2002 Annual Report

The Effects of Coal-Bed Methane Mining on the Breeding Avifauna on Padlock Ranch

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INTRODUCTION

The encroachment of Coal-Bed Methane (CBM) mining into the Hanging Woman Basin on Padlock Ranch, located on the border of Montana and Wyoming, triggered a partnership between Padlock Ranch, Rocky Mountain Bird Observatory (RMBO), and The Nature Conservancy (TNC). As part of this partnership we wanted to establish a pilot project that looked at the effects of CBM mining, if any, on the distribution and abundance of birds in the Wyoming region of Padlock Ranch. CBM mining, in this area, is relatively new and there is little information on the effects that it, and associated disturbances, have on breeding birds. The United States Geological Survey (USGS) recognizes that the "scientific understanding of, and production experience with, coal-bed methane are both in the early learning stages" (Nuccio 2000).

CBM mining, from test wells on Padlock Ranch, involves processes that alter the habitat. It begins with the construction of roads to explore areas that contain suitable sites for production. Once the methane gas is located in a coal seam, mines are drilled to extract water that, in turn, releases the methane gas. The ground water is then pumped to the surface and stored in reservoirs of about 1 acre in surface area. About 1.64 acres is disturbed per well in the process, about 0.31 acres for the well and 1.33 ac for the associated roads (Montana EIS). This estimate does not include the reservoirs associated with the wells, so the total reaches 2.64 acres/well.

Coal-bed Methane test site located on Padlock Ranch

The contribution of CBM to total natural gas production in the United States is expected to increase in the foreseeable future (Nelson 1999). Along with this increase, the amount of disturbance associated with mining will also increase. The effects of CBM mining on wildlife populations need to be determined.

To date, there are virtually no studies demonstrating the direct or indirect effects that CBM mining has on birds and associated habitats. We devised a methodology to collect baseline data at each of two treatment plots and one control. One of the treatment plots contained the CBM stations and the other received increased road traffic. In addition to establishing six transects, we determined UTM locations for CBM pumps, reservoirs, and the locations of nine prairie dog colonies within the Wyoming portion of Padlock Ranch (figure 1). We also compiled a species list of all the birds that we encountered on the ranch during our visit (appendix 1).

