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Habitat Use by Breeding Birds at the Nation
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Study 
Stephen R. Jones
~~October 30, 1993~~

HABITAT USE BY BREEDING BIRDS
AT
THE NATIONAL CENTER FOR ATMOSPHERIC RESEARCH

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1197B Bear Mountain Dr.
Boulder, CO 80303

October 30, 1993

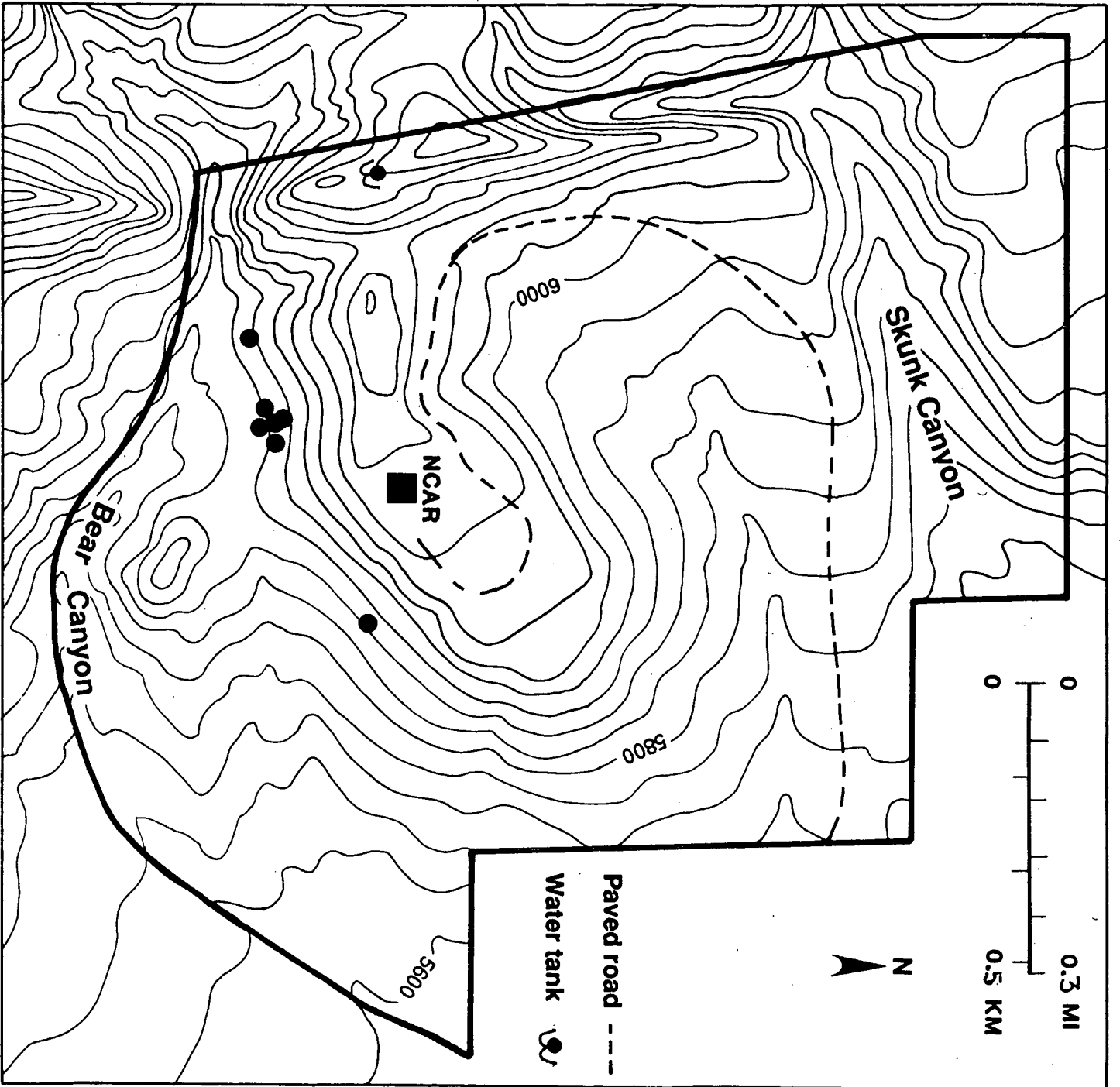


Figure A. Marmot Sightings. Each dot represents one marmot on one survey.

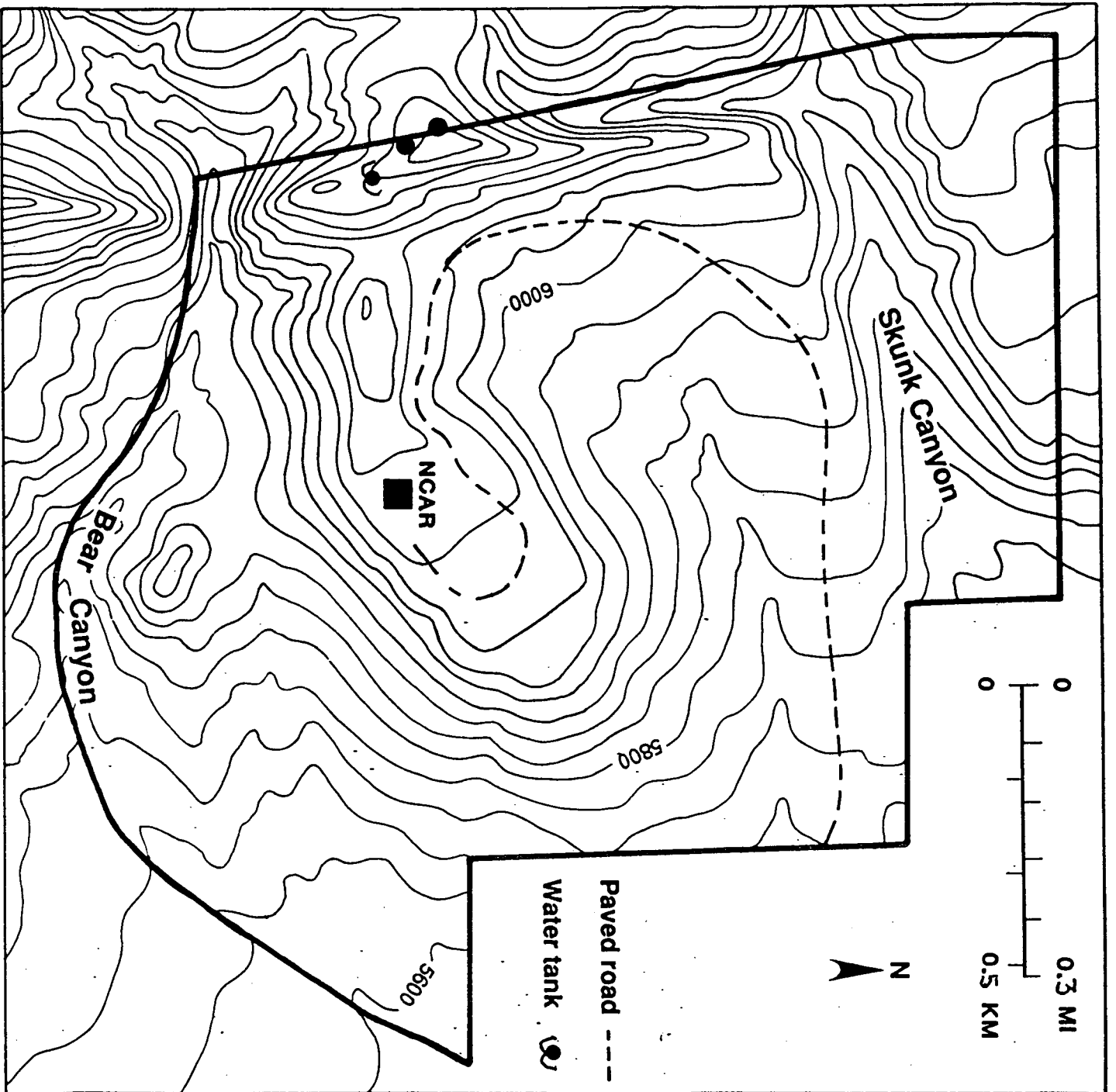


Figure B. Abert's Squirrel Sightings. Each dot represents one squirrel on one survey.

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SUMMARY

At the request of the City of Boulder Open Space Department, a one season breeding bird study was conducted at the National Center for Atmospheric Research (NCAR). Eight, 2 ha breeding bird plots were sampled five times each between 15 May and 30 June, 1993. Walking surveys were conducted throughout the breeding season over the remainder of the property.

A total of 73 avian species were observed on the NCAR property during the 1993 breeding season. Of these, 28 species definitely nested on the property, and another 19 species showed strong evidence of nesting. Eight of the species observed at NCAR are included on the Boulder County Avian Species of Special Concern list (Boulder County Parks and Open Space Department 1993): sharp-shinned hawk, Cooper's hawk, golden eagle, prairie falcon, common nighthawk, scrub jay, gray catbird, and northern mockingbird. Nesting locations for these species of special concern were mapped, and management recommendations are included in this report.

Breeding bird densities in the four major terrestrial habitats at NCAR were compared with breeding bird densities recorded in similar habitats on City of Boulder Open Space by Thompson and Strauch (1986) and in the Boulder Mountain Park by Jones (1989). Mean breeding bird density for the two foothill shrubland plots in lower Skunk Canyon (12.4 individuals/ha) was significantly higher than mean breeding bird density in shrubland plots throughout City

of Boulder Open Space (6.4 individuals/ha). Mean breeding bird density for the two plots located in coniferous forest on NCAR Mesa (5.8 individuals/ha) was slightly lower than mean breeding bird density on coniferous forest plots throughout City of Boulder Open Space (8.1 individuals/ha). Mean breeding bird density in the two riparian woodland plots in lower Bear Canyon (3.6 individuals/ha) was significantly lower than mean breeding bird density in riparian woodland plots throughout City of Boulder Open Space (10.3 individuals/ha). Mean breeding bird density in two grassland plots located in the NCAR Meadow (1.1 individuals/ha) was also significantly lower than mean breeding bird density in grassland plots throughout City of Boulder Open Space (3.3 individuals/ha).

