hay is an important source of roughage. Hay is usually a component of a diet for sheep and will need supplementation with grain or pellets. Refer to the beef section of this chapter for more information on estimating hay quality.



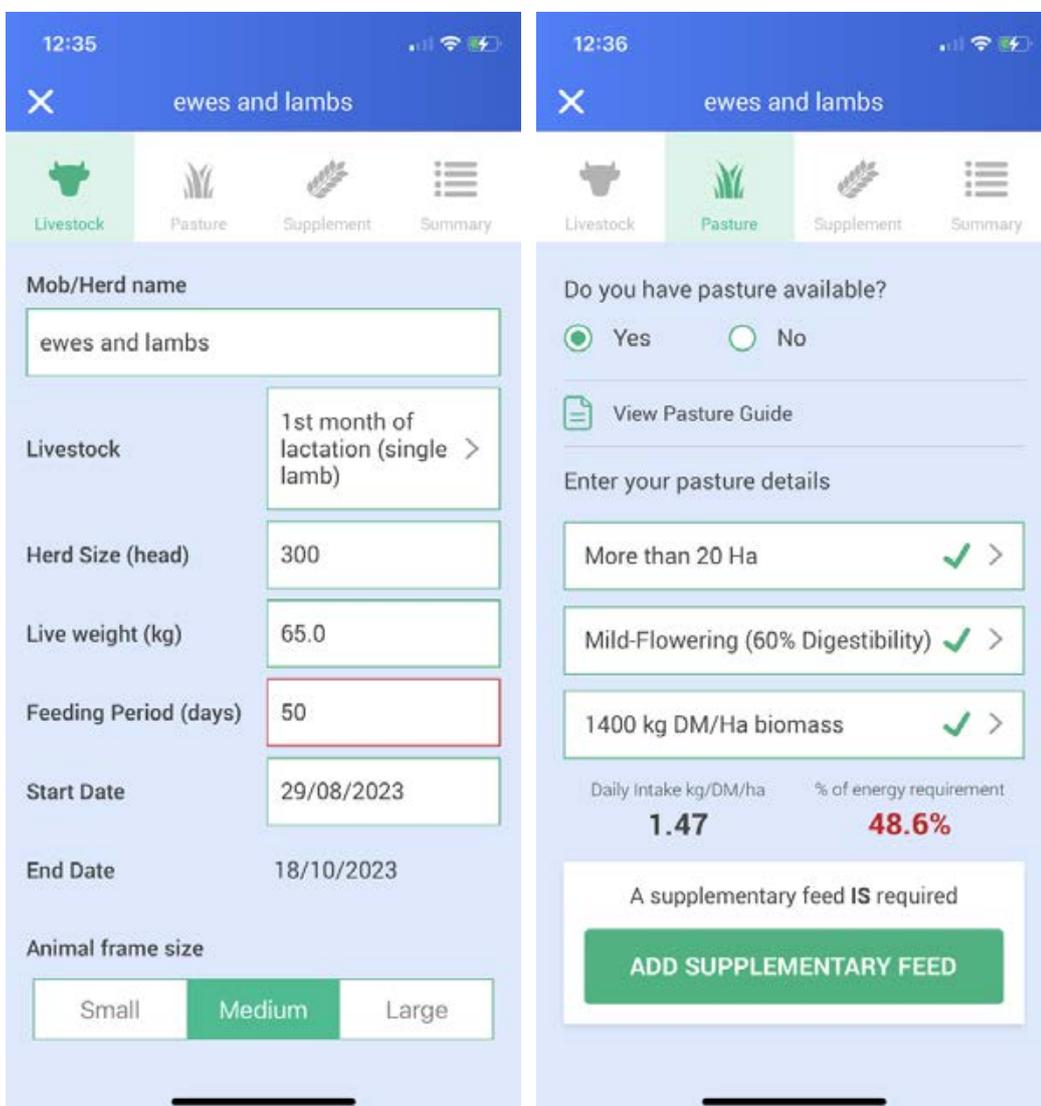
Supplementary feeding when there is limited pasture (less than 500 kg/ha in this photo) or poor quality dry feed improves animal performance.  
Photo: Brett Littler

# Drought and supplementary feeding calculator

The DPI Drought and Supplementary Feed Calculator app is a free tool to assist sheep and cattle producers to develop feed rations during times of nutritional shortages. It allows users to compare the nutritional value from 71 different feed types, calculates the individual feed quantities and auger timings needed when making single and mixed rations, and calculates the nutritional requirements for different sized mobs and livestock classes.

It also estimates pasture quality and quantity using height, density and growth stage estimates. When the livestock class is added, the app indicates whether the available pasture is providing sufficient energy or whether a supplement is required.

Users can then choose from a range of supplements with estimated feed values or use a customised feed source. When recommended supplement amounts are combined with their price, the cost effectiveness of a range of products can be compared. The app can be downloaded on both Apple and Android devices. Visit the [NSW DPI website](#)<sup>1</sup> for more information on how to download and use the app.



The NSW DPI Drought and Supplementary Feed Calculator App allows users to estimate pasture availability and livestock weight gain and to choose from a range of suitable supplements to compare costs.



# Full hand feeding of sheep

## — quantities

The quantity of feed required for full hand feeding depends on the size and stage of production of the animal and on feed quality. It is impossible to estimate feeding rates for animals without knowing the energy and protein content of the feed.

## Nutrients

Sheep, whether being fed for maintenance or production, need a balanced supply of nutrients, including:

- energy
- protein
- minerals
- vitamins.

An adequate supply of drinkable water is also vital for livestock survival, particularly during drought.

## Energy requirements for maintenance

Animals need energy, measured in megajoules (MJ), for all body functions. Animal requirements are assessed as megajoules of metabolisable energy (MJ.ME). Energy in feed is assessed as megajoules of metabolisable energy per kilogram of dry matter (MJ.ME/kg feed dry matter or simply M/D).

In drought, energy is the most limiting nutrient and this needs to be addressed in any drought-feeding program.

Sheep requirements for energy depend on:

- liveweight
- energy concentration of the feed (M/D)
- pregnancy
- lactation
- growth
- weather conditions.

## Calculating the feed requirement for maintenance

The first step in addressing the energy needs of adult sheep is to calculate the amount of feed needed to provide sufficient energy to maintain liveweight, assuming the sheep are neither pregnant nor lactating. Adjustments for pregnancy and lactation are discussed later in this chapter.

The NSW DPI Drought and Supplementary Feeding Calculator estimates the amount of feed required (both dry matter and 'as fed') for different classes of sheep by using average feed testing values for a large range of potential ration components. Alternatively, users can input values for their own feeds. The Feed Cost Calculator can be used to calculate and compare protein, energy and other components for different mixes of livestock feeds.

The following steps provide a guide to calculate maintenance feed requirements, once the energy content of the ration is known. A guide to the energy contained in various feeds is available in the Drought and Supplementary Feed Calculator. Feeds vary in both energy and protein and so a feed test analysis is recommended so that rations can be calculated accurately.

Once the energy content of the feed is known, use Figure 3 to predict the amount of feed needed to meet maintenance requirements. If several feeds are being fed concurrently, the following procedure is used to calculate the energy content of the mixed ration. Use the M/D of the mix to calculate rates from Figure 3.

### Example

A ration containing 80% wheat (13 M/D) and 20% clover hay (9 M/D). The calculation is as follows:

$$\frac{(80 \times 13) + (20 \times 9)}{100} = 12.2 \text{ M/D}$$

Find the appropriate value for 'shorn empty liveweight (kg)' for your sheep and place a ruler intersecting this liveweight and 12.2 on the Feed M/D line. The point where the ruler cuts the right hand line indicates how much dry matter needs to be fed to maintain liveweight. For a 45kg sheep and 12.2 M/D the feeding rate is 500g/hd/day of dry matter.

All feeds contain some water. Hay and grain are typically 90% dry matter, so to determine the quantity of the ration 'as fed', multiply the dry matter feeding rate by 100 and divide by the dry matter percentage.

For example:

$$\frac{500 \times 100}{90} = 555 \text{ g/h/d of the mix}$$

Note that as the energy value of feeds declines below about 7.5 M/D, it is likely that a dry sheep will be unable to consume sufficient quantities to achieve maintenance. For pregnant and lactating ewes, a feed below 9.5 and 11 M/D respectively is unlikely to be sufficient.

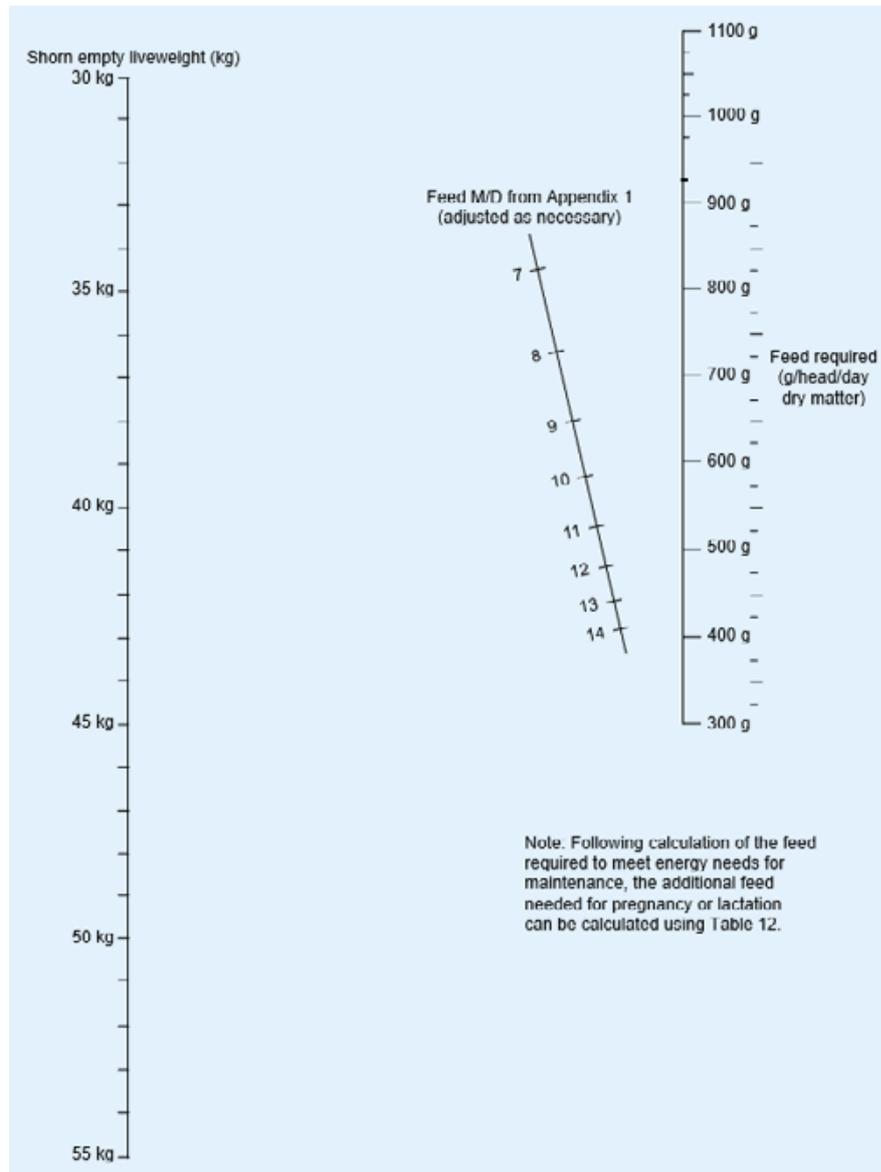


Figure 3. Daily feed (dry matter) required for the maintenance of sheep

Note: following calculation of the feed required to meet energy needs for maintenance, the additional feed needed for pregnancy or lactation can be calculated using Table 4.

Table 4. Allowances for pregnancy and lactation

	Factor	Minimum* crude protein %
Dry ewe or wether	1.0	6
Ewe flock to last month of pregnancy	1.0	6
Ewe flock during the last month of pregnancy	1.7**	8
Ewe flock – first month of lactation	2.5	12
Ewe flock – second and third months of lactation	1.8	12

\* These minimum values are shown as a guide for maintenance feeding in circumstances where feeding costs need to be minimised. For any diet, but especially one based on grain, crude protein must be adequate (see Table 5).

\*\* Feeding levels should be gradually increased to this allowance from 6 weeks before lambing.

## Energy requirement for pregnancy and lactation

Once the feed requirements for a dry sheep have been calculated, allowances can be made for the increased requirements for pregnancy and lactation by multiplying the maintenance requirement by the appropriate factor in Table 5.

The requirements in Table 5 for late pregnancy and lactation are average requirements and assume a flock consisting of both single-bearing (70–80%) and twin-bearing (20–30%) ewes. Individual ewe requirements vary around this average. For example, ewes at the peak of lactation rearing twins need about 3.3 times maintenance but within a flock, ewes vary in their stage of pregnancy and lactation and the factors in Table 6 are the best indication of flock needs.

Table 5. Maintenance feed requirements ('as fed') for full hand feeding of sheep

Stock type	Feed options: Minimum weight (kg) per day 'as fed'					Expected weight gain/day
	Grain only (12ME)	Hay only (8.5ME)	50:50 Grain: Hay	80:20 Grain: Hay	Silage (35% dry matter 9ME)	
Weaner (20 kg)	0.62	1.08	0.80	0.68	2.54	0.1kg
Weaner (30 kg)	0.76	1.32	0.98	0.84	3.09	0.1kg
Adult dry stock (50 kg)	0.65	0.99	0.79	0.7	2.37	Nil
Ewes, Last 6 weeks of pregnancy (50 kg)	1.1	1.68	1.33	1.18	4.02	Nil
Ewe and Lamb to one month (50 kg)	Not Suitable	2.46	1.96	1.74	5.91	Nil
Ewe and Lamb to 2 or 3 months (50 kg)	Not Suitable	1.77	1.41	1.25	4.26	Nil

Table 6. Predicted feed and minimum protein requirements for merino weaners

		Weaner Liveweight									
		10 kg		15 kg		20 kg		25 kg		30 kg+	
Growth target	M/D	Feed g/d	Protein %	Feed g/d	Protein %	Feed g/d	Protein %	Feed g/d	Protein %	Feed g/d	Protein g/d
Maintain weight	8	Feeding to maintain weaners below 20kg is not recommended				510	8.7	590	8.7	680	8.7
	9					440	9.5	510	9.5	590	9.5
	10					380	10.0	450	10.0	510	10.0
	11					340	10.8	400	10.8	450	10.8
	12					300	11.5	350	11.5	400	11.5
	13					270	12.5	320	12.5	360	12.5
50 g/d	10	350	14.5	450	13.0	560	11.8	610	11.1	770	10.4
	11	300	16.3	400	14.0	490	12.9	580	12.0	660	11.6
	12	260	18.7	350	15.4	430	14.0	510	13.0	580	12.5
	13	240	19.5	310	16.7	380	15.2	450	14.1	510	13.6
100 g/d	11	420	17.9	540	15.1	660	13.5	780	12.3	880	11.7
	12	360	20.2	460	17.0	570	14.9	670	13.6	760	12.8
	13	330	22.4	410	18.4	500	16.3	590	14.7	670	13.8
150 g/d	12	470	20.5	590	17.5	710	15.5	840	13.8	950	11.8
	13	420	23.4	510	19.5	620	16.9	730	15.1	830	13.9

## Energy requirements for weaners

Energy and protein are important to achieve adequate performance from weaned lambs.

Table 6 predicts the daily amount of feed of a specific M/D required to achieve a given growth rate in merino weaners. The minimum crude protein requirement for each situation is also shown.

The rate required varies according to the M/D of the feed, the current weight of the lamb and the required weight gain.

Example: for a 15kg weaner to achieve 100g/hd/day weight gain on a ration with 12 M/D the required feeding rate will be 460g/hd/day at a minimum crude protein requirement of 17%.

If a feed M/D is not shown in the table it means that feed of that energy concentration would be unsuitable for the intended liveweight and weight gain. This is because weaners of that weight would reach their intake limit before sufficient ME is consumed to achieve that growth rate target.

Young weaners also need roughage as part of their diet to encourage continued rumen development. This should comprise at least 20% of the total ration and preferably be a high-quality legume hay.

## Energy allowance for chill

Chill (the combination of wind, low temperatures or rain, or both) can significantly increase the energy requirements of sheep. For example, freshly shorn sheep will need at least double the calculated feed requirements if wind conditions approach 15km/h and daily minimum and maximum temperatures are in the range of 0–10°C.

The same sheep, in calm conditions experiencing similar temperatures, require only 60% more than the calculated feed requirement.

For sheep off-shears, 20% more feed will be a minimum requirement even in relatively mild conditions. Chill can significantly influence energy requirements until fleece length exceeds 3 cm.

Good-quality hay is the best source of extra feed during cold stress periods as there is no risk of grain poisoning from increased feeding rates and digestion occurs over a longer time frame, which raises the body temperature for longer. Ad lib feeding is necessary to achieve maximum intake.

Lupins are the only grain that can be fed at rapidly increased quantities without risk of acidosis (grain poisoning). Cottonseed can also be fed ad lib without risk of acidosis in these situations.

## Protein

Rapidly growing sheep or lambs and ewes in late pregnancy and through lactation, have greater needs for protein than do animals just maintaining weight. The amount of protein required must also balance the energy content of the diet if rumen fermentation is to have the greatest efficiency.

Much of the protein in feed is reduced to ammonia in the rumen. Ammonia is then used as a nitrogen source by rumen microbes to construct new protein. It is the flow of microbial protein to the true stomach and intestine that provides the majority of digestible protein to ruminant animals.

Table 7 lists the minimum crude protein requirements for various classes of mature sheep. Table 6 lists the requirements for weaners. The Drought and Supplementary Feed Calculator shows average protein levels for various types of feeds.

If more than one feed is being fed, the following procedure is used to calculate the protein content of the mixed ration.

For example, a ration containing 80% wheat (14% protein) and 20% lucerne hay (16% protein), the calculation is as follows:

$$\frac{(80 \times 14) + (20 \times 16)}{100} = 14.4\% \text{ protein}$$

Although Table 4 indicates relatively low minimum protein requirements for various types of sheep, it may be financially viable to use feeds with a better balance between energy and protein. To do this, you may need to increase the protein proportion of some diets according to the suggested protein contents in Table 7.

Oat grain is a common feed that is often unbalanced for protein. Oat grain can often be at least 11 M/D but only 8% crude protein (CP). Referring to Table 7, it is clear that these oats would need to be 14% CP to be balanced. Some other source of protein or nitrogen could be mixed with the oats to raise the CP of the diet. Lupins are often fed with oats for this purpose.

The benefits of balancing the protein in the ration would come from either increased productivity from the same amount fed, or feeding less for the same level of productivity. For maintenance feeding, the required rate may only be reduced by 10% so the financial viability of adding another source of protein to the grain will depend on the relative cost of feeds (particularly protein-rich feeds). If high levels of production are expected (e.g. finishing lambs), the viability of adding extra protein is likely to be better due to the higher value product. Each circumstance needs to be evaluated on its individual merit.

Table 7. Crude protein required to maintain a balance between energy and protein

Energy content of diet (M/D)	Crude protein requirement* (%)
13	16
12	15
11	14
10	13
9	11.5
8	10
7	9

\* Assumes 70 percent rumen degradability.

## Urea as a protein supplement

Urea, while not a protein, will form ammonia for use by rumen micro-organisms. Adding 1% of urea by ration weight to the diet will increase the overall crude protein by 2.6%.

