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Climate change impacts on northern NSW beef producers

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Abstract: A review of meteorological data from 1957 to 2010 for areas adjacent to the coastal fringe of northern New South Wales indicates that the summer season is increasing in length. The first frost day has been delayed over that time by up to 35 days, with the first 28°C day occurring up to 49 days earlier. Such changes favour an increase in the abundance and distribution of tropical grasses, including several important weeds. Increases in the distribution and severity of tropical pests and diseases are also likely. Several options are available to beef producers wanting to adapt to these changes. The first is to increase *Bos indicus* herd content. Brahman cattle are adapted to grazing in the tropics and well documented research has shown that Brahman infused cows can increase gross margins by 10-50% in those areas. The second option is for producers to utilise the additional, lower quality, pasture produced by tropical grasses using supplements. Finally producers can conserve the additional summer growth. Note that although these management strategies have been already implemented by many coastal NSW producers, climate change is making these practices pertinent to a wider audience.

Keywords: climate change, beef production, northern New South Wales.

Introduction

Data from the Australian Bureau of Meteorology indicate a general warming of Australia's climate. Anecdotal evidence from livestock producers, such as the spread of pests, disease and tropical grass weeds suggests that the effects of such changes could already be happening in north eastern New South Wales. A review of meteorological data for selected centres in that region was undertaken to quantify weather trends over the last 50 years, not as a basis with which to make predictions about future trends, but to evaluate what is currently happening.

Materials and methods

Climatic data from 1957 to 2010 from five locations in the Hunter Valley and adjacent to the north coast of NSW were sourced from the SILO database (<http://silo/silo/ppd>). At each location, the first frost day was identified annually in the historical data. Given that the temperatures are recorded above ground level, it is generally accepted that 2°C is equivalent to a frost on the ground. The exceptions were Dungog and Gloucester where winter temperatures often didn't reach 2°C and so threshold figures of 3°C and 2.5°C were used respectively.

The threshold to indicate the first 'summer' day was 28°C. Research has shown that feed value of ryegrass is reduced, due to the onset of reproduction and senescence, once temperatures reach 28°C (Sinclair, unpublished data). As with the first frost data, the first 28°C day was identified annually at each of the sites. Fitted straight lines were then used to estimate the average date of the first frost and summer day at the beginning and end of the time period studied for each of the sites. The number of days above 35°C was studied at Scone, the hottest of the centres. Regression analysis was

applied to bimonthly and total annual rainfall data covering the period 1957-2009.

Results

The date of onset of frost varied across locations, but was over a month later at the end of the period than at the beginning at Gloucester and Dungog ($P < 0.01$), lesser amounts at Dorriggo and Tocal (both insignificant changes) while there was no change at Scone (see Table 1). The first 28°C day occurred sooner at all locations, varying between 14 days at Scone (not significant), and 58 days at Dorriggo ($P < 0.01$; Table 1 and Figure 1). The number of days above 35°C in Scone has almost doubled in the time period studied (see Figure 2).

There was a trend for reduced autumn and winter rainfall, but more spring rainfall when averaged over the sites. However, there was no significant trend for any change in rainfall within any of the sites (data not shown).

Discussion

Pasture

A lengthened summer season, as represented by later frosts and earlier warm days, favours the growth of tropical grasses (also known as warm season or C4 species) as they are better adapted to warm temperatures and high humidity compared to temperate species. Although much of the beef production on the north coast (kikuyu, Rhodes grass, setaria, couch, carpet grass) and adjacent ranges (redgrass, wiregrass, windmill and plains grasses) already relies heavily on these and other warm season grasses, it is likely that such species will increase in abundance and distribution. Indeed, production from improved tropical species such as bambatsi panic, Rhodes grass, premier digit, purple pigeon and consol lovegrass has increased along the North West Slopes and Hunter regions of New South Wales, in pasture renovation programs.

Temperate grasses produce a smaller amount of higher quality feed and are less competitive than tropicals in warm conditions. A reduction in the length of the 'cool' season (late autumn, winter and spring) may reduce the persistence and vigour of temperate (also known as C3 or cool season) species, including both introduced (fescue, cocksfoot, phalaris, ryegrass) and natives (microlaena and danthonia). Producers relying on crops of ryegrass or oats to fatten stock may have reduced grazing time at the end of the season.

Winter forage crop growing season and grazing time can be maximised by establishing them early. Delayed frosts, however, can mean that establishment of these winter crops can also be hampered by large amounts of summer and autumn pasture growth. Making silage is one strategy to remove this overburden while supplementing animals grazing is another.

