Developing pasture and livestock benchmarks for sheep production in northern New South Wales

G.M. Lodge

Department of Primary Industries, Tamworth Agricultural Institute,
4 Marsden Park Road, Calala NSW 2340; greg.lodge@industry.nsw.gov.au

Abstract*: Focus groups of agency and commercial advisors were used to obtain information on stocking rates and the value of different pasture types for different livestock enterprises in northern New South Wales. A simple spreadsheet-based feed calculator that utilised the livestock months (LSM) concept, where 1 LSM = 250 Megajoules of energy per 30-day month, was used to assign monthly values for pasture/forage supply and animal requirements. This provided a useful tool that enabled changes in pasture types/areas and sheep numbers to be rapidly computed, providing a visual output of the likely match between feed supply and animal requirements for a whole farm.*

Key words: native pastures, forage oats, lucerne, tropical perennial grasses, stocking rates, feed calculator

Introduction

Unfertilised native perennial grass-based pastures are increasingly being used for both sheep and cattle breeding and fattening in northern New South Wales (NSW), despite their unsuitability for these enterprises (Lodge and Roberts 1979; Lodge and Whalley 1983, 1989; Lodge *et al.* 1991; ProGraze manual 2006). In a survey of advisors and leading graziers on the North-West Slopes of NSW (Lodge 2011), all of the respondents indicated that native perennial grass-based pastures were not suited to breeding and fattening, unless their use was integrated with other forage sources or supplements were provided. However, on 55% of the properties monitored as part of the EverGraze northern NSW project (Lodge *et al.* 2008) native grass pastures were either the sole or primary forage source for these enterprises.

Native pastures dominated by C_4 summer-growing, frost susceptible grasses commonly have a 'protein and energy' deficit in the critical later winter-early spring period that coincides with mid to late pregnancy for stock calving or lambing in spring. At this time of the year these species are physiologically unable to meet the benchmark requirements for green herbage mass and quality (ProGraze manual 2003). To meet these requirements in most years native pastures require a substantial component of C_3 winter-growing native perennial grasses and/or oversown annual legumes such as subterranean clover (*Trifolium subterraneum*) in conjunction with applied fertiliser. Alternatively, the use of these pastures as a feed source may be integrated with paddocks of winter-growing forage oats (*Avena sativa*). Less often, sown temperate grass-based pastures or supplementation are used on-farm to help meet animal requirements. With summer dominant rainfall in northern NSW, both lucerne and tropical perennial grasses are widely used as summer forage sources (Harris *et al.* 2010), but the growth of both are limited by colder temperatures in the critical winter period. Below average annual rainfall in the past 10 years (e.g. Lodge and McCormick 2010*a*) in northern NSW and a shift from wethers to sheep and cattle breeding and fattening enterprises has put considerable pressure on the regional feed base and so, for many on-farm situations, the limitations and carrying capacities of different forage sources and how to match feed supply to animal requirements need to be revisited.

Two activities undertaken within the National EverGraze program in northern NSW (Lodge *et al.* 2008) helped to address these issues. The first was a series of advisor focus groups that provided benchmark values for different pasture/forage types, while the second was the development of a simple spreadsheet calculator, based on the livestock month (LSM) concept used in COMPLAN (Buffier and Young 1977), a computerised farm planning service popular in northern NSW in the 1970s and 1980s. This paper reports the outcomes from the focus groups and

demonstrates how a basic knowledge of feed quality and animal requirements can assist with forage budgeting and grazing management.

Methods

Three focus groups for agency and commercial advisors (both agronomy and livestock) were held in 2007–08 and consisted of written responses to questions that were supplementary to the main EverGraze survey undertaken by Lodge (2011) and a structured discussion about stocking rates and the use of different pasture types and forage sources. A summary of the main outcomes including expected stocking rates for different pasture types is reported in Table 1. Stocking rates (Table 1) are expressed on a dry sheep equivalent (DSE) basis with 1 wether/ha = 1 DSE/ha; 1 ewe-lamb/ha = 2 DSE/ha; 1 steer/ha = 10 DSE/ha, and 1 cow-calf/ha = 15 DSE/ha**.** These values are subjective rankings of the annual (12-month) energy requirements of the different classes of livestock relative to the energy requirements of a 50 kg liveweight adult dry sheep which is equivalent to 1 DSE/ha.

