

BREEDING BIRD SURVEY OF RECLAIMED AND NATIVE WOODLANDS IN NORTH DAKOTA¹

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Abstract. Woodlands comprise only about 1% of the landscape of the northern plains and provide valuable habitat for wildlife including breeding birds. Surveys were conducted between 1986 and 2000 for breeding birds on a native and a reclaimed woodland to evaluate the potential of mitigated woodlands lost to surface coal mining operations as replacement for native woodlands. Vegetation characteristics such as species composition and density, canopy cover, structure, amount of edge and ground cover were evaluated. Breeding bird surveys were conducted from mid-May through mid-June using the spot-mapping method. The native woodland had greater plant species diversity, stem density, canopy cover and height structure than the 18 year old reclaimed woodland. Both woodlands had a similar amount of edge of habitat. Breeding bird densities were higher in the native woodland throughout the study period 1986 to 2000. Species richness was higher 12 of 13 sampled years in the native woodland. Trend in density and species richness of breeding birds on the reclaimed woodland was higher throughout the study. Given sufficient time the reclaimed woodland may perform similar functions to native woodlands.

Additional Key Words: reclamation, wildlife, diversity, species richness.

Introduction

Breeding birds have affinities for specific habitats. North Dakota provides numerous unique landscapes for breeding birds, but in western North Dakota, wooded draws are a major habitat. In total landscape, however, wooded draws comprise only 6 to 8% of the total land area of western

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North Dakota (Faanes, 1983; Hopkins, 1983).

Therefore, these wooded habitats are disproportionately important as breeding sites for resident and
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migratory birds in western North Dakota.

Surface mining of lignite coal is an important industry to western North Dakota. This form of mining removes all surface vegetation, including woodland habitats. In addition, topography and hydrology are altered in the mining process which influence the success of woodland re-establishment and resultant plant community structure. Functionality of re-established woodlands as measured by breeding bird use, have not been well documented. The major objective of this paper is to compare species richness, density and diversity of breeding birds between a reclaimed and a native woodland community of the Glenharold Mine in western North Dakota. Other ecological attributes of the two woodlands as they relate to breeding bird populations will also be discussed.

Study Area and Methods

Study Area

The Glenharold Mine is south and west of the Missouri River in western North Dakota. It lies in the Missouri Plateau Physiographic Region where soils formed from glacial deposits and residuum weathered bedrock of the sedimentary Sentinel Butte formation. Agriculture is the primary land use of the region with prairie dominating the landscape.

Within the mine permit area, woodlands comprise approximately 10% of the land area (Nilson et al. 1995). They are generally located on north and east facing, concave slopes. Mack (1981) documented 221 species of plants within these woodlands. Native woodlands were classified into three communities based on vegetation type and height. Deciduous woodlands contain a tree layer consisting predominantly of green ash (*Fraxinus pennsylvanica*), cottonwood (*Populus deltoides*), American elm (*Ulmus americana*) or box elder (*Acer negundo*). Tall shrubs form distinct woodlands or a separate layer within the deciduous woodlands. Dominant tall shrubs are American plum (*Prunus americana*), chokecherry (*Prunus virginiana*), hawthorn (*Crataegus rotundifolia*), silver buffaloberry (*Shepherdia argentea*), and Juneberry (*Amelanchier alnifolia*). Short shrubs may exist alone or form an ecotone between woodland and grassland habitats and include silverberry (*Eleagnus argentea*), western snowberry (*Symphoricarpos occidentalis*), and wood's rose (*Rosa*

woodsii).

Two woodland sites were selected for the study. Criteria for selection of the two sites included vegetation similar to that of tall shrub communities in the region, little or no grazing pressure, similar area of habitat edge, and nearly 20 years of continuous breeding bird surveys.

The reclaimed woodland in its present stage of structural development resembles a tall shrub community. It was located in the NW ¼ of section 29, T144N, R84W. The woodland was reclaimed on an east facing, reclaimed high wall. It had 1,007 m of edge and 2.1 ha of total area. The woodland was reclaimed in 1982 with chokecherry, American plum, wood's rose, silver buffaloberry and scattered green ash. Vegetation sampling in 2001, the 19th growing season, indicated that the site had approximately 27,500 stems per ha. Over 80% of the stems were under 5 m in height with less than 1% greater than 10 m height, and ground cover consisting of 45% grass, 5% forb and 45% litter.

