Cows and Fish Report

The Effects of Livestock Grazing On Vermilion River Breeding Bird Communities

Cows and Fish
Alberta Riparian Habitat Management Program Report No. 023

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About Cows and Fish

Riparian areas are those areas along rivers, streams, lakes, wetlands, springs, and ponds that are strongly influenced by water and are recognized by water-loving vegetation. Cows and Fish is striving to foster a better understanding of how riparian areas function and how improvements in management strategies in riparian areas can enhance landscape health and productivity for the benefit of livestock producers, their communities and others who value these landscapes.

Cows and Fish Partners: Producers and community groups, Alberta Beef Producers, Trout Unlimited Canada, Canadian Cattlemen's Association, Alberta Agriculture, Food and Rural Development, Alberta Sustainable Resource Development, Alberta Environment, Department of Fisheries and Oceans, Prairie Farm Rehabilitation Administration, Alberta Conservation Association

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EXECUTIVE SUMMARY

Breeding bird surveys were conducted within the riparian area along the Vermilion River during June 2002 to examine the effects of livestock grazing on bird community and vegetation characteristics. Overall, 194 point counts were conducted at 69 50-m radius count circles representing idle/low (18 circles), moderate (21 circles), and heavy (30 circles) grazing regimes. Bird abundance and species richness, at a circle level, varied significantly among grazing regimes with idle/low grazed sites having higher values than moderate and heavy grazed sites. Idle/low grazed sites also had slightly higher bird diversity indices, although these were not significantly different from other grazing regimes. Drought conditions and subsequent higher grazing pressure on pastures rates as moderate or heavy grazed may have reduced potential differences in bird community characteristics between these grazing regimes.

There was little difference in the overall number of species detected in idle/low (21 species), moderate (24 species), and heavy (25 species) grazing regimes, possibly due to differences in sampling intensity. Thirteen species were found in all grazing regimes, 10 species in 2, and 11 species in only 1. Clay-colored sparrow and savannah sparrow were the dominant species across all grazing regimes. A number of species, including American robin, gray catbird, black-capped chickadee, and eastern kingbird occurred in low abundance across grazing regimes. Other species, such as yellow warbler, brown-headed cowbird, and LeConte's sparrow, were most frequently recorded at idle/low grazed sites, whereas species such as Spague's pipit, killdeer, American crow, and black-billed magpie were more frequently recorded in moderate/heavy grazed sites. However, the abundance of 5 of 8 species statistically examined exhibited differences among grazing regimes: clay-colored sparrow, savannah sparrow, yellow warbler, and brown-headed cowbird were more abundant at idle/low grazed sites, whereas red-winged blackbird was least abundant at heavy grazed sites.

Vegetation parameters varied among grazing regimes. Idle/low grazed sites were characterized by greater mean height of grass, herbaceous growth, shrubs, as well as a greater percentage of shrubs > 1m tall and grass >15 cm height as compared to moderate and heavy grazed sites. In addition, these sites contained less bare ground, a lower percentage of heavy browsing on preferred browse species, and greater litter weights.

Mean grass height, percent grass >15cm height, litter weight, percent heavy browsing on preferred browse species, and percent bare cover were vegetation variables most strongly

correlated to bird community characteristics. Grass height, grass height >15 cm, and litter weight were positively correlated with mean number of individuals per count, mean number of species per count, total number of species per count circle, and bird diversity index per circle. Heavy browsing was negatively correlated with all bird community variables, and percent bare ground was negatively correlated with all bird community variables except bird diversity. No relationship existed between percent grass cover, percent herbaceous cover, percent shrub cover, vegetative cover diversity index, forb height, and shrub regeneration. Overall, vegetation structure appeared to be more important in determining bird community characteristics than vegetation composition.

Study results indicate that grazing along the Vermilion River has an overall negative effect on bird abundance and species richness in riparian areas. Overall ground cover and height of ground cover, and degree of browsing appear to be factors influencing bird community characteristics. Heavier grazing pressure than was previously documented on grazed sites (Vermilion River health assessment) likely reduced differences in bird community and vegetation characteristics between moderate and heavy grazed pastures. Litter weights indicated that idle/low grazed sites were “healthy” whereas only 1 moderate/heavy grazed site was “healthy”. The majority of heavy grazed and moderate grazed sites were “unhealthy” and “healthy with problems”, respectively. This is comparable to results derived from the 1999 River Riparian Assessment, which based ratings on several factors. However, a comparison of a few variables between the studies indicated that riparian/range condition had declined even further in 2002.

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1.0 INTRODUCTION

1.1 Project Background

Since 1992 the Cows and Fish program has been working with livestock producers and communities in southern Alberta to promote an improved understanding of the functions and values of riparian zones and to lay the groundwork for more effective management of these important landscape areas. Although the program initially focussed on the prairie ecoregions, recent efforts have expanded to the entire province, including the Central Parkland Subregion of the Parkland Natural Region in Alberta. One of the goals of the Cows and Fish Program is to increase our understanding of the ecological services provided by riparian areas and the ways in which these ecological services are affected by land use practices. A recent study by Saunders (2001) provides a comprehensive review of previous research conducted in the prairie regions of Alberta and Saskatchewan related to the effects of livestock grazing on the biodiversity of riparian areas. The study found that although individual bird species responded to grazing in different ways, heavy grazing was generally associated with a reduction in native species abundance and diversity.

As part of its recent efforts to improve our understanding of the effects of agricultural practices on riparian areas in the Central Parkland Subegion, the Cows and Fish program has initiated a study to examine of the relationship between livestock grazing practices and biodiversity along the Vermilion River drainage in east-central Alberta. The Vermilion River was the subject of a riparian health assessment completed by the Land Stewardship Centre of Canada and Westworth Associates Environmental Ltd. in 1999. That study found that, as a result of intensive agricultural use and other land use changes, the Vermilion River has lost its capability to perform many of the ecological functions, characteristic of healthy riparian systems. Although heavy livestock grazing was found to be the most significant factor in the decline of riparian health along this drainage, riparian areas were also being adversely affected by cultivation and hay production.

1.2 Objectives

The main objective of the current study was to examine the effects of different levels of livestock grazing on bird communities within riparian habitat along the Vermilion River. Specific objectives were to:

- Document breeding bird communities in idle/low, moderate, and heavy grazing regimes;
- Document vegetation characteristics in idle/low, moderate, and heavy grazing regimes;
- To examine the relationships between bird community characteristics, vegetation characteristics, and grazing regimes.

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2.0 STUDY AREA and METHODS

The study was conducted along the Vermilion River located in eastern central Alberta. Ecologically the study area occurs within the Central Parkland Subregion of the Parkland Region (Achuff 1994). The Central Parkland Subregion is characterized by a continuum of grassland with groves of aspen in the south, to aspen parkland, and finally to closed aspen forest in the north where the Vermilion River is located. However, <5% of the Central Parkland Subregion exists as natural habitat (Wallis 1987). Most of this ecoregion has been cleared for cropland and livestock agriculture and remnant natural vegetation is generally restricted to wetlands, stream courses, and fragmented aspen stands (Westworth and Knapik 1987).

The Vermilion River originates in the Torlea area, southeast of Bruce and flows 275 kilometres into the North Saskatchewan River at Lea Park. The Vermilion meanders in gently rolling terrain in the headwater section, with the valley gradually deepening in the lower reach. The Vermilion River has been significantly altered by channelization, meander cutoffs, and control structures.

