

# BREEDING BIRD POPULATIONS IN GRAND TETON NATIONAL PARK: DENSITY AND DISTRIBUTION

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## ♦ INTRODUCTION

GTNP (Grand Teton National Park) recently initiated a breeding bird monitoring program, with a view toward assessing population densities of breeding birds and their potential changes, both of residents and neotropical migrants; the 1995 season was the first in which the monitoring protocols of the program were fully instigated. The program goals are the monitoring of both species and densities over a broad range of habitats within the park, with a view to detecting changes over time in these variables, in year-to-year "background" variation and in possible long-term trends. Site selection, mapping and marking, and deployment of various bird census techniques, will be completed and refined over three introductory years, 1995-1997. Thence, it is anticipated that the monitoring program will become permanently established, contributing yearly to an expanding data base on the park's breeding bird populations. This data base, it is believed, will become a useful backup and basis for management decisions, and an increasingly sensitive index from which changes in the park's avifauna, natural or anthropogenic, can be calibrated.

## CENSUS SITES IN GTNP --

By 1995, 29 census sites were selected and mapped (leaving for selection in 1996 one final site, designated as "aspen scrub", in the total of 30). All sites are within the GTNP boundaries, with the exception of a site in the National Elk Refuge a few kilometers south of the park. The sites span an elevational range of almost 1000 m, from the

marshy grasslands at the southern end of Jackson Hole to tundra and subalpine fir habitats on the crest of the Teton Range. More specifically, census sites include the full range of habitats within GTNP, which is remarkably diverse for such a limited area: from marsh and pond wetlands to arid habitat of Great Basin Desert vegetation, and from grasslands (grazed and ungrazed) to sagebrush, willows, aspen and cottonwoods through a range of coniferous forests variously dominated by lodgepole pine, douglas fir, Engelmann spruce and subalpine fir (see, e.g., Cody 1994 and earlier reports).

Among the census sites, two were selected in areas recently burned, in the 1985 fire in lodgepole pine at Taggart Lake and the 1994 Antelope Flats fire in Great Basin sagebrush; both sites have unburned control sites nearby. One site (Timbered Island lodgepole pine) was chosen because of its modest isolation from similar contiguous habitat, in order to evaluate the effects of natural habitat fragmentation on breeding bird populations. A number of sites were chosen in order to monitor bird species that are marginal in GTNP (e.g. American redstart, Least flycatcher, Gray catbird, Bobolink, Lark sparrow, Clay-colored sparrow, Northern waterthrush, etc.), in sites where these species are known to occur in some years, but for the most part, sites are located simply in representative habitat with vegetational characteristics typical of those throughout GTNP.

A small number of the GTNP monitoring sites have extensive histories of prior breeding bird monitoring efforts, in particular some sagebrush, willow and aspen sites. These sites, their breeding

