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Remaining large grasslands may not be sufficient to prevent grassland bird declines

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ABSTRACT

Grassland birds are in steep decline throughout many regions of the world. In North America, even some common species have declined by >50% over the last few decades. Declines in grassland bird populations have generally been attributed to widespread agricultural conversion of grasslands; more than 80% of North American grasslands have been converted to agriculture and other land uses, for example. Remaining large grasslands should thus be especially important to the conservation of grassland birds. The Flint Hills of Kansas and Oklahoma (USA) preserves the largest intact tallgrass prairie (~2 million ha) left in the world. The Flint Hills supports a major cattle industry, however, and therefore experiences widespread grazing and frequent burning. We assessed the regional population status of three grassland birds that are considered the core of the avian community in this region (Dickcissel, *Spiza americana*; Grasshopper Sparrow, *Ammodramus savannarum*; Eastern Meadowlark, *Sturnella magna*). Our approach is founded on a demographic analysis that additionally explores how to model variability in empirically derived estimates of reproductive success across a large heterogeneous landscape, which ultimately requires the translation of demographic data from local (plot) to regional scales. We found that none of these species is demographically viable at a regional scale under realistic assumptions, with estimated population declines of 3–29%/year and a likelihood of regional viability of 0–45% over the two years of study. Current land-management practices may thus be exacerbating grassland bird declines by degrading habitat in even large grassland remnants. Habitat area is thus no guarantee of population viability in landscapes managed predominantly for agricultural or livestock production.

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1. Introduction

Grasslands are among the most endangered ecosystems in the world (White et al., 2000), primarily as a result of widespread conversion to agriculture, which represents one of the more significant global changes wrought by humans (Vitousek et al., 1997). For example, <4% of the tallgrass prairie of the North American Great Plains remains (Samson and

Knopf, 1994), most of which (~80%) is found in the Flint Hills of Kansas and Oklahoma. Given the magnitude of grassland converted to other land uses, it is not surprising that grassland bird populations in North America have declined sharply throughout their range, more so than any other bird group (Knopf, 1994; Peterjohn and Sauer, 1999). In 2007, the National Audubon Society released a report documenting significant declines in more than 20 still-common bird species (those

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with populations >500,000 and a range >10⁶ km²) that had declined by >50% in the past 40 years (Butcher and Niven, 2007). Eight of these 20 species are associated with grasslands (40%), with six grassland birds in the top ten. Although much of the conversion of native grasslands in the Midwestern United States to agriculture was completed by the 1940s (Waisanen and Bliss, 2002), grassland bird populations have continued to decline. Despite the slowing rates of agricultural conversion in recent decades, modern agricultural practices that involve increased mechanization and more intensive management practices, such as intensive grazing, frequent prescribed burns, and increased frequency of haying, may be altering the suitability of remaining, now largely agricultural grasslands to support grassland birds. Agricultural intensification, such as the conversion of pasture to arable land, has also been implicated in the decline of farmland birds throughout Europe (Fuller et al., 1995; Donald et al., 2001), and thus represents a global trend that is not unique to North America.

Given that extinction risk – and population viability more generally – is expected to be inversely correlated with habitat area, remaining large grasslands should be especially important for the conservation of grassland birds (Herkert et al., 2003). The Flint Hills represents the largest intact tallgrass prairie landscape (~2 million ha) remaining in the world. It escaped widespread agricultural conversion because its shallow rocky soils were simply not suitable for cultivation. The region supports a major cattle industry, however, with an inventory of 1 million cattle and annual sales of over \$500 million (USDA, 2002). Thus, far from being pristine prairie, this grassland is intensively managed for cattle production, which involves widespread grazing pressure and frequent pre-

scribed burning across much of the region (Fig. 1). Although fire and grazing have always been part of the natural disturbance regime of this system, current management practices seek to maximize livestock production by promoting uniform forage and grazing across the landscape, which produces a much more homogeneous pattern of disturbance than the shifting disturbance mosaic that characterized the historical landscape (Fuhlendorf and Engle, 2001, 2004).

