

Total grazing pressure – a defining concept for extensive pastoral systems in the southern rangelands of Australia

R. B. Hacker^{A,D}, K. Sinclair^B and C. M. Waters^C

^ARon Hacker Rangeland Consulting Services, 29 Edward St, Tenambit, NSW 2323, Australia; formerly NSW Department of Primary Industries, Trangie Agricultural Research Centre, Trangie, NSW 2823, Australia.

^BNSW Department of Primary Industries, Wollongbar Primary Industries Institute, 1243 Bruxner Highway, Wollongbar, NSW 2477, Australia.

^CNSW Department of Primary Industries, Orange Agricultural Institute, 1447 Forest Road, Orange, NSW 2800, Australia.

^DCorresponding author. Email: ron.hacker@crt.net.au

Abstract. In Australia, particularly in the southern rangelands, large populations of native and feral herbivores (including kangaroos, goats, rabbits, pigs, donkeys and camels, depending on the location) co-exist with domestic livestock. In recent decades the concept of ‘total grazing pressure’ has been developed, and widely accepted, to denote the total forage demand of all vertebrate herbivores relative to the forage supply. This concept provides a framework within which both domestic and non-domestic species can be managed to allow commercially viable livestock production, landscape maintenance or restoration and species conservation. The concept should have relevance wherever pest animal control programs, biodiversity conservation, or commercialisation of wildlife are conducted in conjunction with extensive livestock production. The rationale for the compilation of the Special Issue is outlined.

Additional keywords: pest animals, social licence, sustainable land use, vertebrate herbivores.

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Introduction

Although Australia’s ‘southern rangelands’ are not uniquely defined, they may be considered to be approximately coincident with that part of the continent where rainfall is lower than in the adjacent mixed farming zone and is either winter-dominant or aseasonal (Fig. 1). Almost all of this land lies within the 500 mm average annual rainfall isohyet, and most within the 250 mm isohyet. Extensive tracts are not used for pastoral production.

The broad vegetation types on which extensive pastoral systems are based in this zone are arid mulga woodland (dominantly *Acacia aneura*), central arid woodlands (*A. aneura* and other species), semiarid woodlands (*Eucalyptus*, *Acacia* and other species), saltbush (*Atriplex* spp.) and bluebush (*Maireana* spp.) communities and mallee (*Eucalyptus* spp.), together with some areas of Mitchell grasslands (*Astrebla* spp.) in the north-eastern part of the zone (Harrington *et al.* 1984). Properties are large, ranging from around 20 000 ha on the wetter fringes to more than 200 000 ha in the more arid areas. They are mostly held under some form of long-term pastoral lease from state and territory governments and subdivided, if at all, into paddocks that vary in size across the rainfall gradient from several hundred ha to over 10 000 ha. The pastoral industry within this region is sedentary, with no seasonal movement of livestock, and more or

less continuous grazing is still widely practiced. The characteristics of the industry, and its environment, have been described in more detail by Hacker (2010).

In the southern rangelands, substantial numbers of non-domestic herbivores share the pastoral resource with domestic livestock. The management of the grazing pressure from all sources is fundamental to the capacity of the pastoral industries to maintain economic viability and conserve rangeland resources. Landholders are required to control non-native species that have been declared ‘pests’ under various state or territory instruments, but numbers still often exceed what is desirable for both resource conservation and pastoral production. Currently the adoption of numerous total grazing pressure management options is occurring either through incentive funding programs or independently, but serious issues regarding both the cost-effectiveness and social acceptability of these methods are being raised. This is particularly the case for the management of native herbivores which remain the property of the Crown and whose management is subject to Commonwealth and state regulation. With increasing consumer pressure to ensure that the red meat and fibre industries can demonstrate continuous environmental improvement, and are able to justify their social licence to operate, it is timely to examine the relevant drivers and influences and how