The extraordinarily rich breeding avifauna of lower Skunk Canyon corresponds with a relatively luxuriant growth of shrubs and small deciduous trees along lower Skunk Creek. Human activities that would damage or remove vegetation from this area should be avoided. The relatively depauperate breeding bird populations in NCAR Meadow and along lower Bear Creek may result in part from the disturbed nature of these habitats. Management strategies that encourage the growth of native vegetation and discourage human disturbance in these areas should benefit breeding bird populations.

STUDY AREA

The National Center for Atmospheric Research property is located approximately 5 km south of downtown Boulder at the base of Green Mountain (Figure 1). The property, approximately 2.5 km², is bounded to the south by Bear Creek, to the east by the Table Mesa subdivision, to the north by Enchanted Mesa, and to the west by the interface between the Dakota Hogback and the Morrison formation at the base of Green Mountain. Elevations range from approximately 1700 m in Bear Canyon to approximately 1880 m along the Dakota Hogback near the west property boundary.

The study area lies within the Foothills, or Transition, Life Zone (Mutel and Emerick 1992). Mean annual precipitation is approximately 45 cm, with nearly 40% of the moisture falling during April, May, and June. Mean annual snowfall is approximately 200 cm, with the heaviest snows typically occurring in March and April. Mean July temperature is 20^o C, and mean January temperature is 0^o C (Marr 1961, Barry 1973).

The most prominent physiological feature within the study area is the NCAR Mesa, a remnant of an ancient erosion surface along the east slope of the Rocky Mountains. The top of the mesa and the crest of the Dakota Hogback to the west are covered by scattered groves of ponderosa pine (Pinus ponderosa). The sides of the mesa are covered by mixed grasses, scattered shrubs, and a few ponderosa pines. Riparian woodland, dominated by cottonwoods (Populus sp.) and willows (Salix sp.), and with a mixed shrub understory, occurs

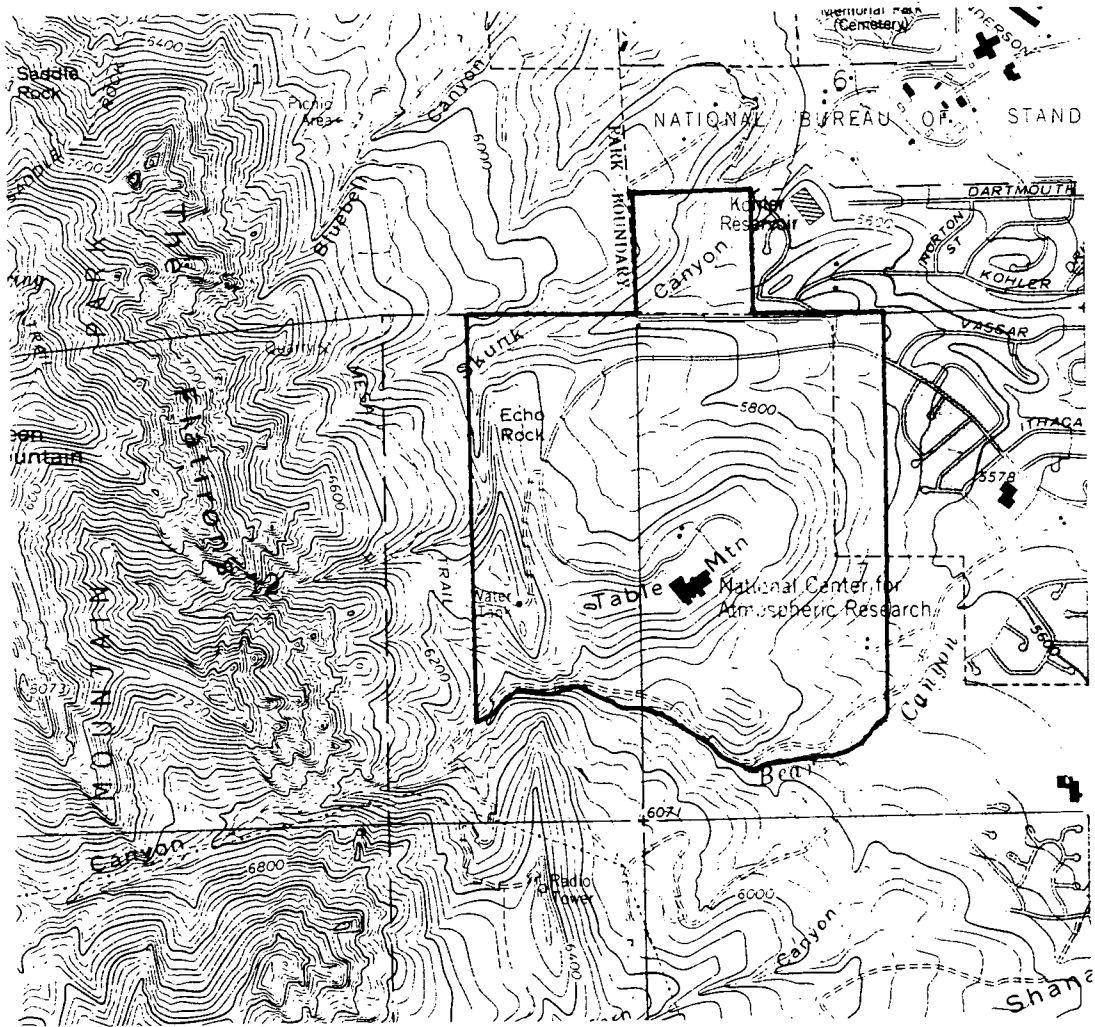


Figure 1. Study Area

along Bear Creek. Foothills shrubland, dominated by chokecherry (Padus virginiana), wild plum (Prunus americana), hawthorn (Crataegus spp.), skunkbrush (Rhus trilobata), and other mixed shrubs occurs along Skunk Creek.

During construction of the NCAR lab in 1963-67, much of the native vegetation on top of the mesa and some of the vegetation in the meadow north of the mesa was removed or disturbed, and the disturbed area was reseeded with a mixture containing non-native grasses (NCAR archives, 1963-87). Vegetation in lower Bear Canyon was disturbed by construction of a wagon road during the late nineteenth century and a service road for a microwave tower during the 1960's. A one lane gravel road, constructed in 1965 to service a small pump station, crosses the south slope of Skunk Canyon. The entire study area was grazed by cattle until the late 1960's. Numerous trails throughout the study area receive heavy use from hikers and joggers.

METHODS

Sampling methods for breeding bird plots followed Thompson and Strauch (1986), Habitat use by Breeding Birds on City of Boulder Open Space. Four major terrestrial habitats were identified on the NCAR property: coniferous forest, grassland, riparian woodland, and foothills shrubland. Habitats were mapped and divided into 2 ha (200 m by 100 m) cells. Cells were numbered, and a random numbers table was used to select two cells within each habitat type for sampling. Plots were oriented medially along the cell's long axis (see Figure 2). Each of the eight plots was sampled five times between 15 May and 30 June. I walked along the medial axis of each plot recording all birds seen or heard within the plot boundary during a 15 minute period. Surveys were conducted between sunrise and 0800 hours. Species richness of each plot was defined as the mean number of species seen or heard per count. Breeding bird density was defined as the mean number of individuals, excluding young of the year, seen or heard per count.

Additional surveys were conducted between 15 May and 15 July to search for breeding birds on the remainder of the NCAR property. I conducted five walking surveys along the length of lower Skunk Creek, lower Bear Creek, and along the top of NCAR Mesa. During all surveys, behavior of birds was noted. Birds were classified as possible breeders, probably breeders, or confirmed breeders based on their observed behaviors and their affinity for potential breeding habitat.

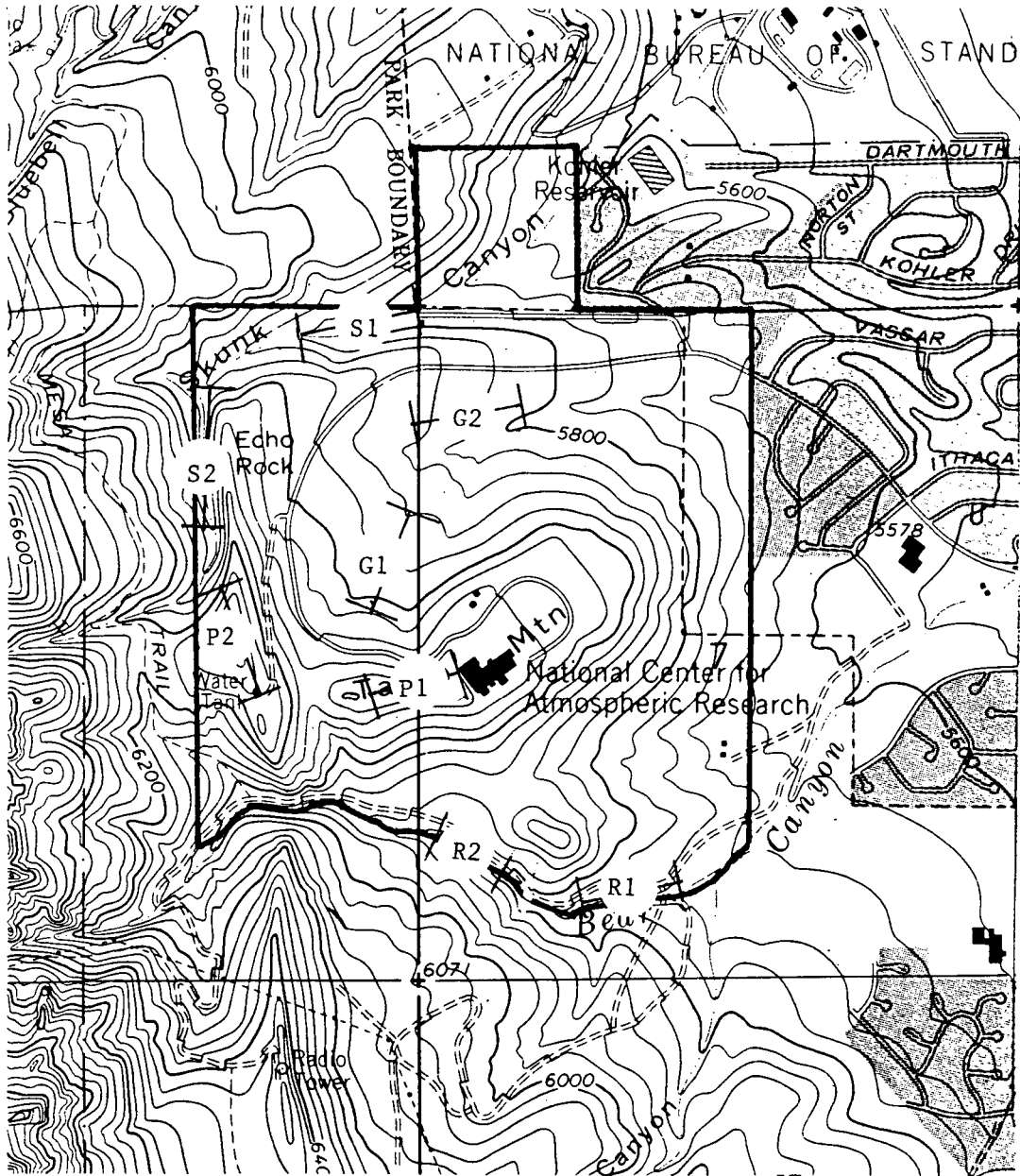


Figure 2. Plot Locations.
See Appendix C for plot descriptions.