Because of mounting concern over how land-management practices may be altering habitat quality for grassland birds in this region (Robbins et al., 2002; Fuhlendorf et al., 2006; Rahmig et al., in press), we sought to develop a region-wide assessment of the population viability of three species, the Dickcissel (*Spiza americana*), Grasshopper Sparrow (*Ammodramus saviarum*) and Eastern Meadowlark (*Sturnella magna*). These three species are considered to represent the core of the tallgrass prairie bird assemblage in this region (Zimmerman, 1993). Eastern Meadowlarks and Grasshopper Sparrows have declined globally by 72% and 65%, respectively, over the past 40 years (Butcher and Niven, 2007). The Dickcissel, although currently exhibiting “stable” population trends (i.e., its rate of decline is not statistically significant; Butcher and Niven, 2007), has experienced significant declines in the past and is therefore still considered a species of conservation concern (National Audubon Society, 2004).

The development of a regional assessment of population viability presents a number of challenges that we sought to overcome in developing this particular modeling approach. Although founded on demographic analysis, our approach explicitly models the heterogeneity or variation that occurs in reproductive success both within and among managed

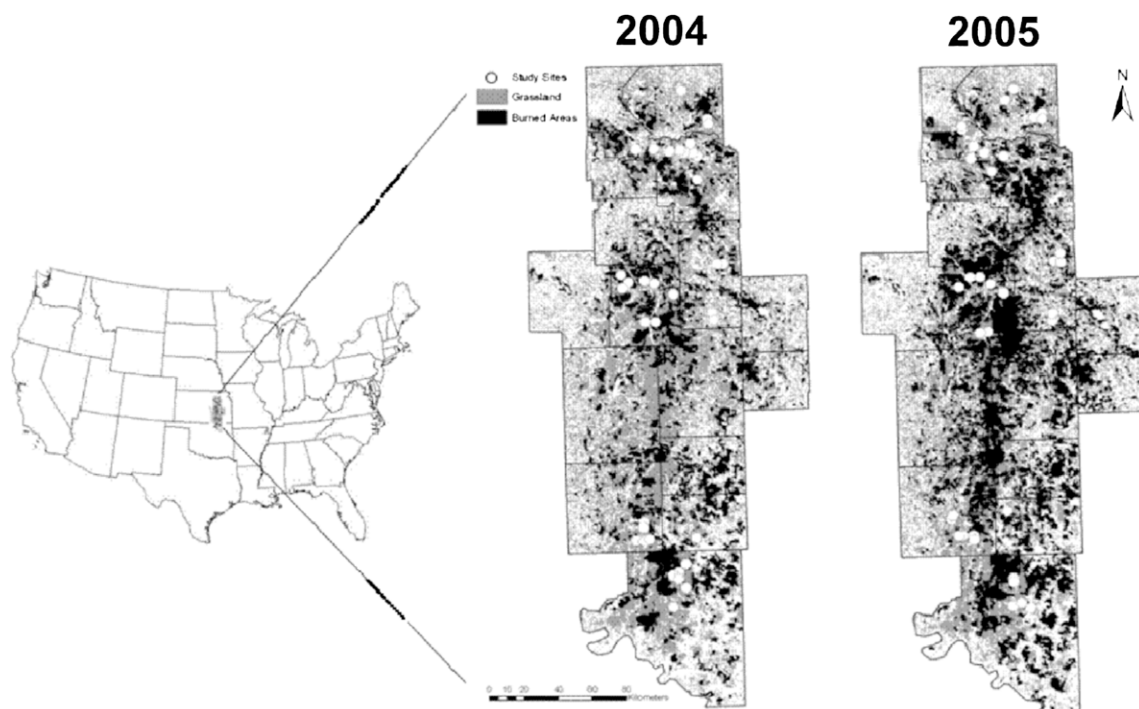


Fig. 1 – Extent of tallgrass prairie and burned grassland in the Flint Hills, the largest remaining tallgrass landscape in North America, based on analysis of remotely sensed imagery (MODIS; R. Mohler and D. Goodin, unpublished data).

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