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'TRIGGER POINTS' FOR STOCKING DECISIONS IN WESTERN NSW

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ABSTRACT
Stocking rate decisions in western NSW are complicated by variable and largely non-seasonal rainfall. We sought to define 'trigger points' that could assist stocking decisions, particularly when little skill is available in seasonal climate risk assessments based on the SOI Phase system. Long term daily pasture growth simulations obtained from the WinGRASP model were used to calculate an index of pasture growth over the following three months, together with the 20th, 50th and 80th percentile values for three-monthly growth, commencing at fortnightly intervals throughout the year. We worked with pastoralists throughout the Western Division and adjacent mixed farming areas to identify 3-monthly pasture growth profiles best suited to their location. Acceptable profiles were identified for 27 locations, together with the broad country types on the respective properties. Interpretation of these profiles should allow other pastoralists in the vicinity, managing similar types of country, to define their own trigger points to assist stocking decisions when useful seasonal risk assessments are not available, or to provide additional support for such decisions at those times when seasonal risk assessments are more useful. Both tactical and strategic management decision should benefit from the growth profiles defined.

INTRODUCTION
Making management decisions that involve taking a chance on future climatic conditions is always difficult, particularly in areas like western NSW where rainfall is not strongly seasonal. While the SOI Phase system can provide useful information on likely pasture growth in the winter-spring period a similar capacity does not exist during the critical summer-autumn season (Hacker *et al.* 2006). Particularly at this time, management decisions might be assisted by a 'rule of thumb' about how long de-stocking might reasonably be delayed in the hope that the season will improve. Alternatively, prudent decisions to take advantage of surplus forage when the season is already looking promising could be assisted by a 'rule of thumb' about when might be the best time to buy.

In this paper we have attempted to encapsulate the idea of 'rules of thumb' in the form of 'trigger points' for stocking decisions. We define trigger points as calendar dates when the prospects for future pasture growth are high or low based on the long-term record.

METHODS
We used the WinGRASP version of the GRASP model (Littleboy and McKeon 1997) to simulate daily pasture growth for a range of locations in western NSW. Climate files for these calculations were derived from either the SILO or CLIMARC data bases. For the latter, daily rainfall, maximum and minimum temperatures, solar radiation, evaporation and vapour pressure for the period 1889-1957 have been computed using an anomaly interpolation spline method. Actual data are available from 1957 onwards. For the former, only average daily data (except for rainfall) were available prior to 1957.

Several parameter sets of the GRASP model relevant to western NSW have been derived from experimental data. These include Gilruth Plains (C4 grassland), Lake Mere (C3 or mixed grassland) and Kinchega (chenopod shrubland). In addition, a 'NSW average' set is also available (Richards *et al.* 2001). These parameter sets were combined with the most appropriate climate files to generate long term daily pasture growth profiles for various locations in western NSW.

To allow identification of trigger points we:

- calculated the exceedance probabilities for pasture growth over three monthly periods commencing at fortnightly intervals throughout the year (i.e. for the three month periods beginning 1 January, 15 January, 29 January etc);
- calculated the area under the exceedance curve for each starting date as a generalised index of future (three month) growth potential; and
- plotted these 'pasture growth indices' to allow visual identification of maxima and minima (i.e. trigger points).

We used the area under the exceedance curve as a generalised index of pasture growth potential as it provides an integrated measure over the entire range of biomass production levels. Its use therefore avoids anomalies that might arise from comparisons based only on the exceedance probability for some fixed level of biomass, or on the median or average level of biomass production.

Based on initial feedback from graziers in response to this concept, we also calculated the 20th, 50th and 80th percentile bands ('critical percentiles') for actual pasture growth to provide an appreciation of the inter-annual variability associated with each starting point.

We subsequently provided data to 41 graziers in western NSW who expressed interest in evaluating the trigger point concept for their location. These co-operators were provided with a range of products, representing combinations of parameter sets and climate files most likely to suit their situation. They were also provided with alternative forms of data presentation *viz.* bar charts of pasture growth indices, or 20th, 50th and 80th percentile traces. Co-operators were asked to comment on (a) the graph (if any) which best reflected the pattern of pasture growth on their property and (b) their preferred form of presentation. If none of the products reflected their perception of the pasture growth pattern, they were asked to amend the graphs accordingly.

RESULTS AND DISCUSSION

Acceptable growth curves were identified for 27 locations throughout western NSW (Figure 1). Of these, 21 were selected from the alternatives provided to co-operators from the model output while in six cases graziers amended the pasture growth index chart to reflect their individual assessment of the expected growth pattern.

