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Sustainable Land Use for Red Meat and Wool Production in the Dunes and Flats Sub-Region (Limestone Coast, SA)

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Key messages:

- Sustainable Dry Sheep Equivalent (DSE) figures for the Dunes and Flats sub-region range from 5 DSE/ha on non-wetting sandy soils in the north east to more than 14 DSE/ha on clay soils in the southern part of the sub-region.
- There are many factors that must be taken into account to work out a potential sustainable carrying capacity on your property/ies.
- Management strategies can be implemented to increase carrying capacity, however farmers should be aware that there are also many constraints that impact carrying capacity.

Introduction

This sub-region covers a large area of the Limestone Coast - see Figure1.

Rainfall and growing season length vary from 500 mm with a 6-month growing season (north-west of Padthaway) to 750 mm with an 8-month growing season around Beachport. Soils also vary from deep non-wetting sands west of Padthaway to peat flats along the coast near Beachport and rendzina clay flats heading north-east from the coast.

Determining the correct carrying capacity on the varied soils and climate of the Dunes and Flats sub-region will depend on rainfall, soil type, grazing management, soil fertility and the type of enterprise. Carrying capacity will also depend on the area able to be cropped and if there is an irrigation licence available.

Working out a potential sustainable carrying capacity is complex and this fact sheet has been compiled using data supplied by producers who are farming in the Dunes and Flats sub-region, thus providing locally relevant information.

Finding a balance in the management of the grazing enterprise between optimum production per animal and production per hectare of land is needed. Overstocking, particularly on sandy soils, will result in severe land degradation, especially due to wind erosion which is difficult and expensive to remediate. Overstocking will also result in the loss of productive pasture species which in turn will significantly reduce livestock production and farm profitability.

Loss of productive pasture species increases infestations of weeds, which can reduce overall productivity, and in some instances also impact on livestock health.

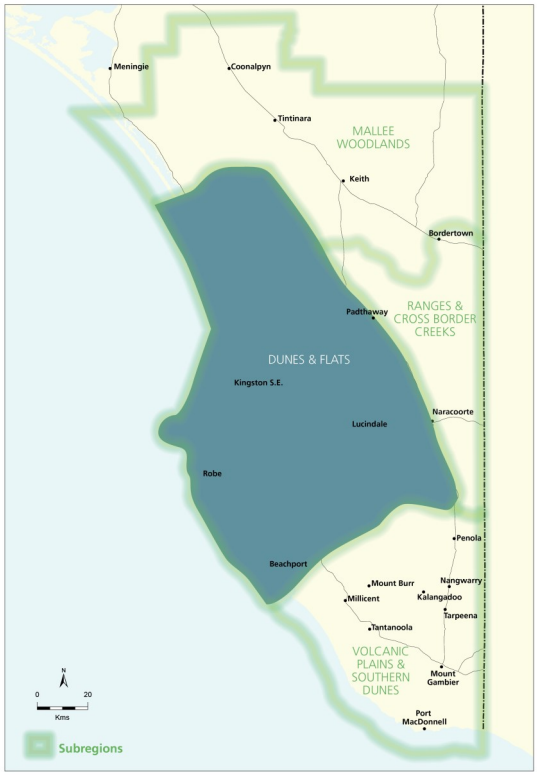

Figure 1: Map showing Dunes and Flats sub-region (Limestone Coast, SA)

Heavy grazing can cause pugging on waterlogged clay soils resulting in soil damage, loss of pasture and paddocks that are less trafficable.

Some producers in the Dunes and Flats use irrigation for livestock as well as an integrated mixed farming approach involving cropping, small seed production or vineyards which offer additional grazing opportunities. Irrigation can significantly increase overall carrying capacity by extending the growing season either before the break of the season or as rainfall declines at the end of the growing season. Irrigation also provides opportunity to grow high quality fodder crops without having to rely on stored soil moisture or variable summer rainfall. Most of the irrigation is located in the southern and eastern parts of the sub-region, due to high ground water salinity levels in the northern and western parts.