**Warning: urea is toxic if fed at too high a rate and is not recommended to be fed to lambs.**

Sheep should receive a maximum of 3 g of urea per 10 kg of liveweight. The percentage added to the ration will be determined by the intended feeding rate. A dry sheep of 50 kg may only need 500 g of feed per day and can safely consume up to 15 g of urea. This equates to 15 g in 500g or 3%. A 25 kg weaner can only consume 7.5 g of urea per day and if eating 800g of feed per day the appropriate maximum urea concentration would be only 1%. If allowed ad lib access, that same weaner may eat up to 1200 g per day and the safe urea rate would be limited to around 0.6%.

Urea concentrations above 2% are likely to depress diet intake. Urea supplementation will only be effective if:

- there is a good supply of energy but protein is limiting
- sheep are fed daily or through self-feeders.

Urea is toxic, so it is important that it be properly mixed into the feed, as concentrated pockets of urea will kill stock. The preferred method of mixing urea with feed is to dissolve it in hot water and spray the solution onto grain when augering or filling the feed bin. The rate will depend on the concentration of the solution and the speed and size of the auger.

## Minerals

Six major minerals and seven minor minerals are important to sheep production. However, only two—calcium and sodium—are needed as extra supplements during full hand feeding. Calcium is deficient when diets consist mainly of cereal grain. To prevent calcium deficiency, add 1.5% by weight of ration of finely ground agricultural limestone (calcium carbonate) to cereal grain. For every 100 kg of grain, add 1.5 kg of limestone. Do not use builders lime, burnt lime or slaked lime.

Spread lime onto grain when filling the feed-out bin. Lime is not lost when feeding-out as the fine particles stick to the grain.

Sodium is also deficient in most grains. Add 0.5% of fine salt to grain diets to prevent a deficiency.

Water can often be a source of sodium. More salt is not needed if the water has high salt levels. The likelihood of any other mineral being deficient is low.

## Vitamins

Vitamins A and E are the only vitamins likely to be deficient as a direct result of drought feeding. Vitamin A is obtained from green pasture, hay with good green colour and yellow maize. Even a short green pick will supply adequate quantities of the vitamin.

Vitamin A is stored in the liver. Young sheep usually experience deficiencies when they have been without green pasture, green hay or yellow maize for six months and adults will be deficient after 12 months. Symptoms are night blindness, eye discharges and ill-thrift.

There is a relationship between vitamin E and selenium. Grains and hays are fair to good sources of vitamin E, although there is considerable variation.

A vitamin E deficiency induces symptoms similar to selenium deficiency (that is, still-born lambs and older lambs that suffer from a stiff, stilted gait, lameness and arch back). If you suspect a deficiency, seek veterinary advice for confirmation and dose rates.

The best solution is to administer a Vitamin A,D,E injection that will alleviate the problems for some months.



Ewes in a confinement feeding area being fed a mixed ration. Photo: Phil Cranney



Weaner sheep in containment feeding area being fed legume grain. Photo: Lauren Adler

# Full hand feeding of sheep— feeding management

Full hand feeding may be required as a result of an emergency situation including drought, flooding or bushfire where there is limited pasture for livestock maintenance. If preparing for a drought situation, it is important to carefully consider the available drought strategies. Keep in mind that as the drought progresses, your options for action decrease.

Making a decision about drought strategies will require assumptions to be made about drought length, stock prices and feed costs. Always use the best available information to support these assumptions and when new information becomes available use this to re-evaluate your current plan.

It is essential to develop a series of budgets ranging from the best case to the worst-case scenario to help you choose the most cost effective strategy. Keep in mind that under-estimating drought length will usually be a more costly mistake than an overestimate because of the different strategies that would be put into place.

## When to start feeding

In practice, feeding is likely to have started as part of the supplementary feeding phase, ensuring sheep weights are well above those indicated in Table 8, on page 121.

The level of supplementation should gradually be increased to a full drought ration just prior to animals reaching the desired weight or fat score target.

If no supplementary feeding has occurred, feeding should start earlier, when animals are 3–4 kg above the desired maintenance weight to allow for additional weight loss during grain introduction.

Table 8 shows the minimum liveweight for various types of sheep (based on frame size) at which dry sheep should not be at risk. These weights should ensure sheep are maintained at a fat score of 1.



Ewes in a confined feeding area after a flood, with access to ad lib hay and a grain ration for maintenance.

Photo: Tracy Lamb

Productive sheep (breeding ewes) should be maintained above these weights. Fat scores in the range of 2–3 (especially if sheep are pregnant or exposed to cold conditions) should be the minimum objective.

If a long period of cold weather is anticipated, set target weights 5 kg heavier to allow a greater safety margin.

Note: if fat score 1 is the target, the lightest, worst-conditioned animals in the mob may need to be separated and fed earlier than for the average.

Table 8. Minimum liveweight for shorn adult sheep in drought.

Animal class	Minimum liveweight (kg)
South Australian merino, crossbreeds, British breeds (65 kg at 3 fat score)	50
Shedding sheep breeds (65 kg at 3 fat score )	50
Peppin-type merino and large frame fine wool merino (55 kg at 3 fat score)	40
Smaller framed fine and superfine wool merino (45 kg at 3 fat score)	35

## Training sheep to feed

It is good practice to include in the mob some sheep that have been fed previously. This encourages the inexperienced sheep to feed.

Untrained sheep are best educated in small paddocks. Start by scattering a highly palatable fodder such as lucerne or clover hay to encourage sheep to start feeding. Holding sheep near to the feed may also be necessary. Do not feed the sheep again until most of the hay is eaten. When the sheep are readily eating the hay, introduce a small quantity of grain (see Table 9).

A general policy of educating lambs to grain feeding prior to weaning (even in good years) will eliminate the often laborious and time-consuming task of starting sheep to feed. It has been shown that lambs that see their mothers eating from a grain trail will more readily adapt to hand feeding, even if some years pass before they are fed again. Just three to four feeds with their mothers with the grains most likely to be fed at some time in the future will be sufficient.

## Monitoring the feeding program

Woolly sheep often look in much better condition than they really are. The weight of animals ignores the fact that sheep can be heavy because of large frame size but may carry little in the way of fat reserves. Manually assessing fat scores helps to put the liveweight into the context of a fat score target. Changes in fat score and liveweight provide an objective method to determine the adequacy of existing feeding levels. Feeding decisions based on fat scoring and liveweights will ensure more efficient use of feed.

Monitor a small portion of the mob on a regular basis. Fat scoring and weighing 50 sheep from a mob of 500 will show if there has been a change within the mob. It is important that these same sheep are assessed on each occasion.

Refer to NSW DPI Prograze Manual, Ninth Edition Segment 4; [Sheep Breeding Package](#)<sup>1</sup> on the technique of fat scoring sheep and lambs.



## Pregnant ewes

Special attention needs to be given to the nutrition of pregnant ewes to prevent mortalities. To ensure adequate lamb birth weights and ewe mothering ability, pregnant ewes should be at least fat score 2 throughout pregnancy and preferably score 3. Although placental development takes place in the first three months of pregnancy, ewes will be adequately maintained with a ration suitable for a dry sheep of the same weight.

Growth of the foetal lamb accelerates during the final six weeks of pregnancy and the feeding rate needs to be increased accordingly. The total increase in weight of the conceptus (including the foetus) during the last six weeks of pregnancy amounts to about 10kg for ewes with a single lamb and more for a mother with twins. Ewes need to increase their gross liveweight by this amount if they are to maintain their own body condition.

Lamb birth weights of over 3.5 kg will ensure good survival rates. However, this is unlikely to occur in drought. Under-nutrition during late pregnancy reduces mothering instincts of ewes. In these circumstances, it is common to see ewes abandoning their lambs shortly after birth.

Splitting mobs into early and late lambers, or according to twins and singles, will enable more precise feeding and will potentially save on the cost of feed.

## Lambing management

Good management in later pregnancy is still no guarantee of live lambs at weaning. Increased feed requirements after lambing will enable good lactation and lamb survival.

The main causes of lamb deaths during drought are usually a combination of two or more of the following:

- mismothering
- starvation
- exposure
- delayed or difficult birth.

Ewes in the later stages of pregnancy and newly born lambs should be closely monitored to minimise the chance of lamb deaths.

A maximum stocking density of 18 ewes per hectare is a reasonable guide for a mixed mob containing single- and twin-bearing ewes and 10 ewes per hectare for twin bearers.

Select lambing paddocks well before lambing starts. Concentrating dry and pregnant stock onto smaller areas will allow lambing paddocks to be locked up early, which may save some pasture for lambing. It may also help avoid hand feeding during lambing, which will reduce the risk of mismothering.

Generally, it is the less vigorous lambs that are mismothered. Adequate feeding during the pre lambing period can reduce this. Self-feeders, spreading legume grains across the paddock or daily feeding can help to reduce the problem. Early afternoon feeding reduces the risk of mismothering.

The right paddock and small mob sizes will reduce the incidence of mismothering. Choose small paddocks free of gullies and dense or fallen timber.

## Ewes and lambs

After lambing, energy and protein requirements increase dramatically. While grain alone is satisfactory for dry and pregnant animals, roughage is needed to ensure better milk production from ewes. Save your best quality hay for lactation.

Lamb survival and growth are improved if there is at least 20% good-quality hay in a grain based diet.

Silage can also be used as a roughage source. If oat grain is chosen, its high fibre content is likely to be sufficient without extra hay. However, oats are often below 10% crude protein and it is important that diets for lactating ewes contain at least 12% crude protein.

Maintain lamb growth rates above 100 g a day for lambs from smaller framed ewes and 150 g a day for large-frame ewes to improve survival rates. Creep feeding<sup>1</sup> of lambs is a useful tool to improve the weight gain of lambs and ensuring the minimum weight gains are reached.

The nutritional requirements for lactating ewes are described in Table 4.

## Weaning

Lambs should be fed grain and hay supplements while they are still on their mothers. If lambs are not 'trained', it will take up to three weeks to bring weaners onto adequate quantities of hay or grain. During that time, substantial weight loss and deaths may occur.

Weaners require high quality rations but have relatively low intake. Weaning lambs early can achieve more efficient use of limited feed resources. Early weaning will also maintain higher ewe condition, increasing conception rates at the next joining. Lambs can be weaned successfully if they are a minimum of 8 kg and are at least eight weeks of age.

## Weaners

Weaners' weight gain should be enough to achieve 20–25 kg by six months of age depending on frame size. Once weaners reach this weight it is acceptable to reduce feeding rates to maintain this weight, but a modest weight gain is preferable.

Incorporate roughage into weaner diets early in the post-weaning phase. Use a high quality hay comprising at least 20% of the ration. Young sheep have a higher need for protein than older dry ewes and wethers.

Consider finishing prime lamb weaners through a feedlot. A realistic budget is the first step in this process as it may be more profitable to sell the lambs as stores and retain valuable feed supplies for other stock.

## Sheep health

There are a number of conditions that occur more commonly when drought-feeding or after an emergency event, especially when sheep are congregated on small areas for feeding. Some of these conditions and prevention and control recommendations are discussed in more detail in Chapter 5 Animal welfare and management. Many diseases in sheep are orally transmitted including salmonellosis, worms, coccidiosis and Johne's disease. The spread of these diseases can be minimised by avoiding faecal contamination of feed and by regularly changing the areas in a paddock where sheep are fed or feeding on troughs.



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Good quality feed and water are important for animal health. While other factors interact to affect an animal's susceptibility to disease during drought, the risks can be minimised by good management and the use of preventative treatments:

- control internal parasites (including fluke where relevant). Monitor sheep worm levels with egg count tests prior to entry
- 5-in-1 vaccination to prevent clostridial diseases; 6-in-1 to include cheesy gland in sheep; 7-in-1 to include leptospirosis
- vitamin treatments

Discuss these and other possible health treatments with your local LLS District Vet or private veterinarian.

## Shearing

When shearing, consider how long the sheep will be without feed. Minimise stress associated with shearing especially for pregnant ewes. Sheep need more feed after shearing so more frequent feeding may be required. If extra feed is needed, good quality hay is the best alternative as it avoids digestive upsets.

Provide shelter for sheep after shearing as all sheep are at risk from exposure. Off-shears losses during drought can be severe. Shelter sheds, sheep coats and sheltered paddocks can all reduce the risk. A well-sheltered and timbered paddock with a north or north-easterly slope with no exposed hills provides protection from high-risk winds. Sheep are less affected by chill once wool length is 3 cm.

## Stock culling priorities

Reducing sheep numbers is the simplest way of making the available feed go further. As the drought progresses, it is probably worth keeping only the most productive sheep, that is, those that you anticipate will contribute greatest to cash flow following the drought. Following is a list of priorities for the disposal of sheep:

- all unthrifty sheep and sheep in poor health including those with confirmation faults (for example, poor mouths and feet, damaged udders) and diseased sheep
- cull weaners and shy feeders
- wethers and aged ewes
- dry ewes
- weaners
- quality breeding stock.

Good-quality breeding ewes and rams are the most valuable sheep at the end of the drought and will need special care if breeding programs are to be maintained.

Making hard decisions and selling stock while they are in good condition minimises the difference between selling price and buy-in price after the drought.

## When the drought breaks

Often the heaviest sheep losses are sustained following drought-breaking rain. Prolonged wet conditions turn sheep off their feed and grain being fed on the ground may largely be wasted. As soon as the first green pick emerges, sheep will often chase this and go off their ration. It is essential that sheep be kept confined to the restricted feeding areas until adequate pasture is available. At that point, allow increasing grazing time each day until full grazing is provided after six to seven days. Allowing immediate full grazing can lead to digestive disorders.

## Grain introduction

When introducing sheep to grain and pelleted diets, there is a significant risk of grain poisoning or acidosis. It is the high starch content of most grains that causes the problem. Lupins, which are low in starch, are the exception and are useful when animals need immediate introduction to a high-energy diet.

Slowly introduce sheep to high-grain diets according to the schedule shown below in Table 9. It is useful to use hay in addition to the recommended rate of grain to get animals eating. The amount of hay can be reduced to nil over the introduction period.

Note: if sheep show symptoms of grain poisoning, return to the next lowest level of feeding for two to three days and treat individual animals for grain poisoning. Adding 2% sodium bentonite or 1% salt to grain rations helps to reduce the risk of poisoning during grain introduction.

Table 9. Grain introductory program

Days	Amount of grain grams per head	Frequency of feeding
1 and 2	50	Daily
3 and 4	100	Daily
5 and 6	200	Daily
7 and 8	300	Daily
9, 10 and 11	370	Daily
12, 13 and 14	430	Daily
15 and 17	860	Every 2nd day
19, 22 and thereafter	1290	Every 3rd day

## Changing grains, nuts or pellets

Sheep that are accustomed to one type of grain cannot immediately adjust to another. A sudden switch in feeds can result in deaths and a high incidence of tender wool. Even the same grain type obtained from a different source can cause losses.

Manufactured feeds can also cause grain poisoning, as the manufacturer may change the major grain ingredients or change the processing procedure from one batch to the next.

If it is necessary to use a different grain/pellet, arrange the supplies early and mix the old grain/ pellet with the new, gradually increasing the concentration of the new grain/ pellet over at least four feeds.

Sodium bentonite, salt (as outlined above) or other buffers/ rumen modifiers can be used to reduce the risk of grain poisoning during the change.

## Frequency of feeding

Frequency of feeding is determined by the physiological state of the sheep, type of feed and availability, the capacity of troughs and self-feeders, and also the risk of feed losses through rain, birds and other animals. Feed dry sheep, and ewes up to the last four weeks of pregnancy, twice weekly as it gives better results than more regular feeding. However, ewes in late pregnancy or during lactation and young weaners require daily feeding or a constant supply of feed from self-feeders. These sheep are commonly fed both hay and grain on alternate days.

## Feeding methods

### Feeding in a confined area

The most convenient feeding method is to have a designated feeding area where stock will be confined in either small paddocks or pens and fed a full and complete ration. These sites can be used in drought conditions or when pastures are affected by other emergencies such as fire or flood.

Benefits include:

- reducing stock energy requirements by less walking to feed and water
- quicker and easier feeding of livestock
- sheep health and weight can be easily monitored
- weeds and pests from introduced feed can be monitored and managed
- maintaining paddock groundcover which will reduce erosion
- protects valuable pasture and soil assets, allowing for rapid recovery after rain.

Troughing or some form of feed bunk is required in confinement feeding areas to separate the feed from the ground to reduce wastage and animal health issues. Trail feeding on the ground is not recommended for confinement feeding as the risk of livestock ingesting soil is considerable and the quantity of feed wasted is substantial. Refer to this comprehensive [Guide to Confinement feeding of sheep and cattle<sup>1</sup>](#) or refer to [Primefact 554 Confinement feeding stock<sup>2</sup>](#).

### Trail Fed

Grains can be fed by trailing on the ground, particularly the larger grains (for example, corn), which are easily picked up by sheep. Trailing is not advisable when the ground is cracked, excessively dusty or waterlogged. To reduce the risk of weed contamination from purchased grains, feed out on the same area so that any weeds that do germinate can be easily controlled.



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### Troughing

Low-cost troughs can be made from surplus farm materials including corrugated iron between steel posts, timber or rubber belting. If using salvaged industrial materials ensure that there is no risk from chemical residues.

It is advisable to feed meals and fine materials in troughs. Trail length and trough space depend on the size and number of sheep, and the amount of ration being fed out. If you are using small daily feeds, allow up to 15 cm of double-sided trough for large-framed sheep. With less frequent feeding, allowances can be reduced to 7 cm.



2

### Self Feeders

Self-feeders have the advantage of feed being available 24/7 and have a reduced labour requirement, as less time is spent feeding out compared to trough feeding systems. Self-feeders do not generally need to be filled every day and may allow twice a week feeding if their capacity is sufficient. There can be issues with blockages and restricting sheep to set amounts can be challenging.

Feed lambs and weaners from troughs with hay placed in hay racks. When feeding hay on the ground, break bales open and scatter them widely to allow ready access. Rolling out round bales will improve accessibility.





## Ration processing

Hammermilling, cracking or soaking grain is not necessary for sheep. All sheep, including young weaners, can digest whole grain without wastage. Hammermilling increases the risk of grain acidosis if animals are likely to gorge. Processing lupins and faba beans may assist with their introduction and acceptance when first introduced.

## Shy feeders

Up to 10% of sheep and lambs may not adapt to grain feeding. The proportion depends on age, previous feeding history, ration, feeding frequency and mob size. The best solution is to remove and feed shy feeders separately. Some of the shy feeders will eventually eat the ration. Those that do not can be fed with good-quality hay or pasture (if available) or sold.

Left: Sheep troughs can be used to feed grain or pellets as part of drought or other emergency feeding plans. Ensure adequate trough space to allow all animals to feed.

Right: Feeding sheep off the ground reduces wastage and disease. However, the trough pictured is too high for some sheep, affecting feed access and intake. Photo: NSW DPI Image library



Shy feeders are a challenge when full feeding commences. These sheep not eating from the trough should be identified and removed from the mob (Note: these sheep did not eat from the trough or from the hay while being observed) Photo: Brett Littler

# Feeding dairy cattle

Herd numbers and feeding levels must be constantly assessed during feed shortages. Reduce stocking rates by agisting, culling and selling, to cope with feed shortages. However the herd is managed during feed shortages, grouping stock according to feed priorities is important.

## Groups of stock

Early-to-mid lactation milkers are the main income earners and require high intakes of good quality feed to maintain moderate to high levels of production. These cows are the most responsive to improved feeding levels and will suffer the most from restricted or poor quality diets. Underfed cows will be difficult to get back in calf, and their milk production is less likely to recover once the season breaks and there is pasture available.