2.1 Site Selection

The Vermilion River Riparian health assessment (Westworth Associates Environmental and Land Stewardship Centre 1999) was used as a starting point in selecting sample sites, although additional air photo analysis and landowner interviews were also undertaken to complete site selection. The reaches of the Vermilion River, extending between the Town of Bruce and the Town of Vegreville, and between the Town of Mannville and the Town of Marwayne were identified as suitable for the study.

Originally 12 sites representing 4 replicates of 3 grazing regimes (idle/low, moderate, and heavy) were selected from the previous health assessment sites to examine the effects of grazing on riparian bird communities along the Vermilion River. However, the relatively low winter precipitation over the last few years followed by a very dry spring/summer in 2002 resulted in lower vegetative growth and heavier than normal grazing pressure on pastures. As a result, pastures receiving grazing pressure were reclassified based on vegetative characteristics (e.g., height of grass, % bare ground cover) in conjunction with subjective judgement of pasture conditions by surveyors/site selectors. Idle/low sites included mainly

sites that had not experienced grazing for a few years, although 2 point count locations in the vicinity of Vermilion Provincial Park had received a low grazing pressure during the survey period.

At each site, between 2 and 8 (typically 5) 50-m radius plots were established within the riparian area, and the center of the plot (e.g., count station) was marked with a numbered pink flag on a metal wire or flagging attached to a shrub or tree where present. The riparian area was identified as the flood plain of the river and the occurrence of willow clumps was used to define the boundary of riparian habitat. At a few sites where willow may have been mechanically removed, the extent of riparian zone was considered to be the floodplain proximate to the river. Each count station was separated by at least 125 m to minimize the potential for the same individuals to be counted at different circles.

2.2 Bird Surveys

The fixed-point count method was used to survey bird communities within each site. Breeding birds were sampled at most point count stations 3 times in June 2002, including the periods of June 5 and 6, June 14 and 15, and June 29 and 30. However, some stations were additionally added or shifted during the overall survey period to better address grazing pressure, resulting in some sites being sampled twice, and 1 site only sampled once. Point counts began at 0430 h and generally ended by 0930 h. After arriving at a point count station, observers waited 1 minute and then recorded all birds seen or heard within the 50 m count circle during a 5-minute interval. As much as possible, individual birds were counted only once and movements of birds were recorded. Birds that flew over the count circle were recorded but were not included in analyses, as were species that moved through the count circle but did not appear to be using the riparian habitat. In addition, birds detected within the riparian zone, although not at a point count station or within a count period, were recorded as additional observations, which again were not included in the analyses. Surveys were not conducted during periods of rain, or in wind conditions in which the observer felt their detection of birds or bird behaviour was adversely affected.

Bird communities in each habitat were summarized by determining the mean number of individuals per circle and mean species richness per circle, as was the total species richness per circle. Bird species diversity indices were calculated using the Shannon-Weaver diversity index: $H = -\sum p_i \ln p_i$, where p_i = the proportion of the individuals of the i^{th} species (Shannon and Weaver 1949). The overall relative abundance of individual species in each grazing regime was also determined as the % of total detections, and the frequency of occurrence in all count circles.

2.3 Vegetation Sampling

Three sets of vegetation measurements were taken within each point count circle during the study: 1) vegetation cover and height, 2) utilization of preferred browse species, and 3) litter weights. Vegetation cover and height in each point count circle were evaluated following the second bird survey period using methods outlined in Prescott and Murphy (1996). Vegetation measurements were taken along 4 transects radiating in cardinal directions from the center of each point count. At 4 meter intervals along each transect the observer recorded the dominant vegetation type (grass, forb, shrub, bare ground) within a 200 cm^2 area around a vertically-placed meter stick. The maximum height of the dominant vegetation type ($\pm$ 1 cm) was also measured. Based on these 48 measurements, the vegetation in each point count circle was described as to: 1) the overall percentage of each cover type, including herbaceous cover (combined grass and forb cover); 2) diversity of vegetation cover based on the Shannon-Weaver diversity index: $H = -\sum p_i \ln p_i$, where p_i = the proportion of the ground cover of the i^{th} type (Shannon and Weaver 1949); 3) mean height of each cover type; 4) percentage of grasses >15 cm height; and 5) percentage of shrubs >1 m height.

Occurrence and utilization of preferred browse species (e.g., aspen, balsam poplar, willows, red osier dogwood, choke cherry, pin cherry) were evaluated following the third bird survey. Species excluded when evaluating a site for browse utilization included Russian olive, snowberry, rose, and hawthorn. The presence of or potential for preferred browse species to occur within each count circle was noted. Shrub regeneration of preferred browse species within the circle was evaluated using the following categories:

- 0 = preferred tree/shrub seedlings or saplings absent;
- 2 = <5% of the total cover of preferred trees/shrubs is seedlings and saplings;
- 4 = 5-15% of the total canopy cover of preferred trees/shrubs is seedlings and saplings; and
- 6 = >15% of the total canopy cover of preferred trees/shrubs is seedlings and saplings.

Utilization of preferred browse species within each count circle was evaluated by selecting 2-3 representative stems of each species and categorizing the degree of browsing as the following:

- 0 = Heavy (>50% of available second year and older leaders of preferred species are browsed);
- 1 = Moderate (25-50% of available second year and older leaders of preferred species are browsed);

- 2 = Light (5-25% of available second year and older leaders of preferred species are browsed);
- 3 = None (0-5% of available second year and older leaders of preferred species are browsed).

The litter survey was conducted in September 2002. A 0.5 m^2 plot was established at the center of each point count circle. Litter, bare, and green vegetation ground cover, were estimated within the plot and litter depth ($\pm$ 1 cm) was determined with a measuring stick. All litter was then collected from the plot, and compared against litter bags of known weights, or dried and weighed ($\pm$ 1 g). Litter weights were placed into representative production categories (lbs/acre).

2.4 Data Analyses

Bird community data was averaged across survey periods, and then across count circles to provide mean values for each site. Vegetation data were averaged within count circles and/or across count circles to provide mean values for each site. ANOVA in conjunction with Duncan's multiple range test was used to evaluate variation in vegetation characteristics and bird species and abundance among grazing regimes. Chi square test was used to determine if the abundance of individuals differed significantly among grazing regimes for species with 10 or more total detections. Pearson's correlation test was used to examine the relationship between vegetation measures and bird species richness and abundance.

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3.0 RESULTS

3.1 Sample Sites

Thirteen sites were sampled during the course of the study, 4 sites with idle/low grazing pressure, 4 sites with moderate grazing pressure, and 5 sites with heavy grazing pressure. The number of point count circles and point counts conducted were, respectively, 18 and 50 for low, 21 and 61 for moderate, and 30 and 83 for heavy grazing regimes (Table 2). Overall, 69 point count circles were sampled with a total of 194 point counts conducted within the 3 sampling periods in June. Locations of the survey sites along the Vermilion River are illustrated in Figures 1-3.

Table 1. Number of point count circles and the total number of point counts conducted in each pasture/site within idle/low, moderate and heavy grazing regimes within riparian areas along the Vermilion River, June 2002.

