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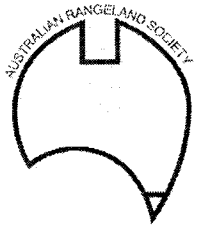

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POPMIX: A DECISION-SUPPORT SYSTEM FOR MULTISPECIES STOCKING OF RANGELAND

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ABSTRACT

POPMIX is a computer-based stocking-rate calculator that estimates carrying capacities of rangeland stocked with one or more types of large herbivore. Based on forage availability, prediction of dietary composition and calculated demand per animal unit of the animal mix, POPMIX estimates the maximum stocking rate consistent with the use of each forage species below a user-specified value (e.g. 35%). POPMIX was designed for use at the scale of plant communities or range sites. Predicted stocking rates can be scaled up to the paddock level through an additive procedure, with spatial adjustment for distance from water and topography.

INTRODUCTION

Realistic estimates of carrying capacity for the conservation of key forage species require consideration of the degree and nature of selective grazing. This is even more crucial when the impact of several animal types is being considered. A clear need exists for a method of assessing carrying capacity that can account for selective grazing by one or more herbivores, especially with animal types that have contrasting foraging behaviours. Such a method would ideally require little or no tuning to local conditions and would be of sufficient accuracy to at least provide a reliable assessment of the relative impacts of various numbers and types of animals on the utilisation of key forages.

In this paper we describe the operation and application of POPMIX, a multispecies stocking-rate calculator within the Grazing Land Applications decision-support system (Ranching Systems Group 1993). POPMIX estimates stocking rates after predicting the botanical composition of the diet for each animal type being considered. POPMIX can therefore account for selective forage use by wild and domestic herbivores, and provide comparisons of harvest efficiencies at the plant community level for different mixes of herbivore species.

OPERATION OF POPMIX

POPMIX operates at the plant community level and requires the following user input: (1) seasonal or annual yield of forage plants on offer; (2) allocation of each forage species to a selection category for each herbivore; (3) maximum harvest efficiency goal for key forage species; and (4) desired mix of animal species and their associated animal unit equivalent.

Based on forage availability, prediction of dietary composition and calculated animal demand, POPMIX estimates the maximum stocking rate consistent with the use of key forage species below the user-specified value (e.g. 35%). Specific output from POPMIX includes: (1) estimate of species composition of diets; (2) suggested carrying capacity of desired livestock mixes; (3) single species stocking capacity; and (4) habitat forage value index (0-100).

DIET SELECTION ALGORITHM

For each combination of animal type and season, forage species are allocated to one of four selection patterns, or categories (Quirk 1995). The preferred category represents consistent selection for a particular forage, the undesirable category represents consistent selection against a forage species, the variable category represents inconsistent selection, while the non-consumed category represents those species not eaten under normal conditions. The contributions of the various categories to the diet are

calculated as overmatching functions of the relative availabilities of preferred and undesirable plant species. Within a preference category, species are assumed to be selected in proportion to their availability. The algorithm also assumes that the selection category for a particular forage species and animal type is constant within a season. Forage is allocated to wildlife prior to livestock calculations.

APPLICATION OF POPMIX

To demonstrate the application of POPMIX, we evaluate different combinations of cattle and Spanish goats for a typical range site within the subtropical thorn shrubland of South Texas. The community is dominated by undesirable shrubs, with the key forage species being buffel grass (*Cenchrus ciliaris*), kleingrass (*Panicum coloratum*) and spiny hackberry (*Celtis pallida*). Whitetail deer graze the community at a nominated density of one deer per 4 ha. POPMIX output (summarised in Fig. 1) shows that, for this example, carrying capacity and harvest efficiency both increase substantially with increasing proportions of goats in the animal mix.

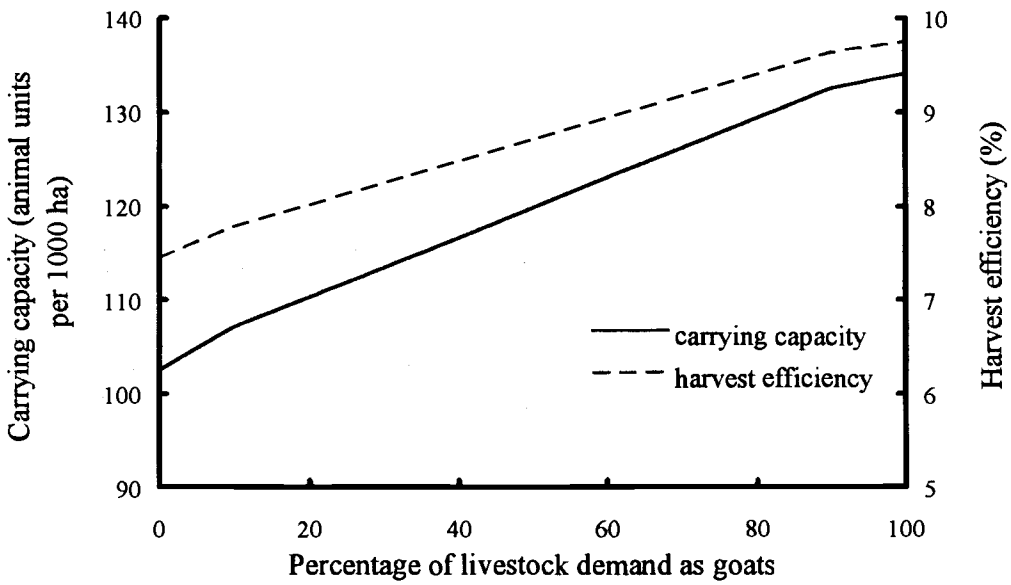

Figure 1. Effect of goat:cattle mix on carrying capacity and harvest efficiency in a subtropical thorn shrubland.

POPMIX thus provides a way of accounting for selective grazing when considering such issues as safe stocking rates, the best mix of animal types and the effect of wildlife on carrying capacity. POPMIX operates at the plant community level but predicted stocking rates can be scaled up to the paddock level through an additive procedure, with spatial adjustment for topography and distance from water. Linkage of POPMIX to models of forage production and landscape use should also allow better assessment of the effects of grazing management on resource condition.

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