Research Report

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E ects of Cattle Grazing on Birds in Interior Douglas- r ( ) Forests of British Columbia

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Abstract

Livestock grazing is a dominant land use across North America and although the e ects of grazing on birds have been studied in grassland, shrubland, and riparian habitats, studies of the e ects in forests are rare. We investigated the e ects of cattle grazing in forests on vegetation, the relationships between vegetation characteristics and the abundance of foraging and nesting guilds of birds, and the overall e ects of grazing on the bird community in the Interior Douglas- r (

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Introduction

Livestock grazing is one of the principal land uses in North America, occurring on 317 million ha in the USA and 26 million ha in Canada (Horton 1996; Lubowski et al. 2006). Grazing can have widespread impacts on vegetation structure and composition. Grazing has direct impacts on vegetation via compaction of soil and trampling and defoliation of plants (Kau -man and Krueger 1984). As some plant species respond positively to grazing pressure while others respond negatively, grazing can alter species composition (Kutt and Woinarski 2007) and facilitate invasions of exotic species (Kimball and Schi man 2003). ese grazing-induced changes in species composition can result in conversion of grassland to shrubland (Skarpe 1990), hasten the regeneration of cleared pasture to forest (Posada et al. 2000; Zimmermann et al. 2009) and facilitate forest expansion (Richardson et al. 2007). Such vegetation changes can in turn impact bird communities. For instance, grazing can reduce the suitability of an area for species that rely on characteristics such as tall grass and greater cover (e.g., Lesser Prairie-Chicken [[illegible]] and Upland Sandpiper [[illegible]]) (Derner et al. 2009), while potentially bene ting those that prefer low cover and bare ground (e.g., Mountain Plover [[illegible]] and Long-billed Curlew [[illegible]]) (Derner et al. 2009). Birds may su er increased nest predation rates due to reduced cover and altered suitability of nesting sites (Ammon and Stacey 1997; Fondell and Ball 2004). In addition, cattle may directly impact birds by exposing, trampling, or otherwise destroying ground nests (Nack and Ribic 2005; Walsberg 2005).

While both the direct and indirect e ects of cattle on vegetation and birds have been relatively well studied in western grasslands, shrublands, and riparian areas (reviewed in Kau man and Krueger 1984; Bock et al. 1993; Fleischner 1994; Saab et al. 1995; Tewksbury et al. 2002), there is less known about the impacts of cattle grazing in forests, particularly on birds (Bock et al.1993; Saab et al. 1995). Studies investigating the e ects of grazing on forest vegetation have revealed that light, controlled grazing can facilitate tree recruitment by removing vegetation that otherwise outcompetes seedlings. However, with more intense or uncontrolled grazing, cattle can reduce shrub understorey and trample and browse seedlings, potentially impacting forest recruitment (reviewed in Adams 1975; see also Harrington and Kathol 2009; Van Uytvanck and Ho mann 2009). Despite early observations that heavy grazing can dramatically alter forest

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structure and avifauna (Dambach 1944) few studies have directly assessed the e ects of cattle on birds in non-riparian forested areas. Bird species are expected to have di ering susceptibilities to cattle grazing depending on the degree to which they use di erent strata of vegetation. Cattle are predicted to have the greatest e ect on birds that primarily use ground or understorey vegetation, and minimal e ects on those using the forest canopy. Martin and Possingham (2005) found that the amount of time spent foraging in particular vegetation strata was a signi cant predictor of the response of individual bird species to grazing in a grassy eucalypt forest. e few studies that have investigated the impact of cattle grazing on birds in non-riparian forest have typically found that more bird species respond negatively to grazing than positively. However, the degree of response of the bird community varies widely, ranging from most species exhibiting a response to cattle (Martin and Possingham 2005; Martin and McIntyre 2007) to almost none (Goguen and Mathews 1998; Kutt and Woinarski 2007). E ects of cattle grazing may also vary with forest type. For example, Alexander et al. (2008) found cattle grazing reduced abundances of shrub-nesting and foliage-gleaning birds in oak woodlands but not in mixed conifer forest. In contrast, they found that grazing increased species richness in the mixed conifer forest but not in the oak woodland.