Site/Pasture (Site Number)	Grazing Regime	Number of Point Count Circles Per Site	Total Number of Counts Conducted Per Site
Maves (3)	Idle/Low	5	15
Otto (8)	Idle/Low	8	24
Provincial Park (100)	Idle/Low	3	7
Freed (9)	Idle/Low	2	4
Total Idle/Low		18	50
Bendixon (48)	Moderate	6	16
Arnold (41)	Moderate	5	15
Roy (42)	Moderate	5	15
Schneider (34)	Moderate	5	15
Total Moderate		21	61
Bendixon (47)	Heavy	5	15
Prills (37)	Heavy	6	18
Otto (82)	Heavy	5	15
Giebelhaus (7)	Heavy	7	21
Wowk (33)	Heavy	7	14
Total Heavy		30	83
Overall Total		69	194

3.2 Overall Species and Relative Abundance

A total of 664 detections of 43 bird species were recorded within point count circles during the 2002 survey period. The majority of species were migrants (91%), with 4 resident species being recorded. Bird groups represented during the surveys included waterfowl (7 species), shorebirds (4 species), rails (2 species), terns (1 species), woodpeckers (1 species), and passerines (28 species) (Appendix 1). Sparrows were the most common and widely distributed birds detected during surveys, accounting for 55.6% of all detections. The most frequently recorded sparrows included the clay-colored sparrow (212 detections, 78.3% of all point count circles) followed by savannah sparrow (77 detections, 53.6% of all point count circles), song sparrow (42 detections, 39.1% of all point count circles), and vesper sparrow (28 detections, 33% of all point count circles). Other relatively abundant species included red-winged blackbird and yellow warbler. The majority of species contributed to <5% of all detections (39 species), and were detected in <10% of the point count circles (34 species).

Additional species recorded within riparian habitat, although not within point count circles, included rock dove, mourning dove, white-throated sparrow, red-eyed vireo, pied-billed grebe, great blue heron, and horned lark. Six additional species recorded flying over the point count circles were likely foraging in the general vicinity; these included the clliff swallow, barn swallow, bank swallow, tree swallow, red-tailed hawk, and Swainson's hawk.

3.3 Effect of Grazing on Birds

In examining the effect of grazing pressure and vegetation characteristics on bird species and abundance, several bird species were removed from the analyses. These included all waterfowl, terns, and rails, as well as shorebirds that are closely associated with water. The presence of these species was strongly biased by the occurrence of water at the point count circles rather than vegetation structure and grazing pressure. As many sections of the Vermilion River were dry, incorporating these species in the analyses would have skewed the results.

The effects of grazing on bird communities was examined by comparing species richness, relative abundance, and bird diversity index among sites within low, moderate, and heavy grazing regimes. Since sample sizes varied among sites and grazing regimes, most comparisons were made at the point count and circle level. Idle/low grazed sites contained significantly higher average number of individuals per count ($P<0.001$), species per count ($P<0.001$), and total species per circle ($P<0.05$) when compared to moderate and heavy grazed sites (Figure 4, Appendix 2). Bird diversity per circle did not vary significantly among grazing regime, although it was somewhat higher on idle/low grazed sites.

Figure 1. Location of survey Sites 3, 7, 8, 9, and 82 along the Vermilion River between Bruce and Vegreville, Alberta.

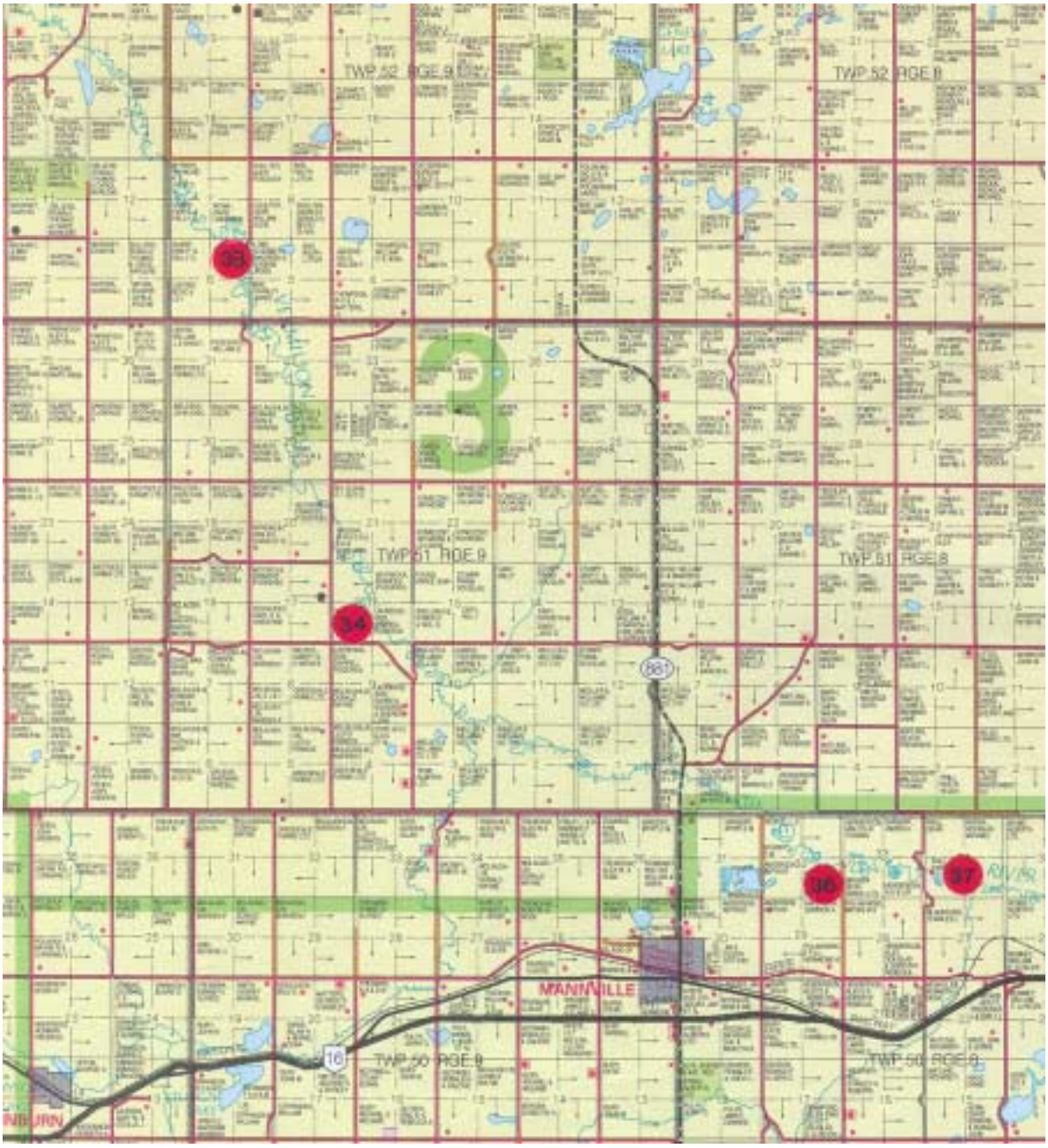

Figure 2. Location of survey Sites 33, 34, 36, 37 along the Vermilion River north of Mannville, Alberta.

