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# Grazing Intensity Influences Ground Squirrel and American Badger Habitat Use in Mixed-Grass Prairies

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## Abstract

Ground squirrel (*Spermophilus* spp.) and American badger (*Taxidea taxus*) burrowing activities are ecologically important disturbances that contribute to the heterogeneity of prairie environments. These activities also have a strong impact on habitat suitability for many other grassland species. However, effects of cattle grazing intensity on ground squirrel and American badger burrows are not well understood. From 2006 to 2012 we evaluated effects of grazing intensity and vegetation type on American badger burrow occurrence and ground squirrel burrow abundance using a manipulative grazing experiment in Grasslands National Park of Canada, Saskatchewan. The study area consisted of nine 300-ha pastures at a range of stocking rates, from very low to very high for the region. Each pasture had 10 plots (six upland and four lowland) where vegetation and burrow surveys were completed. Burrow abundance and occurrence as well as vegetation structure were assessed for 2 yr prior to the introduction of cattle to this landscape in 2008, which followed at least 15 yr without livestock, and from 2009 to 2012, following introduction of livestock. Data were analyzed using generalized linear mixed models. In upland habitats, ground squirrel burrow counts increased with increasing grazing intensity and decreasing vegetation biomass; conversely, badger burrow occurrence increased with decreased stocking rates and increasing average litter cover and vegetation biomass. Abundance and occurrence of both ground squirrel and badger burrows in lowland habitats was relatively independent of grazing intensity or vegetation. Vegetation composition had little impact on ground squirrel or badger burrows. A range of grazing intensities may contribute to maintaining diversity of burrowing mammals in prairie environments.

**Key Words:** burrowing animals, livestock, prairie conservation, vegetation composition, vegetation structure

## INTRODUCTION

Ground squirrels (*Spermophilus* spp.) and American badgers (*Taxidea taxus*) play an ecologically important role in prairie environments (Umbanhowar 1995; Eldridge 2004), primarily due to their creation and expansion of burrows. Excavation activities bring soil to the ground surface, aerate the soil, redistribute nutrients, and can positively or negatively alter soil moisture (Eldridge 2004; Eldridge and Whitford 2009) and local plant community composition (Borchard and Eldridge 2012), while badger burrows may provide shelter for other species including ground squirrels and burrowing owls (*Athene cunicularia*) (Messick and Hornocker 1981; Lindzey 2003). Thus, ecological effects of badger and ground squirrel burrows have both short- and long-term effects.

Few studies have determined the effects of cattle grazing on badger activities or badger habitat use possibly because prey availability, not vegetation structure or composition, has been assumed to be the driving force behind habitat selection by badgers (Lindzey 2003; Eldridge 2004). Habitat selection by ground squirrels is better understood, although the effects of cattle grazing on ground squirrels are not. Cattle grazing might

positively or negatively influence ground squirrel habitat use since large herbivores like cattle may compete with ground squirrels for food, yet promote the relatively short vegetation structure that they prefer (Krueger 1986; Fehmi et al. 2005; Cheng and Ritchie 2006).

The abundance of badger and ground squirrel burrows might have a dynamic relationship under natural conditions due to trophic interactions and predator-prey dynamics. Abundance of grassland herbivores may be controlled by the abundance and quality of the vegetation available for consumption (Báez et al. 2006), and if cattle indirectly affect the abundance of ground squirrels, this may in turn influence the abundance of this food source for badgers and, therefore, habitat use by badgers (Eldridge 2004). Understanding these trophic interactions between herbivores, between herbivores and the plant community, and between herbivores and carnivores could help us further understand the ecological roles and management of badgers and ground squirrels in North American prairies.

We evaluated the effects of grazing intensity and habitat structure and composition on abundance of ground squirrel burrows and occurrence of American badger burrows in a northern mixed-grass prairie. Our objectives were to 1) examine the relationship between cattle grazing intensity and duration as well as ground squirrel burrow abundance and badger burrow occurrence, 2) evaluate relationships between ground squirrel burrow abundance and badger burrow occurrence and vegetation composition and structure, and 3) determine if there is evidence that ground squirrel burrow abundance and badger burrow occurrence are correlated, which might suggest that badgers select sites with greater

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