

**INVENTORY AND MONITORING of  
AVIAN MANAGEMENT INDICATOR SPECIES for the  
MEDICINE BOW NATIONAL FOREST, WYOMING**

***YEAR THREE PROGRESS REPORT***

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## ***INTRODUCTION***

This report provides third-year results (i.e. data collected during summer 2007) of a songbird inventory and monitoring effort on the Medicine Bow National Forest (MBNF). Every year since 2005, the Wyoming Natural Diversity Database (WYNDD) has conducted fixed songbird point-count surveys in target and random habitats in the Sierra Madre, Medicine Bow, and Laramie Mountains. The targeted habitats are conifer forests dominated by spruce and fir, and riparian zones with high willow cover. Random transects are located throughout the forest to test the assumption that management indicator species are more abundant in target habitats than at randomly selected locations. For regional consistency, the design and methods of this study are based on the Rocky Mountain Bird Observatory (RMBO) Point Transect Protocol (Leukering et al. 1998).

The primary goal of this multi-year study is to provide distribution and density estimates of four avian management indicator species (MIS) across the MBNF. The Golden-crowned Kinglet (*Regulus satrapa*) and American Three-toed Woodpecker (*Picoides dorsalis*) were chosen by MBNF as MIS for the spruce/fir community. Wilson's Warbler (*Wilsonia pusilla*) and Lincoln's Sparrow (*Melospiza lincolnii*) were chosen as MIS for the montane riparian community. In this report, density estimates for the four species are compared across years. In addition to showing trends between survey years, MIS density estimates provide a solid baseline for future comparison. If management actions are taken in the future and/or changes in target habitats occur due to fire, climate change, or bark beetle infestation, future impacts on species densities can be measured by repeating the surveys described here.

## ***METHODS***

### **Point Transects**

Transect selection and point count methods generally follow those described in the RMBO Point Transect Protocol, which was last revised in March, 2006 (Leukering et al. 1998). Detailed descriptions of the transect selection process are located in the progress reports for 2005 and 2006. Copies of those reports are located in the CD\_ROM accompanying this report. There are 26 songbird transects in the MBNF (11 spruce-fir, 10 riparian, 5 random). Twenty-five transects are located in the Brush Creek-Hayden and Laramie Ranger Districts and one is in the Laramie Peak Unit of the Douglas Ranger District (Figure 1). Each transect has 15 fixed listening points, 250m

apart, which are navigated to with GPS. All species heard or seen within a 5-minute period are recorded at each point. In contrast, because of their low-density in some areas, MIS are recorded along the entirety of each transect. This means that the 4 indicator species were analyzed as line transects and the rest of the species as point counts.

A few modifications to point locations were made after the 2005 field season for logistical reasons. Road noise near riparian transect R06 drowned out bird songs, so the transect was replaced by R08 in 2006. In addition, locations of a few individual points within other transects were moved to increase observer safety (i.e. to avoid dangerously steep slopes or river crossings). The slate of transects used in 2006 has and will remain unchanged for the duration of this study.

## **2007 Surveys**

For the third year efforts, avian surveys were conducted on all 26 transects between June 2 and July 13, 2007. All counts were conducted between roughly 5:30 am and 11:00 am. Surveyors were experienced birders and were screened for their ability to discern MIS from other species by sight and sound. Surveyors also attended a week-long RMBO training program in May of 2007 to familiarize themselves with survey methodology and the species likely to occur in spruce/fir and montane riparian habitats.

Rain, wind and traffic noise can hinder bird detection, and often result in subdued avian behavior. Point counts were not conducted if wind exceeded 18 mph, or a 4 on the Beaufort wind scale (wind raises dust, leaves, loose paper; small branches in motion). Point counts were also suspended if precipitation exceeded a drizzle, if snowfall noticeably subdued bird behavior, or if traffic noise obscured bird detections.

## **Density Analysis**

Program Distance 5.0 (Thomas et al., 2006) was used to estimate density of MIS at all transects within their target habitats. Density methods are more reliable measures of relative abundance across years than raw numbers because detection probabilities are taken into account (birds further away from surveyor are less likely to be detected). All four MIS were analyzed using line transect methodology as described in Buckland et al., 2001. Detection curves were calculated by species by year and the lowest Akaike's Information Criterion value (AIC) was used to select the model with the best fit.

