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Corticosterone Metabolite Concentrations in Greater Sage-Grouse Are Positively Associated With the Presence of Cattle Grazing

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Abstract

The sagebrush biome in the western United States is home to the imperiled greater sage-grouse (*Centrocercus urophasianus*) and encompasses rangelands used for cattle production. Cattle grazing activities have been implicated in the range-wide decline of the sage-grouse, but no studies have investigated the relationship between the physiological condition of sage-grouse and the presence of grazing cattle. We sampled 329 sage-grouse across four sites (two grazed and two ungrazed) encompassing 13 600 km² during the spring and late summer–early autumn of 2005 to evaluate whether demographic factors, breeding status, plasma protein levels, and residence in a cattle-grazed habitat were associated with the stress hormone corticosterone. Corticosterone was measured in feces as immunoreactive corticosterone metabolites (ICM). Males captured during the lekking season exhibited higher ICM levels than all others. Prenesting female sage-grouse captured in a grazed site had higher ICM levels than those in ungrazed sites and prenesting female plasma protein levels were negatively correlated with ICM concentrations. With the use of a small-scale spatial model, we identified a positive correlation between cattle pat count and sage-grouse ICM levels. Our model indicated that ICM levels increased by 2.60 ng · g⁻¹ dry feces for every increase in the number of cow pats found in the vicinity. Management practices will benefit from future research regarding the consistency and mechanism(s) responsible for this association and, importantly, how ICM levels and demographic rates are related in this species of conservation concern.

Key Words: bird, conservation physiology, corticosterone, endangered species, spatial statistics, stress

INTRODUCTION

The sagebrush biome is an expanse of semiarid rangeland dominated by sagebrush that is experiencing a range of anthropogenic disturbances, which are influencing species composition and native landscape heterogeneity (Connelly et al. 2004). This region is home to many avian species, but is perhaps most typified by the presence of the greater sage-grouse (*Centrocercus urophasianus*). The sage-grouse is a ground-dwelling sagebrush obligate that currently inhabits \cong 56% of its former range (668 412 km² of 1 200 483 km² (Schroeder et al. 2004), with some population estimates indicating a 93% contraction from presettlement times (Braun 2006). Based on

such population estimates, the US Fish and Wildlife Service classified the sage-grouse as a Candidate for Listing under the Endangered Species Act in 2010 (US Fish and Wildlife Service 2010).

Although native mammalian herbivores continue to inhabit the sagebrush biome, domestic cattle grazing is a recent phenomenon in this region, having been introduced during the mid-19th century (Young and Sparks 2002). In an evaluation of the association between land use, environmental and ecological factors, and sage-grouse population trends, Connelly and Braun (1997) identified weather patterns, fire, and livestock grazing as the three factors most likely accounting for the observed range-wide population decline. Although cattle function as keystone species in the sagebrush biome (Knick et al. 2011), and cattle grazing is the most pervasive land use in sage-grouse habitats (Knick et al. 2003), it is the least systematically studied (Knick et al. 2011; Wisdom et al. 2011). We focused our study on the effects of cattle grazing because of the potential negative effects on sage-grouse habitats and because cattle grazing practices can be influenced by management decisions.

Cattle feed on perennial grasses, especially focusing on riparian areas (Platts and Nelson 1985), whereas sage-grouse primarily select forbs and sagebrush (Crawford et al. 2004), yielding a limited potential for competition for specific nutritional resources between cattle and grouse (Gregg et al. 2008). Rather, it is the elimination, by cattle grazing, of proper upland vegetation structure for sage-grouse nesting and brood-rearing activities that may hamper sage-grouse productivity

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