

Study



Berry, Mark

16 December 1996

Mark Berry

Habitat use by breeding birds in foothills shrub habitats: Effects of shrub structure, shrub species composition, landscape setting, and recreational trails.

Annual Report: City of Boulder, Open Space Dept. & Div. of Mountain Parks

Abstract:

Foothills shrub in the northern Colorado Front Range is an understudied habitat which appears to be important to breeding birds. This report describes progress made during the first year of a two-year study addressing patterns of habitat use by breeding songbirds in foothills shrub habitats. Specifically, the influences of shrub structure, shrub species composition, habitat context, and recreational trails on breeding songbirds are being examined. Eighty-four study sites in northern Jefferson County and Boulder County are stratified between locations proximal to and remote from recreational trails. I measured vegetation structure and species composition and censused breeding birds in the 1996 season, and will repeat point counts in 1997. I will evaluate habitat context using aerial photographs. I observed 58 bird species within 50 m of plot centers. Several species observed are largely restricted to shrub habitats, including both locally abundant species such as the Spotted Towhee (*Pipilo maculatus*) and others which are locally uncommon, such as Gray Catbirds (*Dumetella carolinensis*). Preliminary results suggest significant correlations between detectability of common species and habitat variables. This research will provide basic information on the breeding avifauna of foothills shrub and will contribute to scientific understanding of patterns of habitat use by breeding birds.

Objectives:

1. Describe the breeding avifauna of foothills shrub habitats in Boulder County and northern Jefferson County.
2. Describe patterns of habitat use by breeding birds in foothills shrub habitats, including the roles of:
 - Habitat structural variables
 - Shrub species composition
 - Landscape setting (habitat context)
 - Recreational trails

BERRY

utilizing a habitat will be partially determined by structural features of the habitat (MacArthur & MacArthur, 1961; Roth, 1976; Willson, 1974). On a local scale, vegetation species composition may be more important than structural variables in affecting avian community structure within a particular habitat type (Rotenberry, 1985; Tomoff, 1974).

Patches of otherwise similar habitats that occur in different landscape settings may be utilized by different bird species. Small and highly isolated habitat islands typically support fewer species than large islands and islands near a mainland area (MacArthur & Wilson, 1967), and the species that are absent from small habitat islands are not a random subset of the regional species pool (e.g., Bolger, et al, 1991; Møller, 1987; Nilsson, 1986). Habitat context may be an important factor affecting either the habitat quality or the tendency of birds to disperse into the patch (Harris, 1984; Rosensweig, 1995).

The activities of humans may directly affect avian behavior, reproduction, and habitat use (Gutzwiller, et al, 1994; Grubb & King, 1991; Kaiser & Fritzell, 1984; Klein, 1993; Madsen, 1985; Westmoreland & Betts, 1985). Recreational trails with high levels of use have been shown to reduce occurrence of some songbird species and increase the intensity of nest predation (Miller & Knight, in press).

Progress to Date:

I have established 84 study points in the foothills of the Colorado Front Range, on properties managed by City of Boulder Open Space and Mountain Parks, Boulder County Open Space, and Jefferson County Open Space. Locations of study sites have been provided to City Open Space and Mountain Parks staff. I selected study points by attempting to obtain a representative sample of available shrub habitats, including a variety of shrub species and structural characteristics. Study points are stratified between locations within 100 m of recreational trails (n = 42) and locations greater than 200 m from trails (n = 42). Most points remote from recreational trails are located in properties not currently managed as recreational parks. Study points are separated by a minimum of 200 meters to avoid double-counting individual birds (Ralph, et al, 1993).

I described the habitat at each study plot between 1 July and 1 September 1996. I measured habitat characteristics within a 20 meter radius circle centered on each study point, by establishing 16 sampling points located at 10 m and 20 m from the plot center on each of eight cardinal compass directions. I used the point-centered quarter technique (Cottam & Curtis, 1956) at each vegetation

(unpublished data) recorded gnatcatchers as a common species in his 1995 study of Heil Valley Ranch and Hall Ranch, both in northern Boulder County.

I recorded eight species that are listed by either the Colorado Natural Heritage Program (1996) or the Boulder County Nature Association (Hallock, 1993) as species of concern: Gray Catbird (*Dumetella carolinensis*), Northern Mockingbird (*Mimus polyglottos*), Scrub Jay (*Aphelocoma coerulescens*), Indigo Bunting (*Passerina cyanea*), Chestnut-sided Warbler (*Dendroica pensylvanica*), Bushtit (*Psaltriparus minimus*), Cedar Waxwing (*Bombycilla cedrorum*), and Blue Grosbeak (*Guiraca caerulea*).

As a preliminary investigation into avian response to habitat variables, I used bivariate correlation analyses between 12 habitat variables and detectability of the ten most common bird species. Out of 120 tests, 23 were significant at the .05 level. Detectability of each of the 10 most common bird species was significantly associated with at least one habitat variable (Table 3). Five species were positively correlated with shrub cover, and three of these were also negatively correlated with grass cover. Only the Virginia's warbler (*Vermivora virginiae*) showed a significant (positive) correlation with tree cover. Four species were positively correlated with horizontal heterogeneity, while none showed a negative association with this variable. Spotted towhees were negatively correlated with shrub distance, and Broad-tailed hummingbirds (*Selasphorus platycercus*) were positively correlated with shrub height. Six bird species were significantly correlated with at least one shrub species.