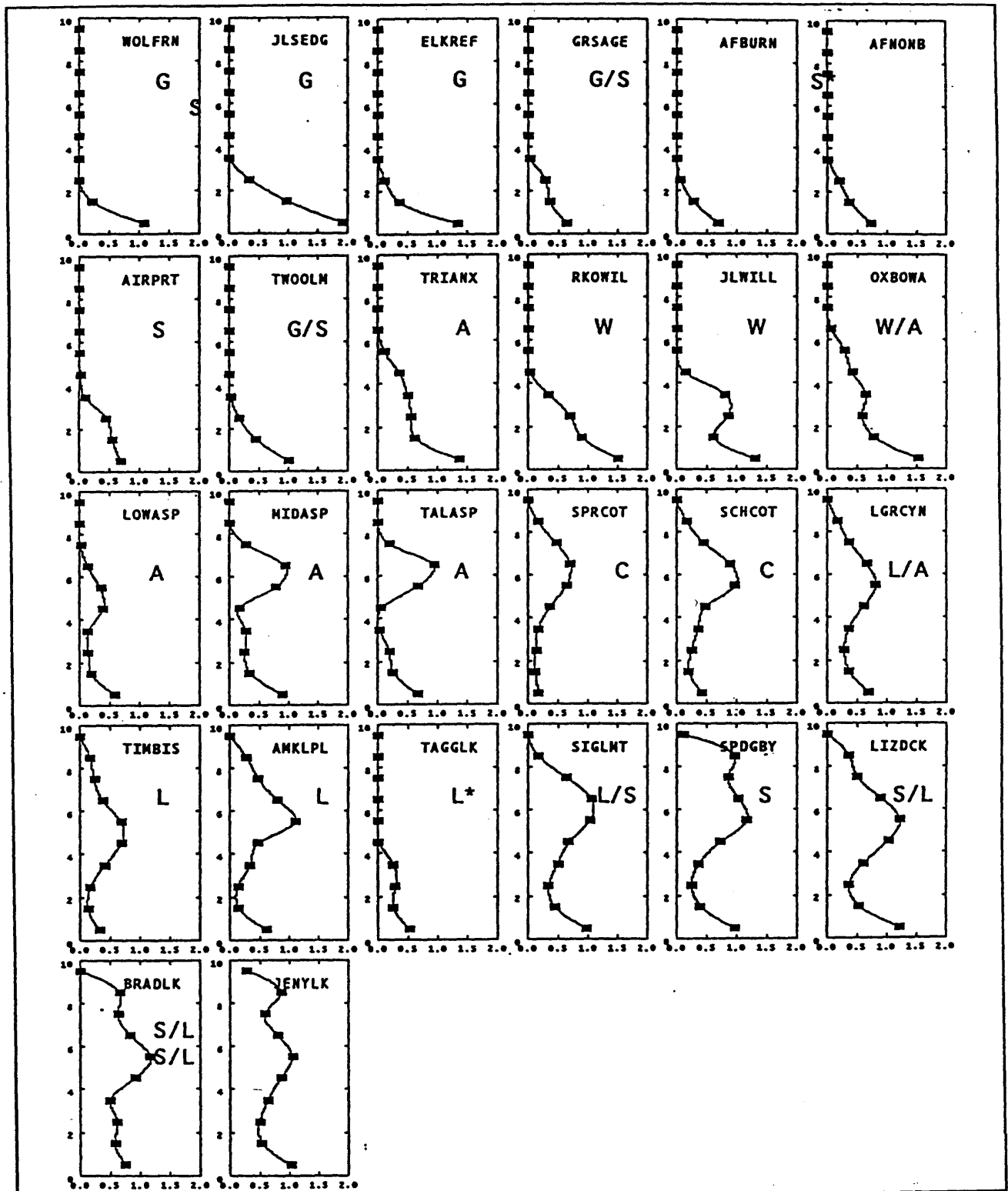


Figure 1. Vegetation profiles of 26 sites in GTNP: Breeding bird monitoring program 1995. Abscissa: Area under foliage profile in height interval; Ordinate: Height intervals above ground as follows: 1 (0-0.3 m); 2 (0.3-0.6 m); 3 (0.6-1.2 m); 4 (1.2-3 m); 5 (3-6 m); 6 (6-10 m); 7 (10-15 m); 8 (15-20 m); 9 (20-30 m); 10 (>30 m). Sites are identified by 6-letter codes, and characterized by general habitat type. Habitat codes: G: grass; S: sage; W: willows; A: aspen; C: cottonwoods; L: lodgepole pine; S: spruce; \*burn site.

birds, and variation in species composition and densities, have been reviewed in detail elsewhere (Cody 1996).

Monitoring sites average 5-6ha in size; each is censused three times per season at different times of day. Census data are entered on a site map, and summarized over the season in terms of species composition and breeding densities (pr/ha). Initial vegetation measurements have been completed at some 26 sites, for which foliage profiles are shown in Fig. 1. Factor analysis of these foliage profiles is depicted in the plane of the first two principal components (accounting for 78% of total variation) in Fig. 2. The first component (abscissa) correlates strongly with profile areas A5-A9, in the vegetation height range 3-30 m, while the second (ordinate) is positively associated with large profile areas in the range 0-3 m (A1-A4). Detailed vegetation monitoring will be conducted at several-year intervals throughout the course of the monitoring program, and at selected sites insect abundances will be measured yearly with the use of Tanglefoot™ boards.