Determining the correct number of livestock to run on a given area will take into consideration grazing management and livestock feed demand relative to pasture productivity and the timing of pasture production relative to livestock pasture demand. Landholders in the Dunes and Flats sub-region are using the following strategies to manage their livestock to maximise sustainable carrying capacity and to maintain pasture:

- Containment feeding, particularly during late summer and early autumn
- Feedlotting or irrigation to finish animals to target weights
- Changing lambing and calving time, so that time of lactation more closely matches the timing of peak green pasture growth
- Sowing improved pasture species, both annuals and perennials
- Pregnancy scanning to remove dry animals in early pregnancy and to manage single and multiple bearing ewes separately
- Soil and pasture nutrition, especially maintaining adequate soil phosphorus levels
- Applying lime to maintain a near-neutral soil pH
- Grazing management, especially rotational grazing and reducing paddock size to reduce pasture waste, providing additional stock water points and using temporary electric fencing
- Supplementary feeding, including the use of lick feeders to feed grain in the paddock and feeding hay on pastures with high legume content
- Feed budgeting and storing adequate hay and grain on farm
- Clay spreading and delving on sandy soils
- Upgrading livestock infrastructure including yards, handling equipment, water, fencing in order to decrease labour costs
- Winter grazing of vineyards, grazing stubbles or potato crop residues
- Genetics and breed of animal, to identify genetically superior animals to improve animal performance
- Grazing crops early in the season and then taking the crop through to grain or hay, or oversowing pastures with cereals and/or annual ryegrass
- Wean lambs and calves at the recommended time frames of 12-14 weeks for lambs and 6-9 months for calves
- Trading animals
- Applying nitrogen fertiliser to annual ryegrass, cereals and phalaris pastures for additional winter pasture

Whilst most landholders are working hard to continue to improve their soils and in particular, better manage both their sandy and waterlogged soils, individual landholders can still be caught out in a very wet or dry year. The key is to monitor grazing paddocks closely, especially soil moisture and ground cover, then make early decisions as required.

Carrying Capacity and Stocking Pressure

Carrying capacity or long-term stocking rate refers to the number of livestock that a paddock or whole property can support over a period of time (several years) without damaging either the soil or the pasture. This is usually measured as a dry sheep equivalent (DSE) per hectare (ha).

On the other hand, stocking pressure is how many DSE/ha are grazing or using an area of land at a particular time and is a management decision regarding how many animals you are going to put on a particular pasture or in a paddock, and for how long. Good pasture managers use carefully monitored high grazing pressure (100+ DSE/ha) for short periods (2 to 10 days) to manage weeds and surplus green pasture, as well as dry pasture over summer/autumn.

Determining your optimal carrying capacity (long-term stocking rate) will rely on many factors including:

- Grazing management
- Livestock type and target markets
- Time of lambing or calving
- Soil type and soil fertility
- Pasture type, persistence and stability
- Labour
- Investment
- Length of the growing season
- Paddock size

Actual carrying capacity can be calculated using historical grazing records (number of animals x DSE x number of days divided by grazing area), or by using one of the numerous grazing record computer programs available.

It is dangerous to target a higher stocking rate without a very flexible and well managed grazing system as soils and pasture can also be easily damaged if grazing and fertiliser management is neglected.

Defining a Dry Sheep Equivalent (DSE)

A DSE is a method of standardising the energy requirements of different classes of livestock, based on their metabolisable energy needs. One DSE is the amount of energy required to maintain a 50 kg wether (or dry ewe) in condition score 2.5, which is equivalent to a requirement of 8.5 megajoules (MJ) of metabolisable energy (ME) per day.

A DSE does not indicate how many MJ of ME per day the animals are actually eating, as this will depend on the quality and availability of the feed on offer.

