

Ecology of grazing lawns in Africa

Gareth P. Hempson^{1,2*}, Sally Archibald^{3,4}, William J. Bond^{1,5}, Roger P. Ellis², Cornelia C. Grant^{6,7}, Fred J. Kruger^{2,8}, Laurence M. Kruger^{1,2}, Courtney Moxley¹, Norman Owen-Smith³, Mike J. S. Peel^{3,9}, Izak P. J. Smit^{3,6} and Karen J. Vickers²

1Department of Biological Sciences, University of Cape Town, Private Bag X1, Rondebosch 7701, South Africa

2Organization for Tropical Studies, PO Box 33, Skukuza 1350, South Africa

3Centre for African Ecology, School of Animal, Plant and Environmental Sciences, University of the Witwatersrand, Private Bag 3, Wits 2050, South Africa

4Natural Resources and the Environment, Council for Scientific and Industrial Research, PO Box 395, Pretoria 0001, South Africa

5South African Environmental Observation Network, National Research Foundation, Private Bag X7, Claremont, 7735, South Africa

6Scientific Services, SANParks, Private Bag X402, Skukuza 1350, South Africa

7Department of Zoology, Nelson Mandela Metropolitan University, PO Box 77000, Port Elizabeth 6031, South Africa

8Centre for Environmental Management, Faculty of Natural and Agricultural Sciences, University of the Free State, PO Box 339, Bloemfontein 9300, South Africa

9Rangeland Ecology, Agricultural Research Council, Animal Production Institute, PO Box 7063, Nelspruit 1200, South Africa

Abstract

Grazing lawns are a distinct grassland community type, characterised by short-stature and with their persistence and spread promoted by grazing. In Africa, they reveal a long co-evolutionary history of grasses and large mammal grazers. The attractiveness to grazers of a low-biomass sward lies in the relatively high quality of forage, largely due to the low proportion of stem material in the sward; this encourages repeat grazing that concomitantly suppresses tall-grass growth forms that would otherwise outcompete lawn species for light. Regular grazing that prevents shading and maintains sward quality is thus the cornerstone of grazing lawn dynamics. The strong interplay between abiotic conditions and disturbance factors, which are central to grazing lawn existence, can also cause these systems to be highly dynamic. Here we identify differences in growth form among grazing lawn grass species, and assess how compositional differences among lawn types, as well as environmental variables, influence their maintenance requirements (i.e. grazing frequency) and vulnerability to

degradation. We also make a clear distinction between the processes of lawn establishment and lawn maintenance. Rainfall, soil nutrient status, grazer community composition and fire regime have strong and interactive influences on both processes. However, factors that concentrate grazing pressure (e.g. nutrient hotspots and sodic sites) have more bearing on where lawns establish. Similarly, we discuss the relevance of enhanced rates of nitrogen cycling and of sodium levels to lawn maintenance. Grazer community composition and density has considerable significance to grazing lawn dynamics; not all grazers are adapted to foraging on short-grass swards, and differences in body size and relative mouth dimensions determine which species are able to convert tall-grass swards into grazing lawns under different conditions. Hence, we evaluate the roles of different grazers in lawn dynamics, as well as the benefits that grazer populations derive from having access to grazing lawns. The effects of grazing lawns can extend well beyond their borders, due to their influence on grazer densities, behaviour and movements as well as fire spread, intensity and frequency. Variation in the area and proportion of a landscape that is grazing lawn can thus have a profound impact on system dynamics. We provide a conceptual model that summarises grazing lawn dynamics, and identify a rainfall range where we predict grazing lawns to be most prevalent. We also examine the biodiversity associated with grazing lawn systems, and consider their functional contribution to the conservation of this biodiversity. Finally, we assess the utility of grazing lawns as a resource in a rangeland context.