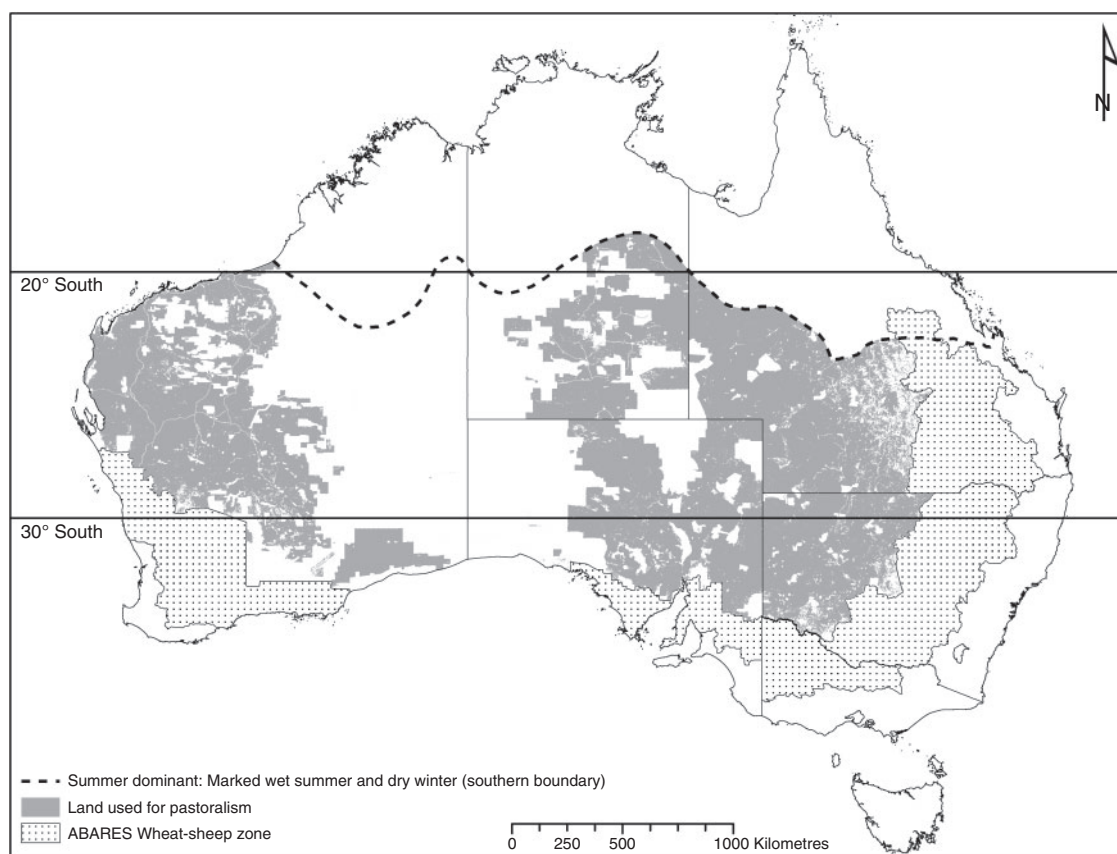


Fig. 1. Approximate boundaries of the southern rangelands. The northern boundary approximates the southern edge of the summer-dominant rainfall zone as defined by the Bureau of Meteorology (http://www.bom.gov.au/jsp/ncc/climate_averages/climate-classifications/index.jsp?maptype=seasgrpb, accessed 25 October 2019). Elsewhere the inland boundary of the wheat-sheep (or mixed farming) zone as defined by the Australian Bureau of Agricultural and Resource Economics Sciences (ABARES) provides a reasonable approximation (<http://www.agriculture.gov.au/SiteCollectionImages/abares/sa-broadacre-regions-large.png>, accessed 25 October 2019). Land used for pastoralism is derived from National Scale Land Use Version 5 (<http://www.agriculture.gov.au/abares/aclump/land-use/data-download>, accessed 25 October 2019).

these may inform rangeland management. This Special Issue draws together several papers intended to provide a basis for further development of the capacity to manage the various components of total grazing pressure in socially acceptable ways.

The Total Grazing Pressure concept

In all grazing-based animal production systems, domestic livestock share the forage resource with a range of non-domestic species – vertebrate and invertebrate, native and exotic. In the more intensive of these systems, located in areas with relatively high rainfall, sown pastures and small paddocks, the non-domestic forage consumption generally forms a benign background that does not prevent the expression of animal production (per head and per ha) as a function of the stocking rate of domestic livestock (Jones and Sandland 1974). In extensive systems, typically in rangelands with lower rainfall and large paddocks, the non-domestic component of forage consumption can assume much larger proportions, probably sufficient to

contribute to the frequent failure to observe relationships between the stocking rate of domestic livestock and animal production per head in these environments, although spatial and temporal variability of forage supply also operate to obscure the relationship (Roshier and Barchia 1993; Ash and Stafford-Smith 1996; Roshier and Nichol 1998).

In some rangeland environments, native (vertebrate) herbivores occurring sympatrically with domestic livestock are either substantially reduced in number through pressure from subsistence pastoralists, as in extensive areas of Africa, or managed for commercial gain, as in parts of the United States and Africa, while exotic herbivores are suppressed as pests. In Australia, however, large populations of non-domestic herbivores, both native and exotic, have persisted in rangelands used primarily for livestock production despite control efforts and a limited degree of commercialisation. The non-domestic herbivores found almost ubiquitously throughout the southern rangelands include kangaroos, unmanaged goats¹ and rabbits, and in some areas feral pigs

¹In some areas goats originating from feral stock are held 'behind wire' and subject to a degree of management as part of commercial enterprises. The term 'unmanaged goats' is commonly used to distinguish feral goats from their 'managed' counterparts.

(strictly, omnivores), donkeys and dromedary camels the latter representing the only large population of feral dromedary camels in the world (Brim Box *et al.* 2016). Harrington *et al.* (1984) (citing Harrington 1983) noted that ‘Australia is the only continent in the world where large native herbivores have actually been advantaged by the incursion of pastoral man’, that advantage flowing from the provision of artificial water sources and the suppression of dingos. So significant is the forage demand from these non-domestic populations that it must be considered in determining the stocking rate of domestic livestock (Campbell and Hacker 2000) and in assessing the impact of overall herbivory on the landscape.