Padlock Ranch
Locations of Transects, Points Counts, CBM Wells and Water

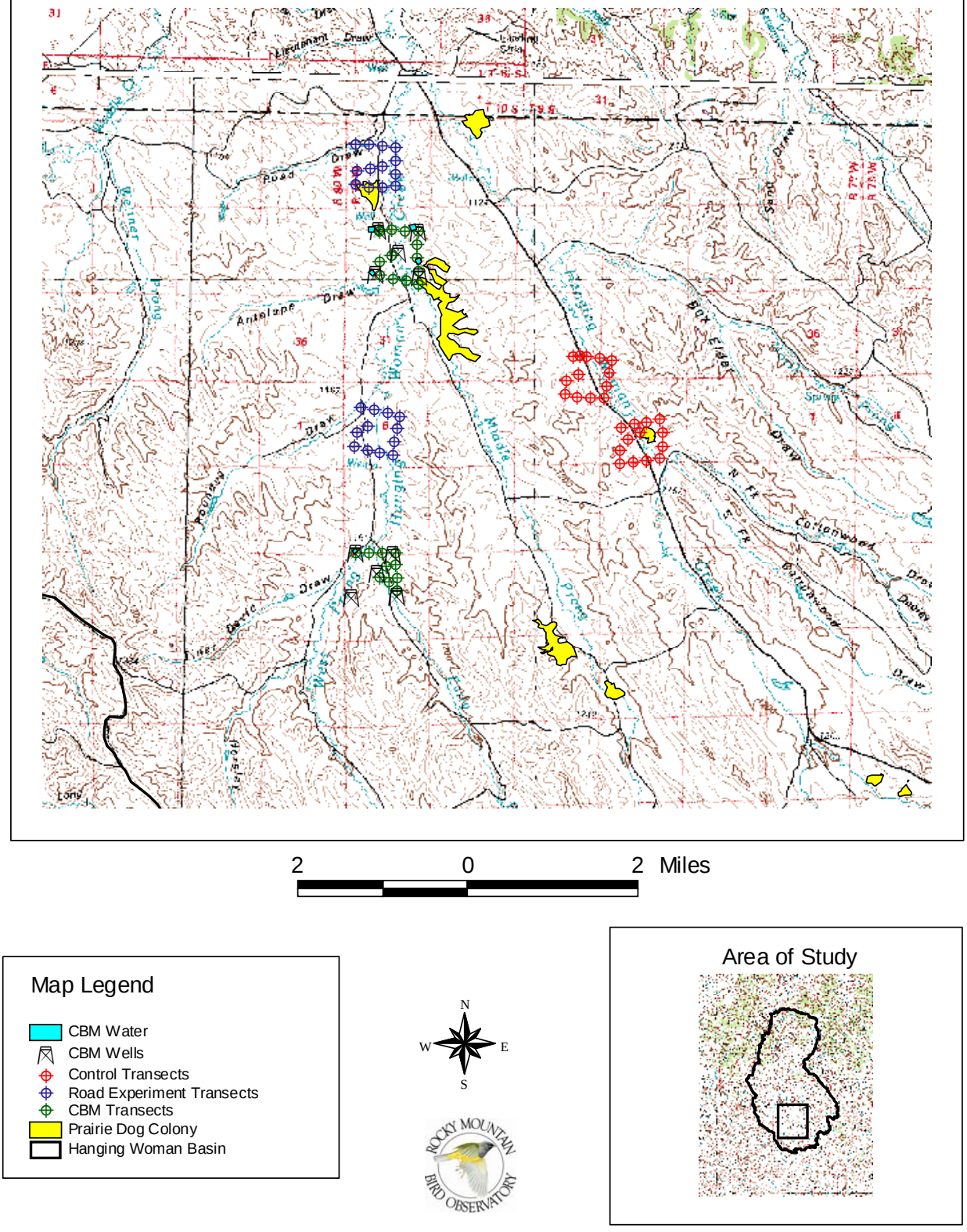

Figure 1. Transect locations, CBM wells, CBM reservoirs, and prairie dog colonies on the Wyoming portion of Padlock Ranch

STUDY AREA

The study area is located on the Wyoming portion of Padlock Ranch and covers approximately 65,000 acres. Two sections on the West Prong of Hanging Woman Creek in the Wyoming portion of the basin have already had test wells installed for CBM. In each section, five quarter-quarter sections have from two to three wells drilled in each, along with a water retention pond in some, but not all, well sites. Since these are test wells, the methane from the wells is dispersed into the air. Power to the test wells is supplied by a portable propane-powered generator. Therefore, well infrastructure consists of an access road, the well sites, the generator shed, on-ground tubing to channel water from the wells, and the 1 acre impoundment (at those well sites where one was constructed). If these test wells develop into viable CBM mines the infrastructure differs. Power would be supplied to the mine via underground or above ground cables causing more disturbance to the site. A tank with additional pipes and compressors would be added to these sites to store the methane gas. The effects of CBM test wells may differ from the actual development and mining of the methane gas.

These pictures show the CBM well and an associated reservoir. This is one location in the CBM study area.

METHODS

Point Transects

We [David Hanni (RMBO), David Mehlman (TNC), Doug Faulkner (RMBO), John Heyneman (Padlock Ranch), and Jim Scott (Padlock Ranch)] decided to conduct six, section based (1mi x 1mi), point transects on the ranch. Two point transects were established in each of two different treatment plots, located in the same valley, and a control located to the valley to the east without CBM test wells: 1) This treatment was created to look at the effects that roads (building and increased traffic) have on breeding bird populations. Increased traffic, due to the exploration, construction and maintainance of the CBM mines, was occurring along this drainage. 2) These plots are located on sections with 5 CBM test wells. Each CBM well site contains a well, generator, and some have a reservoir that stores ground water pumped from the well. These are only test wells and have not been established for methane gas collection and storage.