Late lactation stock partition feed to body weight rather than milk. They should be maintained at a minimum condition score of 4.5 to 5.0 (on a 1 to 8 scale). Check joining and pregnancy test records to determine dry off dates. It is usually more profitable to keep cows in the milking herd and feed them well until dry off date, rather than putting them in the dry paddock. Stock with long dry periods can be fed a maintenance ration.

Springers should be maintained in good condition and fed a transition diet for 14–21 days prior to calving. This will help reduce calving problems and prepare the cow for the demands of early lactation. Springers in poor condition that are expected to calve within two months require supplementation to gain weight while those in moderate to good condition should be maintained.

Unmated heifers are the future milkers. It is essential to determine the minimum numbers required for a replacement program and to feed and manage them appropriately. Weaners should not be fed a maintenance ration for an extended period of time, as this will reduce their lifetime milk production and fertility. If fed a maintenance ration they should be left unjoined.

Calves can be fed a milk replacer once they have received colostrum for the first 24 hours. They may be weaned from milk onto dry feed at 4–6 weeks providing they are eating 0.5 kg to 0.75 kg of high protein concentrates daily.

## Reducing stock numbers

Even if cattle prices are low, it is often more economical to sell sub-standard stock during feed shortages than to feed them. Selling low producers, problem cows and other secondary stock early and in good condition reduces feeding costs while generally also recouping better prices. The availability and cost of agistment depends on the extent and duration of the dry spell.

Agistment considerations

- Prevent unwanted joining
- Springers brought home before calving
- Safe paddocks to prevent accidents and to stop stock from straying
- Biosecurity threats from other livestock and properties

# Stock husbandry

- When there is no paddock feed, confining stock to small paddocks allows better supervision and reduces the amount of energy the animals expend walking. Providing shade in summer and shelter in winter reduces the amount of food used for thermal maintenance.
- Ensure proper and sufficient water supplies at all times. Dairy Australia have a Stock Water Budgeting Tool to help dairy farmers assess the risk of running short on stock water at key times of the year.
- Separate stock into production groups or weight groups to improve feeding schedules. Young stock should be separated from older stock to prevent bullying and ensure adequate feed intake.
- Stock stressed by drought conditions have an increased susceptibility to internal and external parasites. If infected they require treatment, but care should be taken to avoid stress on weak, underfed stock.
- Ensure that all stock are protected against clostridial diseases, for example, blackleg and pulpy kidney.
- Cows calving in poor condition require close supervision to reduce problems associated with calving difficulties and metabolic disorders.
- If necessary, appropriate veterinary treatment must be provided, or where necessary to prevent suffering and distress, humane destruction should occur. For more detailed information on the humane destruction of stock download the [Primefact 310 Humane destruction of stock fact sheet](#)<sup>1</sup>.

## Further resources

The Dairy Australia website provides information on the following emergencies:

- Preparing for floods: Highlights the key priorities, for example, evacuation points, stocking holding areas, farm infrastructure
- Managing in wet conditions: Strategic and practical advice on animal health issues and nutrition
- Preparing for bushfire: Preparation, response to and recovery from bushfires.
- Drought Support: Feed Budgets and Farm Business Management Plans are provided along with key agency contacts
- Managing in Hot conditions: 'The Cool Cows: Strategies for Managing Heat Stress in Dairy Cows' booklet provides options to mitigate the impacts of hot weather and heatwaves



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# Water requirements for sheep and cattle in emergencies

A good supply of clean water is important for animal welfare but also performance, as low availability or poor water quality can hinder feed intake, animal growth and contribute to ill health. The potential issues associated with water supply and quality depends on the nature of the emergency and so the impacts of drought, flood and fire are covered in this section.

The amount and quality of water required varies between species, class and environmental/pasture conditions (Table 10 and Table 11). As a result, the suitability of water for stock use is determined by the following factors:

- water quality, which includes salinity, acidity, toxic elements and compounds, and algal growth
- environmental factors such as air temperature and feed quality
- animal factors including breed, age, condition and class of stock

## Water quality

Water quality is broadly defined as its fitness for consumption by livestock, to maintain satisfactory production. The principal factors affecting water quality are as follows.



A lactating cow eating dry, coarse grass during summer requires up to 100L per day.  
Photo: Todd Andrews

# Salinity

The main factor that determines the suitability of water for stock is the proportion of dissolved salts in the water. Dissolved salts in water are expressed in milligrams per litre (equivalent to parts per million – ppm) or in terms of the electrical conductivity of the water, measured in decisiemens per metre (dS/m) or microsiemens per centimetre (µS/cm).

Maximum advisable levels are shown in Table 11.

(1 dS/m = 1000 µS/cm = approx. 640 mg/L or 640ppm.)

Table 10. Average water requirements of stock

Stock type	Consumption Per head per day (L)
Sheep	
• Weaners	2-4
Adult dry sheep	
• grassland	2-6
• saltbush	4-12
Ewes with lambs	4-10
Cattle – lactating cows	
• grassland	40-100
• saltbush	70-140
Young stock	25-50
Dry stock (400kg)	35-80
Horses	40-50

#### Notes

- Figures quoted for consumption have a wide range; this variation is explained in the text.
- When planning water supply requirements, allow for evaporation losses and consumption by native and feral animals.

For further information on estimating farm water supplies, with a view to developing a ‘water budget’ for stock based on requirements listed above, refer to [Primefact 269 Stocktaking water supply for livestock<sup>1</sup>](#)

Table 11. Tolerances of livestock to total dissolved solids (salinity) in drinking water (mg/L)

Stock	Desirable maximum concentration for healthy growth	Maximum concentration at which good condition might be expected*	Maximum concentration that may be safe for limited periods*
Sheep	5,000	5,000-10,000	10,000-13,000
Beef cattle	4,000	4,000-5,000	5,000-10,000
Dairy cattle	2,500	2,500-4,000	4,000-7,000
Horses	4,000	4,000-6,000	6,000-7,000

\* The level depends on the type of feed. Adapted from Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000.

Surface waters are generally low in salts compared with artesian or underground water. Many factors influence the concentration of salts that animals can tolerate in their drinking water. Salinity increases the intake of water by animals, partly through the taste and partly to allow greater water turnover so that the body can regulate the salt balance.



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## Acidity or alkalinity (pH)

Water with a pH value below (acid) or above (alkaline) 6.5 can cause digestive upsets in stock, resulting in rejection of the water, depressed appetite and consequent loss of production. If this problem is present, animals may perish, even when they have available water.

## Toxic elements and compounds

Water is a potential source of important minerals and other compounds. However, the concentration of these substances can reach toxic levels, particularly in underground water. High concentrations of iron, magnesium, arsenic, lead, mercury, selenium and fluorides can lower livestock productivity.

Bushfires can lead to degraded water quality, particularly if there is heavy rain soon after the fire. Ash and sediment washed into dams and rivers can contain high concentrations of nutrients (eg phosphorous and nitrogen), heavy metals (eg manganese, iron, copper and zinc), suspended solids (turbidity) and sulphates. Higher water temperatures can also lead to algal blooms.

## Algae growth or bloom

Algae occur naturally in both fresh and brackish waters. They respond to sunlight and nutrients, and when environmental conditions are right, algal growth can make water unpalatable to stock.

An algal bloom results from explosive population growth of particular algal species and is most likely to occur when the water is still, warm, and contains high nutrient levels. All algal blooms can cause water use problems however those caused by some blue-green algae can be toxic. More information is provided on the [NSW DPI website](#)<sup>1</sup>



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Depleted dams should be monitored closely during drought and after fires as they can quickly become unacceptable to stock due to dust, ash and nutrient buildup, sometimes also resulting in algal blooms.

Photo: Todd Andrews



## Blue-green algae

Blue-green algae blooms are more likely to appear in warmer months during drought, when water levels in dams are low and watercourses stop flowing and when contaminated with manure or fertiliser. Ingesting large amounts of algal toxins can cause liver damage and death in stock. Lower toxin doses may result in jaundice and photosensitisation. Photosensitisation results in sunburn, particularly of the face, ears and white-haired parts of the body, so it is important to provide adequate shade for affected animals. Veterinary treatment may be required to help the liver to recover.

Blue-green algal blooms are not always toxic but this is more likely during a rapid build-up phase or as the bloom is disintegrating. Problems may occur when algae is concentrated on the shore of a dam if this is where stock drink although they will normally avoid affected water if they have an alternative. If stock are reluctant to drink, it may be because of the presence of blue-green algae and an alternative supply should be provided if possible. Water can be tested, but because toxicity can vary considerably from day to day, the situation may change before or after sampling.

If a bloom is suspected, provide an alternative supply of water for domestic, stock and irrigation use until the algae is identified. If there is no alternative for stock and irrigation use, then use water from deeper in the river or dam, or from areas not covered by scum as these may be less contaminated. It may also be possible to allow stock to drink from an area on the upwind side of the bloom if the bloom is localised. Aeration of dam water can help control algal blooms.

Products are approved for the control of blue-green and some other algae, including Coptrol Aquatic Algacidel® and Cupricide®. These products are registered for use in farm dams, rice paddies and irrigation conveyance systems but must not be used in rivers, streams, creeks, wetlands, lakes or billabongs, and water treated with these products must not be allowed to spill into these water bodies. They cannot be used when birds are feeding on algae or in water containing fish. Read the label to be aware of appropriate safety equipment and other restrictions such as not treating water used by farm animals grazing on heliotrope or ragwort.



Steers cooling off and drinking in a lagoon with a blue-green algal bloom. Not all blooms are toxic, although this can change quickly. Stock generally avoid toxic water if there is an alternative. Photo: Jim Kerr

# Environmental factors

## Temperature

Animals use more water for evaporative cooling in hot weather. For example, shearing increases the heat load on sheep in summer because the insulation formerly provided by the fleece is lost. Sheep adjust to this heat load by increasing evaporative cooling through panting.

Water consumption can increase by up to 80% under extreme conditions although providing shade will largely relieve this situation. In normal conditions with good quality water, consumption in summer will be about 40% higher than in winter. However, with salty water the summer intake may be 50 to 80% higher than in the cooler months.

The amount of water that stock drink also depends on the water temperature. Generally, animals prefer water at or below body temperature, especially in hot conditions, and will avoid warmer water.

Marginal quality water may become unsatisfactory during summer as animals drink more because of high temperatures and drier pasture. The salinity of some water may also increase because of evaporation from water sources.

## Drought

During drought, stock require more water as they are forced to select more fibrous and less digestible feed. The extra water is used to maintain the movement of the coarse feed in the gut. As drought worsens and stock become weaker, marginal water may become unsuitable as the animals' tolerance of the salt decreases.

Feeding salt or salt-based licks or blocks during dry periods also increases water intake. If water quality is marginal, this added salt intake may depress appetite and cause digestive upsets—the opposite of the supplement's purpose.



Small 'poly' troughs heat up faster than larger, concrete troughs and require high flow rates to water large stock numbers in hot conditions.  
Photo: Todd Andrews

# Bushfire

Check water infrastructure such as tanks, troughs, pumps and poly pipes for melting or other damage immediately after a fire. Check foot valves for ash and silt after the fire and continue to monitor them. Monitor dams for water levels and quality issues.

Provide troughs where possible instead of relying on creeks and dams as they are easier to monitor and clean. Promptly remove animal carcasses to reduce the risk of botulism. Aeration, clarification and/or chlorination will resolve most water quality issues that arise from burnt material entering dams.

Aerating water from a stagnant dam is the first step in improving water quality for livestock. Aeration can be done by pumping to a tank and reticulating it to a trough. Storing the aerated water in a tank, rather than returning it to the dam, prevents subsequent dirtying and deoxygenation of this water.

Clarification, the removal of suspended solids and solid particles, can be achieved by adding a flocculent (such as aluminium sulfate or ultrafine gypsum) which causes suspended particles to form into bigger particles and settle out. Whilst a flocculent can be added to a dam or a tank, much less flocculant is needed when treating water in a tank as there will be less suspended material to treat. Clarifying water will also reduce the amount of chlorine needed to treat the water. Filtering water on its way to a tank will also remove suspended matter.

Chlorination will destroy remaining bacteria and ensure water is safe for stock.



Water supplies after a fire can be affected by melted infrastructure and also where dam water has been used to fight fires.

Photo: Todd Andrews

# Flood

Farm dams and channels can become contaminated after a flood, limiting water supplies for stock. Pollutants such as manure, vegetation, chemicals, and animal carcasses can affect flood water. Decaying plants and animals in the water also increase the risk of diseases such as E. coli and botulism. Water quality issues can develop over time if water flow stops in areas with organic material and manure. This can lead to pathogen growth and algal blooms. Producers should assess water quality levels (testing if necessary), remove potential contaminants, fence off contaminated areas and identify alternate water supply options.

# Pasture composition

The diet of stock also influences their water requirement. Good green pasture can supply all an animal's water needs and sheep under these conditions may not need to drink for many weeks. Good pasture allows stock to use water that would normally be unsuitable at higher levels of consumption. In pastoral areas, stock grazing saltbush or other chenopod plants with high salt levels require large volumes of relatively low-salinity water to maintain their bodily salt balance.

# Animal factors

## Age and condition of stock

Young animals, heavily pregnant or lactating females, and aged or weakened stock are less tolerant of saline water. In weaner sheep, high salinity depresses growth rate and wool production and causes scouring.

## Breed differences

British breed sheep need about 20% more water than Merinos in hot weather.

## Watering points

Water consumption can be affected by the cleanliness of the watering point. If the water level in an earth tank or dam is low, animals may be forced to wade through mud to get to the water, which then becomes heavily contaminated with suspended soil and faeces (feral pigs wallowing will have the same effect). This can lead to stock rejecting the water or getting bogged.

As a result, dams with low water levels should be fenced off and the water pumped or gravitated to temporary troughing. This will ensure maximum use of the available water and reduce stock losses from bogging.

Troughs should be drained and cleaned regularly, particularly in confinement feeding areas where large stock numbers are run, often in dusty conditions. In these situations, water flow rates into troughs is also important. Observing where stock are drinking, for example next to inflow valves, may indicate a water temperature or quality issue in the trough.

Algal growth in troughs produce taste and odours that can repel stock. Salinity also builds up due to evaporation if troughs are not drained.

The frequency of cleaning mostly depends on the water temperature, which affects the rates of evaporation and algae growth. The type of stock will also have some influence on the frequency of cleaning, as tolerance of contamination varies with different classes of stock.

Even a slight contamination of trough water causes problems for some stock. For example, weaner sheep sometimes refuse water with a thin layer of dust on the surface of an otherwise clean trough.

When introducing stock to a new paddock, make sure they are familiar with the location of the watering point and are drinking the water, particularly in pastoral areas. If water quality is marginal or unknown, check newly introduced stock during the first week to ensure that there are no problems.

## Watering radius

Sheep normally graze within a radius of about 2.5 km of a watering point, and cattle within a radius of about 5 km. If stock require more water due to lactation, salinity or dry feed, they may need to drink more than once a day. This will reduce their foraging radius and the area of the paddock being used.

# The value and risk of feeding waste materials to stock

## The value of unusual feeds

A wide range of unusual feedstuffs can be safely and effectively fed to livestock. However, livestock producers need to evaluate the feed value, risks, practicality and real cost before replacing more conventional feeds.

Many of these products are relatively low in nutritional value, bulky to transport, difficult to handle, may contain chemical residues and can be difficult to source consistently.

The feeds should be evaluated on a dry matter and feed value basis as some very high moisture feeds may have a low cost per tonne but work out to be very expensive on a dry matter basis, particularly when freight is included.

While indicative or likely composition of most unusual feeds is available (Table 12), only testing can confirm its nutrient value. Composition may vary between samples of the same product at different times or from different sources. Consider the energy value, protein content and dry matter percentage as well as the dry matter digestibility of the feed. Some alternative feeds may appear to have acceptable energy and protein levels but have low digestibility which restricts nutrient intake and availability.

The NSW DPI Drought and Supplementary Feed Calculator (select “Compare Feeds”) can be used to compare the value of different feeds on an energy and protein basis.

Most unusual feeds should be used with caution, introduced into rations gradually over two weeks and comprise no more than around 30% of the total ration. Monitor stock liveweights and fat scores to check that they are eating enough of those feeds with low digestibility or low nutrient value to meet their energy needs.



Grape marc is leftover product from wine grape crushing and contains grape skins, seeds and small branches. Piles may contain edible moulds and other materials such as cork. It should be considered as a roughage source as seemingly reasonable protein levels maybe unavailable due to tannins while energy is mostly in the seed oil and will also be unavailable to stock if the seeds are not crushed during processing. Photo: Todd Andrews

Some unusual feedstuffs include:

- **Bread:** High in digestible carbohydrates but low in fibre; risk of grain poisoning so introduce slowly.
- **Biscuit waste:** Similar to bread but extremely variable in nutrient value.
- **Brewer's grain:** High moisture content restricts delivery distance but a good energy and protein source. Storage requires care or can be ensiled. Low in calcium, high in phosphorus.
- **Cane tops:** Beware of residues. Low in nutritive value and only a roughage source.
- **Citrus pulp:** Composition varies depending on type of fruit and whether skins and seed included. High moisture content limits area of use due to freight cost. Limited storage life but can be ensiled with other materials. Low in calcium. Must be introduced gradually—lemon is more acceptable than orange or grapefruit.
- **Cottonseed hulls:** Palatable but low in feed value.
- **Grape marc:** Generally low and variable in feed value and moisture content. Most of the energy is contained in the seed but unless the product has been ensiled, for example, Nutra marc, the seeds are generally not digested by cattle. However, if they are digested then be aware of high ration oil content when fed with cottonseed.
- **Onions:** Known to cause anemia and cattle deaths and should be avoided or used in small amounts with extreme caution.
- **Potatoes:** High moisture content, low protein but good energy source. Palatable. Some risk of choking. Avoid sprouted potatoes or those that have turned green as a result of exposure to sun.
- **Pumpkins:** Need to be chopped.
- **Rice hulls:** Little feed value, abrasive and can cause impaction if fed at high levels.
- **Rice Straw:** Beware of residues. Low in nutritive value. High silica and oxalate levels may cause problems.
- **Sawdust:** Has no nutritive value at all but at levels up to 15% can be used as a roughage substitute to facilitate rumen function. Hardwood is preferable to cypress pine.
- **Vegetable/Fruit wastes:** For example, cabbage, carrots, whole apples, oranges; beware of residues. Can have high moisture content.
- **Waste paper:** Little feed value. Printed paper may contain toxins.

Table 12. A guide to the average composition of some alternate feeds but producers are strongly urged to have products analysed before purchase.

Source: NSW Department of Primary Industries feeds database, and FeedTest®, Department of Primary Industries, Victoria.

Product	Dry Matter (%)	Crude protein (%)	DDM* %	Energy ME (MJ/kg DM)
Bread	62–85	13.5–18.2	85–89	12.8–13.4
Brewers grain	20–30	17–30	–	9.5–10.0
Cane tops	84.9	2.7–3.5	27.5	3.8–8.3
Citrus pulp	18–25	7.5	–	10.4
Cottonseed hulls	93.4	4.0–11.5	35.5	2.9–6.3
Grape marc	49.1–51.6	11.2–16.1	25.1–48.8	3.8–7.3
Potatoes	16–25	7–14	84–86	10–12
Pumpkins	9	16	–	13
Rice hulls	92.3	2.0–3.1	23.3	2.4
Rice straw	52–93	2.2–9.0	30–55	3.1–7.5

\* Digestible dry matter.

## Dangers in feeding waste material to livestock

If using plant-processing waste, fruit and vegetables and other food waste products as livestock feed may seem a practical and economic way of using or disposing of such materials, however, any material that has been produced for human consumption, rather than for use as stock feed, must be assessed for its potential chemical residue risk prior to feeding.