The term ‘total grazing pressure’ (TGP) is of relatively recent origin. Although the grazing pressure exerted by non-domestic herbivores in Australian rangelands has long been recognised, the term appears only rarely (e.g. p. 37), and without formal definition, in the seminal publication *Management of Australia's Rangelands* (Harrington *et al.* 1984). Nowhere in that publication is the concept used to frame discussion of pastoral management practices. Nor did the concept appear in contemporaneous international discussions of land evaluation for extensive grazing, which drew on expertise from numerous countries which support pastoral production systems (Siderius 1984).

Use of the term to denote the forage demand from all herbivores relative to the forage supply appears to have originated with staff of the New South Wales Soil Conservation Service in the Western Division of that State in the late 1980s (D. Green, pers. comm.). This usage has subsequently become widely accepted by both landholders and agency staff across the southern rangelands. Fisher *et al.* (2004) extended the concept to include the combined grazing pressure exerted by all managed and unmanaged herbivores on vegetation, soil and water resources.

Although the term is used in northern Australia, it is a defining concept for pastoral systems in the southern rangelands (URS 2014; Waters *et al.* 2018) where it has been identified as a major issue for the management of both resource condition and the feed base (Australian Rangeland NRM Alliance 2015). Spatial and temporal variability in both feed demand, from domestic and (largely) unmanaged non-domestic herbivores, and feed supply, present major challenges for land managers in this region.

The term TGP appears to be uniquely Australian, and is generally not found in the literature of other countries with extensive rangeland production systems. The term does not appear in the *Glossary of Terms Used in Range Management* (SRM 1998), although ‘grazing pressure’ and ‘grazing pressure index’ are defined there (in terms of animal units per unit weight of forage). Neither is the term defined in other glossaries including the *Glossary of Range Management Terms* provided by Utah State University Extension (USUE undated) and the similar glossary of Bartlett *et al.* (undated), although the latter contains a definition of ‘grazing pressure’ identical to that provided by SRM (1998). A search for the term on the Global Rangelands website (<https://globalrangelands.org>, accessed 2 December 2018) returned 23 items all but one of which are by Australian authors and relate to Australian rangelands. The remaining item, published in the *African Journal of Range and Forage Science* (2003), is simply the preface to a session of the VIIth International Rangeland Congress convened in Durban, South Africa, in that year. A similar search of the

Grassland Society of Southern Africa website (<http://grassland.org.za>, accessed 1 January 2019) returned no items although the term ‘grazing pressure’ returned 137 items.

Thus, the use of TGP as a framework for considering land management in a holistic manner appears to be almost exclusively the preserve of Australian rangeland scientists and land managers to date, we would contend it is of wider relevance. Wherever pest animal control programs, biodiversity conservation, or commercialisation of wildlife are conducted in conjunction with pastoral livestock production the promotion of integrated management systems should benefit from explicit application of the concept.

Background to the Special Issue

Since TGP is the basic determinant of the impact of herbivory on vegetation, it follows that the successful management of all its components is fundamental to the maintenance or restoration of Australian rangeland landscapes, and to economic pastoral production. The papers contained in this Special Issue are intended to provide a synthesis of available information that can inform future investment in research, development and adoption of appropriate technology, and ensure that the pastoral industries of the region can demonstrate their responsible stewardship of both land and animals, and retain their ‘social licence to operate’. The latter is particularly important in an environment in which public concern for animal welfare is ascendant and its capacity to significantly impact specific red-meat industries has been clearly demonstrated in recent times. Pastoral industries can only expect to retain their ‘social licence to operate’ if they adopt practices that are socially acceptable.

The papers are drawn primarily from two projects funded by Meat & Livestock Australia. The first, ‘Addressing feed supply and demand through total grazing pressure management’, aimed to deliver (i) a review of current knowledge of TGP management and impacts on production and environment; (ii) a database of current TGP knowledge and industry-relevant information; and (iii) an investment plan that identified knowledge gaps, justified investment, and identified producer-prioritised delivery channels. The second, ‘Social acceptability of pest animal management in meeting TGP targets’, addressed questions relating to the acceptability to key stakeholders of control techniques for three specific herbivores (kangaroos, unmanaged goats and feral pigs). The management of grazing pressure exerted by kangaroos, in particular, often raises strong emotions among stakeholders with a wide range of perspectives. Attempting to balance these interests has historically been fraught and so this Special Issue contains also a specific contribution to this topic.

Management of TGP has particular relevance to the extensive grazing industries of the southern rangelands across multiple dimensions including animal production, landscape stability and social acceptability. In some instances, cultural aspects may also be involved although they are not the specific focus of the work presented here. We hope that the following papers will make a material contribution to the socially acceptable management of this fundamental issue.

Conflicts of interest

The authors declare no conflicts of interest.

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