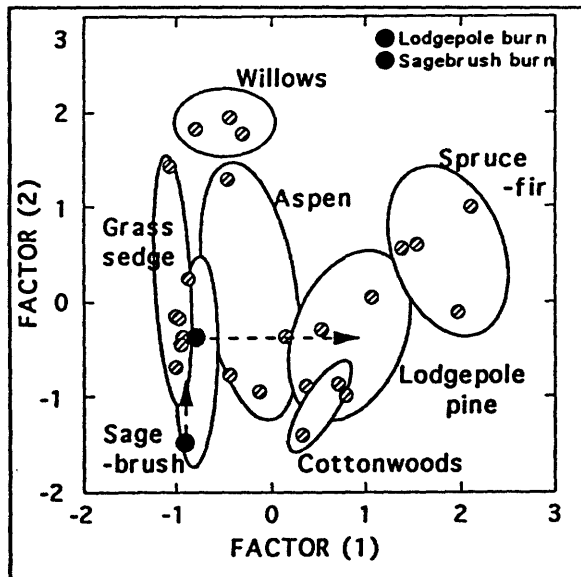


Figure 2. Factor analysis of vegetation profile data shown in Fig. 1. First two principal components (shown) account for 78% of the total variance. Broad habitat categories are delineated. Two burn sites (solid dots) are shown; with arrows showing likely succession trajectories.

#### BREEDING BIRD DIVERSITY AND DENSITY

Around 125 bird species breed in or are monitored at the 29 sites established to date. Breeding birds number in the range of 10-20 species in the grassland and sagebrush sites, and uniformly in the range of 20-30 species over a broad habitat

range from willows and aspen through cottonwoods to coniferous forests (Fig. 3a). The figures for total breeding bird densities (pr/ha) follows the same pattern (Fig. 3b), with grassland and sagebrush sites supporting 1-5 pr/ha and the great majority of other sites 5-10 pr/ha. The exception sites (upper center of figure) with >10 pr/ha are wetter willows or willow-aspen habitats. Species numbers are more strongly correlated ( $r = 0.54$ ) with factor (1), which is closely related to vegetation height or stature, while bird density correlates better ( $r = 0.42$ ) with factor (2), suggesting higher bird density in sites with denser vegetation in the height interval 0-3 m. Single-factor correlations are weak in both plots, however, indicating substantial variation and non-linearity.

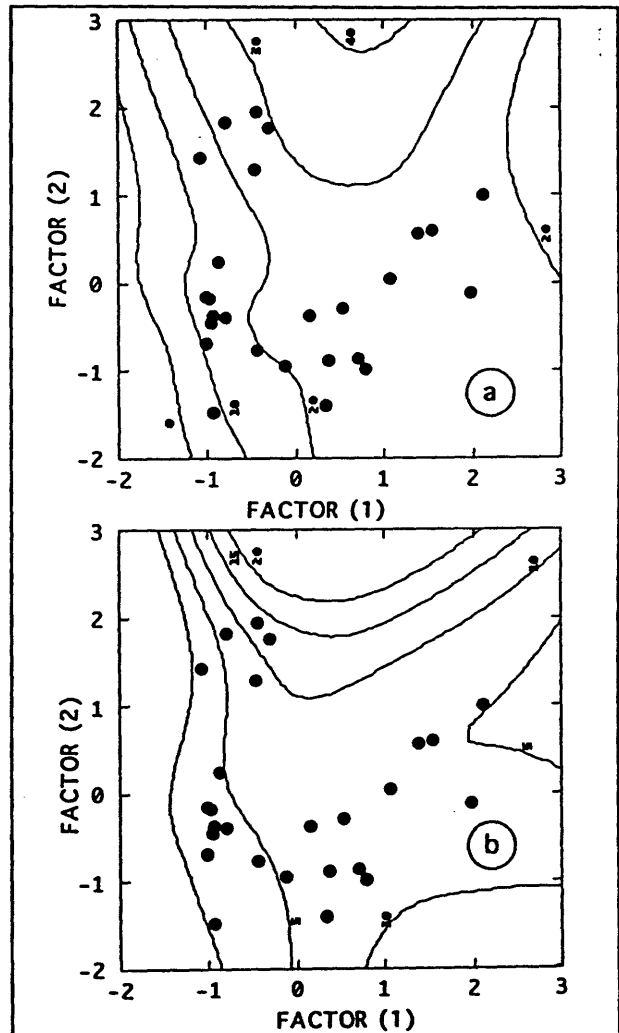


Figure 3. a. Contour plot (DWLS algorithm) of number of breeding species at monitoring sites. b. Similar plot of total breeding bird density at monitored plots. Note that species number and total density are obviously covariant, but the former correlates more strongly with Factor (1), the latter with Factor (2).