CBM Test well

Unfortunately, due to high winds we were only able to collect data on transects in the CBM development sites and the control. Each transect consists of between 11 and 13 point count locations. The methodology we implemented is slightly modified from protocols currently used in Colorado and Wyoming (Leukering 2000). At each of the individual point count locations, we recorded the UTM coordinates, distance from roads (>100m or <100m), general habitat classification, and all birds seen or heard. Individual distances to all birds, seen or heard, were recorded using a rangefinder (Bushnell Yardage Pro 500). Observers also recorded weather data and the time at the start and end of each transect. Weather data recorded at the point count location were sky condition (cloud cover and precipitation), wind (on the Beaufort scale), and temperature. We did not conduct transects in high winds (>4 Beaufort), rain or snow.

The data will be analyzed using program DISTANCE (Thomas 1998-99). The notation, concepts and analysis methods of DISTANCE were developed by Buckland et. al. (1993). We used program DISTANCE to estimate density (D) on species that had a minimum of 15 observations and/or had a CV of less than 50%, the latter of which indicates robust data. During analyses, DISTANCE assigns a unique detection function thus avoiding some potential problems associated with traditional analyses of point counts (e.g., varying detectability among habitats, species, and years). Analysis using program DISTANCE assumes that 1) all birds at distance 0 are detected; 2) distances of the birds close to the points or line are measured accurately; and 3) birds do not move in response to the observer's presence.

In addition to analyzing the data in program DISTANCE, two indices of relative abundance were calculated. The indices were created from the 1) average number of birds per point count for each species and 2) presence/absence data to determine the percentage of points on which each species was detected. When using an index, one assumes that the index has a direct relationship to populations of bird species. The indices will be used to detect change in abundance over time. The information gathered will be used in the future to help direct CMB development.

Ranch Inventory

In addition to the point transects, a species list was composed documenting the sightings of birds on the ranch. Along with the species list, A Geographic Information System map showing the prairie dog colonies on the ranch was also produced. To create the species list, we visited all of the unique habitats on the Ranch (riparian, shrub land, grassland, and coniferous forest). In each of these habitats, we searched for birds, keeping a list of all species encountered. To delineate the prairie dog colonies we used GPS units to trace the perimeter of all of the colonies we located during our stay at the Ranch.

RESULTS

In 2002 we conducted four point transects, two each on CBM development plots and control sites. We recorded a total of 311 birds of 29 species, 165 individuals of 23 species on the CBM plots and 146 individuals of 22 species on the control plots. We recorded an additional 40 bird species on the Ranch while conducting the bird inventory, bringing the Ranch total to 69 species (Appendix 1). We delineated the boundaries of nine prairie dog colonies, with total land area of approximately 340 acres.

Sample size of only one bird species, Western Meadowlark, was sufficient to compare densities in the two plot types (Table 1). As we were only able to compare the densities between plots of one species (looking for overlap of the 95% confidence limits), We also analyzed the data using relative abundances, using the average number of detections per species per point (Table 2, Figure 2). We also created a table of presence and absence to determine the percentage of points on which each species was detected (Table 3).

Table 1. Density estimates for species with >15 detections per treatment (control and CBM). D = Density estimate expressed in birds/hectare, D LCL & D UCL = lower and upper 95% confidence limits of D, DCV = Coefficient of Variation, n = number of detections used to calculate D.

Species	Plot type	D	D LCL	D UCL	D CV	n
Brewer's Sparrow	Control	43.76	20.61	92.88	0.38	16
Vesper Sparrow	Control	24.93	13.10	47.43	0.32	17
Red-winged Blackbird	CBM	22.29	10.53	47.19	0.38	17
Western Meadowlark	CBM	100.24	71.74	140.06	0.16	59
	Control	71.57	32.97	155.34	0.40	54

Table 2. Relative abundance expressed in average number of birds/point per species.

Species	Control Birds/pts.	CBM Birds/pts
Western Meadowlark	2.16	2.57
Vesper Sparrow	0.76	0.35
Brewer's Sparrow	0.64	0.35
Brewer's Blackbird	0.36	0.04
Red-winged Blackbird	0.32	0.74
Brown-headed Cowbird	0.28	0.13
Loggerhead Shrike	0.20	0.09
Lark Sparrow	0.16	0.61
Eastern Kingbird	0.12	0.30
Killdeer	0.12	0.17
Mourning Dove	0.12	0.43
Rock Wren	0.12	0.09
Spotted Towhee	0.12	0.00
Black-billed Magpie	0.04	0.00
Brown Thrasher	0.04	0.00
Bullock's Oriole	0.04	0.09
Burrowing Owl	0.04	0.00
Common Grackle	0.04	0.00
Gadwall	0.04	0.00
Lark Bunting	0.04	0.48
Red-tailed Hawk	0.04	0.00
Yellow Warbler	0.04	0.13
Say's Phoebe	0.00	0.26
Ring-necked Pheasant	0.00	0.09
American Kestrel	0.00	0.04
Mallard	0.00	0.04
Sharp-tailed Grouse	0.00	0.04
Canada Goose	0.00	0.04