"Possible breeders" were those seen or heard in appropriate breeding habitat. "Probable breeders" were those species showing strong indications of breeding, such as territorial defense or courtship. "Confirmed breeders" were species showing evidence of nesting, such as a nest with eggs or young (see Appendix A for a complete list of breeding codes).

Locations of known raptor nests within 3 km of the NCAR property and of known nests of "species of special concern" (Boulder County Parks and Open Space Department 1993) were mapped on 7-1/2 minute topographic maps. Data generated by this study were supplemented by data from previous studies (Thompson and Strauch 1986, Jones 1989, 1991, Figgs and Lederer 1991, Boulder County Audubon Society 1975-93).

BREEDING BIRD POPULATIONS

A total of 73 species were seen or heard on the NCAR property between 15 May and 30 July, 1993 (Table 1). Of this total, 28 species definitely nested on the property (confirmed breeders), 19 species probably nested on the property (probable breeders), 18 species may have nested on the property (possible breeders), and 8 species were nonbreeders on the property (observed species).

The list of possible breeders includes several species that are known to nest in the Boulder Mountain Park, to the west of NCAR. Cooper's hawks have nested on Dinosaur Mountain, 1 km southwest of Echo Rock (Weinberg 1987). White-throated swifts and American crows nest in the Flatirons (Jones 1989). Possible breeders also include birds that are on the edge of their historic nesting range. Northern mockingbirds are fairly common in eastern Colorado, but they are considered rare or casual nesters along the northern Front Range (Boulder County Parks and Open Space 1993). Red crossbills nest in Rocky Mountain coniferous forests, usually at higher elevations than NCAR (Andrews and Righter 1992). These species may occasionally nest at NCAR, but they shouldn't be expected to breed or even to be seen every year.

Table 1. 1993 Breeding Season Sightings

Habitat Codes: B--Buildings, G--Grassland, N--Cliffs and Canyons,
P--Ponderosa Pine Forest, R--Riparian Woodlands, S--Shrublands

Breeding Codes: Ob--Observed nonbreeder, Po--Possible Breeder, Pr--Probable
Breeder, Cf--Confirmed Breeder

Abundance Codes: 1. One breeding pair
2. 2-10 breeding pairs
3. 11-100 breeding pairs
4. More than 100 breeding pairs

Species	Habitat	Abundance	Status	Breeding Behavior
Mallard	R	1	Po	Pair
Sharp-shinned Hawk	R	1	Po	Seen
Cooper's Hawk	P	1	Po	Seen
Red-tailed Hawk	P	1	Po	Seen
Golden Eagle	---	---	Ob	Seen
American Kestrel	R	1	Po	Seen
Prairie Falcon	---	---	Ob	Seen
Rock Dove	P	2	Po	Seen
Mourning Dove	P,R	2	Cf	Occupied nest
Great Horned Owl	P	1	Pr	Pair
Common Nighthawk	P	1	Po	Seen
White-throated Swift	P	---	Po	Seen
Broad-tailed Hummingbird	R,S	3	Cf	Feeding young
Northern Flicker	P,R	2	Cf	Occupied nest
Western Wood-Pewee	P	2	Cf	Feeding young
Dusky Flycatcher	R	2	Pr	Territory

¹See Appendix A for explanation of breeding codes.

Table 1. (Continued)

Species	Habitat	Abundance	Status	Breeding Behavior
Cordilleran Flycatcher	P	2	Pr	Territory
Say's Phoebe	B	1	Cf	Occupied nest
Tree Swallow	---	---	Po	Seen
Violet-green Swallow	P	2	Cf	Nest with young
Barn Swallow	B	2	Cf	Occupied nest
Steller's Jay	P,R	2	Cf	Feeding young
Blue Jay	R	1	Po	Seen
Scrub Jay	S	2	Cf	Nest with young
Black-billed Magpie	P,R	2	Cf	Occupied nest
American Crow	P	---	Po	Seen
Common Raven	---	---	Ob	Seen
Black-capped Chickadee	R	2	Cf	Feeding young
Mountain Chickadee	P	2	Cf	Feeding young
Plain Titmouse	S	---	Ob	Singing male, 7/5
Red-breasted Nuthatch	P	2	Pr	Territory
White-breasted Nuthatch	P	2	Pr	Territory
Pygmy Nuthatch	P	2	Cf	Occupied nest
Rock Wren	N	1	Po	Seen
Canyon Wren	N	1	Pr	Territory
House Wren	P,R,S	3	Cf	Feeding young
Ruby-crowned Kinglet	P	---	Ob	Singing male
Blue-gray Gnatcatcher	R,S	---	Po	Singing male, 5/16
Western Bluebird	P	1	Cf	Nest with young

Table 1. (Continued)

Species	Habitat	Abundance	Status	Breeding Behavior
Mountain Bluebird	G	---	Ob	Seen
Townsend's Solitaire	P	1	Pr	Territory
American Robin	P,R,S	3	Cf	Fledged young
Gray Catbird	S	2	Cf	Feeding young
Northern Mockingbird	P	---	Po	Singing male, 7/6
Starling	B,R	2	Po	Seen
Solitary Vireo	P	2	Pr	Territory
Warbling Vireo	R	2	Pr	Territory
Orange-crowned Warbler	R,S	---	Ob	Singing male, 5/16
Virginia's Warbler	P,S	2	Pr	Multiple males
Yellow Warbler	R	2	Pr	Territory
Yellow-rumped Warbler	P	2	Pr	Territory
MacGillivray's Warbler	R,S	2	Pr	Territory
Prairie Warbler	R	---	Ob	Singing male, 6/11
Yellow-breasted Chat	S	3	Cf	Feeding young
Western Tanager	P	2	Pr	Pair
Black-headed Grosbeak	P,R,S	3	Cf	Feeding young
Lazuli Bunting	R,S	3	Cf	Fledged young
Indigo Bunting	S	1	Pr	Territory
Green-tailed Towhee	P,R,S	2	Cf	Fledged young
Rufous-sided Towhee	R,S	3	Cf	Fledged young
Chipping Sparrow	P	3	Cf	Feeding young
Vesper Sparrow	G	2	Po	Singing males

Table 1. (Continued)

Species	Habitat	Abundance	Status	Breeding Behavior
Song Sparrow	R	1	Po	Singing male
Gray-headed Junco	P	2	Pr	Territory
Western Meadowlark	G	3	Cf	Fledged young
Common Grackle	R	2	Cf	Fledged young
Brown-headed Cowbird	P,R,S	3	Pr	Pair
Northern Oriole	R	2	Cf	Nest with young
House Finch	R,S	2	Pr	Pair
Red Crossbill	P,R	---	Po	Seen
Pine Siskin	P,R	3	Pr	Territory
Lesser Goldfinch	P,R	3	Cf	Fledged young
House Sparrow	S	2	Cf	Fledged young

A total of 47 species were observed in the eight breeding bird plots during the 1993 breeding season (Table 2). Most abundant species, in order of abundance, were rufous-sided towhee, broad-tailed hummingbird, pine siskin, yellow-breasted chat, and black-headed grosbeak. Least abundant species (seen only once in one plot) were mourning dove, northern flicker, barn swallow, scrub jay, common raven, plain titmouse, Swainson's thrush, yellow-rumped warbler, prairie warbler, song sparrow, gray-headed junco, and house finch.

Mountain shrubland plots (S1 and S2) had the highest mean breeding bird densities (12.8 and 11.6 species/29.8 and 19.8 individuals). These values are significantly higher than mean values for mountain shrubland plots sampled throughout City of Boulder Open Space by Thompson and Strauch (see Table 3).

Ponderosa pine forest plots (P1 and P2) ranked second in species richness (6.0 and 8.0 species) and breeding bird density (10.8 and 12.2 individuals). These values are lower than the mean values reported by Thompson and Strauch for coniferous forest plots throughout City of Boulder Open Space.

Riparian plots (R1 and R2) ranked third in species richness (4.6 and 5.8 species) and breeding bird density (6.6 and 7.8 individuals). In contrast, Thompson and Strauch reported mean values for 16 riparian plots throughout City of Boulder open space of 9.2 species/plot and 20.6 individuals/plot. None of the riparian plots sampled by Thompson and Strauch supported breeding bird densities as low as those observed in plots R1 and R2 in lower Bear Canyon.