### SPECIES DISTRIBUTION OVER SITES; TURNOVER AND HABITAT SPECIFICITY

Some breeding bird species are widely distributed over sites, while others are narrowly restricted in their use of habitat. Some of this variation is illustrated in Fig. 4, using two groups of ecological similar species, the small foliage-gleaning insectivores ("warblers" - Parulidae, Vireonidae, Sylviidae; Fig. 4a), and the smaller, largely ground-foraging "sparrows" (Fig. 4b). Some warblers are relatively restricted in habitat usage, e.g. Common yellowthroat to low, scrubby willows, Orange-crowned warbler to tall willow or low aspen, and Northern waterthrush to the single wet willows site. Others, such as Warbling vireo and MacGillivray's warbler, range from tall willow through aspen and cottonwoods into coniferous forest. While Ruby-crowned kinglet is rather widely distributed from aspen and cottonwood with a few conifers interspersed through conifers of all sorts, it's close relative, the Golden-crowned kinglet is restricted to the tallest spruce-fir forest.

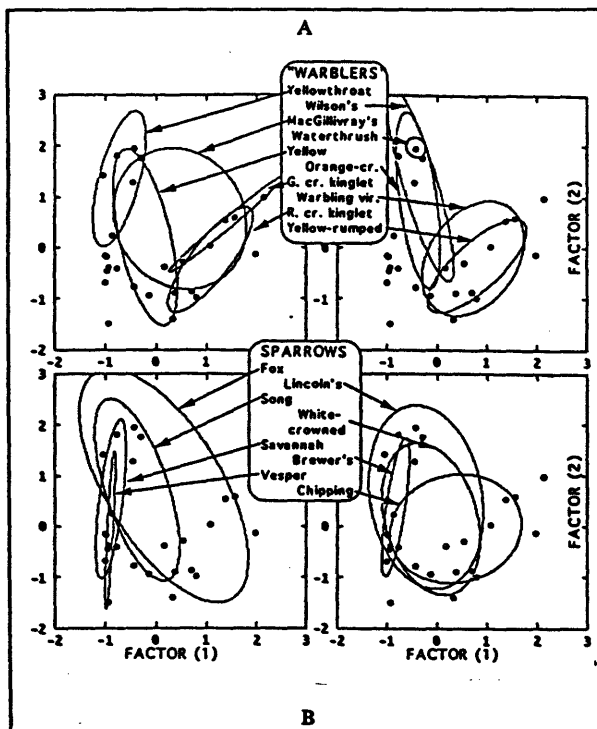


Figure 4. Distribution of various GTNP breeding bird species, roughly grouped into foliage insectivore ("warbler", A) and small groundforager ("sparrow", B) guilds. Axes as in Figs. 2 and 3. Species distributions are represented by 50% confidence ellipses. See text for discussion.

The sparrows (*Emberizidae*) of Fig. 4b show a similar diversity of habitat use, and are in

general more widely distributed than are the foliage insectivores. The more broadly distributed species, Fox, Lincoln's and White-Crowned sparrows, occupy habitat from tall sagebrush (White-crowned, Chipping sparrows) and lower willows (Fox, Lincoln's sparrows) through a wide range of woodland and forest, as long as the taller habitat has a shrubby understory. Song sparrows occupy a range of wetter sites, as long as willows or low aspen are present, but unlike the foregoing four species does not occur in shrub patches within forest. Brewer's sparrow is strictly a sagebrush specialist; Savannah sparrow occurs in all grassland sites, with or without scattered sagebrush, and Vesper sparrow is somewhat intermediate between these two in habitat preference.

Habitat preferences of some species appear directly related to conditions extant in any one year (with extremes of "warm/dry" versus "cool/wet"), and others are likely indirectly affected, perhaps via food supplies, by the same sorts of climatic variations among years. It is expected that habitat ranges will therefore vary among years, and such variation ultimately will be detectable in our extended data set. With more data in hand, the factorial plane might be contoured for species turnover, or  $\beta$ -diversity, to quantify the rate at which species are replaced over the plane in various trajectories.