A DSE only indicates the animal's ME requirements, not the actual ME intake.

Please note that a DSE is only a rough estimate of an animal's feed requirements. The DSE rating will vary considerably depending on whether the calculation is based on actual ME intake, or ME requirements.

For example, using the table below, the DSE rating of a 60 kg ewe with one lamb is based on her ME requirement, which is 21 MJ/day, so her DSE rating is 21÷ 8.5 = 2.5.

If the same ewe is grazing a high-quality pasture with 1800 kg/ha feed on offer she may have an ME intake of 28 MJ/day, so her DSE rating (based on ME intake) will then be 28 ÷ 8.5 = 3.3. So, a DSE rating will depend on whether the calculation is based on requirements or intake. In this fact sheet, all DSE calculations are based on requirements.

Table 1: DSE Ratings for Various Classes of Livestock Based on ME Requirements

Mature Ewes

Liveweight (kg)	Dry	Pregnant (last month)		Lactating (average to weaning)		Average for Year
		Single	Twin	Single	Twin	
50	1	1.4	1.6	2.1	2.7	1.5
60	1.2	1.6	1.9	2.5	3.1	1.8
70	1.3	1.8	2.2	2.8	3.6	2

Growing Lambs

Liveweight (kg)	Growth (g/day)			
	50	100	150	350
20	0.7	0.8	1	1.2
30	0.9	1	1.2	1.7
40	1.1	1.3	1.6	2.3

Wethers

Liveweight (kg)	Maintenance
50	1
60	1.2
70	1.4

Breeding Cattle

Liveweight (kg)	Dry	Pregnant	Lactating		Average for Year
			0-3mth	3-9mth	
400	4.6	6.2	10	13.8	9
500	5.4	6.9	10.8	15.4	12
600	6.2	7.7	12.3	16.9	14

Growing Cattle

Liveweight (kg)	Growth (kg/day)		
	Maintenance	0.5	1
200	3.1	5.4	7.7
300	3.8	7.3	9.2
400	4.6	9.2	10.8

Estimated carrying capacities for the Dunes and Flats sub-region

The table below contains estimates of **carrying capacity** or long-term stocking rate based on information collected by surveying producers across the Dunes and Flats sub-region. There are many variables affecting the carrying capacity and pasture performance, so these figures can only be used as a general guide under normal seasonal conditions.

Table 2: Estimated long-term carrying capacities (stocking rate)

Area/rainfall	Growing Season	Soil/Pasture	DSE/ha Range
North of the old railway line between Naracoorte 500 mm to 600 mm	6 to 6.5 months	Non-wetting sandy soils	5.0 to 6.5
		Clayed/delved sandy soils with	5.5 to 7.5
		Waterlogged flats	7.0 to 8.0
South of the old railway line to the Clay Wells 600 mm to 650 mm	7.0 to 7.5 months	Non-wetting sandy soils	5.5 to 7.0
		Clayed/delved sandy soils with	6.0 to 8.0
		Waterlogged flats	8.0 to 12.0
Coastal zone south of Robe and east to Princes Highway 650 mm to 750 mm	7.5 to 8.0 months	Non-wetting sandy soils	6.0 to 8.0
		Clayed/delved sandy soils with improved adequately fertilised pasture	7.0 to 10.0
		Waterlogged flats	9.0 to 14.0

Strategies to Increase Sustainable Carrying Capacity

Sowing improved pastures combined with **pasture nutrition and fertiliser management** are keys to ensuring sustainable increased pasture production in this region. This involves regular soil testing and regular applications of phosphorus (plus sulphur and potassium if required) along with lime applications to correct soil acidity. This allows for increased stocking rates and therefore increased profitability.