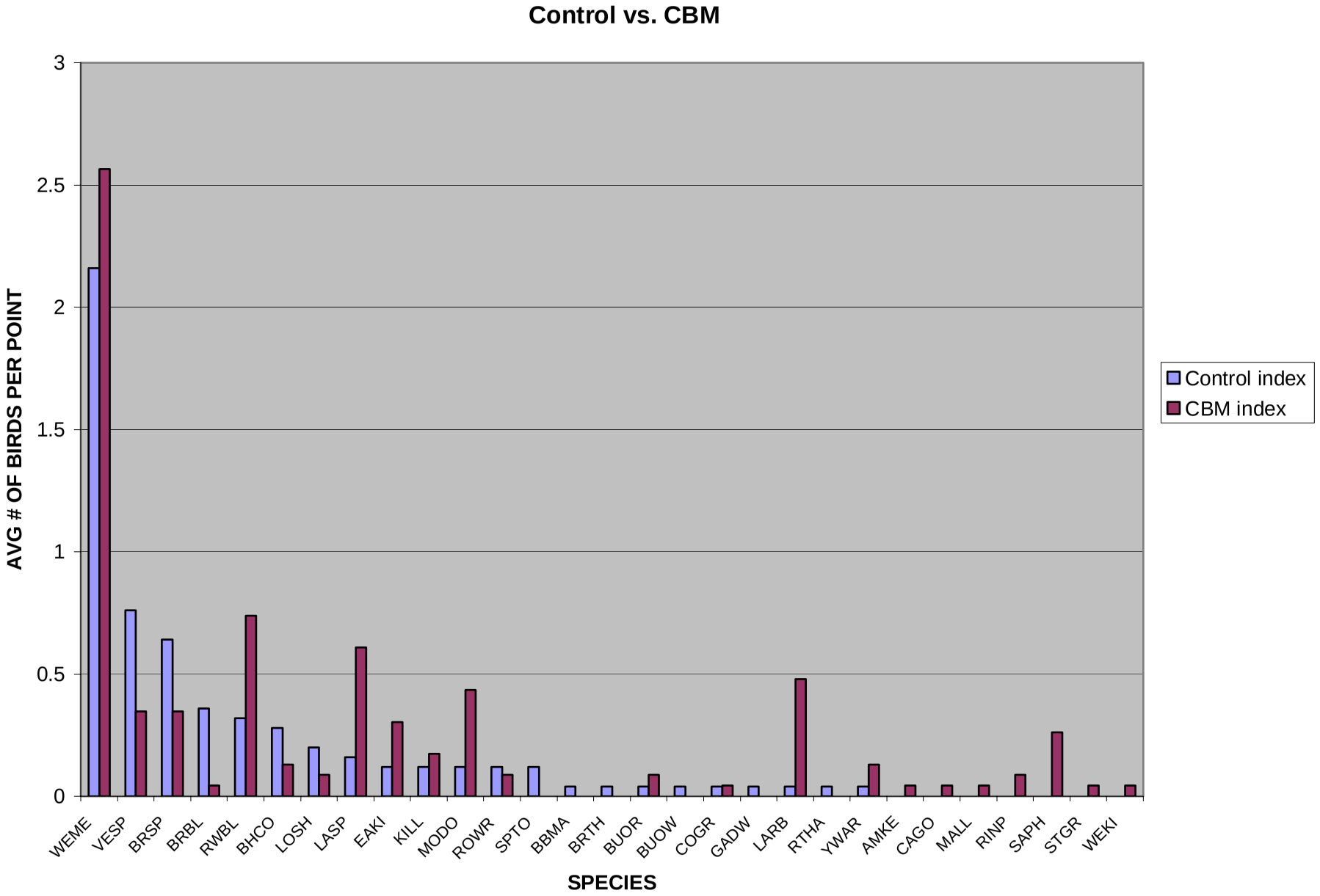

Figure 2.. illustrates the difference between the control and the CBM treatment. Relative abundance of individual species was calculated by dividing the total number of each species per treatment by the number of points.