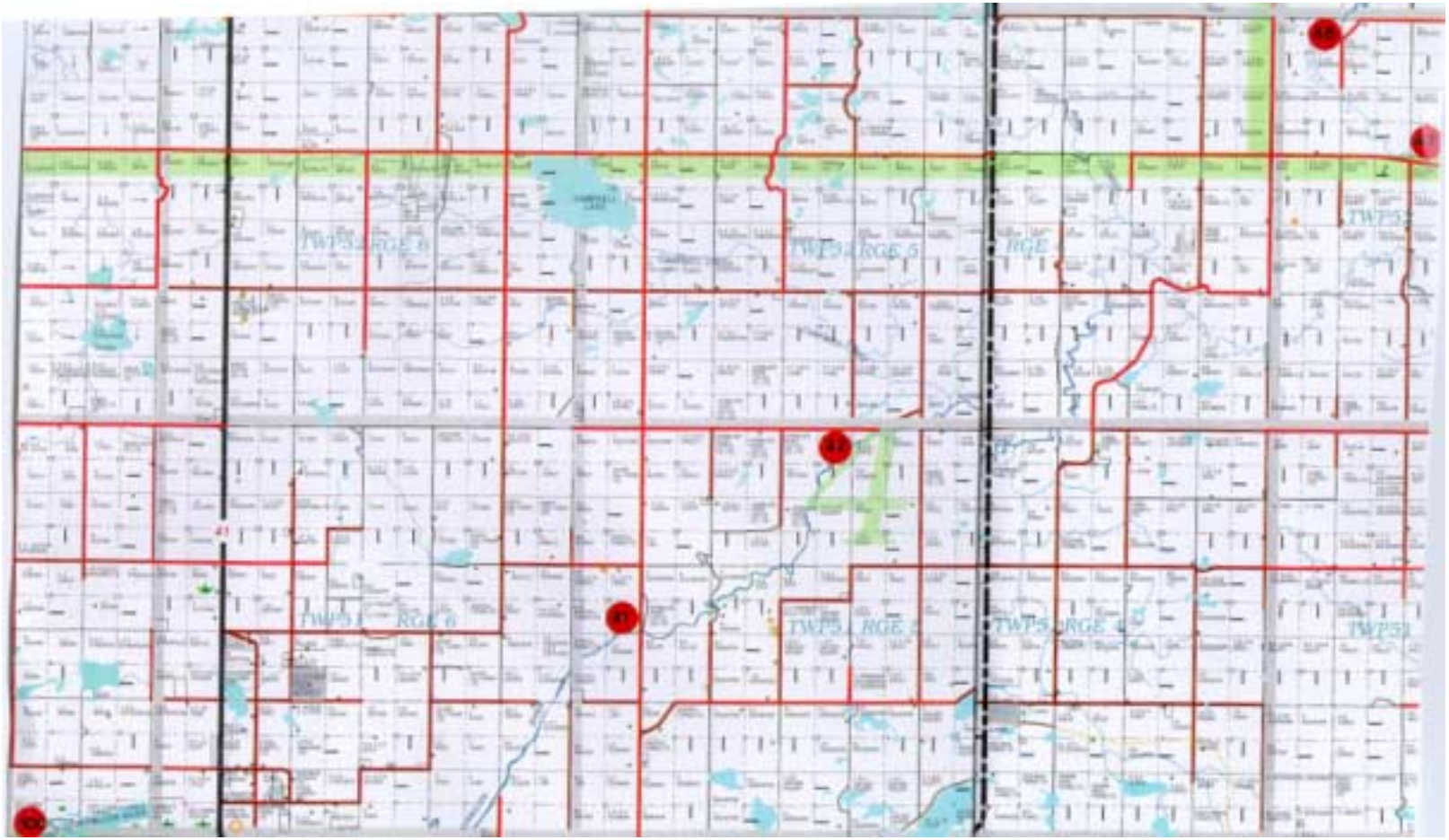

Figure 3. Location of survey Sites 41, 42, 46, 47 and 100 along the Vermilion River between Vermilion Provincial Park and Marwayne, Alberta.

There was little difference in the overall number of species detected in idle/low (21 species), moderate (24 species), and heavy (25 species) grazing regimes (Table 2), possibly due to differences in sampling intensity. Thirteen species were found in all grazing regimes, 10 species in 2, and 11 species in only 1. Clay-colored and savannah sparrows were the dominant species across all grazing regimes. A number of species, including American robin, gray catbird, black-capped chickadee, eastern kingbird occurred in low abundance across grazing regimes. Other species, such as yellow warbler, brown-headed cowbird, and LeConte's sparrow, were most common at idle/low grazed sites, whereas species such as Spague's pipit, killdeer, American crow, and black-billed magpie were more common on grazed sites. Only 2 species, the sharp-tailed sparrow and LeConte's sparrow, were found only in idle/low grazed sites; both these species are generally found in sedge/grass meadows and bushes associated with water. The sharp-tailed sparrow was only detected once at the margins of the river where no standing water was present, and it is uncertain if this species was actually breeding at the site.

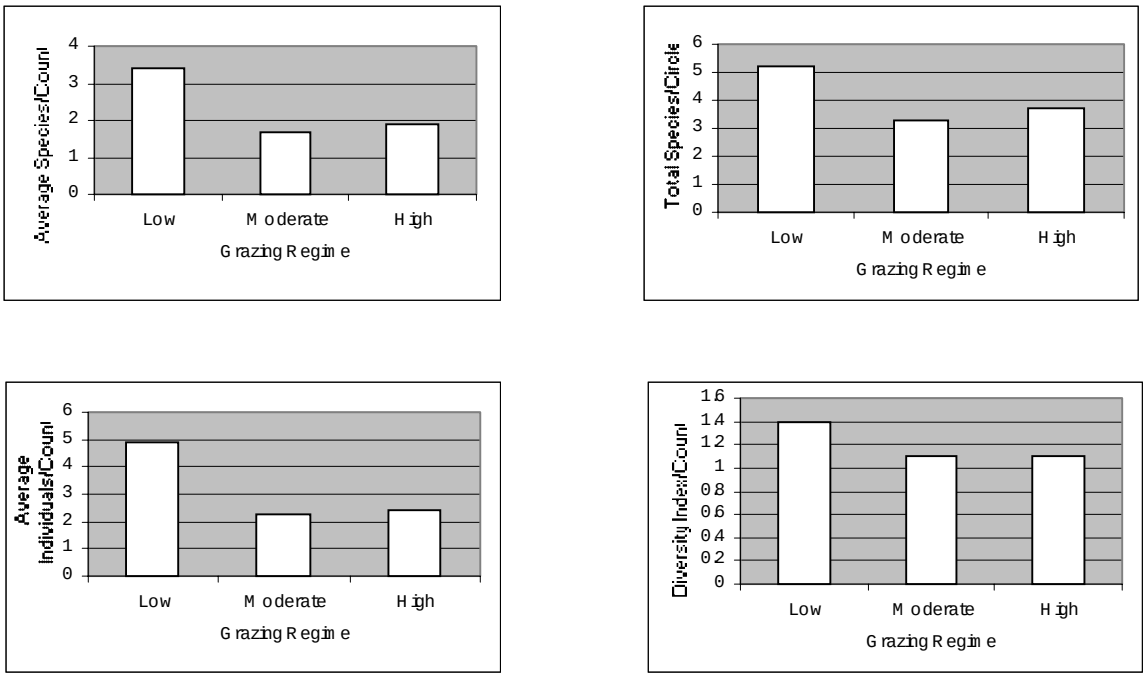

Figure 4. Bird community characteristics (average species/count, total species/circle, average number of individuals/count, and diversity index/circle) among idle/low, moderate, and heavy grazing regimes. (a/b) – denotes grazing regimes which are similar (same letter) or different (different letters).

Table 2. Relative abundance of bird species in idle/low, moderate, and heavy grazing regimes, based on total detections of species.