The native, east facing, wooded draw had 1130 m of edge, a total area of 0.65 ha and was located in the SW ¼ of section 27, T143N, R84W. The dominant species present were green ash, chokecherry, American plum, wood's rose, silver buffaloberry, Juneberry, hawthorn, golden current (*Ribes odoratum*) and western snowberry. Sampling conducted in 2001 estimated the site to have approximately 46,500 stems per ha, with 60% of the stems over 5 m in height, 4% of the stems over 10 m in height, and ground cover consisting of 65% grass, 15% forb and 5% litter.

Breeding Bird Censuses

Breeding bird censuses were taken using the International Spot Map method according to Hall (1964) and Van Velzen (1972). Censusing was initiated in 1982 on the native woodland and 1986 on the reclaimed site. Data will be reported for year 4 (1986), 11 (1993) and 18 (2000). Breeding bird observations were made by multiple observers once per day from dawn until about 10 a.m., coinciding with peak bird song activity. Each site was censused six to eight times during May and June. Bird species diversity was calculated using the Shannon (1948) formula.

Results and Discussion

A total of 30 breeding bird species were identified in the reclaimed and native woodland surveys between 1986 and 2000 (Table 1). Fourteen species were surveyed in both woodlands, while 8 species were identified in the reclaimed or native woodland only. The native woodland had no introduced breeding birds present, while the reclaimed woodland had 2 introduced species.

Considering habitat preference of the breeding birds on the two sites, no difference in habitat preference was evident (Table 1). Both sites had 14 edge species, 2 grassland species and 5 to 6 generalists using the habitats. Breeding habitat preference indicated that the native site attracted more open woodland and shrub nesting species (19) than did the reclaimed woodland (14). Conversely, the reclaimed woodland attracted more open-canopy breeding species than the native woodland (7 vs. 3).

The primary substrate utilized by breeding birds also differed between the study areas (Table 1). Fifteen species in the native woodland primarily used the tree canopy-sapling/shrub substrate, whereas only 10 species used these substrates in the reclaimed woodland. Bird species utilizing ground substrates were greater in the reclaimed woodland (10) compared to the native woodland (7).

Habitat characteristics have been reported to strongly influence density and diversity of breeding birds in native woodlands. Hopkins et al. (1986) and Faanes (1987) reported that, in general, breeding bird densities in western North Dakota woodlands were positively correlated with canopy height and cover, and foliage volume in the high ground layer of wooded draws. James and Warner (1982) reported that tree species richness in woodlands was positively associated with breeding bird species richness. More mature and diverse woodlands provided more nesting sites for birds, such as canopy and cavity nesters.

Habitat characteristics of the two woodlands also played an important role in determining breeding bird distribution and density in this study (Tables 1 and 2). Eleven bird species preferring open woodland/shrub-sapling nesting and foraging habitat were found common to both woodlands. However, in all eleven species, densities were higher in the native woodland. Of the three grassland-ground breeding habitat and foraging bird species common to both woodlands, all three had higher densities in the reclaimed woodland.

Table 1. Ecological attributes of nesting bird species found over the study period in reclaimed and native woodlands on the Glenharold Mine in western North Dakota.

Species	Habitat preference ¹	Breeding	Primary substrates utilized ³						Migratory status	Distribution ³		Presence/Absence	
			Ground	Shrub-sapling	Tree canopy	Bark	Cavit	Aerial		Seasonal	Geographical	Reclaimed	Native
Gray Partridge	Edge	Grass	FN						RES	P	I	+	-
Ring-Necked Pheasant	Edge	Grass	FN						RES	P	I	+	-
Mourning Dove	Generalist	OpWo	F		N				SDM	S	P	+	+
Common Flicker	Generalist	OpWo	F			F	N		SDM	S	P	-	+
Least Flycatcher	Forest interior	OpWo			N			F	LDM	S	N	-	+
Willow Flycatcher	Edge	Shrub		N				F	LDM	S	P	-	+
Eastern Kingbird	Edge	OpTr		N	N			F	LDM	S	P	+	+
Western Kingbird	Edge	OpTr		N	N			F	LDM	S	W	+	-
Cliff Swallow	Generalist	Resi					N	F	LDM	S	P	+	-
Tree Swallow ⁴	Generalist	Wetl					N	F	SDM	S	P	+	-
House Wren	Edge	OpWo		F				N	LDM	S	P	-	+
Eastern Bluebird ⁴	Edge	OpWo	F					N	SDM	S	E	+	+
American Robin	Generalist	OpWo	F		N				SDM	S	P	+	+
Gray Catbird	Edge	Shrub		FN					LDM	S	P	+	+
Brown Thrasher	Edge	Shrub	FN	FN					SDM	S	E	+	+
Cedar Waxwing	Generalist	OpWo		FN	FN			F	SDM	P	P	-	+