Table 3. Percentage of points, calculated using the data collected from the point transects, that individual species were detected on during Padlock Ranch bird inventory.

Species	% Control	% CBM
Western Meadowlark	52%	57%
Vesper Sparrow	44%	22%
Brewer's Sparrow	40%	13%
Brewer's Blackbird	28%	4%
Brown-headed Cowbird	24%	13%
Red-winged Blackbird	20%	30%
Lark Sparrow	12%	30%
Loggerhead Shrike	12%	9%
Mourning Dove	12%	35%
Rock Wren	12%	9%
Eastern Kingbird	8%	22%
Killdeer	8%	13%
Spotted Towhee	8%	0%
Black-billed Magpie	4%	0%
Brown Thrasher	4%	0%
Bullock's Oriole	4%	9%
Burrowing Owl	4%	0%
Common Grackle	4%	4%
Gadwall	4%	0%
Lark Bunting	4%	26%
Red-tailed Hawk	4%	0%
Yellow Warbler	4%	9%
Say's Phoebe	0%	26%
Ring-necked Pheasant	0%	9%
American Kestrel	0%	4%
Canada Goose	0%	4%
Mallard	0%	4%
Sharp-tailed Grouse	0%	4%
Western Kingbird	0%	4%

DISCUSSION

During this first year (2002), we were able to establish point-count locations on Padlock Ranch for six transects and collect baseline data from four of these. The data collected from these four transects in addition to a basic ranch inventory revealed several species of management interest, identified by the Partners in Flight species assessment database, which we will discuss throughout this document and are highlighted in bold. Partners in Flight, an interdisciplinary bird conservation group, designates these species though a process that evaluates seven different aspects of the biology and conservation of almost all bird species in the U.S., Canada, and Mexico. The seven categories are: 1) relative abundance, 2) breeding distribution, 3) non-breeding distribution, 4) importance of the area to the species, 5) threats to the species breeding habitat, 6) threats to the species non-breeding habitat, 7) population trend of the species. Through the analysis of these categories, species of management interest are tiered: Tier I = high overall priority; Tier II = high regional priority; Tier III = additional watch list species (Panjabi et al. 2001). The results from this database that I use in this report represent breeding birds in Bird Conservation Region 17 (Badlands and Prairies) as delineated by the North American Bird Conservation Initiative.

Density estimates for Western Meadowlark could be compared for the two study plots. In this comparison no statistically significant difference was detected due to the overlap in the 95% confidence limits. Instead, we compare the treatment (CBM mines) with the control using two indices, relative abundance and percent of points on which each species was detected. These indices for some species were greater in the control plots compared to those in the treatment plots (Vesper Sparrow, **Brewer's Sparrow**, Brewer's Blackbird, Loggerhead Shrike, Brown-headed Cowbird, and Rock Wren), of these species the Brewers Sparrow is a tier II species. Tier II species are of high regional priority and may be experiencing declines in the core of its range so short term conservation efforts could reverse these trends. In which case, the development of CBM mines might negatively affect these species. Other species occurred in greater relative abundance on the CBM treatment plots than on the control plots (Red-winged Blackbird, Lark Sparrow, **Western Meadowlark**, Mourning Dove, Eastern Kingbird, Killdeer, Bullock's Oriole, **Lark Bunting**). The Western Meadowlark (Tier III), which occurs in high relative proportions in this area, and the Lark Bunting (Tier II), which is a species that is on the U.S. Watch List (Pashley et al. 2000), are species that are of management interest in BCR 17. Increased mining could potentially have a positive affect on these species but differences between CBM and control plots may be due to chance or to systematic differences in habitat availability between the two types of plots and that only additional study will be able to sort this out.

Some species were detected only in the control plots (Spotted Towhee, Black-billed Magpie, Brown Thrasher, **Burrowing Owl**, Gadwall, Red-tailed Hawk) or only in the treatment plots (Ring-necked Pheasant, American Kestrel, Canada Goose, Mallard, **Sharp-tailed Grouse**, and Western Kingbird). These species occurred on the Ranch in

relatively low densities, thus any differences are somewhat meaningless and possibly due to chance.