Quality control systems, such as with-holding periods for grazing and cutting for hay, are used to ensure that any materials fed to stock, and the final livestock products, meet stringent residue standards. Conversely, there are no specific systems in place to prevent the occurrence of unacceptable chemical residues in plant waste materials.

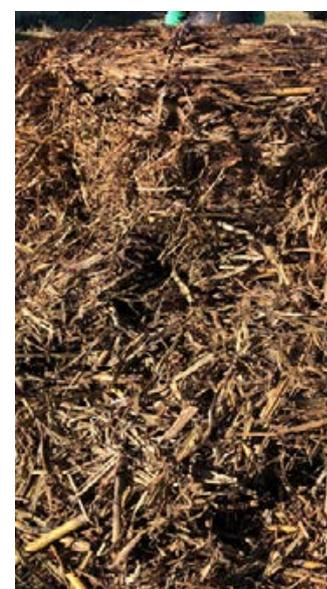
There are also legal restrictions on the materials that may be fed to certain livestock to prevent the development and/or spread of several serious animal diseases such as foot and mouth disease and transmissible spongiform encephalopathies (mad cow disease and scrapie). As a result, it is important to ensure that unusual feedstuffs have not been in contact with or do not include any restricted materials such as meat, fish or feather meal, bone or blood meal, poultry litter or pet foods. Spent mushroom compost is also unacceptable unless it is free of any poultry waste.

## Chemical residue risks

Livestock producers are responsible for ensuring that the animals and products that they market do not contain unacceptable chemical residues. The ramifications for failing to manage these risks are significant:

- Australian meat exports into overseas markets may be potentially banned
- affected livestock are legally restricted from entering the domestic food chain
- affected animal products can be condemned without payment to the producer.

Some chemicals concentrate in wastes, which increases the stock residue risks. Materials such as cottonseed trash, citrus pulp, fruit pomace, grape marc, vegetable skins and outer leaves can have higher residues than the commodity from which they are derived.



While the feed value of sugarcane/tops is generally extremely low, there is also the potential for chemical residues from any crops grown where organochlorine insecticides were historically used. Photo: Nathan Jennings.

Some chemicals registered for use on fibre crops and on fruit and vegetables are not registered for use on stock feeds or livestock. Consequently, there may be no maximum residue limits (MRLs) set for the chemical in animal products. If a chemical has no animal product MRLs then any detectable level of that chemical in these products breaches food standards and may lead to export market closures.

Organochlorine (OC) residues have been found in stock fed waste plant material such as sugar cane tops and cotton trash but particularly root vegetables including potatoes, and carrots, and cucurbits including pumpkin, squash, and zucchini grown on OC contaminated land. When fed as a major part of the diet and/or for prolonged periods, trace levels of OCs concentrate in animal fats and organs. With a half-life of four to six months in cattle, many months on clean feed are required for products to reach minimum residue thresholds.

Feed can be tested for chemical contamination by an accredited testing laboratory before they are used as a drought feed although this screening typically only tests for a narrow range of chemicals. However, any potential stockfeeds, such as cotton trash, sugarcane/tops and vegetable wastes, from crops that could have been grown on organochlorine contaminated land may contain OC residues and should be tested prior to feeding stock.

## Residue risk assessments of feeds

Producers must assess the chemical residue status of any feed prior to feeding to stock. Refer to [Primefact 311 Dangers in feeding waste material to livestock!](#) for the steps involved in completing a Specific Risk Assessment for a particular seed source.

Requesting a [Commodity Vendor Declaration](#)<sup>2</sup> when sourcing an alternative feed helps to ensure that the feed is suitable for stock as it details the contents, treatment history and storage of the material. Where this is not possible, there are other approaches that producers may use to protect themselves and their industry from potential loss.



1



2



**This product contains restricted animal material - DO NOT FEED TO CATTLE, SHEEP, GOATS, DEER OR ANY OTHER RUMINANTS TO BE FED TO PIGS ONLY.**

Feeds manufactured specifically for animals will specify whether it contains restricted animal materials (RAM).

Photo: Todd Andrews

The most practical of these is for stock to be fed for at least 60 days on a known 'clean' feed prior to sale. Previous research on a range of byproducts (apple pomace, citrus pulp, cotton trash, grape marc, sugarcane and vegetables) showed that residues in meat and byproducts had declined sufficiently in that time to meet domestic and export residue standards for the registered chemicals considered in the assessments. Note that this research could not account for residues that might result from unregistered chemicals or chemicals used outside of label recommendations.

Cattle fed by-product stock feeds in the 60 days prior to slaughter must be identified by answering "Yes" to Question 4 on a National Vendor Declaration (NVD) for cattle. By-product stock feeds include 'any plant material not produced primarily for livestock consumption such as waste fruit, vegetables and fibre crops, including cotton trash, peel, pulp, pressings, stem and leaf material'. It does not include grain and grain by-products (such as DDG), cottonseed, oilseed meals, tallow or molasses.

Note that cotton trash has its own specialised [LPA protocol](#)<sup>1</sup> when being fed to livestock.

## Livestock feeds – prohibited and restricted substances

Anyone intending to feed waste materials to ruminant animals including cattle, sheep, goats and deer, or to pigs, must ensure that it is free from 'prohibited or restricted substances'.

The *Biosecurity Act 2015* and Biosecurity Regulations 2017 restrict the feeding of some materials to livestock. Part 2, Division 9 of the Regulation says that: a person must not feed a prohibited substance to stock or cause or permit stock to feed on a prohibited substance.

The maximum penalty is 100 penalty units (currently \$11,000).

## Prohibited substances in ruminant feeds

For ruminant animals, the prohibited substances are defined as 'restricted animal material' by Clause 34 of the Biosecurity Regulation (as mentioned above). They include tissue, blood or feathers derived from the carcass of an animal and any substance produced from or containing any such tissue, blood or feathers.

This definition covers most materials derived from vertebrate animals including feather and fish meals. Only milk products, tallow and gelatine are exempt.

## Prohibited substances in pig feeds

Prohibited substances in pig feed include any product from a mammal (including tissue or blood) except if authorised. They are defined by Clause 37 of the Biosecurity Regulation 2017. The feeding of household or commercial garbage or waste that contains meat, tissue or blood of mammals is also prohibited. These prohibited substances are often referred to as 'swill'. For more information on feeding pigs, contact your Local Land Services District Veterinarian.





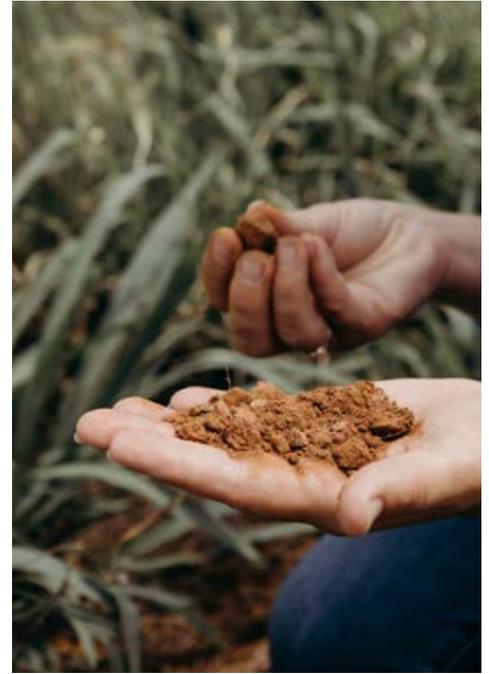


# Managing pastures and soils

Pastures are quite resilient to extreme seasonal events to a point — utilising strategies to plan for these events will ensure they remain a strong foundation for your farm business.

In this chapter: learn about tips during each management phase (preparation, management and recovery) of drought, fire and flood.





The productivity, profitability and resilience of soil and pasture systems is dependent on appropriate long term management. Soils and pastures are extremely closely linked and when maintained in a healthy condition can endure and recover after adverse conditions or situations; such as flood, fire and drought.

It is important to understand that well managed pastures can be quite resilient and have a variety of defence mechanisms that help them to survive adverse conditions.

In most situations a perennial pasture that is well adapted and established prior to flood, fire or drought provides vital groundcover, helping to protect the soil surface, reduce erosion and inhibit potential weed incursions. Perennial pasture are also able to respond and grow quickly for an established base when it rains, provided they have not been overgrazed or otherwise stressed. Additionally, many annual pastures are adapted for survival after a natural disaster due to their hard seed and the large number of seeds within the soil seedbank.

A soil that is well managed and is healthy prior to adverse conditions will respond and recover most quickly following a flood, fire or drought.

The interaction of pasture with its soil base is extremely important. Soils rely on pasture plants to provide protection, structural stability, and the addition of organic matter to maintain and support the soils natural nutrient cycling processes.

A soils ability to build carbon is influenced by soil type, texture and climate (rainfall and temperature). Optimising pasture production using appropriate legumes, fertiliser, liming and applying good grazing management will help to maintain and build soil carbon in the long term.

# Preparing for drought, flood and fire

## Pastures

- Being prepared for a natural disaster involves both short-term and long-term planning.
- Pastures that are in good condition will better survive a particular natural disaster.
- While it is difficult to forecast when a drought, flood or fire will occur, good management of your soil and pasture base will help reduce the impact of these events. Sowing well-adapted pasture species, such as persistent perennial plants, and managing the pasture to improve production and persistence will help to reduce the impact of drought. It will also improve pasture production for each millimetre of rain and will help pastures to carry feed further into a drought. Pastures will recover faster and with greater productivity after drought, flood and fire.
- In many situations, native species are more resilient than introduced species, and may better survive drought conditions. They are the dominant species in most semi-arid and arid regions of NSW. As they can be difficult and expensive to source, reseeding is often not an option. Conservation is key to their long-term survival in dry systems.
- Consider your options prior to a natural disaster and what you are most likely to be able to do under a wide set of circumstances. Give yourself time to put the plan into action and ensure that you have all necessary materials in place prior to the natural disaster occurring. This will result in the best possible outcome under the circumstances.
- After a fire or flood (or during a drought), think about how to make your pastures and soil more resilient to future drought, flood and fire events. This will involve making sure that pastures are:
  - suitable for your area and farm system. Refer to (refer to [Selecting pastures for NSW<sup>1</sup>](#) and [Pasture mixes for your region<sup>2</sup>](#))
  - managed appropriately.



## Soils

- Managing your pastures appropriately under conditions of drought, flood or fire will mean that you are also managing your soils appropriately.
- Identify and manage soil constraints by soil testing and seek advice from your local agronomist or LLS ag advisory staff.
- Maintain optimal groundcover levels – minimum 70% on slopes and plains, 50% in the rangelands.





## During a natural disaster

### Pastures

- Dry and/or flood conditions are not the only stressors on pastures. Other factors that can contribute to the death of plants, especially perennials, and increase the effect of drought/flood include:
  - poor species selection
  - inappropriate grazing management
  - poor general pasture health due to previous disease or insect attack
  - poor soil nutrition or structure
  - shallow soil depth and/or pasture root depth.
- A well-managed pasture that is adapted to the soil, climate and livestock system is more likely to survive drought, flood or fire than a pasture that is poorly matched to the environment, is poorly managed, and is already under stress.
- If surviving pastures are affected, they will need time to recover or they may decline or die.



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### Drought

- Paddocks will vary in value to the livestock enterprise during and after the drought. An assessment of a paddock's value, based on herbage mass and pasture quality measurements, is essential to make decisions in a deepening drought.
- Lock up the most valuable paddocks if pasture survival is under threat. This includes management of total grazing pressure from both native animals and invasive pests such as kangaroos and feral pigs.
- To prepare a feed budget and determine the value of the pasture refer to [Feed Budgeting - YouTube](#)<sup>1</sup>



## Pastures in the Coastal, Tablelands and Slopes regions

As dry conditions worsen, assess each paddock for its pasture composition, condition, cost of resowing, and its future productivity when the drought breaks. You will need to lock up some (or many) paddocks and reduce stocking rates in others.

When assessing paddocks consider the following.

- The risk of death of perennial pastures greatly increases in dry conditions when a pasture is repeatedly defoliated and given insufficient time to recover. Pasture plants need to not only produce new leaves, but also restore their energy reserves in their root systems. This should apply at all times, not only during dry times.
- Groundcover. Paddock lock-up is also determined by the minimum groundcover level required to prevent erosion. The appropriate groundcover level depends on the slope, the likely rainfall intensity and the soil type. Some examples of minimum groundcover percentage are:
  - 70% in all areas, from gently sloping through to the plains – except those areas listed below
  - 85% to 90% on the slopes and steep areas, especially within the coastal zone.
- For more information on groundcover, including how to estimate it, and appropriate amounts of groundcover for your region, please refer to [Maintaining ground to reduce erosion and sustain production<sup>1</sup>](#).



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40% groundcover



80% groundcover

Figure 1: Estimate of 40% and 80% groundcover.

From the [Sustainable land management practices for graziers<sup>2</sup>](#).

Photo: B Stein, NSW Industry and Investment

## Pastures in semi-arid rangelands and rangelands

- In the semi-arid rangelands of western NSW, consider the guidelines for [Managing native pastures](#)<sup>1</sup> to encourage a high persistence of rangelands species.
- Under drought conditions, desirable perennial grasses are more likely to die when more than 30% of fresh/new growth is removed, as the plant is unable to replenish its energy reserves for ongoing growth and persistence. This risk increases the longer the grasses are subjected to high or prolonged grazing pressure.
- In dry conditions, it's important to monitor paddocks when usage rises above 30% so you can reduce stocking rates or close up paddocks when necessary. This is particularly important if paddocks have been heavily grazed in the previous year.
- Consider the total grazing pressure on your paddocks. While you may have destocked or greatly reduced stocking numbers, other grazers such as kangaroos, feral goats, rabbits, and deer can cause ongoing overgrazing of paddocks. Other feral animals (pigs, foxes, wild dogs, feral cats) can also impact biodiversity.
- Ensure groundcover is not less than 40%. This is when soil loss by water or wind erosion can increase rapidly.



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## Flood and fire

- With fire and floods, there is often little that can be done at the time to minimise their effects on vegetation and soils. Therefore, the implementation of measures that will mitigate their impacts, prior to their occurrence, are critical:
  - maintaining long-term groundcover levels above 70% in most areas, 50% in rangelands and 90% on steep and highly sloped country
  - maintaining a strong perennial pasture stand with a legume component
  - applying grazing management strategies that match carrying capacity to feed availability.
- Pastures that were in good condition prior to a fire or a flooding event will be more likely to survive. A well-managed pasture is more likely to result in a large and healthy soil seed bank that will help the pasture recover after fire and flood.





# Soils

## Drought

- During a period of drought, soil loss due to erosion should be a primary cause for concern. Thus, maintaining ground cover is key to reducing soil erosion.
- During a drought, soil loss (and carbon associated with it) is usually caused by wind erosion. However, water erosion is possible if there are heavy rains. As well as the carbon lost from erosion, substantial amounts are also lost through respiration by soil microbes.
- With low or no plant growth occurring during a drought there can be a significant decline in carbon-rich inputs by plants into the soil. Maintenance of groundcover reduces this by:
  - maintain plant roots, root hairs and fungal hyphae, all of which help to bind soil and reduce erosion
  - provide shade to reduce soil temperature and provide protection from rainfall impacts when rain does occur
  - reduce wind speed close to the ground and reduce wind erosion.
- Water repellence can increase during drought, especially in sandier surface soils. Maintaining groundcover will minimise this impact and allow greater infiltration of rain.
- Prolonged dry conditions can exacerbate soil chemical constraints, including salinity, alkalinity, sodicity and some toxicities such as boron. Monitor the soil and pasture system during drought for signs of these issues.
- During a drought, decreased plant growth combined with ongoing mineralisation of organic forms of phosphorus (and other elements, nitrogen, sulphur, etc) can often lead to an increase in many important plant nutrients. As a result, you can reduce the use of fertilisers during this period.



## Fire

- There is often little that can be done at the time of the fire to minimise the effects on vegetation and soils. Therefore, implementation of measures that will mitigate their impacts prior to their occurrence are critical. These include
  - maintaining long-term groundcover levels above 70% in most areas, 50% in rangelands and 90% on steep and highly sloped country
  - maintaining a strong perennial pasture stand with a legume component.
  - applying grazing management strategies that match carrying capacity to feed availability.
- High intensity fires, usually associated with high fuel loads and in heavily wooded grasslands, have much higher temperatures and last longer, which can severely damage soil.
- Low intensity fires have less impact on the soil. Most grass fires usually only have a small residence time (minutes) on any given area and burn with lower heat intensity because of lower fuel loads (often low during drought). Soil is also a good insulator so temperatures usually only increase slightly, and these changes occur at shallow depths (a few centimetres).
- Water repellence can occur in fire-affected soils, reducing water infiltration and intensifying the erosion risk from water moving across the soil surface. Establish erosion mitigation strategies as soon as you identify water repellence.
- Erosion risk is at its highest during the period immediately after fire. Protect the steeper sloped areas of your property to reduce erosion down the slope by placing materials such as log barriers and hay bales across the slope to slow water movement.
- In less sloping country, mulch the soil surface with organic materials, such as hay or small branches, to help protect the soil surface from further erosion. This approach is not practical on a large scale.
- For more information on managing soil after fire refer to [Soil Science Australia<sup>1</sup>](#) resource.



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## Flood

- Waterlogged soils, especially those with high clay content, compact easily. Restrict vehicle and livestock traffic to minimise soil compaction.
- Flooding can cause erosion. However, the extent of erosion depends on the vegetation and topography of the landscape as well as the type of flood event including the speed of water movement, depth of water and duration. It's more likely that sediments, mud, sand and other debris will be deposited. The extent of sedimentation will depend on the factors outlined above.



# Recovering from drought, flood or fire

## Pastures

### Drought

- How you care for your natural resources during a drought will determine how quickly your property will recover and return to productivity.
- Farm management during a drought that aids a smooth transition from drought to 'normality' is important. It also leaves the farm in a condition that allows it to respond favourably to drought-breaking conditions.
- Weeds often recover faster than pasture after a drought and compete for nutrients and moisture. It's important to monitor pasture recovery and have an effective weed management program in place.
- Stock should be confined to feeding areas until adequate pasture is available. At that point, allow increased grazing time each day until full grazing after six to seven days. Immediate full grazing can lead to digestive disorders.
- Rain after a drought will produce a flush of new green pasture growth. Livestock will chase this 'green pick' and this may result in overgrazing of new growth and lead to the death of these grasses or reduce future growth. It is important to give pastures time to grow and recover.
- After drought-breaking rains, stock losses can occur because of an increased risk of [nitrate / nitrite poisoning](#)<sup>1</sup> and grazing of newly emerged and potentially toxic [weed species](#)<sup>2</sup> (that may have been brought onto a property from purchased feed).
- Good rainfall may provide favourable conditions to replant, but it is important to consider that:
  - perennials are generally more expensive to replace than annuals
  - replacing pastures with native perennials may be impractical because of lack of seed
  - pasture re-establishment costs are high and the pasture may be out of production for a long time.