Bird Species	Idle/Low Grazing			Moderate Grazing			Heavy Grazing		
	N (% Total Number)	% Count Circles	% of All Counts	N (% Total Number)	% Count Circles	% of All Counts	N (% Total Number)	% Count Circles	% of All Counts
killdeer	1 (0.4)	5.6	2	10 (7.2)	19.0	11.5	6 (2.9)	16.7	6.0
willet	0	0	0	2 (1.4)	4.7	3.3	1 (0.5)	3.3	1.2
marbled godwit	0	0	0	2 (1.4)	4.7	1.6	0	0	0
common snipe	1 (0.4)	5.6	2	1 (0.8)	4.7	1.6	0	0	0
northern flicker	0	0	0	1 (0.8)	4.7	1.6	1 (0.5)	3.3	1.2
alder flycatcher	3 (1.3)	16.7	6	0	0	0	1 (0.5)	3.3	1.2
least flycatcher	0	0	0	1 (0.8)	4.7	0.7	0	0	0
eastern phoebe	0	0	0	0	0	0	1 (0.5)	3.3	1.2
eastern kingbird	2 (0.9)	11.1	4	1 (0.8)	4.7	1.6	2 (1.0)	6.7	2.4
black-billed magpie	0	0	0	0	0	0	4 (1.9)	6.7	4.8
American crow	0	0	0	0	0	0	2 (1.0)	3.3	2.4
black-capped chickadee	1 (0.4)	5.6	2	2 (1.4)	9.5	3.3	1 (0.5)	3.3	1.2
house wren	2 (0.9)	11.1	4	0	0	0	4 (1.9)	6.7	4.8
American robin	2 (0.9)	11.1	4	3 (2.1)	9.5	3.3	1 (0.5)	3.3	1.2
gray catbird	2 (0.9)	11.1	4	3 (2.1)	9.5	4.9	4 (1.9)	10.0	4.8
Sprague's pipit	0 (0)	0	0	5 (3.6)	19.0	8.2	3 (1.4)	6.7	3.6
cedar waxwing	0	0	0	2 (1.4)	4.7	1.6	0	0	0
yellow warbler	31 (13.3)	72.2	50	0	0	0	5 (2.4)	10.0	6.0
common yellowthroat	2 (0.9)	5.6	4	2 (1.4)	9.5	3.3	2 (1.0)	6.7	2.4
clay-colored sparrow	96 (41.0)	100	90	23 (16.6	38.1	29.5	93 (44.7)	93.0	67.5
vesper sparrow	6 (2.6)	22.2	12	6 (4.30)	23.8	8.2	16 (7.7)	46.7	18.1
savannah sparrow	30 (12.8)	77.8	52	21 (15.1)	33.3	21.3	26 (12.5)	46.7	24.1
LeConte's sparrow	4 (1.7)	16.7	8	0	0	0	0	0	0
sharp-tailed sparrow	1 (0.4)	5.6	2	0	0	0	0	0	0
song sparrow	8.1	55.5	34	10 (7.2)	33.3	7.2	13 (6.3)	33.3	14.5
Lincoln's sparrow	2 (0.9)	11.1	4	1 (0.8)	4.7	1.6	0	0	0
sparrow spp.	0	0	0	1 (0.8)	4.7	1.6	1 (0.5)	3.3	1.2
red-winged blackbird	14 (6.0)	16.7	14	19 (13.7)	47.6	23.0	7 (3.4)	23.3	8.4
yellow-headed blackbird	0	0	0	17 (12.3)	19.0	9.8	0	0	0
western meadowlark	1 (0.4)	5.6	2	4 (2.9)	14.3	6.6	3 (1.4)	6.7	3.6
Brewer's blackbird	0	0	0	0	0	0	3 (1.4)	3.3	2.4
brown-headed cowbird	11 (4.7)	38.9	20	0	0	0	7 (3.4)	13.3	7.2
northern oriole	0	0	0	1 (0.8)	4.7	1.6	0	0	0
American goldfinch	3 (1.3)	11.1	6	1 (0.8)	4.7	1.6	1 (0.5)	3.3	1.2

For some species with a low frequency of detection, occurrence or abundance may not adequately reflect the species response to grazing pressure. Only 8 species were considered to have enough detections to statistically examine variation in abundance among grazing regimes. Of these, 5 species exhibited differences among grazing regimes. Yellow warbler, clay-colored sparrow, savannah sparrow, and brown-headed cowbird occurred more frequently in idle/low grazed sites, whereas red-winged blackbird were least often recorded in heavy grazed sites (Table 3).

3.4 Effect of Grazing on Vegetation and Forage Productivity

The majority of vegetation variables relating to vegetation structure differed significantly ($P \leq 0.05$) amongst grazing regimes. Idle/low grazed sites were characterized by greater mean height of grass, herbaceous growth, and a greater percentage of shrubs > 75 cm tall, and grass >15 cm height (Figure 5,Table 4, Photos 1-3). In addition, they contained less bare ground, a lower percentage of heavy browsing on preferred browse species, and greater litter weights (Photos 4-8). Although shrub height was also greater on idle/low sites, no significant difference occurred between grazing regimes. The mean height of forbs, percentage of grass, and degree on browse regeneration was similar to moderately grazed sites. Fewer differences occurred between moderate and heavy grazed sites. Moderate grazed sites had greater mean grass, forb, and herbaceous growth heights, and a greater percentage of grass >15 cm height than heavy grazed sites. Grass, forb, herbaceous, and shrub vegetation cover and the overall cover diversity at sites did not differ significantly amongst grazing regimes.

A comparison of preferred shrub (browse) utilization and bare ground cover between the 1999 Vermilion Riparian Health Assessment (Westworth Associates Environmental Ltd. and Land Stewardship Centre of Canada 1999) and this study is presented in Table 5. Since sampling was at the count circle level in 2002, results are not directly comparable to the 1999 data. However, changes can be derived from this information. Utilization of preferred browse species on idle/low grazed sites continued to be relatively low (< % browsing) during the 2002 survey, although there appeared to be an increase in browsing intensity over the 1999 survey. Heavy utilization of preferred shrubs was evident on most grazed sites, and characterized some of these areas. An increase in human-caused bare ground was also evident on grazed sites in 2002, and was mainly associated with heavy grazing pressure reducing ground cover. Trampling of ground cover at resting areas and supplemental feeding locations was also evident at some of the sites.

Table 3. Relative abundance of bird species with 10 or more detections in idle/low, moderate and heavy grazing regimes. Chi-square tests were used to examine differences among grazing regimes (* P= 0.05, ** P= 0.01, *** P= 0.001, n.s.= not significant.).

Species	Idle/Low Grazing #/Circle ± S.E.	**Moderate Grazing** #/Circle ± S.E.	Heavy Grazing #/Circle ± S.E.	P
Killdeer	0.01 ± 0.01	0.15 ± 0.11	0.07 ± 0.05	n.s.
Yellow warbler	0.66 ± 0.16	0.0	0.06 ± 0.04	***
Clay-colored sparrow	1.95 ± 0.31	0.39 ± 0.30	1.14 ± 0.28	***
Vesper sparrow	0.11 ± 0.05	0.11 ± 0.05	0.17 ± 0.04	n.s.
Savannah sparrow	0.48 ± 0.18	0.35 ± 0.31	0.35 ± 0.11	*
Song sparrow	0.42 ± 0.19	0.16 ± 0.09	0.12 ± 0.04	n.s.
Red-winged blackbird	0.36 ± 0.28	0.31 ± 0.14	0.09 ± 0.05	*
Brown-headed cowbird	0.18 ± 0.07	0.0	0.08 ± 0.04	***

Table 4. Comparison of vegetation measures in pastures/sites classified as low, moderate, and heavy grazing regimes (* P= 0.05, ** P= 0.01, *** P= 0.001, n.s.= not significant).