## ***RESULTS AND DISCUSSION***

### **MIS Density**

Table 1 shows density estimates for all MIS using line transect analysis methods in program Distance. The same data are expressed graphically in Figures 2 and 3. Density estimates are expressed as the number of birds per km<sup>2</sup> within the target habitat. For example, in 2007, Golden-crowned Kinglets had an estimated density of 55 (95%CI of 32-96) birds per km<sup>2</sup> within spruce/fir habitat. The random placement of transects and robust sample size gives us reasonable confidence that this figure can be applied across the MBNF within areas mapped as Spruce/Fir. Density figures are likely to be an underestimate of true species density due to the lower detectability of females. In Golden-crowned Kinglets and Three-toed Woodpeckers, this is less of a problem because females are detected almost as often as males. For Wilson's Warblers and Lincoln Sparrows, however, females are extremely difficult to see or hear. In fact, 95% of all detections for those two species are males. Assuming an equal sex ratio, real density estimates are, therefore, probably almost double.

Confidence intervals for the three years are so wide, that it's hard to say definitively if there have been any changes in MIS densities over the three-year period. It is possible that MIS densities increased somewhat between 2005 and 2006 given that raw observations almost doubled for three of the four MIS (a pattern seen across other surveyed taxa as well). Lincoln Sparrows were the most abundant of the MIS for all years, yielding 87 birds per km<sup>2</sup> (95%CI 47-159) in 2007. The next most abundant MIS was the Golden-crowned Kinglet with 55 birds per km<sup>2</sup> (95%CI 32-96). Wilson's Warbler was the next most abundant with 45 birds per km<sup>2</sup> (95%CI 26-81). Three-toed Woodpeckers have consistently been the least abundant for the three years of the study (9 birds per km<sup>2</sup> (95%CI 4-19) in 2007).

Table 2 shows the average number of individuals seen per transect in random, riparian, and spruce/fir habitats. With the possible exception of Golden-crowned Kinglet, each species shows a clear preference for its habitat type; Golden-Crowned Kinglets and American Three-toed Woodpeckers being found predominantly on spruce-fir transects, while Wilson's Warblers and Lincoln's Sparrows were found mostly on riparian transects.

Most transects do not have enough observations of MIS to produce reliable transect-level densities. This prevents us from comparing species densities between transects. However, one gets a sense of this by looking at the number of observations of MIS by transect in Table 3. The best

overall habitat for both riparian MIS based on number of observations is R02 (Douglas Creek) and R03 (Horse Creek). Golden-crowned Kinglets may be selecting slightly different habitat than Three-toed Woodpeckers based on observations in Table 3. However, transects that seem to provide good habitat for both species are SF 27 (Haskin's Creek) and SF28 (East Fork Savery Creek).

### **Abundant and Rare Species**

A summary of all avian observations in 2007 is presented in Table 4. A total of 3,726 bird observations were made during formal point-counts transects, which is nearly double the number of observations in 2005 and about the same as in 2006. The most commonly detected species were Dark-eyed Junco, Pine Siskin, Yellow-rumped Warbler (Audubon's race), Ruby-crowned Kinglet, and Lincoln's Sparrow. These are also the top five species that were observed in 2005 and 2006. On the other end of the spectrum, Table 4 shows several species that were only seen once or twice during surveys. Of particular conservation interest are American Pipit, Band-tailed Pigeon, Cooper's Hawk, Evening Grosbeak, Flammulated Owl, Lewis Woodpecker, Northern Goshawk, Orange-crowned Warbler, Sandhill Crane, Williamson's Sapsucker, and White-winged Crossbill.

### ***FUTURE ANALYSES***

Although not formally part of current contracts, and thus not included in current budget figures, there are several additional analyses, some of which are listed below, that could be conducted in future years. We are interested in receiving feedback on the utility of these analysis from biologists at the MBNF. Analyses deemed useful by MBNF can be incorporated into contracts for future years. Further, please let us know if there are additional analyses not mentioned here that would be useful so we can discuss the feasibility of collecting and analyzing the appropriate data in future years.

- Habitat quality for MIS can be more quantitatively described for biologists and managers of the MBNF. This can be done by pairing habitat data collected at survey points in 2005 and 2006 with MIS observations. In this way, vegetation cover and structure could be more tightly coupled with MIS presence. This may help inform management strategies that promote ecosystem health and MIS densities. For example, analysis of finer scale habitat

data could be of particular interest for spruce/fir species, since in many cases Lodgepole Pine is a dominant component of portions of transects classified as 'Spruce/Fir'.