For more information around replanting refer to the [Drought Recovery Guide](#)<sup>3</sup>



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## Flood

- Pasture species vary in their ability to survive a flood. Pasture survival depends on their condition going into the drought as well as severity, depth and duration of the flooding event as well as the time of the year the flooding event occurred. Pastures flooded when they are not actively growing are better able to survive provided they are not covered by mud, sand or other debris.
- The time of year when flooding occurs can have a major impact. Floods that occur in warmer months are likely to result in greater plant death. However post-flood, pastures will recover faster during spring or warmer parts of the year.
- Where possible, keep stock out of flood-impacted paddocks as plants will be more vulnerable to trampling, soils will be prone to pugging and compaction, and animals are more likely to contract a range of diseases. For more information on animal health Chapter 6 Animal welfare and management.
- Pugging can cause increased soil density and a reduction in air-filled porosity, which can also affect pasture growth.
- Prolonged wet conditions can turn animals off their feed. It is highly recommended that stock only be allowed back onto the flood impacted paddocks after they have had the chance to dry out. This may require you to
  - livestock agistment
  - moving stock onto another property
  - setting up a containment feeding system in an area of your property that will limit damage, is easier to revegetate or is the least productive
  - selling stock.
- Deposition of mud, sand, silt and other debris can damage or kill pastures. If ongoing rain (15 to 20 mm) does not remove this material from plants, consider light slashing (if able to access the paddock).
- Due to reductions in competition and the possibility that weed species may have been deposited by floodwater/sedimentation into the flooded areas, weed control may be necessary.
- Wait at least 2 to 3 weeks after a flood to assess how pastures are recovering. In some cases, particularly if the flood occurred when little to no pasture growth was present, the extent of damage may not be obvious until the next growing season. Consider enrolling in a [PROGRAZE® course](#)<sup>1</sup> to better understand pasture recovery.
- If you need to resow paddocks to pasture, there are several factors to consider to multiple factors post-flood. See [Planting pasture after a flood](#)<sup>2</sup>.



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## Fire

- Seasonal conditions before and after a fire will affect pasture recovery. It may be many months before there is adequate pasture and this should be considered in grazing management.
- Give your pasture sufficient time to recover and regrow. While 4 to 6 weeks is usually enough time, it may take longer if there is not enough rainfall.
- Feed will be in short supply following fire so it may be necessary to either use containment feeding or graze some paddocks. Paddocks that contain perennial that will recover faster (phalaris, digit grass) should be grazed first but grazing management will be carefully managed to allow them to recover completely.
- After fire, the loss of vegetation can result in a flush of annual clovers, particularly sub-clover. This will lead to potential bloat risk that will need to be managed carefully.
- With the loss of vegetation and a potentially good crop of clover present this can provide an opportunity to plant either a forage crop (oats, brassica, etc) or to plant a perennial pasture mix.
- Weed control after a fire is important to prevent weeds from regrowing or spreading. Many weeds have a competitive advantage after a fire. Research indicates that weeds can be more of an issue in the second year after a fire.
- For more information on planting a perennial pasture refer to [Pasture recovery after bushfires<sup>1</sup>](#).





## Soils

### Drought

- The extent of soil erosion depends on how much groundcover was maintained during the drought. If relatively high groundcover was maintained, soil losses will be reduced.
- While the use of fertiliser is often reduced or stopped during a drought, pasture recovery from drought can be limited by soil fertility. It is important to soil test paddocks after a drought to identify any limitations and apply extra fertiliser to help recovery.
- Loss of soil carbon because of soil respiration will also have occurred. Soil carbon levels will increase over time as pasture grasses recover and grow. Ensuring that grazing does not occur too early in their recovery will ensure that soil carbon will increase to the greatest extent possible following a drought.
- For more information on managing soil during and after drought in grazing systems refer to [Managing soil during and after drought in grazing systems](#)<sup>1</sup>



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## Fire

- Post-fire, the soil surface is fragile. Restrict heavy machinery and stock traffic to prevent more damage to the soil surface.
- Nutrient loss depends on the duration and intensity of the fire.
- During a fire, nutrient loss occurs through combustion of plant materials. However, the nutrient content of the ash created during the fire and after fire from windblown deposition can counteract some of the combustion losses. Soil testing should be undertaken to determine if additional nutrient inputs may be required to aid recovery.
- Low soil fertility can reduce pasture growth and production slower making it more difficult for pastures to recover and grow. If soil testing detects deficiencies, apply appropriate fertiliser.
- Ash produced by fire can change the soil pH, which may lead to surface soil pH increases. It is important to monitor the soil via a soil test, as these changes may affect which pasture species recover. See [Soil testing: how and why - YouTube](#)<sup>1</sup>
- Post-fire flushes of growth are common after a fire.
  - Annual clovers require careful management of stock in order to avoid the chance of bloat from occurring.
  - Weeds will quickly re-establish on fire-affected areas. Although these weeds may provide initial protection from surface soil erosion, they should be carefully monitored and managed to ensure that pasture recovery is not compromised, and weeds are not allowed to set seed.
- For more information on the impacts of fire on soil refer to [Soil fire impacts and management](#)<sup>2</sup>



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## Flood



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- In areas of prolonged flooding, compaction may restrict water infiltration and pasture re-establishment. Adding calcium rich materials such as lime or gypsum may help the softening and recovery of these soils.
- The combination of leaching, erosion and inhibition of mineralisation process often results in fewer available plant nutrients, especially nitrogen. Reduced soil fertility in flood-affected areas can slow pasture recovery. Soil testing should be undertaken to assess nutrient availability and determine input requirements as part of your pasture re-establishment program.
- Test soil in areas with significant new soil deposition to ensure that soil characteristics such as pH and nutrient content will not restrict pasture recovery or re-establishment.
- For more information on managing soil erosion after flooding refer to [Managing erosion before and after floods](#)<sup>1</sup>





# Managing cropping and soil

A soil that has been well-managed and is in good health prior to a drought, fire or flood will recover faster afterwards, provided measures are taken to mitigate their impact on productivity.

In this chapter, learn about

- soil management for croppers
- managing during and after drought, flood or fire
- recovering from drought, flood, or fire.



Three farming systems account for much of the cropping in NSW:

- cropping-only farms with a mix of cereals, pulses, and oilseeds
- mixed farms with cropping and livestock grazing pastures, cereals and winter canola
- grazing enterprises that include grazing crops that fill autumn-winter feed gaps and reduce grazing pressure on pastures.

The following considerations outlined here are important for all three farming systems.



For information about horticultural crops, refer to:

- [Drought strategies for temperate fruit orchards<sup>1</sup>](#)
- [Managing horticultural crops in drought<sup>2</sup>](#)
- [Macadamia growers guide: lessons from the drought for macadamia growers<sup>3</sup>](#)
- [Irrigation management of blueberries in Northern NSW<sup>4</sup>](#)
- [Water use efficiency in blueberries<sup>5</sup>](#)
- [Managing citrus orchards with less water<sup>6</sup>](#)
- [Monitoring vine water status: part one<sup>7</sup>](#)
- [Monitoring vine water status: part part two<sup>8</sup>](#)



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# Soil management for croppers

Long-term farm productivity and profitability depends on maintaining soils in a healthy condition. This is achieved by adopting the following practices:

- minimising tillage and direct drilling to increase soil water and nutrient availability
- retaining stubbles to protect the soil surface from wind and water erosion, decrease runoff and soil evaporation, and increase infiltration and soil water
- controlling traffic by tramlining to reduce soil compaction, as well as increase seed, fertiliser, herbicide, fuel and labour efficiency
- rotating cereal crops with break crops or pasture to assist weed and disease management.

A soil that has been well-managed and is in good health prior to a drought, fire or flood will recover faster afterwards, provided measures are taken to mitigate their impact on productivity. Productivity will mainly be affected if soil erosion occurs. Wind erosion is the main cause of soil loss and carbon during droughts and is a risk to soils after a fire. Water erosion is a risk during floods, after fires, and when high intensity storms occur during or at the end of a drought.

Maintaining ground cover is the key to reducing both forms of soil erosion. Erosion risk is minimised by maintaining long-term groundcover levels above 70% in most areas, at least 50% in rangelands, and 90% on steep and highly sloped country. Maintaining groundcover is vital during drought and flood. Plant roots, root hairs and fungal hyphae all help to bind soil and reduce erosion. Vegetation or stubbles reduce erosion risk by:

- cutting wind speed close to the ground and reducing the energy to dislodge and transport soil particles
- protecting the soil from raindrop impact, slowing surface run-off when rain occurs, and cutting the speed of floodwater at the soil surface
- shading and reducing soil temperatures, which moderates conditions for soil biota and reduces water loss through soil evaporation.

Tillage removes vegetation and increases erosion risk, so its use should be carefully considered. Studies in NSW have shown that cultivating once every five years has no long-term effect on soil structure. Extending rotations to five years (and including break crops) will benefit soil structure as well minimising the potential area of bare soil on the farm should a drought or flood occur.

Additionally, you should ensure yields are not limited by nutrition or soil constraints

- soil tests should be done regularly and at the same locations to monitor soil health and nutrition.
- soil nutrition can be managed like farm management deposits: i.e. built up when finances are good and drawn down when finances are tight.
- soil ameliorants such as lime can be managed in the same way. Lime should be spread and incorporated during fallows to manage soil acidity as an investment in soil fertility.

These soil best management practices will maximise productivity by making more soil water available to crops that are not limited by nutrition, weeds, or disease. This will place your farm business in the best position to cope with and recover from drought, fire and flood.

## Drought

- Water repellence is more of a problem during periods of drought, especially in sandier surface soils. Maintaining groundcover will minimise the impact of water repellence by ensuring greater infiltration of any rain that does fall.
- Prolonged dry conditions can exacerbate soil chemical constraints, including salinity, alkalinity, sodicity and some toxicities such as boron. Monitor your soils for signs of these issues during drought.

## Fire

- High fuel loads (e.g. good crops) produce high intensity fires, which have a greater impact on soils because they are far hotter and last longer.
- Low fuel loads produce low intensity fires that have less impact on the soil because the soil is a good insulator (particularly if dry), they are cooler, and they only have a small residence time (minutes) on any given area. Soil temperatures usually only increase minimally, and these temperature changes occur at shallow depths (a few centimetres).
- Water repellence can occur in fire (and drought) affected soils, reducing water infiltration and intensifying erosion risk. If you identify water repellence, start erosion mitigation strategies as soon as possible.
- Erosion risk is highest after a fire and before any regrowth of vegetation. You should prioritise protecting steeper areas to reduce erosion risk. Seek advice first (see information below).

## Flood

- Saturated soils cannot supply enough oxygen to plant roots to sustain growth and prolonged saturation can kill crops. The impact on crops depends on how long they are inundated, as well as the time it takes for the soil to drain and air to enter after flood waters recede. Soils with high clay contents and/or sodicity are particularly at risk.
- High temperatures (> 30°C) during inundation with shallow water can lead to scalding and complete crop death.
- Nitrogen may not be readily available until soils have re-aerated sufficiently for mineralisation to occur. Phosphorous, on the other hand, may become tied up after soils are re-aerated.
- Soils that are waterlogged, especially those with high clay contents, compact easily. It's a good idea to restrict vehicle and livestock traffic until sub-soils have dried enough to resist compaction.
- Erosion may be an issue, depending on topography and vegetation, as well as the speed and depth of the flood, and the duration of inundation.
- In many cases, sediment and other debris will be deposited. The type of sediment (clay, silt, sand) and its extent determine the impact on productivity. This will also depend on the factors outlined above.

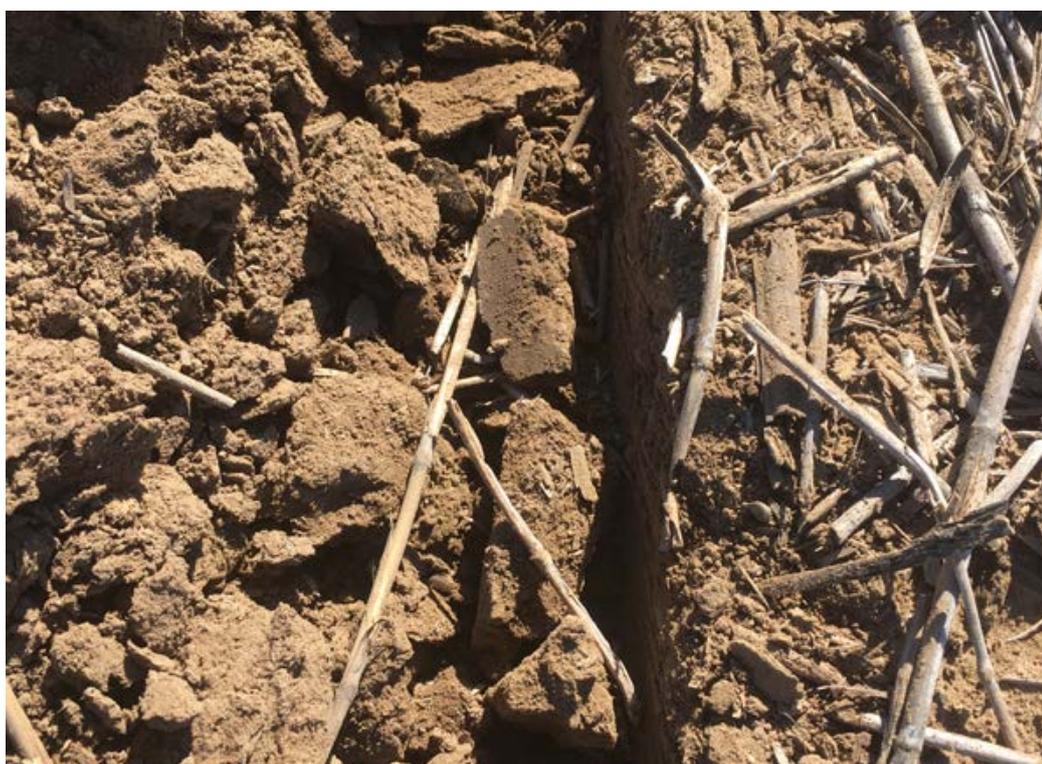
## More information and advice

### Management guides can be found at

- [www.dpi.nsw.gov.au/agriculture/broadacre-crops/guides](http://www.dpi.nsw.gov.au/agriculture/broadacre-crops/guides)<sup>1</sup>
- [www.dpi.nsw.gov.au/agriculture/broadacre-crops/winter-crops](http://www.dpi.nsw.gov.au/agriculture/broadacre-crops/winter-crops)<sup>2</sup>

### For more localised advice contact your

- [Local Land Services](#)<sup>3</sup> on 1300 795 299 or find your local office



Disc planting equipment reduce soil disturbance and maintains ground cover



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# Management during and after drought

How you care for your natural resources during a drought will determine how quickly your property recovers and returns to productivity after the drought.

Farm management during a drought that aids a smooth transition from drought to 'normality' is important. It also leaves the farm in a condition that allows it to respond favourably to drought-breaking conditions.

The riskiest time for soil erosion can be the breaking of drought, so retaining cover (stubbles) on paddocks is essential. It is essential to keep stock confined to feeding areas to protect groundcover.

The following specific management actions are recommended.

## Use seasonal climate forecasts

Use the Bureau of Meteorology's seasonal forecast to inform any sowing decisions. Seasonal forecasts are an assessment of the probability of an occurrence and should be seen as such. You should assess both the likelihood of an occurrence and the accuracy of the forecast.

Use the seasonal forecast and an assessment of stored soil moisture (below) to set a target yield and plan to apply inputs (sowing and fertiliser rates) appropriately.

## Check soil moisture at sowing

An assessment of how much water is stored in the soil is critical to making an informed decision about whether to sow, what to sow, and at what level of inputs. Using stored soil water to reduce the reliance on in-crop rainfall has traditionally been more important in northern NSW where summer rainfall predominates. Increasingly variable rainfall patterns mean that stored soil water at sowing is now important anywhere crops are grown and is particularly important for early sown and dual-purpose grazing crops that are subject to warmer temperatures and higher evaporation rates.

A steel push probe inserted into the soil is an easy and quick way to assess the depth of water in the top metre of soil. A push probe cannot measure plant available water, as this varies with factors such as soil texture. More than 1,100 soils across Australia have been characterised and plant available water holding capacity (PAWC) estimated. These are available on the APSoil database. Deep soil testing down to 1.8 to 2.0 m can be used on the vertosol soils of northern NSW to estimate PAWC and soil nitrogen (N). This helps match N fertiliser requirements to soil water. Find out more about measuring PAWC for a specific paddock and its characteristics in the [Grains Research & Development Corporation guide: Estimating Plant Available Water!](#)



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These online tools can provide you with an estimate of conditions in your region:

- [NSW DPI Combined Drought indicator<sup>1</sup>](#)
- Bureau of Meteorology, [Australian Water Outlook for current modelled soil moisture contents<sup>2</sup>](#)
- CSIRO's [National Soil Moisture Information Processing System<sup>3</sup>](#)

Soil moisture sensors are becoming more popular as a tool to monitor paddock soil water status and inform cropping decisions. Install your own sensors (see Agriculture Victoria's article on [Choosing the right soil moisture monitoring device<sup>4</sup>](#) or connect to an existing soil moisture monitoring network:

- NSW DPI Seasonal Conditions Monitoring Network - [www.dpi.nsw.gov.au/dpi/climate/seasonal-conditions-and-drought/future-ready-regions-edis-development/drought-monitoring-network<sup>5</sup>](http://www.dpi.nsw.gov.au/dpi/climate/seasonal-conditions-and-drought/future-ready-regions-edis-development/drought-monitoring-network<sup>5</sup>)
- Hunter Valley - [www.lls.nsw.gov.au/regions/hunter/projects-and-programs/Soil-moisture-network-project<sup>6</sup>](http://www.lls.nsw.gov.au/regions/hunter/projects-and-programs/Soil-moisture-network-project<sup>6</sup>)
- Holbrook Landcare Network - [holbrooklandcare.org.au/projects/weather-stations<sup>7</sup>](http://holbrooklandcare.org.au/projects/weather-stations<sup>7</sup>)
- Riverine Plains Inc - [riverineplains.org.au/riverine-plains-soil-moisture-probe-weather-station-network<sup>8</sup>](http://riverineplains.org.au/riverine-plains-soil-moisture-probe-weather-station-network<sup>8</sup>)

## Select suitable crops

A short season, low risk crop such as barley is ideal for paddocks with low soil water reserves. Barley also provides rapid groundcover to protect against wind erosion. Paddocks with insufficient stored soil water at sowing can be fallowed through to a summer crop in northern NSW, or long fallowed to the following year's winter crop in western areas of central and southern NSW, provided there is sufficient groundcover.

## Test soil before sowing

During a drought, reductions in plant growth combined with ongoing mineralisation of organic forms of phosphorus (P) (and other elements such as N, and sulphur (S)) generally result in an increase in many important plant nutrients. As a result, fertiliser application can be reduced.

Mineralisation often continues during drought, although the amount depends on soil carbon levels and total rainfall. When combined with the potential carryover of nutrients from previous failed crops, the only reliable method for determining N status is to test deep soil N on each cropping paddock. N rates need to be matched with the amount of stored soil water and the paddock yield target. Where winter rainfall is more reliable, splitting N between sowing and topdressing in-crop is a good risk management strategy.

Crop P requirements are also best determined by soil testing. Soil P can be stratified (layered) in no-till farming systems, where P is applied relatively shallow and near the seed. If the topsoil is dry, P will not be available to the crop. Using soil tests and previous experience with P applications following a drought is the best guide. Anecdotal evidence following previous droughts suggests that P rates can be reduced by about 30% on normal rates. Note that P applied at sowing is most effective.



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# Manage herbicide residues

The rate at which herbicide residues are broken down is affected by soil moisture and temperature, and pH in some cases. As a result, droughts increase the risk of crop injury, particularly from residues of group 2 herbicides (including sulfonylureas, imidazolinones, Broadstrike® and Spinnaker®) and group 5 herbicides (triazines). Note also that the plant-back period for Group 4 products such as Phenoxy and Pyridines applied for summer weed control does not start until a specific amount of rainfall is received.