As well as altering the composition of favourable pasture species, temperature changes may also affect the abundance of weedy species. For example, warm season weeds such as giant Parramatta grass (*Sporobolus fertilis*), African lovegrass (*Eragrostis curvula*) and Coolatai grass (*Hyparrhenia hirta*) may increase their range in warmer conditions, and anecdotal evidence already supports this in some areas. Grasses not declared noxious, but still considered by some to be weedy, such as common couch, (*Cynodon dactylon*) may also increase in abundance.

Pests and diseases

Apart from the impact on pasture species and growth, a gradual reduction in the cool season means pests and diseases that overwinter in sub-tropical areas and move south in summer may also extend their range. For example, anecdotal evidence suggests that buffalo flies and bush ticks may have increased their range during the last 10 years. Changes in temperature may also lead to an increase in the occurrence and severity of diseases, such as Theileriosis and Bovine Ephemeral Fever (three-day sickness), that are spread by insects.

Management options

An increase in the distribution and abundance of tropical grass pastures will reduce overall pasture quality. When combined with increases in the number of hot days and pests and diseases, beef producers in the areas studied face challenges to increase or maintain production. Some combination of adjusting herd genotype, providing supplements and more intensive grazing

management will help adapt to a changing climate.

Bos indicus cattle are well adapted to grazing tropical pastures and also have a much higher tolerance to pests and diseases compared with *B. Taurus* cattle. Research conducted by NSW Agriculture at Grafton during the 1980s (Barlow et al. 1989) showed that *B. indicus* infused cow herds were 10-50% more profitable on medium to low quality pastures respectively (see Table 2).

In those studies, the medium quality pasture contained kikuyu, setaria, paspalum, carpet grass and white clover while the low quality pasture contained native warm season grasses with little to no clover content. The gross margin calculations took into account a reduction in cow numbers of 10% and 25% for the crossbred cows in the medium and low quality pastures respectively (based on their heavier liveweights and greater pasture intake) and the cost of replacement first cross heifers. The increased gross margin for first cross Brahman x Hereford cow herds was a result of higher weight gain and value of weaners, reduced mortality and increased weight and value of cull cows. There was also a difference in weaning percentage, particularly on low quality pastures.

Growth rates for cattle grazing fresh growth from tropical grasses, typically during spring and early-mid summer, can be excellent. Prodigious growth of tropical species during late summer and early autumn, however, results in pasture that is low in both protein and energy. Young stock need 14-18% protein, depending on age, while lactating cows need about 12% and dry cows about 8%, whereas levels in rank, dead tropical grasses can fall to as low as 4-5%, with digestibility of about 40%. Additionally, a high carryover of this growth can reduce the germination and establishment of legumes and valuable temperate grasses during the cooler months.

Falling pasture protein levels result in a shortage of nitrogen needed by rumen microbes to breakdown the fibrous material. Supplementing with additional nitrogen, in either protein or non-protein (NPN) form, helps correct this imbalance. The most common form of NPN is urea while true or bypass protein is most often supplied to stock in the form of protein meals; by products of the oilseed crushing industry.

Note that stock grazing low quality pastures also respond to energy-based supplements such as grains (Lee et al. 1987). While this may be necessary when the amount of available pasture drops below threshold levels, providing urea is the most efficient in

the first instance because it increases digestibility and therefore stimulates intake of low quality herbage (see Table 3).

Urea based supplements are only able to slow or negate weight loss in stock grazing low quality pasture (Table 3). As a result, they must be supplied as soon as pasture quality begins to deteriorate, in order to preserve stock condition over time. Urea has been safely and easily supplied to stock in the form of lick blocks or molasses mixes for many years and these recipes are readily available. Simple dry licks based on salt, urea and sulphate of ammonia can also be used and are increasing in popularity.

While urea provides a source of non-protein nitrogen for utilisation by rumen microbes, which in turn are digested by the animal, 'meals' or other protein supplements such as copra meal contain high levels of bypass protein. Such protein is not degraded in the rumen but is available for direct utilisation by the animal. Protein meals generally contain good energy levels in the form of oil, so stock weights can be maintained or increased depending on the amounts fed. The downside to feeding protein meals is that they are more costly, and so the return to investment is much lower than for urea.