### REGIONAL PERSPECTIVE: WILLOWS OUTGROUP HABITAT

Our GTNP wet willows site (Site #10: Jackson Lake Junction) is one at which breeding bird observations have been made for nearly half a century (dating from Salt's work in the early 1950's). This habitat type was selected to sharpen our regional perspective on interyear changes in breeding bird density, and the site has been replicated as nearly as possible at two locations outside GTNP. Willows monitoring sites have been established at Rocky Mountain National Park (RMNP) and at Glacier National Park (LNP), sites around 800 km respectively SE and NNW of GTNP. At RMNP, the willows site is located near Onahu Creek at the SW corner of the park (Site #10S), and at GNP near Coonsa Creek (Site #10N) near the SE corner of the park, each selected for the structural similarity of its willows vegetation to that at GTNP site #10.

Breeding bird species in these three willows sites are basically similar, although over this range of latitude there are differences both in species composition and in relative and absolute abundances. These similarities and differences are represented in Table 1, which lists core willows species in several guilds along with breeding density data. Note that there are both species turnovers and density trends in certain species that progress north to south; in some guilds, ecological equivalent species (Veery to Swainson's thrush, Rufous to Calliope to Broad-tailed hummingbird) are substituted among sites. Overall, species numbers are higher in GNP, but densities are higher at GTNP, although insufficient data are at hand to confirm these differences as generalizations. Whether or not the commonest breeding species change in density among years in synchrony or otherwise among sites is a question that will be answered following extended monitoring studies.

## ✦ LITERATURE CITED

- Cody, M.L. 1994. Monitoring breeding bird populations in Grand Teton National Park. UW-NPS 18th Annual Report 1994: 42-45.
- Cody, M.L. 1996. Bird communities in the Central Rocky Mountains. Ch. 11 In Cody, M.L., & J.A. Smallwood (eds.), *Long Term Studies of Vertebrate Communities* Academic Press, Orlando, FL.

Table 1. Comparison of breeding birds in three wet willows sites: Grand Teton National Park, Rocky Mountain National Park, and Glacier National Park. Core species are listed (those not water-dependent with territories at least potentially entirely within census plots). GTNP data are 6y averages; RMNP data 1995; GNP data are 1996. \*indicates occasional breeder; \*\* regular forager.

Species	GNP 10ha	GTNP 3.5ha	RMNP 6.5ha
<b>FOLIAGE INSECTIVORES: "PARULID" GUILD</b>			
American redstart	0.10	0	0
Orange-crowned warbler	0.10	0	0
Warbling vireo	0.04	*	0
Northern waterthrush	0.60	0.06	0
MacGillivray's warbler	0.15	0.09	0
Yellow warbler	1.80	2.249	0.12
Common yellowthroat	0.60	2.35	0.15
Wilson's warbler	0.10	1.01	0.73
Marsh wren	0	0.11	0.12
<b>SMALL LOW/GROUND FORAGERS: "EMBERIZID" GUILD:</b>			
American goldfinch	0.05	*	0
Savannah sparrow	0.10	0.05	0.08
Song sparrow	0.50	1.43	0.15
Lincoln's sparrow	0.30	1.20	0.92
White-crowned sparrow	0.08	0.75	0.15
Fox sparrow	0.20	1.03	0.12
Clay-colored sparrow	0	*	0
Black-headed grosbeak	0	*	0
<b>LARGE GROUND FORAGERS: "TURDID" GUILD</b>			
Veery	0.25	0	0
Gray catbird	0.15	*	0
American robin	0.15	**	0.12
Swainson's thrush	0	0.05	0.04
<b>AERIAL FLYCATCHERS</b>			
Willow flycatcher	0.33	0.45	0.23
Dusky flycatcher	0	0	0.08
Mountain bluebird	0	0	0.04
<b>NECTARIVORES</b>			
Rufous hummingbird	0.10	0	0
Calliope hummingbird	0	0.45	0
Broad-tailed hummingbird	0	*	0.19
<b>CORE SPECIES:</b>			
CORE DENSITY:	5.7	11.5	3.3
TOTAL SPECIES:	29	26	25
TOTAL DENSITY:	7.0	15.7	3.4