- Although the focus and level of effort for our current project is tailored to the four MIS species discussed above, the current data suggest that sufficient observations are available to derive density for roughly 18 additional avian species.

### ***REFERENCES***

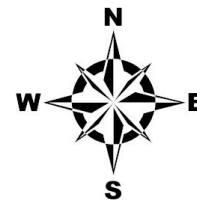
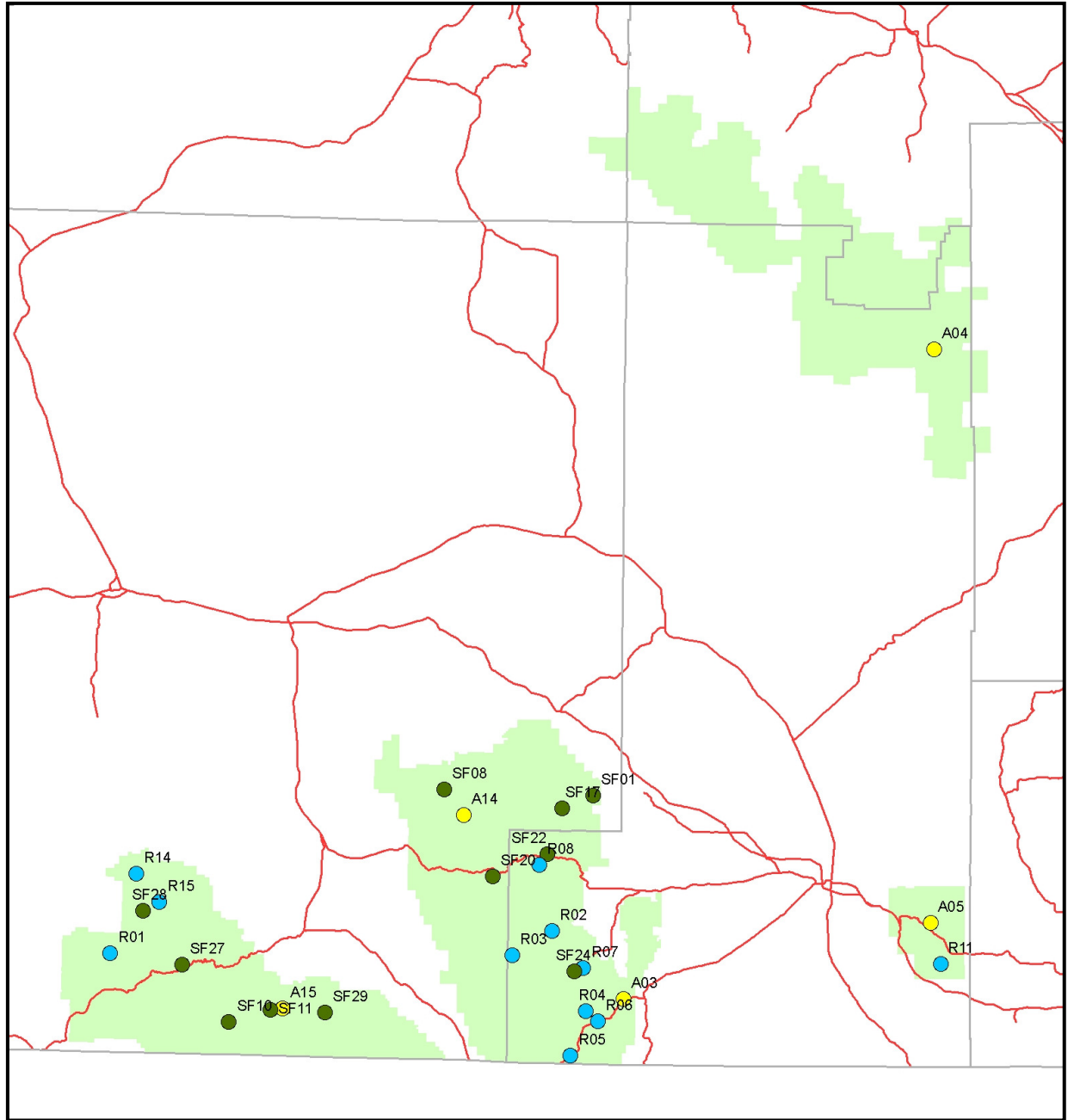