The feed calculator is based on a LSM, which is defined as the energy required to maintain a 50 kg dry sheep grazing a 'medium quality pasture' for a month (30 days), after allowing for an amount of 35% of the fasting metabolism for exercise (Rickards and Passmore 1971). In energy terms, a LSM is equivalent to 250 Megajoules (MJ) per month or 8.33 MJ per day. Livestock month values were calculated seasonally and monthly by Buffier and Young (1977) for a wide range of crops, forage crops and pastures grown on the North-West Slopes and northern Tablelands of NSW, as well as for all of the major sheep and beef cattle enterprises. These values were also used by Lodge and Frecker (1990) in devising a decision support system for whole-farm forage budgeting in northern NSW. The only LSM values not calculated by Buffier and Young (1977) were those for tropical perennial grass pastures and these were estimated from growth curves (ProGraze manual 2006). Livestock month units were also split into 'general purpose' (maintenance) and 'special purpose' (growth) values to take account of the seasonal differences in feed quality (reflecting the amount of green and dead herbage) and the differing feed requirements of livestock at different stages of reproduction and lactation.

In the feed calculator, there are LSM values for eight different pasture types; timbered country, poor native pasture (PNP, unfertilised pastures dominated by C_4 grasses), good native pasture (GNP, fertilised native pasture dominated by C_3 grasses), native pasture + subterranean clover (native pasture oversown with subterranean clover and fertilised), improved temperate pasture (sown temperate grass/legume pastures with fertiliser applied), lucerne, forage oats and tropical perennial grass pastures. All pasture types, except timbered country and PNP were assumed to receive adequate fertiliser application. There are also three different sheep enterprises; wethers, self-replacing Merino ewes and Merino ewes crossed to a terminal sire, with both ewe enterprises lambing in spring. All values were for an 'average run of seasons' each year, but could be scaled monthly to allow for seasonal variations. Property size, areas of different pastures and stock numbers can all be varied, but in the reported example a 'typical farm', as defined by a local producer group (McCormick *et al.* 2009), was used with a total area of 400 ha, running 1500 spring-lambing Merino ewes. Graphical outputs (radar graphs) indicate the monthly total metabolisable energy (ME) supplied by the different forage sources and the total ME required by the sheep. Monthly total values are also partitioned into those supplied or required for stock maintenance and growth. Altering the area of different pasture types and/or stocking rates allows the user to instantly visualise changes in feed supply and demand each month and so adjust for any feed deficits or surpluses (which can be used for fodder conservation).

Results and discussion

Advisor focus groups highlighted that unfertilised native perennial grass-based pastures were not suited to breeding or fattening enterprises (Table 1) and that their on-farm use needed to be integrated with other forage sources, including supplements. This point was also reinforced by the data in Figure 1*a*

which indicated that in an average year a 400 ha good native pasture would not meet the ME requirements of 1500 self-replacing Merino ewes from May to mid November (i.e. for 6.5 months) each year. However, the same pasture could carry 1300 Merino wethers/year (a stocking rate of 3.25 DSE/ha) without the need for alternative forage sources or supplementation (data not shown). If, instead of having 400 ha of good native pasture, the farm had 200 ha of good native pasture, 50 ha of fertilised native pasture oversown with subterranean clover, 50 ha of lucerne, 50 ha of forage oats and 50 ha of tropical perennial grass pastures, then it would easily meet the total ME requirements in an average year (Figure 1*b*), as well as those for growth, pregnancy and lactation of the 1500 ewe breeding flock. A range of pasture/forage types was required to meet the seasonal demands (lucerne in spring-summer, tropical perennial grasses in late summer-autumn and forage oats in late autumn-winter). Also, with a variable climate (e.g. Lodge and McCormick 2010*a*) different annual, perennial and C_3/C_4 species can respond to different niches (Lodge and McCormick 2010*b*).