Yellow Warbler	Edge	OpWo		FN		LDM	S	P	+	+
Common Yellowthroat	Generalist	Wetl	FN	FN		LDM	S	P	+	-
Yellow-Breasted Chat	Edge	Shrub		FN		LDM	S	P	-	+
Black-Headed Grosbeak	Edge	OpWo			FN	LDM	S	W	-	+
Lazuli Bunting	Edge	Shrub	F	N		LDM	S	W	+	-
Rufous-Sided Towhee	Edge	OpWo	FN	N		SDM	S	P	+	+
Clay-Colored Sparrow	Edge	Shrub		FN		LDM	S	W	+	+
Field Sparrow	Edge	Shrub	FN	N		SDM	S	E	+	+
Grasshopper Sparrow	Grassland	Grass	FN			LDM	S	P	+	+
Song Sparrow	Edge	Shrub		FN		SDM	S	P	-	+
Vesper Sparrow	Edge	Grass	FN			SDM	S	P	+	+
Western Meadowlark	Grassland	Grass	FN			SDM	S	W	+	+
Brown-Headed Cowbird	Generalist	OpWo	F	N	N	SDM	S	P	+	+
American Goldfinch	Edge	Shrub	F	N	N	SDM	S	P	+	+

Breeding habitat: OpWo=open woodlands, OpTr=open habitat with scattered trees or shrubs, Wetl=wetland, Shrub-shrubland, Grass-grassland, Resi-residential.

Primary Substrates Utilized: F = Foraging, N = Nesting.

Migration: RES = resident, LDM = Long distance migrant, SDM = short distant migrant.

Distribution: Seasonal: S = Summer Resident, P = Permanent Resident.

Geographical: E = Eastern, W = Western, N = Northern, P = Pandemic, I = Introduced.

¹Faanes and Stewart 1982.

²Ilg & Johnson 1997.

³Hopkins et al. 1986.

⁴Present due to nest boxes.

Table 2. Comparison of breeding bird pairs on reclaimed and native woodlands on the Glenharold Mine in western North Dakota.

Species	Year					
	1986		1993		2000	
	Recl.	Ref.	Recl.	Ref.	Recl.	Ref.
	-----no. ha ⁻¹ -----					
Ring-Necked Pheasant	0	0	0.53	0	0	0
Mourning Dove	0	0	0	0	0.53	3.08
Least Flycatcher	0	1.54	0	1.54	0	0
Willow Flycatcher	0	3.08	0	4.62	0	4.62
Eastern Kingbird	0	1.54	0.53	3.08	0.53	1.54
Cliff Swallow	0	0	0.53	0	0	0
Tree Swallow	0	0	0	0	0.53	0
American Robin	0	1.54	0	3.08	0	0
Gray Catbird	0	1.54	0	3.08	0.53	3.08
Brown Thrasher	0	1.54	0.53	3.08	0.53	1.54
Cedar Waxwing	0	0	0	0	0	1.54
Yellow Warbler	0	3.08	0.53	5.38	1.58	7.69
Common Yellowthroat	0	0	0	0	1.05	0
Yellow-Breasted Chat	0	1.54	0	0	0	1.54
Black-Headed Grosbeak	0	0	0	1.54	0	0
Lazuli Bunting	1.05	0	0	0	0	0
Rufous Sided Towhee	0	0	0	0	0.53	0.77
Clay-Colored Sparrow	0	4.62	2.11	1.54	4.74	7.69
Field Sparrow	0.53	0	0.53	0	0.53	0
Grasshopper Sparrow	1.05	0	1.05	1.54	1.05	2.31
Song Sparrow	0	0	0	0	0	0.77
Vesper Sparrow	1.05	0	0.53	1.54	0	0
Western Meadowlark	0.79	0	0.53	0	0.53	0
Brown-Headed Cowbird	0	1.54	0.53	1.54	0	0
American Goldfinch	1.05	1.54	1.05	3.08	1.05	3.08
Species Richness (no. ha ⁻¹)	6	11	12	13	13	13

Density (no. ha ⁻¹)	5.5	23.1	9.0	34.6	13.7	39.3
Diversity (H')	1.77	2.30	2.34	2.46	2.21	2.32

The native woodland vegetation was comprised of approximately 46,500 stems per ha of which 60% of the stems exceeded 5 m in height. Breeding birds attracted to a tall, dense habitat for nesting or foraging such as the least flycatcher, willow flycatcher and yellow-breasted chat were only found in the native woodland (Tables 1 and 2). It should be noted that the willow flycatcher and yellow-breasted chat have been observed breeding on other reclaimed woodlands at the Glenharold Mine. Other species preferring this habitat but only surveyed sparingly in the native woodland were the black-headed grosbeak, cedar waxwing and song sparrow. These bird species were not observed in the reclaimed woodland.