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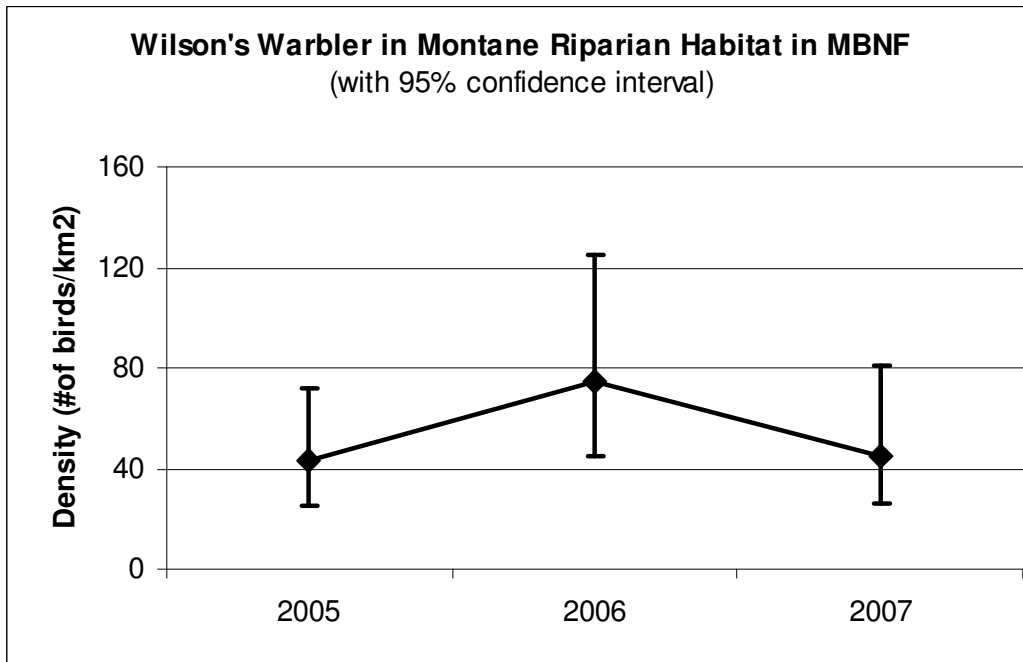
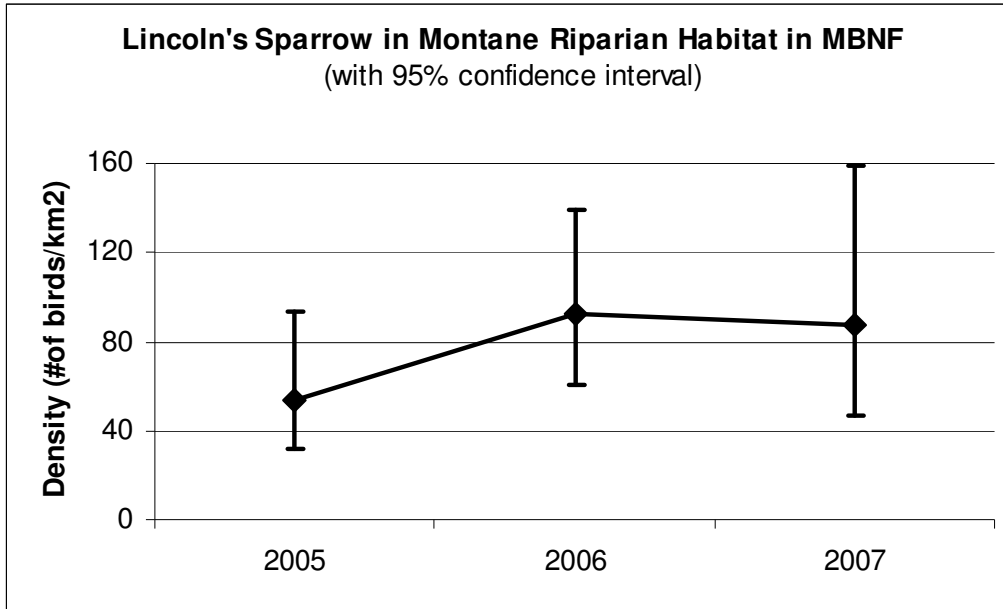
## FIGURES AND TABLES

**Figure 1:** Approximate location of songbird transects to monitor avian management indicator species within the Medicine Bow National Forest of southern Wyoming.

