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DIRECT IMPACTS OF CATTLE GRAZING ON GRASSLAND NESTING BIRDS

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Abstract.— We used nest success data from a 2003 field season to examine the direct impacts of cattle grazing on grassland nesting birds. We found that 7% of nest loss was due directly to cattle through trampling of nests (6%) and abandonment (1%). We conclude that changes in grazing management could mitigate the degree to which cattle directly impact nesting success of grassland birds, and discuss these suggestions in light of our results.

Introduction.—Grazing was a part of prairie ecosystems long before European settlement of the Great Plains. Large herds of bison (*Bos bison*) and other native grazers such as elk (*Cervus elephus*), deer (*Odocoileus* spp.), and pronghorn antelope (*Antilocapra americana*) were found throughout the Great Plains. After European settlement of the Great Plains and extirpation of bison, cattle ranching played a major role in development of the frontier, as it still does today.

Grazing can increase heterogeneity in grassland systems and is thought to create a variety of niches for grassland bird species (Fuhlendorf and Smeins 1999, Fuhlendorf and Engle 2001). Most avian research conducted on grazing effects has investigated its impact on population density and productivity (Kantrud 1981, Rohrbaugh et al. 1999, Steuter and Hidinger 1999, Temple et al. 1999). These studies have shown that the impact of grazing on bird density and productivity varies depending on location, habitat, and grazing-management regime.

Few studies have investigated the direct impacts of grazing on nesting birds (i.e., impacts caused by the animals themselves). Trampling of nests by cattle could be the most common of these impacts. Several studies have used artificial nests or clay pigeon shooting targets to estimate direct effects of cattle on nesting (Koerth et al. 1983, Bareiss et al. 1986, Jensen et al. 1990, Paine et al. 1996, Paine et al. 1997), but to our knowledge, only 1 study has published direct impacts of cattle trampling on actual grassland bird nests (Rohrbaugh et al. 1999). We summarize the direct impacts of cattle grazing on nesting grassland birds during the 2003 nesting season at the Tallgrass Prairie Preserve, Osage County, Oklahoma.

Methods.—Our research was conducted at The Nature Conservancy's Tallgrass Prairie Preserve (hereafter, the Preserve) in Osage County, Oklahoma (36°50'N,

96°25'W) from 1 May to 1 August 2003. One-half of the preserve is grazed by cattle, and the other half is grazed by bison (Fuhlendorf and Engle 2001). The Preserve is located at the southern extent of the Flint Hills Region, which is not suitable for crop agriculture due to its rocky soils. Average total precipitation for the area is 877 mm with 70% of the precipitation falling between April and September (Coppedge et al. 1998). The dominant grasses of the Preserve are big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), indiangrass (*Sorghastrum nutans*), and switchgrass (*Panicum virgatum*). Forbs include ironweed (*Vernonia baldwinii*), milkweed (*Asclepias viridis*), and ashy sunflower (*Helianthus mollis*) (Smith 1996).

All treatment pastures were moderately stocked with weaned stocker calves (1 calf/1.2 ha). The grazing season began in mid-April and ended in late July. Two cattle grazing/fire regimes are used on the Preserve. The first is a traditional grazing regime, and represents the prevalent grazing management practice in the Osage County (e.g., complete burning of pastures every spring). The second is patch-burn grazing management, which is an experimental treatment that uses prescribed fire and grazing to mimic natural grazing of the region prior to European settlement (Fuhlendorf and Engle 2004). In the patch-burn grazing treatment, one-third of a pasture is burned each year, and this burned area receives the majority of the grazing pressure during the ensuing growing season. The other two-thirds of the pasture are generally relieved from grazing pressure for 2 years until the burning cycle repeats itself. Our study focused on 2 traditional and 2 patch-burn pastures of about 600-ha (approximately the same size as local ranch pastures). Both traditional and patch-burn grazing pastures receive intensive early stocking where cattle graze for half the amount of time as with many grazing management methods, but the cattle are stocked at twice the density as other management methods.