Padlock Ranch contains a diversity of habitat types (riparian, grassland, shrubland, rocky outcrops, woodlands and prairie dog colonies) that are beneficial to a variety of birds (Appendix A). During the ranch inventory we located 69 species of which 10 are species of management interest, according to Partners in Flight. In development of CBM mining the affects to these species should be carefully considered. The development of CBM is a hot topic and there are virtually no studies that directly address this issue. This question is very valuable and will shape CBM development in the future by determining the effects that this particular mining technique has on birds. Due to the low number of detections of individuals, we should consider expanding the project throughout the basin, as this would increase sample sizes and allow for statistically significant results. In the future, we should establish more transects throughout the basin or conduct the transects in different temporal patterns to increase the number of detections of individuals which would give more power to the analysis. This will allow us to identify statistically significant results that can be used to show the effects of CBM mining. This, in turn, will give us the information that is needed to make educated decisions about the development of CBM mining in the Hanging Woman Basin.

LITERATURE CITED

Nelson, C.R., 1999. Changing Perceptions regarding the size and production potential of Coalbed Methane resources, in Gas TIPS: Gas Research Institute, v.5, no.2, p.4-11.

Nuccio, V. 2000. Coal-bed Methane: Potential and Concerns. U.S. Department of the Interior, United States Geological Survey. Fact Sheet FS-123-00.

Panjabi, A. and C. Beardmore, P. Blancher, G. Butcher, M. Carter, D. Demarest, E. Dunn, C. Hunter, D. Pashley, K. Rosenberg, T. Rich, and T. Will. 2001. The Partners in Flight Handbook on Species Assessment and Prioritization. Version 1.1. Rocky Mountain Bird Observatory, Brighton, CO.

Pashley, D.N. C.J. Beardmore, J.A. Fitzgerald. R.P. Ford, W.C. Hunter, M.S. Morrison, and K.V. Rosenberg. 2000. Partners in Flight: Conservation of the land birds of the United States. American Bird Conservancy. 92 pp.

Richmond, T. and G. Hallsten, M. Bloom. 2002 in press. Montana Statewide Draft Oil and Gas Environmental Impact Statement and Amendment of the Powder River and Billings Resource and Management Plans. United States Department of the Interior, Bureau of Land Management. State of Montana.

Appendix A. Bird species detected on Padlock Ranch, 04-08 June 2002. The species that are in bold are designated in the Partners in Flight Species Assessment Database as species of management interest and are classified as Tier I through III species.