Table 2. Plot Densities of Breeding Birds¹

<u>Species</u>	G ₁	G ₂	P ₁	P ₂	R ₁	R ₂	S ₁	S ₂	<u>Total</u>
Rock Dove	0	0	0.4	0	0	0	0	0	0.4
Mourning Dove	0	0	0	0.2	0	0	0	0	0.2
White-throated Swift	0	0	0	0.6	0	0	0	0	0.6
Broad-tailed Hummingbird	0	0	0.4	0.6	1.6	0.8	4.4	2.8	10.6
Northern Flicker	0	0	0	0.2	0	0	0	0	0.2
Western Wood Pewee	0	0	0.2	0.4	0	0	0.2	0	0.8
Say's Phoebe	0	0.2	0.2	0	0	0	0	0	0.4
Violet-green Swallow	0	0	0.6	2.0	0	0	0	0	2.6
Barn Swallow	0	0	0.2	0	0	0	0	0	0.2
Steller's Jay	0	0	0	0	0.2	0	0	0.2	0.4
Scrub Jay	0	0	0	0	0.2	0	0	0	0.2
Black-billed Magpie	0.2	1.4	0.6	0	0.4	0	0.8	0.4	3.8
Common Raven	0	0	0	0.2	0	0	0	0	0.2
Black-capped Chickadee	0	0	0	0	0	0	1.8	0.6	2.4
Mountain Chickadee	0	0	1.4	0	0	0.4	0.4	0.4	2.6
Plain Titmouse	0	0	0	0	0.2	0	0	0	0.2
Red-breasted Nuthatch	0	0	0	0	0	0	0.2	0.8	1.0
White-breasted Nuthatch	0	0	0	0.8	0	0.2	0	0	1.0
Pygmy Nuthatch	0	0	0	1.2	0	0	0	0	1.2
House Wren	0	0	0	0	0	0.2	1.0	1.4	2.6
Blue-gray Gnatcatcher	0	0	0	0	0	0	0.4	0	0.4
Western Bluebird	0	0	0	1.0	0	0	0	0	1.0
Swainson's Thrush	0	0	0	0	0	0	0	0.2	0.2
American Robin	0	0.2	0.4	0.6	0.2	0.4	1.4	0.4	3.6
Gray Catbird	0	0	0	0	0	0	1.2	0	1.2
Warbling Vireo	0	0	0	0	0	0	0	0.4	0.4
Virginia's Warbler	0	0	0	0	0	0.4	1.6	0.4	2.4
Yellow-rumped Warbler	0	0	0	0	0	0	0	0.2	0.2
McGillivray's Warbler	0	0	0	0	0	0.2	0	0.8	1.0

¹Mean number of each species seen on each plot.

Table 2. (Continued)

<u>Species</u>	G ₁	G ₂	P ₁	P ₂	R ₁	R ₂	S ₁	S ₂	<u>Total</u>
Prairie Warbler	0	0	0	0	0	0.2	0	0	0.2
Yellow-breasted Chat	0	0	0	0	0	0.2	3.2	2.0	5.4
Black-headed Grosbeak	0	0	0	0	0	0	3.0	2.0	5.0
Lazuli Bunting	0	0	0	0	0	0.2	1.6	0.8	2.6
Green-tailed Towhee	0	0	0	0.2	0	0.2	0.4	0	0.8
Rufous-sided Towhee	0	0	0.2	0.6	0.6	1.4	5.4	4.4	12.6
Chipping Sparrow	0	0	2.4	1.2	0	0	0	0	3.6
Vesper Sparrow	0.2	0.4	0	0	0	0	0	0	0.6
Song Sparrow	0	0	0	0	0	0	0.2	0	0.2
Gray-headed Junco	0	0	0	0.2	0	0	0	0	0.2
Western Meadowlark	0.6	0.8	0.2	0	0	0.2	0	0	1.8
Common Grackle	0	0	0.8	0	0.4	0	0	0	1.2
Brown-headed Cowbird	0	0	0	0	0.8	0.8	1.6	1.4	4.6
Northern Oriole	0	0	0	0	0.8	1.2	0.6	0	2.6
House Finch	0	0	0	0	0.2	0	0	0	0.2
Red Crossbill	0	0	0	0	0.4	0	0	0	0.4
Pine Siskin	0	0.4	2.2	2.2	0.6	0.6	0.2	0	6.2
Lesser Goldfinch	0	0	0.6	0	0	0.2	0.2	0.2	1.2
Mean Species	1.0	2.2	6.0	8.0	4.6	5.8	12.8	11.6	
Mean Individuals	1.0	3.4	10.8	12.2	6.6	7.8	29.8	19.8	

Table 3. Breeding Bird Densities in Selected Boulder Ecosystems

<u>Ecosystem</u>	<u>Individuals/ha</u>		
	<u>NCAR</u>	<u>Open Space</u> ¹	<u>Mt. Park</u> ²
Grassland	1.1	3.3	2.4
Ponderosa Pine Forest	5.8	8.1	4.5
Riparian Woodland	3.6	10.3	5.6
Foothills Shrubland	12.4	6.4	7.0

¹Thompson and Strauch, 1986. N=16. 2 ha plots.

²Jones, 1990. N = Grassland 1, Ponderosa 7, Riparian 6, Shrubland 1. 5 ha plots.

Grassland plots (G1 and G2) at NCAR ranked last, both in species richness (1.0 and 2.2 species) and breeding bird density (1.0 and 3.4 individuals). These values are significantly lower than the mean values reported by Thompson and Strauch for plots located in unirrigated grasslands. All of the birds observed within the two grassland plots at NCAR appeared to be either late migrants (vesper sparrow and pine siskin) or foraging species that were nesting outside of the plot boundaries (black-billed magpie, American robin, and western meadowlark). There was no evidence that any birds nested in either of these plots.

The pronounced differences in breeding bird densities in the four major terrestrial habitats at NCAR may result, in part, from differences in the structure and condition of these habitats. In lower Skunk Canyon, dense shrub growth and a mosaic of shrublands, meadows, cottonwood groves, and coniferous forest create a rich foraging and nesting environment for a variety of species. In contrast, the riparian woodlands along much of lower Bear Creek are characterized by stunted trees, a poorly developed shrub understory, and extensive human disturbance. Studies conducted in western North American coniferous forests have found breeding bird densities to be dependent on foliage density and height (Balda 1975, Mannan and Meslow 1984, Jones 1989). Other studies have shown that fragmentation of habitats by trail or road construction reduces breeding bird abundance (Whitcomb et. al. 1981).

The absence of grassland-nesting species in NCAR meadow is puzzling. There is extensive vegetative cover in the meadow. In

places the grasses are nearly two meters tall. Hikers occasionally cross the meadow, but there are no established trails. Vesper sparrows, lark sparrows, and grasshopper sparrows nest in similar habitat throughout City of Boulder Open Space. Vesper sparrows were present in NCAR meadow in May, but none were observed after 1 June. No lark sparrows or grasshopper sparrows were observed in the meadow.

The absence of grassland-nesting species in NCAR meadow may result from:

1. Human disturbance. Many people hike through the meadow during the nesting season. Dogs roaming at large are occasionally seen there as well.
2. Location. NCAR lies on the extreme western edge of the breeding range of grasshopper sparrow and lark sparrow (Andrews and Righter 1992).
3. Fragmentation. The Table Mesa subdivision to the east of NCAR may isolate NCAR meadow from other grassland habitat in the City of Boulder Parks and Open Space system.
4. Vegetation structure. Much of the NCAR meadow is dominated by non-native grasses such as tall oatgrass (Arrhenatherum sp.). There is little shrub growth throughout much of the meadow.

The relationship of grassland structure to breeding bird populations is not well known. Wiens (1973) found that breeding bird population densities in selected North American grasslands

correlated with moisture and grazing intensity but not with plant species composition. Balda (1975a) concluded that, in many cases, disturbed grasslands supported more breeding bird species than were found in "natural" grasslands. Pending further research, not enough is known about habitat requirements of grassland-nesting birds to determine which of the factors listed above may affect breeding bird densities in NCAR meadow.

RAPTORS

No raptor nests were found within the study area during the 1993 breeding season, but a number of birds of prey were observed. Cooper's hawks, which were seen in Skunk Canyon, have nested on Dinosaur Mountain, approximately 1 km west of the study area (Weinberg 1987). Sharp-shinned hawks, observed in both Skunk Canyon and Bear Canyon, also nest to the west of the study area in the Boulder Mountain Park (Weinberg 1987--see Figure 3). I watched a pair of red-tailed hawks hunting and courting over NCAR Mesa in June, 1993. Red-tailed hawks have nested in the Flatirons and on adjacent mesas (Thompson and Strauch 1986).

Golden eagles have nested approximately 1 km west of the study area in upper Skunk Canyon since 1983 (Figgs and Lederer 1991--see Figure 4). I observed the female of this pair soaring low over NCAR Mesa on three occasions during the 1993 breeding season. The pair nested successfully in 1993, fledging one young (Nan Lederer, pers. comm.).

Prairie falcons nest in the Flatirons rock formation to the west of the study area and often fly over Enchanted Mesa and NCAR Mesa (pers. obs.). During the 1992 breeding season, prairie falcons nested successfully on the Third Flatiron and in Fern Canyon (Figure 4). Both territories were active in 1993 (Steve Armstead, pers. comm.). A pair of peregrine falcons has nested in the Shadow Canyon area for three years (Rod Moraga, pers. comm.).

A variety of owl species have been observed within the study area or within 1 km of its boundaries (see Figure 5). Northern