Nest searching of 16-ha plots located within pastures began in mid-May 2003. We located nests using an adult behavioral cue technique (Martin and Geupel 1993, Ralph et al. 1993). Study plots were visited by a researcher every 2 days. When a nest was located, it was checked every 2-4 days to assess its outcome. A nest was considered successful if at least 1 nestling fledged. We also recorded causes of nest failure (e.g., predation, cattle trampling, brood parasitism, abandonment and unknown). Predation was defined as prematurely empty nests and trampling events by tracks with crushed nest contents. Brood parasitism was detected when brown-headed cowbird (*Molothrus ater*) eggs or nestlings were present in the nest and a nest was abandoned when the adults no longer attended the nest even though eggs or nestlings were present. Those data were collected following protocols of the Breeding Biology Research and Monitoring Database and PRBO (Martin 2002, PRBO 2002).

We tested for differences in the number of nests trampled by cattle between the 2 grazing treatments investigated during this study using a 1-way ANOVA in SPSS ®. Due to the small sample size for the analysis all species were combined in the analysis.

Results.—During 2003, we found 209 nests, with the majority (157) being Dickcissel nests. Nests of Grasshopper Sparrow (*Ammodramus savannarum*), Eastern Meadowlark (*Sturnella magna*), Common Nighthawk (*Chordeiles minor*), Red-winged Blackbird (*Agelaius phoeniceus*), Horned Lark (*Eremophila alpestris*), Greater Prairie-chicken (*Tympanuchus cupido*), Lark Sparrow (*Chondestes grammacus*), Loggerhead Shrike (*Lanius ludovicianus*), and Mourning Dove (*Zenaida macroura*) also were found. All species, except for the Red-winged Blackbird and Loggerhead Shrike, built their nests on or near ($\leq$ 0.3 m) the ground. Overall, 33% of the nests were successful, and 67% were unsuccessful. Predation was the major cause (46%) of nest loss (Fig. 1). Cattle accounted for 7% of the losses with 6% due to trampling and 1% due to cattle-induced abandonment. Other causes of nest loss included unknown, abandoned, and weather (Fig. 1). There were 7 nests trampled in the traditional treatment and 2 nests trampled in the patch-burn treatment. There was no statistical difference in the number of nests trampled by cattle in the 2 grazing treatments investigated ($F = 0.949$, $df = 1,6$, $P = 0.368$).

On 2 occasions, a female Dickcissel was trampled along with her nest. On the first occasion, the nest was rolled over with the trampled female and destroyed eggs inside. The trampling likely had occurred within an hour of the observation, because her body was still warm and flexible. On the second occasion, a crushed dome of blackberry (*Rubus* spp.) branches that once sheltered the nest and a large hoof print indicated the nest was stepped on. The nest was filled with the remiges, most of the rectrices, and many of the body feathers of an adult Dickcissel along with $\geq$ 2 crushed eggs, but the body of the bird was not located. We are not sure if the bird narrowly escaped trampling or if the remains were scavenged prior to our visit.

We observed nest abandonment due to cattle on 2 occasions. On the first occasion, we observed eggs hatching in the nest so we left and returned the following day to determine the fate of the unhatched eggs. Upon our return, we found all hatchlings dead, probably due to exposure. Within 10 m of the nest, we observed that $\geq$ 3 cattle had bedded down for an unknown amount of time. On the second occasion, we observed a nest abandoned during the incubation stage when a calf bedded < 0.5 m of the nest and 3 other steers bedded < 15 m of the nest. In cases of nest abandonment, it is difficult to positively identify the cause of abandonment, but in each case described above, several clues indicated that cattle were the cause of abandonment.

Discussion.—Nest destruction by cattle should be related positively to cattle density during the nesting period. However, it is difficult to compare our estimates of nest loss from cattle with those of other studies because stocking density during the nesting season varies widely between studies. Stocking density of 1 steer/1.2 ha in our study was lower than stocking density reported in most other cattle impact studies (4–60 animals/ha) (Paine et al. 1996, 1997, Jensen 1990). In our study, stocking density also was less than stocking density in surrounding ranches under the same kind of cattle grazing system (i.e., intensive early stocking with stocker cattle). Other grazing systems use either greater or lesser stocking density while holding stocking rate, which includes a time element, at similar levels. Inintensive early stocking systems, including the system employed in our study, the time of cattle grazing is nearly the same as the nesting season of grassland birds,