Table 1. Expected stocking rate (DSE/ha) of different pasture types/forage sources, together with their suitability for breeding/fattening (the more shaded boxes the better) and comments.

Pasture/forage condition	Expected stocking rate (DSE/ha)			Suitability for breeding/ fattening	Comments
	Average	Minimum	Maximum		
Native pasture – unfertilised					
Poor	1.0	0.5	1.5	□	Advisors indicated that summer-growing grass pastures are bestsuited to store stock only.
Average	3.1	2.5	5.0	□	
Good	4.3	3.0	5.0	□	
Native pasture + fertiliser + subterranean clover					
Poor	3.3	2.5	5.0	□	Use S-based fertiliser ~every 2 yr. Use mid-late season sub clovers. Sub clover may fail in drier years.
Average	5.4	5.0	6.5	□■■	
Good	7.8	7.0	9.0	■■■	
Temperate perennial grass/legume					
Poor	4.8	3.0	6.0	■	Sow only in favoured areas. Allow tiller development and flowering one year in three.
Average	9.3	7.0	10.0	■■■	
Good	13.5	10.0	15.0	■■■■■	
Tropical perennial grass					
Poor	5.8	5.0	8.0	■	Rotationally graze to maintain green leaf. Maintain quality by adding legumes or N.
Average	9.9	7.0	12.5	■■	
Good	15.0	10.0	20.0	■■■■	
Lucerne					
Poor	6.3	5.0	10.0	■	Rotationally graze. Allow plants to flower. Consider using pasture mixtures for good ground cover.
Average	9.5	6.0	12.0	■■■	
Good	14.1	7.5	20.0	■■■■■	
Forage oats					
Poor	8.6	5.0	15.0	■	Sow in late Feb.–early March. Strip or rotationally graze for best use. Apply N for best response.
Average	18.8	10.0	25.0	■■■	
Good	25.8	15.0	30.0	■■■■■	

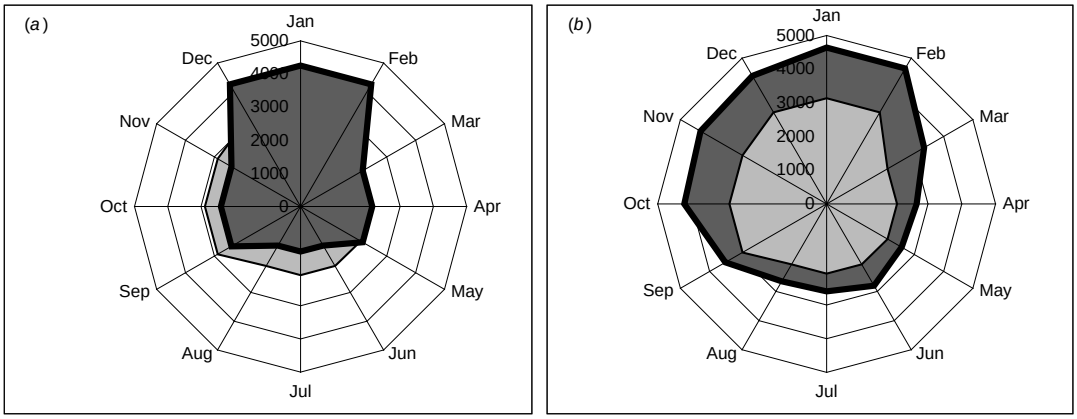

Figure 1. Total metabolisable energy (MJ/month) required by 1500 self-replacing Merino ewes (light shading) and supplied by pasture (dark shading) consisting of (*a*) 400 ha of good native pasture or, (*b*) 200 ha of good native pasture, 50 ha of native pasture+subterranean clover, 50 ha of lucerne, 50 ha of forage oats and 50 ha of tropical perennial grasses.