Some producers in the Dunes and Flats sub-region, with properties containing deeper soils, are mixed enterprise farmers who run **complementary cropping and livestock programs**. Stubbles are a major feed source at the end of harvest and are used to maintain core breeding animals as well as finish and provide seed free paddocks for lambs. The cropping program also provides an opportunity for producers to grow their own supplementary feed, making them less vulnerable to volatile hay and grain markets, particularly in times of widespread feed shortages.

Early sowing cereals for grazing (not necessarily for grain) has become more common to help fill the winter feed gap in the region.

Sowing cereals for lambing ewes has enabled producers to set stock lambing ewes and to minimise feeding during the lambing period. These producers are sowing cereals with a companion species such as vetch, subclover/medic or ryegrass to maximise the value of the feed.

Cereals and annual ryegrass are highly responsive to **nitrogen fertiliser** applied at seeding with additional applications before the three-leaf stage and again following each grazing. Producers are applying several applications of up to 30 kg/ha N per application during early and mid-winter. Regular small applications (less than 30 kg/ha N per application) are recommended rather than single large doses such as 50 kg/ha N.

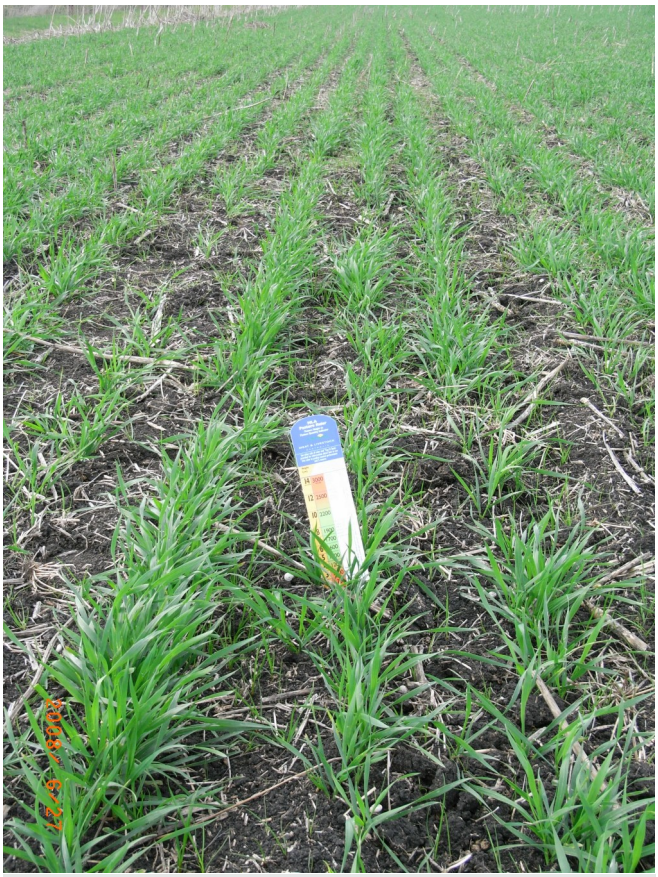

Figure 2: Cereals can be used for valuable winter grazing in the Dunes and Flats sub-region

Gibberellic acid application in early winter can also provide additional short term (up to 30 days) pasture growth in winter but won't increase tiller growth or pasture vigour.

Clay spreading and delving has been used widely to modify non-wetting sands resulting in improved moisture holding capacity and infiltration, reduced leaching of fertilisers through the soil profile, improved microbe activity in the soil, increased frost resistance and reduced wind erosion. This has brought about increased quality and productivity of pastures on deep sands. Some farmers are also using heavy duty tyned machinery to crack the limestone on shallow stony soils, therefore improving pasture root depth.

Containment feeding sheep to defer grazing following opening rains is used to increase carrying capacity outside of dry or drought season management. Sometimes containment feeding is also used to prevent sandhills in paddocks becoming bare during late summer, but in this region, containment feeding is increasingly used for a short period (4 to 6 weeks) during late autumn and early winter to allow pastures to germinate, establish a root system and reach sufficient leaf area to maximise pasture growth rate during winter. This also maximises supplementary feed efficiency and prevents livestock chasing the 'green pick' and therefore expending more energy than they obtain from grazing.