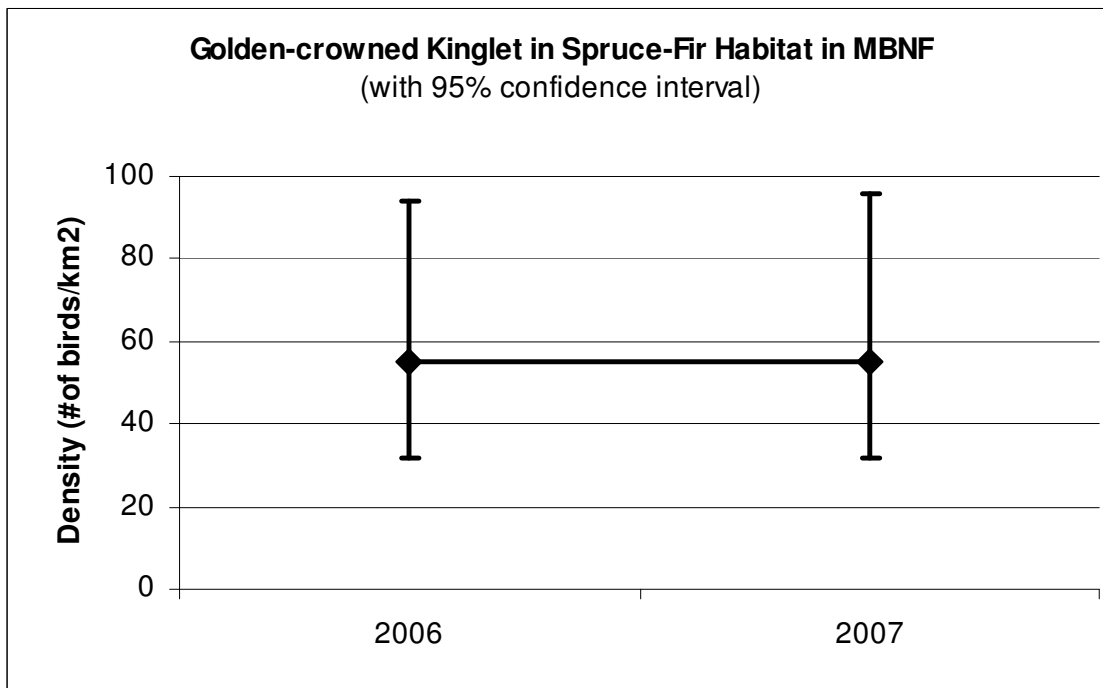
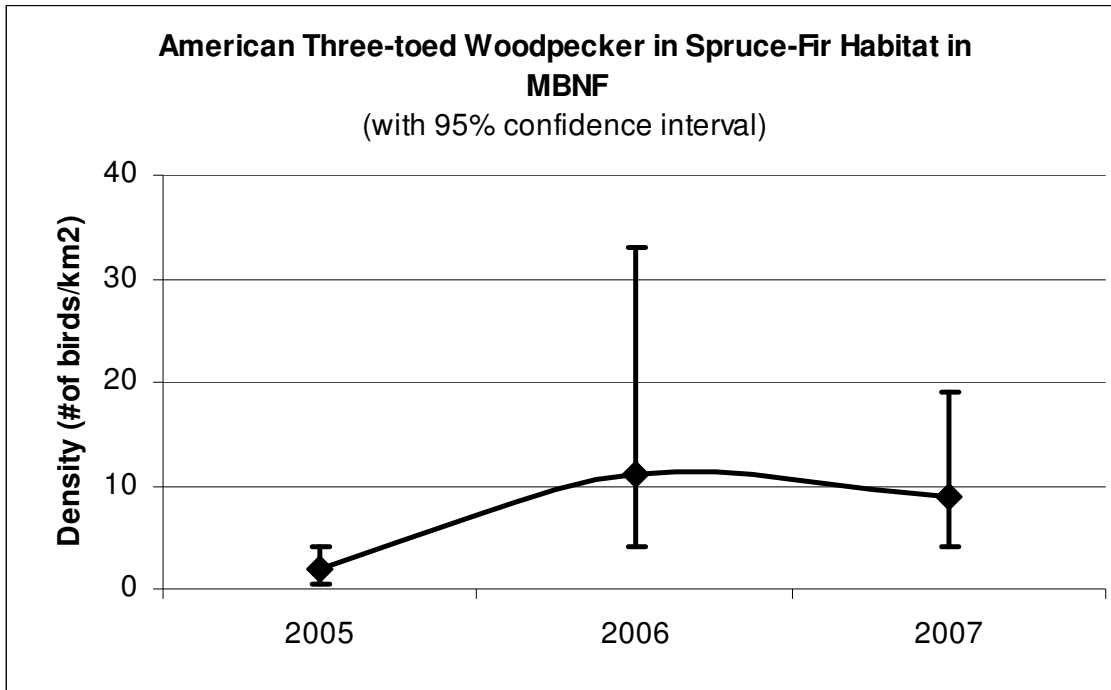