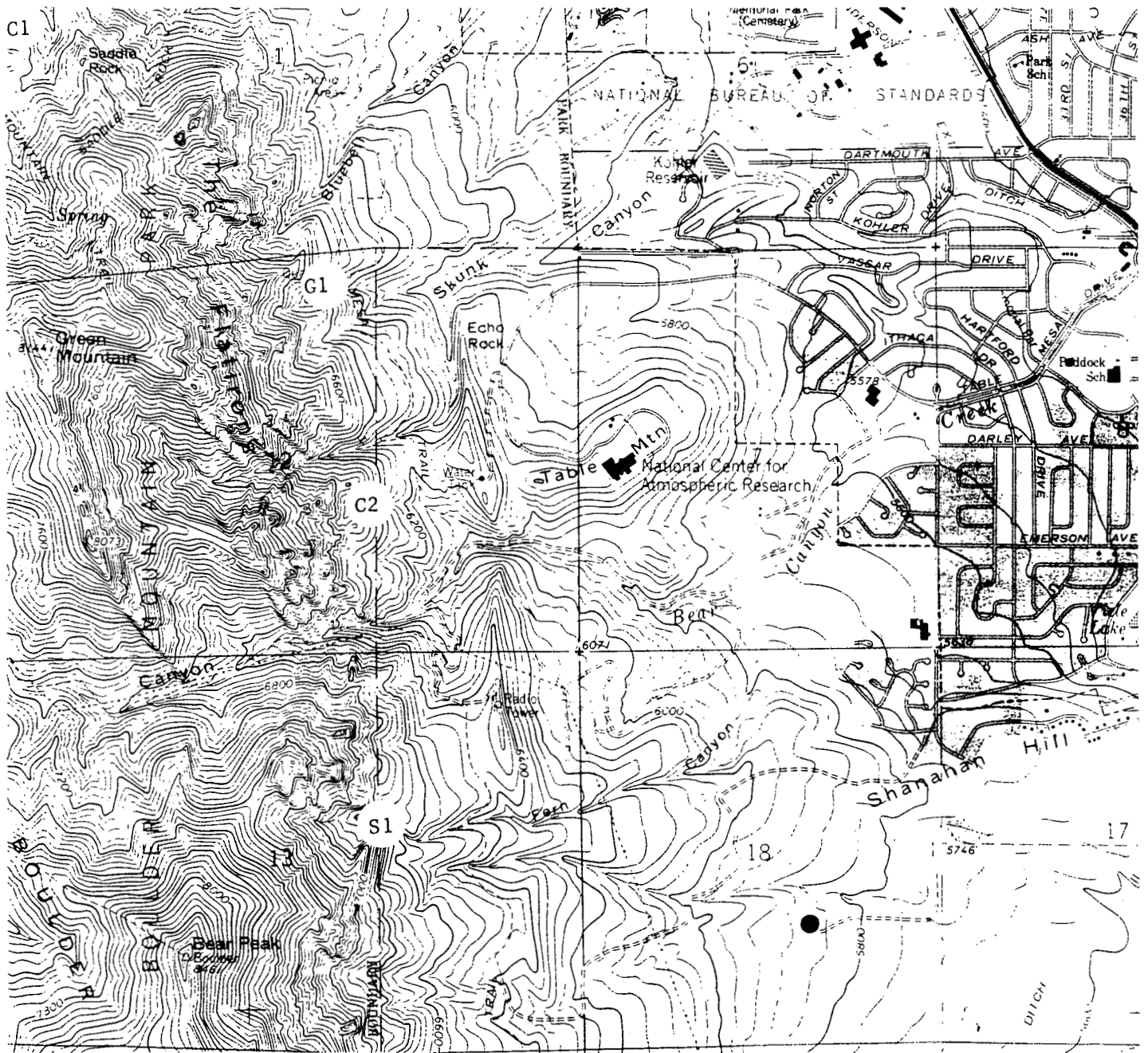


Figure 3. Accipiter Nest Locations (from Weinberg 1987).

- S--Sharp-shinned Hawk, 1986
- C--Cooper's Hawk, 1986
- G--Northern Goshawk, 1982

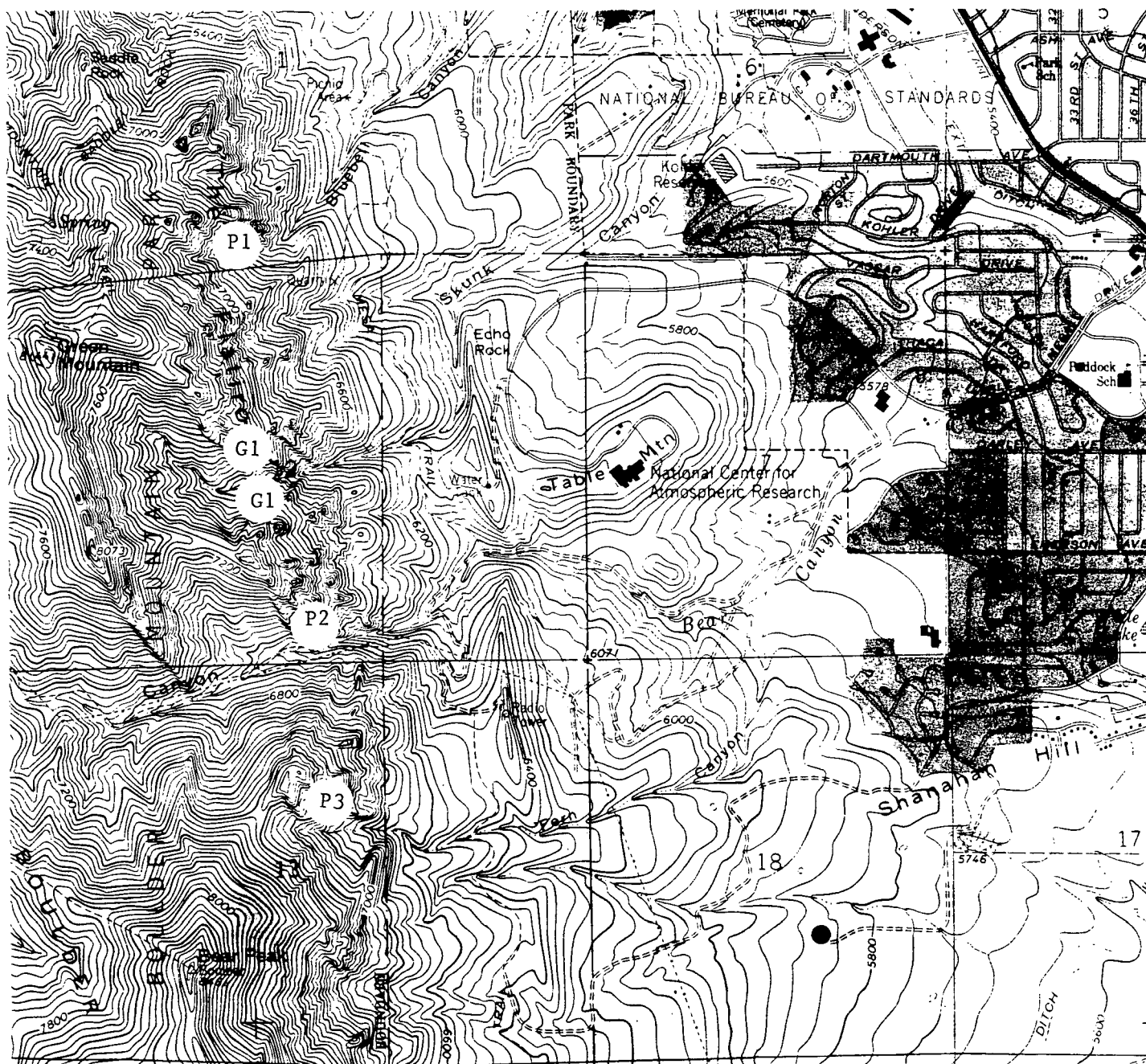


Figure 4. Golden Eagle and Prairie Falcon Nest Locations.

- P1: Prairie falcon, Third Flatiron, 1982-93
- P2: Prairie falcon, Bear Canyon, 1987-9
- P3: Prairie falcon, Fern Canyon, 1985-93
- G1: Golden eagle, Skunk Canyon, 1982-93

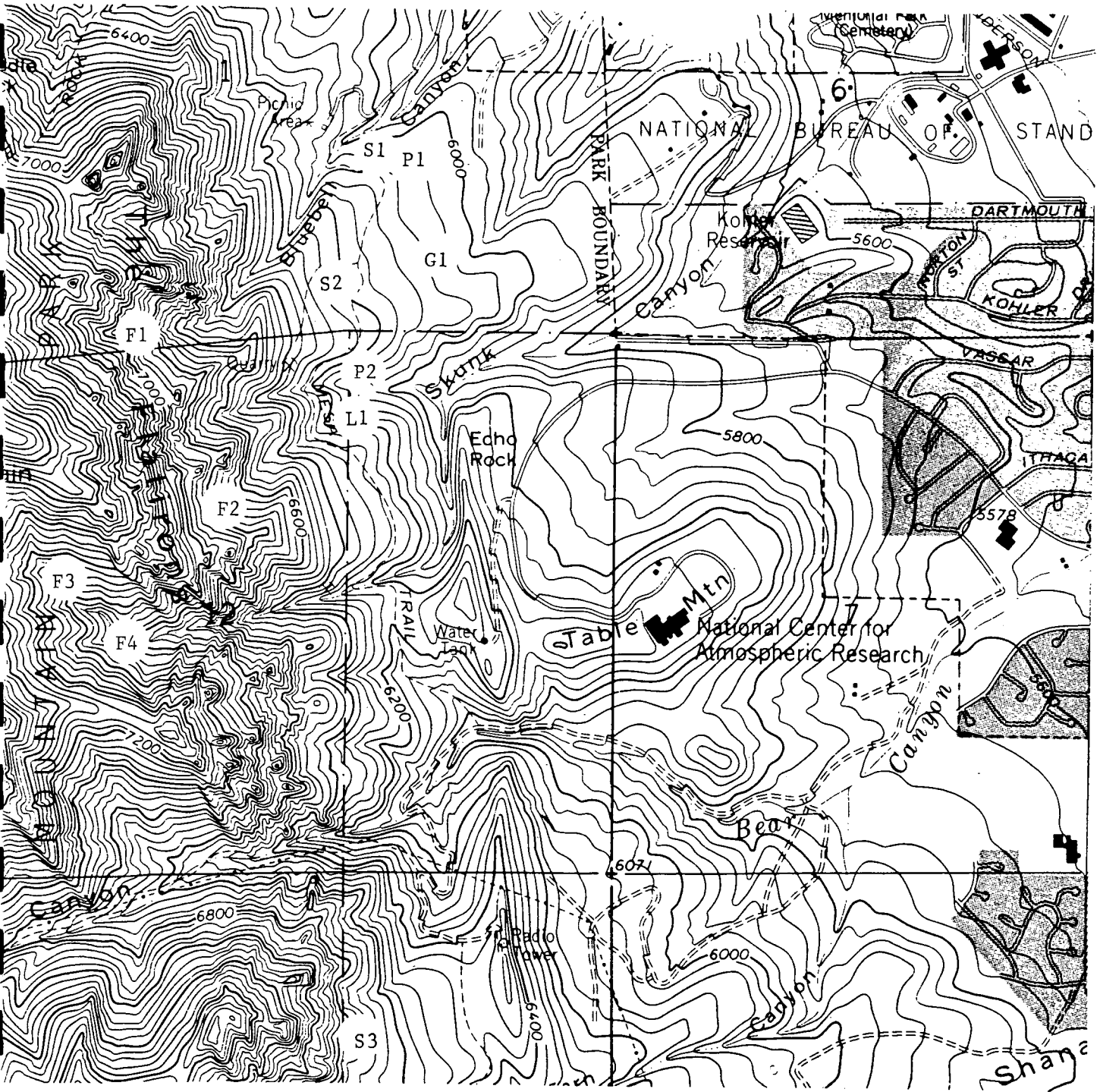


Figure 5. Owl Nest Locations, 1985-93.

F--Flammulated Owl	L--Long Eared Owl	S--Northern Saw-whet Owl
G--Great Horned Owl	P--Northern Pygmy Owl	

pygmy owls and northern saw-whet owls have nested on Enchanted Mesa and in upper Skunk Canyon (Jones 1989). Long-eared owls nested in upper Skunk Canyon from 1985-89 (Jones 1989). Great horned owls and eastern screech owls have been seen or heard on Enchanted Mesa and along the Mesa Trail, west of the study area (Jones 1989, 1990).