Time of lambing is an important consideration as it has a significant impact on winter carrying capacity as well as lamb and ewe survival. Autumn lambing requires significant amounts of supplementary feeding (or irrigation) because dryland pasture reserves and quality are almost always inadequate for lactating ewes. However autumn lambing also provides greater opportunity to finish lambs before pasture quality declines and grass seed infestations of lambs becomes a problem, particularly in situations where grass seed free paddocks have not been prepared.

Figure 3: Sheep being fed in containment in the Dunes and Flats sub-region

Later lambing (in winter) ensures adequate pasture is available to meet the demands of lambing ewes therefore increasing ewe and lamb survival and lamb growth rates. However, a later lambing may impact on the ability to finish lambs particularly if adequate stubbles or alternative means of finishing lambs other than pasture are not available.

Time of calving is an important consideration; almost all producers in the Dunes and Flats sub-region calve their cows in autumn or early winter. In this sub-region, calving in late winter or early spring compared with autumn or early winter can significantly reduce calf weaning weight due to the spring born calf spending a several months on dry summer pasture whilst still young and its nutritional requirements are high.

Some producers are choosing to start calving as late as July/August/September. Later dropped calves (and their mothers) are then grazing an abundance of spring pasture putting less pressure on cows in early winter. The impact of later calving on the growth rate of weaner calves is mitigated in paddocks containing lucerne or on properties with irrigation or strawberry clover on coastal peat soils.

Weaning calves at around 6-9 months rather than the traditional 9-10 months after birth and weaning lambs at 12-14 weeks after start of lambing means better quality pastures can be allocated to weaners, and cows and ewes have more time to recover. Better utilisation and allocation of pasture results in improved weaner calf/lamb performance, reducing the time to achieve target sale weights which in turn improves the overall profitability and carrying capacity of the livestock enterprise.

Insect control on pastures is important and in particular lucerne flea and redlegged earth mite should be monitored. High redlegged earth mite population causes severe damage to both established and emerging pastures. Redlegged earth mite also reduces pasture palatability and seed production in late spring. Severe infestations of lucerne flea can skeletonise the plant leaves and stunt or kill plant seedlings. Pastures are most susceptible to lucerne flea and redlegged earth mite at the time of emergence.

Improved grazing and pasture management has significantly contributed to increasing carrying capacity in this sub-region, with improved pasture species and increased feed utilisation resulting from subdividing paddocks and providing additional water supplies allowing paddocks to be rotationally grazed.