Ranching in forestland is a widespread practice in the interior of British Columbia, Canada. Cattle ranchers have been using forested areas since the 1890s, and by 1950, 2.8 million ha of forestland were grazed (Tisdale 1950). Currently, at least 70% of all rangeland in the province is in forest (Wikeem et al. 1993). is region has experienced considerable forest ingrowth and encroachment in the last century, altering the structure of the forest-grassland matrix (Ross 2000, Bai et. al. 2004). To date, no studies have examined the e ects of cattle grazing on birds in the Interior Douglas- r ([illegible]) biogeoclimatic (BEC) zone, which is the most important zone for grazing in the southern interior of British Columbia (Wikeem et al. 1993). We therefore set out to examine the e ects of current grazing practices on both vegetation and birds in the Douglas- r forest of the Cariboo-Chilcotin region. We rst investigated the e ects of grazing on ground vegetation and forest structure, and then assessed relationships between particular vegetation characteristics and the abundance of di erent foraging and nesting guilds of birds. Finally, we assessed if changes in vegetation associated with cattle grazing and guild-level responses to vegetation led to di erences in the bird community composition, overall abundance, and diversity between grazed and ungrazed areas.

Methods

Study Area

We conducted this study in the Cariboo-Chilcotin region of the Interior Douglas- r biogeoclimatic zone (IDF) in British Columbia, Canada, where the lower elevations of the Fraser and Chilcotin River valleys are grassland, grading into the dry, open forest at higher elevations. At our study sites, forest canopy is dominated by Douglas- r (97% of trees). Understorey consists primarily of Douglas- r saplings (80% of saplings) and a mixture of Common Snowberry ( ), rose (spp.), and juniper (spp.). Dominant ground cover includes Bluebunch Wheatgrass (A), Pine Grass ( ), Kentucky Bluegrass ( ), and Rosy Pussytoes (A). Soils of the Douglas- r/pinegrass subzone of the IDF are primarily Orthic Grey Luvisols, while the higher elevations of the grassland subzone are Dark Grey Chernozems (Annas and Coupé 1979). Ranching is an important land use of the area. Current stocking rates in the region for grassland and forest range are estimated to average 1.2 AUM (animal unit month)/ha and do not exceed 3.3 AUM/ha (C. Mumford and W. Heyes-van Vliet, personal communication July 2009), and pastures extend across the grassland-forest ecotone and into the forest. e study was conducted at three sites located within 70 km of each other: Churn Creek Protected Area (CCPA; average aspect 100°; average elevation 834 m; BEC variant IDFxm) on the western plateau above the Fraser River; the OK Ranch (OKR; average aspect 200°; average elevation 1176 m; BEC variants IDFxm and IDFxw) on the eastern plateau above the Fraser River; and Junction Sheep Range Provincial Park (JSR; average aspect 83°; average elevation 912 m; BEC variant IDFxm) which lies above the junction of the Chilcotin and Fraser Rivers. We categorized sites as either: 1. currently grazed (OKR and CCPA) or 2. ungrazed (JSR) but were unable to further categorize the intensity of grazing due to local variability in the timing, duration and intensity of grazing, both temporally and geographically. During the study we attempted to get cattle counts and length of times on sites from the ranchers involved but were unable to obtain this information. However, eld crews who spent considerable time at the sites noted that grazed plots were being actively grazed during the study. JSR has not been grazed by cattle in over 30 years. We established 116 point count stations in forest (>30% tree cover; assessed visually) across the three di erent sites in a grid pattern, with each station 250 m apart.

Bird Abundance

Each station was surveyed for birds three times between mid-May and mid-July in 2007 and again in 2008. All birds seen or heard within a 50 m radius during a six minute point-count were identi ed to species and recorded. As woodpeckers are not well recorded with passive point count surveys, surveys were followed by an eight minute playback of local woodpecker calls. Any woodpeckers seen or heard at any distance during the point count or playback were noted. Woodpeckers not successfully identi ed to species were recorded as "unknown woodpecker." Surveys were conducted between 0500 and 1000 hours or occasionally until 1100 hours if the day was cool and birds were still singing. Counts were not conducted during high winds or rain. We de ned species abundance as the maximum number of individuals of each species seen at a given station during the year, to re ect the peak in local breeding density. As the species-level abundance data contained many zeros, abundances were combined into nesting (cavity, ground, shrub/tree) and foraging guilds (aerial insectivore, bark insectivore, foliage insectivore, and ground insectivore); omnivores and raptors were omitted from guild-level analyses due to low abundances (Appendix A). Species were classi ed to guilds based on their primary feeding habitats during the nesting period, following Poole (2010). Red Crossbills ( ) were omitted from all analyses because they were encountered in large foraging ocks (up to 35 individuals) that did not re ect local breeding abundance.

