

Response of the endemic Long-tailed Meadowlark (*Sturnella loyca obscura*) to grazing exclusion in herbivore-dependent upland grasslands of Argentina

Laura M. Bellis^{A,B,C} and Nadia Muriel^B

^AInstituto de Diversidad y Ecología Animal, Consejo Nacional de Investigaciones Científicas y Técnicas, Facultad de Ciencias Exactas Físicas y Naturales, Universidad Nacional de Córdoba (IDEA-CONICET-UNC), Vélez Sarsfield 299, 5000, Córdoba, Argentina.

^BCátedra de Ecología, Facultad de Ciencias Exactas Físicas y Naturales, Universidad Nacional de Córdoba, Córdoba, Argentina. Vélez Sarsfield 299, 5000, Córdoba, Argentina.

^CCorresponding author. Email: lbellis@com.uncor.edu

Abstract. In grassland ecosystems livestock grazing is one of the main activities that modify habitat and which can lead to positive or negative effects on birds. In the Sierras Grandes of Córdoba, Argentina, livestock grazing began early in the 17th century, causing severe soil erosion. To restore the grasslands, livestock were excluded from a large area in 1997. However, the impact of grazing exclusion on endemic birds is not clear. We evaluated the effect of grazing exclusion on density and habitat attributes of populations of Long-tailed Meadowlarks (*Sturnella loyca obscura*). The highest density was recorded in ungrazed sites. Fitted models explained up to 75% of the variability in density of Long-tailed Meadowlarks. Litter depth, percentage of bare soil (with positive effects), soil compaction (estimated as impedance) and percentage of moss cover (with negative effects) were the most important variables explaining the variation in the estimated density of birds. We concluded that 11 years of grazing exclusion favoured Meadowlark populations, providing increased availability of resources, mainly those related to soil quality. Hence, we recommend promoting alternative management practices, such as reintroduction of large native herbivores where possible and livestock grazing at reduced stocking rates, to counterbalance the cost of soil loss and the benefit that large herbivores provide to the system.

Additional keywords: Córdoba, density, ground-feeding birds, livestock effects, mountains.

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Introduction

Both historical and present-day vegetation dynamics in grasslands are mediated by variation in disturbance intensity and frequency, such as ungulate grazing (Knapp *et al.* 1999). Among the most common effects produced by livestock grazing are the simplification of vegetation structure (Fondell and Ball 2004), changes in vegetation species composition, and loss of seed banks (Díaz *et al.* 1994; Pucheta *et al.* 1997, 1998; Vargas *et al.* 2002). In addition, long-term overgrazing greatly increases soil erosion by reducing litter cover, soil nutrients, soil-retention capacity and soil-chemical properties, and by increasing soil impedance (Yates *et al.* 2000; Cingolani *et al.* 2003, 2008a). These changes affect feeding and nesting resources for birds (Whitmore 1981; Hutto 1985; Marone *et al.* 1997; Albanesi *et al.* 2014) and therefore their distribution, survival and population density (Wilson *et al.* 2005; Gilroy *et al.* 2008). As a result of this degradation, 75% of grassland birds in North America and 70% in Europe have experienced population declines owing to changes in land use (Donald *et al.* 2006; Askins *et al.* 2007). In South America, nearly 10% of globally threatened birds are species that inhabit grasslands, with populations of

several resident grassland birds extirpated from large areas of their historical ranges (Azpiroz *et al.* 2012). In addition, livestock grazing has contributed to the expansion of a range and abundance of avian brood parasites, such as the Shiny Cowbird (*Molothrus bonariensis*), which may exert further pressure on declining populations of grassland specialists such as Pampas Meadowlarks (*Sturnella defilippii*), Black-and-white Monjitas (*Xolmis dominicanus*), and Saffron-cowled Blackbirds (*Xanthopsar flavus*) (Gabelli *et al.* 2004; Azpiroz *et al.* 2012).

Grazing exclusion in systems that coevolved with large native herbivores can also reduce or locally extirpate avian populations adapted to vegetation modulated by grazing (Bock 1999; Söderström *et al.* 2001; García *et al.* 2008). In such environments, livestock have positive effects on some species under moderate grazing intensity (Bock 1999; Söderström *et al.* 2001; Macchi and Grau 2012). Thus, the effects of livestock on avian populations are still controversial, in part because the effects of grazing of domestic livestock on ecosystems varies and in part because this effect is difficult to evaluate owing to the paucity of areas without livestock.