Vegetation Measure	Low Grazing (N = 18)		Moderate Grazing (N = 21)		Heavy Grazing (N = 30)		P[1]
	Mean ± SE	Range	Mean ± SE	Range	Mean ± SE	Range	
% Grass Cover	67.3 ± 7.05	52.3 – 79.4	72.2 ± 3.82	63.6 – 86.6	61.8 ± 6.7	37.1 – 72.9	n.s.
% Forb Cover	10.2 ± 1.15	7.2 – 12.8	5.9 ± 1.49	3.4 – 9.9	7.1 ± 2.19	0.8 – 13.1	n.s
% Herbaceous Cover	77.4 ± 7.15	62.0 – 91.9	78.1 ± 4.22	70.0 – 90.0	68.9 ± 8.5	37.9 – 86.0	n.s.
% Shrub Cover	19.7 ± 8.7	4.2 – 38.0	9.1 ± 4.0	0.0 – 18.9	17.4 ± 8.56	0.9 – 50.4	n.s.
% Bare Ground	2.9 ± 2.08 (a)	0.0 – 8.8	12.4 ± 1.16 (b)	10.0 – 15.2	13.7 ± 7.28 ©	7.5 – 26.2	*
Cover Diversity	0.76 ± 0.06	0.65 – 0.88	0.72 ± 0.11	0.39 – 0.9	0.86 ± 0.03	0.76 – .95	n.s.
Mean Grass Height	25.7 ± 4.1 (a)	17.5 – 36.3	11.2 ± 1.75 (b)	8.1 – 14.5	7.3 ± 0.67 (b)	5 – 9.1	***
Percent Grass Height >15 cm	80.2 ± 11.3 (a)	54.0 - 100	26.4 ± 10.6 (b)	3.5 – 46.0	8.0 ± 2.6 (b)	0.9– 16.3	***
Mean Forb Height	22.4 ± 3.01 (a)	13.4 – 26.1	18.2 ± 3.9 (a)	7.6 – 25.1	8.3 ± 2.7 (b)	4.7 – 19.1	*
Mean Herbaceous Height	23.7 ± 3.11 (a)	17.3 – 30.6	13.2 ± 2.77 (b)	7.7 – 19.8	7.8 ± 1.44 (b)	4.8 – 13.3	*
Mean Shrub Height	104.5 ± 19.9	60.3 – 157.2	25.5 ± 7.9	9.7 – 33.5	70.6 ± 35.08	21.1 – 210.0	n.s.
Percent Shrub Height > 75 cm	56.8 ± 3.8 (a)	48.0-63.7	6.1 ± 3.1 (b)	0 – 10.0	20.5 ± 13.8 (b)	0 – 75.0	*
Number of Preferred Shrub (Browse) Species	2.6 ± 0.72 (a)	1.4 – 4.5	0.3 ± 0.11 (b)	0 – 0.5	2.1 ± 0.64 (a)	0 – 3.6	*
% Heavy Browsing	8.3 ± 8.3 (a)	0 – 33.3	83.3 ± 16.7 (b)	50 - 100	46.0 ± 10.6 (b)	20.2-70.6	**
Preferred Shrub (Browse) Regeneration	2.7 ± 0.44 (a)	2 - 4	1.0 ± 0.12 (b)	0.8 – 1.2	2.9 ± 0.50 (a)	2.3 – 4.4	*
Litter Weight	2210 ± 400.6 (a)	1400 - 2990	558.3 ± 224.1 (b)	70.0 – 1083.0	375.0 ± 138.0 (b)	50.0 – 770.0	***

(a/b) – denotes grazing regimes which are similar (same letter) or different (different letters).

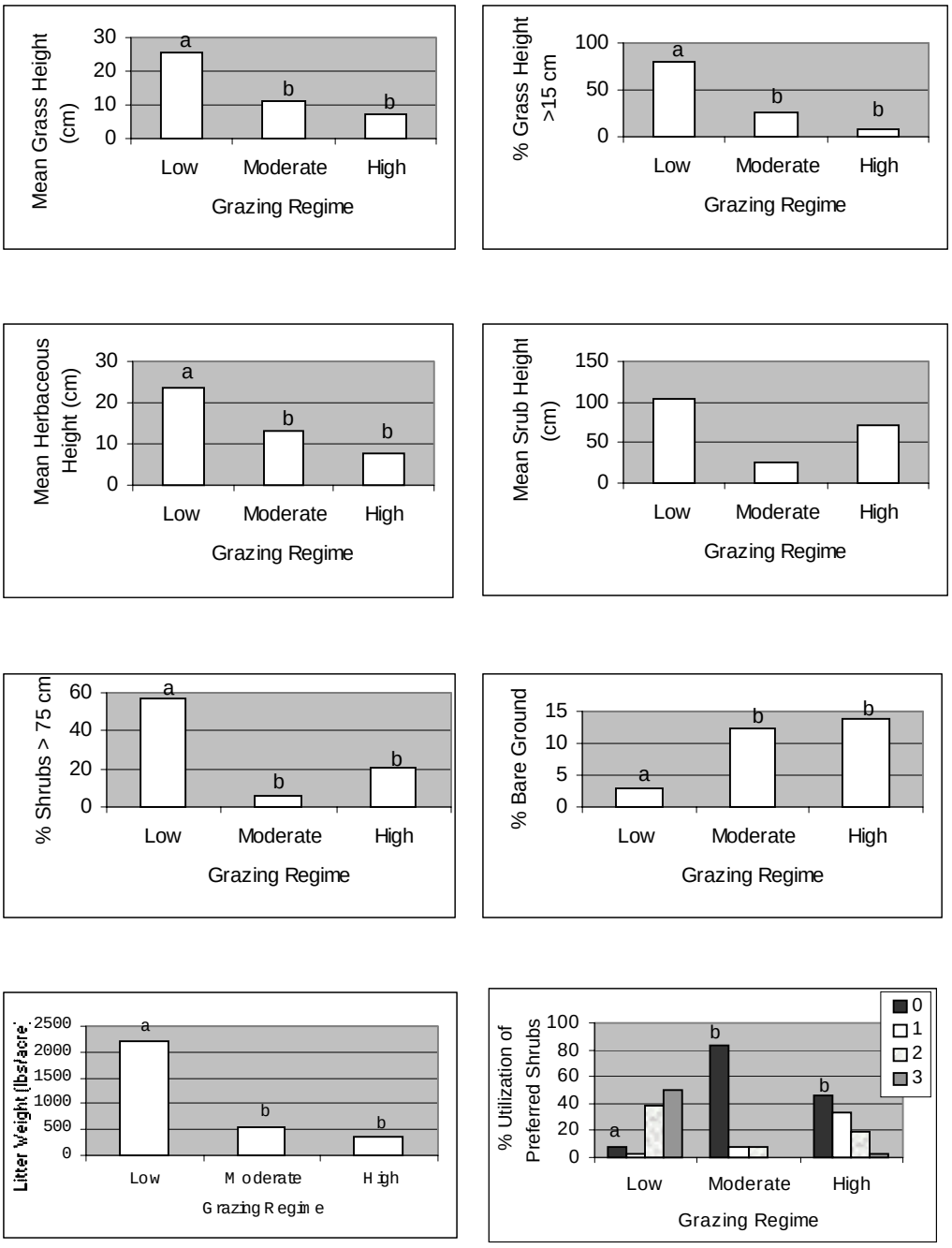

Figure 5. Selected vegetation characteristics among idle/low, moderate, and heavy grazing regimes. Shrub utilization categories: 0=Heavy (>50%); 1=Moderate (25-50%), 2=Low (5-25%), 3=None (0-5%). (a/b) – denotes grazing regimes which are similar (same letter) or different (different letters).