Acknowledgments

EverGraze is a Future Farm Industries CRC, Meat & Livestock Australia and Australian Wool Innovation research and delivery partnership. The Department of Primary Industries (formerly Industry & Investment NSW) is a core partner of the Future Farm Industries CRC. The interest and assistance of the cooperating advisors and producers involved in the EverGraze northern NSW project is gratefully acknowledged.

References

Buffier BD, Young DF (1977) COMPLAN Handbook No. 1 – Enterprise budgets for the North West of N.S.W. (University of New England: Armidale)

Harris CA, McCormick LH, Boschma SP, Lodge GM (2010) Tropical Perennial Grasses for Northern Inland NSW. (Bookbound Publishing Pty Ltd: Gumma)

Lodge GM (2011) Surveys of grazing industry end-users in northern New South Wales. In 'Proceedings of the 26th annual conference of the Grassland Society of NSW.' (Eds G Lodge, J Scott, W Wheatley). pp. 108 (Grassland Society of NSW Inc.: Orange

Lodge GM, Roberts EA (1979) The effects of phosphorus, sulphur and stocking rate on the yield, chemical and botanical composition of natural pasture, North-West Slopes, New South Wales. *Australian Journal of Experimental Agriculture and Animal Husbandry* **19**, 698–705.

Lodge GM, Whalley RDB (1983) Seasonal variations in the herbage mass, crude protein and in vitro digestibility of native perennial grasses on the North-West Slopes of New South Wales. *Australian Rangeland Journal* **5**, 20–27.

Lodge GM, Whalley RDB (1989) Native and natural pastures on the Northern Slopes and Tablelands of New South Wales: a review and annotated bibliography. NSW Agriculture & Fisheries, Technical Bulletin No. 35.

Lodge GM, Frecker TC (1990) FEEDBAL: An integrated expert system for calculating whole-farm forage budgets. *Computers and Electronics in Agriculture* **5**, 101–117.

Lodge GM, McCormick LH, Dadd CP, Burger AE (1991) A survey of graziers and pasture management practices on the Northern Slopes of New South Wales. NSW Agriculture & Fisheries, Technical Bulletin No 43.

Lodge GM, Boschma SP, Brennan MA (2008) EverGraze research in northern New South Wales. In 'Proceedings of the 23rd Annual Conference of the Grassland Society of NSW'. (Eds SP Boschma, LM Serafin, JF Ayres). pp. 133–134. (NSW Grassland Society Inc.: Orange)

Lodge GM, McCormick LH (2010*a*) Comparison of recent, short-term rainfall observations with long-term distributions for three centres in northern New South Wales. In 'Proceedings of the 25th annual conference of the Grassland Society of NSW.' (Eds C Waters, D Garden). pp. 104–107. (Grassland Society of NSW Inc.: Orange)

Lodge GM, McCormick LH (2010*b*) Long-term annual rainfall and the distribution of simulated annual pasture intake of ewes grazing different pastures on the North-West Slopes of New South Wales. In 'Proceedings of the 25th annual conference of the Grassland Society of NSW.' (Eds C Waters, D Garden). pp. 123–126. (Grassland Society of NSW Inc.: Orange)

McCormick LH, Boschma SP, Lodge GM, Scott JF (2009) Producer-identified constraints to widespread adoption of sown tropical grass pastures on the north-west slopes of New South Wales. *Tropical Grasslands* **43**, 263–266.

ProGraze manual (2006) ProGraze – profitable, sustainable grazing. Sixth edition. (Ed. B Noad). (NSW Agriculture, Orange and Meat & Livestock Australia, Sydney)

Rickards PA, Passmore AL (1971) Planning for Profit in Livestock Grazing Systems. Professional Farm Management Guidebook No. 7. (Agricultural Business Research Institute, UNE: Armidale)