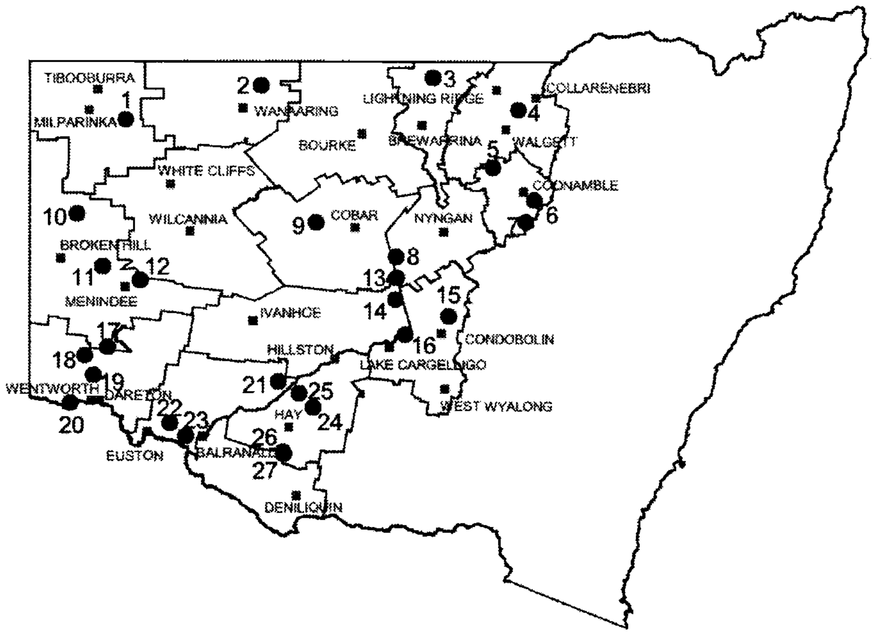

Figure 1: Location diagram showing the 27 locations for which acceptable growth profiles, and hence trigger points, were identified

Co-operators were more or less evenly divided between pasture growth index and critical decile traces as the preferred means of data presentation. For future extension purposes, both forms of presentation will be combined into a single display, except where grazier modification of the growth profiles prevents the calculation of critical percentiles (Figure 2).

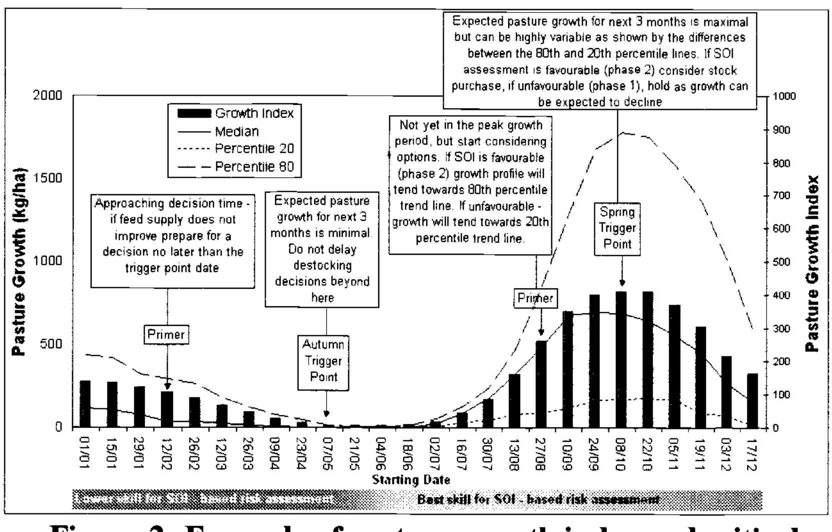

Figure 2: Example of pasture growth index and critical percentile profiles and their use to determine trigger points. Note the 'primer' point, some time before the trigger point, when preparation for a decision and consideration of options should start

Defining trigger points is straight forward for the growth potential index as the highest and lowest values are easily identified although in some instances, where index values are similar for a number of starting dates, there may be no strong reason to choose one date over another.

Inter-annual variability of pasture growth associated with each starting date – indicated by the difference between the 20th and 80th percentile values - may lead to some adjustment of the trigger points that would otherwise be identified from the 50th percentile values or the pasture growth index alone.

Significantly, the time of peak pasture growth typically coincides with the time when the skill of seasonal climate outlooks also reaches a maximum (winter-spring) in western NSW. At these times, it should be possible to use both the trigger point date and the seasonal growth outlook based on the SOI phase to help with stocking decisions. However, the period of minimum growth potential occurs at times when there is little skill in the SOI phase system (summer-autumn). At these times, knowing when the period of minimum pasture growth is about to start should be a particularly useful aid for stocking decisions under deteriorating seasonal conditions.

While identification of trigger points should have application to tactical decision making, the growth profiles now available may also assist strategic decisions. Timing of lambing or calving, for example, could be related to growth expectations, with correlated consequences for other critical dates in the management calendar.

Since co-operators' returns also provided broad details of the vegetation types on their properties, the total set should allow other landholders to select growth curves, and the associated trigger points, most likely to reflect their own conditions.

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