Photo 1. Idle/low grazed site along the Vermilion River,
Alberta, 16 June 2002.

Photo 2. Moderate grazed site along the Vermilion River, Alberta, 29 June 2002.

Photo 3. Heavy grazed site along the Vermilion River, Alberta, 16 June 2002.

Photo 4. Vegetation growth and litter on idle/low grazed site in September 2002.

Photo 5. Vegetation growth and litter on moderate grazed site in September 2002.

Photo 6. Vegetation growth and litter on heavy grazed site in September 2002.

Photo 7. Light browsing on willow at a idle/low grazed site along the Vermilion River, Alberta, June 2002.

Photo 8. Heavy browsing on aspen at a heavy grazed site along the Vermilion River, Alberta, June 2002.

Table 5. Comparison of preferred shrub utilization and the amount of human caused bare ground recorded during the 1999 Riparian Health Assessment and the 2002 surveys.

Site	1999 Riparian Health Assessment			2002 Bird and Vegetation Survey		
	Grazing Regime	Browse Utilization	Bare Ground	Grazing Regime	Browse Utilization	Bare Ground
3	L	3	6	L	2 = 57% 3 = 43%	6
8	L	2	6	L	2 = 46% 3 = 54%	6
9	L	3	6	L	1=5.4% 2=37.8%	6
7	M	1	6	H	0 = 63.5% 1 = 28.4%	2
33	M	2	2	H	0=52.4% 1=30.2%	2
41	M	N/A	0	M	0*	2
42**	M	3	4	M	2=50% 4=50%	2
47	L	3	6	H	0=42.9% 1=42.9%	2
48	H	1	2	M	0***	2

- * Preferred shrub species only present in 1 count circle; previous assessment present in area examined.
- ** Very few stems of preferred browse species present in 2003.
- *** For count circles where preferred shrub species were present.

The derivation of shrub regeneration categories at sampling sites differed between the 1999 and 2002 surveys such that meaningful site comparisons could not be made.

Litter weights indicated that idle/low grazed sites were all “healthy”, whereas moderate/heavy grazed sites were generally “unhealthy” or “healthy with problems” (Table 6). The Vermilion Riparian Health Assessment also indicated that these moderate and heavy grazed sites were generally not healthy.

Table 6. Average litter weights for sites of idle/low, moderate, and high grazing regimes, and health rating based on litter thresholds and the Riparian Health Assessment.

Site	Litter Weight: lbs/acre (range)	Litter Threshold Ratings 2002[1]	Riparian Health Assessment Ratings 1999
Idle/Low			
3	2990 (	Healthy	Healthy
8	1650	Healthy	Healthy
9	2800	Healthy	Healthy with Problems
100	1400	Healthy	N/A
Moderate			
48	1083	Healthy	Unhealthy
41	70	Unhealthy	Unhealthy
42	750	Healthy with Problems	Unhealthy
34	330	Unhealthy	Unhealthy
Heavy			
7	250	Unhealthy	Healthy with Problems
33	179	Unhealthy	Unhealthy
37	50	Unhealthy	Unhealthy
47	770	Healthy with Problems	Healthy
82	630	Healthy with Problems	N/A

[1] Litter thresholds for the Aspen Parkland, Bl Chernozem loamy district, which encompasses the study area: Healthy = >975 lbs/acre; Healthy with Problems = 525-975 lbs/acre; Unhealthy = <525 lbs/acre (H. Loonen, Public Lands, personal communication).

3.5 Relationship Between Vegetation and Birds

Mean grass height, percent grass height >15cm, litter weight, percent heavy browsing on preferred browse species and percent bare cover were vegetation variables most strongly correlated to bird community characteristics (Table 7). Grass height, grass height >15 cm and litter weight were positively correlated with mean number of individuals per count, mean number of species per count, total number of species per count circle, and bird diversity index per circle. Heavy browsing was negatively correlated with all bird community variables, and percent bare ground was negatively correlated with all bird community variables except bird diversity. Height of herbaceous growth and number of browse species present were also positively correlated with abundance and species richness. Vegetation measures that were not significantly correlated with bird community characteristics included percent grass cover, percent herbaceous cover, percent shrub cover, forb height, vegetation cover diversity index, and degree of browse regeneration.

Table 7. Correlation values of vegetation measurements and bird characteristics for Vermilion River (Pearson's correlation test; * = P<.05, ** = P≤ .01, *** = P≤ .001, only significant correlation values are presented; n.s. = not significant).

	Mean Number of Individuals per Count	Mean Number of Species per Circle	Total Number of Species per Circle	Diversity Index per Circle
%Forb Cover	n.s.	**.5650***	n.s.	n.s.
% Bare Cover	**-.7940 *** **	**-.7855 ** **	**-.5472 * **	n.s.
Grass Height	**.6977 ** **	**.7183 ** **	**.5268** [1]	**.5013** [1]
% Grass ≥ 15 cm	**.7757 ** **	**.7871 ** **	**.6126 * **	**.5898 * **
Herb Height	**.6197 * **	**.6032 * **	n.s.	n.s.
Shrub Height	n.s.	**.5292 * **	n.s.	n.s.
% Shrub ≥ 1 m	n.s.	**.5950***	n.s.	n.s.
Litter Weight	**.8688 *** **	**.8162 *** **	**.6832** **	**.35303 * **
Number of Browse Species	**.5945 * **	**.5894 * **	n.s.	n.s.
% Heavy Browsing	**-.7467 ** **	**-.7616 ** **	**-.7915 ** **	**-.6477 * **

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4.0 Discussion and Conclusions

The results of the 2002 survey indicate that livestock grazing is having a marked effect on bird community characteristics in riparian habitats along the Vermilion River. Analysis of data from 69 count circles sampled in June 2002 showed that abundance and species richness of birds was higher on idle/low grazed riparian habitats as compared to moderately or heavily grazed sites. Although differences between grazed and ungrazed sites were pronounced, differences in bird abundance or species richness between moderately and heavily grazed sites were not significant. It is likely that drought conditions contributed to a decline in pasture condition and thus forage availability. This coupled with heavier than normal use of grazing areas as compared to the Vermilion River Riparian Health Assessment resulted in a general decline in condition of riparian vegetation communities. During 2002, total precipitation in east central Alberta was below normal values (Environment Canada 2002). A number of landowners interviewed indicated that drought conditions resulted in reduced forage yields and created a need to make greater use of seasonal pastures. Thus some pastures originally assessed as moderate were grazed extremely heavy, and were in worse condition than some pastures originally assessed as heavy. Pastures were reclassified into heavy and moderate grazing regimes, however, the vegetative differences between these two grazing regimes was not as evident as under years with the typical grazing pressure. In turn, bird abundance and species richness between moderate and heavy grazing regimes was quite similar.

The observed effect of grazing on bird community characteristics in riparian areas is in general agreement with other studies in Alberta and Saskatchewan. Bird abundance, species richness, and bird diversity tend to be higher in ungrazed or lightly grazed sites as compared to heavier grazed sites, particularly when non-native species are removed from the analysis of other studies (Wershler and Smith 1995, Hurly and Saunders 1998, Saunders and Hurly 2000). The lack of a decreasing trend in bird abundance and species richness between moderately grazed and heavily grazed sites, as was observed by Hurly and Saunders (1998) and Saunders and Hurly (2000), has been explained above.