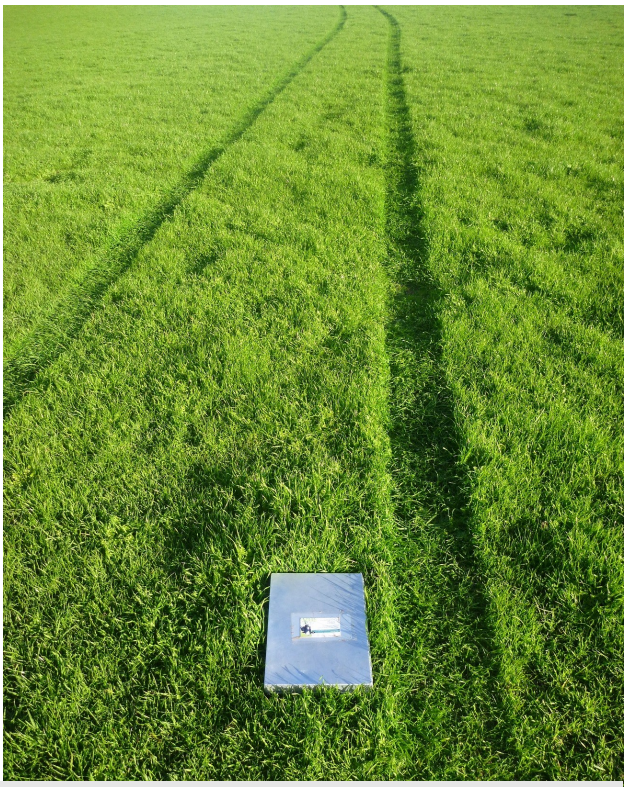

Figure 4: Dense pasture in the Dunes and Flats sub-region in early winter following deferred grazing in late autumn, with adequate soil fertility and a late summer phosphorus fertiliser application.

Subdividing paddocks enables more even grazing across all paddocks and within paddocks and helps prevent the "baring out" of areas favoured by livestock. Smaller paddocks can help to increase pasture utilisation, improve the quality of feed, increase pasture productivity and protect the soil from erosion. This in turn can increase the profitability and productivity of the livestock enterprise.

Grazing waterlogged paddocks can result in pugging and pasture/soil damage. The impact of pugging can be minimised by deferred grazing (and application of N fertiliser) in early winter so that wet paddocks have 1500 to 1800 kg/ha feed on offer before they are grazed. Pugging is also reduced by spreading livestock over a bigger area to reduce grazing pressure, especially if deferred grazing (plus N fertiliser if required) have been used to create a feed wedge before paddocks become waterlogged in winter.

Lucerne is an important pasture species that capitalises on any summer rainfall received, allowing later calving/lambing, and therefore increasing pasture utilisation. It is important to implement strict rotational grazing strategies with lucerne to ensure it is not over grazed and to maintain longevity (and productivity) of the lucerne pasture.

The **type of livestock** within an enterprise has a significant impact on the potential carrying capacity. Many producers have reduced their breeder numbers to incorporate a component of trading animals which can be introduced or off loaded depending on feed availability.

Some producers are using genetics to influence carrying capacity on their properties, aiming for a more moderate frame size, which require less maintenance energy than larger-framed animals. In this sub-region red meat production is important, and there has been a shift from wool to prime lamb and beef production.

Frequent **feed budgeting** is needed to make sure there is enough feed ahead on the farm to meet future livestock needs. This is extremely important if you are running a higher-than-average stocking rate to ensure you are not caught out with inadequate feed resources. This can result in costly damage to your soil and pastures, and may also result in paying more than necessary for supplementary feed.

Dryland brassica **forage crops** sown in early spring are an effective way of cleaning a run-down pasture and still providing useful high-quality feed for livestock during summer/autumn, dependent on the amount of summer rainfall and water storage capacity (depth) of soil.

Pregnancy scanning enables individual management of ewes or cows according to their pregnancy status. Dry females can be sold, re-mated or stocked at higher rates. In ewes, single and multiple bearing ewes can be identified and managed according to nutritional requirements and enabling optimal use of pasture and feed resources. It enables producers to calculate lamb or calf losses between scanning and marking and also to measure the reproductive potential of their flock or herd.

Figure 5: Brassica forage crop under-sown with a perennial ryegrass pasture in early summer, following a September sowing.

Drainage is common in this area; between 1960 and 2015, hundreds of kilometres of drains were dug in this sub-region to help move surface water north into the Coorong wetlands, or into coastal lakes south of Robe. This has resulted in reduced waterlogging and reduced land salinisation, leading to improved carrying capacity and the ability to grow crops (and lucerne) in paddocks where this was not possible before drainage.

Encourage **dung beetles** by taking care with your cattle drenching program, and ensuring you have the complete suite of winter, spring, summer and autumn active beetle species. Dung beetles aerate the soil and incorporate animal dung into the soil to reduce pasture loss due to uneaten pasture around dung pats.