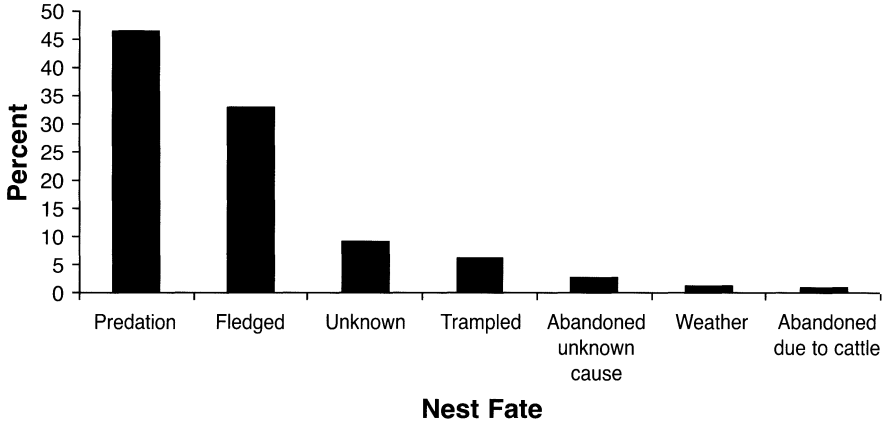

Fig. 1. Fate of 209 nests of grassland birds (Dickcissel, Grasshopper Sparrow, Eastern Meadowlark, Common Nighthawk, Red-winged Blackbird, Horned Lark, Greater Prairie-chicken, Lark Sparrow, Loggerhead Shrike, and Mourning Dove) for traditional and patch-burn grazing regimes at the Tallgrass Prairie Preserve, Oklahoma, in 2003.

and stocking density is high compared with grazing systems in which cattle are grazed for a greater proportion of the year. Multi-pasture grazing systems that rapidly rotate cattle among pastures usually involve even greater cattle stocking densities than intensive early stocking, but multi-pasture systems rarely are used in the tallgrass-prairie.

Rohrbaugh et al. (1999) conducted their study at the same location as ours and had a similar stocking density, but the study was conducted under different grazing conditions. In their study, cattle trampled 13.5, 9.1, and 1.5% of nests of Eastern Meadowlark, Grasshopper Sparrow, and Dickcissel, respectively. They reported an overall average trampling rate of 8%, which was similar to the 6% rate for our study. In contrast, a study using artificial nests with much higher stocking densities (the lowest was 4 head/ha), reported > 85% of the nests were lost to trampling after 9 days (Jensen et al. 1990). In other studies, trampling rates varied from 25 to 95% (Paine et al. 1996, 1997).

Direct impacts of cattle on nesting grassland birds can take many forms. Research using artificial nests reported observing cattle removing eggs or clay pigeons from nests and leaving the item intact far from the nest location (Paine et al. 1997). Other forms of nest destruction by cattle include trampling, crushing by the animal's muzzle, or defecating on the nest (Paine et al. 1996). We observed 2 other types of nest destruction not previously described: trampling of the female as she incubates and abandonment of the nest caused by cattle bedding near the nest.

Rohrbaugh et al. (1999) reported that Eastern Meadowlarks were the most common species trampled, followed by Grasshopper Sparrows and Dickcissels. During our study, we found the opposite pattern; Dickcissels were most commonly trampled followed by Grasshopper Sparrows. We did not find any trampled Eastern Meadowlark nests. The differences between our study and Rohrbaugh et al. (1999) may be attributed to differences in grazing regimes between the 2 studies. Most of our meadowlark nests occurred on unburned plots where few cattle were present because the cattle prefer recently burned areas. In contrast, large numbers of

Dickcissel nests occurred in pastures that were entirely burned and preferred by cattle. Consequently, most of the nests were trampled in those plots. Rohrbaugh et al. (1999) suggested that less nest trampling occurred in Dickcissels (*Spiza americana*) because they tended to nest higher in vegetation than the other 2 species. However, we found 4 Dickcissel nests placed higher in the vegetation had been tipped over by passing cattle with the eggs or young dumped onto the ground. From our work, it seems that nest height had little effect on disturbance by cattle. Jensen et al. (1990) reported a similar result when they examined effects of cover on nest trampling and found that there were similar trampling rates between nests that had cover and those that did not have cover.

Direct cattle impacts on nest success of grassland birds was small when compared to nest predation. Nevertheless, land managers should be aware of the impacts of cattle grazing on nesting birds. Proper management (e.g., lowering stocking density and creating refuge areas that are not as heavily grazed) could lessen effects of cattle trampling, while having little impact on cattle production (Fuhlendorf and Engle 2004). By controlling stocking density and creating ungrazed portions of pastures, managers can increase grassland bird productivity.

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