Keeping tropical grasses in the vegetative stage for as long as possible into summer and autumn maximises animal production. Since total pasture growth often far exceeds stock intakes during this period, mechanical methods will also have a role on some properties. While slashing and mulching have long been used to keep summer pastures short in north eastern New South Wales, the use of round bale silage is also increasing. Making silage has the added benefits of conserving fodder to fill winter feed gaps and opening up the pasture sward to allow establishment of cool season crops and pastures. The outstanding growth of tropical grasses during summer also provides producers with the flexibility to fallow land (either chemically or mechanically) over this period, without impacting stocking rates, to grow specialist winter crops.

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Appendix

Table 1. The average date of the first frost and 28°C day as determined by fitted lines, for locations in north eastern NSW, in 1957 and 2009.

Location	First '2°C' day*		Change (days)	First '28°C' day		Change (days)
	1957	2009		1957	2009	
Dorrigo	19 th May	31 st May	+11	13 th December	16 th October	-58**
Dungog	30 th May	4 th July	+35**	4 th October	11 th September	-23**
Gloucester	6 th June	5 th July	+33**	12 th October	6 th September	-33**
Scone	25 th May	25 th May	0	4 th October	20 th September	-14
Total	15 th June	21 st June	+6	6 th October	8 th September	-28**

*The temperatures monitored were 3°C at Dungog and 2.5°C at Gloucester. ** P<0.01

Table 2. Gross margins (\$/ha) for pure Hereford (H) and crossbred Simmental (SxH), Friesian (FxH), Brahman (BxH) and Angus (AxH; high quality pasture only) cow herds, when joined back to Hereford bulls. Percent change in gross margins within pasture types are listed in brackets. Adapted from Barlow et al. (1989)

Pasture Quality	Cow breed				
	H	SxH	FxH	BxH	AxH
Low	101	88 (-13)	112 (11)	152 (50)	
Medium	218	233 (7)	227 (4)	244 (12)	
High	250	274 (10)	292 (17)	252 (0)	261 (4)

Table 3. Liveweight gain of steers fed low quality tropical grass hay and supplemented with both protein and non-protein nitrogen sources. Adapted from Hennessy et al. (1989)

Supplement	Nil	cottonseed meal 500g	copra meal 500g	copra meal 1000g	copra meal 500g + Urea 30g	Urea 30g
Weight Gain (g/d)	233	505	548	946	718	357
Additional gain (g/d)	0	272	315	713	485	124

Figure 1. The first 28°C day at Dorriggo between 1957 and 2009

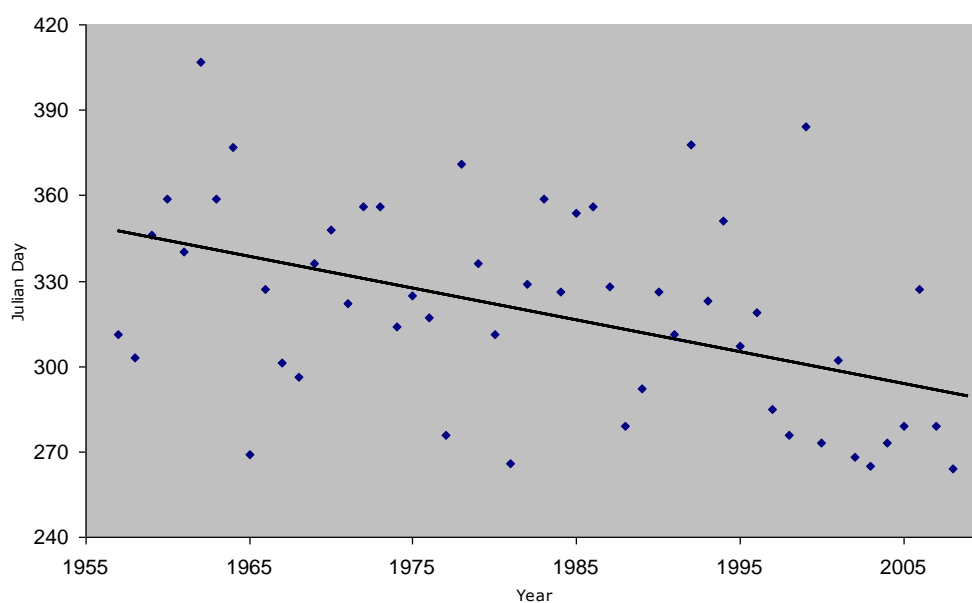


Figure 2. The number of days above 35°C at Scone between 1957 and 2009