CAVITY-NESTING BIRDS

Cavity-nesters comprised 31% of all birds observed in the two coniferous forest plots. Cavity-nester density was higher on plot P2 (42%) than on plot P1 (19%). Of the four species of cavity-nesters observed on plot P2, three species (violet-green swallow, pygmy nuthatch, and western bluebird) nested in a single ponderosa pine snag on Echo Rock ridge, 100 m north of the water tank.

Scott, Whelan, and Svoboda (1980), who summarized the results of eight studies of cavity-nesting bird density in Rocky Mountain coniferous forests, reported a mean cavity-nester density in ponderosa pine forests of 42% with a range of 32-46%. The mean cavity-nester density for 20, 5 ha breeding bird plots sampled in the Boulder Mountain Park in 1989-90 was 26% (Jones 1990).

Since populations of cavity-nesting birds in any forest will vary from year to year (Balda 1975b), it is not possible to draw conclusions about the quality of habitat for cavity-nesting birds at NCAR from these data. The snag density on the two coniferous forest plots at NCAR was approximately 1 snag/ha (snags greater

than 20 cm DBH). A density of at least 5 snags/ha is generally recommended for maintaining cavity-nesting bird populations in Rocky Mountain coniferous forests (Balda 1975a, Scott 1978, Ffolliot 1983). In the NCAR plots, low snag density combined with a moderate cavity-nesting bird density suggests a high utilization of existing snags. Removal or loss of existing snags could have serious negative impacts on cavity-nesting bird populations at NCAR.

SPECIES OF SPECIAL CONCERN

The Boulder County Parks and Open Space Department has published a list of avian species of special concern in Boulder County (Boulder County Parks and Open Space 1993). This list includes the following categories of avian species:

- I. Rare and Declining
- II. Declining (but not yet rare)
- III. Rare and Stable
- IV. Extirpated
- V. Isolated or Restricted Population
- VI. Additional National or Statewide Concern

Eight of the species observed at NCAR during the 1993 breeding season are included on this list: northern mockingbird (III), golden eagle (V), prairie falcon (V), gray catbird (V), sharp-shinned hawk (VI--Audubon Blue List), Cooper's hawk (VI--blue list), common nighthawk (VI--blue list), and scrub jay (VI--blue list). Species accounts follow.

Northern Mockingbird

III.--Rare and stable

Northern mockingbirds are considered casual breeders in Boulder County. I observed a singing male northern mockingbird in lower Skunk Canyon on 5 July (see Figure 6). This individual was not seen or heard during three subsequent July visits to the area.

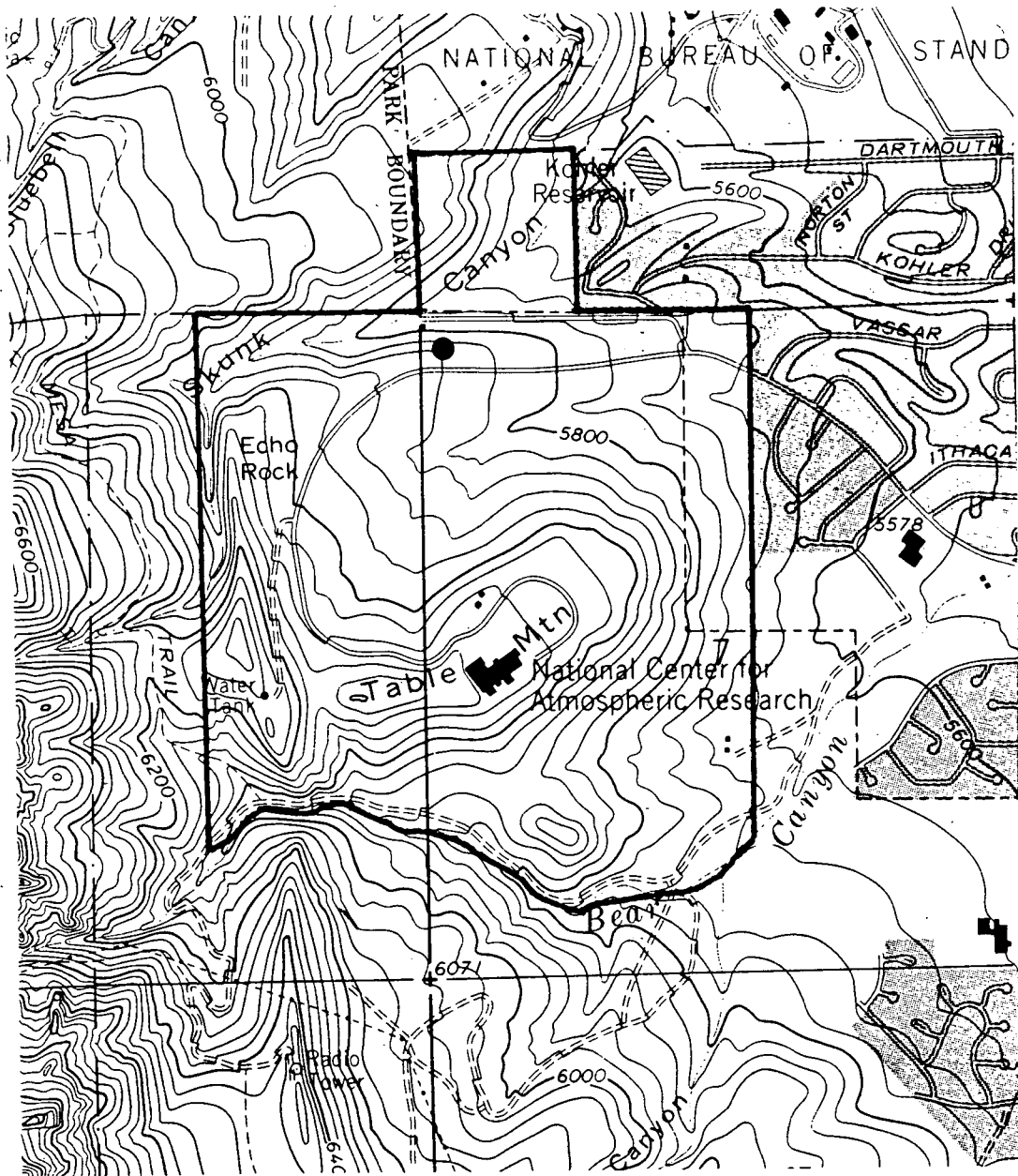


Figure 6. Northern Mockingbird Sighting Location.

Golden Eagle

V.--Isolated or restricted population

Golden eagles have nested in upper Skunk Canyon since at least 1983 and in the Flatirons since at least 1941 (Figgs and Lederer 1991). Golden eagles from the Skunk Canyon eyrie are frequently seen soaring over the NCAR Mesa. Open meadows and the presence of marmots, rabbits, and carrion probably attract golden eagles to the NCAR Mesa. The mesa also serves as a buffer between upper Skunk Canyon and the Table Mesa subdivisions.

Prairie Falcon

V.--Isolated or Restricted Population

After fledging their young in July, prairie falcons from the Third Flatiron, Bear Canyon, and Fern Canyon eyries move down onto the mesas below the Flatirons (pers. obs.). Songbird populations at NCAR probably provide prey for these prairie falcons and for peregrine falcons nesting in Shadow Canyon. In July 1988, I observed prairie falcons with young along the Walter Orr Roberts Nature Trail on NCAR Mesa.

Gray Catbird

V.--Isolated or Restricted Population

In Boulder County gray catbirds nest only within a narrow belt of shrublands at the base of the foothills (Boulder County Comprehensive Plan 1988, Jones 1989). Gray catbirds nested in lower Skunk Canyon in 1989, 1990, and 1993 (Jones 1989, 1990, present study). The catbirds nest in dense growth of chokecherry,

hawthorn, wild plum, and other shrubs along Skunk Creek. Two pairs nested in 1993 (Figure 7).

Sharp-shinned Hawk

VI.--Audubon Blue List

The Audubon Blue List tracks species that are believed to be declining throughout North America (Tate 1986). Sharp-shinned hawks are considered uncommon breeders in Boulder County (Boulder County Comprehensive Plan 1988). They nest in dense Douglas-fir groves in the foothills and mountains (Weinberg 1987). Sharp-shinned hawks have nested in Fern Canyon (Weinberg 1987), but most of the sharp-shinned hawks seen at NCAR are probably migrants. Some may be individuals that nest in the Boulder Mountain Park and forage along lower Bear Creek and lower Skunk Creek.

Cooper's Hawk

VI.--Audubon Blue List

Cooper's hawks have nested in dense groves of Douglas-fir in Ranger Canyon and on Dinosaur Mountain (Weinberg 1987). Cooper's hawks are frequently seen throughout the year soaring over lower Skunk Canyon (Jim Knopf, pers. comm.). They probably hunt songbirds and small mammals within the study area.

Common Nighthawk

VI.--Audubon Blue List

Common nighthawks probably nest within the Boulder Mountain Park (Jones 1990). One male was seen within the NCAR study area during the 1993 breeding season.