Other herbicides that can persist in soils are listed under '[Guidelines for crop rotations](#)'<sup>1</sup> in the [NSW DPI guide Weed control in winter crops](#)<sup>2</sup>. More information on herbicide residues in dry conditions can be found at [Herbicide residues after drought](#)<sup>3</sup> and [Residual herbicides - carryover and behaviour in dry conditions](#)<sup>4</sup>.

Keep accurate records of herbicide use in paddocks to ensure that residues do not affect subsequent crops. There are many farm software products available with simple record keeping functions.



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## Post sowing

### Top-dressing

Limiting the amount of N applied at sowing to an establishment rate will reduce upfront costs and minimise risk if crops have been planted into limited soil moisture. This will restrict vegetative growth and reduce crop water extraction during the early part of the season, leaving more water available to the crop for flowering and grain filling if the season stays dry. If rain does fall and replenishes soil moisture levels, then top-dressing allows N application to be adjusted according to seasonal conditions and yield expectations.



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### Grazing out or cutting for hay if the season cuts out

The decision to graze or cut for hay should take into consideration the amount of soil water remaining and the seasonal forecast. Depending on the crop, peak biomass usually occurs at or near flowering. The time of cutting will depend on crop species, the use to which it is to be put, and whether the crop is too stressed to produce saleable grain or even continue to grow. Take care that crops cut for hay or silage are not within any pesticide withholding periods.



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## Control summer-fallow weeds

Stubble retention and strict summer fallow weed control programs maximise stored soil water for winter crops. While retaining stubble is critical to preventing soil loss through erosion, weed control has the biggest immediate benefit. Research in New South Wales, Victoria and South Australia shows a return of \$3 to \$8/ha (averaging \$5/ha) for every dollar spent on fallow weed control. Uncontrolled weeds can remove up to 40 to 50 mm of stored soil water but also remove about 50 kg N/ha. These results are also relevant in mixed farming businesses where weed control decisions are often compromised by livestock feed needs: it is rare that the feed value of summer weeds is greater than the value of the water to the winter crop.

Weed control using herbicides will retain stubbles and protect soils from erosion, as well as maintain soil organic matter and physical condition as much as possible. Weed control using cultivation will remove ground cover and deplete already reduced soil carbon stocks, so its use needs to be considered carefully.



- In high clay content soils (> 30% clay), clays act as the major binding agent, so cultivation may have little effect on erosion risk. Cultivation for weed control or to roughen the soil surface to reduce wind and water erosion risk may be justified.
- In lighter textured soils, soil carbon, plant roots and fungal hyphae act as the major binding agents, so cultivation that destroys structure and pulverises these soils will leave them at high risk of being blown or washed away. Cultivation of these soils during drought is not recommended.

## Protect soils when groundcover is low

### Cover cropping

If managed correctly, cover crops can increase soil moisture storage in paddocks with low levels of groundcover. This involves planting a cereal crop and then terminating its growth with herbicide once it has produced sufficient dry matter but has not yet started to significantly deplete deeper stored soil moisture. This is often after around 6 to 8 weeks growth. To be successful, there needs to be low levels of groundcover when the cover crop is planted and a fallow of sufficient length after the cover crop is terminated to allow soil moisture to build-up.

For more information see: [Cover crops can boost soil water storage and crop yields<sup>1</sup>](#).

### Surface roughening

Cultivating eroding areas in paddocks with **loam and clay soils** can reduce wind erosion IF there is insufficient ground cover to protect the soil surface (less than 50%), Cultivating loam and clay soils to produce large clods increases the roughness of the soil surface, slowing the wind and trapping loose soil that is at risk of moving.

You should aim to create evenly spaced tillage ridges about 10 cm high and perpendicular to the prevailing wind direction. Clods need to be greater than 2 cm in size to be effective. It is important to bear in mind that cultivation is only a short-term solution as ridges will eventually 'melt' away.

Larger clods are essential to reduce wind erosion, so this practice is only recommended in medium to high clay content soils. **Sandy soils will typically fail to produce clods of an adequate size and are not suited to this technique.** Always do a test cultivation first to assess the suitability and effectiveness of your technique.

In sloping country, the risk from water erosion is greater than that from wind erosion, so cultivate at right angles to the slope rather than to the prevailing wind direction. This is also likely to increase infiltration and reduce runoff of any rain that does fall.

Further information on surface roughening see [Wind Erosion<sup>2</sup>](#).



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# Management during and after flood

Depending on the depth and severity of flood it may be 2 to 3 weeks before you are able to accurately assess the state of your paddocks.

## Factors affecting yields

Crops vary in their tolerance to flooding and the effect depends on the depth and duration of the flooding event and its timing in relation to the crop stage. In general:

- Cereals are more tolerant of inundation and waterlogging than canola, and canola is more tolerant than pulses and legumes.
- Crops are more tolerant under cooler conditions as soil microbes are less active and oxygen is more available to plants. Temperatures above 27°C to 30°C when paddocks have shallow water on them may lead to scalding and crop death.
- The most sensitive growth stages are establishment and early growth; and leading up to and during flowering and early grain fill.
- The shorter the duration flooding and the shallower the water, the less the effect on yields.

## Test your soil

A combination of leaching, erosion and inhibition of mineralisation can decrease plant available nutrients after a flood, especially N. You should test your soils to assess nutrient availability and determine input requirements prior to sowing next season's crop or pasture.

## Compaction

Wet soils lack bearing strength and cohesion and are easily compacted. Compacted soils contain less air and water, and high soil strength can restrict root growth at even moderately high moisture contents. Wet, flood compacted soils may also have low plant available N. This can severely limit crop growth in paddocks that have been flooded.

Dig to check sub-soil moisture and to assess any compaction. Avoid compacting soils by limiting machinery and stock traffic until soils are sufficiently dry. Sample and test soils to see if adding calcium rich materials (lime or gypsum) will aid softening and recovery, and the rate required.

- In high clay content soils, assisting the soil to dry deeply and crack will repair it to a pre-flood condition and allow organic N to be made available through mineralisation.
- In lighter textured soils, consider deep tillage to restore porosity and get air into the soil. However, this should only be done after soil testing and consultation. More information can be found in the [GRDC Deep ripping fact sheet<sup>1</sup>](#).



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# Sediment

Deposition of mud, sand, silt, and other debris may reduce production and kill crops. Test the soil in areas where significant new soil deposition has occurred to ensure that soil pH, texture and nutrient content won't restrict future crops.

If the deposited layer has a high fine sand and silt content, it will slake and crust, decreasing air and water entry and affecting germination of post-flood crops. Tillage may be needed to mix the deposited layer with the old topsoil after the paddock has dried. Test your soil, seek advice, cultivate at the right moisture content, and do not bring hostile sub-soil to the surface.

# Weeds

Weed control may be needed due to a reduction in competition with the loss of pre-flood vegetation and the possibility that weed seed may have been deposited by floodwater and sedimentation.

# Erosion

For information on managing soil erosion after flooding refer to [Managing erosion fact sheet](#)!



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Left: Check moisture with a push probe before planting

Right: Herbicide damage can occur in crops planted after drought

# Management during and after fire

Fire is most likely after flowering when the crop is senescing and drying down. The financial impact of fire will best be managed through crop insurance. Other impacts also need to be managed, particularly:

- weeds
- soil health, particularly nutrition and erosion.

## Weeds

Weeds are likely to take advantage of the reduced competition and may provide initial protection of the soil surface from erosion. However, if not monitored and managed to prevent seed set, weeds can become a major issue in the second year after a fire.

## Soil health

Nutrient loss occurs during a fire through combustion of organic matter. The nutrient content of the ash created during the fire and in windblown deposition after fire can counteract some of the combustion losses. How hot the fire is and how long it takes to pass determines how deep into the soil that soil organic matter is combusted. This affects the level of nutrient loss and the impact of the fire on soil structure.

## Soil nutrition

Crop production will be reduced if soil fertility is reduced. Sampling and testing soils will show whether nutrients are deficient or if soils are constrained by pH or sodicity. Apply fertilisers or soil amendments (lime/gypsum) in line with soil test recommendations to improve your soil's condition. Refer to [How to take a soil test](#)<sup>1</sup>.

## Soil erosion

Burning the organic matter in a soil will degrade its structure. Check your surface soils for signs of crusting, hardsetting or water repellence. The loss of vegetation cover also leaves soils prone to wind and water erosion. To protect the soil, plant a cover crop (either a forage crop or a pasture mix), if there is sufficient soil moisture and a likelihood of germinating rains. See the section on Cover cropping in this Guide for more detail.

The soil surface will be fragile post-fire, so restricting traffic from machinery and stock will prevent further damage to the soil surface.

For more information on the impacts of fire refer to Factsheet: [Soil - fire impacts & management](#)<sup>2</sup>.



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# Recovering from drought, flood, or fire

There are a range of agronomic factors that can affect cropping decisions in the years after a run of poor crops resulting from drought, fire, or flood. These include a higher risk of herbicide residues (see [Manage herbicide residues](#)) and soil borne diseases. However, there are also potential benefits such as a carryover of soil nutrients and a lower risk of foliar diseases.

Given the importance of prudent cash spending after a natural disaster, sowing decisions should be based on good information about stored soil water, fertility, and likely disease pressure. Ask for advice from farm consultants and agronomists with access to soil and disease testing tools or make use of decision support tools.

## Compare crop growing costs, gross margins, and risk

Gross margin budgets help to evaluate the potential returns of different crop options. A gross margin is the projected gross income from an enterprise less the variable costs (seed, fertiliser, pesticides, fuel, harvesting costs, freight, insurance). Fixed or overhead costs (depreciation, interest payments, rates, permanent labour) are not included. Choose crops that can generate a positive gross margin under a range of conditions over newer, high risk/high reward crops. Gross margins can be used to show potential returns over a range of possible prices and yields. For more information, see NSW DPI - [Farm budgets & costs](#)<sup>1</sup>.

## Seed supplies and seed quality

Seed is the most important single input into a farming system and supplies for winter crops are often low after persistent, widespread drought. If using seed retained from previous seasons, get the seed tested for germination and vigour by an accredited laboratory. Good quality seed should have a germination percentage greater than 90%, although high germination rates do not always result in good seedling vigour. Small and shrivelled seed is likely to have poor germination and vigour, as will seed stored incorrectly (high moisture and high temperature) or for long periods.

Grading to remove smaller seed significantly improves overall germination and vigour. Retained canola seed should be graded to 2 mm diameter for sowing. Some seed dressings can reduce vigour by reducing coleoptile length, which might lead to poor establishment rates. Refer to the NSW DPI [Winter crop variety sowing guide](#)<sup>2</sup> for more information.

Ensure that purchased seed is true to the variety claimed by the vendor so that it can be sown at the recommended time. Select varieties best suited to your area, and include seed costs when calculating gross margins. For example, pulse seed costs can be up to \$100/ha after drought, while canola seed may cost as little as \$5/ha for retained supplies.



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# Sowing time

Sowing dates should not alter significantly after a drought, fire, or flood, except where the main aim of the crop is to generate feed and ground cover. Capitalise on accumulated soil water and N by sowing as early as possible within the recommended sowing period for each variety. To sow all crops within the sowing window, some crop types may need to be sown slightly earlier than recommended. Make sure you consider your location and frost risk.

# Rotations and diseases

Following a natural disaster, the aim should be to get paddocks back into a sound agronomic rotation/crop sequence as quickly as possible. Where failed crops were grazed or made into hay, avoid sowing the same crop the following year if possible. On paddocks with low groundcover, it is best to choose a cereal crop that will generate some stubble and cover for the next summer, rather than planting a low biomass crop such as lentils. Pulses should be sown into paddocks with relatively high stubble loads. Similarly, paddocks with high groundcover will be more likely to retain moisture close to the surface for germination of crops such as canola.



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Finding good herbicide options is an important consideration in paddocks where weed control has been compromised. For example, break crops or fallows are generally not as effective during drought as in other years. Consider using pre-emergent herbicides to reduce early weed pressure on crops.



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The risk of soil-borne disease is often higher after drought because low moisture slows decomposition of crop residues that harbour disease inoculum. The main diseases to look out for are crown rot in cereals, Ascochyta blight in chickpeas and blackleg in canola. Canola blackleg inoculum is carried over on stubble, including crops cut for hay. Crops grazed or sprayed out in mid-winter will have much less inoculum carryover. There is also a lower risk of foliar diseases in a dry season, which may reduce the risk of infection in subsequent years. Seek advice on the lowest risk options that best fit your farming system.



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The PREDICTA® B test is a reliable technique for assessing the risk of crown rot and a range of other soil or stubble-borne pathogens prior to sowing. Consult your local agronomist if you are in an area with a history of crown rot.



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- [Predicta B \(broadacre\)<sup>1</sup>](#)
- [Crown rot - Northern<sup>2</sup>](#)
- [Chickpea – disease management<sup>3</sup>](#) (Southern and Northern regions)
- [Blackleg Management Guide<sup>4</sup>](#)
- [Rhizoctonia<sup>5</sup>](#)



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# Cereals for grazing

Forage and dual-purpose cereals are often grown to help overcome autumn and winter feed shortages. Oats and other grazing cereals have higher winter growth rates than most pastures. Crop and variety selection, together with sowing time, influence the total amount of feed produced. Dual purpose varieties can be harvested for grain after grazing. For hay production, avoid cereals with large awns such as barley, some triticales, cereal rye and some wheats. The same applies to grazing awned varieties when head emergence cannot be avoided.

Ideally, there should only be one type of cereal sown in a paddock, as stock will preferentially graze one cereal over another. Oats will generally produce more forage than wheat, barley, cereal rye, or triticale. Grain recovery, however, is not so clear cut, with winter wheats and triticale often having similar or better yields than oats and a higher dollar value. You can find more information on growth habit, maturity, sowing time, grazing management, stocking rates, and livestock health in the NSW DPI [Winter crop variety sowing guide](#)<sup>1</sup>.



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# Dual-purpose canola

Grazing canola is becoming a more popular choice on mixed farms of the upper slopes and tablelands because it provides early, good quality forage and then recovers for grain harvest, helping to improve total farm profitability. Winter-types are preferred and are commonly sown in February to March, subject to soil moisture and sowing opportunity. Longer season spring types can be sown from late March to early April and grazed as well.



Low groundcover after fire increases erosion risk





Soil sampling is useful after drought and flood to determine nutrient levels



# Managing weeds and pests

Droughts can often set back long-term weed and pest control strategies.

In this chapter, learn about managing:

- weeds
- invertebrate pests
- feral and pest animals.

9

# Weeds

Weeds introduced in feed can be a biosecurity risk and costly to manage. Fodder and grain sometimes contain seeds of new weeds (e.g. parthenium weeds) and herbicide-resistant weeds (e.g. annual ryegrass), especially when imported from other regions or states. The best way to manage this risk is to follow a sound biosecurity plan including the following.

- Sourcing grain or fodder from trusted and reliable sources so that you have confidence in its quality and contents. If this is not possible, try to find the origin of the grain or fodder so that you can anticipate any potential problems.
- Asking for a commodity vendor declaration when purchasing feed.
- Storing imported grain and fodder in a designated area and keeping a record of the area.
- Restricting the area over which imported grain or fodder is fed out and keeping a record of the area.
- Periodically observing the areas where feed was stored and fed for the next few years. Note any new plants and have them identified by your Biosecurity (Weeds) Officer.



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If buying seed to sow fodder crops or pasture, use certified or quality assured seed wherever possible and check its germination and purity. Ask for a copy of the certificate of seed analysis. In addition to details on the germination and purity of the seed, this certificate will also identify any weeds that may be present in the seed lot.



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## More information:

- [Weeds and drought<sup>1</sup>](#)
- [Look out for new weeds in fodder booklet<sup>2</sup>](#)
- [Weeds in hay and grain booklet<sup>3</sup>](#)
- [Explanation of information on seed certificates<sup>4</sup>](#)



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# Invertebrate pests

The impact of drought, fire and flood on invertebrate pests varies with pest species, vegetation, landscape, and farming operations. Environmental conditions can increase or decrease the incidence of invertebrate pests including insects, mites, snails and slugs. Importing fodder and grain for livestock also increases the risk of importing new pests.

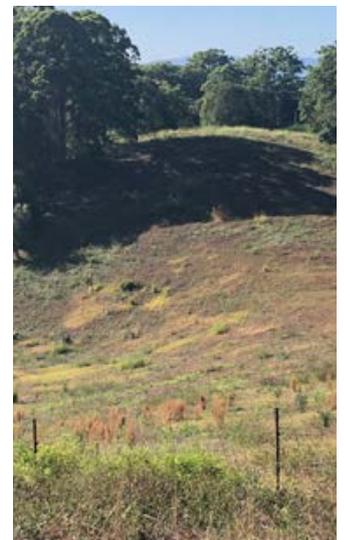
Some invertebrate pests populations increase in hot, dry conditions such as spider mites. Some insect and mite populations are attracted to stressed plants. For example, macadamia trees are more prone to attack from bark beetles during dry conditions. Fodder movement and wind can increase the geographical spread of plant disease vectors such as aphids. This may result in more insect-transmitted diseases in crops and pastures. Drought can also mask the presence of some pests such as pasture mealybugs, which are associated with pasture dieback. This mealybug feeds on and kills summer grass pastures. It moves into the soil and mulch material when conditions are dry and/or cold, returning to the soil and plant surfaces when conditions are favourable. Stressed or unhealthy plants are generally more susceptible to mealybug attack.

Drier conditions are usually associated with fewer migratory pests; however, incursions of some invasive species such as grasshoppers can occur. In drier seasons, there are fewer outbreaks of armyworms and native budworms, which are significant pests of grass pastures, cereals, pulse and oil crops. Outbreaks of these pests are linked to rainfall and the growth of their host plants. More insect outbreaks occur post-drought when conditions are more favourable including fruit spotting bugs and swarming beetles, which are pests of horticultural crops including avocados, guavas, macadamia nuts, pecan nuts, lychees and mangoes.

Slugs in cropping systems may respond differently to drought events. Dry conditions may slow the establishment of several slug species, while others thrive following drought conditions as they are better adapted to drier environments.

It is important to maintain pest surveillance to monitor changes in endemic invertebrates and incursions of invasive pests in all conditions; during drought and post-drought, fire and flood. The most efficient and sustainable approach for pest management is to use a range of strategies including crop agronomy, natural enemies, and insecticides. You may need to adjust the timing of pesticide spraying in response to changes in pest populations. Consider crop rotation, inter-row cropping, mulching, crop sanitation, pruning of infested parts for better outcomes. Given environmental conditions such as drought may limit the effectiveness of natural enemies in managing pest population, planting flowering plants, banker plants can support the establishment and long-term conservation of beneficial insects on the farm.

During drought, fire and flood recovery, a lot of fodder and grain for livestock is imported from other regions and states. This movement increases the risk of new invertebrate pests also being imported such as the highly invasive and aggressive pest, the red imported fire ant. Fire ants cause serious social, economic, and environmental harm. Fire ants are not known to occur in NSW, but currently occur in South East Queensland with nests found close to the border. Fire ants live under the ground so are not affected by drought or fire. While these ants can fly, travel over and underground, and raft on water, accidental movement in fodder, turf, organic mulch and manure, and agricultural equipment and machinery is an opportunity for these ants to be moved long distances.



Top: Bark beetles damaging the trunk of a macadamia tree

Middle: Pasture dieback

Bottom: Pasture mealybug on setaria



## Be aware of red imported fire ants

Anyone bringing hay, turf, soil, mulch, potted plants or machinery into NSW from Queensland should check the measures that must be implemented before entering NSW.