It was difficult to examine the effects of grazing pressure on individual bird species because of the low detection rates for most species. However, yellow warbler, clay-colored sparrow, savannah sparrow, and brown-headed cowbirds occurred at higher relative abundance at

idle/low grazed sites than at moderate or heavy grazed sites. Some other trends consistent with the literature were evident. For example killdeer, which prefers very open habitats, were found more frequently on grazed sites. As well, LeConte's sparrow and sharp-tailed sparrow, which prefer marshy habitats with sedges and emergent vegetation, were only recorded in idle/low grazed sites. Sprague's pipit, although generally associated with intermediate grass heights (Prescott and Murphy 1996), was only found on moderate and heavy grazed sites. The taller, dense cover associated with idle/low sites may have been unsuitable habitat for this species, and some individuals may have used marginal habitat (e.g., moderate, heavy grazed sites) as a result of widespread overgrazing. It is also possible that vegetation cover and height declined throughout spring and early summer on some sites, such that vegetation measurements were not be fully representative of pasture conditions at the time of breeding site selection.

Overall, vegetation structure appeared to be more important in determining bird community characteristics than vegetation composition. Grass height, and height of herbaceous growth, percent bare ground, and litter weights (indicative of both vegetation height and cover) were the best predictors of bird community characteristics. The importance of vegetation structure in determining bird abundance and species richness has been well identified in the literature.

Litter weights indicated that moderate/heavy grazed sites were generally "unhealthy" or "healthy with problems". The Vermilion Riparian Health Assessment also indicated that moderate and heavy grazed sites were generally not healthy. Utilization of preferred shrubs and the area of bare ground on grazed sites appeared to increase in 2002 over that recorded during the 1999 Vermilion River Riparian Health Assessment. This may reflect a heavier grazing pressure on these sites between the 2 survey periods. Grazing pressure appeared to be particularly heavy during the spring of 2002, as well as summer on sites where livestock were maintained for the entire period. This higher than usual grazing pressure appears to have had a negative effect on the productivity of the riparian system and associated bird communities. Additional studies in the future would provide information on trends of the riparian health of pastures along the river as well as associated avian communities.

5

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6.0 Appendices

Appendix 1. Bird species detections and frequency of occurrence in point count circles during surveys within riparian habitats along the Vermilion River, June 2002.

Species	Total Number of Detections	% All Detections	Number Detections in All Count Sessions (N=194)	% Detected in All Point Count Sessions (N=194)	Number Detections at All Point Count Sites (N=69)	% Detected at All Point Count Sites (N=69)
mallard *	18	2.7	6	3.1	5	7.3
blue-winged teal *	17	2.5	9	4.7	8	11.6
northern shoveler *	3	0.5	2	1.0	2	2.9
gadwall *	4	0.6	2	1.0	1	1.5
American wigeon *	6	0.9	4	2.1	3	4.4
lesser scaup *	15	2.3	6	3.1	5	7.3
common goldeneye *	6	0.9	1	0.5	1	1.5
sora *	1	0.2	1	0.5	1	1.5
American coot *	6	0.9	4	2.1	3	4.4
killdeer	17	2.6	13	6.7	10	14.5
willet	3	0.5	3	1.6	2	2.9
marbled godwit	2	0.3	1	0.5	1	1.5
common snipe	2	0.3	2	1.0	2	2.9
black tern *	7	1.1	1	0.5	1	1.5
northern flicker	2	0.3	2	1.0	2	2.9
alder flycatcher	4	0.6	4	2.1	4	5.8
least flycatcher	1	0.2	1	0.5	1	1.5
eastern phoebe	1	0.2	1	0.5	1	1.5
eastern kingbird	5	0.8	5	2.6	5	7.3
black-billed magpie	4	0.6	4	2.1	2	2.9
American crow	2	0.3	2	1.0	1	1.5
black-capped chickadee	4	0.6	4	2.1	4	5.8

Species	Total Number of Detections	% All Detections	Number Detections in All Count Sessions (N=194)	% Detected in All Point Count Sessions (N=194)	Number Detections at All Point Count Sites (N=69)	% Detected at All Point Count Sites (N=69)
house wren	6	0.9	6	3.1	4	5.8
American robin	6	0.9	5	2.6	5	7.2
gray catbird	9	1.4	9	4.6	8	11.6
Sprague's pipit	8	1.2	8	4.1	6	8.7
cedar waxwing	2	0.3	1	0.5	1	1.5
yellow warbler	36	5.4	30	15.5	16	23.2
common yellowthroat	6	0.9	6	3.1	5	7.3
clay-colored sparrow	212	31.9	119	61.3	54	78.3
vesper sparrow	28	4.2	26	13.4	23	33.3
savannah sparrow	77	11.6	59	30.4	37	53.6
LeConte's sparrow	4	0.6	4	2.1	3	4.4
sharp-tailed sparrow	1	0.2	1	0.5	1	1.5
song sparrow	42	6.3	38	19.6	27	39.1
Lincoln's sparrow	3	0.5	3	1.6	3	4.4
sparrow spp.	2	0.3	2	1.0	2	2.9
red-winged blackbird	40	6.0	28	14.4	20	29.0
yellow-headed blackbird	17	2.6	6	3.1	4	5.8
western meadowlark	8	1.2	8	4.1	6	8.7
Brewer's blackbird	3	0.5	2	1.0	1	1.5
brown-headed cowbird	18	2.7	16	8.3	11	15.9
northern oriole	1	0.2	1	0.5	1	1.5
American goldfinch	5	0.7	5	2.6	4	5.8

* Species excluded from the data analysis.

Appendix 2. Comparison of bird characteristics in pastures/sites classified as low, moderate, and heavy grazing regimes.
(* P= 0.05, ** P= 0.01, *** P= 0.001, n.s.= not significant).

Bird Characteristics	Idle/Low Grazing		Moderate Grazing		Heavy Grazing		
	Mean ± SE	Range	Mean ± SE	Range	Mean ± SE	Range	P[1]
Average Individuals/Circle	5.0 ± 0.56 (a)	3.9 – 6.5	2.3 ± 0.10 (b)	2.0 – 2.5	2.5 ± 0.31 (b)	1.4 – 3.1	**
Average # Species /Circle	3.3 ± 0.27 (a)	2.8 – 3.8	1.6 ± 0.19 (b)	1.1 – 2.0	1.9 ± 0.17 (b)	1.3 – 2.3	**
Total # Species/Circle	4.9 ± 0.39 (a)	4.3 – 6.0	3.3 ± 0.44 (b)	4.0 – 4.5	3.7 ± 0.29 (b)	3.0 –4.6	*
Diversity Index/Circle	1.4 ± 1.0	1.13 – 1.6	1.1 ± 0.14	0.77 – 1.44	1.1 ± 0.09	0.8 – 1.3	n.s.

(a/b) – denotes treatments which are similar (same letter) or different (different letters).

Appendix 3. Legal land descriptions for the pastures/sites included in the Vermilion River study.

Site/Pasture (Site Number)	Legal Land Description
Maves (3)	SE1-49-14-W4
Otto (8)	NW10-49-14-W4
Provincial Park (100)	SE2-51-7-W4
Freed (9)	NW7-51-14-W4
Bendixon (48)	NE31-52-3-W4
Arnold (41)	SE19-51-5-W4
Roy (42)	E1/2 34-51-5-W4
Schneider (34)	SE19-51-6-W4
Bendixon (47)	SW28-52-3W4
Prills (37)	SW34, SE34-50-8-W4
Otto (82)	SW21-49-14-W4
Giebelhaus (7)	NE12-50-15-W4
Wowk (33)	NE6-52-9-W4

Appendix 4. Photos of selected examples of vegetation plots in low, moderate, and heavy grazing regimes in Vermillion River Study Area, 2002