**Figure 2:** Forest-wide density estimates for Montane Riparian Management Indicator Species; Lincoln's Sparrow and Wilson's Warbler.



**Figure 3:** Forest-wide density estimates for Spruce/Fir Management Indicator Species; American Three-toed Woodpecker and Golden-crowned Kinglet.



**Table 1:** Forest-wide density estimates for all Management Indicator Species within their target habitats. GCKI = Golden-crowned Kinglet, LISP = Lincoln's Sparrow, ATTW = American Three-toed Woodpecker, and WIWA = Wilson's Warbler.

	<b>Density (#birds/km<sup>2</sup>)</b>			
	<b><u>LISP</u></b>	<b><u>WIWA</u></b>	<b><u>ATTW</u></b>	<b><u>GCKI</u></b>
<b>2005</b>	<b>54</b>	<b>43</b>	<b>2</b>	<b>*</b>
95% CI	32, 93	25, 72	0.5, 4	*
<b>2006</b>	<b>92</b>	<b>75</b>	<b>11</b>	<b>55</b>
95% CI	61, 139	45, 125	4, 33	32, 94
<b>2007</b>	<b>87</b>	<b>45</b>	<b>9</b>	<b>55</b>
995% CI	47, 159	26, 81	4, 19	32, 96

- Not enough observations to produce reliable density estimates

**Table 2 :** Average number of birds observed per transect by habitat type (2005-2007)

	ATTW	GCKI	LISP	WIWA
Random	2	5	6	1
Riparian	1	2	64	48
Spruce/Fir	8	14	4	0

**Table 3:** Summary of management indicator species observed by transect 2005-2007. GCKI = Golden-crowned Kinglet, LISP = Lincoln's Sparrow, ATTW = American Three-toed Woodpecker, and WIWA = Wilson's Warbler.

Transect	Starting Elevation (ft)	ATTW			GCKI			LISP			WIWA		
		2005	2006	2007	2005	2006	2007	2005	2006	2007	2005	2006	2007
A03 - Medicine Bow (Porter and Woods Creeks)	8353										1		
A04 - Laramie Range (Clark Draw off Murphy Canyon)	7000		1					1					
A05 - Pole Mountain (Bisbee Hill and Lodgepole Creek)	8241							2	3				
A14 - Medicine Bow (Brush Creek and Turpin Reservoir)	9400		1			5	2	4	9	7			2
A15 - Sierra Madre (Soldier Creek and Encampment River)	9065		4	3	2	4	13		2				
R01 - Sierra Madre (Big Sandstone Creek)	7674							5	9	3	9		
R02 - Medicine Bow (Douglas Creek and Cinnibar Park)	9596							30	43	63	30	31	40
R03 - Medicine Bow (Horse Creek)	9599		2	5	2	1	3	22	32	53	18	30	27
R04 - Medicine Bow (Fox Creek and Tributary)	9000							5	14	8	14	20	12
R05 - Medicine Bow (Pelton Creek at WyColo)	8799		1			3		8	28	28	6	24	32
R07 - Medicine Bow (Lake Creek at Dry Park Road)	9200		1			2		8	46	43	9	24	4
R08 - Medicine Bow (Bear Lake)	10147	-			-			-	15	18	-	14	14
R11 - Pole Mountain (Middle Crow Creek west of Granit Springs Res.)	8000							5	13	5	3		4
R14 - Sierra Madre (Savery Creek)	8569		1		3	4		28	16	14	9	7	11
R15 - Sierra Madre (Jack Creek)	8600						2	30	25	26	29	27	31
SF01 - Medicine Bow (Fourmile Creek)	9176						1			1			
SF08 - Medicine Bow (East Kenneday Peak and Purse Creek)	8835	5	5	1	1	8	17	1	2	3			
SF10 - Sierra Madre (Hog Park Northwest, Little Snake River)	8600		1	3	4	7	7	1		1			
SF11 - Sierra Madre (Hog Park Northeast, Robinson Creek)	9396				1	3	2						
SF17 - Medicine Bow (Trail Creek)	9800	5	1	1	1	3	2	1					
SF20 - Medicine Bow (Silver Lake and Sucker Lake)	10462	1	2	15		1		1	1	4			
SF22 - Medicine Bow (Snowy Range Natural Area)	10160			7	2	4	12		1	6			
SF24 - Medicine Bow (Muddy Mountain)	7278		6	2	3	11	8	1	4	6		2	
SF27 - Sierra Madre (Haskin's Creek Campground)	9202	1	1	9	4	5	12		3	3			
SF28 - Sierra Madre (East Fork Savery Creek and Continental Divide)	9130		1	6	5	9	16						
SF29 - Sierra Madre (Billie Creek and Blackhall Mountain)	9222	3	13		2	4	4	2					
<b>Species Total (all transects)</b>		<b>15</b>	<b>41</b>	<b>52</b>	<b>30</b>	<b>74</b>	<b>101</b>	<b>164</b>	<b>266</b>	<b>292</b>	<b>134</b>	<b>179</b>	<b>177</b>

