Modelling basal area of perennial grasses in Australian semi-arid wooded grasslands

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Introduction In many semi-arid pastoral systems, landscape processes easily become dysfunctional. Shifts to less functional states may be irreversible, and have long-term consequences for pastoral profitability and social viability of rural communities. Typically, shifts to lower functional states involve a decline in perennial grasses (Hodgkinson, 1994). Here we develop a conceptual basis for modelling the basal area of perennial grasses in a semi-arid grassland and validate the model using data from a 10-year grazing study.

Modelling concepts Change in the basal area of perennial grasses occurs with the growth, decline or death of existing plants or the recruitment of new plants (see Figure 1 c). These processes are primarily dependant on the level of soil water and grazing pressure. The model uses average soil water level over the previous month to determine whether perennial grass basal area increases, decreases or remains unchanged. Average height of the grasses over the previous 12 months (influenced by grazing and growing conditions) is used to determine the magnitude of the change. The basal area derived in the model is an important feedback mechanism for limiting potential perennial grass biomass following drought or overgrazing.

Output and validation The model component, described above, was used to simulate the basal area of palatable perennial grasses at three sheep stocking rates (0, 0.4 and 0.8 sheep/ha). Climate data for Louth, western NSW (average rainfall 270 mm per annum) was used for the simulation. Figures 1 a) and b) display the validation results of the basal area model for the runoff and interception landscape zones respectively.

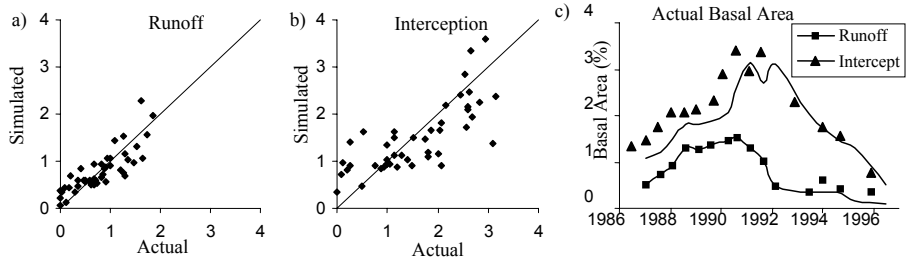

Figure 1 a) and b) Actual versus simulated palatable perennial grass basal area (%) for two landscape zones from 1987-1996 for three sheep stocking rates (0, 0.4 and 0.8 sheep/ha) and c) Actual palatable perennial grass basal area over time in two landscape zones for 0.4 sheep/ha.

Conclusions The basal area of perennial grasses in semi-arid grasslands changes considerably through time for each zone in the landscape, in response to climate variability and grazing levels. A simple modelling approach involving soil water and height of grasses adequately explained these changes. The basal area model is sufficiently robust to simulate basal area over long periods to evaluate the effects of grazing and periodic drought on the basal area and hence biomass production of perennial grasses in semi-arid wooded grasslands.

References

Hodgkinson, K. C. (1994). Tactical grazing can help maintain stability of semi-arid wooded grasslands. *Proceedings of the Seventeenth International Grassland Congress*, pp. 75-76.