I compared bird species detectability between trail plots and no-trail plots using analysis of variance. Tree cover was significantly greater on trail plots than no-trail plots ($p < 0.05$). To avoid confounding trail effects with the effects of tree cover, I categorized each plot as high tree cover (5 % or greater) or low tree cover (4 % or less), and used two-factor analysis of variance with tree cover and trail presence as independent variables. No bird species were more commonly observed away from trails. The Western Tanager was the only species more commonly observed near trails ($p < 0.005$). Although this result is statistically significant, tanagers were observed on only 12 plots, and I suspect the result is not due to a trail effect. I will conduct an additional investigation into trail effects by testing for correlations between avian detectabilities and distance from recreational trails among the 42 plots within 100 m of trails.

species composition. The role of landscape setting has not yet been analyzed. Preliminary analyses suggest that recreational trails do not decrease occurrence of any bird species breeding in foothills shrub, in contrast to local work in ponderosa pine forest or grassland (Miller & Knight, in press). Occurrence of bird species would be the last measure to show an impact of human disturbance: behavior and nesting success could be negatively impacted by disturbance without altering occurrence patterns.

Foothills shrub in the northern Colorado Front Range is important breeding habitat for several bird species, including locally abundant species (e.g., Spotted Towhee) and locally uncommon species (e.g. Gray Catbird). Foothills shrub habitats in the northern Front Range foothills are limited in extent, especially in their east-west distribution. Conservation of remaining foothills shrub habitats should be a high priority for Open Space managers.

Table 2. Bird species recorded within 50 m of plot centers during three ten-minute point counts at 84 plots.

Code	# of counts	# of plots	Common name
SPTO	224	83	Spotted towhee
BHCO*	104	57	Brown-headed cowbird
LABU	85	53	Lazuli bunting
GTTO	79	44	Green-tailed towhee
BTHU	69	40	Broad-tailed hummingbird
YBCH	71	36	Yellow-breasted chat
VIWA	55	36	Virginia's warbler
BGGN	41	23	Blue-gray gnatcatcher
BBMA	35	23	Black-billed magpie
WEME	32	18	Western meadowlark
AMRO	31	21	American robin
BHGR	21	12	Black-headed grosbeak
HOWR	19	15	House wren
CHSP	18	15	Chipping sparrow
WETA	17	12	Western tanager
DUFL	16	13	Dusky flycatcher
MAWA	16	11	Macgillivray's warbler
AMGO	16	13	American goldfinch
LEGO	16	12	Lesser goldfinch
ROWR	15	7	Rock wren
GRCA	14	9	Gray catbird
SOVI	14	9	Solitary vireo
VESP	14	9	Vesper sparrow
MODO	12	11	Mourning dove
WWPE	11	8	Western wood pewee
STJA	11	9	Steller's jay
MTCH	11	9	Mountain chickadee
WAVI	11	7	Warbling vireo
PISI	10	7	Pine siskin
NOOR	9	8	Northern oriole
HOFI	8	8	House finch
LASP	7	4	Lark sparrow
NOMO	6	5	Northern mockingbird
BRSP	6	6	Brewer's sparrow

Table 3. Significant linear correlations ($p < 0.05$) between detectability of the 10 most commonly observed bird species and 12 habitat variables.

Detectability of:	Positively Corr.:	Negatively Corr.:
SPTO	Shrub cover Horizontal heterogeneity	Grass cover Shrub distance Hawthorn
BHCO	Shrub cover Horizontal heterogeneity Shrub height	Wild plum
LABU	Wild plum	-
GTTO	Shrub cover	-
BTHU	Wild plum Horizontal heterogeneity	Mountain mahogany
YBCH	Shrub cover Horizontal heterogeneity	Grass cover
VIWA	Tree cover	-
BGGN	Shrub cover	Grass cover
BBMA	-	Mountain mahogany
WEME	Grass cover Skunkbrush	Shrub cover