- Transect codes designate habitat types: SF = spruce fir, R = riparian-willow and A = random. These designations represent the primary habitat type in each transect, but not all points within a given transect fall within the noted habitat. Control transects were randomly placed throughout the Medicine Bow National Forest and generally contained a mixture of habitat types (most often lodgepole pine dominated conifer) and intersected at least one riparian area.



Species	A03	A04	A05	A14	A15	R01	R02	R03	R04	R05	R07	R08	R11	R14	R15	SF01	SF08	SF10	SF11	SF17	SF20	SF22	SF24	SF27	SF28	SF29	Grand Total
Golden-crowned Kinglet				2	13			3							2	1	17	7	2	2		12	8	12	16	4	101
Gray Jay			1	1			1	2			2					3			4	2	5			1	2	1	25
Gray Catbird											1																1
Green-tailed Towhee	10	5	7			9						1	5	1													38
Hammond's Flycatcher		5																									5
Hairy Woodpecker	1	2		1						2	1			2		4		1	3			2	2			5	26
Hermit Thrush	2	1	1	11	13		3	2	2		1		1	5		16	12	11		13	4	6	4	9	10	4	131
Horned Lark			7																								7
House Wren	2	4	7			1							4	3	1												22
Lazuli Bunting						1																					1
Lewis Woodpecker			1																								1
Lincoln Sparrow				7		3	63	53	8	28	43	18	5	14	26	1	3	1			4	6	6	3			292
Mallard							1																				1
MacGillivray's Warbler						7							1	3	2					1							14
Mountain Bluebird	3		1									2		1													7
Mountain Chickadee	12	5	4	11	6	1	5	4	6	4	9	1	2	5		4	8	7	3	5	12	13	18	10	8	11	170
Mourning Dove		2			1						1			4	2	4											14
Northern Flicker	4	3	6		2	2					1	1		2		3	2	3				1		1			31
Northern Goshawk									1						1												2
Northern Harrier											1																1
Orange-crowned Warbler	1														1												2
Olive-sided Flycatcher					4	3								4	2	5			2	1							21
Pine Grosbeak		4		2	1						1	4				4	1	5		3	14	3	2		2	2	48
Pine Siskin	6		1	24	10	4	14	12	5	9	7	28	3	5	3	18	34	9	11	23	45	14	7	12	15	13	332
Plumbeous Vireo		3																									3
Pygmy Nuthatch		6																									6
Red-breasted Nuthatch	2	3	1		2			2		1	2				1	15	4	5	2	3	6	4	1	4	6	4	68
Ruby-crowned Kinglet	12		9	20	16	4	14	10	13	20	16	11	1	21	20	11	13	4	17	7	6	4	5	15	4	14	287
Red Crossbill	3	3	7	5	6		1	1	1		1	1		1	1	5	1	12	7	8	15	9	5	5	8	3	109
Ring-necked Duck											2																2
Red-napped Sapsucker		4			1			1	1					1	2			1					1			1	13

