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The 21st International Grassland Congress / 8th International Rangeland Congress took place in Hohhot, China from June 29 through July 5, 2008.

Proceedings edited by Organizing Committee of 2008 IGC/IRC Conference

Published by Guangdong People's Publishing House

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## A resource-explicit population model for the management of a dominant shrub that takes into account the ruminants' feeding strategy

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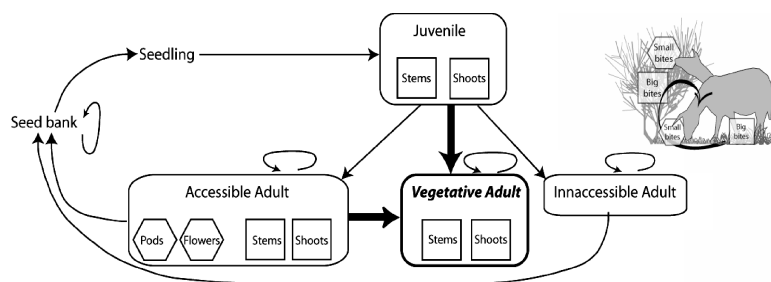
**Key words :** pastoral resources, dominant shrub species, population demography, grazing, feeding strategy

**Introduction** European environmental policies encourage the livestock farmers to graze their animals on shrubby rangelands to maintain plant communities in states that are favorable to the protected wild fauna and flora species and then often provide incentives to slow down the encroachment of shrub species with strong dominance ability.

Current scientific knowledge and technical references are often insufficient to encompass uncertainties about the feed value of shrubs and the real impact of grazing on encroachment dynamics. In order to propose management practices at paddock level, conciliating seasonal resources renewal for flock and long term control of shrub dynamics, we propose a new conceptual model of plant population capable of linking the population demography of a dominant plant species and the functional feeding resources offered to the flock.

**Materials and methods** We carried out direct observations of small ruminant (sheep) feeding behaviour at bite scale and continuously during each meal per day and during whole grazing sequences in paddock (10-15 days) (Parker *et al.* 1993, Agreil and Meuret, 2004). Focusing on scotch broom (*C. scoparius*) as a model of grazed dominant shrub species, we identify the diversity of organs potentially consumed and defined their functional role in the feeding strategy with regards to the potential bite mass they offer (Agreil *et al.*, 2005). Observations and experimentations on *C. scoparius* populations also allowed us to build a basic model of population structure based on the demographic strategy of this species with identification of main developmental stages (juveniles, adults, seedlings, non dormant seeds, dormant seeds, ...) and quantitative estimation of transition between stages (Caswell, 2001). We relate explicitly feed items defined by ruminant feeding strategy with demographic items organizing the population dynamics pattern.

**Results** Our results show that the feeding strategy of small ruminant is to exploit the diversity of the species-structures through combining small and large bite masses, allowing the maintenance of intake levels until the end of the stay in the paddock. Several organs of scotch broom (Flowers, young pods, young shoots, mature stems) provide feed items but with different functional status for animal feeding according to their mass. (Figure 1). It shows that two main stages (juvenile and adult) produce each, different feed items. As cumulative impact of repeated grazing seems to change adult demographic behaviour towards a long term vegetative status, we create a new demographic item as "vegetative adult" revealing through this modification of the population structure possible irreversible impact of grazing.



**Figure 1** Life cycle of *Cytisus scoparius* population built on development stages (seedling, adult, juvenile ...) and feeding resources for herbivores (small bites, big bites). The vegetative adult stage, not present in ungrazed population, is created by repeated browsing.

**Conclusions** Such a conceptual model, taking in account the ruminant feeding strategy at bite level, allows us to model the real impact of grazing on shrub population dynamics. It reveals the diversity of the possible ways of regulation as several demographic processes are impacted by grazing according to organs consumed (fecundity, survival rate, maturation age ...). Modelling is now in progress to simulate the impact of different management scenarios.

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