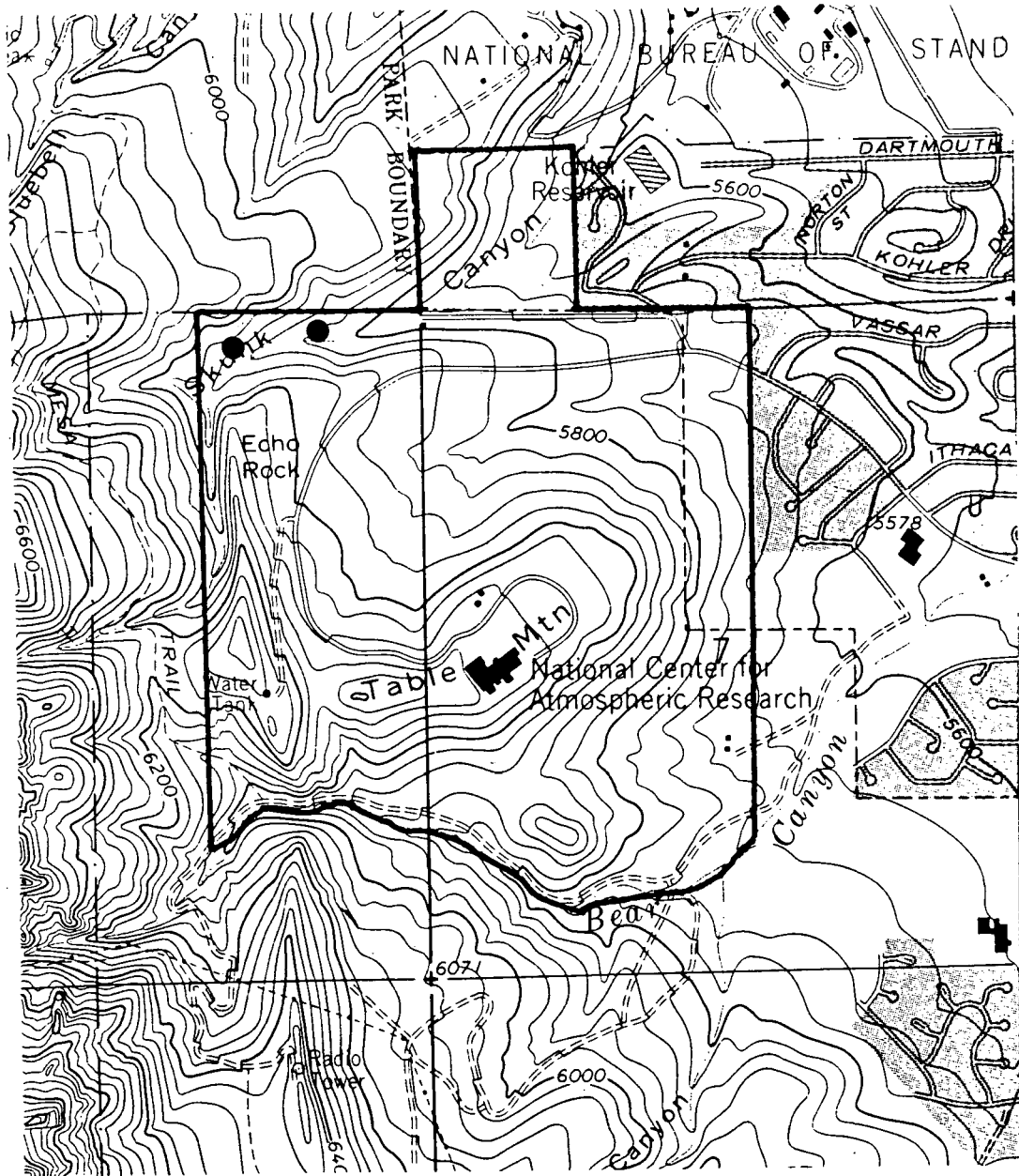


Figure 7. Gray Catbird Nest Locations.

Scrub Jay

VI--Audubon Blue List

Scrub jays are uncommon breeders in Boulder County foothills shrublands. One pair has nested in lower Skunk Canyon each year from 1988-93 (Jones 1989, Jim Knopf pers. comm., this study). I observed a second pair in lower Bear Canyon during the 1993 breeding season (Figure 8).

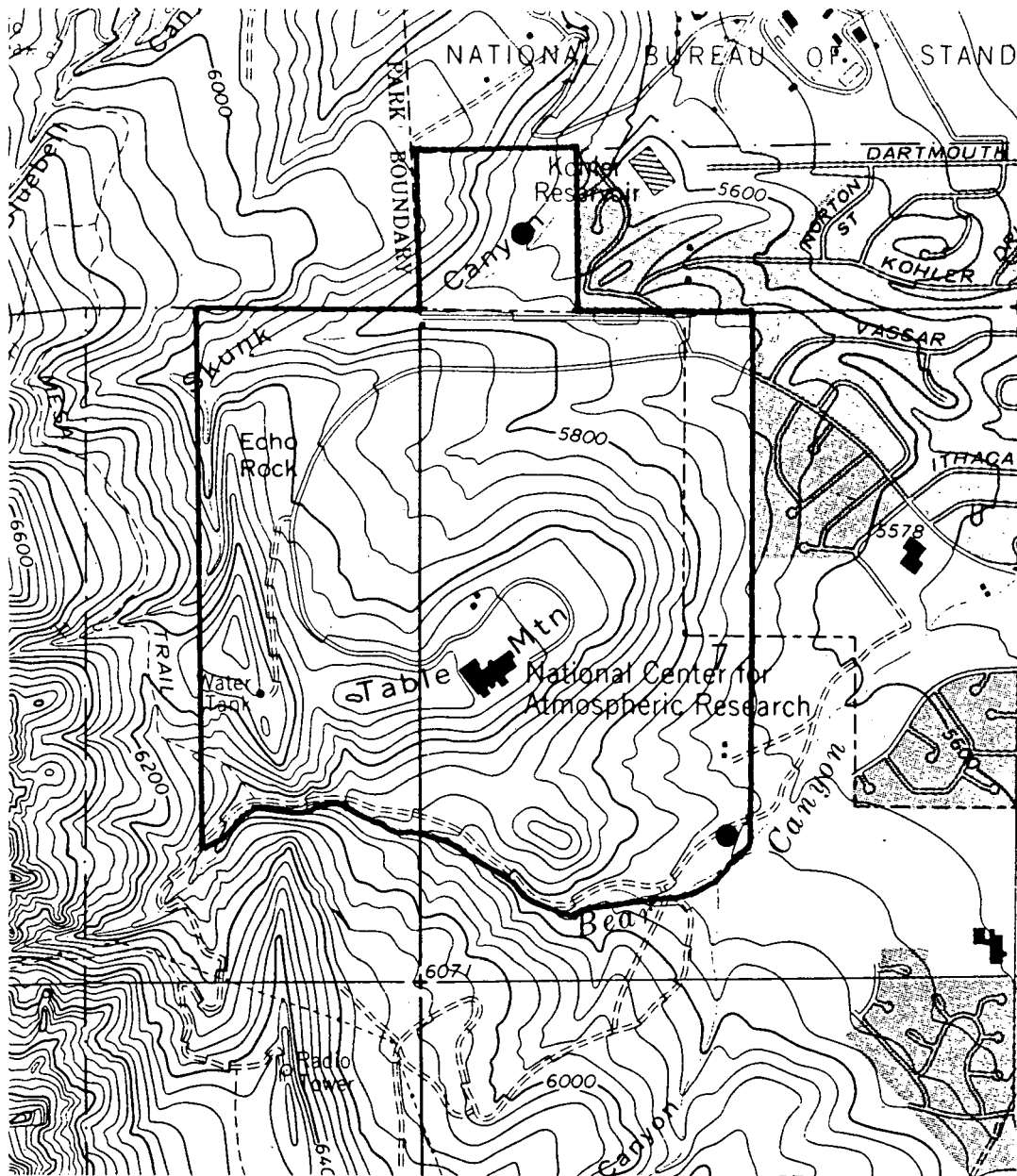


Figure 3. Scrub Jay Nest Locations.

MANAGEMENT RECOMMENDATIONS

NCAR's breeding avifauna will benefit from a management approach that minimizes human disturbance of nesting sites, prevents fragmentation or destruction of natural areas, and seeks to restore native vegetation to disturbed areas.

Preservation of the shrublands in lower Skunk Canyon is of critical importance. Plots in this area supported the highest density of breeding birds observed within any non-wetland plots sampled in City of Boulder Parks and Open Space. These shrublands support three species of concern (scrub jay, gray catbird, and northern mockingbird). Trails in lower Skunk Canyon should avoid areas of dense shrub growth wherever possible. People should be discouraged from venturing into the untrailed area of Skunk Canyon west of Echo Rock.

Restoration of native vegetation in lower Bear Canyon should improve breeding bird habitat in this area. Efforts should be made to discourage the creation of "casual" trails within this riparian corridor.

Snags should be maintained, and, perhaps, created within the groves of ponderosa pine forest atop NCAR Mesa and along Echo Rock ridge. Regular monitoring of snag densities and cavity-nesting bird populations in these areas will help to determine if artificial snag creation is necessary to maintain nesting sites for western bluebirds, white-breasted and pygmy nuthatches, violet-green swallows, hairy woodpeckers, and other cavity-nesting birds.

Dr. Carl Bock, of the University of Colorado's Environmental, Population, and Organismic Biology Department, has initiated a study of structural characteristics and animal populations of grasslands on City of Boulder Open Space. Results of this study may shed light on the habitat requirements of grassland-nesting birds in the Boulder area. This information may contribute to articulation of conservation strategies for grassland-nesting birds at NCAR Meadow and in similar habitats along the plains/mountain interface. Meanwhile, the use of non-native seed mixes for grassland restoration at NCAR should be discontinued.



RECEIVED MAY - 3 1993

From the OFFICE OF THE CITY ATTORNEY

To: Mark Gershman, Open Space Department

From: Alan Boles, Assistant CA

Date: May 2, 1993

Re: Hobart Smith

LAB

I think that we can probably justify engaging Hobart Smith as an independent contractor, so go ahead with the draft of a contract.

OPEN SPACE OPERATIONS

MAY - 5 1993

LITERATURE CITED

- Andrews, R. and R. Righter 1992. Colorado Birds.
- Balda, R. P. 1975a. Vegetation structure and breeding bird diversity. Proceedings of the Symposium on Management of Forest and Range Habitats for Nongame Birds. U.S.D.A., Forest Service General Technical Report WO-1. Washington, D.C., 59-80.
- Balda, R. P. 1975b. The relationship of secondary cavity nesters to snag densities in western coniferous forests. U.S.D.A., Forest Service Wildlife Habitat Technical Bulletin 1, 37pp.
- Barry, R. G., 1973. A climatological transect on the eastern slope of the Front Range, Colorado. Arctic and Alpine Research 5:89-110.
- Boulder County Audubon Society. 1975-93. Monthly wildlife inventories.
- Boulder County Parks and Open Space Dept. 1988. Boulder County Comprehensive Plan, Environmental Resources Element.
- Boulder County Parks and Open Space. 1993. Boulder County avian species of special concern.
- Figgs, M., and N. Lederer. 1991. Status of nesting golden eagles in Boulder County and adjacent areas of the Front Range in Colorado. Boulder County Nature Association Publication No. 12.
- Ffolliott, P. 1983. Implications of snag policies on management of southwestern ponderosa pine forests. Proc. of Symposium on Snag Habitat Management. U.S.D.A., Forest Service General Technical Report RM-99, 28-29.
- Jones, S. R. 1989. Boulder Mountain Park Forest Bird Study. Boulder Parks and Recreation Dept., Boulder, Co.
- Jones, S. R. 1990. Managing Boulder Mountain Park Ecosystems for Bird and Mammal Populations. Unpublished Report for Boulder Parks and Recreation Dept.
- Jones, S. R. 1991. Distribution of small forest owls in Boulder County, Colorado. C.F.O. Journal 25: 55-70.
- Mannan, R. W. 1980. Assemblages of bird species in western coniferous old-growth forests. Management of Western Forests and Grasslands for Nongame Birds. U.S.D.A., Forest Service General Technical Report INT-86. Ogden, Utah, 357-368.