- Wildlife Society Bulletin 21: 31-39.
- MacArthur, R. H. and J. W. MacArthur. 1961. On bird species diversity. Ecology 42: 594-8.
- MacArthur, R. H., and E. O. Wilson. 1967. The theory of island biogeography. Princeton Univ. Press, Princeton, NJ.
- Madsen, J. 1985. Impact of disturbance on field utilization of pink-footed geese in West-Jutland, Denmark. Biological Conservation 33:53-63.
- Miller, S. G. & R. L. Knight. In press. Recreational trails and bird communities. Journal of Wildlife Management.
- Møller, A.P. 1987. Breeding birds in habitat patches: random distribution of species and individuals? Journal of Biogeography 14: 225-36.
- Nilsson, S. G. 1986. Are bird communities in small biotope patches random samples from communities in large patches? Biological Conservation 38: 179-204.
- Ralph, C. J., G. R. Geupel, P. Pyle, T. E. Martin, & D. F. DeSante. 1993. Handbook of field methods for monitoring birds. USDA Forest Service Gen. Tech. Rep. PSW-GTR-144.
- Ralph, C. J. & J. M. Scott. 1981. Estimating numbers of terrestrial birds. Studies in Avian Biology No. 6, Cooper Ornithological Society.
- Rosensweig, M. L. 1995. Species diversity in space and time. Cambridge Univ. Press, Cambridge.
- Rotenberry, J. T. 1985. The role of habitat in avian community composition: physiognomy or floristics? Oecologia 67: 213-7.
- Roth, R. R. 1976. Spatial heterogeneity and bird species diversity. Ecology 57: 773-82.
- Tomoff, C. S. 1974. Avian species diversity in desert scrub. Ecology 55: 396-403.
- Verner, J. & L. V. Ritter. 1986. Hourly variation in morning point counts of birds. Auk 103:117-24.
- Vestal, A. G. 1917. Foothills vegetation in the Colorado Front Range. Bot. Gazette 68: 153-193.
- Westmoreland, D. & L. B. Best. 1985. The effect of disturbance on Mourning Dove reproductive success. Auk 102: 774-80.
- Willson, M. F. 1974. Avian community organization and habitat structure. Ecology 55: 1017-29.

OSMP Locations

Agency	Plot	Latitude	Longitude	Elevation (m)
City MP	CH 1	39 ° 59' 48.959 "	105 ° 17' 27.072 "	1781
City MP	CH 2	39 ° 59' 35.803 "	105 ° 17' 18.47 "	1834
City MP	CH 3	39 ° 59' 26.373 "	105 ° 17' 15.269 "	1830
City MP	CH 4	39 ° 59' 38.235 "	105 ° 16' 52.778 "	1789
City MP	CH 5	39 ° 59' 32.693 "	105 ° 16' 50.449 "	1780
City MP	CH 6	39 ° 59' 18.715 "	105 ° 16' 52.124 "	1802
City MP	CH 7	39 ° 59' 50.466 "	105 ° 17' 10.386 "	1755
City MP	NC 1	39 ° 58' 35.459 "	105 ° 17' 1.182 "	1849
City MP	NC 2	39 ° 58' 44.423 "	105 ° 17' 0.066 "	1879
City MP	NC 3	39 ° 59' 7.245 "	105 ° 16' 44.964 "	1766
City OS	CC 1	39 ° 55' 8.481 "	105 ° 14' 2.247 "	1794
City OS	CC 2	39 ° 55' 15.195 "	105 ° 13' 47.321 "	1811
City OS	DD 1	39 ° 55' 30.957 "	105 ° 15' 11.105 "	1832
City OS	DD 2	39 ° 55' 21.572 "	105 ° 15' 22.92 "	1830
City OS	DD 3	39 ° 55' 7.079 "	105 ° 15' 32.76 "	1830
City OS	DD 4	39 ° 54' 31.703 "	105 ° 16' 14.177 "	1894
City OS	DD 5	39 ° 54' 14.889 "	105 ° 16' 20.389 "	1954
City OS	DD 6	39 ° 54' 38.232 "	105 ° 16' 2.079 "	1870
City OS	MM 1	39 ° 57' 15.858 "	105 ° 12' 58.073 "	1696
City OS	MM 2	39 ° 57' 7.623 "	105 ° 13' 15.243 "	1688
City OS	MM 3	39 ° 56' 59.186 "	105 ° 13' 32.583 "	1708
City OS	MM 4	39 ° 56' 54.617 "	105 ° 13' 49.613 "	1728
City OS	MS 1	40 ° 1' 30.432 "	105 ° 17' 45.268 "	1710
City OS	MS 2	40 ° 1' 40.536 "	105 ° 17' 53.28 "	1751
City OS	MS 3	40 ° 1' 51.542 "	105 ° 17' 49.421 "	1769
City OS	SM 1	39 ° 56' 30.565 "	105 ° 15' 43.877 "	1727
City OS	SM 2	39 ° 56' 38.906 "	105 ° 16' 23.039 "	1816
City OS	SM 3	39 ° 56' 34.887 "	105 ° 16' 47.892 "	1894
City OS	SM 4	39 ° 56' 19.217 "	105 ° 16' 52.72 "	1859
City OS	SM 5	39 ° 57' 8.189 "	105 ° 16' 48.08 "	1899
City OS	SM 6	39 ° 57' 7.074 "	105 ° 16' 28.407 "	1847
City OS	SM 7	39 ° 56' 57.84 "	105 ° 16' 11.564 "	1795
City OS	SM 8	39 ° 57' 3.218 "	105 ° 15' 55.744 "	1759
City OS	WL 1	40 ° 3' 38.194 "	105 ° 17' 52.128 "	1825
City OS	WL 2	40 ° 3' 26.386 "	105 ° 17' 52.817 "	1808
City OS	WL 3	40 ° 3' 1.366 "	105 ° 17' 55.245 "	1796