Species	A03	A04	A05	A14	A15	R01	R02	R03	R04	R05	R07	R08	R11	R14	R15	SF01	SF08	SF10	SF11	SF17	SF20	SF22	SF24	SF27	SF28	SF29	Grand Total	
Red-tailed Hawk	2		1			2							1	1	1													8
Red-winged Blackbird										2			1															3
Sandhill Crane						2								3	2													7
Savanna Sparrow								3		2		1																6
Song Sparrow			1			19		1		2		2	14	2	11													52
Spotted Sandpiper						3	1				1	2		1	1													9
Steller's Jay			2		1				1																			4
Swainson's Thrush						2									1		1	2								3		9
Townsend's Solitaire	5	3		1	2	1				1										1	5	1						20
Tree Swallow										2		1	1	1	1													6
Turkey Vulture	1				1								4															6
Unknown bird		6			1		1				1	5	6	1						2			3	1				27
Veery	2																											2
Vesper Sparrow	4		2			2							1															9
Violet-green Swallow			1			1									2						1							5
Virginia's Warbler		1				4								1										1				7
Warbling Vireo	15	7	3		1	19			2	4			3	2											3			59
White-breasted Nuthatch		2																1							1			4
Western Tanager	4	4		2	3	2					1	1		3			4						2		15	5		46
Western Wood-pewee		2			2	1				1				3	9													18
White Pelican														1														1
Williamson's Sapsucker		1							1																			2
Wilson's Snipe				3			4	10		1	6				2													26
White-crowned Sparrow						1	16	15		14	13	38		1	8						9	3						118
Wilson's Warbler				2			40	27	12	32	4	14	4	11	31													177
White-winged Crossbill																							3					3
Yellow Warbler			2			19							28															49
Yellow-rumped Warbler	13	18	12	23	17	4	12	8	8	3	7	6	3	8	1	25	21	15	16	10	10	12	15	20	10	13		310
<b>Grand Total</b>	<b>115</b>	<b>109</b>	<b>100</b>	<b>120</b>	<b>112</b>	<b>176</b>	<b>185</b>	<b>160</b>	<b>66</b>	<b>164</b>	<b>144</b>	<b>150</b>	<b>127</b>	<b>140</b>	<b>194</b>	<b>157</b>	<b>135</b>	<b>100</b>	<b>99</b>	<b>96</b>	<b>209</b>	<b>136</b>	<b>99</b>	<b>142</b>	<b>104</b>	<b>86</b>	<b>3426</b>	

## ***APPENDIX: DIGITAL FILES***

The CD-ROM attached to this report stores several documents and a shapefile:

- **MBNFSongbirds05.pdf** is the annual report for the first year of the study.
- **MBNFSongbirds06.pdf** is the annual report for the second year of the study.
- **RMBO PC Protocol May06.pdf** is the Rocky Mountain Bird Observatory's point transect protocol (same as Leukering et al, 1998).
- **Bird\_obs\_05-07.shp** contains the point observation data collected for this project.

Each record in this shapefile (9,968 in total) represents an observation of one bird. The fields are defined as follows:

1. YEAR: The year in which the observation was made.
2. TRANSECT: The transect on which the observation was made. "R" transects are riparian, "SF" transects are spruce-fir, and "A" transects are the random controls.
3. POINT: The point on the transect at which the observation was made. There are 15 points on each transect. Points with a decimal extension mean the observation was made between two points. For example, "10.5" means the observation was made between point 10 and point 11. There are no UTM coordinates for between-point observations.
4. TRANSPT: A concatenation of the Transect and Point fields, see above.
5. SPECIES\_FI: The 4-letter species code for the observed bird. See Leukering et al. (1998) for a definition of these codes.
6. HOW\_MOD: The method used to make the observation, as described in Leukering et al. 1998. In general, F = flyover, S = song, C = call, V = visual, D = drumming, O = other.
7. CLUSTER\_CO: If the observed bird was part of a cluster (see Leukering et al. 1998 for definition of cluster), then there will be a letter designation in this field. Adjacent observations with the same letter were part of the same cluster.
8. UTME: The X-coordinate, or UTM Easting, of the point in question (Zone 13, NAD 1983)
9. UTMN: The Y-coordinate, or UTM Northing, of the point in question (Zone 13, NAD 1983)