- Mannan, R. W., and E. C. Meslow. 1984. Bird populations and vegetative characteristics in managed and old-growth forests, northeastern Oregon. *Journal of Wildlife Management*, 48:1219-1238.
- Marr, J. W., 1961. Ecosystems of the east slope of the Front Range in Colorado. Boulder, CO, U. Colo. Stud., Biol. 8
- Mutel, C. F., and J. C. Emerick. 1992. From Grassland to Glacier: the Natural History of Colorado. Johnson Books, Boulder, CO.
- NCAR Archives. 1963-87. Miscellaneous letters and reports.
- Scott, V. E. 1978. Characteristics of ponderosa pine snags used by cavity-nesting birds in Arizona. *Journal of Forestry*, 76(1):26-28.
- Scott, V. E., J. A. Whelan, and P. L. Svoboda. 1980. Cavity-nesting birds and forest management. Management of Western Forests and Grasslands for Nongame Birds. U.S.D.A., Forest Service General Technical Report INT-86. Ogden, Utah, 311-324.
- Tate, J. Jr. 1986. The blue list for 1986. *American Birds*, 40(2): 227-237.
- Thompson, R. W., and J. G. Strauch, Jr. 1986. Habitat Use by Breeding Birds on City of Boulder Open Space, 1985. Boulder County Nature Association Publication No. 6. Boulder, Colorado, 167 pp.
- Weinberg, H. 1987. The accipiter census. Unpublished manuscript.
- Whitcomb, R. F., C. S. Robbins, J. F. Lynch, B. L. Whitcomb, M. K. Klimkiewicz, and D. Bystrak 1981. Effects of forest fragmentation on avifauna of the eastern deciduous forest. *Forest Island Dynamics in Man-Dominated Landscapes* (Burgess, R. L., D. M. Sharpe, eds.). 125-205.
- Wiens, J. A. 1973. Pattern and process in grassland bird communities. *Ecological Monographs* 45: 237-270.

APPENDIX A
BREEDING BIRD CODES

The codes used to categorize breeding birds were adapted from the Colorado Breeding Bird Atlas. Birds were listed as "confirmed," "probable," or "possible," based on observed behaviors.

Possible

SPECIES OBSERVED or breeding calls heard in suitable nesting habitat.

SINGING MALE present in suitable nesting habitat during breeding season.

Probable

MULTIPLE MALES: seven different singing males heard in suitable nesting habitat.

PAIR observed in suitable nesting habitat.

TERRITORY presumed through territorial behavior.

COURTSHIP behavior between a male and a female.

AGITATED behavior or anxiety calls of adult.

Confirmed

NEST BUILDING or adult carrying nesting material.

USED NEST or eggshells found.

FLEDGED YOUNG with limited mobility, including young incapable of sustained flight.

OCCUPIED NEST indicated by adult entering or leaving nest site.

FEEDING YOUNG: adult seen carrying food for young.

NEST WITH EGGS.

NEST WITH YOUNG seen or heard.

APPENDIX B

SCIENTIFIC NAMES OF BIRDS MENTIONED IN TEXT

<u>Family</u>	<u>Common Name</u>	<u>Scientific Name</u>
Accipitridae	Sharp-shinned Hawk	<u>Accipiter striatus</u>
	Cooper's Hawk	<u>Accipiter cooperii</u>
	Goshawk	<u>Accipiter gentilis</u>
	Red-tailed Hawk	<u>Buteo jamaicensis</u>
	Golden Eagle	<u>Aquila chrysaetos</u>
Falconidae	American Kestrel	<u>Falco sparverius</u>
	Peregrine Falcon	<u>Falco peregrinus</u>
	Prairie Falcon	<u>Falco mexicanus</u>
Columbidae	Rock Dove	<u>Columba livia</u>
	Mourning Dove	<u>Zenaida macroura</u>
Strigidae	Flammulated Owl	<u>Otus flammeolus</u>
	Eastern Screech Owl	<u>Otus asio</u>
	Great Horned Owl	<u>Bubo virginianus</u>
	Northern Pygmy-Owl	<u>Glaucidium gnoma</u>
	Long-eared Owl	<u>Asio otus</u>
	Northern Saw-whet Owl	<u>Aegolius acadicus</u>
Caprimulgidae	Common Nighthawk	<u>Chordeiles minor</u>
	Common Poorwill	<u>Phalaenoptilus nuttallii</u>
Apodidae	White-throated Swift	<u>Aeronautes saxatalis</u>
Trochilidae	Broad-tailed Hummingbird	<u>Selasphorus platycercus</u>
Picidae	Northern Flicker	<u>Colaptes auratus</u>
Tyrannidae	Western Wood Pewee	<u>Contopus sordidulus</u>
	Dusky Flycatcher	<u>Empidonax oberholseri</u>
	Western Flycatcher	<u>Empidonax difficilis</u>
	Say's Phoebe	<u>Sayornis saya</u>
Hirundiade	Tree Swallow	<u>Tachycineta bicolor</u>
	Violet-green Swallow	<u>Tachycineta thalassina</u>
Corvidae	Steller's Jay	<u>Cyanocitta stelleri</u>
	Blue Jay	<u>Cyanocitta cristata</u>
	Scrub Jay	<u>Aphelocoma coerulescens</u>
	Black-billed Magpie	<u>Pica pica</u>
	American Crow	<u>Corvus brachyrhynchos</u>
	Common Raven	<u>Corvus corax</u>
Paridae	Black-capped Chickadee	<u>Parus atricapillus</u>
	Mountain Chickadee	<u>Parus gambeli</u>
	Plain Titmouse	<u>Parus inornatus</u>

Appendix B (Continued)

<u>Family</u>	<u>Common Name</u>	<u>Scientific Name</u>
Sittidae	Red-breasted Nuthatch	<u>Sitta canadensis</u>
	White-breasted Nuthatch	<u>Sitta carolinensis</u>
	Pygmy Nuthatch	<u>Sitta pygmaea</u>
Troglodytidae	Rock Wren	<u>Salpinctes obsoletus</u>
	Canyon Wren	<u>Catherpes mexicanus</u>
	House Wren	<u>Troglodytes aedon</u>
Muscicapidae	Blue-gray Gnatcatcher	<u>Polioptila caerulea</u>
	Western Bluebird	<u>Sialia mexicana</u>
	Mountain Bluebird	<u>Sialia currocoides</u>
	Townsend's Solitaire	<u>Myadestes townsendi</u>
	American Robin	<u>Turdus migratorius</u>
Mimidae	Gray Catbird	<u>Dumetella carolinensis</u>
	Northern Mockingbird	<u>Mimus polyglottos</u>
Sturnidae	European Starling	<u>Sturnus vulgaris</u>
Vireonidae	Solitary Vireo	<u>Vireo solitarius</u>
	Warbling Vireo	<u>Vireo gilvus</u>
Emberizidae	Orange-crowned Warbler	<u>Vermivora celata</u>
	Virginia's Warbler	<u>Vermivora virginiae</u>
	Yellow Warbler	<u>Dendroica petechia</u>
	Yellow-rumped Warbler	<u>Dendroica coronata</u>
	Prairie Warbler	<u>Dendroica discolor</u>
	McGillivray's Warbler	<u>Oporornis tolmiei</u>
	Yellow-breasted Chat	<u>Icteria virens</u>
	Western Tanager	<u>Piranga ludoviciana</u>
	Black-headed Grosbeak	<u>Pheucticus melanocephalus</u>
	Lazuli Bunting	<u>Passerina amoena</u>
	Indigo Bunting	<u>Passerina cyanea</u>
	Green-tailed Towhee	<u>Pipilo chlorurus</u>
	Rufous-sided Towhee	<u>Pipilo erythrophthalmus</u>
	Chipping Sparrow	<u>Spizella passerina</u>
	Vesper Sparrow	<u>Pooecetes gramineus</u>
	Dark-eyed Junco	<u>Junco hyemalis</u>
	Western Meadowlark	<u>Sturnella neglecta</u>
Brown-headed Cowbird	<u>Molothrus ater</u>	
Northern Oriole	<u>Icterus galbula</u>	
Fringillidae	Cassin's Finch	<u>Carpodacus cassinii</u>
	House Finch	<u>Carpodacus mexicanus</u>
	Red Crossbill	<u>Loxia curvirostra</u>
	Pine Siskin	<u>Carduelis pinus</u>
	Lesser Goldfinch	<u>Carduelis psaltria</u>
	American Goldfinch	<u>Carduelis tristis</u>
Passeridae	House Sparrow	<u>Passer domesticus</u>

APPENDIX C

Plot Locations

Beginning and end points of medial (long) axes are marked with metal flashing bearing the plot number and the initials "SJ." Plots are 200 x 100 m.

G1

Begins: Largest rock 25 m north of road.
Ends: Small, flat rock.
Direction: 13 N.

G2

Begins: 15 m east of lone, marked ponderosa.
Ends: Flat rock.
Direction: 66 E.

P1

Begins: Rock marked "Walter Roberts Nature Trail."
Ends: 15 m east of trail signpost.
Direction: 260 W.

P2

Begins: North side of water tank (no marker).
Ends: Ponderosa pine.
Direction: 335 NW.

R1

Begins: Metal/wooden post 1 m north of road.
Ends: Cottonwood on creek bank.
Direction: 85 E.

R2

Begins: Metal/wooden post south of trail intersection.
Ends: Cottonwood on creek bank.
Direction: 120 SE.

S1

Begins: Signpost at trail intersection.
Ends: 30 m south of marked ponderosa.
Direction: 260 W.

S2

Begins: Cottonwood on east side of creek.
Ends: Cottonwood in creekbottom.
Direction: 180 S.