Impact of climate variability on predicted annual pasture intake of sheep grazing native pastures in northern NSW

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Abstract
The SGS Pasture Model was used to predict daily intake of Merino wethers and ewes and lambs in different grazing systems for perennial native grass-based pastures in northern NSW. These simulations indicated that variations in annual rainfall markedly affected the ability of different pasture types to meet the predicted intake requirements of different livestock systems.

Key words
Biophysical model, SGS Pasture Model, Merino wethers, ewes and lambs, subterranean clover.

Introduction

Climate variability is a major factor in the long term success of different pasture management and grazing systems, but its effects are often poorly understood, since the timeframes involved may be decadal or generational. This variability is also of particular importance when considering the impacts of climate change on grazing practices, and the implications for future levels of livestock production. Monthly and annual rainfall data are readily available and provide a means of estimating variability by comparing values with long term averages. This allows patterns to be detected (e.g. periods of wet or dry years) and standard statistics to be applied to assess variability. For example, Clewett *et al.* (2003) found that the long term (1882-2004) mean annual rainfall for Barraba in northern NSW was 692 mm (with a coefficient of variation of 26%, but from 1900-49 it was 638 mm, while from 1950-99 it was 737 mm. The implications of this variability for sheep production systems and long term stocking rate has not previously been investigated.

This paper describes the outcomes of long term (99-year) model simulations that demonstrate the effects of climate variability on the ability of native pasture grazing systems in northern NSW to provide forage for different sheep production systems and stocking rates as assessed by predicted animal intake. These grasslands are dominated by summer growing, frost-susceptible (C4) native perennial grasses and grazed mainly by store stock (wethers and steers) at an average stocking rate of 3.3 dry sheep equivalents/ha (Lodge *et al.* 2003).

Methods

The SGS Pasture Model (Johnson *et al.* 2003; version 4.2.3) and daily climate data from the SILO Data Drill (Jeffery *et al.* 2001) were used to simulate daily intake for Merino wethers and ewes and lambs grazing a native perennial grass pasture (30°34'S; 150°38'E, 510 m a.s.l.) previously described by Lodge *et al.* (2003). Model parameterisation was as described by Johnson *et al.* (2003), and total predicted annual intake (t/ha) from both pasture and supplementary feed was expressed as the proportion (%) provided by the pasture. Mature sheep grazing the pastures were assumed to have a bodyweight of 50 kg and minimum liveweight was maintained above 40 kg. In the model simulations, wethers received a supplement (quality sufficient to meet daily metabolisable energy (ME) needs) if the pasture provided <60% of their daily ME requirement, and ewes were supplementary fed if their daily milk production was <95% of potential or the pasture provided <90% of their daily ME requirement. Simulations were run from 1 January 1906 to 31 December 2004 for wethers continuously grazing an unfertilised native pasture (a mixture of both C4 and C3 species) at stocking rates of 4, 6 and 8 wethers/ha, and for ewes and lambs grazing the same native grass-based pasture, fertilised and oversown with subterranean clover and grazed continuously at 4, 8 and 12 ewes/ha.

Results and discussion

Unfertilised native pasture grazed at 4 wethers/ha was predicted to provide >80% of total animal intake for 35% of years from 1906-2004 (Figure 1). As stocking rate increased, this declined to 6 and 2% of

years. From 1906-49 (lower annual rainfall), pasture was predicted to provide >80% of intake for only 20% (4 wethers/ha), 2% (6/ha) and none (8/ha) of the years. Conversely, for the wetter years (1950-99) the pasture was predicted to provide >80% of intake for 48, 8 and 2% of years.

Fertilised native grass/subterranean clover pasture grazed at 4 ewes/ha was predicted to provide >80% of total animal intake for 69% of the years from 1906-2004 (Figure 2), declining to 16 and 1% of years as stocking rate increased. From 1906-49, the pasture was predicted to provide >80% of intake for 52% (4 ewes/ha), 7% (8/ha) and none (12/ha) of the years. In contrast, from 1950-99 the pasture was predicted to provide >80% of intake for 82, 24 and 2% of years, respectively for stocking rates of 4, 8 and 12 ewes/ha (Figure 2).

These results indicate potentially large differences in the ability of native pastures in northern NSW to meet animal intake needs, depending on climatic variability. Interestingly, if climate change scenarios of drier conditions, similar to those in the first half of the last century are correct, then lower stocking rates could be expected. Also, the "collective memory" of graziers as to what constitutes "normal seasons" is likely to be in the second half of last century, when rainfall was higher.

References

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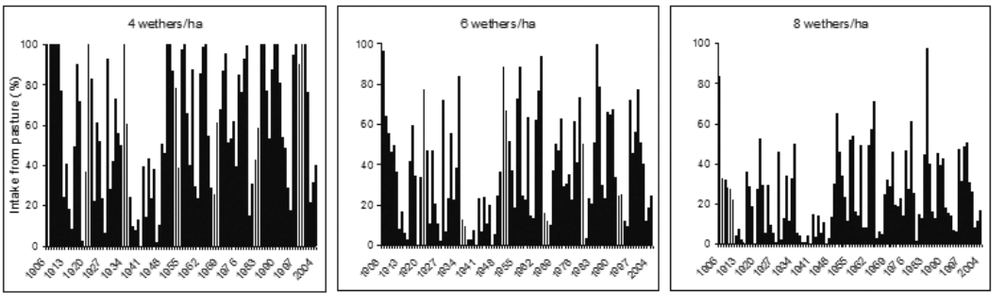

Figure 1. Percentage of the predicted annual total intake of Merino wethers (1906-2005) provided by an unfertilised native pasture at Barraba, NSW for stocking rates of 4, 6 and 8 wethers/ha.

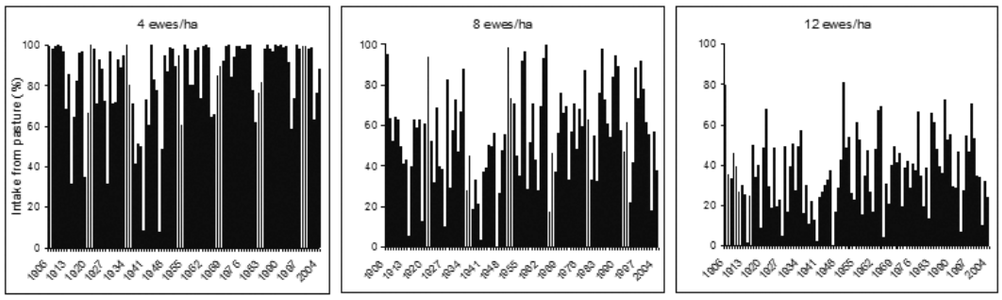

Figure 2. Percentage of the predicted annual total intake of Merino ewes and lambs (1906-2005) provided by a fertilised native pasture oversown with subterranean clover at Barraba, NSW for stocking rates of 4, 8 and 12 ewes/ha.