Vegetation

We collected two sets of vegetation data at point count stations: and was assessed as the percent cover of bare ground, biocrust, forbs, grass, and litter within a 5 m radius circle centred on the point count station, and on

Strongly supported (QAIC $_c$ < 2) and null models relating abundance by foraging guild to forest structure and ground vegetation. All candidate sets contained 8 models.

Guild	Model		[1]	QAIC [2]	ΔQAIC [3]	[4]
Aerial insectivore	Forest structure					
	1. (null)	63	2	159.64	0.00	0.33
	2. Number of saplings	63	3	160.63	0.99	0.20
	3. Number of shrubs	63	3	161.43	1.78	0.13
	Ground vegetation					
	1. (null)	113	2	219.21	0.00	0.44
	2. Height of ground vegetation	113	3	220.46	1.25	0.23
Bark insectivore	Forest structure					
	1. Number of saplings	63	3	145.49	0.00	0.28
	2. Number of saplings + number of trees	63	4	146.11	0.62	0.20
	3. (null)	63	2	146.83	1.34	0.14
	4. Number of trees	63	3	146.99	1.50	0.13
Foliage insectivore	Forest structure					
	1. Number of saplings	63	3	193.60	0.00	0.44
	2. Number of saplings + number of trees	63	4	194.82	1.22	0.24
	3. Number of shrubs + number of saplings	63	4	195.36	1.76	0.18
	5. (null)	63	2	200.12	6.52	0.02
Ground insectivore	Ground vegetation					
	1. (null)	113	2	512.18	0.00	0.39
	2. Forb cover + grass cover	113	4	514.00	1.82	0.16
	3. Height of ground vegetation	113	3	514.10	1.93	0.15
	4. Bare ground + biocrust cover	113	4	514.16	1.98	0.15

1 e number of estimated parameters in the model including the variance.

2 A measure of the level of t of the data to the model weighted by the number of variables in the model, corrected for small sample sizes.

3 e di erence between the QAIC of each model and that of the most parsimonious model.

4 e likelihood of the model given the data, relative to the other models in the candidate set.

Strongly supported (QAIC $_c$ < 2) and null models relating abundance by nesting guild to forest structure and ground vegetation. All candidate sets contained 8 models. See Table 4 for de nitions of column headings.

G			AIC	AIC	

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Mean bird abundance by foraging guild at grazed (n = 32) and ungrazed (n = 200) point-count stations. Error bars represent 95% CI.

Response of Bird Community to Grazing

We found no evidence that grazing a ected bird abundance or diversity. While the top-ranked models for both abundance and diversity consisted of a grazing

Discussion

Studies examining how grazing impacts vegetation structure and bird communities have primarily been conducted in grassland, shrubland and riparian areas, while studies examining the effects of grazing on birds in forest are rare (Bock et al. 1993; Saab et al. 1995). Our study is the first to examine the influence of cattle grazing in forests on bird community composition, abundance, and diversity in the Interior Douglas-fir biogeoclimatic zone of British Columbia, Canada, despite forest grazing being a widespread practice in the area (Tisdale 1950; Wikeem et al. 1993). We observed vegetation structure to differ between grazed and ungrazed sites, and several bird guilds responded to vegetation characteristics that were potentially altered by grazing. However these effects generally did not scale up to overall differences in bird community composition, abundance, or diversity between grazed and ungrazed sites.

Grazed sites differed from a long-term ungrazed site in terms of both ground vegetation and forest structure, having less grass cover, shorter ground vegetation and somewhat greater forb cover, as well as greater density of grazed sites. However, foliage insectivores, cavity nesters, and shrub/tree nesters also exhibited positive associations with sapling density, but this did not translate into increased abundance on grazed sites. e increase in sapling density associated with cattle grazing may have been too small to a ect abundance of these guilds. Aerial insectivores exhibited much lower abundance at the grazed sites, even though they did not respond to any measured vegetation characteristic of either ground vegetation or forest structure. Aerial insectivores may be responding to aspects of the vegetation that we did not measure, such as species composition, or they may be responding to factors such as predation risk, nest site suitability, and food availability, which may not exhibit close correlations with the vegetation characteristics we measured. In addition, as we only had one ungrazed site, we cannot rule out the possibility of site e ects.

Despite altering bird community composition, cattle grazing did not a ect overall bird abundance or diversity at our sites. Mixed e ects between guilds may have negated overall abundance trends, with decreases in a-eed sites. HhiRT5 esobbility, and food avainr(i)12(t)-6(h de)-5(68(v)8(e n)4(es)-8(e)]TJT*[(in s)-6(as5 e8(va56(i)3(12(t5 es)5 did

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