The reclaimed woodland had just over 50% of the stem density (27,500 stems per ha) and approximately 25% of the tall canopy (15% vs. 60%) of the native woodland. Bird species utilizing this more open habitat were those preferring shorter shrub and grassland habitats (Tables 1 and 2). These bird species included the common yellow-throat and field sparrow. A total of fourteen bird species preferring open woodland/shrub-sapling habitat for nesting and foraging were surveyed in the reclaimed woodland; however, the estimated breeding pair density of these species was much less than the native woodland.

Richness, density and diversity of breeding birds in both woodlands increased over time (Table 2). Species richness increased from 6 and 11 ha⁻¹ in the reclaimed and native woodland, respectively, in 1986 to 13 species ha⁻¹ in both woodlands in 2000. Between 1986 and 2000, density of breeding pairs increased from 5.5 ha⁻¹ to 13.7 ha⁻¹ in the reclaimed woodland, and 23.1 ha⁻¹ to 39.3 ha⁻¹ in the native woodland. Diversity of breeding bird species improved from 1.77 to 2.21 in the reclaimed woodland between 1986 and 2000, and remained relatively constant in the native woodland (2.30 vs. 2.32).

Breeding bird density in 2000 was higher in the native (39.3 ha⁻¹) compared to the reclaimed (13.7 ha⁻¹) woodland (Table 2). Hopkins et al. (1986) stated that the variety and density of birds occupying a woodland habitat are strongly influenced by the variety in richness, density, canopy and understory vegetation of that habitat. In this study the reclaimed woodland had fewer species of woodland plants available (5 vs. 10), significantly fewer stems in the tree-shrub canopy (27,500 vs. 46,500 ha⁻¹), no canopy exceeding 10 m in height, and a much reduced tall shrub stem density (> 5 m) compared to the native woodland (15 vs. 60%). The reduced physical structure and plant species composition of the reclaimed woodland presumably would provide less foraging and nesting sites

for many breeding birds.

Conclusion

The re-established woodland in this study did appear to be functioning as a nesting and foraging site for breeding birds. By 2000, 18 years after establishment, species richness of breeding birds surveyed in the reclaimed woodland equaled that of a native woodland. Despite equal richness, bird species composition was different between the reclaimed and native woodlands with the reclaimed site having more grassland and short shrub breeding species, and the native woodland attracting more open woodland and shrub-sapling nesting species. The most significant difference in surveys between the woodlands selected in this study was breeding bird density. In 2000, 18 years after establishment, there was a three-fold advantage in breeding bird density on the native woodland compared to the reclaimed site. However, breeding bird density of this reclaimed woodland compared favorably with several native woodlands being monitored on the Glenharold Mine (data not presented).

The differences in breeding birds surveyed between the woodlands is most likely related to the differences in habitat characteristics of the two sites. The edge and area of the woodlands were similar but plant species composition and physical structure were significantly different. The native woodland had significantly more species of trees and shrubs (10 vs. 5), nearly double the number of stems (46,500 vs. 27,500 stems ha⁻¹), and a more diverse height and canopy structure. The native woodland had 60% of the stem density exceeding 5 m in height, whereas the reclaimed woodland had over 80% of the tree and shrub stems under 5 m in height. Plant species diversity and diversity of physical structure, height and cover, of woodlands have been reported to be positively associated with species richness and density of breeding birds.

Finally, woodland reclamation plans should consider the following elements to provide attractive and functional replacement habitat for breeding birds. Edge and interior habitats should be maximized for those bird species attracted to these features of a woodland. The re-established tree and shrub species composition should attempt to mimic the diversity of plant species occupying native woodland habitats. Including trees in the plant species mix is necessary to increase diversity of breeding bird nesting and foraging sites. Lastly, stem density should be maximized through the

use of multiple-level canopy shrub (low and medium height) and tree mixes. Providing a variety and diversity of nesting and foraging sites would attract a diversity and greater density of breeding birds to re-established, replacement woodlands.

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