Common Name	Species code	Scientific Name	Habitat preference
Turkey Vulture	TUVU	*Cathartes aura*	Open country
Canada Goose	CAGO	*Branta canadensis*	Wetlands
Gadwall	GADW	*Anas strepera*	Wetlands
American Wigeon	AMWI	*Anas americana*	Wetlands
Mallard	MALL	*Anas platyrhynchos*	Wetlands
Blue-winged Teal	BWTE	*Anas discors*	Wetlands
Green-winged Teal	GWTE	*Anas crecca*	Wetlands
Northern Harrier	NOHA	*Circus cyaneus*	Wetlands/Open Country
Golden Eagle	GOEA	*Aquila chrysaetos*	Open Country
Sharp-shinned Hawk	SSHA	*Accipiter striatus*	Woodlands
Cooper's Hawk	COHA	*Accipiter cooperii*	Woodlands
Swainson's Hawk	SWHA	*Buteo swainsoni*	Open Country
Red-tailed Hawk	RTHA	*Buteo jamaicensis*	Open Country
American Kestrel	AMKE	*Falco sparverius*	Open Country
Prairie Falcon	PRFA	*Falco mexicanus*	Open Country
Ring-necked Pheasant	RINP	*Phasianus colchicus*	Farmland/brushy habitat
Sharp-tailed Grouse	STGR	*Tynpanuchus phasianellus*	srublands
Killdeer	KILL	*Charadrius vociferus*	Wetlands
Upland Sandpiper	UPSA	*Bartramia longicauda*	Grassland
Wilson's Phalarope	WIPH	*Phalaropus tricolor*	Wetlands
Mourning Dove	MODO	*Zenaida macroura*	Variety of habitats
Great Horned Owl	GHOW	*Bubo virginianus*	Woodlands
Burrowing Owl	BUOW	*Athene cunicularia*	Prairie dog colonies
Common Nighthawk	CONI	*Chordeiles minor*	Open Country
Common Poorwill	COPO	*Phalaenoptilus nuttallii*	Shrublands
Hairy Woodpecker	HAWO	*Picoides villosus*	Woodlands
Northern Flicker	NOFL	*Colaptes auratus*	Woodlands
Dusky Flycatcher	DUFL	*Empidonax oberholseri*	Woodlands
Western Wood-Pewee	WWPE	*Contopus sordidulus*	Woodlands
Say's Phoebe	SAPH	*Sayornis saya*	Rocky outcrops
Cassin's Kingbird	CAKI	*Tyrannus vociferans*	Variety of habitats
Western Kingbird	WEKI	*Tyrannus verticalis*	Open Country
Eastern Kingbird	EAKI	*Tyrannus tyrannus*	Woodlands
Loggerhead Shrike	LOSH	*Lanius ludovicianus*	Shrublands
Plumbeous Vireo	PLVI	*Vireo plumbeus*	Woodlands
Black-billed Magpie	BBMA	*Pica hudsonia*	Woodlands
Horned Lark	HOLA	*Eremophila alpestris*	Grassland
Violet-green Swallow	VGSW	*Tachycineta thalassina*	Woodlands
Cliff Swallow	CLSW	*Petrochelidon pyrrhonota*	Open Country/cliffs
Barn Swallow	BARS	*Hirundo rustica*	Anthropogenic features
Black-capped Chickadee	BCCH	*Poecile atricapilla*	Woodlands
White-breasted Nuthatch	WBNU	*Sitta carolinensis*	Woodlands
Rock Wren	ROWR	*Salpinctes obsoletus*	Rocky outcrops
House Wren	HOWR	*Troglodytes aedon*	Woodlands

Common Name	Species code	Scientific Name	Habitat preference
Mountain Bluebird	MOBL	*Sialia currucoides*	Woodlands
American Robin	AMRO	*Turdus migratorius*	Variety of habitats
Northern Mockingbird	NOMO	*Mimus polyglottos*	Variety of habitats
Brown Thrasher	BRTH	*Toxostoma rufum*	Woodlands
European Starling	EUST	*Sturnus vulgaris*	Variety of habitats
Yellow Warbler	YWAR	*Dendroica petechia*	Riparian
Yellow-rumped Warbler	AUWA	*Dendroica coronata*	Woodlands
Green-tailed Towhee	GTTO	*Pipilo chlorurus*	Shrublands
Spotted Towhee	SPTO	*Pipilo maculatus*	Riparian/shrubland
Chipping Sparrow	CHSP	*Spizella passerina*	Woodlands
Brewer's Sparrow	BRSP	*Spizella breweri*	Shrublands
Vesper Sparrow	VESP	*Pooecetes gramineus*	Shrublands
Lark Sparrow	LASP	*Chondestes grammacus*	Shrublands
Lark Bunting	LARB	*Calamospiza melanocorys*	Shrublands
Grasshopper Sparrow	GRSP	*Ammodramus savannarum*	Grassland
Black-headed Grosbeak	BHGR	*Pheucticus melanocephalus*	Woodlands
Red-winged Blackbird	RWBL	*Agelaius phoeniceus*	Wetlands
Western Meadowlark	WEME	*Sturnella neglecta*	Grassland
Yellow-headed Blackbird	YHBL	*Xanthocephalus xanthocephalus*	Wetlands
Common Grackle	COGR	*Quiscalus quiscula*	Variety of habitats
Brewer's Blackbird	BRBL	*Euphagus cyanocephalus*	Open country
Brown-headed Cowbird	BHCO	*Molothrus ater*	Variety of habitats
Bullock's Oriole	BUOR	*Icterus bullockii*	Woodlands
American Goldfinch	AMGO	*Carduelis tristis*	Woodlands
House Sparrow	HOSP	*Passer domesticus*	Anthropogenic habitats