Unsuccessful Strategies Implemented by Farmers

Grazing crops with the aim of also taking the crop through to grain have been trialled over the years using Grain and Graze strategies. This strategy has had mixed results attributed to the narrow window to graze crops without impacting on grain yield, larger sizes of cropping paddocks, livestock damage to cropping paddocks and drier finishes in many seasons.

Some improved pasture species have been sown and not persisted well. These have included annual **ryegrass** and **biserrula** on sandy soils, **chicory** in paddocks prone to waterlogging and lucerne where soil $pH_{(water)}$ is less than 6.0 especially at 30-40 cm depth.

Shrubs such as tagasaste and salt bush have proven hard to manage properly to ensure they remain productive.

Constraints Impacting on Potential Carrying Capacity

Soil constraints in surface and subsoil layers are common in the Dunes and Flats sub-region. These may be a barrier to increasing carrying capacity. Constraints include:

- Shallow sheet limestone, which restricts root growth and reduces the persistence of perennial grasses
- Highly alkaline soils on some flats ($pH_{(water)}$ higher than 8.0) restricting pasture legume growth and persistence, leading to nutrient and trace element imbalances in sheep and cattle
- Waterlogging in paddocks not close to a drain
- Soil acidity (low pH) in dunes in both surface and subsurface layers, and in the surface in sand over clay soils. Soil acidity can also be present in the surface of sandy soils where there is limestone at depth
- Plant Available Water Capacity (PAWC) can also be low on shallow soils.

Figure 6: Steers grazing in late summer in the Dunes and Flats sub-region.

Soil testing is essential to identify the need for beneficial amendments, such as lime (for acidity) or gypsum (to reduce the impact of hard setting soils). Thorough investigation is warranted to determine the chemical and physical condition in the top 30 cm before conducting any soil amelioration activity (such as deep ripping or mixing) to avoid causing further degradation.

Inadequate **fertiliser application**, particularly phosphorus, sulphur, potassium and nitrogen are major constraints to maximising pasture productivity. If soil nutrients are lacking, pastures will be unable to reach their potential regardless of how much water and sunlight is available and how effective grazing management is. Soil testing is essential to identify optimum phosphorus, sulphur and potassium application levels.

Weed infested pastures impact on carrying capacity. Weeds are often a lower feed value (especially in spring), affect animal health and lower the value of animal products as a result of grass seed infestation. Weeds may arise from livestock overgrazing in autumn, or by livestock preferentially grazing desirable pasture species rather than weed species, highlighting the importance of grazing management in weed control. Good weed control is critical when establishing new pastures.

The **autumn/winter feed gap** can be a challenge, particularly in seasons with a late break, when there is a narrow window of time before ground temperatures drop significantly, or soils become waterlogged, reducing pasture growth. Producers in the district use various strategies to combat this issue including deferred grazing, coupled with containment feeding and supplementary feeding, dry sowing cereals (or annual Italian ryegrass) to maximise early feed production, soil testing and applying adequate phosphorus, sulphur and potassium and applying nitrogen fertiliser in early winter.

Poor utilisation of pasture occurs either through under or over-grazing as a result of inadequate **grazing management**. Good grazing management makes the best use of pasture grown through managing the frequency and intensity of livestock grazing the pasture. Different pastures have particular characteristics meaning they respond differently to grazing and it is important to understand this to maintain productive pastures.

A **labour shortage** on many properties as a result of movement of people from this sub-region to cities and large regional centres, along with competing industries such as mining, have reduced the capacity of some farmers to intensify their grazing system due to labour shortages and the ability to pay a competitive wage.

For further information, please contact your local livestock consultant, soils consultant, or agronomist.

This fact sheet has been compiled by Tim Prance, Pastures and Grazing Systems Consultant, T Prance Rural Consulting and Claire Dennerley, Land Management Consultant, Rural Solutions SA with information sourced from producers farming across the Dunes and Flats sub-region.

The aim of this fact sheet is to capture and formalise local intelligence on sustainable land use for red meat and wool production in the Dunes and Flats sub-region.

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