For information on red imported fire ant, go to [www.dpi.nsw.gov.au/rifa](http://www.dpi.nsw.gov.au/rifa)<sup>1</sup>. If you suspect you may have fire ants, please submit an online report or call 1800 680 244.

### More information:

- [Australian plague locust](#)<sup>2</sup>
- [Drought resources for nut producers](#)<sup>3</sup>
- [Insect and mite control in field crops](#)<sup>4</sup>
- [Locust and grasshopper outbreaks in Australia](#)<sup>5</sup>
- [NSW Macadamia plant protection guide 2020–21](#)<sup>6</sup>
- [Pasture dieback](#)<sup>7</sup>
- [Red imported fire ants](#)<sup>8</sup>
- [Slugs in crops](#)<sup>9</sup>
- [Tools, guides and advice covering biosecurity, conservation and integrated pest management](#)<sup>10</sup>



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# Feral and pest animals

Reducing the rate of population increase should be the focus of vertebrate pest management strategies. Prolonged drought generally causes a decline in vertebrate pest population. If the pest population is already low, further reducing numbers by follow-up control measures is a good investment because the recovery rate of the population is much slower. A coordinated approach between adjoining land managers will maximise and prolong the benefits. Consider coordinated aerial baiting and shooting operations as part of an integrated pest management approach.

## Rabbits

Rabbits living in areas with a lot of seed in the soil, particularly clover or medics, survive and breed well into a drought. When this feed source is exhausted, the population can suddenly crash. In most areas, rabbit populations decline or contract to core warrens during drought, as the absence of green pick slows breeding. Remaining rabbits are likely to be hungry and because they seek food with high moisture content, poison baits are effective.

After a poison baiting or fumigation program, warrens should be ripped and the area could be sown with pasture seed ready for rain. There is an increased risk of erosion around ripped warrens, and this should be weighed against the long-term benefits of ripping.

Biological control agents such as myxomatosis or calicivirus (also known as RHDV) can be effective depending on the seasonal conditions and susceptibility of the rabbit population in your area. This should not be the only method of control. Rapid population knockdown and harbour destruction will have the best results.



## Feral deer

Feral deer compete with livestock for pasture and can become accustomed to supplementary feeding regimes. Drought conditions often force the population to congregate at permanent water sources, which may make them more vulnerable to control measures. Primary control measures include ground and aerial shooting. In some areas, trapping will be successful.



## Feral pigs

During the early stages of drought, feral pigs often benefit from increased feed availability from carrion. As drought progresses, however, they stop breeding and many piglets die as they are highly dependent on water for thermo-regulation and quality forage for reproduction and lactation.

As populations retract to areas with permanent water, they can foul those water sources, reducing availability of clean water for livestock. Their concentrated distribution and the lack of cover during drought make pigs susceptible to baiting, trapping and aerial shooting programs. Coordinated and effective control programs during drought can significantly reduce long-term pig populations.





## Wild dogs

Wild dog populations often increase during the early stages of drought because there are more food sources including weakened or mismothered lambs, native animals and carrion. Wild dog populations may decline during extended droughts, especially if there are significant declines in native prey such as kangaroos and wallabies, lower feral goat and sheep populations, fewer calves, and dwindling water sources.

Predation can be more obvious as stock become weaker and gather around water or feed sources. Control programs such as coordinated aerial and ground baiting and trapping should be targeted in these areas to reduce wild dog numbers during drought.

Competition for baits by foxes, pigs and birds may increase during drought. Leg-hold trapping is effective in removing troublesome dogs that refuse baits. It should be conducted by experienced trappers using soft-jawed traps.

If wild dog populations decline during drought, there is often less predation after the drought. Some dogs will disperse to new areas, regardless of food availability. This may be more obvious as they scavenge on dead livestock in previously unaffected areas. Landholders should remain vigilant, particularly in autumn and winter when dogs usually disperse.

**Monitoring wild dog activity during drought and after fires will help to reduce livestock losses. There are strict regulations governing the poisoning of wild dogs.**



## Foxes



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Fox populations generally remain static, even during extreme climatic events, if there is a supply of carrion such as lambs, kangaroos and wallabies. Foxes will also prey on insects such as locusts to sustain themselves. However, this alternative food supply does not necessarily reduce lamb predation as foxes will increase their territories in search of alternate prey.



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In Australia, young foxes disperse from late summer through to the onset of breeding in winter (December to June). Local Land Services coordinates group baiting programs across the state to coincide with juvenile dispersal and pre-lambing. A second round of baiting in spring is recommended. If juveniles do not disperse, then there is a potential for much more localised predation of lambs and poultry.

## Other pest species

Other pest species may exist in your area during drought including feral camel, wild horse, and feral or rangeland goats. Local Land Services can provide advice on control and management of these species.



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## More information:

- [LLS vertebrate pest animals<sup>1</sup>](#)
- [NSW DPI vertebrate pest animals<sup>2</sup>](#)
- [PestSmart Connect<sup>3</sup>](#)





# Managing natural assets

Natural assets, including water, soil and vegetation, are the key ingredients of a healthy and productive landscape. It's essential to manage your natural assets to maintain the health of your property and work towards a sustainable and resilient production system in the long term. With good management, the natural assets on your property will boost your bottom line and help to build your property's resilience.

In this chapter, learn about managing water, soils, vegetation and biodiversity during drought, fire and flood.





## Key Actions

Below are the key actions you can take to manage the natural assets in preparation for, response to and recovery from drought, flood and fire:

- Control and actively manage stock access to waterways and drainage lines, dams and springs, as well as rocky outcrops, remnant and regenerating native vegetation areas. This will improve water quality, increase the water holding capacity of soils, prevent erosion and support biodiversity.
- Provide off-source watering points for stock to manage supply and quality of water resources.
- Monitor and actively manage grazing pressure to maintain native vegetation and groundcover. To prevent erosion, improve soil infiltration, filter run-off and help the vegetation on your farm recover rapidly after drought, flood or fire.
- Manage pests and weeds to reduce grazing pressure, maintain groundcover, and help support regeneration of native vegetation.

Read on to learn more detail about the actions you can take to:

- benefit the environment and agricultural productivity during events like drought, flood and fire
- help your farm recover as soon as possible after drought, flood or fire.

# Water

The water resources on your property include waterways, dams and groundwater sources, as well as run-off and soil moisture. Maintaining the quality of your water resources will benefit production, keeping your stock healthier and encouraging increased weight gains. The benefits ripple out beyond the farm gate too. Improved water quality and reduced erosion on your property will benefit your neighbours and community downstream, resulting in a more productive landscape and more resilient local community.

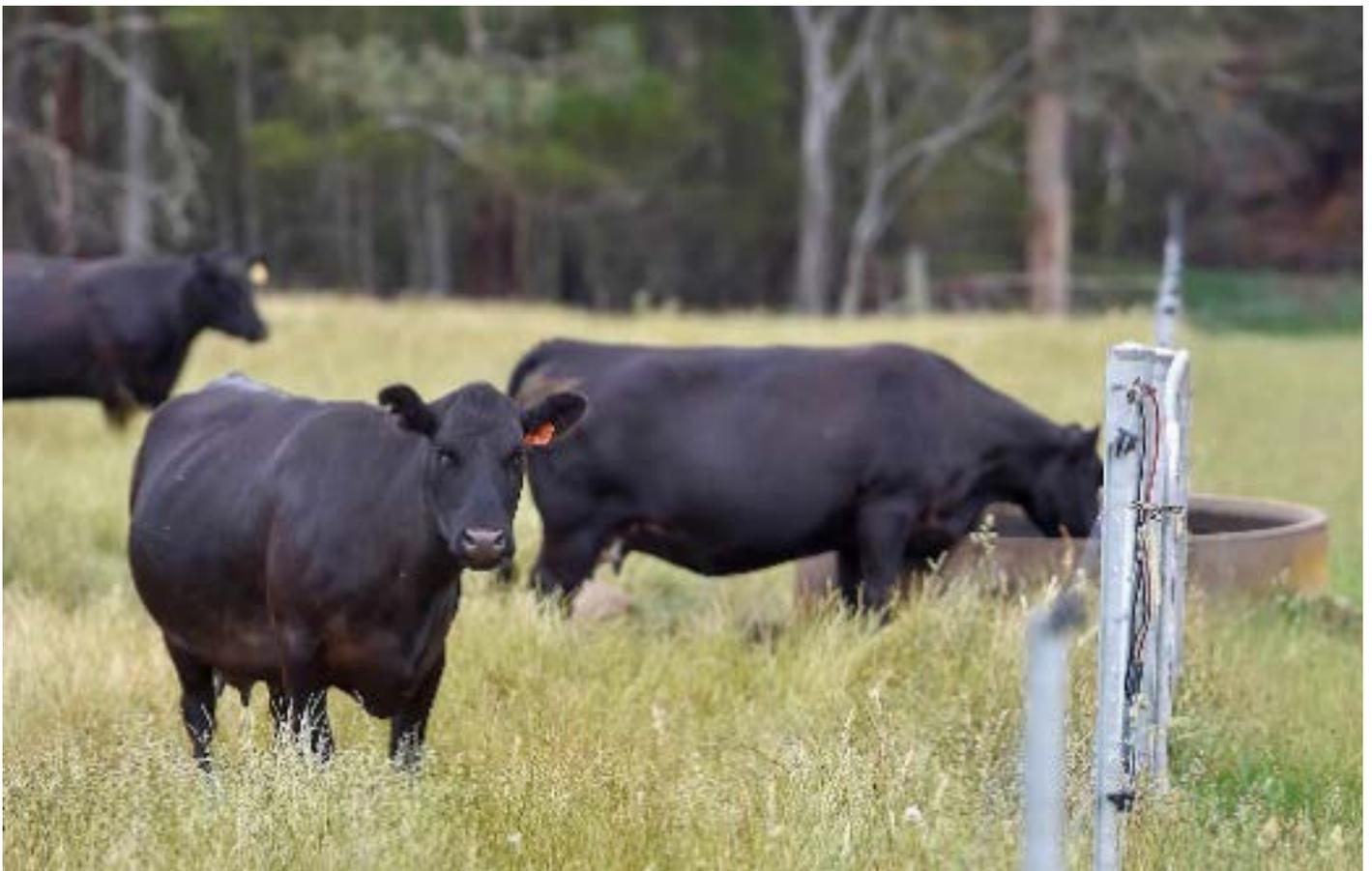
## Managing waterways, dams and wetlands

Actively managed waterways, dams and wetlands improve the quantity and quality of water available for livestock, increase the water holding capacity of soils, and support the local biodiversity that underpin sustainable landscapes. The areas around these water sources are important to manage too. Vegetation around waterways, dams and wetlands improves water quality by filtering out nutrients, stabilising banks and reducing erosion, as well as providing critical refuge for native species. These functions support the resilience of your on-farm water resources to drought, flood and fire.

### Control stock access to maintain water quality and minimise erosion

- Fence off waterways, wetlands, dams and drainage lines on your property and manage stock access to prevent soil compaction, erosion of banks and slopes, and fouling of water from increased nutrient and sediment loads. This is particularly important during drought and prior to drought breaking rain events.
- Maintain and upgrade fencing to withstand flood and fire impacts.

Photo: Adam Hollingworth



## Install off-source watering points and infrastructure to improve the resilience of your farm watering system

- Install and maintain stock water infrastructure, including tanks, to provide clean water after flood and fire, or during drought when dams and waterways dry out. Tanks can be readily filled by a water tanker if local water is unusable or unavailable.
- Pipe water from fenced off dams and waterways to tanks and external troughs to maintain water quality and maximise use of available water.
- Ensure troughs are drained and cleaned regularly to prevent salinity build-up or algal growth.
- Construct a hardened access point to farm dams to provide a backup for stock if troughs cannot be checked or are damaged during fire and flood. This will prevent erosion from stock trampling vulnerable areas and mitigate the risk of stock becoming 'stuck in the mud' when water levels are low.
- Learn more about how to enhance your farm dam by reading the [Enhancing Farm Dams guide](#)<sup>1</sup> from Sustainable Farms and Local Land Services. Learn more about watering system options for your farm via the [Stock and Waterways website](#)<sup>2</sup>.



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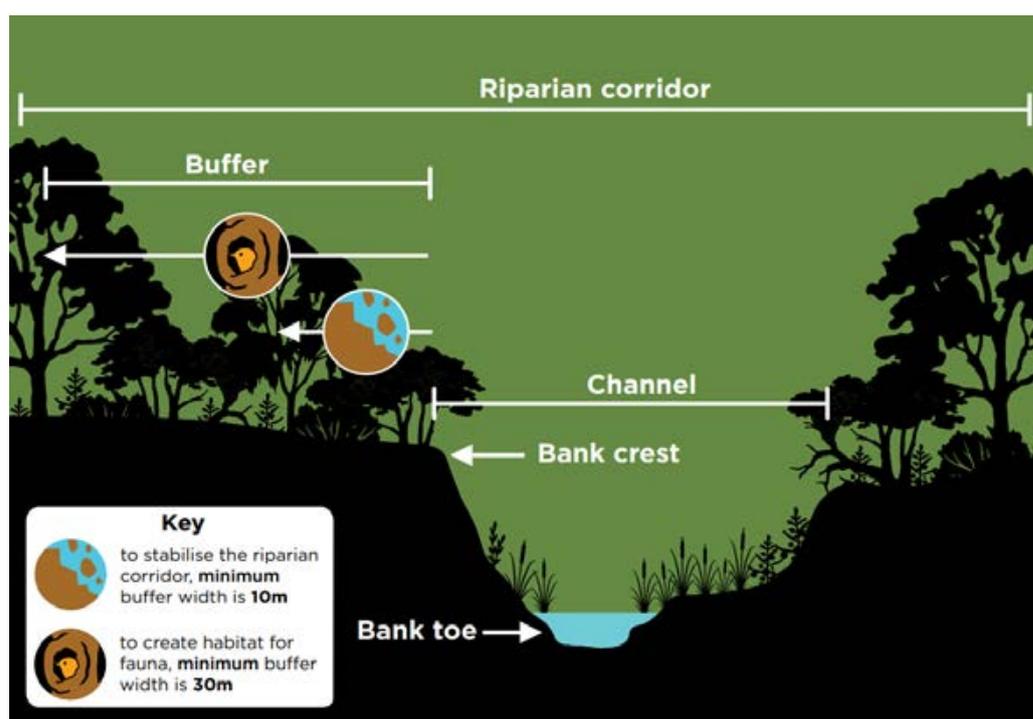


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## Maintain a vegetation buffer to filter out nutrients and reduce sedimentation and erosion

- Include a vegetation buffer within the fenced off area around dams, waterways and wetlands to reduce loss of water from evaporation, stabilise soil, filter runoff and provide habitat that supports biodiversity. Around waterways, it is recommended to maintain a minimum buffer width of 10m for bank stabilisation, and a minimum of 30m to provide habitat for biodiversity. Learn more about setting up [riparian fencing on the Stock and Waterways](#)<sup>3</sup> and [NSW DPI](#)<sup>4</sup>.
- Encourage natural regeneration of vegetation around dams, waterways, drainage lines and gullies. You can support regrowth by planting or seeding appropriate riparian and wetland vegetation. You'll need to maintain weed and pest control in regenerating riparian areas; however, maintenance will decrease once native groundcover is restored.



Source: Good practices in riparian rehabilitation © State of New South Wales and Department of Planning, Industry and Environment 2020”

- Manage grazing to maintain the vegetation around riparian areas. You can use high density, short-term grazing to reduce fuel load and manage annual weed species in the growth period (autumn to spring), while preventing loss of groundcover. During times of drought, these areas can be used as short-term refuge grazing options. Learn more about the benefits of strategic grazing via the [Local Land Services website](#)<sup>1</sup>.

### Leave fallen logs and dead branches for water retention, flood resilience and habitat

- Leave fallen logs and branches in waterways and dams to help stabilise riverbeds and banks and slow the water flow rate, which is particularly important during and after floods. Removing fallen logs and branches can have detrimental impacts on waterways, such as initiating erosion, exacerbating down-stream flooding and destroying habitat and important food sources.
- Seek expert advice and appropriate approvals before repositioning or removing fallen branches, logs or other woody debris. For help navigating the legislation, regulations and policy concerning waterways, read the [Riparian and in-stream works community guideline](#)<sup>2</sup> on the Local Land Services website.



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### Monitor water levels and protect deeper pools and waterholes

- Protect and manage deeper pools and waterholes along waterways to maintain and prolong the storage capacity of waterways, both as a productive resource and as a refuge for biodiversity.
- Supply stock water from tanks and troughs to avoid poor water quality, algae, parasites and disease issues.
- Seek advice on design and approvals for waterway management and recovery to improve resilience to future events.



# Managing groundwater

Groundwater helps to keep moisture in the landscape, supports important water dependent ecosystems and during drought, it can be one of the only supplies of fresh water. Protecting groundwater quality is essential for sustainable production at a farm-scale, but also important to make sure there is a safe, clean supply of water for the surrounding community.

## Maintain and protect soaks and springs to recharge aquifers, retain soil moisture and increase landscape water holding capacity

- Fence off the area around soaks and springs to manage or exclude stock from the area and prevent degradation. Include a buffer zone within the fenced area to maintain vegetation and encourage regrowth to improve water quality and increase water holding capacity.
- Use silt fencing or coir logs uphill from soaks and springs to prevent eroded sediment from impacting water quality in post-fire and drought rains.
- Monitor water levels and water quality regularly by marking water levels and testing salinity and pH. If unsure how to manage your groundwater sources, contact the NSW Natural Resources Access Regulator, [www.nrar.nsw.gov.au](http://www.nrar.nsw.gov.au)<sup>1</sup> or call Water Infrastructure NSW at 1300 081 047.
- Some sites contain high salt levels and need to be managed in different ways.

## Maintain vegetation and groundcover to manage groundwater and salinity levels

- Maintain coverage with a mix of native perennial and annual vegetation and grasses to help manage groundwater and salinity levels. Deep-rooted native perennial species increase water infiltration into the soil, reducing run-off and preventing the water table from rising too high.
- If soil salinity is an issue, plant a mix of salt tolerant species and mulch to ensure cover is maintained and soil organic matter increased.
- Keep stock out of wet or scalded areas to maintain groundcover and help with its recovery.
- Focus on maintaining groundcover and control erosion in drainage lines to avoid interception of saline groundwater, which may occur from gully erosion.
- Monitor water levels to check if the water table is dropping.



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Learn more about managing groundwater in drought via the [NSW Department of Planning and Environment - Water](#)<sup>2</sup>.



# Soils

Soil health is crucial to ensure your property is resilient to the impacts of drought, flood and fire. The factors contributing to soil health include:

- soil structure – managed by maintaining groundcover to improve soil moisture and organic matter.
- chemical composition – managed by maintaining organic matter, correcting and limiting deficiencies and toxicities.
- biological – managed by maintaining groundcover to support diverse soil biota.

More information on managing soils in the paddock is provided in chapter 7 and 8 of this guide. It is also important to manage soil health beyond the paddock including the riparian zone around waterways, areas with existing vegetation, and gullies to improve resilience to drought, flood and fire across your property.

## Improving soil moisture and infiltration

Landscape response to drought, flood and fire is impacted by the capacity of soil to hold water. During dry times, the goal is to improve soil moisture by minimising the amount of water lost to evaporation or run-off due to sun exposure or soil compaction. Following fire, restoring soil infiltration is important for landscape recovery.

Vegetation and groundcover are critical for soil health and improving soil infiltration. Without adequate groundcover or shading provided by canopy vegetation, evaporation will increase, and top soil will be lost through surface water run-off, increasing erosion and decreasing infiltration. Other landscape features, such as drainage lines, gullies and rocky outcrops, can also improve soil moisture by carrying water and slowing run-off so it can be absorbed and released into the surrounding landscape.

### Maintain groundcover and native vegetation to prevent evaporation

- Maintain ground and canopy cover with a mix of annuals and perennial species to ensure year-round coverage.
- Fence off and actively manage drainage lines and gullies to maintain groundcover, encourage natural regeneration of native vegetation and improve infiltration of run-off into the soil.



Rocky outcrops add roughness to the landscape, slow run-off and provide unique habitat that supports biodiversity.



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## Retain roughness in the landscape to slow run-off and keep water in the soil

- Roughness in the landscape is important to slow run-off enough to allow water to be absorbed into the soil, and prevent erosion. Groundcover, and vegetation including shrubs and trees contribute to landscape roughness, as well as fallen logs or branches and rocky outcrops.
- Protect and manage rocky outcrops by fencing off and managing grazing around rocky outcrops and control stock access and to prevent soil compaction and improve infiltration. Rocky outcrops help slow run off, facilitate water infiltration into the soil, and provide unique habitat for native plants and animals. Learn more about how enhance rocky outcrops on your farm via the [Sustainable Farms website](#)<sup>1</sup>.
- In areas with minimal roughness in the landscape, particularly erosion-prone slopes, consider establishing contour banks and swales that can slow and divert surface water run-off to stable ground and waterways. Run-off systems such as contour banks and swales need to be planned carefully and well maintained to prevent adverse impacts. For advice on these structural works, contact [Local Land Services](#)<sup>2</sup>, your [local Landcare group](#)<sup>3</sup> or the [Soil Conservation Service](#)<sup>4</sup>.



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## Managing erosion and sediment

Drought, flood and fire can all intensify erosion, which contributes to soil degradation and water quality issues if left unmanaged. To prepare for or respond to erosion caused by drought, flood and fire, you can:



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### Monitor and manage existing erosion and areas vulnerable to erosion

- Observe and monitor existing erosion or areas that are vulnerable to erosion. This can be as easy as setting up photo points at the same place at different times of the year. Vulnerable areas include drainage lines and gullies, waterways or steep slopes, as well as other areas with minimal groundcover. Focus on rehabilitating groundcover and vegetation in these areas to help prepare your property for drought, flood or fire. Watch these videos on [identifying priorities for erosion control on your property](#)<sup>5</sup>, [managing small scale erosion](#)<sup>6</sup> and [dealing with bare areas on your property](#)<sup>7</sup> from Local Land Services to learn more.
- After drought, flood or fire, assess existing and new areas of erosion. Plan and prioritise restoration efforts using erosion and sediment control techniques.
  - Using coir logs, silt fencing, or hay bales to capture loose sediment from exposed slopes or paddocks or divert run-off away from areas of active erosion. Place silt fencing or coir logs across exposed slopes or drainage lines, or uphill of active erosion points. Secure with stakes, cut level with the coir log or hay bale to reduce risk of flood debris being caught.
  - Laying jute or coir mesh over exposed slopes. Make sure to anchor the mesh down properly using timber pegs, metal staples or rocks. You can make holes in the mesh for planting seedlings to increase vegetation cover and stabilise the slope.



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- Constructing flumes to divert water away from slopes vulnerable to erosion and onto stable ground.
- Mulching on bare ground or planting cover crops to provide temporary groundcover and prevent erosion. Only apply mulch on areas with low or no resilience to erosion. Avoid applying mulch too heavily on regenerating areas and make sure mulch is managed to still enable natural regeneration. Leaf litter from the surrounding area can be used as mulch, but make sure mulch is free of weed seeds or propagules.
- If erosion is serious, seek specialist advice on stabilising the soil. Talk to [Local Land Services](#)<sup>1</sup> for advice on erosion control on your property. Contact the [Soil Conservation Service](#)<sup>2</sup> for advice if structural work is required.

Left: Coir logs anchored with wooden pegs installed on an exposed slope after fire to slow water run-off and trap sediment. Right: Jute mesh placed over active erosion point, with haybales anchored by wooden pegs installed to divert water.

### Encourage natural regeneration of groundcover by reducing grazing pressure

- In areas without groundcover, encourage natural regrowth by excluding or managing stock levels. In most circumstances, the soil seedbank will be able to provide sufficient seed to regenerate, however stock will need to be kept off or closely managed until it has become well established.
- Under some conditions, there will be insufficient seed to regenerate new growth, such as following severe bushfire, or if the soil is heavily degraded. If this is the case, it may be necessary to either seed in a new perennial pasture or an annual cover crop, for example ryegrass or millet.
- During drought, consider using stock containment areas, or drought lots, to allow groundcover to be maintained or recover. Learn more about setting up stock containment areas on your property via the [Local Land Services website](#)<sup>3</sup>.

### Prioritise establishing vegetation groundcover on steep slopes in preparation to prevent landslips.

- Steep slopes are particularly vulnerable to erosion but can be difficult to revegetate without causing further disturbance. Hydro mulching and aerial seeding are approaches to quickly revegetate exposed slopes with minimal disturbance.
- Create your own seed bombs to distribute on steep slopes as a cost-effective way to recover groundcover on exposed slopes.



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# Vegetation and biodiversity

Vegetation helps hold moisture in the soil, prevents erosion from water and wind, filters nutrients to improve water quality, and supports biodiversity that provides critical ecosystem services such as pollination, pest control and enhanced microbial activity. The shade and shelter that vegetation provides also has production benefits, improving feed efficiency, decreasing water requirements and contributing to increased weight gains.

During drought, vegetation helps to retain moisture in the landscape and reduce erosion. During flood, vegetation slows high velocity flows, allows water to be absorbed more quickly into the soil, and stabilises waterways. Vegetation can be managed to control the spread of fire and help landscape recovery. Active management of vegetation is critical to prepare, respond and recover from drought, flood and fire and to improve landscape resilience.

## Managing remnant native vegetation and existing vegetation

Remnant vegetation is the native vegetation that existed on your property prior to past clearing events. These native vegetation areas are well-adjusted to the local conditions and help to support landscape resilience and biodiversity. Remnant native vegetation and other existing vegetation can act as windbreaks, decreasing erosion and evaporation, as well as providing shelter for stock and habitat for biodiversity. Vegetated areas need to be actively managed to provide these benefits to production, biodiversity and make sure the native seedbank is protected through drought, flood and fire.



### **Maintain and enhance remnant native vegetation to decrease evaporation and provide shading**

- Fence off and actively manage remnant native vegetation and control stock access to mitigate damage from over-grazing. All remnant vegetation is valuable; however, the benefits will be amplified if larger areas are protected, and landscape connectivity is maintained.
- Install fencing around clumps of existing vegetation or individual trees within paddocks to facilitate recovery and generation of seeds after drought, flood and fire.
- Remnant vegetation can be used as short-term refuge grazing option, but stock access should be actively managed to mitigate damage from over-grazing.
- Remove grazing in areas with threatened ecological communities or threatened species if possible.

Remnant vegetation supports local biodiversity, provides shade and cover that helps prevent erosion. They can also be beautiful areas on your property for you and your family to enjoy!

## Ensure diversity of vegetation types to boost biodiversity and increase resilience

- Plant and maintain a diversity of native vegetation species to provide habitat for beneficial insect species (pollinators, parasitoids, predators) that can be crucial during drought and fire recovery.
- Aim to maintain or establish areas with native vegetation of different ages and sizes (canopy, understory, groundcover), which contributes towards fire resilience by creating a mosaic in the landscape that can slow the spread of fire. This depends on the fuel load within vegetated areas being managed appropriately.

## Manage fine fuel load with grazing and cool burning to improve landscape fire resilience

- Grazing of remnant and existing vegetation can help manage fine fuel load. Plan periodic high-density, short-term grazing to prevent the accumulation of dry fuel, without damaging live vegetation and groundcover. This type of grazing can be used as a refuge grazing option that allows groundcover recovery in other grazing areas.
- Consider planning a cool burn to reduce the fine fuel load, where and when appropriate. These burns use low-intensity fires that only affect the understory, reducing the fuel load and spurring regrowth, which also contributes to fire resilience by introducing greater diversity in the age of vegetation. Fire is used in traditional Aboriginal land management by applying cool burning techniques with cultural perspective and applications, and there are organisations that can provide cultural and cool burning services.
- Protect your vulnerable hollow bearing trees from bush fires and burn offs by raking around them.
- Contact the [Rural Fire Service](#)<sup>1</sup> for advice on conducting burning safely on your property.

## Improve vegetation cover

In areas that have minimal vegetation cover, taking action to regenerate or revegetate sections of your property can go far in improving drought, flood and fire resilience. Improving the extent of vegetation cover on your property will introduce benefits such as increased shade and soil infiltration, and reduced erosion and evaporation.

### Encourage natural regeneration to increase vegetation cover with local species.

- Identify and encourage natural regeneration in areas where vegetation will provide the best shade and shelter. Regeneration will be quickest and cheapest in sites that are already in reasonably good condition.
- Manage threats such as weeds and pest animals to reduce pressure on regenerating native plants. Selective weed control is particularly important while seedlings become established.
- Exclude and actively manage stock grazing in regenerating areas to protect seedlings and enable natural regeneration. Wait until seedlings are above browsing height and stems thick enough to withstand rubbing by livestock, then grazing can be used strategically to support weed and fuel load management.



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Left: Revegetation around a waterway. The area has been fenced off to control stock access.

Right: Natural regrowth following bushfire.

- Following fire and flood, some native species might grow quickly and dominate the landscape. This is a natural process of recovery, and it's not necessary to remove these plants. Allow the natural regeneration process to continue, and this will help other native plants to re-establish.
- Continue regular weed and pest control. You can get expert advice from your local council weeds officer or the [Local Land Services](#)<sup>1</sup> office in your area.

### Plan revegetation activities



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- Consider revegetation in areas where the land is highly degraded or severely damaged to supplement natural regeneration.
- Allow for seasonal conditions when planning revegetation. If dry conditions are expected, your planting design and management strategies should include manual watering. It's not recommended to undertake revegetation activities in drought. Instead, take the opportunity to collect and source seeds in preparation for revegetation as part of landscape drought recovery. Ensure you follow native seed collection regulations and guidelines.
- Select locations for revegetation by prioritising landscape connectivity. Consider planting 'stepping stones' across heavily modified landscapes to support biodiversity, pollination and natural pest control. These revegetated patches should be designed to provide a diversity of food sources for native animals and beneficial insects.
- Observe which native trees and vegetation perform well during drought and continue to use these species in revegetation activities to protect soils and water and to support wildlife. For planting techniques and species lists for your local area contact [Local Land Services](#)<sup>1</sup> or your [local Landcare group](#)<sup>2</sup>.
- Continue weed management after revegetation to give the planted species the best chance of survival.
- Learn more about [planning, preparing and managing revegetation activities on your property](#)<sup>3</sup> on the Local Land Services website.



# Weed and pest control

Weed and pest control helps to reduce pressure on native vegetation and groundcover. Following disturbances such as drought, flood and fire, weeds can quickly take over, so weed control is critical in recovery. On the other hand, the conditions during drought or following fire can be used as an opportunity to get on top of the weed production cycle.

## Use physical weed management during drought

- Take advantage of slow plant growth during drought by removing weeds using physical methods such as hand-pulling, cut and paint or slashing to prepare for and reduce weed incursion following post-drought rains.
- Beware not to expose too much soil, or mulch over areas where weed control has been undertaken, to prevent evaporation and soil loss.

## Eradicate weed seed following fire

- Use the 6 to 8 months post-bushfire to capitalise on the germination of weed seed by undertaking weed control before new seedlings produce the next generation of seed.

Learn more about identifying and managing weeds via the [Local Land Services website](#)<sup>1</sup> and from the Weeds and pest management chapter of this publication.

# Supporting native wildlife

Native wildlife such as birds, insects and reptiles contribute to biodiversity, soil health, the pollination of crops, and the regeneration of native vegetation, which can be especially important to support landscape recovery following drought, flood and fire.

## Provide water, shelter and feed supply for native wildlife

- Consider providing a temporary supply of water, food and shelter to help native wildlife survive and recover.
- Provide water in containers of various sizes and depths and in different locations to cater for a range of birds and animals. Leave a stick or rope in the water container to allow small animals to climb out if needed.
- Only provide support feeding if available native vegetation has been destroyed or significantly damaged. Support feeding should be phased out as native vegetation recovers. Provide appropriate food types and monitor how much is being eaten by looking for animal tracks and scats near the food source. Learn more about how to set up temporary support feeding via the [Department of Planning and Environment website](#)<sup>1</sup>.
- If you choose to provide water or feed to wildlife, choose a location that is:
  - protected from pests and predators
  - close to usual food sources
  - away from the roadside
  - shaded.

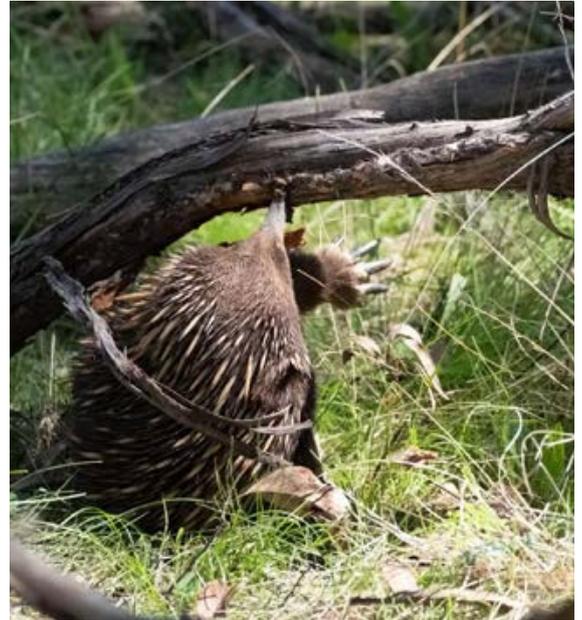


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Left: The critically endangered Swift Parrot.  
Photo: Chris Tzaros.



Right: An echidna clambering under a fallen branch, which provides important habitat protection.  
Photo: Suzannah Macbeth.



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- Nest boxes can be used to provide shelter for fauna when mature trees have been damaged by drought, fire or flood.
- Learn more about how to help native wildlife in emergencies via the [Department of Planning and Environment website<sup>2</sup>](#).

### Leave fallen timber and dead branches as habitat for native wildlife

- Leave fallen timber, dead branches or trees as habitat for native wildlife, including in the clean-up after fire and flood. It can provide shelter for wildlife if their habitat has been destroyed or damaged by drought, flood or fire.
- Note: you may need to increase effort to control pests, such as rabbits, in areas where logs are retained.

### Use wildlife-friendly fencing

- Install wildlife-friendly fencing when repairing or replacing fencing. Wildlife-friendly fencing allows wildlife to cross the landscape without getting caught or injured.
- To make fencing wildlife-friendly, use multi-strand high-tensile plain wire. To ensure wildlife-friendly fences are stock proof, consider using electrified fences.
- Learn more about wildlife friendly fencing via the [Wildlife Friendly Fencing website<sup>3</sup>](#).



# Appendix



## Drought plan | Template

A written drought plan can remind you of what you need to do and when you need to do it. Looking ahead and focusing on the factors you can change or influence is an essential key to managing dry times effectively.

Forward planning helps you to spot opportunities that otherwise could be easily missed and take proactive action to limit your losses. It is never too late to plan ahead.

Livestock on hand Date: \_\_\_\_\_

# Step 1

Class of stock	On hand	Value (\$)	To sell	Sale date	Keep and feed	Feed cost (\$)
1 <sup>st</sup> calf heifers						
Cows and calves						
Dry cows						
Bulls						
Weaner/yearling heifers						
Weaner/yearling steers						
1-2 year old steers						
<b>Total cattle</b>						
Maiden ewes with lambs						
Mature ewes with lambs						
Dry ewes						
Weaned lambs						
Hoggets						
Weathers						
Rams						
<b>Total sheep</b>						
<i>Other livestock</i>						
<b>Total other</b>						

## Fodder on hand

Date	Fodder	Quantity	Value

## Water

Estimated total usable water	ML*(A)
Stock water requirement per day for current stock numbers	ML/day (B)
Days of stock water available (divide A by B)	days

Visit the Local Land Services website for more information on water requirements for livestock  
[www.lls.nsw.gov.au/stock-water-requirements-in-drought](http://www.lls.nsw.gov.au/stock-water-requirements-in-drought)

# Step 2

Fodder on hand will last until

---

Pasture available will last until

---

Water available will last until

---

Take into account feeding for production, not just survival, and allow for increased energy requirements for pregnant and lactating breeders.

**Put your drought plan in writing with trigger points for action.**

## Set trigger points

Trigger points are predetermined points where a decision must be made.

Examples of trigger points Include:

1. Water supply becomes unpredictable or insecure
2. Feed requirements outstrip supply
3. Feed costs reach a certain point
4. Funds available to purchase feed fall below a certain point
5. Reaching a date with no rain for crop or pasture growth.



Action	Planned date	Review of progress	Achieved
<i>E.g. Contact agent to assess stock suitable for sale</i>	<i>4/09/2023</i>	<i>Agent visiting 10 am 4/09/2023</i>	<input type="checkbox"/>
<i>E.g. Order cotton seed</i>	<i>1st of each month</i>	<i>20T ordered for delivery 2/09/2023</i>	<input type="checkbox"/>
			<input type="checkbox"/>

## Financial resources:

Know your numbers. Your financial position will be a major determining factor regarding the options you have available and the decisions you need to make. Keep financial records up to date so you can regularly assess cash flow and keep yourself in control.

Assess your current financial situation and complete a 12 month cash flow projection to forecast the impact of the drought on your financial situation. Rural financial counsellors provide free and confidential assistance with helping you assess your financial position.

# Step 3

## Implement your plan

Know and act on the critical dates you have identified. Continue to stay informed.

At each point look for support, advice and information through these contacts:

- [www.droughthub.nsw.gov.au](http://www.droughthub.nsw.gov.au)
- Local Land Services livestock officers and biosecurity staff
- Livestock agents
- Rural financial counsellors.

## Remember to look after your most important asset – you and your people!

It is essential to look after yourself so that you are in good shape to continue to monitor your business position, performance and outlook and make decisions in a timely manner as the season progresses.

You are your business's most important asset yet often the most easily neglected one as far as regular care and maintenance goes. Take proactive steps to actively manage stress and keep your mindset positive.

Consider how you might be able to take a break. Building and using support networks in your community will mean you have access to timely information relevant to your needs.

Seeking help when you need it from various support services will see you in the best shape possible to minimise losses and recover quickly when it does rain.

## For more information, advice and help:

### NSW Droughthub

[www.droughthub.nsw.gov.au](http://www.droughthub.nsw.gov.au)

### Australian Animal Welfare Standards and Guidelines

[www.animalwelfarestandards.net.au](http://www.animalwelfarestandards.net.au)

We acknowledge being in drought is a highly stressful and emotional situation. It can be hard to prioritise your own well-being as you manage competing demands on the farm and at home. Talking to someone could help ease some of your concerns.

Please consider talking to your GP, or utilise one of these free services, who will be able to provide you with strategies to help you cope.

If you're concerned about your own or someone else's mental health, you can contact:

### NSW Mental Health Line

1800 011 511 for advice

### Lifeline

13 11 14

[www.lifeline.org.au](http://www.lifeline.org.au)

### Beyond Blue

1300 224 636

[www.beyondblue.org.au](http://www.beyondblue.org.au)

### National Centre for Farmer Health

[www.farmerhealth.org.au](http://www.farmerhealth.org.au)

### Rural Adversity Mental Health Program

[www.ramhp.com.au](http://www.ramhp.com.au)









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